Quality Assurance Project Plan

Cabot Portion of Cabot Carbon/Koppers Site
Gainesville, Florida

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Abbreviations

ACEPD	Alachua County Environmental Protection Department
Beazer	Beazer East, Inc.
Cabot	Cabot Corporation
CCA	Chromate Copper Arsenate
CCB	Continuing Calibration Blank
CCC	Continuing Calibration Check
COC	Chain of Custody
DQI	Data Quality Indicator
DQO	Data Quality Objective
EDD	Electronic Disk Deliverable
FB	Field Blank
FD	Field Duplicate
FDEP	Florida Department of Environmental Protection
FID	Flame Ionization Detector
FTL	Field Team Leader
GRU	Gainesville Regional Utilities
HCl	Hydrochloric Acid
HVAC	Heating, Ventilation, and Air Conditioning
ICB	Initial Calibration Blank
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IDW	Investigation-derived Waste
IRC	Information Resource Center
GC	Gas Chromatography
LCS	Laboratory Control Sample
LFB	Laboratory Fortified Blank
LIMS	Laboratory Information Management System
MB	Method Blank
MD	Matrix Duplicate
MDL	Method Detection Limit
MPC	Measurement Performance Criteria
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ORP	Oxidation Reduction Potential
OSHA	Occupational Safety and Health Administration
PCP	Pentachlorophenol
PID	Photo-ionization Detector
QAPP	Quality Assurance Project Plan
QA	Quality Assurance
QAO	Quality Assurance Officer
QC	Quality Control
QL	Quantitation Limit
ROD	Record of Decision

RPD	Relative Percent Difference
RSD	Relative Standard Deviation
SDG	Sample Delivery Group
SOP	Standard Operating Procedure
SVOC	Semi-volatile Organic Compound
TB	Trip Blank
TIC	Tentatively Identified Compound
US EPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
Weston	Weston Solutions, Inc.

A Project Overview

This Quality Assurance Project Plan (QAPP) defines quality assurance/quality control (QA/QC) procedures to be performed in support of remedial activities on the Cabot portion of the Cabot Carbon/Koppers Superfund Site (Site), located in Gainesville, Florida. This QAPP fulfills the requirements of the "Quality Management Plan for EPA Region 4" (US EPA Region IV, 2007) specified in the checklist provided by the United States Environmental Protection Agency (US EPA) to Cabot Corporation (Cabot) on October 20, 2014. A copy of the QAPP checklist is included as Appendix A.

A.3[1] Distribution List: Including Addresses of All Entities or Agencies Requiring Copies of the QAPP

Table A.3.1 lists the individuals and organizations to whom the QAPP will be distributed. Each iteration of the document will be dated and assigned a revision number to track the distribution of original and revised documents. Gradient will maintain a copy of this table throughout the duration of the project.

Tables A.3.2 and A.3.3 provide the Project Personnel Sign-off Sheet and Laboratory Personnel Sign-off Sheet, respectively. The Personnel Sign-off Sheets will be used to document that the project team (including off-Site laboratory personnel) have read the QAPP and understand the requirements presented herein. The list will be revised as personnel are added to or leave the project team. The Project Coordinator will gather and retain signed originals of the Project Personnel Sign-off Sheet and Laboratory Personnel Sign-off Sheet.

A.4 Project – Task Organization

This section identifies key project personnel, specifies technical disciplines, details roles and responsibilities associated with project personnel, and presents the project chain of command.

A.4.1 Project Organization

The Project Coordinator, who has primary responsibility for implementation of the work on the Cabot portion of the Site is the Cabot Manager of Environmental Assessment and Remediation, Wayne Reiber. The key representatives for Cabot at the Site are Gradient, as the Supervising Contractor, and Weston Solutions, Inc. (Weston), as the Field Operations Contractor. The Supervising Contractor (Gradient) is responsible for overall project coordination, technical oversight, direction of all aspects of the work implemented at the Site, and management of the project team. The Field Operations Contractor (Weston) is responsible for implementation of sampling, remedial, and other field activities as well as coordination with subcontractors and the laboratory. The primary analytical laboratory for the Cabot portion of the Site is TestAmerica, although other laboratories may be identified and used for specialty analyses, if the need arises. The organizational chart is presented as Figure A.4.1.

[1]The organization, major section headings, and section numbering in this QAPP are aligned with the US EPA Region IV checklist in Appendix A. Sections A.1 and A.2 are the cover page and Table of Contents.

A.4.2 Communication Pathways

Formal communication between Cabot and the US EPA, as well as other stakeholders – including the Florida Department of Environmental Protection (FDEP), the Alachua County Environmental Protection Department (ACEPD), and Gainesville Regional Utilities (GRU) – will take place through Cabot's representative(s), unless specific authorization is given to do otherwise. In general, Weston will schedule and implement field activities, and Gradient will provide technical review and comment. Gradient and/or Weston will complete project documentation and report preparation for submittal to US EPA and other stakeholders.

A.4.3 Personnel Responsibilities and Qualifications

Key personnel during implementation of Site-specific investigations associated with this QAPP include: the US EPA project manager and Cabot's representatives (Gradient and Weston project teams).

US EPA Remedial Project Manager

The Remedial Project Manager for the Site is Mr. Scott Miller. Mr. Miller's primary responsibilities include administration of US EPA's responsibilities and administrative oversight of the environmental investigations and remedial actions conducted at the Site under the Consent Decree.

Gradient Project Team

Gradient is responsible for overall project coordination and management of the project team. Gradient is also responsible for technical review and oversight; database management and data analysis; QA review; and communication with Cabot, US EPA, and other team members. The key Gradient personnel are listed below.

- **Principal Engineer – Manu Sharma, PE:** The Principal Engineer provides technical expertise, review, and guidance to advance the conceptual understanding of the Site and meet overall project goals.
- **Project Manager – Meghna Swamy:** The Project Manager reviews Site investigation information; oversees the data management and analysis to support project objectives; coordinates with other team members; and prepares reports and other documents at the request of the Cabot, US EPA, and other stakeholders.
- **Quality Assurance Officer (QAO) – Kim Reid:** The Gradient team will include a QAO, who will provide quality surveillance of the analytical program and The Gradient QAO will be responsible for assessing the general usability of the laboratory analytical data generated (*i.e.*, assessment of data completeness, sensitivity, accuracy, *etc.* – see Sections A.7.2 and D) and working with the laboratory to resolve any data quality issues that are identified.

Weston Project Team

Weston's primary function on the Cabot team is to obtain environmental data, which includes installing monitoring wells/borings and collecting samples, maintaining the interceptor trench groundwater collection system, and implementing other remedial activities, as needed. The key Weston personnel are listed below.

- **Field Operations Manager – Mark Taylor, PG:** The Field Operations Manager manages overall field project implementation, including directing the planning and the execution of field activities, developing investigation-related deliverables, coordinating with the laboratory, drillers, and other subcontractors, conducting day-to-day client communication, managing the field work schedule and budgets, and achievement of project objectives.
- **Field Team Leader – As Assigned:** The Field Team Leader (FTL) works with the Field Operations Manager to plan and oversee the implementation of the field events. Additionally, the FTL monitors compliance with activity-specific standard operating procedures (SOPs) and coordinates subcontractors in the field.
- **Field Scientists/Engineers – As Assigned:** The Field Scientists and Engineers support the Field Operations Manager and FTL to carry out the Site activities and data reduction (*e.g.*, preparation of boring logs, summary of field procedures, data tables, and exploration location plan).
- **Quality Manager – As Assigned:** The Quality Manager provides QA surveillance of field project activities to ensure compliance with the QAPP.
- **Health & Safety Officer – As Assigned:** The Health and Safety Officer is responsible for overseeing compliance with applicable health and safety rules and regulations. Mr. Glenn also reviews the health and safety plan updates and works with the Field Operations Manager and FTL, to stay current on health and safety requirements and practices, as well as supports and reviews periodic project safety audits.

A.5 Problem Definition/Background

The Cabot Carbon/Koppers Superfund Site (Site) consists of two distinct portions: the former Koppers property to the west, which is a former wood treating facility, operated until 2009 by Koppers Inc. and currently owned by Beazer East, Inc. (Beazer); and the former Cabot property to the east, which is a former pine tar plant, owned and operated by Cabot Carbon from 1945 to 1966 (E2 Inc., 2011). The former Cabot property is the primary subject of this QAPP.

Industrial operations at the former Cabot property began in the 1910s and included the production of turpentine and other naval stores (*i.e.*, pine sap-based cordage, pitch, and tar). In 1928, the Retort Chemical Company built a pine tree processing plant at the Site, which was acquired and operated by Cabot from 1945 until the mid-1960s, for the manufacture of pine-based oils and tars. Cabot sold the property to a local investor in 1967 and, about 10 years later, the property was resold and redeveloped for commercial use (US EPA, 1990). West of the former Cabot property is the former Koppers property, where wood-treating operations were conducted from 1916 until 2009, using various chemicals during that time, including chromate copper arsenate (CCA) salts, pentachlorophenol (PCP), and creosote.

Currently, the Cabot portion of the Site is partially occupied by a shopping mall (referred to as the Northside Shopping Center), with several retail stores (*e.g.*, Winn Dixie, Harbor Freight Tools), two automobile dealerships, a boat dealership and service shop, and a number of smaller office buildings.

The pine processing operation conducted historically at the former Cabot property consisted of extracting and concentrating oils and tars – naturally occurring in pine trees – by a process known as destructive distillation. Pine tree stumps were baked in airtight retorts at a high temperature (*i.e.*, pyrolyzed) to distill the liquid fraction of pine wood, which was then condensed and refined to produce a variety of pine oil and pine tar products. The operation also generated charcoal, which was the remnant of the pine wood after baking. Initially, liquids generated from the process were allowed to settle in a concrete-lined pond prior to being refined into products. After 1949, however, the distilled liquids were conveyed to earthen lagoons located at the northwest corner of the former Cabot property (former Cabot Lagoons), where light oils and tars cooled, separated, and were then refined into a variety of finished pine oil and pine tar products. Cabot ceased operations in 1966, and the plant was dismantled.

A plan view of the Site is shown in Figure A.5.1. The Site geology consists of several layered units. The surficial aquifer overlies the Hawthorn Group, separated by a clay layer (the Upper Clay). The Hawthorn Group is divided into upper and lower units by the Middle Clay. The Floridan Aquifer is separated from the overlying Hawthorn Group deposits by the Lower Clay. Drinking water for residents of Gainesville and other areas of Alachua County is obtained from the Floridan Aquifer *via* the Murphree wellfield located 2.5 miles to the northeast of the Site (E2 Inc., 2011, pp. 16-17).

Environmental investigations completed on the Cabot portion of the Site since the mid-1980s have collected extensive data regarding the nature and extent of contamination at the Site. Remedial actions in the surficial aquifer, as required in the Record of Decision (ROD) (US EPA, 1990), were implemented at the former Cabot facility in 1995 and included the installation of a groundwater interceptor trench (Gradient, 2005). During the 2010 Site Five-year Review, the interceptor trench was found to be functioning as designed and effectively mitigating off-Site migration of the pine tar-related plume in the surficial aquifer (E2 Inc., 2011; Gradient, 2009). Remedial investigations and design associated with potential impacts to the Hawthorn Group and Floridan Aquifer (if any) at the Cabot portion of the Site are ongoing (Gradient, 2012, 2013, 2014). Data relevant to the source characterization and remedial efforts on the Cabot portion of the Site are collected and recorded in a database maintained by Gradient. Further information regarding the Site status is available in the Site's Third Five-year Review (E2 Inc., 2011) and other recent investigation/sampling reports in the ACEPD online document repository at: www.alachuacounty.us/Depts/EPD.

A.6 Project/Task Description

This QAPP is intended to be a generic program document applicable to future Site-specific investigations associated with the former Cabot portion of the Site and includes investigation procedures, sampling methods, analytical methods, sample management, documentation procedures, and QA review procedures. The overall objective of the work is to characterize environmental conditions at the former Cabot portion of the Site and undertake remedial actions, as necessary, to be protective of human health and the environment.

Given the potentially long duration of the project, modifications to the QAPP may occur if project activities require significant modifications to achieve project goals. Activities that may require a modification or addendum submittal include:

- Significant changes to sample collection procedures;
- Addition or change in laboratory used for analysis;
- Revisions to or addition of sample analysis procedures; or
- Major modifications to Site-specific investigation procedures.

Any change in procedure will only be implemented after review and approval by US EPA. Additionally, a separate work plan will be prepared and submitted for each field investigation. Each work plan will provide details specific to that investigation, including a description of the specific problem being investigated, scope of work proposed to investigate the problem, specific data quality objectives (DQOs), sample locations, sample count and media, sampling and analytical procedures, and schedule of implementation.

A variety of instruments and equipment are needed to conduct sampling events and remedial investigations at the Site. The equipment includes various monitoring and measuring instruments for data collection and health and safety monitoring as well as heavy equipment for boring/well installation and investigation-derived waste (IDW) management. A summary of relevant information regarding the equipment and instrumentation typically used at the Site is provided in Table A.6.1. Key field personnel are discussed in Section A.4.

A.7 Data and Field Quality Objectives and Criteria for All On-Site and Off-Site Measurement Data

This section presents the DQOs and criteria relevant to field measurements and analyses of samples for the Cabot portion of the Site. The use of QA/QC procedures to monitor both field and laboratory performance will ensure that a level of data quality is obtained from monitoring events and investigations that will meet project DQOs.

A.7.1 Project Data Quality Objectives

DQOs refer to the quality of data obtained from field-related sampling activities necessary to support administrative decisions and regulatory action. The DQOs for the project in general are listed in Table A.7.1, consistent with the requirements of EPA-QA/G-4 (US EPA, 2006). However, the data collected at the Site will be evaluated with DQOs specific to each field investigation. The intended uses of data collected at the Site are as follows:

- Characterize the source, distribution, and temporal trends of contaminants of concern (COCs) related to operations associated with the former Cabot Carbon Site;
- Secondarily, assess the presence, distribution, and temporal trends of contaminants of concern (COCs) associated with other sources; and
- Support and evaluate remedial action decision-making.

The ability to meet project DQOs will be achieved through the use of QA/QC procedures, prescribed sampling procedures, and analytical data quality levels. Further, while each individual work plan will define specific objectives and methodologies associated with the proposed investigation, the data collected at the Site will be screened against health-based criteria listed in Tables A.7.2 and A.7.3. These lists were developed based on analytes detected at the Site at a frequency greater than 5% since 2009 that have readily available health-based criteria.

Appendix B presents the target analyte list and reporting limits for all laboratory analytical methods that are expected to be used at the Site. Individual work plans will include a detailed sampling and analysis plan, including number of samples, sample media, and laboratory analytical methods to be used for sample analysis. For SVOC analysis, work plans will also specify whether a "Standard" or "Low-Level" 8270D method will be used to analyze a given sample. Based on discussions with the laboratory, it was decided that the lab would use a Low-Level 8270D method to analyze relatively low-impact samples (*i.e.*, from surficial aquifer wells, peripheral wells, *etc.*) for SVOCs in order achieve the reporting limits listed in Appendix B. Samples with high contaminant concentrations and/or matrix interference issues (*e.g.*, source area HG groundwater samples or borings) will be analyzed using the standard 8270D method. The lab is expected to dilute these samples prior to analysis to prevent instrument damage and severe disruption to lab operations. They will utilize a few different dilutions determined based on prior experience at the Site. Thus, the SVOC detection limits for highly impacted samples will likely be higher than the reporting limits for the standard method listed in Appendix B. Once a remedy has been implemented in the Hawthorn deposits and concentrations in the groundwater plume decline, lower reporting limits will be achieved in these samples.

Laboratory SOPs are presented in Appendix C; however, it should be noted that the SOPs include the typical reporting limits that may be different from the values listed in Appendix B, *i.e.*, the values that the laboratory has agreed to and can realistically achieve for samples from the Site.

A.7.2 Measurement Performance Criteria

Field activities performed in support of Site investigations will involve many tasks relative to the acquisition of chemical data. The measurement performance criteria (MPC) for groundwater and soil collection will be evaluated to confirm the presence or absence of constituents of concern, determine the change in distribution of constituents of concern encountered in those media, and provide quantitative results for evaluating compliance with relevant health-based criteria. The laboratory methods used to analyze these constituents and details defining sampling procedures and analyses are presented in Section B. Sampling frequency and task-specific project DQOs will be detailed in individual work plans.

Analytical chemistry MPCs are statements developed to specify the quality and quantity of data needed from a particular data activity to support project DQOs. The analytical chemistry MPC will be defined and evaluated by the participating laboratories in their analytical methods and SOPs, and are listed by analyte in Appendix B.

A.7.2.1 Data Quality Indicators

Data quality indicator (DQI) measurements and MPCs for precision, sensitivity, accuracy, representativeness, comparability, and completeness have been defined and developed for organic and inorganic analyses of groundwater and soil, based, in part, on the project DQOs, data end use objectives, analytical methods, historical data, and published guidelines. The approach to providing reliable data that meet the project DQOs will include QA/QC requirements for each of the chemical data types generated during the monitoring. The details of field sampling QA/QC procedures are included in Section B.5.1. The QA/QC efforts for off-Site laboratory analyses will include collection and submittal of QC samples and the assessment of data from the subcontract laboratories, as described in Section B.5.2.

A.7.2.1.1 Precision

Precision is a measure of the reproducibility of individual measurements of the same property under a given set of conditions. It is a qualitative measure of the variability of a group of data compared to their average value. Precision is generally monitored through the use of duplicate analyses, with results expressed in terms of relative percent difference (RPD), or relative standard deviation (RSD). Measurement of precision is dependent upon sampling technique and analytical method implementation. Both sampling and analysis will follow strict protocols as outlined in the work plan and this QAPP, respectively, to provide the consistency necessary to meet precision objectives.

QC samples, including field and laboratory duplicate samples and matrix spikes (MSs) and matrix spike duplicates (MSDs), will be analyzed and used to monitor precision for selected parameters. For organic compounds, the comparison of surrogate recoveries between the unspiked, MSs, and MSD sample aliquots is an additional measure of precision.

Precision will be expressed as the RPD, calculated as follows:

$$RPD = \frac{|X1 - X2|}{(X1 + X2)/2} \times 100$$

where:

RPD	=	Relative percent difference between duplicate results
X1 and X2	=	Results of duplicate analyses
|X1 - X2|	=	Absolute difference between duplicates X1 and X2

A.7.2.1.2 Accuracy

Accuracy is a measure of the bias in a measurement system, which may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are, in part, laboratory error, sampling inconsistency, field or laboratory contamination, improper handling, matrix interference, and improper preservation. Field, trip, and laboratory method blank (MBs), MSs, MSDs, surrogate spikes (organic analyses only), laboratory fortified blanks (LFBs), and laboratory control samples (LCS) will be analyzed as indicators of accuracy, where applicable. Equipment calibration and maintenance checks are listed in Table B.6.1.

Accuracy will be measured *via* blank concentrations, calibration results, and percent recoveries for MSs, LCS (or blank spikes), and surrogate standards. Percent recoveries of the surrogate, blank spikes, and MSs will be calculated as follows:

$$\%\ recovery = \left(\frac{X - B}{T}\right) \times 100$$

where:

X	=	Measured amount in sample after spiking
B	=	Background amount in sample
T	=	Amount of spike added

A.7.2.1.3 Representativeness

Representativeness is the degree to which a single measurement is indicative of the characteristics of a larger sample or area. More specifically, it is the degree to which the data gathered for the project accurately and precisely represent the actual field conditions. The methods (*e.g.*, sampling, handling, and preserving) specified in Section B will help ensure representativeness.

Comparison of the analytical results from field duplicates (FDs) will provide a direct measure of individual sample representativeness. FDs are defined as two or more subsamples taken from the same location and depth interval during a single sampling event. When collected, these subsamples will be aliquoted into separate sample containers and sent to the laboratories blind for analysis as discrete samples.

A.7.2.1.4 Comparability

Comparability is a qualitative parameter that expresses the confidence with which data sets can be compared. Comparable data allow for the ability to combine analytical results acquired from various sources using different methods for samples taken over the period of the monitoring. Comparability relies upon precision and accuracy within the individual data sets to be acceptable to ensure confidence in the data sets. The consistent use of standard analytical and sampling methods are essential in ensuring that separate data sets are comparable. In addition, comparability is affected by QA/QC criteria such as sample preservation, holding times, blank contamination, method detection limits (MDLs)/contract-required quantitation limits (QLs), and calibrations.

A.7.2.1.5 Completeness

Completeness is defined as the percentage of data judged to be valid in order to achieve the objectives of the Site investigations compared to the total amount of data. Deficiencies in the data may be due to sampling techniques, poor accuracy or precision, or laboratory error. While these deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. The completeness objective for this project is 90%. Note that completeness will be evaluated only for samples that are successfully collected. For example, dry wells and dry surface water locations will not be considered in the final completeness calculation.

A.7.2.1.6 Sensitivity

Sensitivity may be expressed in project detection and QLs and is defined by the ability of the method and instrument to detect target analytes to meet the target detection levels of interest. Method and instrument sensitivity will be evaluated through instrument detection limit (IDL) and MDL studies, sample QLs, and instrument calibration.

QLs and full analyte lists for all parameters are listed in Appendix B. The QLs have been chosen to be equal to or less than the target detection levels. QLs presented in Tables A.7.2 and A.7.3 represent the minimum concentration that can be routinely identified and quantitated above the laboratory MDL or IDL. Sample QLs will be adjusted for secondary dilutions, sample size, and final concentrated volume.

A.8 Special Training Requirements and Special Certifications

A.8.1 Training Requirements and Management

Specialized training and/or certifications are required for performance of work activities associated with the Site to comply with federal, state, and local laws and regulations. The key areas of training that apply to the work at the Site include health and safety training to comply with Occupational Safety and Health Administration (OSHA) regulations and professional registration for geologists, engineers, and surveyors. Table A.8.1 shows the personnel training requirements for the work at the Site.

The Field Operations Manager will be responsible for making sure that personnel assigned to work on the project have the appropriate training. The FTL will be responsible for making sure that all on-Site personnel have the appropriate training.

A.8.2 Communication of New Training Requirements

New safety requirements are usually communicated from the corporate health and safety officer to the local safety officers, then to the project teams. People that hold specific licenses are responsible for keeping up with any new requirements and communicating these to their supervisors. Contractors are responsible for keeping up with training and certification requirements specific to their duties. The Field Operations Manager and the subcontracts manager are responsible for checking that the contractor meets appropriate training and certification requirements at the time of subcontract execution.

A.8.3 Quality Training

Quality training begins when new employees arrive and are assigned a sponsor to help them integrate into Weston's procedures and practices, including QA/QC. Weston maintains a Quality Management Manual that provides local quality leaders with tools to train new employees and conduct needed refresher trainings. Weston also has a "Quality" web portal site that contains a wide variety of tools and resources to support education of employees regarding quality, including the online tool "Lesson Track," which captures lessons learned on projects throughout the company. All employees have access to and can review these lessons, so that the knowledge gained from them can be applied to future and ongoing projects.

A.9 Documentation and Records

A variety of records and documents will be generated during the sample collection, chemical analysis, and data review and reporting processes, including sample collection records and laboratory data package deliverables.

A.9.1 Field Sample Collection Records

Sample collection records will include (as appropriate):

- Field logbooks/notes;
- Daily field report (as needed);
- Field data collection sheets or forms (*e.g.*, field sampling forms);
- Chain of custody (COC) forms;
- Custody seals (as needed);
- Sampling labels;
- Shipment air bills;
- Any forms or documentation that may be associated with field analyses (*e.g.*, field test kits); and
- Other documents, as appropriate (*e.g.*, sign-in log sheet, telephone logs).

Examples of these forms are provided in Appendix D.

A.9.2 Fixed Laboratory Data Package Deliverables

The laboratory will provide a Level 2 data package for each set of samples submitted for analysis. Laboratory deliverables will also include an electronic disk deliverable (EDD) containing sample results for each set of samples submitted for analysis.

Each laboratory data packages will include:

- Unique sample delivery group (SDG) number;
- A comprehensive case narrative describing all method and QC exceedances;
- The COC form(s);
- Sample log-in form(s);
- Sample results;
- QC blank results;
- QC results, including method/laboratory control limits, true values, and percent recoveries;
- Dilution factors;
- Tentatively identified compound (TIC) summary forms, if applicable; and
- Forms summarizing all QC measurement parameters specified in the method.

Forms summarizing all QC measurement parameters specified in the method include:

- Instrument tuning summary and associated sample summary;
- Initial and continuing calibration data summaries;
- Internal standard response and retention time summaries;
- LCS data summaries;
- MS and MSD precision and accuracy results (including percent recoveries);
- Surrogate standard results (including percent recoveries);
- Method and calibration blank results;
- Laboratory duplicate summaries; and
- Dual column confirmation data (for gas chromatography [GC] analysis), if applicable.

A.9.3 Turnaround and Retention Time

The turnaround time for analytical laboratory data deliverables in the electronic format will be 21 business days for the EDD and the initial laboratory report (as PDF files). The complete laboratory data package (as PDF files) will be provided or made available for download 15 business days following EDD and the initial report submission. Documents will be provided only in electronic format (*i.e.*, PDF files); *i.e.*, no hard copies will be provided.

Documents and records will be retained for up to 10 years after the completion of the investigation. Study records, laboratory reports, and formal reports and documents will be saved on servers or files maintained by Weston and/or Gradient.

B Sample Collection and Analysis

B.1 Sampling Process Design

Individual work plans submitted for the Site will include the type and number of samples required for collection, as well as the sample matrices and the rationale for the sampling system design. The analytes of interest and analytical methods will be selected from Appendix B; analytical method requirements are provided in Table B.1.1.

B.2 Sampling Method Requirements

B.2.1 Field Sample Collection Procedures, Protocols, and Methods

Sampling at the Site will mainly include groundwater and soil sampling, which will be conducted as part of the routine quarterly sampling events and other remedial investigations. Amendments can be made to the QAPP in the future if other media are sampled at the Site. The sample collection procedures, protocols, and methods for work at the Site are described below. A list of the SOPs and other relevant details are provided in Table B.2.1.

B.2.1.1 General/Common Sampling Procedures

Certain sampling procedures are common to all types of samples collected at the Site. These common procedures are described below.

- Sample containers will be labeled with the sample designation, sample collection date, time of collection, analyses to be performed, preservatives used, and initials of the sampler(s).
- Sample collection information will be recorded on a COC form that will remain with the samples until receipt by the analytical laboratory.
- Samples will be placed in a cooler with ice (unless the sampling technique and analytical method specifies otherwise) for shipment to the analytical laboratory.

Specific sampling procedures for the various types of samples to be collected at the Site are described below.

B.2.1.2 Groundwater Sampling

Groundwater samples can be collected from monitoring wells or temporary borings. The procedure for sample collection for each type of groundwater sample is described below.

B.2.1.2.1 Groundwater Sampling from Monitoring Wells

Wells will be purged and sampled using low-flow techniques in accordance with the SOPs listed in Table B.2.1. During well purging, water quality parameters, including pH, specific conductance, temperature, dissolved oxygen, oxidation reduction potential (ORP) and turbidity, will be monitored and recorded in the field book, groundwater sampling forms, and/or electronically. Purging will continue until the measured parameters have stabilized or until three well casing volumes of water have been removed. In accordance with US EPA Region 4 Guidance, the stabilization criteria are as follows:

- pH remains within 0.1 standard units for three consecutive readings;
- specific conductive varies by no more than 5%; and
- turbidity is either stable or below 10 NTUs.

Groundwater will be purged and collected using Teflon tubing or Teflon-lined polyethylene tubing attached to either a peristaltic or submersible pump. For some wells, dedicated tubing may be used (see discussion of dedicated equipment in Section B.2.5.3). The groundwater samples will be discharged directly into the laboratory-provided sample containers. Samples will be labeled with the well identification and analysis to be performed as well as the date and time of sample collection.

To reduce the influence of development-related effects on the sampling results, the first round of groundwater samples will be collected from newly-installed, permanent monitoring wells no earlier than 2 weeks after the wells have been developed, unless otherwise specified within the individual work plan. A subsequent round of confirmatory groundwater samples will be collected at least 4 weeks after the first sampling event. Deviations, if any, from the development, field parameter measurement, or sample collection methods outlined above will be discussed in individual work plans.

B.2.1.2.2 Groundwater Sampling from Borings

Groundwater samples from borings will be collected through a temporary well screen. Teflon tubing or Teflon-lined polyethylene tubing will be placed in the boring in the screen interval, and water will be removed using a submersible or peristaltic pump. During well purging, water quality parameters, including pH, specific conductance, temperature, dissolved oxygen, ORP, and turbidity, will be monitored and recorded in the field book, groundwater sampling forms, and/or electronically. If sufficient water is available from the temporary well, purging will continue until at least three sets of measurements have been collected. If the temporary well has a slow recharge rate, as if often the case with Upper Hawthorn Group wells, then only one set of physical parameter measurements will be made prior to sample collection.

Groundwater samples will be collected from the tubing and discharged directly into the laboratory-provided sample containers. Samples will be labeled with the well identification and analysis to be performed as well as the date and time of sample collection.

B.2.1.3 Soil Sampling

Soil samples at the Site are taken from soil cores associated with soil borings, from hand augers, or from the surface, using spoons or scoops. Soil sampling will be conducted in accordance with the SOPs listed in Table B.2.1. A description of soil sample methodologies is provided below.

B.2.1.3.1 Soil Core Sampling

Once the soil core has been retrieved from the boring, the core barrel will be placed on clean plastic sheeting situated on a flat surface (*e.g.*, table), after which the core barrel or plastic sleeve will be opened. Soils in the barrel/sleeve will be visually inspected for staining and screened using a photo-ionization detector (PID) and/or flame ionization detector (FID). Samples collected for volatile organic compounds (VOCs) analysis will be collected first, using syringes and/or other approved soil coring devices (*e.g.*, TerraCore), in accordance with the selected analytical method.

Soil samples for analyses of non-VOC analytes will be collected from the core barrels using a clean scoop, spoon, or clean gloved hand and placed directly into the laboratory-provided containers. If specified in a work plan, composite samples will be collected from a soil core by collecting roughly equal parts of soil from at least three different sections of the core barrel, evenly spaced apart. The individual soil sample portions will not be mixed, but placed directly into the sample container (*e.g.*, jar or syringe) until the respective container is filled.

Photographs will be made of each soil core, alongside a tape measure showing the sampling interval. The sampling interval, sample designation, and soil characteristics will be documented in soil sampling forms, the field log book, and/or electronically.

B.2.1.3.2 Hand Auger Soil Sampling

Once retrieved from the borehole, the hand auger bucket will be placed on clean plastic sheeting situated on a flat surface (*e.g.*, table), after which the soil will be removed from the auger with as little disturbance as possible. Soils will be visually inspected for staining and screened using a PID and/or FID. Samples collected for VOC analysis will be collected first, using syringes and/or other approved soil coring devices (*e.g.*, TerraCore), in accordance with the selected analytical method. Soil samples for analyses of non-VOC analytes will be collected from the core barrels using a clean scoop, spoon, or clean gloved hand and placed directly into the laboratory-provided containers. Composite samples, if needed, will be collected using the approach described above. Photographs will be made of each soil core, alongside a tape measure showing the sampling interval. The sampling interval, sample designation, and soil characteristics will be documented in soil sampling forms, the field log book, and/or electronically.

B.2.1.3.3 Surface Soil Sampling

Surface soil samples will be collected with a clean scoop or spoon. The soil will placed directly into the laboratory-provided containers. Samples collected for VOC analysis will be collected first, using syringes and/or other approved soil coring devices (*e.g.*, TerraCore), in accordance with the selected analytical method. The sampling interval, sample designation, and soil characteristics will be documented in soil sampling forms, the field log book, and/or electronically.

B.2.1.4 Lift Station Sampling

Compliance water samples are collected on a quarterly basis from the on-Site lift station. These water samples will be collected from a sample port attached to the Parshall flume located inside the lift station building on the east side of the Gainesville Dodge dealership. Water samples from the lift station will be collected directly in the laboratory provided containers.

B.2.1.5 Investigation-derived Waste Sampling

Sampling of IDW is conducted to provide waste characterization data to the appropriate disposal facility. IDW sampling will be conducted in accordance with FDEP SOP FS 5000. Numerous samples have been collected of the impacted areas associated with the Site and the characteristics and toxicity of the waste are reasonably well understood. The IDW is expected to be non-hazardous and generally presents only low-level health and safety concerns. Descriptions of the sampling procedures for the IDW sample collection are provided below.

B.2.1.6 Drum Sampling

Both soil and water samples are collected from drums that typically contain drill cuttings and fluids. When possible, the samples will be collected through the drum bung. If the bung cannot be opened, then the drum lid will be removed prior to sample collection. Prior to opening the drum, the drum will be inspected for signs of pressure build up (*e.g.*, bulging). If evidence of pressure build-up is observed, then another drum will be chosen for sampling. Soil samples will be collected using a push tube, if sampling is done through a drum bung, or using a scoop, spoon, or clean gloved hand, if sampling is done through an open drum. Water samples will be collected using a clean disposable Teflon bailer. Samples will be placed directly from the sampling device into the laboratory-provided containers. The designation and sample characteristics will be documented in sampling forms, the field log book, and/or electronically.

B.2.1.7 Tank Sampling

Samples will be collected from water storage tanks that contain IDW water (*e.g.*, from well development, well purging, *etc.*). Water samples will be collected from the tank using a clean disposable Teflon bailer or peristaltic pump equipped with Teflon or Teflon-lined polyethylene tubing. Samples will be placed directly from the sampling device into the laboratory provided containers, with VOC samples collected first. The designation and characteristics of the sample will be documented in sampling forms, the field log book and/or electronically.

B.2.2 Sampling Equipment

A variety of sampling equipment is used to conduct sampling activities at the Site. The equipment includes pumps to extract water, organic vapor monitors to screen soils and water (*e.g.*, PID or FID), drill rigs to collect soil cores, and field water quality measuring instruments. A list of the sampling equipment used at the Site is provided in Table B.2.2.

B.2.3 Site Support Facilities for the Field Staff

There are a variety of support facilities available to the field staff. Weston rents a storage unit less than half a mile from the Site. This unit contains a variety of field equipment and sampling supplies, a refrigerator for temporary sample storage, and health and safety supplies that are readily available to the field team. Additionally, during field activities of longer duration, Weston creates a work staging area on a portion of the Site that includes an office trailer with electricity as well as heating, ventilation, and air conditioning (HVAC), a decontamination pad, portable restrooms, an IDW storage area, and a solid waste dumpster for household trash. The staging area is fenced and can be locked. Expendable supplies (*e.g.*, ice, tape, drinking water) can be readily obtained at the Winn Dixie located on the Site. A Federal

Express shipping center is located less than 5 miles northwest of the Site, for receipt and shipment of samples and equipment.

B.2.4 Key Study Personnel for Sampling/Data Collection Activities

The key study personnel for investigations and other field work at the Site include the Field Operations Manager, FTL, the project geologist, the field team members, the Site health and safety officer, and the Laboratory Project Managers. Table B.2.3 provides a list of assigned personnel and their responsibilities.

B.2.5 Equipment Decontamination

The equipment decontamination process is an important means of avoiding cross contamination and helping to ensure the representativeness of the samples collected. Equipment decontamination procedures are specific to the type of equipment and its intended use. The equipment decontamination procedures planned for this Site are described below.

B.2.5.1 Non-disposable Drilling Equipment

All non-disposable down-hole drilling equipment will be decontaminated prior to use and between sampling locations. The decontamination procedures used to clean down-hole equipment include:

1. Steam cleaning (*i.e.*, high-pressure hot water with soap);
2. Using a brush, if necessary, to remove particulate matter and difficult-to-remove surface films;
3. Rinsing thoroughly with tap water; and
4. Removing the equipment from the decontamination pad and covering with clean, unused plastic.

Additionally the portion of the drill rig and/or Geoprobe that could contact the down-hole equipment will be steam cleaned prior to being set up on each drill site.

B.2.5.2 Non-disposable Sampling Equipment

Non-disposable sampling equipment used at the Site includes items such as pumps and sampling tools. Non-disposable sampling equipment will be decontaminated using the following procedures:

1. Cleaning with potable water and a non-phosphate containing liquid detergent, using a brush, if necessary, to remove particulate matter and surface films;
2. Rinsing thoroughly with tap water;
3. Rinsing thoroughly with organic/analyte-free water;
4. Rinsing thoroughly with solvent (reagent-grade isopropanol). PVC or plastic items will not be included in the solvent rinse;
5. Rinsing thoroughly with organic/analyte-free water. If organic/analyte-free water is not available, equipment will be allowed to completely air dry; and
6. Removing the equipment from the decontamination area and covering with plastic.

B.2.5.3 Dedicated Equipment

In some instances, a well is assigned a dedicated length of tubing, which connects to water sample collection pumps and remains closed inside the well between sampling events. Prior to sample collection, the tubing is inspected. If it is observed to be soiled, stained, or damaged, it is removed from the well to be disposed of, and new, clean tubing is placed in the well. Dedicated tubing is not used in heavily impacted wells, to avoid the potential for degradation of the tubing.

The existing monitoring wells at the Site with dedicated tubing include ITW-1, ITW-2, WMW-17E, WMW-18E, ESE-002, ESE-004, and ITW-13. Additional surficial aquifer and peripheral Hawthorn Group wells are likely to be installed with dedicated tubing as part of future investigations and remedial efforts. Work plans will list all monitoring wells (current and future) that will utilize dedicated tubing for sample collection.

B.2.6 Sample Containers, Preservation, and Holding Times

The sample container, preservation, and holding times are specific to the analytical methods that will be used to process the sample. Table B.1.1 provides a list of the container, preservation, and holding time requirements for each analytical method that will be used for samples collected at the Site.

B.3 Sample Handling and Custody Requirements

B.3.1 Procedures for Sample Handling

An essential part of any sampling/analytical scheme is the ability to document the history of samples. Documentation is begun as soon as the samples are in custody.

Sample custody procedures will be followed during sample handling activities both in the field and in the laboratory. This program is designed to assure that each sample is accounted for at all times. The appropriate sampling and laboratory personnel will complete COC forms and laboratory receipt sheets.

The objective of sample custody identification and control is to assure, to the extent practicable, that:

- All samples scheduled for collection, as appropriate for the data required, are uniquely identified per the associated work plan;
- The correct samples are analyzed and have traceable records from collection to analysis;
- Important sample characteristics, such as sampling location and time, are properly documented;
- Samples are protected from loss or damage;
- Any alteration of samples (*e.g.*, filtration, preservation) is documented; and
- A record of sample integrity is established for legal purposes.

The primary objective of sample custody procedures is to obtain an accurate written record that can be used to trace the handling of all samples during the sample collection process, through analysis, until final disposition. Logbooks, field sampling forms, or electronic forms will be used to record field collection activities, *i.e.*, information pertaining to sample locations, numbers/types of samples, field measurements, and sampling conditions. All written documentation entries will be written in indelible blue or black ink. Electronically recorded field data will be backed up using external flash drives.

COCs establish the documentation and control necessary to identify and trace a sample from collection to final analysis. Such documentation includes labeling, to prevent sample misidentification; applying container seals, to prevent unauthorized tampering with the contents; and maintaining the necessary records, to support potential litigation or other potential challenges of the data. These precautions are crucial for a valid COC. The COC forms will be reviewed by the FTL or designee to determine compliance with the sample custody protocol described in this QAPP.

The containers and preservatives specified in Table B.1.1 will be used for the collection of soil and water samples. Sample containers will be packaged according to the procedures outlined in Section B.3.3. During collection and transport, field personnel will keep the soil and water samples cool (4°C) by placing them in an ice-filled cooler, then shipping them to the laboratory for analysis. During transit, it is not always possible to rigorously control the temperature of the samples; thus, samples may arrive at the laboratory at temperatures slightly above 4°C.

Sample preservation is required to retain sample integrity. The most common preservation techniques include pH adjustment and temperature control. Field personnel will use the recommended containers, preservation techniques, and sample volumes for the parameters of concern as directed by the laboratory and specified by the analytical method in the appropriate laboratory SOP (see Table B.1.1 and Appendix C).

Pre-cleaned sample containers for water samples, which will contain the appropriate preservatives, as specified per Table B.1.1, will be provided by a vendor that specializes in environmental sample containers or by the project analytical laboratory. Sample containers will be pre-cleaned in accordance with US EPA specifications for glassware cleaning. Level II certified sample containers will be used for project sample collection. Certificates of cleanliness will be kept on file in the laboratory. The blank system (materials blanks with Type II reagent grade water or equivalent water) will be used to monitor potential problems with contaminated sample containers.

Samples to be used for laboratory QC, such as MS/MSD, laboratory duplicate, or serial dilution analyses, will be designated on the COC by the field personnel for each matrix. At a minimum, samplers should collect and provide triple volumes of sample for each method for all such designated QC samples at the frequency specified per Table B.3.1.

B.3.2 Chain of Custody Procedures

Sample custody procedures in the field and COC documentation are discussed in this section.

B.3.2.1 Sample Custody

In order to maintain and document sample custody, the following COC procedures will be strictly followed. A sample is considered to be under custody if the following conditions are met:

- It is in actual possession of the responsible person;
- It is in view, following physical possession;
- It is in the possession of a responsible person and is locked or sealed to prevent tampering; or

- It is in a secure area.

B.3.2.2 Chain of Custody Record

Sample custody is maintained by the COC. The COC form is completed by the individual designated by the Field Operations Manager (*e.g.*, the FTL) as being responsible for the sample's shipment and must be completed at the sampling site. The individual collecting the sample will maintain a COC form supplied by the appropriate analytical laboratory for all field and field QC samples. The information recorded on the COC form will be as listed in Table B.3.2.

COC forms will be prepared and tracked by SDG. SDGs will be identified by Weston during sampling activities. An SDG shall consist of up to 20 field samples for analysis, inclusive of associated field QC samples. Each set of samples will be assigned a single line on the COC form. Shipment of samples for SDGs should be within a 7 calendar-day period, unless a short holding time has to be met. The participating analytical laboratories will identify each SDG with a unique batch number.

The sample custody protocol followed by the sampling team will include:

- Documenting procedures and amounts of reagents or supplies (*e.g.*, filters), which become an integral part of the sample, beginning with sample preparation and preservation;
- Recording sampling locations, sample bottle identification, and specific sample acquisition measures on the appropriate forms; and
- Using sample labels to document all information necessary for effective sample tracking.

A copy of the completed and signed original COC form will be a permanent part of the project records and will accompany the samples to the laboratory to document transfer. The laboratory will eventually return the original COC form in the laboratory data report.

If changes or corrections are required, then all copies of the COC forms will be corrected. Incorrect items will be stricken by a single line, and the person(s) making the corrections will initial and date such changes on all copies of the COC in their possession, then contact all other parties with working copies of the COC to have the same corrections made to their COC forms.

Copies of completed COC forms will be forwarded to Weston and Gradient following sampling events.

B.3.2.3 Transfer of Custody

Field personnel initially collecting the sample(s) are responsible for the care and custody of the sample(s) until properly transferred or delivered to laboratory personnel. All samples will be accompanied by a COC form. When transferring possession of samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of the transfer on the record. The company from which the sample is relinquished and to which person and/or company it is delivered, as well as the reason for transfer, will be noted. This record documents the transfer of samples from the custody of the sampler to that of another person or the fixed base laboratory. The relinquishing individual will record specific shipping data (air bill number, company, time, and date) on the original and duplicate custody records. It is the FTL's responsibility to verify that all shipping data are consistent and are made part of the permanent project files.

Samples will be received by the laboratory sample custodian. Samples will be unpacked and should be inspected for the following:

- Temperature;
- Broken or leaking bottles;
- Presence of all samples listed on field COC form;
- Bottle labels match field COC form; and
- Number of coolers received matches number shown on air bill.

The sample custodian will fill out a Shipment Condition Inspection Report or equivalent laboratory form. If problems or discrepancies are noted, they will be documented on the Inspection Report and the Laboratory Manager will be contacted. Discrepancies in the number of samples received or sample bottle labels will also be documented on the field COC form. The sample custodian will then sign and date the field COC form.

After accepting custody of the samples, the sample custodian will log-in the samples. Each sample will be assigned a unique, sequential laboratory number, which will be used for tracking the sample through the laboratory and in the Laboratory Information Management System (LIMS). After log-in, samples will be placed in storage, pending analysis. The field COC form, inspection report, and air bill will then be forwarded to the Laboratory Project Manager.

The Laboratory Project Manager or designee will inspect the paperwork and, if all is in order, will direct the laboratory sections to begin analysis. If problems are noted, the Laboratory Project Manager or designee will resolve them with the Laboratory Manager. Laboratory personnel will comply with all internal laboratory COC procedures. The signed field COC and internal laboratory COC Records will be provided with the laboratory deliverables for the project.

B.3.3 Sample Packaging and Shipping

All samples will be packaged carefully to avoid breakage or contamination and will be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids will not be mixed. All sample lids will stay with the original containers.
- If the sample volume level is low because of limited sample availability, then the level will be marked on the outside of the container with a grease pencil. This procedure will help the laboratory determine if any leakage occurred during shipment.
- Custody seals will be used on sample containers or on plastic bags containing multiple sample containers when there is a chance that custody seals or sample containers may be tampered with. For example, if the sample container must be stored for any period of time in an unsecured location or refrigerator or if the sample container must leave the custody of the contractor for any reason, either unpackaged or in a cooler or shipping container not otherwise custody-sealed.
- All glass sample bottles will be wrapped in bubble pack or an equivalent and sealed in self-sealing plastic bags, to minimize the potential for contamination and breakage during shipment. Plastic bottles will not be wrapped but will be sealed in self-sealing plastic bags. Soil samples contained in stainless steel liners will be sealed in self-sealing plastic bags. Volatile organic

analysis (VOA) sample vials will be placed in a foam VOA holder or an equivalent and sealed in self-sealing plastic bags.

- All samples will be cooled unless "no cooling" has been specified. The sample containers will be packed in coolers in an upright position. Empty space in the cooler will be filled with inert packing material such as bubble wrap. Under no circumstances will locally-obtained material (sawdust, sand, *etc.*) be used. The coolers will then be filled with ice within self-sealing bags, ice contained within a liner, or blue ice. (Note: blue ice will not be used in any coolers containing samples to be analyzed for VOCs, due to the potential for styrene cross-contamination.) A temperature blank will be included in each cooler for temperature determination upon receipt at the laboratory. If the cooler has a drain spout, then the spout will be sealed with duct tape to prevent any water leaks during transport.
- If the cooler is being shipped by Federal Express, the Federal Express air bill will be placed on the cooler with the return address and laboratory address affixed.
- The original COC record will be sealed in a plastic bag and placed the inside the cooler, then transported along with the coolers to the laboratory. If the cooler is being transported to the laboratory *via* laboratory courier, then the COC will remain outside the cooler, and custody will be transferred to the courier with the cooler.
- All shipping containers will be locked or custody-sealed for shipment to the laboratory. The custody seal will consist of a custody seal or filament tape wrapped around the shipping container at least twice with the tape end signed before the sample is shipped. The shipping containers will be transported as environmental samples to the laboratory as expeditiously as possible, most likely by Federal Express overnight delivery service or courier.

B.3.4 Sample Identification/Labeling

Samples will be labeled with a unique sample number. Samples are identified by a sample label with the following information recorded:

- Unique field sample ID;
- Date and time of collection;
- Analyses requested;
- Type of preservative used (if any);
- Filtered or unfiltered (for water samples); and
- Sampler's name or initials.

Table B.3.3 shows the planned sample identification scheme for various types of samples to be collected at the Site.

The unique field sample ID, date and time the sample was obtained, sampler's signature, matrix type, preservatives, number of containers, container size and type, and analyses requested will be recorded on the COC record for each sample. All information on the COC record, as well as additional sample information, will be maintained in a database for later electronic matching with laboratory analytical information for each sample.

The final evidence file for the project will consist of laboratory data packages (summary and raw data, if requested, from the analysis of QC samples and investigative samples, chromatograms, mass spectra, calibration data, worksheets, sample preparation logs, COC records), logs, field log-books, pictures, and subcontractor reports. All originals will reside in secure archives for 10 years with the contractor or subcontractor who originally generated them. The final evidence file will reside at Weston.

B.3.5 Turnaround Time

The standard turnaround time for analytical laboratory samples (*e.g.*, VOCs, semi-volatile organic compounds [SVOCs], metals, *etc.*) is typically 21 business days. Occasionally, expedited turnaround is requested for more immediate data needs. The laboratories can provide 3- and 5-day turnaround. The expedited turnaround time is dependent on the analysis to be performed (*e.g.*, samples requiring extraction take longer to process) and the workload of the laboratory at the time of the request.

B.4 Analytical Method Requirements

Appendix B presents a general listing of the analytes and analytical methods that may be selected for future Site investigations. This list includes analytes and analytical methods that are likely to be selected in future programs, but not all parameters and procedures listed may be analyzed in any given investigation. The list of analytes and analytical methods selected for an investigation will be presented in individual work plans. If additional methods are required beyond those listed in this QAPP, those procedures will be defined in the individual work plans and will be added to this document during subsequent revision.

Table B.1.1 and Appendix B lists the main analytical methods likely to be used during the Site investigations. Laboratory SOPs for the analytical methods are provided in Appendix C, and the required laboratory instrumentation is provided in Table B.4.1. The turnaround time for hard copy and EDD files is specified in Section A.9.3, and the individuals responsible for each analysis or corrective action are listed in Table B.4.2.

B.5 Quality Control Requirements

QC requirements include both field and laboratory check samples as well as procedures designed to ensure and document the overall quality of the data. QC check samples are controlled samples introduced into the analytical system at specific points. The results of QC checks are used to evaluate the precision, sensitivity, accuracy, and representativeness of the overall sampling and analytical program. A summary of field and laboratory QC requirements/frequency is presented in Table B.3.1.

B.5.1 Field Quality Control

Field QC will be conducted using controlled samples that are introduced to the laboratory from the field.

B.5.1.1 Blanks

Field QC blanks include temperature blanks, trip blanks (TBs), field blanks (FBs, source water used for equipment decontamination), and equipment rinse blanks. Blanks measure the amount and type of contamination introduced at any point throughout the entire sampling and analysis process, including sample handling and transport. If significant contamination is identified in the blanks, corrective actions will be taken during the field program by the FTL to identify the cause of the contamination and prevent its recurrence. Corrective actions may include implementation of more aggressive decontamination procedures or replacement of equipment.

Blanks must be prepared from a reliable source of distilled or deionized water, as appropriate. Analyte-free water is purchased from a reputable vendor (*e.g.*, Fisher Scientific) or supplied by the laboratory. Holding times for blanks will be consistent with the holding times stipulated for the various analytical methods. This "designated blank-source water" must be stored, tightly sealed, in a contaminant-free area and may be used for up to 3 months, as long as it remains sealed and is stored in a contaminant-free area.

B.5.1.1.1 Trip Blanks

TB results are used as indicators of contamination originating from the proximity of sample containers to one another during shipment and storage. TBs will only be prepared and analyzed for VOCs. A TB is provided by the analytical laboratory, consists of a sample container filled with the laboratory-designated blank-source water, and is preserved with hydrochloric acid (HCl). A TB will accompany each set of up to 20 sample containers to be analyzed for VOCs from the laboratory, to the field, and back to the laboratory, without being opened until it is to be analyzed. TBs for aqueous samples will consist of laboratory water.

B.5.1.1.2 Temperature Blanks

Temperature blanks will consist of a water-filled container provided by the laboratory that will be shipped to the off-Site laboratory with each cooler of samples submitted for laboratory analyses. During sample receipt, the sample custodian will measure the temperature in the blank to determine the status of sample preservation during shipment to the laboratory. The preservation goal for the samples is to maintain temperatures at 4°C, but not exceed 6°C. If the cooler temperature is outside this range (*i.e.*, above 6°C), the laboratory will contact the client for guidance as to whether to proceed with the analyses.

B.5.1.1.3 Equipment Rinse Blanks

The potential for cross-contamination, within or on sampling apparatus where contact with the sample occurs, is assessed by rinsing the sampling apparatus with deionized water following decontamination. Equipment rinse blanks will consist of equipment rinsate collected directly into the appropriate bottles.

For water and soil samples, rinsate blanks are collected by pouring water over or through the field-cleaned sampling device with the designated blank-source water until the appropriate sample bottles are filled. Container(s) are then capped and labeled in the same manner used for water field samples.

Rinsate blanks will be collected at a frequency of 5% (*i.e.*, 1 rinsate blank for every 20 samples) per equipment type. Rinsate blanks will not be collected for sampling procedures completed using dedicated sampling equipment, except for a one-time demonstration that the dedicated sampling equipment is free of contamination. For this evaluation, one set of clean and unused equipment will be rinsed with water, and the rinsate blank will be submitted as a rinsate blank to be analyzed for the same parameters as the associated samples (*e.g.*, groundwater).

B.5.1.1.4 Field Blanks

FBs will be collected from sources of water used during field sampling events that may come in contact with samples or sampling equipment and have a possible impact on sample results. FBs are collected from water used as the final rinse in equipment decontamination, water used to prepare equipment rinse blanks, or water used in drilling activities. FBs will be collected at a rate of one per source for each sampling event. FBs consist of samples made by filling appropriate sample bottles from the source location where water is obtained for use in the field.

For dissolved metals, a separate FB must be collected, which will be either field or laboratory filtered prior to analyses. This filtered water blank will be obtained by processing the designated blank-source water through the field filter-apparatus, then preserving and handling this blank-water sample in the same way as field-filtered metals samples. For every 20 samples collected for dissolved metals, a filtered-blank must be generated.

B.5.1.2 Field Duplicates

FDs provide a measure of the reproducibility (precision) of the sampling procedures and the representativeness of the samples. When collecting FDs, two subsamples from a single sample location and depth interval are obtained and prepared/analyzed by the laboratory. Each sample is labeled with a unique sample number, and both are submitted to the laboratory for the appropriate analyses. FD samples will be collected at a frequency of 5 percent (1:20) per matrix for each parameter. FDs will be collected from the same sampling location, depth, or interval as the original field sample.

Aqueous FD samples will be collected immediately after the original sample. The FD sample bottle will be filled using the same procedures as the original sample.

For soil samples, the field sampler will attempt to collect a sample that is representative of the same geologic strata as the original sample. Duplicate samples will be collected directly from the sampling location or sampling device. Samples will not be homogenized prior to selection.

B.5.1.3 Matrix Spike/Matrix Spike Duplicates

All MS QC samples will be specified in the individual work plans and listed on the COC for the analytical laboratory. MS/MSD analyses are performed in association with all samples analyzed for organic compounds. Analysis of MS/MSD is performed in association with all samples analyzed for inorganic analytes as well as for wet chemistry parameters, where applicable.

MS samples are designated in the field on the COCs. The MS samples are then prepared in the fixed laboratory by placing a known quantity of analytes into the field sample. The MS is then processed in a manner identical to the other samples. Percent recovery of each of the spiked compounds or analytes reflects the ability of the laboratory and method to accurately determine the quantity of the analyte in that particular sample (*i.e.*, is a measure of accuracy in the specific sample matrix). Note that it does not reflect the laboratory's ability to determine the quantity of the analyte in other, even similar, samples. If a quantity of the spiked analyte exists in the sample prior to addition of the spike, this quantity is subtracted from the MS result to determine the quantity of the spike that has been "recovered."

The MSD samples prepared as QC checks on the precision of organic analyses are identical to MS samples. A second aliquot of the same field sample used for the MS is fortified with the same quantity of the spiking compounds and is processed in an identical manner. The results for the MS/MSD pair provide a measure of the precision of the analyses' determinations by assuring the availability of positive results for comparison.

A MS/MSD pair analysis will be performed for all organic parameters at the minimum frequency of 1 per 20 samples per matrix or per SDG (minimum 5% frequency).

Matrix duplicates (MDs) will be analyzed for all inorganic and wet chemistry analyses at the minimum frequency of 1 per 20 samples per matrix or per SDG (minimum 5% frequency).

B.5.2 Fixed Laboratory Quality Control

The laboratory analytical methods chosen to support the Site investigation include required QC procedures, acceptance criteria, and corrective actions, so that comparable data will be produced by the analytical laboratories throughout the duration of the project. Analytical QC will be monitored through laboratory QC checks, which include analysis of blanks, spiked samples (MS/MSD), and initial and continuing calibration checks (CCCs). All laboratory QC activities are specified in the analytical method and are incorporated into the laboratory SOPs in Appendix C.

In general, laboratory QC checks include, but are not limited to: MBs to assess contamination during sample analysis; calibration and surrogate standards (for organics), for assessing accuracy; MS/MSD or MS/MD, to assess accuracy, precision, and presence of matrix effects; second dissimilar column confirmation, for GC analyses; and LCS analytes, to determine instrument accuracy. Control limits for these laboratory QC checks are summarized in Table B.5.2, for groundwater samples, and Table B.5.3, for soil samples. Some of the QC samples are described in more detail, below.

B.5.2.1 Method and Analytical Blanks

MBs or preparation blanks are generated within the laboratory during the processing of the field samples. These blanks are processed using the same reagents and procedures at the same time as the samples being analyzed. Contamination found in the MB would indicate that similar contamination found in associated samples may have been introduced in the laboratory, and not actually be present in the samples. MBs will be analyzed at a minimum frequency of 1 per 20 samples per matrix per parameter, per preparation/analysis batch), or as stipulated in each analytical method.

Analytical blanks such as initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) are also included. These blanks are laboratory reagent-grade water and acid solutions to match sample digestates analyzed at the beginning, intervals during and at the end of an analytical sequence, to assess contamination and instrument drift. The ICB is analyzed at the beginning of the analytical run following the calibration and the initial calibration verification (ICV). The CCB is analyzed prior to sample analyses, every 10 samples thereafter, throughout the analytical run, and at the end of the analytical sequence.

B.5.2.2 Surrogate Spikes

Where appropriate for the analytical method, each aqueous (groundwater) and soil sample to be analyzed for organic compounds will have surrogate compounds added to it before extraction. The recovery of these surrogates aids the analysts in determining matrix effects on recovery of compounds in each sample and is a measure of accuracy.

B.5.2.3 Laboratory Fortified Blanks/Laboratory Control Samples

LCSs and LFBs are samples containing known amounts of compounds which the laboratory prepares and analyzes concurrently with project samples. The recovery of analytes or compounds in these samples provides a measure of method accuracy in the absence of matrix effects (as compared to MS samples). Analytical frequency is 1 LCS or LFB per preparation batch, not to exceed 20 samples per batch.

B.5.3 Definitions for Statistical Parameters

Definitions of accuracy, precision, completeness, comparability, sensitivity, and representativeness are provided in Section A.7.2.1.

B.6 Instrument or Equipment Testing and Inspection Requirements

In situ testing instruments and field equipment, along with their acceptance criteria and corrective action measures, are provided in Table B.6.1. A comprehensive list of supplies and their acceptance criteria are given in Table B.6.2.

On-site equipment is typically checked at the beginning of the day or before it is put into use for the day. The water level meter is checked with the battery test button before each new groundwater level measurement. Routine equipment checks include checking the level of remaining charge (*i.e.*, battery life), inspecting the equipment to ensure it is properly assembled, calibration of the equipment per the manufacturer's recommendations, checking the hydrogen level in the FID, and checking to make sure the equipment has been properly cleaned. Spare parts are kept on-hand at the Site for maintenance and repair activities. These parts include items such as new batteries, additional hydrogen and calibrations gases, moisture filters, and various calibration fluids. The spare parts are usually located in the either the equipment storage case (often kept in the field vehicle), the field office, or the field equipment storage unit.

B.7 Instrument Calibration and Frequency

All instrumentation used to perform chemical measurements must be properly calibrated prior to use, in order to obtain valid results.

B.7.1 Field Instrumentation

Field measurement calibration procedures will follow the protocols described in the associated SOPs provided in Appendix D. It is the responsibility of field personnel to follow described procedures. Field instruments that require calibration are the water quality meter, the photo ionizing detector, the flame ionizing detector, photo ionization detector, turbidity meter, and the water level meter. Table B.6.1 provides the calibration requirements for each instrument, maintenance activities, the acceptance criteria, the corrective action, and the person responsible for ensuring successful calibration and testing of these instruments.

B.7.2 Fixed Laboratory Instrumentation

The analytical methods selected for potential use at the Site specify the types and frequency of calibration needed for the laboratory instruments. Calibration requirements are detailed for each analytical method in the appropriate SOPs in Appendix C.

For accessory analytical equipment, such as balances and ovens, that are required in preparation procedures, calibrations will be performed per manufacturers' instructions and the following guidelines:

1. Calibrations of balances and ovens must be checked daily and recorded in a logbook;
2. Corrective actions must be taken for out-of-control check measurements, as described in the laboratory's QA/QC manual; and
3. The equipment will not be used until either it is recalibrated or corrective action results in a subsequent check standard meeting control criteria.

B.7.3 Calibration Documentation

Calibration activities and results will be documented either on a designated calibration form, in the field log book, or electronically. The documentation will include the date and time of the calibration, the results of the calibration, as well as any corrective actions that were needed. The calibration record (if in paper format) will be scanned into PDF format and transferred to the project files record.

B.8 Inspection/Acceptance Criteria and Requirements for Supplies and Consumables

A variety of consumable supplies are needed to implement field activities at the Site. These items include calibration solutions and gases, decontamination fluids, hydrogen for the FID, sample bottles, and personal protective equipment. It is important to inspect these supplies when they arrive at the Site. Table B.6.2 contains a list of consumables to be used at the Site and shows the acceptance criteria for each consumable, along with the person responsible for inspecting the items.

Laboratory procedures that will be performed to ensure that supplies used during the course of providing analytical services for the Site investigations are available as well as free of chemical constituents and interferences are described in each laboratory's QA Plan.

B.9 Data Acquisition Requirements for Non-direct Measurements

Information and/or data generated and collected outside of the Site investigations that will be used to make environmental decisions may have limitations associated with variable collection conditions, variable reporting standards, and use of outdated analytical techniques. In general, data from non-direct measurements will be used to assess the potential sources of contamination, the nature and extent of contamination, and hydrogeological conditions at the Site. Due to the age of the Site and the number of previous data collection investigations (see Section A.5), previously collected data can also be valuable for preliminary assessments or directing areas for new data collection.

Only previously generated chemical data of known quality (*i.e.*, generated by US EPA/state-certified laboratories) will be incorporated into the database managed by Gradient. If such data are used, a note will be provided when reporting the data to all end data users and stakeholders.

B.10 Data Management

Gradient will maintain and update the existing database of analytical results, which are typically obtained from the subcontract laboratory *via* Weston. Diskette deliverables in the EDD format (Table B.10.1), or a suitable equivalent, will be provided to Gradient by Weston. The EDDs may be submitted *via* e-mail or on disk. Hard copy data packages will not be considered complete until the associated EDDs are submitted.

Gradient will maintain the database for this investigation in a Microsoft Access-based database system on password-protected computers. All EDDs received from the laboratories will be uploaded into the database, which has the capability to sort, manipulate, tabulate, and present the data according to various parameters. The upload process will be checked for accuracy by manually comparing a selection of queried results against the original reports issued by the laboratories. Following upload, the data results will be screened against the project target detection levels. Any compounds/analytes exceeding the QAPP-specified target detection levels will be summarized in a summary report table. Gradient will generate data spreadsheets from the database, which will be provided, after each sampling event, to Cabot, Weston, and US EPA for review and comment.

B.10.1 Database Review

During the database review process, data summary tables will be produced for all methods and all sample analyses completed by the off-Site laboratories. The accuracy of the data presented on these tables will be verified by the Gradient QAO to ensure that the electronic data matches the hard copy documentation provided by the laboratories. Data qualifiers identified in the laboratory reports will be incorporated into the database and will be verified by the QAO during table output review prior to using the data in investigation reports. Further, as discussed previously, prior to the database upload, the Gradient QAO will provide an overall assessment of the laboratory data package for completeness, sensitivity, accuracy, *etc.* (see Sections A.7.2 and D), and work with the laboratory to resolve any data quality issues that are identified.

B.10.2 Data Tracking and Control

B.10.2.1 Data Tracking

Implementation of standard COC procedures will allow for tracking of individual samples and data from sampling, through analysis, to the final database. All data will be in the custody of the Gradient Project Manager, who will ensure that all hard copies and electronic files are stored in an organized manner for easy retrieval. EDDs will be submitted to EPA Region 4 in accordance with the procedures outlined in the Region 4 Environmental Data Submission Guidance SESDGUID-106-R0 available at http://www.epa.gov/region4/superfund/allresource/edd/Environmental-Data-Submission.pdf.

B.10.2.2 Data Storage, Archival, and Retrieval

For the duration of the project, all electronic files will be stored on Gradient's computer network within a dedicated project directory folder. Electronic copies of the final project database will be stored indefinitely on Gradient's network. After the project is closed, the Gradient Project Manager will instruct Gradient's Information Resource Center (IRC) to permanently archive all electronic files on CD-ROM and store all hard copy documents at Gradient's off-site storage facility.

B.10.3 Comparison to Health-based Concentration Criteria

Soil and groundwater results reported by the laboratories will be compared to the health-based concentration criteria listed in Tables A.7.2 and A.7.3, to assess the magnitude of contamination and evaluate the remedial strategy for the Cabot portion of the Site.

C Quality Assurance

C.1 Assessments, Audits, and Corrective Actions

At various times throughout this program, situations may arise that will require some degree of corrective action, ranging from simple corrections on routine field documentation to systematic problems in the fixed laboratory that necessitate shutting down sample analyses until the problem is identified and corrected.

Corrective action procedures must be implemented when these situations occur, as well as when deviations from the QAPP are noted by project personnel (*i.e.*, field sampling and/or analytical problems) outside of the formal assessment process. The following paragraphs describe how situations requiring corrective action should be handled and documented in both the field and the laboratory for the purposes of this project.

A nonconformance detected during a laboratory system audit will be grounds for delay in project completion until corrective action that effectively addresses the nonconformance has been taken. The Laboratory Project Manager will be responsible for carrying out the corrective action. The Laboratory Project Manager shall evaluate each nonconformance report and shall require a written response describing the action taken to correct the deficiency.

The Laboratory Project Manager is also responsible for ensuring that no additional work dependent on the nonconforming activity is performed until the nonconformance report is corrected. All technical staff are responsible for reporting suspected technical and QA non-conformances to the Laboratory QA Manager.

Appropriate corrective action for non-conformances include re-performance of the nonconforming task, rejecting the results of the nonconforming task, accepting the results of the nonconforming task as-is, or other action. In all cases the nonconformance must be reported, the potential effects of the nonconformance on other related tasks identified, and the effectiveness of the corrective action evaluated.

The nonconformance evaluation for non-laboratory activities will, at a minimum, include evaluating the following:

- Field notebooks, logsheets, and tracking forms, and determining any inconsistencies and/or omissions therein;
- Individual work plans; and
- Final reports – reports and deliverables shall be peer reviewed before being issued.

C.1.1 Field Corrective Action

In the field, situations such as equipment or instrument malfunction may occur, which will then require subsequent corrective action. Additional problems may also be identified as a result of a field audit. Wherever possible, immediate corrective action should be taken. Immediate corrective actions taken must be clearly described in the field logbooks, but no other formal documentation is required unless further corrective action is deemed necessary.

Any problem or situation that cannot be solved through immediate corrective action will fall into the long-term corrective action category. The steps for long-term corrective action are as follows:

- Identify and define the problem;
- Investigate and determine the cause of the problem;
- Determine and implement a corrective action to eliminate the problem; and
- Verify that the corrective action has eliminated the problem.

A field Corrective Action Request Form or equivalent will be completed by the person finding the quality problem. This form identifies the problem, possible causes, and the person responsible for action on the problem. The responsible person may be a supervisor or FTL. If no person is identified as responsible for action, the FTL will investigate the situation and determine who is responsible in each case.

The Corrective Action Request Form includes a description of the corrective action planned, the date it was taken, as well as a space for follow-up. The FTL will check to be sure that initial corrective action has been taken, appears effective, and, at an appropriate later date, will check again to see if the problem has been fully solved. The FTL will receive a copy of all Field Corrective Action Forms, and will enter them into the Corrective Action Log. This permanent record will be maintained by the Field Operations Manager or designee, will aid the FTL in follow-up action, and will be reviewed by the QA Manager during program audits.

If the severity of the problem warrants discussions with the regulatory agencies, the corrective action will be discussed with US EPA Region IV prior to its implementation. An example of a situation requiring such notification is the release or threatened release of hazardous substances, pollutants, or chemical constituents that may threaten public health, welfare, or the environment. Within 24 hours of becoming aware of such a situation, US EPA Region IV will be notified with information concerning the event that occurred and the measures that have been and will be taken to mitigate the occurrence and prevent recurrence of the event.

C.1.2 Laboratory Corrective Action

As a result of a system audit, a case audit, or observation of or by laboratory personnel, discrepancies affecting the validity of quality of analytical data may be found. Corrective actions will be implemented to correct the deficiency or weakness and to identify any analytical data that may have been affected. Immediate corrective actions taken must be noted in laboratory logbooks, but no other formal documentation is required unless further corrective action is deemed necessary. If the subject laboratory has a written corrective action SOP in place, then the laboratory-specific corrective action SOP will be followed. A general description of the planned approach for laboratory corrective action is described below. The laboratory area supervisor is responsible for corrective action.

If a problem persists or cannot be readily identified, a formal corrective action procedure is initiated. The Laboratory QA Manager will use this procedure to ensure that the condition is reported to the person responsible for correcting it, who is part of a closed-loop action and follow-up plan.

The essential steps in the closed-loop corrective action system will include the following:

- Identification and definition of the problem;
- Delegation of responsibility for investigating the problem;
- Investigation and determination of the cause of the problem;
- Determination of a corrective action to eliminate the problem;
- Delegation and acceptance of responsibility for implementing the corrective action;
- Establishment of effectiveness of the corrective action and its implementation; and
- Verification that the corrective action has eliminated the problem
  - A Corrective Action Request may be initiated by an analyst supervisor or Laboratory QA Manager, or during a lab audit. A Laboratory Corrective Action Request Form or an equivalent will be completed by the person who found the quality problem. This form identifies the problem, its possible cause, and the person responsible for taking action to correct the problem. The responsible person may be an analyst, supervisor, or the Laboratory QC Manager. If no person is identified as responsible for implementing the corrective action, the Laboratory QC Manager will investigate the situation and determine the course of action for the problem's resolution.

The Corrective Action Request Form includes a description of the corrective action planned, the date it was taken, as well as a space for follow-up. The laboratory QC Manager will check that initial corrective action has been taken, appears effective, and, at an appropriate later date, will check again to see if the problem has been fully solved. The Laboratory QC Manager will receive a copy of all Laboratory Corrective Action Forms, and will enter them into the Corrective Action database. This permanent record will aid the Laboratory QC Manager in follow-up action, and this log will be reviewed by the Laboratory QA Manager during program audits.

C.2 Reports to Management

Reports for a variety of Site-related activities will be generated during this project. These reports will be submitted to numerous members of the project team as well as to the US EPA Region IV, when appropriate. The reports will include, but will not be limited to, routine monitoring reports and Site-specific investigation reports. Reports will be maintained by Gradient on its servers for the duration of the project.

C.2.1 Project Deliverables

Preparation of each report will begin following completion of the investigation activities detailed in each work plan. The specific contents of reports to be generated will be identified in each work plan. In general, reports contain historical summaries of past activities and data, summaries of field investigation activities, data quality evaluations, geologic and hydrologic data interpretations, chemical data, contamination and risk assessments, and recommendations on future actions.

Report development will involve drafting of text and compilation of data tables and figures for geologic, hydrogeologic, chemical, and risk assessment. Draft reports will be prepared under the direction of the Gradient Project Manager.

D Data Review

D.1 & D.2 Data Review, Verification, and Validation

Data review is an internal process where data are reviewed and evaluated by personnel within the laboratories. Data validation is an independent process of reviewing data and accepting, qualifying, or rejecting them on the basis of sound criteria. At this time there are no plans for a formalized data validation program, however, data generated from the fixed laboratories may be validated in future sampling events; in those instances, data will be validated according to the appropriate US EPA data validation guidance (see EPA QA/G-8; US EPA, 2002).

For the currently planned site investigations, the Gradient QAO will assess the laboratory analytical data for completeness, sensitivity, accuracy, *etc.* (see Sections A.7.2 and D), and contact the laboratory regarding data quality issues, if any.

D.3 Reconciliation of the Data to the Project-specific Data Quality Objectives

Analytical data generated for the project will be reviewed by Gradient (and/or designated representatives) prior to finalizing results for use in investigation reports.

Data review will include a comparison of the results to site-specific health limits specified in Tables A.7.2 and A.7.3. An assessment of instrument and method sensitivity will be accomplished *via* a review of the reported QLs, and overall precision *via* review of FD analyses. Completeness for individual Site investigations will be assessed by determining the percentage of data that is judged to be valid compared to the total amount of data.

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Tables

Table A.3.1 QAPP Distribution List

QAPP Recipients	Title	Organization
Manu Sharma	Principal Engineer	Gradient
Kim Reid	Quality Assurance Officer	Gradient
Scott Miller	Remedial Project Manager	US EPA
Lisa Harvey	Laboratory Project Manager	TestAmerica
Tina Green	Laboratory Project Manager	BC Labs
Mark Taylor	Field Operations Manager	Weston
Wayne Reiber	Environmental Assessment and Remediation Manager	Cabot Corporation
Kelsey Helton	Remedial Project Manager	Florida Department of Environmental Protection
John Mousa	Pollution Prevention Manager	Alachua County Environmental Protection Department
Rick Hutton	Supervising Engineer	Gainesville Regional Utilities
Pat Cline	Technical Consultant	Protect Gainesville Citizens

Table A.3.2 Project Personnel Sign-off Sheet

Project Personnel	Title	Organization	Signature	Date QAPP Read	QAPP Acceptable as Written
Manu Sharma	Principal Engineer	Gradient			
Kim Reid	Quality Assurance Officer	Gradient			
Scott Miller	Remedial Project Manager	US EPA			
Mark Taylor	Field Operations Manager	Weston			

Table A.3.3 Laboratory Personnel Sign-off Sheet

Project Personnel	Title	Organization	Signature	Date QAPP Read	QAPP Acceptable as Written
Lisa Harvey	Laboratory Project Manager	TestAmerica			
Tina Green	Laboratory Project Manager	BC Labs			

Table A.6.1 Instruments and Equipment Needed to Conduct Ongoing Work at the Site

Instrument/Equipment Description	Function	Purpose for This Site	Models/Types Typically Used at the Site
Water Quality Meter	Measures water quality parameters (*e.g.* , pH, temperature, specific conductivity, ORP, turbidity, dissolved oxygen).	Measuring water quality parameters during water sampling and well development activities. See EPA Region 4 SOPs SESDPROC-100-R3, SESDPROC-102-R4, SESDPROC-101-R5, SESDPROC-113-R1, SESDPROC-103-R3, and SESDPROC-106-R3.	YSI 6920 YSI 556, with the YSI 5083 flow-through cell
Turbidity Meter	Measures turbidity in liquids.	Measure turbidity in water samples. See EPA Region 4 SOP SESDPROC-103-R3.	LaMott 2020
Photo Ionizing Detector (PID)	Detects presence of VOCs.	Detects presence of VOCs in soil samples, well headspace, and air monitoring for health and safety.	Mini-RAE 3000
Flame Ionizing Detector (FID)	Detects presence of VOCs.	Detects presence of VOCs in soil samples, well headspace, and air monitoring for health and safety.	PhotoVac Microfid
Water Level Indicator	Measures depth to water.	Determine depth to water in wells, sumps, and piezometers. See EPA Region 4 SOP SESDPROC-105-R2.	Solonist Model 101 P2
Peristaltic Pump	Pumps liquids.	Well development. Purging and water sampling. See EPA Region 4 SOP SESDPROC-203-R3.	Geotech Geopump 2
Submersible Pumps and Control Boxes	Pumps liquids.	Well development. Purging and water sampling. Liquid transfer from tanks. See EPA Region 4 SOP SESDPROC-203-R3.	Geotech SS GeoSub Grundfos Redi Flow II Proactive SS Monsoon Pump Little Giant
Sonic Drill Rig	Drills borings/wells. Advances casings.	Install wells and soil borings. Over-drill casings to abandon wells.	Geoprobe 8140 Mini Sonic
Rotary Drill Rig	Drills borings/wells.	Install wells/borings/casings/piezometers.	BK-81 Barber Rotary Rig
Direct Push Drill Rig	Drills borings/wells.	Install borings/wells/piezometers.	Geoprobe 6620
In Situ Water Samplers	Collects water inside wells.	Collect downhole water samples.	Pro Hydro SNAP Sampler
Bailers	Collect liquids from wells.	Develop low producing wells and collect product from wells.	Teflon
Steam Cleaner		Equipment decontamination (*e.g.* , drill rig).	Various
Skid Steer	Lifting/grading/hauling.	Haul materials and supplies. Create access paths. Restore site conditions.	Various
Excavator	Digging.	Site Clearing, test pits.	Various
Loader		Loading bulk soils, site preparation, restoration. Site grading.	Various
Vac Truck	Collects liquids and sludges.	Collect IDW for off-site disposal or transportation to lift station.	Various As Supplied By Contractor
Hand Tools		Repair, maintenance, assembly.	Various
Water Storage Tanks	Contain liquids.	Store purge/development water/drilling fluids/aquifer testing water.	Portable Poly-Tanks Steel Frac Tanks
Trucks/SUVs		Transport personnel.	Various
Syringes	Collect measured amount of solids/liquids.	Soil and sediment sampling for specific VOC methods. See EPA Region 4 SOP SESDPROC-300-R3.	Plastic
Scoops	Collects solids.	Soil/sediment sampling. See EPA Region 4 SOP SESDPROC-300-R3.	
Pocket Penetrometer	Measures soil compaction rates.	Determine soil consolidation in soil cores.	AMS
Soil Color Chart	Provides soil colors for comparison with accompanying numbers.	Helps determine soil colors in a consistent repeatable method.	Munsell
Generator	Generate portable electricity.	Electricity for pumps, office trailer, power tools, portable lighting.	Various
Welder	Metal fabrication.	Weld casing segments together for steel isolation casings.	Various
Cutting Torch	Cutting and working metals.	Cutting steel casings pipes.	Various
Office Trailer	Mobile office.	On-site office. Store equipment and supplies during field operations.	William Scotsman ModSpace

Notes:

IDW = Investigation-Derived Waste; ORP = Oxidation Reduction Potential; VOC = Volatile Organic Compound.

Table A.7.1 Seven Steps of the DQO Process

Step of the DQO Process	Project-specific Information
State the Problem	See Section A-5
Identify the Goal of the Study	See Section A-6
Identify Information Inputs	Will vary by investigation; see individual work plans (Section A-6)
Define the Boundaries of the Study	Will vary by investigation; see individual work plans (Section A-6)
Develop the Analytical Approach	Parameters of interest are listed in Tables A.7.2 and A.7.3
Specify Performance or Acceptance Criteria	See Section A.7.2
Develop the Plan for Obtaining Data	Will vary by investigation; see individual work plans (Section A-6)

Note:
DQO = Data Quality Objectives.

Table A.7.2 Health-based Criteria for Analytes in Groundwater[a]

Analyte	Health-based Criteria (µg/L)	Source	Standard Laboratory Reporting Limit (µg/L)	Low Level Laboratory Reporting Limit (µg/L)	Detection Frequency
Volatile Organic Compounds (VOCs)					
2-Butanone	4,200	GCTL Sys	10	NA	37%
Acetone	6,300	GCTL Sys	10	NA	48%
Benzene	1	ROD	1	NA	63%
Bromodichloromethane	0.6	GCTL Car	1	NA	14%
Chloroform	70	GCTL Sys	1	NA	23%
Dibromochloromethane	0.4	GCTL Car	1	NA	11%
Ethylbenzene	700	MCL FDEP	1	NA	57%
Isopropylbenzene	450	EPA RSL	1	NA	22%
Methyl acetate	20,000	EPA RSL	5	NA	9%
Toluene	1,000	MCL FDEP	1	NA	75%
Xylenes (Total)	10,000	MCL FDEP	1	NA	53%
Semi-volatile Organic Compounds (SVOCs)					
2,4-Dimethylphenol	140	GCTL Sys	10	2	67%
2-Methylnaphthalene	28	GCTL Sys	10	0.2	27%
2-Methylphenol	35	GCTL Sys	10	2	53%
3+4-Methylphenol	3.5[b]	GCTL Sys	10	2	59%
Acenaphthene	260	ROD	10	0.2	16%
Dibenzofuran	28	GCTL Sys	10	1	8%
Fluorene	323	ROD	10	0.2	10%
Naphthalene	18	ROD	10	0.2	52%
Phenanthrene	210	GCTL Sys	10	0.2	7%
Phenol	2,630	ROD	10	1	52%

Notes:

(a) List includes all compounds that have health-based criteria and have been detected in at least 5% of all groundwater samples collected at the Cabot portion of the Site in sampling events conducted since 2009.

(b) 35 µg/L is the GCTL for 3-methylphenol, and 3.5 µg/L is the GCTL for 4-methylphenol.

Reporting limit is multiplied by dilution factor when dilutions are used.

GCTL = Florida Groundwater Clean-Up Target Levels, as provided in FDEP (2005). See also GCTL Technical Report (University of Florida, 2005).

GCTL Sys = GCTL Minimum Criteria, Systemic Toxicant (FDEP, 2005).

GCTL Car = GCTL Minimum Criteria, Carcinogen (FDEP, 2005).

MCL = Maximum Contaminant Levels established by Florida Department of Environmental Protection ("FDEP") or US Environmental Protection Agency ("US EPA") (FDEP, 2014a; US EPA, 2014a).

ROD = Record of Decision site-specific cleanup levels (US EPA, 1990).

RSL = US EPA Regional Screening Levels for Tapwater (US EPA, 2014b).

µg/L = Micrograms per liter.

Health-based criteria were retained, depending on availability, in the following order: ROD, MCL FDEP, MCL US EPA, and GCTL. For isopropyl benzene and methyl acetate, US EPA RSLs were used.

Table A.7.3 Florida Direct Exposure Criteria for Analytes in Soil[a]

Analyte	Health-based Criteria (µg/kg)	Standard Laboratory Reporting Limit (µg/Kg)	Low Level Laboratory Reporting Limit (µg/L)	Detection Frequency
Volatile Organic Compounds (VOCs)				
2-Butanone	110,000,000	25	NA	22%
Acetone	68,000,000	50	NA	25%
Benzene	1,700	5	NA	16%
Ethylbenzene	9,200,000	5	NA	42%
Isopropylbenzene	1,200,000	5	NA	14%
Methyl acetate	38,000,000	25	NA	27%
Styrene	23,000,000	5	NA	5%
Toluene	60,000,000	5	NA	51%
Xylenes (Total)	700,000	10	NA	39%
Semi-volatile Organic Compounds (SVOCs)				
2,4-Dimethylphenol	18,000,000	330	66	39%
2-Methylnaphthalene	2,100,000	330	6.7	48%
2-Methylphenol	31,000,000	330	33	33%
3+4-Methylphenol	3,400,000	330	33	47%
Acenaphthene	20,000,000	330	6.7	33%
Acenaphthylene	20,000,000	330	6.7	27%
Anthracene	300,000,000	330	6.7	31%
Benzo(g,h,i)perylene	52,000,000	330	6.7	20%
Dibenzofuran	6,300,000	330	33	11%
Fluoranthene	59,000,000	330	6.7	30%
Fluorene	33,000,000	330	6.7	26%
Naphthalene	300,000	330	6.7	61%
Phenanthrene	36,000,000	330	6.7	42%
Phenol	220,000,000	330	33	38%
Pyrene	45,000,000	330	6.7	35%
Carcinogenic Polycyclic Aromatic Hydrocarbons				
Benzo(a)anthracene	6,600	330	6.7	34%
Benzo(a)pyrene	700	330	6.7	33%
Benzo(b)fluoranthene	6,500	330	6.7	26%
Benzo(k)fluoranthene	66,000	330	6.7	20%
Chrysene	640,000	330	6.7	35%
Indeno(1,2,3-cd)pyrene	6,600	330	6.7	19%

Notes:
µg/kg = Micrograms per kilogram.
(a) List includes all compounds that have health-based criteria and have been detected in at least 5% of all soil samples collected at the Cabot portion of the Site in sampling events conducted since 2009.

Florida DEP Direct Exposure Criteria values accessed at University of Florida (2005).

A.8.1 Special Personnel Training Requirements

Project Function	Specialized Training by Title of Course Description	Training/ Certification Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles and Organizational Affiliation	Location of Training Records or Certifications
Field Operations Manager	• Professional Geologist Florida • 8-Hour Occupational Safety and Health Administration (OSHA) Refresher Training • Cardiopulmonary Resuscitation (CPR) • First Aid Training	State of Florida/Weston & various registered 3rd party organizations	Within previous 12 months	Mark Taylor	Sr. Project Manager/Weston	Weston Office Fernandina Beach, FL
Field Team Leader	• Field Safety Officer Training • 40-Hour Hazardous Waste Operations and Emergency Response and associated medical program training • 8-Hour Occupational Safety and Health Administration (OSHA) Refresher Training • Cardiopulmonary Resuscitation (CPR) • Dangerous Good Shipping • First Aid Training	Weston	Within previous 12 months	As assigned	Geologist	Weston Office Norcross, GA
Health & Safety Officer[a]	• Field Safety Officer Training • 40-Hour Hazardous Waste Operations and Emergency Response and associated medical program training • 8-Hour Occupational Safety and Health Administration (OSHA) Refresher Training • Cardiopulmonary Resuscitation (CPR) • First Aid Training	Weston	Within previous 12 months	As assigned	Scientist/Engineer	Weston Office Norcross, GA
Field Scientists/Engineers	• 40-Hour Hazardous Waste Operations and Emergency Response and associated medical program training • 8-Hour Occupational Safety and Health Administration (OSHA) Refresher Training • Cardiopulmonary Resuscitation (CPR) • First Aid Training	Weston	Within previous 12 months	As assigned	Scientist/Engineer	Weston Office Norcross, GA
Drilling Contractor	• State of Florida Licensed Driller • 8-Hour Occupational Safety and Health Administration (OSHA) Refresher Training	State of Florida or 3rd party	Current license Within previous 12 months	Lead driller/On-site drilling personnel	Selected contractor	Provided with Proposal/Health & Safety Plan
Surveying Contractor	• Florida Registered Land Surveyor	State of Florida	Must be current registration	Tom Tracz	DeGrove Surveying	Contractor's Office

Notes:
O&M = Operations and Maintenance.
(a) Various field team personnel and/or the project manager may serve as the site health & safety officer, as long as the person has the required training.

Table B.1.1 Sample Container Requirements, Preservation and Holding Times

Analyte	Method	Chemical Preservation	Thermal Preservation	Holding Time (To Extraction)[a]	Holding Times (To Analysis)[a]	Container Type	Container Size	Preparation Requirements
Water								
VOCs	8260 B	HCl to pH < 2	Cool to 4°C	NA	14 days	Glass	40 mL X 2	No headspace
SVOCs	8270 D	None	Cool to 4°C	7 days	40 days	Amber glass	500 mL X 2	
SVOCs	8270 D LL	None	Cool to 4 ^{0}C	7 Days	40 Days	Amber glass	250 ml X 2	
SVOCs (Terpenes)	8270	None	Cool to 4°C	7 days	40 days	Amber glass	500 mL X 2	
Metals	6010 C/7470 A	HNO3 to pH < 2	Cool to 4°C	NA	180	Plastic	250 mL	
Anions	9056 A	None	Cool to 4°C	NA	48 hours for nitrate/nitrite 28 days for other anions	Plastic	125 mL	
Alkalinity	2320 B	None	Cool to 4°C	NA	14 days	Plastic (Water) Glass/plastic (Soil)	125-250 mL (Water) 4-8 oz. (Soil)	
COD	410.4	None	Cool to 4°C	NA	28 days	Plastic	125 mL	
Sulfide	SM 4500 S2F	NaOH	Cool to 4°C	NA	7 days	Plastic	250 mL	
Dissolved Gasses	RSK 175	HCl to pH < 2	Cool to 4°C	NA	14 days	Glass	40 mL X 2	No headspace
Bromide	300.1B 28D	None	Cool to 4°C	NA	28 days	Plastic	125 mL	
TOC	415.1	H_2SO_4 to pH < 2	Cool to 4°C	NA	28 days	Glass	40 mL X 2	No headspace
Soil								
VOCs	8260 B	H_2O & MeOH	Cool to 4°C	NA	48 hours to freeze 14 days to analyze	Glass	40 mL X 3	Terra core kit
VOCs (TCLP)	8260/1311	None	Cool to 4°C	14 days to prep. leachate	14 days from leachate	Glass	4 oz.	No headspace and TCLP extraction
SVOCs	8260	None	Cool to 4°C	14 Days	40 days from extraction	Glass	16 oz. with PTFE-lined lids	
SVOCs	8260 LL	None	Cool to 4°C	14 Days	40 days from extraction	Glass	16 oz. with PTFE-lined lids	
SVOCs (TCLP)	8270/1311	None	Cool to 4°C	14 days to prep. leachate	14 days from leachate	Glass	1 L	Minimum headspace and TCLP
Metals	6010 C/7470 A	None	Cool to 4°C	None	28 days	Plastic	8 oz. Plastic	
Metals (TCLP)	6010/7470/1311	None	Cool to 4°C	6 months to prep. leachate	6 months from leachate	Glass or plastic	500 mL X 2	TCLP
TPH and Fingerprinting	8015	None	Cool to 4°C	7 days	40 days	Amber glass	1 L (Water) 30 g (Soil)	
TOC	Walkley Black	None	Cool to 4°C	NA	28 days	Glass	4 oz.	
Grain Size	ASTM D 422	None	None	None	None	Glass/ plastic	24 oz.	
Total Porosity Air Filled Porosity Dry Bulk Density	API RP 40	None	Place in cooler with wet or dry ice	NA	None if sealed	Plastic sleeve	Length of core barrel (2-4 ft.)	Mark depths in ft. below ground surface/minimize disturbance
Air/Water Capillary Pressure	ASTM D 836	None	Place in cooler with wet or dry ice	NA	None if sealed	Plastic sleeve	Length of core barrel (2-4 ft.)	Mark depths in ft. below ground surface/minimize disturbance
Permeability to Air/Water Hydraulic Conductivity	API RP 40 EPA 9100	None	Place in cooler with wet or dry ice	NA	None if sealed	Plastic sleeve	Length of core barrel (2-4 ft.)	Mark depths in ft. below ground surface/minimize disturbance

Notes:

COD = Chemical Oxygen Demand; NA = Not applicable; SVOC = Semi-volatile Organic Compounds; TCLP = Toxicity Characteristic Leaching Protocol; TOC = Total Organic Carbon; PTFE = Polytetrafluoroethylene; VOC = Volatile Organic Compound.

(a) Holding times are from sample collection date unless otherwise specified.

Table B.2.1 Sampling SOP References

Sampling Type	SOP Title and Reference Number	Source of SOP	Equipment Type	Modified for Project (Yes/No)
Groundwater Sampling from Monitoring Wells	Groundwater Sampling - SESDPROC-301-R3	US EPA Region IV SESD	Pumps/tubing, Water quality meters	No
	Groundwater Sampling - FS 2200	FDEP (2014b)		
	Field pH Measurement - SESDPROC 100-R3	US EPA Region IV SESD		
	Field Temperature Measurement - SESDPROC-102-R4	US EPA Region IV SESD		
	Field Specific Conductance Method - SESDPROC-101-R5	US EPA Region IV SESD		
	Field Measurement of Oxidation Reduction Potential - SESDPROCE-113-R1	US EPA Region IV SESD		
	Field Turbidity Measurement - SESDPROC-103-R3	US EPA Region IV SESD		
	Field Measurement of Dissolved Oxygen - SESDPROC 106-R3	US EPA Region IV SESD		
	Groundwater Level and Well Depth Measurement - SESDPROC-105-R2	US EPA Region IV SESD		
	Pump Operation - SESDPROC-203-R3	US EPA Region IV SESD		
	Management of Investigative Derived Waste - SESDPROC-202-R3	US EPA Region IV SESD		
Groundwater Sampling from Borings	Groundwater Sampling - SESDPROC-301-R3	US EPA Region IV SESD	Pumps/tubing, Water quality meters	Yes
	Groundwater Sampling from Borings - FS 2200	FDEP (2014b)		
	Field pH Measurement - SESDPROC 100-R3	US EPA Region IV SESD		
	Field Temperature Measurement - SESDPROC-102-R4	US EPA Region IV SESD		
	Field Specific Conductance Method - SESDPROC-101-R5	US EPA Region IV SESD		
	Field Measurement of Oxidation Reduction Potential - SESDPROCE-113-R1	US EPA Region IV SESD		
	Field Turbidity Measurement - SESDPROC-103-R3	US EPA Region IV SESD		
	Field Measurement of Dissolved Oxygen - SESDPROC 106-R3	US EPA Region IV SESD		
	Groundwater Level and Well Depth Measurement - SESDPROC-105-R2	US EPA Region IV SESD		
	Pump Operation - SESDPROC-203-R3	US EPA Region IV SESD		
	Management of Investigative Derived Waste - SESDPROC-202-R3	US EPA Region IV SESD		
Soil Sampling	Soil Sampling - FS 3000	FDEP (2014c)	Core barrels, Scoops, Hand auger, Spoons	No
	Soil Sampling - SESDPROC-300-R3	US EPA Region IV SESD		
	Management of Investigative Derived Waste - SESDPROC-202-R3	US EPA Region IV SESD		
IDW Sampling	Waste Sampling - FS 5000	FDEP (2014d)	Bailer, Scoops, Spoons, Pumps/tubing	No
	Waste Sampling - SESDPROC-302-R2	EPA Region IV SESD		
Monitoring Well Installation	Design & Installation of Monitoring Wells - FDEP Bureau of Water Facilities Reg. 2008	FDEP (2008)	Drill Rigs, Pumps/ Tubing, Water Quality Meters	No
	Monitoring Well Design and Construction Guidance Manual - SESDGUID-101-R1	US EPA Region IV SESD		
	Field pH Measurement - SESDPROC 100-R3	US EPA Region IV SESD		
	Field Temperature Measurement - SESDPROC-102-R4	US EPA Region IV SESD		
	Field Specific Conductance Method - SESDPROC-101-R5	US EPA Region IV SESD		
	Field Measurement of Oxidation Reduction Potential - SESDPROCE-113-R1	US EPA Region IV SESD		
	Field Turbidity Measurement - SESDPROC-103-R3	US EPA Region IV SESD		
	Field Measurement of Dissolved Oxygen - SESDPROC 106-R3	US EPA Region IV SESD		
	Groundwater Level and Well Depth Measurement - SESDPROC-105-R2	US EPA Region IV SESD		
	Pump Operation - SESDPROC-203-R3	US EPA Region IV SESD		
	Management of Investigative Derived Waste - SESDPROC-202-R3	US EPA Region IV SESD		

Notes:
FDEP = Florida Department of Environmental Protection; IDW = Investigation-derived Waste; SESD = Science and Ecosystem Support Division.
All Field SOPs not publicly available online are included in Appendix D.

Table B.2.2 Sampling Equipment Used to Conduct Ongoing Work at the Site

Instrument/Equipment Description	Use for Sampling Activities	Models/Types Typically Used at the Site
Water Quality Meter	Measuring water quality parameters during water sampling and well development activities.	YSI 6920 YSI 556, with the YSI 5083 flow-through cell
Turbidity Meter	Measure turbidity in water samples.	LaMott 2020
Photo Ionizing Detector (PID)	Measuring VOC concentrations in soil and water samples, well headspace, and air monitoring for health and safety.	Mini-RAE 3000
Flame Ionizing Detector (FID)	Measuring VOC concentrations in soil and water samples, well headspace, and air monitoring for health and safety.	PhotoVac Microfid
Water Level Indicator	Determine depth to water in wells, sumps, piezometers. Measures well draw down for low flow purging.	Solonist Model 101 P2
Peristaltic Pump	Well development, well purging, and water sampling.	Geotech Geopump 2
Submersible Pumps & Control Boxes	Well development, well purging, water sampling, and liquid transfer from tanks.	Geotech SS GeoSub Grundfos Redi Flow II
Sonic Drill Rig	Install wells and soil borings and collect soil cores.	Geoprobe 8140 Mini Sonic
Direct Push Drill Rig	Install borings/wells/piezometers and collect soil cores.	Geoprobe 6620
In Situ Water Samplers	Collect downhole water samples.	Pro Hydro SNAP Sampler
Bailers	Develop low producing wells, collect product from wells, and collect IDW samples.	Teflon
Syringes	Soil and sediment sampling for specific VOC methods.	TerraCore
Scoops/Spoons	Soil/sediment sampling.	Stainless Steel or Teflon Coated
Pocket Penetrometer	Determine soil consolidation in soil cores.	AMS
Soil Color Chart	Helps determine soil colors in a consistent repeatable method.	Munsell

Notes:

IDW = Investigation-derived Waste; VOC = Volatile Organic Compound.

Table B.2.3 Key Study Personnel

Project Role	Name	Function/Responsibilities	Comment
Field Operations Manager	Mark Taylor	• Supervises Field Team Leader/Project Geologist • Monitors compliance with work plan • Coordinates with property owners • Organizes subcontractor efforts • Communicates work progress to client and stakeholders	
Field Team Leader	As assigned for specific work item	• Directs the field team • Manages on-site subcontractors • Prepares daily reports	
Field Scientists/Engineer	As assigned	• Supports Field Team Leader in carrying out field activities • Collects and processes samples • Prepares field documentation	
Quality Manager	As assigned	• Provides QA surveillance of field work • Ensures compliance with QAPP SOPs and requirements	
Laboratory Project Manager	Lisa Harvey (TestAmerica) Tina Green (BC Labs) Michael Brady (PTS Labs)	• Coordinates shipment of sampling bottles and supplies • Coordinates receipt of samples • Manages preparation of analytical deliverables • Manages problem resolution	
Site Health & Safety Officer	As assigned	• Monitors compliance with site specific health & safety plan	Field team member with appropriate training and qualifications

Table B.3.1 Quality Control Check Summary

QC Checks	Frequency		
	Field Team	**TestAmerica**	**BC Labs**
Field Blank (FB)	1 per matrix per parameter per SDG	NA	NA
Trip Blank (TB)	1 per cooler	NA	NA
Temperature Blank	1 per cooler	1 per cooler	1 per cooler
Field Duplicate (FD)	1 per matrix per parameter per 20 samples or SDG	1 per matrix per parameter per 20 samples or SDG	NA
Method (Preparation) Blank (MB)		1 per batch, not to exceed 20 samples	1 per analytical batch
Matrix Spike (MS)	One per 20 or SDG	1 per 20 or SDG or as specified by reference method	1 per analytical batch
Matrix Spike Duplicate (MSD)	1 per 20 samples per matrix or SDG (minimum 5 percent frequency)	1 per 20 or SDG or as specified by reference method	1 per analytical batch
Matrix Duplicate (MD)	1 per 20 samples per matrix or SDG (minimum 5 percent frequency)	As specified by reference method	1 per analytical batch, not to exceed 20 samples
Laboratory Control Sample (LCS)	NA	1 per analytical batch not to exceed 20 samples	1 per analytical batch, not to exceed 20 samples
Continuing Calibration Check (CCC)	NA		Every 12 hours or per shift, not to exceed 12 hours (or at the beginning and end of 10 field samples), method-dependent
Performance Evaluation (PE) Samples	NA	Biannually	Biannually per matrix and field of testing
Initial Calibration Verification Check (ICV)	NA	Once after each initial calibration	Once after initial calibration
Initial Calibration Blank (ICB)	NA	As required by referenced method	Once after initial calibration
Continuing Calibration Verification Check (CCV)	NA	As required by referenced method	Every 10 samples during analytical run or every 12 hours, method-dependent
Continuing Calibration Blank (CCB)	NA	As required by referenced method	Every 10 samples during analytical run or every 12 hours, method-dependent
Surrogate Spike	NA	All samples and batch QC items, as required by the reference method	Every analytical run (organics only)

Notes:
NA = Not Applicable; QC = Quality Control; SDG = Sample Delivery Group.

Table B.3.2 Transfer of Custody Documentation Parameters

Parameter	Description
Laboratory	The laboratory name and address where the samples are being sent.
Contact	The primary contact at the laboratory along with the phone and fax numbers.
Client	The Contractor's office address contracting the sample analyses.
Shipment Number	A unique identifier applied to the shipment.
Method of Shipment	*e.g.* , FedEx, courier.
Air Bill Number	Shipper's unique identifier for the shipment.
Project Number	The Contractor's project task number under which the samples were collected.
Project Name	A description of the Contractor's project task number.
Project Contact	The Contractor's Project Manager's name, along with the phone and fax numbers.
Sampler's Signature	Signature of the person responsible for the collection of the samples and filling out the chain-of-custody form.
Lab Job	This field is filled in by laboratory personnel after the samples have been logged in.
Ship Date	The date the samples are shipped to the laboratory.
Page	The page number of the chain-of-custody (*e.g.* , page 1 of 2).
Sample	A unique sample number is generated for each field sample ID listed, which helps to distinguish samples across multiple lines and pages of the chain-of-custody form.
Field Sample ID	The unique sample identifier.
Sampling Date	The date the sample was collected.
Sampling Time	The time the sample was collected.
Matrix Type	The matrix type of the sample (*e.g.* , S for solid, W for aqueous, and A for air/vapor).
Type/Size of Container	*e.g.* , Stainless steel sleeve or 40 mL VOA vial.
Preservation - Temp.	*e.g.* , 4°C.
Preservation - Chemical	*e.g.* , Hydrochloric acid.
Filtered	Check box if sample was filtered in the field.
No. of Containers	Enter the number of sample containers.
Analyses Requested	List all analyses to be performed on the samples listed, and then check the boxes under each analysis on the lines for each sample.
Remarks	Enter any sample or analysis-specific remarks (*e.g.* , MS/MSD requests, short holding time).
Relinquished by - Signature	Signature of the person relinquishing the shipment of samples.
Relinquished by - Printed	Printed name of the person relinquishing the shipment of samples.
Relinquished by - Company	Company the person that is relinquishing the shipment of samples works for.
Relinquished by - Reason	Reason the samples are being relinquished.
Relinquished by - Date/Time	Date and time the samples are relinquished.
Received by – Signature	Signature of the person receiving the shipment of samples.
Received by – Printed	Printed name of the person receiving the shipment of samples.
Received by – Company	Company the person that is receiving the shipment of samples works for.
Received by – Date/Time	Date and time the samples are received.
Comments	Enter any shipment related comments (*e.g.* , level of data requested, QC sample designation, special sample handling instructions, high concentration sample information, turnaround time, *etc.*).

Notes:

ID = Identification; MS/MSD = Matrix Spike/Matrix Spike Duplicate; QC = Quality Control; VOA = Volatile Organic Analysis.

Table B.3.3 Sample Identification Plan

Sample Type	Primary Sample Designation	Secondary Sample Designation	Tertiary Sample Designation	Example Number	Comments
Groundwater Sample from Surficial Aquifer Monitoring Well	Well Number	None	None	SA-33	
Groundwater Sample from Hawthorn Group Monitoring Well	Well Number	Upper (S) or Lower (D) Hawthorn Group	None	HG-30S/D	
Groundwater Sample from Upper Floridan Aquifer Monitoring Well	Well Number	Multiport Sampling Zone (Z)	None	CFW-1-Z1	
Soil Sample from Boring	Boring Designation with SB Prefix	Sample Interval in Feet	None	SB23-15-20	
Groundwater Sample from Boring	Boring Designation with WS Prefix	Sample Interval in Feet	None	WS22-20-25	
Drum Sample	Prefix "Drum"	Sample Type (*e.g* ., soil, water, sludge)	Drum Designation	Drum-Water-SB23	Drums are labeled with source of material (*e.g* ., well designation).
Tank Sample	Prefix "Tank"	Tank Type (*e.g.* , poly tank, frac tank)	Tank Designation	Tank-Poly 3	Tanks on-site are numbered consecutively.

Table B.4.1 Laboratory Instruments

Analysis	Method	Instrumentation	Example Equipment[a]
VOCs Water	8260	Head Space Device, GC with FID, GC/Mass Spectrometer	Headspace Device Tekmar 70000, GC Agilent 5890, 6890 or 7890, MS Agilent 5973
SVOCs Water	8270	Liquid/Liquid Extractor, Turbo Trap Concentration Device, and GC/MS	GC Agilent 6890 or 7890 and MS Agilent 5973 & 5975
VOCs Soil	8260	Head Space Device, GC with FID, GC/Mass Spectrometer	Terracores/Encores, Headspace Device Tekmar 70000, GC Agilent 5890, 6890 or 7890, MS Agilent
SVOCs Soil	8270	Ultrasonic Disruptor, Microwave Extractor, Turbo Trap Concentration Device, and GC/MS	GC Agilent 6890 or 7890 and MS Agilent 5973 & 5975
Metals By ICP	6010 & 200.7	Digestion Block, Turbidity Meter, ICP Emission Spectrometer	ES Varian 730
Metals By ICP MS	6020 &200.8	Digestion Block and ICP Emission Spectrometer	Agilent 7500CE with ORS
Anions	300.0 and 9056A	Ion Chromatography System	Dionex ICS 2000 (RFIC)
Alkalinity	2320 B	pH Meter, Conductivity Meter, and Titrate Autoanalyzer	PC Titrate Plus Auto Titration System
COD Water	410.4	Spectronic	Milton Roy Model 301
Sulfide	SM 4500 S2F	Centrifuge	
TOC Water	415.1	TOC-VCPN Carbon Analyzer	Shimadzu TOC-VCPN Carbon Analyzer
Dissolved Gases Water	RSK 175 & RSK 175 Modified	GC FID/TCD	Varian 3600 with FID & TCD or Agilent 6890 with FID & TCD
TCLP (SVOCs & Metals)	1311	Non-ZHE Extractor	
TCLP (VOCs)	1311	ZHE Extractor	
Grain Size	ASTM D2217 or D42263	Hydrometer & Sieves (3.0" to #200)	Gilson Co. Sieves
Fingerprinting			
Terpenes	8270C	GC/MS	HP 5690 Series II/HP 5971 and HP 5890 Series II/HP 5972
TPH and Fingerprinting	8015	GC, FID	HP vectra VL with HP 35900 E interface, HP GC Chemstation Software

Notes:

COD = Chemical Oxygen Demand; FID = Flame Ionization Detector; GC = Gas Chromatograph; ICP = Inductively Coupled Plasma ; MS = Mass Spectrometer; ORS = Octopole Reaction System; RFIC = Reagent-free Ion Chromatography; SVOC = Semi-volatile Organic Compound; TCLP = Toxicity Characteristic Leaching Protocol; TCD = Thermal Conductivity Detector; TOC = Total Organic Carbon; VOC = Volatile Organic Compound; ZHE = Zero Headspace Extractor.

(a) Equipment models and manufactures are shown as examples and may vary.

Table B.4.2 Analytical Testing Responsibilities

Analysis	Method	Responsible Party for Success of Analysis	Responsible Party for Corrective Action
VOCs (soil and water)	8260	Analyst	QC/Lab Area Manager
SVOCs Water	8270	Analyst	QC/Lab Area Manager
SVOCs Water	8270 Low Level	Analyst	QC/Lab Area Manager
SVOCs Soil	8270	Analyst	QC/Lab Area Manager
SVOCs Soil	8270 Low Level	Analyst	QC/Lab Area Manager
Metals By ICP	6010 & 200.7	Analyst	QC/Lab Area Manager
Metals By ICP MS	6020 & 200.8	Analyst	QC/Lab Area Manager
Anions	300.0 and 9056A	Analyst	QC/Lab Area Manager
Alkalinity	2320 B	Analyst	QC/Lab Area Manager
COD Water	410.4	Analyst	QC/Lab Area Manager
Sulfide	SM 4500 S2F	Analyst	QC/Lab Area Manager
TOC Water	415.1	Analyst	QC/Lab Area Manager
Dissolved Gases Water	RSK 175 & RSK 175 Modified	Analyst	QC/Lab Area Manager
TCLP (SVOCs & Metals)	1311	Analyst	QC/Lab Area Manager
TCLP (VOCs)	1311	Analyst	QC/Lab Area Manager
Grain Size	ASTM D2217 or D42263	Analyst	QC/Lab Area Manager
Fingerprinting			
Terpenes	8270C	Analyst	QC/Lab Area Manager
TPH and Fingerprinting	8015	Analyst	QC/Lab Area Manager

Notes:

COD = Chemical Oxygen Demand; ICP = Inductively Coupled Plasma; MS = Mass Spectrometer; QC = Quality Control; SVOC = Semi-volatile Organic Compound; TCLP = Toxicity Characteristic Leaching Protocol; TOC = Total Organic Carbon; TPH = Total Petroleum Hydrocarbon; VOC = Volatile Organic Compound.

Table B.5.2 Quality Control Check Reference for Fixed Laboratory Analyses in Groundwater

Laboratory Parameters	Calibration	Applicable Quality Control Check for Water												
		FB	TB	FD	MB	MS	MSD	MD	LCS	CCC	ICV	ICB	CCV	CCB
Groundwater														
VOCs *via* 8260	X	X	X	X	X	X	X		X		X		X	
SVOCs	X	X		X	X	X	X		X		X		X	
Metals	X	X		X	X	X	X		X		X	X	X	X
Anions *via* IC	X	X		X	X	X	X		X[a]		X	X	X	X
Alkalinity	X	X		X	X			X	X		X		X	
Sulfide		X		X	X	X	X		X					
Dissolved Gases (Methane, Ethane, Ethylene) *via* RSK 175	X	X		X	X	X	X		X		X		X	
Dissolved Gases (CO_2, Methane, Ethane, Ethylene) *via* RSK 175	X	X		X	X	X	X		X		X		X	
COD	X	X		X	X	X			X		X	X	X	X
Fingerprinting														
Terpenes *via* 8270C	X	X		X	X	X	X		X		X		X	
TPH and Finerprinting *via* 8015	X	X		X	X	X	X		X		X		X	

Notes:

CCB = Continuing Calibration Blank; CCC = Continuing Calibration; CCV = Continuing Calibration Verification; COD = Chemical Oxygen Demand; FB = Field Blank; FD = Field Duplicate; IC = Ion Chromatography; ICB = Initial Calibration Blank; ICV = Initial Calibration Verification; LCS = Laboratory Control Sample; MB = Method Blank; MD = Matrix Duplicate; MS = Matrix Spike; MSD = Matrix Spike Duplicate; SVOC = Semi-volatile Organic Compound; TB = Trip Blank; TPH = Total Petroleum Hydrocarbon; VOC = Volatile Organic Compound.

Quality control checks are defined in Table B.3.1 and Section B.5 in the text.

(a) LCS is not required for mercury analyses of water samples.

Table B.5.3 Quality Control Check Reference for Fixed Laboratory Analyses in Soils

Laboratory Parameters	Calibration	Applicable Quality Control Check for Soil												
		FB	TB	FD	MB	MS	MSD	MD	LCS	CCC	ICV	ICB	CCV	CCB
VOCs *via* 8260	X	X	X	X	X	X	X		X		X		X	
SVOCs	X	X		X	X	X	X		X		X		X	
Metals	X	X		X	X	X	X		X		X	X	X	X
TCLP VOCs	X	X	X	X	X	X	X		X		X		X	
TCLP SVOCs	X	X		X	X	X	X		X		X		X	
TCLP Metals	X	X		X	X	X	X		X		X	X	X	X
TOC *via* Lloyd Khan				X	X				X[a]				X	X
TOC *via* Walkley Black				X	X				X[a]				X	X

Notes:

Quality control checks are defined in Table B.3.1 and Section B.5 in the text.

(a) For total organic carbon, the LCS can equal the ICV, provided it is a separate source from the calibration standards.

CCB = Continuing Calibration Blank; CCC = Continuing Calibration Check; CCV = Continuing Calibration Verification; FB = Field Blank; FD= Field Duplicate; ICB = Initial Calibration Blank; ICV = Initial Calibration Verification; LCS = Laboratory Control Sample; MB = Method Blank; MD = Matrix Duplicate MS = Matrix Spike; MSD = Matrix Spike Duplicate; SVOC = Semi-volatile Organic Compound; TB = Trip Blank; TCLP = Toxicity Characteristic Leaching Procedure; TOC = Total Organic Carbon; VOC = Volatile Organic Compounds.

Table B.6.1 Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Water Quality Meter	Daily calibration for conductivity, pH, ORP, DO, and turbidity, in accordance with the manufacturer recommends.	Daily cleaning of the probes and replacement as necessary in accordance with manufacturer recommends.	See calibration activity.	Daily inspection of probes, cables and connectors.	Daily	Based on manufacturer user guide.	Replace batteries; Shut down and restart; Unit and probe replacement.	Field Team Leader	Manufacturer (YSI) User Guide
Water Level Meter	Weekly: Check water level in bucket or drum for accuracy of response.	Cleaning between wells. Change battery as needed.	Use/test “Battery Test Button” before each use; Check water level accuracy weekly.	Daily: Inspect tape and connection to sonde; Check battery with test button; Inspect for staining.	Daily	Based on manufacturer user guide.	Replace battery; Clean instrument; Replace Instrument.	Field Team Leader	Manufacturer (Solonist) User Guide
Photo Ionizing Detector (PID)	Daily: Use calibration gas as per manufacturer.	Recharge battery.	Test response with Sharpie.	Inspect probe intake; Check battery life; Check moisture filter.	Daily	Based on manufacturer user guide.	Remove any obstructions from probe intake; Recharge battery; Recalibrate; Replace instrument; Replace moisture filter.	Field Team Leader	Manufacturer (RAE Instruments) User guide
Flame Ionizing Detector (FID)	Daily: Use calibration gas per manufacturer.	Recharge battery.	Test response with Sharpie.	Inspect probe intake; Check battery life; Check moisture filter.	Daily	Based on manufacturer user guide.	Remove any obstructions from probe intake; Recharge battery; Recalibrate; Replace instrument; Replace moisture filter.	Field Team Leader	Manufacturer (Photovac/ Inficon) User
Turbidity Meter	Daily: Use DI water, then 10.0 NTU standard; Notch on calibration bottle lined up with arrow on meter.	Change battery.	Check battery level.	Check calibration solutions are closed; Check measuring vial is clear of smudges.	Daily	Match Reference Standard.	Recalibrate; Wipe fingerprints from calibration standard bottle; Replace calibration check battery.	Field Team Leader	LaMott 2020 Turbidity Meter User's Guide

Notes:
DI = De-ionized; DO = Dissolved Oxygen; ORP = Oxidation Reduction Potential; SOP = Standard Operating Procedure.

Table B.6.2 List of Consumables/Supplies and Acceptance Criteria

Item Description	Acceptance Criteria	Responsible Person
Teflon-lined Tubing	• Package sealed • No visible dirt or staining	Field Team Member opening supplies
Silicone Tubing	• Package sealed • No visible dirt or staining	Field Team Member opening supplies
pH Buffer Solutions	• New bottle is sealed • Check expiration date • Check container for leaks • Container label confirms contents	Field Team Member opening supplies
KCl Solution	• New bottle is sealed • Check expiration date • Check container for leaks • Container label confirms contents	Field Team Member opening supplies
Calibration Gases (*e.g.* , Isobutylene)	• Cylinder in good condition • Threads on discharge fitting undamaged • Check if cylinder is full on first use • Cylinder label confirms contents	Field Team Member opening supplies
Surgical Gloves	• Box or packaging is unopened	Field Team Member opening supplies
Soil Sampling Syringes (*e.g* ., Terra Core)	• Syringe kit is sealed/unopened • Syringe is appropriate size	Field Team Member using item
Sample Bottles – Unpreserved	• Packaging arrives unopened • Container is intact, undamaged and clean	Field Team member opening sample bottle container (*i.e.* , cooler or box)
Sample Bottle – Preserved	• Packaging arrives unopened • Container is intact, undamaged and clean • Lid is closed • Preservative is inside bottle, and label on bottle showing preservative type	Field Team member opening sample bottle container (*i.e.* , cooler or box)
Analyte-free Water	• Container seal is intact • No leaks in container • Container label confirms contents	Field Team Member opening shipment
Isopropanol	• Container seal is intact • No leaks in container • Container label confirms contents	Field Team Member opening shipment
Phosphate-free Detergent (*e.g.* , Liquinox)	• Container lid is closed • No leaks in container • Container label confirms contents	Field Team member opening shipment
Custody Seals	• Seals are dry, clean, not folded, and not torn, and adhesive still working	Field Team Member using seals
Compressed Hydrogen for FID	• Cylinder in good condition • Threads on discharge fitting undamaged • Check if cylinder is full on first use • Cylinder label confirms contents	Field Team Member using cylinder

Notes:

FID = Flame Ionization Detector; KCl = Potassium Chloride.

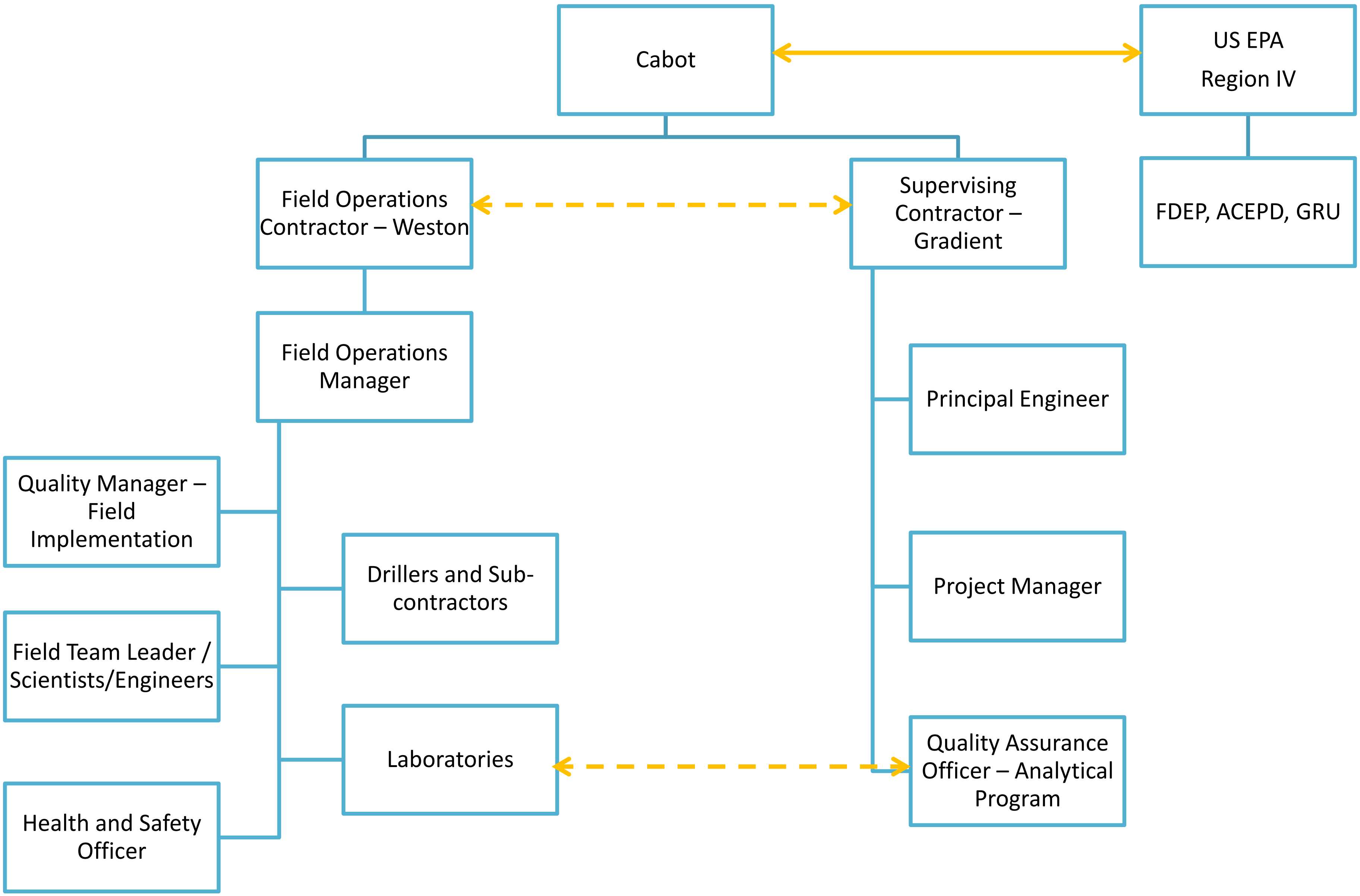
Table B.10.1 Electronic Disk Deliverable Requirements

Field Name	Comments
Laboratory	The laboratory name (include division if applicable).
Project Description	Client-assigned project description (*e.g.,* Cabot 2014 Q3 Sampling).
Laboratory ID	Laboratory defined sample identifier (alpha numeric).
Result Type	Qualifies the type of result provided (*e.g.,* "Dilution" indicates the result came from a dilution of the original sample).
Sample Type	Specifies whether sample is collected from the field or a QC sample (*e.g.* method blank, laboratory control sample, *etc.*).
Sample ID	Sample ID as recorded on the COC (do not append "RE," "DL," *etc.* for reanalysis, dilutions – put this information in the Aliquot field).
Medium	The matrix of the sample (*e.g.,* soil, aqueous, sludge, product).
Date Sampled	Date of sample collection (yyyy-mm-dd).
Sampling Time	Time of sample collection (hh:mm).
Date Analyzed	Date the sample was analyzed (yyyy-mm-dd).
Date Extracted	Date of sample extraction or preparation, if applicable (yyyy-mm-dd).
Method	The analytical method that was followed when analyzing this parameter. For method references that are not parameter-specific like "CLP," include the parameter type in this field (*e.g.,* "CLP-VOA" or "CLP-INORG").
SDG Number	The laboratory assigned SDG or Task Number.
Chemical Code	The chemical's CAS number (no leading zeros).
Chemical Name	The name of the constituent analyzed for (must use same chemical naming dictionary supplied to lab). If the chemical name contains commas, the entire name must be enclosed in quotes (*e.g* ., "1,2-dichlorobenzene").
Units	Concentration units (*i.e.,* µg/L, µg/kg, ppb, %). Can be upper or lower case.
Result	Concentration of the constituent. Significant figures must match the significant figures on the reporting sheets.
Qualifiers	Laboratory qualifiers applied to the result (*e.g.,* "U" for nondetect results, "J" for estimated results, *etc.*).
Reporting Limit	Laboratory-set analyte concentration below which values are estimated.
Quantitation/Detection Limit	Sample specific quantitation/detection limit.
Dilution Factor	The sample/analyte dilution factor.
Batch ID	Laboratory-assigned number for a group of analyzed samples.
Percent Solids	For soils and sediments, the percentage of solids in the sample analyzed.
Basis	Specifies whether results are for total or dissolved values.
TIC Indicator (Yes/No)	This field should indicate whether the reported compound is a TIC. If reported in the data package, TICs should also be included on the EDD.

Notes:

COC = Chain of Custody; CLP = Contract Laboratory Program; EDD = Electronic Disk Deliverable; ID = Identification; SDG = Sample Delivery Group; TIC = Tentatively Identified Compound; VOA = Volatile Organic Analysis.

Figures



GRADIENT

Organizational Chart

Cabot Carbon/Koppers Superfund Site - Gainesville, Florida

FIGURE
A.4.1

Date: 02/26/2015

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GRADIENT

Site Plan

Cabot Carbon/Koppers Superfund Site - Gainesville, Florida

FIGURE

A.5.1

Date: 3/2/2015

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