SAMPLING AND ANALYSIS PLAN
FOR
GCL TIE AND TREATING SUPERFUND SITE OU-2
SIDNEY, NEW YORK

CONTRACT NUMBER: W912WJ-12-C-0011

Prepared for

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U.S. Army Corps of Engineers
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May 2013

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LIST OF ACRONYMS

ASTM	American Society for Testing and Materials
bgs	below ground surface
BOD	Biochemical Oxygen Demand
BTEX	benzene, toluene, ethylbenzene, and xylenes
BS	blank spike
BSD	blank spike duplicate
°C	degrees Celsius
CDM	CDM Federal Programs Corporation
CLP	contract laboratory program
CO	Contracting Officer
COC	contaminants of concern
CSP	Certified Safety Professional
1,1-DCA	1,1-dichloroethane
DESA	Division of Environmental Science and Assessment
DO	dissolved oxygen
DOT	U.S. Department of Transportation
DQCR	daily quality control report
DNAPL	dense non-aqueous phase liquid
EM	Engineering Manual
GCL	GCL Tie and Treating Superfund Site
GETS	groundwater extraction and treatment system
HGL	HydroGeoLogic, Inc
H&S	H&S Environmental, Inc
ID	identification

IDW	investigation-derived waste
L/min	liters per minute
LCS	laboratory control sample
LTM	long-term monitoring
LTRA	long-term remedial action
MS	matrix spike
MSD	matrix spike duplicate
NAPL	non-aqueous phase liquid
NPL	National Priorities List
NTU	nephelometric turbidity units
NYSDE	New York State Department of Conservation
ORP	oxidation-reduction potential
OU	Operable Unit
PAH	polyaromatic hydrocarbons
PID	photoionization detector
PM	project manager
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA	Removal Action
RPD	relative percent deviation
SAP	Sampling Analysis Plan
SOP	standard operating procedure
SOW	scope of work

SRM	standard reference material
SVOC	semi-volatile organic compound
1,1,1-TCA	1,1,1-trichlorethane
trans-1,2-DCE	*trans*-1,2-dichloroethene
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VC	vinyl chloride
VOA	volatile organic analyte
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbons

1.0 INTRODUCTION

H&S Environmental, Inc. (H&S) has prepared this Sampling and Analysis Plan (SAP) for the U.S. Army Corps of Engineers, New England District (USACE) under Contract W912WJ-12-C-0011. This SAP describes the means, methods, and procedures required that will be performed during environmental sampling activities at the GCL Tie and Treating Superfund Site Operable Unit (OU) -2, Sidney, New York.

This plan is based on the following documents/regulations:

- The Statement of Work (SOW) prepared by USACE entitled GCL Tie & Treating Superfund Site, OU-2 - Sidney, NY, Groundwater Treatment Plant & Extraction System, Operations & Maintenance 2012 to 2116 (USACE April 11, 2012)
- USACE Engineering Manual EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans (USACE, 2001)
- U.S Environmental Protection Agency Ground Water Issue: Low-Flow (minimal drawdown) Groundwater Sampling Procedures (USEPA, 1996)
- Standard Operating Procedures (SOP) issued by the U.S. Environmental Protection Agency (USEPA) Region 2 Division of Environmental Science and Assessment (DESA) dated March 2005.

1.1 Purpose of the Sampling and Analysis Plan

The purpose of this SAP is to identify the required media to be sampled, media sample collection and handling procedures, and associated field documentation of sampling activities to be performed. Activities shall be performed in accordance with the requirements set forth by the USACE SOW dated April 11, 2012.

The following site remedial objectives were established in the OU-2 Record of Decision (USEPA, 1995):

- Prevent public and biotic exposure to contaminant sources that present a significant threat (contaminated groundwater and surface water sediments)
- Reduce the concentration of contaminants in the groundwater to levels that are protective of human health and the environment (e.g., wildlife)
- Prevent further migration of groundwater contamination.

The primary objective of the groundwater extraction and treatment system (GETS), according to the second Five Year Review (USEPA, 2008), is to treat groundwater contamination to levels acceptable for discharge to surface water pursuant to New York State standards. The groundwater monitoring and treatment system process monitoring activities measure the effectiveness of the GETS to evaluate the success of the remedy.

H&S will maintain and update this plan as necessary during the course of work, based on the need to do so or at the direction of the Contracting Officer (CO) or authorized representative. This document is applicable to services performed by H&S as the prime contractor as well as any subcontractors under H&S' control.

1.2 Site Description and History

The GCL Tie and Treating Superfund Site GCL) is located in the Village of Sidney, Delaware County, New York, and occupies a 26-acre site located in a commercial/industrial area. A site location map is presented as Figure 1. The site is bordered to the north by a rail line owned by the Delaware and Hudson Railroad. Meadwestvaco, Inc., a calendar manufacturer, and the Sidney Municipal Airport are located to the north of the rail line. To the east, the site is bordered by Unalam, Inc., a laminated wood manufacturer, and Delaware Avenue runs along the southern border of the site in a northeast to southwest direction (GeoTrans, 2006). A drainage ditch and wooded area separate the site from Delaware Avenue (USEPA, 1994). Along the western border of the site lies an undeveloped scrub/shrub area with wetlands. The Superfund Site encompasses approximately 60 acres of land comprised of the GCL property (26 acres) and two adjacent properties to the east (34 acres), referred to as the non-GCL property. The non-GCL areas to the east are currently a vacated sawmill operation and the Unalam property.

GCL was historically used as a tie and treating facility since the 1940s. Four structures were located on the site, which were used in the process of treating wood (primarily railroad ties). The largest building housed the wood pressure treatment operations, which included two treatment vessels, an office, and a small laboratory. The vessels were 50 feet long and 7 feet in diameter and were used to pressure treat wood with creosote. The remaining three structures were used to house a sawmill and general storage space (USEPA, 1994).

Two operational units (OUs) address the source of contamination and the cleanup of the groundwater. OU-1, completed in August 2000, consisted of the excavation and on-site treatment of approximately 109,000 tons of soil, sediment, and debris by a thermal desorption process. OU-2 consisted of the construction of an on-site groundwater treatment facility for the extraction, collection and on-site treatment of contaminated groundwater. Construction of the GETS was completed on August 30, 2004, (USEPA, 2008) and remains in operation.

1.3 Site Hydrology

The GCL site is located in the Appalachian Plateau Geomorphic Province of south central New York. The province is characterized by forested hills with moderate to steep slopes that are separated by relatively flat and broad valleys. Much of the shape of the unconsolidated deposits is attributable to the Wisconsinian ice sheet advance. The site lies in the broad Susquehanna River Valley, approximately 4,000 feet southeast of the river. The site and surrounding areas are characterized by Devonian bedrock overlain by glacial till, glaciofluvial, and glaciolacustrine deposits.

The hydrogeology of the GCL site and surrounding area can be roughly subdivided into bedrock and unconsolidated (glacial deposit) aquifer systems. Within the bedrock system, groundwater moves primarily through fractures, joints and bedding plates. The general direction of groundwater flow in the bedrock and intermediate unconsolidated aquifers at the GCL site is to the north-northwest, toward the Susquehanna River (USEPA, 2008).

1.4 Contamination Characteristics

Contamination at the GCL Site resulted from the pressurized wood treatment process. After treatment, wood was allowed to drip dry in open areas with no containment. In addition, one of the treatment vessels malfunctioned and released approximately 30,000 gallons of creosote. The contaminated soil was removed and placed in a mound without any further action. In 1991, the USEPA initiated a Removal Action (RA) that involved site stabilization, delineation of surface contamination, installation of chain-link fence, identification and disposal of all hazardous waste, segregating and staging approximately 6,000 cubic yards of contaminated soil and wood debris for disposal, and developing a pilot study to determine the effectiveness of composting for bioremediation for creosote-contaminated soil (USEPA, 1994). In 1994, the site was added to the National Priorities List (NPL). Site characterization and remediation has been divided into two OUs: OU-1 to address contaminated soils and OU-2 to address remaining contaminated soils (if any) and contaminated groundwater. The OU-1 remedy was completed in August 2000, and successfully addressed the soil contamination to the extent that no soil contamination needs to be addressed as part of OU-2. The OU-2 remedy operated for several months beginning in August 2004, before it was temporarily shut down due to lack of funding during negotiations of the State Superfund Contract. Long-term remedial action (LTRA) officially began in October 2005. The system was restarted in January 2006.

Creosote contamination still persists in the phreatic zone as soil contamination, dense non-aqueous phase liquid (DNAPL), and as dissolved groundwater contamination. Although the DNAPL is relatively discontinuous with isolated areas of non-aqueous phase liquid (NAPL) and residual product, it has been observed as NAPL in several monitoring wells. Groundwater contamination is an ongoing concern due to the soil and DNAPL sources. The primary contaminants of concern (COC) at the site include: benzene, toluene, ethylbenzene, and xylenes (BTEX); naphthalene; 2-methyl-naphthalene; and other polyaromatic hydrocarbons (PAH). Contaminants from two nearby sites are also present in the groundwater underlying the GCL. The contaminants from these sites include toluene; ethylbenzene; 1,1-dichloroethane (1,1-DCA); *trans*-1,2-dichloroethene (*trans*-1,2-DCE); trichloroethene (TCE); vinyl chloride (VC); and 1,1,1-trichloroethane (1,1,1-TCA). Both of the nearby sites have remedial actions in place. Concentrations of the COCs have been tracked and identified primarily immediately downgradient of the source area. In the intermediate zone (overburden), concentrations above the cleanup standards have historically been confined to an area approximately 200 to 300 feet from the source area. Site investigations revealed that contaminant migration is more extensive in the bedrock zone. A chronology of historical groundwater sampling events at the GCL OU-2 are presented in Table 1.

2.0 TREATMENT SYSTEM PROCESS WATER, GROUNDWATER AND WASTE CHARACTERIZATION SAMPLING

Various media are sampled as part of ongoing GETS operation and maintenance activities. Media sampling events include:

- Treatment system process water sampling (including groundwater extraction wells)
- Monitoring well sampling
- Waste characterization sampling.

2.1 Treatment System Process Water Sampling

Ongoing treatment system process water sampling activities are described below. Well construction details and water level information is provided in Table 2. Historical groundwater analytical results are provided in Table 3.

2.1.1 *Monthly Treatment System Process Water Sampling*

Process water samples are currently collected on a monthly frequency from three locations within the GETS:

- Sample tap ST-6, the combined GETS influent
- The mid-liquid-phase carbon sample tap
- Sample tap ST-1, the GETS effluent.

The treatment system process water samples are analyzed for the following analytical methods by TestAmerica Laboratories, Inc. in Savannah, Georgia, an off-site contract laboratory:

- Volatile organic compounds (VOCs) by SW-846 method 8260B
- PAHs and 1,4-dioxane by SW-846 8270C SIM
- Total Metals (iron and manganese) by SW-846 method 6020
- Total Mercury by SW-846 method 7470A
- Total Hardness by Standard Method 2340B
- Dissolved Metals (iron and manganese) by SW-846 method 6020
- Biochemical Oxygen Demand (BOD) by Standard Method 5210B
- Total Dissolved Solids (TDS) and Total Suspended Solids (TSS) by Standard Methods 2540C and 2540D, respectively
- Alkalinity by USEPA method 310.1
- Chloride and Sulfate by SW-846 method 9056, and
- Kjeldahl Nitrogen by USEPA method 351.2.

The mid-liquid-phase carbon sample is analyzed for VOCs only. The ST-6 and ST-1 samples are analyzed for all the analytes described above.

2.1.2 *Sample Collection*

Process water samples are collected only when the plant is operational and the pumps are on. Before sampling, one 5-gallon bucket is filled with purge water from the sampling port. After sufficient purging, the samples are collected directly from the sampling port. The sample containers are filled slowly and continuously, with VOCs sampled first. During sample collection, a bucket is kept under the sample port to contain process water between filling sample containers. Dissolved metals samples are field filtered using an inline 0.45 micron filter. Other parameters are recorded and the samples are preserved (where applicable). The caps are secured tightly and the bottles are labeled with an appropriate sample label. All sample containers, including trip blanks, are sealed in plastic bags and placed on ice in a cooler immediately after sample collection. The purge water from each sampling port is then properly disposed of into a process sump, which then recycles the water through the GETS.

2.1.3 *Sample Containers and Preservation*

Laboratory-provided sample containers are used during sampling events. Sample containers are not reused. The laboratory provides pre-preserve sample containers as appropriate for the analysis to be performed. Field personnel conduct a visual check to ensure that pre-preserved sample containers contain preservative. If the sample containers are not pre-preserved, field personnel will either use a replacement container or add the appropriate preservative. A summary of the sample containers, preservation, and holding times for water samples are presented in Table 4.

2.1.4 *Sample Identification*

All samples are assigned a unique sample identifier. Field personnel generate a label for each sample container that contains the sample identifier, date and time of sample collection, the sampler's initials, analytical parameters, and type of preservation used. The sampler initial any change in the label information prior to the sample collection.

A sample numbering system is used to identify each sample collected and submitted for analysis. The purpose of the numbering system is to assist in the tracking of samples and to facilitate retrieval of analytical results. The sampling number will be used on sample labels, sample tracking forms, chain of custody forms (Appendix A), field log books, and for other applicable documentation. The field sample numbering system will follow the format used for previous sampling events. The sample identification (ID) for groundwater extraction wells will be the name of the particular groundwater extraction well. Examples are listed below:

Sample Location:	**Sample ID:**
Mid-liquid-phase carbon sample tap (dated MM/DD/YY)	GCL-GAC-MMDDYY
EW-1B (dated MM/DD/YY)	EW-1B- MMDDYY

2.1.5 *Trip Blanks*

Trip blanks are submitted to the laboratory in conjunction with VOC samples. Trip blanks are used to identify the potential for contamination associated with sample shipment, containers, and storage to affect the samples in a shipment. TestAmerica prepares trip blanks in the laboratory by filling preserved volatile organic analyte (VOA) vials with American Society for Testing and Materials (ASTM) Type II water and ships them to the field. A set of trip blanks is included in each cooler containing samples for VOC analysis and returned to the laboratory with the environmental samples. Once prepared by the laboratory, trip blanks are not opened.

2.1.6 *Chain of Custody*

Sample custody will be maintained at all times. A sample is considered to be in custody under the following situations:

- The sample is directly in the sampler's possession
- The sample is clearly in the sampler's view
- The sample is placed in a locked location, or
- The sample is in a designated secure area.

If an overnight courier is used, adhesive custody seals are used to demonstrate that the samples and coolers have not been tampered with during shipment. The custody seals are placed across the cooler lids in such a manner that they will be visibly disturbed upon opening of the cooler. The seals are initialed and dated by field personnel when affixed to the container and cooler.

Documentation of the chain of custody of the samples is necessary to demonstrate that the integrity of the samples has not been compromised between collection and delivery to the laboratory. A chain of custody record to document the transfer of custody from the field to the laboratory will accompany each sample cooler. All information requested in the chain of custody record form is completed. If samples are shipped by an overnight courier, the air bill number assigned by the overnight courier is listed on the chain of custody record or the general logbook. One copy of the custody form is retained by the samplers and placed in the project records file. The remaining pages are sealed in a plastic bag and placed inside the cooler. Upon receipt at the laboratory, the chain of custody forms are completed and a cooler receipt form will be completed (Appendix A). It is the responsibility of the laboratory to document the condition of custody seals and sample integrity upon receipt.

2.1.7 *Sample Shipment*

Sample containers are placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. Bagged sample containers are placed in insulated coolers with bubble wrap or other wrapping to eliminate the chance of breakage during delivery or shipment. Ice in plastic bags will be placed in the coolers to keep the samples between 2 and 6 degrees Celsius (ºC) throughout storage and shipment.

Sample delivery or shipment is performed in strict accordance with all applicable U.S. Department of Transportation (DOT) regulations. The samples are transported from the site to the laboratory by laboratory personnel or shipped to the laboratory by an overnight courier service. Arrangements are made between H&S and the contract laboratory point-of-contact for samples that are to be delivered to the laboratory on a weekend to ensure that holding times and cooler temperatures are not compromised.

2.2 Monitoring Well Sampling

Groundwater monitoring well sampling activities are described below.

2.2.1 *Annual Groundwater Monitoring Well Sampling Locations*

Groundwater samples will be collected from 20 monitoring wells and 8 extraction wells during each annual groundwater monitoring event in accordance with the USACE SOW dated April 11, 2012. Based on a review of available information from previous sampling events, monitoring wells include: MW-1S, MW-1D, MW-3S, MW-3I, MW-3B, MW-7I, MW-7D, MW-8I, MW-10B, MW-11I, MW-11B, MW-12B, MW-12I, MW-13I, MW-13B, MW-14I, MW-14B, MW-15B, MW-16I, MW-16D; and extraction wells: EW-5I, EW-1I, EW-2I, EW-3I, EW-4I, (using the same sampling procedure as monitoring wells) and EW-1B EW-2B, EW-4B (sampled from taps inside treatment building). The monitoring wells and extraction well locations are depicted on Figure 2.

Extraction wells (EW-5I, EW-1I, EW-2I, EW-3I, and EW-4I) will be sampled using the USEPA low-flow technique as discussed in Section 2.2.4. Active extraction wells will be sampled from taps inside the water treatment building. One round of water quality reading taken from groundwater collected at the sample taps.

Information regarding previous groundwater monitoring well installation and sampling events is summarized below for ease of reference.

- In October 2002, six new extraction wells were installed (EW-3I, EW-1I, EW-2I, EW-5I, EW-1B, and EW-2B). One well, EW-5I, yielded little or no flow; therefore, it was not connected to the groundwater treatment plant. Instead, it was used as a monitoring well (USEPA, 2008).
- Six monitoring wells were installed on the Mead Westvaco property in November 2003 (MW-13I, MW-13B, MW-14I, MW-14B, MW-15I, and MW-15B). These wells were used to monitor the groundwater flow east of the GCL property. Two extraction wells (EW-4I and EW-4B) were also installed on the Mead Westvaco property and connected to the GCL site groundwater treatment plant (USEPA, 2008).
- A baseline sampling event was conducted from June 22 through June 30, 2004, for groundwater from 14 monitoring wells, 8 extraction wells and 2 piezometers on the GCL and Mead Westvaco properties (USEPA, 2008).
- Two groundwater events were performed in May 2006, and June 2007, by Conti Environment and Infrastructure. They consisted of sampling groundwater at 21 monitoring wells, one piezometer, and 8 extraction wells for VOCs, PAHs, iron, and manganese. Groundwater elevations were measured in 39 wells, including 7 extraction wells (USEPA, 2008).
- In June 2007, CDM Federal Programs Corporation (CDM) conducted a sampling event that included performing a well survey and collecting groundwater samples. The 2007 Well Information and Water Levels are presented in Table 6.
- In March 2008, Lockheed Martin performed monitoring well installation and groundwater sampling activities under the direction of the USEPA Environmental Response Team. Three wells, MW-16I, MW-16D, and MW-8DI, were installed on Mead

Westvaco property, down gradient relative to the existing monitoring well network. Monitoring well MW-8DI was installed with a screen depth interval of 100.2 to 110.2 feet below surface grade (bgs), which is within the very fine sand of the glaciolacustrine deposit. Monitoring well MW-16I was installed with a screen depth interval of 169.7 to 179.7 feet bgs, which is within the glacial till layer between the bedrock and glaciolacustrine deposit. Monitoring well MW-16D was installed with a screen depth interval of 232.1 to 252.1 feet bgs, which is in the siltstone bedrock (Lockheed Martin, 2008). Thirty-three monitoring wells (seven of which were extraction wells), both on and off site, were sampled in May 2008.

Groundwater sampling results since system start-up, are presented in Table 3. There was a brief lapse in the annual monitoring well sampling beginning in 2008. The annual monitoring well sampling events will resume in 2011.

H&S will complete the sampling using USEPA low-flow sampling techniques. It is anticipated that the groundwater sampling can be completed during a 1- week period. The samples will be collected and analyzed per the project Quality Assurance Project Plan (QAPP) (Attachment A). Groundwater samples will be analyzed for the parameters discussed in Section 2.2.2. Well information and water levels are presented on Table 2.

2.2.2 *Groundwater Analytical Methods*

Analytical methods and analytes utilized for groundwater monitoring well sampling events will be in accordance with this document and the QAPP (Attachment A). Table 4 lists the analytical parameters, sample container quantities, preservation, holding times and quality control (QC) samples required for groundwater monitoring well sampling. The sample methods for groundwater monitoring are presented in Table 4. Action levels to be used in the assessment of potential COC off site migration are presented in Table 5. Specific analytical parameters and methods to be used during monitoring well sampling events are summarized below:

- VOCs (SW-846 method 8260B)
- PAHs (SW-846 method 8270C SIM)
- Total Metals (iron and manganese) (SW-846 method 6020)
- Dissolved Metals (iron and manganese) (SW-846 method 6020).

Field measurements will be collected during groundwater monitoring well purging activities to determine when purging requirements are achieved. Specific field parameters to be collected include pH, temperature, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (ORP) and turbidity. The collection of field measurements is discussed in Section 2.2.4.2.

2.2.3 *Pre-sampling Activities*

The Groundwater Sampling Checklist presented in Appendix A summarizes action items that will be performed before and during each sample event to ensure that tasks are completed.

The following sections provide more detailed discussions of the activities that will be conducted prior to the collection of water samples.

2.2.3.1 *Equipment and Supplies*

The following equipment and supplies will be utilized in the collection of low-flow groundwater samples:

- Dedicated and non-dedicated variable speed submersible bladder pumps and Teflon®-lined tubing
- Water level indicator
- DO, pH, specific conductance, ORP, and temperature probes (within a single unit) and appropriate calibration solutions
- Turbidity meter (separate meter from the above unit)
- Flow-through cell
- Pre-cleaned sample containers, equipped with Teflon®-lined lids or septa and certified “clean” per Office of Solid Waste and Emergency Response Directive 9240.9-05
- Sample preservation solutions
- Decontamination supplies including isopropyl alcohol and detergent
- VOC-free deionized water
- 500-milliliter graduated cylinder
- Graduated 5-gallon buckets for purge water and decontamination
- Plastic sealable bags
- 0.45 micron in-line filters
- Well keys
- Field log book and field sampling forms
- Chain of custody forms and seals
- Cooler with packing material and ice to cool all samples to 4 ºC, +/- 2 ºC
- Temperature blank for each cooler to be submitted to the laboratory
- Trip blanks
- Polyethylene sheeting
- Paper towels.

2.2.3.2 *Site Location, Security and Access*

The GCL groundwater monitoring wells are generally located in secured areas. Therefore, security of the groundwater monitoring wells is not a concern at the present time. Security measures will be enacted if evidence of tampering or suspicious damage is noted. Damaged wells will be reported to the Army for appropriate action. Information to be reported will include a written description and photograph of each damaged well location. Arrangements will be made to coordinate long-term monitoring (LTM) activities at any groundwater monitoring wells that are located on the Mead or Municipal Airport property and will be conducted in a timeframe that is acceptable to the property owner.

2.2.3.3 Initial Well Opening and Inspection

Olfactory and visual observations will be made upon opening the well casing protective cap. A photoionization detector (PID) will be used immediately to monitor the headspace of the well casing for VOCs. All observations, including any observed odors, will be documented in the log book and on the Static Groundwater Elevation Form presented in Appendix A. The general condition of the protective cover, its associated concrete apron, well casing protective cap, and the well casing will be inspected and noted in the log book. Any damage, evidence of tampering, or immediately necessary repairs will be communicated to the USACE-NAE PM within 24 hours.

2.2.3.4 Water Level Measurements

Water level measurements will be collected at each groundwater monitoring well before purging and sampling activities are performed. Field personnel will wait approximately 1 hour after opening each monitoring well before water level measurements are collected to ensure that the well's water level has adequate time to equilibrate with atmospheric conditions. Water level measurements will be collected on the marked side of the riser pipe and will be accurate to the nearest 0.01 feet. Water level measurements will be collected on the north side of any riser pipe that has not been previously marked. Every effort will be made to minimize the physical disturbance of water in the monitoring wells. Water level data will be recorded on a Static Groundwater Elevation Form (Appendix A). The water level probe end and tape will be decontaminated before use in the first well, between each well, between sample locations, and at the conclusion of sample activities in accordance with the procedures specified in Section 2.2.6.4. Total well depth measurements will be collected as part of the post-sampling activities described in Section 2.2.6.1 In some instances, however, total well depth measurements will be collected prior to the collection of water samples if information is not available for a particular well and is necessary to facilitate the correct placement of a groundwater sample pump.

2.2.4 *Sampling Procedures*

2.2.4.1 Equipment Calibration

Some equipment that will be used during the sampling event will require periodic calibration to ensure optimum performance, including a PID, YSI 600XL water quality meter, and Lamotte 2020 turbidimeter. This equipment will be calibrated in accordance with manufacturer's instructions before its initial use at the site and at the beginning of each work day thereafter. The equipment calibration also will be checked at the conclusion of each work day. Calibrations will be documented on log sheets included in Appendix A.

2.2.4.2 Well Purging

Each groundwater monitoring well will be purged in accordance with the USEPA Ground Water Issue: Low- Flow (minimal drawdown) Ground- water Sampling Procedures (USEPA 1996), included as Appendix B, prior to sampling. The goal of low-flow purging and sampling is to remove stagnant water from the well and collect representative samples at near ambient conditions. A dedicated or properly decontaminated, submersible, low-flow pump will be used to purge the wells. Dedicated Teflon®-lined tubing will be used during purging and sampling activities.

The depth to water will be measured with a water level indicator in accordance with Section 2.2.3.4 prior to installing the submersible pump in the well. Caution will be exercised to minimize disturbance of the well water. The submersible bladder pump will be placed into the well gently such that the intake will be located in the middle or slightly below the middle of the screened interval to ensure that most of the water will be pumped directly from the formation.

A properly calibrated water quality parameter probe will be fitted into the flow-through cell provided with the instrument with the included mounting hardware. The line from the in-well submersible pump will be attached to the barbed hose fitting on the bottom of the flow-through cell. A spigot will be attached to the line from the in-well submersible pump prior to the flow-through cell for the purpose of collecting turbidity samples. A drain line will be attached to the top fitting of the flow-through cell to direct the effluent to a bucket.

The depth to water will be re-measured to account for any water level variations caused by the placement of the submersible bladder pump. The pre- and post-pump placement measurements will be recorded on the field sampling form and in the field log book. Flow rates of 0.1 to 0.5 liters per minute (L/min) will be used for purging. The pump will be operated at a flow rate where minimal drawdown occurs during purging. The goal of low- flow purging is for the drawdown to be less than or equal to 0.3 feet.

Water quality measurements will be used as the basis for establishing the stabilization of the well water. Well stabilization parameters will include pH, specific conductance, temperature, ORP and turbidity. Turbidity samples must be collected from a spigot placed on the sample tubing prior to the flow-through cell and measured with a stand-alone meter. The parameters will be measured every 3 to 5 minutes until stabilization of all parameters is achieved. Stabilization has been reached when pH measurements remain constant within 0.1 standard unit, specific conductance is constant within 3%, the temperature is constant within 3%, ORP is constant within 10 millivolts and the turbidity is either constant within 10% for values above 5 Nephelometric Turbidity Units (NTU) or below 5 NTUs for three consecutive readings. All measurements will be tabulated for comparison on the Groundwater Field Sampling Data Sheet (Appendix A). Observations such as odors, water color or the appearance of soil particles or iron floc will also be recorded on the Groundwater Field Sampling Data Sheet. Final measurements will be recorded in the sampling log book.

If the water level drops more than the goal of 0.3 feet during purging, additional measures such as reducing the purge flow rate, will be enacted to reduce drawdown. These activities will be documented. Purging will continue until well stabilization parameters stabilize, the water level drops to the screened interval for wells with shorter screened intervals, or until the water level drops to the top of the pump for wells with longer screened intervals that encompass the pre-purging groundwater level. If the water level drops to the top of the pump or the screened interval, purging will be stopped and up to 24 hours will be allowed to pass for the well to recharge. The well will be sampled using low-flow sample collection procedures although it will not be purged and it will not be necessary for field parameters to stabilize.

2.2.4.3 Sample Containers and Preservatives

Laboratory provided sample containers will be used during sampling events. Sample containers will not be reused. The laboratory will pre-preserve sample containers as appropriate for the analysis to be performed. Field personnel will conduct a visual check to ensure that pre-preserved sample containers contain preservative. Field personnel will either use a replacement container or add the appropriate preservative if it observed that containers needing preservative are not pre-preserved. A summary of the sample containers, preservation, and holding times for water samples are presented in Table 4.

2.2.5 *Sample Collection*

Dedicated and non-dedicated variable speed submersible bladder pumps will be used to collect samples from groundwater monitoring wells. The objectives and methods for this procedure are described in the USEPA Ground Water Issue: Low-Flow (minimal drawdown) Ground-water Sampling Procedures (USEPA 1996) that is presented in Appendix B. The goal of sampling monitoring wells is to provide groundwater quality data that is representative of actual aquifer conditions with minimal alteration caused by inappropriate or variable sampling techniques.

Once groundwater quality parameters have stabilized, groundwater samples will be collected directly from the tubing connected to the pump. The sampling flow rate will be the same flow rate that was used during the purging process to maintain equilibrium between the well and the formation. The flow-through cell will be bypassed or disconnected during the collection of samples. Sample containers will be filled by allowing water from the pump to gently enter the containers with minimal disturbance. Sampling will begin with the VOC portion of the sample and continue with other portions of the sample. Once full, containers will be sealed in plastic bags and immediately placed on ice in a cooler. All samples will be labeled as described in Section 2.2.5.1 and immediately placed in a cooler with ice to maintain a sample temperature of approximately 2 to 6 ^{o}C.

2.2.5.1 Sample Identification

All samples will be assigned a unique sample identifier. Field personnel will generate a label for each sample container that will contain the sample identifier, date and time of sample collection, the sampler’s initials, analytical parameters, and type of preservation used. The sampler will initial any change in the label information prior to the sample collection.

A sample numbering system will be used to identify each sample collected and submitted for analysis. The purpose of the numbering system is to assist in the tracking of samples and to facilitate retrieval of analytical results. The sampling number will be used on sample labels, sample tracking forms, chain of custody forms (Appendix A), field log books, and for other applicable documentation. The field sample numbering system will follow the format used for previous sampling events. The sample ID for groundwater monitoring wells will be the name of the particular groundwater monitoring well. Similarly, the sample ID for surface water and sump samples will be the name of the surface water or sump location name. Duplicate sample IDs will be documented in the field forms without revealing the parent sample ID to the laboratory. Matrix spike/matrix spike duplicate (MS/MSD) sample IDs will be indicative of the parent sample ID. Examples are listed below:

Sample Location:	**Sample ID:**
GCLMonitoring Well 13I	MW-13I
Blind Duplicate from Monitoring Well 14B	MW-DUP01
Matrix Spike from Monitoring Well 7D	MW-7D MS
Matrix Spike Duplicate from Monitoring Well 7D	MW-7D MSD

2.2.5.2 Quality Assurance / Quality Control Samples

Quality assurance (QA)/QC samples will be collected during each sampling event. The following sub-sections specify the type and quantity of samples to be collected for QA/QC purposes. Table 6 shows primary number of samples and related QC samples.

2.2.5.3 Duplicate Sample

Field duplicate samples will be collected and submitted for analysis in conjunction with all analyses associated with primary field samples. Field duplicates are additional samples subjected to the same collection methods, preparation and analysis as the original sample but are identified with a unique identification number so that they are blind to the laboratory. These samples will be used to evaluate the precision of sample collection, field sample preparation and laboratory analysis. A duplicate will be collect in a frequency of one per twenty samples.

2.2.5.4 Rinsate Blank

Sampling methods called for in this plan include the use of both dedicated and non-dedicated sampling equipment. Therefore, some gauging or sampling equipment will be used in more than one well and will require decontamination between uses. In these cases, rinsate blanks will be prepared and submitted for analysis to determine the potential for cross-contamination from the sampling equipment. Rinsate blanks are prepared by decontaminating the field equipment according to the procedure specified in Section 2.2.6.4, followed by pumping distilled water through the submersible pump and capturing the rinsate water in a sample bottle. One rinsate blank will be collect for the non-dedicated equipment.

2.2.5.5 Trip Blank

Trip blanks will be submitted to the laboratory in conjunction with VOC samples. Trip blanks are used to identify the potential for contamination associated with sample shipment, containers, and storage to affect the samples in a shipment. TestAmerica will prepare trip blanks in the laboratory by filling preserved VOA vials with ASTM Type II water and shipping them to the field. A set of trip blanks is included in each cooler containing samples for VOC analysis and returned to the laboratory with the environmental samples. Once prepared by the laboratory, trip blanks are not opened.

2.2.5.6 Matrix Spike / Matrix Spike Duplicate

MS/MSD samples will be submitted for all analyses in conjunction with primary field samples. Results from MS/MSD samples will be used to evaluate the potential for sample matrix interferences versus laboratory analytical errors as well as to assess the accuracy of the analysis. Samples from MS/MSD locations will have a total of three times the standard volume collected. MS/MSD will be collect in a frequency of one per twenty samples.

2.2.6 *Post-Sampling Activities*

2.2.6.1 Total Well Depth Measurement

The total depth in each well will be measured and recorded following the collection of groundwater samples. Bladder pumps are narrow enough to allow total depth measurement in wells with dedicated bladder pumps without removing the pumps. Every effort will be made to minimize the physical disturbance of water in the monitoring wells. Water level data will be recorded on a Groundwater Field Sampling Data Sheet (Appendix A). The total depth measurements will be used to evaluate potential well screen failure or the need for well development. The water level probe end and tape will be decontaminated before use in the first well, between each well, between sample locations, and at the conclusion of sample activities in accordance with the procedures specified in Section 2.2.6.4.

2.2.6.2 Chain of Custody

Sample custody will be maintained at all times. A sample is considered to be in custody under the following situations:

- The sample is directly in a staff member’s possession;
- The sample is clearly in a staff member’s view;
- The sample is placed in a locked location; and
- The sample is in a designated secure area.

If an overnight courier is used, adhesive custody seals will be used to demonstrate that the samples and coolers have not been tampered with during shipment. The custody seals will be placed across the cooler lids in such a manner that they will be visibly disturbed upon opening of the cooler. The seals will be initialed and dated by field personnel when affixed to the container and cooler.

Documentation of the chain of custody of the samples is necessary to demonstrate that the integrity of the samples has not been compromised between collection and delivery to the laboratory. A chain of custody record to document the transfer of custody from the field to the laboratory will accompany each sample cooler. All information requested in the chain of custody record will be completed. If samples are shipped by an overnight courier, the air bill number assigned by the overnight courier will be listed on the chain of custody record or the general logbook. One copy of the custody form will be retained by the samplers and placed in the project records file. The remaining pages will be sealed in a plastic bag and placed inside the cooler. Upon receipt at the laboratory, the chain of custody forms will be completed and a cooler receipt form will be completed (Appendix A). It is the responsibility of the laboratory to document the condition of custody seals and sample integrity upon receipt.

2.2.6.3 Sample Delivery / Shipment to Laboratory

Sample containers will be placed inside sealed plastic bags as a precaution against cross-contamination caused by leakage or breakage. Bagged sample containers will be placed in insulated coolers with bubble wrap or other wrapping to eliminate the chance of breakage during delivery or shipment. Ice in plastic bags will be placed in the coolers to keep the samples between 2 and 6ºC throughout storage and shipment.

Sample delivery or shipment will be performed in strict accordance with all applicable U.S. DOT regulations. The samples will be transported from the site to the laboratory by laboratory personnel or shipped to the laboratory by an overnight courier service. Arrangements will be made between H&S and the contract laboratory point-of-contact for samples that are to be delivered to a laboratory on a weekend to ensure that holding times and cooler temperatures are not compromised.

2.2.6.4 Equipment Decontamination

Equipment or supplies that cannot be effectively decontaminated (e.g., sample tubing or rope) will be disposed of after sampling, if not dedicated. Gauging/sampling equipment will be decontaminated at the site before use, between sampling locations, and after its last use at the site. Decontamination of field equipment will be noted in the project logbook. If it is necessary to make decontamination procedural changes in the field, the changes will be noted in the logbook. Otherwise, a notation will be made each day that decontamination was conducted as specified in the project documents. Procedures for decontaminating sampling equipment that may be used at the GCL site will be conducted in accordance with guidance specified in the USEPA Ground Water Issue: Low-Flow (minimal drawdown) Groundwater Sampling Procedures (USEPA 1996) and is summarized below:

Groundwater gauging equipment and non-dedicated sampling equipment and materials will be decontaminated using the following procedure:

- Potable water flush immediately after use.
- Detergent scrub with brushes (Alconox, Liquinox or equivalent detergent). The solution will be changed periodically.
- Potable or deionized water flush to remove all detergent solution. The solution will be changed periodically.
- Lightly spray down with pesticide-grade isopropyl alcohol.
- Distilled/deionized water flush. The water will not be recycled.
- Air dry.
- Cover with aluminum foil (if not to be used immediately)

2.2.6.5 Investigation-Derived Waste

This section identifies the methodology for the handling, sampling, and disposal of investigation-derived waste (IDW) at the GCL site. All IDW will be handled in a manner consistent with

USACE and USEPA guidance for managing IDW for site investigations (USEPA, 1991) and applicable Federal and State regulations. IDW to be generated will include:

- Decontamination water
- Well purge water
- Personal protective equipment (PPE).

The primary source of IDW will be well purge water and decontamination water. Purge water will be containerized and processed onsite through the GETS for disposal.

Waste PPE will be double bagged and placed in the site refuse container pending removal for off-site disposal.

2.2.7 *Data Validation*

Data evaluation for this project will be consistent with EM 200-1-10 Guidance for “Evaluating Performance Based Chemical Data Packages” and will not be accompanied by contract laboratory program (CLP)-type validation normally associated with Level IV data collection activities. For each type of chemical analysis, data validators will use a Data Review Worksheet to review laboratory analytical data. The data validation for this project will include the following USACE items:

- Review of chain of custody documents to verify sample identities.
- Review of sample log-in documents to verify any potential problems with custody seals, container integrity, sample preservation, labeling, etc.
- Review of rinsate blank data to ascertain any potential problems with container contamination, preservative contamination, sampling equipment contamination, or cross contamination between samples during transport.
- Review of trip blank data to identify any potential problems with sample container contamination, preservative contamination, laboratory reagent water contamination, or cross contamination between samples during transport.
- Review of method blank data to determine the presence of any sources of contamination in the analytical process.
- Review the MS data to evaluate the potential for matrix effects and as a measure of analytical accuracy. MS recoveries will be compared against laboratory acceptance criteria to determine if they are within or outside of warning and control limits for percent recoveries.
- Review of MS/MSD data to evaluate sample homogeneity and as a measure of analytical precision. MS/MSD data will be compared to laboratory acceptance criteria for the maximum relative percent deviation (RPD).
- Review of any blank spike (BS) data (if available) as a measure of analytical accuracy.
- BS recoveries will be compared against laboratory acceptable criteria to determine if they are within or outside of warning and control limits for percent recoveries.
- Review of BS and blank spike duplicate (BSD) data (if available) as a measure of analytical precision. BS/BSD data will be compared to laboratory acceptance criteria for the maximum RPD.

- Review of standard reference material (SRM) or Laboratory Control Sample (LCS) data (if available) as a measure of analytical accuracy. SRM and LCS data will be compared to the certified acceptable ranges of the analytical values.
- Review of sample and sample duplicate data (if available) as a measure of sample homogeneity and as a measure of analytical precision. Sample and sample duplicate data will be compared against the laboratory acceptance criteria for the maximum RPD.
- Review of surrogate recovery data to assess extraction efficiency, effectiveness of sample introduction, and possible loss during cleanup activities. Surrogate recoveries will be compared to laboratory acceptance criteria to determine if they are within or outside of acceptable limits.
- Review of sample dates, extraction/digestion dates, and analysis dates to determine if maximum holding times were met or exceeded.

Additional details are provided in the QAPP (Attachment A). The following items would not typically be reviewed under a Definitive Data validation effort unless serious problems with the data arise as a result of initial data evaluation, in which case this information will be made available so that some or all of these might be evaluated to resolve any data usability issues:

- Instrument tunes
- Standard curves
- System performance check compound results
- Continuing calibration results
- Inter-element correction check results
- Laboratory notebook pages
- Calculations.

2.3 Waste Characterization Sampling

Operation and maintenance of the GETS generates waste that must be periodically removed from the site for disposal at a permitted treatment or disposal facility. Waste streams include:

- Spent liquid and vapor-phase carbon
- Spent bag filters
- Manganese sludge
- Spent green sand filtration media.

Waste characterization samples are analyzed using the following analytical methods by

TestAmerica Laboratories, Inc., an off-site contract laboratory:

- Toxicity Characteristic Leaching Procedure (TCLP) VOCs by SW-846 method 8260B
- TCLP SVOCs by SW-846 method 8270C SIM
- TCLP Metals and Mercury by SW-846 method 6020 and 7470A
- TCLP Pesticides by SW-846 method 8081A
- TCLP Polychlorinated biphenyls by SW-846 method 8082
- TCLP Herbicides by SW-846 method 8151A
- Ignitability by SW-846 method 1030

- Total Cyanide by SW-846 method 9012A
- pH by SW-846 method 9045C
- Total Sulfide by SW-846 method 9034.

Treatment system waste is typically containerized in storage vessels such as 55-gallon storage drums, 275-gallon totes (manganese sludge), 2,000-pound super sacks (liquid and vapor-phase carbon), or cubic yard boxes (spent bag filters). Spent green sand media is removed from the vessels and transported directly offsite to a permitted facility by a vacuum truck that no interim waste storage container is necessary. Waste samples are collected as a core sample and scooped directly into a glass container. Several samples are cored from multiple depths and locations within each storage container, including the container walls, bottom, and approximately 2-3 inches from the top of the waste surface. Final representative waste samples are a discrete grab from the composited core samples and do not undergo homogenization. Finally, the Teflon®-lined cap is secured tightly, and the sample container is labeled with an appropriate label. The sample containers are immediately placed inside an ice-cooled sample transport cooler pending shipment to the designated laboratory.

Additional samples may be collected for individual waste streams depending upon the testing requirements of the intended waste disposal facility.

2.4 Field Documentation

2.4.1 *Field Log Books*

During all site activities, field log books will be maintained to record information related to site activities, health and safety, level of protection worn and any upgrades, visitors to the site, sampling activities/locations and observations. Field log books will be bound volumes with sequentially numbered pages. No pages will be removed from the logbooks for any reason. If corrections are necessary, they will be made by drawing a single line through the original entry (so that original entry can still be read) and writing the corrected entry alongside it. The correction will be initialed and dated. Information to be recorded, if appropriate, will include, but is not limited to, the following:

- Project name and number
- Arrival and departure times
- Personnel on site and their affiliation
- Date and time
- Tasks for the day
- Weather conditions
- Site activities
- Health and safety meetings and issues
- Names and affiliations of visitors
- Sample location (including field sketches, if appropriate)
- Sample number
- Sample depth
- Sample time

- Number of aliquots
- Media type
- Air monitoring readings and equipment used (including serial numbers)
- Sampling personnel present
- Sampling equipment used
- PPE level, clothing, and equipment used
- Analyses requested
- Sample preservation
- Associated QC samples
- Decontamination procedures
- Field observations
- Photographic records
- Other project specific information.

All entries will be in ink with any corrections crossed out with a single line, initialed and dated. Each page of the logbook will be signed and dated at the bottom by each individual making an entry. The log books will be marked with the project number and the sequential number of the log book (i.e., Logbook #1, #2, etc.) using indelible, waterproof ink. At the completion of field activities, the log books will be maintained in the permanent project files.

2.4.2 *Field Sample Collection Sheets*

Indelible water proof ink will be used to record data and observations on Field Sample Collection Sheets. Field Sample Collection Sheets will be maintained by sampling personnel to supplement the field log book. An example of the field sheets to be used is provided in Appendix A. Copies of the sample collection field sheets will be hand delivered to the PM for review and distribution at the completion of each sampling event and will be maintained in the permanent project files.

2.4.3 *Daily Quality Control Reports*

Field data and pertinent QA/QC information will be recorded in Daily Quality Control Reports (DQCR) during all field activities. A sample DQCR form is presented in Appendix A. DQCRs will be prepared, signed, and dated by the field team leader. Copies of the DQCR sheets will be attached to annual LTM reports. If problems are encountered, H&S' PM will be notified by telephone and a copy of the relevant DQCR faxed as soon as possible for transmission to USACE's Technical Manager.

2.4.4 *Photographic Documentation*

A photographic record of all sampling locations will be prepared by the field team. New photographs will be obtained during subsequent sampling events only if site conditions change or new sample locations added. If film cameras are used, photographs and rolls of film will be numbered and recorded as appropriate in the field log books and on DQCR documentation, including identification of the subject and area photographed. Digital images will be downloaded from the digital media to the digital project files.

2.4.5 *Project File*

Project files will be maintained by H&S' PM and, after completion of field and analytical work, will include a minimum of the following project records:

- Project plans and specifications, if any
- Field log books and data records
- Photographs, maps, and drawings
- Sample identification documents
- Chain of custody records (copies)
- Analytical data package from the laboratory, including QC documentation
- Data review notes
- References and literature
- Report notes and calculations
- Progress and technical reports
- Correspondence and other pertinent information
- Authorizations (e.g., property access, well installation forms, etc.).

3.0 REPORTING

H&S will prepare an Annual Groundwater Sampling Report that includes a summary of field/sample collection efforts, tables providing the results of the sample analyses, figures mapping the groundwater surface elevation in both the overburden and bedrock, figures mapping the plume concentrations for VOCs, SVOCs, and metals in both overburden and bedrock, and conclusions on the effectiveness the GETS to capture and treat the contaminated groundwater plume. Validated laboratory data will also be submitted.

4.0 REFERENCES

Conti Environmental Services, Inc. 2007. *June 2007 Groundwater Sampling Report, GCL Tie and Treating Superfund Site, Operable Unit 2, Sidney, New York.* September.

Lockheed Martin, 2008. Letter re: GCL Tie and Treating, Sidney, New York Trip Report, Work Assignment #0-286. August.

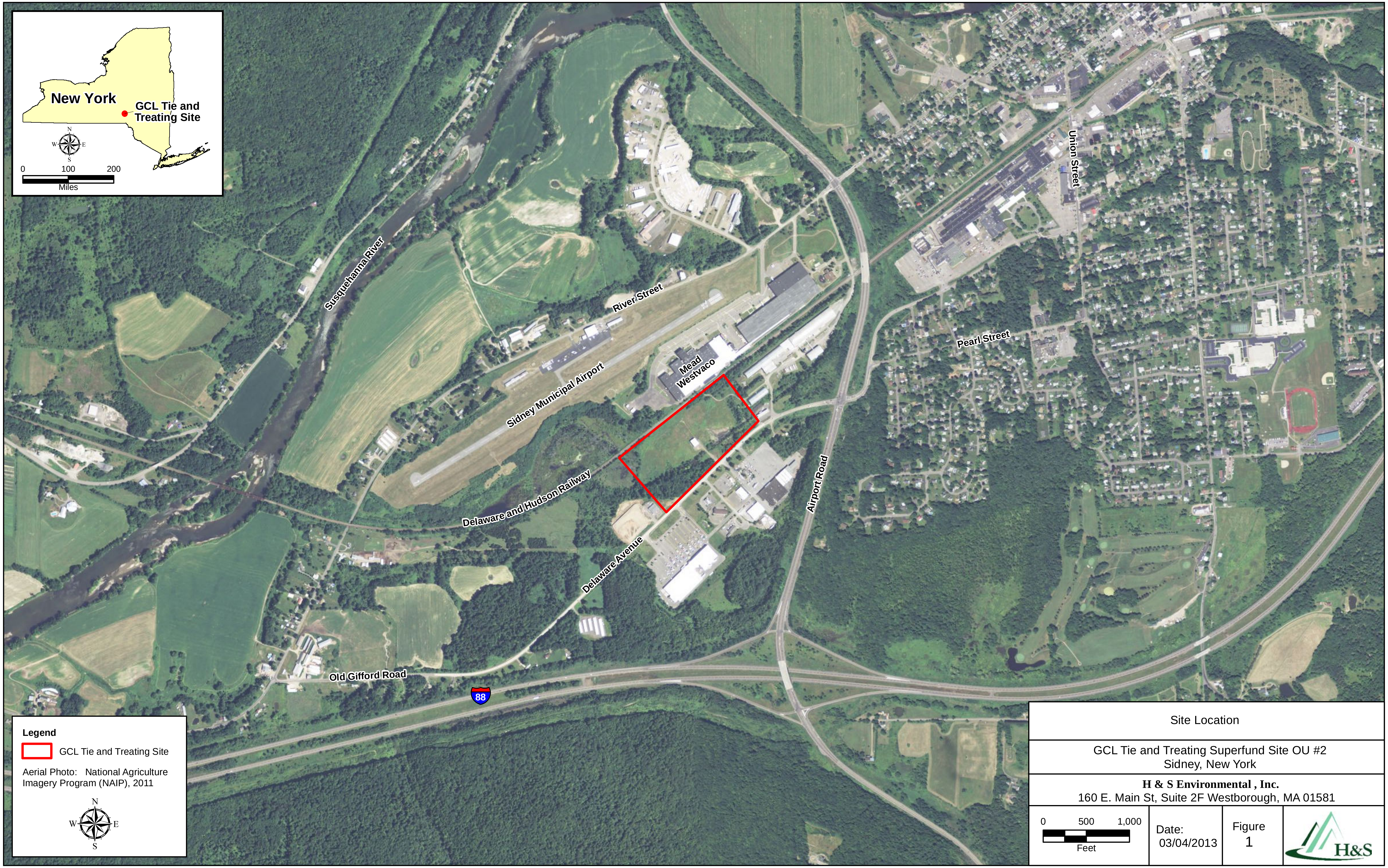
U.S. Army Corps of Engineers (USACE), 2001. EM-200-1-3 *Requirements for the Preparation of Sampling and Analysis Plans*. February.

USEPA – Region 2, 1995. *Record of Decision, GCL Tie and Treating, OU-2, Sidney, New York*. March.

USEPA, 1996. *Ground Water Issue: Low-Flow (minimal drawdown) Ground-water Sampling Procedures.* July. Revision 2.

USEPA, 2008. *Five Year Review Report. GCL Tie and Treating, Village of Sidney, Delaware County, New York.* September.

FIGURES



Legend

▭ GCL Tie and Treating Site

Aerial Photo: National Agriculture Imagery Program (NAIP), 2011

Site Location

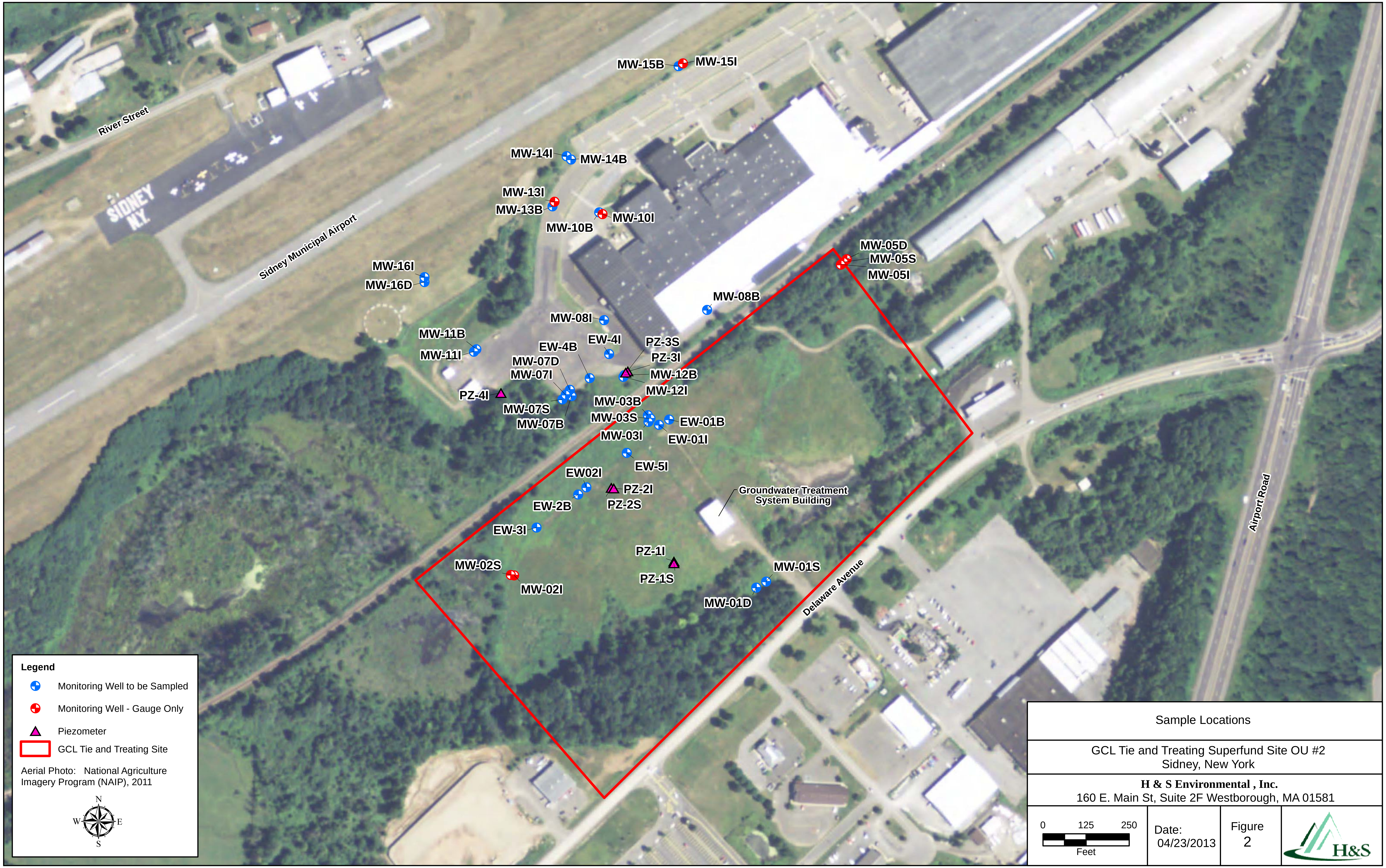
GCL Tie and Treating Superfund Site OU #2
Sidney, New York

H & S Environmental , Inc.
160 E. Main St, Suite 2F Westborough, MA 01581

Date: 03/04/2013

Figure 1

File: SNY_SiteLocation.mxd



Sample Locations

GCL Tie and Treating Superfund Site OU #2
Sidney, New York

H & S Environmental , Inc.
160 E. Main St, Suite 2F Westborough, MA 01581

Date:
04/23/2013

Figure
2

File: SNY_SampleLocations042313.mxd

TABLES

Table 1
Groundwater Sampling Event Summary
GCL OU-2 Site

Date	Event	Purpose/Explanation
June 22, 2004	Baseline Sampling	Characterize pre-pumping conditions
December 14, 2005	Groundwater Sampling	Assess contaminant levels at downgradient wells to re-characterize conditions since the plant was shut down and prior to the plan re-startup; a second abbreviated baseline round.
January 5, 2006	Extraction Well Sampling	Characterize extraction well water (influent) with samples collected at treatment plant
May 15, 2006	Groundwater Sampling	Characterize pumping conditions
June 7, 2007	Groundwater Sampling	Characterize pumping conditions
May 30, 2008	Groundwater Sampling	To determine if contaminated groundwater is increasing in depth as it migrates northward from the site.

Table 2
Well Information and Water Levels

Well	Screened/ Open Intervals (ft bgs)	Total Depth (as installed) (ft bgs)	Measured Total Depth (ft btoc)	Surveyed TOC Elevation (ft amsl)
Monitoring Wells				
MW-01S	8-22	22	16.65	997.13
MW-01D	65.2-75.2	75.2	75.19	995.66
MW-02S	11.9-21.9	21.9	22.04	995.88
MW-02I	27-37	37	37.02	995.06
MW-03S	10.3-20.3	20.3	20.05	993.08
MW-03I	51.9-61.9	61.9	59.54	994.51
MW-03B	96.9-133.3	133.3	132.31	996.13
MW-04S	NA	NA	NA	994.28
MW-05S	6.5-16.5	16.5	17.1	994.77
MW-05I	37.5-47.5	47.5	42.8	994.9
MW-05D	91.7-101.7	101.7	102	993.33
MW-07S	9.9-19.9	19.9	19.9	998.39
MW-07I	40.2-50.2	50.2	49.45	999.7
MW-07D	124.2-134.2	134.2	129.52	999.77
MW-07B	128-138	138	137.45	998.22
MW-08I	44.7-54.7	54.7	50.8	995.88
MW-08B	106.4-121.4	121.4	17.7	998.26
MW-08DI	100.2-110.2	NA	NA	NA
MW-10I	54.7-69.7	69.7	67.93	998.32
MW-10B	149.8-159.8	159.8	146.84	998.1
MW-11I	94.7-104.7	104.7	103.41	1002.49
MW-11B	149.7-169.7	169.7	169.27	1002.51
MW-12I	44.6-54.6	54.6	54.75	995.41
MW-12B	119.7-129.7	129.7	130.22	995.55
MW-13I	125-135	135	136.8	1003.92
MW-13B	159-169	169	170.54	1003.72
MW-14I	106.5-116.5	116.5	118.25	1005.25
MW-14B	178-188	188	189.94	1004.58
MW-15I	113-123	123	122.9	NA
MW-15B	179-189	189	188.56	NA
MW-16I	169.7-179.7	NA	NA	NA
MW-16D	232.1-252.1	NA	NA	NA
PZ-01S	7.1-17.1	17.1	16.92	994.52
PZ-01I	42.1-52.1	52.1	51.42	994.3
PZ-02S	7-17	17	16.8	995.37
PZ-02I	41.7-51.7	51.7	51.34	995.34
PZ-03S	4.6-14.6	14.6	14.4	995.33
PZ-03I	39.6-49.6	49.6	NA	995.14
PZ-04I	NA	NA	NA	999.68
Extraction Wells				
EW-1I	41.3-56.3	56.3	55.8	997.27
EW-1B	92.5-131	131	136	997.41
EW-2I	45.4-59.4	59.4	59.03	997.5
EW-2B	92-115.5	115.5	114.22	996.45
EW-3I	45.5-60.5	60.5	60.22	995.45
EW-4I	70.5-90.5	90.5	90.5	949.5
EW-4B	120.5-144	144	149	925
EW-5I	35.1-55.1	55.1	55.55	995.84

Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-1S								MW-1D							
				6/23/2004	12/2005	1/2006	5/15/2006	6/7/2007	5/30/2008	12/12/2011	5/9/2012	6/23/2004	12/2005	1/2006	5/15/2006	6/7/2007	5/30/2008	12/12/2011	5/9/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**1,020**	**6,700**	NS	**2,000**	**390**	NS	NS	NS	**371J**	**2,090**	NS	**4,400**	**2,600**
	Manganese Total	µg/L	300	NS	NS	NS	18.5	44.1	NS	28	10	NS	NS	NS	8.19J	18.9U	NS	120	46
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	92.5J	148	NS	**510**	33U	NS	NS	NS	10.2J	20.9J	NS	**470**	140
	Manganese	µg/L	300	NS	NS	NS	16.4J	16.6	NS	23	7	NS	NS	NS	2.92J	4.25J	NS	51	23
VOCs - SW8260B	Benzene	µg/L	1	1U	NS	NS	1U	1U	5U	0.25U	0.25U	1U	NS	NS	1U	1U	5U	0.25U	0.25U
	Carbon Tetrachloride	µg/L	5	NS	NS	NS	2U	2U	NS	0.50U	0.50U	NS	NS	NS	2U	2U	5U	0.50U	0.50U
	Chlorobenzene	µg/L	5	NS	NS	NS	2U	2U	5U	0.25U	0.25U	NS	NS	NS	NS	NS	NS	NS	0.25U
	Chloroform	µg/L	7	NS	NS	NS	2U	2U	5U	0.19J	0.14U	NS	NS	NS	2U	2U	5U	0.36J	0.34J
	Chloromethane	µg/L	NA	NS	NS	NS	5U	5U	5U	0.33U	0.33U	NS	NS	NS	5U	5U	5U	0.33U	0.33U
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	3.4	1.6 J	5U	5.6	2.5	NS	NS	NS	**8.3**	**7.1**	**10**	**16**	**18**
	1,2-Dichloroethane	µg/L	0.6	NS	NS	NS	0.59	2U	5U	0.76J	0.24J	NS	NS	NS	NS	NS	NS	NS	2.2
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	**25**	**11**	**21**	**45**	**17**	NS	NS	NS	**43**	**39**	**47**	**94**	**100**
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	3	1.4	NS	4.9	1.8	NS	NS	NS	**7.6**	**6.9**	**9.2**	**15**	**13**
	1,1-Dichloropropene	µg/L	NA	NS	NS	NS	2U	2U	NS	0.25U	0.25U	NS	NS	NS	N	N	NS	NS	0.25U
	Ethylbenzene	µg/L	5	2U	NS	NS	2U	2U	5U	0.11U	0.11U	2U	NS	NS	2U	2U	5U	0.11U	0.11U
	Methylene chloride	µg/L	5	NS	NS	NS	5U	5U	NS	1.0U	1.0U	NS	NS	NS	5U	5U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	2U	NS	NS	2U	2U	5U	0.20U	0.20U	2U	NS	NS	2U	2U	5U	0.20U	0.20U
	Trichloroethene	µg/L	5	NS	NS	NS	**11**	**9.4**	**7.5**	**13**	**5.3**	NS	NS	NS	**17**	**14**	**16**	**24**	**27**
	1,1,2,2-Tetrachloroethane	µg/L	NA	NS	NS	NS	2U	2U	5U	0.18U	0.18U	NS	NS	NS	NS	NS	NS	NS	0.18U
	Toluene	µg/L	5	2U	NS	NS	2U	2U	5U	0.33U	0.33U	2U	NS	NS	2U	2U	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	**13**	**8.4**	**11**	**16**	**9.3**	NS	NS	NS	**27**	**26**	**26**	**38**	**43**
	o-Xylene	µg/L	5	2U	NS	NS	2U	2U	5U	0.25U	0.25U	2U	NS	NS	2U	2U	5U	0.25U	0.25U
	m,p-Xylene	µg/L	5	2U	NS	NS	2U	2U	5U	0.20U	0.20U	2U	NS	NS	2U	2U	5U	0.20U	0.20U
	Vinyl Chloride	µg/L	2	NS	NS	NS	2U	2U	5U	0.18U	0.18U	NS	NS	NS	NS	NS	NS	NS	0.18U
	Naphthalene	µg/L	10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	1.2J	5U	7	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Acenaphthene	µg/L	20	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Acenaphthylene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Anthracene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Benzo(a)anthracene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Benzo(a)pyrene	µg/L	ND	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Benzo(b)fluoranthene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Benzo(k)fluoranthene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Chrysene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.045U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.045U	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Fluorene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Fluoranthene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	Naphthalene	µg/L	10	0.073J	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	NS	0.10U	0.097U
	Phenanthrene	µg/L	NA	0.12	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	13	0.10U	0.097U
	Pyrene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1U	5U	0.096U	0.099U	0.11U	NS	NS	0.1UJ	0.1U	5U	0.10U	0.097U
	1,4-Dioxane	µg/L	NA	NS	NS	NS	27	50U	NS	14J	6.9	NS	NS	NS	80	71	NS	46J	44

Notes:

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Results reported in µg/L unless otherwise specified

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Table 3
Groundwater Sampling Results Since System Startup

Method	**Analyte**	**Units**	**ROD Action Levels**[1]	**MW-03S**									
				3/13/2000	**3/13/2000 DUP**	**6/2004**	**12/2005**	**1/2006**	**5/15/2006**	**6/10/2007**	**5/30/2008**	**12/12/2011**	**5/10/2012**
Total Metals - SW6020	Iron	µg/L	300	2.06J	1.34	NS	NS	NS	212	225	NS	**570**	**390**
	Manganese	µg/L	300	NS	NS	NS	NS	NS	**11,700**	**11,700**	NS	**10,000**	**10,000**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	NS	183	143	NS	**640**	280
	Manganese	µg/L	300	NS	NS	NS	NS	NS	**12,100**	**11,000**	NS	**11,000**	**9,300**
VOCs - SW8260B	Acetone	µg/L	NA	45J	44J	NS	NS	NS	100U	100U	10U	NS	NS
	2-Butanone	µg/L	NA	4J	3J	NS	NS	NS	NA	100U	10U	NS	NS
	n-Butylbenzene	µg/L	5	5U	5U	NS	NS	NS	20U	20U	NS	NS	NS
	sec-Butylbenzene	µg/L	5	**100**	5U	NS	NS	NS	20U	20U	NS	NS	NS
	tert-butylbenzene	µg/L	5	5U	5U	NS	NS	NS	20U	20U	NS	NS	NS
	1,2-Dichlorobenzene	µg/L	3	5U	5U	NS	NS	NS	20U	20U	NS	NS	NS
	Isopropylbenzene	µg/L	5	**13**	**11**	NS	NS	NS	**8.4J**	**13J**	**16**	NS	NS
	n-Propylbenzene	µg/L	5	5U	5	NS	NS	NS	20U	**5.6J**	NS	NS	NS
	Benzene	µg/L	1	**47**	**49**	NS	NS	NS	**48**	**30**	**28**	**15**	**6.5**
	Ethylbenzene	µg/L	5	**140DJ**	**210DJ**	NS	NS	NS	**120**	**140**	**150**	**96**	**56**
	Methylene chloride	µg/L	5	5U	5U	NS	NS	NS	50U	5.2U	NS	10U	10U
	Styrene	µg/L	5	**170**	**150**	NS	NS	NS	**79**	**91**	**83**	**36**	**44**
	Toluene	µg/L	5	**170DJ**	**200DJ**	NS	NS	NS	**230**	**190**	**190**	**120**	**66**
	1,1,1-Trichloroethane	µg/L	5	5U	5U	NS	NS	NS	20U	20U	NS	5.0U	5.0U
	1,2,4-trimethylbenzene	µg/L	5	**270DJ**	NS	NS	NS	NS	**270**	**350**	NS	**370**	**150**
	1,3,5-trimethylbenzene	µg/L	5	**150DJ**	**120**	NS	NS	NS	**110**	**150**	NS	**150**	**62**
	o-Xylene	µg/L	5	NS	NS	NS	NS	NS	**260**	**270**	**210**	**170**	**100**
	m,p-Xylene	µg/L	5	**690D**	**840D**	NS	NS	NS	**450**	**490**	**400**	**330**	**190**
	Naphthalene	µg/L	10	**14,000D**	**13,000D**	NS	NS	NS	**9,900**	**12,000J**	**15,000K**	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	2,400J	3,200	NS	NS	NS	750	960J	3,200L	770	390
	Acenaphthene	µg/L	20	**1,800**	**1,900**	NS	NS	NS	**320J**	**410J**	**2,600**	**180**	**190**
	Acenaphthylene	µg/L	NA	1,000U	1,000U	NS	NS	NS	19	22R	110	19 U	13J
	Anthracene	µg/L	NA	2J	300	NS	NS	NS	20	24R	690	19U	9.7U
	Benzo(a)anthracene	µg/L	50	**300J**	**400**	NS	NS	NS	7.1J	13	**870**	19U	9.7U
	Benzo(a)pyrene	µg/L	ND	200U	200U	NS	NS	NS	**2.1J**	**6.2J**	**300**	19U	9.7U
	Benzo(b)fluoranthene	µg/L	50	200U	200U	NS	NS	NS	4J	4.7J	**500**	19U	9.7U
	Benzo(g,h,i)perylene	µg/L	NA	200U	200U	NS	NS	NS	0.62J	2J	35	19U	9.7U
	Benzo(k)flouranthene	µg/L	NA	200U	200U	NS	NS	NS	1.2J	2.9J	100	19U	9.7U
	Chrysene	µg/L	50	**240J**	**320**	NS	NS	NS	5J	10J	**580**	8.6U	4.4U
	Dibenzo(a,h)anthracene	µg/L	NA	200U	200U	NS	NS	NS	0.22J	0.7J	12	19U	9.7U
	Fluorene	µg/L	50	**1,000**	**1,200**	NS	NS	NS	**140**	**190J**	**2,000**	**79**	**92**
	Fluoranthene	µg/L	50	**1,700J**	**2,200**	NS	NS	NS	**62J**	**96J**	**2,900**	26J	21
	Indeno(1,2,3-cd)pyrene	µg/L	NA	200U	200U	NS	NS	NS	0.76J	1.9J	51	19U	9.7U
	Naphthalene	µg/L	10	**13,000**	**12,000**	NS	NS	NS	**6,200**	**6,000R**	NS	**6,300B**	**2,800**
	Phenanthrene	µg/L	NA	3,000J	3,800	NS	NS	NS	180	260J	6,600	75	74
	Pyrene	µg/L	NA	1,100J	1,400	NS	NS	NS	37J	60J	2,200	19U	14J

Notes:

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-03I									
				3/13/20001	6/28/2004	6/28/2004 DUP	12/2005	1/2006	5/17/2006	6/10/2007	5/30/2008	12/12/2011	5/10/2012
Total Metals - SW6020	Iron	µg/L	300	2.67	NS	NS	NS	NS	**3,020**	**1,660**	NS	**2,000**	**4,300**
	Manganese	µg/L	300	NS	NS	NS	NS	NS	**11,500**	**14,500**	NS	**39,000**	**46,000**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	NS	**1,800**	**1,430**	NS	**2,100**	**3,200**
	Manganese	µg/L	300	NS	NS	NS	NS	NS	**13,200**	**15,700**	NS	**42,000**	**44,000**
VOCs - SW8260B	1,2-Dichlorobenzene	µg/L	3	5U	NS	NS	NS	NS	20U	20U	5U	NS	NS
	Isopropylbenzene	µg/L	5	4J	NS	NS	NS	NS	**5.2J**	**7.9J**	**13**	NS	NS
	4-Methyl-2-pentanone	µg/L	NA	5U	NS	NS	NS	NS	100U	100U	NS	NS	NS
	n-Propylbenzene	µg/L	5	5U	NS	NS	NS	NS	20U	20U	NS	NS	NS
	Benzene	µg/L	1	**88**	**41**	**41**	NS	NS	**98**	**110**	**180**	**69**	**100**
	Chloroform	µg/L	7	5U	NS	NS	NS	NS	20U	20U	5U	0.70U	0.70U
	Chloromethane	µg/L	NA	5U	NS	NS	NS	NS	50U	50U	5U	1.7U	1.7U
	1,1-Dichloroethane	µg/L	5	**6**	NS	NS	NS	NS	20U	20U	5U	3.2J	**6.7**
	1,2-Dichloroethane	µg/L	0.6	5U	NS	NS	NS	NS	20U	20U	5U	0.50U	0.50U
	cis -1,2-Dichloroethene	µg/L	5	**19**	NS	NS	NS	NS	20U	20UJ	5U	**6.4J**	**13**
	1,1-Dichloroethene	µg/L	5	3J	NS	NS	NS	NS	10U	10U	5U	1.2J	2.6J
	Ethylbenzene	µg/L	5	1J	2U	1J	NS	NS	**18J**	**23**	5U	**20**	**61**
	Methylene chloride	µg/L	5	5U	NS	NS	NS	NS	50U	50U	5U	5.0U	5.0U
	Methyl tert-butyl ether	µg/L	NA	NS	2U	2U	NS	NS	20U	20U	5U	1.0U	1.0U
	Styrene	µg/L	5	NS	NS	NS	NS	NS	**43**	20U	5U	**8.6J**	**30**
	Trichloroethene	µg/L	5	**21**	NS	NS	NS	NS	20U	20U	5U	1.4J	3.3J
	Toluene	µg/L	5	5U	0.97	1J	NS	NS	**64**	20U	5U	**11**	**47**
	1,1,1-Trichloroethane	µg/L	5	**12**	NS	NS	NS	NS	20U	20U	5U	2.5U	2.5U
	1,2,4-Trimethylbenzene	µg/L	5	5	NS	NS	NS	NS	**92**	**110**	NS	**40**	**94**
	1,3,5-Trimethylbenzene	µg/L	5	2J	NS	NS	NS	NS	**28**	**38**	NS	**7.7J**	**39**
	o-Xylene	µg/L	5	NS	**59**	**59**	NS	NS	**140**	**140**	**150**	**140**	**210**
	m,p-Xylene	µg/L	5	**46**	**19**	**20**	NS	NS	**170**	**44**	**12**	**47**	**100**
	Napthalene	µg/L	10	**11**	NS	NS	NS	NS	**4,100**	**1,600J**	**140**	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	10U	17	17	NS	NS	110	7.2R	6.3	24	56
	Acenaphthene	µg/L	20	**54**	**45**	**45**	NS	NS	**33J**	**29R**	**62**	**49**	**53**
	Acenaphthylene	µg/L	NA	10U	4.4	4.6	NS	NS	2.3	1.7J	5U	9.4U	5.0U
	Anthracene	µg/L	NA	2U	15R	0.37	NS	NS	0.22	0.21J	5U	9.4U	5.0U
	Benzo(a)anthracene	µg/L	50	2U	0.11U	0.11U	NS	NS	0.11UJ	0.1J	5U	9.4U	5.0U
	Benzo(a)pyrene	µg/L	ND	2U	0.11U	0.11U	NS	NS	0.11UJ	0.11UJ	5U	9.4U	5.0U
	Benzo(b)fluoranthene	µg/L	50	2U	0.11U	0.11U	NS	NS	0.054J	0.13J	5U	9.4U	5.0U
	Benzo(g,h,i)perylene	µg/L	NA	2U	0.11U	0.11U	NS	NS	0.11UJ	0.11UJ	5U	9.4U	5.0U
	Benzo(k)flouranthene	µg/L	NA	2U	0.11U	0.11U	NS	NS	0.11UJ	0.11UJ	5U	9.4U	5.0U
	Chrysene	µg/L	50	2U	0.11U	0.11U	NS	NS	0.11UJ	0.079J	5U	4.2U	2.2U
	Dibenzo(a,h)anthracene	µg/L	NA	2U	0.11U	0.11U	NS	NS	0.11UJ	0.11UJ	5U	9.4U	5.0U
	Fluorene	µg/L	50	25	27	27	NS	NS	8.4	6.1J	14	12J	18
	Fluoranthene	µg/L	50	2U	0.11U	0.089	NS	NS	0.11UJ	0.42J	5U	9.4U	5.0U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	2U	0.11U	0.11U	NS	NS	0.11UJ	0.11UJ	5U	9.4U	5.0U
	Naphthalene	µg/L	10	**14**	**17**	**16**	NS	NS	**2,800**	**440J**	NS	**1,600**	**2,000**
	Phenanthrene	µg/L	NA	5.1	16J	16	NS	NS	3.4	1.3J	5U	9.4U	11
	Pyrene	µg/L	NA	2U	0.11U	0.058	NS	NS	0.054J	0.28J	5U	9.4U	5.0U

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Table 3

Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-03B								
				4/11/2001	6/2004	12/2005	1/2006	5/17/2006	6/10/2007	5/30/2008	12/12/2011	5/10/2012
Total Metals - SW6020	Iron	µg/L	300	1.47	NS	NS	NS	4,380	5,400	NS	2,500	3,100
	Manganese	µg/L	300	NS	NS	NS	NS	604	1,340	NS	370	540
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	360	1,200	NS	1,500	500
	Manganese	µg/L	300	NS	NS	NS	NS	528	1,240	NS	360	450J
VOCs - SW8260B	Isopropylbenzene	µg/L	5	3J	NS	NS	NS	20U	5.8J	6.8	NS	NS
	n-Propylbenzene	µg/L	5	1J	NS	NS	NS	20U	20U	NS	NS	NS
	Benzene	µg/L	1	2J	NS	NS	NS	10U	6.6J	15	5.9J	16
	1,1-Dichloroethane	µg/L	5	9	NS	NS	NS	8.3J	9.4J	9.6	23	18
	1,2-Dichloroethane	µg/L	0.6	2J	NS	NS	NS	20U	20UJ	5U	2.3J	1.0U
	cis-1,2-Dichloroethene	µg/L	5	45	NS	NS	NS	48	57	63	210	140
	1,1-Dichloroethene	µg/L	5	7	NS	NS	NS	10U	6.2J	15	6.1J	4.9J
	Ethylbenzene	µg/L	5	20	NS	NS	NS	20U	40	25	35	52
	Methylene chloride	µg/L	5	NS	NS	NS	NS	NS	5.9U	5U	10U	10U
	Styrene	µg/L	5	16	NS	NS	NS	20U	23	11	5.7J	20
	Trichloroethene	µg/L	5	28	NS	NS	NS	24	30	49	19J	19
	Toluene	µg/L	5	18	NS	NS	NS	5.5J	38	21	34	56
	1,1,1-Trichloroethane	µg/L	5	28	NS	NS	NS	21	23	29	10J	11
	1,2,4-Trimethylbenzene	µg/L	5	78	NS	NS	NS	26	140	NS	57	120
	1,3,5-Trimethylbenzene	µg/L	5	40	NS	NS	NS	12J	66	NS	26	52
	o-Xylene	µg/L	5	NS	NS	NS	NS	12J	90	68	47	100
	m,p-Xylene	µg/L	5	120	NS	NS	NS	21	190	140	110	220
	Naphthalene	µg/L	10	3500D	NS	NS	NS	1,800	9,500J	1,900	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	850	NS	NS	NS	97	890J	1,000	380J	610
	Acenaphthene	µg/L	20	420	NS	NS	NS	110J	330J	510	140J	210
	Acenaphthylene	µg/L	NA	7.9U	NS	NS	NS	5.5	23R	29	9.7U	97U
	Anthracene	µg/L	NA	42	NS	NS	NS	18	31R	21	12J	97U
	Benzo(a)anthracene	µg/L	50	41	NS	NS	NS	27J	33	5U	9.7U	97U
	Benzo(a)pyrene	µg/L	ND	1.8U	NS	NS	NS	9J	17J	5U	9.7U	97U
	Benzo(b)fluoranthene	µg/L	50	3.2U	NS	NS	NS	17J	20J	5U	9.7U	97U
	Benzo(g,h,i)perylene	µg/L	NA	2.8U	NS	NS	NS	3J	6.6J	5U	9.7U	97U
	Benzo(k)flouranthene	µg/L	NA	1.3U	NS	NS	NS	5.8J	17R	5U	9.7U	97U
	Chrysene	µg/L	50	1.8U	NS	NS	NS	17J	26R	5U	4.5J	44U
	Dibenzo(a,h)anthracene	µg/L	NA	4.8U	NS	NS	NS	1.1J	9.4J	5U	9.7U	97U
	Fluorene	µg/L	50	230	NS	NS	NS	78	170J	280	68	100J
	Fluoranthene	µg/L	50	230	NS	NS	NS	110J	110J	39	22J	97U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	2.7U	NS	NS	NS	3.6J	2.4J	5U	9.7U	97U
	Naphthalene	µg/L	10	2,300	NS	NS	NS	240	5,400R	NS	2,800	5,800
	Phenanthrene	µg/L	NA	520	NS	NS	NS	130	280J	320	100J	110J
	Pyrene	µg/L	NA	150	NS	NS	NS	66J	71J	24	15J	97U

Notes:

[1] The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

NA = Not Applicable

ND = DEC Groundwater Standard is a Non-Detected Concentration

NS= Not Sampled

Results reported in µg/L unless otherwise specified

79 = Exceedance in the ROD or ARAR Action Levels

Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-7I								MW-07D								
				6/26/2004	12/2005	1/2006	5/17/2006	6/9/2007	5/30/2008	12/13/2011	5/9/2012	7/28/2001	6/2004	12/2005	1/2006	5/17/2006	6/9/2007	5/30/2008	12/13/2011	5/9/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	42.6J	138 U	NS	59 J	230J	NS	NS	NS	NS	26 J	21.5 U	NS	72J	150J
	Manganese	µg/L	300	NS	NS	NS	254J	241	NS	**350**	**380**	NS	NS	NS	NS	232	124	NS	**520**	**820**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	8.28	13	NS	33 U	33U	NS	NS	NS	NS	100 J	6.58 J	NS	33U	33U
	Manganese	µg/L	300	NS	NS	NS	261	252	NS	**370**	300J	NS	NS	NS	NS	207	87.1 B	NS	**650**	**1,100J**
VOCs - SW8260B	Acetone	µg/L	NA	NS	NS	NS	4.6U	10U	10U	NS	NS	NS	NS	NS	NS	NS	23U	10U	NS	NS
	2-Butanone	µg/L	NA	NS	NS	NS	10U	10U	10U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	n-Butylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	250U	NS	NS	NS	2U	2U	NS	NS	NS
	sec-Butylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	250U	NS	NS	NS	2U	2U	NS	NS	NS
	tert-Butylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	250U	NS	NS	NS	2U	2U	NS	NS	NS
	Isopropylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	250U	NS	NS	NS	2U	2U	NS	NS	NS
	n-Propylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	250U	NS	NS	NS	2U	2U	NS	NS	NS
	4-methyl-2-pentanone	µg/L	NA	NS	NS	NS	10U	10U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Benzene	µg/L	1	1.0U	NS	NS	1U	1U	5U	0.25 U	0.25U	250U	NS	NS	NS	**1.4**	**2.5**	5U	0.44J	0.32J
	Chlorobenzene	µg/L	5	NS	NS	NS	2U	2U	5U	0.25 U	0.25U	NS	NS	NS	NS	NS	NS	NS	NS	0.25U
	Chloroform	µg/L	7	NS	NS	NS	NS	NS	NS	NS	0.14U	250U	NS	NS	NS	2U	2U	5U	0.14U	0.14U
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.25U	250U	NS	NS	NS	2.5	2.8	5U	2.2	2.6
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	2U	2UJ	5U	0.15 U	0.15U	250U	NS	NS	NS	**8.9**	**8.6**	**6.3**	**6.2**	**8.9**
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.11U	250U	NS	NS	NS	1.6	1.3	5U	0.85J	1.4
	Ethylbenzene	µg/L	5	2.0U	NS	NS	2U	2U	5U	0.11 U	0.11U	**51J**	NS	NS	NS	2U	1.5J	5U	0.50J	0.34J
	Methylene chloride	µg/L	5	NS	NS	NS	5U	5U	5U	1.0 U	1.0U	250U	NS	NS	NS	5U	0.81 U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	2.0U	NS	NS	2U	2U	5U	0.20 U	0.20U	NS	NS	NS	NS	NS	NS	NS	NS	0.20U
	Styrene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.11U	250U	NS	NS	NS	2U	0.67 J	5U	0.19J	0.20J
	Trichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.13U	250U	NS	NS	NS	**12**	**10**	**11**	5	**6.3**
	Toluene	µg/L	5	2.0U	NS	NS	2U	2U	5U	0.33 U	0.33U	**52J**	NS	NS	NS	2U	2U	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.50U	250U	NS	NS	NS	**7.3**	4.6	5U	2	3.3
	1,2,4-trimethylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.33U	**150J**	NS	NS	NS	1.5J	**12**	NS	**5.3**	4.4
	1,3,5-trimethylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.33U	**64J**	NS	NS	NS	0.65J	**5.5**	NS	3.1	2.3
	o-Xylene	µg/L	5	2.0U	NS	NS	2U	2U	5U	0.25 U	0.25U	NA	NS	NS	NS	2U	4.2	5U	0.88J	0.60J
	m,p-Xylene	µg/L	5	2.0U	NS	NS	2U	2U	5U	0.20 U	0.20U	**340**	NS	NS	NS	0.87J	**7.7**	5U	2.3	1.5J
	Naphthalene	µg/L	10	NS	NS	NS	1.7J	1.2J	5U	NS	NS	**8800**	NS	NS	NS	**60**	**130 R**	NS	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	0.10U	NS	NS	0.11U	0.1UJ	5U	0.095 U	0.097U	570P	NS	NS	NS	23	58 J	29	87	48
	Acenaphthene	µg/L	20	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	500U	NS	NS	NS	14J	**31 R**	**18**	**61**	**43**
	Acenaphthylene	µg/L	NA	0.10U	NS	NS	0.11U	0.1UJ	5U	0.095 U	0.097U	500U	NS	NS	NS	0.57	1.8 J	5U	4.7UJ	1.6
	Anthracene	µg/L	NA	0.10U	NS	NS	0.11U	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	1.9	3.3 J	5U	4.7UJ	4.5J
	Benzo(a)anthracene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	0.45J	0.81	5U	4.7UJ	1.7J
	Benzo(a)pyrene	µg/L	ND	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	**0.14J**	**0.22 J**	5U	4.7UJ	**0.52J**
	Benzo(b)fluoranthene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	0.22J	0.37 J	5U	4.7UJ	0.49U
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	0.04J	0.14 J	5U	4.7U	0.49U
	Benzo(k)fluoranthene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	0.08J	0.13 J	5U	4.7UJ	0.49U
	Chrysene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.043 U	0.044U	100U	NS	NS	NS	0.26J	0.42 J	5U	2.2J	1.0
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	0.11UJ	0.25 J	5U	4.7U	0.49U
	Fluorene	µg/L	50	0.10U	NS	NS	0.11U	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	11	19 R	12	40J	32J
	Fluoranthene	µg/L	50	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	6.3J	8.4 J	5U	20J	22J
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	0.11UJ	0.10 UJ	5U	4.7U	0.49U
	Naphthalene	µg/L	10	0.10U	NS	NS	0.06J	0.1R	NS	0.095 U	0.097U	2500	NS	NS	NS	**36**	**27 R**	NS	**220**	**93**
	Phenanthrene	µg/L	NA	0.10U	NS	NS	0.11U	0.1UJ	5.8	0.095 U	0.097U	110	NS	NS	NS	23	26 R	22	71J	71
	Pyrene	µg/L	NA	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095 U	0.097U	100U	NS	NS	NS	4J	4.6 J	5U	15J	15J

Notes:

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-8DI	MW-8I							
				6/2/2008	6/26/2004	12/2005	1/2006	05/16/06	06/09/07	6/6/2008	12/13/2011	5/8/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	**2,360**	**3,190**	NS	**620**	**2,300**
	Manganese	µg/L	300	NS	NS	NS	NS	**1,230**	**1,200**	NS	**950**	**1,100**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	41.4J	19.8J	NS	33U	33U
	Manganese	µg/L	300	NS	NS	NS	NS	**438**	**522**	NS	**450**	**320**
VOCs - SW8260B	Isopropylbenzene	µg/L	5	NS	NS	NS	NS	2U	2U	5U	NS	NS
	4-Isopropyltoluene	µg/L	5	NS	NS	NS	NS	2U	2U	NS	0.33U	NS
	Benzene	µg/L	1	5U	0.79J	NS	NS	1U	1U	5U	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	5U	NS	NS	NS	NS	NS	NS	NS	0.25U
	1,2-Dichloroethane	µg/L	0.6	5U	NS	NS	NS	NS	NS	NS	NS	0.10U
	cis -1,2-Dichloroethene	µg/L	5	5U	NS	NS	NS	NS	NS	NS	NS	0.15U
	1,1-Dichloroethene	µg/L	5	5U	NS	NS	NS	NS	NS	NS	NS	0.11U
	Ethylbenzene	µg/L	5	5U	2U	NS	NS	2U	2U	5U	0.11U	0.11U
	Methylene chloride	µg/L	5	5U	NS	NS	NS	NA	0.59U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	5U	2U	NS	NS	2U	2U	5U	0.20U	0.20U
	Trichloroethene	µg/L	5	5U	NS	NS	NS	NS	NS	NS	NS	0.13U
	Toluene	µg/L	5	5U	2U	NS	NS	2U	2U	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	5U	NS	NS	NS	NS	NS	NS	NS	0.50U
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	2U	2U	NS	0.33U	0.33U
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	2U	2U	NS	0.33U	0.33U
	o-Xylene	µg/L	5	5U	2U	NS	NS	2U	2U	5U	0.25U	0.25U
	m,p-Xylene	µg/L	5	5U	2U	NS	NS	2U	2U	5U	0.20U	0.20U
	Naphthalene	µg/L	10	5U	NA	NS	NS	0.068 J	5 R	5U	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	5U	0.094J	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Acenaphthene	µg/L	20	5U	0.4	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Acenaphthylene	µg/L	NA	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Anthracene	µg/L	NA	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Benzo(a)anthracene	µg/L	50	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Benzo(a)pyrene	µg/L	ND	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Benzo(b)fluoranthene	µg/L	50	5U	0.10U	NS	NS	0.068J	0.11U	5U	0.12U	0.10U
	Benzo(g,h,i)perylene	µg/L	NA	5U	0.10U	NS	NS	0.036J	0.11U	5U	0.12U	0.10U
	Benzo(k)flouranthene	µg/L	NA	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Chrysene	µg/L	50	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.056U	0.045U
	Dibenzo(a,h)anthracene	µg/L	NA	5U	NS	NS	NS	NS	NS	NS	NS	0.10U
	Fluorene	µg/L	50	5U	0.062J	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Fluoranthene	µg/L	50	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	5U	0.10U	NS	NS	0.12	0.11U	5U	0.12U	0.10U
	Naphthalene	µg/L	10	NS	**41**	NS	NS	5U	0.064J	NS	0.12U	0.10U
	Phenanthrene	µg/L	NA	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	Pyrene	µg/L	NA	5U	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.10U
	1,4-Dioxane	µg/L	NA	NS	0.10U	NS	NS	0.1U	0.11U	5U	0.12U	0.31U

Notes:

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NS= Not Sampled

Results reported in µg/L unless otherwise specified

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-10I						MW-10B							
				6/24/2004	12/18/2005	1/2006	5/2006	6/9/2007	6/4/2008	6/24/2004	12/18/2005	1/2006	5/17/2006	6/9/2007	6/4/2008	12/14/2011	5/8/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	**432**	NS	NS	NS	NS	**2,530**	**16,000**	NS	**5,000**	**1,000**
	Manganese	µg/L	300	NS	NS	NS	NS	**520**	NS	NS	NS	NS	43.2	237U	NS	**330**	110
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	24.9J	NS	NS	NS	NS	100U	14.0J	NS	33U	33U
	Manganese	µg/L	300	NS	NS	NS	NS	**428**	NS	NS	NS	NS	1.06J	2.3U	NS	140	79
VOCs - SW8260B	Isopropylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	4-Isopropyltoluene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Benzene	µg/L	1	1U	1U	NS	NS	1.0U	5U	1U	1U	NS	1U	1U	5U	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	3.2	NS	2.5	2.3	5U	0.25U	0.25U
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	**6**	NS	**5.5**	**5.5**	5U	0.15U	0.15U
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.77J	NS	0.75J	0.54J	5U	0.11U	0.11U
	Ethylbenzene	µg/L	5	2U	2U	NS	NS	2.0U	5U	2U	2U	NS	2U	2U	5U	0.11U	0.11U
	Methylene chloride	µg/L	5	NS	NS	NS	NS	0.66U	5U	NS	NS	NS	NA	0.65U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	2U	2U	NS	NS	2.0U	5U	2U	2U	NS	2U	2U	5U	0.20U	0.20U
	Trichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	3.8	NS	3.6	3.2	5U	0.13U	0.13U
	1,1,2,2-Tetrachloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	2U	NS	2U	2U	NS	NS	0.18U
	Toluene	µg/L	5	2U	2U	NS	NS	2.0U	5U	2U	2U	NS	2U	0.62J	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	2U	NS	2U	2U	5U	0.15U	0.50U
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.33U
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.33U
	o-Xylene	µg/L	5	2U	2U	NS	NS	2.0U	5U	2U	2U	NS	2U	2U	5U	0.25U	0.25U
	m,p-Xylene	µg/L	5	2U	2U	NS	NS	2.0U	5U	2U	2U	NS	2U	2U	5U	0.20U	0.20U
	Naphthalene	µg/L	10	NS	5U	NS	NS	5.0R	5U	NS	5.3	NS	7.6	3.6R	5U	NS	NS
SVOCs - SW8270C	Dibenzofuran	µg/L	NA	NS	NS	NS	NS	0.11U	5U	NS	NS	NS	NS	NS	NS	NS	NS
	2-Methylnaphthalene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	1.1	0.92	NS	0.74	0.16	5U	0.095U	0.098U
	Acenaphthene	µg/L	20	0.10U	0.10U	NS	NS	0.11U	5U	0.93	0.61	NS	0.59J	0.055J	5U	0.095U	0.098U
	Acenaphthylene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.057J	NS	0.11U	0.1U	5U	0.095U	0.098U
	Anthracene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11U	0.1U	5U	0.095U	0.098U
	Benzo(a)anthracene	µg/L	50	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Benzo(a)pyrene	µg/L	ND	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Benzo(b)fluoranthene	µg/L	50	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Benzo(k)fluoranthene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Chrysene	µg/L	50	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.043U	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.041J	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Fluorene	µg/L	50	0.10U	0.10U	NS	NS	0.11U	5U	0.4	0.24	NS	0.25	0.1U	5U	0.095U	0.098U
	Fluoranthene	µg/L	50	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	0.052J	NS	NS	0.11U	5U	0.10U	0.052J	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	Naphthalene	µg/L	10	0.10U	0.10U	NS	NS	0.11U	NS	**11**	7.1	NS	7.4	2.6	NS	0.68	0.41
	Phenanthrene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.29	0.2	NS	0.22	0.1U	5U	0.095U	0.098U
	Pyrene	µg/L	NA	0.10U	0.10U	NS	NS	0.11U	5U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.095U	0.098U
	1,4-Dioxane	µg/L	NA	NS	NS	NS	NS	NS	NS	NS	40J	NS	50U	50U	NS	0.29U	0.30U

Notes:

[1] The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

NA = Not Applicable

ND = DEC Groundwater Standard is a Non-Detected Concentration

NS= Not Sampled

Results reported in µg/L unless otherwise specified

79 = Exceedance in the ROD or ARAR Action Levels

Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-11I											MW-11B								
				6/25/2004	12/18/2005	1/2006	5/16/2006	6/8/2007	6/8/2007 Dup	5/30/2008	12/14/2011	12/14/2011 Dup	5/7/2012	5/7/2012 DUP	6/29/2004	12/18/2005	1/2006	5/16/2006	6/8/2007	5/30/2008	6/6/2008	12/14/2011	5/7/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**1,030**	**1,780**	**1,840**	NS	**4,300**	**4,200**	**3,500**	**3,400**	NS	NS	NS	**1,010**	**603**	NS	NS	**470**	**470**
	Manganese	µg/L	300	NS	NS	NS	**477**	**659**	**701**	NS	**2,300**	**2,200**	**2,000**	**2,100**	NS	NS	NS	22.1	33.4U	NS	NS	250	75
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**361**	**1,220**	**1,280**	NS	**3,200**	**3,200**	**2,100**	**2,000**	NS	NS	NS	100U	24.3J	NS	NS	45J	33U
	Manganese	µg/L	300	NS	NS	NS	**494**	**694**	**726**	NS	**2,500**	**2,500**	**2,100**	**2,000**	NS	NS	NS	15U	16.7	NS	NS	200	66
VOCs - SW8260B	Acetone	µg/L	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	5U	10U	NS	10U	10U	10U	NS	NS	NS
	Benzene	µg/L	1	**1.2**	1U	NS	1U	1U	1U	5U	0.25U	0.25U	0.25U	0.25U	1U	1U	NS	1U	1U	5U	NS	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	NS	0.78J	NS	0.77J	2U	2U	5U	0.25U	0.25U	0.25U	0.25U	2J	2.5	NS	2.2	1.6J	5U	NS	0.92J	0.66J
	1,2-Dichloroethane	µg/L	0.6	NS	2U	NS	2U	2U	2U	5U	0.10U	0.10U	0.10U	0.10U	**1J**	2U	NS	2U	2U	5U	NS	0.10U	0.10U
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.15U	0.15U	**6**	4.6	NS	4.3	3.2	5U	NS	1.9	1.4
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.11U	0.11U	1J	0.71J	NS	0.53J	0.66J	5U	NS	0.54J	0.26J
	Ethylbenzene	µg/L	5	2U	2U	NS	2U	2U	2U	5U	0.11U	0.11U	0.11U	0.11U	**5.9**	1J	NS	0.75J	2U	5U	NS	0.11U	0.11U
	Methyl tert-butyl ether	µg/L	NA	2U	2U	NS	2U	2U	2U	5U	0.20U	0.20U	0.20U	1.0U	2U	2U	NS	2U	2U	5U	NS	0.20U	0.20U
	Trichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.13U	0.13U	**6**	2.7	NS	2.8	2.9	5U	NS	2.4	1.4
	Toluene	µg/L	5	2U	2U	NS	2U	2U	2U	5U	0.33U	0.33U	0.33U	0.33U	3.7	1J	NS	0.8J	2U	5U	NS	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.50U	0.50U	**6**	2U	NS	0.55J	0.64J	5U	NS	1.3	0.58J
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.33U	0.33U	5	1.6J	NS	1.2J	0.72J	NS	NS	0.33U	0.33U
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.33U	0.33U	2J	0.76J	NS	0.58J	2U	NS	NS	0.33U	0.33U
	o-Xylene	µg/L	5	2U	2U	NS	2U	2U	2U	5U	0.25U	0.25U	0.25U	0.25U	**9.4**	1.5J	NS	1.4J	0.77J	5U	NS	0.25U	0.25U
	m,p-Xylene	µg/L	5	2U	2U	NS	2U	2U	2U	5U	0.20U	0.20U	0.20U	0.20U	**12**	3	NS	2.2	1.2J	5U	NS	0.20U	0.20U
	Naphthalene	µg/L	10	NS	5U	NS	5U	5U	5U	5U	NS	NS	NS	NS	NS	**140**	NS	**88**	**53**	NS	5U	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	39	3.6	NS	5.7	2.1	NS	5U	0.10U	0.099U
	Acenaphthene	µg/L	20	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	1.4	2.8	NS	1.9	1U	NS	5U	0.10U	0.099U
	Acenaphthylene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	1.4	0.26	NS	0.19	0.075J	NS	5U	0.10U	0.099U
	Anthracene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.33	0.097J	NS	0.57J	0.11U	NS	5U	0.10U	0.099U
	Benzo(a)anthracene	µg/L	50	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Benzo(a)pyrene	µg/L	ND	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Benzo(b)fluoranthene	µg/L	50	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Benzo(g,h,i)perylene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Benzo(k)fluoranthene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Chrysene	µg/L	50	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.043U	0.043U	0.045U	0.044U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.046U	0.045U
	Dibenzo(a,h)anthracene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Fluorene	µg/L	50	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	4.8	0.49	NS	0.49	0.24	NS	5U	0.10U	0.099U
	Fluoranthene	µg/L	50	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.1	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.11U	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U
	Naphthalene	µg/L	10	0.11U	0.10U	NS	0.11U	0.1U	0.11U	NS	0.095U	0.095U	0.10U	0.099U	**580**	**95**	NS	**110**	**28**	NS	NS	1.5	0.13J
	Phenanthrene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	2.5	0.5	NS	0.73	0.38	NS	5U	0.10U	0.099U
	Pyrene	µg/L	NA	0.11U	0.10U	NS	0.11U	0.1U	0.11U	5U	0.095U	0.095U	0.10U	0.099U	0.053	0.10U	NS	0.1U	0.11U	NS	5U	0.10U	0.099U

Notes:

[1] The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-12I								MW-12B								
				6/27/2004	12/2005	1/2006	5/17/2006	5/17/2006 DUP	6/9/2007	6/9/2007 DUP	6/6/2008	3/10/2001	3/10/2001 DUP	12/2005	1/2006	5/17/2006	6/9/2007	6/6/2008	12/14/2011	5/9/2012
Total Metals - SW6020	Iron (mg/L)	µg/L	300	NS	NS	NS	**684**	**731**	**506**	**498**	NS	1.50E	NS	NS	NS	**360**	55U	NS	**830**	**770**
	Manganese	µg/L	300	NS	NS	NS	**8,650**	**9,000**	**18,500**	**18,800**	NS	NS	NS	NS	NS	173	172	NS	240	200
Dissolved Metals - SW6020	Iron (mg/L)	µg/L	300	NS	NS	NS	**635**	**748**	**440**	**439**	NS	NS	NS	NS	NS	15J	24.1	NS	140	130
	Manganese	µg/L	300	NS	NS	NS	**8,970**	**9,330**	**18,600**	**18,500**	NS	NS	NS	NS	NS	161	177	NS	190	160J
VOCs - SW8260B	Acetone	µg/L	NA	NS	NS	NS	NA	100U	10U	10U	10UJ	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Isopropylbenzene	µg/L	5	NS	NS	NS	**5.9J**	**5.6J**	2.5	2.6	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Benzene	µg/L	1	**23**	NS	NS	10U	10U	0.53J	0.57 J	5U	250U	1	NS	NS	1U	1U	5U	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**8**	**5.5**	**10**	**7.1**	**5.7**
	1,2-Dichloroethane	µg/L	0.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**0.79J**	**0.66J**	5U	**0.79J**	**0.64J**
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**43**	**28**	**63**	**17**	**18**
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	4.8	3	5U	2	2.1
	Ethylbenzene	µg/L	5	**120**	NS	NS	**22**	**21**	2.5	2.8	5U	250U	**5.6**	NS	NS	2U	2U	5U	0.43U	0.11U
	Methylene chloride	µg/L	5	NS	NS	NS	NA	NA	0.77U	0.57U	5U	NS	NS	NS	NS	NS	0.57U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	2U	NS	NS	20U	20U	2U	2U	5U	NS	NS	NS	NS	2U	2U	5U	0.50U	0.84J
	Trichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**27**	**18**	**28**	**10**	**13**
	Toluene	µg/L	5	**68**	NS	NS	**20J**	**21**	2.9	3	5U	250U	**6.8**	NS	NS	2U	2U	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**15**	**10**	**9.7**	4.9	4.6
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	NS	**150**	**150**	**19J**	**19J**	NS	**91J**	NS	NS	NS	2U	0.97J	NS	1.5	0.33U
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	NS	**45**	**45**	**6.2**	**6.6**	NS	**52J**	NS	NS	NS	2U	2U	NS	0.96U	0.33U
	o-Xylene	µg/L	5	**200**	NS	NS	**90**	**89**	**20**	**21**	**16**	NS	**21**	NS	NS	0.65J	1.1J	5U	1.6	0.44J
	m,p-Xylene	µg/L	5	280	NS	NS	**98**	**97**	**9.5**	**10**	5U	**110J**	**29**	NS	NS	0.6J	0.89J	5U	1.5J	0.20U
	Vinyl chloride	µg/L	2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.9J	1.9J	**10**	**3.5**	**2.1**
	Naphthalene	µg/L	10	NS	NS	NS	**4,500**	**4,800**	**270**	**240**	NS	**5,200**	NS	NS	NS	**66**	**90R**	**100**	NS	NS
SVOCs - SW8270C	Dibenzofuran	µg/L	NA	NS	NS	NS	NS	NS	NS	0.1U	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS
	2-Methylnaphthalene	µg/L	NA	1300	NS	NS	290	320	0.11U	0.1U	5U	610	240	NS	NS	0.12U	1.9	21	5.1U	0.11J
	Acenaphthene	µg/L	20	**53**	NS	NS	**40J**	**41J**	4.6	2.3	7.4	400U	**100**	NS	NS	0.12UJ	6.1	14	19	3.0
	Acenaphthylene	µg/L	NA	1.2	NS	NS	2.7	2.7	0.19	0.13	5U	400U	5.2	NS	NS	0.12U	0.25	5U	5.1U	0.15J
	Anthracene	µg/L	NA	0.16J	NS	NS	0.087J	0.11J	0.11U	0.1U	5U	80U	3.9J	NS	NS	0.12U	0.41	5U	5.1U	0.19J
	Benzo(a)anthracene	µg/L	50	0.11U	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	5U	80U	0.46	NS	NS	0.12UJ	0.081J	5U	5.1U	0.099U
	Benzo(a)pyrene	µg/L	ND	0.11U	NS	NS	**0.065J**	**0.59J**	0.11U	0.1U	4U	80U	0.10U	NS	NS	0.12UJ	0.11U	5U	5.1U	0.099U
	Benzo(b)fluoranthene	µg/L	50	0.11U	NS	NS	0.11UJ	0.11UJ	0.080 J	0.1U	5U	80U	0.073J	NS	NS	0.12UJ	0.11U	5U	5.1U	0.099U
	Benzo(g,h,i)perylene	µg/L	NA	0.043J	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	5U	80U	0.10U	NS	NS	0.12UJ	0.11U	5U	5.1U	0.099U
	Benzo(k)fluoranthene	µg/L	NA	0.11U	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	4U	80U	0.10U	NS	NS	0.12UJ	0.11U	5U	5.1U	0.099U
	Chrysene	µg/L	50	0.11U	NS	NS	0.15J	0.15J	0.11U	0.1U	5U	80U	0.27	NS	NS	0.12UJ	0.11U	5U	2.3U	0.045U
	Dibenzo(a,h)anthracene	µg/L	NA	0.11U	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	5U	80U	0.10U	NS	NS	0.12UJ	0.11U	5U	5.1U	0.099U
	Fluorene	µg/L	50	1.5	NS	NS	3.7	3.9	0.16	0.1U	5U	**120**	**54**	NS	NS	0.12U	3.9	7.4	8.7J	1.8
	Fluoranthene	µg/L	50	0.085J	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	5U	80U	13J	NS	NS	0.3J	1.3	5U	5.1U	0.71
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.11U	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	5U	80U	0.10U	NS	NS	0.12U	0.11U	5U	5.1U	0.099U
	Naphthalene	µg/L	10	**9,100**	NS	NS	**1,800**	**2,100**	0.19R	0.12R	8.5	**4,200**	**1,300**	NS	NS	0.087J	9.7	NS	**160**	**21**
	Phenanthrene	µg/L	NA	0.15J	NS	NS	0.11U	0.11U	0.11U	0.1U	5U	**110**	65J	NS	NS	0.12U	2.9	12	13	3.2
	Pyrene	µg/L	NA	0.11U	NS	NS	0.11UJ	0.11UJ	0.11U	0.1U	5U	80U	7.5J	NS	NS	1.4J	0.81	5U	5.1U	0.35

Notes:

[1]The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-13I								MW-13B								
				6/29/2004	12/17/2005	1/2006	5/15/2006	6/7/2007	6/4/2008	12/13/2011	5/8/2012	6/27/2004	12/17/2005	12/17/2005 DUP	1/2006	5/15/2006	6/7/2007	6/4/2008	12/13/2011	5/8/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**1,110**	**718**	NS	**340**	**340**	NS	NS	NS	NS	45.7J	62.6	NS	160	230
	Manganese	µg/L	300	NS	NS	NS	**1,010**	**656**	NS	**520**	**530**	NS	NS	NS	NS	167	92	NS	57	39
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**929**	**589**	NS	280	250	NS	NS	NS	NS	22.6J	21.9J	NS	77J	33
	Manganese	µg/L	300	NS	NS	NS	**974**	**635**	NS	**500**	**520**	NS	NS	NS	NS	158	87.3	NS	19	16
VOCs - SW8260B	Carbon disulfide	µg/L	60	NS	NS	NS	0.86J	2U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Benzene	µg/L	1	**3**	**4.1**	NS	0.98J	**8.1**	5U	0.25UJ	0.25U	**1.3**	**2.6**	**2.6**	NS	0.82J	0.51J	5U	0.25UJ	0.28J
	1,1-Dichloroethane	µg/L	5	NS	**7.3**	NS	4.7	**5.5**	5U	4.1J	4.7	NS	**10**	**11**	NS	**10**	**8.2**	**7.6**	**6J**	**6.0**
	1,2-Dichloroethane	µg/L	0.6	NS	NS	NS	NS	NS	NS	NS	0.10U	NS	**1.4J**	**1.3J**	NS	**1.5J**	**1.3J**	5U	**1J**	**0.83J**
	cis -1,2-Dichloroethene	µg/L	5	NS	0.71J	NS	2U	2U	5U	0.15UJ	0.15U	NS	**30**	**30**	NS	**27**	**23**	**18**	**13J**	**14**
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.11U	NS	**5.4**	**5.6**	NS	**7.2**	**5.5**	5U	3.2J	3.7
	Ethylbenzene	µg/L	5	2U	2U	NS	2U	2U	5U	0.11UJ	0.11U	2U	2U	2U	NS	2U	2U	5U	0.11UJ	0.11U
	Methyl tert-butyl ether	µg/L	NA	2U	2U	NS	2U	2U	5U	0.20U	0.20U	2U	2U	2U	NS	2U	2U	5U	0.20UJ	0.20U
	Trichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	0.13U	NS	**26**	**27**	NS	**24**	**23**	**17**	**12J**	**12**
	Toluene	µg/L	5	2U	2U	NS	2U	2U	5U	0.33UJ	0.33U	2U	2U	2U	NS	2U	2U	5U	0.33UJ	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	3.3	NS	2U	2U	5U	0.50UJ	0.50U	NS	**26**	**26**	NS	**26**	**22**	**14**	**13J**	**11**
	o-Xylene	µg/L	5	2U	2U	NS	2U	2U	5U	0.25UJ	0.25U	3.4	0.63J	0.67J	NS	2U	2U	5U	0.25UJ	0.25U
	m,p-Xylene	µg/L	5	2U	2U	NS	2U	2U	5U	0.20UJ	0.20U	2U	2U	2U	NS	2U	2U	5U	0.20UJ	0.20U
	Naphthalene	µg/L	10	0.16	0.11R	NS	0.1U	5U	5U	NS	NS	NS	2.9J	3.1J	NS	5U	5U	NS	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	0.11U	0.10U	NS	0.1R	0.1U	5U	0.10U	0.18J	7.8	0.13	0.13	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Acenaphthene	µg/L	20	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	9.3	4.7	4.8	NS	0.091J	0.072J	5U	0.097U	0.099U
	Acenaphthylene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.8	0.67	0.69	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Anthracene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.55	0.41	0.44	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Benzo(a)anthracene	µg/L	50	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Benzo(a)pyrene	µg/L	ND	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Benzo(b)fluoranthene	µg/L	50	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Benzo(g,h,i)perylene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Benzo(k)fluoranthene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Chrysene	µg/L	50	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.045U	0.044U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.044U	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.10U	0.10U	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Fluorene	µg/L	50	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.22	0.3	0.3	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Fluoranthene	µg/L	50	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.7	0.47	0.5	NS	0.23J	0.1U	5U	0.097U	0.099U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.10U	0.046J	0.047J	NS	0.11UJ	0.1U	5U	0.097U	0.099U
	Naphthalene	µg/L	10	NS	NS	NS	5R	0.1U	NS	0.10U	0.098U	**200**	3.4	3.3	NS	0.085J	0.15U	NS	0.097U	0.099U
	Phenanthrene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	10	7.4	7.6	NS	0.11UJ	0.53	5U	0.097U	0.099U
	Pyrene	µg/L	NA	0.11U	0.10U	NS	0.1UJ	0.1U	5U	0.10U	0.098U	0.28	0.3	0.34	NS	0.16J	0.1U	5U	0.097U	0.099U
	1,4-Dioxane	µg/L	NA	NS	41J	NS	91	67	NS	25	35	NS	57	52	NS	120	120	NS	29	48

Notes:

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Results reported in µg/L unless otherwise specified

79 = Exceedance in the ROD or ARAR Action Levels

Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-14I								MW-14B									
				6/2004	12/17/2005	1/2006	5/16/2006	6/8/2007	6/4/2008	12/13/2011	5/8/2012	6/2004	12/17/2005	1/2006	5/16/2006	6/8/2007	6/4/2008	12/13/2011	12/13/2011 Dup	5/8/2012	5/8/2012 DUP
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**3,120**	**2,850**	NS	**2,300**	**2,000**	NS	NS	NS	**640**	**467**	NS	190	210	100	89
	Manganese	µg/L	300	NS	NS	NS	**3,010**	**2,800**	NS	**3,100**	**3,300**	NS	NS	NS	104	122	NS	160	190	180	180
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**5,120**	**4,310**	NS	**2,300**	**1,900**	NS	NS	NS	41.3J	61.1	NS	33 U	33U	33	33
	Manganese	µg/L	300	NS	NS	NS	**5,120**	**4,320**	NS	**3,200**	**3,300**	NS	NS	NS	95.4	109	NS	170	170	77	77
VOCs - SW8260B	Benzene	µg/L	1	NS	1U	NS	1U	1U	5U	0.25UJ	0.25U	NS	1U	NS	1U	1U	5U	0.25 U	0.25UJ	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	NS	0.72J	NS	2U	0.57J	5U	0.57J	0.65J	NS	NS	NS	NS	NS	NS	NS	NS	0.25U	0.25U
	Ethylbenzene	µg/L	5	NS	2U	NS	2U	2U	5U	0.11UJ	0.11U	NS	2U	NS	2U	2U	5U	0.11 U	0.11UJ	0.11U	0.11U
	Methylene chloride	µg/L	5	NS	NS	NS	NS	NS	NS	NS	1.0U	NS	NS	NS	NA	0.69U	5U	1.0 U	1.0UJ	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	NS	2U	NS	2U	2U	5U	0.20UJ	0.20U	NS	2U	NS	2U	2U	5U	0.20 U	0.20UJ	0.20U	0.20U
	Toluene	µg/L	5	NS	2U	NS	2U	2U	5U	0.33UJ	0.33U	NS	2U	NS	2U	2U	5U	0.33 U	0.33UJ	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	0.75J	NS	2U	2U	5U	0.50UJ	0.50U	NS	NS	NS	NS	NS	NS	NS	NS	0.50U	0.50U
	o-Xylene	µg/L	5	NS	2U	NS	2U	2U	5U	0.25UJ	0.25U	NS	2U	NS	2U	2U	5U	0.25 U	0.25UJ	0.25U	0.25U
	m,p-Xylene	µg/L	5	NS	2U	NS	2U	2U	5U	0.20UJ	0.20U	NS	2U	NS	2U	2U	5U	0.20 U	0.20UJ	0.20U	0.20U
	Naphthalene	µg/L	10	NS	NS	NS	5U	5U	5U	NS	NS	NS	NS	NS	5U	5U	5U	NS	NS	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Acenaphthene	µg/L	20	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Acenaphthylene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Anthracene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Benzo(a)anthracene	µg/L	50	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Benzo(a)pyrene	µg/L	ND	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Benzo(b)fluoranthene	µg/L	50	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Benzo(g,h,i)perylene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Benzo(k)flouranthene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.098U
	Chrysene	µg/L	50	NS	0.10U	NS	0.11U	0.11U	5U	0.22U	0.044U	NS	0.10U	NS	0.11U	0.1U	5U	0.043 U	0.043U	0.045U	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.099U
	Fluorene	µg/L	50	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.099U
	Fluoranthene	µg/L	50	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.099U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.099U
	Naphthalene	µg/L	10	NS	0.10U	NS	0.11U	0.11U	NS	0.49U	0.099U	NS	0.10U	NS	0.11U	0.057U	NS	0.095 U	0.095U	0.099U	0.099U
	Phenanthrene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.099U
	Pyrene	µg/L	NA	NS	0.10U	NS	0.11U	0.11U	5U	0.49U	0.099U	NS	0.10U	NS	0.11U	0.1U	5U	0.095 U	0.095U	0.099U	0.099U
	1,4-Dioxane	µg/L	NA	NS	58	NS	70	50U	NS	54	74	NS	NS	NS	NS	NS	NS	NS	NS	1.5J	0.30U

Notes:

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-15I						MW-15B							
				6/2004	12/17/2005	1/2006	5/16/2006	6/8/2007	6/4/2008	6/2004	12/17/2005	1/2006	5/16/2006	6/8/2007	6/4/2008	12/14/2011	5/8/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**389**	**661**	NS	NS	NS	NS	278	177	NS	**320**	**3,900**
	Manganese	µg/L	300	NS	NS	NS	**2,550**	**2,270**	NS	NS	NS	NS	74.9	56.2U	NS	99J	210
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	63.3J	95.2J	NS	NS	NS	NS	90.4J	137	NS	59	65
	Manganese	µg/L	300	NS	NS	NS	**2,480**	**2,250**	NS	NS	NS	NS	66.5	52.5B	NS	62	85
VOCs - SW8260B	Benzene	µg/L	1	NS	1U	NS	1U	1U	5U	NS	0.63J	NS	1U	1U	5U	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	**15**	NS	3.7	0.77J	5U	1	1.4
	1,2-Dichloroethane	µg/L	0.6	NS	NS	NS	NS	NS	NS	NS	**2.1**	NS	2U	2U	5U	0.10U	0.12J
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	**75**	NS	**15**	3.1	5U	1.5	1.5
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	**8.3**	NS	2.2	1U	5U	0.11U	0.11U
	Ethylbenzene	µg/L	5	NS	2U	NS	2U	2U	5U	NS	2U	NS	2U	2U	5U	0.11U	0.11U
	Methylene chloride	µg/L	5	NS	NS	NS	NS	0.71U	5U	NS	NS	NS	NS	0.63U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	NS	2U	NS	2U	2U	5U	NS	2U	NS	2U	2U	5U	0.20U	0.20U
	Trichloroethene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	**39**	NS	**11**	2	5U	0.94J	0.48J
	Toluene	µg/L	5	NS	2U	NS	2U	2U	5U	NS	2U	NS	2U	2U	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	NS	NS	NS	NS	**40**	NS	**7.4**	1.4J	5U	0.50U	0.50U
	o-Xylene	µg/L	5	NS	2U	NS	2U	2U	5U	NS	2U	NS	2U	2U	5U	0.25U	0.25U
	m,p-Xylene	µg/L	5	NS	2U	NS	2U	2U	5U	NS	2U	NS	2U	2U	5U	0.20U	0.20U
	Naphthalene	µg/L	10	NS	NS	NS	5U	5U	5U	NS	NS	NS	3.2J	5R	5U	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	0.066J	NS	0.1U	0.11U	5U	0.095U	0.097U
	Acenaphthene	µg/L	20	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	2.3	NS	0.15	0.11U	5U	0.095U	0.097U
	Acenaphthylene	µg/L	NA	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	0.23	NS	0.1U	0.11U	5U	0.095U	0.097U
	Anthracene	µg/L	NA	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	0.14	NS	0.1U	0.11U	5U	0.095U	0.097U
	Benz(a)anthracene	µg/L	50	NS	0.076J	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Benzo(a)pyrene	µg/L	ND	NS	**0.076J**	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Benzo(b)fluoranthene	µg/L	50	NS	0.12	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Benzo(g,h,i)perylene	µg/L	NA	NS	0.076J	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Benzo(k)flouranthene	µg/L	NA	NS	0.11	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Chrysene	µg/L	50	NS	0.076J	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.043U	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	NS	0.096J	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Fluorene	µg/L	50	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	0.59	NS	0.11	0.11U	5U	0.095U	0.097U
	Fluoranthene	µg/L	50	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	NS	0.11R	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	Naphthalene	µg/L	10	NS	0.10U	NS	0.11UJ	0.1UR	NS	NS	0.53R	NS	0.63	0.11U	NS	0.095U	0.097U
	Phenanthrene	µg/L	NA	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	1.8	NS	0.1	0.18	5U	0.095U	0.097U
	Pyrene	µg/L	NA	NS	0.10U	NS	0.11UJ	0.1U	5U	NS	0.10U	NS	0.1U	0.11U	5U	0.095U	0.097U
	1,4-Dioxane	µg/L	NA	NS	NS	NS	NS	NS	NS	NS	59	NS	50U	50U	NS	2.4	3.7

Notes:

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	MW-16D	MW-16I		
				5/30/2008	6/6/2008	12/14/2011	5/8/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	**930**	**880**
	Manganese	µg/L	300	NS	NS	86	88
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	94J	120
	Manganese	µg/L	300	NS	NS	82	83
VOCs - SW8260B	Benzene	µg/L	1	5U	5U	0.25U	0.25U
	1,1-Dichloroethane	µg/L	5	5U	5U	2.1	2.1
	1,2-Dichloroethane	µg/L	0.6	5U	5U	0.10U	0.19J
	cis -1,2-Dichloroethene	µg/L	5	5U	5U	3.6	3.4
	1,1-Dichloroethene	µg/L	5	5U	5U	0.71J	0.59J
	Ethylbenzene	µg/L	5	5U	5U	0.11U	0.11U
	Methylene chloride	µg/L	5	5U	5U	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	5U	5U	0.20J	0.20U
	Trichloroethene	µg/L	5	5U	5U	3	2.6
	Toluene	µg/L	5	5U	5U	0.33U	0.48J
	1,1,1-Trichloroethane	µg/L	5	5U	5U	1.3	1.1
	o-Xylene	µg/L	5	5U	5U	0.25U	0.25U
	m,p-Xylene	µg/L	5	5U	5U	0.20U	0.20U
	Naphthalene	µg/L	10	5U	5U	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	5U	5U	0.096U	0.099U
	Acenaphthene	µg/L	20	5U	5U	0.096U	0.099U
	Acenaphthylene	µg/L	NA	5U	5U	0.096U	0.099U
	Anthracene	µg/L	NA	5U	5U	0.096U	0.099U
	Benzo(a)anthracene	µg/L	50	5U	5U	0.096U	0.099U
	Benzo(a)pyrene	µg/L	ND	5U	5U	0.096U	0.099U
	Benzo(b)fluoranthene	µg/L	50	5U	5U	0.096U	0.099U
	Benzo(g,h,i)perylene	µg/L	NA	5U	5U	0.096U	0.13J
	Benzo(k)flouranthene	µg/L	NA	5U	5U	0.096U	0.11J
	Chrysene	µg/L	50	5U	5U	0.043U	0.059J
	Dibenzo(a,h)anthracene	µg/L	NA	5U	5U	0.096U	0.16J
	Fluorene	µg/L	50	5U	5U	0.096U	0.099U
	Fluoranthene	µg/L	50	5U	5U	0.096U	0.099U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	5U	5U	0.096U	0.12J
	Naphthalene	µg/L	10	NS	NS	0.14J	0.099U
	Phenanthrene	µg/L	NA	5U	5U	0.096U	0.099U
	Pyrene	µg/L	NA	5U	5U	0.096U	0.099U
	1,4-Dioxane	µg/L	NA	NS	NS	11	12

Notes:

[1] The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

NA = Not Applicable

ND = DEC Groundwater Standard is a Non-Detected Concentration

NS= Not Sampled

Results reported in µg/L unless otherwise specified

79 = Exceedance in the ROD or ARAR Action Levels

Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	EW-01I							EW-1B									
				6/29/2004	6/29/2004 Dup	12/2005	1/5/2006	5/18/2006	6/10/2007	5/30/2008	6/29/2004	12/2005	1/5/2006	5/18/2006	6/10/2007	5/30/2008	5/30/2008 Dup	12/13/2011	3/14/2012	5/10/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**2,470**	**367**	**981**	NS	NS	NS	**444**	**8,870**	223	NS	NS	100	66J	98J
	Manganese	µg/L	300	NS	NS	NS	**10,600**	**11,000**	**12,700**	NS	NS	NS	179	**600**	98	NS	NS	**400**	**420**	**480**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	**2,300**	**350**	**923**	NS	NS	NS	55.4	17.8J	56.3J	NS	NS	NS	NS	NS
	Manganese	µg/L	300	NS	NS	NS	**10,300**	**11,100**	**13,400**	NS	NS	NS	98.8	197	94	NS	NS	NS	NS	NS
Wet Chemistry	Hardness (As CaCO3)	mg/L	NA	NS	NS	NS	190	NS	NS	NS	NS	NS	260	NS	NS	NS	NS	NS	NS	NS
	pH	NA	NA	NS	NS	NS	6	NS	NS	NS	NS	NS	6.4	NS	NS	NS	NS	NS	NS	NS
	Total Dissolved Solids	mg/L	NA	NS	NS	NS	610	NS	NS	NS	NS	NS	910	NS	NS	NS	NS	NS	NS	NS
	Total Suspended Solids	mg/L	NA	NS	NS	NS	4	NS	NS	NS	NS	NS	5	NS	NS	NS	NS	NS	NS	NS
	Total Alkalinity	mg/L	NA	NS	NS	NS	110	NS	NS	NS	NS	NS	110	NS	NS	NS	NS	NS	NS	NS
VOCs - SW8260B	2-Hexanone	µg/L	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	10UJ	10U	10U	10U	NS	NS	NS
	Isopropylbenzene	µg/L	5	NS	NS	NS	**5.3J**	20U	20U	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Benzene	µg/L	1	**130**	**130**	NS	**24**	**43**	**21**	**31**	1U	NS	1U	**1.2**	0.58J	5U	5U	**1.6**	**1.6**	**1.5**
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	**7.3J**	**7.9J**	**5.6J**	**6.2**	NS	NS	**16**	**14**	**11**	**13**	**13**	**12**	**13**	**11**
	1,2-Dichloroethane	µg/L	0.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	**2.3**	**1.8J**	**1.7J**	5U	5U	**1.6**	**1.5**	**1.3**
	cis -1,2-Dichloroethene	µg/L	5	NS	NS	NS	**27**	**39**	**28J**	**30**	NS	NS	**91**	**79**	**64J**	**69**	**67**	**66**	**73**	**64**
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NA	**5.3J**	10U	5U	NS	NS	**11**	**9.8**	**8.9**	**11**	**10**	**9**	**9.3**	**7.5**
	Ethylbenzene	µg/L	5	**66**	**72**	NS	**36**	**17J**	**16J**	**19**	2U	NS	2U	1.4J	0.72J	5U	5U	1.9	1.7	1.6
	Methylene chloride	µg/L	5	NS	NS	NS	NA	NS	5.5U	5U	NS	NS	NS	NS	NS	NS	NS	NS	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	2U	2U	NS	20U	20U	20U	5U	2U	NS	NS	2U	2U	5U	5U	3.4J	3.1J	2.3J
	Styrene	µg/L	5	NS	NS	NS	**35**	**5.7J**	**8.6J**	**9.1**	NS	NS	NS	NS	NS	NS	NS	NS	0.95J	0.84J
	Trichloroethene	µg/L	5	NS	NS	NS	**15J**	**21**	**14J**	**12**	NS	NS	**43**	**43**	**40**	**39**	**39**	**34**	**35**	**31**
	Toluene	µg/L	5	**20**	**22**	NS	**42**	**9.3J**	**8.4J**	**9.9**	2U	NS	0.51J	3.6	1.2J	5U	5U	2.4	2.5	2.0
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	**12J**	**20J**	**15J**	**11**	NS	NS	**44**	**39**	**34**	**31**	**30**	**26**	**24**	**21**
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	NS	**68**	**36**	**40**	NS	NS	NS	1.4J	**5.3**	3.3	NS	NS	**8.9**	**8.7**	**9.9**
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	NS	**24**	**12J**	**14J**	NS	NS	NS	0.68J	2.4	1.8J	NS	NS	4.4	4.2	4.8
	o-Xylene	µg/L	5	**180**	**190**	NS	**96**	**46**	**53**	**56**	0.63J	NS	0.74J	4.4	2.2	5U	5U	**5.6**	**5.6**	**5.6**
	m,p-Xylene	µg/L	5	**230**	**260**	NS	**160**	**43**	**54**	**56**	0.66J	NS	1.3J	**7.7**	3.8	5U	5U	**9.8**	**10**	**9.6**
	Naphthalene	µg/L	10	NS	NS	NS	**6,000**	**570**	**3,700J**	**1,600**	NS	NS	**65**	**250J**	**120J**	5U	5U	NS	NS	NS
SVOCs - SW8270C	tert-Butylbenzene	µg/L	5	NS	NS	NS	NS	**5.6J**	0.11U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Styrene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.064J	2U	NS	5U	1.1	NS	NS
	2-Methylnaphthalene	µg/L	NA	400	470	NS	240	6.4	42R	41NJ	1.9	NS	0.10U	0.11U	0.1UJ	5U	5U	70	1.1J	1.7
	Acenaphthene	µg/L	20	4.3	4.2	NS	**84**	**41J**	**29R**	**61**	2.3	NS	3	1.7J	0.38J	5U	5U	**110**	**46**	**49**
	Acenaphthylene	µg/L	NA	0.93	0.89	NS	5.5J	1.3	2J	5U	0.15	NS	0.18	0.096J	0.1UJ	5U	5U	4.1	5.9	4.3
	Anthracene	µg/L	NA	0.31	0.32	NS	0.49	0.41	0.43J	5U	0.078	NS	0.1	0.23	0.056J	5U	5U	15	6.8	7.3
	Benzo(a)anthracene	µg/L	50	0.10U	0.11U	NS	0.1J	0.11UJ	0.11U	5U	0.10U	NS	0.65J	0.09J	0.082J	5U	5U	8.8	6.3	8.2
	Benzo(a)pyrene	µg/L	ND	0.10U	0.11U	NS	**0.95J**	0.11UJ	0.11UJ	5U	0.10U	NS	**0.055J**	**0.064J**	0.1UJ	5U	5U	**3.2**	**2.6**	**2.8**
	Benzo(b)fluoranthene	µg/L	50	0.10U	0.11U	NS	0.095J	0.11UJ	0.11UJ	5U	0.10U	NS	0.05J	0.085J	0.077J	5U	5U	3.6	2.7	3.6
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	0.11U	NS	0.07J	0.11UJ	0.11UJ	5U	0.10U	NS	0.10U	0.11UJ	0.1UJ	5U	5U	0.96U	0.95U	0.89J
	Benzo(k)fluoranthene	µg/L	NA	0.10U	0.11U	NS	0.085J	0.11UJ	0.11UJ	5U	0.10U	NS	0.10U	0.11UJ	0.1UJ	5U	5U	4.2	2.9	3.2
	Chrysene	µg/L	50	0.10U	0.11U	NS	0.09J	0.11UJ	0.11UJ	5U	0.10U	NS	0.10U	0.069J	0.1UJ	5U	5U	6.3	4.5	5.6
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	0.11U	NS	0.09J	0.11UJ	0.11UJ	5U	0.10U	NS	0.10U	0.11UJ	0.1UJ	5U	5U	0.96U	0.95U	0.49U
	Fluorene	µg/L	50	0.15	0.14	NS	5.5J	6	6J	13	1.2	NS	0.92	0.7	0.1UJ	5U	5U	**87**	35	40
	Fluoranthene	µg/L	50	0.11J	0.11J	NS	0.18	0.3J	0.29J	5U	0.29	NS	0.36	0.91J	0.12J	5U	5U	**70**	43	**50**
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	0.11U	NS	0.09J	0.11UJ	0.11UJ	5U	0.10U	NS	0.045J	0.11UJ	0.1UJ	5U	5U	0.96U	0.95U	1.0
	Naphthalene	µg/L	10	**7,600**	**7,600**	NS	**15,000**	0.4	**690R**	NS	**20**	NS	0.075J	0.13	0.1UR	NS	NS	**110**	0.95U	0.49U
	Phenanthrene	µg/L	NA	3.4	3.3	NS	18	23	15R	34	0.53	NS	0.42	0.11U	0.1UJ	5U	5U	190	51	79
	Pyrene	µg/L	NA	0.065J	0.058J	NS	0.11	0.11J	0.1J	5U	0.17	NS	0.4	0.83J	0.37J	5U	5U	48	26	28
	1,4-Dioxane	µg/L	NA	NS	NS	NS	NS	NS	NS	NS	NS	NS	63	55J	50R	NS	NS	32	23	22

Notes:

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	EW-2I						EW-2B										
				6/29/2004	12/2005	1/5/2006	5/18/2006	6/10/2007	5/30/2008	6/29/2004	12/2005	1/5/2006	5/18/2006	5/18/2006 DUP	6/10/2007	6/10/2007 DUP	5/30/2008	12/13/2011	3/14/2012	5/10/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	175	130	**468**	5U	NS	NS	**2,620**	**502**	**528**	117U	120U	NS	**2,600**	**340**	**730**
	Manganese	µg/L	300	NS	NS	**4,090**	**4,250**	**5,720**	5U	NS	NS	**378**	**693**	**706**	**1,090**	**1,090**	NS	**1,200**	**1,200**	**1,200**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	194	190	**493**	5U	NS	NS	56.4	94.1J	76.1J	73.8J	81.7 J	NS	NS	NS	NS
	Manganese	µg/L	300	NS	NS	**4,150**	**4,330**	**5,590**	5U	NS	NS	266	**689**	**704**	**1,050**	**1,040**	NS	NS	NS	NS
Wet Chemistry	Hardness (As CaCO3)	mg/L	NA	NS	NS	250	NS	NS	5U	NS	NS	220	NS	NS	NS	NS	NS	NS	NS	NS
	pH	NA	NA	NS	NS	5.9	NS	NS	5U	NS	NS	6.3	NS	NS	NS	NS	NS	NS	NS	NS
	Total Dissolved Solids	mg/L	NA	NS	NS	680	NS	NS	5U	NS	NS	660	NS	NS	NS	NS	NS	NS	NS	NS
	Total Suspended Solids	mg/L	NA	NS	NS	8	NS	NS	5U	NS	NS	160	NS	NS	NS	NS	NS	NS	NS	NS
	Total Alkalinity	mg/L	NA	NS	NS	130	NS	NS	5U	NS	NS	110	NS	NS	NS	NS	NS	NS	NS	NS
VOCs - SW8260B	Acetone	µg/L	NA	NS	NS	3.6J	10U	10U	10U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Isopropylbenzene	µg/L	5	NS	NS	NS	0.56J	0.69J	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Tetrahydrofuran	µg/L	NA	NS	NS	3.4J	10U	10U	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Benzene	µg/L	1	1U	NS	**1.7**	**17**	**15**	**5.3**	1U	NS	10U	10U	10U	**2.3**	10U	5U	0.43J	0.26J	0.26J
	1,1-Dichloroethane	µg/L	5	NS	NS	3.6	4	2.7	5U	NS	NS	**14J**	**8.1J**	**8J**	5	20U	**8.6**	**6**	**7.1**	**6.0**
	cis- 1,2-Dichloroethene	µg/L	5	NS	NS	**13**	**17**	**15J**	**7.5**	NS	NS	**78**	**44**	**39**	**30J**	**28J**	**50**	**35**	**44**	**36**
	1,1-Dichloroethene	µg/L	5	NS	NS	2.2	2.5	1.9	5U	NS	NS	**9.7J**	**6.4J**	**5.3J**	4.5	10U	NS	**5.1**	**6.3**	4.7
	Ethylbenzene	µg/L	5	2U	NS	2U	1.8J	2.8	5U	0.63J	NS	**5.5J**	20U	20U	2.3	20U	5U	0.19J	0.17J	0.15J
	Methyl tert-butyl ether	µg/L	NA	2U	NS	2U	2U	2U	5U	2U	NS	20U	20U	20U	2U	20U	5U	0.20U	0.20U	0.20U
	Styrene	µg/L	5	NS	NS	NA	3.8	2.8	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.18U	0.11U
	Trichloroethene	µg/L	5	NS	NS	**16**	**17**	**13**	**8.5**	NS	NS	**34**	**21**	**19J**	**18**	**17J**	**23**	**15**	**16**	**13**
	Toluene	µg/L	5	2U	NS	1.3J	**16**	**14**	5U	0.77J	NS	**9.6J**	20U	20U	3.5	20U	5U	0.45J	0.33U	0.39J
	1,1,1-Trichloroethane	µg/L	5	NS	NS	**11**	**11**	**8.6**	5U	NS	NS	**39**	**21**	**20**	**18**	**17J**	**22**	**16**	**16**	**14**
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	0.92J	**6.5**	**8.2**	5U	NA	NS	**13J**	**7.2J**	**8J**	**8.4**	**7.4J**	NS	2.1	2.1	1.6
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	NS	2.4	3.3	5U	NA	NS	**28**	**16J**	**16J**	**17**	**16J**	NS	3.9	1.2	0.93J
	o-Xylene	µg/L	5	2U	NS	0.94J	**11**	**13**	5U	1.7J	NS	**12J**	**5.7J**	**6.5J**	**9.5**	**8.3J**	5U	2.5	1.5	1.3
	m,p-Xylene	µg/L	5	2U	NS	1.8J	**18**	**22**	5U	2.8	NS	**25**	**13J**	**16J**	**11**	**10J**	5U	2.3	1.5J	1.5J
	Naphthalene	µg/L	10	NS	NS	**27**	**220**	**470J**	**72**	NA	NS	**1600**	**940**	**1000**	**960J**	**1200J**	5U	NS	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	0.10U	NS	1.4	0.44	7.6R	5U	41	NS	450	150J	14	0.58J	2.7J	5.9	30	10	7.3
	Acenaphthene	µg/L	20	0.10U	NS	0.54	2J	3.5J	5U	**37**	NS	**400**	**340J**	**230J**	**64J**	**89J**	**130**	**50**	**25**	**22**
	Acenaphthylene	µg/L	NA	0.10U	NS	0.2	0.12	0.84J	5U	2	NS	24	17J	10	2J	3.3J	5U	3.4	2.2	3.0
	Anthracene	µg/L	NA	0.10U	NS	0.12	0.1U	0.11UJ	5U	3.5	NS	120	120J	76	16J	35J	48	18	2.9	4.8
	Benzo(a)anthracene	µg/L	50	0.10U	NS	0.28	0.1UJ	0.11U	5U	0.6	NS	**200**	**180J**	**120J**	21	50	**71**	**60**	1.8	10
	Benzo(a)pyrene	µg/L	ND	0.10U	NS	**0.16**	0.1UJ	0.11UJ	5U	**0.15**	NS	**71**	**71J**	**48J**	**9J**	**19J**	**31**	**31**	**0.76**	**4.7**
	Benzo(b)fluoranthene	µg/L	50	0.10U	NS	0.21	0.1UJ	0.11UJ	5U	0.22	NS	**120**	**120J**	**81J**	9.3J	20J	45	34	0.93	4.3
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	NS	0.04J	NA	0.11UJ	5U	0.057J	NS	18	22J	15J	3.4J	8.2J	8.7	8.3	0.17J	1.5
	Benzo(k)fluoranthene	µg/L	NA	0.10U	NS	0.08J	0.1UJ	0.11UJ	5U	0.083J	NS	46	39J	30J	9.4J	22R	17	28	0.90	4.8
	Chrysene	µg/L	50	0.10U	NS	0.34	0.1UJ	0.11UJ	5U	0.4	NS	**110**	**110J**	**70J**	15J	40J	**54**	41	1.6	7.3
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	NS	0.055J	0.1UJ	0.11UJ	5U	0.10U	NS	7J	8.1J	4J	1.2J	2.5J	5U	3.5	0.16J	0.54
	Fluorene	µg/L	50	0.10U	NS	0.16	0.66	1.4J	5U	24	NS	**240**	**330J**	**220**	**51J**	**85J**	**110**	46	19	18
	Fluoranthene	µg/L	50	0.10U	NS	0.3	0.1UJ	0.11UJ	5U	9	NS	**980**	**830J**	**560J**	**98J**	**230J**	**290**	**140**	15	38
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	NS	0.095J	0.1UJ	0.11UJ	5U	0.068J	NS	29	25J	16J	3.2J	7.6J	12	9.5	0.12J	1.7
	Naphthalene	µg/L	10	0.13	NS	**20**	0.51	**89J**	NS	**130**	NS	**440**	**18J**	0.33	0.1R	0.35R	NS	**18**	**16**	**12**
	Phenanthrene	µg/L	NA	0.10U	NS	0.35	0.1U	0.27J	5U	31	NS	1300	1000J	530	100J	250J	350	110	26	30
	Pyrene	µg/L	NA	0.10U	NS	0.29	0.1UJ	0.11UJ	5U	6.4	NS	970	540J	370J	69J	150J	160	100	10	27
	1,4-Dioxane	µg/L	NA	NS	NS	23J	50U	50R	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS	10	10

Notes:

[1] The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

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NS= Not Sampled

Results reported in µg/L unless otherwise specified

79 = Exceedance in the ROD or ARAR Action Levels

Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	EW-3I					
				6/28/2004	12/2005	1/5/2006	5/18/2006	6/10/2007	5/30/2008
Total Metals - SW6020	Iron	µg/L	300	NS	NS	**2,500**	**2,210**	**1,140**	NS
	Manganese	µg/L	300	NS	NS	**3,420**	**1,720**	**1,820**	NS
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	**2,270**	**4,280**	**1,200**	NS
	Manganese	µg/L	300	NS	NS	**3,340**	**1,870**	**1,750**	NS
Wet Chemistry	Hardness (As CaCO3)	mg/L	NA	NS	NS	130	NS	NS	NS
	pH	NA	NA	NS	NS	5.3	NS	NS	NS
	Total Dissolved Solids	mg/L	NA	NS	NS	400	NS	NS	NS
	Total Suspended Solids	mg/L	NA	NS	NS	4U	NS	NS	NS
	Total Alkalinity	mg/L	NA	NS	NS	58	NS	NS	NS
VOCs - SW8260B	Acetone	µg/L	NA	NS	NS	8.1J	10U	10U	10U
	Methylene chloride	µg/L	5	NS	NS	NS	NS	0.51U	5U
	Methyl tert-butyl ether	µg/L	NA	2U	NS	2U	2U	2U	5U
	Tetrahydrofuran	µg/L	NA	NS	NS	13	10U	10U	NS
	Benzene	µg/L	1	1U	NS	1U	1U	1U	5U
	Toluene	µg/L	5	2U	NS	2U	2U	2U	5U
	Ethylbenzene	µg/L	5	2U	NS	2U	2U	2U	5U
	m,p-Xylene	µg/L	5	2U	NS	2U	2U	2U	5U
	o-Xylene	µg/L	5	2U	NS	2U	2U	2U	5U
	Naphthalene	µg/L	10	NS	NS	NS	1.8J	1.2J	5U
SVOCs - SW8270C	Naphthalene	µg/L	10	0.10U	NS	0.26	0.14	0.081R	NS
	2-Methylnaphthalene	µg/L	NA	0.10U	NS	0.065J	0.1U	0.13J	5U
	Acenaphthylene	µg/L	NA	0.10U	NS	0.10U	0.14	0.12UJ	5U
	Acenaphthene	µg/L	20	0.10U	NS	0.10U	0.057J	0.13J	5U
	Fluorene	µg/L	50	0.10U	NS	0.10U	0.094J	0.10J	5U
	Phenanthrene	µg/L	NA	0.10U	NS	0.10U	0.21	0.27J	5U
	Anthracene	µg/L	NA	0.10U	NS	0.10U	0.052J	0.12UJ	5U
	Fluoranthene	µg/L	50	0.10U	NS	0.10U	0.21J	0.12J	5U
	Pyrene	µg/L	NA	0.10U	NS	0.10U	0.19J	0.087J	5U
	Benzo(a)anthracene	µg/L	50	0.10U	NS	0.10U	0.1UJ	0.12U	5U
	Chrysene	µg/L	50	0.10U	NS	0.10U	0.1UJ	0.12UJ	5U
	Benzo(b)fluoranthene	µg/L	50	0.10U	NS	0.10U	0.1UJ	0.070J	5U
	Benzo(k)flouranthene	µg/L	NA	0.10U	NS	0.10U	0.1UJ	0.12UJ	5U
	Benzo(a)pyrene	µg/L	ND	0.10U	NS	0.10U	0.1UJ	0.12UJ	5U
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	NS	0.10U	0.1UJ	0.12UJ	5U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	NS	0.045J	0.1UJ	0.12UJ	5U
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	NS	0.10U	0.1UJ	0.12UJ	5U

Notes:

[1] The ROD limit is listed unless the most recent ARAR from the New York Department of Environmental Conservation (DEC) is more conservative of human and environmental health.

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Results reported in µg/L unless otherwise specified

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	EW-4I								EW-4B									
				6/28/2004	12/2005	1/5/2006	5/18/2006	6/10/2007	5/30/2008	12/14/2011	5/9/2012	6/27/2004	12/2005	1/10/2006	5/18/2006	6/10/2007	5/30/2008	5/30/2008 Dup	12/13/2011	3/14/2012	5/10/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	**11,100**	**339**	**667**	NS	**4,900**	**4,500**	NS	NS	**678**	20.9J	137U	NS	NS	44U	**37,000**	67J
	Manganese	µg/L	300	NS	NS	**7,710**	**7,100**	**6,490**	NS	**8,200**	**8,100**	NS	NS	**738**	**409**	**353**	NS	NS	**730**	**760**	**760**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	**3,350**	293	**555**	NS	**4,500**	**3,900**	NS	NS	100	100U	69.7J	NS	NS	NS	NS	NS
	Manganese	µg/L	300	NS	NS	**7,330**	**7,280**	**6,370**	NS	**7,500**	**7,400**	NS	NS	15	**417**	**337**	NS	NS	NS	NS	NS
Wet Chemistry	Hardness (As CaCO3)	mg/L	NA	NS	NS	290	NS	NS	NS	NS	NS	NS	NS	270	NS	NS	NS	NS	NS	NS	NS
	pH	NA	NA	NS	NS	6.4	NS	NS	NS	NS	NS	NS	NS	6.3	NS	NS	NS	NS	NS	NS	NS
	Total Dissolved Solids	mg/L	NA	NS	NS	480	NS	NS	NS	NS	NS	NS	NS	490	NS	NS	NS	NS	NS	NS	NS
	Total Suspended Solids	mg/L	NA	NS	NS	21	NS	NS	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS
	Total Alkalinity	mg/L	NA	NS	NS	330	NS	NS	NS	NS	NS	NS	NS	250	NS	NS	NS	NS	NS	NS	NS
VOCs - SW8260B	Isopropylbenzene	µg/L	5	NS	NS	**7.2**	**5.6**	4.5	5U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	n-Propylbenzene	µg/L	5	NS	NS	0.9J	0.7J	2U	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	1,2,3-Trichlorobenzene	µg/L	5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	**97**	NS	2U	5U	5U	NS	NS	NS
	Benzene	µg/L	1	**62**	NS	**120**	**59**	**22**	**13**	**5.6**	**5.3**	**2.6**	NS	NS	**1.5**	**1.1**	5U	5U	**3**	**2.8**	**2.6**
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	2.4	2.2	5U	0.25U	0.25U	NS	NS	**7.7**	**6**	4.2	**5.3**	**5.2**	4.1	4.1	3.6
	1,2-Dichloroethane	µg/L	0.6	NS	NS	NS	NS	NS	NS	NS	0.10U	NS	NS	NS	**0.62J**	2U	5U	5U	0.56J	0.51J	0.10U
	cis- 1,2-Dichloroethene	µg/L	5	NS	NS	0.91J	**5.1**	**5.9**	5U	0.15U	0.15U	NS	NS	NS	**20**	**14**	**16**	**15**	**12**	**13**	**11**
	1,1-Dichloroethene	µg/L	5	NS	NS	NA	0.88J	1.2	5U	0.11U	0.11U	NS	NS	NS	2.9	2.8	5U	5U	2.4	2.4	1.9
	Ethylbenzene	µg/L	5	**5.7**	NS	0.83J	0.76J	2U	5U	0.11U	0.11U	**8.8**	NS	NS	2U	2U	5U	5U	0.12J	0.16J	0.15J
	Methylene chloride	µg/L	5	NS	NS	NS	NS	0.56U	5U	1.0U	1.0U	NS	NS	NS	NS	NS	NS	NS	NS	1.0U	1.0U
	Methyl tert-butyl ether	µg/L	NA	2U	NS	2U	2U	2U	5U	0.20U	0.20U	2U	NS	NS	2U	2U	5U	5U	0.20U	0.20U	0.20U
	Trichloroethene	µg/L	5	NS	NS	0.99J	4.9	4.5	**5.8**	0.13U	0.13U	NS	NS	**27**	**19**	**15**	**17**	**17**	**13**	**14**	**12**
	Toluene	µg/L	5	3.4	NS	1.4J	0.82J	2U	5U	0.33U	0.33U	**10**	NS	0.60J	2U	2U	5U	5U	0.33U	0.36J	0.33J
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	2.8	3.6	5U	0.50U	0.50U	NS	NS	**18**	**13**	**8.6**	**8.6**	**8.4**	**6.4**	**6.2**	**4.9**
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	**14**	**9.8**	**6**	NS	0.62J	0.33U	NS	NS	3.6	0.75J	2U	NS	NS	0.33U	0.34J	0.35J
	1,3,5-Trimethylbenzene	µg/L	5	NS	NS	1.6J	1.3J	0.65J	NS	0.33U	0.33U	NS	NS	2.0J	NS	2U	NS	NS	0.33U	0.33U	0.33U
	o-Xylene	µg/L	5	**96**	NS	**37**	**30**	**15**	**14**	**10**	**6.3**	**22**	NS	1.7J	0.78J	2U	5U	5U	1.1	1.1	1.2
	m,p-Xylene	µg/L	5	**12**	NS	2.3	2.1	0.84J	5U	0.20U	0.23J	**38**	NS	2.1	2U	2U	5U	5U	0.45U	0.47J	0.47J
	Naphthalene	µg/L	10	NS	NS	**33**	**33**	2.5J	7.7	NS	NS	NS	NS	**260**	**110**	**63**	**39**	**34**	NS	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	31	NS	0.56	0.06J	0.11UJ	5U	0.095U	0.098U	190	NS	0.72	27	13R	7.3	6.3	2	1.2	1.4
	Acenaphthene	µg/L	20	12	NS	7	9.6J	6.5J	5U	5.2	4.9	**78**	NS	**29**	17J	12J	14	12	4	3.4	2.6
	Acenaphthylene	µg/L	NA	1.5	NS	0.62	0.93	0.45J	5U	0.095U	0.51	5.4	NS	1.6	0.96	0.64J	5U	5U	0.096U	0.25	0.11J
	Anthracene	µg/L	NA	0.31J	NS	0.15	0.18	0.11UJ	5U	0.095U	0.29	3.2J	NS	1.7	1.7	1.6J	NS	5U	0.46	0.29	0.34
	Benzo(a)anthracene	µg/L	50	0.10U	NS	0.085J	0.11UJ	0.11U	5U	0.095U	0.098U	0.47	NS	0.4	0.92J	2.1	8.7	5U	0.096U	0.095U	0.099U
	Benzo(a)pyrene	µg/L	ND	0.10U	NS	**0.07J**	0.11UJ	0.11UJ	5U	0.095U	0.098U	**0.15**	NS	**0.17**	**0.31J**	**1J**	5U	5U	0.096U	0.095U	0.099U
	Benzo(b)fluoranthene	µg/L	50	0.10U	NS	0.07J	0.11UJ	0.11UJ	5U	0.095U	0.098U	0.22	NS	0.21	0.51J	1.9J	5U	5U	0.096U	0.095U	0.099U
	Benzo(g,h,i)perylene	µg/L	NA	0.10U	NS	0.10U	0.11UJ	0.11UJ	5U	0.095U	0.098U	0.053J	NS	0.040J	0.089J	0.4J	5U	5U	0.096U	0.095U	0.099U
	Benzo(k)fluoranthene	µg/L	NA	0.10U	NS	0.10U	0.11UJ	0.11UJ	5U	0.095U	0.098U	0.08J	NS	0.070J	0.16J	0.49J	5U	5U	0.096U	0.095U	0.099U
	Chrysene	µg/L	50	0.10U	NS	0.07J	0.11UJ	0.11UJ	5U	0.043U	0.044U	0.36	NS	0.24	0.49J	1J	5U	5U	0.043U	0.064J	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	0.10U	NS	0.10U	0.11UJ	0.11UJ	5U	0.095U	0.098U	0.11U	NS	0.070J	0.11UJ	0.24J	5U	5U	0.096U	0.095U	0.099U
	Fluorene	µg/L	50	0.23	NS	0.24	0.11U	0.11J	5U	0.095U	0.098U	39	NS	14	11	9.7J	11	8.3	3.2	2.7	2.1
	Fluoranthene	µg/L	50	0.32J	NS	0.29	0.092J	0.11UJ	5U	0.095U	0.098U	8.4J	NS	5.3	7.2J	8.4J	35	8	1.3	1.1	1.1
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.10U	NS	0.045J	0.11UJ	0.11UJ	5U	0.095U	0.098U	0.069J	NS	0.1	0.11J	0.47J	5U	5U	0.096U	0.095U	0.099U
	Naphthalene	µg/L	10	**45**	NS	**31**	**33**	1.8R	NS	2.3	1.5	**1,300**	NS	NS	**54**	**36J**	NS	NS	**30**	**20**	**24**
	Phenanthrene	µg/L	NA	0.7J	NS	0.35	0.12	0.11UJ	5U	0.095U	0.098U	44J	NS	14	18	19R	40	18	6	2.4	4.1
	Pyrene	µg/L	NA	0.16J	NS	0.28	0.076J	0.11UJ	5U	0.095U	0.098U	4.4J	NS	3	4.4J	5.7J	25	5.7	0.94	0.64	0.79
	1,4-Dioxane	µg/L	NA	NS	NS	NS	NS	NS	NS	NS	0.57U	NS	NS	28J	NS	50UJ	NS	NS	11	9.8	7.6

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Table 3
Groundwater Sampling Results Since System Startup

Method	Analyte	Units	ROD Action Levels[1]	EW-5I								
				6/27/2004	6/27/2004 DUP	12/2005	1/2006	05/18/06	06/10/07	6/6/2008	12/13/2011	5/9/2012
Total Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	**2,340**	**1,290**	NS	**3,900**	**860**
	Manganese	µg/L	300	NS	NS	NS	NS	**8,790**	**12,200**	NS	**19,000J**	**18,000**
Dissolved Metals - SW6020	Iron	µg/L	300	NS	NS	NS	NS	**2,170**	**1,070**	NS	**4,300**	94J
	Manganese	µg/L	300	NS	NS	NS	NS	**8,890**	**11,700**	NS	**17,000**	**17,000**
VOCs - SW8260B	Isopropylbenzene	µg/L	5	NS	NS	NS	NS	**13**	**6.9**	**8.5**	NS	NS
	Benzene	µg/L	1	**2**	**1.9**	NS	NS	**14**	**8.7J**	**20**	**2.7**	0.80J
	1,1-Dichloroethane	µg/L	5	NS	NS	NS	NS	2.5	1.4J	5U	**9.3**	**7.5**
	cis-1,2-Dichloroethene	µg/L	5	NS	NS	NS	NS	**6.8**	2.4	5U	**10**	**9.7**
	1,1-Dichloroethene	µg/L	5	NS	NS	NS	NS	0.9J	1U	5U	0.54J	1.8
	Ethylbenzene	µg/L	5	2U	2U	NS	NS	2U	0.64J	5U	0.14J	0.11J
	Methyl tert-butyl ether	µg/L	NA	2U	2U	NS	NS	2U	2U	5U	0.20U	0.20U
	Trichloroethene	µg/L	5	NS	NS	NS	NS	**11**	4.1	5U	3.2	4.2
	Toluene	µg/L	5	2U	2U	NS	NS	2U	2U	5U	0.33U	0.33U
	1,1,1-Trichloroethane	µg/L	5	NS	NS	NS	NS	1.8J	2U	5U	2.7	2.6
	1,2,4-Trimethylbenzene	µg/L	5	NS	NS	NS	NS	0.73J	1.1J	NS	0.33U	0.33U
	o-Xylene	µg/L	5	0.95J	1J	NS	NS	2.5	**6**	**11**	1	0.25U
	m,p-Xylene	µg/L	5	2U	2U	NS	NS	0.86J	1.3J	5U	0.35J	0.20U
	Naphthalene	µg/L	10	NS	NS	NS	NS	7	**24**	6.7	NS	NS
SVOCs - SW8270C	2-Methylnaphthalene	µg/L	NA	0.11U	0.10U	NS	NS	1.3	1.8J	5U	0.095U	0.097U
	Acenaphthene	µg/L	20	0.36	0.34	NS	NS	1.1J	2.2J	5U	1.9	0.31
	Acenaphthylene	µg/L	NA	0.11U	0.10U	NS	NS	0.14	0.19J	5U	0.095U	0.099J
	Anthracene	µg/L	NA	0.074J	0.062J	NS	NS	0.64	0.57J	5U	0.095U	0.2
	Benzo(a)anthracene	µg/L	50	0.11U	0.10U	NS	NS	0.21J	0.18	5U	0.095U	0.097U
	Benzo(a)pyrene	µg/L	ND	0.11U	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095U	0.097U
	Benzo(b)fluoranthene	µg/L	50	0.11U	0.10U	NS	NS	0.064J	0.073J	5U	0.095U	0.097U
	Benzo(g,h,i)perylene	µg/L	NA	0.11U	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095U	0.097U
	Benzo(k)fluoranthene	µg/L	NA	0.11U	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095U	0.097U
	Chrysene	µg/L	50	0.11U	0.10U	NS	NS	0.11J	0.17J	5U	0.043U	0.044U
	Dibenzo(a,h)anthracene	µg/L	NA	0.11U	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095U	0.097U
	Fluorene	µg/L	50	0.11U	0.10U	NS	NS	1.1	1.7J	5U	0.2	0.097U
	Fluoranthene	µg/L	50	0.11U	0.10U	NS	NS	2.4J	1.5J	5U	0.095U	0.097U
	Indeno(1,2,3-cd)pyrene	µg/L	NA	0.11U	0.10U	NS	NS	0.11UJ	0.1UJ	5U	0.095U	0.097U
	Naphthalene	µg/L	10	1.3	1.3	NS	NS	5.4	8.3R	NS	1.3	0.097U
	Phenanthrene	µg/L	NA	0.11U	0.10U	NS	NS	3.8	4.1J	5U	0.13J	0.097U
	Pyrene	µg/L	NA	0.11U	0.10U	NS	NS	1.6J	1.1J	5U	0.095U	0.097U

Notes:

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Table 4
Sample Preparation and Analysis Methods, Containers, Holding Times and Preservatives

Parameter	Analytical Method	Sample Container	Preservative	Holding Time
Monthly Process Sampling				
VOCs	SW8260B	3 x 40-ml vials with teflon septa screw caps; no headspace	HCl to pH < 2; 4° ± 2°C	14 Days
SVOCs	SW8270C LL	1 x 1-L amber glass	4° ± 2°C	7 Days (extraction) 40 days (analysis)
Total and Dissolved Metals	SW6020	500 ml HDPE	HNO_3 to pH < 2; 4° ± 2°C	180 Days
Total Mercury	SW7470A	500 ml HDPE	HNO_3 to pH < 2; 4° ± 2°C	28 Days
Hardness	SM 2340B	500 ml HDPE	HNO_3 to pH < 2; 4° ± 2°C	180 Days
Dissolved Metals	SW6020	500 ml HDPE	HNO_3 to pH < 2; 4° ± 2°C	180 Days
Carbonaceous Biochemical Oxygen Demand	SM 5210B	500 ml HDPE	4° ± 2°C	48 hours
Total Dissolved Solids and Total Suspended Solids	SM2540C and SM2540D	500 ml HDPE	4° ± 2°C	7 days
Alkalinity	E310.1	500 ml HDPE	4° ± 2°C	14 Days
Chloride and Sulfide	SW9056	500 ml HDPE	4° ± 2°C	28 days
Nitrogen, Kjeldahl	E351.2	500 ml HDPE	4° ± 2°C	48 hours

Table 4
Sample Preparation and Analysis Methods, Containers, Holding Times and Preservatives

Quarterly Extraction Well Sampling				
VOCs	SW8260B	3 x 40-ml vials with teflon septa screw caps; no headspace	HCl to pH < 2; 4° ± 2°C	14 Days
PAHs	SW8270C-LL PAH method	1 x 1-L amber glass	4° ± 2°C	7 Days (extraction) 40 days (analysis)
Total Metals (Iron and Manganese Only)	SW6020	500 ml HDPE	HNO_3 to pH < 2; 4° ± 2°C	180 Days
Annual Monitoring Well Sampling				
VOCs	SW8260B	3 x 40-ml vials with teflon septa screw caps; no headspace	HCl to pH < 2; 4° ± 2°C	14 Days
PAHs	SW8270C-LL PAH method	1 x 1-L amber glass	4° ± 2°C	7 Days (extraction) 40 days (analysis)
Total and Dissolved Metals (Iron and Manganese Only)	SW6020	500 ml HDPE	HNO_3 to pH < 2; 4° ± 2°C	180 Days

Table 5
Action Levels

Constituent	NPDES Discharge Criteria for GETS (µg/L)	ROD Cleanup Criteria (µg/L)
VOCs		
Benzene	5	5
Toluene	5	5
Etheylbenzene	5	5
Xylenes	5	5
1,1-Dicholoroethane	5	5
1,1-Dicholoroethene	7	50
Cis-1,2-Dicholoroethene	10	50
Styrene	10	50
1,1,1-Trichloroehane	10	50
Trichloroethene	5	50
1,3,5-Trimethylbenzene	10	50
1,2,4-Trimethylbenzene	10	50
PAHs		
Naphthalene	13	NS
2-methyl naphthalene	4.7	NS
Acenaphthene	5.3	NS
Anthracene	3.8	NS
Benzo(a) anthracene	0.05	NS
Benzo(a) pyrene	0.09	NS
Benzo(b) fluoranthene	0.2	NS
Benzo(k) fluoranthene	0.2	NS
Chrysene	0.2	NS
Fluoranthene	10	NS
Fluorene	4.8	NS
Indeno (1,2,3-cd) pyrene	0.4	NS
Phenanthrene	5	NS
Pyrene	4.6	NS
Inorganics		
Iron	300[1]	NS
Manganese	300[1]	NS
Total Dissolved Solids (mg/L)	500	NS

Notes: [1] Iron and manganese each have a limit of 300 µg/L and a combined limit of 500 µg/L.
NPDES=National Pollutant Discharge Elimination System
GETS = Ground water extraction treatment system
NS = No Standard

Table 6
Sample Summary
GCL OU-2 Site

Well or Sample Designation	Sample Parameters						
	Sampling Frequency	**VOC SW-846 Method**	**TAL Metals(a)**	**PAH SW-846 Method 8270**	**Sampling**	**Gauging**	**Field Parameters(b)**
Groundwater							
MW-1S	Annual	X	X	X	Low-Flow	X	X
MW-1D	Annual	X	X	X	Low-Flow	X	X
MW-3S	Annual	X	X	X	Low-Flow	X	X
MW-3I	Annual	X	X	X	Low-Flow	X	X
MW-3B	Annual	X	X	X	Low-Flow	X	X
MW-7I	Annual	X	X	X	Low-Flow	X	X
MW-7D	Annual	X	X	X	Low-Flow	X	X
MW-8I	Annual	X	X	X	Low-Flow	X	X
MW-10B	Annual	X	X	X	Low-Flow	X	X
MW-11I	Annual	X	X	X	Low-Flow	X	X
MW-11B	Annual	X	X	X	Low-Flow	X	X
MW-12B	Annual	X	X	X	Low-Flow	X	X
MW-13I	Annual	X	X	X	Low-Flow	X	X
MW-13B	Annual	X	X	X	Low-Flow	X	X
MW-14I	Annual	X	X	X	Low-Flow	X	X
MW-14B	Annual	X	X	X	Low-Flow	X	X
MW-15B	Annual	X	X	X	Low-Flow	X	X
MW-16I	Annual	X	X	X	Low-Flow	X	X
MW-16D	Annual	X	X	X	Low-Flow	X	X
Extraction Well							
EW-1I	Annual	X	X	X	Low-Flow	X	X
EW-1B	Annual	X	X	X	Sample Tap	X	X
EW-2I	Annual	X	X	X	Low-Flow	X	X
EW-2B	Annual	X	X	X	Sample Tap	X	X
EW-3I	Annual	X	X	X	Low-Flow	X	X
EW-4I	Annual	X	X	X	Low-Flow	X	X
EW-4B	Annual	X	X	X	Sample Tap	X	X
EW-5I	Annual	X	X	X	Low-Flow	X	X
Number of QC Samples							
Trip blank	Annual	1					
Rinsate blank	Annual	1	1	1			
Field duplicate	Annual	2	2	2			
MS/MSD	Annual	2	2	2			

NOTES:

(a) Total and dissolved metals by SW-846 method 6020 for iron and manganese.

(b) Determination of field parameters in accordance with U.S. Environmental Protection Agency/600/4-79/020 using the following methods: pH (Method 150.1), temperature (Method 170.1), specific conductance (Method 120.1), and turbidity (180.1); optional field parameters, including dissolved oxygen (Method 360.1) and oxidation reduction potential (ORP) were also recorded. Includes water leve measurement.

VOC = volatile organic compound.
NR = Procedure not required.
EPA = U.S. Environmental Protection Agency.
MW = Monitoring well
EW = Extraction well

APPENDIX A
SAMPLING FORMS

Monitoring Well Inspection Sheet

Project Site: ___________________ **Location:** _____________________

Well ID: ____________ **Date:** ________________

Inspector's Name: _________________________ **Time:** ________________

Inspection Item	Types of Problems	Status		Observation
		S	U	
Well Tag	Is it in place, legible?			
Well Security	Condition of protective case, cap and lock.			
Well Pad	Concrete or gravel and condition			
Well Seal	Condition of…			
Area Immediately around well pad.	Record any evidence of/or standing water in area of well			
Dedicated sampling equipment	Condition…			
PVC Riser	Condition of riser and survey reference point			

Comments:

____

____

____

____

Signature: ____________________________________

Date: _____________________________

S= Satisfactory, U= Unsatisfactory
Check one, if unsatisfactory please explain

Instrument Calibration Log

Project/Site Name: ___________________________

Calibrated By: ________________________________

Instrument/Serial Number	Pre-Cal 0-AM (NTU)	Pre-Cal 0-PM (NTU)	Pre-Cal 10-AM (NTU)	Pre-Cal 10-PM (NTU)	Post-Cal 0-AM (NTU)	Post-Cal 0-PM (NTU)	Post-Cal 10-AM (NTU)	Post-Cal 10-PM (NTU)	Date

Signature: ____

Date: ___________________________

Instrument Calibration Log

Project/Site Name: ____________________ **Date:** ______________________ **Weather:** ______________________

Calibrated By: ________________________ **Instrument:** _________________ **Serial Number:** _________________

______________________________ ________________________________

Parameters	Morning Calibration	Cal. Temperature ºC	Afternoon Cal. Check	Comments
Conductivity (µS/cm^{c})				
pH (7)				
pH (4)				
pH (10)				
ORP (mv)				
Dissolved Oxygen (%)				
Zero Dissolved Oxygen (mg/L)				
Barometric Pressure (mmHg)				

Signature: ____ Date: ________________________________

H&S Environmental, Inc.

Low Flow/ Low Stress Groundwater Sampling Log

Project: ________________________________

Location: _______________________________

Well ID: _________________________________

Date: ____________________________

Sampler: ________________________

PID: _____________________________

Start Time: _________ **End Time:** ___________

Well Construction: _______________________

Depth to Water: __________________________

Well Depth: ______________________________

Water Column: __________________________

Total Volume Removed (L): ______________

Dedicated Pump in Well?: ________________

Field Testing Equipment

Make	Model	Serial #

Time (hh:mm)	Volume Removed (L)	Flow Rate (ml/min)	Depth to Water (ft)	Temp (ºC)	pH (STD)	SPC (µS/cm^c)	DO (mg/L)	ORP (mv)	Turbidity (NTU)	Color

Acceptance Criteria: <0.3ft 3% ±0.1 3% 10% ± 10mv 10%

2" Screen Volume = 0.163 gal/ft or 616 ml per foot

Sample Collection

Time	Sample ID	Container	# Bottles	Preservative	Analysis

Comments

____

____

____

Signature

Date

APPENDIX B

USEPA LOW-FLOW (MINIMAL DRAWDOWN) GROUNDWATER SAMPLING PROCEDURES

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

July 30, 1996
Revision 2

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

This standard operating procedure (SOP) provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with mobile particulates). The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground-water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

This procedure does not address the collection of samples from wells containing light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). For this the reader may wish to check: Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation; C.K. Smoley (CRC Press), Boca Raton, Florida and U.S. Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance; Washington, DC (EPA/530-R-93-001).

The screen, or open interval of the monitoring well should be optimally located (both laterally and vertically) to intercept existing contaminant plume(s) or along flowpaths of potential contaminant releases. It is presumed that the analytes of interest move (or potentially move) primarily through the more permeable zones within the screen, or open interval.

Proper well construction and development cannot be overemphasized, since the use of installation techniques that are appropriate to the hydrogeologic setting often prevents "problem well" situations from occurring. It is also recommended that as part of development or redevelopment the well should be tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in shortest amount of time. With this information field crews can then conduct purging and sampling in a more expeditious manner.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permealability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations. The Sampling and Analysis Plan must provide clear instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

Changes to this SOP should be proposed and discussed when the site Sampling and Analysis Plan is submitted for approval. Subsequent requests for modifications of an approved plan must include adequate technical justification for proposed changes. All changes and modifications must be approved before implementation in field.

II.EQUIPMENT

A. Extraction device

Adjustable rate, submersible pumps are preferred (for example, centrifugal or bladder pump constructed of stainless steel or

Teflon).

Adjustable rate, peristaltic pumps (suction) may be used with caution. Note that EPA guidance states: "Suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" (EPA/540/P-87/001, 1987, page 8.5-11).

The use of inertial pumps is discouraged. These devices frequently cause greater disturbance during purging and sampling and are less easily controlled than the pumps listed above. This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

B. Tubing

Teflon or Teflon lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for inorganics analyses. However, these materials should be used with caution when sampling for organics. If these materials are used, the equipment blank (which includes the tubing) data must show that these materials do not add contaminants to the sample.

Stainless steel tubing may be used when sampling for VOCs, SVOCs, pesticides, and PCBs. However, it should be used with caution when sampling for metals.

The use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred. This will help ensure the tubing remains liquid filled when operating at very low pumping rates.

Pharmaceutical grade (Pharmed) tubing should be used for the section around the rotor head of a peristaltic pump, to minimize gaseous diffusion.

C. Water level measuring device(s), capable of measuring to 0.01 foot accuracy (electronic “tape”, pressure transducer). Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each record.

D. Flow measurement supplies (e.g., graduated cylinder and stop watch).

E. Interface probe, if needed.

F. Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate the samples.

G. Indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Use of a flow-through-cell is required when measuring all listed parameters, except turbidity. Standards to perform field calibration of instruments. Analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846. For Eh measurements, follow manufacturer's instructions.

H. Decontamination supplies (for example, non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.).

I. Logbook(s), and other forms (for example, well purging forms).

J. Sample Bottles.

K. Sample preservation supplies (as required by the analytical methods).

L. Sample tags or labels.

M. Well construction data, location map, field data from last sampling event.

N. Well keys.

O. Site specific Sample and Analysis Plan/Quality Assurance Project Plan.

P. PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

III.PRELIMINARY SITE ACTIVITIES

Check well for security damage or evidence of tampering, record pertinent observations.

Lay out sheet of clean polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook.

A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) be measured the day before, in order to allow for re-settlement of any particulates in the water column. If measurement of total well depth is not made the day before, it should not be measured until after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe are usually not needed unless analytical data or field head space information signal a worsening situation. Note: procedures for collection of LNAPL and DNAPL samples are not addressed in this SOP.

IV.PURGING AND SAMPLING PROCEDURE

Sampling wells in order of increasing chemical concentrations (known or anticipated) is preferred.

1. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the midpoint of the zone to be sampled. The Sampling and Analysis Plan should specify the sampling depth, or provide criteria for selection of intake depth for each well (see Section I). If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well. Collection of turbid free water samples may be especially difficult if there is two feet or less of standing water in the well.

2. Measure Water Level

Before starting pump, measure water level. If recording pressure transducer is used-initialize starting condition.

3. Purge Well

3a. Initial Low Stress Sampling Event

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 l/min) to ensure stabilization of indicator parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

3b. Subsequent Low Stress Sampling Events

After synoptic water level measurement round, check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). Perform purging operations as above.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, Eh, DO) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at three (3) to five (5) minute intervals, are within the following limits:

turbidity (10% for values greater than 1 NTU),
DO (10%),
specific conductance (3%),
temperature (3%),
pH (± 0.1 unit),
ORP/Eh (± 10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must be submerged in water at all times. If two flow-through-cells are used in series, the one containing the dissolved oxygen probe should come first (this parameter is most susceptible to error if air leaks into the system).

5. Collect Water Samples

Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

Add preservative, as required by analytical methods, to samples immediately after they are collected if the sample containers are not pre-preserved. Check analytical methods (e.g. EPA SW-846, water supply, etc.) for additional information on preservation. Check pH for all samples requiring pH adjustment to assure proper pH value. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required, and the filter size (0.45 um is commonly used) should be based on the sampling objective. Pre-rinse the filter with approximately 25 - 50 ml of ground water prior to sample collection. Preserve filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in ground water for human health risk calculations.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

6. Post Sampling Activities

If recording pressure transducer is used, remeasure water level with tape.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth is optional after the initial low stress sampling event. However, it is recommended if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

V.DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

VI.FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one set per VOC sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Temperature blank (one per sample cooler).

Equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds.

Collect samples in order from wells with lowest contaminant concentration to highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

If split samples are to be collected, collect split for each analyte group in consecutive order (VOC original, VOC split, etc.). Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

VII.FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

Well identification.

Well depth, and measurement technique.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.

Well sampling sequence and time of each sample collection.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analysis.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling equipment used, including trade names, model number, diameters, material composition, etc.

VIII. DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, and whatever field logbook information is needed to allow for a full evaluation of data useability.

EXAMPLE (Minimum Requirements) Page____of____

Well PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_________________________
Well Number_________________Date_______________________
Field Personnel____
Sampling Organization___________________________________
Identify MP____

Depth to (below MP) _______/________ of screen
top bottom
Pump Intake at (ft. below MP)_______________
Purging Device; (pump type)_________________

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP/ Eh[3] mv	DO mg/L	Turb-idity NTU	Comments

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25 °C.
3. Oxidation reduction potential (stand in for Eh).

ATTACHMENT A
QUALITY ASSURANCE PROJECT PLAN

FINAL
PROJECT-SPECIFIC UNIFORM FEDERAL POLICY QUALITY ASSURANCE PROJECT PLAN
LONG-TERM REMEDIAL ACTION PROGRAM
GCL TIE AND TREATING SUPERFUND SITE OU-2
SIDNEY, NEW YORK

CONTRACT NUMBER: W912WJ-12-C-0011
DELIVERY ORDER DB01

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MAY 2013

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REFERENCES

APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

AB	accreditation body
ADR	automated data review
ARAR	applicable or relevant and appropriate requirements
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BFB	4-bromofluorobenzene
BOD	Biochemical Oxygen Demand
BTEX	benzene, toluene, ethylbenzene, and xylene
CA	corrective action
CAS	Chemical Abstract Service
CBOD	carbonaceous biological oxygen demand
CCB	continuing calibration blank
CCC	calibration check compound
CCS	contract compliance screening
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COB	close of business
CoC	chain of custody
COC	contaminants of concern
CQCM	Construction Quality Control Management
CRI	contract required detection limit verification standard
CVAA	cold vapor atomic absorption
%D	percent difference
1,1-DCA	1,1-dichloroethane
trans-1,2-DCE	trans-1,2-dichloroethene
DCAA	2,4-dichlorophenyl acetic acid
DFTPP	decafluorotriphenylphosphine
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DoD	Department of Defense
DQE	data quality evaluation
DQI	data quality indicator
DQO	data quality objective
ECD	electron capture detector
EDD	electronic data deliverable
EDMS	environmental data management system
EM	Engineer Manual

eQAPP	electronic QAPP
FIA	flow injection analysis
ft btoc	feet below top of casing
GC/ECD	gas chromatography with an electron capture
GC/MS	gas chromatography/mass spectrometry
GCL	GCL Tie and Treating Superfund Site
GW	groundwater
H&S	health and safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high density polyethylene
IC	ion chromatography
ICB	initial calibration blank
ICP-MS	inductively coupled plasma mass spectrometry
ICS	interference check sample
ICV	initial calibration verification
IS	internal standard
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LD	laboratory duplicate
LPGAC	liquid-phase granular activated carbon
LTM	long-term monitoring
LTRA	Long-Term Remedial Action
LQM	Laboratory Quality Manual
MB	method blank
MDL	method detection limit
µg/L	micrograms per liter
mg/L	milligrams per liter
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
MTBE	methyl *tert*-butyl ether
NA	not applicable
NAE	New England District
NAPL	non-aqueous phase liquid
NBOD	Nitrogenous Biochemical Oxygen Demand
NC	not calculated
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NELAP	National Environmental Laboratory Accreditation Program
NPDES	National Pollutant Discharge System

NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
O&M	operations and maintenance
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
OU	operable unit
%	percent
PAH	polyaromatic hydrocarbon
PAL	project action limits
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
.pdf	portable document format
PID	photoionization detector
PM	project manager
PQL	project quantitation limit
PQO	project quality objectives
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QM	Quality Manual
QSM	Quality Systems Manual
%R	percent recovery
r	correlation coefficient
RB	rinsate blank
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
RRF	relative response factor
%RSD	percent relative standard deviation
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SC	specific conductance
SDG	sample delivery group
SEDD	Staged Electronic Data Deliverable
SIM	selected ion monitoring
SOP	standard operating procedure
SPCC	system performance check compound
SS	Site Supervisor
SVOC	semi-volatile organic compound

TAL	TestAmerica Laboratories, Inc.
TBD	to be determined
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TSS	total suspended solids
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VC	vinyl chloride
VOA	volatile organic analysis
VOC	volatile organic compound

SITE HISTORY AND BACKGROUND

The GCL Tie and Treating Superfund Site (GCL) is located in the Village of Sidney, Delaware County, New York, and occupies a 26-acre site located in a commercial/industrial area, as depicted in Figure 1.1 of the GCL Sampling and Analysis Plan (SAP). The site is bordered to the north by a rail line owned by the Delaware and Hudson Railroad. Meadwestvaco, Inc., a calendar manufacturer, and the Sidney Municipal Airport are located to the north of the rail line. To the east, the site is bordered by Unalam, Inc., a laminated wood manufacturer, and Delaware Avenue runs along the southern border of the site in a northeast to southwest direction (GeoTrans, 2006). A drainage ditch and wooded area separate the site from Delaware Avenue (U.S. Environmental Protection Agency [USEPA], 1994). Along the western border of the site lies an undeveloped scrub/shrub area with wetlands. The Superfund Site encompasses approximately 60 acres of land comprising the GCL property (26 acres) and two adjacent properties to the east (34 acres), referred to as the non-GCL property. The non-GCL areas to the east are currently a vacated sawmill operation and the Unalam property.

GCL was historically used as a tie and treating facility since the 1940s. Four structures were located on the site, and were used in the process of treating wood (primarily railroad ties). The largest building housed the wood pressure treatment operations, which included two treatment vessels, an office, and a small laboratory. The vessels were 50 feet long and 7 feet in diameter and were used to pressure treat wood with creosote. The remaining three structures were used to house a sawmill and general storage space (USEPA, 1994).

Two operational units (OU) address the source of contamination and the cleanup of the groundwater. OU-1, completed in August 2000, consisted of the excavation and on-site treatment of approximately 109,000 tons of soil, sediment, and debris by a thermal desorption process. OU-2 consisted of the construction of an on-site groundwater treatment facility for the extraction, collection and on-site treatment of contaminated groundwater. The system achieved construction completion in August 30, 2004, (USEPA, 2008) and the groundwater treatment system remains in operation.

Creosote contamination still persists in the phreatic zone as soil contamination, dense non-aqueous phase liquid (DNAPL), and as dissolved groundwater contamination. Although the DNAPL is relatively discontinuous with isolated areas of non-aqueous phase liquid (NAPL) and residual product, it has been observed as NAPL in several monitoring wells. Groundwater contamination is an ongoing concern due to the soil and DNAPL sources. The primary contaminants of concern (COC) at the site include: benzene, toluene, ethylbenzene, and xylenes (BTEX); naphthalene; 2-methyl-naphthalene; and other polyaromatic hydrocarbons (PAH). Contaminants from two nearby sites are also present in the groundwater underlying GCL. The contaminants from these sites include toluene, ethylbenzene, 1,1-dichloroethane; *trans*-1,2-dichloroethene; trichloroethene (TCE); vinyl chloride; and 1,1,1-trichloroethane. Both of the nearby sites have remedial actions in place. Concentrations of the COCs have been tracked and identified primarily immediately downgradient of the source area. In the intermediate zone (overburden), concentrations above the cleanup standards have historically been confined to an area approximately 200 to 300 feet from the source area. Site investigations revealed that contaminant migration is more extensive in the bedrock zone.

QAPP Worksheet #1
Title and Approval Page

Title: LTRA Program QAPP
Revision Number: 0
Revision Date: 05/07/2013
Page: 1 of 2

Project-Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan (QAPP) Long-Term Remedial Action (LTRA) Program, GCL Tie and Treating Superfund Site OU-2, Sidney, New York
Document Title

USEPA, Region 2
Lead Organization

Steven Kawchak, H&S Env.
Preparer's Name and Organizational Affiliation

160 East Main Street, 2F, Westborough, MA 01581, 609-462-2540, skawchak@hsenv.com
Preparer's Address, Telephone Number, and E-mail Address

10 May 2013
Preparation Date (Day/Month/Year)

Investigative Organization's Project Manager: ____________________
Signature

Steven Kawchak/PM/H&S Environmental
Printed Name/Organization/Date

Investigative Organization's Quality Control Manager: ____________________
Signature

Patrick Schauble, P.E./H&S Environmental
Printed Name/Organization/Date

Lead Organization's Project Manager: ____________________
Signature

Ashley Wiedemer, USEPA Remedial Project Manager
Printed Name/Organization/Date

QAPP Worksheet #1
Title and Approval Page (continued)

Title: LTRA Program QAPP
Revision Number: 0
Revision Date: 05/07/2013
Page: 2 of 2

Approval Signatures: ______________________________________
Signature

Ashley Wiedemer, USEPA Remedial Project manager
Printed Name/Title/Date

Other Approval Signatures: ______________________________________
Signature

____
Printed Name/Title/Date

Document Control Number:______________________________________

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: GCL LTRA Program
Site Location: Sidney, New York
Site Number/Code: NYD981566417
Operable Units: OU-2

Title: LTRA Program QAPP
Revision Number: 0
Revision Date: 05/07/2013
Page: 1 of 4

Contractor Name: H&S
Contract Number: W91ZDQ-08-D-0061
Contract Title: LTRA, Operation, Maintenance & Monitoring of Treatment Systems – GCL Tie and Treating Superfund Site OU-2
Delivery Order: DB01

1. Identify guidance used to prepare the Quality Assurance Project Plan (QAPP): USEPA Intergovernmental Data Quality Task Force Workbook for UFP-QAPPs, Part 2A; USEPA Region 2 Record of Decision (ROD) for GCL OU-2 (March 31, 1995); Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, version 4.2; and Test America Savannah analytical standard operating procedures (SOP).
2. Identify regulatory program: USEPA Region 2 Comprehensive Environmental Response, Compensation, and Liability (CERCLA), Superfund Amendments and Reauthorization Act of 1986 (SARA), Resource Conservation and Recovery Act (RCRA), and National Oil and Hazardous Substances Pollution Contingency Plan (NCP) programs.
3. Identify approval entity: USEPA Region 2
4. Indicate whether the QAPP is a generic or [✓ project specific] QAPP. (circle one)
5. List dates of scoping sessions that were held: None held.
6. List dates and titles of QAPP documents written for previous site work, if applicable:

   Title Approval Date None provided.

7. List organizational partners (stakeholders) and connection with lead organization: U.S. Army Corps of Engineers (USACE)-New England District (NAE) and USEPA Region 2
8. List data users: H&S, USACE-NAE, and USEPA Region 2
9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Quality Assurance (QA) Assessments (UFP-QAPP Section 4.1) are not scoped for this project.

QAPP Worksheet #2
QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background	9 10, Site History and Background (Introductory Section)
2.6 Project Quality Objectives (PQO) and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12, 15
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	13 13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	14 15 16

QAPP Worksheet #2
QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sampling Locations and Methods/Standard Operating Procedures (SOP) Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17 18 19 20 21 21 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	TestAmerica Laboratories, Inc. (TAL) Laboratory Quality Manual (QM) (Attachment A) 23 24 25, Attachment A
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection, Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification	26, 27 26, 27
3.4 Quality Control (QC) Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	20 Not Applicable (NA)
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	29 30 Appendix B

QAPP Worksheet #2
QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action (CA) Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and CA Responses Table	31, 32 31, 32 31, 32 31, 32
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report		33
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		 28 36, Appendix D 14, 36, Appendix D

QAPP Worksheet #3
Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control No.
Steven Kawchak	Project Manager (PM)	H&S Environmental	(609) 462-2540	(508) 366-7445	skawchak@hsenv.com	
Pat Schauble, P.E.	QC Manager	H&S Environmental	(484) 437-6644	(508) 366-7445	pschauble@hsenv.com	
Roy Kruger	Site Supervisor	H&S Environmental	607-644-2510	(607) 563-3371	RKruger@hsenv.com	
Sherri Pullar	Project Chemist	H&S Environmental	(508) 366-7443	(508) 366-7445	Spullar@hsenv.com	
Linda Wolfe	PM	TAL-Savannah	(912) 354-7858	(912) 352-0165	linda.wolfe@testamericainc.com	
Ashley Wiedemer	USEPA Remedial Project Manager (RPM)	USEPA Region 2	(212) 637-4263	(212) 637-3966	wiedemer.ashley@epa.gov	
William Taylor	USACE PM	USACE-NAE	(978) 318-8084	(978) 318-8891	William.C.Taylor@usace.army.mil	
Christine Johnson	USACE Project Engineer	USACE-NAE	(978) 318-8125		Christine.M.Johnson@usace.army.mil	

QAPP Worksheet #4-1
Project Personnel Sign-Off Sheet

Organization: H&S Environmental, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Steven Kawchak	H&S PM	(518) 877-0390		
Stacey Lee	H&S Staff Biologist	(508) 614-0729		
Rosa Mastrocola	H&S Staff Scientist	(508) 330-8020		
Roy Kruger	Lead Treatment System Operator	(607) 563-3372		
Rick Vogel	Plant Operator	(607) 563-3372		

QAPP Worksheet #4-2
Project Personnel Sign-Off Sheet

Organization: TAL-Savannah ______

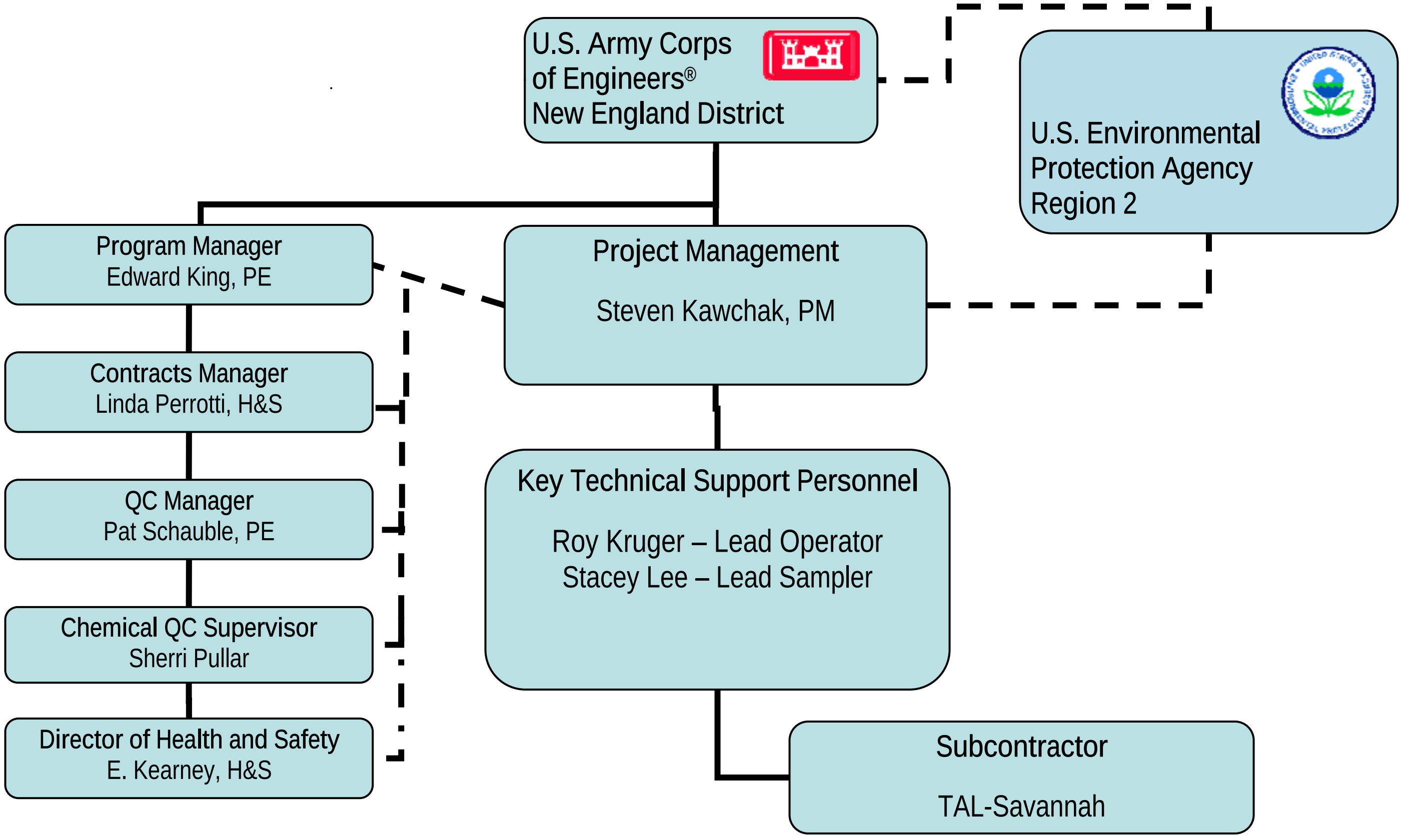
Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Linda Wolfe	TAL-Savannah PM	(912) 354-7858		

QAPP Worksheet #4-3
Project Personnel Sign-Off Sheet

Organization: USACE-NAE

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
William Taylor	USACE PM	(978) 318-8084		
Christine Johnson	USACE Project Engineer	(978) 318-8125		

QAPP Worksheet #5
GCL Organization Chart



The roles, responsibilities, and communication pathways for each person in the above diagram are discussed in detail in Worksheets #6 and 7.

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Corporate oversight and resource allocation	H&S Corporate Program Manager	Edward King	(484) 505-9572	Evaluates project support requirements at periodic program staffing meetings and at request of PM.
Management of all project phases	H&S PM	Steven Kawchak	(609) 462-2540	Interacts with the Program Manager, H&S personnel, subcontractors, USACE, and stakeholders.
				Notifies USACE PM of field-related problems by phone, e-mail, or fax by close of business (COB) the next business day.
				Approves all real-time changes to the QAPP.
				Transmits all project deliverables (including revisions) to USACE.
Field sampling	H&S Lead Sampler	Stacey Lee	(508) 614-0729	Coordinates field activities with on-site contractors and H&S personnel.
				Informs PM of field issues requiring resolution.
				Notifies PM immediately if work is stopped due to technical or health and safety (H&S) issues.
				Alerts PM or Project Chemist of need for real-time modification of QAPP if field conditions warrant.
Project analytical program oversight	H&S Chemist	Sherri Pullar	(508) 366-7442	Provides guidance through memoranda, e-mail, or phone to H&S field staff, laboratory subcontractor, and data validation staff to ensure that data of required quality are obtained.
				Approves validated data for release for project use.
				Identifies QAPP non-conformances and recommends corrective action to the PM.
				Informs PM whether real-time deviations from the QAPP can be considered single-instance or require QAPP modification.

QAPP Worksheet #6
Communication Pathways (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Overall project QC	H&S Corporate QC Manager	Pat Schauble, P.E.	(484) 880-1896	Communicates program QC requirements to the H&S PM and Project Chemist.
				Determines need to develop procedural changes to address QC deficiencies.
Laboratory project management	TAL-Savannah PM	Linda Wolfe	(912) 354-7858	Approves transmittal of analytical reports to the H&S PM and Project Chemist.
				Informs H&S PM and/or Project Chemist of QC issues by COB next business day.
				Alerts H&S PM and/or Project Chemist of need to modify QAPP based on analytical conditions.
				Coordinates interaction of the laboratory manager, laboratory QA manager, and analytical staff with H&S management as needed to resolve QA/QC issues.
Document control	USACE-NAE	William Taylor	(978) 318-8084	Any major changes to the QAPP require approval from USACE-NAE and USEPA Region 2 prior to implementation.
				Oversees the distribution of documents to the approval authorities.
Stop work and initiation of corrective action	H&S	Steven Kawchak	(609) 462-2540	Real-time determination if field work should be stopped immediately and a corrective action implemented.
				Real-time determination if laboratory analyses should be stopped immediately and a corrective action implemented.

QAPP Worksheet #6
Communication Pathways (continued)

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Real-time modification, notifications and approval	USACE-NAE	William Taylor	(978) 318-8084	Approves significant modifications to the project and initiates notifications on a lead organization level.
	H&S	Steven Kawchak	(609) 462-2540	Approves significant modifications to the project and initiates notifications on a lead contractor level.
Reporting of project issues	H&S	Steven Kawchak	(609) 462-2540	All field and general project issues should be reported to the H&S PM. The H&S PM will determine what corrective action is required, if any.
		Sherri Pullar	(508) 366-7442	All issues pertaining to the laboratories should be reported to the H&S Project Chemist. The Project Chemist will determine what corrective action is required, if any.
Corrective action	H&S	Steven Kawchak	(609) 462-2540	Determines what corrective action is required, if any, for all field and general project issues, and performs an audit, if necessary.
				Determines what corrective action is required, if any, for all issues pertaining to the laboratories, and performs an audit, if necessary.

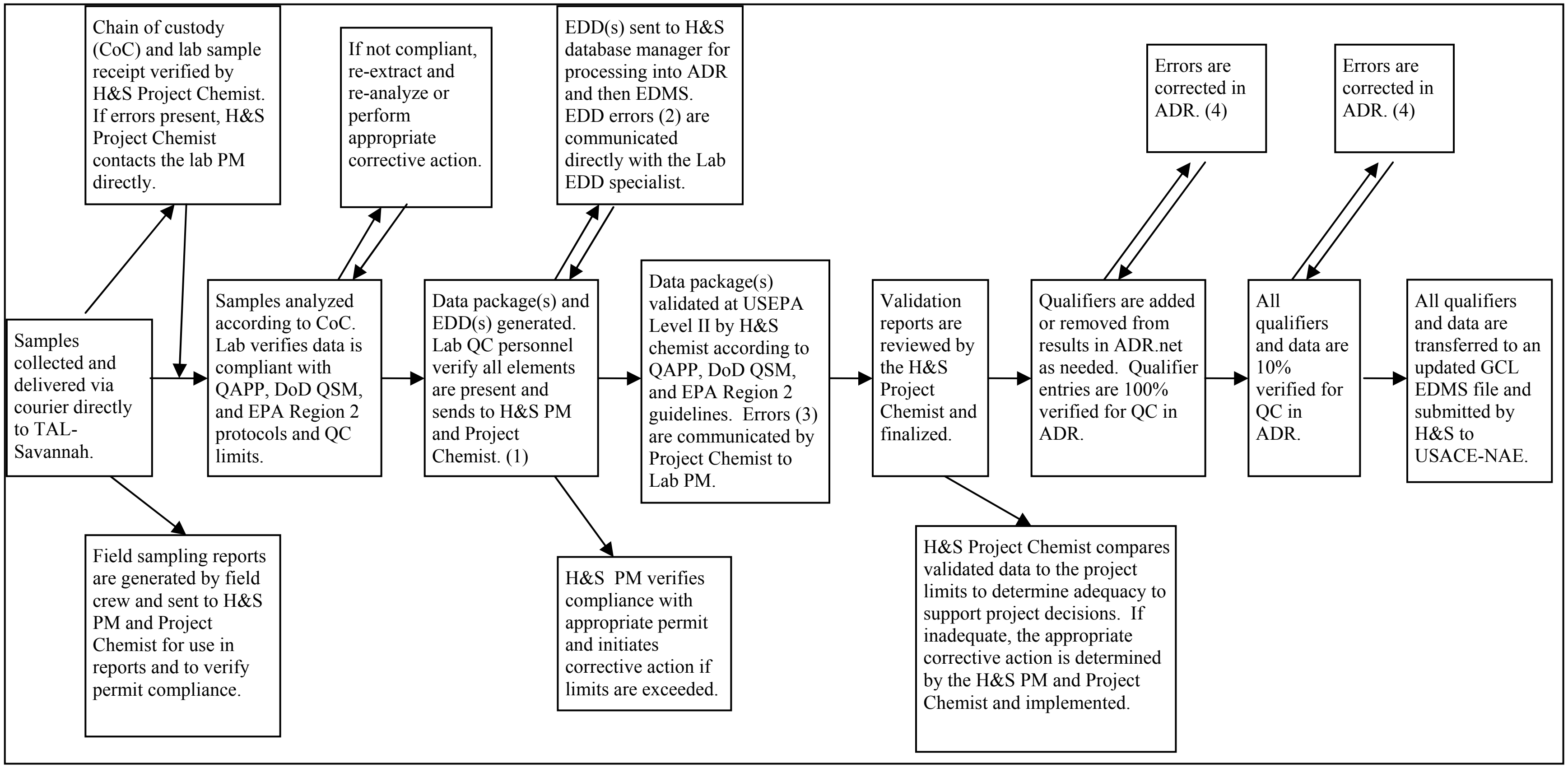
QAPP Worksheet #7-1
Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Ashley Wiedemer	USEPA RPM	USEPA-Region 2	USEPA-Region 2 approval authority and RPM for the GCL Superfund Site.	NA
William Taylor	USACE PM	USACE-NAE	Environmental Management – PM for the GCL Superfund Site.	Not provided
Christine Johnson	USACE Project Engineer	USACE-NAE	Liaison between USACE and H&S; verifies H&S compliance with the contract terms, conditions and specifications.	Not provided
Edward King, PE	Corporate Program Manager	H&S	Oversight responsibility for contractual and technical performance.	BS Civil Engineering, Penn State University
Steven Kawchak	PM	H&S	Manages project technical and contractual requirements; coordinates between H&S senior management, USACE, stakeholders, and project staff. Serves as the site H&S coordinator.	BS Geology, University of Pittsburgh
Pat Schauble, PE	QC Manager	H&S	QC oversight of project execution.	BSC Physical Science, Villanova University MS Environmental Engineering, Villanova University
Sherri Pullar	Project Chemist	H&S	Prepares QAPP, enforces QAPP requirements, and approves data validation reports. Responsible for data collection, analysis review, storage, and reporting.	BS, Biology, SUNY New Paltz
Stacey Lee	Lead Sampler	H&S	Supervises field sampling and coordinates field activities.	BS, Biology, Northeastern University
Ed Kearny	Corporate H&S Officer	H&S	Provides overall supervision of the H&S program.	M.S. Environmental Analysis, University of New England, ME Certified Industrial Hygienist Certified Safety Professional

QAPP Worksheet #7-1
Personnel Responsibilities and Qualifications Table (continued)

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Linda Wolfe	PM	TAL-Savannah	Contractual and technical performance of laboratory in providing analytical services.	Not provided
Jamie McKinney	QA Officer	TAL-Savannah	Implements laboratory QA program.	Not provided

QAPP Worksheet #7-2
Data Acquisition and Data Management Flow Chart



%= Percent
EDMS = environmental data management system

[1] Laboratories must review all electronic data deliverables (EDD) against the GCL automated data review (ADR) library provided by H&S using the ADR Contract Compliance Screening (CCS) software prior to submission to H&S.

[2] Such errors may include loading errors, incomplete or missing data, or using "ambient" rather than a value for sample cooler temperatures.

[3] Such errors may include the use of recovery criteria other than that stated in this UFP-QAPP, use of non-site samples for Matrix Spike/Matrix Spike Duplicate (MS/MSDs), or use of calibrations that do not meet the DoD QSM criteria.

[4] Such errors may include incorrect qualifiers or incorrect data values.

QAPP Worksheet #8
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field sampling	Occupational Safety and Health Administration (OSHA) 40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER) with annual 8-hour refresher courses	Varies	Varies	All field sampling personnel and plant operations	H&S	H&S Human Resources Department
Site supervision	OSHA 8-Hour Site Supervisor course	Varies	Varies	SS	H&S	H&S Human Resources Department
First Aid	American Red Cross First Aid and Cardio Pulmonary Resuscitation course	Varies	Varies	SS	H&S	H&S Human Resources Department
System maintenance	OSHA Confined Space Entry course, as required by system work	Varies	Varies	All plant operations	H&S	H&S Human Resources department
Lab Requirement	National Environmental Laboratory Accreditation Program (NELAP) Accreditation	New York	NA	NA	TAL-Savannah	TAL-Savannah
Lab Requirement	DoD QSM version 4.2	DoD	NA	NA	TAL-Savannah	TAL-Savannah

QAPP Worksheet #9
Project Scoping Session Participants Sheet

Project Name: LTRA Program

Projected Date(s) of Sampling: December 2011 for Option Period 4

Project Manager: Steven Kawchak

Site Name: GCL Tie and Treating Superfund Site OU-2

Site Location: Sidney, NY

Date of Session: No scoping sessions were conducted for this project.

Scoping Session Purpose:

Name	Title	Affiliation	Phone #	E-mail Address	Project Role

Comments/Decisions: NA.

Action Items: NA.

Consensus Decisions: NA.

QAPP Worksheet #10
Problem Definition

The problem to be addressed by the project: The general problem to be addressed at GCL, as covered by the LTRA Program, is to determine the levels of contamination and whether spatial and temporal trends support the remediation requirements of the 1995 USEPA ROD and second Five Year Review. In accordance with the SAP, the following will be performed at GCL:

- Process water samples will be collected monthly from 3 locations along the pump and treat system to verify that New York State effluent limitations are not exceeded.
- Groundwater extraction well samples will be collected quarterly from 3 active wells.
- Groundwater monitoring samples will be collected annually from 20 existing monitoring wells to determine natural attenuation and measure the effectiveness of the treatment system to ensure remedy success.
- Manifest waste samples will be collected, as necessary, to verify compliance with the requirements of a permitted treatment or disposal facility.

The environmental questions being asked: Each of the following questions is applicable to the LTRA Program:

- Are the groundwater COC concentrations attenuating?
- Does groundwater COC migration present a risk to off-site groundwater or surface water?
- Are all COC concentrations below the levels discussed in the 1995 USEPA ROD?
- Are the requirements of the treatment facility effluent limits being met?

A more detailed discussion of the data quality objective (DQO) process is located in Appendix A.

Observations from any site reconnaissance reports: A summary of treatment system operation and groundwater sampling events at GCL OU-2 are presented in Table 1.1 of the SAP.

QAPP Worksheet #10
Problem Definition (continued)

A synopsis of secondary data or information from site reports: See Worksheet #13 for the references to the below documents.

- The 1994 site-specific ROD generated by the USEPA states the history of the GCL OU-1 site, a synopsis of the research investigations and risk assessments performed at the site, the best-fit technology and supporting rationale that was agreed on by the USEPA for use to remediate OU-1 and the clean-up levels that are to be obtained.
- The 1995 site-specific ROD generated by the USEPA states the history of the GCL OU-2 site, a synopsis of the research investigations and risk assessments performed at the site, the best-fit technology and supporting rationale that was agreed on by the USEPA for use to remediate OU-2 and the clean-up levels that are to be obtained.
- The USEPA Region 2 National Priorities List (NPL) History Fact Sheet states the history of the GCL site and known environmental incidents. The fact sheet summarizes the remediation technology discussed in both RODs and clean-up progression through 2009.
- The Request for Proposal specifies the project operations and maintenance (O&M) objectives and procedures, project deliverables, and permit requirements.

QAPP Worksheet #10
Problem Definition (continued)

The possible classes of contaminants and the affected matrices: Project-specific method and analyte lists are presented in detail in Worksheet #15. As a summary, the site-specific COC analyte lists include:

- Volatile organic compounds (VOC) in the groundwater monitoring samples, groundwater extraction well samples, process water samples, and potentially TCLP VOCs in the manifest waste samples;
- TCLP semi-volatile organic compounds (SVOC) (selected compounds) in the manifest waste samples;
- PAHs (selected compounds) in the groundwater monitoring samples, groundwater extraction well samples, and process water samples;
- TCLP pesticides (selected compounds) in the manifest waste samples;
- TCLP herbicides (selected compounds) in the manifest waste samples;
- Metals (extended list or selected total and dissolved metals) in the groundwater monitoring samples, groundwater extraction well samples, process liquid samples, and TCLP Metals in the manifest waste samples;
- Water quality parameters in the process water samples; and
- Wet chemistry parameters (ignitability, corrosivity, and reactivity) in the manifest waste samples.

The rationale for inclusion of chemical and non-chemical analyses: The LTRA requirements for the site are already in place. The COCs and chemical analysis methods specified in Worksheets #23 and #15 are based on the March 31, 1995, ROD for the GCL Tie and Treating Superfund Site, the appropriate Code of Federal Regulations (CFR) for manifest waste samples, or were developed by the USACE-NAE based on previous site activities.

Information concerning various environmental indicators: During sampling activities, each sampling location will be inspected for signs that the institutional controls are not effective (e.g., broken fencing; signs of trespass or site use).

QAPP Worksheet #10
Problem Definition (continued)

Project decision conditions ("If..., then..." statements):

- If process water influent sample results or groundwater sample results indicate that COC concentrations are not attenuating or are not attenuating sufficiently to meet the COC-specific criteria within the timetable of the 1995 ROD, the Selected Remedy in the ROD will be re-evaluated and suggestions made. Attenuation progression will be evaluated by USACE based on qualitative trend analysis.
- If groundwater sample results indicate that COC migration poses a threat to off-site groundwater or surface water, corrective action will be evaluated and implemented as appropriate. COC migration will be evaluated by USACE based on contaminant concentration mapping.
- If effluent process water contaminant concentration limits are exceeded, the corrective action(s) required by the State of New York will be implemented. The corrective actions include notifying USACE-NAE for follow up with USEPA and may include shutting down the treatment system, if applicable. Other potential corrective actions include changing out the LPGAC in one or more of the vessels or making other process-related corrections.
- If waste contaminant concentration limits are exceeded (i.e., waste sampling results are above acceptable limits for disposal at a non-hazardous waste facility), the waste will be characterized and disposed as a hazardous waste per 40 CFR 260.

The information summarized in this worksheet is supplemented by the evaluation of DQOs presented as Appendix A.

QAPP Worksheet #11-1
Project Quality Objectives/Systematic Planning Process Statements

Matrix: Groundwater Monitoring Samples (aqueous)
Concentration: Low

Who will use the data? The primary data user will be H&S; secondary users will include USACE-NAE and USEPA Region 2.

What will the data be used for?

- The data will be used by H&S to prepare reports and monitor contaminant movement, reduction, and natural attenuation.

- USACE-NAE will use the data to answer environmental questions, monitor delineation of the existing contamination, support the project decision conditions, prepare studies and reports, evaluate the effectiveness of the remedial action, and establish attainment of the remedial clean-up goals.

What types of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) A detailed list of the site-specific analytical data requirements is presented in Worksheet #15. As a summary, the groundwater monitoring COC analyte list includes:

- VOCs (extended list);
- PAHs (select compounds);
- Total and dissolved iron and manganese; and
- Field parameters.

QAPP Worksheet #11-1
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Groundwater Monitoring Samples (aqueous)
Concentration: Low

How "good" do the data need to be in order to support the environmental decision? Quantitative data must be of comparable or better quality than the LTRA Program data collected in past sampling events. This will allow H&S and USACE-NAE to accurately compare historic and current data when making judgments regarding contaminant movement, reduction, and natural attenuation.

Definitive data must be of sufficient quality to support evaluation of results against the requirements of the 1995 USEPA ROD and any other site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

Screening data, also identified as field parameters measured during sample collection and during site-specified intervals detailed in Worksheet #15, must be of sufficient quality to support evaluation of results against the requirements of any site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

How much data are needed? (number of samples for each analytical group, matrix, and concentration) A detailed list of the field and QC samples required per each matrix and the associated target analytes are discussed in Worksheets #15, 18, and 20. In general, the number of groundwater monitoring samples required per target analytical group are as follows:

- VOCs: 20 monitoring well (groundwater) samples and 5 QC samples/event
- PAHs: 20 monitoring well (groundwater) samples and 4 QC samples/event
- Total and dissolved metals: 20 monitoring well (groundwater) samples and 4 QC samples/event
- Field parameters: 20 monitoring well (groundwater) samples/event

Where, when, and how should the data be collected/generated? Groundwater monitoring samples are collected on an annual basis. A sampling timeline is detailed in Worksheet #16. General and matrix-specific sampling procedures are presented in Worksheets #17 and 18. Sampling locations are detailed in Worksheet #18 and Figure 3.1 of the GCL SAP.

QAPP Worksheet #11-1
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Groundwater Monitoring Samples (aqueous)
Concentration: Low

Who will collect and generate the data? H&S field teams under the supervision of the SS identified in Worksheet #3 will collect all required samples and field parameters. Analytical data will be generated by TAL-Savannah.

- TAL-Savannah is a laboratory certified under the NELAP through the State of New York (primary accreditation body [AB]) and compliant with the DoD QSM for Laboratories, Version 4.2.

How will the data be reported? All data will be reported as follows:

- Field observations and data will be recorded in bound logbooks.
- Laboratory data from TAL-Savannah will be reported in analytical data packages (produced in .pdf format) that will, at a minimum, contain all necessary information to allow for validation in accordance with the USEPA Region 2 Level II protocols.
- EDDs from TAL-Savannah will meet the requirements of Staged Electronic Data Deliverable (SEDD), Stage IIa.
- Validated data generated by an H&S chemist will be reported in validation reports, one report per analysis in each data package.
- Laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through ADR and held within the GCL Environmental Data Management System (EDMS). The EDMS tables will be used for the H&S 100% and 10% QC process, and all qualifier changes and/or additions will be performed within ADR prior to final upload into the GCL EDMS for further data processing and submission to data end users.

A detailed list of all H&S submittals to USACE-NAE is documented in Worksheet #33.

How will the data be archived?

- Laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through the ADR software and uploaded to EDMS. The EDMS tables will be used for the H&S 100% and 10% QC process, and all qualifier changes and/or additions will be performed within the ADR software prior to final upload into the GCL EDMS for further data processing and submission to data end users.
- Complete project file records will be maintained in H&S's Westborough, Massachusetts, office and will be updated by the Project Administrator under the PM's direction. Project records will be maintained during the regulatory lifespan of the site, plus 10 years.

QAPP Worksheet #11-2
Project Quality Objectives/Systematic Planning Process Statements

Matrix: Process Water Samples (aqueous)
Concentration: Low

Who will use the data? The primary data user will be USACE-NAE; secondary users will include USEPA Region 2 and H&S.

What will the data be used for?

- The data will be used by H&S to prepare reports and monitor LPGAC effectiveness.

- USACE-NAE will use the data to answer environmental questions, monitor delineation of the existing contamination, support the project decision conditions, prepare studies and reports, evaluate the effectiveness of the remedial action, and establish attainment of the remedial clean-up goals.

- Process water data will be used to determine compliance with the New York State standards for effluent discharge to surface water.

What types of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) A detailed list of the site-specific analytical data requirements is presented in Worksheet #15. As a summary, the process water COC analyte list includes:

- VOCs (extended list);
- PAHs (select compounds) and 1,4-dioxane;
- Metals (select total and dissolved metals and mercury);
- Wet chemistry parameters (total hardness, carbonaceous biological oxygen demand [CBOD], total dissolved solids [TDS], total suspended solids [TSS], alkalinity, chloride, sulfate, and kjeldahl nitrogen); and
- Field parameters.

QAPP Worksheet #11-2
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Process Water Samples (aqueous)
Concentration: Low

How "good" do the data need to be in order to support the environmental decision? Quantitative data must be of comparable or better quality than the LTRA Program data collected in past sampling events. This will allow H&S and USACE-NAE to accurately compare historic and current data when making judgments regarding contaminant movement, reduction, and natural attenuation.

Definitive data must be of sufficient quality to support evaluation of results against the requirements of the 1995 USEPA ROD, the New York State standards for discharge to surface water, and any other site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

Screening data, also identified as field parameters measured during sample collection and during site-specified intervals detailed in Worksheet #15, must be of sufficient quality to support evaluation of results against the requirements of the discharge standards and any other site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

How much data are needed? (number of samples for each analytical group, matrix, and concentration) A detailed list of the field and QC samples required per each matrix and the associated target analytes are discussed in Worksheets #15, 18, and 20. In general, the number of process water samples required per target analytical group are as follows:

- VOCs: 3 process water samples and 1 QC sample per event;
- PAHs and 1,4-dioxane: 3 process water samples per event;
- Metals and mercury: 2 process water samples per event;
- Wet chemistry parameters: 2 process water samples per event; and
- Field parameters: 2 process water samples per event.

Where, when, and how should the data be collected/generated? Process water samples are collected on a monthly basis. A sampling timeline is detailed in Worksheet #16. General and matrix-specific sampling procedures are presented in Worksheets #17 and 18. Sampling locations are detailed in Worksheet #18.

QAPP Worksheet #11-2
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Process Water Samples (aqueous)
Concentration: Low

Who will collect and generate the data? H&S field teams under the supervision of the SS identified in Worksheet #3 will collect all required samples and field parameters. Analytical data will be generated by TAL-Savannah.

- TAL-Savannah is a laboratory certified under the NELAP through the State of New York (primary accreditation body [AB]) and compliant with the DoD QSM version 4.2.

How will the data be reported? All data will be reported as follows:

- Field observations and data will be recorded in bound logbooks.
- Laboratory data from TAL-Savannah will be reported in analytical data packages (produced in .pdf format) that will, at a minimum, contain all necessary information to allow for validation in accordance with the USEPA Region 2 Level II protocols.
- EDDs from TAL-Savannah will meet the requirements of Staged Electronic Data Deliverable (SEDD), Stage IIa.
- Validated data generated by an H&S chemist will be reported in validation reports, one report per analysis in each data package.
- Laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through ADR and held within the GCL EDMS. The EDMS tables will be used for the H&S 100% and 10% QC process, and all qualifier changes and/or additions will be performed within ADR prior to final upload into the GCL EDMS for further data processing and submission to data end users.

A detailed list of all H&S submittals to USACE-NAE is documented in Worksheet #33.

How will the data be archived?

- Laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through the ADR software and uploaded to EDMS. The EDMS tables will be used for the H&S 100% and 10% QC process, and all qualifier changes and/or additions will be performed within the ADR software prior to final upload into the GCL EDMS for further data processing and submission to data end users.
- Complete project file records will be maintained in H&S's Westborough, Massachusetts, office and will be updated by the Project Administrator under the PM's direction. Project records will be maintained during the regulatory lifespan of the site, plus 10 years.

QAPP Worksheet #11-3
Project Quality Objectives/Systematic Planning Process Statements

Matrix: Groundwater Extraction Well Samples (aqueous)
Concentration: Low

Who will use the data? The primary data user will be USACE-NAE; secondary users will include USEPA Region 2 and H&S.

What will the data be used for?

- The data will be used by H&S to prepare reports and monitor contaminant movement, reduction, and natural attenuation.

- USACE-NAE will use the data to answer environmental questions, monitor delineation of the existing contamination, support the project decision conditions, prepare studies and reports, evaluate the effectiveness of the remedial action, and establish attainment of the remedial clean-up goals.

What types of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) A detailed list of the site-specific analytical data requirements is presented in Worksheet #15. As a summary, the groundwater extraction well COC analyte list includes:

- VOCs (extended list);
- PAHs (select compounds) and 1,4-dioxane;
- Total metals (iron and manganese); and
- Field parameters.

QAPP Worksheet #11-3
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Groundwater Extraction Well Samples (aqueous)
Concentration: Low

How "good" do the data need to be in order to support the environmental decision? Quantitative data must be of comparable or better quality than the LTRA Program data collected in past sampling events. This will allow H&S and USACE-NAE to accurately compare historic and current data when making judgments regarding contaminant movement, reduction, and natural attenuation.

Definitive data must be of sufficient quality to support evaluation of results against the requirements of the 1995 USEPA ROD and any other site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

Screening data, also identified as field parameters measured during sample collection and during site-specified intervals detailed in Worksheet #15, must be of sufficient quality to support evaluation of results against the requirements of any site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

How much data are needed? (number of samples for each analytical group, matrix, and concentration) A detailed list of the field and QC samples required per each matrix and the associated target analytes are discussed in Worksheets #15, 18, and 20. In general, the number of groundwater extraction well samples required per target analytical group are as follows:

- VOCs: 3 groundwater extraction well samples and 1 QC sample per event;
- PAHs and 1,4-dioxane: 3 groundwater extraction well samples per event;
- Total metals: 3 groundwater extraction well samples per event; and
- Field parameters: 3 groundwater extraction well samples per event.

Where, when, and how should the data be collected/generated? Groundwater extraction well samples are collected on a quarterly basis. A sampling timeline is detailed in Worksheet #16. General and matrix-specific sampling procedures are presented in Worksheets #17 and 18. Sampling locations are detailed in Worksheet #18 and Figure 3.1 of the GCL SAP.

QAPP Worksheet #11-3
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Groundwater Extraction Well Samples (aqueous)
Concentration: Low

Who will collect and generate the data? H&S field teams under the supervision of the SS identified in Worksheet #3 will collect all required samples and field parameters. Analytical data will be generated by TAL-Savannah.

- TAL-Savannah is a laboratory certified under the NELAP through the State of New York (primary accreditation body [AB]) and compliant with the DoD QSM version 4.2.

How will the data be reported? All data will be reported as follows:

- Field observations and data will be recorded in bound logbooks.
- Laboratory data from TAL-Savannah will be reported in analytical data packages (produced in .pdf format) that will, at a minimum, contain all necessary information to allow for validation in accordance with the USEPA Region 2 Level II protocols.
- EDDs from TAL-Savannah will meet the requirements of Staged Electronic Data Deliverable (SEDD), Stage IIa.
- Validated data generated by an H&S chemist will be reported in validation reports, one report per analysis in each data package.
- Laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through ADR and held within the GCL EDMS. The EDMS tables will be used for the H&S 100% and 10% QC process, and all qualifier changes and/or additions will be performed within ADR prior to final upload into the GCL EDMS for further data processing and submission to data end users.

A detailed list of all H&S submittals to USACE-NAE is documented in Worksheet #33.

How will the data be archived?

- Laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through the ADR software and uploaded to EDMS. The EDMS tables will be used for the H&S 100% and 10% QC process, and all qualifier changes and/or additions will be performed within the ADR software prior to final upload into the GCL EDMS for further data processing and submission to data end users.
- Complete project file records will be maintained in H&S's Westborough, MA, office and will be updated by the Project Administrator under the PM's direction. Project records will be maintained during the regulatory lifespan of the site, plus 10 years.

QAPP Worksheet #11-4
Project Quality Objectives/Systematic Planning Process Statements

Matrix: Waste Manifesting Samples (Solid)
Concentration: Low

Who will use the data? The primary data user will be USACE-NAE; secondary users will include USEPA Region 2 and H&S.

What will the data be used for?

- The data will be used by H&S to characterize waste as hazardous or non-hazardous prior to transport from the site for disposal or treatment at a permitted facility (after USEPA approval).

- Manifest waste sample data will be used to determine compliance with the requirements of the 40 CFR 261, 40 CFR 262, 40 CFR 268, 49 CFR 172, and 49 CFR 178.

What types of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) A detailed list of the site-specific analytical data requirements is presented in Worksheet #15. As a summary, the waste manifest COC analyte list includes:

- Toxicity Characteristic Leaching Procedure (TCLP) VOCs (select compounds);
- TCLP SVOCs (select compounds);
- TCLP Pesticides (select compounds);
- TCLP Herbicides (select compounds);
- TCLP metals (select total metals including mercury); and
- Waste quality parameters (ignitability, corrosivity, and reactivity).

QAPP Worksheet #11-4
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Waste Manifesting Samples (Solid)
Concentration: Low

How "good" do the data need to be in order to support the environmental decision? Quantitative data must be of comparable or better quality than the LTRA Program data collected in past sampling events.

Definitive data must be of sufficient quality to support evaluation of results against the requirements of the applicable CFRs, the 1995 USEPA ROD, and any other site-specific clean-up goals. A detailed list of the site-specific analytical data requirements is presented in Worksheet #15.

How much data are needed? (number of samples for each analytical group, matrix, and concentration) A detailed list of the field and QC samples required per each matrix and the associated target analytes are discussed in Worksheets #15, 18, and 20. In general, the number of waste manifest samples required per target analytical group are as follows:

- VOCs: 4 manifest waste samples, as required;
- SVOCs: 4 manifest waste samples, as required;
- Total metals and mercury: 4 manifest waste samples, as required;
- Herbicides: 4 manifest waste samples, as required;
- Pesticides: 4 manifest waste samples, as required;
- Ignitability: 4 manifest waste samples, as required;
- Corrosivity: 4 manifest waste samples, as required; and
- Reactivity: 4 manifest waste samples, as required.

Where, when, and how should the data be collected/generated? Waste manifest samples are collected as needed. A sampling timeline is detailed in Worksheet #16. General and matrix-specific sampling procedures are presented in Worksheets #17 and 18. Sampling locations are detailed in Worksheet #18.

QAPP Worksheet #11-4
Project Quality Objectives/Systematic Planning Process Statements (continued)

Matrix: Waste Manifesting Samples (Solid)
Concentration: Low

Who will collect and generate the data? H&S field teams under the supervision of the SS identified in Worksheet #3 will collect all required samples and field parameters. Analytical data will be generated by TAL-Savannah.

- TAL-Savannah is a laboratory certified under the NELAP through the State of New York AB and compliant with the DoD QSM version 4.2.

How will the data be reported? All data will be reported as follows:

- Field observations and data will be recorded in bound logbooks.
- Laboratory data from TAL-Savannah will be reported in analytical data packages (produced in .pdf format) that will, at a minimum, contain all necessary information to allow for validation in accordance with the USEPA Region 2 Level II protocols.

A detailed list of all H&S submittals to USACE-NAE is documented in Worksheet #33.

How will the data be archived?

- Complete project file records will be maintained in H&S's Westborough, Massachusetts, office and will be updated by the Project Administrator under the PM's direction. Project records will be maintained during the regulatory lifespan of the site, plus 10 years.

QAPP Worksheet #12-1
Measurement Performance Criteria Table – Organic Analyses in Water

Matrix	Groundwater (GW) Monitoring, Process Water, and Groundwater Extraction Well Samples				
Analytical Group	Organics - VOCs (method SW-846 8260B) and PAHs and 1,4-dioxane (method SW-846 8270C-SIM).				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
GW Monitoring: S-1 GW Extraction: S-2 Process Water: S-2	VOCs: SW8260B PAHs and 1,4-dixoane: SW8270C-SIM	Accuracy/Bias	Analyte-specific (see Worksheet #15)	Laboratory control sample (LCS) recoveries	A
				Matrix spike (MS)/MS duplicate (MSD) recoveries	S&A
			Method-specific (see Worksheet #15)	Surrogate spikes	A
		Precision	Analyte-specific (see Worksheet #15)	MS/MSD relative percent differences (RPD)	S&A
				LCS/LCS duplicate (LCSD) RPDs[3]	A
				Field duplicate RPDs	S&A
		Accuracy/Bias and Representativeness	No target compound concentrations > 1/2 reporting limit (RL)	Method blanks (MB), trip blanks, and rinsate blanks (RB)	S&A
		Completeness	>90%	Data completeness check	S&A

QAPP Worksheet #12-1
Measurement Performance Criteria Table – Organic Analyses in Water (continued)

Matrix	Groundwater (GW) Monitoring, Process Water, and Groundwater Extraction Well Samples				
Analytical Group	Organics - VOCs (method SW-846 8260B) and PAHs and 1,4-dioxane (method SW-846 8270C-SIM).				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
GW Monitoring: S-1 GW Extraction: S-2 Process Water: S-2 (continued)	VOCs: SW8260B PAHs and 1,4-dixoane: SW8270C-SIM (continued)	Sensitivity	Analyte method detection limit (MDL) <1/2 RL	Annual MDL Study; quarterly verification	A
			Analyte MDL	Determined and verified with standards in accordance with Section D.1.2.1 of the DoD QSM version 4.2.	A
			Analyte RL	Quarterly verification by analysis of standard meeting QC criteria at 1-2x stated RL per analyte and matrix, in accordance with Section C.3 of the DoD QSM version 4.2.	A, P
			Instrument calibration	Low concentration of calibration curve at or below RL for each analyte	A

[1] Reference number from QAPP Worksheet #21.
[2] Reference number from QAPP Worksheet #23.
[3] LCSDs are not method requirements; however, if this information is provided, it will be evaluated.

QAPP Worksheet #12-2
Measurement Performance Criteria Table – Inorganic Analyses in Water

Matrix	Groundwater Monitoring, Process Water, and Groundwater Extraction Well Samples				
Analytical Group	Inorganics – Metals (method SW-846 6020) and Mercury (method SW-846 7470A)				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
GW Monitoring: S-1 GW Extraction: S-2 Process Water: S-2	Metals: SW6020 Mercury: SW7470A	Accuracy/Bias	Analyte-specific (see Worksheet #15)	LCS recoveries	A
				MS/MSD recoveries	S&A
		Precision	Analyte-specific (see Worksheet #15)	MS/MSD RPDs	S&A
				LCS/LCSD RPDs[3]	A
				Laboratory duplicate RPDs	A
				Field duplicate RPDs	S&A
		Accuracy/Bias and Representativeness	No target compound concentrations > 1/2 RL	MBs, initial and continuing calibration blanks, and RBs	S&A
		Completeness	>90%	Data completeness check	S&A
		Sensitivity	Analyte MDL <1/2 RL	Annual MDL Study; quarterly verification	A
			Analyte MDL	Determined and verified with standards in accordance with Section D.1.2.1 of the DoD QSM version 4.2.	A

QAPP Worksheet #12-2
Measurement Performance Criteria Table – Inorganic Analyses in Water (continued)

Matrix	Groundwater Monitoring, Process Water, and Groundwater Extraction Well Samples				
Analytical Group	Inorganics – Metals (method SW-846 6020) and Mercury (method SW-846 7470A)				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
GW Monitoring: S-1 GW Extraction: S-2 Process Water: S-2 (continued)	Metals: SW6020 Mercury: SW7470A (continued)	Sensitivity (continued)	Analyte RL	Quarterly verification by analysis of standard meeting QC criteria at 1-2x stated RL per analyte and matrix, in accordance with Section C.3 of the DoD QSM version 4.2.	A, P
			Instrument calibration	Low concentration of calibration curve at or below RL for each analyte	A

[1] Reference number from QAPP Worksheet #21.
[2] Reference number from QAPP Worksheet #23.
[3] LCSDs are not method requirements; however, if this information is provided, it will be evaluated.

QAPP Worksheet #12-3
Measurement Performance Criteria Table – Wet Chemistry Analyses in Water

Matrix	Process Water Samples				
Analytical Group	Inorganics – USEPA Wet Chemistry Methods: Total Alkalinity (method E310.1) and Kjeldahl Nitrogen (method E351.2). USEPA SW-846 Methods: Sulfate and Chloride (method SW9056). American Water Works Association (AWWA) Standard Methods: Total Hardness (method SM2340B); CBOD (method SM5210B); TDS (method SM2540C); and TSS (method SM2540D).				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**[3]	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Process Water: S-2	Alkalinity: E310.1 Nitrogen: E351.2 Sulfate: SW9056 Chloride: SW9056 Hardness: SM2340B CBOD: SM5210B TDS: SM2540C TSS: SM2540D	Accuracy/Bias	Analyte-specific (see Worksheet #15)	LCS recoveries	A
				MS/MSD recoveries	S&A
		Precision	Analyte-specific (see Worksheet #15)	MS/MSD RPDs	S&A
				LCS/LCSD RPDs[4]	A
				Laboratory duplicate RPDs	A
				Field duplicate RPDs	S&A
		Accuracy/Bias and Representativeness	No target compound concentrations > 1/2 RL	MBs, initial and continuing calibration blanks, and RBs	S&A
		Completeness	>90%	Data completeness check	S&A
		Sensitivity	Analyte MDL <1/2 RL	Annual MDL Study; quarterly verification	A

QAPP Worksheet #12-3
Measurement Performance Criteria Table – Wet Chemistry Analyses in Water (continued)

Matrix	Process Water Samples				
Analytical Group	Inorganics – USEPA Wet Chemistry Methods: Total Alkalinity (method E310.1) and Kjeldahl Nitrogen (method E351.2). USEPA SW-846 Methods: Sulfate and Chloride (method SW9056). American Water Works Association (AWWA) Standard Methods: Total Hardness (method SM2340B); CBOD (method SM5210B); TDS (method SM2540C); and TSS (method SM2540D).				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**[3]	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Process Water: S-2 (continued)	Alkalinity: E310.1 Nitrogen: E351.2 Sulfate: SW9056 Chloride: SW9056 Hardness: SM2340B CBOD: SM5210B TDS: SM2540C TSS: SM2540D (continued)	Sensitivity (continued)	Analyte MDL	Determined and verified with standards in accordance with Section D.1.2.1 of the DoD QSM version 4.2.	A
			Analyte RL	Quarterly verification by analysis of standard meeting QC criteria at 1-2x stated RL per analyte and matrix, in accordance with Section C.3 of the DoD QSM version 4.2.	A, P
			Instrument calibration	Low concentration of calibration curve at or below RL for each analyte	A

[1] Reference number from QAPP Worksheet #21.
[2] Reference number from QAPP Worksheet #23.
[3] Note that not all QC samples or activities are required for each wet chemistry method. See the method- and method group-specific tables (Worksheet #28-6) for the requirements appropriate for each method.
[4] LCSDs are not method requirements; however, if this information is provided, it will be evaluated.

QAPP Worksheet #12-4
Measurement Performance Criteria Table – Organic Analyses in Solids

Matrix	Solid (Waste Manifest Samples)
Analytical Group	TCLP Organics - VOCs (method SW-846 8260B); SVOCs (method SW-846 8270C); Herbicides (method SW-846 8151A); and Pesticides (method SW-846-8081A).
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Solid: S-3	VOCs: SW8260B SVOCs: SW8270C Herbicides: SW8151A Pesticides: SW8081A	Accuracy/Bias	Analyte-specific (see Worksheet #15)	LCS recoveries	A
				MS/MSD recoveries	S&A
			Method-specific (see Worksheet #15)	Surrogate spikes	A
		Precision	Analyte-specific (see Worksheet #15)	MS/MSD RPDs	S&A
				LCS/LCSD RPDs[3]	A
				Field duplicate RPDs	S&A
		Accuracy/Bias and Representativeness	No target compound concentrations > 1/2 RL	MBs, trip blanks, and RBs	S&A
		Completeness	>90%	Data completeness check	S&A
		Sensitivity	Analyte MDL <1/2 RL	Annual MDL Study; quarterly verification	A
			Analyte MDL	Determined and verified with standards in accordance with Section D.1.2.1 of the DoD QSM version 4.2.	A

QAPP Worksheet #12-4
Measurement Performance Criteria Table – Organic Analyses in Solids (continued)

Matrix	Solid (Waste Manifest Samples)				
Analytical Group	TCLP Organics - VOCs (method SW-846 8260B); SVOCs (method SW-846 8270C); Herbicides (method SW-846 8151A); and Pesticides (method SW-846-8081A).				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Solid: S-3 (continued)	VOCs: SW8260B SVOCs: SW8270C Herbicides: SW8151A Pesticides: SW8081A (continued)	Sensitivity (continued)	Analyte RL	Quarterly verification by analysis of standard meeting QC criteria at 1-2x stated RL per analyte and matrix, in accordance with Section C.3 of the DoD QSM version 4.2.	A, P
			Instrument calibration	Low concentration of calibration curve at or below RL for each analyte	A

[1] Reference number from QAPP Worksheet #21.
[2] Reference number from QAPP Worksheet #23.
[3] LCSDs are not method requirements; however, if this information is provided, it will be evaluated.

QAPP Worksheet #12-5
Measurement Performance Criteria Table – Inorganic Analyses in Solids

Matrix	Solid (Waste Manifest Samples)				
Analytical Group	TCLP Inorganics – Total Metals (method SW-846 6020) and Mercury (method SW-846 7471B)				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Solid: S-3	Metals: SW6020 Mercury: SW7471B	Accuracy/Bias	Analyte-specific (see Worksheet #15)	LCS recoveries	A
				MS/MSD recoveries	S&A
		Precision	Analyte-specific (see Worksheet #15)	MS/MSD RPDs	S&A
				LCS/LCSD RPDs[3]	A
				Laboratory duplicate RPDs	A
				Field duplicate RPDs	S&A
		Accuracy/Bias and Representativeness	No target compound concentrations > 1/2 RL	MBs, initial and continuing calibration blanks, and RBs	S&A
		Completeness	>90%	Data completeness check	S&A
		Sensitivity	Analyte MDL <1/2 RL	Annual MDL study; quarterly verification	A
			Analyte MDL	Determined and verified with standards in accordance with Section D.1.2.1 of the DoD QSM version 4.2.	A

QAPP Worksheet #12-5
Measurement Performance Criteria Table – Inorganic Analyses in Solids (continued)

Matrix	Solid (Waste Manifest Samples)				
Analytical Group	TCLP Inorganics – Total Metals (method SW-846 6020) and Mercury (method SW-846 7471B)				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Solid: S-3 (continued)	Metals: SW6020 Mercury: SW7471B (continued)	Sensitivity (continued)	Analyte RL	Quarterly verification by analysis of standard meeting QC criteria at 1-2x stated RL per analyte and matrix, in accordance with Section C.3 of the DoD QSM version 4.2.	A, P
			Instrument calibration	Low concentration of calibration curve at or below RL for each analyte	A

[1] Reference number from QAPP Worksheet #21.
[2] Reference number from QAPP Worksheet #23.
[3] LCSDs are not method requirements; however, if this information is provided, it will be evaluated.

QAPP Worksheet #12-6
Measurement Performance Criteria Table – Wet Chemistry Analyses in Solids

Matrix	Solid (Waste Manifest Samples)
Analytical Group	Inorganics – Ignitability (method SW-846 1030); Corrosivity (method SW-846 9045C); and Reactivity (methods SW-846 9012A and 9034).
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**[3]	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Solid: S-3	Ignitability: SW1030 Corrosivity: SW9045C Reactivity: SW9034 & SW9012A	Accuracy/Bias	Analyte-specific (see Worksheet #15)	LCS recoveries	A
				MS/MSD recoveries	S&A
		Precision	Analyte-specific (see Worksheet #15)	MS/MSD RPDs	S&A
				LCS/LCSD RPDs[4]	A
				Laboratory duplicate RPDs	A
				Field duplicate RPDs	S&A
		Accuracy/Bias and Representativeness	No target compound concentrations > 1/2 RL	MBs, initial and continuing calibration blanks, and RBs	S&A
		Completeness	>90%	Data completeness check	S&A
		Sensitivity	Analyte MDL <1/2 RL	Annual MDL Study; quarterly verification	A

QAPP Worksheet #12-6
Measurement Performance Criteria Table – Wet Chemistry Analyses in Solids (continued)

Matrix	Solid (Waste Manifest Samples)				
Analytical Group	Inorganics – Ignitability (method SW-846 1030); Corrosivity (method SW-846 9045C); and Reactivity (methods SW-846 9012A and 9034).				
Concentration Level	Low				
Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**[3]	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
Solid: S-3 (continued)	Ignitability: SW1030 Corrosivity: SW9045C Reactivity: SW9034 & SW9012A (continued)	Sensitivity (continued)	Analyte MDL	Determined and verified with standards in accordance with Section D.1.2.1 of the DoD QSM version 4.2.	A
			Analyte RL	Quarterly verification by analysis of standard meeting QC criteria at 1-2x stated RL per analyte and matrix, in accordance with Section C.3 of the DoD QSM version 4.2.	A, P
			Instrument calibration	Low concentration of calibration curve at or below RL for each analyte	A

[1] Reference number from QAPP Worksheet #21.
[2] Reference number from QAPP Worksheet #23.
[3] Note that not all QC samples or activities are required for each wet chemistry method. See the method- and method group-specific tables (Worksheet #28-7) for the requirements appropriate for each method.
[4] LCSDs are not method requirements; however, if this information is provided, it will be evaluated.

QAPP Worksheet #13
Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
2009 USEPA Region 2 NPL History GCL Tie & Treating Fact Sheet	USEPA: GCL Tie & Treating, EPA ID# NYD981566417, EPA Region 2, Congressional District 23, Delaware County, Sidney, New York, NPL Listing History; January 2009	USEPA: A brief discussion of site history, COC threats, the clean-up approached agreed on by the USEPA and the New York State Department of Environmental Conservation (NYSDEC), and remediation progression to date; 2009	Compared to historic results to identify spatial and temporal trends at GCL, and identify changes in discharge concentrations	None
1994 USEPA Superfund ROD	EPA/ROD/R02-94/243: EPA Superfund Record of Decision: GCL Tie & Treating Inc (OU-1), Sidney, New York; September 30, 1994.	USEPA: Selected response action for GCL Tie & Treating OU-1 in accordance with CERCLA and approved by the NYSDEC; 1994	Compared to historic results to identify spatial and temporal trends at GCL, and identify changes in discharge concentrations	None
1995 USEPA Superfund ROD	EPA/ROD/R02-95/244: EPA Superfund Record of Decision: GCL Tie & Treating, Inc. (OU-2), Sidney, Delaware County, New York; March 31, 1995.	USEPA: Selected response action for GCL Tie & Treating OU-2 in accordance with CERCLA and approved by the NYSDEC; 1995	Compared to historic results to identify spatial and temporal trends at GCL, and identify changes in discharge concentrations	None

QAPP Worksheet #14
Summary of Project Tasks

Sampling Tasks: A summarized list of sampling tasks is provided below; for more details per task, refer to Worksheets #17 through #20, #26 and #27.

- Annual monitoring well (groundwater) sampling from on-site monitoring wells (MW-01S, MW-01D, MW-03S, MW-03I, MW-03B, and EW-5I) and off-site wells (MW-07I, MW-07D, MW-08I, MW-10B, MW-11I, MW-11B, MW-12B, MW-13I, MW-13B, MW-14I, MW-14B, MW-15B, MW-16I, and EW-4I).
- Monthly process water (groundwater) sampling from sample tap ST-6 (the combined plant influent), the mid-LPGAC sample tap, and sample tap ST-1 (the plant effluent).
- Quarterly extraction well (groundwater) sampling from on-site wells (EW-1B and EW-2B) and an off-site well (EW-4B).
- As needed waste (solid) sampling of spent liquid and vapor-phase carbon, spent bag filters, manganese sludge, and spent green sand filtration media.

<u>Analysis Tasks</u>: A summarized list of analysis tasks is provided below; for more details per task, refer to Worksheets #15, #18 through #24, and #28.

Groundwater Monitoring Samples:
Field analyses -

- The following stabilization parameters will be measured at each well at 5 minute intervals and immediately prior to sampling: temperature, pH, specific conductance (SC), dissolved oxygen (DO), oxidation-reduction potential (ORP), turbidity, and water level.

Laboratory analyses - (performed by TAL-Savannah)

- VOCs by extraction method SW5030B and analysis method SW8260B,
- PAHs by extraction method SW5030B and analysis method SW8270C-SIM, and
- Total and dissolved iron and manganese by extraction method SW3005A and analysis method SW6020.

Process Water Samples:
Laboratory analyses - (performed by TAL-Savannah)

- VOCs by extraction method SW5030B and analysis method SW8260B,

QAPP Worksheet #14
Summary of Project Tasks (continued)

- PAHs and 1,4-dioxane by extraction method SW5030B and analysis method SW8270C-SIM,
- Total and dissolved iron and manganese by extraction method SW3005A and analysis method SW6020,
- Total mercury by extraction method SW3005A and analysis method SW7470A,
- Total hardness by method SM2340B,
- CBOD by method SM5210B,
- TDS by method SM2540C,
- TSS by method SM2540D,
- Total alkalinity by method E310.1,
- Chloride and sulfate by method SW9056, and
- Kjeldahl nitrogen by method E351.2.

Groundwater Extraction Well Samples:
Laboratory analyses - (performed by TAL- Savannah)

- VOCs by extraction method SW5030B and analysis method SW8260B,
- PAHs and 1,4-dioxane by extraction method SW5030B and analysis method SW8270C-SIM, and
- Total iron and manganese by extraction method SW3005A and analysis method SW6020.

Waste Manifesting Samples:
Laboratory analyses - (performed by TAL-Savannah)

- VOCs by extraction method SW1311 and analysis method SW8260B,
- SVOCs by extraction method SW1311 and analysis method SW8270C,
- Total metals by extraction method SW1311 and analysis method SW6020,
- Total mercury by extraction method SW1311 and analysis method SW7471B,
- Pesticides by extraction method SW1311 and analysis method SW8081B,
- Herbicides by extraction method SW1311 and analysis method SW8151A,
- Ignitability by method SW1030,
- Corrosivity by method SW9045C, and
- Reactivity by methods SW9012A and SW9034.

QAPP Worksheet #14
Summary of Project Tasks (continued)

Quality Control Tasks: A complete list of QC samples per matrix and analysis is provided in Worksheet #20.

- All groundwater monitoring samples will have the following field QC samples collected and analyzed: field duplicates, MS/MSDs, trip blanks (VOCs only), and RBs (when appropriate).
- All process water samples and groundwater extraction well samples will have the following field QC samples collected and analyzed: trip blanks (VOCs only).
- All analytical methods will be controlled by initial, initial verification, and continuing calibrations, instrument tuning, MBs, surrogate spikes, LCS, laboratory duplicates, and all other QC procedures defined in the project analytical methods (see Worksheet #28) and required to produce definitive data.

Secondary Data: A complete list of secondary data and limitations is provided in Worksheet #13.

Data Management Tasks: A flowchart depicting the process by which sample data are generated, validated, reported, and archived is at the end of this Worksheet.

- Analytical data will be delivered by TAL-Savannah in a database that meets the requirements of SEDD Stage IIa using an electronic QAPP (eQAPP) data library constructed by H&S.
- All laboratory data submitted as EDDs to H&S by TAL-Savannah will be processed through ADR. All qualifier changes and/or additions and all QC will be performed directly within ADR prior to being reported and archived in the GCL EDMS.

Documentation and Records: All field observations and sampling records will be entered into bound logbooks. CoC forms, air bills, well stabilization parameter logs, field instrument calibration logs, and investigation-derived waste records will be prepared and retained. Examples of the field forms are located in Appendix A of the GCL SAP.

QAPP Worksheet #14
Summary of Project Tasks (continued)

Analytical Data Packages: Analytical data packages will be required to contain all data required to perform data review in accordance with Level II data validation protocols as defined by the Region 2 USEPA and DoD QSM version 4.2. Sufficient documentation must be provided to allow for calibration, QC, blank, and other relevant information to be related to all associated sample analyses. A detailed description of analytical data package requirements is presented in Appendix B. At a minimum, Level III data packages should include all information necessary to validate the applicable method parameters discussed in Worksheets #15, #24, and #28, which comprise the following:

- A laboratory narrative discussing the performance of QC measures;
- Sample handling and receipt conditions;
- All associated CoC forms;
- A list of sample identifications;
- Sample analysis data;
- MS/MSD analyses;
- LCS/LCSD analyses;
- Surrogate spike results;
- Method and field blank analyses;
- All corresponding initial calibration, initial calibration verification, and continuing calibration verification data;
- Instrument tuning and internal standard results; and
- All other QC procedures defined in the project analytical methods (see Worksheet #28).

Assessment/Audit Tasks: Laboratory compliance with the DoD QSM and NELAP certification status were reviewed prior to award of the contract; laboratory precision, accuracy, and sensitivity performance was compared to the project requirements.

- TAL-Savannah is a laboratory certified under the NELAP through the State of New York AB and compliant with the DoD QSM version 4.2.

QAPP Worksheet #14
Summary of Project Tasks (continued)

Data Review Tasks: A flowchart depicting the process by which sample data are generated, validated, reported, and archived is at the end of this Worksheet. Once field and laboratory data acquisitions are complete, data verification, validation, and reconciliation to DQOs will be performed to determine the extent to which the data conform to the specified criteria and satisfy the project objectives. Data review and validation are processes whereby project data are compared against the QA/QC requirements of this UFP-QAPP, specifically the data are evaluated for precision, accuracy, and completeness. Data failing to conform to the QA/QC requirements are identified and qualified. Below is a summary of the data review and validation processes, and a detailed discussion is documented in the data delivery requirements of Appendix B and the data validation process of Appendix C. Prior to laboratory data generation, the H&S Project Chemist will review the associated CoC and laboratory sample receipt form to verify sample delivery and condition, and verify that the appropriate analyses and target analytes are scheduled.

Laboratory Data Review by TAL-Savannah:

- All analytical data will be extensively reviewed internally by the laboratory prior to report release to assure validity. This internal data evaluation process will cover the areas of data generation, reduction into contract laboratory program (CLP) summary forms, and a minimum three levels of documented review, including analyst, peer, and administrative reviews, and will be supplemented by QA reviews. Each level of review will be documented using an appropriate checklist that is signed and dated by the reviewer. Each step of this review process involves evaluation of data quality based on the results of the QC data.
- All data generated and reduced into CLP summary forms will follow the Laboratory Quality Manual (LQM) and the DoD QSM version 4.2.
- All data logbooks generated at the laboratory will be reviewed in accordance with this process. Spaces on logbook pages that are not used or are not applicable should be filled with “NA” or crossed out with a single line and initialed and dated, as appropriate.
- Before the data packages are released by the laboratory, both the sample and QC data are reviewed to verify sample identity, detection limits, dilution factors, instrument calibration, transcription accuracy, numerical computations, and chemical interpretations. Additionally, the QC data are reduced into CLP summary forms (per the requirements and forms listed in Appendix B), spike recoveries are included in control charts, and the resulting data are reviewed to determine whether they are within the QAPP-defined limits for accuracy and precision. All non-conforming data will be discussed in the data package case narrative, and all analytical and QC documentation associated with each data package will be retained by the laboratory.
- All EDDs and hard-copy data deliverables must also be reviewed to verify that they are consistent with each other and ensure an accurate database.
- All EDDS must be reviewed against the GCL ADR library provided by H&S using the ADR CCS check software prior to submission to H&S.

H&S Data Validation:

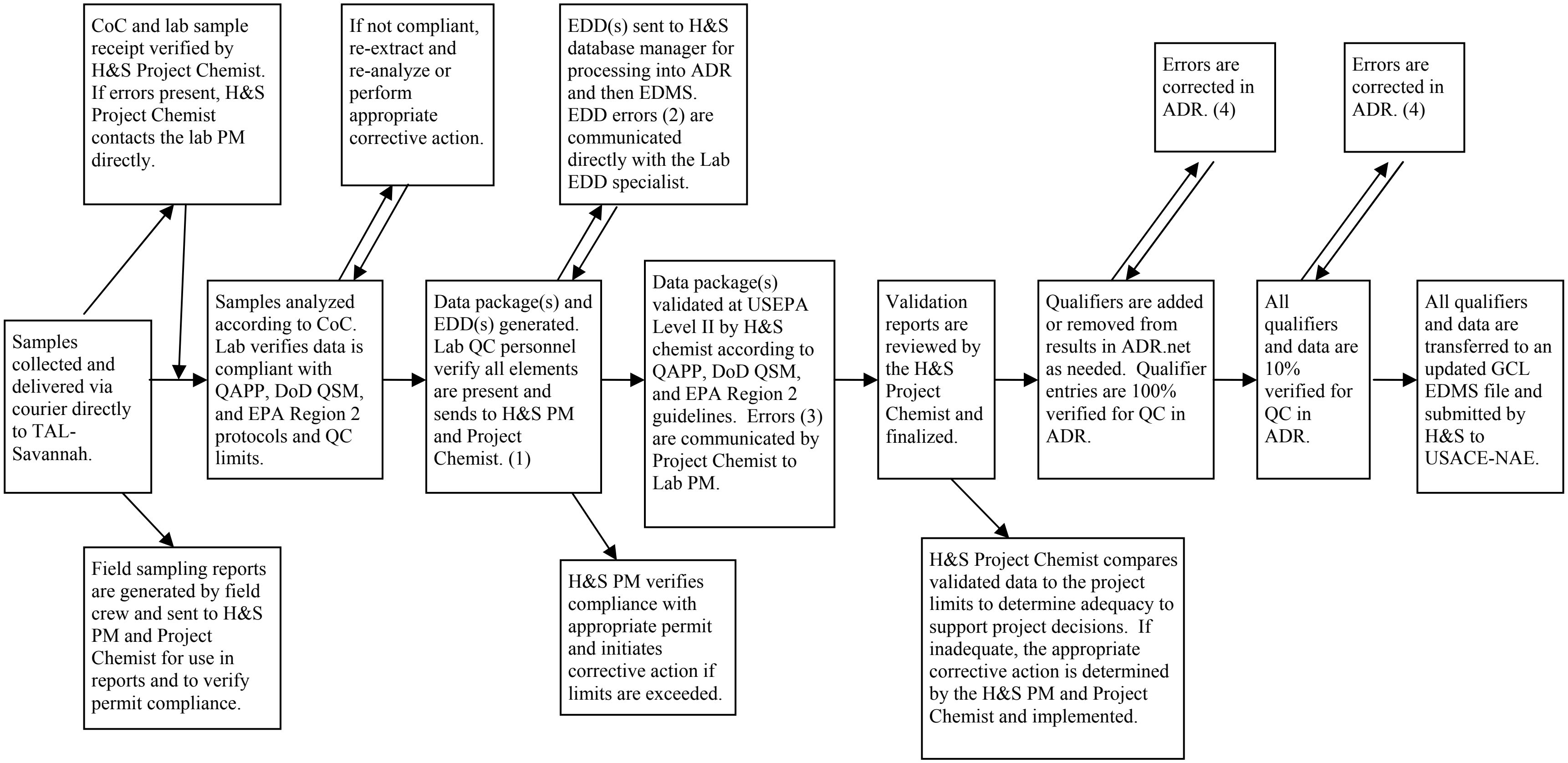
QAPP Worksheet #14
Summary of Project Tasks (continued)

- The data review and validation process is independent of the laboratory's review, as it focuses on the usability of the data to support the project data interpretation and decision-making process.
- To achieve consistent data validation, reports will be produced using H&S's internal data validation documentation format.
- An H&S chemist will perform the equivalent to USEPA Level II validation on 100% of the data received from TAL-Savannah with the exception of all waste manifesting sample data, which will be validated as necessary. All definitive data will be validated according to the full list of QC parameters and criteria listed in Worksheets #15, #24, and #28, and the USEPA Region 2 validation guidelines and DoD QSM version 4.2. A detailed discussion of the data validation process is in Appendix C.
- Sample results that do not meet the QC acceptance criteria are indicated as prescribed by the USEPA Region 2 validation guidelines and DoD QSM version 4.2 with a single qualifying flag, which is a one or two-letter abbreviation that indicates a possible problem with the data. The data qualifiers that will be applied to project data are the following:
    - **No qualifier** – The analyte was detected at the reported concentration.
    - **J** – The analyte was detected at the reported concentration; the quantitation is an estimate.
    - **R** – The data are rejected due to deficiencies in the ability to analyze the sample and meet QC criteria.
    - **U** – The analyte was analyzed for, but not detected. The associated numerical value is the RL. This qualifier is also applied to results that are considered to be artifacts based on contamination in the associated blanks. In these cases, the numerical value is the originally reported analyte concentration.
    - **UJ** – The analyte was analyzed for but not detected. The associated numerical value is the RL, which is estimated due to deficiencies in the QC criteria. This qualifier is also applied to results that are considered to be artifacts based on contamination in associated blanks and have other associated QC discrepancies. In these cases, the numerical value is the originally reported analyte concentration.
    - **X** – Excluded. The data point is associated with reanalyses or diluted analyses and is excluded because another result has been selected as the definitive result for the analyte.
- The H&S project chemist will verify all qualifier assignments and validation reports prior to use by H&S and USACE-NAE.
- All definitive data will also be reviewed via ADR and uploaded to the GCL EDMS file. After the in-house validation is completed, all ADR output will be verified by an H&S chemist. Although the ADR.net software can aid as a data review tool, it will not be used for data validation purposes. Hence, all qualifiers assigned by ADR will be compared to those assigned by the H&S chemist, and any discrepancies will defer to the H&S chemist's validation report for resolution.

QAPP Worksheet #14
Summary of Project Tasks (continued)

- Data qualifiers will be directly applied by the H&S validator within ADR, and all definitive data will receive a 100% and 10% QC check by a separate H&S chemist prior to final upload into the GCL EDMS. The 100% data QC check verifies that 100% of the data qualifiers entered into ADR correspond with the qualifiers assigned in the H&S validation reports. The 10% QC check requires the H&S chemist to review 10% of all qualified and unqualified data entered into ADR, ensuring that all EDDs from the laboratory are correct.
- In the reports, analytical performance will be reconciled with the DQOs and compliance with precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) requirements will be determined. Completeness will be assessed on a per-matrix basis, and corrective action will be initiated as required.
- Field measurement results (both from direct reading instruments and from test kits) will be reviewed by the field team leader to verify that results were obtained using properly conducted procedures.

QAPP Worksheet #14
Summary of Project Tasks (continued)



Samples collected and delivered via courier directly to TAL-Savannah.

CoC and lab sample receipt verified by H&S Project Chemist. If errors present, H&S Project Chemist contacts the lab PM directly.

Field sampling reports are generated by field crew and sent to H&S PM and Project Chemist for use in reports and to verify permit compliance.

Samples analyzed according to CoC. Lab verifies data is compliant with QAPP, DoD QSM, and EPA Region 2 protocols and QC limits.

If not compliant, re-extract and re-analyze or perform appropriate corrective action.

Data package(s) and EDD(s) generated. Lab QC personnel verify all elements are present and sends to H&S PM and Project Chemist. (1)

EDD(s) sent to H&S database manager for processing into ADR and then EDMS. EDD errors (2) are communicated directly with the Lab EDD specialist.

H&S PM verifies compliance with appropriate permit and initiates corrective action if limits are exceeded.

Data package(s) validated at USEPA Level II by H&S chemist according to QAPP, DoD QSM, and EPA Region 2 guidelines. Errors (3) are communicated by Project Chemist to Lab PM.

Validation reports are reviewed by the H&S Project Chemist and finalized.

H&S Project Chemist compares validated data to the project limits to determine adequacy to support project decisions. If inadequate, the appropriate corrective action is determined by the H&S PM and Project Chemist and implemented.

Qualifiers are added or removed from results in ADR.net as needed. Qualifier entries are 100% verified for QC in ADR.

Errors are corrected in ADR. (4)

All qualifiers and data are 10% verified for QC in ADR.

Errors are corrected in ADR. (4)

All qualifiers and data are transferred to an updated GCL EDMS file and submitted by H&S to USACE-NAE.

[1] Laboratories must review all EDDs against the Cosden ADR library provided by H&S using the ADR CCS software prior to submission to H&S.
[2] Such errors may include loading errors, incomplete or missing data, or using "ambient" rather than a value for sample cooler temperatures.
[3] Such errors may include the use of recovery criteria other than that stated in this UFP-QAPP, use of non-site samples for MS/MSDs, or use of calibrations that do not meet the DoD QSM criteria.
[4] Such errors may include incorrect qualifiers or incorrect data values.

QAPP Worksheet #15-1
Reference Limits and Evaluation Table

Matrix: Groundwater Monitoring Samples (aqueous)
Analytical Group: Total and Dissolved Metals (SW6020)
Concentration Level: Low

Analyte	CAS Number	Project Action Limit (PAL) (µg/L)	Project Quantitation Limit (PQL) (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
Iron, total	7439-89-6	300	100	NYSDEC	NS	NS	300	NC	NC	44	100
Iron, dissolved		300	100	NYSDEC	NS	NS	300	NC	NC	33	100
Manganese, total	7439-96-5	300	15	NYSDEC	NS	NS	300	NC	NC	2.0	15
Manganese, dissolved		300	15	NYSDEC	NS	NS	300	NC	NC	2.0	15

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method (SW)6020, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For method SW6020, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
NS = No standard provided.
NYDEC = New York Department of Environmental Conservation
ROD = March 1995 EPA Superfund Record of Decision for GCL Tie & Treating, Inc., OU2, Sidney, Delaware County, New York.

QAPP Worksheet #15-2
Reference Limits and Evaluation Table

Matrix: Groundwater Monitoring Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
1,1,1-Trichloroethane	71-55-6	5	2.0	NYSDEC	50	200	5	0.08	0.5	0.5	2.0
1,1,2,2-Tetrachloroethane	79-34-5	5	2.0	NYSDEC	NS	NS	5	0.04	0.1	0.18	2.0
1,1-Dichloroethane	75-34-3	5	2.0	ROD	5	NS	5	0.04	0.5	0.25	2.0
1,1-Dichloroethene	75-35-4	5	1.1	NYSDEC	50	7	5	0.12	0.24	0.11	1.1
1,1-Dichloropropene	563-58-6	NS	2.0	ROD	NS	NS	NS	0.10	0.5	0.25	2.0
1,2,4-Trimethylbenzene	95-63-6	5	2.0	NYSDEC	50	NS	5	0.13	0.5	0.33	2.0
1,2-Dichloroethane	107-06-2	0.6	2.0	NYSDEC	NS	5	0.6	0.06	0.1	0.10	2.0
1,3,5-Trimethylbenzene	108-67-8	5	2.0	NYSDEC	50	NS	5	0.05	0.5	0.33	2.0
Benzene	71-43-2	1	1.0	NYSDEC	5	5	1	0.04	0.1	0.25	1.0
Carbon tetrachloride	56-23-5	5	2.0	NYSDEC	NS	5	5	0.21	0.5	0.50	2.0
Chlorobenzene	108-90-7	5	2.0	NYSDEC	NS	NS	5	0.04	0.1	0.25	2.0
Chloroform	67-66-3	7	2.0	NYSDEC	NS	NS	7	0.03	0.5	0.14	2.0
Chloromethane	74-87-3	NS	5.0	ROD	NS	NS	NS	0.13	0.5	0.33	5.0
cis-1,2-Dichloroethene	156-59-2	5	2.0	NYSDEC	50	70	5	0.12	0.5	0.15	2.0
Ethylbenzene	100-41-4	5	2.0	NYSDEC	5	700	5	0.06	0.1	0.11	2.0
Methylene chloride	75-09-2	5	5.0	NYSDEC	NS	5	5	0.03	0.1	1.0	5.0

QAPP Worksheet #15-2
Reference Limits and Evaluation Table (continued)

Matrix: Groundwater Monitoring Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
Methyl *tert*-butyl ether	1634-04-4	NS	2.0	NYSDEC	NS	NS	NS	0.09	0.4	0.20	2.0
m,*p*-Xylene	179601-23-1	5	2.0	NYSDEC	5	5	5	0.13	0.5	0.20	2.0
o-Xylene	95-47-6	5	2.0	NYSDEC	5	5	5	0.11	0.5	0.25	2.0
Styrene	100-42-5	5	2.0	NYSDEC	50	100	5	0.04	0.1	0.11	2.0
Toluene	108-88-3	5	2.0	NYSDEC	5	1,000	5	0.11	0.5	0.33	2.0
Trichloroethene	79-01-6	5	2.0	NYSDEC	50	5	5	0.19	0.5	0.13	2.0
Vinyl chloride	75-01-4	2	2.0	NYSDEC	NS	2	2	0.17	0.5	0.18	2.0

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8260B, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
Cell value bold and shaded = Laboratory RL above the PAL concentration
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NS = No standard provided.
NYDEC = New York Department of Environmental Conservation
ROD = March 1995 EPA Superfund Record of Decision for GCL Tie & Treating, Inc., OU2, Sidney, Delaware County, New York.

QAPP Worksheet #15-3
Reference Limits and Evaluation Table

Matrix: Groundwater Monitoring Samples (aqueous)
Analytical Group: PAHs (SW8270C-SIM)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
2-Methylnaphthalene	91-57-6	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Acenaphthene	83-32-9	20	0.19	NYSDEC	NS	NS	20	NC	NC	0.096	0.19
Acenaphthylene	208-96-8	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Anthracene	120-12-7	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(a)anthracene	56-55-3	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(a)pyrene	50-32-8	ND	0.19	NYSDEC	NS	0.2	ND	NC	NC	0.096	0.19
Benzo(b)fluoranthene	205-99-2	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(g,h,i)perylene	191-24-2	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(k)fluoranthene	207-08-9	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Chrysene	218-01-9	NS	0.19	ROD	NS	NS	NS	NC	NC	0.043	0.19
Dibenzo(a,h)anthracene	53-70-3	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Fluorene	86-83-7	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Fluoranthene	206-44-0	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Indeno(1,2,3-cd)pyrene	193-39-5	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Naphthalene	91-20-3	10	0.19	NYSDEC	NS	NS	10	NC	NC	0.096	0.19

QAPP Worksheet #15-3
Reference Limits and Evaluation Table

Matrix: Groundwater Monitoring Samples (aqueous)
Analytical Group: PAHs (SW8270C-SIM)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
Phenanthrene	85-01-8	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Pyrene	129-00-0	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8270C, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For method SW8270C, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
ND = non detected
NS = No standard provided.
ROD = March 1995 EPA Superfund Record of Decision for GCL Tie & Treating, Inc., OU2, Sidney, Delaware County, New York.

QAPP Worksheet #15-4
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: Total and Dissolved Metals (SW6020) and Mercury (SW7470A)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	NPDES Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
Aluminum, total	7429-90-5	2,000	200	NYSDEC	NS	NS	2,000	NC	NC	50	200
Antimony, total	7440-36-0	6	20	NYSDEC	NS	6	6	NC	NC	2.0	20
Arsenic, total	7440-38-2	10	5.0	Federal	NS	10	50	NC	NC	1.3	5.0
Barium, total	7440-39-3	2,000	200	NYSDEC	NS	2,000	2,000	NC	NC	1.4	200
Beryllium, total	7440-41-7	4	4.0	Federal	NS	4	NS	NC	NC	0.15	4.0
Cadmium, total	7440-43-9	5	5.0	Federal	NS	5	10	NC	NC	0.13	5.0
Calcium, total	7440-70-2	NS	2,500	NPDES	NS	NS	NS	NC	NC	170	2,500
Chromium, total	7440-47-3	100	10	Federal	NS	100	NS	NC	NC	2.5	10
Cobalt, total	7440-48-4	NS	50	NPDES	NS	NS	NS	NC	NC	0.12	50
Copper, total	7440-50-8	400	25	NYSDEC	NS	NS	400	NC	NC	1.1	25
Iron, total	7439-89-6	300	100	NPDES	300	NS	600	NC	NC	44	100
Iron, dissolved		300	100	NPDES	300	NS	600	NC	NC	33	100
Lead, total	7439-92-1	50	5.0	NYSDEC	NS	NS	50	NC	NC	0.50	5.0
Magnesium, total	7439-95-4	NS	2,500	NPDES	NS	NS	NS	NC	NC	100	2,500
Manganese, total	7439-96-5	300	15	NPDES	300	NS	600	NC	NC	2.0	15
Manganese, dissolved		300	15	NPDES	300	NS	600	NC	NC	2.0	15

QAPP Worksheet #15-4
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: Total and Dissolved Metals (SW6020) and Mercury (SW7470A)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (µg/L)**	**PQL (µg/L)**	**PAL Source**	**NPDES Limits (µg/L)**	**Federal Limits (µg/L)**	**NYDEC Limits (µg/L)**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
								MDLs (µg/L)	**RLs (µg/L)**	**MDLs (µg/L)**	**RLs (µg/L)**
Nickel, total	7440-02-0	200	40	NYSDEC	NS	NS	200	NC	NC	2.0	40
Potassium, total	7440-09-7	NS	2,500	NPDES	NS	NS	NS	NC	NC	330	2,500
Selenium, total	7782-49-2	20	5.0	NYSDEC	NS	50	20	NC	NC	1.1	5.0
Silver, total	7440-22-4	100	7.0	NYSDEC	NS	NS	100	NC	NC	0.18	7.0
Sodium, total	7440-23-5	NS	2,500	NPDES	NS	NS	NS	NC	NC	170	2,500
Thallium, total	7440-28-0	2	2.0	Federal	NS	2	NS	NC	NC	0.25	2.0
Vanadium, total	7440-62-2	NS	50	NPDES	NS	NS	NS	NC	NC	3.2	50
Zinc, total	7440-66-6	5,000	20	NYSDEC	NS	NS	5,000	NC	NC	8.4	20
Mercury, total	7439-97-6	1.4	0.24	NYSDEC	NS	2	1.4	NC	NC	0.091	0.24

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Methods (SW6020 and SW7470A), which are the basis for the TAL-Savannah SOPs.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
Cell value bold and shaded = Laboratory RL above the PAL concentration
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For methods SW6020 and SW7470A, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
NS = No standard provided.
NPDES = National Pollutant Discharge Elimination System

QAPP Worksheet #15-5
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	NPDES Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
1,1,1-Trichloroethane	71-55-6	10	2.0	NPDES	10	200	NS	0.08	0.5	0.50	2.0
1,1,1,2-Tetrachloroethane	630-20-6	NS	2.0	NPDES	NS	NS	NS	0.05	0.5	0.33	2.0
1,1,2,2-Tetrachloroethane	79-34-5	NS	2.0	NPDES	NS	NS	NS	0.04	0.1	0.18	2.0
1,1,2-Trichloroethane	79-00-5	1	2.0	NYSDEC	NS	5	1	0.10	0.5	0.13	2.0
1,1-Dichloroethane	75-34-3	5	2.0	NPDES	5	NS	NS	0.04	0.5	0.25	2.0
1,1-Dichloroethene	75-35-4	7	1.1	NPDES	7	7	NS	0.12	0.24	0.11	1.1
1,1-Dichloropropene	563-58-6	NS	2.0	NPDES	NS	NS	NS	0.10	0.5	0.25	2.0
1,2,3-Trichlorobenzene	87-61-6	NS	2.0	NPDES	NS	NS	NS	0.03	0.5	0.35	2.0
1,2,3-Trichloropropane	96-18-4	0.04	2.0	NYSDEC	NS	NS	0.04	0.32	2.0	0.41	2.0
1,2,4-Trichlorobenzene	120-82-1	70	2.0	Federal	NS	70	NS	0.04	0.5	0.25	2.0
1,2,4-Trimethylbenzene	95-63-6	10	2.0	NPDES	10	NS	NS	0.13	0.5	0.33	2.0
1,2-Dibromo-3-chloropropane	96-12-8	0.04	5.0	NYSDEC	NS	NS	0.04	0.26	0.5	0.44	5.0
1,2-Dibromoethane	106-93-4	NS	2.0	NPDES	NS	NS	NS	0.06	0.5	0.25	2.0
1,2-Dichlorobenzene	95-50-1	3	2.0	NYSDEC	NS	600	3	0.03	0.1	0.21	2.0
1,2-Dichloroethane	107-06-2	0.6	2.0	NYSDEC	NS	5	0.6	0.06	0.1	0.10	2.0
1,2-Dichloropropane	78-87-5	1	2.0	NYSDEC	NS	5	1	0.04	0.1	0.13	2.0

QAPP Worksheet #15-5
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	NPDES Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
1,3-Dichlorobenzene	541-73-1	3	2.0	NYSDEC	NS	NS	3	0.12	0.5	0.25	2.0
1,3-Dichloropropane	142-28-9	NS	2.0	NPDES	NS	NS	NS	0.04	0.5	0.13	2.0
1,3,5-Trimethylbenzene	108-67-8	10	2.0	NPDES	10	NS	NS	0.05	0.5	0.33	2.0
1,4-Dichlorobenzene	106-46-7	3	2.0	NYSDEC	NS	75	3	0.03	0.2	0.28	2.0
2-Butanone (MEK)	78-93-3	NS	10	NPDES	NS	NS	NS	0.48	2.0	1.0	10
2-Chlorotoluene	95-49-8	NS	2.0	NPDES	NS	NS	NS	0.04	0.5	0.17	2.0
2-Hexanone	591-78-6	NS	10	NPDES	NS	NS	NS	0.39	1.0	1.0	10
2,2-Dichloropropane	594-20-7	NS	2.0	NPDES	NS	NS	NS	0.35	2.0	0.12	2.0
4-Chlorotoluene	106-43-4	NS	2.0	NPDES	NS	NS	NS	0.06	0.5	0.27	2.0
4-Methyl-2-pentanone	108-10-1	NS	10	NPDES	NS	NS	NS	0.17	0.4	1.0	10
4-Isopropyltoluene	99-87-6	NS	2.0	NPDES	NS	NS	NS	0.12	0.5	0.13	2.0
Acetone	67-64-1	NS	25	NPDES	NS	NS	NS	0.28	1.0	5.0	25
Benzene	71-43-2	1	1.0	NYSDEC	5	5	1	0.04	0.1	0.25	1.0
Bromobenzene	108-86-1	NS	2.0	NPDES	NS	NS	NS	0.03	0.5	0.16	2.0
Bromochloromethane	74-97-5	NS	2.0	NPDES	NS	NS	NS	0.04	0.5	0.14	2.0
Bromodichloromethane	75-27-4	NS	2.0	NPDES	NS	NS	NS	0.08	0.1	0.25	2.0

QAPP Worksheet #15-5
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (µg/L)**	**PQL (µg/L)**	**PAL Source**	**NPDES Limits (µg/L)**	**Federal Limits (µg/L)**	**NYDEC Limits (µg/L)**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
								MDLs (µg/L)	**RLs (µg/L)**	**MDLs (µg/L)**	**RLs (µg/L)**
Bromoform	75-25-2	NS	2.0	NPDES	NS	NS	NS	0.12	0.5	0.50	2.0
Bromomethane	74-83-9	NS	2.0	NPDES	NS	NS	NS	0.11	0.5	0.80	2.0
Carbon disulfide	75-15-0	120	2.0	NYSDEC	NS	NS	120	0.093	0.2	0.60	2.0
Carbon tetrachloride	56-23-5	5	2.0	NYSDEC	NS	5	5	0.21	0.5	0.50	2.0
Chlorobenzene	108-90-7	100	2.0	Federal	NS	100	NS	0.04	0.1	0.25	2.0
Chloroethane	75-00-3	NS	5.0	NPDES	NS	NS	NS	0.10	0.5	1.0	5.0
Chloroform	67-66-3	7	2.0	NYSDEC	NS	NS	7	0.03	0.5	0.14	2.0
Chloromethane	74-87-3	NS	5.0	NPDES	NS	NS	NS	0.13	0.5	0.33	5.0
cis-1,2-Dichloroethene	156-59-2	10	2.0	NPDES	10	70	NS	0.12	0.5	0.15	2.0
cis-1,3-Dichloropropene	10061-01-5	NS	1.1	NPDES	NS	NS	NS	NC	NC	0.11	1.1
Dibromochloromethane	124-48-1	NS	2.0	NPDES	NS	NS	NS	0.05	0.1	0.10	2.0
Dibromomethane	74-95-3	NS	2.0	NPDES	NS	NS	NS	0.24	2.0	0.20	2.0
Dichlorodifluoromethane	75-71-8	NS	5.0	NPDES	NS	NS	NS	0.10	0.5	0.25	5.0
Diethyl ether	60-29-7	NS	5.0	NPDES	NS	NS	NS	NC	NC	1.0	5.0
Ethylbenzene	100-41-4	5	2.0	NPDES	5	700	NS	0.06	0.1	0.11	2.0
Hexachlorobutadiene	87-68-3	0.5	2.0	NYSDEC	NS	NS	0.5	0.11	0.5	0.40	2.0

QAPP Worksheet #15-5
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (µg/L)**	**PQL (µg/L)**	**PAL Source**	**NPDES Limits (µg/L)**	**Federal Limits (µg/L)**	**NYDEC Limits (µg/L)**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
								MDLs (µg/L)	**RLs (µg/L)**	**MDLs (µg/L)**	**RLs (µg/L)**
Isopropylbenzene	98-82-8	NS	2.0	NPDES	NS	NS	NS	0.11	0.5	0.10	2.0
Methylene chloride	75-09-2	5	5.0	NYSDEC	NS	5	5	0.03	0.1	1.0	5.0
Methyl *tert*-butyl ether	1634-04-4	NS	2.0	NPDES	NS	NS	NS	0.09	0.4	0.20	2.0
m,p-Xylene	179601-23-1	5	2.0	NPDES	5	5	NS	0.13	0.5	0.20	2.0
Naphthalene	91-20-3	13	5.0	NPDES	13	NS	NS	0.04	0.5	1.0	5.0
n-Butylbenzene	104-51-8	NS	2.0	NPDES	NS	NS	NS	0.11	0.5	0.10	2.0
N-Propylbenzene	103-65-1	NS	2.0	NPDES	NS	NS	NS	0.04	0.5	0.15	2.0
o-Xylene	95-47-6	5	2.0	NPDES	5	5	NS	0.11	0.5	0.25	2.0
sec-Butylbenzene	135-98-8	NS	2.0	NPDES	NS	NS	NS	0.13	0.5	0.16	2.0
Styrene	100-42-5	5	2.0	NYSDEC	10	100	5	0.04	0.1	0.11	2.0
t-Butanol	75-65-0	NS	50	NPDES	NS	NS	NS	NC	NC	2.6	50
tert-Butylbenzene	98-06-6	NS	2.0	NPDES	NS	NS	NS	0.14	0.5	0.12	2.0
Tetrachloroethene	127-18-4	5	2.0	Federal	NS	5	NS	0.14	0.5	0.15	2.0
Tetrahydrofuran	109-99-9	NS	10	NPDES	NS	NS	NS	NC	NC	0.48	10
Toluene	108-88-3	5	2.0	NPDES	5	1,000	NS	0.11	0.5	0.33	2.0
trans-1,2-Dichloroethene	156-60-5	100	2.0	Federal	NS	100	NS	0.06	0.1	0.20	2.0

QAPP Worksheet #15-5
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (µg/L)**	**PQL (µg/L)**	**PAL Source**	**NPDES Limits (µg/L)**	**Federal Limits (µg/L)**	**NYDEC Limits (µg/L)**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
								MDLs (µg/L)	**RLs (µg/L)**	**MDLs (µg/L)**	**RLs (µg/L)**
trans-1,3-Dichloropropene	10061-02-6	NS	1.0	NPDES	NS	NS	NS	NC	NC	0.21	1.0
Trichloroethene	79-01-6	5	2.0	NPDES	5	5	5	0.19	0.5	0.13	2.0
Trichlorofluoromethane	75-69-4	NS	2.0	NPDES	NS	NS	NS	0.08	0.5	0.25	2.0
Vinyl chloride	75-01-4	2	2.0	NYSDEC	NS	2	2	0.17	0.5	0.18	2.0

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8260B, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
Cell value bold and shaded = Laboratory RL above the PAL concentration
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For method SW8260B, select analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
NS = No standard provided.
NPDES = National Pollutant Discharge Elimination System

QAPP Worksheet #15-6
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: PAHs and 1,4-dioxane (SW8270C-SIM)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	NPDES Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
2-Methylnaphthalene	91-57-6	4.7	0.19	NPDES	4.7	NS	NS	NC	NC	0.096	0.19
Acenaphthene	83-32-9	5.3	0.19	NPDES	5.3	NS	NS	NC	NC	0.096	0.19
Acenaphthylene	208-96-8	NS	0.19	NPDES	NS	NS	NS	NC	NC	0.096	0.19
Anthracene	120-12-7	3.8	0.19	NPDES	3.8	NS	NS	NC	NC	0.096	0.19
Benzo(a)anthracene	56-55-3	0.05	**0.19**	NPDES	0.05	NS	NS	NC	NC	0.096	0.19
Benzo(a)pyrene	50-32-8	ND	**0.19**	NYDEC	0.09	0.2	ND	NC	NC	0.096	0.19
Benzo(b)fluoranthene	205-99-2	0.2	0.19	NPDES	0.2	NS	NS	NC	NC	0.096	0.19
Benzo(g,h,i)perylene	191-24-2	NS	0.19	NPDES	NS	NS	NS	NC	NC	0.096	0.19
Benzo(k)fluoranthene	207-08-9	0.2	0.19	NPDES	0.2	NS	NS	NC	NC	0.096	0.19
Chrysene	218-01-9	0.2	0.19	NPDES	0.2	NS	NS	NC	NC	0.043	0.19
Dibenz(a,h)anthracene	53-70-3	NS	0.19	NPDES	NS	NS	NS	NC	NC	0.096	0.19
Fluorene	86-83-7	4.8	0.19	NPDES	4.8	NS	NS	NC	NC	0.096	0.19
Fluoranthene	206-44-0	10	0.19	NPDES	10	NS	NS	NC	NC	0.096	0.19
Indeno(1,2,3-cd)pyrene	193-39-5	0.4	0.19	NPDES	0.4	NS	NS	NC	NC	0.096	0.19
Naphthalene	91-20-3	13	0.19	NPDES	13	NS	NS	NC	NC	0.096	0.19

QAPP Worksheet #15-6
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: PAHs and 1,4-dioxane (SW8270C-SIM)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (µg/L)**	**PQL (µg/L)**	**PAL Source**	**NPDES Limits (µg/L)**	**Federal Limits (µg/L)**	**NYDEC Limits (µg/L)**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
								MDLs (µg/L)	**RLs (µg/L)**	**MDLs (µg/L)**	**RLs (µg/L)**
Phenanthrene	85-01-8	5	0.19	NPDES	5	NS	NS	NC	NC	0.096	0.19
Pyrene	129-00-0	4.6	0.19	NPDES	4.6	NS	NS	NC	NC	0.096	0.19
1,4-Dioxane	123-91-1	NS	48	NPDES	NS	NS	NS	NC	NC	0.30	48

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8270C, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
Cell value bold and shaded = Laboratory RL above the PAL concentration
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For method SW8270C, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
ND = not detected
NS = No standard provided.
NPDES = National Pollutant Discharge Elimination System

QAPP Worksheet #15-7
Reference Limits and Evaluation Table

Matrix: Process Water Samples (aqueous)
Analytical Group: Wet Chemistry Parameters (various methods)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	NPDES Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (mg/L)	RLs (mg/L)	MDLs (mg/L)	RLs (mg/L)
Hardness, total (SM2340B)	Hardness	NS	17,000	NPDES	NS	NS	NS	NC	NC	3.3	17
CBOD (SM5210B)	CBOD	NS	2,000	NPDES	NS	NS	NS	NC	4.0	2.0	2.0
TDS (SM2540C)	TDS	500	20,000	NPDES	500	NS	1,000,000	NC	NC	10	20
TSS (SM2540D)	TSS	NS	5,000	NPDES	NS	NS	NS	NC	NC	5.0	5.0
Alkalinity, total (E310.1)	AKL-Lab	NS	10,000	NPDES	NS	NS	NS	NC	NC	5.0	10
Chloride (SW9056)	16887-00-6	500,000	5,000	NYDEC	NS	NS	500,000	NC	NC	1.0	5.0
Sulfate (SW9056)	14808-79-8	500,000	10,000	NYDEC	NS	NS	500,000	NC	NC	2.6	10
Nitrogen, Kjeldahl (E351.2)	7727-37-9	10,000	1,000	NYDEC	NS	NS	10,000	NC	NC	0.15	1.0

[1] Analytical MDLs and QLs are those documented in the associated validated methods, which are the basis for the TAL-Savannah SOPs.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
Cell value bold and shaded = Laboratory RL above the PAL concentration
µg/L = micrograms per liter
mg/L = milligrams per liter
CAS = Chemical Abstract Service
NC = For select methods, analytical MDLs and RLs were not calculated and, therefore, are not reported in this table.
NS = No standard provided.
NPDES = National Pollutant Discharge Elimination System

QAPP Worksheet #15-8
Reference Limits and Evaluation Table

Matrix: Groundwater Extraction Well Samples (aqueous)
Analytical Group: Total Metals (SW6020)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
Iron, total	7439-89-6	300	100	NYDEC	NS	NS	300	NC	NC	44	100
Manganese, total	7439-96-5	300	15	NYDEC	NS	NS	300	NC	NC	2.0	15

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method (SW)6020, which is the basis for the TAL-Savannah SOP.

[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For method SW6020, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
NS = No standard provided.
ROD = March 1995 EPA Superfund Record of Decision for GCL Tie & Treating, Inc., OU2, Sidney, Delaware County, New York.

QAPP Worksheet #15-9
Reference Limits and Evaluation Table

Matrix: Groundwater Extraction Well Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method^1		Achievable Laboratory Limits^2	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
1,1,1-Trichloroethane	71-55-6	5	2.0	NYDEC	50	200	5	0.08	0.5	0.5	2.0
1,1,2,2-Tetrachloroethane	79-34-5	5	2.0	NYDEC	NS	NS	5	0.04	0.1	0.18	2.0
1,1-Dichloroethane	75-34-3	5	2.0	ROD	5	NS	5	0.04	0.5	0.25	2.0
1,1-Dichloroethene	75-35-4	5	1.1	NYDEC	50	7	5	0.12	0.24	0.11	1.1
1,1-Dichloropropene	563-58-6	NS	2.0	ROD	NS	NS	NS	0.10	0.5	0.25	2.0
1,2,4-Trimethylbenzene	95-63-6	5	2.0	NYDEC	50	NS	5	0.13	0.5	0.33	2.0
1,2-Dichloroethane	107-06-2	0.6	2.0	NYDEC	NS	NS	0.6	0.06	0.1	0.10	2.0
1,3,5-Trimethylbenzene	108-67-8	5	2.0	NYDEC	50	NS	5	0.05	0.5	0.33	2.0
Benzene	71-43-2	1	1.0	NYDEC	5	5	1	0.04	0.1	0.25	1.0
Carbon tetrachloride	56-23-5	5	2.0	NYDEC	NS	5	5	0.21	0.5	0.50	2.0
Chlorobenzene	108-90-7	5	2.0	NYDEC	NS	100	5	0.04	0.1	0.25	2.0
Chloroform	67-66-3	7	2.0	NYDEC	NS	NS	7	0.03	0.5	0.14	2.0
Chloromethane	74-87-3	NS	5.0	ROD	NS	NS	NS	0.13	0.5	0.33	5.0
cis-1,2-Dichloroethene	156-59-2	5	2.0	NYDEC	50	70	5	0.12	0.5	0.15	2.0
Ethylbenzene	100-41-4	5	2.0	ROD	5	700	5	0.06	0.1	0.11	2.0

QAPP Worksheet #15-9
Reference Limits and Evaluation Table

Matrix: Groundwater Extraction Well Samples (aqueous)
Analytical Group: VOCs (SW8260B)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (µg/L)**	**PQL (µg/L)**	**PAL Source**	**ROD Limits (µg/L)**	**Federal Limits (µg/L)**	**NYDEC Limits (µg/L)**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
								MDLs (µg/L)	**RLs (µg/L)**	**MDLs (µg/L)**	**RLs (µg/L)**
Methylene chloride	75-09-2	5	5.0	NYDEC	NS	NS	5	0.03	0.1	1.0	5.0
Methyl *tert*-butyl ether	1634-04-4	NS	2.0	ROD	NS	NS	NS	0.09	0.4	0.20	2.0
m,p-Xylene	179601-23-1	5	2.0	ROD	5	5	5	0.13	0.5	0.20	2.0
o-Xylene	95-47-6	5	2.0	ROD	5	5	5	0.11	0.5	0.25	2.0
Styrene	100-42-5	5	2.0	NYDEC	50	100	5	0.04	0.1	0.11	2.0
Toluene	108-88-3	5	2.0	ROD	5	1,000	5	0.11	0.5	0.33	2.0
Trichloroethene	79-01-6	5	2.0	NYDEC	50	5	5	0.19	0.5	0.13	2.0
Vinyl chloride	75-01-4	2	2.0	NYDEC	NS	2	2	0.17	0.5	0.18	2.0

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8260B, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
Cell value bold and shaded = Laboratory RL above the PAL concentration
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NS = No standard provided.
ROD = March 1995 EPA Superfund Record of Decision for GCL Tie & Treating, Inc., OU2, Sidney, Delaware County, New York.

QAPP Worksheet #15-10
Reference Limits and Evaluation Table

Matrix: Groundwater Extraction Well Samples (aqueous)
Analytical Group: PAHs and 1,4-dioxane (SW8270C-SIM)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
2-Methylnaphthalene	91-57-6	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Acenaphthene	83-32-9	20	0.19	NYDEC	NS	NS	20	NC	NC	0.096	0.19
Acenaphthylene	208-96-8	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Anthracene	120-12-7	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(a)anthracene	56-55-3	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(a)pyrene	50-32-8	ND	0.19	NYDEC	NS	0.2	ND	NC	NC	0.096	0.19
Benzo(b)fluoranthene	205-99-2	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(g,h,i)perylene	191-24-2	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Benzo(k)fluoranthene	207-08-9	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Chrysene	218-01-9	NS	0.19	ROD	NS	NS	NS	NC	NC	0.043	0.19
Dibenz(a,h)anthracene	53-70-3	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Fluorene	86-83-7	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Fluoranthene	206-44-0	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Indeno(1,2,3-cd)pyrene	193-39-5	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Naphthalene	91-20-3	10	0.19	NYDEC	NS	NS	10	NC	NC	0.096	0.19

QAPP Worksheet #15-10
Reference Limits and Evaluation Table

Matrix: Groundwater Extraction Well Samples (aqueous)
Analytical Group: PAHs and 1,4-dioxane (SW8270C-SIM)
Concentration Level: Low

Analyte	CAS Number	PAL (µg/L)	PQL (µg/L)	PAL Source	ROD Limits (µg/L)	Federal Limits (µg/L)	NYDEC Limits (µg/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
								MDLs (µg/L)	RLs (µg/L)	MDLs (µg/L)	RLs (µg/L)
Phenanthrene	85-01-8	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
Pyrene	129-00-0	NS	0.19	ROD	NS	NS	NS	NC	NC	0.096	0.19
1,4-Dioxane	123-91-1	NS	48	ROD	NS	NS	NS	NC	NC	0.30	48

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8270C, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
µg/L = micrograms per liter
CAS = Chemical Abstract Service
NC = For method SW8270C, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
ND = non detected
NS = No standard provided.
ROD = March 1995 EPA Superfund Record of Decision for GCL Tie & Treating, Inc., OU2, Sidney, Delaware County, New York.

QAPP Worksheet #15-11
Reference Limits and Evaluation Table

Matrix: Waste Manifesting Samples (solid)
Analytical Group: TCLP Total Metals (SW6020) and Mercury (SW7471B)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (mg/L)**	**PQL (mg/L)**	**PAL Source**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
					MDLs (mg/L)	**RLs (mg/L)**	**MDLs (mg/L)**	**RLs (mg/L)**
Arsenic	7440-38-2	5.0	0.2	CFR	NC	NC	0.2	0.2
Barium	7440-39-3	100	1.0	CFR	NC	NC	1.0	1.0
Cadmium	7440-43-9	1.0	0.1	CFR	NC	NC	0.1	0.1
Chromium	7440-47-3	5.0	0.2	CFR	NC	NC	0.2	0.2
Lead	7439-92-1	5.0	0.2	CFR	NC	NC	0.2	0.2
Selenium	7782-49-2	1.0	0.5	CFR	NC	NC	0.5	0.5
Silver	7440-22-4	5.0	0.1	CFR	NC	NC	0.1	0.1
Mercury	7439-97-6	0.2	0.02	CFR	NC	NC	0.02	0.02

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Methods 6020 and 7471B, which are the basis for the TAL-Savannah SOPs.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
mg/L = milligrams per liter
CAS = Chemical Abstract Service
CFR = Code of Federal Regulations, 40 CFR 261.21-24 (effective July 31, 2009)
NC = For methods SW6020 and SW7471B, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.

QAPP Worksheet #15-12
Reference Limits and Evaluation Table

Matrix: Waste Manifesting Samples (solid)
Analytical Group: TCLP VOCs (SW8260B)
Concentration Level: Low

Analyte	CAS Number	PAL (mg/L)	PQL (mg/L)	PAL Source	Analytical Method[1]		Achievable Laboratory Limits[2]	
					MDLs (mg/L)	RLs (mg/L)	MDLs (mg/L)	RLs (mg/L)
1,1-Dichloroethene	75-35-4	0.7	0.02	CFR	NC	NC	0.02	0.02
1,2-Dichloroethane	107-06-2	0.5	0.02	CFR	NC	NC	0.02	0.02
Benzene	71-43-2	0.5	0.02	CFR	NC	NC	0.02	0.02
Carbon tetrachloride	56-23-5	0.5	0.02	CFR	NC	NC	0.02	0.02
Chlorobenzene	108-90-7	100	0.02	CFR	NC	NC	0.02	0.02
Chloroform	67-66-3	6.0	0.02	CFR	NC	NC	0.02	0.02
2-Butanone (MEK)	78-93-3	200	0.2	CFR	NC	NC	0.2	0.2
Tetrachloroethene	127-18-4	0.7	0.02	CFR	NC	NC	0.02	0.02
Trichloroethene	79-01-6	0.5	0.02	CFR	NC	NC	0.02	0.02
Vinyl chloride	75-01-4	0.2	0.02	CFR	NC	NC	0.02	0.02

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8260B, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
mg/L = milligrams per liter
CAS = Chemical Abstract Service
CFR = Code of Federal Regulations, 40 CFR 261.21-24 (effective July 31, 2009)
NC = For method SW8260B, analytical RLs and MDLs were not calculated for solids and, therefore, are not reported in this table.

QAPP Worksheet #15-13
Reference Limits and Evaluation Table

Matrix: Waste Manifesting Samples (solid)
Analytical Group: TCLP SVOCs (SW8270C)
Concentration Level: Low

Analyte	CAS Number	PAL (mg/L)	PQL (mg/L)	PAL Source	Analytical Method[1]		Achievable Laboratory Limits[2]	
					MDLs (mg/L)	RLs (mg/L)	MDLs (mg/L)	RLs (mg/L)
1,4-Dichlorobenzene	106-46-7	7.5	0.05	CFR	NC	NC	0.05	0.05
2,4,5-Trichlorophenol	95-95-4	400	0.05	CFR	NC	NC	0.05	0.05
2,4,6-Trichlorophenol	88-06-2	2.0	0.05	CFR	NC	NC	0.05	0.05
2,4-Dinitrotoluene	121-14-2	0.13	0.05	CFR	NC	NC	0.05	0.05
2-Methylphenol	95-48-7	200	0.1	CFR	NC	NC	0.1	0.1
3- & 4-Methylphenol	108-39-4 / 106-44-5	200	0.1	CFR	NC	NC	0.1	0.1
Hexachlorobenzene	118-74-1	0.13	0.05	CFR	NC	NC	0.05	0.05
Hexachlorobutadiene	87-68-3	0.5	0.05	CFR	NC	NC	0.05	0.05
Hexachloroethane	67-72-1	3.0	0.05	CFR	NC	NC	0.05	0.05
Nitrobenzene	98-95-3	2.0	0.05	CFR	NC	NC	0.05	0.05
Pentachlorophenol	87-86-5	100	0.25	CFR	NC	NC	0.25	0.25
Pyridine	110-86-1	5.0	0.25	CFR	NC	NC	0.25	0.25

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8270C, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
mg/L = milligrams per liter
NC = For method SW8270C, analytical RLs and MDLs were not calculated and, therefore, are not reported in this table.
CFR = Code of Federal Regulations, 40 CFR 261.21-24 (effective July 31, 2009)

QAPP Worksheet #15-14
Reference Limits and Evaluation Table

Matrix: Waste Manifesting Samples (solid)
Analytical Group: TCLP Herbicides (SW8151A)
Concentration Level: Low

Analyte	CAS Number	PAL (mg/L)	PQL (mg/L)	PAL Source	Analytical Method[1]		Achievable Laboratory Limits[2]	
					MDLs (mg/L)	RLs (mg/L)	MDLs (mg/L)	RLs (mg/L)
2,4,5-TP (Silvex)	93-72-1	1	0.05	CFR	NC	NC	0.05	0.05
2,4-D	94-75-7	10	0.05	CFR	NC	NC	0.05	0.05

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8151A, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
mg/L = milligrams per liter
CAS = Chemical Abstract Service
CFR = Code of Federal Regulations, 40 CFR 261.21-24 (effective July 31, 2009)
NC =For method SW8151A, analytical RLs and MDLs were not calculated for solids and, therefore, are not reported in this table.

QAPP Worksheet #15-15
Reference Limits and Evaluation Table

Matrix: Waste Manifesting Samples (solid)
Analytical Group: TCLP Pesticides (SW8081A)
Concentration Level: Low

Analyte	**CAS Number**	**PAL (mg/L)**	**PQL (mg/L)**	**PAL Source**	**Analytical Method[1]**		**Achievable Laboratory Limits[2]**	
					MDLs (mg/L)	**RLs (mg/L)**	**MDLs (mg/L)**	**RLs (mg/L)**
Chlordane	57-74-9	0.03	0.025	CFR	NC	NC	0.025	0.025
Endrin	72-20-8	0.02	0.005	CFR	NC	NC	0.005	0.005
Heptachlor	76-44-8	0.008	0.0025	CFR	NC	NC	0.0025	0.0025
Heptachlor epoxide	1024-57-3	0.008	0.0025	CFR	NC	NC	0.0025	0.0025
gamma-BHC (Lindane)	58-89-9	0.4	0.0025	CFR	NC	NC	0.0025	0.0025
Methoxychlor	72-43-5	10	0.025	CFR	NC	NC	0.025	0.025
Toxaphene	8001-35-2	0.5	0.25	CFR	NC	NC	0.25	0.25

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Method 8081A, which is the basis for the TAL-Savannah SOP.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.

NOTES:
mg/L = milligrams per liter
CAS = Chemical Abstract Service
CFR = Code of Federal Regulations, 40 CFR 261.21-24 (effective July 31, 2009)
NC = Not calculated. For method SW8081A, analytical RLs and MDLs were not calculated for solids and, therefore, are not reported in this table.

QAPP Worksheet #15-16
Reference Limits and Evaluation Table

Matrix: Waste Manifesting Samples (solid)
Analytical Group: Wet Chemistry Parameters (various SW-846 SOPs)
Concentration Level: Low

Analyte	CAS Number	PAL (mg/L)	PQL (mg/L)	PAL Source	Analytical Method[1]		Achievable Laboratory Limits[2]	
					MDLs (mg/L)	RLs (mg/L)	MDLs (mg/L)	RLs (mg/L)
Ignitability (SW1030)	Note 3	60 ºC	NA	CFR	NC	NC	NA	NA
Corrosivity (SW9045C)	Note 3	pH≤2 or ≥12.5	NA	CFR	NC	NC	NA	NA
Reactivity (SW9012A and SW9034)	Note 3	Note 4	25	CFR	0.2	NC	NA	25

[1] Analytical MDLs and QLs are those documented in the validated SW-846 Methods 1030, 9045C, 9012A, and 9034, which are the basis for the TAL-Savannah SOPs.
[2] Achievable MDLs and QLs are limits that TAL-Savannah can achieve when performing the specified analytical method.
[3] Refer to CFR 40 Part 261.21-24 for the CAS classification of a substance, as determined by the severity of the target analyte.
[4] Refer to CFR 40 Part 261.23 for the characteristics of a reactive substance.

NOTES:
mg/L = milligrams per liter
CAS = Chemical Abstract Service
CFR = Code of Federal Regulations, 40 CFR 261.21-24 (effective July 31, 2009)
NC = Not calculated. For methods SW1030, SW9045C, SW9012A, and SW9034, analytical RLs and/or MDLs were not calculated and, therefore, are not reported in this table.

QAPP Worksheet #16-1
Project Schedule/Timeline Table

Matrix: Groundwater Monitoring Samples (aqueous)
Concentration: Low

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Frequency	**Duration**		
Sampling Objectives					
Groundwater monitoring sampling (20 total wells)[1]	H&S	Annual event	5 days	Analytical data package and EDDs	Within 21 calendar days of sample receipt
Field Testing of groundwater physical parameters (20 total wells)[1]	H&S	Annual event	5 days	Field log-book	Same day
Reports					
In-house USEPA Level II validation of data packages received from laboratory.	H&S	1/method in each analytical data package	NA	Data validation report	Completed within 3 weeks of data package receipt
Update GCL EDMS file with validated data via ADR.	H&S	1/year	NA	EDMS file	Completed annually and submitted with the annual report
Data quality evaluation	H&S	1/year	NA	Annual Report	Completed annually to supplement the EDMS submission to USACE-NAE

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[1] See Worksheet #18 for the Sample Locations and compounds to be analyzed.

QAPP Worksheet #16-2
Project Schedule/Timeline Table

Matrix: Process Water Samples (aqueous)
Concentration: Low

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Frequency	Duration		
Sampling Objectives					
Process liquid sampling (3 plant pipe locations)[1]	H&S	Monthly event	1 day	Analytical data package and EDDs	Within 21 calendar days of sample receipt

[1] See Worksheet #18 for the Sample Locations and compounds to be analyzed.

QAPP Worksheet #16-3
Project Schedule/Timeline Table

Matrix: Groundwater Extraction Well Samples (aqueous)
Concentration: Low

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Frequency	**Duration**		
Sampling Objectives					
Groundwater extraction well sampling (3 total wells)[1]	H&S	Quarterly event	1 day	Analytical data package and EDDs	Within 21 calendar days of sample receipt
Reports					
In-house USEPA Level II validation of data packages received from laboratory.	H&S	1/method in each analytical data package	NA	Data validation report	Completed within 3 weeks of data package receipt
Update GCL EDMS file with validated data via ADR.	H&S	1/quarter	NA	EDMS file	Completed quarterly and submitted with the annual report
Data quality evaluation	H&S	1/ quarter	NA	Quarterly email	Completed quarterly within 30 days of data package receipt

[1] See Worksheet #18 for the Sample Locations and compounds to be analyzed.

QAPP Worksheet #16-4
Project Schedule/Timeline Table

Matrix: Waste Manifesting Samples (Solid)
Concentration: Low

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Frequency	**Duration**		
Sampling Objectives					
Waste samples collected from spent liquid and vapor-phase carbon, spent bag filters, manganese sludge, and spent green sand filter media.[1]	H&S	As required by the receiving treatment or disposal facility	1 day	Analytical data package and EDDs	Within 21 calendar days of sample receipt

[1] See Worksheet #18 for the Sample Locations and compounds to be analyzed.

QAPP Worksheet #17
Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach): The sampling approach for the site is biased and is based on the sampling approach originally implemented in 2004 to comply with the requirements of the site-specific ROD. Sampling rationale is based on the results of the 2004 through 2008 LTRA Program sampling events and is meant to meet all system effluent discharge requirements and monitor natural attenuation at the GCL site and downgradient from the site. Waste manifest samples will comply with the analytical requirements of 40 CFR 261, 40 CFR 262, 40 CFR 268, 49 CFR 172, and 49 CFR 178.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:
GCL project sample types:

- Groundwater monitoring samples;
- Process water samples;
- Groundwater extraction well samples; and
- Waste manifest samples.

See Worksheets #15, 18, 20, and 28 for additional details.
A detailed discussion of all procedures related to collecting each project sample type is provided in Section 3.0 of the GCL SAP. Example field forms and the field sample collection SOP are also located in the GCL SAP, as Appendices A and B, respectively. All proposed and historic groundwater monitoring and extraction well locations are depicted in Figure 3.1 of the GCL SAP.

QAPP Worksheet #18-1
Sampling Locations and Methods/SOP Requirements Table

Sampling Location[1]	Matrix	Depth of Pump Intake (ft bgs)	Analytical Group[2]	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[3]	Rationale for Sampling Location
MW-01S	Groundwater Monitoring Samples (aqueous)	15.0	*Laboratory:* VOCs, PAHs, and Total and Dissolved Metals. *Field:* field meter readings of water quality parameters	Low	See Worksheet #20-1	S-1	Monitor Natural Attenuation
MW-01D		70.2		Low		S-1	
MW-03S		15.3		Low		S-1	
MW-03I		56.9		Low		S-1	
MW-03B		115.1		Low		S-1	
MW-07I		45.2		Low		S-1	
MW-07D		129.2		Low		S-1	
MW-08I		49.7		Low		S-1	
MW-10B		154.8		Low		S-1	
MW-11I		99.7		Low		S-1	
MW-11B		159.7		Low		S-1	
MW-12B		124.7		Low		S-1	
MW-13I		130.0		Low		S-1	
MW-13B		164.0		Low		S-1	
MW-14I		111.5		Low		S-1	
MW-14B		183.0		Low		S-1	

QAPP Worksheet #18-1
Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location[1]	Matrix	Depth of Pump Intake (ft bgs)	Analytical Group[2]	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[3]	Rationale for Sampling Location
MW-15B	Groundwater Monitoring Samples (aqueous)	184.0	*Laboratory:* VOCs, PAHs, and Total and Dissolved Metals. *Field:* field meter readings of water quality parameters	Low	See Worksheet #20-1	S-1	Monitor Natural Attenuation
MW-16I		174.7		Low		S-1	
EW-4I		80.5		Low		S-1	
EW-5I		45.1		Low		S-1	

[1] All proposed and historic groundwater monitoring and extraction well locations are depicted in Figure 3.1 of the GCL SAP.
[2] See Worksheets #15-1 through #15-3 for the specific compounds to be analyzed and the associated methods.
[3] See the Project Sampling SOP References Table in Worksheet #21.

NOTES:
ft bgs = feet below ground surface
NA = not applicable

QAPP Worksheet #18-2
Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Matrix	Depth to Bottom (feet)	Analytical Group[1]	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[2]	Rationale for Sampling Location
ST-6	Process Water Samples (aqueous)	NA	*Laboratory:* VOCs, PAHs and 1,4-Dioxane, Total and Dissolved Metals, Mercury, and Wet Chemistry Parameters.	Low	See Worksheet #20-2	S-2	Monitor compliance with New York State effluent discharge limits.
ST-1		NA		Low		S-2	
Mid-LPGAC		NA	*Laboratory:* VOCs	Low		S-2	

[1]See Worksheets #15-4 through #15-7 for the specific compounds to be analyzed and the associated methods.
[2]See the Project Sampling SOP References Table in Worksheet #21.

NOTES:
NA = not applicable

QAPP Worksheet #18-3
Sampling Locations and Methods/SOP Requirements Table

Sampling Location[1]	Matrix	Depth of Pump Intake (ft bgs)	Analytical Group[2]	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[3]	Rationale for Sampling Location
EW-1B	Groundwater Extraction Well Samples (aqueous)	48.8	*Laboratory:* VOCs, PAHs and 1,4-Dioxane, and Total Metals.	Low	See Worksheet #20-3	S-2	Monitor Natural Attenuation
EW-2B		103.8		Low		S-2	
EW-4B		132.3		Low		S-2	

[1] All proposed and historic groundwater monitoring and extraction well locations are depicted in Figure 3.1 of the GCL SAP.
[2] See Worksheets #15-8 through #15-10 for the specific compounds to be analyzed and the associated methods.
[3] See the Project Sampling SOP References Table in Worksheet #21.

NOTES:
ft bgs = feet below ground surface

QAPP Worksheet #18-4
Sampling Locations and Methods/SOP Requirements Table

Sampling Location	Matrix	Depth to Bottom (feet)	Analytical Group[1]	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[2]	Rationale for Sampling Location
LPGAC carbon	Waste Manifesting Samples (solid)	NA	*Laboratory:* Select TCLP VOCs, SVOCs, Pesticides, Herbicides, Metals (including mercury), Ignitability, Corrosivity, and Reactivity.	Low	See Worksheet #20-4	S-3	Monitor Compliance with 40 CFR Part 261.21-24
VPGAC carbon		NA		Low		S-3	
Bag filters		NA		Low		S-3	
Manganese sludge		NA		Low		S-3	
Green sand filtration media		NA		Low		S-3	

[1] See Worksheets #15-11 through #15-16 for the specific compounds to be analyzed and the associated methods.
[2] See the Project Sampling SOP References Table in Worksheet #21.

NOTES:
NA = not applicable

QAPP Worksheet #19-1
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Preparation Method	Analytical Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Groundwater Monitoring Samples (aqueous)	VOCs	Low	SW5030B	SW8260B	120 milliliters (mL)	3 x 40-mL glass volatile organic analysis (VOA) vials with Teflon-lined septum; no headspace	4 ° ± 2°C, HCl to pH <2, $Na_2S_2O_3$ if residual Cl present	14 days (Preserved) 7 days (Unpreserved)
	PAHs	Low	SW5030B	SW8270C-SIM	1 L	1 x 1-L amber glass bottle with Teflon-lined septum; no headspace	4° ± 2°C	7 days (extraction) 40 days (analysis)
	Metals, total	Low	SW3005A	SW6020	500 mL	1 x 500-mL HDPE	4 ° ± 2°C, HNO_3 to pH <2	6 months
	Metals, dissolved	Low	SW3005A	SW6020	500 mL	1 x 500-mL HDPE	filter immediately via 0.45 µm glass-fiber filter; 4 ° ± 2°C, HNO_3 to pH <2	6 months

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #19-2
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Preparation Method	Analytical Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Process Water Samples (aqueous)	VOCs	Low	SW5030B	SW8260B	120 mL	3 x 40-mL glass VOA vials with Teflon-lined septum; no headspace	4 º ± 2ºC, HCl to pH <2	14 days (Preserved) 7 days (Unpreserved)
	PAHs	Low	SW5030B	SW8270C-SIM	1 L	1 x 1-L amber glass bottle with Teflon-lined septum	4º ± 2ºC	7 days (extraction) 40 days (analysis)
	Metals, total	Low	SW3005A	SW6020	500 mL	1 x 500-mL HDPE	4 º ± 2ºC, HNO_3 to pH <2	6 months
	Mercury	Low		SW7470A				28 days
	Metals, dissolved	Low	SW3005A	SW6020	500 mL	1 x 500-mL HDPE	filter immediately via 0.45 µm glass-fiber filter; 4 º ± 2ºC, HNO_3 to pH <2	6 months
	Hardness	Low	NA	SM2340B	250 mL	1 x 250-mL HDPE	4 º ± 2ºC, HNO_3 to pH <2	6 months
	CBOD	Low	NA	SM5210B	1 L	1 x 1-L HDPE	4 º ± 2ºC	48 hours
	TDS	Low	NA	SM2540C	500 mL	1 x 500-mL HDPE	4 º ± 2ºC	7 days
	TSS	Low	NA	SM2540D				
	Alkalinity	Low	NA	E310.1	250 mL	1 x 250-mL HDPE	4º ± 2ºC	14 days
	Chloride/ Sulfate	Low	NA	SW9056	125 mL	1 x 125-mL HDPE	4º ± 2ºC	28 days
	Nitrogen, Kjeldahl	Low	NA	E351.2	250 mL	1 x 250-mL HDPE	4 º ± 2ºC, H_2SO_4 to pH <2	28 days

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #19-3
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Preparation Method	Analytical Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Groundwater Extraction Well Samples (aqueous)	VOCs	Low	SW5030B	SW8260B	120 mL	3 x 40-mL glass VOA vials with Teflon-lined septum; no headspace	4 ° ± 2°C, HCl to pH <2	14 days (Preserved) 7 days (Unpreserved)
	PAHs	Low	SW5030B	SW8270C-SIM	1 L	1 x 1-L amber glass bottle with Teflon-lined septum; no headspace	4° ± 2°C	7 days (extraction) 40 days (analysis)
	Metals, total	Low	SW3005A	SW6020	500 mL	1 x 500-mL HDPE	4 ° ± 2°C, HNO_3 to pH <2	6 months

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #19-4
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Preparation Method	Analytical Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Waste Manifesting Samples (solid)	TCLP VOCs	Low	SW1311	SW8260B	4 oz	2 x 4 oz glass bottle with Teflon-lined septum; no headspace	4 º ± 2ºC	14 days
	TCLP SVOCs	Low	SW1311	SW8270C	8 oz	2 x 16 oz glass bottle		14 days (extraction) 40 days (analysis)
	TCLP Metals	Low	SW1311	SW6020	4 oz	2 x 16 oz glass bottle		6 months
	TCLP Mercury	Low	SW1311	SW7471B	4 oz			28 days
	TCLP Herbicides	Low	SW1311	SW8151A	8 oz	2 x 16 oz glass bottle		14 days (extraction) 40 days (analysis)
	TCLP Pesticides	Low	SW1311	SW8081A	8 oz	2 x 16 oz glass bottle		
	TCLP Ignitability	Low	NA	SW1030	4 oz	3 x 8 oz glass bottle		7 days
	TCLP Corrosivity (as pH)	Low	NA	SW9045C	4 oz			
	TCLP Reactivity (as total cyanide and sulfide)	Low	NA	SW9012A / SW9034	4 oz			

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #20-1
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concen. Level	Prep SOP	Analytical SOP Ref.[1]	No. of Sampling Locations	No. of Field Duplicates	No. of MS Samples	No. of MSD Samples	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	TOTAL No. of Samples to Lab
Groundwater Monitoring Samples (aqueous)	VOCs	Low	SW5030B	SW8260B	20/annual	1/event	1/event	1/event	5/event	1/event	0	29/annual
	PAHs	Low	SW5030B	SW8270C-SIM	20/annual	1/event	1/event	1/event	0	1/event	0	24/annual
	Metals, total	Low	SW3005A	SW6020	20/annual	1/event	1/event	1/event	0	1/event	0	24/annual
	Metals, dissolved	Low	SW3005A	SW6020	20/annual	1/event	1/event	1/event	0	1/event	0	24/annual

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #20-2
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concen. Level	Prep SOP	Analytical SOP Ref.[1]	No. of Sampling Locations	No. of Field Duplicates	No. of MS Samples	No. of MSD Samples	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	TOTAL No. of Samples to Lab
Process Water Samples (aqueous)	VOCs	Low	SW5030B	SW8260B	3/month	0	0	0	1/event	0	0	4/month
	PAHs	Low	SW5030B	SW8270C-SIM	2/month	0	0	0	0	0	0	2/month
	Metals, total	Low	SW3005A	SW6020	2/month	0	0	0	0	0	0	2/month
	Metals, dissolved	Low	SW3005A	SW6020	2/month	0	0	0	0	0	0	2/month
	Mercury	Low	SW3005A	SW7470A	2/month	0	0	0	0	0	0	2/month
	Hardness	Low	NA	SM2340B	2/month	0	0	0	0	0	0	2/month
	CBOD	Low	NA	SM5210B	2/month	0	0	0	0	0	0	2/month
	TDS	Low	NA	SM2540C	2/month	0	0	0	0	0	0	2/month
	TSS	Low	NA	SM2540D	2/month	0	0	0	0	0	0	2/month
	Alkalinity	Low	NA	E310.1	2/month	0	0	0	0	0	0	2/month
	Chloride/ Sulfate	Low	NA	SW9056	2/month	0	0	0	0	0	0	2/month
	Nitrogen, Kjeldahl	Low	NA	E351.2	2/month	0	0	0	0	0	0	2/month

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #20-3
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concen. Level	Prep SOP	Analytical SOP Ref.[1]	No. of Sampling Locations	No. of Field Duplicates	No. of MS Samples	No. of MSD Samples	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	TOTAL No. of Samples to Lab
Groundwater Extraction Well Samples (aqueous)	VOCs	Low	SW5030B	SW8260B	3/quarter	0	0	0	1/event	0	0	4/quarter
	PAHs	Low	SW5030B	SW8270C-SIM	3/quarter	0	0	0	0	0	0	3/quarter
	Metals, total	Low	SW3005A	SW6020	3/quarter	0	0	0	0	0	0	3/quarter

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #20-4
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concen. Level	Prep SOP	Analytical SOP Ref.[1]	No. of Sampling Locations	No. of Field Duplicates	No. of MS Samples	No. of MSD Samples	No. of Trip Blanks	No. of Equip. Blanks	No. of PT Samples	TOTAL No. of Samples to Lab
Waste Manifesting Samples (solid)	VOCs	Low	SW1311	SW8260B	5/as required	0	0	0	0	0	0	5/as required
	SVOCs	Low	SW1311	SW8270C	5/as required	0	0	0	0	0	0	5/as required
	Metals/ Mercury	Low	SW1311	SW6020, SW7471B	5/as required	0	0	0	0	0	0	5/as required
	Herbicides	Low	SW1311	SW8151A	5/as required	0	0	0	0	0	0	5/as required
	Pesticides	Low	SW1311	SW8081A	5/as required	0	0	0	0	0	0	5/as required
	Ignitability	Low	NA	SW1030	5/as required	0	0	0	0	0	0	5/as required
	Corrosivity (as pH)	Low	NA	SW9045C	5/as required	0	0	0	0	0	0	5/as required
	Reactivity (as total cyanide and sulfide)	Low	NA	SW9012A, SW9034	5/as required	0	0	0	0	0	0	5/as required

[1] See analytical SOP references table in Worksheet #23.

QAPP Worksheet #21
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number[1]	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-1	Low Stress (Low-Flow) Purging and Sampling Procedure for the collection of Groundwater Samples from Monitoring Wells, (includes decontamination of sampling equipment)	USEPA Region 1	Bladder pumps, peristaltic pumps, bailers	N	Sampling SOP for groundwater monitoring samples.
S-2	Appendix C, part C.3.4.2 of USACE Engineer Manual (EM) 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans, 2001	USACE	Dip/grab sampler	N	Sampling SOP for groundwater extraction well samples and process water samples.
S-3	Section 7, Subsection 7.6.3 of the USEPA Environmental Response Team Drum Sampling SOP #2009, Coring Device, 1994.	USEPA	Core sampler	N	Waste manifest sample collection SOP.

[1] The referenced USACE and USEPA sampling documents are included as Appendix B of the GCL SAP. Section 3.0 of the GCL SAP also discusses in detail the H&S sample collection, handling, and custody procedures that adhere to the USACE and USEPA procedures listed above, as well as the field equipment calibration procedures.

QAPP Worksheet #22
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

For additional information, refer to Section 3.2.4.1 of the GCL SAP. Example Field Forms are located in Appendix A of the GCL SAP.

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]	Analytes
YSI Water Quality Meter	• pH by 3-point calibration • all other parameters by manufacturer's recommendation	Probe must be rinsed with deionized water following calibration and between each sample collected.	Groundwater Monitoring Sampling	Visual and Calibration	Prior to each sampling event.	• Turbidity +/-10% • DO +/- 10% • pH +/- 0.01 • SC +/- 2%	Re-calibrate	Stacey Lee	S-1	Temperature, pH, SC, DO, and ORP
Turbidity Meter	Unit is factory calibrated.	Unit response is checked at the 0-10 range, 0-100 range, and 0-1000 range.	Groundwater Monitoring Sampling	Visual and Maintenance	Prior to each sampling event.	+/- 10%	Re-calibrate	Stacey Lee	S-1	Turbidity
Water Level Meter	Unit is factory calibrated.	Probe must be rinsed with deionized water between each sample collected.	Groundwater Monitoring Sampling	Visual and Maintenance	Prior to each sampling event.	+/- 10%	Re-analyze sample	Stacey Lee	S-1	Water level

[1] See project sampling SOP references table in Worksheet #21.

QAPP Worksheet #23
Analytical SOP References Table

Reference Number[1]	Title, Revision Date, and/or Number[2]	Definitive[3] or Screening[4] Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SW8260B	SOP VM20:03.04.04:5B: Volatile Compounds by GC/MS (Method: USEPA 8260B), Revision 5.0; 03/14/07	Definitive	VOCs	GC/MS	TAL-Savannah	N
SW8270C	SOP SM08:03.10.08:3: Low Level Polyaromatic Hydrocarbons (PAH) by GC/MS (Method: Modified USEPA 8270C), Revision 3.0; 04/14/08	Definitive	SVOCs	GC/MS	TAL-Savannah	N
SW6020	SOP SA-ME-074: Elements by ICP-MS (Methods: EPA 200.8, EPA 6020, and EPA 6020A), Revision 6.0; 06/09/11	Definitive	Metals	Inductively coupled plasma mass spectrometry (ICP-MS)	TAL-Savannah	N
SW7470A, SW7471B	SOP SA-ME-028: Mercury Preparation and Analysis (Methods: USEPA 245.1, SW-846 7470A, SW-846 7471A, and SW-846 7471B), Revision 5.0; 04/27/09	Definitive	Metals	Cold vapor atomic absorption (CVAA)	TAL-Savannah	N
SW8151A	SOP SG65:09.20.06:7B: Chlorinated Herbicides (Methods: USEPA 515.1, 615, and SW-846 8151A, Revision 7.0; 06/12/09	Definitive	Herbicides	GC/electron capture detector (ECD)	TAL-Savannah	N
SW8081A	SOP SG45:02.09.06:10A: Organochlorine Pesticides by GC (Methods: USEPA 508, 608, 8081A, and 8082), Revision 10.0; 03/14/07	Definitive	Pesticides	GC/ECD	TAL-Savannah	N

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number[1]	Title, Revision Date, and/or Number[2]	Definitive[3] or Screening[4] Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SM2340B	SOP SA-ME-074: Elements by ICP-MS (Methods: EPA 200.8, EPA 6020, and EPA 6020A), Revision 6.0; 06/09/11	Screening	Wet Chemistry	ICP-MS Calculation	TAL-Savannah	N
SM5210B	SOP SA-GE-202: Oxygen Demand: Biochemical Oxygen Demand (BOD), Carbonaceous Biochemical Oxygen Demand (CBOD), and Nitrogenous Biochemical Oxygen Demand (NBOD) (Methods: EPA 405.1 and SM5210B), Revision 2.0; 12/02/10	Screening	Wet Chemistry	DO Meter	TAL-Savannah	N
SM2540C, SM2540D	SOP SA-GE-190: Solid/Residue Determinations (Methods: Various), Revision 1.0; 08/11/08	Screening	Wet Chemistry	Laboratory Balance	TAL-Savannah	N
E310.1	SOP SA-GE-193: Measurement of Analytes using the PC Titrate Auto-Analyzer (Methods: Various), Revision 2.0; 10/15/11	Screening	Wet Chemistry	Titration	TAL-Savannah	N
SW9056	SOP SA-GE-115: Anions by Ion Chromatography (Methods EPA 300.0, EPA 9056, EPA 9056A, and SM4110B), Revision 12.0; 01/06/11	Screening	Wet Chemistry	Ion chromatography (IC)	TAL-Savannah	N
E351.2	SOP SA-GE-020: Digestion Procedures: Total Kjeldahl Nitrogen and Total Phosphorus (Methods: EPA 351.2 and EPA 365.4), Revision 8.0; 08/11/08	Screening	Wet Chemistry	Block Digester	TAL-Savannah	N

QAPP Worksheet #23
Analytical SOP References Table (continued)

Reference Number[1]	Title, Revision Date, and/or Number[2]	Definitive[3] or Screening[4] Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
SW1030	SOP GE140:07.03.07:4: Ignitability (Method: USEPA 1010 and 1030), Revision 4.0; 08/05/07	Screening	Wet Chemistry	Pensky Martens Closed-Cup Tester	TAL-Savannah	N
SW9045C	SOP SA-GE-191: pH Determination (Methods: USEPA 150.1, SW-846 9040B, SW-846 9040C, SW-846 9045C, SW-846 9045D, and SM4500H$^+$ B), Revision 1.0; 08/11/08	Screening	Wet Chemistry	Direct-reading Probe	TAL-Savannah	N
SW9012A	SOP SA-GE-040: Cyanide: Total, Amenable, and Weak Acid Dissociable (Methods: Various), Revision 8.0; 06/23/11	Screening	Wet Chemistry	Flow Injection Analysis (FIA) System	TAL-Savannah	N
SW9034	SOP GE100:09.01.04:4B: Sulfide by Iodometric Titration (Methods: USEPA 376.1, SW-846 9034, and SM4500-S-E), Revision 4.0; 02/19/09	Screening	Wet Chemistry	Titration	TAL-Savannah	N

[1] The notation of "SW#" refers to the USEPA document *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) on which the corresponding TAL-Savannah SOPs are based.
The notation of “SM#” refers to the American Water Works Association (AWWA) document *Standard Methods for the Examination of Water and Wastewater* on which the corresponding TAL-Savannah SOPs are based.
The notation of “E#” references the accepted USEPA method on which the corresponding TAL-Savannah SOP is based.

[2] Laboratory SOPs referenced in this worksheet are available on request.

[3] In some cases, methods listed as capable of producing definitive data will only be required to produce screening level data based on the DQOs associated with the results.

[4] Wet chemistry parameters are often considered as "screening" quality by laboratories due to the nature of the analysis and validation. For instance, use of a field photoionization detector (PID) meter is along the same premise as a laboratory balance or direct-reading probe.

QAPP Worksheet #24
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS	Initial Calibration	Initially; thereafter as the continuing calibration fails	Percent relative standard deviation (%RSD) of calibration check compounds (CCC) $\leq$30%; relative response factors (RRF) for all system performance check compounds (SPCC) $\geq$ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane and $\geq$0.10 for chloromethane, bromoform, and 1,1-dichloroethane; Target Analyte Evaluation: r^2 $\geq$0.990 or %RSD $\leq$15% for each analyte[2]	1) Evaluate System 2) Recalibrate as necessary **All SPCC and CCC acceptance criteria must be met before accepting initial calibration**	TAL-Savannah	SW8260B
	Initial Calibration Verification (ICV)	Following initial calibration	Percent recovery (%R) = 80% to 120% if the ICV is from the same source; %R = 75% to 125% if the ICV is from a second source	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW8260B
	Continuing Calibration Verification (CCV)	Daily before sample analysis and every 12 hours, after instrument tune	CCCs percent difference (%D) $\leq$ 20%; RRFs for SPCCs $\geq$ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane and $\geq$0.10 for chloromethane, bromoform, and 1,1-dichloroethane; Target compound %Ds $\leq$20%	1) Evaluate System 2) Clean system 3) Reanalyze affected samples since the last in-control CCV **All SPCC and CCC acceptance criteria must be met before accepting CCV**	TAL-Savannah	SW8260B

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/MS	Initial Calibration	Initially; thereafter as the continuing calibration fails	%RSD of CCCs ≤30% RRFs for all SPCCs ≥ 0.05 Target Analyte Evaluation: r^2 ≥0.990 or %RSD ≤15% for each analyte[2]	1) Evaluate System 2) Recalibrate as necessary **All SPCC and CCC acceptance criteria must be met before accepting initial calibration**	TAL-Savannah	SW8270C
	ICV	Following initial calibration	%R = 80% to 120% if the ICV is from the same source; %R = 75% to 125% if the ICV is from a second source	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW8270C
	CCV	Daily before sample analysis and every 12 hours, after instrument tune	%RSD of CCCs ≤20% RRFs for all SPCCs ≥ 0.05 Target Analyte Evaluation: r^2 ≥0.990 or %RSD ≤20% for each analyte[2]	1) Evaluate System 2) Clean system 3) Reanalyze affected samples since the last in-control CCV **All SPCC and CCC acceptance criteria must be met before accepting CCV**	TAL-Savannah	SW8270C
ICP-MS	Initial Calibration	Daily	Correlation coefficient (r) ≥ 0.995	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW6020
	ICV	Following initial calibration	%R = 90% to 110%	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW6020

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
ICP-MS (continued)	Low-Level Calibration Check (CRI)	Daily, spiked at 2-5x analyte-specific RLs	%R = 80% to 120%	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW6020
	CCV	Every 10 samples and at the end of analytical sequence	%R = 90% to 110%	1) Evaluate system 2) Repeat calibration check (ICV/CCV) 3) Recalibrate as necessary 4) Reanalyze affected samples	TAL-Savannah	SW6020
CVAA	Initial Calibration	Daily	$r \geq 0.995$	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW7470A; SW7471B
	ICV	Following initial calibration	%R = 90% to 110%	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW7470A; SW7471B
	CCV	Every 10 samples and at the end of analytical sequence	%R = 80% to 120%	1) Evaluate system 2) Repeat calibration check (ICV/CCV) 3) Recalibrate as necessary 4) Reanalyze affected samples	TAL-Savannah	SW7470A; SW7471B
GC/ECD	Initial Calibration	Daily before sample analysis	All target analytes within specified retention time; average $r^2 \geq 0.990$ or average %RSD ≤20% for each target compound	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW8151A; SW8081A

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/ECD (continued)	ICV	Following initial calibration	All target analytes within specified retention time; %R = 80% to 120% if the ICV is from the same source; %R = 75% to 125% if the ICV is from a second source	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW8151A; SW8081A
	CCV	Daily before sample analysis, after every 10 samples, and at end of the analytical sequence	All target analytes within specified retention time; %D ≤20% for each target compound	1) Evaluate System 2) Clean system 3) Reanalyze affected samples since the last in-control CCV	TAL-Savannah	SW8151A; SW8081A
	Secondary Column	As needed when positive results are detected	Calibration and QC criteria same for initial and primary column analysis; primary and second column RPD ≤ 40% for each detected compound.	NA	TAL-Savannah	SW8151A; SW8081A
ICP-MS Calculation	None	NA	NA	NA	TAL-Savannah	SM2340B
DO Meter	None	NA	NA	NA	TAL-Savannah	SM5210B
Laboratory Balance	None	NA	NA	NA	TAL-Savannah	SM2540C; SM2540D
Titration	None	NA	NA	NA	TAL-Savannah	E310.1
IC	Initial Calibration	Daily before sample analysis	Average r^2 ≥0.995 or average %RSD ≤10% for each target analyte	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW9056

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
	ICV	Following initial calibration	% R = 90%-110%	1) Evaluate system 2) Recalibrate as necessary	TAL-Savannah	SW9056
IC (continued)	CCV	Daily before sample analysis, after every 10 samples, and at end of the analytical sequence	% R = 90%-110%	1) Evaluate System 2) Clean system 3) Reanalyze affected samples since the last in-control CCV	TAL-Savannah	SW9056
Block Digester	None	NA	NA	NA	TAL-Savannah	E351.2
Pensky-Martens Closed-Cup Tester	None	NA	NA	NA	TAL-Savannah	SW1030
Direct-reading Probe	Initial Calibration	Daily	pH = 6.975-7.025	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW9045C
	Second Source pH 7 Buffer Check	Before each sample analysis	pH = 6.95-7.05	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW9045C
	CCV pH 7 Buffer Check	Daily before sample analysis, after every 10 samples, and at end of the analytical sequence	pH = 6.90-7.1	1) Evaluate System 2) Clean system 3) Reanalyze affected samples since the last in-control CCV	TAL-Savannah	SW9045C

QAPP Worksheet #24
Analytical Instrument Calibration Table (continued)

Instrument	**Calibration Procedure**	**Frequency of Calibration**	**Acceptance Criteria**	**Corrective Action (CA)**	**Person Responsible for CA**	**SOP Reference[1]**
FIA System	Initial Calibration	Daily, minimum of 6 standards and 1 blank	r ≥ 0.995	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW9012A
FIA System (continued)	High and Low Distilled standards	One each per multi-point calibration	% R = 85% to 115%	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW9012A
	ICV	Following initial calibration	% R = 85% to 115%	1) Evaluate system 2) Recalibrate	TAL-Savannah	SW9012A
	CCV	Every 10 samples and at the end of an analytical sequence with a mid-level standard	% R = 90% to 110%	1) Evaluate system 2) Re-prepare CCV standard and repeat CCV analysis 3) Recalibrate as necessary 4) Reanalyze affected samples	TAL-Savannah	SW9012A
Titration	None	NA	NA	NA	TAL-Savannah	SW9034

[1] See the Analytical SOP References Table in Worksheet #23.
[2] This requirement also applies to CCCs reported as target compounds.

QAPP Worksheet #25
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[2]
GC/MS	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW8260B; SW8270C
ICP-MS	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW6020
CVAA	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW7470A; SW7471B
GC/ECD	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW8151A; SW8081A
ICP-MS Calculation	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SM2340B
DO Meter	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SM5210B
Laboratory Balance	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SM2540C; SM2540D
Titration Apparatus	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	E310.1; SW9034
IC	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW9056
Block Digester	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	E351.2
Pensky Martens Closed-Cup Tester	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW1030
Direct-reading probe	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW9045C
FIA System	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	TAL-Savannah	SW9012A

[1] All TAL-Savannah analytical instruments used for the GCL project will be maintained, tested, and inspected in accordance with the requirements and frequency presented in each analytical method SOP and LQM (included as Attachment A).

[2] See the Analytical SOP References Table in Worksheet #23.

QAPP Worksheet #26
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT[1]
Sample Collection (Personnel/Organization): Site staff/H&S
Sample Packaging (Personnel/Organization): Site staff/H&S
Coordination of Shipment (Personnel/Organization): Site Supervisor/H&S and Courier Supervisor/TAL-Savannah
Field Sample Storage: Samples may be retained onsite for up to 8 hours prior to pick-up by the TAL-Savannah Courier
Type of Shipment/Carrier: Courier/TAL-Savannah service center
Sample Identification Format: Each sample will be identified using the sampling location in Worksheets #18-1 through #18-4 appended with the sampling date in the format MMDDYY. For instance, an EW-1B sample collected on December 14, 2011 will be identified as "EW-1B-121411."
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Management Staff/TAL-Savannah
Sample Custody and Storage (Personnel/Organization): Sample Management Staff/TAL-Savannah
Sample Preparation (Personnel/Organization): Organic Preparation Staff; Bench Chemists/TAL-Savannah
Sample Determinative Analysis (Personnel/Organization): Bench Chemists/TAL-Savannah
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): NA
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 30 days from report release
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample management staff/TAL-Savannah
Number of Days from Analysis: 30 days from report release; up to 6 months on sample-specific request from H&S

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[1] See Section 3.0 and Appendix B of the GCL SAP for additional information.

QAPP Worksheet #27
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): See the GCL SAP.
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Project-specific requirements are presented in the GCL SAP. See also the TAL-Savannah LQM for general guidance (Attachment A).
Sample Identification Procedures: *Field*: See the GCL SAP; *Laboratory*: See the TAL-Savannah LQM (Attachment A).
CoC Procedures: *Field*: See the GCL SAP; *Laboratory*: See the TAL-Savannah LQM (Attachment A).

QAPP Worksheet #28-1
Method QC Table - Metals

Matrix	Water, Solid
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	S-1, S-2, and S-3
Analytical Method/ SOP Reference	SW6020
Sampler's Name	To Be Determined (TBD)
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	30

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial Calibration Blank (ICB)	Following ICV	Analytes not detected > MDL; no negative values > |MDL| (see Worksheets 15-1, 15-4, 15-8, and 15-11).	1) Rerun 2) Clean system 3) Qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
Interference Check Sample (ICS)	Beginning of analytical sequence	ICSA: all non-spiked analyte values < |MDL| ICSA and ICSAB: %R = 80% to 120% for spiked analytes.	1) Evaluate system 2) Recalibrate 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-1
Method QC Table – Metals (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Continuing Calibration Blank (CCB)	Following CCV	Analytes not detected > MDL; no negative values > |MDL| (see Worksheets 15-1, 15-4, 15-8, and 15-11).	1) Rerun 2) Clean system 3) Reanalyze affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
MBs	Every analytical batch (maximum of 20 samples)	Analytes not detected > 1/2 RL; no negative values > |1/2 RL| (see Worksheets 15-1, 15-4, 15-8, and 15-11).	1) Rerun 2) Evaluate batch 3) Re-digest affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria.	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-1.

QAPP Worksheet #28-1
Method QC Table – Metals (continued)

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS (and MSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Rerun; if still out, perform post-digestion spike 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-1.
Laboratory Duplicate (LD)	Every analytical batch (maximum of 20 samples)	RPD ≤ 20%.	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-1.
Post Digestion Spike	Every analytical batch of 20 samples, only if MS analysis fails	%R = 75% to 125%	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Accuracy/Bias	DoD QSM v. 4.2 QC criteria
Serial Dilution	Every analytical batch (maximum of 20 samples)	%D ≤10% for all analytes present in the parent sample at concentrations >50x MDL.	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Precision	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-1
Method QC Table – Metals (continued)

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
RBs (Rinsate)	One per event, as necessary	Analytes not detected > 1/2 RL; no negative values > |1/2 RL| (see Worksheets 15-1, 15-4, 15-8, and 15-11).	Determine if RB contamination requires corrective action in equipment decontamination procedures or at the laboratory.	Stacey Lee (H&S)	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
Field Duplicate	As submitted by H&S	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Stacey Lee (H&S)	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-1.

QAPP Worksheet #28-1
Method QC Table – Metals (continued)

Analyte	Accuracy (%R)		Precision
	Lower Limit	Upper Limit	RPD
ICP-MS Metals (SW6020)			
Aluminum	80	120	20
Antimony	80	120	20
Arsenic	80	120	20
Barium	80	120	20
Beryllium	80	120	20
Cadmium	80	120	20
Calcium	80	120	20
Chromium	80	120	20
Cobalt	80	120	20
Copper	80	120	20
Iron	80	120	20
Lead	80	120	20
Magnesium	80	120	20
Manganese	80	120	20
Nickel, total	80	120	20
Potassium	80	120	20
Selenium	80	120	20
Silver	80	120	20
Sodium	80	120	20
Thallium	80	120	20
Vanadium	80	120	20
Zinc	80	120	20

QAPP Worksheet #28-2
Method QC Table - Mercury

Matrix	Water, Solid
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	S-2 and S-3
Analytical Method/ SOP Reference	SW7470A and SW7471B
Sampler's Name	TBD
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	2 (SW7470A); 5 (SW7471B)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICB	Following ICV	Analytes not detected > MDL; no negative values > |MDL| (see Worksheets 15-4 and Worksheet 15-11).	1) Rerun 2) Clean system 3) Qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
CCB	Following CCV	Analytes not detected > MDL; no negative values > |MDL| (see Worksheets 15-4 and Worksheet 15-11).	1) Rerun 2) Clean system 3) Reanalyze affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-2
Method QC Table – Mercury (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
MBs	Every analytical batch (maximum of 20 samples)	Analytes not detected > 1/2 RL; no negative values > |1/2 RL| (see Worksheets 15-4 and Worksheet 15-11).	1) Rerun 2) Evaluate batch 3) Re-digest affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria.	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-2.
MS (and MSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Rerun; if still out, perform post-digestion spike 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-2.
LD	Every analytical batch (maximum of 20 samples)	RPD ≤ 20%.	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-2.

QAPP Worksheet #28-2
Method QC Table – Mercury (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	As submitted by H&S	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Stacey Lee (H&S)	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-2.

Analyte	Accuracy (%R)		Precision
	Lower Limit	Upper Limit	RPD
Mercury (SW7470A and SW7471B)			
Mercury	80	120	20

QAPP Worksheet #28-3
Method QC Table - VOCs

Matrix	Water, Solid
Analytical Group	VOCs
Concentration Level	Low
Sampling SOP	S-1, S-2, and S-3
Analytical Method/ SOP Reference	SW8260B
Sampler's Name	TBD
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	31

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Instrument tune with 4-bromofluorobenzene (BFB)	Daily prior to sample analysis and every 12 hours.	Must meet mass vs. ion abundance criteria as listed in the method.	1) Evaluate System 2) Re-tune the instrument	TAL-Savannah	Critical instrument performance element	DoD QSM v. 4.2 QC criteria
MBs	Every analytical batch (maximum of 20 samples).	Target analytes not detected >1/2 RL (see Worksheets 15-2, 15-5, 15-9, and 15-12).	1) Rerun 2) Evaluate Batch. 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-3
Method QC Table – VOCs (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples).	Analyte-specific %R and RPD acceptance criteria.	1) Rerun 2) Evaluate Batch. 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-3.
MS/MSD	As indicated on CoC forms, and as required for batch control.	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Evaluate MS/MSD to assess matrix interference 2) Evaluate batch and qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-3.
Surrogate Recovery	Every sample.	Surrogate-specific %R acceptance criteria.	1) Rerun 2) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-3.
Internal Standards (IS)	Every sample.	IS peak retention times within ±30 seconds of the corresponding peak in the associated CCV; IS peak areas within 50%-200% of the corresponding peak areas in the associated CCV.	1) Evaluate sample chromatographs to assess matrix interference 2) Evaluate system 3) Reanalyze affected samples	TAL-Savannah	Accuracy/Bias	DoD QSM v. 4.2 QC criteria
TBs	Every sample shipment	Target analytes not detected >1/2 RL (see Worksheets 15-2, 15-5, 15-9, and 15-12).	Determine if TB contamination requires CA at the laboratory.	Denise Rivers (H&S)	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-3
Method QC Table – VOCs (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
RBs	One per event, as necessary	Target analytes not detected >1/2 RL (see Worksheets 15-2, 15-5, 15-9, and 15-12).	Determine if RB contamination requires CA in equipment decontamination procedures or at the laboratory.	Stacey Lee (H&S)	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
Field Duplicate	As submitted by H&S	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Stacey Lee (H&S)	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-3.

QAPP Worksheet #28-3
Method QC Table – VOCs (continued)

Analyte	Accuracy (%R) (Aqueous)		Precision (Aqueous) (RPD)	Accuracy (%R) (Solid)		Precision (Solid) (RPD)
	Lower Limit	Upper Limit		Lower Limit	Upper Limit	
1,1,1-Trichloroethane	65	130	30	NA	NA	NA
1,1,1,2-Tetrachloroethane	80	130	30	NA	NA	NA
1,1,2,2-Tetrachloroethane	65	130	30	NA	NA	NA
1,1,2-Trichloroethane	75	125	30	NA	NA	NA
1,1-Dichloroethane	70	135	30	NA	NA	NA
1,1-Dichloroethene	70	130	30	65	135	30
1,1-Dichloropropene	75	130	30	NA	NA	NA
1,2,3-Trichlorobenzene	55	140	30	NA	NA	NA
1,2,3-Trichloropropane	75	125	30	NA	NA	NA
1,2,4-Trichlorobenzene	65	135	30	NA	NA	NA
1,2,4-Trimethylbenzene	75	130	30	NA	NA	NA
1,2-Dibromo-3-chloropropane	50	130	30	NA	NA	NA
1,2-Dibromoethane	80	120	30	NA	NA	NA
1,2-Dichlorobenzene	70	120	30	NA	NA	NA
1,2-Dichloroethane	70	130	30	70	135	30
1,2-Dichloropropane	75	125	30	NA	NA	NA
1,3-Dichlorobenzene	75	125	30	NA	NA	NA
1,3-Dichloropropane	75	125	30	NA	NA	NA
1,3,5-Trimethylbenzene	75	130	30	NA	NA	NA
1,4-Dichlorobenzene	75	125	30	NA	NA	NA
2-Butanone (MEK)	30	150	30	30	160	30
2-Chlorotoluene	75	125	30	NA	NA	NA

QAPP Worksheet #28-3
Method QC Table – VOCs (continued)

Analyte	Accuracy (%R) (Aqueous)		Precision (Aqueous) (RPD)	Accuracy (%R) (Solid)		Precision (Solid) (RPD)
	Lower Limit	Upper Limit		Lower Limit	Upper Limit	
2-Hexanone	55	130	30	NA	NA	NA
2,2-Dichloropropane	70	135	30	NA	NA	NA
4-Chlorotoluene	75	130	30	NA	NA	NA
4-Methyl-2-pentanone	60	135	30	NA	NA	NA
4-Isopropyltoluene	75	130	30	NA	NA	NA
Acetone	40	140	30	NA	NA	NA
Benzene	80	120	30	75	125	30
Bromobenzene	75	125	30	NA	NA	NA
Bromochloromethane	65	130	30	NA	NA	NA
Bromodichloromethane	75	120	30	NA	NA	NA
Bromoform	70	130	30	NA	NA	NA
Bromomethane	30	145	30	NA	NA	NA
Carbon disulfide	35	160	30	NA	NA	NA
Carbon tetrachloride	65	140	30	65	135	30
Chlorobenzene	80	120	30	75	125	30
Chloroethane	60	135	30	NA	NA	NA
Chloroform	65	135	30	70	125	30
Chloromethane	40	125	30	NA	NA	NA
cis-1,2-Dichloroethene	70	125	30	NA	NA	NA
cis-1,3-Dichloropropene	70	130	30	NA	NA	NA
Dibromochloromethane	60	135	30	NA	NA	NA
Dibromomethane	75	125	30	NA	NA	NA

QAPP Worksheet #28-3
Method QC Table – VOCs (continued)

Analyte	Accuracy (%R) (Aqueous)		Precision (Aqueous) (RPD)	Accuracy (%R) (Solid)		Precision (Solid) (RPD)
	Lower Limit	Upper Limit		Lower Limit	Upper Limit	
Dichlorodifluoromethane	30	155	30	NA	NA	NA
Diethyl ether	10	200	30	NA	NA	NA
Ethylbenzene	75	125	30	NA	NA	NA
Hexachlorobutadiene	50	140	30	NA	NA	NA
Isopropylbenzene	75	125	30	NA	NA	NA
Methylene chloride	55	140	30	NA	NA	NA
Methyl *tert*-butyl ether (MTBE)	65	125	30	NA	NA	NA
m,p-Xylene	75	130	30	NA	NA	NA
Naphthalene	55	140	30	NA	NA	NA
n-Butylbenzene	70	135	30	NA	NA	NA
N-Propylbenzene	70	130	30	NA	NA	NA
o-Xylene	80	120	30	NA	NA	NA
sec-Butylbenzene	70	125	30	NA	NA	NA
Styrene	65	135	30	NA	NA	NA
t-Butanol	20	195	30	NA	NA	NA
tert-Butylbenzene	70	130	30	NA	NA	NA
Tetrachloroethene	45	150	30	65	140	30
Tetrahydrofuran	10	135	30	NA	NA	NA
Toluene	75	120	30	NA	NA	NA
trans-1,2-Dichloroethene	60	140	30	NA	NA	NA
trans-1,3-Dichloropropene	55	140	30	NA	NA	NA
Trichloroethene	70	125	30	75	125	30

QAPP Worksheet #28-3
Method QC Table – VOCs (continued)

Analyte	Accuracy (%R) (Aqueous)		Precision (Aqueous) (RPD)	Accuracy (%R) (Solid)		Precision (Solid) (RPD)
	Lower Limit	Upper Limit		Lower Limit	Upper Limit	
Trichlorofluoromethane	60	145	30	NA	NA	NA
Vinyl chloride	50	145	30	60	125	30
Surrogates						
Dibromofluoromethane	85	115	NA	75	121	NA
1,2-Dichloroethane-*d4*	70	120	NA	70	120	NA
Toluene-*d8*	85	120	NA	85	115	NA
4-Bromofluorobenzene	75	120	NA	85	120	NA

NA = These compounds are not within the target analytes for the waste manifesting samples.

QAPP Worksheet #28-4
Method QC Table – SVOCs

Matrix	Water, Solid
Analytical Group	SVOCs
Concentration Level	Low
Sampling SOP	S-1, S-2, and S-3
Analytical Method/ SOP Reference	SW8270C and SW8270C-SIM
Sampler's Name	TBD
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	25 (SW8270C-SIM); 5 (SW8270C)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Instrument tune with decafluoro-triphenylphosphine (DFTPP)	Daily prior to sample analysis and every 12 hours.	Must meet mass vs. ion abundance criteria as listed in the method.	1) Evaluate System 2) Re-tune the instrument	TAL-Savannah	Critical instrument performance element	DoD QSM v. 4.2 QC criteria
MBs	Every analytical batch (maximum of 20 samples).	Target analytes not detected >1/2 RL (see Worksheets 15-3, 15-6, 15-10, and 15-13).	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-4
Method QC Table – SVOCs (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples).	Analyte-specific %R and RPD acceptance criteria.	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-4.
MS/MSD	As indicated on CoC forms, and as required for batch control.	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Evaluate MS/MSD to assess matrix interference 2) Evaluate batch and qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-4.
Surrogate Recovery	Every sample.	Surrogate-specific %R acceptance criteria.	1) Rerun 2) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-4.
ISs	Every sample.	IS peak retention times within ±30 seconds of the corresponding peak in the associated CCV; IS peak areas within 50%-200% of the corresponding peak areas in the associated CCV.	1) Evaluate sample chromatographs to assess matrix interference 2) Evaluate system 3) Reanalyze affected samples	TAL-Savannah	Accuracy/Bias	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-4
Method QC Table – SVOCs (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
RBs	One per event, as necessary	Target analytes not detected >1/2 RL (see Worksheets 15-3, 15-6, 15-10, and 15-13).	Determine if RB contamination requires CA in equipment decontamination procedures or at the laboratory.	Stacey Lee (H&S)	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria
Field Duplicate	As submitted by H&S	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Stacey Lee (H&S)	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-4.

QAPP Worksheet #28-4
Method QC Table – SVOCs (continued)

Analyte	Accuracy (%R) (Aqueous Samples)		Precision (Aqueous) (RPD)	Analyte	Accuracy (%R) (Solid Samples)		Precision (Solid) (RPD)
	Lower Limit	Upper Limit			Lower Limit	Upper Limit	
2-Methylnaphthalene	45	105	30	1,4-Dichlorobenzene	35	105	30
Acenaphthene	45	110	30	2,4,5-Trichlorophenol	50	110	30
Acenaphthylene	50	105	30	2,4,6-Trichlorophenol	45	110	30
Anthracene	55	110	30	2,4-Dinitrotoluene	50	115	30
Benzo(a)anthracene	55	110	30	2-Methylphenol	40	105	30
Benzo(a)pyrene	55	110	30	3- & 4-Methylphenol	40	105	30
Benzo(b)fluoranthene	45	120	30	Hexachlorobenzene	45	120	30
Benzo(g,h,i)perylene	40	125	30	Hexachlorobutadiene	40	115	30
Benzo(k)fluoranthene	45	125	30	Hexachloroethane	35	110	30
Chrysene	55	110	30	Nitrobenzene	40	115	30
Dibenz(a,h)anthracene	40	125	30	Pentachlorophenol	25	120	30
Fluorene	50	110	30	Pyridine	50	150	30
Fluoranthene	55	115	30				
Indeno(1,2,3-cd)pyrene	45	125	30				
Naphthalene	40	100	30				
Phenanthrene	50	115	30				
Pyrene	50	130	30				
1,4-Dioxane	11	110	30				
Surrogates							
2-Fluorobiphenyl	50	110	NA	2-Fluorobiphenyl	45	105	NA
Nitrobenzene- D_5	40	110	NA	Nitrobenzene- D_5	35	100	NA

QAPP Worksheet #28-4
Method QC Table – SVOCs (continued)

Analyte	Accuracy (%R) (Aqueous Samples)		Precision (Aqueous) (RPD)	Analyte	Accuracy (%R) (Solid Samples)		Precision (Solid) (RPD)
	Lower Limit	Upper Limit			Lower Limit	Upper Limit	
Terphenyl- D_{14}	50	135	NA	Terphenyl- D_{14}	30	125	NA
Surrogates (continued)							
2,4,6-Tribromophenol	40	125	NA	2,4,6-Tribromophenol	35	125	NA
2-Fluorophenol	20	110	NA	2-Fluorophenol	35	105	NA
				Phenol-D_5	40	100	NA

NA = These compounds are not within the target analytes for the water or waste manifesting samples.

QAPP Worksheet #28-5
Method QC Table – Pesticides and Herbicides

Matrix	Solid
Analytical Group	GC
Concentration Level	Low
Sampling SOP	S-3
Analytical Method/ SOP Reference	SW8151A and SW8081A
Sampler's Name	TBD
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	5 (SW8151A); 5 (SW8081A)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Retention Time Windows	Prior to initial calibration and after major maintenance.	3 times the standard deviation for each quantitation peak retention time from a 72-hour study.	NA	TAL-Savannah	Critical instrument performance element	DoD QSM v. 4.2 QC criteria
MBs	Every analytical batch (maximum of 20 samples).	Target analytes not detected >1/2 RL (see Worksheets 15-14 and 15-15).	1) Rerun 2) Evaluate Batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Representativeness	DoD QSM v. 4.2 QC criteria

QAPP Worksheet #28-5
Method QC Table – Pesticides and Herbicides (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria.	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-5.
MS/MSD	As indicated on CoC forms, and as required for batch control	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Evaluate MS/MSD to assess matrix interference 2) Evaluate batch and qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-5.
Surrogate Recovery	Every sample	Surrogate-specific %R acceptance criteria.	1) Rerun 2) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-5.
Field Duplicate	As submitted by H&S	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Denise Rivers (H&S)	Precision	The DoD QSM v. 4.2 criteria is in a table following Worksheet 28-5.

[1] The cell information indicates the number of sampling locations that correspond with the Laboratory SOP in parentheses.

QAPP Worksheet #28-5
Method QC Table – Pesticides and Herbicides (continued)

Analyte	Accuracy (%R)		Precision
	Lower Limit	Upper Limit	RPD
Herbicides (SW8151A)			
2,4,5-TP (Silvex)	45	125	30
2,4-D	35	145	30
Surrogate			
2,4-dichlorophenyl acetic acid (DCAA)	50	150	NA
Pesticides (SW8081A)			
Chlordane	65	125	30
Endrin	60	135	30
Heptachlor	50	140	30
Heptachlor epoxide	65	130	30
Lindane (gamma-BHC)	60	125	30
Methoxychlor	55	145	30
Toxaphene [1]	NA	NA	NA
Surrogate			
Tetrachloro-m-xylene	70	125	NA
Decachlorobiphenyl	55	130	NA

[1] Toxaphene is not spiked into LCSs or MS/MSDs.

QAPP Worksheet #28-6
Method QC Table – Sulfate, Chloride, Kjeldahl Nitrogen, Alkalinity, Total Dissolved and Suspended Solids, Total Hardness, and Carbonaceous Biochemical Oxygen Demand

Matrix	Water
Analytical Group	Wet Chemistry
Concentration Level	Low
Sampling SOP	S-2
Analytical Method/ SOP Reference	SM2340B, SM5210B, SM2540C, SM2540D, E310.1, SW9056, and E351.2
Sampler's Name	TBD
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	2

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICB	Following ICV	Target analytes not detected >1/2 RL (see Worksheet 15-7).	1) Rerun 2) Clean system 3) Qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	USEPA method, SW-846 method, and Standard Methods criteria

QAPP Worksheet #28-6
Method QC Table – Sulfate, Chloride, Kjeldahl Nitrogen, Alkalinity, Total Dissolved and Suspended Solids, Total Hardness, and Carbonaceous Biochemical Oxygen Demand (continued)

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
CCB	Following CCV	Target analytes not detected >1/2 RL (see Worksheet 15-7).	1) Rerun 2) Clean system 3) Reanalyze affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	USEPA method, SW-846 method, and Standard Methods criteria
MBs	Every analytical batch (maximum of 20 samples)	Target analytes not detected >1/2 RL (see Worksheet 15-7).	1) Rerun 2) Evaluate batch 3) Reanalyze affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	USEPA method, SW-846 method, and Standard Methods criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria.	1) Rerun 2) Evaluate batch 3) Reanalyze or qualify results as necessary	TAL-Savannah	Accuracy/Bias and Precision	The USEPA, SW-846, and Standard Methods QC criteria are in a table following Worksheet #28-6.
MS (and MSD, if performed)	Every analytical batch (maximum of 20 samples)	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Accuracy/Bias and Precision	The USEPA, SW-846, and Standard Methods QC criteria are in a table following Worksheet #28-6.

QAPP Worksheet #28-6
Method QC Table – Sulfate, Chloride, Kjeldahl Nitrogen, Alkalinity, Total Dissolved and Suspended Solids, Total Hardness, and Carbonaceous Biochemical Oxygen Demand (continued)

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
LD	Every analytical batch (maximum of 20 samples)	Analyte-specific RPD acceptance criteria.	1) Rerun 2) Evaluate batch 3) Qualify sample results as appropriate	TAL-Savannah	Precision	The USEPA, SW-846, and Standard Methods QC criteria are in a table following Worksheet #28-6.
Field Duplicate	As submitted by H&S	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Denise Rivers (H&S)	Precision	The USEPA, SW-846, and Standard Methods QC criteria are in a table following Worksheet #28-6.

QAPP Worksheet #28-6

Method QC Table – Sulfate, Chloride, Kjeldahl Nitrogen, Alkalinity, Total Dissolved and Suspended Solids, Total Hardness, and Carbonaceous Biochemical Oxygen Demand (continued)

Method/Analyte	Accuracy (%R)		Precision RPD	Laboratory Duplicate (%D)
	Lower Limit	Upper Limit		
Hardness, total (SM2340B)	NA	NA	NA	NA
CBOD (SM5210B)	85	115	30	30
TDS (SM2540C)	80	120	25	25
TSS (SM2540D)	80	120	25	25
Alkalinity, total (E310.1)	80	120	30	30
Chloride (SW9056)	90	110	15	10
Sulfate (SW9056)	90	110	15	10
Nitrogen, Kjeldahl (E351.2)	75	125	NA	NA

NA = not applicable; due to the nature of the total hardness and Kjeldahl nitrogen methods %R and/or RPD criteria are not available.

QAPP Worksheet #28-7
Method QC Table – Ignitability, Corrosivity, and Reactivity

Matrix	Solid
Analytical Group	Wet Chemistry
Concentration Level	Low
Sampling SOP	S-3
Analytical Method/ SOP Reference	SW1030, SW9045C, SW9012A, and SW9034
Sampler's Name	TBD
Field Sampling Organization	H&S
Analytical Organization	TAL-Savannah
No. of Sample Locations	5

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
ICB	Following ICV.	Target analytes not detected >1/2 RL (see Worksheet 15-16).	1) Rerun. 2) Clean system. 3) Qualify results as appropriate.	TAL-Savannah	Accuracy/Bias and Representativeness	USEPA SW-846 Method criteria
CCB	After every 10 samples and at the end of the sample sequence; following a CCV.	Target analytes not detected >1/2 RL (see Worksheet 15-16).	1) Rerun. 2) Clean system. 3) Reanalyze affected samples or qualify results as appropriate.	TAL-Savannah	Accuracy/Bias and Representativeness	USEPA SW-846 Method criteria

QAPP Worksheet #28-7
Method QC Table – Ignitability, Corrosivity, and Reactivity (continued)

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
MBs	Every analytical batch (maximum of 20 samples).	Target analytes not detected >1/2 RL (see Worksheet 15-16).	1) Rerun 2) Evaluate batch 3) Reanalyze affected samples or qualify results as appropriate	TAL-Savannah	Accuracy/Bias and Representativeness	USEPA SW-846 Method criteria
LCS (and LCSD, if performed)	Every analytical batch (maximum of 20 samples).	Analyte-specific %R and RPD acceptance criteria.	1) Rerun. 2) Evaluate batch. 3) Reanalyze or qualify results as necessary.	TAL-Savannah	Accuracy/Bias and Precision	The SW-846 Method QC criteria are in a table following Worksheet #28-7.
MS (and MSD, if performed)	Every analytical batch (maximum of 20 samples).	Analyte-specific %R and RPD acceptance criteria. Not applicable if parent sample concentration ≥ 4x the spike level.	1) Rerun. 2) Evaluate batch. 3) Qualify sample results as appropriate.	TAL-Savannah	Accuracy/Bias and Precision	The SW-846 Method QC criteria are in a table following Worksheet #28-7.
LD	Every analytical batch (maximum of 20 samples).	Analyte-specific RPD acceptance criteria.	1) Rerun. 2) Evaluate batch. 3) Qualify sample results as appropriate.	TAL-Savannah	Precision	The SW-846 Method QC criteria are in a table following Worksheet #28-7.

QAPP Worksheet #28-7
Method QC Table – Ignitability, Corrosivity, and Reactivity (continued)

QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	As submitted by H&S.	Analyte-specific RPD acceptance criteria (see Appendix B) if both results > 5x the PQL; absolute difference <PQL for evaluation of low-level results (<5x PQL).	Determine if sampling procedures require modification.	Stacey Lee (H&S)	Precision	The SW-846 Method QC criteria are in a table following Worksheet #28-7.

QAPP Worksheet #28-7
Method QC Table – Ignitability, Corrosivity, and Reactivity (continued)

Method/Analyte	Accuracy (%R)[1]		Precision[1] RPD	Laboratory Duplicate (%D)[1]
	Lower Limit	Upper Limit		
Waste Manifesting Samples				
Ignitability (SW1030)	NA	NA	NA	± 1.5°F
Corrosivity (SW9045C)	63	158	40	40
Reactivity (SW9012A and SW9034)	50	150	50	50

[1] Laboratory duplicate units are percent (%) unless otherwise noted.

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records[1]	On-site Analysis Documents and Records[1]	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Field notes (bound logbook) • Daily QC Reports • CoC records • Air bills • Custody seals • Telephone logs, e-mails, faxes, and correspondence • Corrective action forms • Photographs	• Equipment calibration logs • Equipment maintenance, testing, and inspection logs • Field sampling data sheets • Waste disposal records	• Sample receipt, custody, and tracking records • Standard traceability logs • Equipment calibration logs • Sample preparation logs • Analytical run logs • Analytical discrepancy forms • Reported analytical results • Reported results for standards, QC checks, and QC samples • Data package completeness checklists • Sample disposal records • Extraction and cleanup records • Raw data (stored electronically) • Telephone logs, e-mails, faxes, and correspondence	• USEPA Level II data validation reports written by an H&S chemist • Automated data review by ADR.net • Database QC Spreadsheets • Update GCL EDMS file following validation and QC via ADR.net • Telephone logs, e-mails, faxes, and correspondence	• Project planning documents • Project deliverables • Telephone logs, e-mails, faxes, and correspondence • Permits • Site maps

[1] Examples of the field forms are in Appendix A of the GCL SAP.

QAPP Worksheet #30
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Groundwater Monitoring samples (aqueous)	VOCs, PAHs, and Metals (Worksheet 23)	Low	See Worksheet 18	See Worksheet 23	21 Days (non-validated)	TestAmerica, Inc. 5102 LaRoche Ave. Savannah, GA 31404 PM: Linda Wolfe Main: (912) 354-7858 Fax: (912) 352-0165 www.testamericainc.com	None
Process Water samples (aqueous)	VOCs, PAHs, Metals, and Wet Chemistry (Worksheet 23)	Low	See Worksheet 18	See Worksheet 23	21 Days (non-validated)		None
Groundwater Extraction Well samples (aqueous)	VOCs, PAHs, and Metals (Worksheet 23)	Low	See Worksheet 18	See Worksheet 23	21 Days (non-validated)		None
Waste Manifesting samples (solid)	VOCs, SVOCs, Herbicides, Pesticides, Metals, and Wet Chemistry (Worksheet 23)	Low	See Worksheet 18	See Worksheet 23	21 Days (non-validated)		None

QAPP Worksheets #31
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing CA (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
QC Reports of any non-conformance	Daily as required	Internal	H&S	Roy Kruger, H&S Lead Operator	Sherri Pullar, H&S Project Chemist	Steve Kawchak, H&S PM	Steve Kawchak, H&S PM
Laboratory UFP-QAPP compliance	All sampling events	Internal	H&S	Sherri Pullar, Project Chemist	Steve Kawchak, H&S Project Manager	Sherri Pullar, H&S Data Validator	Steve Kawchak, H&S PM
Field Safety Audit	1/year	Internal	H&S	Ed Kearney, H&S Corporate H&S Officer	Steve Kawchak, H&S PM	Roy Kruger, H&S Lead Operator; Steven Kawchak, H&S PM	Ed Kearney, H&S Corporate H&S Officer
Data review and processing by ADR.net	All sampling events	Internal	H&S	Sherri Pullar, Project Chemist	Stacey Lee, H&S Senior Database Administrator	Steve Kawchak, H&S PM	Sherri Pullar, H&S Senior Database Administrator
Data validation	All sampling events	Internal	H&S	Sherri Pullar, H&S Validator	Sherri Pullar H&S Data Validator	Sherri :Pullar, H&S Project Chemist	Sherri Pullar, H&S Project Chemist
Field documentation review	All sampling events	Internal	H&S	Stacey Lee, H&S Lead Sampler	Steve Kawchak, H&S PM	Roy Kruger, H&S Lead Operator	Steve Kawchak, H&S PM
Document and sample review for waste shipments	As required	Internal	H&S	Roy Kruger, H&S Lead Operator	Steve Kawchak, H&S PM	Roy Kruger, H&S Lead Operator	Steve Kawchak, H&S PM

QAPP Worksheet #32
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Internal Laboratory Audit	As defined in LQM	Linda Wolfe, TAL PM	Annually	As defined in LQM	Laboratory Personnel	As defined in LQM
Laboratory non-conformance	Email or phone call and Laboratory Narrative	Sherri Pullar, H&S Project Chemist	Immediately	Revised data package and Laboratory Corrective Action Report	Linda Wolfe, TAL PM	Within 1 week
Field sampling audit or field non-conformance	Email or phone call and Field log-book	Stacey Lee, H&S Field Lead	Immediately	Field CA Report	H&S Field sampling crew and Steven Kawchak, H&S PM	Within 1 week
Data review and processing by ADR	Email or phone call	Sherri Pullar, H&S Senior Database Administrator	Immediately	Revised EDD and Laboratory CA Report	Linda Wolfe, TAL PM	Within 1 week
Data validation	Email or phone call	Sherri Pullar H&S Project Chemist	Immediately	Data validation report	Linda Wolfe, TAL PM	Within 1 week
H&S audit	H&S audit report	Ed Kearney, H&S Corporate H&S Officer	Annually	CA Report	Steven Kawchak, H&S PM	Within 2 weeks

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Laboratory CA Report	As needed	Initiated on discovery of deficiency; completed within 1 week of corrective action	Linda Wolfe, TAL PM	Sherri Pullar, H&S Project Chemist
Daily QC Reports	Daily for each day of field work (see Worksheet #18)	Appendix to project report. If discrepancy identified, transmitted by fax to H&S PM the same business day.	Stacey Lee H&S Field Lead	Steven Kawchak, H&S PM
Data validation report	1/ method per sampling event analytical data package	Completed within 3 weeks of data package receipt	Sherri Pullar, H&S Validator	Steven Kawchak, H&S PM
Chemical QC Summary Report	1 at project completion; after all data are validated and EDMS is updated	6 weeks following project completion; included as appendix to project final report	Sherri, H&S Project Chemist	USACE-NAE
Project Final Report	1 at project completion; after all data are validated and EDMS is updated	6 weeks following project completion	Steven Kawchak, H&S PM	USACE-NAE
Field CA Report	As needed	Initiated on discovery of deficiency; completed within 1 week of corrective action	Stacey Lee, H&S Field Lead	Steven Kawchak, H&S PM
H&S Audit	1/annual inspection	Completed within 1 week of audit	Ed Kearney, H&S Corporate H&S Officer	Steven Kawchak, H&S PM

QAPP Worksheet #34
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
CoC (shipping)	CoC forms will be reviewed upon completion and verified against the packed sample coolers and against the site-specific sample tables (Worksheet #18). This QC check will be verified by initialing the CoC form next to the shipper's signature. A copy of the CoC form will be retained in the project file, and the original and one copy will be taped inside the cooler in a waterproof bag.	Internal	Stacey Lee, H&S Field Lead
Field notes and logbook review	Log reviews will be performed on a daily basis. This review will be performed to verify that all field monitoring equipment are maintained, calibrated, and operated properly. In addition, the review denotes all required information has been correctly documented in the field logbooks and log sheets.	Internal	Stacey Lee, H&S Field Lead
CoC (receipt)	CoC forms will be reviewed and compared to cooler contents. Any discrepancies (sample bottles, sample IDs, requested methods) will be communicated to the laboratory PM for resolution with the H&S Project Chemist.	External	Linda Wolfe, TAL-Savannah
Analytical data package	All data used to prepare analytical data packages will be reviewed at multiple levels throughout the laboratory. The requirements for this review process are described in Appendix B. No data packages will be delivered to H&S without the necessary approval.	External	Linda Wolfe, TAL-Savannah
EDD (export)	All EDDs will be verified against the requirements of a SEDD Stage 2A EDD prior to transmittal to H&S. TAL-Savannah will use the data library provided by H&S to populate EDD fields.	External	Linda Wolfe, TAL-Savannah
EDD (import)	First, any EDD non-conformances from the laboratory are reviewed and addressed before the data is processed further in the ADR software. The EDDs are then imported and screened with the ADR EDD Compliance Screening Module versus the project specific library. This check is performed on the EDD to ensure that it is in the correct format and that it contains the correct standard values. Any errors or warnings are addressed before processing the data further.	Internal	Sherri Pullar, H&S Data Management Specialist

QAPP Worksheet #34
Verification (Step I) Process Table (continued)

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Project database	All data qualifiers applied to the project database by ADR or by manual entry will receive a 100% QC check for accuracy and completeness. Prior to final approval and upload to the GCL EDMS file, each EDD output will receive a 10% QC check of electronically reported results against the hardcopy laboratory reports.	Internal	Sherri Pullar, H&S Senior Database Administrator
UFP-QAPP	As standard practice, the project-specific UFP-QAPP is reviewed by the laboratory personnel during all analytical and data processing procedures, and by H&S personnel during all field sampling, data validation, and ADR processing procedures to ensure adherence by all parties involved.	Internal / External	Sherri Pullar, H&S field, validation, & database personnel Laboratory personnel

QAPP Worksheet #35
Validation (Steps IIa and IIb) Process Table[1]

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Data Packages	100% of data packages: The validator will verify data package completeness, review case narratives, and evaluate sample delivery and condition.	Sherri Pullar, H&S Validator
IIb	QC elements listed in Worksheets 15, 24, and 28 provided in the EDD	100% of EDDs: ADR will be used to review all QC elements identified in the method-specific worksheets plus preparation and analysis holding times.	Sherri Pullar, H&S Data Management Specialist
IIb	QC elements listed in Worksheets 15, 24, and 28 provided in the laboratory data packages	100% of EDDs and data packages: The results of the review by ADR will be evaluated by a staff chemist for accuracy and completeness. ADR qualifiers may be over-ridden using validator judgment. A data validation report will be generated for each laboratory data package and analytical fraction. All data qualifiers applied to the project database by ADR or by manual entry will receive a 100% QC check for accuracy and completeness. Prior to final approval and upload to the GCL EDMS file, each EDD output will receive a 10% QC check of electronically reported results against the hardcopy laboratory reports.	Sherri Pullar, H&S Validator
IIb	Data validation reports	100% of data validation reports: Project chemist review of data validation reports to approve of all validation results and final qualifiers. All data validation reports will include the following: • Documentation of method QC results to establish that all method-required QC samples were analyzed and met the required limits; • Documentation of UFP-QAPP QC sample results do ensure that QC samples required by this UFP-QAPP were analyzed and met the required project action limits; and • Documentation that all sample results met the project quantitation limits specified in this UFP-QAPP.	Sherri Pullar, H&S Validator (Validator)

[1] The validation process summarized in this table is presented in more detail in Appendix C.

QAPP Worksheet #36
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria[1]	Data Validator (title and organizational affiliation)
IIa	Aqueous and Solid	Metals, Mercury, VOCs, SVOCs, Pesticides, Herbicides, and Wet Chemistry Parameters	Low	Worksheets 28-1 through 28-7, CoC forms Holding Times: Worksheet 19 Narrative: Additional items noted for resolution or clarification	Sherri Pullar, H&S Validator (Validator) / Project Chemist (Reviewer)
IIb	Aqueous and Solid	Metals	Low	DQIs: Worksheet 28-1; Worksheets15-1, 15-4,15-8, and 15-11 Qualification: DoD QSM for Environmental Laboratories, Version 4.2	
IIb	Aqueous and Solid	Mercury	Low	DQIs: Worksheet 28-2; Worksheets 15-4 and #15-11 Qualification: DoD QSM for Environmental Laboratories, Version 4.2	
IIb	Aqueous and Solid	VOCs	Low	DQIs: Worksheet 28-3; Worksheets 15-2, 15-5, 15-9, and 15-12 Qualification: DoD QSM for Environmental Laboratories, Version 4.2	
IIb	Aqueous and Solid	SVOCs	Low	DQIs: Worksheet 28-4; Worksheets 15-3, 15-6, 15-10, and 15-13 Qualification: DoD QSM for Environmental Laboratories, Version 4.2	
IIb	Solid	Pesticides and Herbicides	Low	DQIs: Worksheet 28-5; Worksheets 15-14 and 15-15 Qualification: DoD QSM for Environmental Laboratories, Version 4.2	
IIb	Aqueous	Hardness, CBOD, TDS, TSS, Alkalinity, Chloride, Sulfate, and Kjeldahl Nitrogen	Low	DQIs: Worksheet 28-6; Worksheet 15-7 Qualification: *DoD QSM for Environmental Laboratories, Version 4.2*	
IIb	Solid	Corrosivity, Reactivity, and Ignitability	Low	DQIs: Worksheet 28-7; Worksheet 15-16 Qualification: *USEPA Region 2 Validation of Metals for the Contract Laboratory Program (SOP #HW-2)*	

[1] In **all** cases, the method-specific requirements as presented in this UFP-QAPP will supersede any conflicting requirements of any cited external validation guidance document (e.g., evaluation of calibration data for VOCs and SVOCs). Qualification criteria in *italics* denote that the qualification guidance was not written for the analytical method; however, the qualification response for QC discrepancies will be applied using the method guidance document selected as being most relevant.

QAPP Worksheet #37
Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: A detailed description of the H&S data validation process is in Appendix C. The data management team will perform the operations summarized in Worksheets #33 through #35 in order to evaluate sampling team and laboratory compliance with the requirements in this UFP-QAPP and other project planning documents. Evaluation activities will be documented in the QA reports listed in Worksheet #33 and will be used to assess the usability of project data in levels of detail ranging from an analyte- and sample-specific basis to the overall data set for the sampling event.

Useable data is that which meet the PARCCS requirements as discussed in Worksheet #12, with the analyte-specific criteria noted in Worksheets #15, #24 and #28. During each data validation assessment, all data are grouped within three broad categories, usable without qualification, usable but estimated, and unusable/rejected, and qualified for use in decision making. Assignment of qualifiers to the usable but estimated data is in accordance with the requirements of this UFP-QAPP, the DoD QSM version 4.2, and the USEPA Region 2 validation guidelines. Data gaps will be present if a sample is not collected, a sample is not analyzed for the requested parameters, or the data are determined to be unusable.

All data are usable as qualified by the H&S validator with the exception of rejected data. Estimated and/or biased results are considered usable, and outliers, if present, will be addressed on a case-by-case basis. There is no generic formula for determining whether or not a result is an outlier. Potential outliers will be referred to a statistician, as directed by the USEPA, who will determine which formulas are appropriate for classifying data points in a statistically appropriate and defendable manner.

At the completion of the sampling event, the H&S PM, Project Chemist and Field Sampling Manager will document any deviations to this UFP-QAPP.

Describe the evaluative procedures used to assess overall measurement error associated with the project: A detailed description of the H&S data validation process is in Appendix C. The in-depth assessment will include an evaluation of the QC elements relating to the PARCCS requirements (both sample collection and analytical), as discussed in Worksheet #12, with the analyte-specific criteria noted in Worksheets #15, #24 and #28. The validation will follow the requirements of the DoD QSM version 4.2 and the USEPA Region 2 validation guidelines to assess conformance with the requirements of the methods, SOPs and objectives stated in this UFP-QAPP.

A data summary report(s) issued by H&S will address the results of the usability assessment review (PARCCS) performed by the project data management team. The report(s) will be submitted to the USACE-NAE and USEPA for review and approval. The impact of any data gaps resulting from sampling incompleteness (e.g., due to insufficient water in a well) or rejected data will be evaluated in the report(s).

QAPP Worksheet #37
Usability Assessment

Identify the personnel responsible for performing the usability assessment: Steven Kawchak, H&S PM; Sherri Pullar, H&S Project Chemist/ Senior Database Manager
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: Evaluation activities will be documented in the QA reports listed in Worksheet #33. The data validation reports will identify precision and accuracy exceedances relating to the PARCCS requirements with respect to the laboratory performance for each batch of samples, as well as comparability of field and laboratory duplicates. An overall quality assessment of the impact of data usability issues will be presented in the data summary report(s). Because this project involves long-term monitoring (LTM), the usability assessment will evaluate the overall data set from the site and compare results to data from previous sampling events to identify trends and potential anomalous results.

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APPENDIX A

H&S STANDARD OPERATING PROCEDURES

APPENDIX A

STANDARD OPERATING PROCEDURES (SOPs)

SOP#	**TITLE**
001	SITE-SPECIFIC HEALTH AND SAFETY TRAINING
002	MONITORING EQUIPMENT CALIBRATION
003.	WATER LEVEL MEASUREMENT
004	EXTRACTION WELL FLOW RATE MEASUREMENT
005	INVESTIGATION-DERIVED WASTE MANAGEMENT
006	FIELD DECONTAMINATION PROCEDURES
007	FIELD DOCUMENTATION PROCEDURES

H&S SOP #001

001 SITE-SPECIFIC HEALTH AND SAFETY TRAINING

Personnel who will be performing construction-related, non-intrusive, non-hazardous onsite tasks are not required to have been trained according to U.S. Department of Labor OSHA Standard 29 CFR 1926.65 *Hazardous Waste Operations and Emergency Response.* These workers will have appropriate safety and health training based upon their specific job tasks and activities.

The Field Manager, Site Safety and Health Officer/Emergency Coordinator, or other personnel conducting the field sampling and monitoring for contaminants, performing intrusive operations, or performing any site task in which site contaminants may be encountered will be trained as required to meet the U.S. Department of Labor OSHA Standard 29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response,* to qualify as hazardous waste site workers and supervisors. Training will include:

- A minimum of 40 hours of initial offsite instruction
- A minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor
- An 8-hour “refresher” training period annually
- Additional training that addresses unique or special hazards/operational requirements.

Onsite supervisors who are directly responsible for or who supervise employees will receive at least 8 additional hours of hazardous waste operations training for supervisors. Copies of training certificates and dates of attendance for H&S personnel will be available through the Site Safety and Health Officer/Emergency Coordinator upon request.

Prior to entering the Site, personnel will attend a pre-entry orientation session presented by the Site Safety and Health Officer/Emergency Coordinator. Visitors entering designated work areas will be subject to applicable safety and health regulations during field operations at the Site. The Field Manager and/or Site Safety and Health Officer/Emergency Coordinator is responsible for briefing the personnel onsite of potential hazards that may be encountered on the Site, the presence and location of the Site HASP, and emergency response procedures. Visitors will be under the direct supervision of the Field Manager and/or Site Safety and Health Officer/Emergency Coordinator or his/her representative.

At a minimum, the pre-entry orientation session will discuss the contents of this HASP, PPE, potential hazards, and health effects of hazards associated with onsite activities and the potential hazards presented by unearthing unidentified hazardous materials. Personnel will be instructed in emergency procedures, to include onsite communications and implementation of the site-specific contingency plans.

Non-hazardous waste site workers will be medically examined as needed to meet OSHA requirements specific to their job. Hazardous waste site workers must have satisfactorily completed a comprehensive medical examination by a licensed physician within 12 months (or 24 months, pending physician’s approval) prior to the start of site operations. Subcontractors will provide this information in writing to the Project Manager for their workers prior to mobilization onsite. Copies of this information will be kept onsite by the Site Safety and Health Officer/Emergency Coordinator. A licensed physician who is certified in Occupational Medicine by the American Board of Preventative Medicine will review medical surveillance protocol and examination results. Medical surveillance protocols will comply with 29 CFR 1910.120. The content of medical examinations will be determined by the attending physician and will be based upon the guidelines in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.* Medical examinations and consultations will be provided for employees covered by this program on the following schedule:

- Prior to field work assignment
- At least annually for employees covered by the program
- At termination of employment
- As soon as possible upon the development of signs or symptoms that may indicate an overexposure to hazardous substances or other health hazards or that an unprotected person has been exposed in an emergency situation
- More frequently if the physician deems such examination necessary to maintain employee health.

An accurate record of the medical surveillance will be maintained for each employee for a period of no less than 30 years after the termination of employment. Records must include at least the following information about the employee:

- Name and social security number
- Physician’s written opinions, recommendations, limitations, and test results
- Employee medical complaints related to hazardous waste operations
- Information provided to the physician by the employee concerning possible exposures, accidents, etc.

Site-specific health and safety training of all field staff will be provided as part of the site mobilization and is also addressed in Worksheet No. 8.

H&S SOP #002

002 MONITORING EQUIPMENT CALIBRATION

A Water Quality meter (YSI 600XL, or equivalent) is used to obtain measurements of temperature, pH, dissolved oxygen (DO), conductivity/specific conductance, turbidity, and oxidation-reduction potential (ORP). Review the operation manual before using.

Turbidity is measured using a separate instrument (Turbidity Meter [LaMotte 2020, or equivalent]) because turbidity cannot be measured accurately in a flow-through cell.

To start operation, make sure the sensor is connected to the instrument properly and press the POWER key. To obtain correct measurement, it is necessary to calibrate the sensor using the standard solution before performing measurement.

TEMPERATURE

Most instrument manuals state that calibration of the temperature sensor is not required, but this SOP requires that the temperature sensor be checked to verify its accuracy. This accuracy check is performed at least once per year and the accuracy check date/information is kept with the instrument. If the accuracy check date/information is not included with the instrument or the last check was performed over a year prior to the date of use, it is recommended that the temperature sensor accuracy be checked at the beginning of the sampling event. If the instrument contains multiple temperature sensors, each sensor must be checked.

Verification Procedure

- Allow a container filled with water to equilibrate to ambient temperature.
- Place a NIST-traceable thermometer and the instrument’s temperature sensor into the water and wait approximately five minutes for both temperature readings to stabilize.
- Compare the two measurements. The instrument’s temperature sensor must agree with the NIST-traceable thermometer measurement within the accuracy of the sensor (usually ±0.15ºC). If the measurements do not agree, the instrument may not be working properly and the manufacturer needs to be consulted.

DISSOLVED OXYGEN

DO is the volume of oxygen that is dissolved in water and is measured using a membrane electrode. The DO probe’s membrane and electrolyte solution should be replaced prior to the sampling period. Failure to perform this step may lead to erratic or erroneous measurements.

Calibration Procedure

- Gently dry the temperature sensor according to manufacturer's instructions.
- Place a wet sponge or a wet paper towel on the bottom of the DO calibration container that comes with the instrument.
- Place the DO probe in the container without the probe coming in contact with the wet sponge or paper towel. The probe must fit loosely in the container to ensure it is vented to the atmosphere.
- Allow the confined air to become saturated with water vapor (saturation occurs in approximately 10 to 15 minutes). During this time, turn-on the instrument to allow the DO probe to warm-up. Select monitoring/run mode. Check temperature readings. Readings must stabilize before continuing to the next step.
- Select calibration mode; then select "DO%."
- Enter the local barometric pressure (usually in mm of mercury) for the sampling location into the instrument. This measurement can be determined from an on-site barometer. Do not use barometric pressure obtained from the local weather services unless the pressure is corrected for the elevation of the sampling location and unless this is the only source of barometric data. [**Note:** inches of mercury times 25.4 mm/inch mercury equals mm of mercury].
- The instrument should indicate that the calibration is in progress. After calibration, the instrument should display percent saturated DO. Check the reading against the Temperature/Atmospheric Pressure table in Attachment A. For example, if the barometric pressure is 752 mm Hg at an elevation of 278 feet, the percent saturation value after calibration should be 99%.
- While the probe is still in the calibration cup, select monitoring/run mode. Compare the DO mg/L reading to the Oxygen Solubility at Indicated Pressure chart in Attachment B. For example, if the barometric pressure is 750 mm Hg and the temperature inside the calibration cup is 20ºC, the DO mg/L reading should be 8.94 mg/L. If they do not agree to the accuracy of the instrument (usually ±0.2 mg/L), repeat calibration. If this does not work, change the membrane and electrolyte solution and repeat calibration.
- Remove the probe from the container, rinse it with distilled water, pat it dry with a towel, and place it into a 0.0 mg/L DO Standard. The standard must be filled to the top of its container and the DO probe must fit tightly into the standard's container (no headspace). Check temperature readings. They must stabilize before continuing.
- Wait until the "mg/L DO" readings have stabilized. The instrument should read <0.5 mg/L or to the accuracy of the instrument (usually ±0.2 mg/L) within 30 seconds. If the instrument cannot reach this value, it will be necessary to clean the probe, and change the membrane and electrolyte solution. If this does not work, prepare a new 0.0 mg/L standard. If these measures do not work, contact the manufacturer.

pH (ELECTROMETRIC)

The pH is the measure of the degree of the acidity or alkalinity of a solution as measured on a scale of 0 to 14. The pH of a sample is determined electrometrically using a glass electrode. All pH measurements are in standard units (SU).

Choose the appropriate buffered standards that will bracket the expected values at the sampling locations. For ground water, the pH will usually be close to seven. Three standards are needed for the calibration: one close to seven, one at least two pH units below seven and the other at least two pH units above seven. For those instruments that will not accept three standards, the instrument will need to be re-calibrated if the water sample's pH is outside the range defined by the two standards used in the initial calibration.

Calibration Procedure

- Allow the buffered standards to equilibrate to the ambient temperature.
- Fill calibration containers with the buffered standards so each standard will cover the pH probe and temperature sensor.
- Remove the cover of the probe, rinse in a cup filled with distilled water or use a spray bottle, and blot dry with soft tissue.
- Select monitoring/run mode. Immerse probe in the initial buffered standard (e.g., pH 7) and allow at least 1 minute for temperature equilibration before proceeding.
- Enter the buffered standard value (7) into the pH calibration menu of the instrument. Allow the pH reading to stabilize for approximately 30 seconds and if the reading does not change, finish the calibration. The reading should remain within the manufacturer's specifications; if it changes, recalibrate. If readings continue to fluctuate or readings do not stabilize after recalibration, consult the manufacturer.
- Remove probe from the initial buffered standard, rinse in a cup filled with distilled water or use a spray bottle, and blot dry with soft tissue.
- Immerse probe into the second buffered standard (e.g., pH 4). Repeat step 5, substituting "4" into the pH calibration menu instead of "7."
- Remove probe from the second buffered standard, rinse in a cup filled with distilled water or use a spray bottle, and blot dry with soft tissue. If the instrument only accepts two standards the calibration is complete. Proceed to step 11. Otherwise continue with step 9.
- Immerse probe in third buffered standard (e.g., pH 10). Repeat step 5, substituting "10" into the pH calibration menu instead of "7."
- Remove probe from the third buffer standard, rinse in a cup filled with distilled water or use a spray bottle, and blot dry with soft tissue.
- Select monitoring/run mode, if not already selected. To ensure that the initial buffered calibration standard (e.g., pH 7) has not changed, immerse the probe into the initial standard. Wait for the reading to stabilize. The reading should read the initial standard value (e.g., 7) within the manufacturer's specifications. If not, re-calibrate the instrument. If re-calibration does not help, the calibration range may be too great. Reduce calibration range by using standards that are closer together.

SPECIFIC CONDUCTANCE

Conductivity is used to measure the ability of an aqueous solution to conduct an electrical current. Specific conductance is the conductivity value corrected to 25ºC. Calibrating an instrument for specific conductance automatically calibrates the instrument for conductivity, and vice-versa.

Most instruments are calibrated against a single standard which is near, but below the specific conductance of the environmental samples. A second standard which is above the environmental sample specific conductance is used to check the linearity of the instrument in the range of measurements.

Calibration Procedure

- Allow the calibration standard to equilibrate to the ambient temperature.
- Remove probe from its standard container, rinse the probe with a small amount of the conductivity/specific conductance standard (discard the rinsate), and place the probe into the conductivity/specific conductance standard. Gently move the probe up and down in the solution to remove any air bubbles from the sensor. Allow the probe to sit in the solution for at least 1 minute for temperature equilibration before proceeding.
- Select calibration mode.
- Select Specific Conductance from the Calibration menu. Enter the calibration value of the solution (mS/cm at 25ºC) and continue. Allow the Specific Conductance reading to stabilize for approximately 30 seconds and finish the calibration. The reading should remain within manufacturer’s specifications. If it does not, recalibrate. If readings continue to change after recalibration, consult the manufacture.
- Remove probe from the standard, rinse the probe with a small amount of the second conductivity/specific conductance standard (discard the rinsate), and place the probe into the second conductivity/specific conductance standard. The second standard will serve to verify the linearity of the instrument. Read the specific conductance value from the instrument and compare the value to the specific conductance on the standard. The two values should agree within the specifications of the instrument. If they do not agree, re-calibrate. If readings do not compare, then the second standard may be outside the linear range of the instrument. Use a standard that is closer but above the first standard and repeat the verification. If values still do not compare, try cleaning the probe or consult the manufacturer.

NOTE: These procedures should only be used for instruments that are capable of automatically correcting specific conductance for temperature (to 25ºC). For instruments that cannot calibrate for specific conductance, follow the procedures in the instrument’s manual for conductivity calibration. If calibrating for conductivity instead of specific conductance, the solutions conductivity value must be corrected for the temperature that the sensor is reading.

OXIDATION-REDUCTION POTENTIAL (ORP)

The oxidation-reduction potential is the electrometric difference measured in a solution between an inert indicator electrode and a suitable reference electrode. The electrometric difference is measured in millivolts and is temperature dependent.

Calibration or Verification Procedure

- Allow the calibration standard (a Zobell Solution) to equilibrate to ambient temperature.
- Remove the cover of the probe and place it into the standard.
- Select monitoring/run mode.
- While stirring the standard, wait for the probe temperature to stabilize, and then read the temperature.
- Look up the millivolt (mV) value at this temperature from the millivolt versus temperature correction table found in Attachment C. It may be necessary to interpolate millivolt values between temperatures. Select “calibration mode,” then “ORP.” Enter the temperature-corrected ORP value and calibrate the instrument.
- Select monitoring/run mode. The reading should remain unchanged within manufacturer’s specifications. If it changes, re-calibrate. If readings continue to change after calibration, consult manufacturer.
- If the instrument instruction manual states the instrument is factory calibrated, then verify the factory calibration against the standard. If reading does not agree within the specification of the instrument, the instrument will need to be re-calibrated by the manufacturer.

TURBIDITY

Turbidity refers to how clear the water is and is a measure of relative sample clarity. The greater the amount of total suspended solids in the water, the higher the measured turbidity. The turbidity method is based upon a comparison of intensity of light scattered by a sample under defined conditions with the intensity of light scattered by a standard reference suspension. A turbidity meter is a nephelometer with a visible light source for illuminating the sample and one or more photo-electric detectors placed ninety degrees to the path of the light source.

Some instruments will only accept one standard. For these instruments, the standards will serve as check points.

Calibration Procedures

- If the standard cuvette is not sealed, rinse a cuvette with deionized water. Shake the cuvette to remove as much water as possible. Do not wipe the inside of the cuvette because lint from the wipe may remain in the cuvette. Add the standard to the cuvette.
- Before performing the calibration procedure, make sure the cuvettes are not scratched and the outside surfaces are dry, free from fingerprints and dust. If the cuvette is scratched or dirty, discard or clean the cuvette, respectively.
- Zero the instrument by using either a zero or 0.02 NTU standard. A zero standard (approximately 0 NTU) can be prepared by passing distilled water through a 0.45 micron

pore size membrane filter.

- Using a standard at 1 NTU, calibrate according to manufacturer’s instructions or verify calibration if instrument will not accept a second standard. If verifying, the instrument should read the standard value to within the specifications of the instrument. If the instrument has a range of scales, check each range that will be used during the sampling event with a standard that falls within the range.
- Using a standard at 10 NTU, calibrate according to manufacturer’s instruction or verify calibration if instrument does not accept a third standard. If verifying, the instrument should read the standard value to within the specifications of the instrument.

Note: If only performing a two-point calibration (depending on project requirements), the 0.02 NTU and 10 NTU standard should be used.

H&S SOP #003

003 WATER LEVEL MEASUREMENT

Water table gauging is conducted with an electronic interface probe prior to groundwater sample collection. One synoptic round is required as part of each groundwater sampling event. This requires measurements be collected within the shortest time possible during one day, no sooner than 24 hours following a significant precipitation event. Groundwater level measurements will be taken from each monitoring well prior to collection of a groundwater sample.

For those wells that are sampled using standard sampling techniques, groundwater-level measurements will be taken prior to standard sampling and during the purging process (at specified intervals corresponding to removal of purge volumes). The probe will be lowered slowly until the instrument alarm and light response indicate that the water surface has been encountered. The measurement will be taken from the surveyed point on the well’s protective enclosure, which is normally present on the north edge of the inner well casing and will be checked by slowly raising and lowering the tape and watching the instrument response.

For aretesian wells where the potentiometric surface rises above ground level, a casing extension of known length will be attached to the well and the water level allowed to equilibrate prior to gauging.

Water level measurements will be recorded to the nearest 0.01 foot and referenced to a top of casing notch or north side of the well casing. The probe should be cleaned with deionized water and detergent before gauging, between wells and after use. Whenever possible, gauge "cleanest" wells first to avoid cross-contamination.

All gauge readings should be obtained at the point of elevation survey. Readings should be made to the nearest 0.01 foot.

Record all gauge readings on a Well Monitoring Form.

H&S SOP #004

004 EXTRACTION WELL FLOW RATE MEASUREMENT

The flow rates will be calculated by reading the flow meter on each extraction well to obtain the total number of gallons extracted. The volume of water extracted for the current quarter will be calculated by subtracting the total number of gallons extracted reading from the previous quarter reading. In addition, the instantaneous flow rates will be measured for each extraction well by timing the number of gallons extracted over a two-minute interval. The instantaneous rate will be used for comparison to the overall average extraction rate.

H&S SOP #005

005 INVESTIGATION-DERIVED WASTE MANAGEMENT

Groundwater purged during sample collection will be collected in containers. These containers will be transported to the Groundwater Treatment Plant (GWTP) building and emptied into the floor sump. The purge water will be processed through the GWTP. Other non-hazardous wastes will be accumulated on site and disposed of properly.

No hazardous waste disposal is anticipated for this project.

H&S SOP #006

006 FIELD DECONTAMINATION PROCEDURES

All decontamination procedures outlined herein are conducted by H&S personnel who have read and understand the decontamination process and who are accountable for ensuring that proper procedures and guidelines are followed.

All H&S personnel or other personnel who handle equipment in accordance with this procedure will wear, at a minimum, protective gloves and eyewear during the decontamination process.

All non-disposable sampling and field equipment is to be decontaminated prior to sample collection and/or at the end of each sampling or field event.

At the end of each sampling or field event, decontaminated equipment is to be stored in a clean protective casing or carefully wrapped in aluminum foil. Any portion of the equipment that comes into contact with water or soil is cleaned, or disposed of and replaced, prior to re-use.

All nondisposable field equipment will be decontaminated as described below before each use to avoid cross-contamination between samples and to ensure the health and safety of the field crews. The following decontamination procedures are to be followed for all non-disposable soil and groundwater sampling equipment:

- Remove gross contamination from all equipment and sampling devices with a tap water rinse and a soft-bristled brush.
- Flush necessary sampling devices (pumps and tubing) with two gallons of distilled water.
- Flush necessary sampling devices (pumps and tubing) with deionized (DI) water.
- Wash equipment with Alconox detergent or equivalent and water
- Rinse equipment thoroughly with distilled water
- Give equipment a final rinse with distilled water
- Place the sampling equipment on a clean surface and air dry.

H&S SOP #007

007 FIELD DOCUMENTATION PROCEDURES

- All entries will be legible and will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the person recording the information. The correction shall be written adjacent to the error.

- Each field book assigned to a project will have the following information on the title page:
    - Project name
    - Site location
    - Project number
    - Person to whom the logbook is assigned
    - H&S' name, address and phone

- Each field book will have a designated number listed on the outside front cover.

- Each field book will be a bound field survey book or notebook, water-resistant, and have sequentially numbered pages.

- The following logbooks may or may not be required, dependent on the project needs, at the discretion of the project manager:
    - Daily Activity Log
    - Daily Personnel Log
    - Field Log
    - Photograph Log
    - Equipment Calibration Log
    - Health & Safety Log

- Daily Activity Logbook will typically be completed by the Field Team Leader and is intended to summarize daily activities. Entries into the log will typically include the following:
    - Date of field activity
    - Person(s) documenting field activity
    - All H&S and subcontractor personnel on site
    - Time of arrival and departure
    - Weather conditions
    - Sample collected
    - Difficulties encountered
    - How difficulties were resolved.

- Daily Personnel Logbook will be maintained for the duration of the project to record the identities of all personnel who are onsite. The log will record the following information:

- Names of field personnel
- Names of subcontractor personnel
- Names of visitors
- Affiliation of each person on-site
- Date/Time of entry and exit

- Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. Entries will be described in as much detail as possible. At the beginning of each entry, the date, start time, weather, and names of all sampling team members present will be entered. Each page of the logbook will be signed and dated by the person making the entry. Information included in the logbook is listed below. Sample information including field measurements may be collected on field loghsheets instead of in the logbook.
- Chronology of activities, including entry and exit times
- Names of all people involved in sampling activities and organizational affiliations
- Level of personal protection used
- Any changes made to planned protocol
- Names of visitors to the site during sampling and reason for their visit
- Sample location and identification
- Weather conditions, including temperature and relative humidity
- Dates (month/day/year) and times (military) of sample collection
- Measurement equipment identification (model/manufacturer) and calibration information
- Field screening results
- Site observations
- Sample collection methods and equipment
- Sample collection date and time
- Sample depths
- Whether grab or composite sample collected
- How sample is composited, if applicable
- Sample description (color, odor, texture, etc.)
- Sample identification code
- Tests or analyses to be performed
- Sample preservation and storage conditions
- Equipment decontamination procedures
- QC sample collection
- Unusual observations
- Record of photographs
- Sketches or diagrams
- Signature of person recording the information.

- The person recording the notes will sign the top of the new page and indicate the date, time, and weather conditions, prior to recording information about the field activity. When the designated person recording the notes either relinquishes the field logbook to another team member or turns the book in at the end of the day, the person relinquishing the field logbook will affix a signature and date to the bottom of the last page used. If the page is not complete, a diagonal line will be struck across the blank portion of the page.

- Field data forms shall be used to document sampling information for activities that have an associated form. H&S field data forms include:
    - Field data record
    - Groundwater -Field data record
    - Well development
    - Sample log sheet
    - Photograph log

- Photograph log may be required and should note the date and time of all photographs taken at the site and may include the following:
    - General site topography
    - Sampling locations
    - Existing monitoring locations
    - Physical appearance of environmental samples
    - Physical appearance of groundwater and soil/sediment
    - Evidence of possible contamination

- Equipment calibration logs will be maintained to record which instruments were calibrated each day (identified by manufacturer, model number and serial number), the individual who performed the calibration, adjustments made to the instruments during calibration, and any notes regarding the maintenance of the instrument. It should be noted that this information may be recorded in the field logbook in lieu of an equipment calibration log.

- Health and Safety Log may be maintained to record any Health and Safety issues that arise during field activities. Any injuries, illnesses, use of first aid supplies, use of personal protective equipment (for levels A, B, or C only, if needed), or possible work-related symptoms will be recorded in the log together with the date, the name(s) of the affected individual(s), and a description of the incident. The Health and Safety Log should be include a record of all air monitoring results, any action level exceedances, and actions taken as the result of any action level exceedances. It should be noted that this information may be recorded in the field logbook in lieu of a health and safety log.

CHAIN OF CUSTODY/SHIPPING

Sample Labels

Field personnel are responsible for uniquely identifying and labeling all samples collected during a field investigation program. All labeling must be completed in indelible/waterproof ink and securely affixed to the sample container. No reference to the site name can be shown on the sample labels.

- All sample bottles will contain a label which typically contains the following information:
- Unique sample identification number
- Sample location/description number, if different from above
- Type of analysis to be performed
- Type of chemical preservation used
- Grab or composite designation
- Sampling date and time
- Sampler’s initials

Custody Seals

Custody seals will be secured across the shipping container to ensure content integrity. Samples will be picked up by a courier service from the laboratory, therefore, custody seals are not required.

Chain-of-Custody

Pre-formatted Chain-of-Custody (COC) forms will be used as the primary documentation mechanism to ensure that information pertaining to each sample is recorded. All samples will be adequately marked for identification from the time of collection and packaging through shipping and storage.

A chain of custody (COC) record will be initiated in the field and will accompany each group of samples during shipment to the laboratory. The field sampling team will be responsible for the maintenance and custody of any samples collected until those samples are delivered to a courier, the laboratory, or common carrier. The custody form will be filled out by the field personnel at the time of sampling. The original will be stored in a Ziploc™ bag presented to the laboratory currier when coolers are picked up. The currier will sign the COC and give the field personnel the second part of the form. This will be retained by the field personnel for the project files.

COC will contain the following pertinent information:

- Turnaround time
- Date shipped
- Laboratory address and contact person
- Sampler name
- Sampler signature
- Matrix
- Concentration level
- Composite or grab sample designation
- Preservative used
- Required analysis
- Station location identification
- Date/time sample collected
- Samplers initials for each sample
- Corresponding organic/inorganic sample ID.

Shipping

After sample collection, samples must be maintained at 4 ± 2°C and shipped to the laboratory within 48 hours of collection, in order to meet holding time requirements of the shortest holding time test. One COC form will be included with each sample shipment along with the samples. Each sample shipment container will also be sealed with a COC seal.

Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly.

Place all bottles in separate and appropriately sized plastic zip-loc bags and close the bags. Up to three VOA vials may be packed in one bag. Bottles should be wrapped in bubble wrap. It is preferable to place glass sample bottles and jars into the cooler vertically. Due to the strength properties of a glass container, there is much less chance for breakage when the container is packed vertically rather than horizontally.

Put ice in large plastic zip-loc bags (double bagging the zip-loc bags is preferred) and properly seal. Place these ice bags on top of, and between the samples. Fill all remaining space between the bottles with packing material.

Samples will be shipped overnight. Tracking numbers will be logged on the COC form.

APPENDIX B

TESTAMERICA LABORATORIES, INC.
ANALYTICAL SOPS AND QUALITY ASSURANCE MANUAL
(ON CD-ROM)