APPENDIX J

MONITORING AND SAMPLING PLAN OPERABLE UNIT NOS. 1 AND 2

FORMER EMERSON POWER TRANSMISSION FACILITY
TOMPKINS COUNTY
ITHACA, NEW YORK
NYSDEC SITE NO. 755010

EMERSON

PROJECT NO.: 31401545.001
DATE: AUGUST 2022

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1 INTRODUCTION

This Monitoring and Sampling Plan (Plan) describes the measures for evaluating the overall performance and effectiveness of the selected remedies for the former Emerson Power Transmission Corp. facility (Site No. 755010) in Ithaca, New York (the Site; Figure 1). The selected remedies are described in the 2021 Record of Decision Amendment (AROD). This Plan is an integral part of the Interim Site Management Plan (SMP) and shall not be used as a standalone document. The Plan may only be revised with the approval of the New York State Department of Environmental Conservation (NYSDEC).

The Site is divided into two Operable Units (OUs) as shown on Figure 2:

- OU-1 includes the former Fire Water Reservoir (FWR). A groundwater pump and treat system was installed as an Interim Remedial Measure (IRM) to address volatile organic compound (VOC)-affected groundwater near the FWR in 1991; the groundwater pump and treat system was replaced with a dual-phase extraction (DPE) and treatment system in 1996.
- OU-2 consists of the former manufacturing plant complex. OU-2 includes several areas of concern, which were addressed during the 2018-2019 Soil IRM (WSP 2020). Approximately 4,550 cubic yards of VOC-, barium-, and cyanide-affected soils were removed during the Soil IRM. The OU-2 Soil IRM is a component of the final remedy for the Site while providing for the removal of sources to groundwater contamination.

This Monitoring and Sampling Plan provides information on the following.

- Site monitoring programs including sampling locations, environmental media, protocols, and frequency;
- Sampling and Analysis Plan;
- Quality Assurance/Quality Control (QA/QC) procedures

Reporting requirements are described in detail in Section 7.0 of the Interim SMP.

2 MONITORING PROGRAMS

To monitor the effectiveness of the Soil IRMs and the DPE and treatment system, samples shall be collected from groundwater monitoring wells, groundwater extraction wells, and outfalls (seeps) on a routine basis as described in the following sections. Site monitoring and extraction well construction information is provided in Table 2.1. In addition, monitoring procedures for outfalls in accordance with the State Pollutant Discharge Elimination System (SPDES) permit equivalent (see Section 2.3), non-aqueous phase liquid (NAPL) monitoring and recovery (see Section 2.4), and vapor intrusion monitoring are provided.

2.1 SITE-WIDE GROUNDWATER MONITORING

Site-wide groundwater monitoring will be completed on an annual basis (fall) to evaluate groundwater quality across the Site. The network of existing monitoring wells has been selected to monitor upgradient, within, and downgradient of Soil IRMs. The Site-wide groundwater monitoring network is shown on Figure 3. The well network has been selected based on the following criteria:

— Historical chlorinated volatile organic compound (CVOC), barium, or cyanide concentrations;

— Proximity to Soil IRMs.

Table 2.2 summarizes the analytes for which specific wells will be sampled, along with information regarding sampling methods. The sampling methods are discussed in Section 3.7 and analytical procedures in Section 4.1.

2.2 DPE AND TREATMENT SYSTEM GROUNDWATER MONITORING

DPE and treatment system groundwater monitoring will be completed on a semiannual basis (spring and fall) from select monitoring wells, and from groundwater extraction wells on an annual basis (fall) in accordance with Table 2.3 and Section 3 to evaluate groundwater quality and effectiveness of the DPE and treatment system. The well network has been selected based on the following criteria (Figure 4):

— Historical CVOC concentrations;

— Proximity to the former FWR;

— Delineation of the groundwater capture zone.

In addition, groundwater levels will be collected annually while the DPE and treatment system is offline and compared to groundwater levels with the DPE and treatment system operating. A comparison of these elevations provides the hydraulic influence (i.e., drawdown and radius of influence) of the operating system in both the B and C bedrock zones. One week prior to the fall semiannual sampling event all wells listed in Table 2.3 shall be gauged with the DPE and treatment system running. Care shall be taken to ensure that the samples are collected while the aquifer is under steady state conditions (i.e., no unplanned shutdowns have occurred in the preceding weeks). Extraction wells shall be gauged through the sampling port in the well-head assembly after the vacuum line valve is closed. Upon completion of the gauging activities, the DPE and treatment system shall be turned off to allow recovery of all extraction wells and monitoring wells within the radius of influence. At the beginning of the fall semiannual sampling event, all wells shall be gauged prior to restarting the system.

The sampling methods are discussed in Section 3.7 and analytical procedures in Section 4.1.

2.3 SPDES PERMIT EQUIVALENT REQUIREMENTS

The SPDES permit equivalent, effective August 1, 2022 to July 31, 2027, for the Site is included in Appendix A and requires sampling of four outfalls (Figure 5):

— Outfall 01A – is the discharge from the groundwater treatment system

— Outfall 001 – receives discharges of stormwater, groundwater seepage, and treated groundwater from Outfall 01A

— Outfall 009 – receives stormwater and groundwater seepage

— Outfall 011 – receives stormwater and groundwater seepage from a ditch designated as "Open Ditch 1"

The SPDES permit equivalent requirements are summarized in Table 2.4.

Flow from Outfall 01A is metered with a flow totalizer, and Outfall 001 is equipped with a V-Notch Weir. Flow from Outfall 001 shall be estimated from head measured in the V-Notch Weir using an online calculator (https://www.lmnoeng.com/Weirs/vwier.php).

As of the date of this document (August 2022), a pre-design study is underway to determine the final remedy to address the groundwater seeps. The pre-design study report with recommendations for the final remedy is expected to be completed in the fall of 2022. As such, this section will be updated once the pre-design study is finalized (with input from NYSDEC).

The sampling methods are discussed in Section 3.8 and analytical procedures in Section 4.1.

2.4 NAPL MONITORING AND RECOVERY

The remedy for addressing NAPL in select monitoring wells and behind the wall in Building 4, as described in the AROD consists of the following: (1) construction of a collection trench and sump or wells for recovery of weathered petroleum product along the base of the eastern wall in Building 4; and (2) passive product collection and removal from existing on-site wells.

Quarterly performance monitoring of NAPL recovery wells MW-8B, MW-5-25, MW-50-160D, LBA-MW-35, and LBA-MW-39 and systems shall include gauging of product thickness, visual descriptions of any NAPL present, and removal and replacement of product absorbent socks (Figure 4). Sorbent socks shall be deployed to a depth at which they straddle the water table in the well to ensure direct contact with the NAPL/groundwater interface.

The gauging methods are discussed in Section 3.7.

2.5 SOIL VAPOR INTRUSION MONITORING

CVOCs have been detected in sub-slab gas and indoor air samples at concentrations greater than the New York State Department of Health (NYSDOH) indoor air guidelines in many of the onsite buildings. While there are no currently active sub-slab depressurization (SSD) systems operating at the Site, the AROD requires mitigation of impacts from the potential for soil vapor intrusion (SVI) into existing or future buildings onsite. SSD systems or other appropriate engineering controls to address indoor air may be used in existing buildings as an engineering control in the future. An SVI evaluation work plan shall be submitted to the NYSDEC prior to a change of use that involves modifications to existing buildings and/or construction of new buildings, including underground parking structures.

Currently, no SVI sampling is conducted for the Site. However, SVI sampling may be required in the future. Refer to Appendix C of the Interim SMP for the division of responsibilities between the Owner of OU-2 and Remedial Party. The sampling methods are discussed in Section 3.9 and analytical procedures in Section 4.1 below.

3 SAMPLING AND ANALYSIS PLAN

The following section details the elements of the sampling and analysis plan (SAP).

3.1 SAMPLING OBJECTIVES

The primary objective in collecting and analyzing environmental samples is to produce results that are representative of the matrix material from which the samples were collected. This requires the following:

— Appropriate measures to be taken to ensure that samples are not contaminated during the process of collecting, transporting, and analyzing the samples.
— Analysis of the actual samples that were collected from the Site, and for which data was reported.
— Appropriate holding times and adequate storage methods for samples are maintained in order to minimize degradation between the time of sample collection and the time of sample analysis.
— A laboratory QA/QC program is implemented that is sufficient to ensure that data reported by the laboratory are a reasonable indication of conditions in the samples at the time of analysis, and, therefore, assuming the preceding criteria are met, are representative of matrix conditions at the time of sampling.

To meet the sampling objectives outlined above, procedures were developed in accordance with accepted industry standards to ensure that appropriate and acceptable sampling and analysis techniques and equipment are consistently applied during sampling at the Site.

3.2 SAMPLING PERSONNEL

The field sampling crew shall be trained and qualified to perform the tasks necessary to collect representative samples. Before beginning field activities, the Site-specific Health and Safety Plan (HASP) shall be modified, if appropriate, in accordance with the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard, 29 CFR 1910.120 and 29 CFR 1926.65 (see Section 3.3). All personnel are required to review the HASP before beginning work, and a safety meeting shall be held at the beginning of each workday. Key responsibilities and tasks which must be completed by field personnel are identified below.

— Reviewing the SAP and the HASP; field sampling personnel will develop an understanding of sampling locations, methods, sample quantities, and personal protective measures required onsite.
— Ensuring that a copy of the SAP and the HASP is available for reference at the Site each time samples are collected.
— Ensuring that samples are representative of the Site conditions and the matrix from which the sample was collected by following the procedures outlined in the SAP.
— Ensuring that only equipment specified in the SAP is used to collect samples.
— Properly decontaminating non-dedicated sampling equipment.
— Properly preserving, packaging, sealing, and shipping samples to ensure that the samples arrive at the laboratory unchanged.
— Implementing chain-of-custody procedures and properly documenting field conditions.

3.3 HEALTH AND SAFETY PLAN

The site-specific HASP shall be reviewed and revised, if necessary, before starting the work specified in this plan. The HASP shall comply with 29 CFR 1910.120 and 29 CFR 1926.65. All subcontractors will also be required to prepare and adhere to their own HASP that is provided that such procedures are not inconsistent with the HASP developed for the Site and commensurate with the planned work and activities.

The primary anticipated hazards include potential worker and public exposure to construction hazards and potential chemical exposure. Worker and public safety hazards will include those typically found at a construction site using heavy equipment.

Potential chemical exposures are anticipated to derive from inhalation of particulates. The following safety precautions will be established to minimize these exposures: work zones will be established and workers will wear personal protective equipment (PPE) as specified in the HASP; air monitoring will be conducted while work is being performed to reliably measure airborne contaminants and to verify that control measures are adequate.

A copy of the HASP developed for the Site is included in Appendix G of the Interim SMP.

3.4 GENERAL SAMPLING PROCEDURES

All sampling shall be conducted in accordance with WSP Field Standard Operating Procedures (SOPs; Appendix B) and the NYSDEC's Department of Environmental Remediation (DER) Technical Guidance (DER-10) for Site Investigation and Remediation (NYSDEC 2010).

In accordance with the HASP, proper PPE shall be selected and used during the sampling activities. Standard procedures shall be followed to prevent cross contamination and contamination of the environment when collecting samples. In accordance with the SOPs, a new pair of disposable gloves shall be donned immediately before each sample is collected to limit the possibility of cross-contamination from accidental contact.

All Site activities will be recorded in a Site field book in accordance with WSP SOP 1 – Note Taking and Field Book Entries Procedure (Appendix B).

3.5 MONITORING EQUIPMENT

During the sampling effort, various types of monitoring and sampling equipment shall be used to assess the surrounding environment (air) or collect samples. An inspection of sampling and monitoring equipment integrity shall be conducted prior to sampling in order to assess the operating condition of the sampling equipment. The condition of sampling equipment shall be documented in the field book, and necessary maintenance shall be performed on the equipment prior to sampling. All manufacturer's operation manuals for calibration, use, and decontamination procedures shall be followed.

Manufacturer's guidelines shall be consulted before beginning the calibration process and the manufacturer's technical support shall be contacted if problems or questions arise. Air and water quality monitoring equipment shall be tested and calibrated daily before use and shall be recalibrated daily in accordance with WSP SOP 7 – Water Quality Monitoring Equipment Procedure (Appendix B). All calibration procedures performed shall be documented in the field book and shall include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which the readings were taken, and the calibration readings.

- Before calibrating and using air quality monitoring equipment in the field, the sensors shall be inspected to ensure that they are clean, installed properly, and are not damaged.
- Field calibration shall be conducted in an area sheltered from wind, dust, and temperature/sunlight fluctuations, such as inside a room or vehicle in which the ambient temperature of the standards are maintained at a temperature >40 degrees Fahrenheit (ºF) and < 100°F.
- The air quality monitoring equipment shall be allowed to warm up for at least 10 minutes after being turned on and the display will be set to read the appropriate measurement units.
- The brand, concentration, lot numbers and expiration dates of standard calibration products shall be recorded in the field book.

Following calibration, the air quality monitoring equipment shall be used to collect field parameters and the field measurements shall be recorded on sampling forms and in the field book; conditions that may affect the quality of the data (e.g., changes in weather) shall also be noted.

3.6 DECONTAMINATION

Non-dedicated equipment must be adequately decontaminated between locations in accordance with WSP SOP 6 – Decontamination Procedure (Appendix B). Where possible, each individual piece shall be decontaminated in accordance with the manufacturer's specifications. Specifically, the decontamination process shall include the following steps:

- physical removal of debris
- bucket wash with non-phosphate soap such as Liquinox®, or equivalent and scrub brush
- distilled water wash and rinse

The project geologist, scientist, or engineer may also elect to use a pesticide-grade solvent rinse (e.g., hexane or isobutyl alcohol), followed by air drying and a final distilled water rinse, in instances where notable impact from organic compounds (e.g., oil) is present in the sample or associated non-dedicated equipment.

3.7 GROUNDWATER SAMPLING

Monitoring or extraction wells shall be purged and sampled using traditional (bailer) or low-flow techniques in accordance with WSP SOP 11 – Groundwater Sampling Procedure (Appendix B). Prior to sampling, the groundwater level and NAPL thickness (where present) in the wells shall be measured to the nearest 0.01-foot using an electronic water level indicator or oil-water level indicator, as appropriate. Prior to gauging, the wells shall be uncapped and allowed to equilibrate with atmospheric conditions. In the event that NAPL is observed, groundwater samples will not be collected from that well. All water level and NAPL thickness measurements shall be recorded in the Site-dedicated field book.

Select monitoring or extraction wells listed in Tables 2.2 and 2.3 shall be purged of a minimum of three well volumes using dedicated disposable polyethylene bailers before sampling. Groundwater samples shall be collected from each monitoring well using the dedicated disposable bailer for the respective well.

Select monitoring or extraction wells listed in Tables 2.2 and 2.3 shall be sampled in accordance with U.S. Environmental Protection Agency's (EPA's) *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (EPA 2017) and WSP SOP 11 with a pneumatic submersible pump (Appendix B). The intake depths for the monitoring wells shall be set to coincide with the approximate mid-point of the screened interval, open interval, or the mid-point of the water column if the screened/open interval is not fully submerged. If a sufficient water column is not present in the well to conduct low-flow sampling, an alternative purge and sample method shall be employed using peristaltic pumps, bailers, or submersible pumps in accordance with WSP SOP 11. If the well is purged dry, samples shall be collected upon sufficient recharge.

During purging, field measurements of temperature, pH, specific conductance, dissolved oxygen, oxidation-reduction potential, and turbidity, shall be monitored in accordance with WSP SOP 11 with a portable water quality meter; a flow-through cell shall be used when appropriate. Depth-to-water measurements shall be collected throughout sampling to track and minimize water column drawdown. In accordance with WSP SOPs, groundwater samples shall be collected following the stabilization of the field parameters.

3.8 SURFACE WATER AND WASTEWATER SAMPLING

Samples will be collected in general accordance with the WSP SOP 7 - Water Quality Monitoring Equipment Procedure, SOP 12 - Surface Water Sampling Procedure, and SOP 18 – Wastewater[1] Sampling Procedure (Appendix B). The measurements of pH and temperature shall be conducted in the field with a portable water quality meter. All samples for laboratory analysis shall be collected directly into laboratory provided containers.

[1] Wastewater discharge samples collected in accordance with the SPDES permit equivalent consist of stormwater, groundwater seepage, and/or treated groundwater depending on the outfall.

3.9 SVI SAMPLING

All SVI evaluations will require a work plan that is submitted to and approved by the NYSDEC and the NYSDOH. The work plan will include procedures. The following sections summarize the procedures for conducting an SVI evaluation; however, the NYSDOH's Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006, and associated updates shall be consulted for a more detailed explanation or revisions.

3.9.1 PRE-SAMPLING SITE INSPECTION

The first step to conducting an SVI evaluation is to perform a building inspection and material inventory. The pre-sampling site inspection shall be conducted a minimum of 2 days before conducting the sampling activities. During the Site inspection, the building construction shall be evaluated, the NYSDOH's indoor air quality questionnaire and building inventory form shall be completed, and an inventory of materials and equipment stored in accessible areas on the first floor of the building will be conducted. The materials and equipment of concern include, but are not limited to, petroleum products, gas-powered equipment, kerosene heaters, paints, varnishes, products containing petroleum distillates or solvents, and pesticides. In general, the volatile ingredients of each material, if available, will be photographed or recorded on the inventory form, and the containers will be scanned with a photoionization detector (RAE Systems ppbRAE or equivalent) for potential vapor emissions. If the contents of a container are not listed on the label, the product name and manufacturer's name and address (if available) will be recorded on the inventory form. It will be recommended that any materials that contain VOCs be removed from the building, or the containers sealed in plastic bags.

Site conditions, including temperature, wind direction and velocity, barometric pressure, and the occurrence of precipitation shall be documented during the sampling activities.

3.9.2 INDOOR AIR

Indoor air samples shall be collected using evacuated 1-liter or 6-liter SUMMA®-style canister with flow controllers and particulate filters installed. Each of the indoor air sample canisters shall be placed approximately 3 feet above the floor to be representative of the breathing zone. Physical and visual barriers shall be placed around the canisters, if necessary, so that they are not disturbed during sample collection. The flow regulators shall be pre-set by the laboratory to collect the samples over an 8-hour period (for commercial and industrial buildings) or a 24-hour period for residential buildings. The flow regulator will be connected to the canister and opened to initiate sample collection. After the sample collection period, the flow regulator will be closed to complete the sample collection. The sample name, location, time and date of sample collection, canister and regulator number, and the analytical method to be used shall be recorded on the chain-of-custody form and in the field logbook. Site conditions, including temperature and barometric pressure, will be documented during the indoor air sampling activities.

3.9.3 AMBIENT AIR

An ambient air (i.e., outdoor) sample shall be collected from one location upwind of the facility concurrently with indoor air sample collection. In accordance with NYSDOH guidance, the outdoor air sample shall be collected approximately 3 to 5 feet above the ground and away from wind obstructions, if possible (e.g., trees, brush, wooden fences). The outdoor air sample shall be collected with an evacuated 1-liter or 6-liter SUMMA®-style canister and dedicated flow controller over an 8-hour or 24-hour period using the same procedures described above for the indoor air samples.

3.9.4 SUB-SLAB SOIL GAS

Should sub-slab soil gas samples be required by the NYSDEC or the NYSDOH, the samples shall be collected at each location using a Colvin Cox® Vapor Pin™ sub-slab soil gas probe. An electric hammer drill or rotary hammer shall be used to drill an outer hole of 1 ½-inch diameter approximately 2 inches into the slab. Then, a 5/8-inch diameter hole will be advanced approximately 1 inch into the sub-slab material to form a void. The hammer drill will be equipped with a shroud or cowling connected to a dust collection system with a high-efficiency particulate air filter in accordance with the OSHA Standard 1926.1153. Once assembled, the Vapor Pin™ assembly will be tapped into place at each location.

Prior to sampling, a tightness test will be performed at each location to evaluate the integrity of the sub-slab probe seals and ensure that the soil gas samples will not be diluted by indoor air. To perform the test, an enclosure will be placed over the sub-slab probe, and the Teflon®-lined tubing used for the sample probe will pass under the edge of the enclosure, or through an opening in the enclosure, to allow monitoring of the sub-slab soil gas from outside of the enclosure using an electronic helium detector (a Restek-brand Electronic Leak Detector, or equivalent). After the monitoring equipment is in place, the dome will be charged with helium through an opening in the enclosure. The sub-slab probe will then be monitored for a minimum of 2 minutes to verify that there is no short-circuiting to the helium-enriched atmosphere above the concrete slab.

Before each sub-slab soil gas sample is collected, a pre-sample purge will be conducted to remove dilution air from the tubing and probe assembly. One to three probe-volumes of air will be evacuated from each sample location at a rate not exceeding 0.2 liter per minute using a pump or syringe. The purged air will be collected in a Tedlar® bag and discharged outdoors. Following the pre-sample purge, vapor samples will be collected using evacuated 1-liter or 6-liter SUMMA®-style canisters and dedicated flow controllers that are pre-set by the laboratory. The flow regulators shall be pre-set by the laboratory to collect the samples over an 1-hour period (for commercial and industrial buildings) to 24-hour period for residential buildings. The flow regulator will be connected to the canister and opened to initiate sample collection. After the sample collection period, the flow regulator will be closed to complete the sample collection. The sample name, location, time and date of sample collection, canister and regulator number, and the analytical method to be used shall be recorded on the chain-of-custody form and in the field logbook. Site conditions, including temperature and barometric pressure, will be documented during the indoor air sampling activities.

The sub-slab sampling probes maybe be removed after sampling activities are complete and the slab will be repaired with similar material.

3.10 INVESTIGATION-DERIVED WASTE

Investigation-derived waste (IDW), including recovered NAPL, used product-absorbent socks, decontamination rinsate, pump tubing and single-use parts, and PPE, shall be contained in Department of Transportation-compliant 55-gallon steel drums, tanks or totes, as appropriate. The containers shall be labeled and moved to or stored in a temporary storage area on the Site for subsequent management and disposal. Investigation-derived waste shall be promptly characterized and disposed of in accordance with state and federal requirements.

Purged groundwater will be pumped into the equilibration tank of the DPE and treatment system using submersible sump pumps for eventual processing through the system.

3.11 SAMPLE HANDLING

All containers used for the collection of laboratory samples shall be new containers with the exception of canisters used for the collection of air or sub-slab soil gas samples. The canisters used for sampling activities shall be 100% individually certified-clean by the laboratory by analyzing the ambient air inside a clean canister by EPA Method TO-15.

Temperature control for aqueous samples shall be achieved by placing the samples in a cooler immediately after collection. Air and sub-slab samples shall be submitted under ambient conditions to the laboratory. The cooler shall be packed with sufficient ice to cool the samples to approximately 4° Celsius and maintain the temperature until arrival at the laboratory; the temperature shall be measured upon receipt at the laboratory.

Adhesive waterproof labels or tags will be placed on each sample container, and shall include, at a minimum, the following information:

- Project location
- Sample identification number (which will reflect the sample location)
- Date and time of sample collection
- Parameters requested for analysis
- Type of preservative added (if applicable)

This information shall be written on the label with an indelible, waterproof pen or marker.

Sample custody shall be controlled and maintained through the chain-of-custody procedures. Chain-of-custody procedures shall allow for the tracing of possession and handling of samples from the field to the laboratory. A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it up to prevent tampering. Items to be used to document the possession and handling of samples and protect their integrity include sample labels, custody seals, a logbook, and chain-of-custody forms.

In accordance with WSP SOPs, the chain-of-custody form shall be used to trace sample possession from the time of collection to receipt at the laboratory. Dated and signed adhesive seals shall be affixed to the shipping containers so that the containers cannot be opened without breaking the seal to demonstrate that they have not been opened during shipment.

4 QA/QC PROCEDURES

The following QA/QC procedures are provided to ensure that controls are initiated and maintained throughout sample collection and analysis. Field QA/QC procedures, such as the use of proper sampling technique and decontamination procedures, were discussed in earlier sections of this plan. Additional QA/QC measures include the use of standardized methods (Section 4.1), control samples (Section 4.2), and data validation (Section 4.3).

4.1 ANALYTICAL PROCEDURES

Laboratory analyses shall be performed by a laboratory accredited by the NYSDOH under its Environmental Laboratory Accreditation Program. Laboratory Sample Delivery Groups (SDGs) shall be prepared in accordance with New York State's Analytical Services Protocols Category B deliverable format. Electronic Data Deliverables (EDDs) shall be formatted for upload to the NYSDEC EQuiS database. Category B SDGs and EQuiS EDDs are not required for SPDES permit equivalent samples.

Table 4.1 (groundwater) and Table 4.2 (wastewater discharge) provide the analytical methods, analyte lists, reporting limits, preservation requirements and holding times. All air and sub-slab soil gas samples will be analyzed for VOCs by U.S. Environmental Protection Agency Method TO-15; the analyte lists, reporting limits, preservation requirements and holding times will be included in the SVI evaluation work plan. The analytical method used, extraction date, and date of actual analysis shall be recorded by the laboratory.

Analytical results submitted to the NYSDEC for review shall include, at a minimum, signed chain-of-custody sheets, sampling dates, analysis dates, analytical methods used, reporting limits, and QC results. Raw data consisting of chromatograms, recorder outputs, mass spectrum reports, computer printouts, charts, graphs, bench sheets, or any other hard copy data generated during sampling and analysis shall be available on request by NYSDEC.

4.2 CONTROL SAMPLES

Control samples are introduced into the train of actual samples as a monitor on the performance of the sampling procedures and the analytical system. A control sample may consist of a standard or natural matrix. Control samples for this monitoring plan include field duplicates, equipment blanks, trip blanks, and temperature blanks. Each type provides a different form of QC for the analytical system.

4.2.1 FIELD DUPLICATE

Field duplicates are useful in documenting the precision of the sampling process. One field duplicate shall be collected per media at an approximate ratio of 1 to 20 for groundwater, air, and sub-slab soil gas samples. One field duplicate shall be collected per quarter for SPDES permit equivalent sampling. The duplicate sample shall be collected at the same time from the same sample aliquot and in the same order as the corresponding field sample. The field duplicate identity shall not be provided to the laboratory but shall be recorded in the field book.

A duplicate air or sub-slab soil gas sample shall be collected from one of the proposed sample locations. The duplicate sample shall be collected at the same time and from the same sample location using a T-splitter. The field duplicate identity shall not be provided to the laboratory. Field duplicates are useful in documenting the precision of the sampling and laboratory analysis.

4.2.2 MATRIX SPIKES/MATRIX SPIKE DUPLICATES

Matrix spikes/matrix spike duplicates (MS/MSDs) are used to determine laboratory bias and precision for a given method and matrix. One MS/MSD shall be collected for every 20 groundwater, air, and sub-slab soil gas samples; an MS/MSD is not required for SPDES permit equivalent sampling. The MS/MSDs shall be collected at the same time from the same sample aliquot and in the same order as the corresponding field sample. The sample identification shall be identical to the field sample and include an "MS" and "MSD" (e.g., MW-13-100MS and MW-13-100MSD).

4.2.3 EQUIPMENT BLANKS

Equipment blanks are useful in documenting adequate decontamination of sampling equipment. One equipment blank shall be collected each sampling day per type of equipment used to collect groundwater samples. A blank shall be prepared by collecting rinsate from non-dedicated equipment after the equipment has been decontaminated; laboratory-provided deionized water shall be used for rinsing. The equipment blank shall be analyzed for all analytes for which sample collection was performed on a given date. The unique sample identification shall indicate that the sample is an equipment blank and shall include the sampling date (e.g., EB-MMDDYY).

4.2.4 TRIP BLANKS

Trip blanks are used to document contamination attributable to shipping and field handling procedures. Trip blank(s) shall be prepared at the laboratory and shall accompany the aqueous sample bottles in the field and with each cooler returned to the laboratory for analysis of VOCs. The trip blank(s) shall be labeled in the field: the unique sample identification shall indicate that the sample is a trip blank and shall include the shipping date (e.g., TB-MMDDYY).

In addition, a laboratory-prepared trip blank shall accompany the air or sub-slab soil gas sample canisters from the laboratory to the field and from the field to the laboratory. The trip blank shall be used to evaluate the potential for sample cross-contamination during shipment and sample collection.

4.2.5 TEMPERATURE BLANK

Temperature blanks are used to determine if proper sample thermal preservation has been maintained by measuring the temperature of the sample container upon arrival at the laboratory. Laboratory-provided temperature blank(s) shall be returned to the laboratory in each cooler.

4.3 DATA VALIDATION

To ensure the quality and utility of the data, the data packages shall be validated by a third-party consistent with the EPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review (EPA 2014a and 2014b). The EQuiS-formatted deliverables shall include any qualifications made during the data validation process, and the final report shall include a copy of the Data Usability Summary Report as specified in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation.

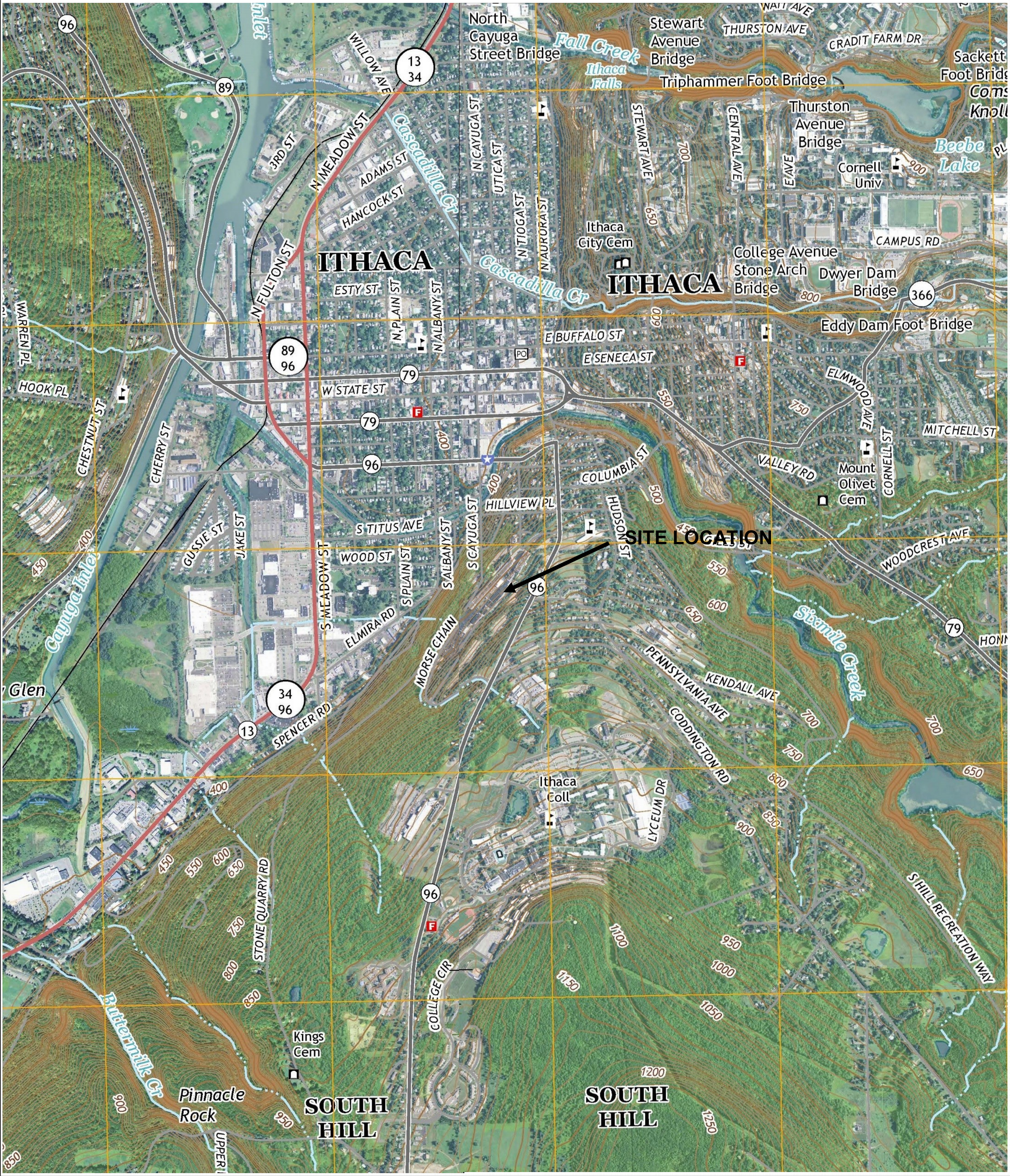
5 REPORTING

Section 7.0 of the Interim SMP describes the reporting requirements associated with this Monitoring and Sampling Plan.

REFERENCES

- EPA 2017. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. September 19.
- NYSDEC 2021. Amended Record of Decision – Morse Industrial Corporation Operable Unit Numbers: 1 and 2, Ithaca, Tompkins County Site No. 755010. September.
- NYSDEC 2010. DER-10 Technical Guidance for Site Investigation and Remediation. May 3.
- NYSDOH 2006. Guidance for Evaluating Soil Vapor Intrusion in the State of New York. October.
- WSP 2022. Interim Site Management Plan (OU-1 and OU-2) Former Emerson Power Transmission Facility, Ithaca, New York, Site No. 755010. July.
- WSP 2020. Interim Remedial Measures Construction Completion Report (OU-2), Former Emerson Power Transmission Facility, Ithaca, New York, Site No. 755010. March 26.
- 29 CFR 1926.65. February 18, 2020
- 29 CFR 1910.120. May 14, 2019

FIGURES



REFERENCE:
7.5 MINUTE SERIES TOPOGRAPHIC QUADRANGLE
ITHACA EAST AND WEST, NEW YORK 2016
SCALE 1:24,000

QUADRANGLE LOCATION

N

0 1000 2000 4000
SCALE, FEET

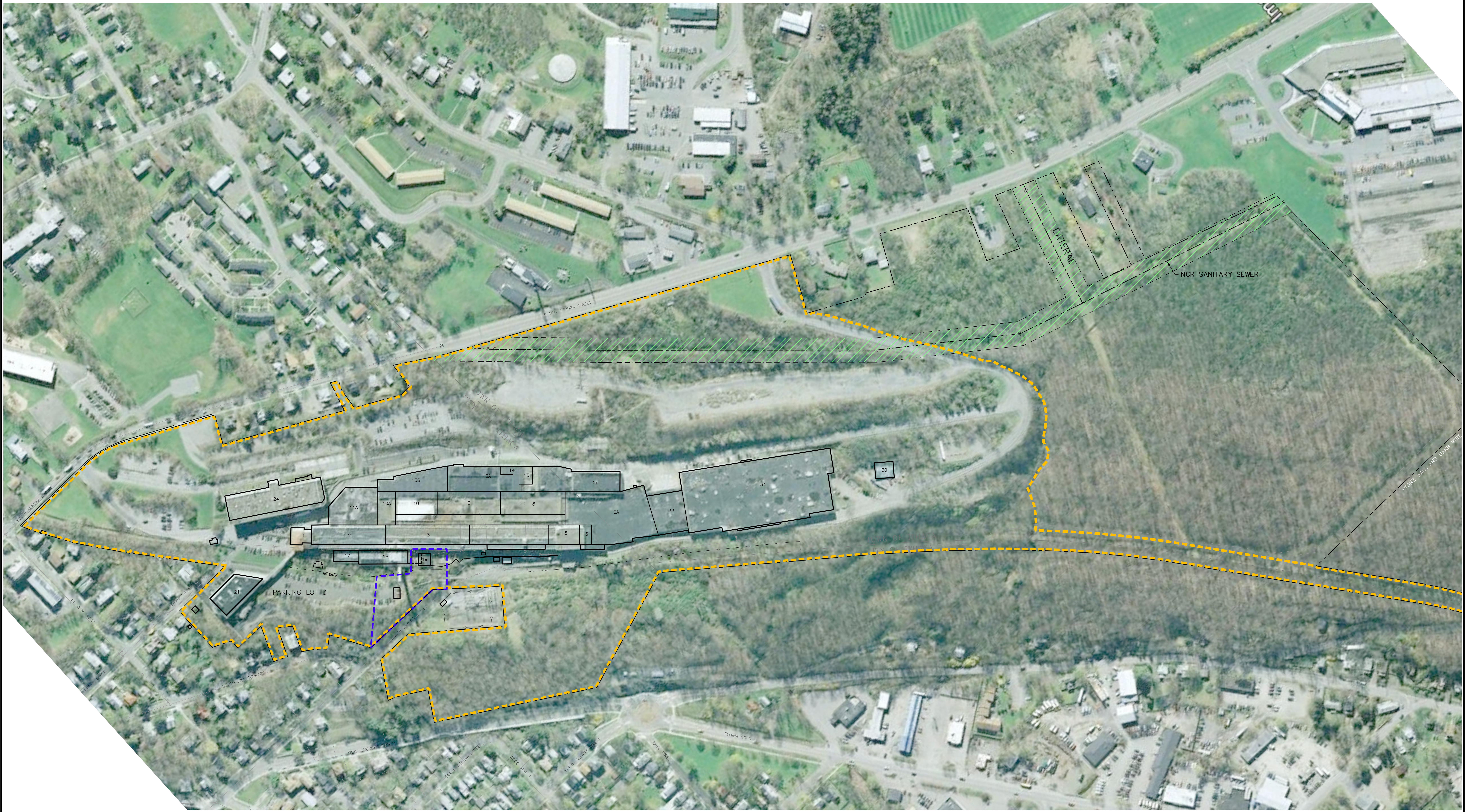
WSP USA Inc.
11 STANWIX STREET
SUITE 950
PITTSBURGH, PA 15222
TEL: +1 412.604.1040

FIGURE 1

SITE LOCATION

FORMER EMERSON POWER TRANSMISSION
ITHACA, NEW YORK
PREPARED FOR
EMERSON
ST. LOUIS, MISSOURI

DWG Name: 314P1545.001_Figure 1-1_A01.pub
Checked:
Approved:
Drawn By: emk 03/14/19
A



LEGEND

34 BUILDING NUMBER

SANITARY SEWER

PROPERTY LINE

DEED RESTRICTION PLACED BY EMERSON

BOUNDARY FOR OU-1 (RETAINED PROPERTY)

BOUNDARY FOR OU-2

150 0 150 300

SCALE, FEET

THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK & WHITE REPRODUCTION MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.

D

REVISIONS

REV	DESCRIPTION

SEAL

DATE

DRAWN BY	RA 03/12/2020
CHECKED	09/01/2021
APPROVED	

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SITE LAYOUT

SITE MANAGEMENT PLAN
FORMER EMERSON POWER TRANSMISSION
ITHACA, NEW YORK

PREPARED FOR
EMERSON – ST. LOUIS, MISSOURI

WSP USA Inc.
11 STANWIX STREET, SUITE 950
PITTSBURGH, PA 15222
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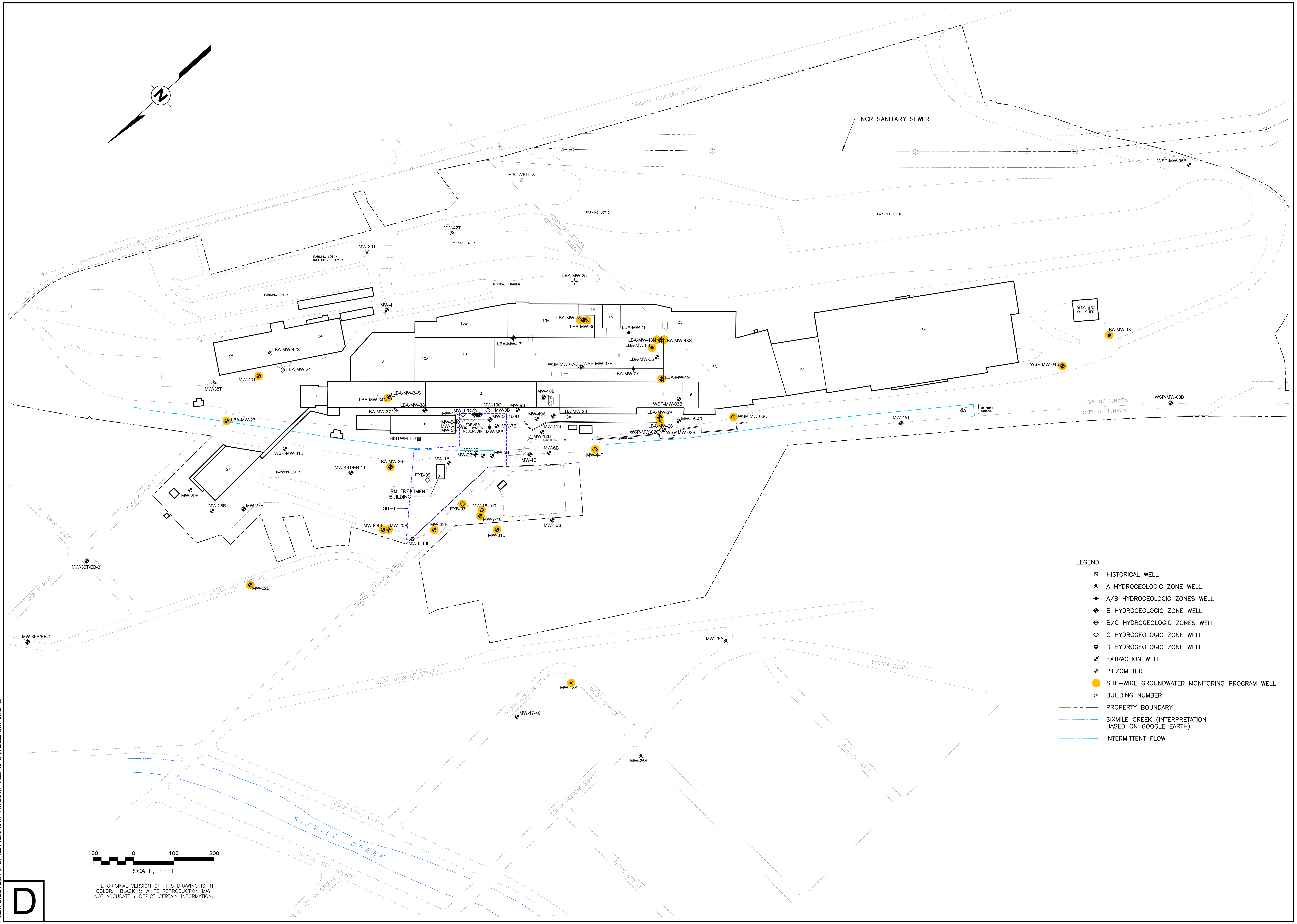
FIGURE 2

Drawing Number

314P1545.001–D132



REVISIONS

SITE-WIDE GROUNDWATER MONITORING PROGRAM

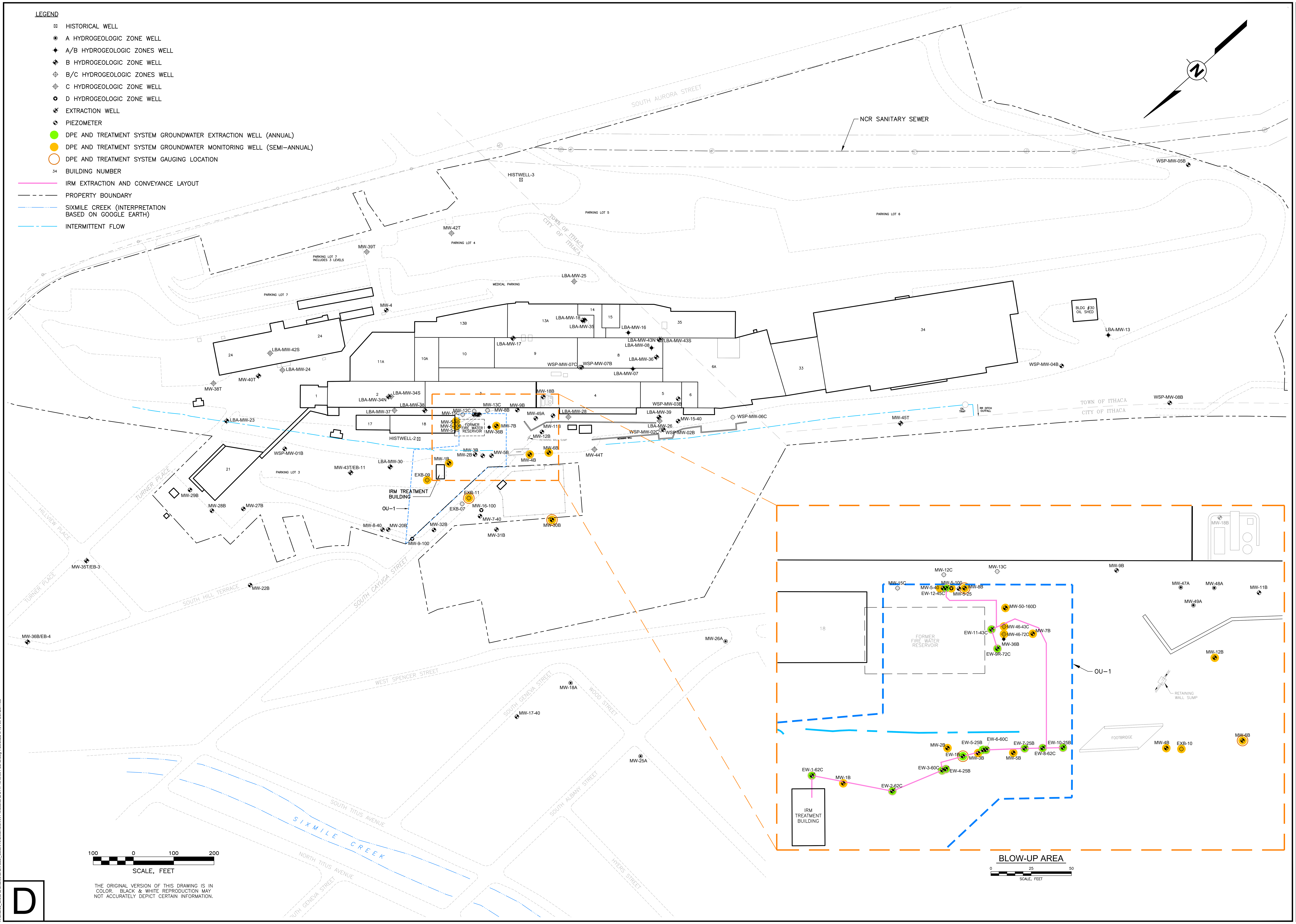
FORMER EMERSON POWER TRANSMISSION
ITHACA, NEW YORK

PREPARED FOR
EMERSON
ST. LOUIS, MISSOURI

WSP USA Inc.
11 STANWIX STREET, SUITE 950
PITTSBURGH, PA 15222
TEL: +1 412.604.1040

FIGURE 3

Drawing Number
314P1545.001-D211



REVISIONS

REV	DESCRIPTION

SEAL

DATE

DRAWN BY RAE 07/19/2022
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DPE AND TEATMENT SYSTEM GROUNDWATER MONITORING PROGRAM

FORMER EMERSON POWER TRANSMISSION
ITHACA, NEW YORK

PREPARED FOR
EMERSON
ST. LOUIS, MISSOURI

WSP USA Inc.
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PITTSBURGH, PA 15222
TEL: +1 412.604.1040

FIGURE 4

Drawing Number
314P1545.001-D212

LEGEND

- 34 BUILDING NUMBER
- SANITARY SEWER
- PROPERTY LINE
- DRAINAGE DITCH
- DEED RESTRICTION PLACED BY EMERSON
- BOUNDARY FOR OU-1 (RETAINED PROPERTY)
- BOUNDARY FOR OU-2

N

50 0 50 100
SCALE, FEET

THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK & WHITE REPRODUCTION MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.

D

REVISIONS

REV	DESCRIPTION
	Revised: Chkd: Appr.:
	Revised: Chkd: Appr.:
	Revised: Chkd: Appr.:

SEAL

DATE

DRAWN BY RA 07/19/2022
CHECKED AMR 07/26/2022
APPROVED

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SPDES PERMIT EQUIVALENT OUTFALL LOCATIONS

FORMER EMERSON POWER TRANSMISSION
ITHACA, NEW YORK

PREPARED FOR
EMERSON
ST. LOUIS, MISSOURI

WSP USA Inc.
11 STANWIX STREET, SUITE 950
PITTSBURGH, PA 15222
TEL: +1 412.604.1040

FIGURE 5

Drawing Number
314P1545.001-D210

TABLES

Table 2.1

Well Construction Details
Former Emerson Power Transmission Facility
Ithaca, New York (a)

Well ID		Installation Date	State Plane Coordinates Easting	State Plane Coordinates Northing	Elevations (feet AMSL) Ground Surface	Elevations (feet AMSL) Top of Casing	Total Depth (feet bgs)	Total Depth (feet AMSL)	Diameter (inches)	Screened Interval (feet bgs)	Screened Interval (feet AMSL)		Monitored Zone
EW-01B		09/2005	843106.18	886208.09	564.92	564.54	17.5	547.42	2	7 - 17	557.9 - 547.9		B
EW-1-62C	(c)	08/2007	843159.95	886285.60	566.59	565.34	62	504.59	6	18.7 - 62.7	547.9 - 503.9	(b)	C
EW-2-62C	(c)	-	843119.30	886255.15	565.33	563.93	60.5	504.82	2.75	18.7 - 62.7	546.6 - 502.6	(b)	C
EW-3-60C	(c)	-	843108.21	886223.35	565.12	563.28	60.6	504.52	-	19.2 - 60.6	545.9 - 504.5	(b)	C
EW-4-25B		10/2008	843107.29	886221.29	564.04	562.90	25.5	538.54	-	15 - 25	549.0 - 539.0		B
EW-5-25B		09/2008	843100.60	886196.14	564.49	563.37	25.2	539.29	-	15 - 25	549.5 - 539.5		B
EW-6-60C		-	843099.51	886194.81	564.49	563.84	54	510.51	-	19.2 - 60.6	545.3 - 503.9	(b)	C
EW-7-25B		09/2008	843084.17	886176.33	563.28	561.76	25	538.28	-	15 - 25	548.3 - 538.3		B
EW-8-62C		08/2007	843076.90	886167.91	562.94	561.82	61.5	501.44	-	23.5 - 61.5	539.4 - 501.4	(b)	C
EW-9R-72C		06/2019	843141.55	886147.62	586.13	585.19	79.3	506.83	4	55 - 79.3	531.1 - 506.8	(b)	C
EW-10-25B		09/2008	843068.65	886158.34	563.04	561.82	25	538.04	-	15 - 25	548.0 - 538.0		B
EW-11-43C	(c)	03/2011	843153.00	886142.06	586.80	586.2	45	541.80	4	25 - 45	561.8 - 541.8	(b)	C
EW-12-45C	(c)	08/2007	843188.42	886146.63	587.05	586.47	45	542.05	4	25 - 45	562.1 - 542.1	(b)	C
EXB-07		08/2007	843046.56	886317.64	529.19	529.06	25	504.19	-	5 - 25	524.2 - 504.2	(b)	C
EXB-09		05/2008	843148.53	886342.70	565.83	565.19	64	501.83	-	-	-	(b)	C
EXB-10		05/2008	843018.96	886104.16	560.34	560.07	64	496.34	-	-	-	(b)	C
EXB-11		05/2008	843046.16	886295.68	532.82	532.43	80	452.82	-	-	-	(b)	C
MW-1B		07/2004	843143.24	886274.67	566.40	566.34	20	546.60	4	14.8 - 20	551.6 - 547		B
MW-2B		10/2003	843116.22	886211.86	564.74	564.00	20.5	544.24	4	10.5 - 20.5	554.2 - 544.2		B
MW-3B		10/2003	843101.31	886199.75	564.46	564.24	25	539.46	4	15 - 25	549.5 - 539.5		B
MW-4B		07/2004	843025.61	886110.77	561.36	563.83	23	538.36	4	15 - 20	546.4 - 541.4		B
MW-5B		10/2003	843087.01	886183.36	563.35	563.22	21	542.35	4	11 - 21	552.4 - 542.4		B
MW-5-25		07/1988	843185.23	886140.54	587.03	586.55	36	551.03	2	3.6 - 12	583.4 - 575.4		B
MW-5-40		07/1988	843192.04	886147.65	587.03	586.43	40.3	546.73	3	17.3 - 40.3	569.7 - 546.7	(b)	B
MW-5-100		08/1989	843188.52	886143.83	587.03	586.23	99	488.03	2	79 - 99	508.0 - 488.0		D
MW-6B		10/2003	843468.17	886629.39	560.01	559.59	20	540.01	4	10 - 20	550.0 - 540.0		B
MW-7B		08/2007	843133.79	886125.10	587.53	587.26	21	566.53	4	10 - 20	577.5 - 567.5		B
MW-7-40		07/1988	842994.20	886304.99	531.11	533.00	38	493.11	3	18 - 38	513.1 - 493.1	(b)	B
MW-8B		08/2007	843183.09	886137.66	587.12	586.64	21.3	565.82	4	10 - 20	577.1 - 567.1		B
MW-8-40		07/1988	843130.89	886507.35	518.27	517.98	43.2	475.07	3	17.1 - 43.2	501.2 - 475.1	(b)	B
MW-15-40		07/1988	842841.44	885781.25	584.11	583.66	38.2	545.91	3	18.7 - 38.2	565.4 - 545.9	(b)	B
MW-16-100		08/1988	843001.02	886309.73	530.86	533.47	100	430.86	2	80 - 100	450.9 - 430.9		D
MW-17-40		07/1988	842562.71	886569.16	394.89	394.21	47.9	346.99	3	37.9 - 47.9	357.0 - 347.0	(b)	B
MW-18A		02/2005	842535.84	886413.92	396.38	396.13	20	376.38	2	10 - 20	386.4 - 376.4	(b)	B
MW-18B		06/2012	843109.91	885990.51	586.68	587.95	28	558.68	2	23 - 28	563.7 - 558.7		B
MW-19A		02/2005	842560.06	886630.33	395.72	394.23	20	375.72	2	10 - 20	385.7 - 375.7		A
MW-20B		03/2005	843121.55	886496.75	517.53	516.09	20.2	497.33	2	15.2 - 20.2	502.3 - 497.3		B
MW-22B		03/2005	843247.83	886844.08	490.95	489.46	16.5	474.45	2	11.5 - 16.5	479.5 - 474.5		B
MW-30B		08/2005	842868.03	886178.14	532.55	534.64	24.5	508.05	2	17.5 - 24.5	515.1 - 508.1		B
MW-31B		08/2005	842942.15	886296.68	532.52	533.45	24.5	508.02	2	17.5 - 24.5	515.0 - 508.0		B
MW-32B		08/2005	843045.08	886412.97	514.49	512.78	11	503.49	2	5 - 11	509.5 - 503.5		B
MW-40T		-	-	-	-	-	-	-	-	- -	- -		-
MW-44T		-	-	-	-	-	-	-	-	- -	- -		-
MW-46-43C		07/2017	843149.02	886135.40	586.83	586.55	50	536.58	2	40 - 50	546.8 - 536.8		C
MW-46-72C		07/2017	843141.52	886138.55	586.04	585.1	84	502.24	2	68.6 - 83.6	517.4 - 502.4		C

Table 2.1

Well Construction Details
Former Emerson Power Transmission Facility
Ithaca, New York (a)

	Installation Date	State Plane Coordinates		Elevations (feet AMSL)		Total Depth		Diameter	Screened Interval		Monitored Zone
		Easting	Northing	Ground Surface	Top of Casing	(feet bgs)	(feet AMSL)	(inches)	(feet bgs)	(feet AMSL)	
Well ID											
MW-50-160D	06/2021	-	-	-	-	163.7	-	4	84 160	- -	D
WSP-MW-04B	11/2015	842307.23	884980.93	593.85	593.57	41.2	552.65	2	26.2 - 41.2	567.7 - 552.7	B
WSP-MW-06C	12/2015	842757.85	885673.66	585.06	584.72	66.0	519.06	2	55.8 - 65.8	529.3 - 519.3	C
LBA-MW-18	07/1905	843185.61	885790.13	612.46	615.23	13.4	599.06	2	3.4 - 13.4	609.1 - 599.1	B
LBA-MW-26	07/1905	842872.44	885815.25	581.86	581.57	44	537.86	2	34 - 44	547.9 - 537.9	C
LBA-MW-30	07/1905	843234.05	886389.37	566.77	566.43	25	541.77	2	15 - 25	551.8 - 541.8	B
LBA-MW-34N	07/1905	843366.49	886275.74	587.63	587.35	21	566.63	4	4 - 21	583.6 - 566.6	B
LBA-MW-35	07/1905	-	-	-	-	32	-	4	5.1 - 32	-	B
LBA-MW-39	07/1905	842880.05	885810.29	583.06	582.61	25.5	557.56	4	14 - 25.5	569.1 - 557.6	B
LBA-MW-43N	07/1905	843023.26	885681.37	612.50	612.17	25	587.50	4	8 - 25	604.5 - 587.5	B
LBA-MW-43S	07/1905	843020.13	885677.87	612.51	612.23	47	565.51	2	36 - 47	576.5 - 565.5	C

a/ ID = identification; AMSL = above mean sea level; bgs = below ground surface; PVC = polyvinyl chloride; SS = stainless steel; NA = not applicable; "-" information not available.
b/ Open borehole.
c/ EW-1-62C (Formerly EXB-05)
EW-2-62C (Formerly EW-01)
EW-3-60C (Formerly EW-02)
EW-11-43C (Formerly MW-14C)
EW-12-45C (Formerly EXB-02)

Table 2.2

Site-Wide Groundwater Monitoring Program
Former Emerson Power Transmission Facility
Ithaca, New York (a)

Well ID	Monitored Zone	IRM	Network Location	Sampling Frequency (b)	Parameters	Sampling Method
LBA-MW-08	B	AOC-27	Downgradient	Annual	Cyanide	Low-Flow
LBA-MW-13	B	AOC-28	Downgradient	Annual	Cyanide	Low-Flow
LBA-MW-18	B	AOC-27	Downgradient	Annual	Barium	Low-Flow
LBA-MW-19	B	AOC-27	Downgradient	Annual	Cyanide	Low-Flow
LBA-MW-23	B	AOC-32	Downgradient	Annual	VOCs	Bailer Purge
LBA-MW-26	B	AOC-27	Downgradient	Annual	Barium	Low-Flow
LBA-MW-30	B	AOC-35	Downgradient	Annual	Barium, Cyanide	Low-Flow
LBA-MW-34N	B	AOC-35	Downgradient	Annual	VOCs, Barium	Low-Flow
LBA-MW-35	B	AOC-27	Downgradient	Annual	Barium, Cyanide	Low-Flow
LBA-MW-39	B	AOC-27	Downgradient	Annual	VOCs, Cyanide	Low-Flow
LBA-MW-43N	B	AOC-27	Downgradient	Annual	Cyanide	Low-Flow
LBA-MW-43S	C	AOC-27	Downgradient	Annual	Barium, Cyanide	Low-Flow
MW-31B	B	AOC-27	Downgradient	Annual	Barium	Low-Flow
MW-40T	B	AOC-26	Downgradient	Annual	VOCs	Bailer Purge
MW-44T	C	AOC-27	Downgradient	Annual	Barium, Cyanide	Low-Flow
WSP-MW-04B	B	AOC-28	Downgradient	Annual	Metals, Cyanide, VOCs	Low-Flow
WSP-MW-06C	C	AOC-27	Downgradient	Annual	Barium	Low-Flow
EXB-07	C	FWR & OU-1	Downgradient	Annual	VOCs	Low Flow Purge
MW-16-100	C	FWR & OU-1	Downgradient	Annual	VOCs	Low Flow Purge
MW-18A	A	FWR & OU-1	Downgradient	Annual	VOCs	Bailer Purge
MW-20B	B	FWR & OU-1	Downgradient	Annual	VOCs	Bailer Purge
MW-22B	B	FWR & OU-1	Downgradient	Annual	VOCs	Bailer Purge
MW-31B	B	FWR & OU-1	Downgradient	Annual	VOCs	Low Flow Purge
MW-32B	B	FWR & OU-1	Downgradient	Annual	VOCs	Bailer Purge
MW-7-40	C	FWR & OU-1	Downgradient	Annual	VOCs	Low Flow Purge
MW-8-40	C	FWR & OU-1	Downgradient	Annual	VOCs	Bailer Purge

a/ VOCs = volatile organic compounds; IRM = interim remedial action; AOC = area of concern; FWR = fire water reservoir; OU-1 = operable unit 1.
b/ Wells gauged prior to sampling

Table 2.3

DPE and Treatment System Groundwater Monitoring Program
Former Emerson Power Transmission Facility
Ithaca, New York (a)

Well ID		Monitored Zone	Network Location	Sampling Frequency (b)	Parameters	Sampling Method
EW-1B	(c)	B	Lower Treatment Area	-	-	-
EW-01-62C		C	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-02-62C		C	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-03-60C		C	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-04-25B		B	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-05-25B		B	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-06-60C		C	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-07-25B		B	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-08-62C		C	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-10-25B		C	Upper Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-11-43C		B	Lower Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-12-45C		C	Upper Treatment Area	Annual	VOCs	Bailer Grab Sample
EW-9R-72C		C	Upper Treatment Area	Annual	VOCs	Bailer Grab Sample
EXB-10		C	Side gradient	Semiannual	VOCs	Low Flow Purge
EXB-11	(d)	B	Side gradient	-	-	-
EXB-09		C	Side gradient	Semiannual	VOCs	Low Flow Purge
MW-12B	(d)	B	Downgradient	-	-	-
MW-1B		B	Lower Treatment Area	Semiannual	VOCs	Bailer Purge
MW-2B		B	Lower Treatment Area	Semiannual	VOCs	Bailer Purge
MW-30B	(d)	B	Downgradient	-	-	-
MW-3B		B	Lower Treatment Area	Semiannual	VOCs	Bailer Purge
MW-46-43C		C	Upper Treatment Area	Semiannual	VOCs	Bailer Purge
MW-46-72C		C	Upper Treatment Area	Semiannual	VOCs	Bailer Purge
MW-4B		B	Side gradient	Semiannual	VOCs	Bailer Purge
MW-50-160D		D	Upper Treatment Area	Semiannual	VOCs	Low Flow Purge
MW-5-100		C	Upper Treatment Area	Semiannual	VOCs	Bailer Purge
MW-5-40		C	Upper Treatment Area	Semiannual	VOCs	Bailer Purge
MW-5B		B	Lower Treatment Area	Semiannual	VOCs	Bailer Purge
MW-6B	(d)	B	Side gradient	-	-	-
MW-7B		B	Upper Treatment Area	Semiannual	VOCs	Bailer Purge
MW-8B	(d)	B	Upper Treatment Area	-	-	-

a/ "-" = not applicable, VOCs = volatile organic compounds
b/ Wells gauged prior to sampling
c/ Gauged annually
d/ Gauged semiannually

Table 2.4

SPDES Permit Equivalent Monitoring
Former Emerson Power Transmission Facility
Ithaca, New York (a)

Parameter	Discharge Limits		Units	Minimum Monitoring Requirements	
	Monthly Average	Daily Max		Measurement Frequency	Sample Type
Outfall 01A - Treated Remediation Wastewater					
Flow	Monitor		GPD	Monthly	Totalizer
pH (range)	6.5 - 8.5		SU	Monthly	Grab
Temperature	Monitor		Deg F.	Monthly	Grab
Tetrachloroethene	-	0.001	mg/l	Monthly	Grab
Trichloroethene	-	0.01	mg/l	Monthly	Grab
Sum of Dichlorobenzenes	-	0.01	mg/l	Monthly	Grab
Bromoform	-	0.01	mg/l	Monthly	Grab
Chlorobenzene	-	0.005	mg/l	Monthly	Grab
Chlorodibromomethane	-	0.01	mg/l	Monthly	Grab
Chloroform	-	0.01	mg/l	Monthly	Grab
Dichlorobromomethane	-	0.01	mg/l	Monthly	Grab
1,1-Dichloroethane	-	0.01	mg/l	Monthly	Grab
1,1-Dichloroethene	-	0.01	mg/l	Monthly	Grab
Methylene chloride	-	0.01	mg/l	Monthly	Grab
1,1,2,2-Tetrachloroethane	-	0.01	mg/l	Monthly	Grab
Toluene	-	0.05	mg/l	Monthly	Grab
trans-1,2-Dichloroethene	-	0.01	mg/l	Monthly	Grab
cis-1,2-Dichloroethene	-	0.01	mg/l	Monthly	Grab
1,1,1-Trichloroethene	-	0.01	mg/l	Monthly	Grab
Xylenes, total	-	0.01	mg/l	Monthly	Grab
Vinyl chloride	-	0.01	mg/l	Monthly	Grab
Benzene	-	0.001	mg/l	Monthly	Grab
Free Cyanide	5.2	22	ug/l	Monthly	Grab
Outfall 001 - Stormwater, Groundwater Seepage and Treated Remedial Wastewater					
Flow	Monitor		GPD	Monthly	Estimate
pH (range)	6.5 - 8.5		SU	Monthly	Grab
Total Barium	Monitor		mg/l	Quarterly	Grab
Total Lead	-	7.4	ug/l	Monthly	Grab
Mercury	Monitor		ng/l	Quarterly	Grab
Tetrachloroethene	-	0.001	mg/l	Monthly	Grab
Trichloroethene	-	0.01	mg/l	Monthly	Grab
Free Cyanide	5.2	22	ug/l	Quarterly	Grab
Outfall 009 - Stormwater and Groundwater Seepage					
Free Cyanide (b)	5.2	22	ug/l	Quarterly	Grab
Outfall 011 - Groundwater Seepage					
Free Cyanide (c)	Monitor		ug/l	3 Samples (c)	Grab

a/ GPD = gallons per day; SU = standard units; Deg. F = degrees Fahrenheit; ug/l = micrograms per liter; mg/l = milligrams per liter; ng/l = Method. nanograms per liter; EPA = U.S. Environmental Protection Agency; SM = Standard

b/ The discharge limit of 5.2 ug/l monthly average and 22 ug/l daily maximum for cyanide will become effective on August 1, 2025. An interim limit of Monitoring Only applies from August 1, 2022, until July 31, 2025 (dates subject to change per NYSDEC).

c/ A sample shall be collected during the first discharge of each month until three samples have been collected.

Table 4.1

Laboratory Analytical Requirements - Groundwater
Former Emerson Power Transmission Facility
Ithaca, New York (a)

EPA Method	Container	Preservative	Holding Time	Parameter	RL (b) (µg/l)	MDL (b) (µg/l)
8260	40 ml VOA vial	Cool to ≤ 6°C, HCL to pH ≤ 2	14 days	Acetone	10	3.1
				Benzene	0.50	0.43
				Bromodichloromethane	1.0	0.45
				Bromoform	1.0	0.63
				Bromomethane	2.0	1.6
				2-Butanone (MEK)	10.0	6.9
				Carbon disulfide	2.0	0.46
				Carbon tetrachloride	1.0	0.55
				Chlorobenzene	1.0	0.56
				Chloroethane	1.0	0.73
				Chloroform	1.0	0.50
				Chloromethane	1.0	0.76
				Cyclohexane	5.0	0.78
				1,2-Dibromo-3-chloropropane	2.0	0.53
				Dibromochloromethane	1.0	0.56
				1,2-Dibromoethane	1.0	0.48
				1,2-Dichlorobenzene	1.0	0.53
				1,3-Dichlorobenzene	1.0	0.54
				1,4-Dichlorobenzene	1.0	0.51
				Dichlorodifluoromethane	2.0	0.56
				1,1-Dichloroethane	1.0	0.57
				1,2-Dichloroethane	1.0	0.60
				1,1-Dichloroethene	1.0	0.59
				cis-1,2-Dichloroethene	1.0	0.51
				trans-1,2-Dichloroethene	1.0	0.54
				1,2-Dichloropropane	1.0	0.51
				cis-1,3-Dichloropropene	1.0	0.47
				trans-1,3-Dichloropropene	1.0	0.43
				Ethylbenzene	1.0	0.60
				Freon 113	5.0	0.58
				2-Hexanone	5.0	2.0
				Isopropylbenzene	1.0	0.65
				Methyl Acetate	5.0	0.80
				Methylcyclohexane	5.0	0.60
				Methyl Tert Butyl Ether	1.0	0.51
				4-Methyl-2-pentanone(MIBK)	5.0	1.9
				Methylene chloride	2.0	1.0
				Styrene	1.0	0.49
				1,1,2,2-Tetrachloroethane	1.0	0.65
				Tetrachloroethene	1.0	0.90
				Toluene	1.0	0.53
				1,2,4-Trichlorobenzene	1.0	0.50
				1,1,1-Trichloroethane	1.0	0.54
				1,1,2-Trichloroethane	1.0	0.53
				Trichloroethene	1.0	0.53
				Trichlorofluoromethane	2.0	0.40
				Vinyl chloride	1.0	0.79
				Xylene (total)	1.0	0.59
6010	250 ml plastic	HNO_3 to pH <2	6 months	Arsenic	8.0	2.67
				Barium	200	13.37
				Cadmium	3	1.04
				Chromium	10	1.99
				Lead	3	1.8
				Selenium	10	4.94
				Silver	10	6.07
7470	250 ml plastic	HNO_3 to pH <2	28 days	Mercury	0.2	0.0952
335.4	1 l plastic	Cool to ≤ 4°C, NaOH + Ascorbic	14 days	Total Cyanide	10	4.1

a/ EPA = U.S. Environmental Protection Agency; µg/l = micrograms per liter; ml = milliliters; VOA = volatile organic analysis; °C = degrees Celsius; HCl = hydrochloric acid; HNO_3 = nitric acid; NaOH = sodium hydroxide; l = liter.
b/ As provided by SGS Analytical Laboratories, Dayton, New Jersery; subject to change.

Table 4.2

Laboratory Analytical Requirements - SPDES Permit Equivalent
Former Emerson Power Transmission Facility
Ithaca, New York (a)

Analytical Method	Container	Preservative	Holding Time	Parameter	RL (b) (mg/l)	MDL (b) (mg/l)
SM 4500-H+ B	150 ml plastic	None required	15 minutes	pH (range)	-	-
SM 2500B	-	None required	15 minutes	Temperature	-	-
EPA Method 624	40 ml VOA vial	Cool ≤ 6 °C	7 days until extraction, 40 days after extraction	Tetrachloroethene	0.001	0.00041
				Trichloroethene	0.001	0.00043
				Sum of Dichlorobenzenes	0.001	0.00030 - 0.00050
				Bromoform	0.001	0.00
				Chlorobenzene	0.001	0.00033
				Chlorodibromomethane	0.001	0.00043
				Chloroform	0.001	0.00
				Dichlorobromomethane	0.001	0.00035
				1,1-Dichloroethane	0.001	0.00042
				1,1-Dichloroethene	0.001	0.00059
				Methylene chloride	0.001	0.00041
				1,1,2,2-Tetrachloroethane	0.001	0.00032
				Toluene	0.001	0.00036
				trans-1,2-Dichloroethene	0.001	0.00046
				cis-1,2-Dichloroethene	0.001	0.00051
				1,1,1-Trichloroethene	0.001	0.00054
				Xylenes, total	0.001	0.00035
				Vinyl chloride	0.001	0.00079
				Benzene	0.001	0.00034
EPA 200.7	250 ml plastic	HNO_3 to pH<2	6 months	Total Barium	0.2	0.017
				Total Lead (µg/l)	3.0	2.4
EPA Method 1631	500 ml glass	5 ml/l 12N HCl or 5 ml/l BrCl	28 days	Mercury (ng/l)	0.038	0.038
ASTM D7237-15A	250 ml plastic	Cool ≤ 6°C, NaOH to pH >10	14 days	Free Cyanide (µg/l)	0.003	-

a/ mg/l = milligram per liter; VOA = volatile organic analysis; ng/l = nanogram per liter; ug/l = microgram per liter; SM = Standard Method;
EPA = U.S. Environmental Protection Agency; °C = degrees Celsius; NaOH = sodium hydroxide; HNO3 = nitric acid; HCl = hydrochloric acid;
mL/L = milliliter per liter; BrCl = bromine monochloride.
b/ As provided by SGS Analytical Laboratories, Dayton, New Jersey; subject to change.

APPENDIX

A

SPDES PERMIT EQUIVALENT

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Water, Bureau of Water Permits
625 Broadway, Albany, New York 12233
www.dec.ny.gov

Emerson Electric Co.

Project Site Remediation
Wastewater Discharge SPDES Permit Equivalent

DRAINAGE BASIN: **07 / 05**		DER Site No:	7-55-010
		Effective Date:	**August 1, 2022**
		Expiration Date:	**July 31, 2027**

Discharger Name and Address:

Emerson Electric Co.
ATTN: Steve Clarke
8000 W. Florissant Ave, Station 1963
(314) 553 1953
Contact Email Address: steve.clarke@emerson.com

is authorized to discharge from the facility described below:

Emerson Electric Co.
620 South Aurora St.
Ithaca, NY 14850

From the following outfall(s):

Outfall No.	Outfall Description	Location	Receiving Water	WIN *	Class
01A	Treated Remediation Wastewater	42°25'57.18"N 76°29'53.95"W	Tributary of Cayuga Lake	0-66-12-P296-75-6	C
001	Stormwater, Ground water seepage and treated remedial wastewater	42°25'56.03"N 76°29'54.85"W	Tributary of Cayuga Lake	0-66-12-P296-75-6	C
009	Stormwater and Groundwater Seepage	42°25'51.67"N 76°29'59.86"W	Tributary of Cayuga Lake	0-66-12-P296-75-6	C
011	Groundwater seepage	42°25'56.46"N 76°29'55.25"W	Tributary of Cayuga Lake	0-66-12-P296-75-6	C

* Water Index Number

The discharges from the treatment facility shall be limited and monitored by the operator as specified below:

Outfall No. and Parameter	CAS No.	Discharge Limitations		Units	Minimum Monitoring Requirements		FN
		Monthly Avg.	Daily Max		Measurement Frequency	Sample Type	
Outfall 01A - Treated Remediation Discharge							
Flow		Monitor	Monitor	GPD	Monthly	Totalizer	
pH (range)	NA	6.5 – 8.5		SU	Monthly	Grab	
Temperature	NA		Monitor	°F	Monthly	Grab	
Tetrachloroethylene	00127-18-4		0.001	mg/l	Monthly	Grab	
Trichloroethylene	-		0.01	mg/l	Monthly	Grab	
Sum of Dichlorobenzenes	-		0.01	mg/l	Monthly	Grab	
Bromoform	00075-25-2		0.01	mg/l	Monthly	Grab	
Chlorobenzene	00108-90-7		0.005	mg/l	Monthly	Grab	
Chlorodibromomethane	00124-48-1		0.01	mg/l	Monthly	Grab	
Chloroform	00067-66-3		0.01	mg/l	Monthly	Grab	
Cyanide, Free	-	5.2	22	ug/l	Monthly	Grab	1
Dichlorobromomethane	00075-27-4		0.01	mg/l	Monthly	Grab	

1,1 Dichloroethane	00075-34-3		0.01	mg/l	Monthly	Grab	
1,1 – Dichloroethylene	00075-35-4		0.01	mg/l	Monthly	Grab	
Methylene Chloride	00065-09-2		0.01	mg/l	Monthly	Grab	
1,1,2,2- Tetrachloroethane	00079-34-5		0.01	mg/l	Monthly	Grab	
Toluene	00108-88-3		0.05	mg/l	Monthly	Grab	
1,2-(trans)-Dichloroethylene	00156-60-5		0.01	mg/l	Monthly	Grab	
1.2-(cis)-Dichloroethylene	00156-59-2		0.01	mg/l	Monthly	Grab	
1,1,1-Trichloroethane	00071-55-6		0.01	mg/l	Monthly	Grab	
Xylenes, Total	00095-47-6 00108-38-3 00106-42-3		0.01	mg/l	Monthly	Grab	
Vinyl Chloride	00075-01-4		0.01	mg/l	Monthly	Grab	
Benzene	00071-43-2		0.001	mg/l	Monthly	Grab	

Outfall No. and Parameter	CAS No.	Discharge Limitations		Units	Minimum Monitoring Requirements		FN
		Monthly Avg.	Daily Max		Measurement Frequency	Sample Type	
Outfall 001 - Stormwater, Groundwater Seepage and Treated Groundwater							
Flow	NA		Monitor	GPD	Monthly	Estimate	
pH (range)	NA	6.5 – 8.5		SU	Monthly	Grab	
Total Barium	07440-39-3		Monitor	mg/l	Quarterly	Grab	
Total Lead	07439-92-1		7.4	ug/l	Monthly	Grab	
Mercury	07439-97-6		Monitor	ng/l	Quarterly	Grab	2
Tetrachloroethylene	00127-18-4		0.001	mg/l	Monthly	Grab	
Trichloroethylene	-		0.01	mg/l	Monthly	Grab	
Cyanide, Free		5.2	22	ug/l	Quarterly	Grab	1

Outfall No. and Parameter	CAS No.	Discharge Limitations		Units	Minimum Monitoring Requirements		FN
		Monthly Avg.	Daily Max		Measurement Frequency	Sample Type	
Outfall 009 – Stormwater and Groundwater Seepage							
Cyanide, Free	-	5.2	22	ug/l	Quarterly	Grab	1

Footnotes: (see on the next page)

1: Free Cyanide is the sum of HCN and CN, expressed as CN. The WQBEL of 5.2 ug/l Monthly Average and 22 ug/l Daily Max for Cyanide will become effective on August 1, 2025. An interim limit of Monitor Only shall apply from August 1, 2022, until July 31, 2025.

2. Mercury shall be analyzed using USEPA Method 1631

Schedule of Compliance for Cyanide: The permittee shall comply with the following schedule:

Outfall No.	Parameters	Compliance Action	Due Date
009	Cyanide	The permittee shall monitor for Free Cyanide at the frequency specified in the effluent limit tables.	August 1, 2022
		Following 2 years of monitoring, permittee shall submit a report summarizing free Cyanide trends and if the final effluent limits are exceeded, measures to be taken to meet final limits and a schedule to be made enforceable under this permit equivalent. The schedule to address free cyanide exceedances shall not exceed 18 months.	September 30, 2024
		The facility shall meet effluent discharge limitations for Cyanide.	November 1, 2025
011	Cyanide	The discharge from Outfall 011 shall be sampled for Free Cyanide. A sample shall be collected during the first discharge of each month from Outfall 011 until three (3) samples have been collected.	March 1, 2023
		Sampling results shall be submitted to the DER project engineer.	

Additional Conditions:

1. Discharge is not authorized until such time as an engineering submission showing the method

of treatment is approved by the Department. The discharge rate may not exceed the effective or design treatment system capacity. A summary of the monthly monitoring data shall be submitted to the Department twenty-eight (28) days following the end of each monthly monitoring period. All monitoring data, engineering submissions and modification requests must be submitted to:

Karen A Cahill
Division of Environmental Remediation
NYSDEC R7
615 Erie Blvd West
Syracuse, NY 13204-2400
Tel: 315-426-7432
Email: karen.cahill@dec.ny.gov

2. Samples and measurements, to comply with the monitoring requirements specified above, must be taken from the effluent side of the final treatment unit prior to discharge to the receiving water body unless otherwise noted above.

3. Monitoring and analysis shall be conducted using sufficiently sensitive test procedures approved under 40 CFR Part 136 unless other test procedures have been specified in this permit equivalent.

4. Only site generated wastewater is authorized for treatment and discharge.

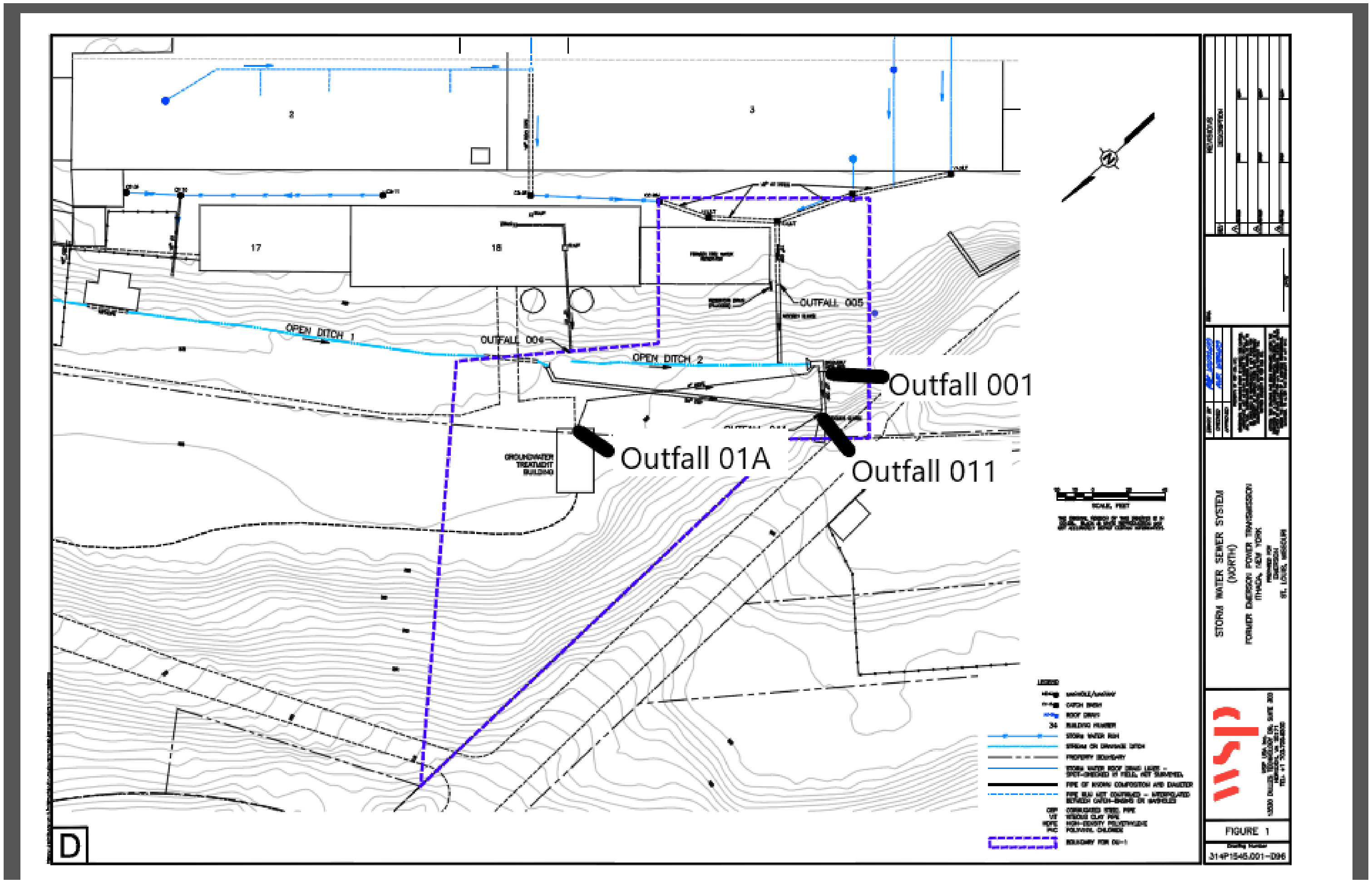
5. Authorization to discharge is valid only for the period noted above but may be renewed if appropriate. A request for renewal must be received 6 months prior to the expiration date to allow for a review of monitoring data and reassessment of monitoring requirements.

6. Any use of corrosion/scale inhibitors, biocidal-type compounds, or other water treatment chemicals used in the treatment process must be approved by the department prior to use.

7. This discharge and administration of this discharge must comply with the substantive requirements of 6NYCRR Part 750.

MONITORING LOCATIONS:

Outfall 001 and 01A



Site Name: Emerson Electric Co.
DER Site ID#: 7-55-010
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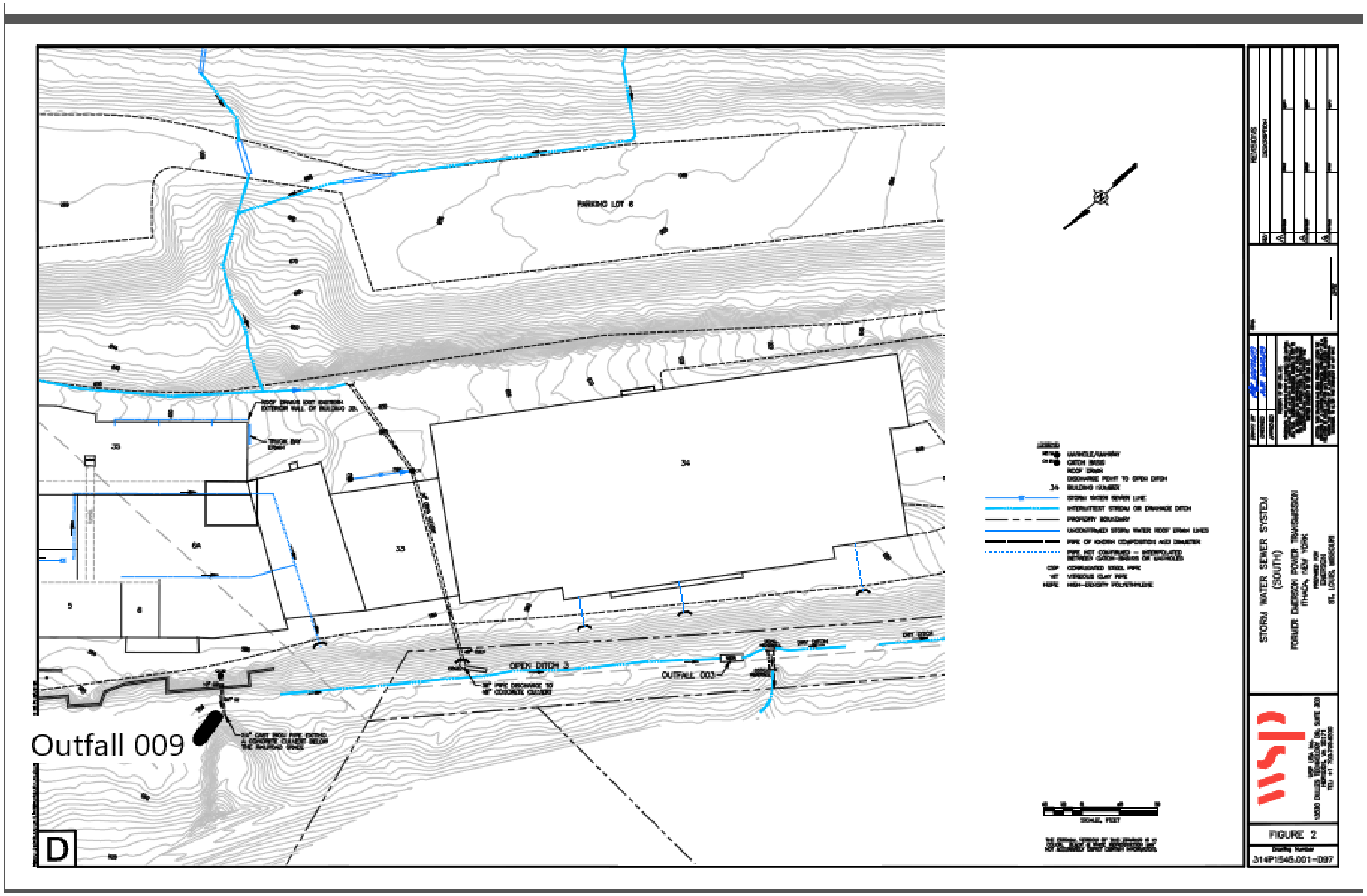

APPENDIX

B

FIELD STANDARD OPERATING PROCEDURES

FIELD STANDARD OPERATING PROCEDURE #1

NOTE TAKING AND FIELD BOOK ENTRIES PROCEDURE

The field book is a record of the day's activities that serves as a reference for future reporting and analyses. The field book is also a legal record for projects that may be used during legal proceedings. It is of the utmost importance that all notes are complete and comprehensive. The user is advised to read the entire standard operating procedure (SOP) and review the project site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities.

1.1 ACRONYMS AND ABBREVIATIONS

HASP	Health and safety plan
IDW	Investigation-derived waste
PSP	Project safety plan
SOP	Standard operating procedure

1.2 MATERIALS

- Permanently-bound waterproof field book (e.g., Rite-in-the-Rain® #550, or equivalent)
- Black or blue ballpoint pen (waterproof ink recommended; do not use felt-tip pens)

1.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company's SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field standard operating procedures, and the Quality Management System.

The purpose of the field book is to provide a written log of all of field events and conditions. The notes must include sufficient detail (i.e., who, what, when, where, why, and how) to enable others to reconstruct the day's activities for analysis, reporting, or litigation. It is important to be objective, factual, and thorough. Language must be free of personal comments or terminology that might prove inappropriate. Additional data logs or worksheets, such as low flow groundwater sampling sheets, may be used as a supplement; however, under no circumstances should the data sheets be used as a substitute for the daily record of events to be recorded in the field book.

The field book forms the foundation upon which most of the project work (reports, subsequent work plans, etc.) is based. It is critical that the field book's chain of custody be maintained at all times.

1.4 SET-UP PROCEDURES

The first step in setting up a new field book is to add the information necessary for you to identify the field book in the future and for others to return the book to the company, should it be lost. On the first page of the field book (or, for some field books, the inside cover), place a "Return for Reward" notice. Include the following information:

- An "If Found – Return for Reward" notice in bold letters
- Our company name
- Our company address (usually the office where the project is being managed)
- Our company phone number

Reserve the second page of the field book for project-specific information, such as:

- The project name and number
- The project manager's name
- The site telephone number, address, and onsite contact (if appropriate)
- The names and telephone numbers for all key (onsite) personnel
- The emergency telephone numbers including the police, fire, and ambulance (found in the HASP)

Business cards from individuals who visit the site, (including the person in charge of the field book) can be affixed to the inside back cover.

1.5 FIELD BOOK ENTRIES

Start each day on a new page. Include the following information in the header of the first page (and all subsequent pages):

- The date
- The project name
- The page number (if not pre-printed in the field book)

Precede field book entries by the time entered along the left margin of the page using a 24-hour or military clock (e.g., 1330 for 1:30 PM). The first entry of the day must include your and your subcontractor's arrival time at the site, a description of the planned activities, key onsite personnel (including subcontractors), and the weather forecast. The first entry must also detail the tailgate review of the site-specific HASP or PSP with the onsite personnel. Be sure that field book entries are LEGIBLE and contain factual, accurate, and inclusive documentation of project field activities. Blank lines between field book entries should not be included unless necessary to accommodate a large entry (e.g., table or sketch); if blank lines are necessary, draw a line diagonally through any blank lines and initial at the end of the diagonal line. If a mistake is made in an entry, cross out the mistake with a single line and place your initials at the end of the line. Any acronyms written in the field book (including your initials) must be spelled out prior to the first use.

Subsequent log entries must document the day's activities in sequence and must be completed throughout the day as events occur (i.e., do not wait until the end of the work day to complete the notes); should notes need to be entered out of sequence, please identify the non-sequential entries using a footnote or by clearly indicating "Late Entry." Notes must be descriptive and provide location information or diagrams (if appropriate) of the work area or sample locations. Note any changes in the weather and document all deviations from the work plan. Arrival and departure times of all personnel, operational periods of standby, decontamination, and specific activities must be recorded.

Include the following information in entries describing field activities:

- The equipment, materials and methods used by subcontractors, if appropriate (e.g., drill rig type, boring diameters, well casing materials, etc.)
- The equipment, materials and methods used to obtain samples (e.g., split-spoon sampler, polyethylene bailer, pump types, geochemical, water or air monitoring equipment, low-flow purging procedures, etc.)
- The sample identification, which should include the location and depth, as appropriate
- The sample location, including a description of the approximate location as measured from a known point (e.g., 50 feet north of the building entrance; for points not yet surveyed)

- Any air or water monitoring equipment used, associated calibration activities, and measurements
- The sample collection time
- The sample identification of associated quality assurance/quality control samples (e.g., blind duplicate)
- The sample media and analyses to be performed; sizes, numbers, and types of containers; preservation (if any), and any resulting reactions (e.g., effervescence)
- If supplemental data recording logs (digital or hard copy) are used, such as groundwater sampling logs, chains-of-custody, and shipping records, the above information must be entered in the field book and the supplemental records cross-referenced
- The decontamination and disposal procedures for all equipment, samples, and personal protective equipment
- An inventory of the investigation-derived waste (IDW) materials generated during the site activities
- A description of the IDW labeling procedures and the onsite staging information; other sampling-specific information to be included in the IDW log is provided in SOP 5

Maintain a sequential log if the sample locations and areas of interest are photographed (strongly recommended). The photographic log must include:

- The date and time of the photograph
- The sequential number of the photograph (e.g., photograph-1, photograph-2, etc.)
- The general direction faced when the photograph was made
- A description of the subject in the image

1.6 CLOSING NOTES

The last entry of the day must include a brief wrap up of the work accomplished, a description of how the site is being secured, and a description of any near hits, accidents, and incidents that occurred during the day's work. Draw a line through the remainder of the page from the row of text diagonally through any blank lines and initial at the end of the diagonal line.

FIELD STANDARD OPERATING PROCEDURE #2

UTILITY LOCATING PROCEDURE

The purpose of this procedure is to ensure that all required and appropriate procedures are followed to locate and mark subsurface utilities (e.g., electrical lines, natural gas lines, communication lines) before initiating any intrusive field activities (e.g., drilling, test pits, trenching, excavation). The company's preference, as indicated in our subcontractor agreement templates, is for our contractors to be responsible for both public and private utility mark-outs; this includes contacting the public authority and obtaining a subcontractor for private utility locating services, if needed. Guidance for contractors to follow to conduct a utility clearance is provided in our request for proposal (RFP) template and must be included in all RFP's for intrusive field activities.

In rare circumstances, the company may choose to accept responsibility for clearing utilities, which will require a change to the language of our subcontractor agreement. This assumption of increased liability by the company requires written rationale and approval from the cognizant Regional Manager, with written concurrence from the Director of Operations, which shall be obtained prior to submitting the Request for Subcontract to Contract Administration.

For projects where the company will be responsible for clearing utilities, compliance with this procedure is mandatory. **ALL** deviations from this standard operating procedure (SOP) **MUST** be approved by the project manager and a Regional Manager, with confirmation from the Director of Operations **BEFORE** beginning intrusive work.

Field personnel have the authority and responsibility to postpone intrusive activities if a contractor has not completed utility clearances to the company's satisfaction; if sufficient information, as stipulated in this SOP, is not available; or if onsite reconnaissance identifies inconsistencies in the findings of utility locators. In these instances, field personnel must notify the project manager or the health and safety officer, or their designee, before proceeding with the proposed work; approval from a Regional Manager, with confirmation from the Director of Operations, is required before the work commences.

The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities.

2.1 ACRONYMS AND ABBREVIATIONS

HASP	health and safety plan
PSP	project safety plan
RFP	request for proposal
SOP	standard operating procedure

2.2 MATERIALS

- Utility Locating Form (Attachment 1)
- Field book
- Wood stakes
- Spray paint
- Flagging tape
- As-built drawings for sub-grade utilities (if available)
- Hand auger or post-hole digger

2.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This procedure is intended to allow the work to proceed safely and minimize the potential for damaging underground and aboveground utilities. Intrusive work includes all activities that require the company's employees or its subcontractors to penetrate the ground surface. Examples of intrusive work include, but are not limited to, hand augering, probing, drilling, injections, test pit excavations, trenching, and remedial excavations.

This SOP assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1).

2.4 PRE-FIELD MOBILIZATION PROCEDURES

Regardless of who is responsible for completing these activities (company or a contractor), public rights-of-way and private property must be cleared of buried utilities and overhead utilities must be identified before any intrusive work can begin. The first step in this process is notifying the state public utility locating service of the planned work. These services provide a link between the entities performing the work and the various utility operators (e.g., the water company, the electric company, etc.). All of the public utility locating service call centers in the United States have been streamlined under a single "Call Before You Dig" phone number: 811. However, the appropriate state or provincial call center (http://call811.com/811-your-state) will need to be contacted.

Please note, some state or provincial laws require that the person who will actually be conducting the intrusive work must be the person who places the call to the public utility locating service. This means that the company cannot make this call on the contractor's behalf; the contractor must place the call in those states where required. If there is any doubt about the requirements for the state where a project is located, the relevant state authority must be contacted (http://call811.com/811-your-state).

When the appropriate call center is contacted, information regarding the site (e.g., location, nearest cross street, township, etc.) and work activity (e.g., drilling, excavation) will need to be provided to the operator to aid in locating the likely utilities at the work site. The information provided on the Utility Locating Form (Attachment 1) must be recorded (by the contractor or the company) and a completed copy of this form must be maintained as part of the project file. Be aware that several states, including California, require that the proposed drilling locations be marked with white spray paint before contacting the locating services.

The following information must accompany the field team at all times during the field project:

- The utility clearance ticket number
- The ticket's legal dig date
- The ticket's expiration date
- Utility providers that were contacted

The ticket number serves as a point of reference for both the utility service providers and for the company or contractor should follow up (e.g., renewing the ticket) with the locating service be required. The legal dig and expiration dates reflect the times when it will be legal to perform the proposed work. The legal dig date reflects the lead time necessary, typically between 48 and 72 hours after you call, for the utility service providers to mark the utilities in you work area. Be sure to include this delay when scheduling your work. Most utility clearance tickets expire about 2 weeks after the legal dig date. If your work is delayed beyond the expiration date, the 811 utility locating service will need to be called again and the ticket renewed. The renewed ticket will have a new legal dig date that incorporates the same lead-time (48 to 72 hours) as the original ticket.

The locating service will also provide the caller with a list of utility companies that will be notified. Compare this list with utilities generally expected at all sites (e.g., sewer, water, gas, communication, and electric). Some utilities (e.g., sewer, water, cable television) may not be included. If any expected utilities are absent from the contact list, the utilities **MUST** be contacted directly for clearance before the start of intrusive activities. All contacts should be recorded on the Utility Locating Form.

2.4.1 PRIVATE UTILITY LOCATORS AND OTHER SOURCES

Public utility service providers will generally mark their underground lines within the public right-of-way up to the private property boundary. A public utility locating service must be contacted prior to any intrusive work, regardless of whether the intrusive work is located on public or private property. However, be aware that most public utility locating services will not locate utilities on private property. If your work is to be conducted on private property, a private utility locating service **MUST** be used to clear the work area. These companies typically use a variety of methods (e.g., electromagnetic detectors, ground-penetrating radar, acoustic plastic pipe locator, trace wire) to locate utilities in the work area, including those that may be buried beneath onsite buildings. Pseudoscientific methods (e.g., dowsing, divining, witching) are not acceptable utility locating methods.

For all operating facilities and to the extent possible for closed facilities, identify a site contact familiar with the utilities on the property (e.g., plant manager, facility engineer, maintenance supervisor), and provide this individual with a site plan showing the proposed locations of all soil borings, monitoring wells, test pits, and other areas where intrusive activities will be conducted. These individuals often have knowledge of buried structures or process-specific utilities that may not be identified by the private utility locator. This is particularly important for work performed inside industrial buildings where reinforced concrete and other metallic components of the structure may interfere with the scanning devices used by the private utility locator. Ask the site contact for all drawings concerning underground utilities in the proposed work areas for future reference.

Keep in mind that no intrusive work may be done before the legal dig date provided by the state utility locating service and no digging, drilling, or other ground-breaking activities may be begin until all utilities on the list have been marked and visually verified in the work area (see below). It is **NOT ACCEPTABLE** to rely solely on as-built drawings or verbal utility clearances from the site contact (these should be used as guides only). A private locator may not be necessary in rare instances; however, nonconformity with the private locate requirement must be approved by the project manager **AND** a Regional Manager, with confirmation from the Director of Operations.

2.5 SITE MOBILIZATION PROCEDURES

Upon arrival, the first step in determining if you are clear of buried and overhead utilities is to locate all of the proposed drilling and trenching locations and mark them with (white) spray paint, stakes, or other appropriate markers. This will help you judge distances from marked drilling and trenching locations to underground and overhead utilities and minimizes any potential misunderstandings regarding the locations between you, the subcontractors (drillers, excavators, private utility locator), and the site contact.

Once you have the proposed work areas marked, verify that ALL utility companies listed by the state public utility locating service, and any contacted directly by the company or the contractor, have either marked the underground lines in the specified work areas or have responded (via telephone, facsimile, or e-mail) with “no conflict.” Document on the Utility Locating Form (Attachment 1) and in the field book as each utility mark is visually confirmed. When receiving verbal clearances by telephone from utility companies, or their subcontractors, it is imperative that you verify the utilities that are being cleared, particularly when dealing with subcontractors that may be marking more than one utility.

Review all available as-built utility diagrams and plans for your general work area and conduct a site walk to identify potential areas where underground lines may be present; include the site contact in these activities. It is a good idea to survey your surroundings during the walk to identify any features that may indicate the presence of underground utilities, such as linear depressions in the ground, cuts in concrete or asphalt, old road cuts, catch basins, or manholes. Keep in mind that many sewer lines can be offset from catch basins. The presence of aboveground utilities, such as parking lot lights or pad-mounted transformers, is also a good indicator of buried electrical lines. Check these items against the Utility Locating Form checklist and discuss the locations with the private utility locating service.

2.5.1 SAFE WORKING DISTANCES AND HAND CLEARING

A minimum of 5 feet clearance must exist between utilities and proposed drilling locations, and a minimum of 6 feet between utilities and proposed trenching locations. Be aware that some clients, states and localities (e.g., New York City, Long Island) may require greater minimum working distances, depending on the utility (e.g., for high pressure gas mains). A minimum distance of 15 feet must be maintained by heavy equipment (e.g., excavator buckets, drill rig towers and rods) from overhead power lines and a safe distance of 25 feet must be maintained from high-tension overhead power lines. In the event that work must be conducted within 25 feet of high tension wires, the lines must be wrapped and insulated by the local utilities. Increase these minimum distances whenever possible to offer additional assurance that buried or overhead utilities will not be encountered.

If a utility conflict is identified within the minimum safe clearance distance, adjust the proposed location(s) using the criteria given above. It is recommended to have the private utility locator sweep a relatively large area (e.g., a 20-foot circle around a proposed drilling location) to provide room for adjustment should the proposed drilling or excavation area need to be moved to avoid a buried utility. Subsurface work within five feet of a confirmed or suspected utility or other subsurface structure must be done by nondestructive clearing techniques to the point where either the utility/structure is visually located and exposed, or in the case of soil borings, where the bottom depth of the structure is surpassed and drilling may begin.

Uncertainty may exist in some circumstances (e.g., inside a building) even after the area has been swept for utilities. In these cases, advance the first few feet of a soil boring (or probe the area for excavation) using a hand auger or post-hole digger. If hand digging is unable to penetrate the subsurface soils, soft dig or air knife equipment service providers may be retained to clear the location. This equipment applies high pressure air to penetrate, loosen, and extract subsurface soils in the borehole, thereby safely exposing any utilities. If using either hand digging or soft digging, the probe hole should be advanced a minimum of 5 feet below ground surface at each proposed drilling or excavation location. Complete a sufficient number of probe holes so that the area is cleared for the proposed intrusive activity (i.e., use several holes for a proposed excavation). The use of hand digging or soft digging methods **does not** replace the need for state and private utility locating services.

Protect and preserve the markings of approximate locations of facilities until the work activities are completed. If the markings of utility locations are destroyed or removed before excavation commences or is completed, stop work. Notify the utility company, utility protection service, or the utility locating service to inform them that the markings have been destroyed. Do not continue work until the utilities have been re-marked.

2.5.2 EXPANDED WORK AREAS AND TICKET RENEWAL

Many projects begin with well-defined work areas only to expand quickly as the investigation or remediation progresses. If the scope of intrusion expands or includes new onsite or offsite area(s), you will need to review the existing ticket and work performed by the private utility locator to determine whether work can progress into the new area safely. It may be necessary, depending on the scope, to contact (or for the Contractor to contact) the state locating service and request another clearance for the new area(s) of investigation and retain a private locating service. Remember, the new request will provide a new legal dig date before which NO INTRUSIVE WORK CAN BEGIN. Additionally, if a clearance ticket will expire while the work is ongoing (typically after 2 weeks), a new clearance must be requested before the first ticket expires so that work can continue uninterrupted. Refer to the Utility Locating Form (Attachment 1) for the legal dig date time frame required by the state locating service.

2.5.3 UTILITY DAMAGE

It is possible, even if you followed all of the procedures outlined in this SOP, to damage an underground or overhead utility. Assuming it can be done safely, quickly turn off the drilling or excavating equipment, or move the equipment from the damaged line. Avoid contact with escaping liquids, live wires, and open flames. Abandon the equipment, evacuate the personnel from the area, and maintain a safe perimeter if there are any concerns about safety. If a fiber optic cable is damaged, do not handle the cable or look into the end of the cable as serious eye damage may occur. Once personnel are in a secure location, immediately notify the facility operator or site contact and 811; additionally, send an immediate alert or notification via iSMS and send an email to SafetyTeam@wsp.com. You should also, as applicable, contact your immediate supervisor, human resources and sector management in accordance with company policy. If the damaged utility has the potential to cause, or is causing, dangerous conditions, immediately notify the local emergency response number listed in your HASP or PSP.

** This form is mandatory for all intrusive work, regardless of who is responsible for the public and/or private locate.

Utility Locating Form

Project Name	Project No. and Task	Work being done for (Company or Individual Name)	Project Manager

Office Address	Office Phone	Field Contact	Field Contact Phone

Project Location: Street Address	City/Township	County	State

Nearest Intersecting Street

Description of Work Area (street working on, which side of street, how far in which direction from nearest intersecting street; etc.)

Type of Work	Explosives (Y/N)	Directional Borings (Y/N)	Dig Locations Marked (Y/N)	Mark Type (e.g., stake)

Scheduled Work Start (Date & Time)	Estimated Work Stop Date	One-call Phone Number/Website Address	One-call Service Name

Call/Web Notification Made By (Name, Title and Company)	Date & Time of Call/Web Notification	Operator Name

Ticket No.	Legal Dig Date	Ticket Expiration Date	Ticket Renewal Date

Utilities Notified		Complete After Receiving Notification (e.g., e-mail, facsimile) from Utilities or Subcontractor		
		Utilities Present (Y/N)	Onsite Meeting (Y/N; if "Y" Date & Time)	Contact Name and Phone
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Form Completed By (Signature)	
	(e-mail completed page 1 to Project Manager)

** This form is mandatory for all intrusive work, regardless of who is responsible for the public and/or private locate.

Private Utility Locator Information			
Company	**Contact Name**	**Phone**	**E-mail**
Who Contracted Locator?		**Scheduled Start (Date & Time)**	**Contract Executed (Y/N/NA)**

Onsite Visual Confirmation of Utilities **Marking Color**	**Utility Type and Visual Clues**	**Cleared or Marked (Y/N)**	**No Markings - Comments**
Blue	Potable water: fire hydrant, manholes; water meter, ASTs, interior connections, hose bib, valve box		
Yellow	Gas, oil steam, petroleum: gas meter, manholes; yellow bollards, interior connections, valve box		
Red	Electric power lines, lighting cables, parking lot lights, overhead lines (telephone poles), conduits: interior connections, underground vaults, manholes, transformers/switchgear, conduit on buildings		
Green	Sewer and drain lines: underground vaults, manholes, drain grates, leach field, sand mound, no evidence of sanitary sewer (for septic system)		
Orange	Communication, alarm or signal lines, cables or conduits: red/orange bollards, telephone poles, interior connections; manholes; conduit on buildings		
Purple	Reclaimed water, irrigation, and slurry lines: sprinkler heads, hose bibs		
Pink	Survey markings		
White	Proposed locations for excavation and drilling		

Project Manager Notified of any Conflicts? (Y/N)

Notes:

Marks Verified By (Signature)	
	(scan and save to client file)

wsp

FIELD STANDARD OPERATING PROCEDURE #3

SAMPLE PACKAGING AND SHIPMENT PROCEDURE

Shipping samples is a basic but important component of field work. The majority of field activities include the collection of environmental samples. Proper packing and preservation of those samples is critical to ensuring the integrity of our work product. The user is advised to read the entire standard operating procedure (SOP) and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

3.1 ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
IATA	International Air Transport Association
HASP	Health and safety plan
PPE	Personal protective equipment
PSP	Project safety plan
SOP	Standard operating procedure

3.2 MATERIALS

- Suitable shipping container (e.g., plastic cooler)
- Chain-of-custody forms
- Custody seals
- Sample container custody seals (as necessary)
- Mailing address labels (as necessary)
- Shipping form (with account number, as necessary)
- Tape (e.g., strapping, clear packing)
- Permanent marker
- PPE
- Bubble wrap or other packing material

Temperature-preserved samples:

- Large plastic garbage bag
- Wet ice
- Heavy-duty zipper-style plastic bags
- Universal sorbent materials

Note: Some materials will be supplied by the laboratory, while others are must be supplied by the sampler. Confirm supplier of materials prior to mobilizing to the field.

3.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field standard operating procedures, and the Quality Management System.

This SOP is designed to provide the user with a general outline for shipping samples and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample collection and quality assurance procedures (SOP 4), and investigation derived waste management procedures (SOP 5).

Most environmental samples are classified non-hazardous materials due to unknown characteristics and hazardous classes, however environmental samples can meet the definition of U.S. Department of Transportation (DOT) hazardous materials when shipped by air, ground, or rail from a project site to the laboratory (e.g., free product, samples preserved with a hazardous material [TerraCore® samplers]). As such, field staff must work with their assigned company compliance professional to determine whether the sample shipment is subject to any specific requirements (e.g., packaging, marking, labeling, and documentation) under the DOT hazardous materials regulations.

3.4 SAMPLE SHIPMENT PROCEDURES

The two major concerns in shipping samples are incidental breakage during shipment and complying with applicable DOT and courier requirements for hazardous materials shipments.

> **NOTE: Many couriers, including Federal Express and United Parcel Service, have requirements that the company register with them before shipping hazard materials. In most cases, it is the sampling location, not the company office address, which needs to be registered. Therefore, each project will likely have unique requirements. Please contact your company compliance professional to determine whether or not you will be required to register for your shipment.**

Protecting the samples from incidental breakage can be achieved using "common sense." Pack all samples in a manner that will prevent them from moving freely about in the cooler or shipping container. Do not allow glass surfaces to contact each other. When possible, repack the sample containers in the same materials that they were originally received in from the laboratory. Cushion each sample container with plastic bubble wrap, styrofoam, or other nonreactive cushioning material. A more detailed procedure for packing environmental samples is presented below.

3.4.1 NON-HAZARDOUS MATERIAL ENVIRONMENTAL SAMPLES

The first step in preparing your samples for shipment is securing an appropriate shipping container. In most cases, the analytical laboratory will supply the appropriate container for bottle shipment, which can be used to return samples once they have been collected. Be sure that the container is large enough to contain the samples plus a sufficient amount of packing materials, and if applicable, enough wet ice to maintain the samples at the preservation temperature (usually 4 degrees Celsius). Use additional shipping containers as needed so that sample containers are protected from breakage due to overcrowding. Do not use lunch-box sized coolers or soft sided coolers, which do not offer sufficient insulation or protection from damage.

3.4.1.1 TEMPERATURE-PRESERVED SAMPLE CONTAINER PREPARATION

Temperature-preserved samples should be shipped to the laboratory in an insulated container (e.g., cooler). If using a plastic cooler with a drain, securely tape the inside of the drain plug with duct tape or other material to ensure that no water leaks from the cooler during shipment. Place universal sorbent materials (e.g., sorbent pads) in the bottom of the insulated container. The amount of sorbent material must be sufficient to absorb any condensation from the wet ice and a reasonable volume of water from melted wet ice (if a bag were to rupture) or a damaged (aqueous) sample container.

The next step is to line the insulated container with a large, heavy-duty plastic garbage bag. If shipping breakable sample containers (e.g., glass), place bubble wrap or other packing materials on the bottom of the container. Place the samples, including a temperature blank, on the packing materials with sufficient space to allow for the addition of more bubble wrap or other packing material between the sample containers. Place large or heavy sample containers on the bottom of the cooler with lighter samples placed on top to minimize the potential for breakage. Place all sample containers in the shipping container right-side up. Do not overfill the cooler with samples; room must be left for a sufficient volume of wet ice. Wet ice must be double-bagged in heavy-duty zipper-style plastic bags (1 gallon-sized, or less); properly seal both bags before placing in the insulated container. Place the bags of ice on top of or between the samples. Place as much ice as possible into the cooler to ensure the samples arrive at the lab at the required preservation temperature, even if the shipment is delayed. Fill any remaining space in the container with bubble wrap or other packing material to limit the airspace and minimize the shifting of the sample containers and in-transit melting of ice. Securely close the top of the heavy-duty plastic bag and knot or seal with tape.

3.4.1.2 NON-TEMPERATURE-PRESERVED SAMPLE CONTAINER PREPARATION

Non-temperature-preserved samples should be shipped to the laboratory in a durable package (e.g., hard plastic container or cardboard box). If shipping breakable sample containers (e.g., glass), place bubble wrap or other packing materials on the bottom of the container. Place the samples on the packing materials with sufficient space to allow for the addition of more bubble wrap or other packing material between and on top of the sample containers. Place large or heavy sample containers on the bottom of the container with lighter samples placed on top to minimize the potential for breakage. Place all sample containers within the shipping container right-side up. Fill any remaining space in the container with bubble wrap or other packing material to limit the airspace and minimize the shifting of the sample containers and in-transit melting of ice.

3.4.1.3 CONTAINER SHIPMENT

Samples in the container should be cross-checked against the chain-of-custory before signing off on the form and sealing the cooler. Place the original chain-of-custody form (i.e., laboratory copy) into a heavy-duty zipper-style plastic bag, affix/tape the bag to the shipping container's inside lid, and then close the shipping container; as required, include return shipping labels for the laboratory to return company-owned coolers. Only one chain-of-custody form is required to accompany one of the shipping containers per sample shipment; the other coolers in the shipment do not need to include chain-of-custody forms, unless required by the project. At this point, sample shipment preparations are complete if using a laboratory courier.

Once the shipping container is sealed, shake test the shipping container to make sure that there are no loose sample containers. If loose sample containers are detected, open the shipping container, repack the contents, and reseal the shipping container. If sending the sample shipment through a commercial shipping vendor, place two signed and dated chain-of-custody seals on alternate sides of the shipping container lid so that it cannot be opened without breaking the seals. Securely fasten the top of the shipping container shut with clear packing tape; carefully tape over the custody seals to prevent damage during shipping.

Affix a mailing label with the ship to and return to addresses to the top of the shipping container using clear shipping tape. Use the pre-printed return mailing label from the laboratory, if provided, or complete a new mailing label from the shipping carrier. Ship environmental samples to the contracted analytical laboratory using an appropriate delivery schedule. **Note: Samples can be shipped for Saturday delivery once the lab has been verified to be open and receiving samples on the weekend.**

Verify whether the shipment cost should be billed to the sender or recipient, and ensure the internal billing reference section on the mailing label includes either the laboratory's billing reference number, if the shipment is billed to the laboratory, or the project billable number, if the shipment is billed to WSP.

Declare the value of samples on the shipping form for insurance purposes, if applicable. When shipping samples to a lab, identify a declared value equal to the carrier's default value ($100); additional fees will be charged based on a higher value declared. Our preferred carrier, Federal Express, will only reimburse for the actual value of the cooler and its contents if a sample shipment is lost; they will not reimburse for the cost of having to re-collect the samples. [Please note: if you are shipping something other than samples, such as field equipment, declare the replacement value of the contents.]

Record the tracking numbers from the shipping company forms (i.e., the airbill number) in the field book and retain a copy of the shipping airbill. On the expected delivery date, confirm sample receipt by contacting the laboratory or tracking the package using the tracking number; provide this confirmation information to the project manager.

> **NOTE: Most shipping carriers adhere to transit schedules with final pickup times each day; these schedules are subject to change and vary by service location. If shipping containers are dropped off at a service location after the final pickup time, transit to the laboratory will not be initiated until the following day, and samples may not be properly preserved. Therefore, confirm transit schedules in advance of each sampling event, and ensure samples are delivered to the carrier before the final pickup time of the day.**

3.4.2 HAZARDOUS MATERIALS SAMPLES

Employees rarely ship hazardous materials due to DOT shipping requirements. If you find that your samples could be considered a DOT hazardous material, first coordinate with the assigned company compliance professional and project manager to make a hazardous material classification and, if necessary, establish the necessary protocols and to receive the appropriate training/certification.

> **NOTE: Employees shipping samples regulated as hazardous materials or exempt hazardous materials by air must have International Air Transport Association (IATA) training. IATA training is a separate training required in addition to DOT hazardous materials training for such shipments. Most of our employees do not have IATA training and therefore, anyone who needs to ship by air MUST consult with a company IATA-trained compliance professional.**

FIELD STANDARD OPERATING PROCEDURE #5

INVESTIGATION DERIVED WASTE MANAGEMENT PROCEDURE

The purpose of this standard operating procedure (SOP) is to provide instructions for handling, storing, and managing investigation derived waste (IDW) pending disposal. All IDW, which includes (but is not limited to) soil cuttings, development water, purge water, drilling fluids, decontamination fluids, personal protective equipment (PPE), and sampling equipment, must be managed in compliance with applicable or relevant and appropriate requirements. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper PPE must be selected and used appropriately.

5.1 ACRONYMS AND ABBREVIATIONS

DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
IDW	investigation derived waste
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PSP	project safety plan
RCRA	Resource Conservation and Recovery Act
SOP	standard operating procedure
TSCA	Toxic Substances Control Act

5.2 MATERIALS

- Pre-printed weatherproof waste labels (e.g., non-hazardous waste, hazardous waste, polychlorinated biphenyls [PCBs], etc.)
- IDW log (Figure 1)
- Permanent ink marking pen, paint, stick/pen
- Sampling equipment (refer to sampling SOPs)
- Impermeable covers (tarps), as needed
- Duct tape, rope, or other material to secure tarp
- Copy of the waste manifest or bill of lading

5.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field standard operating procedures, and the Quality Management System.

This SOP is designed to provide the user with a general outline for handling, storing, and managing IDW pending disposal and assumes the user has received current U.S. Department of Transportation (DOT) training, Hazardous Waste Operations and Emergency Response training, and Resource Conservation and Recovery Act (RCRA) training (if required) and is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), and equipment decontamination (SOP 6). The SOP does not cover investigation planning; DOT, RCRA, and Toxic Substances Control Act (TSCA) regulations; nor does it cover the evaluation of the analytical results. **Consult and involve the company's compliance professionals during all phases of IDW management and disposal.**

It is important to note that information contained in this SOP is based on federal regulations and interpretive guidance provided by the U.S. Environmental Protection Agency (EPA) and other federal regulatory sources; therefore, information provided in this SOP may be superseded by state or local-specific statutes or regulations. Field personnel must plan for and discuss the handling procedures with the project manager and assigned company compliance professional before mobilizing to the field.

5.4 IDW GENERAL PROCEDURES

Nearly all intrusive field activities will generate solid or liquid wastes. Examples include:

Solid Waste

- Soil cuttings
- Drilling mud
- Plastic sheeting
- Spent carbon or filters
- PPE (e.g., Tyvek coveralls, gloves, respirator cartridges)
- Disposable or dedicated sampling equipment (e.g., bailers, hoses, clamps, buckets, cartridge filters)
- Field analytical waste (e.g., HACH kits, Chlor-n-Soil kits, Gastech tubes)
- Compressed gas cylinders (e.g., isopropylene, helium)
-
- Disposable cleaning materials (e.g., wipes or rags)

Liquid Waste

- Decontamination water
- Development water
- Drilling fluids
- Purge water
- Soap or wash solutions
- Reagents (e.g., hexane, nitric acid, methanol)

The specific procedures for dealing with these materials after the field activities have been completed will vary depending on whether the materials are considered to be non-hazardous, RCRA hazardous (characteristic or listed wastes), TSCA-regulated PCB waste, and/or DOT hazardous materials. The characterization of the wastes to be generated should be determined in conjunction with a company compliance professional before the field event occurs, based on previously generated data; however, in some cases, particularly for new sites, the status of the wastes may not be known. In these cases, handle IDW as hazardous waste until the status can be verified. Field personnel must consult their assigned company compliance professionals for assistance in proper waste characterization and to determine waste management requirements applicable to the site.

5.4.1 WASTE MINIMIZATION

As possible, select investigation methods and techniques that will minimize the amount of wastes generated during field activities, particularly if the IDW is hazardous. Examples include using direct-push methods instead of hollow stem augers (to minimize soil cuttings) during a soil investigation, if appropriate, eliminating the use of solvents or solvent-based cleaners for decontamination, if possible, and limiting contact with the materials to reduce the amount of PPE required. Minimizing the amount of waste generated will reduce handling requirements and overall project costs, and is consistent with the company's corporate goals for sustainability.

5.5 ONSITE IDW MANAGEMENT PROCEDURES

Onsite handling procedures typically involve containerization of the IDW for offsite disposal at a regulated facility or, in the case of certain non-hazardous wastes, onsite disposal. Should more than one waste stream be present onsite, segregate the IDW containers by waste stream to facilitate the future waste disposal. The procedures for each type of waste are presented below.

5.5.1 NON-HAZARDOUS WASTE MANAGEMENT

If the IDW is classified as non-hazardous waste, the following procedures must be implemented only if approved by the applicable regulatory agency and after being discussed and approved by the project manager, project compliance professional, client, and facility personnel:

- Soil can be either:
  - spread around the borehole or other onsite location
  - placed back in the boring or excavated test pit
  - containerized and disposed of offsite
- Groundwater and decontamination fluids can be either:
  - poured onto the ground next to the well to allow infiltration
  - discharged to either the publically-owned treatment works or storm sewer
  - discharged to the onsite wastewater treatment plant
  - containerized and disposed of offsite
- After rendering the IDW unusable (e.g., cutting or tearing material), PPE, plastic sheeting, disposable cleaning materials, and spent bag filters can be double bagged and disposed of as general trash or containerized and disposed of offsite.
- Compressed gas cylinders should be depressurized and disposed of as general trash, recycled as scrap metal, or containerized and disposed of offsite.
- Field analytical waste (e.g., HACH® kits, Chlor-n-Soil® kits) can be disposed of in accordance with the manufacturer's instructions provided the disposal method is approved by the company's project manager and compliance professional.
- Minimize the volume of reagents as much as possible. Consult a company compliance professional to determine the proper disposal of any quantity of unused reagents. Empty reagent containers may be disposed of as general trash after removing all chemical name and warning labels, or may be containerized and disposed of offsite.
- Spent water treatment media (e.g., carbon, resin) should be containerized and disposed of offsite.
- Exploration and production exempt waste derived from material that was downhole at an oil and gas production site.

If the IDW is containerized and is classified as non-hazardous, the following procedures will apply:

- Place the non-hazardous IDW in DOT-compliant containers (e.g., 55-gallon drum, roll-off container, or temporary storage tank). Before placing IDW in the containers, ensure that the containers are in good condition and will not leak.
- Drums used as containers must remain closed except when adding, sampling, or inspecting the waste. The drums cannot be used as a work surface once waste is put in the container.
- Mark the container with the appropriate waterproof, self-adhesive non-hazardous waste label. The label must include a description of the contents of the container (e.g., soil cuttings, purge water) and the generator name (the client or the facility, never the company). **Field personnel must consult the project compliance professional for help in properly completing the labels.**
- Complete the IDW Log (Figure 1) before leaving the site. Present one copy of the log to the site contact and the original to the project manager.
- The IDW containers must be properly closed, wiped clean, and stored in a secure onsite location.

5.5.2 HAZARDOUS WASTE MANAGEMENT

If site data or generator knowledge indicates that the IDW is RCRA hazardous, the following procedures will apply:

- Place IDW in DOT-compliant containers (e.g., 55-gallon drum, roll-off container, or temporary storage tank). Before placing IDW in the containers, ensure that the containers are appropriate for the type of IDW generated (e.g., solid in containers authorized for transport of solids), in good condition and will not leak.

- Containers must remain closed except when adding, sampling, or inspecting the material. The containers cannot be used as a work surface once waste is put in the container.
- Mark the container with an appropriate waterproof, self-adhesive hazardous or radiological waste label. The label must include the accumulation start date, a description of the contents of the container (e.g., soil cuttings, purge water), the EPA identification number, the generator name (the client or the facility, never the company), and the hazardous waste codes, if known. **Field personnel must consult the project compliance professional for help in properly completing the labels.**
- The IDW containers must be properly closed, wiped clean, and stored in a secure onsite location (i.e., a designated facility hazardous waste storage area) to limit access. At a minimum, place the drums on an impermeable surface (if available) in an area of limited access. If stored outside, cover the containers with a secured tarp at the end of each field day until the containers are picked up for disposal.
- Complete the IDW Log (Figure 1) before leaving the site. Present one copy of the log to the site contact and the original to the project manager.
- If applicable, ensure that weekly inspections are conducted, and the proper inspection forms for documentation are completed during the entire time the waste is stored onsite. **Field personnel must consult the project compliance professional for help to determine if weekly inspections are required.**

If the IDW is presumed to be hazardous and sampling is required to confirm its classification, it must be labeled "Hazardous Waste-Pending Analysis" and sampled for the parameters specified by the project compliance professional or project manager before leaving the site. Any waste confirmation samples must be collected in accordance with the company's SOPs. Treatment, storage, and disposal facilities will usually specify the required analysis for waste profiles.

5.5.3 PCB WASTE MANAGEMENT

If information exists to classify PCB-containing IDW as TSCA-regulated IDW (i.e., PCBs greater than 50 milligrams per kilogram), the following procedures must be implemented:

- Place the PCB-containing IDW in DOT-compliant containers (e.g., 55-gallon drum, roll-off container, or temporary storage tank). Before placing IDW in the containers, ensure that the containers are in good condition and will not leak.
- Containers must remain closed except when adding, sampling, or inspecting the material. The containers cannot be used as a work surface once waste is put in the container.
- Mark the container with an appropriate waterproof, self-adhesive yellow label with the words "Caution Contains PCBs", the "removed from service" date (the accumulation start date), and a description of the contents of the container (e.g., soil cuttings). Complete the label with the name and phone number of the company personnel to contact in the event of an accident or spill. **Field personnel must consult the project compliance professional for help in properly completing the labels.**
- The IDW containers must be properly closed, wiped clean, and stored in a secure PCB storage area onsite. If a PCB storage area is not available, construct a temporary PCB storage area. Cover the containers with a secured tarp at the end of each field day until the drums are picked up for disposal. Place one yellow 6" x 6" "Caution Contains PCBs" label on the outside of the tarp, and note the "Removed from service date" on the label.
- Complete the IDW Log (Figure 1) before leaving the site. Present one copy of the log to the site contact and the original to the project manager.
- If applicable, inspect the area and the containers for leaks once every 30 days in accordance with TSCA requirements during the entire period the waste is stored onsite. **Field personnel must consult the project compliance professional for help to determine if weekly inspections are also required.**

5.6 POST-FIELD IDW MANAGEMENT ACTIVITIES

Field personnel must follow up on the management of the IDW after returning from the field. RCRA hazardous and TSCA-regulated PCB-containing wastes have storage time limits and periodic inspection requirements to remain in compliance with federal, state, or local regulations. Arrangements for proper disposal of wastes must be made within the required time limits and must be consistent with all applicable regulatory requirements, as well as the company's contracting procedures and policies for waste disposal. Copies of waste disposal documentation (e.g., bill of lading, waste manifest, land disposal restriction form, etc.) should be provided to the project manager and saved with the project files.

INVESTIGATION DERIVED WASTE LOG

Date/Time:___________________

Site Information:
Site Name: _____________________________________ Site EPA ID #: ______________________________
Site Contact: ____________________________________ Site Address: ______________________________
Site Contact Telephone No: ____________________________

Origin of Material: ____
Type of Waste Generated:

☐ Soil Cuttings ☐ PPE ☐ Decontamination Water
☐ Groundwater ☐ Storm Water ☐ Drilling Fluids
☐ Other (Describe): ____

Field Activities that Generated the Waste:

☐ Soil Borings ☐ Well Sampling ☐ Well Installation
☐ Decontamination ☐ Excavation ☐ Pumping Tests
☐ Other (Describe): ____

Generation Date: __________________________ ***90/180/270-Day Deadline(for hazardous waste)***: _______________________
Quantity of Waste Generated and Container Type: ____

____

Storage Location: ____
Waste Identification:

☐ Non-hazardous Waste (pending analysis)
☐ Non-hazardous Waste (based on site information or generator knowledge)
☐ Hazardous Waste (pending analysis)
☐ Hazardous Waste (based on site information or generator knowledge)
☐ PCB-containing Waste
☐ Radiological Waste

If generator knowledge or site information was used for identification, explain: ___________________________

____

____

Type of Label Applied to Container: ☐ Non-hazardous ☐ Hazardous ☐ PCB ☐ Radiological
WSP Information (Note: One copy to site contact - the original copy to project manager)
Personnel/Contact: ____________________________________ Project No.:_________________________
Telephone: ____

Date Removed: ____________________________ Signature: _________________________________

FIELD STANDARD OPERATING PROCEDURE #6

DECONTAMINATION PROCEDURE

The decontamination procedures outlined in this standard operating procedure (SOP) are designed to ensure that all sampling equipment is free from the analytes that could potentially interfere with sample results. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

6.1 ACRONYMS AND ABBREVIATIONS

DI	deionized water
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SOP	standard operating procedure

6.2 MATERIALS

- Field book
- PPE
- Polyethylene sheeting and/or garbage bags
- Laboratory-grade non-phosphate detergent[1] (e.g., Luminox® or Liquinox®)
- Cleaning reagents, as needed (e.g., isopropyl alcohol, methanol, hexane, nitric acid)
- Potable water
- Deionized (DI) water
- Containers (e.g., plastic buckets)
- Bristle brushes
- Aluminum foil
- Spray bottles
- Paper towels
- Pressurized steam cleaner (e.g., steam jenny), as needed
- Waste collection containers (e.g., drums), as needed
- Decontamination pad, as needed

6.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

[1] Not all laboratory-grade detergents are phosphate free. Be sure to verify the detergent's phosphate content before use.

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company's SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for decontamination and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), and investigation-derived waste management procedures (SOP 5). All decontamination references must be available for consultation in the field, including:

— Company's SOPs
— Applicable state and federal guidelines or procedures
— Manufacturer's manuals
— Project-specific work plan, PSP and/or HASP, and QAPP

6.4 GENERAL PROCEDURES

The cleaning and decontamination procedures described below are designed to ensure that the equipment used for sample collection is free of analytes that could potentially alter the analytical results. These procedures are primarily targeted at preventing the incidence of cross-contamination (i.e., compounds of interest being transferred on the sampling equipment from one sample to another) in order to produce high quality, representative sample results. As with all analytical sampling, the effectiveness of the cleaning procedures must be demonstrated with the collection of equipment blanks; equipment blank sample collection procedures and frequency are discussed in SOP 4.

6.4.1 EQUIPMENT AND REAGENT SELECTION

It is important for employees to evaluate the expected types of contamination before mobilization to a site. State programs (or the U.S. Environmental Protection Agency [EPA], depending on the site) may require more stringent decontamination procedures than those listed in this SOP, specify the types and grades of various cleaning detergents and reagents (e.g., acids and solvents), or allow the use of phosphate-containing detergents, such as Liquinox® liquid detergent (preferred[2]) or the powdered Alconox®. Decontamination equipment (e.g., spray bottles, brushes, etc.) should be constructed of non-reactive, non-leachable materials (e.g., metal, glass, Teflon®-coated, polyethylene, etc.) which are compatible with the reagents and solvents being used for decontamination.

Many of the cleaning reagents (e.g., nitric acid, hexane, methanol) are U.S. Department of Transportation (DOT) hazardous materials and must be shipped using a ground delivery service. The Safety Data Sheets (SDSs) for any hazardous cleaning reagents to be used onsite must be reviewed before the commencement of work, and the potential hazards and protective measures to be employed must be addressed in the HASP. Do not use decontamination liquids that have been improperly stored (e.g., unsealed containers).

In specific cases, it may be necessary to steam clean the field equipment before proceeding with the decontamination steps presented in Section 6.5 (e.g., hollow stem augers). Generally, the company's subcontractors are responsible for bringing or building a decontamination pad, if necessary, to contain the spray from a steam jenny. As possible, decontamination pads should be constructed on a level, paved surface in an area known or believed to be free of surface contamination, and should be of sufficient size to contain the decontamination water. Equipment that is steam cleaned should be placed on racks or saw horses and not on the floor of the

[2] Liquinox® liquid detergent, manufactured by Alconox, Inc., is phosphate-free and does not contribute to nutrient loading or algae blooms in the environment.

decontamination pad. Decontamination water should be removed from the decontamination pad frequently to minimize the potential for leaks or overflow.

Consult and involve the company's compliance professionals for storage procedures and disposal requirements of cleaning reagents, detergents, wastes, and other decontamination-related materials.

6.4.2 OTHER CONSIDERATIONS

In preparing for decontamination, you should perform the following activities (with all observations and measurements noted in the field book):

— Perform a quick reconnaissance of the site to identify a decontamination (pad) area and evaluate the accessibility to and safety of the location.
— If working in a hazardous waste exclusion area, the decontamination area should be located in the contaminant reduction zone.
— Record a description of the decontamination (pad) area.

Survey the breathing zone around the decontamination area with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate. When decontaminating equipment, it is important to find a suitable location away from any sources of cross-contamination that could compromise the integrity of the decontamination. As possible, position the decontamination area away from fuel-powered equipment, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling).

6.5 DECONTAMINATION PROCEDURES

The decontamination procedures described below are a four- to nine-step process, depending on the the applicable federal or state guidelines, the project-specific work plan, or the QAPP. Sampling activities must be initiated with clean, decontaminated equipment. Decontaminate all non-dedicated equipment that contacts the sample directly (e.g., spoons, trowels, pumps), before and between each sample location and sampling interval. record decontamination procedures in the field book. Disposable, single use items, such as bailers or tubing, do not require decontamination.

The decontamination process includes the following four basic steps:

1 Physical removal of soil or debris
2 Wash with non-phosphate detergent, such as Liquinox®, and nylon brush
3 Potable water rinse
4 Laboratory-supplied deionized (DI), analyte-free water rinse (distilled water can be used as a substitute, if necessary)

The first step is to remove as much soil or other debris from the sampling device as possible near the sampling area to limit the spread of potentially-contaminated materials into clean areas of the site. Containerize all soil or debris in DOT-compliant containers in accordance with SOP 5 or the project-specific work plan. Dispose of all wastes in conformance with the project-specific work plan and applicable regulations.

Cleaning and decontamination should occur at a designated area(s) (i.e., decontamination pad) on the site. If gross contamination or an oily film or residue is observed on the equipment, use a steam jenny or wash by hand, using a brush, to remove the particulate matter or surface film. Heavy oils or grease may be initially removed with paper towels soaked with isopropyl alcohol.

The physical removal of debris process is followed by soaking (a simple dunk of the equipment is insufficient) and hand scrubbing the equipment with a solution of potable water and non-phosphate detergent (mixed to the manufacturer's instructions) followed by a potable water rinse. If not using a decontamination pad, the most common set-up uses multiple 5-gallon plastic buckets (or equivalent) for washing and rinsing. The decontamination containers should be labeled as to their contents and pertinent information from original source, such as the date opened or transferred, and the expiration date (as well as any applicable hazardous labels), placed on polyethylene sheeting (to contain drips of decontamination fluids during the decontamination process), and sealed when not in use to prevent accidental release of the fluids. If decontaminating sealed submersible pumps, pump both the non-phosphate detergent wash fluid and the potable water rinse through the pump body itself (usually done in separate buckets) to ensure that the internal components are thoroughly cleaned. Replace the detergent solution and rinse water at least daily or when it becomes oily or silty.

Next, place the DI water for the rinse in a small spray bottle or pour over the equipment after the potable water rinse.

Typically, this level of decontamination (i.e., steps 1 through 4) is sufficient.

Following Steps 1 through 4, additional decontamination (steps 5 through 9) may be required by the applicable federal or state guidelines, the project-specific work plan, or the QAPP. Typically, these decontamination steps are performed when sampling for inorganics or oil-related substances using non-motorized equipment. These steps include:

5. 10% nitric acid rinse (if metals are part of the analyses)
6. Laboratory-supplied DI water rinse
7. Pesticide-grade solvent rinse (e.g., acetone [preferred], hexane, or isopropyl alcohol)
8. Air dry (solvent must evaporate)
9. Laboratory-supplied DI water rinse

Isopropyl alcohol is the recommended solvent for organic contaminants because it is readily available and is not a DOT hazardous material; where possible, lab-grade isopropyl alcohol should be used . However, other solvents (e.g., hexane and methanol) may be more effective in removing certain contaminants, such as oils or polychlorinated biphenyls, but any waste generated using these solvents must be managed accordingly. Solvents are never used for decontamination if sampling for volatiles organic compounds.

Handle the solvents and acid with care and store unused chemicals in their original, labeled, protective containers when not in use. It is a good idea to transfer small quantities of each solution into labeled, laboratory-grade spray bottles, which offer a convenient and controllable way to rinse the equipment. The equipment can then be rinsed over a 5-gallon plastic bucket or other suitable container placed on plastic sheeting as with the first part of the cleaning process. Nitric acid rinses must be used only on non-carbon steel sampling devices. Do not spray acid or solvent into pumps.

Decontamination steps used at sites where radioactive materials are contaminants of concern are similar with a few special considerations. Radiation contamination monitoring is used to help locate contamination and guide the success of the decontamination process. The liberal use of water and fluids as a decontamination agents are minimized, where practicable, because of the expense that can be incurred with disposing of radioactively contaminated decontamination water. Containerized decontamination wastes must be evaluated for radioactive content and disposed of appropriately depending on their content.

6.6 HANDLING DECONTAMINATED EQUIPMENT

Handle any decontaminated equipment using clean gloves to prevent re-contamination. Place the equipment away (preferably upwind) from the decontamination area once the process has been completed on clean plastic sheeting to allow it to air-dry. Once the equipment is dry, protect it from re-contamination by securely wrapping and sealing with aluminum foil (shiny side out) or clean, disposable plastic bags (inorganics only). Plastic bags may be wrapped directly around wet or dry equipment except when the expected contaminants include volatile and extractable organics; under those circumstances, allow the equipment to completely dry or wrap it in aluminum foil.

All sampling equipment must be decontaminated at the end of the investigation (i.e., prior to departure from the site). Label each piece of equipment with the date of decontamination, the initials of personnel performing the decontamination, and the type of decontamination solution(s) used. Containerize all decontamination fluids, and other disposable decontamination materials in DOT-compliant containers in accordance with SOP 5 or the project-specific work plan. Dispose of all wastes, including open and unused solvents or acids, in conformance with the project-specific work plan and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #7

WATER QUALITY MONITORING EQUIPMENT PROCEDURE

The procedures outlined in this Standard Operating Procedure (SOP) are designed to ensure that water quality monitoring equipment is calibrated and used properly. Specifically, this SOP addresses the short-term or discrete-measurement use of portable water quality monitoring equipment for the collection of physical, chemical, or biological field measurements. Common field parameters include temperature, pH, specific conductance (SC), turbidity, oxidation-reduction potential (ORP), and dissolved oxygen (DO). The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

7.1 ACRONYMS AND ABBREVIATIONS

DI	deionized water
DO	dissolved oxygen
°F	degrees Fahrenheit
HASP	health and safety plan
IDW	investigation derived waste
mg/l	milligrams per liter
mV	millivolts
NTU	nephelometric turbidity units
ORP	oxidation-reduction potential
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SC	specific conductance
SDS	safety data sheets
SOP	standard operating procedure
SU	standard units
µS/cm	microsiemens per centimeter
(mS/cm)	millisiemens per centimeter

7.2 MATERIALS

- Field book
- PPE
- Water quality meter
- Flow-through cell, as appropriate
- Display/logger
- Communication cables
- Calibration cup or beaker

- Calibration reagents and standard solutions, as appropriate
- Deionized water (DI) or distilled water
- Decontamination supplies

7.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for preparing water quality monitoring equipment for use and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), investigation derived waste (IDW) management procedures (SOP 5), and equipment decontamination (SOP 6). This SOP does not cover the selection of water quality monitoring equipment, nor does it cover water quality monitoring equipment-specific instructions. These topics require a significant amount of planning and are more appropriately addressed in a project-specific work plan. Be sure to review the project-specific work plan or Quality Assurance Project Plan (QAPP) and any applicable state and federal guidelines or calibration procedures. The sampler should be familiar with the use and calibration of all sampling and monitoring equipment. All sampling references must be available for consultation in the field, including:

- Company's SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan, PSP and/or HASP, and QAPP

7.4 GENERAL EQUIPMENT HANDLING AND MANAGEMENT PROCEDURES

Multi-parameter water quality meters are typically bundled in a single housing unit known as a sonde. These types of units offer a single, convenient device that is capable of measuring most or all of the parameters monitored during a typical sampling event. Individual parameter water quality meters are available and, in some cases, offer a higher degree of accuracy, although the difficulty in deploying multiple meters for most tasks relegates them to specialty use.

Field personnel must consult their assigned company compliance professionals for assistance in proper use, storage, and disposal of all calibration standard solutions.

The manufacturer's recommendations and instructions vary from one instrument to the next; however, all types of water quality monitoring equipment share common handling and management procedures designed to ensure the integrity of the measurements collected. Based on these procedures, the user should:

- Follow the manufacturer's instructions for transportation, assembly, operation, calibration, and maintenance specific to your equipment. The manufacturer's instructions should be followed explicitly in order to obtain accurate results.
- Keep either the sensor guard or transportation/calibration cup installed when not in use to avoid damaging the sensors. Some sensors require a small amount of water in the transportation/calibration cup; follow the manufacturer's recommendations.
- Inspect the sensors to be sure that they are clean, installed properly and are not damaged.

- Ensure that all equipment is in proper working condition, and that batteries are properly charged before using the equipment for field testing measurements.
- Protect instruments that are sensitive to static electricity.
- Record manufacturer name and model number for each instrument used in the field book.
- Calibrate the instrument, as close to the time of use as possible, and repeat at the frequency suggested by the project-specific work plan, QAPP, or manufacturer. All calibration records must be maintained in the project files.
- Protect the instrument from direct sunlight, precipitation, and extremely hot or cold temperatures.
- Store cables only after they are clean, dry, and neatly coiled – do not bend or crimp cables, and attach any provided storage caps.
- Protect cables from abrasion or unnecessary tension when in use.
- Unless otherwise instructed by the manufacturer, decontaminate water quality monitoring equipment using a non-phosphate detergent solution with a small, nonabrasive brush, cotton swab or cloth, followed by a thorough DI water rinse.

7.5 CALIBRATION PROCEDURES

Water quality monitoring equipment must be inspected and the sensors calibrated before use. Calibration frequency is dependent upon project specifications, instrument performance, and manufacturer's recommendations; repeat the calibration procedures as directed in the project-specific work plan, QAPP, or manufacturer's guidance. Consult the manufacturer's guidelines before beginning the calibration process and contact the manufacturer's technical support if problems or questions arise. Maintain all calibration records in the project files.

Conduct the following procedures to ensure proper calibration and record observations in the field book:

- Complete field calibration in an area sheltered from wind, dust, and temperature/sunlight fluctuations such as inside a room or vehicle in which the ambient temperature of the standards is maintained at a temperature greater than 40 degrees Fahrenheit (°F) and less than 100°F, unless otherwise specified by the manufacturer.
- Use standard calibration solutions in accordance with the project-specific work plan, QAPP, or manufacturer's guidance. Allow water quality monitoring equipment to equilibrate to the air temperature for at least 15 minutes after being powered on, or for the specified time period recommended by the manufacturer.
- Record the brand, concentration, lot numbers and expiration dates of standard solutions in the field book.
- Handle standard solutions in a manner that prevents their dilution or contamination. Do not use expired standard solutions. Do not reuse standard solutions or pour solutions back into the bottle; ensure that proper chain-of-custody has been followed for standard solutions stored at a site.
- Ensure that the water quality monitoring equipment has been set to display or record the appropriate measurement units, as available – be sure to record the units of measure in the field book or field form.
- Unless otherwise instructed by the manufacturer, use the calibration cup that comes with the instrument for calibration.
- Use the recommended volume of standard solution when filling the calibration cup (e.g., the standard solution must cover the temperature sensor, as most sensors require temperature compensation).
- Be careful not to over tighten the calibration cup; many calibration cups have vents that allow their equilibration with ambient pressure.
- Rinse sensors thoroughly with DI water after use of each standard solution, followed by a rinse with the next standard solution to be used.
- Wait for readings to stabilize (approximately 30 seconds under normal conditions) before adjusting and saving the calibration point.
- If calibration fails to meet criteria, follow the manufacturer's instructions for corrective action to adjust instrument performance and note any indication of a substandard calibration.
- If the instrument does not start up, meet the requirements above, or calibrate properly, the instrument should not be used.
- Document the time, date, serial number (or other identifier) and calibration status for each instrument.

7.5.1 SPECIFIC CONDUCTANCE

Specific conductance, or, more commonly conductivity, measures the ability of water to conduct an electric current. It is generally reported in either microsiemens per centimeter (μS/cm) or millisiemens per centimeter (mS/cm); be sure to note the units used in the field book. Natural waters, including groundwater, commonly exhibit SC below 1 μS/cm. Elevated SC measurements (i.e., greater than 500 μS/cm) are a proxy for the amount of dissolved solids, which may be indicative of inadequate well development, grout contamination (or an inadequate grout seal), or contamination.

When calibrating water quality monitoring equipment for SC:

- If not specified in the project-specific work plan, choose a SC standard solution recommended by the instrument manufacturer; otherwise, select a standard that is similar to the anticipated conductivity of the water being sampled.
- The presence of air bubbles in conductivity electrodes will cause erroneous readings and incorrect calibration. Transmission lines, alternating-current electrical outlets and radio-frequency noise sources may cause interference; check with the instrument manufacturer's specifications for troubleshooting procedures.

7.5.2 DISSOLVED OXYGEN

Dissolved oxygen measurements are used to assess the water quality with respect to certain metals (the amount of oxygen can control the valence state of metals) and, more typically, biological activity. Concentrations of DO in groundwater under ambient conditions generally range from 1 to 4 milligrams per liter (mg/l). Erratic or elevated (greater than 4 mg/l) DO readings may indicate equipment maintenance issues, such as a fouled sonde, torn membrane, a sensor out of calibration range; or inappropriate monitoring procedures that are causing excessive agitation and aeration of the water column. The meters are sensitive to atmospheric interference: *ex situ* measurements (i.e., those measured outside of the well itself) should only be collected using a flow-through cell.

Dissolved oxygen meters vary widely in their sensitivity. Select the type of DO sensor (i.e., the polarographic [or Clark cell] sensor or the luminescent [optical] sensor) that is most appropriate for the scope of work detailed in the project-specific work plan. The guidance below is for the more common polarographic sensor; consult the manufacturer's guidance for maintenance and calibration procedures specific to optical DO meters.

- Check the DO membrane for bubbles, wrinkles or tears. If necessary, install a new membrane and replace worn or stretched O-rings. Manufacturer guidance generally specifies membrane replacement should be completed at least 3 to 4 hours before use.
- Most manufacturers recommend that the sensor be allowed to equilibrate to the temperature of the water-vapor-saturated air before calibration, as specified in the manufacturer's instructions.
- Fill the calibration cup with less than 1/8 inch of water, or as recommended by the manufacturer.
- Remove any water droplets from the sensor without wiping the membrane. Water droplets on the sensor can cause a temperature compensation error in the DO calibration.
- Do not submerge or wet the sensor when loosely attaching the calibration cup.
- Enter the barometric pressure and wait for readings to stabilize before adjusting and saving the calibration point.

7.5.3 PH

The effective concentration (or activity) of hydrogen ions on a numerical scale known as pH, which is expressed as the negative base-10 logarithm of the hydrogen-ion activity in moles per liter. Natural (uncontaminated) waters typically exhibit a pH ranging from 5 to 9 Standard Units (SU). Deviation of pH from background may indicate the presence of groundwater contamination or well construction problems.

Typically, a two-point calibration is used for pH (i.e., a zero-point and span calibration[s]):

- If not specified in the project-specific work plan, select a 7 SU buffer (zero-point) plus a second pH buffer (4 SU or 10 SU) that brackets the range of expected pH.
- If applicable, calibrate the conductivity and DO sensors before calibrating the pH sensor. This helps prevent cross-contamination of the conductivity sensor from pH buffer solutions (pH buffers have much higher conductivities than most environmental waters).
- Allow time for the pH and temperature sensors to equilibrate to the temperature of the buffer and stabilize before adjusting and saving the calibration point. Record the temperature reading and use the chart provided by the buffer manufacturer to determine the true pH of the buffer at that temperature and adjust the calibration reading to that value.
- Repeat the calibration process with the second buffer.

7.5.4 OXIDATION-REDUCTION POTENTIAL

Oxidation-reduction potential is a numerical index of the intensity of the oxidizing or reducing conditions within an aqueous solution. Oxidizing conditions are indicated by positive potentials and reducing conditions are indicated by negative potentials. These values are frequently used when evaluating the biodegradation capacity of a system. The ORP of natural (uncontaminated) waters typically ranges from +500 to -100 millivolts (mV). The meters for ORP, like those for DO, are sensitive to atmospheric interference and must be measured using a flow-through cell. Avoid touching the sensors during calibration and measurement as calibration can be affected by static electricity.

A one-point calibration, at a known temperature, is used to calibrate the ORP sensor:

- Fill the calibration cup with enough standard solution (i.e., ZoBell's solution) to completely cover the temperature and ORP sensors.
- Allow time for the ORP and temperature sensors to equilibrate to the temperature of the buffer and stabilize before adjusting and saving the calibration point. Record the temperature reading and use the chart provided by the manufacturer to determine the true ORP of the solution at that temperature and adjust the calibration reading to that value.

7.5.5 TURBIDITY

Turbidity is the presence of suspended mineral and organic particles in a water sample. Turbid water may indicate inadequate well construction, development or improper sampling procedures, such as purging at an excessive rate that exceeds the well yield. Purging and sampling in a manner that minimizes turbidity is particularly important when analyzing for total metals and other hydrophobic compounds, such as polychlorinated biphenyls, which may exhibit artificially elevated concentrations in high-turbidity samples due to their adsorption to colloidal material. Generally, the turbidity of *in situ* groundwater is very low (at or below 10 nephelometric turbidity units, NTUs); however, some groundwater zones may have natural turbidity higher than 10 NTUs.

Standard turbidity solutions are not necessarily interchangeable. Serious calibration errors can result from using inappropriate standards. Use only those standard turbidity solutions that are prescribed for the sensor by the instrument manufacturer.

Turbidity consists of a zero-point calibration and a span calibration(s):

- Fill the calibration cup to the reference line with DI or a zero-point standard.
- Allow time for the turbidity sensors to stabilize before adjusting and saving the calibration point.
- Record the temperature and use the chart provided by the manufacturer to determine the true turbidity of the standard and adjust the calibration reading to that value.
- Repeat the calibration process with the standard span calibration standard(s).

7.6 EQUIPMENT USE PROCEDURES

The monitoring equipment is ready to use once the calibration has been completed. The specific use of the device will be dictated by the project-specific work plan or QAPP; however, all projects should follow these general procedures during use:

- Charge instrument batteries per the manufacturer's instructions, as necessary.
- Ensure that instrument is warmed up and the measured value(s) on the water quality monitoring equipment are equilibrated (i.e., readings are representative of the solution, not ambient air) before recording in the field book.
- Biological growth or debris in the water can foul sensors; as possible, avoid inserting the sonde in areas that will result in having to stop and clean algae, sediment, or debris from the sensors (e.g., do not place on bottom of a well or streambed).
- If continuous monitoring is required, follow the manufacturer's instructions for performing continuous data logging events.

For flow through cells:

- Inspect the integrity of the flow-through cell and O-rings.
- Connect the discharge tubing to the bottom of the flow-through cell using properly-sized tubing and fittings. Connect the effluent tubing to the top of the flow-through cell and secure the end of the tubing into the designated groundwater purge container.
- Shield the flow-through cell from direct sunlight to minimize changes in the temperature.

- Do not record any measurements until all the air from the flow-through cell and the effluent tubing has been displaced and the sensors have equilibrated. The presence of air bubbles in the flow-through cell will result in highly biased readings.
- Do not collect samples for laboratory analysis from the groundwater in the flow-through cell.

7.7 CLOSING NOTES

Once field activities are complete, secure the site in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly manage all PPE and IDW in conformance with SOP 6, the project-specific work plan, and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #11

GROUNDWATER SAMPLING PROCEDURE

Groundwater sampling procedures outlined in this Standard Operating Procedure (SOP) are designed to ensure that collected samples are representative of current site conditions. These procedures can be applied to permanently or temporarily installed monitoring wells, direct-push sample points, water supply wells with installed plumbing, extraction wells for remedial groundwater treatment systems, and excavations where groundwater is present. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

11.1 ACRONYMS AND ABBREVIATIONS

ID	inside diameter
DI	deionized
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DTW	depth-to-water
HASP	health and safety plan
IDW	investigation-derived waste
l/min	liters per minute
LNAPL	light non-aqueous phase liquid
mg/l	milligrams per liter
mV	millivolts
NAPL	non-aqueous phase liquid
NTU	nephelometric turbidity unit
ORP	oxygen reduction potential
PID	photoionization detector
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SOP	standard operating procedure
SU	standard units
TD	total depth
TOC	top-of-casing
VOCs	volatile organic compounds

11.2 MATERIALS

- Field book
- PPE
- Air quality monitoring equipment (e.g., photoionization detector [PID]) with calibration reagents and standards, as needed
- Electronic water level indicator or interface probe
- Water quality meter(s) with a flow-through cell, and calibration reagents and standards, as needed
- Field test kits, as needed
- Adjustable wrench or manhole wrench, as needed
- Well key(s), as needed
- Power supply, as needed
- Sampling containers and labeling/shipping supplies
- Deionized (DI) water
- Container(s) for water storage (e.g., bucket, drum)
- Pump or bailers, tubing, and associated lanyard materials
- Filters, as needed
- Decontamination supplies

11.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe, consistent manner; are in accordance with federal and state guidance; and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for conducting groundwater sampling and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), utility location (SOP 2), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), investigation derived waste (IDW) management procedures (SOP 5), equipment decontamination (SOP 6), and use and calibration of all sampling and monitoring equipment (SOPs 7 and 8). This SOP does not cover investigation planning, nor does it cover the analysis of the analytical results. These topics are more appropriately addressed in a project-specific work plan. Before groundwater sampling, be sure to review the project-specific work plan or quality assurance project plan (QAPP) and any applicable state and federal guidelines or sampling procedures. All sampling and monitoring references must be available for consultation in the field, including:

- Company SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan, PSP and/or HASP, and QAPP

11.4 GENERAL PROCEDURES

Although the techniques used to sample groundwater are varied, most sampling events can be broken down into a three-step sequence:

1. Gauging: The measurement of the water column height (i.e., total well depth less depth-to-water) within the well.

2 Purging: The removal of stagnant water from the well bore to ensure that samples collected are representative of groundwater conditions in the water-bearing zone surrounding the well.
3 Sample Collection: After purging, the collection of aliquots of groundwater in method-specific, preserved (as needed) containers.

The procedures and equipment that are used to accomplish these steps are project-specific and should be discussed by the project team before arriving onsite. All types of groundwater sampling, however, regardless of the equipment used, share common handling and management procedures that are designed to ensure the integrity of the samples collected. These procedures include:

- The use of new, disposable, decontaminated, or dedicated sampling equipment
- The use and rotation of the appropriate PPE
- Selection of a suitable sampling location and staging area

Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact with gloves soiled during collection of the previous sample. The gloves must not contact the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised. ***Gloved hands should not be used as a sampling device; always use the appropriate equipment to move the sample from the sampling device to the laboratory-supplied containers.***

11.5 EQUIPMENT SELECTION

Collect all samples using either new, disposable equipment or properly decontaminated sampling equipment. Groundwater purging and sampling equipment should be selected based on the analytical requirements of the project and the project-specific conditions (e.g., well diameter, depth to water, dissolved constituents, etc.) likely to be encountered. The equipment should be constructed of non-reactive, non-leachable materials (e.g., stainless steel, Teflon®, Teflon®-coated steel, polyethylene, polypropylene, etc.) that are compatible with the chemical constituents at the site. Note that project or regulatory guidance may limit the type of equipment for groundwater sampling.

Consider the following when choosing groundwater purging and sampling equipment:

- the diameter and depth of the well
- the depth to groundwater
- the volume of water to be withdrawn
- the sampling and purging technique
- the volume of sample required
- the analytes of interest

Select the decontamination procedures based on the types of sampling to be performed and media encountered; decontamination may require multiple steps or differing cleaning methods (see SOP 6 for decontamination procedures). In no case, should disposable, single-use materials be used to collect more than one sample.

11.6 PRE-SAMPLING CONSIDERATIONS

You should perform the following activities in preparing for sampling with all observations and measurements noted in the field book and on the project-specific groundwater monitoring log, if appropriate:

- Perform a quick reconnaissance of the site to identify sampling locations and evaluate the accessibility to the sampling location.
- Record the approximate ambient air temperature, precipitation, wind (direction and speed), tide, and other field conditions. In addition, any site-specific conditions or situations that could potentially affect the samples at the sample locations should be recorded.
- Record temporary sampling locations with respect to approximate distance to and direction from at least one permanent feature.
- Survey the breathing zone around the sampling location with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate.
- Install the pump, tubing, passive sampler or other appropriate sampling equipment to the depth prescribed in the project-specific work plan or QAPP.

- Containerize and manage purge water in accordance with the project-specific work plan.

It is important to minimize any sources of cross-contamination that could compromise the integrity of the groundwater samples. Consider the following:

- Position fuel-powered equipment away from the sample collection area, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling, decontamination) that could influence the sample. This is particularly important when screening samples in the field for volatile organic compounds with a PID but should not be limited to the active sample collection.
- Establish a secure sample staging area in an uncontaminated area of the site.

11.7 GAUGING PROCEDURES

All wells should be opened to the atmosphere in advance of sampling to allow any pressure differentials, which could artificially raise or depress the water column in the well, to dissipate. The wells should be inspected to ensure that the protective casing is intact and has not been damaged. Remove the well covers and all standing water around the top of the well casing (for flush mounted-protective covers), as necessary, before opening the inner well cap or plug. Unlock and carefully remove well cap and allow the well to stand undisturbed for a minimum of 15 minutes, or as required by the project-specific work plan, before conducting any down-hole testing or measurements. If required by the HASP, survey the open well casing and the breathing zone around the wellhead with a PID to ensure that the level of PPE is appropriate.

11.7.1 GROUNDWATER LEVEL AND TOTAL DEPTH MEASUREMENT PROCEDURES

Depth to water (DTW) and total depth (TD) measurements are collected prior to sampling and are used to determine the volume water to be purged from the well (if using techniques other than no-purge or low flow sampling). The DTW measurements are also used after the field event to establish the groundwater elevation, flow direction, and gradient. Unless otherwise directed, do not place any objects inside the casing of private water wells; accordingly, DTW and TD measurements should not be collected at private water wells. Measurements of TD are not required for low flow and no-purge sampling applications and should not be measured before sampling the well.

Water level measurements must be collected within the shortest interval possible from all the wells to be gauged during the event before beginning any purge and sampling procedures at the site. This will ensure a nearly instantaneous snapshot of the water levels before the formations are disturbed by pumping or acted upon by other outside influences, such as tides, precipitation, barometric pressure, river stage, or intermittent pumping of production, irrigation, or supply wells.

Record the following observations and measurements (and the time when they were collected) in the field book:

- Measure the casing inside diameter (ID) and record in inches
- Measure the DTW with an electronic water level indicator (or an interface meter, if non-aqueous phase liquid [NAPL] is potentially present – see procedures below) from the top-of-casing (TOC) at the surveyor's mark, if present, and record the depth (to the nearest 0.01 foot) in feet below TOC
- If no mark is present, measure from the north side of the casing and mark the measuring point with a knife, metal file (if the inner casing is metal) or indelible marker for future reference
- Measure the TD from TOC at the surveyor's mark or north side of the casing, as appropriate.

Measuring the depth of deep wells with long water columns can be problematic due to tape buoyancy and weight effects or sediment in the bottom of the well casing. Care must be taken, and proper equipment selection must be used in these situations to ensure accurate measurements. Multiple TD measurements in silt-laden wells can provide a more precise assessment of the bottom depth.

11.7.2 GAUGING WELLS WITH NON-AQUEOUS PHASE LIQUID

If NAPL is potentially present at the site, the DTW and NAPL thickness measurements are collected using an interface meter capable of distinguishing between the NAPL and the groundwater, or a weighted tape coated with the appropriate reactive indicator paste for the suspected NAPL. Measuring NAPL thicknesses must be done with care to avoid agitating the liquids and generating an emulsion. This is particularly the case for light NAPL (LNAPL; those having a density less than water), which are typically viscous oils that cling to the probe. Oil coating the probe can result in thickness measurements that are biased high (i.e., overestimate the thickness of the NAPL).

Conduct the following procedures to ensure an accurate measurement of the NAPL thickness:

— For LNAPL, slowly lower the electronic interface probe in the well casing until the electronic tone indicates the probe is at the top of the LNAPL layer; measure the depth below the TOC to the nearest 0.01 foot.
— To gauge the NAPL thickness, advance the probe slowly through the layer until the electronic tone indicates top of the water column and then slowly bring the probe back up to the bottom of the LNAPL. Repeat this process several times to ensure an accurate measurement of the bottom of the LNAPL layer (which can include bubbles and an emulsion layer).
— For dense NAPL (DNAPL), advance the probe through the water column until the tone indicates the top of the DNAPL layer; record the depth below TOC.
— To gauge the DNAPL thickness, advance the probe through the layer to the bottom of the well.

11.8 GROUNDWATER PURGING PROCEDURES

Purging is a process whereby potentially stagnant water is removed allowing the collection of samples that are representative of groundwater conditions in the water-bearing zone. The water in a well bore that has not been purged may be different than the surrounding formation due to exposure to ambient air. There are several purging (and no-purge) methods that may be used, depending on specific conditions encountered (e.g., DTW, hydraulic conductivity of the formation, etc.) and the sampling requirements. The purge/no purge options are described below.

— *Multiple Volume Purge:* Traditional well purging technique that relies on the withdrawal of the volume of the well bore and the surrounding filter pack (if present); three to five well volumes are typically removed using pumps or bailers. This methodology relies on equipment that is easy to obtain and use and is generally accepted in most states as an appropriate purging method.
— *Temporary Well Purge:* A variation of the multiple volume purge technique that often uses inertia lift pumps, peristaltic pumps, or bailers to remove water from a temporary well or discrete groundwater sampler (e.g., a groundwater profiler or direct-push screen point sampler). This is a less stringent technique that is typically done to minimize the turbidity of the samples, which can be high due to the lack of a well filter pack.
— *Private Water Well or In-Place Plumbing Purge:* A variation on the multiple volume purge technique whereby a tap or faucet is opened on a fixed water supply pipe and is allowed to remain open until the potentially stagnant water within the well casing and other components of the system (e.g., fixed piping, pressure tanks, etc.) has been removed and groundwater representative of the water-bearing zone is discharged at the tap.
— *Low Flow (Minimal Drawdown/Low Stress) Purge (and Sampling):* A modified purging technique that establishes an isolated, discrete, horizontal flow zone directly adjacent to the pump intake; this method requires the pump to be placed within a screened-interval or open borehole. Pumping rates are typically 0.1 to 0.5 liters per minute (l/min) or less to minimize the stress on the surrounding formation and reduce the geochemical alteration of the groundwater caused by pumping.
— *No-Purge/Passive Sampling Techniques:* These techniques use specialized equipment, such as trap-style samplers or permeable diffusion bags, to sample the undisturbed water column within a screened interval or open borehole. This methodology assumes that the water in the well is representative of the surrounding formation. This approach is well suited for some volatile organic compounds (VOCs), metals, and hydrophobic compounds, depending on the sampling device used.

11.8.1 CALCULATING ONE PURGE VOLUME

Multiple volume purging techniques require that a ***minimum*** of three well volumes of water must be removed before sample collection. The actual amount of water removed may be greater than the three volumes, depending on geochemical parameter stabilization (the field measurement of these parameters is discussed below).

Calculate the volume of water in a well or boring using the following equation:

$$\textbf{Volume (gallons)} = \textbf{(TD – DTW) x ID}^2 \textbf{ x 0.041}$$

where:

TD = total depth (feet)

DTW = depth to water (feet)

ID = inner diameter (inches)

Alternately, the volume of water in a well or boring may also be calculated by multiplying the water column height by the gallons per foot of water for the appropriate well or boring diameter:

ID	Gallons per foot of water	Gallons per three water columns
1-inch	0.04	0.12
2-inch	0.16	0.48
3-inch	0.37	1.11
4-inch	0.65	1.98

Calculate the total volume of the pump, associated tubing and container for in situ measurements (flow-through cell), using the following equation:

Volume (in gallons) = P + ((0.0041)*D2*L) + fc

where:

P = volume of pump (gallons)
D = tubing diameter (inches)
L = length of tubing (feet)
fc = volume of flow-through cell (gallons)

11.8.2 MULTIPLE VOLUME PURGE PROCEDURES

Begin purging at a rate that will not cause excessive turbulence and drawdown in the well; commonly less than 1 gallon per minute for a typical 2-inch diameter monitoring well. You may need to observe the water elevation after the pump is started and adjust the flow rate to minimize the amount of drawdown in the well casing. The objective is to remove the stagnant water in the casing and surrounding filter pack or open borehole allowing water from the surrounding water-bearing zone to enter the well for sampling with as little disturbance as possible. Excessive pump rates or well dewatering can result in higher turbidity, potential volatilization, and geochemical alteration of dissolved parameters.

Typically collect geochemical parameters (i.e., pH, specific conductance, dissolved oxygen [DO], oxygen-reduction potential [ORP], and temperature) at a minimum frequency of once for every well volume of water removed during the purge process. Record the measurements in the field book along with any other pertinent details, such as the visual quality of the water (e.g., color, odor, and presence of suspended particulates) and the approximate withdrawal rate (this can be estimated using a calibrated container and stopwatch). Review the geochemical measurements to ensure that readings have stabilized (after the minimum purge volume has been achieved). This is a proxy for determining that you are purging formation water rather than potentially stagnant water in the casing. Stabilization occurs when at least three consecutive measurements are within the following tolerances:

Multiple Volume Purge Stabilization Parameters	
pH	± 0.1 standard units (SU)
Specific Conductance	± 3%
Temperature	± 3%
Dissolved Oxygen (DO)	± 0.2 milligrams per liter (mg/l) or 10% (flow-through cell only)
Turbidity	± 10% for values greater than 10 nephelometric turbidity units (NTU)
Oxygen Reduction Potential (ORP)	± 10 millivolts (mV; flow-through cell only)

Parameter stabilization that does not occur within five well volumes may require you consult your project manager to decide whether to collect a sample or to continue purging. Wells with extremely slow recharge may also be problematic. Purging these wells, in some cases, may result in dewatering the well before the minimum purge can be completed. Allow wells or borings purged dry to recharge to a level of approximately 90% of the static (pre-purge) water elevation and proceed immediately to sample collection. If recovery exceeds 2 hours, sample as soon as sufficient sample volume is available, in accordance with applicable regulations.

11.8.3 LOW FLOW PURGE PROCEDURES

Low flow purging and sampling is used to obtain representative groundwater samples without removing all the water within the well. The protocol uses relatively low pumping rates (i.e., less than 0.5 l/min) to establish an isolated zone around the inlet of the pump where flow is horizontal (i.e., from the water bearing zone) rather than from the stagnant water in the well casing above and below the pump. Selection of an appropriate pump is critical to establishing the flow zone: it must be well suited for both low pumping rates and the analytes being sampled. Bailers are not appropriate for low flow sampling.

The set-up for low flow sampling includes positioning the pump at the appropriate depth within the casing such that the pump inlet is within the screened section of the well. Slowly lower the pump, where appropriate, and tubing into the water column to avoid agitating the water column; use of a lanyard is recommended (i.e., do not use the extraction tubing to lift or lower the pump). Secure the pump and/or tubing at the wellhead once the specified sampling depth has been achieved and record the depth in the field book. Avoid contacting the bottom of the well by using pre-cut tubing at the appropriate length or by lowering the pump/tubing simultaneously with an electronic water level indicator. Once the pump/tubing has been inserted and secured, allow the water levels to return to static conditions before initiating the purge.

The discharge tubing must be connected to an in-line flow-through cell equipped with a multi-parameter real-time water quality meter. The flow-through cell minimizes the exposure of the groundwater to ambient air, which can influence DO and ORP measurements.

Start the pump and maintain a steady flow rate that results in a stabilized water level (less than 0.3 feet of drawdown or as specified in the project-specific work plan). The pumping rate may need to be adjusted depending on the response of the water levels in the well. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment. Purging should not exceed 0.5 l/min.

During purging, monitor and record the flow rate and geochemical parameters at 30 seconds to 5-minute intervals (depending on the hydraulic conductivity of the aquifer, diameter of the well, and pumping rate). Stabilization occurs once the following criteria have been met over three successive measurements made at least three minutes apart:

Low Flow Purge Stabilization Parameters	
Water Level Drawdown	<0.3 feet
pH	± 0.1 SU
Specific Conductance	± 3%
Temperature	± 3%
DO	± 0.2 mg/l or 10% (flow-through cell only)
Turbidity	± 10% for values greater than 10 NTU
ORP	± 10 mV (flow-through cell only)

Record any other notable observations in the field book (e.g., groundwater color).

11.8.4 NO-PURGE SAMPLING TECHNIQUES

Several alternate sampling devices are available, such as equilibrated grab samplers, passive diffusion samplers, and other in situ sampling devices, that will allow sample collection without purging the well. These devices may be particularly useful for sampling low permeability geologic materials, assuming the device is made of materials compatible with the analytical parameters, meets data quality objectives, and has been properly evaluated.

No-purge grab or trap samplers are placed in the well before sampling and typically remain closed (i.e., no water is allowed into the sampler during insertion) until the sampler is activated. This allows the sampler device to equilibrate with the surrounding groundwater (to prevent adsorption to the sampler materials) and for the groundwater to recover and re-establish the natural flow after the disturbance caused by the sampler insertion into the well. Typical equilibration times depend on the well recovery rates and the type of sampler used. Samples recovered using the no-purge devices are either transferred to containers at the well head or the sampler itself is shipped to the laboratory for analysis. Examples of equilibrated grab samplers include HydraSleeve™, Snap Sampler™, and Kemmerer samplers.

Equilibration time for diffusion samplers are generally dictated by the diffusion rate through the permeable membrane and, thus, are less sensitive to changes induced within the well during deployment. Most diffusion bag samplers have a minimum equilibration time of 14 days prior to sample collection. The samplers may be deployed for an extended period (e.g., three months or longer), although the continuous exchange between the sampler and the well water means that the sampler will likely reflect only the conditions in the few days preceding the sample collection.

11.8.5 TEMPORARY WELL PURGE PROCEDURES

Procedures used to purge temporary groundwater monitoring wells differ from permanent wells because temporary wells are installed for immediate sample acquisition. Wells of this type may include open bedrock boreholes, standard polyvinyl chloride well screen and riser placed in open boreholes, or drilling rod-based sampling devices (e.g., Wellpoint®, Geoprobe® screen point or Hydropunch® samplers). Purging temporary wells of this type may not be necessary because stagnant water is typically not present. However, if water is used in the drilling process, purging would be necessary. Purging can minimize the turbidity in the sample, which can be significant due to the disturbance caused by the sampler installation and to rinse the sampling system with groundwater. The exception is for groundwater profiling applications (e.g., using a Waterloo Profiler®) where a more rigorous purge is used (using the multiple volume purge techniques described above) to limit the potential for cross-contamination between sample intervals.

11.8.6 PRIVATE WATER WELL OR IN-PLACE PLUMBING PURGE PROCEDURES

The configuration and construction of private water wells varies widely and access points for obtaining groundwater samples may be limited. WSP personnel should coordinate with the property owner or site representative to access functioning ports and valves to avoid causing any inadvertent damage.

Collect the groundwater sample as close to the well as possible (e.g., from a sample port at the well head) to ensure the sample is representative. Ideally, the sample should be collected upstream of the piping and treatment equipment (e.g., particulate filter, water softener, carbon filters, ultra-violet lights), heating unit, or storage tanks. The following potential sampling locations are presented in order of preference:

- Sampling port or spigot near the well head or piping system prior to entry into the storage tank
- Sampling port or spigot at storage tank
- Sampling port or spigot downstream of the pressure tank or holding tank but upstream of any water treatment equipment
- Tap or faucet

If purging from a tap or faucet, try to remove any aerators, filters, or other devices from the tap before purging and work with the property owner or site representative to bypass any water treatment systems. Document where the sample was collected and any steps that were taken to minimize the potential alteration of the water sample in the field book.

Purge the system by opening the tap or spigot and allowing the water to run for several minutes. Observe and record the purge rate for the system. The minimum purge volume must be more than the combined volume of the pump, tanks, piping, etc. Review the geochemical measurements (after the minimum purge volume has been removed) to ensure that readings have stabilized using the same procedures as those used for the multiple volume purge detailed above. Purge the system for a minimum of 15 minutes if the minimum volume is unknown. Sample only after the geochemistry parameters have stabilized and no there are no suspended particles (e.g., iron or rust) visible. Record the final purge volume in the field book and any water quality observations.

11.9 GROUNDWATER SAMPLE COLLECTION PROCEDURES

Collect groundwater samples as soon as possible after the geochemical parameters indicate representative groundwater is present. As practically possible, reduce the pump flow rate, but maintain a flow rate high enough to deliver a smooth stream of water without splashing or undue agitation. Collect samples directly from the tubing as it exits the well bore; do not sample on the downstream side of flow-through cells or any other instrumentation. If using a bailer for sample collection, lower and raise the bailer slowly and smoothly to minimize the disturbance to the water within the well.

Collect groundwater samples in order of volatilization sensitivity with organic compounds sampled first followed by inorganic compounds:

- VOCs
- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Per- and Polyfluoroalkyl substances
- Total metals
- Dissolved metals (see filtering procedures below)
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

Collect quality assurance/quality control samples in accordance with SOP 4 and the project-specific work plan or QAPP.

As necessary, conduct field tests or screening in accordance with the project-specific work plan and manufacturer’s specifications for field testing equipment. Field samples must be directly transferred from the sampling equipment to the container that has been specifically prepared for that given parameter; intermediate containers should be avoided. If field chemical preservation is required, check the pH preservation by pouring a small portion of sample onto a pH test strip Adjust pH with additional preservative, if necessary.

Record the sample depth interval, if applicable, in the field book. Note the volume, phases, odor, and color of the groundwater.

11.9.1 GROUNDWATER FILTRATION PROCEDURES

Filtered groundwater samples are sometimes used for field kit analyses and should only be collected for laboratory analysis after approval from the appropriate regulatory agency or project manager. The filtered samples can be collected by attaching the in-line filter directly to the outlet tubing for a pressurized bailer, a submersible pump or a peristaltic pump. Intermediate containers can be used with a peristaltic pump if the well is too deep to use the pump to recover the sample directly. The intermediate container should be unpreserved laboratory-supplied glassware to avoid any cross-contamination during the filtering process.

Filtered samples using pumps should use the following procedures:

- Use a variable speed peristaltic pump with the in-line filter fitted on the outlet end of the tubing and the pump inlet tubing into the intermediate container holding the unpreserved groundwater sample; or,
- If a submersible pump is used to collect the groundwater sample, attached the in-line filter to the outlet end of the tubing (do not allow the groundwater to pass through flow-through cells or any other instrumentation while sampling)

Once the filter is connected:

- Turn on the pump and maintain a flow rate high enough to deliver a smooth stream of water without splashing or undue agitation. Hold the filter upright with the inlet and outlet in the vertical position and pump groundwater through the filter until all atmospheric oxygen has been removed and the minimum volume of water has been flushed through the filter, in accordance with the manufacturer's specifications
- Collect the filtered samples by placing the filtered output directly into the sample container
- If sediment is visible in the sample container after filtration, filter break-through has occurred and the sampling and filtering process should be repeated
- Discard the tubing and filter appropriately

Record sample filtration in the field book.

11.9.2 NON-AQUEOUS PHASE LIQUID SAMPLING PROCEDURES

Non-aqueous phase liquid is typically sampled to identify the compound, usually through an analytical "fingerprint" analysis. If samples are to be collected, the sampling options and techniques should be discussed with the assigned WSP compliance professional and project manager to ensure that the NAPL is either not considered to be a hazardous material for shipping to the laboratory or is properly shipped by qualified personnel using appropriate shipping containers (SOP 3). Samples of NAPL should be collected using the same procedures as above and placed in the appropriate laboratory-supplied containers, packed on ice, and shipped to the analytical laboratory using procedures outlined in SOP 3.

11.9.3 SAMPLE LABELING AND PREPARATION FOR SHIPMENT

Groundwater samples for offsite laboratory analysis should be prepared as follows:

1. Clean the outside of the sample container, if necessary
2. Affix a sample tag or label to each sample container and complete all required information (sample number, date, time, sampler's initials, analysis, preservatives, place of collection)
3. Place clear tape over the tag or label (if non-waterproof labels are used), as needed
4. If needed, preserve samples immediately after collection by placing them into an insulated cooler filled with bagged wet ice to maintain a temperature of approximately 4°Celcius
5. Record the sample designation, date, time, and the sampler's initials in the field book and on a sample tracking form, if appropriate
6. Complete the chain-of-custody forms with appropriate sampling information, including:
   - location
   - sample name
   - sample collection date and time
   - number of sample containers

  - analytical method
  - field filtration status

7 Secure the sample packing and shipping in accordance with proper procedures

Do not ship hazardous waste samples without first consulting a WSP compliance professional.

11.10 CLOSING NOTES

Secure and restore the site once sampling is completed. This may include locking permanent monitoring wells, staging the IDW, and disposing of (in conformance with applicable regulations) sampling expendables, such as plastic sheeting, tubing, and PPE. All locations where temporary wells or other sampling devices (e.g., profilers or direct-push equipment) should be marked with spray paint, stakes, or other appropriate method for future reference or survey, including collecting Global Positioning System coordinates and photographs, in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly manage all PPE and investigation-derived wastes in conformance with SOP 6, the project-specific work plan, and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #12

SURFACE WATER SAMPLING PROCEDURE

Surface water sampling procedures outlined in this Standard Operating Procedure (SOP) are designed to ensure that surface water samples are representative of the water body from which they were collected and that they have not been altered or contaminated by the sampling and handling methods. Potential surface water sample locations include freshwater and marine environments such as streams, rivers, ponds, lakes, canals, ditches, wetlands, lagoons, and estuaries. Surface water samples are collected for onsite screening or for offsite laboratory analysis. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

12.1 ACRONYMS AND ABBREVIATIONS

HASP	health and safety plan
IDW	investigation derived waste
NAPL	non-aqueous phase liquid
PPE	personal protective equipment
PSP	project safety plan
QAPP	quality assurance project plan
SOP	standard operating procedure

12.2 MATERIALS

- Field book
- PPE
- Air quality monitoring equipment (e.g., photoionization detector [PID]) with calibration reagents and standards, as needed
- Electronic water level indicator or interface probe
- Water quality meter(s) with calibration reagents and standards, as needed
- Field test kits, as needed
- Power supply, as needed
- Sampling containers and labeling/shipping supplies
- Hip-waders or rubber boots, as needed
- Personal flotation device, as needed
- Expanding ruler or tape measure
- Surface sampler (e.g., dipper, pump, bailer, composite sampler)
- Tubing, as needed
- Lanyard materials (e.g., nylon rope, steel cable), as needed
- Filters, as needed
- Decontamination supplies

12.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel

and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company's SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for conducting groundwater sampling and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), investigation derived waste (IDW) management procedures (SOP 5), equipment decontamination (SOP 6), and use and calibration of all sampling and monitoring equipment (SOPs 7 and 8). This SOP does not cover investigation planning, nor does it cover the analysis of the analytical results. These topics are more appropriately addressed in a project-specific work plan. Before sampling, be sure to review the project-specific work plan or Quality Assurance Project Plan (QAPP) and any applicable state and federal guidelines or sampling procedures.

All sampling and monitoring references must be available for consultation in the field, including:

- Company SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan, PSP and/or HASP, and QAPP

12.4 GENERAL PROCEDURES

Although the sampling equipment and techniques used to sample surface water are varied, most sampling can be broken down into a two-step sequence:

1. Gauging: provides an indication of the surface water elevation
2. Sample Collection: collection of aliquots in method-specific, preserved (as needed) containers that are representative of the conditions in the surface water body

Be aware that stagnant and moving water bodies may require varying the sampling order and could also require concurrent monitoring and recording of geochemical parameters to assist with identifying a sample interval. Follow your project-specific work plan to accommodate any variances in sampling order.

The procedures and equipment that are used to accomplish these steps are project-specific and should be discussed by the project team before arriving onsite. All types of surface water sampling, regardless of the equipment used, share common handling and management procedures that are designed to ensure the integrity of the samples collected. These procedures include:

- The use of new, disposable or decontaminated sampling equipment
- The use, changing, and disposal of the appropriate PPE
- Selection of a suitable sampling location and staging area

Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact with gloves soiled during collection of the previous sample. The gloves must not contact the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised. ***Gloved hands should not be used as a sampling device; always use the appropriate equipment to move the sample from the sampling device to the laboratory-supplied containers.***

12.4.1 EQUIPMENT SELECTION

Collect all samples using either new, disposable equipment, or properly decontaminated sampling equipment. Surface water gauging and sampling equipment should be selected based on the analytical requirements of the project and the project-specific conditions (e.g., water body depth, sample volume, chemical constituents in sample water, etc.) likely to be encountered. The equipment should be constructed of non-reactive, non-leachable materials (e.g., stainless steel, Teflon®, Teflon®-coated steel, polyethylene, polypropylene, etc.). Extension rods or other appropriate devices can be used, as necessary, to allow the sample to be collected from a distance (or through deeper water) to minimize the safety risk to the sampler. Note that project or regulatory guidance may limit the type of equipment for sampling.

Consider the following when choosing sampling equipment:

- the type and location of the surface water
- the required depth of the sample
- the volume of sample required
- the analytes of interest

Select the decontamination procedures based on the types of sampling to be performed and decontamination may require multiple steps or differing cleaning methods, depending on the sampling goals (see SOP 6 for decontamination procedures). In no case should disposable, single use materials be used to collect more than one sample.

12.4.2 PRE-SAMPLING CONSIDERATIONS

You should perform the following activities in preparing for sampling with all observations and measurements noted in the field book and on the project-specific groundwater monitoring log, if appropriate:

- Perform a quick reconnaissance of the site to identify sampling locations. Note that project or regulatory guidance may limit the type of equipment for surface water sampling.
- Record the approximate ambient air temperature, precipitation, wind (direction and speed), tide, and other field conditions. In addition, any site-specific conditions or situations that could potentially affect the samples at the sample locations should be recorded.
- Describe the sampling location including the width of the surface water, depth of surface water, water color and clarity (transparency), and approximate surface flow (e.g., slow, fast moving, etc.).
- Record sampling locations with respect to approximate distance to and direction from at least one permanent feature.
- Survey the breathing zone around the sampling location with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate.

When sampling surface water, it is important to find a suitable sampling location away from any sources of cross-contamination that could compromise the integrity of the samples. Consider the following:

- Position the sample collection area away from fuel-powered equipment, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling, decontamination) that could influence the sample. This is particularly important when screening samples in the field for volatile organic compounds, but should not be limited to the active sample collection.
- If sediment samples are being collected concurrently, collect the surface water samples first to avoid disturbing the bottom and suspending sediment in the water column.
- Avoid wading into surface water, if possible, to avoid sediment suspension and potential cross-contamination.
- If collecting several surface water samples from a stream or river, start sampling at the downstream location and progressively move upstream.
- If using watercraft, orient the watercraft so that the bow is positioned in the upstream direction; collect samples near the bow, away and upwind from any fuel-powered equipment.
- Establish a secure sample staging area in an uncontaminated area of the site.

12.4.3 SAFETY CONSIDERATIONS

Surface water sampling presents a number of unique safety challenges. All water bodies, particularly those with moving water, are inherently dangerous and must be approached with caution. Steep embankments, loose footing, and the potential presence of subsurface hazards (or dangerous plants or wildlife, for some parts of the country) can lead to serious injury or even death.

A minimum of two people must be present during collection and samplers must use appropriate safety equipment (as outlined in the project HASP), such as insulated waders, snake chaps, and flotation devices. If possible, avoid wading into surface water. Be aware of recent weather conditions, tidal changes, or other events (e.g., a dam release), which may result in unexpectedly higher water or flow conditions (or temperature changes) at different times of the year. Do not bodily enter pipes, such as storm sewers or other drainage conveyances during surface water collection as these may be considered confined spaces.

12.5 SURFACE WATER LEVEL MEASUREMENT PROCEDURES

Surface water level measurements are typically collected prior to surface water sampling and are used after the sampling event is completed to establish surface water elevation, discharge, and groundwater/surface water interaction (e.g., gaining or losing stream, flow direction).

Surface water level measurements **MUST** be collected within the shortest interval possible from **all selected existing stream gauges or established measuring points** during the event. If groundwater level measurements are to be collected, gauging should be performed concurrently in accordance with SOP 11. This will ensure a nearly instantaneous snapshot of the water levels before the water body is acted upon by other outside influences, such as tides, precipitation, barometric pressure, river stage, or intermittent pumping of nearby production, irrigation, or supply wells.

Measure the surface water level on the stream gauge or depth to water and total depth from an established measuring point (e.g., bridge) with an electronic water level tape or appropriate equipment and record observations and measurements in the field book. If non-aqueous phase liquids (NAPL) are present on the surface water body, measure the NAPL thickness using the stream gauge (or other appropriate equipment) and record observations and measurements in the field book.

12.6 SURFACE WATER SAMPLE COLLECTION PROCEDURES

Collect surface water samples using the appropriate sampling vessel in accordance with the project-specific work plan. Slowly lower the method-specific sampling vessel (e.g., dippers, sampling container, etc.) into the surface water to the desired sampling depth; Kemmerer, Niskin, Van Dorn, or similar samplers, pumps equipped with tubing, or double check valve bailers can be used to collect samples 12 inches or deeper below the water surface. Allow surface water to slowly enter the sampling vessel until the necessary sample volume has been collected. Once filled, slowly retrieve the sampling vessel and transfer the surface water directly to the sample containers. As applicable, retrieve the sampler at a slightly tilted angle in the upstream direction to minimize the disturbance. If necessary, collect additional surface water to provide sufficient sample volume. Field samples must be directly transferred from the sampling equipment to the container that has been specifically prepared for that given parameter; intermediate containers should be avoided.

Automatic composite samplers are frequently deployed at sites needing long-term surface water sampling. In some sampling situations, automatic composite samplers are permanently installed at surface water stations and remain in the field for months or even years.

Collect surface water samples in order of volatilization sensitivity with organic compounds sampled first followed by inorganic compounds:

- Volatile organic compounds
- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Per- and Polyfluoroalkyl substances
- Total metals

— Dissolved metals (see filtering procedures below)
— Inorganic non-metallic and physical and aggregate properties
— Microbiological samples
— Radionuclides

Water quality parameters (e.g.,temperature, depth, dissolved oxygen, pH, total dissolved solids, specific conductance, turbidity, salinity, oxidation reduction potential, and others) are typically measured in the field as specified in the project planning documents. Collect quality assurance/quality control samples in accordance with SOP 4 and the project-specific work plan or QAPP.

As necessary, conduct field tests or screening in accordance with the project-specific work plan and manufacturer's specifications for field testing equipment. Field samples must be directly transferred from the sampling equipment to the container that has been specifically prepared for that given parameter; intermediate containers should be avoided. If field chemical preservation is required, check the pH preservation by pouring a small portion of sample onto a pH test strip. Adjust pH with additional preservative, if necessary.

Record the depth interval, if applicable, which the sample was collected in the field book. Note the volume, phases, and color of the surface water in the field book.

12.6.1 SURFACE WATER FILTRATION PROCEDURES

Filtered surface water samples are sometimes used for field kit analyses and should only be collected for laboratory analysis after approval from the appropriate regulatory agency and/or project manager. If surface water sample filtration is necessary, the following procedures should be followed:

Filtered samples using pumps should use the following procedures:

— Use a variable speed peristaltic pump with the in-line filter fitted on the outlet end; pressurized bailers or submersible pumps can also be used if sampling the surface water body directly.
— Insert the pump inlet tubing into the intermediate container holding the unpreserved surface water sample or surface water body.

Once the filter is connected:

— Turn on the pump and reduce the flow rate, but maintain a flow rate high enough to deliver a smooth stream of water without splashing or undue agitation, hold the filter upright with the inlet and outlet in the vertical position and pump surface water through the filter until the minimum volume of water has been flushed through the filter, in accordance with the manufacturer's specifications.
— Collect the filtered samples directly into the sample container from the pump-filter assembly.
— If sediment is visible in the sample container after filtration, filter break-through has occurred and the sampling and filtering process should be repeated; the sediment-containing sample should be discarded appropriately.
— Discard the tubing and filter appropriately.
— Record sample filtration in the field book.

12.6.2 NAPL SAMPLING PROCEDURES

NAPL samples are not typically collected from surface water. If samples are to be collected, sampling options and techniques should be discussed with the assigned project compliance professional and project manager; ensure that the NAPL is not considered to be a hazardous material for the purpose of shipping to the laboratory (SOP 3). Samples of NAPL should be placed in the appropriate laboratory-supplied containers, packed on ice, and shipped to the analytical laboratory using procedures outlined in SOP 3.

12.6.3 SAMPLE LABELING AND PREPARATION FOR SHIPMENT

Samples for offsite laboratory analysis should be prepared as follows:

1 Clean the outside of the sample container, if necessary

2. Affix a sample tag or label to each sample container and complete all required information (sample number, date, time, sampler's initials, analysis, preservatives, place of collection)
3. Place clear tape over the tag or label (if non-waterproof labels are used)
4. If needed, preserve samples immediately after collection by placing them into an insulated cooler filled with bagged wet ice to maintain a temperature of approximately 4°Celcius
5. Record the sample designation, date, time, and the sampler's initials in the field book and on a sample tracking form, if appropriate
6. Complete the chain-of-custody forms with appropriate sampling information, including:
   - location
   - sample name
   - sample collection date and time
   - number of sample containers
   - analytical method
   - field filtration status
7. Secure the sample packing and shipping in accordance with proper procedures

Do not ship hazardous waste samples without first consulting a WSP compliance professional.

12.7 CLOSING NOTES

Once sampling is completed, secure the locations in accordance with the project-specific project work plan. Mark all sample locations with stakes or other appropriate markers for future reference or survey, including collecting Global Positioning System coordinates and photographs, in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly manage all PPE and IDW in conformance with SOP 6, the project-specific work plan, and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #18

WASTEWATER SAMPLING PROCEDURES

Wastewater sampling procedures outlined in this standard operating procedure (SOP) are designed to ensure that samples are representative of the wastewater from which they were collected and that they have not been altered or contaminated by the sampling and handling methods. Wastewater samples are generally collected from influent or effluent waste streams at domestic and non-domestic facilities, including water treatment systems and outfalls (e.g., streams, rivers, ponds, lakes, canals, ditches, wetlands, lagoons, and estuaries); wastewater samples are also collected from liquids associated with solid waste materials. Wastewater samples can be collected for onsite screening or for laboratory analysis. The user is advised to read the entire SOP and review the site health and safety plan (HASP) and/or project safety plan (PSP) before beginning any onsite activities. In accordance with the HASP or PSP, proper personal protective equipment (PPE) must be selected and used appropriately.

18.1 ACRONYMS AND ABBREVIATIONS

HASP	Health and safety plan
IDW	Investigation-derived waste
NAPL	Non-aqueous phase liquid
PID	Photoionization detector
PPE	Personal protective equipment
PSP	Project safety plan
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
SOP	Standard operating procedure
VOC	Volatile organic compounds

18.2 MATERIALS

- Field book
- PPE
- Air quality monitoring equipment (e.g. photoionization detector [PID]) with calibration reagents and standards, as needed
- Electronic water level indicator or interface probe
- Water quality meter(s) with calibration reagents and standards
- Field test kits, as needed
- Sample bottles, labels, indelible markers, and clear tape
- Hip-waders or rubber boots, as needed
- Expanding ruler or tape measure
- Wastewater sampler (e.g., dipper, pump, bailer, composite sampler)
- Tubing, as needed
- In-line filter; variable-speed peristaltic pump or a submersible pump, as needed
- Lanyard materials, as needed
- Decontamination supplies

18.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

WSP requires that all personnel performing specific project assignments be appropriately qualified, including having required certifications or licenses, and properly trained in accordance with the requirements of their assignment, the Environmental Service Line's field SOPs, and the Quality Management System.

This SOP is designed to provide the user with a general outline for conducting wastewater sampling and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), investigation-derived waste (IDW) management procedures (SOP 5), equipment decontamination (SOP 6), use and calibration of all sampling and monitoring equipment (SOPs 7 and 8), and solid waste sampling (SOP 17). This SOP does not cover investigation planning, waste storage, waste characterization, or waste profiling, nor does it cover the evaluation of the analytical results. These topics are more appropriately addressed in a project-specific work plan. Before sampling, be sure to review the project-specific work plan or quality assurance project plan (QAPP) and any applicable state and federal guidelines or sampling procedures.

Consult the company's compliance professionals during all phases of wastewater sampling. Do not ship hazardous waste samples without first consulting a company compliance professional.

All sampling and monitoring references must be available for consultation in the field, including:

- Company SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan, project safety plan and/or HASP, and QAPP

18.4 GENERAL PROCEDURES

Wastewater sampling presents a number of unique challenges for safe collection due to the potentially hazardous environment(s) where waste materials are located. Sampling of closed waste containers (e.g., drums, tanks) is considered a higher hazard risk because of the potential of exposure to toxic gases, internal pressure, or flammable/explosive atmospheres. The breathing zone must be monitored with the appropriate equipment when waste containers are opened for sampling to ensure that the safety of the work environment is not compromised. Follow the appropriate safety requirements stipulated in the HASP. Do not bodily enter tanks, sumps, or waste containers, or pipes, such as storm sewers or other drainage conveyances, during sample collection.

Company personnel are not authorized to open closed units that are unlabeled or contain unknown contents.

Each sampling situation will have a unique set of sampling equipment requirements and techniques. The selected equipment and procedures are project-specific and should be discussed by the project team, including the assigned compliance professional, before arriving onsite. All types of wastewater sampling, regardless of the equipment used, share common handling and management procedures that are designed to ensure the integrity of the samples collected. These procedures include:

- The use of new, disposable or decontaminated sampling equipment
- The use and rotation of the appropriate PPE
- Selection of a suitable sampling location and staging area

Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact with gloves soiled during collection of the previous sample. The gloves must not contact the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised. ***Gloved hands should not be used as a sampling device; always use the appropriate equipment to move the sample from the sampling device to the laboratory-supplied containers.***

18.4.1 EQUIPMENT SELECTION

Collect all samples using either new, disposable equipment, or properly decontaminated sampling equipment. Common wastewater sampling equipment includes handheld tools (e.g., dippers, bailers), pumps, permanently-deployed automatic or manual composite samplers, or sampling ports. Follow the manufacturer's operation manual for proper sampling procedures. When choosing sampling equipment, give consideration to:

- the type and location of the waste unit
- the required depth of the sample
- the volume of sample required
- the analytes of interest

The equipment should be selected based on the analytical and project-specific requirements and should be constructed of non-reactive, non-leachable materials (e.g., stainless steel, Teflon®, Teflon®-coated steel, polyethylene, polypropylene) that are compatible with the chemical constituents at the site. Extension rods can be used, as necessary, to minimize the risk to the sampler by allowing the sample to be collected at a distance or through deeper water.

Select the decontamination procedures based on the types of sampling to be performed and media encountered; decontamination may require multiple steps or differing cleaning methods, depending on the sampling objectives and media encountered (see SOP 6 for decontamination procedures). In no case should disposable, single use materials be used to collect more than one sample.

18.4.2 SAMPLING CONSIDERATIONS

In preparation for sampling, you should perform the following activities (all observations and measurements noted in the field book):

- Perform a quick reconnaissance of the site to identify sampling locations and evaluate the accessibility to the waste unit, including ladders or stairs, and ensure that proper grounding is present, if needed.
- Record the approximate ambient air temperature, precipitation, wind (direction and speed), tide, and other field conditions in the field book. In addition, any site-specific conditions or situations that could potentially affect the samples at the sample locations should be recorded.
- Record sample locations with respect to approximate distance to and direction from at least one permanent feature.
- Describe the sampling location including width of discharge (or diameter of pipe), depth of discharge, water color and clarity (transparency), and approximate surface flow (e.g., slow, fast moving)
- Survey the breathing zone around the sampling location with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate.

When sampling, it is important to find a suitable sampling location away from any sources of cross-contamination that could compromise the integrity of the samples. Consider the following:

- Position the sample collection area away from fuel-powered equipment, such as engines or generators, and upwind of other site activities (e.g., purging, sampling, decontamination) that could influence the sample. This is particularly important when screening samples in the field for volatile organic compounds (VOCs) with a PID, but should not be limited to the active sample collection.
- Establish a secure sample staging area in an uncontaminated area of the site.
- If solid waste or sediment samples are being collected from the same location or vessel, collect the wastewater samples first to avoid disturbing the bottom and suspending solid wastes or sediment in the water column.
- If collecting several wastewater samples from a linear water body with moving water (e.g., stream, ditch, pipe, or river), start sampling at the downstream location and progressively move upstream.

- Avoid wading into surface discharges, if possible, to avoid sediment suspension and potential cross-contamination; if not possible to avoid wading into the discharge for sample collection, use extreme caution and carefully approach the sample location to minimize disturbance of fine sediments.
- Field personnel should coordinate the sample collection with the property owner/representative for the safety of the field personnel, as well as to minimize potential interference with wastewater operations.
- If using watercraft, collect samples near the bow, away and upwind from any fuel powered equipment; orient the watercraft so that the bow is positioned in the upstream direction. This is particularly important when screening for VOCs with a PID, but should not be limited to the active sample collection.
- Store samples already collected from the field for laboratory analysis in clean containers in an ice-filled cooler (as required) and securely stage, if possible, in an uncontaminated area of the site.

18.4.3 SAFETY CONSIDERATIONS

Wastewater sampling may present a number of unique challenges. All water bodies, particularly those with moving water, are inherently dangerous and must be approached with caution. Steep embankments, loose footing, and the potential presence of subsurface hazards (or dangerous plants or wildlife, for some parts of the country) can lead to serious injury or even death.

Samplers must use appropriate safety equipment (as outlined in the project HASP), such as insulated waders, snake chaps, and flotation devices. If possible, avoid wading into wastewater streams. Be aware of weather conditions, tidal changes, or other events (e.g., a dam release), which may result in unexpectedly higher water, flow conditions, or temperature changes. Do not attempt to sample surface impoundments used to manage potentially hazardous wastes from a boat; all sampling should be conducted from the banks or piers of surface impoundments.

Employees are not authorized to sample surface impoundments used to manage wastes from a boat; all sampling should be conducted from the banks or piers of surface impoundments.

Company personnel are only authorized to open closed units that contain known contents.

Because waste often stratifies over time due to different densities of phases, settling of solids, or varying wastes generated at different times, both solid and liquid waste samples may need to be collected (see SOP 17 for solid and semi-solid waste material sampling procedures).

Before opening, visually inspect all waste units for the following:

- pressurization (bulging/dimples)
- crystals formed around the drum opening
- leaks, holes, stains
- labels, markings, hazardous warnings, potential shock sensitivity (as indicated by contents listed on waste label)
- composition and type (steel/polyethylene/polypropylene and open/bung)
- dead vegetation around drum
- condition, age, rust
- sampling accessibility (including a determination if it qualifies as a confined space)

Caution should be exercised when :

- Opening closed waste containers, such as sealed drums, because of the potential pressurization and presence of explosive/flammable gases and/or toxic vapors.
- Sampling in situ wastes (e.g., landfills) because of the potential presence of explosive/flammable gases or toxic vapors.
- Sampling stockpiled waste or the surface of a waste disposal unit may not be stable and could present an engulfment hazard.

Waste containers showing evidence of pressurization and/or crystals must be furthered assessed to determine if remote opening is needed.

If containers cannot be accessed for sampling, heavy equipment may be necessary to stage the containers before sampling. Adequate time should be allowed for the contents to stabilize after a container is handled.

A grounding strap must be used when sampling metal waste containers, such as 55-gallon steel drums, due to the potential presence of explosive/flammable gases. First attach a grounding strap, then touch the waste container opening with a gloved hand and allow an electrically conductive path to form, as appropriate. Using spark-resistant tools, slowly open the waste container (e.g., vents, pressure release valves, bung or drum ring and/or lid) to allow the unit to vent to the atmosphere. Do not attempt to use a manual bung wrench or de-header on drums that potentially contain shock-sensitive, reactive, explosive or flammable materials. Once sampling is complete, (re)seal the waste container in accordance with the manufacturer's instructions.

Do not bodily enter containers, such as roll off boxes, or pipes, such as storm sewers or other drainage conduits, during sample collection as these may be considered confined spaces.

Heavy equipment may also be necessary to collect samples from inaccessible locations (e.g., excavator bucket used to collect sample from an excavation pit).

18.5 WASTEWATER PURGING PROCEDURES

There are two primary types of wastewater samples: grab samples and composite samples. A grab sample is a single sample collected at one time, while a composite wastewater sample consists multiple temporal or spatially discrete samples combined and treated as a single sample. Refer to the project-specific work plan for prescribed sampling procedures, and refer to the manufacturer's specifications for sample collection equipment used.

Access points for obtaining waste water samples may be limited. Field personnel should coordinate with the property owner/representative to access functioning ports and valves to avoid causing any inadvertent damage.

If purging from a port, tap or faucet, try to remove any aerators, filters, or other devices from the tap before purging. Document where the sample was collected and any steps that were taken to minimize the potential alteration of the sample in the field book. Start to purge the system by opening the tap or spigot. Observe and record the wastewater purge rate, and continue the purge for 1 to 2 minutes to allow the settled solids to flush from the pipe, and then proceed with sample collection. Record in the field book:

- the total purge volume
- sample collection time; for composite samplers, also record the start and stop sample collection date and time for temporal composite samples, or sample locations for spatially discrete composite samples
- any water quality observations

18.6 WASTEWATER SAMPLE COLLECTION PROCEDURES

For locations without permanent samplers or ports, slowly lower the method-specific sampling vessel (e.g., dippers, sampling container) into the wastewater body to the desired sampling depth; Kemmerer, Niskin, Van Dorn, or similar samplers, pumps equipped with tubing, or double check valve bailers can be used to collect samples 12 inches or deeper below the water surface. Allow the wastewater to slowly enter the sampling vessel until the necessary sample volume has been collected. Once filled, slowly retrieve the sampling vessel at a slightly tilted angle in the upstream direction to minimize the disturbance. If necessary, collect additional wastewater to provide sufficient sample volume. Field samples must be directly transferred from the sampling equipment to the container that has been specifically prepared for that given parameter; avoid use of intermediate containers, unless filtration is required (see Section 18.6.1).

For sample collection with permanent samplers or ports, reduce the flow rate to maintain a flow rate high enough to deliver a smooth stream of wastewater without splashing or undue agitation.

Collect wastewater samples in order of volatilization sensitivity with organic compounds sampled first followed by inorganic compounds:

- VOCs (if possible, collect at a flow rate less than 100 milliliters per minute)
- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Per- and Polyfluoroalkyl substances

- Total metals
- Dissolved metals (see filtering procedures below)
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

Collect quality assurance/quality control samples in accordance with SOP 4 and the project-specific work plan or QAPP.

As necessary, conduct field tests or screening in accordance with the project-specific work plan and manufacturer's specifications for field testing equipment. Field samples must be directly transferred from the sampling equipment to the container that has been specifically prepared for that given parameter; intermediate containers should be avoided.

Record the sample depth interval, if applicable, in the field book. Note the volume, phases, and color of the wastewater in the field book.

18.6.1 WASTEWATER FILTRATION PROCEDURES

Filtered wastewater samples are sometimes used for laboratory or field kit analyses and should only be collected for laboratory analysis after approval from the appropriate regulatory agency and/or project manager. Wastewater filtration is typically done using a variable-speed peristaltic pump or a submersible pump with the in-line filter fitted on the outlet end of the attached tubing. If wastewater sample filtration is necessary, the following procedures should be followed:

1. Insert the pump inlet tubing in the surface water body or, if appropriate, into a laboratory-supplied intermediate container holding the surface water sample to be filtered
2. Turn on the pump; maintain a flow rate high enough to deliver a smooth stream of water but low enough to minimize splashing or undue agitation. Hold the filter upright with the inlet and outlet in the vertical position and pump surface water through the filter until all atmospheric oxygen has been removed and the minimum volume of water has been flushed through the filter, in accordance with the manufacturer's specifications
3. Collect the filtered samples directly into the laboratory-supplied sample container from the pump-filter assembly
4. If sediment is visible in the sample container after filtration, filter break-through has occurred and the sampling and filtering process should be repeated
5. Discard the tubing and filter appropriately

18.6.2 NON-AQUEOUS PHASE LIQUID SAMPLING PROCEDURES

Non-aqueous phase liquids (NAPL) are not typically collected from wastewater units. If NAPL samples are required, the sampling options and techniques should be discussed with the assigned compliance professional and project manager to ensure that the NAPL is not considered to be a hazardous material for the purpose of shipping to the laboratory (SOP 3). Samples of NAPL should be collected using the same procedures as above and placed in the appropriate laboratory-supplied containers, packed on ice, and shipped to the analytical laboratory using procedures outlined in SOP 3.

18.6.3 SAMPLE LABELING AND PREPARATION FOR SHIPMENT

Once collected, prepare the wastewater samples for offsite laboratory analysis:

1. Clean the outside of the sample container, if necessary
2. Affix a sample tag or label to each sample container and complete all required information (sample number, date, time, sampler's initials, analysis, preservatives, place of collection)
3. Place clear tape over the tag or label (if non-waterproof labels are used)
4. If needed, preserve samples immediately after collection by placing them into an insulated cooler filled with bagged wet ice to maintain a temperature of approximately 4°Celcius

5 Record the sample designation, date, time, and the sampler's initials in the field book and on a sample tracking form, if appropriate
6 Complete the chain-of-custody forms with appropriate sampling information, including:
   - location
   - sample name
   - sample collection date and time
   - number of sample containers
   - analytical method
7 Secure the sample packing and shipping in accordance with proper procedures

Do not ship hazardous waste samples without first consulting a WSP compliance professional.

18.7 CLOSING NOTES

Once sampling is completed, secure the wastewater unit(s) in accordance with the project-specific work plan. If possible, restore and mark all sample locations with spray paint, stakes, or other appropriate marker for future reference or survey, including collecting Global Positioning System coordinates and photographs, in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly manage all PPE and IDW in conformance with SOP 6, the project-specific work plan, and applicable regulations.