FINAL

QUALITY ASSURANCE PROJECT PLAN

Upland Operable Unit Remedial Investigation

Bradford Island
Bonneville Lock and Dam Project
Cascade Locks, Oregon

Prepared for

U.S. Army Corps of Engineers
Portland District
333 SW First Avenue
Portland, Oregon 97208-2946

October 2008

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Additionally, this document will be made available to the project Technical Advisory Group (TAG), and to the public via the website: https://www.nwp.usace.army.mil/issues/bradford/documents.asp.

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LIST OF ABBREVIATIONS

AF	attenuation factor
AOPC	area of potential concern
bgs	below ground surface
BPA	Bonneville Power Administration
bss	below sediment surface
CCV	continuing calibration verification
COI	contaminant of interest
COR	contracting officer’s representative
CRITFC	Columbia River Inter-Tribal Fish Commission
DOC	dissolved organic carbon
DOD	Department of Defense
DQCR	daily quality control report
DQO	data quality objective
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
FS	feasibility study
ft	foot
GIS	Geographical Information System
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations and Emergency Response
HDPE	high density polyethylene
HMSA	Hazardous Materials Storage Area
HTRW CX	Directorate of Environmental Munitions Center of Expertise, Huntsville Engineering and Support Center
IDW	investigation-derived waste
ITR	independent technical review
kg	kilogram
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MDL	method detection limit
µg	microgram
m^3	cubic meters
mg	milligram
ml	milliliter
MQL	method quantitation limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NAD27	North American Datum of 1927

NAD83	North American Datum of 1983
ND	not detected
NE	not established
NELAP	National Environmental Laboratory Accreditation Program
NRWQC	National Recommended Water Quality Criteria
NWP	Portland District USACE
NWS	Seattle District USACE
NWTPH-Dx	Northwest Total Petroleum Hydrocarbons – diesel range
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons – gasoline range
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODHS	Oregon Department of Human Services (Health Division)
OU	operable unit
PAH	polynuclear aromatic hydrocarbon
PCE	tetrachloroethene
PCB	polychlorinated biphenyl
pdf	portable document format
PID	photoionization detector
PDT	Project Delivery Team
PM	Project Manager
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
QSM	Quality System Manual
RBC	risk based concentration
RI	remedial investigation
RPD	relative percent difference
SIM	selective ion monitoring
SLV	screening level value
SM	Standard Method
SOP	standard operating procedure
SVOC	semi-volatile organic compound
TAG	Technical Advisory Group
TCE	trichloroethene
TDS	total dissolved solids
TOC	total organic carbon
TPH	total petroleum hydrocarbon
TSS	total suspended solids
URS	URS Corporation

USCS	Unified Soil Classification System
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WDNR	Washington Department of Natural Resources
WDOE	Washington Department of Ecology
WDOEn	Washington Department of Energy
WMGJ	wide mouth glass jar
WRD	Oregon Water Resources Department
VOA	volatile organic analysis
VOC	volatile organic compound

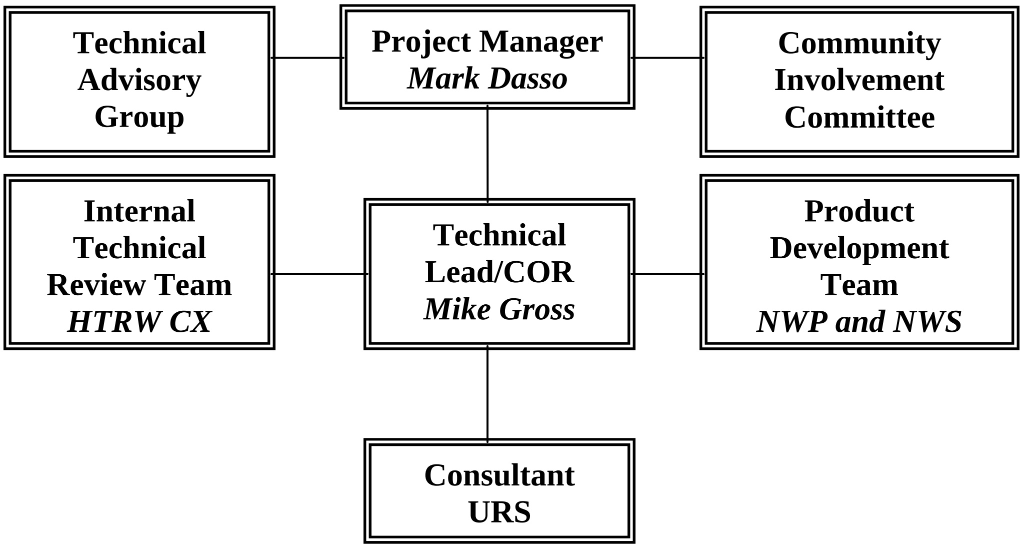
A PROJECT MANAGEMENT

A 1.0 Project Organization

The United States Army Corps of Engineers (USACE) Portland District is performing a remedial investigation/feasibility study (RI/FS) at Bradford Island at Bonneville Dam, Oregon (Figure 1). The project area has been divided into two operable units (OUs) based on media affected and geographical area: the Upland OU, which encompasses work that has taken or will take place on Bradford Island, and the River OU, which encompasses work that has taken or will take place in the Columbia River proximate to the Bonneville Dam (Figure 2). This Quality Assurance Project Plan (QAPP) describes the sampling and analysis activities intended to address the identified data needs for the Upland OU. It has been prepared in accordance with the Uniform Federal Policy for Quality Assurance Plans (EPA, 2005). The River OU QAPP was finalized on September 7, 2007, and investigative activities described in the River OU QAPP have been completed.

The following is an organizational chart. A brief description of the groups identified in the chart is provided below.

Organization Chart



COR = Contracting Officer Representative
HTRW CX = Directorate of Environmental Munitions Center of Expertise, Huntsville Engineering and Support Center
NWP = Portland District USACE
NWS = Seattle District USACE

A 1.1 USACE Personnel

USACE Project Manager – Mark Dasso, Engineer. The USACE Project Manager (PM) will have project management authority throughout the life of the project and is responsible for overall management and execution of the project, including project quality, cost, and schedule.

USACE Technical Lead and Contracting Officer Representative (COR) – Mike Gross, Engineer. Mr. Gross manages the Project Delivery Team (PDT) to deliver quality products on time and within budget. He is the main point of contact for architecture/environmental (A/E) contractors and task orders. He initiates and manages this task order (preparing statement of work, [SOW], negotiating, etc.). He manages PDT funding by assessing finding needs and communicating these to the PM, and tracks schedules. He also acts as PM if directed to do so (i.e. for extended PM absences, etc.), and in other times assists the PM as necessary.

USACE Technical Team Support – John Wakeman, Risk Assessor. Mr. Wakeman assists Mr. Gross to achieve the technical objectives of this project. He will help keep the USACE PM and technical lead informed of technical issues. **Cathy Martin**, Chemist. Ms. Martin will also be assisting Mr. Gross to achieve the technical objectives of this project.

USACE Independent Technical Reviewers (ITR) – Thomas Georgian, chemist, and **Sam Bass,** geologist of the USACE Directorate of Environmental and Munitions Center of Expertise, Huntsville Engineering and Support Center. The ITRs are responsible for assuring that the technical approach to the project is scientifically defensible and that the plans and reports are sufficient to support project decisions.

USACE Bonneville Dam Contacts – Pat Hunter, Carlton Morris, and Frank Salber will serve as the facility contacts for URS and its subcontractors and coordinate all onsite activities with dam operations staff. Mr. Morris is the facility Environmental Compliance Coordinator and will take control of all investigation-derived waste generate by the field investigation.

A 1.2 Contractors to USACE

URS Corporation (URS) is responsible for the development of the QAPP to ensure it accurately describes the sampling and analytical methodologies to be used for the collection and testing of the environmental samples. URS will accomplish the activities described in this QAPP including the collection of samples, overseeing the analytical testing and preparing a data report summarizing the activities and results of this project. **Mike Powell** will serve as URS' Project Manager. **Zack Oremland** is anticipated to direct most field operations and serve as the site health and safety officer. He will be assisted in the field by several URS staff scientists. **Christina Wheeler, PhD** is the project chemist who will be responsible for data quality review according to the quality assurance procedures detailed in this QAPP. **Laura McWilliams, PhD** will serve as assistant project manager, assist with coordination of this plan, and provide technical direction to the field team as needed.

URS will subcontract with an analytical laboratory, a marine services company (to provide a boat for the seep survey), a surveyor, utility locators, and one or more drilling companies to complete the work.

A 1.3 Product Development Team

The Product Development Team includes all technical and administrative elements that provide input and support to project driven products, including but nor limited to: Operations Division, Bonneville Project as the customer and District Environmental Compliance; Programs and Project Management Division, Administrative and Environmental Coordination; Engineering and Construction Division (both in Seattle and Portland) technical expertise and support; Contracting Division, Office of Counsel Public Affairs Office.

A 1.4 Technical Advisory Group and Community Involvement Committee

The Technical Advisory Group consists of regulatory and resource agencies and tribes providing technical support, review and advice to the USACE as the lead agency. A listing of organizations who have attended meetings or provided comment on work include: Confederated Tribes of Warm Springs, Grande Ronde, Umatilla, Yakama Nation, Nez Perce, Cowlitz, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), Bonneville Power Administration (BPA), U.S. Environmental Protection Agency (EPA), Oregon Department of Environmental Quality (ODEQ), Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Human Services (ODHS) (Health Division), Washington Department of Energy (WDOEn), Washington Department of Natural Resources (WDNR) and Columbia River Inter-Tribal Fish Commission (CRITFC).

The Community Involvement Committee is comprised of community members who have expressed interest in the project and volunteer to meet periodically.

A 1.5 Special Training/Certification

The Accident Prevention Plan (URS, 2008b) that describes the health, safety, and training requirements for the sampling event will be used by URS. All site personnel will meet the Hazardous Waste Operations and Emergency Response (HAZWOPER) training requirements and other requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent;
- Eight hours of annual refresher training for all personnel (as required);
- Eight hours of supervisor training for personnel serving as the Site Health and Safety Officer;
- Three days of work activity under the supervision of a trained and experienced supervisor.

All site personnel will participate in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Prior to the start of operations at the site, the Site Health and Safety Officer will conduct a site safety briefing, which will include all personnel involved in site operations. All site personnel are to attend the briefings and sign the briefing form. Briefings will also be conducted if new personnel report to the site. For each briefing, the Site Health and Safety Officer will complete a site safety briefing form that will be kept in the project file.

A 2.0 Project Background, Problem Definition, and Objectives

A 2.1 Project Background

The upland operable unit is located on the eastern portion of Bradford Island, upstream of Bonneville Dam (Figure 2). This site is physically isolated from the Oregon and Washington shorelines by the Columbia River and is a controlled access area. The area is either used by Bonneville Dam personnel (buildings, roadways, etc.) or remains natural undeveloped land. The Sandblast Area AOPC includes paved and unpaved areas, a building formerly used for sandblast operations, and a Hazardous Materials Storage Area where a covered drum storage pad is located and a small chemical storage shed. This area generally slopes to the north toward the river. West of the Sandblast Area AOPC are mostly paved areas and buildings including offices and service buildings used for dam-related maintenance activities. To the south, the Sandblast Area AOPC is bordered by upland forest. The Landfill AOPC is grass-covered, and undeveloped except for a dirt access road. The area is bordered on the south by upland forest and fringed on the north and east by with clumps of shrubs and trees. Very steep, nearly vertical banks are locally present especially along the north, east, and south sides of the island near the landfill. The Pistol Range AOPC is a relatively small area located on the south side of Bradford Island. This area has not been used in many years and is overgrown with shrubs and grasses except following clearing to support field investigations. The Pistol Range AOPC is flat and is located fairly close to the Powerhouse One forebay. The Bulb Slope AOPC consists of a small portion of the steeply sloping bank north of the Landfill access road.

As presented in the final Management Plan (URS, 2007a), a significant amount of investigation and risk assessment work has been completed for the Upland OU.

The four areas of potential concern (AOPCs) for the Upland OU are depicted on Figure 2 and include:

- Landfill
- Sandblast
- Pistol range
- Bulb slope

This QAPP describes sampling of upland media (soil, groundwater, surface water and, soil gas) to support the RI and risk assessment. The Bulb Slope is the only AOPC that does not have any sampling needs required to complete the RI.

A 2.1.1 Site History

Bonneville Dam is located on the Columbia River approximately 40 miles east of Portland, Oregon, near Cascade Locks, Oregon at River Mile 146 (Figure 1). The "Bonneville Lock and Dam Project" was built by the USACE and involved building two powerhouses, a spillway, and a navigation lock. The first powerhouse was completed in 1938 and is located between the Oregon shore and Bradford Island. The second powerhouse was built in 1982, and is located between the Washington shore and Cascades Island. Bonneville Dam is currently operated and maintained by the USACE Portland District.

Bradford Island is a natural island that was incorporated into the Bonneville Lock and Dam Project. From about 1942 until about 1982, the northeast portion of Bradford Island was used as a landfill to dispose of household garbage, oil and grease, paint, solvents, scrap metals, mercury vapor lamps, pesticide residues, cables, and sand blast grit. Some electrical components were also placed in the landfill. The landfill, which has been closed since the early 1980s, is about one-half acre in size and holds an estimated 8,800 cubic yards of material (URS, 2004a).

A 2.1.2 Previous Investigations

For approximately 40 years, the USACE managed, stored and disposed of waste materials at the eastern end of Bradford Island. Landfilling was apparently done in excavated pits or existing depressions within a 0.5-acre area. Three separate investigations have been conducted at the Landfill AOPC (the site inspection [Tetra Tech 1998], the supplemental site inspection [URS 2000], and the site characterization report [URS, 2004a]). A total of 44 soil samples were collected from several test pits (up to 10 feet deep). Five groundwater sampling events have resulted in 29 groundwater samples from up to nine wells. In addition, a limited sampling event collected nine surface soil samples from the northern and eastern edges of the island, between the Landfill and the Columbia River (URS, 2007b). These investigations concluded that soil and groundwater in the Landfill AOPC have been impacted by petroleum hydrocarbons, organochlorine pesticides, polychlorinated biphenols (PCBs), selected volatile and semivolatile organic compounds (VOCs and SVOCs), and a few metals.

During these investigations and risk assessments, a mix of EPA Region IX PRGs, DEQ Level II SLVs, site-specific background levels for levels (Tetra Tech 1998), Washington Department of Ecology's (WDOE's) background levels for Clark County (metals only), ODEQ default background levels (metals only), and site-specific risk-based concentrations (RBCs) were used to identify areas of impacted soils and groundwater. In the Site Inspection reports, each sample was compared to the selected screening criteria, while in the risk assessments, either the maximum or 90% UCL concentration was compared to the selected criteria (i.e., maximum for immobile receptors and 90% UCL for mobile receptors). These historical investigations are discussed in the Management Plan, Sections 4.1.1 through 4.1.5 (URS, 2007a).

Investigations at the Sandblast Area AOPC are summarized in two reports (URS, 2002 and URS, 2006). Limited sampling was also completed in conjunction with cleaning stormwater drains and conveyance lines in the AOPC (URS, 2002). A total of 70 soil and sandblast grit samples, 10 groundwater samples, and four catch basin samples were collected. The primary source of soil contamination in the Sandblast Area is from the disposal of sandblast grit. The sandblast grit contains metals (primarily lead and chromium) and butyltins (dibutyltin and tributyltin). The stormwater drain cleaning technical memorandum (URS, 2002) concluded that spent sandblast grit has been transported into the storm drain system. Minor potential sources of contamination include the storage of dam-related equipment along the Landfill access road, incineration of wastes in a former burn pit, and maintenance of PCB-containing transformers. These sources have impacted the AOPC with petroleum hydrocarbons, butyl-tins, pesticides, SVOCs, and PCBs. Additionally, an apparent release of hazardous materials at the southwest corner of the hazardous waste storage area within the Sandblast AOPC has resulted in localized VOC impacts in the soils and groundwater. These past investigations are described in detail in Section 4.2 of the Management Plan (URS, 2007a).

During a Preliminary Assessment/Site Assessment conducted at the Pistol Range AOPC (URS, 2003a), 73 soil samples were collected from 42 sample locations (in some locations samples were collected at multiple depths) from an approximately 200 feet long and between 20 to 30 feet wide (approximately 4,550 square feet). Impacted soils were identified by comparing concentrations of copper, lead, nickel, and zinc in each sample to EPA Region IX PRGs for an industrial exposure scenario (URS, 2003a). In addition, concentrations of lead were also found to be above the Maximum Theoretical Leachate Concentration (MTLC) of 100 mg/kg, which was calculated following RCRA guidance by multiplying the Toxicity Characteristic (or regulatory limit) for lead of 5 mg/L, as measured by the TCLP method, by a dilution factor of 20 (URS, 2003a). Section 4.3 of the Management Plan provides additional information regarding previous investigation activities at the Pistol Range (URS, 2007a).

A reconnaissance investigation of the bulb slope was conducted in November 2002 [URS, 2003b] which included the collection of eight soil samples. Impacted soils were identified by comparing concentrations of PCBs, lead, and mercury in each sample to EPA Region IX PRGs for an industrial exposure scenario. Section 4.4 of the Management Plan provides additional information regarding previous investigation activities at the Bulb Slope (URS, 2007a).

A 2.2 Problem Definition

In Section 5.3 of the Management Plan (URS, 2007a), a standardized approach to identifying contaminants of interest (COIs) for each of the Upland AOPCs was performed by using the same set of screening levels and background levels for all AOPCs. The maximum detected concentration of each analyte was compared to the background level and/or selected screening level, depending on whether the purpose was to identify COIs for in-place soils or COIs that could migrate to the river. The COIs identified under this approach were used as the basis for identifying data gaps for each AOPC Section 8.2 of the Management Plan). Additional data are required to characterize the Bradford Island Upland OU to allow the USACE to prepare a RI report and baseline risk assessment, and to complete a feasibility study.

A 2.3 Project Objectives

This section provides a brief summary of the project objectives and data requirements.

The principal objective of the RI is to characterize the nature and extent of potential impacts in environmental media that may pose a risk to human and ecological receptors. Individual objectives for the Upland OU are summarized below:

- Determine the baseline risk to human and ecological receptors from COIs in soil of the Upland OU
- Determine the baseline risk to human and ecological receptors from COIs in groundwater of the Upland OU
- Determine the risk to human receptors from vapor intrusion from contaminants underlying structures in the vicinity of the Sandblast Area AOPC.
- Determine the potential for COIs in soil and groundwater of the Upland OU to impact the River OU

Data requirements include:

- Assess background concentrations of metals and selected organics in soil and groundwater at Bradford Island for comparison to potentially contaminated areas.
- Characterize contaminant concentrations in soil and groundwater of the Upland AOPCs to provide information for estimation of risks to human and ecological receptors of the Upland OU.
- Characterize VOC concentrations in soil gas in the vicinity of structures in the Sandblast Area AOPC to provide information for estimation of risks to human receptors within the structures.
- Evaluate the potential for soil and groundwater from the Upland OU to impact the adjacent River OU.

The Management Plan (URS, 2007a) describes the objectives in more detail, using the Environmental Protection Agency's (EPA) data quality objective (DQO) and systematic planning processes. Table 1 provides a summary of the project objectives and how each objective will be accomplished.

A 3.0 Project/Task Description and Schedule

Soil, groundwater, surface water, sediment, and soil gas samples will be collected and analyzed for the COIs specified in the Management Plan (URS, 2007a). The following sections discuss the tasks, products, and schedule that will be used to support the sampling effort.

A 3.1 Work Tasks and Products

The work tasks and products to be completed as part of this sampling effort include:

- Installation of additional monitoring wells (five in the sandblast AOPC and one in the reference area on Bradford Island).
- Assess the potential for soil erosion at of the Landfill, Sandblast Area, and Pistol Range AOPCs to evaluate the potential for soil migration to the river.
- Evaluate the existing storm water conveyance system associated with the two outfalls at the Sandblast Area AOPC.
- Collection of four quarters of groundwater data from new and existing monitoring wells.
- Completion of a survey to identify groundwater seeps adjacent to the Landfill and Sandblast Area AOPCs.
- Collection of four quarters of seep and surface water data (if seeps are present).
- Tabulation and reporting of the groundwater/seep/surface water sample results on a quarterly basis.
- Collection and analysis of surface and near-surface soil samples in selected areas from the Landfill AOPC and Sandblast Area AOPC.
- Collection and analysis of surface soil samples from the reference area.
- Collection and analysis of soil gas samples from the vicinity of the hazardous waste storage area of the Sandblast Area AOPC.
- Collection and analysis of reconnaissance groundwater samples from the Pistol Range AOPC and sediment samples from the adjacent lagoon.
- Preparation of a report that described the investigative activities and findings, and assesses if the project objectives have been accomplished.

A 3.2 Project Schedule

Some of the work described in this Upland QAPP has already been completed. Upon consultation with the TAG, six new groundwater monitoring wells were installed and the first round of groundwater/seep/surface water sampling was completed in March-April 2008. The field activities were completed in accordance with a memorandum dated January 28, 2008 (URS, 2008a). Completion of these critical-path tasks prior to the finalization of this Upland QAPP resulted in a compression of the schedule by approximately 6 months. For completeness, all of the completed activities are included in this Upland QAPP, such that this document supersedes the January 28, 2008 memorandum.

Monitoring wells, seeps, and surface water will continue to be sampled on a quarterly basis with sampling events occurring during July 2008, October 2008, and January 2009. Surface soil, sediment, soil gas, and grab groundwater sampling will be completed following approval of this QAPP (approximately Fall 2008).

Installation of the new monitoring wells is described in the Sandblast and Reference Areas Well Installation Report (URS, 2008c). Quarterly groundwater/seep/surface water data will be reported in technical memorandum provided after each of the four quarterly sampling events. It is anticipated that these technical memorandum will be available approximately July 2008, October 2008, January 2009, and April 2009. A separate technical memorandum will be prepared describing the additional upland field activities (i.e soil, grab groundwater, sediment, and soil gas data). This technical memorandum will be available approximately four months after these field activities are completed. After completion of all upland field activities, the entire upland data set will be evaluated for sufficiency to complete the RI, risk assessment and FS. This evaluation will be included in the Upland OU Data Sufficiency Evaluation Report (anticipated completion 2009).

A 4.0 Project Objectives and Measurement Performance Criteria

The Management Plan describes in detail the objectives for the Upland OU. As stated in the Management Plan, meeting the project objectives requires the collection of new information. The new information will consist of topographic/erodibility surveys, along with samples from the following media: soil, groundwater, surface water, sediment, and soil gas. Table 1 summarizes the remedial investigation objectives and strategy for the Upland OU. Measurement performance criteria required to meet these objectives are discussed in Section B 5.3.

B DATA GENERATION AND ACQUISITION

B 1.0 Sampling Process Design

This section describes the sampling process design and rationale that will be used to govern the Upland OU sample collection. Figures 2 and 3 provide an overview of the sampling areas. URS will complete the sampling activities in four areas: a site-specific background reference area, the Landfill AOPC, the Sandblast Area AOPC, and the Pistol Range AOPC.

All geospatial data for this project is maintained in a common coordinate system: the North American Datum of 1927 (NAD27) State Plane Oregon North (US feet). This coordinate system was selected because the original photographs and topographic base map used for producing figures were obtained from the USACE and/or the USGS were received this coordinate system. The database is maintained in Geographic Information System (GIS).

Station locations are established in the field by one of two methods:

1. The horizontal position of temporary stations is measured using a hand-held Global Positioning System (GPS) unit with an accuracy of approximately 1 meter. The GPS unit records accuracy information with each saved location, and this accuracy information is saved in the project database. The GPS coordinates are downloaded into our project

database and converted to the NAD27 State Plan Oregon North coordinate system using GIS software.

2. The locations of selected permanent stations (i.e., monitoring wells) are surveyed by a licensed surveyor to an accuracy of 0.1 ft horizontally and 0.01 ft vertically. The data is provided electronically by the surveyors in the NAD27 State Plan Oregon North coordinate system for direct inclusion in the project database.

For the production of some figures, GIS is used to convert station coordinates into North American Datum of 1983 (NAD83) State Plane Oregon North (US feet) so that they can be overlain on more recent aerial photographs.

B 1.1 Reference Area

The objective of the reference area sampling is to provide site specific background concentrations of metals and selected organics in soil and groundwater. The stations for reference soil and groundwater samples were selected to meet the following criteria:

- The reference stations should be upgradient of and unaffected by the site related waste handling activities.
- The reference samples should reflect background or ambient concentrations of all COIs.
- The reference samples should exhibit similar soil characteristics (i.e., total organic carbon and grain size distribution) as samples from the other areas sampled on Bradford Island.

The reference area for the soil and groundwater sampling is the undeveloped, forested hilly area south and east of the Upland AOPCs (Figure 3). The soil sampling stations need only be accessibly by foot since the samples will be collected with hand tools. Proposed station locations are shown in Figure 3. Within the reference area, the location for the background groundwater monitoring well was selected based on low elevation (to minimize the drilling depth required to reach the desired aquifer) accessibility for a drill rig. The well will be installed southeast of the Landfill AOPC, at the terminus of an abandoned dirt road (Figure 3). Soil and groundwater in these reference areas are unaffected by activities at any of the Upland AOPCs.

B 1.1.1 Groundwater

The location chosen for the reference area monitoring well (MW-10) is at the end of an abandoned dirt road leading south from the eastern end of the landfill. No development is observed in conjunction with this road. It is very overgrown and obviously has not been accessed from some time. However, after the brush is cleared it will allow a track-mounted drill rig to reach an area of level ground at the end of the abandoned round (Figure 3) to install a monitoring well. Other potential sites were considered, but access is limited in the steep, rocky terrain. This well location is hydrologically upgradient of both the Landfill and Sandblast Area AOPCs.

The monitoring well will be installed using a track-mounted sonic drill rig. Consistent with the Landfill and Sandblast Area monitoring wells, the target screen interval will be the shallow groundwater zone at the base of the unconsolidated overburden. The elevation of the slide-block (basement) underlying the overburden is unknown at the proposed location. Therefore, the borehole will be advanced until bedrock is encountered. The screen will then be set in the saturated soils near the base of the unconsolidated layer or in the upper portion of the bedrock if the overburden is unsaturated. Following installation, the well will be developed and a slug test will be conducted.

Groundwater elevation will be measured and the monitoring well will be sampled during each of the four quarterly sampling events. Samples will be collected using low-flow sampling methods. The objective of the upgradient monitoring well is to determine local background concentrations of metals. Therefore, all four quarters of samples will be analyzed for the complete list of metals in both the total and dissolved fractions (Table 2). To demonstrate that the well has not been impacted by site-related activities, the first round sample will also be analyzed for the organic COIs associated with the Landfill and/or Sandblast Area OUs (Table 3). And, to complete the characterization of background groundwater conditions, the first round sample will also be analyzed for the major anions, total organic carbon (TOC), dissolved organic carbon (DOC), and Fe^{2+} (the cations are already included in the metals list).

B 1.1.2 Surface Soil

Surface soil samples will be collected from fourteen locations within the reference area (R1 through R8). The proposed station locations shown on Figure 3 represent a randomly-chosen grid overlain on the reference area footprint. Based on field conditions (i.e., safe access, boulders and vegetation, any evidence of human disturbance) the field geologist will locate an appropriate station location in the vicinity of each of the proposed locations. The soil samples will be collected from the top six inches of native soil (below any leaf litter, twigs, or other detritus) using a decontaminated stainless steel scoop. The soil samples will be analyzed for metals, selected SVOCs, total organic carbon, and grain size distribution (Table 4).

B 1.2 Landfill AOPC

The Landfill AOPC sampling design is based on data gaps as described in the Management Plan (URS, 2007a). Additional soil and groundwater/seep/surface water data are needed to complete the ecological risk assessment of the Landfill AOPC.

B 1.2.1 Groundwater

A total of nine existing groundwater monitoring wells (MW-1 through MW-9) were installed in 1998 (MW1 through MW-4), 1999 (MW-5), and 2002 (MW-6 through MW-9) and a total of five groundwater monitoring events have been conducted (Tetra Tech, 1998 and URS, 2004a). Total petroleum hydrocarbons (TPH), butyltins, metals, selected VOCs and SVOCs, and p-Nitrophenol have been detected in the groundwater samples. Four consecutive quarterly rounds of groundwater sampling and analysis will examine the range of concentrations over the course of one year, after which time, the potential need for additional data will be evaluated. The analytical results from each quarter will be used in the risk assessment of groundwater in this AOPC.

Locations of the nine existing monitoring wells are shown on Figure 4. Groundwater elevations will be measured and the monitoring wells will be sampled during each of the four quarterly sampling events. Samples will be collected using low-flow sampling methods. Each sample will be analyzed for the analytes listed in Table 2. The list of analytes was developed based on COIs identified in the Management Plan (URS, 2007a). The first round samples will also be analyzed for the major cations and anions, TOC/DOC, and Fe^{2+} (Table 3). The anion and cation data will be used to compare groundwater, seep, and surface water chemistry. The data will be compared quantitatively using commonly-graphical displays of water chemistry data such as trilinear plots. Interpretations of the relationship of the seep water to groundwater, and conclusions regarding the impact on the river will likely be qualitative. In addition to major ion chemistry, conclusions will consider factors such as chemistry of other analytes for which there is data available, chemistry and the variability of water chemistry over time, groundwater flow pattern, and seasonal presence/absence of groundwater seepage, and the hydrogeologic characterization of the site.

B 1.2.2 Seep and Surface Water

Seeps have been historically observed along the northern bank of Bradford Island (URS, 2004a). The elevation of these seeps (i.e., above the river level) suggests that the shallow groundwater derives from rain water, rather than river incursion. These seeps will be sampled to document any differences in seep versus river water chemistry and to measure any COIs that may be discharged to the river.

A detailed visual survey of the north shore of Bradford Island took place on March 24. The survey was conducted from a small boat maneuvered slowly along the shoreline and extended from the eastern end of the island to drain outfall #2 (shown on Figure 2). Each location where damp soils were observed along the riverbank was inspected as a possible seep location. The field geologist disembarked from the boat and, guided by lithologic horizons (i.e., potential outcrops of basement rock) and observed moisture, used a field hammer to remove surface soils and clear a small shelf in the riverbank. If water was observed dripping from the riverbank, and/or accumulated in a depression on the created shelf, the geologist flagged the area as a potential seep.

Four potential seeps were identified using this method. The potential seeps were numbered S1 through S4 and flagged so that the sampling team can return to the seep location and collect samples from shore. The location of each seep was recorded using a portable GPS unit and the elevation of each seep was measured relative to the Columbia River surface water elevation at the time of the survey. The approximate seep locations are shown on Figure 4.

Concurrently with each round of groundwater sampling, the sampling team will return to each of the four potential seep locations and attempt to collect a pair of water samples. Each pair will consist of a sample collected from the seep itself, and a grab surface water sample collection from the Columbia River immediately adjacent to the seep. If no (or insufficient) water is observed discharging from a seep, neither the seep nor the surface water sample will be collected. The goal is to obtain up to three representative seep-surface water pairs during each quarterly sampling event. Seep and surface water samples will be analyzed for the same analytes as groundwater samples from the Landfill AOPC (Tables 2 and 3).

B 1.2.3 Soil

The Level II risk assessment report (URS, 2004b) concluded that risks to human health at the landfill were considered acceptable under current land use conditions, but there exists a concern for direct exposure toxicity for ecological receptors in the gully area. The potential ecological exposure stems from elevated COI concentrations detected in one historical sample collected in 2001 (011015B1LO4IDW). This sample was taken from excavated soils from the gully area, so the depth represented by the sample, and the origin of the elevated COI concentrations are unknown (URS, 2004a). Therefore, additional data are necessary to understand the current concentration of surface and near-surface soils within the gully area. As stated in Section 8.2.1.1 of the RI/FS MP, the additional data collected from the gully area will supplement the database for the Landfill AOPC as a whole (the gully area is not considered a separate exposure unit).

An additional eight soil samples will be collected in the gully area to assess the current ecological risk. Approximate locations of four proposed sample stations (L1 through L4) are shown in Figure 4. Two soil samples will be collected from each station, one from the interval 0-1 feet below ground surface (ft bgs) and one from the interval 1-3 ft bgs. Due to the rocky nature of the soils in the gully area, hand augering will not be possible. Instead, the samples will be collected using a small track-mounted excavator following the methods outlined in SOP 3.1. Vegetation and surface debris will be cleared from an area approximately 15 feet by 15 feet in the vicinity of the two historical samples. The excavator will then be carefully positioned to collect a sample at each of the four corners of the cleared area (approaching the area from the perimeter). An intact scoop of soil extending from 0 to 3 ft bgs will be collected in the excavator bucket and the bucket will be placed on the ground. The field geologist will then collected two composite samples from the intact soil volume within the excavator, taking care to avoid any soils in contact with the excavator bucket. One composite sample will be from the 0-1 ft bgs interval and the second will be from the 1-3 ft bgs interval. If an intact scoop (which holds its shape against gravity) of soil is not produced through exaction, the soil sample will be collected from the sidewalls of the excavation pit. In either case, the surficial 3-4 inches of soil will be removed with a dedicated stainless-steel spoon prior to expose a fresh surface prior to collecting the soil sample. The sample will then be collected using EPA Method 5035 syringe-type sampling devices, as described in SOP 3.1.

Each of the eight samples will be analyzed for selected VOCs and SVOCs as described in Table 4. The list of analytes was developed based on COIs identified in the Management Plan (URS, 2007a) and the results of historical samples collected from the gully area (URS, 2004a). The results from these samples will be added to the existing dataset for the Landfill, as the gully area is a part of the Landfill AOPC.

B 1.2.4 Soil Erosion Evaluation

Surface water may erode and mobilize impacted soil in the Landfill AOPC. Mobilized soil may migrate to the Columbia River. The following methodology will be used to assess if surface soils can migrate to the river:

- The site will be mapped and surveyed to develop topographic and baseline site characteristics. The mapping will include a description of ground surface microtopography and ground cover (soil texture and vegetation cover) that may affect surface runoff, soil erosion and redeposition (perhaps prior to reaching the river). Erosion and deposition patterns and pathways to the river will be mapped. Representative slope profiles will be selected for future evaluation.
- Surface soil samples will be collected from the Landfill AOPC to develop an assessment of soil erodibility. Samples will be analyzed for grain size distribution. The intent is to have samples sufficient to characterize regions of homogenous ground surface conditions at each AOPC. The precise number of samples collected will be based on field observations, the topographic survey and the number of selected profiles.
- Average annual sediment yield from surface erosion processes under current conditions will be estimated using the Water Erosion Prediction Project (WEPP) model interface developed by the US Forest Service. Using slope profiles, soil characteristics, and land cover data, this model estimates and accounts for both erosion and redeposition of soil. The evaluation of the potential for migration will include an evaluation of preferential pathways (i.e., storm drains, gullies/rills). Sediment yield will be evaluated on the basis of a field-based mass balance estimate. Site records, including photographs, will be used where possible to document the period of formation and transport from these pathways.
- A total site sediment yield from water erosion processes will be estimated from the summation of the surface erosion and channel/storm drain erosion (where present).
- Estimated annual loading of COIs to the Columbia River will be developed as the product of estimated average annual sediment yield and average COI concentrations of the erodable soils. Available data will be used to be extent that it represents erodable soil units. If necessary multi-point composite samples will be collected and analyzed for selected COIs to characterize erodable soils where data does not already exist.
- Conclusions regarding the accuracy of the model predictions will considered in conjunction with field observations.

B 1.3 Sandblast Area AOPC

Additional samples of groundwater and soil are needed to complete the evaluation of the migration to the river pathway and assess risks for both human and ecological receptors at the sandblast AOPC. Samples of soil gas are also needed to complete the nature and extent determination and assess risks for human receptors at this AOPC. The Sandblast Area AOPC sampling design is based on data gaps as described in the Management Plan (URS, 2007a), with the exception that additional soil properties data will not be required to complete the soil gas risk evaluation. Figures 5, 6 and 7 depict the proposed Sandblast Area sampling stations.

B 1.3.1 Groundwater

Elevated concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) were detected in grab groundwater samples collected in the Sandblast Area OU in November 2004. Measured concentrations at each of the 12 sample stations are shown on Figure 5. The source of these VOCs is believed to be a release near the southwest corner of the Hazardous Materials Storage Area (HMSA). Section 7.3 of the Sandblast Area Supplemental Site Investigation Report (URS, 2006) recommends that monitoring wells be installed downgradient of the HSMA to delineate the groundwater plume and evaluate groundwater flow patterns. Accordingly, the Management Plan (URS, 2007a) outlines an investigation strategy including a minimum of four monitoring wells which will be sampled quarterly in conjunction with seep and surface water sampling.

Proposed locations for the construction of five new monitoring wells (MW-11 through MW-15) are shown in Figure 5. The locations include one monitoring well in the vicinity of the suspected source (MW-11), two monitoring wells near the Columbia River (MW-14 and MW-15) and two monitoring wells in between the suspected source and the river (MW-12 and MW-13). The locations are spaced sufficiently far apart to allow determination of seasonal groundwater flow directions. All wells will be completed in saturated soils of the shallow groundwater zone located in the unconsolidated overburden. Based on the groundwater elevations encountered during the 2004 sampling event, this is anticipated to be approximately 10-20 ft bgs. These wells will be installed using hollow-stem auger or other suitable drilling techniques. Following installation, the wells will be developed and single-well slug tests will be performed in two to five of the monitoring wells to assist in evaluating the hydrogeologic characteristics of the uppermost water-bearing unit at this AOPC.

Groundwater elevation will be measured and the monitoring well will be sampled during each of the four quarterly sampling events. Samples will be collected using low-flow sampling methods. Groundwater samples from the Sandblast Area monitoring wells (MW-11 through MW-15) will be analyzed for the Sandblast Area COIs, as listed in Table 2. These analytes were based on the COI list developed in the Management Plan (URS, 2007a), with the addition of diesel-range hydrocarbons, which has been added for completeness since gasoline- and residual-range hydrocarbons are included. TPH was detected in the grab groundwater samples previously collected in the Sandblast Area AOPC. Since SLVs are not available for TPH, TPH was retained as a COI for this AOPC.

The VOCs of interest (principally PCE and TCE) in the Sandblast Area AOPC may be reductively dechlorinated into other compounds (i.e., dichloroethenes, vinyl chloride). Subsurface reduction-oxidation (redox) conditions will determine the potential for this type of chemical degradation (as opposed to physical dilution and dispersion). Therefore the first round of groundwater, seep, and surface water samples from the Sandblast Area OU will also include analysis for the major cations and anions, TOC/DOC, and Fe^{2+}. In addition, the first round of groundwater samples from monitoring wells MW-11 through MW-15 will be analyzed for the full suite of VOCs (standard list for EPA Method 8260B) so that the potential occurrence of PCE and/or TCE degradation products can be evaluated. These additional first-round analyses are listed in Table 3.

B 1.3.2 Seep and Surface Water

The shoreline adjacent to the Sandblast Area AOPC is heavily rip-rapped. No seeps were identified during the seep survey conducted on March 24, 2008 (see Section B 1.2.2). Therefore no seep or surface water samples will be collected in conjunction with this AOPC.

B 1.3.3 Soil

A total of 16 surface and near-surface soil samples will be collected from eight sampling stations (SB1 through SB8) in the Sandblast Area AOPC. Proposed station locations, based on randomly selected grid stations are shown in Figure 6. Soil samples will be collected by means of a hand auger, advanced to 3 ft bgs. Two soil samples will be generated from each station, one from 0-1 ft bgs and the second from 1-3 ft bgs. Samples from each depth interval will be submitted to the analytical laboratory for sieving and lead analysis, according to the following procedure (from USEPA, 2000a):

1. Sieve sample through a 2 mm sieve. Analyze fraction smaller than 2 millimeters (mm) as the “total” lead concentration.
2. Sieve sample through a 250 micron sieve. Analyze fraction smaller than 250 microns as the “fine” fraction.

The objective of analyzing the fraction smaller than 250 microns is to collect samples that would represent soil that may impact receptors through the inhalation pathway. Analysis of the subsurface (1-3 ft bgs) interval will be used to evaluate potential risk to maintenance or utility workers from soil that might be exposed during shallow excavations.

B 1.3.4 Soil Gas

A total of six soil gas samples will be collected from the proposed locations SB9 through SB14, shown in Figure 7. These locations were selected to evaluate soil gas within 10 feet of four different buildings that are in the vicinity of the Sandblast Area AOPC. Stations SB9 and SB10 are on either side of the HMSA, a thick concrete pad which sits on top of the inferred source of the groundwater VOC plume. An enclosed, secure chemical storage shed exists on the western side of the concrete pad (roughly between the two proposed soil gas sampling stations). Personnel only enter the chemical storage shed to retrieve or deliver containers of chemicals. Stations SB11 and SB12 are adjacent to the barricaded Sandblast Building. All access to the Sandblast Building is restricted due to contamination within the building; however, it is an enclosed structure so it is included in the soil gas evaluation. Stations SB14 and SB15 are located adjacent to the only two occupied buildings (the Equipment Building and the Service Center) in the vicinity of the Sandblast Area AOPC. Both buildings are over 200 feet upgradient of the known extent of the groundwater VOC plume.

Soil gas samples will be collected using a temporary direct-push drill stem, outfitted with a soil gas sampling tool. The target depth interval for each soil gas sample is a two-foot interval above the groundwater capillary fringe. Based on historical groundwater elevations in the area (approximately 10 ft bgs), the target depth interval is therefore 6 to 8 ft bgs. All soil gas samples will be collected in 1L Suma canisters and analyzed using Method TO-15 for a standard list of VOCs (Table 5).

B 1.3.5 Soil Erosion Evaluation

Surface water may erode and mobilize and discharge impacted soil in the Sandblast Area AOPC to the Columbia River. The methodology to be used for the evaluation of soil erosion in this area is similar to that which will be used in the Landfill Area AOPC as described in Section B 1.2.4.

The sandblast area also has storm water catch basins and two direct outfalls that discharge to the Columbia River in the spillway forebay. These features may act as preferential migration pathways for impacted surface soil to migrate to the river. In addition the soil erosion evaluation, an assessment of the existing storm water conveyance system associated with the outfalls will be completed, based on catchment areas, the construction of these systems and the current maintenance protocols.

B 1.4 Pistol Range

Additional samples of groundwater and sediment are needed to complete the nature and extent determination and assess risks for both human and ecological receptors at the Pistol Range AOPC.

B 1.4.1 Groundwater

To characterize the potential for leaching of soil COIs to groundwater, three grab groundwater samples will be collected. Two of these samples will be collected within the footprint of the pistol range AOPC, at the locations where the highest lead concentrations were measured in soil samples collected in 2001. The third sample will be collected downgradient of the AOPC. Figure 7 shows the proposed groundwater grab sample locations (PR1 through PR3). Grab groundwater samples will be collected by advancing a direct-push drill stem into the saturated interval then inserting a temporary well screen to collect a sample from an interval approximately 2 to 6 feet below the observed groundwater table. The groundwater samples will be collected using a peristalitic pump. Since grab groundwater samples are not collected from properly-developed monitoring wells, they typically have a significant quantity of entrained soils. Therefore the samples will be analyzed for total suspended solids (TSS), total dissolved solids (TDS), and total and dissolved concentrations of the metals associated with the Pistol Range AOPC (copper, lead, nickel, and zinc), see Table 6.

B 1.4.2 Soil Erosion Evaluation

Surface water may erode and mobilize and discharge impacted soil in the Pistol Range AOPC to the Columbia River. The methodology to be used for the evaluation of soil erosion in this area is similar to that which will be used in the Landfill Area AOPC as described in Section B 1.2.4.

B 1.4.3 Sediment

Although a risk assessment has not been completed for the Pistol Range AOPC, screening of surface soils indicate that if they are mobile and migrate to the river, they may be a risk to ecological receptors. Site topography is such that surface water runoff from the former pistol range will run downhill to the northwest corner of an adjacent shallow lagoon. Five sediment samples will therefore be collected within the lagoon to assess the potential occurrence of this historical pathway. Grab sediment samples will be collected from approximately the top 1 foot sediment interval, using a hand-held scoop, a small Van Veen or ponar sampler, a short corer or another sampling device as appropriate. The samples will be analyzed for the COIs associated with the Pistol Range AOPC (copper, lead, nickel, and zinc), see Table 4.

B 1.5 Post-Sampling Data Analysis

Post data collection activities generally follow those outlined in USEPA's Guidance for Data Quality Objectives (USEPA, 2000b). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools, including but not limited to box plots, scatter plots and normal probability plots, will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.

B 2.0 Sampling Methods

This section describes monitoring well construction procedures, sampling methods (for soil, groundwater, surface water, sediment, and soil gas), sample processing procedures, equipment decontamination procedures, and investigation-derived waste (IDW) handling procedures. Standard Operating Procedures (SOPs) are included in Appendix B and blank field forms are included in Appendix A. All activities will be recorded in one or more field logbook(s) as described in SOP 1.1.

B 2.1 Groundwater Monitoring Well Installation

Additional groundwater monitoring wells will be installed at the Sandblast AOPC and in the reference location in accordance with Oregon regulatory document OAR 690-240 and in general accordance with USACE Engineer Manual EM 1110-1-4000 (November 1, 1998). In the case of discrepancies between the two, the Oregon guidance will take precedence.

B 2.1.1 Drilling

Wells in the reference area (MW-10) and Sandblast Area AOPC (MW-11 through MW-15) will be installed using either hollow stem auger or sonic drilling techniques. Drilling will be performed by a qualified drilling contractor and supervised by a URS geologist, following the procedures outlined in SOP 2.1 and SOP 2.3. If practical, soil samples will be collected using drive samplers at 5-ft intervals during drilling. If little or no sample can be recovered using the drive sampler, drill cuttings will be used to characterize subsurface conditions. Soil samples will be classified by the geologist according to the Unified Soil Classification System (USCS) as described in SOP 2.1. Soil samples will be field-screened for the presence of VOCs using an photoionization detector (PID). The PID will be calibrated according to the manufacturer's instructions, and as described in SOP 1.4. No soil samples will be retained or submitted for laboratory analysis.

B 2.1.2 Casing and Screen

Monitoring wells in the Sandblast Area AOPC (MW-11 through MW-15) will be completed in saturated soils of the shallow groundwater zone located in the unconsolidated overburden. Based on the groundwater elevations encountered during the 2004 sampling event, this is anticipated to be approximately 10-20 feet below ground surface (bgs). MW-10 will be screened in saturated soils near the base of the unconsolidated layer.

All monitoring wells will be constructed using flush-threaded, nominal 2-inch (2.37-inch outside diameter), schedule 40 polyvinyl chloride (PVC) casing and screen. Well screens will be factory-slotted and of sufficient size to minimize fines entering the well during development and sample collection. A threaded end cap will be attached to the bottom of the well screen, and the pipe will be placed into the borehole through the inside of the temporary borehole casing. No glues or chemical cements will be used to assemble the well construction materials.

B 2.1.3 Filter Pack and Bentonite Seal

The well casing and screen will be suspended in the borehole while a clean sand filter pack of appropriate uniform-graded silica sand will be placed into the annular space around the well screen, from the bottom of the borehole to between 1 to 3 feet above the top of the screened interval. The filter pack will constructed of 10/20-size silica sand.

The depth to which materials are placed will be checked with a weighted measuring line to ensure that bridging has not occurred. Dispersing agents such as phosphates or acids will not be used in well installation or development. Also, there will be no attempt to chemically disinfect the wells.

A tremie pipe will be used to place the filter pack downhole into the annular space between the riser pipe and the temporary borehole casing. To consolidate the sandpack, the well will be gently surged with a bailer or surge block. If settling occurs, sand will be added to the annular space to bring the sandpack back up to 1 to 3 feet above the top of the well screen.

Once the filter pack is installed, a filter pack seal will be placed on top. The filter pack seal will consist of a minimum 3-foot-thick layer of dry bentonite (either ¼- or 3/8-inch pellets). The pellets will be poured down the borehole annulus, followed by water as required for hydration. The bentonite will be installed in 1-foot lifts, with approximately 2 gallons of water will be added per lift to hydrate the bentonite pellets.

B 2.1.4 Surface Completions

Four of the monitoring wells in the Sandblast Area AOPC will be completed with flush-mount monuments unless otherwise directed by USACE representatives. An approximately 4-foot-square concrete pad will be placed around monuments installed in areas without preexisting concrete or asphalt. The concrete pad will be sloped to direct surface runoff away from the well.

One of the wells in the Sandblast Area AOPC (MW-12) and the reference area monitoring well will be completed with above-ground monuments. For these monuments, the protective casing will be a minimum of 6 inches in diameter and extend approximately 2-1/2 feet above ground surface, with the remainder set in the grout seal the same day as initial grout placement. The protective casing will extend no more than 0.2 feet above the top of the inner well casing. A hinged cover or other cover will be placed on top to keep direct precipitation and cap runoff out of the inner casing. Three 3-inch diameter, concrete-filled steel posts will be placed around the well to protect it from damage. Each post will be filled with concrete and set 2 to 3 feet below ground, and will extend at least 3 feet above the ground surface. The protective casing and guard posts will be painted yellow to match existing on-site monitoring wells.

The measuring point will be marked in the field with a notch or permanent pen mark on the north side of the top of the casing for each monitoring well. The location and elevation (ground surface and measuring point) of each of the monitoring wells will be surveyed by a licensed surveyor.

B 2.1.5 Delivery, Storage, and Handling of Materials

Water used in drilling operations will be from a potable source, either brought on site by the drilling contractor in a clean container or obtained from a water supply source at the Bonneville Project. Well materials such as PVC riser, screen, steel casings, filter pack, and grout material will be supplied by the drilling contractor. Sand, bentonite, and grout will be stored on wooden pallets or plastic sheeting until used. PVC well material will remain in factory-sealed containers until used. The driller and driller's helper will wear clean, disposable nitrile gloves while handling well materials.

B 2.1.6 Documentation

Records of drilling operations and related activities will be documented by the URS geologist and by the drilling subcontractor. These records will consist of the soil boring log (Appendix A) and information recorded in the project field notebook (SOP 1.1). Copies of these records will be maintained at the drill site while drilling is in progress, and will be provided with the well installation report. Pertinent well construction data will be recorded on a monitoring well construction diagram (Appendix A).

The soil boring log will include descriptions of soil encountered, total depth of the boring, diameter of the hole, formation contacts, occurrence of first water, sampling depths, water level measurements, amount of sealing material used for abandonment, and any other information deemed appropriate by field personnel. A detailed description of the geologist's field procedures is outlined in SOP 2.1.

A daily field drilling report will be prepared and maintained by the drilling contractor. The report will specify the number of hours worked, materials used, unusual problems, and other comments and observations. A copy of the report will be approved by and provided to URS staff at the end of each day.

As required by Oregon law, a start card will be filed with the Oregon Water Resources Department (WRD) before beginning work. One start card will be filed for each well to be constructed. Within 30 days after completion or abandonment of a monitoring well, a monitoring well report will be filed with the WRD. Start cards and monitoring well reports will be filed by an Oregon-licensed monitoring well constructor employed by the drilling subcontractor.

B 2.1.7 Groundwater Monitoring Well Development and Slug Testing

Newly installed monitoring wells will be developed no sooner than 24 hours after the grout seal is placed. The depth to water and total depth of the well will be measured as described in SOP 4.1. The wells will be developed by a URS field geologist using submersible pump, decontaminated between wells. All purge water will be placed into labeled drums for characterization and disposal by the USACE. During development, the wells should be periodically surged by vigorously moving the pump up and down across the screened interval in order to remove fine sediment from the well screen and filter pack. Wells will be considered developed when one or more of the following criteria were met: stabilization of water quality parameters (conductance, dissolved oxygen, oxidation/reduction potential and pH), no significant decrease in turbidity after continual purging, and/or removal of more than 10 casing volumes.

The following list provides guidelines for water quality equilibration (the below listed order is the preferred order of stabilization for these parameters):

• pH	± 0.1 pH units
• Conductivity	± 3 %
• ORP	± 10 mV
• Turbidity	± 10 % (if above 5 NTU)
• Dissolved oxygen	greater of ± 10% or ± 0.2 mg/L

Downhole tools will be decontaminated in accordance with SOP 1.6. Up to 10 casing volumes will be removed during development (if the well does not bail or pump dry first). Temperature, pH, dissolved oxygen, conductivity, oxidation-reduction (redox) potential, and turbidity will be monitored periodically during development (see SOP 1.5) and recorded on a monitoring development form (Appendix A). The water quality meter will be monitored periodically (preferably at the beginning and end of each day) using standard solutions to confirm meter is holding calibration. If the readings of the standard solutions are bias high or low during the calibration check, the meter will be recalibrated in accordance with manufacturer's recommendations (SOP 1.4), with standard solutions appropriate to the instrument and analytical method. If the calibration checks are within appropriate levels as determined by the manufacture of the calibration standard, the meter will not be recalibrated. After surging the well, field personnel will measure and record the total depth of the well and evaluate whether fines are present in the bottom of the casing.

Pumping, turbidity monitoring, and surging will be repeated until the well yields clean water or until turbidity ceases to significantly change with continued development. Development will continue until the discharge water appears reasonably free of sediment, water quality parameters stabilize to within 10 percent of the previous sample, or turbidity ceases to significantly improve with continued development. Purge water generated during development will be containerized in 55-gallon drums, as described in SOP 1.8. Drums will be labeled as described in Section B 2.9.

Single-well slug tests will be performed in two to five of the monitoring wells to assist in evaluating the hydrogeologic characteristics of the uppermost water-bearing unit in the Upland OU. Slug tests will be conducted after the wells have been developed and water levels have stabilized using the procedures outlined in SOP 2.4.

An In-Situ® or similar pressure transducer and data logger will be used to measure water level data during the slug tests. The slug test data will be downloaded from the data logger into the software package AQTESOLV for Windows, and analyzed using one or more methods appropriate for the well design and site conditions at the time of the test.

B 2.2 Groundwater Monitoring Well Sampling

This section describes the location, and procedure for collecting groundwater samples from monitoring wells on the site.

B 2.2.1 Sample Locations

One primary groundwater sample will be collected from each monitoring well, on a quarterly basis (e.g., approximately every three months) for four quarters resulting in a total of 9 x 4 samples from the Landfill, 5 x 4 samples from the Sandblast Area and 4 samples from the reference monitoring well. Existing and proposed monitoring well locations are shown in Figure 9.

B 2.2.2 Sampling Methods

Groundwater samples will be collected using low-flow techniques, disposable polyethylene tubing, and a peristaltic pump. One groundwater sample will be collected from each well. A minimum of 24 hours will elapse after completion and well development before the newly installed monitoring wells are sampled. Before sampling, each well will be purged and groundwater quality measurements will be taken, including temperature, pH, conductivity, dissolved oxygen, redox potential, and turbidity. The procedure for collecting groundwater samples is described in detail in SOP 4.2. The water quality meter will be monitored periodically (preferably at the beginning and end of each day) using standard solutions to confirm meter is holding calibration. If the readings of the standard solutions are bias high or low during the calibration check, the meter will be recalibrated in accordance with manufacturer’s recommendations (SOP 1.4), with standard solutions appropriate to the instrument and analytical method. Auto-calibration solutions can be used for calibration, if two-point manual calibration is included at least once during each field mobilization to confirm that the auto-calibration is within specified limits. SOP 1.5 describes the procedures for measuring groundwater parameters.

B 2.2.3 Sample Analysis

Analytical testing for groundwater samples is summarized in Tables 2 and 3. Groundwater samples will be analyzed for VOCs by EPA method 8260B, for SVOCs and pesticides by EPA method 8270C-SIM, for metals by EPA methods 6000/7000 series, and for TPH by methods NWTPH-Gx (gasoline-range hydrocarbons) and NWTPH-Dx (diesel- and heavy-oil-range petroleum hydrocarbons). The sample analyses, containers, preservation requirements, and hold times are listed in Table 7. Sample control, labeling, tracking, handling, packaging, and shipping procedures are outlined in SOPs 1.2 and 1.3.

B 2.2.4 Field QA/QC Sampling

The monitoring well groundwater samples will be batched with the concurrently-collected seep and surface samples. Quality assurance/quality control (QA/QC) samples will be collected as described in Tables 2 and 3. QA/QC samples include field duplicates, matrix spike (MS), matrix spike duplicate (MSD), and trip blanks (see SOP 1.7). In the Landfill Area AOPC, the field duplicate sample and extra volume for the MS/MSD analysis will be collected from either monitoring well MW-6 or MW-9, because these wells are closest to the river's edge and therefore assumed to be most representative of water discharging to the river. If there is difficulty obtaining water from either of these wells, then one of the remaining wells with the most reliable flow will be used. Equipment rinsate blanks are not required for groundwater samples since only disposable sampling equipment will be used.

B 2.3 Seep and Surface Water Sampling

As described in Section 1.2.2, four potential seep locations were identified adjacent to the Landfill AOPC (Figure 4). During each of the four groundwater monitoring events, the sampling team will return on shore to each identified seep location and attempt to collect a pair of water samples. Each pair will consist of a sample collected from the seep itself, and a grab surface water sample collection from the Columbia River immediately adjacent to the seep.

B 2.3.1 Sampling Methods

The seep samples will be collected using the following method:

1. Excavate a pit in the siltstone below the seep with a decontaminated rock hammer, and place a laboratory-provided, dedicated glass sample jar in the pit with the mouth oriented such that the jar captured the water flowing from the seep.

2. Allow sufficient time for the suspended sediment in the laboratory-provided collection container to settle prior to placing dedicated polyethylene tubing into the jar to collect seep water sample via a peristaltic pump. Care should be taken to avoid placing the inlet near the sediments at the bottom of the jar. Seep samples should be pumped into clean-laboratory provided containers.

3. Fill sample containers for VOC analyses prior to filling containers for other analyses. After all of the sample containers have been filled, remove the tubing and place the sensor for a calibrated water quality meter directly into the jar. Record water quality parameters for the seep once the readings on the meter have stabilized. After taking the water quality measurements, use the same aliquot of unfiltered water for ferrous iron analysis using a Hach colorimetric field test kit.
4. Use a hand-held GPS unit to establish coordinates for each sampling location. Measure and record the elevation of the seep relative to river elevation at the time of sampling.

Grab surface water samples will be obtained by using a peristaltic or centrifugal pump and disposable tubing, with the intake placed one foot below the river surface and approximately five foot from the shoreline. Pumping rates typical flow rates will be maintained between 0.5 and 1.0 L/min to minimize turbulence.

Water quality measurements will be taken, including temperature, pH, conductivity, dissolved oxygen, redox potential, and turbidity at all sample locations. The water quality meter will be calibrated in accordance with manufacturer’s recommendations (SOP 1.4), with standard solutions appropriate to the instrument and analytical method. Auto-calibration solutions can be used for calibration at the beginning and end of each day, if two-point manual calibration is included at least once during each field mobilization to confirm that the auto-calibration is within specified limits. SOP 1.5 describes the procedures for measuring water quality parameters.

B 2.3.2 Sample Analysis

Analytical testing for seep and surface water samples is summarized in Tables 2 and 3. Samples will be analyzed for the same suite of analytes as the groundwater samples from the Landfill AOPC. The sample analyses, containers, preservation requirements, and hold times are listed in Table 7. Sample control, labeling, tracking, handling, packaging, and shipping procedures are outlined in SOPs 1.2 and 1.3.

B 2.3.3 Field QA/QC Sampling

The monitoring well groundwater samples will be batched with the concurrently-collected seep and surface samples (see SOP 1.7). QA/QC samples will be collected from the groundwater monitoring wells as described in Section B 2.2.4. The only additional QA/QC sample that needs to be collected for the seep sampling is an equipment rinsate blank for the non-disposable equipment used in sampling the seeps (see Tables 2 and 3).

B 2.4 Soil Sampling

Soil samples will be collected from the Landfill AOPC, Sandblast Area AOPC, and reference area, as described below.

B 2.4.1 Sampling Methods

Soil samples will be collected using a stainless steel scoop, a hand auger, or a small excavator, as described above. Detailed sampling methods are described in SOP 3.1. Non-dedicated sampling equipment will be decontaminated as described in SOP 1.6 before sampling and between sampling locations. Each sample will be given a unique sample number. Samples will be placed in a cooler with ice to maintain them at 4°C ± 2°C while sample collection continues and during shipment to the laboratory.

A GPS unit will be used to establish coordinates for each sampling location. A wooden stake with flagging will be placed at each sampling location and photographed for visual identification. The flags will list the sample number and sample depth.

B 2.4.2 Sample Analysis

Analytical testing for soil samples varies by location, as summarized in Table 4. Subsets of the soil samples will be analyzed for VOCs by EPA Method 8260B, for SVOCs by EPA Method 8270C, and/or for metals by EPA methods 6000/7000 series. Soils from the reference area will also be analyzed for TOC by the modified Plumb method, and grain size distribution and percent solids by the Puget Sound Estuary Program (PSEP, 1996) protocols. The sample analyses, containers, preservation requirements, and hold times are listed in Table 8. Sample control, labeling, tracking, handling, packaging, and shipping procedures are outlined in SOPs 1.2 and 1.3.

B 2.4.3 Field QA/QC Sampling

Separate QA/QC samples will be collected for each of the three groups of soil samples (Landfill AOPC, Sandblast Area AOPC, and reference area), as described on Table 4. QA/QC samples for each batch of samples includes a field duplicate, a MS/MSD sample, an equipment rinsate blank, and trip blanks, as required (see SOP 1.7).

B 2.5 Soil Gas Sampling

As discussed in Section B.1.3.4, a total of six soil gas samples will be collected, adjacent to enclosed structures in the Sandblast Area AOPC and vicinity. Proposed sampling locations are shown in Figure 6.

B 2.5.1 Sampling Methods

Soil gas samples will be collected from each of the six stations using a temporary direct-push drill stem, outfitted with a soil gas sampling tool. Detailed sampling methods are described in SOP 3.3. The target soil gas sample interval is 6-8 ft bgs (above the anticipated capillary fringe), but the depth may be modified if necessary based on groundwater elevations measured at the nearby monitoring well MW-11. The direct-push soil gas sampling tool seals the borehole from the ambient air so that a soil gas sample can be collected from a discrete depth interval.

Upon reaching the target depth, the sample point will be established using dedicated polyethylene Teflon-lined tubing, as described in SOP 3.3. The field team will then wait 20 minutes to allow soil conditions to reestablish equilibrium before collecting a sample. A T-valve with a flow regulator will be used to attach two laboratory-supplied 1-liter Summa canisters to the sampling tool. One canister will be used to purge the sample tubing by drawing soil gas through the system. The purge volume will be a minimum of 2 times, but no more than 4 times, the estimated volume of the probe and tubing. The sample will then be collected into a separate 1 liter Summa canister. Throughout purging and sampling, flow rates will be maintained between 100 and 200 ml/min. These slow flow rates limit stripping and prevent ambient air from diluting the samples.

A GPS unit will be used to establish coordinates for each sampling location. A wooden stake with flagging will be placed at each sampling location and photographed for visual identification. The flags will list the sample number and sample depth.

B 2.5.2 Sample Analysis

The soil gas samples will be analyzed for VOCs by Method TO-15 (Table 5). Sample containers, preservation requirements, and hold times are listed in Table 8. Sample control, labeling, tracking, handling, packaging, and shipping procedures are outlined in SOPs 1.2 and 1.3.

B 2.5.3 Field QA/QC Sampling

Since the soil gas samples are collected in laboratory-supplied, pre-cleaned canisters, only a subset of the standard QA/QC samples are required (see SOP 1.7). Summa canisters cleaning certification will be done on a per batch basis. A field duplicate sample will be collected at one of the sample stations by placing a “T” connector at the common inlet to simultaneously collect the soil gas into two canisters. In addition, three collocated samples will be collected at station SB10 (anticipated to have the highest soil gas concentrations) to qualitatively evaluate local variability. An equipment blank will be collected by running laboratory-supplied nitrogen through the sampling apparatus. Since only dedicated tubing is used, no decontamination is required. The equipment blank will confirm the efficiency of purging the system. Methods for collecting these QA/QC samples are included in SOP 3.3.

B 2.6 Groundwater Grab Sampling

As discussed in Section B.1.4.1, three grab groundwater samples will be collected in the Pistol Range AOPC. Proposed sampling locations are shown in Figure 7.

B 2.6.1 Sampling Methods

Grab groundwater samples will be collected by advancing a direct-push drill stem into the saturated interval, inserting a temporary well screen, and collecting a groundwater sample using a peristaltic pump. Detailed are included in SOP 2.1. Soil samples will not be recovered and soil boring logs will not be prepared. The target sample from an interval approximately 2 to 6 feet below the observed groundwater table.

The groundwater samples will be collected using a peristalitic pump and disposable tubing. To the extent possible, low-flow sampling techniques will be followed (SOP 4.2) to minimize sample turbidity as much as possible. Before sampling, each well will be purged and groundwater quality measurements will be taken, including temperature, pH, conductivity, redox potential, and turbidity. SOP 1.5 describes the procedures for measuring groundwater parameters. After sample collection each borehole will be abandoned as described in SOP 2.2.

A GPS unit will be used to establish coordinates for each sampling location. A wooden stake with flagging will be placed at each sampling location and photographed for visual identification. The flags will list the sample number and sample depth.

B 2.6.2 Sample Analysis

The grab groundwater samples will be analyzed to TSS and TDS by method SM 2540C/D and selected metals by EPA Method 6010/6020 (Table 6). Sample methods, sample containers, preservation requirements, and hold times are listed in Table 7. Sample control, labeling, tracking, handling, packaging, and shipping procedures are outlined in SOPs 1.2 and 1.3.

B 2.6.3 Field QA/QC Sampling

QA/QC sample requirements are listed on Table 6. A field duplicate, a MS/MSD sample, and an equipment rinsate blank of the temporary well screen will be analyzed (see SOP 1.7).

B 2.7 Sediment Sampling

Surface sediment samples will be collected adjacent to the Pistol Range AOPC, at the depth interval 0 to 1 foot below the sediment surface (bss). Proposed sample grid locations are depicted in Figure 8.

B 2.7.1 Sampling Methods

Surface sediment samples will be collected by a scientist equipped with hip waders and using a hand-held sediment sampler. During low pool elevation conditions, the proposed sediment stations should be in water less than three feet deep. If one or more of the proposed stations is in deeper water at the time of sampling, the station will be relocated closer to shore. Grab sediment samples will be collected from approximately the top 1 foot sediment interval, using a hand-held scoop, a small van veen or ponar sampler, a short corer or another sampling device as appropriate. Sampling methods are included in SOP 3.2. A GPS unit will be used to establish coordinates for each sampling location.

B 2.7.2 Sample Analysis

The sediment samples will be analyzed for copper, lead, nickel, and zinc (Table 4). Sample methods, sample containers, preservation requirements, and hold times are listed in Table 8. Sample control, labeling, tracking, handling, packaging, and shipping procedures are outlined in SOPs 1.2 and 1.3.

B 2.7.3 Field QA/QC Sampling

QA/QC sample requirements are listed on Table 7. A field duplicate, a MS/MSD sample, and an equipment rinsate blank of the sampling apparatus will be analyzed.

B 2.8 Decontamination Procedures

Potential sources of contamination in the field include sampling equipment, vehicles, and dust. Sample handling will be minimized and sources of contamination will be carefully avoided. Samplers will wear disposable powder-free nitrile gloves during all sample handling procedures.

Any other non-disposable sampling equipment will be decontaminated prior to initiation of sampling and between sampling locations, following the procedures outlined in SOP 1.6. In the field, 5-gallon buckets will be used to collect the decontamination water, which will then be transferred to 55-gallon drums, and labeled as described in Section B.9.

B 2.9 Investigation-Derived Waste Handling

Following SOP 1.8, all IDW from well installation, direct-push boreholes, and all sampling activities, including soil cuttings, decontamination water, and purge water, will be containerized on-site in 55-gallon drums. Soils from each boring will be containerized separately. Well development and well purge water generated during groundwater sampling from multiple wells may be combined. Similarly, decontamination water can be combined.

Drums will be labeled and turned over to the Bonneville Dam Environmental Compliance Coordinator for characterization and disposal. Disposable personal protective equipment (PPE) will be disposed of in an onsite dumpster. The USACE Hazardous Waste Handling and Disposal Policy, Section K of the Bonneville Lock and Dam Project Safety Plan (USACE, 2008) describes in detail the steps that the Environmental Compliance Coordinator will take to characterize and manage wastes generated onsite, including the IDW resulting from these sampling activities.

B 3.0 Sample Handling and Custody

This section describes the sample handling procedures from sample collection through sample disposal. The purpose of these procedures is to ensure that the quality of samples is maintained during collection, transportation, storage, and analysis. Additional details are provided in SOPs 1.2 and 1.3.

B 3.1 Sample Labeling and Identification

All samples will be labeled and accompanied by a chain-of-custody form when delivered to the laboratory for analysis. Information on the sample label shall contain, at a minimum, sample identification number, matrix, analysis requested, sampling date and time, and the initials of the field sampler.

All samples will be labeled in the following manner:

- The first part of the sample name will be the sample collection date and the station name. Codes for station names are as follows:
    - R – Reference, MW – Monitoring Well, S – Seep, L – Landfill, SB – Sandblast, PR – Pistol Range

- The second part of the sample name will include two letters designating the sample matrix followed by the sample depth interval in feet bgs (or bss). Matrix codes are as follows:
    - SO – Soil, SD – Sediment, GW – Groundwater, SW – Surface Water, SP – Seep, SG – Soil Gas.
- An example of a sample identification number for a soil sample collected from 0 to 1 ft bgs at station L1 on September 12, 2008 is 080912-L1-0-1SO (or date 2008-09-12 + station ID L1 + depth interval 0 to 1 ft bgs + sample matrix SO).
- An example of a sample identification number for a groundwater sample collected at monitoring well MW-12 on April 15, 2008 with a screened interval of 15 to 20 ft bgs is 080415-MW12-15-20GW (or date 2008-09-12 + station ID MW12 + depth interval 15-20 ft bgs + sample matrix GW).

B 3.2 Sample Packaging and Shipment

Except for the soil gas Suma canisters, the samples will be packed in coolers using bubble wrap and ice packs or crushed ice to maintain samples at 4 degrees Celsius during transport to the laboratory. Suma canisters will be packed in laboratory-supplied shipping boxes. All samples will be accompanied by chain-of-custody forms. Chain-of-custody records will be maintained by URS to document and verify sample transfer to the laboratory. A temperature blank, consisting of a small jar of water labeled “temperature blank,” will be shipped with each cooler. This will facilitate the measurement of the cooler temperature upon lab receipt. Processed samples will be shipped on crushed ice in coolers via either courier or Federal Express with adequate ice to keep samples cool for at least two days.

B 3.3 Sample Custody

After sample collection, samples will be kept in the custody of field personnel until formally transferred to the laboratory or storage area. For the purposes of this work, custody will be defined as follows:

- Samples are in plain view of the field personnel; or
- Samples are stored inside an appropriate container that is in plain view of the field personnel; or
- Samples are stored inside any locked space such as a cooler, locker, car, truck, or trailer to which field personnel have the only immediately available key(s) or lock combination.

Custody Records

Custody records, defined as formal chain-of-custody forms, will be maintained for all samples. The information on the chain-of-custody form shall contain, at a minimum, the following:

- Project Name

- Sample identification number
- Date and time of sample collection
- Sample location identification and/or description
- Sample matrix type
- Sample preservation
- Signatures of sample handlers
- Type of analyses requested
- Number of containers submitted for each sample
- Method of shipment
- Signatures indicating relinquishment and acceptance of samples including date and time of sample transfer
- Phone number and name of person to whom results should be reported

The field coordinator from URS will be responsible for sample tracking and chain-of-custody procedures in the field. At the end of the work day, the field coordinator, or his/her designee, will fill out the chain-of-custody forms prior to transferring samples into shipping coolers, and will ensure that the field notebook has been filled out. All information on the chain-of-custody forms will be cross-checked against field notebook entries and sample labels prior to sample transfer. One chain-of-custody form will be filled out for each cooler. The chain-of-custody form will be sealed in a resealable plastic bag and taped to the inside lid of the cooler prior to sealing the cooler for shipping.

Custody seals will be affixed to the shipping containers. The custody seals will contain, at a minimum, the name and title of the person responsible for the samples, the signature of that person, and the date when the custody seal was applied.

Laboratory Custody Procedures

A sample custodian at the laboratory will accept custody of the shipped samples from the carrier and enter the preliminary information about the samples into a sample receipt log, including the initial of the person delivering the samples and the status of the custody seals on the coolers (i.e., broken versus unbroken). The custodian responsible for sample log-in will follow the laboratory's SOP for opening the coolers, checking cooler temperature, checking the contents, and verifying that the information on the chain-of-custody forms agrees with the samples received.

B 4.0 Analytical Methods, Screening Levels, and Reporting Limits

Analytical methods and associated performance criteria, screening levels, and reporting limits for sample analysis are discussed briefly below.

B 4.1 Chemical Analyses and Performance Criteria

The analytical methods are based on the most current analytical protocols as cited. The project-specific QC criteria are based on the performance criteria listed in the following documents in order of priority:

- Department of Defense (DOD) Quality Systems Manual (QSM) for Environmental Laboratories (DOD, 2006)
- Test Methods as represented in SW-846 Manual, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (EPA, 2004) or other cited method.
- In-house laboratory performance criteria (in these instances, URS will obtain documentation from the laboratories detailing how these values are generated (i.e., number of samples, sample matrix etc.).

Selected water (groundwater, seep, and surface water), soil, and sediment samples will be analyzed by the analyses listed on Tables 7 and 8. Not all samples will by analyzed for all analytes. Analyses include:

- Total and dissolved metals (including common cations) by 6000/7000 series EPA Methods.
- SVOCs and Pesticides by EPA Method 8270C for solids and 8270C-SIM for water samples. Selective Ion Monitoring (SIM) will be used for water samples instead of a full scan monitoring due to the low detection limits needed for the screening level criteria.
- Butyltins by Krone Method (Krone, 1998).
- TPH by methods NWTPH-Gx and NWTPH-Dx.
- TOC and DOC by EPA Method 415.1 (water) and the modified plumb method (solids).
- TSS and TDS by method SM 2540C/D.
- Anions (carbonate, bicarbonate, fluoride, chloride, bromide, sulfate, and nitrite+nitrate) by EPA Methods 2320B, 300.0, and 353.3.
- VOCs in soil and water by EPA Methods 5035 (preparatory method) and 8260B.
- VOCs in soil gas by EPA Method TO-15.
- Grain Size distribution and percent solids by the PSEP methods (PSEP, 1996).

A gravimetric moisture content analysis will be performed on all solid (soil and sediment) samples. The extraction methods for each sample matrix will be determined in conjunction with the contracted laboratory. Performance criteria for each method, where applicable, are listed on Tables 9 and 10.

B 4.2 Screening Values

Available screening level values (SLVs) have been compiled so that appropriate analytical method limits can be chosen. The use of these SLVs to select analytical methods does not imply that the analytical results will necessarily be compared to these screening values during the risk assessments. The SLVs are provided on Tables 9, 10, and 11 for the purpose of comparing method reporting limits to available SLVs for each media type. The SLVs include:

1. **Groundwater, Seep, and Storm Water** – National Recommended Water Quality Criteria (NRWQC) (EPA, 2006), Oregon Department of Environmental Quality (ODEQ) Surface Water Quality Criteria (ODEQ, 2004), and ODEQ Groundwater Risk Based Concentrations (RBCs) for residential water (ODEQ, 2008). If ODEQ RBCs are not established the corresponding EPA Regional (Regions 3, 6, and 9) Human Health Medium-Specific Screening Level Value (SLVs) for tap water (EPA, 2008) are identified within the SLV table.

2. **Soil and Sediment** – ODEQ's SVLs for soils and for freshwater sediment (ODEQ, 2001), and ODEQ's sediment bioaccumulation SLVs (ODEQ, 2007a). ODEQ's RBCs for Soil Ingestion, Dermal Contact, and Inhalation the most conservative of Occupational, Construction Worker and Excavation Worker, (ODEQ, 2008). If ODEQ RBCs are not available the corresponding EPA Regional SLVs for industrial soil (EPA 2008) are identified.

3. **Soil Gas –** ODEQ's RBCs for Air Inhalation for Occupational Worker (ODEQ, 2008). These values have been multiplied by an attenuation faction (AF) of 500 to obtain appropriate soil gas screening criteria based on conversations with Paul Seidel at ODEQ (ODEQ, 2007b). Similar to the above-listed matrices, if ODEQ RBCs are not established, the EPA Regional SLVs for industrial air (times AF of 500) are included.

Note that screening levels are not applicable to TOC and DOC since these parameters are not contaminants of potential concern.

B 4.3 Analytical Method Limits

Sensitivity requirements for analytical methods are driven by the project objectives. The laboratory methods and method reporting limits should ensure sufficient sensitivity to meet project objectives (the matrix-specific SLVs). The method detection limit (MDL), method quantitation limit (MQL), and method reporting limit (MRL) are defined below.

Method Detection Limit

The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero, and it is determined from analysis of a sample in a given matrix containing the analyte.

Method Quantitation Limit

The MQL represents the value for which the laboratory has demonstrated the ability to reliably quantify target analytes within prescribed performance criteria for the method performed. Operationally, it is equivalent to the concentration of the lowest calibration standard in the initial calibration curve and must be at least three times the MDL.

Method Reporting Limit

The MRL is a threshold value below which the laboratory reports a result of non-detect. It may be based on project-specific concentrations of concern, regulatory action levels, or sensitivity capability of method and instrument. The MRLs are adjusted based on the sample matrix and any necessary sample dilutions. Operationally, it is equivalent to the MQL adjusted based on the sample matrix and any necessary dilutions.

B 4.3 Assignment of Numbers to Nondetected Values and Summation of PCBs

All PCB Aroclors will be reported as detected at concentrations at or above the MDL. For nondetected PCB Aroclor values the qualifier “U” will be associated with their MRL and not MDL (e.g., 1.6U, where the MRL was 1.6 and the MDL was somewhat lower).

The following summation criteria for PCBs will be used:

- Only PCB Aroclors detected at or above the MRL will be summed.
- Nondetected PCBs will not be summed. In the case of all Aroclors reported as not detected. The highest MRL (for an individual Aroclor) will be presented with the “U” qualifier.

B 4.3 Use of Nondetected Data for Analytes where the MDLs exceed the SLVs

Arsenic is the only inorganic analyte for which the proposed analytical methods are not anticipated to achieve reporting limit concentrations below the most conservative screening criteria (as presented in Tables 9 and 10). For solid matrices (Table 10), the SLV of 1.7 mg/kg (protective of protective of occupational, construction, and excavation workers) is lower than the background concentration of arsenic listed as 7 mg/kg in the ODEQ Guidance for Assessing Bioaccumulative Chemicals of Concern (ODEQ 2007a). For purposes of risk assessment, it would be appropriate to default to the background concentration as the screening level based on the common assumption that any remedial efforts would not serve to achieve target cleanup levels below background for metals. The background for arsenic (7 mg/kg) is between the RL and MDL achievable by Method 6020 therefore, the data reported through this method are expected to be of adequate quality for the risk assessment. The most conservative arsenic screening criteria in water matrices is 0.018 ug/L (protective of human health for water matrices, the most conservative (Table 9). More sensitive analytical methods are not available for arsenic analysis. During the risk assessment, the procedure described below for organic analytes will also be used to address arsenic in water, as necessary.

A few organic analytes also have RLs/MDLs which are higher than the most conservative screening criteria (Table 9). More sensitive analytical methods are not available. It is typical for the reporting limits (RL) for some organic chemicals to be higher than the most stringent risk-based screening levels associated with water, especially when drinking water-based screening levels are used. This is because many screening levels are based on a strictly toxicological basis and do not necessarily take into account analytical limitations. For analytes in which the RLs/MDLs exceed the lowest SLVs the following process will be used in the risk assessment:

- If it is analytically infeasible to achieve the screening level, the analytical data are reviewed closely after analysis. All data reported as estimated quantities (i.e., J-qualified) are included as detected values even if they are below the RL.
- Chemicals that are reported as non-detect (ND) but whose RLs are higher than the screening values are evaluated qualitatively to determine if they are likely to be site-related chemicals of interest (COIs). If they have not been detected in any earlier data for the site and if there is no reason to believe that they may occur at the site (based on site history), they may be excluded from the quantitative risk assessment but will be discussed in the uncertainty section. They may also be excluded if the RL is only slightly higher than the screening value, e.g., if the RL is two times higher than the screening value, one-half the RL would equal the screening value, which means that the potential for underestimating risk is likely to be low.
- If the ND chemicals cannot be excluded on the basis of site history, they may be included in the quantitative risk assessment, by using either the RL or one-half the RL as the exposure concentration. The estimated risks associated with using such an exposure concentration will be discussed in the risk characterization and uncertainty sections of the risk assessment with respect to the potential for overestimation of risk. Depending on the magnitude of the results, the risk estimates may also be presented with and without the inclusion of the ND-based chemicals.
- In addition, it should also be noted although potable water screening levels will be used for the initial comparison, there is actually no consumption of groundwater as a potable water supply source anywhere on the Island. This is not a complete pathway under current or likely future conditions.

B 5.0 Quality Control

The overall quality assurance objectives for field sampling and laboratory analysis are to produce data of known and appropriate quality to support the project objectives. Appropriate procedures and quality control checks will be used so that known and acceptable levels of precision, accuracy, representativeness, completeness, comparability, sensitivity and contract compliance are maintained as applicable for each definable feature of work data set. Quality control will be maintained by means of a three-phase process, as described in Appendix G of the USACE guidance for the preparation of sampling and analysis plans (USACE, 2001) for each definable feature of work.

A definable feature of work is an activity or task which is separate and distinct from other activities, and which requires separate control activities. The definable features of work identified for this project include distinct elements of fieldwork (i.e., drilling, groundwater sampling, soil sampling, station surveys, soil gas sampling, etc.) The URS Project Manager is responsible for ensuring that all three of the phase quality control processes are planned, coordinated, executed and reported as required. Under direction of the URS Project Manager, the URS Project Chemist will take responsibility for all laboratory related issues. Where logistics prohibit conducting face-to-face activities and visual inspection is not required, quality control activities may be conducted via teleconference.

The three phases of quality control include:

1. **Preparatory Phase**. This phase involves activities that are completed before work commences (i.e., before the field team travels to the site). These activities may include, but are not limited to:

   Review task order requirements as outlined in this QAPP and SSHP.

   Discuss project requirements with the analytical laboratory and ensure that the laboratory is prepared to receive the samples and analyze them in accordance with the requirements outlined in this QAPP (i.e., turnaround time, MRLs, etc).

   Discuss with subcontractors (i.e., drillers) appropriate health and safety, drilling, and sampling methods, as applicable.

   Verify that all necessary materials and equipment are present and meet appropriate quality specificications (i.e., tubing is correct type and length, correct number and type of analytical sample containers, calibration fluids have not expired).

   The results of Preparatory Phase evaluation will be documented on the first Daily QC Report submitted to USACE in conjunction with the definable feature of work.

2. **Initial Phase**. This phase is performed after the initiation of each definable feature of work. This may be after sampling the first station or drilling the first borehole, or other activity as appropriate. The USACE will be notified no less that 48 hours prior to the commencement of the definable work feature (i.e., arrival on site for field activities) so that the USACE can participate, if desired. The objective of this phase is to verify that all project requirements are being met and documented as established in the initial phase. Activities associated with this phase may include, but are not limited to:

   Ensure adequate coordination between the field team, URS, and the USACE

   Review minutes from pre-work health and safety meeting to ensure that all hazards were discussed and all participants acknowledged participation in the meeting.

   Review field notes and daily logs to ensure that required elements (time, date, weather conditions, sample names, sample analyses, geologic logging, etc) are recorded appropriately.

Make sure that subcontractors and field geologist(s) are effectively communicating and working together to resolve any conflicts.

Check to see that required field QA samples (i.e., field duplicates, entra volume for MS/MSD, trips blanks, etc.) are being collected.

Communicate with the laboratory to ensure that samples were received in good conditions with all appropriate paperwork. Review sample confirmation receipts.

The results of Initial Phase evaluation will be documented as a brief narrative on the first Daily QC Report submitted to USACE in conjunction with the definable feature of work.

3. **Follow-up Phase.** This phase is performed for each definable feature of work on an as-needed basis to ensure that all project requirements continue to be met throughout the project execution. Activities associated with this phase may include, but are not limited to:

Continue coordination with the analytical laboratory.

Verify that field notes and daily logs contain all required elements (time, date, weather conditions, sample names, sample analyses, geologic logging, etc) are recorded appropriately.

Verify that any nonconforming conditions are identified and corrected in accordance with this QAPP.

Field quality control and laboratory quality control samples will be employed to evaluate data quality. Quality control samples are controlled samples introduced into the analysis stream whose results are used to review data quality and to calculate the accuracy and precision of the chemical analysis program. The purpose of each type of quality control sample, collection and analysis frequency, and evaluation criteria are described in this section. Laboratory quality control samples, as described in the referenced methods, will be followed.

The quality of field and laboratory measurements will generally be determined by the quality control requirements and quality criteria described in analytical methods. All quality control measurements and data assessment for this project will be conducted on samples from and within batches of samples from this project alone when possible.

Quality control checks for sample collection will be accomplished by a combination of chain-of-custody protocols, field quality control samples, and laboratory quality assurance (QA) as described in the sampling or analytical methods. The QC measures may include the following: rinsate and method blanks; matrix, surrogate, and laboratory control spikes; and laboratory duplicate samples. The laboratory will notify the URS Project Chemist of any quality control exceedances outlined in this QAPP immediately. Additional details are provided in SOP 1.7.

B 5.1 Field Quality Control Samples

Field quality control samples are collected to evaluate the quality of the field sampling program. Specifically, field duplicate samples are collected to monitor the variability associated with sample collection techniques and equipment rinsate blank samples are collected to monitor the effectiveness of decontamination procedures. Field quality control samples will be selected by the sampling team and designated in the field logbook, as appropriate.

Field Duplicates

Field duplicates will be collected and analyzed at a minimum frequency of one per twenty samples or one per sample batch. Field duplicates are used to evaluate the variability associated with sample collection, therefore field duplicates will not be performed on these media.

Rinsate Blanks

Rinsate blanks are used to monitor cross-contamination of samples by non-disposable sampling equipment. They are not necessary when samples come in contact with only dedicated, disposable equipment. Rinsate blank sample will be collected in conjunction the seep samples, soil samples, grab groundwater samples, and sediment samples. Rinsate blanks are collected as follows:

- Decontaminate non-disposable sampling equipment as described in SOP 1.6.
- Run laboratory-supplied analyte-free water over the decontaminated sampling equipment. If several non-disposable components are included (i.e., hand auger, bowl, spoon), the water will pass over all surfaces of all components.
- Collect the water into sampling containers supplied by the laboratory. Rinsate blanks will be analyzed for the same set of chemical analytes as the primary samples.
- Rinsate blanks are not required for physical parameters, such as TSS and grain size distribution.

An equipment blank for the soil gas sampling will be collected in a similar manner, except that laboratory-supplied nitrogen gas will be run through the decontaminated sampling apparatus (instead of analyte-free water) and collected in an empty Suma canister. The contents of the canister will then be analyzed for the same chemical analytes as the primary samples.

B 5.2 Laboratory Quality Control Samples

Laboratory QC checks are accomplished by analyzing initial and continuing calibration samples, method blanks, surrogate spikes, laboratory control samples (LCSs), and laboratory duplicate samples. Not all of these QC samples will be required for all methods.

Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. Laboratory method blanks will be analyzed at a minimum frequency of 1 in 20 samples or one per analytical batch. Analytical results for each sample shall be clearly associated with a particular method blank. In order to evaluate low level determinations of target compounds in samples, the laboratory will report any detected concentration found in method blanks that exceed control criteria specified in this QAPP.

Laboratory Control Samples

Laboratory Control Samples (LCS) are used to monitor the laboratory’s day-to-day performance of routine analytical methods, independent of matrix effects. The LCS is prepared by spiking deionized water with standard solutions prepared independently of those used in establishing instrument calibration. The LCS are extracted and analyzed with each batch of samples. Results are compared on a per-batch basis to established control limits and are used to evaluate laboratory performance for precision and accuracy. LCS may also be used to identify any background interference or contamination of the analytical system that may lead to the reporting of elevated concentration levels or false positive measurements.

For soil gas analyses LCS are prepared by spiking nitrogen with a prepared standard containing common VOCs. LCS are analyzed with a frequency of one for every 20 samples or at least one per sample delivery group.

Matrix Spike/Matrix Spike Duplicate Samples

Matrix spikes are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy of the analysis. Known concentrations of analytes are added to environmental samples; the matrix spike/matrix spike duplicate (MS/MSD) samples are then processed through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery of the known spiked amount. MS/MSD samples will be analyzed at a minimum frequency of one per twenty samples or one per analytical batch. The MS/MSD samples will be analyzed for the same parameters as the associated field samples in the same analytical batch.

MS samples will be identified on the chain-of-custody form, and additional sample volumes will be provided to the laboratory. MS analyses not meeting quality control criteria specified in this QAPP will be further evaluated through additional cleanup or reanalysis once. If subsequent analyses result in out of control recoveries, both results will be reported by the laboratory and the corresponding data flagged.

MS/MSD are not applicable to soil gas analyses due to the sample medium and sample collection system. Standards cannot be spiked into a Summa sampling container. Surrogate spikes are introduced with every sample to check method accuracy. LCS and LCS duplicates as well as laboratory duplicates are used to ensure that the method is meeting precision requirements.

Laboratory Duplicate Samples

Precision of the analytical system is evaluated by using laboratory duplicates. Laboratory duplicates are two portions of a single homogeneous sample analyzed for the same parameter. Laboratory duplicates with be analyzed at a minimum frequency of 1 in 20 samples or one per analytical batch.

B 5.3 *Analytical Data Quality Indicators*

Analytical data quality indicators of precision, accuracy (bias), representativeness, comparability, completeness, and sensitivity (PARCCS) are defined below. The project-specific control limits required to meet the measurement performance criteria are outlined in Tables 9, 10, and 11. These project-specific criteria are based primarily on criteria listed in the Department of Defense (DOD) Quality Systems Manual (DOD, 2006). Where the DOD QSM does not have established control limits, the project-specific control limits are based on criteria found in the documents outlined in Section B 4.1. Any data that falls outside of the project-specific control limits must be justified, and the effects on project objectives must be assessed. In the cases where project-specific control limits are not met, response actions will be taken, as explained in Section C 1.2.

B 5.3.1 Precision

Precision is defined as the degree of agreement between or among independent, similar, or repeated measures. Precision is related to analytical variability and for this project will be measured as the relative percent difference (RPD) between results for laboratory duplicate pairs. Precision will be calculated as the RPD as follows:

$$\%RPD_i = \frac{2\left|O_i - D_i\right|}{\left(O_i + D_i\right)} \times 100\%$$

where:

$\%RPD_i$ = Relative percent difference for compound *i*

O_i = Value of compound *i* in original sample

D_i = Value of compound *i* in duplicate sample

The resultant RPD will be compared to project-specific acceptance control limits shown in Tables 9 and 10. The RPD will be reviewed during data quality review, and the reviewer will note any deviations from the specified control limits and comment on any effects on the data.

B 5.3.2 Accuracy

Accuracy is the amount of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components. Laboratory accuracy will be measured as the percent recovery of MS samples and LCS samples. Additional potential bias will be quantified by the analysis of method blank samples. Accuracy shall be calculated as percent recovery of the target analyte as follows:

$$\%R_i = \left(Y_i \div X_i\right) \times 100\%$$

where:

$\%R_i$ = percent recovery for compound i

Y_i = measured analyte concentration in sample i

X_i = known analyte concentration in sample i

The LCS resultant percent recoveries will be compared to project-specific control limits shown in Tables 9 and 10. The LCS acceptance ranges will be used for the MS recoveries as well. If the control limits are not met, the laboratory will justify why the control limits were exceeded and implement appropriate corrective actions discussed in Section C 1.2. Percent recoveries will be reviewed during data quality review, and the reviewer will note any deviations from the specified control limits and comment on any effects on the data.

B 5.3.3 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a parameter that focuses primarily on the proper design of the sampling program or the subsampling of a given sample. The sampling design is discussed in Section B 1.0.

B 5.3.4 Comparability

Comparability is a qualitative parameter that expresses the confidence with which data from one study can be compared with data from another. This goal will be achieved by using standard techniques to collect and analyze representative samples and by reporting analytical results in appropriate units. Comparability will be evaluated during the data quality review.

B 5.3.5 Completeness

Completeness for usable data is defined as the percentage of usable data out of the total amount of planned data. Completeness for usable data shall be defined as 95% for each individual analytical method. Completeness will be calculated as follows:

$$\%C = \frac{A}{I} x 100\%$$

where:

$\%C$ = Percent completeness (analytical)

A = Measurements that are judged to be usable (based on project-specific requirements)

I = Intended number of measurements

Invalid data (i.e., data qualified as “R,” rejected) will be identified during the data quality review.

The following completeness calculations will be performed using individual analytes in each matrix:

- *Technical Completeness* = (number of useable results/total reported results) x100
- *Analytical Completeness* = (number of unqualified results/total reported results) x100
- *Contract Completeness* = (number of contract compliant results/total reported results) x100
- *Field Sampling Completeness* =(number samples collected/total reported results) x100

B 5.3.6 Sensitivity

Sensitivity is defined as the capability of a method or instrument to discriminate between measurement responses representing different concentrations of COIs. The sensitivity of the analytical methods (i.e., method reporting limits) identified for this project are sufficient to allow comparison of project results to selected CLVs, as listed in Tables 9, 10, and 11.

The uncertainty associated with results reported between the MDL and the MRL is higher than the uncertainty associated with results reported at concentrations above the MRL. Results falling between the MDL and the MRL will be flagged accordingly.

B 6.0 Equipment Maintenance

Laboratory instrumentation will be examined and tested prior to being put into service and will be maintained according to the manufacturer’s instructions. All laboratory instruments will be maintained as specified in the project laboratory’s QA plan and according to manufacturers’ instructions. Manufacturer’s instructions will be followed for any additional equipment that is required for this project.

B 7.0 Instrument Calibration

Laboratory instrument calibration will be conducted in accordance with the QC requirements identified in the DOD QSM (DODEDQW, 2006) manufacturers’ instructions and the laboratory SOP. General requirements are summarized in SOP 1.4 and discussed below.

B 7.1 Laboratory Instruments

As stated in DOD QSM, EPA SW-846 and applicable laboratory SOPs, calibration of all analytical instrumentation is required to ensure that the analytical system is operating correctly and functioning at the sensitivity required to meet project objectives. Each instrument will be calibrated with standard solutions appropriate to the instrument and analytical method. QC requirements for calibration must meet or exceed the requirments specified in Appendix B of the DOD QSM. For those analytical methods not specified in the DOD QSM, calibration should follow guidelines set forth in the cited method. The calibration and maintenance history of the fixed laboratory instrumentation is an important aspect of the project’s overall QA/QC program. As such, all initial and continuing calibration procedures will be implemented by trained personnel following the manufacturer’s instructions and in accordance with applicable EPA protocols to ensure the equipment is functioning within the tolerances established by the manufacturer and the method-specific analytical requirements.

B 7.2 Standard Solutions

A critical element in the generation of quality data is the purity/quality and traceability of the standard solutions and reagents used in the analytical operations. To ensure the highest purity possible, all primary reference standards and standard solutions will be obtained from a reliable commercial source. The laboratories will maintain a written record of the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and all other pertinent information for all standards, standard solutions, and individual standard preparation logs.

Standard solutions will be validated prior to use. Validation procedures can range from a check for chromatographic purity to verification of the concentration of the standard solution using another standard solution prepared at a different time or obtained from a different source. Stock and working standard solutions will be checked regularly for signs of deterioration, such as discoloration, formation of precipitates, or change of concentration. Care will be exercised in the proper storage and handling of standard solutions, and all containers will be labeled as to compound, concentration, solvent, expiration date, and preparation data (initials of preparer/date of preparation). Reagents will be examined for purity by subjecting an aliquot or subsample to the corresponding analytical method as well.

B 8.0 Data Management

The approach to data management for this project will ensure that analytical data maintain their integrity through the use of appropriate documentation procedures.

B 8.1 Data Reduction

The laboratory will perform in-house analytical data reduction under the direction of the laboratory QA manager. Data reduction will be conducted as follows:

- Raw data produced by the analyst will be processed and reviewed for attainment of QC criteria as outlined in this QAPP and/or established EPA methods, for overall reasonableness, and for transcription or calculations errors.
- Upon acceptance of the preliminary reports by the laboratory QA data reviewer, final reports will be generated. The turnaround for the final data reports will be negotiated with the contracted analytical laboratory.

Laboratory data reduction procedures will be those specified in EPA SW-846 (4th edition) and those described in the laboratory SOPs. The data reduction steps will be documented, signed, and dated by the analyst.

The laboratories will maintain detailed procedures for laboratory record keeping in order to support the validity of all analytical work. Each data report package will contain the laboratories' written certification that the requested analytical method was run and that all QA/QC checks were performed. The laboratory program administrator will provide the USACE

PM with QC reports of their external audits if appropriate, which will become part of the project files.

B 8.2 Laboratory Data Deliverables

The laboratory data reports will consist of data packages that will contain complete documentation and all raw data to allow independent data verification and review of analytical results from laboratory bench sheets, instrument raw data outputs, chromatograms, and mass spectra. Each laboratory data report will include the following:

- Case narrative identifying the laboratory analytical batch number. The laboratory manager or their designee must sign the narrative.
- Matrix and number of samples included.
- Analyses performed and analytical methods used.
- Description of any problems or exceedances of QC criteria and corrective action taken.
- Copy of chain-of-custody records for all samples included in the analytical batch.
- Tabulated sample analytical results with units, data qualifiers, percent solids, sample weight or volume, dilution factor, laboratory batch and sample number, field sample number, and dates sampled, received, extracted, and analyzed all clearly specified. Surrogate percent recoveries will be included for organic analyses.
- Method reporting limits and method detection limits will be reported for each analyte. Those analytes which have concentrations above the method detection limit but below the method reporting limits will be appropriately flagged by the laboratory.
- All calibration, QC, and sample raw data including bench sheets, preparation logs, chromatograms, mass spectra, mass spectrometer tuning results, quantitation reports, and other instrument output data as applicable to analytical method.
- Blank summary results indicating samples associated with each blank.
- Matrix spike result summaries with calculated percent recovery.
- Laboratory control sample results, when applicable, with calculated percent recovery.

In addition to the laboratory data report, the laboratories will provide the data in an electronically formatted data deliverable (EDD) which mirrors the written laboratory report.

B 8.3 Electronic Data Management

An electronic data management system (Microsoft Access®) will be used to track, access, and report the following:

- Sample location (northing and easting), using coordinate systems compatible with earlier field work.

- Sample collection information including sample number, matrix, type of sample (primary, MS, duplicate), date of collection, and sampler.
- Analytical results including concentration, units, qualifiers and analytical method.

Laboratory EDDs will be directly loaded into the data management system by the database administrator, thereby avoiding hand-entry errors. The accuracy between the analytical results reported in the portable document format (pdf) and the EDD deliverables are checked by the database administrator at a frequency of 20% or greater. If discrepancies are encountered between the laboratory deliverables, the laboratory is notified and a 100% check is performed on that data set. Corrective action is taken, which typically includes the database administrator removing the effected EDD and reloading the laboratory corrected EDD into the data management system.

Changes in analytical results or qualifiers due to the QA/QC review as presented in the QCSR report are incorporated into the project data management system. The accuracy of these database modifications is checked by producing reports (or tables) from the data management system which are crosschecked against the QCSR.

Within the data management system, the database administrator records:

- Date of EDD upload
- Verification of pdf to EDD crosscheck and frequency
- Date of qualifiers added as a result of QA/QC review
- Any other pertinent project notes (i.e. sample description)

B 8.3 Documents and Records

The following documents and records will be produced during this investigation:

- Monitoring Well Installation and Sampling Program Memorandum – January 28, 2008
- Upland OU QAPP – Final version August 2008
- Sampling and analysis records (field notebooks and forms, photographs, chain-of-custody records, shipping records, corrective action requests, variances, etc.) - delivery to the USACE within the applicable below-listed Memorandums/Reports
- Daily Quality Control Reports (DQCRs) – delivery to the USACE as applicable
- Technical memorandum – Monitoring well installation construction summary – June 2008.
- Technical memorandum including analytical data and data quality review summaries for quarterly groundwater/seep/surface water sampling events. These will each include a Quality Control Summary Report (QCSR).
    - 1st Quarter – July 2008

  - 2nd Quarter – October 2008
  - 3rd Quarter – January 2009
  - 4th Quarter – April 2009
- Technical memorandum with analytical data and data quality review summary – Surface soil, grab groundwater, sediment, and soil gas field summary, a QCSR, and sample results – March 2009
- Upland OU Data Sufficiency Evaluation Report - 2009

All field activities will be recorded in a bound field logbook that has consecutively numbered pages. The field notebook will provide a daily record of significant events, observations, and measurements taken during the field investigation. The field notebook is intended to provide sufficient data and observations to enable the field team to reconstruct events that occurred during the project. The field notebook will contain the following at a minimum:

- Date and time of sample collection
- Weather conditions, including temperature
- The station number and name
- Location of sampling point, i.e. GPS coordinates
- Sample identification number
- Type of sample, matrix, species (biological samples)
- Field measurements made: water depth, temperature, etc.
- Field observations, especially any unexpected odors or stains
- References, such as maps or photographs of the sampling site
- Any procedural steps taken that deviate from those outlined in this QAPP
- Physical observations
- Any QC samples (i.e., field duplicates, extra volume taken for MS/MSD) collected

The field team will complete DQCRs each day during the site activities. Appendix A contains a copy of the DQCR form and other sampling forms. The DQCRs will be dated and signed by a field team representative and submitted to the USACE weekly. If significant modifications to the QAPP are required, USACE will be contacted as soon as possible. Attachments to the DQCR may include quality assurance sample tables, chain-of-custody records, field screening results, and any other pertinent project forms. The DQCR will contain, at a minimum, the following information:

- Location at time of sampling
- Field instrument measurements
- Field instrument calibrations

- List of samples collected and shipped
- Departures from the QAPP
- Discussion of problems encountered and resolutions
- Instructions from USACE

Interpretation of the data will be provided in the technical memorandum or reports to determine if the stated objectives have been met.

C ASSESSMENT AND OVERSIGHT

C 1.0 Assessments and Response Actions

C 1.1 Assessments

Assessments will be used to increase the user's understanding of the activity being assessed and to provide a basis for improving that activity. Assessments, including performance and systems audits, may be conducted by the USACE to determine whether:

- The QA program has been documented in accordance with specified requirements
- The documented program has been implemented
- Any nonconformances were identified and corrective action or identified deficiencies was implemented

As the Contracting Officer's Representative (COR) for this project, the Portland District Technical Lead will be responsible for initiating audits, selecting the audit team, and overseeing audit implementation. The Contractor, URS, is responsible for supervising and checking that samples are collected and handled in accordance with this plan and that documentation of work is adequate and complete. The Contractor is also responsible for ensuring that the project performance satisfies the QA objectives set forth in this QAPP.

Reports and technical correspondence will be peer reviewed by qualified individuals before being finalized. Copies of all audit reports will be submitted to the USACE PM upon completion.

A copy of the laboratory's most current National Environmental Laboratory Accreditation Program (NELAP) certification record is included in Appendix C.

Performance Audits

Performance audits are used to determine the status and effectiveness of laboratory measurement systems and to provide a quantitative measure of the quality of data generated. For laboratories, this audit can involve the use of standard reference materials. These samples have known concentrations of constituents that are analyzed as unknowns in the laboratory. Results of the laboratory analyses are calculated and compared for accuracy against the known concentrations of the samples and evaluated in relation to the project measurement quality objectives. Standard reference samples will be used according to the requirements of the laboratory methods selected for this project.

Technical Systems Audits

Technical system audits are used to confirm the adequacy of the data collection (field operation) and data generation (laboratory operation) systems. On-site audits are conducted to determine whether the project-specific plans, field methods and laboratory SOP are being properly implemented. A system audit may cover the field or laboratory portions of the project. As COR for this project, the Portland District Technical Lead may request that a system audit of the field methods or laboratory operations be performed.

C 1.2 Response Actions

The ultimate responsibility for maintaining quality throughout the project rests with the USACE PM. The day-to-day responsibility for assuring the quality of field and laboratory data rests with the Contractor, URS, and the laboratory program administrator, to be determined, respectively.

Any nonconformance with the established QC procedures will be expeditiously identified and controlled. Where procedures are not in compliance with the established protocol, corrective actions will be taken immediately. Prior work affected by the nonconforming activity will be corrected immediately; such correction may include redoing all or portions of the prior work. Subsequent work that depends on the nonconforming activity will not be performed until the identified nonconformance is corrected.

Field Corrective Action

The URS project manager will review the procedures being implemented in the field for consistency with the established protocols. Sample collection, preservation, labeling, etc., will be checked for completeness. Where procedures are not strictly in compliance with the established protocol, the deviations will be documented and corrected. Corrective actions will be defined by the Technical Lead as appropriate. Upon implementation of the corrective action, the technical lead will provide the USACE PM with a written memo documenting field implementation. The memo will become part of the project file.

Laboratory Corrective Action

The laboratory QA data reviewer will review the data generated to ensure that all QC samples have been run as specified in the cited method and URS protocol. Recoveries of LCS, MS, and surrogate samples for consistency with method and project-specific accuracy, and RPD for matrix replicate and MS/MSD samples for consistency with method and project-specific precision.

Laboratory personnel will be alerted that corrective actions are necessary if any of the following occur:

- The QC data are outside the warning or acceptance windows established for precision and accuracy. The laboratory project manager will contact the laboratory QA manager to discuss out-of-control data sets. If the analyses cannot produce data sets that are within control, the URS chemist will be notified within 48 hours of any analysis that fails to meet the measurement quality objectives specified in this QAPP.
- Blanks contain contaminants at concentrations above the levels specified in the laboratory QA plan for any target compound.
- Undesirable trends are detected in MS or LCS recoveries or RPDs between matrix replicates and MS/MSD.
- Unusual changes in MDL are observed.
- Deficiencies are detected by the laboratory QA manager during internal or external audits, or from the results of internal performance evaluation samples.

If any nonconformances in analytical methodologies or QC sample results are identified by the analyst, corrective actions will be implemented immediately. Specific corrective actions are outlined in each laboratory SOP. Corrective action procedures will be handled initially at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors, check the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. The analyst will immediately notify his/her supervisor of the identified problem and the investigation that is being conducted. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor and laboratory QA manager for further investigation. Once resolved, full documentation of the corrective action procedure will be filed by the laboratory QA manager, and if data are affected, the URS PM will be provided a corrective action memo for inclusion into the project file.

Corrective action may include, but will not be limited to the following:

- Performing appropriate sample cleanup procedures
- Reanalyzing suspect samples if holding time criteria permit
- Evaluating and amending sampling and/or analytical procedures
- Accepting data with an acknowledged level of uncertainty
- Recalibrating analytical instruments
- Evaluating and attempting to identify limitations of the data

If the data is deemed unacceptable following the implementation of the corrective action measures, the URS project chemist will be notified to explore possible follow-up corrective actios. The URS chemist will include the USACE technical lead, PM, and/or chemist in discussion regarding laboratory corrective action measures. The USACE chemist will be included if data are at risk of not meeting project objective regarding data usability (i.e., when data may potentially be rejected due to serious deficiencies.)

Corrective Actions Following Data Evaluation

Field and laboratory data generated for this project will be reviewed to ensure that all project objectives are met. If any nonconformances are found in the field procedures, sample collection procedures, field documentation procedures, laboratory analytical and documentation procedures, and data evaluation and quality review procedures, the impact of those nonconformances on the overall project objectives will be assessed. Appropriate actions, including resampling and reanalysis, may be recommended to the USACE PM so that the project objectives can be accomplished.

Selected split samples may be analyzed by an independent laboratory, as requested by the USACE chemist. Based on the results, the USACE chemist may recommend corrective action(s) to ensure that project objectives are met.

C 2.0 Reports to Management

A sampling and analysis data report will be prepared that documents the results of this investigation as described in Section A 7.0.

D DATA VALIDATION AND USABILITY

D 1.0 Data Review, Verification, and Validation

The purpose of the data quality review is to eliminate unacceptable analytical data and to designate a data qualifier for any data quality limitation discovered. The data quality review will include a review of laboratory performance criteria and sample-specific criteria. The reviewer will determine whether the measurement quality objectives have been met, and will calculate the data completeness for the project.

The data are reviewed in accordance with the criteria contained in the DOD guidance document (DOD, 2006) modified for the analytical methods used. An expanded validation of the data (i.e., checks of column confirmation and calibrations) will be performed on 15% of the data. Pending results of the initial 15% check it may be necessary to perform the expanded data validation on a larger subset of the data. The data quality review will include verification of the following:

- Compliance with this QAPP
- Chain-of custody records
- Case Narrative
- Proper sample collection and handling procedures
- Holding times
- Field QC results
- Laboratory blank analysis
- Method detection and reporting limits

- Laboratory duplicate precision
- MS recoveries
- LCS recoveries
- Surrogate compound recoveries
- Continuing calibration verification (CCV) standards
- Data completeness and format
- Data qualifiers assigned by the laboratory
- Mass spectrometer tuning results (as applicable) (15%)
- Primary and secondary column verification (15%)
- Instrument calibration verification (15%)
- Instrumentation calibration linearity (15%)
- Verification of reported data in electronic data deliverable with the hard copy deliverable

Qualifiers will be added to data during the review as necessary. Qualifiers applied to the data as a result of the review will be limited to:

U	The analyte was analyzed for but was not detected above the reporting limit.
J	The analyte was detected at a concentration less than the laboratory reporting limit, and the result is therefore considered an estimated quantity.
UJ	The analyte was not detected above the sample reporting limit. However, the reporting limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet QC criteria. The presence or absence of the analyte cannot be verified. No associated value is reported.

The corrective action and flagging criteria as listed in Appendix B of the DOD document (DOD, 2006) will be used as guidance for applying the above flags to the samples results. A detailed summary of the data quality review will be included in the QCSR which will provide a interpretation of the data quality, identify which sample results were flagged and why as well as evaluate the need for corrective actions and/or comprehensive data validation.

D 2.0 Reconciliation with User Requirements

After the field work, chemical analyses, and data quality reviews have been completed, a data quality review report will be prepared. In this report, all data generated for this project will be reconciled with the project objectives. The report will include an evaluation of overall precision, accuracy, completeness, representativeness, comparability, and sensitivity of the sampling data; it will include an assessment of the overall usability of the data and describe any limitations on its use; and it will summarize any audit information, indicating any corrective actions taken. The data quality review report will be appended to the sampling and analysis data report.

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TABLES

Table 1. Project Objectives and Data Requirements

Project Objective	Data Requirements	Investigation Strategy	Decision Criteria/ Performance Specifications
Determine baseline risk to human and ecological receptors from COIs in Soil of the Upland OU (URS, 2007)	COI concentrations in surface and subsurface soils at upland AOPCs, in areas where sufficient data does not already exist Site-specific background metals concentrations in soil.	Analyze surface and near surface soils in the gully area of the Landfill AOPC for selected VOCs and PAHs. Analyze surface soil samples containing grit or fine-grained materials from the Sandblast Area AOPC for lead. Analyze background soil samples for metals.	Locations of samples will be selected to complete nature and extent delineation of soils. Background soils samples will be collected from areas not impacted by site activities. Laboratory analyses will be based on COIs defined in the Management Plan. Laboratory reporting limits will be based on screening levels.
Determine baseline risk to human and ecological receptors from COIs in groundwater of the Upland OU (URS, 2007)	COI concentrations in shallow groundwater. Site-specific background metals concentrations in groundwater.	Analyze (for 4 quarters) groundwater samples from monitoring wells in the Landfill and Sandblast Area AOPCs for AOPC-related COIs. Analyze grab groundwater samples from the Pistol Range AOPC for selected metals. Analyze (for 4 quarters) samples from upgradient well to determine background groundwater metals concentrations.	Locations of samples will be selected to complete nature and extent delineation of groundwater. Background monitoring wells will be located in an area not impacted by site activities. Laboratory analyses will be based on COIs defined in the Management Plan. Laboratory reporting limits will be based on screening levels.
Determine risk to human receptors of VOC concentrations in soil gas in the vicinity of structures in the Sandblast Area AOPC. (URS, 2007)	COI concentrations in soil gas in the vicinity of enclosed structures	Analyze concentrations of VOCs in soil gas within 10 feet of enclosed structures	Locations of samples will be selected based on proximity to enclosed structures. Laboratory analyses will be based on COIs defined in the Management Plan. Laboratory reporting limits will be based on screening levels.
Determine potential for COIs in soil of Upland OU to impact River OU (URS, 2007)	Evaluation of stability of surface soils COI concentrations in surface soils at upland AOPCs, in areas where sufficient data does not already exist	Map surface topography, slope profiles, and groundcover; analyze surface soils for granisize distribution as needed. Evaluate the existing storm water conveyance system associated with the two outfalls at the Sandblast Area AOPC. Analyze sediment samples from lagoon adjacent to the Pistol Range AOPC for selected metals. Analyze surface soil samples from the Landfill and Sandblast Area AOPCs as described above.	Locations of sediment samples will be selected based on proximity to Pistol Range AOPC. Laboratory analyses will be based on COIs defined in the Management Plan. Laboratory reporting limits will be based on screening levels.
Determine potential for COIs in groundwater of Upland OU to impact River OU (URS, 2007)	COI concentrations in groundwater seeps at the point of discharge to the river Where seeps exist, COI concentrations in groundwater adjacent to the river. Site-specific background metals concentrations in groundwater.	Analyze (for 4 quarters) seep water from 1 to 4 locations (depending on availability) adjacent to the Landfill and Sandblast Area AOPCs for AOPC-related COIs. Analyze surface water adjacent to seep samples. Analyze (for 4 quarters) groundwater samples from wells closest to shore at Landfill and Sandblast AOPCs for AOPC-related COIs. Analyze grab groundwater samples from the Pistol Range AOPC for selected metals. Analyze (for 4 quarters) samples from background well for metals.	Locations of seep and surface water samples will be selected based on a seep survey conducted by boat. Laboratory analyses will be based on COIs defined in the Management Plan. Laboratory reporting limits will be based on screening levels.

Reference:
URS, 2007. Bradford Island RI/FS Management Plan. Bradford Island, Bonneville Dam Forebay, Cascade Locks, Oregon. August.

Table 2. Groundwater/Seep/Surface Water Analyses

Analyte	Landfill AOPC			Sandblast Area AOPC		Upgradient Groundwater Sample (MW-10)	QA/QC Samples[3]				Total Number of Samples
	Groundwater Samples (MW-1 through MW-9)	Seep Samples (approx. number)	Surface Water Samples (approx. number)	Groundwater Samples (MW-11 through MW-15)	Seep and Surface Water Samples[2]		Trip Blank Samples	Field Duplicate Samples	Rinsate Blank Samples	MS/MSD Samples	
METALS (TOTAL and DISSOLVED[1])											
Aluminum	--	--	--	--	--	2	--	2	--	4	8
Antimony	--	--	--	--	--	2	--	2	--	4	8
Arsenic	18	8	8	10	--	2	--	4	2	8	60
Barium	--	--	--	--	--	2	--	2	--	4	8
Beryllium	--	--	--	--	--	2	--	2	--	4	8
Cadmium	--	--	--	--	--	2	--	2	--	4	8
Calcium	--	--	--	--	--	2	--	2	--	4	8
Chromium	--	--	--	--	--	2	--	2	--	4	8
Cobalt	--	--	--	--	--	2	--	2	--	4	8
Copper	--	--	--	--	--	2	--	2	--	4	8
Iron	18	8	8	10	--	2	--	4	2	8	60
Lead	18	8	8	--	--	2	--	4	2	8	50
Magnesium	--	--	--	--	--	2	--	2	--	4	8
Manganese	18	8	8	--	--	2	--	4	2	8	50
Mercury	--	--	--	--	--	2	--	2	--	4	8
Nickel	--	--	--	--	--	2	--	2	--	4	8
Potassium	--	--	--	--	--	2	--	2	--	4	8
Selenium	--	--	--	--	--	2	--	2	--	4	8
Silver	--	--	--	--	--	2	--	2	--	4	8
Sodium	--	--	--	--	--	2	--	2	--	4	8
Thallium	--	--	--	--	--	2	--	2	--	4	8
Vanadium	--	--	--	10	--	2	--	2	--	4	18
Zinc	--	--	--	--	--	2	--	2	--	4	8
BUTYLTINS											
Monobutyltin	9	4	4	5	--	--	--	2	1	4	29
Dibutyltin	9	4	4	--	--	--	--	1	1	2	21
VOCs											
2,2-Dichloropropane	--	--	--	5	--	--	1	1	--	2	9
Chloroform	9	4	4	5	--	--	2	2	1	4	31
Tetrachloroethene	9	4	4	5	--	--	2	2	1	4	31
Trichloroethene	--	--	--	5	--	--	1	1	--	2	9
Vinyl chloride	9	4	4	5	--	--	2	2	1	4	31
cis-1,2-Dichloroethene	--	--	--	5	--	--	1	1	--	2	9
SVOCs											
Carbolic Acid	9	4	4	--	--	--	--	1	1	2	21
Benzoflouranthenes	--	--	--	5	--	--	--	1	--	2	8
Phenanthrene	9	4	4	5	--	--	--	2	1	4	29
p-Dichlorobenzene	9	4	4	--	--	--	--	1	1	2	21
PESTICIDES											
p-Nitrophenol	9	4	4	--	--	--	--	1	1	2	21
TPHs											
Gasoline Range Hydrocarbons	9	4	4	5	--	--	2	2	1	4	31
Diesel Range Hydrocarbons	9	4	4	5	--	--	--	2	1	4	29
Residual Range Hydrocarbons	9	4	4	5	--	--	--	2	1	4	29

Notes:

AOPC = area of potential concern
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

[1] Each station will include a total and a dissolved sample for metals. Therefore the indicated number of samples is two times the number of stations.

[2] The shoreline adjacent to the Sandblast Area AOPC is entirely covered in rip-rap. No seeps were identified during the seep survey conducted March 24, 2008.

[3] Quality Assurance/Quality Control (QA/QC) samples include one field duplicate, one matrix spike (MS), and one matrix spike duplicate (MSD) for each batch of up to 20 primary samples. One trip blank is also included for each batch of VOC and gasoline-range TPH analyses. One equipment rinsate blank is also included for the non-disposible equipment required for sampling seeps.

Table 3. Additional Groundwater/Seep/Surface Water Analyses - First Quarter Only

Analyte	Landfill AOPC			Sandblast Area AOPC		Upgradient Groundwater Sample (MW-10)	QA/QC Samples[2]				Total Number of Samples
	Groundwater Samples (MW-1 through MW-9)	Seep Samples (approx. number)	Surface Water Samples (approx. number)	Groundwater Samples (MW-11 through MW-15)	Seep and Surface Water Samples[2]		Trip Blank Samples	Field Duplicate Samples	Rinsate Blank Samples	MS/MSD Samples	
CATIONS and ANIONS (dissolved concentrations only)											
Sodium	9	4	4	5	--	--	--	1[3]	1[3]	2[3]	26
Potassium	9	4	4	5	--	--	--	1[3]	1[3]	2[3]	26
Calcium	9	4	4	5	--	--	--	1[3]	1[3]	2[3]	26
Magnesium	9	4	4	5	--	--	--	1[3]	1[3]	2[3]	26
Iron	--[1]	--[1]	--[1]	--[1]	--	--[1]	--	0	0	0	0
Fluoride	9	4	4	5	--	1	--	2	1	4	30
Chloride	9	4	4	5	--	1	--	2	1	4	30
Bromide	9	4	4	5	--	1	--	2	1	4	30
Nitrite	9	4	4	5	--	1	--	2	1	4	30
Nitrate	9	4	4	5	--	1	--	2	1	4	30
Sulfate	9	4	4	5	--	1	--	2	1	4	30
Carbonate/Bicarbonate	9	4	4	5	--	1	--	2	1	4	30
BUTYLTINS											
Monobutyltin	--	--	--	--	--	1	--	0[3]	0	0[3]	1
Dibutyltin	--	--	--	--	--	1	--	0[3]	0	0[3]	1
VOCs											
1,1,1,2-Tetrachloroethane	--	--	--	5	--	--	1	1	0	2	9
1,1,1-Trichloroethane	--	--	--	5	--	--	1	1	0	2	9
1,1,2,2-Tetrachloroethane	--	--	--	5	--	--	1	1	0	2	9
1,1,2-Trichloroethane	--	--	--	5	--	--	1	1	0	2	9
1,1-Dichloroethane	--	--	--	5	--	--	1	1	0	2	9
1,1-Dichloroethene	--	--	--	5	--	--	1	1	0	2	9
1,1-Dichloropropene	--	--	--	5	--	--	1	1	0	2	9
1,2,3-Trichlorobenzene	--	--	--	5	--	--	1	1	0	2	9
1,2,3-Trichloropropane	--	--	--	5	--	--	1	1	0	2	9
1,2,4-Trichlorobenzene	--	--	--	5	--	--	1	1	0	2	9
1,2,4-Trimethylbenzene	--	--	--	5	--	--	1	1	0	2	9
1,2-Dibromo-3-chloropropane	--	--	--	5	--	--	1	1	0	2	9
1,2-Dibromoethane	--	--	--	5	--	--	1	1	0	2	9
1,2-Dichlorobenzene	--	--	--	5	--	--	1	1	0	2	9
1,2-Dichloroethane	--	--	--	5	--	--	1	1	0	2	9
1,2-Dichloropropane	--	--	--	5	--	--	1	1	0	2	9
1,3,5-Trimethylbenzene	--	--	--	5	--	--	1	1	0	2	9
1,3-Dichlorobenzene	--	--	--	5	--	--	1	1	0	2	9
1,3-Dichloropropane	--	--	--	5	--	--	1	1	0	2	9
1,4-Dichlorobenzene	--	--	--	5	--	--	1	1	0	2	9
2,2-Dichloropropane	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
2-Butanone	--	--	--	5	--	--	1	1	0	2	9
2-Chlorotoluene	--	--	--	5	--	--	1	1	0	2	9
2-Hexanone	--	--	--	5	--	--	1	1	0	2	9
4-Chlorotoluene	--	--	--	5	--	--	1	1	0	2	9
4-Isopropyltoluene	--	--	--	5	--	--	1	1	0	2	9
4-Methyl-2-pentanone	--	--	--	5	--	--	1	1	0	2	9
Acetone	--	--	--	5	--	--	1	1	0	2	9
Benzene	--	--	--	5	--	--	1	1	0	2	9
Bromobenzene	--	--	--	5	--	--	1	1	0	2	9
Bromochloromethane	--	--	--	5	--	--	1	1	0	2	9
Bromodichloromethane	--	--	--	5	--	--	1	1	0	2	9
Bromoform	--	--	--	5	--	--	1	1	0	2	9
Bromomethane	--	--	--	5	--	--	1	1	0	2	9
Carbon disulfide	--	--	--	5	--	--	1	1	0	2	9
Carbon tetrachloride	--	--	--	5	--	--	1	1	0	2	9
Chlorobenzene	--	--	--	5	--	--	1	1	0	2	9
Chloroethane	--	--	--	5	--	--	1	1	0	2	9
Chloroform	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
Chloromethane	--	--	--	5	--	--	1	1	0	2	9
Dibromochloromethane	--	--	--	5	--	--	1	1	0	2	9
Dibromomethane	--	--	--	5	--	--	1	1	0	2	9
Dichlorodifluoromethane	--	--	--	5	--	--	1	1	0	2	9
Ethylbenzene	--	--	--	5	--	--	1	1	0	2	9
Hexachlorobutadiene	--	--	--	5	--	--	1	1	0	2	9
Isopropylbenzene	--	--	--	5	--	--	1	1	0	2	9
Methyl ethyl ketone	--	--	--	5	--	--	1	1	0	2	9
Methylene chloride	--	--	--	5	--	--	1	1	0	2	9
Naphthalene	--	--	--	5	--	--	1	1	0	2	9
Styrene	--	--	--	5	--	--	1	1	0	2	9
Tetrachloroethene	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
Toluene	--	--	--	5	--	--	1	1	0	2	9
Trichloroethene	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
Trichlorofluoromethane	--	--	--	5	--	--	1	1	0	2	9
Vinyl acetate	--	--	--	5	--	--	1	1	0	2	9
Vinyl chloride	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
cis-1,2-Dichloroethene	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
cis-1,3-Dichloropropene	--	--	--	5	--	--	1	1	0	2	9
m,p-Xylene	--	--	--	5	--	--	1	1	0	2	9
n-Butylbenzene	--	--	--	5	--	--	1	1	0	2	9
n-Propylbenzene	--	--	--	5	--	--	1	1	0	2	9
o-Xylene	--	--	--	5	--	--	1	1	0	2	9
sec-Butylbenzene	--	--	--	5	--	--	1	1	0	2	9
tert-Butylbenzene	--	--	--	5	--	--	1	1	0	2	9
trans-1,2-dichloroethene	--	--	--	5	--	--	1	1	0	2	9
trans-1,3-Dichloropropene	--	--	--	5	--	--	1	1	0	2	9
SVOCs											
Carbolic Acid	--	--	--	--	--	1	--	0[3]	0	0[3]	1
Benzoflouranthenes	--	--	--	--	--	1	--	0[3]	0	0[3]	1
Phenanthrene	--	--	--	--	--	1	--	0[3]	0	0[3]	1
p-Dichlorobenzene	--	--	--	--	--	1	--	0[3]	0	0[3]	1
PESTICIDES											
p-Nitrophenol	--	--	--	--	--	1	--	0[3]	0	0[3]	1
Organic Carbon											
Total Organic Carbon	9	4	4	5	--	1	--	2	1	4	30
Dissolved Organic Carbon	9	4	4	5	--	1	--	2	1	4	30
TPHs											
Gasoline Range Hydrocarbons	--	--	--	--	--	1	0[3]	0[3]	0	0[3]	1
Diesel Range Hydrocarbons	--	--	--	--	--	1	--	0[3]	0	0[3]	1
Motor Oil Range Hydrocarbons	--	--	--	--	--	1	--	0[3]	0	0[3]	1

Notes:

AOPC = area of potential concern
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbon
VOC = volatile organic compound

[1] Iron is already included in the metals analyte lists. Fe^{2+} will be measured in the field using Hach Method #8146.

[2] Quality Assurance/Quality Control (QA/QC) samples include one field duplicate, one matrix spike (MS), and one matrix spike duplicate (MSD) for each batch of up to 20 primary samples. One trip blank is also included for each batch of VOC and gasoline-range TPH analyses. One equipment Rinsate blank is also included for the non-disposible equipment required for sampling seeps.

[3] It is assumed these samples will be batched with the first-quarter samples listed on Table 2. Only one additional set of QA/QC samples are required for the cations. Where sufficient QA/QC samples for the organic analytes are already included in Table 2, additional QA/QC samples are not added here.

Table 4. Soil and Sediment Analyses

Analyte	Landfill Gully Area Soil Samples	Sandblast Area Soil Samples	Pistol Range Sediment Samples	Background Soil Samples	QA/QC Samples[1]				Total Number of Samples
					Trip Blank Samples	Field Duplicate Samples	Rinsate Blank Samples	MS/MSD Samples	
INORGANICS									
Aluminum	--	--	--	14	--	1	1	2	18
Antimony	--	--	--	14	--	1	1	2	18
Arsenic	--	--	--	14	--	1	1	2	18
Barium	--	--	--	14	--	1	1	2	18
Beryllium	--	--	--	14	--	1	1	2	18
Cadmium	--	--	--	14	--	1	1	2	18
Calcium	--	--	--	14	--	1	1	2	18
Chromium	--	--	--	14	--	1	1	2	18
Cobalt	--	--	--	14	--	1	1	2	18
Copper	--	--	5	14	--	2	2	4	27
Iron	--	--	--	14	--	1	1	2	18
Lead	--	16 < 2 mm 16 < 250 micron	5	14	--	4	4	8	67
Magnesium	--	--	--	14	--	1	1	2	18
Manganese	--	--	--	14	--	1	1	2	18
Mercury	--	--	--	14	--	1	1	2	18
Nickel	--	--	5	14	--	2	2	4	27
Potassium	--	--	--	14	--	1	1	2	18
Selenium	--	--	--	14	--	1	1	2	18
Silver	--	--	--	14	--	1	1	2	18
Sodium	--	--	--	14	--	1	1	2	18
Thallium	--	--	--	14	--	1	1	2	18
Vanadium	--	--	--	14	--	1	1	2	18
Zinc	--	--	5	14	--	2	2	4	27
VOCs									
Tetrachloroethylene	8	--	--	--	1	1	1	2	13
Toluene	8	--	--	--	1	1	1	2	13
o-Xylene	8	--	--	--	1	1	1	2	13
SVOCs									
Acenaphthene	8	--	--	14	--	2	2	4	30
Acenaphthylene	8	--	--	14	--	2	2	4	30
Anthracene	8	--	--	14	--	2	2	4	30
Benzo(a)anthracene	8	--	--	14	--	2	2	4	30
Benzo(a)pyrene	8	--	--	14	--	2	2	4	30
Benzo(b)fluoranthene	8	--	--	14	--	2	2	4	30
Benzo(g,h,i)perylene	8	--	--	14	--	2	2	4	30
Benzo(k)fluoranthene	8	--	--	14	--	2	2	4	30
Chrysene	8	--	--	14	--	2	2	4	30
Dibenzo(a,h)anthracene	8	--	--	14	--	2	2	4	30
Fluoranthene	8	--	--	14	--	2	2	4	30
Fluorene	8	--	--	14	--	2	2	4	30
Indeno(1,2,3-cd)pyrene	8	--	--	14	--	2	2	4	30
Napthalene	8	--	--	14	--	2	2	4	30
Phenanthrene	8	--	--	14	--	2	2	4	30
Pyrene	8	--	--	14	--	2	2	4	30
Other analyses									
Total Organic Carbon (TOC)	--	--	5	14	--	2	2	4	27
Grain size distribution	--	--	5	14	--	--	--	--	19

Notes:

mm = millimeter

SVOC = semivolatile organic compound

VOC = volatile organic compound

[1] Quality Assurance/Quality Control (QA/QC) samples include one field duplicate, one rinsate blank, one matrix spike (MS), and one matrix spike duplicate (MSD) for each batch of up to 20 primary samples. One trip blank is also included for each batch of VOCs.

Table 5. Soil Gas Analyses

Analyte	Soil Gas Samples	QA/QC Samples[1]			Total Number of Samples
		Field Duplicate Samples	Equipment Blank Samples	LCS/LCSD Samples	
VOCs					
Freon 12	6	1	1	2	10
Freon 114	6	1	1	2	10
Chloromethane	6	1	1	2	10
Vinyl Chloride	6	1	1	2	10
1,3-Butadiene	6	1	1	2	10
Bromomethane	6	1	1	2	10
chloroethane	6	1	1	2	10
Freon 11	6	1	1	2	10
Ethanol	6	1	1	2	10
Freon 13	6	1	1	2	10
1,1-Dichloroethene	6	1	1	2	10
Acetone	6	1	1	2	10
2-Propanol	6	1	1	2	10
Carbon Disulfide	6	1	1	2	10
3-chloropropene	6	1	1	2	10
Methylene Chloride	6	1	1	2	10
Methyl tert-butyl ether	6	1	1	2	10
trans-1,2-Dichloroethene	6	1	1	2	10
Hexane	6	1	1	2	10
1,1-Dichloroethane	6	1	1	2	10
2-Butanone (Methyl Ethyl Ketone)	6	1	1	2	10
cis-1,2-Dichloroethane	6	1	1	2	10
Tetrahydrofuran	6	1	1	2	10
Chlorofrom	6	1	1	2	10
1,1,1-Trichloroethane	6	1	1	2	10
Cyclohexane	6	1	1	2	10
Carbon Tetrachloride	6	1	1	2	10
2,2,4-Trimethylpentane	6	1	1	2	10
Benzene	6	1	1	2	10
1,2-Dichloroethane	6	1	1	2	10
Heptane	6	1	1	2	10
Trichloroethene	6	1	1	2	10
1,2-Dichloropropane	6	1	1	2	10
1,4-Dioxane	6	1	1	2	10
Bromodichloromethane	6	1	1	2	10
cis-1,3-Dichloropropene	6	1	1	2	10
4-Methyl-2-pentanone	6	1	1	2	10
Toluene	6	1	1	2	10
trans-1,3-Dichloropropene	6	1	1	2	10
1,1,2-Trichloroethane	6	1	1	2	10
Tetrachloroethane	6	1	1	2	10
2-Hexanone	6	1	1	2	10
Dibromochloromethane	6	1	1	2	10
1,2-Dibromoethane (EDB)	6	1	1	2	10
Chlorobenzene	6	1	1	2	10
Ethyl Benzene	6	1	1	2	10
m,p-Xylene	6	1	1	2	10
o-Xylene	6	1	1	2	10
Styrene	6	1	1	2	10
Bromoform	6	1	1	2	10
Cumene	6	1	1	2	10
1,1,2,2-Tetrachloroethane	6	1	1	2	10
Propylbenzene	6	1	1	2	10
4-Ethyltoluene	6	1	1	2	10
1,3,5-Trimethylbenzene	6	1	1	2	10
1,2,4-Trimethylbenzene	6	1	1	2	10
1,3-Dichlorobenzene	6	1	1	2	10
1,4-Dichlorobenzene	6	1	1	2	10
alpha-Chlorotoluene	6	1	1	2	10
1,2-Dichlorobenzene	6	1	1	2	10
1,2,4-Trichlorobenzene	6	1	1	2	10
Hexachlorobutadiene	6	1	1	2	10

Notes:

VOC = volatile organic compound

[1] Quality Assurance/Quality Control (QA/QC) samples include one field duplicate and one equipment blank for each batch of up to 20 primary samples. Trip blanks, matrix spike (MS), and one matrix spike duplicates (MSDs) are not applicable to soil gas canisters. Laboratory control spike (LCS) and laboratory control LCSD analyses will be performed in lieu of MS/MSD analyses.

Table 6. Grab Groundwater Analyses

Analyte	Grab Groundwater Samples	QA/QC Samples[2]			Total Number of Samples
		Field Duplicate Samples	Rinsate Blank Samples	MS/MSD Samples	
METALS (TOTAL and DISSOLVED[1])					
Copper	6	1	1	2	10
Lead	6	1	1	2	10
Nickel	6	1	1	2	10
Zinc	6	1	1	2	10
Other Analyses					
Total suspended solids (TSS)	3	1	1	-	5
Total dissolved solids (TDS)	3	1	1	-	5

Notes:

[1] Each station will include a total and a dissolved sample for each inorganic analyte. Therefore the indicated number of samples is two times the number of stations.

[2] Quality Assurance/Quality Control (QA/QC) samples include one field duplicate, one matrix spike (MS), and one matrix spike duplicate (MSD) for each 20 primary samples. One equipment Rinsate blank is also included since the sampling equipment for grab groundwater is non-disposible.

Table 7. Sample Methods, Containers, Preservation, and Holding Time Requirements for Water

Analytes	Analytical Method	Container Description	Minimum Volume Required	Preservation	Field Filtered	Hold Time
Metals, incl. Mercury (Total)	EPA 6000/7000	1 L HDPE bottle	300 ml	HNO_3 to pH< 2; Cool to 4 ^oC	No	6 months, 28 days for mercury
Metals and Cations, incl. Mercury (Dissolved)	EPA 6000/7000	1 L HDPE bottle	300 ml	HNO_3 to pH< 2; Cool to 4 ^oC	Yes	6 months, 28 days for mercury
Butyltins	Krone[1]	1 L polycarbonate bottle	500 ml	Cool to 4 ^oC	No	7 days to extract 40 days to analyze
VOCs	EPA 8260B	3 x 40 ml VOA vials	2 vials	HCl to pH< 2; Cool to 4 ^oC	No	14 days
SVOCs and p-Nitrophenol	EPA 8270C-SIM	1 L amber glass bottle	1 L	Cool to 4 ^oC	No	7 days to extract 40 days to analyze
TPH (gasoline range)	NWTPH-Gx	3 x 40 ml VOA vials	2 vials	HCl to pH< 2; Cool to 4 ^oC	No	14 days
TPH (diesel and residual range)	NWTPH-Dx	1L Amber glass bottle	500 ml	HCl to pH< 2; Cool to 4 ^oC	No	14 days to extract 40 days to analyze
TSS and TDS (lab will filter aliquot for dissolved fraction)	SM 2540C/D	1 L HDPE bottle	400 ml	Cool to 4 ^oC	No	7 days
Nitrite + Nitrate	EPA 353.3	1 L HDPE bottle	125 ml	H_2SO_4 to pH< 2; Cool to 4 ^oC	Yes	28 days
Dissolved Organic Carbon (DOC)	EPA 415.1					
Total Organic Carbon (TOC)	EPA 415.1	1 L HDPE bottle	100 ml	Cool to 4 ^oC	No	28 days
Carbonate, Bicarbonate	EPA 2320B	500 ml HDPE bottle	100 ml	Cool to 4 ^oC	Yes	14 days
Fluoride, Chloride, Bromide, Sulfate	EPA 300.0					28 days

Notes:

Not all samples will be analyzed for all analytes listed above, see Tables 2, 3, and 6.

EPA = Environmental Protection Agency

HDPE = high density polyethylene

NWTPH = Northwest Total Petroleum Hydrocarbons

SVOC = volatile organic compound

SM = Standard Method

TPH = total petroleum hydrocarbon

VOA = volatile organic analysis vial

VOC = volatile organic compound

1= Krone, C.A. et al, *A Method for Analysis of Butyltin Species and Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound* , Environmental Conservation Division, Northwest and Alaska Fisheries Center, National Marine Fisheries Service, NOAA, November, 1998.

Table 8. Sample Methods, Containers, Preservation, and Holding Time Requirements for Solids and Soil Gas

Analytes	Analytical Method	Container Description	Preservation	Hold Time
Soil and Sediment				
Total Metals and Cations	EPA 6000/7000	Fill one 16oz glass jar per sample station	Cool to 4°C	6 months
Total Mercury	EPA 7471A		Cool to 4°C	28 days
SVOCs	EPA 8270C		Cool to 4°C	14 days to extract 40 days to analyze
Grain Size	PSEP[1]		none	6 months
Total Organic Carbon	Modified Plumb[2]		Cool to 4°C	28 days
% Solids	PSEP[1]		Cool to 4°C	6 months
VOCs	EPA 8260B w/ EPA 5035A prep.	3 VOA vials (1 w/ methanol, 2 w/ sodium bicarbonate)	Cool to 4°C	14 days
Soil Gas				
VOCs	EPA TO-15[3]	Suma canister	none	30 days

Notes:

Not all samples will be analyzed for all analytes listed above, see Table 4.

EPA = Environmental Protection Agency

SVOC = volatile organic compound

VOA = volatile organic analysis vial

VOC = volatile organic compound

WMGJ = Wide mouth glass jar with Teflon-lined lid.

1=Puget Sound Estuary Program: Recommended Protocols For Measuring Selected Environmental Variables in Puget Sound. Tetra Tech, Inc. March 1986 and Jan 1996.

2=Plumb, R. H. Jr., *Procedures for Handling and Chemical Analysis of Sediment & Water Samples* , May 1981, USACE Publication.

3= Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS).

Table 9. Measurement Performance Criteria for Water (Groundwater, Seep, and Surface Water)

		Laboratory Reporting Limits (ug/L)		EPA NRWQC (2006) (ug/L)[1]			ODEQ Water Quality Criteria (2004) (Fresh) Surface Water (ug/L)[2]				ODEQ RBCs (2008)[3]		Project-Specific Control Limits[4]						
Parameter	**Method**	**MDL**	**RL**	**Freshwater CCC (Chronic)**	**Human Health (Water+Organism)**	**Human Health (Organism Only)**	**Freshwater CCC (Chronic)**	**Human Health (Water+Organism)**	**Human Health (Organism Only)**	**Drinking Water MCL**	**Residential Water (ug/L)**	**Most Conservative Water Quality Criteria**	**Surrogate Recovery (%)**	**MS/MSD Recovery (%)**	**MS/MSD RPD (%)**	**LCS/LCSD Recovery (%)**	**LCS/LCSD RPD (%)**	**Laboratory Duplicate RPD (%)**	**Limit Reference[4]**
Total Petroleum Hydrocarbons																			
Gasoline range	NWTPH-Gx (Ecology, 1997)	13	250	NE	NE	NE	NE	NE	NE	NE	100	100		62-130	≤30	62-130	≤30	≤30	CAS
Diesel-range	NWTPH-Dx (Ecology, 1997)	11	100	NE	NE	NE	NE	NE	NE	NE	88	88	--	69-123	≤30	69-123	≤30	≤30	CAS
Oil-range	NWTPH-Dx (Ecology, 1997)	19	100	NE	NE	NE	NE	NE	NE	NE	290	290	--	--	--	--	--	--	CAS
1,4-Difluorobenzene (gasoline-range)	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	50-150	--	--	--	--	--	CAS
o-Terphenyl (diesel- and oil-range)	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	50-150	--	--	--	--	--	CAS
VOCs	**EPA 8260**																		
1,1,1,2-Tetrachloroethane		0.12	0.5	2,400	NE	NE	NE	NE	NE	NE	0.52 (N)	0.52	--	80-130	≤30	80-130	≤30	≤30	QSM
1,1,1-Trichloroethane		0.12	0.5	NE	NE	NE	NE	NE	NE	NE	73,000	73,000	--	65-130	≤30	65-130	≤30	≤30	QSM
1,1,2,2-Tetrachloroethane		0.14	0.5	NE	0.17	4.0	NE	NE	NE	NE	0.067 (N)	0.067	--	65-130	≤30	65-130	≤30	≤30	QSM
1,1,2-Trichloroethane		0.14	0.5	9,400	0.59	16	NE	NE	NE	NE	0.20	0.20	--	75-125	≤30	75-125	≤30	≤30	QSM
1,1-Dichloroethane		0.11	0.5	NE	NE	NE	NE	NE	NE	NE	2.0	2.0	--	70-135	≤30	70-135	≤30	≤30	QSM
1,1-Dichloroethene		0.15	0.5	NE	330	7,100	NE	330	7,100	NE	340	330	--	75-130	≤30	75-130	≤30	≤30	QSM
1,1-Dichloropropene		0.15	0.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	75-130	≤30	75-130	≤30	≤30	QSM
1,2,3-Trichlorobenzene		0.33	2	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	55-140	≤30	55-140	≤30	≤30	QSM
1,2,3-Trichloropropane		0.24	0.5	NE	NE	NE	NE	NE	NE	NE	0.0096 (N)	0.0096	--	75-125	≤30	75-125	≤30	≤30	QSM
1,2,4-Trichlorobenzene		0.22	2	NE	35	70	NE	35	70	NE	8.2 (N)	8.2	--	65-135	≤30	65-135	≤30	≤30	QSM
1,2,4-Trimethylbenzene		0.15	2	NE	NE	NE	NE	NE	NE	NE	12	12	--	75-130	≤30	75-130	≤30	≤30	QSM
1,2-Dibromo-3-chloropropane		1	2	NE	NE	NE	NE	NE	NE	NE	0.00032 (N)	0.00032	--	50-130	≤30	50-130	≤30	≤30	QSM
1,2-Dibromoethane		0.1	2	NE	NE	NE	NE	NE	NE	NE	0.0065 (N)	0.0065	--	80-120	≤30	80-120	≤30	≤30	QSM
1,2-Dichlorobenzene		0.12	0.5	NE	NE	NE	NE	420	1,300	NE	50	50	--	70-120	≤30	70-120	≤30	≤30	QSM
1,2-Dichloroethane		0.12	0.5	NE	0.38	37	NE	0.38	37	NE	0.15 (N)	0.15	--	70-130	≤30	70-130	≤30	≤30	QSM
1,2-Dichloropropane		0.14	0.5	NE	0.50	15	NE	0.5	15	NE	0.39 (N)	0.39	--	75-125	≤30	75-125	≤30	≤30	QSM
1,3,5-Trimethylbenzene		0.35	5	NE	NE	NE	NE	NE	NE	NE	12	12	--	75-130	≤30	75-130	≤30	≤30	QSM
1,3-Dichlorobenzene		0.11	0.5	NE	320	960	NE	320	960	NE	15	15	--	75-125	≤30	75-125	≤30	≤30	QSM
1,3-Dichloropropane		0.15	0.5	NE	NE	NE	NE	NE	NE	NE	730 (N)	730	--	75-125	≤30	75-125	≤30	≤30	QSM
1,4-Dichlorobenzene		0.12	0.5	NE	63	190	NE	63	190	NE	0.48	0.48	--	75-125	≤30	75-125	≤30	≤30	QSM
2,2-Dichloropropane		0.18	0.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	70-135	≤30	70-135	≤30	≤30	QSM
2-Chlorotoluene		0.12	2	NE	NE	NE	NE	NE	NE	NE	730 (N)	730	--	75-125	≤30	75-125	≤30	≤30	QSM
2-Hexanone		4	20	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	55-130	≤30	55-130	≤30	≤30	QSM
4-Chlorotoluene		0.12	4	NE	NE	NE	NE	NE	NE	NE	2,600 (N)	2,600	--	75-130	≤30	75-130	≤30	≤30	QSM
4-Isopropyltoluene		0.13	2	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	75-130	≤30	75-130	≤30	≤30	QSM
4-Methyl-2-pentanone		2.7	20	NE	NE	NE	NE	NE	NE	NE	2,000 (N)	2,000	--	60-135	≤30	60-135	≤30	≤30	QSM
Acetone		4.1	20	NE	NE	NE	NE	NE	NE	NE	22,000 (N)	22,000	--	40-140	≤30	40-140	≤30	≤30	QSM
Benzene		0.14	0.5	NE	2.2	51	NE	NE	NE	NE	0.35	0.35	--	80-120	≤30	80-120	≤30	≤30	QSM
Bromobenzene		0.18	2	NE	NE	NE	NE	NE	NE	NE	20 (N)	20	--	75-125	≤30	75-125	≤30	≤30	QSM
Bromochloromethane		0.17	0.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	65-130	≤30	65-130	≤30	≤30	QSM
Bromodichloromethane		0.11	0.5	NE	NE	NE	NE	NE	NE	NE	1.1 (N)	1.1	--	75-120	≤30	75-120	≤30	≤30	QSM
Bromoform		0.28	0.5	NE	4.3	140	NE	4.3	140	NE	7.2	4.3	--	70-130	≤30	70-130	≤30	≤30	QSM
Bromomethane		0.22	0.5	NE	NE	NE	NE	NE	NE	NE	8.5	8.5	--	30-145	≤30	30-145	≤30	≤30	QSM
Carbon disulfide		0.16	0.5	NE	NE	NE	NE	NE	NE	NE	1,000 (N)	1,000	--	35-160	≤30	35-160	≤30	≤30	QSM
Carbon tetrachloride		0.14	0.5	NE	0.23	1.6	NE	0.23	1.6	NE	0.17	0.17	--	65-140	≤30	65-140	≤30	≤30	QSM
Chlorobenzene		0.14	0.5	NE	130	1,600	NE	130	1,600	NE	90	90	--	80-120	≤30	80-120	≤30	≤30	QSM
Chloroethane		0.23	0.5	NE	NE	NE	NE	NE	NE	NE	3.9	3.9	--	60-135	≤30	60-135	≤30	≤30	QSM
Chloroform		0.14	0.5	1,240	5.7	470	NE	NE	NE	NE	0.18	0.18	--	65-135	≤30	65-135	≤30	≤30	QSM
Chloromethane		0.14	0.5	NE	NE	NE	NE	NE	NE	NE	190	190	--	40-125	≤30	40-125	≤30	≤30	QSM
Dibromochloromethane (Chlorodibromomethane)		0.11	0.5	NE	0.40	13	NE	NE	NE	NE	0.68	0.40	--	60-135	≤30	60-135	≤30	≤30	QSM
Dibromomethane		0.12	0.5	NE	NE	NE	NE	NE	NE	NE	370 (N)	370	--	75-125	≤30	75-125	≤30	≤30	QSM
Dichlorodifluoromethane		0.17	0.5	NE	NE	NE	NE	NE	NE	NE	390 (N)	390	--	30-155	≤30	30-155	≤30	≤30	QSM
Ethylbenzene		0.13	0.5	NE	530	2,100	NE	NE	NE	NE	1.2	1.2	--	75-125	≤30	75-125	≤30	≤30	QSM
Hexachlorobutadiene		0.28	2	9.3	0.44	18	NE	0.44	18	NE	0.86 (N)	0.44	--	50-140	≤30	50-140	≤30	≤30	QSM
Isopropylbenzene (cumene)		0.11	0.5	NE	NE	NE	NE	NE	NE	NE	680 (N)	680	--	75-125	≤30	75-125	≤30	≤30	QSM
Methyl ethyl ketone (2-Butanone)		0.11	2	NE	NE	NE	NE	NE	NE	NE	7,100 (N)	7,100	--	30-150	≤30	30-150	≤30	≤30	QSM
Methylene chloride		0.2	2	NE	4.6	590	NE	4.6	590	NE	4.8 (N)	4.8	--	55-140	≤30	55-140	≤30	≤30	QSM
Styrene		0.1	0.5	NE	NE	NE	NE	NE	NE	NE	1,600	1,600	--	65-135	≤30	65-135	≤30	≤30	QSM
Tetrachloroethylene (PCE)		0.13	0.5	NE	0.69	3.3	NE	0.69	3.3	NE	0.091	0.091	--	45-150	≤30	45-150	≤30	≤30	QSM
Toluene		0.11	0.5	NE	1,300	15,000	NE	1,300	15,000	NE	2,300	1,300	--	75-120	≤30	75-120	≤30	≤30	QSM
Trichloroethene		0.14	0.5	NE	2.5	30	NE	2.5	30	NE	0.029	0.029	--	70-125	≤30	70-125	≤30	≤30	QSM
Trichlorofluoromethane (Freon 11)		0.14	0.5	NE	NE	NE	NE	NE	NE	NE	1,300	1,300	--	60-145	≤30	60-145	≤30	≤30	QSM
Vinyl acetate		0.67	5	NE	NE	NE	NE	NE	NE	NE	410 (N)	410	--	10-196	≤30	10-196	≤30	≤30	CAS
Vinyl chloride		0.04	0.5	NE	0.025	2.4	NE	0.025	2.4	NE	0.025	0.025	--	50-145	≤30	50-145	≤30	≤30	QSM
cis-1,2-dichloroethene		0.12	0.5	NE	NE	NE	NE	NE	NE	NE	61	61	--	70-125	≤30	70-125	≤30	≤30	QSM
cis-1,3-dichloropropene		0.11	0.5	NE	0.34	21	NE	0.34	21	NE	0.43 (N)	0.34	--	70-130	≤30	70-130	≤30	≤30	QSM
m,p-Xylene		0.22	0.5	NE	NE	NE	NE	NE	NE	NE	210	210	--	75-130	≤30	75-130	≤30	≤30	QSM
n-Butylbenzene		0.23	2	NE	NE	NE	NE	NE	NE	NE	61	61	--	70-135	≤30	70-135	≤30	≤30	QSM
n-Propylbenzene		0.1	2	NE	NE	NE	NE	NE	NE	NE	61	61	--	70-130	≤30	70-130	≤30	≤30	QSM
o-Xylene		0.11	0.5	NE	NE	NE	NE	NE	NE	NE	210	210	--	80-120	≤30	80-120	≤30	≤30	QSM
sec-Butylbenzene		0.13	2	NE	NE	NE	NE	NE	NE	NE	61	61	--	70-125	≤30	70-125	≤30	≤30	QSM
tert-Butylbenzene		0.13	2	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	70-130	≤30	70-130	≤30	≤30	QSM
trans-1,2-dichloroethene		0.15	0.5	NE	NE	NE	NE	NE	NE	NE	110	110	--	60-140	≤30	60-140	≤30	≤30	QSM
trans-1,3-Dichloropropene		0.09	0.5	NE	0.34	21	NE	0.34	21	NE	0.43 (N)	0.34	--	55-140	≤30	55-140	≤30	≤30	QSM
1,2-Dichloroethane-d4	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	70-120	--	--	--	--	--	QSM
4-Bromofluorobenzene	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	75-120	--	--	--	--	--	QSM
Dibromofluoromethane	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	85-115	--	--	--	--	--	QSM
Toluene-d4	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	85-120	--	--	--	--	--	QSM

Table 9. Measurement Performance Criteria for Water (Groundwater, Seep, and Surface Water)

		Laboratory Reporting Limits (ug/L)		EPA NRWQC (2006) (ug/L)[1]			ODEQ Water Quality Criteria (2004) (Fresh) Surface Water (ug/L)[2]				ODEQ RBCs (2008)[3]		Project-Specific Control Limits[4]						
Parameter	Method	MDL	RL	Freshwater CCC (Chronic)	Human Health (Water+Organism)	Human Health (Organism Only)	Freshwater CCC (Chronic)	Human Health (Water+Organism)	Human Health (Organism Only)	Drinking Water MCL	Residential Water (ug/L)	Most Conservative Water Quality Criteria	Surrogate Recovery (%)	MS/MSD Recovery (%)	MS/MSD RPD (%)	LCS/LCSD Recovery (%)	LCS/LCSD RPD (%)	Laboratory Duplicate RPD (%)	Limit Reference[4]
SVOCs	**EPA 8270-SIM or EPA 8270C with high volume injection**																		
1,4-dichlorobenzene	8270C	0.02	0.2	NE	63	190	NE	63	190	NE	0.48	0.48		30-100	≤30	30-100	≤30	≤30	QSM
Benzo(b)fluoranthene	8270-SIM	0.00024	0.0034	NE	0.0038	0.018	NE	0.0038	0.018	NE	0.029	0.0038	--	45-120	≤30	45-120	≤30	≤30	QSM
Benzo(k)fluoranthene	8270-SIM	0.00019	0.0034	NE	0.0038	0.018	NE	0.0038	0.018	NE	0.29	0.0038	--	45-125	≤30	45-125	≤30	≤30	QSM
Carbolic Acid (Phenol)	8270C	0.02	0.5	NE	21,000	1,700,000	NE	NE	NE	NE	11,000 (N)	11,000	--	32-117	≤30	32-117	≤30	≤30	CAS
Naphthalene	8270-SIM	0.29	2	NE	620	NE	NE	NE	NE	NE	0.12	0.12	--	55-140	≤30	55-140	≤30	≤30	QSM
Phenanthrene	8270-SIM	0.0018	0.0034	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	50-115	≤30	50-115	≤30	≤30	QSM
p-Nitrophenol	8270C	0.54	2	150	NE	NE	NE	NE	NE	NE	NE	150		33-136	≤30	33-136	≤30	≤30	CAS
2-Fluorobiphenyl	*Surrogate (8270C)*	--	--	--	--	--	--	--	--	--	--	--	50-110	--	--	--	--	--	QSM
Terphenyl-d14	*Surrogate (8270C)*	--	--	--	--	--	--	--	--	--	--	--	50-135	--	--	--	--	--	QSM
2,4,6-Tribromophenol	*Surrogate (8270C)*	--	--	--	--	--	--	--	--	--	--	--	40-125	--	--	--	--	--	QSM
2-Fluorophenol	*Surrogate (8270C)*	--	--	--	--	--	--	--	--	--	--	--	20-110	--	--	--	--	--	QSM
Nitrobenzene-d5	*Surrogate (8270C)*	--	--	--	--	--	--	--	--	--	--	--	40-110	--	--	--	--	--	QSM
Phenol-d6	*Surrogate (8270C)*	--	--	--	--	--	--	--	--	--	--	--	10-115	--	--	--	--	--	QSM
Fluoranthene-d10	*Surrogate (8270-SIM)*	--	--	--	--	--	--	--	--	--	--	--	45-135	--	--	--	--	--	CAS
Fluorene-d10	*Surrogate (8270-SIM)*	--	--	--	--	--	--	--	--	--	--	--	45-135	--	--	--	--	--	CAS
Terphenyl-d14	*Surrogate (8270-SIM)*	--	--	--	--	--	--	--	--	--	--	--	50-135	--	--	--	--	--	CAS
Metals (Total and Dissolved)	**EPA SW-846**																		
Aluminum	6020	0.3	2	NE	NE	NE	NE	NE	NE	NE	37,000 (N)	37,000	--	80-120	≤20	80-120	≤20	≤20	QSM
Antimony	6020	0.03	0.09	NE	5.6	640	1,600	NE	NE	NE	15 (N)	5.6	--	80-120	≤20	80-120	≤20	≤20	QSM
Arsenic	6020	0.08	0.5	150	0.018	0.14	48	0.018	0.14	NE	0.038	0.018	--	80-120	≤20	80-120	≤20	≤20	QSM
Barium	6020	0.02	0.06	NE	1,000	NE	NE	NE	NE	NE	7,300	1,000	--	80-120	≤20	80-120	≤20	≤20	QSM
Beryllium	6020	0.01	0.02	NE	NE	NE	5.3	NE	NE	NE	73	5.3	--	80-120	≤20	80-120	≤20	≤20	QSM
Cadmium	6020	0.01	0.02	0.25	NE	NE	NE	NE	NE	NE	18	0.25	--	80-120	≤20	80-120	≤20	≤20	QSM
Calcium	6010B	30	90	NE	NE	NE	NE	NE	NE	NE	18 (N)	18	--	80-120	≤20	80-120	≤20	≤20	QSM
Chromium	6020	0.07	0.02	11(IV), 74(III)	NE	NE	11 (VI)	NE	NE	NE	55,000 (III), 110 (VI)	11 (VI)	--	80-120	≤20	80-120	≤20	≤20	QSM
Cobalt	6020	0.01	0.02	NE	NE	NE	NE	NE	NE	NE	11 (N)	11	--	80-120	≤20	80-120	≤20	≤20	QSM
Copper	6020	0.02	0.1	9.0	1,300	NE	NE	NE	NE	NE	1,400	9	--	80-120	≤20	80-120	≤20	≤20	QSM
Iron[5]	6010B	3	20	1,000	300	NE	NE	NE	300	NE	26,000 (N)	300	--	80-120	≤20	80-120	≤20	≤20	QSM
Lead	6020	0.01	0.03	2.5	NE	NE	NE	NE	NE	NE	15	2.5	--	80-120	≤20	80-120	≤20	≤20	QSM
Magnesium	6010B	0.7	20	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	80-120	≤20	80-120	≤20	≤20	QSM
Manganese	6020	0.02	0.06	NE	50	100	NE	50	100	NE	1,700	50	--	80-120	≤20	80-120	≤20	≤20	QSM
Mercury	7470	0.03	0.2	0.77	NE	NE	NE	NE	NE	NE	11	0.77	--	80-120	≤20	80-120	≤20	≤20	QSM
Nickel	6010B	0.07	0.2	52	610	4,600	NE	NE	610	4,600	730	52	--	80-120	≤20	80-120	≤20	≤20	QSM
Potassium	6010B	900	2700	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	80-120	≤20	80-120	≤20	≤20	QSM
Selenium	6020	0.4	1.2	5.0	170	4,200	NE	NE	170	NE	180 (N)	5	--	80-120	≤20	80-120	≤20	≤20	QSM
Silver	6020	0.01	0.03	NE	NE	NE	0.10	NE	NE	NE	180	0.1	--	80-120	≤20	80-120	≤20	≤20	QSM
Sodium	6010B	50	150	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	80-120	≤20	80-120	≤20	≤20	QSM
Thallium	6020	0.003	0.02	NE	0.24	0.47	40	NE	NE	NE	2.4 (N)	0.24	--	80-120	≤20	80-120	≤20	≤20	QSM
Vanadium	6010B	0.08	0.2	NE	NE	NE	NE	NE	NE	NE	180 (N)	180	--	80-120	≤20	80-120	≤20	≤20	QSM
Zinc	6010B	7	21	120	7,400	26,000	NE	NE	NE	NE	11,000	120	--	80-120	≤20	80-120	≤20	≤20	QSM
Anions/Cations (mg/L)													--						CAS
Fluoride	300.0	0.006	0.2	NE	NE	NE	NE	NE	NE	NE	2,200 (N)	2,200	--	80-120	≤20	80-120	≤20	≤20	CAS
Chloride	300.0	0.009	0.2	230,000	NE	NE	230,000	NE	NE	NE	NE	230,000	--	80-120	≤20	80-120	≤20	≤20	CAS
Bromide	300.0	0.2	1	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	80-120	≤20	80-120	≤20	≤20	CAS
Nitrate/Nitrite	353.3	0.006	0.05	NE	10,000	NE	NE	10,000	NE	NE	3,700 (N)	3,700	--	80-120	≤20	80-120	≤20	≤20	CAS
Sulfate	300.0	0.007	0.2	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	80-120	≤20	80-120	≤20	≤20	CAS
Carbonate/Bicarbonate	2320B	1	2	NE	NE	NE	NE	NE	NE	NE	NE	NE	--	80-120	≤20	80-120	≤20	≤20	CAS
Butyltins	**Krone**																		CAS
Monobutyltin		0.02	0.05	NE	NE	NE	NE	NE	NE	NE	NE	NE		22-184	≤30	22-184	≤30	≤30	CAS
Dibutyltin		0.01	0.05	NE	NE	NE	NE	NE	NE	NE	NE	NE		39-136	≤30	39-136	≤30	≤30	CAS
Tripropyltin	*Surrogate*	--	--	--	--	--	--	--	--	--	--	--	10-145	--	--	--	--	--	CAS

Notes:

CAS = Columbia Analytical Services (Kelso, Washington)
CCC = Criteria Continuous Concentration (Chronic)
µg/L = microgram per liter
EPA = U.S. Environmental Protection Agency
LCS/LCSD = laboratory control sample/laboratory control sample duplicate
MDL = method detection limit
MS/MSD = matrix spike/matrix spike duplicate
NE = not established

NWTPH-Dx = Northwest Total Petroleum Hydrocarbons—diesel range
ODEQ = Oregon Department of Environmental Quality
RL = reporting limit
RPD = relative percent difference
SIM = select ion monitoring
SLV = Screening Level Value
QSM = Department of Defense Quality System Manual (QSM) for Environmental Laboratories, Final version 3, January 2006.
-- = Not Applicable
▨ = screening criteria below laboratory reporting limit and/or method detection limit.

MDLs and RLs are from CAS (Kelso, Washington).
1 = EPA National Recommended Water Quality Criteria, 2006.
2 = Oregon DEQ Water Quality Criteria Summary (OAR 340-041, Table 33A, 33B and 33C)
3= Groundwater Risk Based Concentrations (RBCs) for ingestion and inhalation from Tapwater,*Oregon Department of Environmental Quality (ODEQ) Risk Based Decision Making for Petroleum Contaminated Sites* , revision 3, October 2008.
(N) = If ODEQ RBCs are not established for an analyte, the national EPA risk-based screening levels (RSLs) for Tapwater are indicated if criteria are establised*EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites* , updated September 12, 2008.
4 = Project-specific QC criteria was established using QSM limits when available and CAS (Kelso, Washington) laboratory limits when QSM limits were not available.
5 = Iron as Fe^{2+} will also be measured in the field using Hach Method #8146.

Table 10. Measurement Performance Criteria for Solids (Soil and Sediment)

		Soil/Sediment Laboratory Reporting Limits		ODEQ RBCs (2008)[1] Ingestion, Dermal Contact and Inhalation Soils	ODEQ Level II SLVs for ERA (2001)[2] Terrestrial Receptors Soils				ODEQ Level II SLVs for ERA (2001)[3] Sediment	ODEQ Sediment Bioaccumlation SLVs (2007)[4]					Project-Specific Control Limits[5]						
Parameter	**Method**	**MDL**	**RL**		**Plants**	**Inverts**	**Birds**	**Mammals**	**Freshwater**	**Birds (Indivdual)**	**Mammals (Individual)**	**Fish (Freshwater)**	**Humans (Subsistence)**	**Most Conservative Soil/Sediment SLV**	**Surrogate Recovery (%)**	**MS/MSD Recovery (%)**	**MS/MSD RPD (%)**	**LCS/LCSD Recovery (%)**	**LCS/LCSD RPD (%)**	**Laboratory Duplicate RPD (%)**	**Limit Reference[4]**
VOCs (ug/kg dry)	**EPA 8260**			**(ug/kg dry)**	**(ug/kg dry)**				**(ug/kg dry)**	**(ug/kg dry)**											
Tetrachloroethylene		0.085	0.5	5,100	10,000	NE	NE	80,000	NE	NE	NE	NE	NE	5,100	--	65-140	≤30	65-140	≤30	≤30	QSM
Toluene		0.11	0.5	24,000,000	200,000	NE	NE	1,440,000	NE	NE	NE	NE	NE	200,000	--	70-125	≤30	70-125	≤30	≤30	QSM
o-Xylene		0.082	0.5	19,000,000	1,000	NE	NE	NE	NE	NE	NE	NE	NE	1,000	--	75-125	≤30	75-125	≤30	≤30	QSM
4-Bromofluorobenzene	*Surrogate*				--	--	--	--	--	--	--	--	--	--	85-120	--	--	--	--	--	QSM
Toluene-d4	*Surrogate*				--	--	--	--	--	--	--	--	--	--	85-115	--	--	--	--	--	QSM
SVOCs (ug/kg dry)	**EPA 8270C**				**(ug/kg dry)**				**(ug/kg dry)**	**(ug/kg dry)**											
Acenaphthene		1.4	10	16,000,000	20,000	NE	NE	NE	290	NE	NE	NE	NE	290	--	45-110	≤30	45-110	≤30	--	QSM
Acenaphthylene		1.4	10	NE	NE	NE	NE	NE	160	NE	NE	NE	NE	160		45-105	≤30	45-105	≤30		QSM
Anthracene		1.4	10	90,000,000	NE	NE	NE	NE	57	NE	NE	NE	NE	57	--	55-105	≤30	55-105	≤30	--	QSM
Benz(a)anthracene		1.4	10	2,700	NE	NE	NE	NE	32	NE	NE	NE	NE	32	--	50-110	≤30	50-110	≤30	--	QSM
Benzo(a)pyrene		1.6	10	270	NE	NE	NE	125,000	32	NE	NE	NE	NE	32	--	50-110	≤30	50-110	≤30	--	QSM
Benzo(b)fluoranthene		2.5	10	2,700	NE	NE	NE	NE	NE	NE	NE	NE	NE	2,700	--	45-115	≤30	45-115	≤30	--	QSM
Benzo(g,h,i)perylene		2.3	10	NE	NE	NE	NE	NE	300	NE	NE	NE	NE	300	--	40-125	≤30	40-125	≤30	--	QSM
Benzo(k)fluoranthene		2.5	10	27,000	NE	NE	NE	NE	27	NE	NE	NE	NE	27	--	45-125	≤30	45-125	≤30	--	QSM
Chrysene		1.4	10	270,000	NE	NE	NE	NE	57	NE	NE	NE	NE	57	--	55-110	≤30	55-110	≤30	--	QSM
Dibenz(a,h)anthracene		2.2	10	270	NE	NE	NE	NE	33	NE	NE	NE	NE	33	--	40-125	≤30	40-125	≤30	--	QSM
Fluoranthene		2.2	10	8,900,000	NE	NE	NE	NE	111	NE	190	37,000	62,000	111	--	55-115	≤30	55-115	≤30	--	QSM
Fluorene		1.7	10	12,000,000	NE	30,000	NE	NE	77	NE	NE	NE	NE	77	--	50-110	≤30	50-110	≤30	--	QSM
Indeno(1,2,3-cd)pyrene		1.9	10	2,700	NE	NE	NE	NE	17	NE	NE	NE	NE	17	--	40-120	≤30	40-120	≤30	--	QSM
Napthalene		0.3	10	22,000	10,000	NE	NE	3,900,000	176	NE	NE	NE	NE	176		40-105	≤30	40-105	≤30		QSM
Phenanthrene		1.3	10	NE	NE	NE	NE	NE	42	NE	NE	NE	NE	42	--	50-110	≤30	50-110	≤30	--	QSM
Pyrene		1.3	10	6,700,000	NE	NE	NE	NE	53	NE	9,500	1,900	47,000	53	--	45-125	≤30	45-125	≤30	--	QSM
2-Fluorobiphenyl	*Surrogate (8270C)*	--	--		--	--	--	--	--	--	--	--	--	--	45-105	--	--	--	--	--	QSM
Terphenyl-d14	*Surrogate (8270C)*	--	--		--	--	--	--	--	--	--	--	--	--	30-125	--	--	--	--	--	QSM
2,4,6-Tribromophenol	*Surrogate (8270C)*	--	--		--	--	--	--	--	--	--	--	--	--	35-125	--	--	--	--	--	QSM
2-Fluorophenol	*Surrogate (8270C)*	--	--		--	--	--	--	--	--	--	--	--	--	35-105	--	--	--	--	--	QSM
Phenol-d6	*Surrogate (8270C)*	--	--		--	--	--	--	--	--	--	--	--	--	40-100	--	--	--	--	--	QSM
Nitrobenzene-d5	*Surrogate (8270C)*	--	--		--	--	--	--	--	--	--	--	--	--	35-100	--	--	--	--	--	QSM
Metals (mg/Kg dry)	**EPA SW-846**			**(mg/kg dry)**	**(mg/kg dry)**				**(mg/kg dry)**	**(mg/kg dry)**											
Aluminum	6010B	7	21	990,000 (N)	50	600	450	107	NE	NE	NE	NE	NE	50	--	80-120	≤20	80-120	≤20	≤20	QSM
Antimony	6020	0.05	0.05	410 (N)	5	NE	NE	15	3	NE	NE	NE	NE	3	--	80-120	≤20	80-120	≤20	≤20	QSM
Arsenic	6020	5	20	1.7	10 (AsIII)	60 (AsIII)	10 (AsIII)	29 (AsIII)	6 (AsIII)	7	7	7	7	1.7	--	80-120	≤20	80-120	≤20	≤20	QSM
Barium	6010B	0.2	2	62,000	500	3,000	85	638	NE	NE	NE	NE	NE	85	--	80-120	≤20	80-120	≤20	≤20	QSM
Beryllium	6010B	0.03	1	610	10	NE	NE	83	NE	NE	NE	NE	NE	10		80-120	≤20	80-120	≤20	≤20	QSM
Cadmium	6020	0.009	0.020	150	4	20	6	125	0.6	1	1	1	1	0.6	--	80-120	≤20	80-120	≤20	≤20	QSM
Calcium	6010B	2	10	810 (N)	NE	NE	NE	NE	NE	NE	NE	NE	NE	810		80-120	≤20	80-120	≤20	≤20	QSM
Chromium	6020	0.2	0.2	180 (CrVI)	1 (CrIII)	0.4 (CrIII)	4 (CrIII)	340,000 (CrIII) 410 (CrVI)	37 (total)	NE	NE	NE	NE	0.4	--	80-120	≤20	80-120	≤20	≤20	QSM
Cobalt	6010B	0.6	2	300 (N)	20	1,000	NE	150	NE	NE	NE	NE	NE	20	--	80-120	≤20	80-120	≤20	≤20	QSM
Copper	6010B	0.7	2	11,000	100	50	190	390	36	NE	NE	NE	NE	36	--	80-120	≤20	80-120	≤20	≤20	QSM
Iron	6010B	0.6	4	720,000 (N)	10	200	NE	NE	NE	NE	NE	NE	NE	10		80-120	≤20	80-120	≤20	≤20	QSM
Lead	6010B	20	50	800	50	500	16	4,000	35	17	17	17	17	16	--	80-120	≤20	80-120	≤20	≤20	QSM
Magnesium	6010B	2	6	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		80-120	≤20	80-120	≤20	≤20	QSM
Manganese	6010B	0.07	2	14,000	500	100	4,125	11,000	1,100	NE	NE	NE	NE	100		80-120	≤20	80-120	≤20	≤20	QSM
Mercury	7471A	0.006	0.02	93	0.3	0.1	1.5	73	0.2	0.07	0.07	0.07	0.07	0.07	--	80-120	≤20	80-120	≤20	≤20	QSM
Nickel	6010B	3	9	6,200	30	200	320	625	18	NE	NE	NE	NE	18	--	80-120	≤20	80-120	≤20	≤20	QSM
Potassium	6010B	200	600	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		80-120	≤20	80-120	≤20	≤20	QSM
Selenium	6020	0.4	1	5,100 (N)	1	70	2	25	NE	2	2	2	2	1		80-120	≤20	80-120	≤20	≤20	QSM
Silver	6010B	2	6	1,500	2	50	NE	NE	4.5	NE	NE	NE	NE	2		80-120	≤20	80-120	≤20	≤20	QSM
Sodium	6010B	20	60	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE		80-120	≤20	80-120	≤20	≤20	QSM
Thallium	6010B	3	20	66 (N)	1	NE	NE	1	NE	NE	NE	NE	NE	1	--	80-120	≤20	80-120	≤20	≤20	QSM
Vanadium	6010B	40	200	7,200 (N)	2	NE	47	25	NE	NE	NE	NE	NE	2	--	80-120	≤20	80-120	≤20	≤20	QSM
Zinc	6010B	200	500	310,000 (N)	50	200	60	20,000	123	NE	NE	NE	NE	50	--	80-120	≤20	80-120	≤20	≤20	QSM

Notes:

CAS = Columbia Analytical Services (Kelso, Washington)
µg/kg dry = microgram per kilogram dry weight
mg/kg dry = milligram per kilogram dry weight
EPA = U.S. Environmental Protection Agency
LCS/LCSD = laboratory control sample/laboratory control sample duplicate
MDL = method detection limit
MS/MSD = matrix spike/matrix spike duplicate
NE = not established

ODEQ = Oregon Department of Environmental Quality
PCBs = Polychlorinated Biphenyls
RL = reporting limit
RPD = relative percent difference
SIM = select ion monitoring
QSM = Department of Defense Quality System Manual (QSM) for Environmental Laboratories, Final version 3, January 2006.
-- = Not Applicable
🟧 = screening criteria below laboratory reporting limit and/or method detection limit.

MDLs and RLs are from CAS (Kelso, Washington).

1 = Risk Based Concentrations (RBCs) for Soil Ingestion, Dermal Contact, and Inhalation the most conservative of Occupational, Construction Worker and Excavation Worker. *Oregon Department of Environmental Quality (ODEQ) Risk Based Decision Making for the Remediation of Petroleum Contaminated Sites*, revision 3, October 2008.
(N) = If ODEQ RBCs are not established for an analyte, the national EPA risk-based screening levels (RSLs) for Industrial Soil are indicated if criteria are establised. *EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites*, updated September 12, 2008.
2 = Table 1 in Guidance for Ecological Risk Assesment (ERA): Levels I, II, II, IV, Oregon Department of Environmental Quality (ODEQ), Final December 2001.
3 = Table 2 in Guidance for Ecological Risk Assesment (ERA): Levels I, II, II, IV, Oregon Department of Environmental Quality (ODEQ), Final December 2001.
4 = Table A-1 in Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment, Oregon Department of Environmental Quality (ODEQ), Updated April 3, 2007.
5 = Project-specific QC criteria was established using QSM limits when available and CAS (Kelso, Washington) laboratory limits when QSM limits were not available. The QSM control limits are for 'solid' matrices, the QSM does not distinguish between soil and sediment.

Table 11. Measurement Performance Criteria for Soil Gas

Parameter	Laboratory Detection Limits[1] (ug/m³)	Laboratory Reporting Limits[2] (ug/m³)	Air Inhalation ODEQ RBC x 500 AF[3] (ug/m³)	Project-Specific Control Limits[4]						Limit Reference[3]
				Surrogate Recovery (%)	MS/MSD Recovery (%)	MS/MSD RPD (%)	LCS/LCSD Recovery (%)	LCS/LCSD RPD (%)	Laboratory Duplicate RPD (%)	
TO-15										
Freon 12	0.38	2.5	NE	--	--	--	70-130	≤30	≤30	Air Toxics
Freon 114	0.62	3.6	NE	--	--	--	70-130	≤30	≤30	Air Toxics
Chloromethane	0.58	4.2	190,000	--	--	--	70-130	≤30	≤30	Air Toxics
Vinyl Chloride	0.18	1.3	1,350	--	--	--	70-130	≤30	≤30	Air Toxics
1,3-Butadiene	0.27	1.1	205 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
Bromomethane	0.35	2.0	10,000	--	--	--	70-130	≤30	≤30	Air Toxics
Chloroethane	0.50	1.3	7,000	--	--	--	70-130	≤30	≤30	Air Toxics
Freon 11	0.51	2.8	NE	--	--	--	70-130	≤30	≤30	Air Toxics
Ethanol	0.60	3.8	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Freon 113 (Trichloro-1,2,2-trifluoroethane)	0.61	3.9	65,000,000	--	--	--	70-130	≤30	≤30	Air Toxics
1,1-Dichloroethene	0.20	2.0	415,000	--	--	--	70-130	≤30	≤30	Air Toxics
Acetone	2.38	4.8	70,000,000 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
2-Propanol	0.34	5.0	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Carbon Disulfide	0.12	1.6	1,550,000 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
3-Chloropropene	1.0	6.4	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Methylene Chloride	0.35	1.8	13,000 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Methyl tert-butyl ether	0.25	1.8	22,500	--	--	--	60-140	≤30	≤30	Air Toxics
trans-1,2-Dichloroethene	0.28	2.0	125,000	--	--	--	60-140	≤30	≤30	Air Toxics
Hexane	0.39	1.8	1,550,000 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
1,1-Dichloroethane	0.28	2.0	415,000	--	--	--	70-130	≤30	≤30	Air Toxics
2-Butanone (Methyl Ethyl Ketone)	0.21	1.5	11,000,000 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
cis-1,2-Dichloroethene	0.32	2.0	75,000	--	--	--	70-130	≤30	≤30	Air Toxics
Tetrahydrofuran	0.29	1.5	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Chlorofrom	0.49	2.5	250	--	--	--	70-130	≤30	≤30	Air Toxics
1,1,1-Trichloroethane	0.55	2.8	11,000,000 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Cyclohexane	0.24	1.7	13,000,000 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
Carbon Tetrachloride	0.94	3.2	385	--	--	--	70-130	≤30	≤30	Air Toxics
2,2,4-Trimethylpentane	0.093	2.4	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Benzene	0.29	1.6	750	--	--	--	70-130	≤30	≤30	Air Toxics
1,2-Dichloroethane	0.28	2.0	38,500 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Heptane	0.53	2.1	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Trichloroethene	0.38	2.7	50	--	--	--	70-130	≤30	≤30	Air Toxics
1,2-Dichloropropane	0.092	2.3	600 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
1,4-Dioxane	0.76	7.3	1,850	--	--	--	60-140	≤30	≤30	Air Toxics
Bromodichloromethane	0.40	3.4	330	--	--	--	60-140	≤30	≤30	Air Toxics
cis-1,3-Dichloropropene	0.41	2.3	1,550 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
4-Methyl-2-pentanone	0.20	2.1	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Toluene	0.23	1.9	10,000,000	--	--	--	70-130	≤30	≤30	Air Toxics
trans-1,3-Dichloropropene	0.32	2.3	1,550 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
1,1,2-Trichloroethane	0.28	2.8	365	--	--	--	70-130	≤30	≤30	Air Toxics
1,1,1,2 Tetrachloroethane	0.68	3.4	850 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
2-Hexanone	0.45	8.3	NE	--	--	--	60-140	≤30	≤30	Air Toxics
Dibromochloromethane	0.68	4.3	NE	--	--	--	60-140	≤30	≤30	Air Toxics
1,2-Dibromoethane (EDB)	0.61	3.9	10 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Chlorobenzene	0.32	2.3	100,000	--	--	--	70-130	≤30	≤30	Air Toxics
Ethyl Benzene	0.35	2.2	2,300	--	--	--	70-130	≤30	≤30	Air Toxics
m,p-Xylene	0.43	2.2	210,000 (Total Xylenes)	--	--	--	70-130	≤30	≤30	Air Toxics
o-Xylene	0.17	2.2	210,000 (Total Xylenes)	--	--	--	70-130	≤30	≤30	Air Toxics
Styrene	0.26	2.2	2,100,000	--	--	--	70-130	≤30	≤30	Air Toxics
Bromoform	0.62	5.2	5,500	--	--	--	60-140	≤30	≤30	Air Toxics
Cumene (isopropylbenzene)	0.25	2.5	9,000,000 (N)	--	--	--	60-140	≤30	≤30	Air Toxics
1,1,2,2-Tetrachloroethane	0.62	3.5	105 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Propylbenzene	0.29	2.5	75,000	--	--	--	60-140	≤30	≤30	Air Toxics
4-Ethyltoluene	0.25	2.5	NE	--	--	--	60-140	≤30	≤30	Air Toxics
1,3,5-Trimethylbenzene	0.29	2.5	12,500	--	--	--	70-130	≤30	≤30	Air Toxics
1,2,4-Trimethylbenzene	0.25	2.5	12,500	--	--	--	70-130	≤30	≤30	Air Toxics
1,3-Dichlorobenzene	0.24	3.0	17,000	--	--	--	70-130	≤30	≤30	Air Toxics
1,4-Dichlorobenzene	0.54	3.0	850	--	--	--	70-130	≤30	≤30	Air Toxics
alpha-Chlorotoluene	0.21	2.6	NE	--	--	--	70-130	≤30	≤30	Air Toxics
1,2-Dichlorobenzene	0.54	3.0	50,000	--	--	--	70-130	≤30	≤30	Air Toxics
1,2,4-Trichlorobenzene	2.89	15	9,000 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Hexachlorobutadiene	1.81	22	280 (N)	--	--	--	70-130	≤30	≤30	Air Toxics
Toluene-d8 (surrogate)		--	--	70-130	--	--	--	--	--	Air Toxics
1,2-Dichloroethane-d4 (surrogate)		--	--	70-130	--	--	--	--	--	Air Toxics
4-Bromofluorobenzene (surrogate)		--	--	70-130	--	--	--	--	--	Air Toxics

Notes:

µg/m³ = microgram per cubic meter	NE = not established
-- = Not Applicable	RL = reporting limit
DL = method detection limit	RPD = relative percent difference

LCS/LCSD = laboratory control sample/laboratory control sample duplicate

MS/MSD = matrix spike/matrix spike duplicate

QSM = Department of Defense Quality System Manual (QSM) for Environmental Laboratories, Final version 3, January 2006.

1= DLs are from Air Toxics Ltd. (California) and may vary by instrument. They do not take into account sample dilution due to canister pressurization.

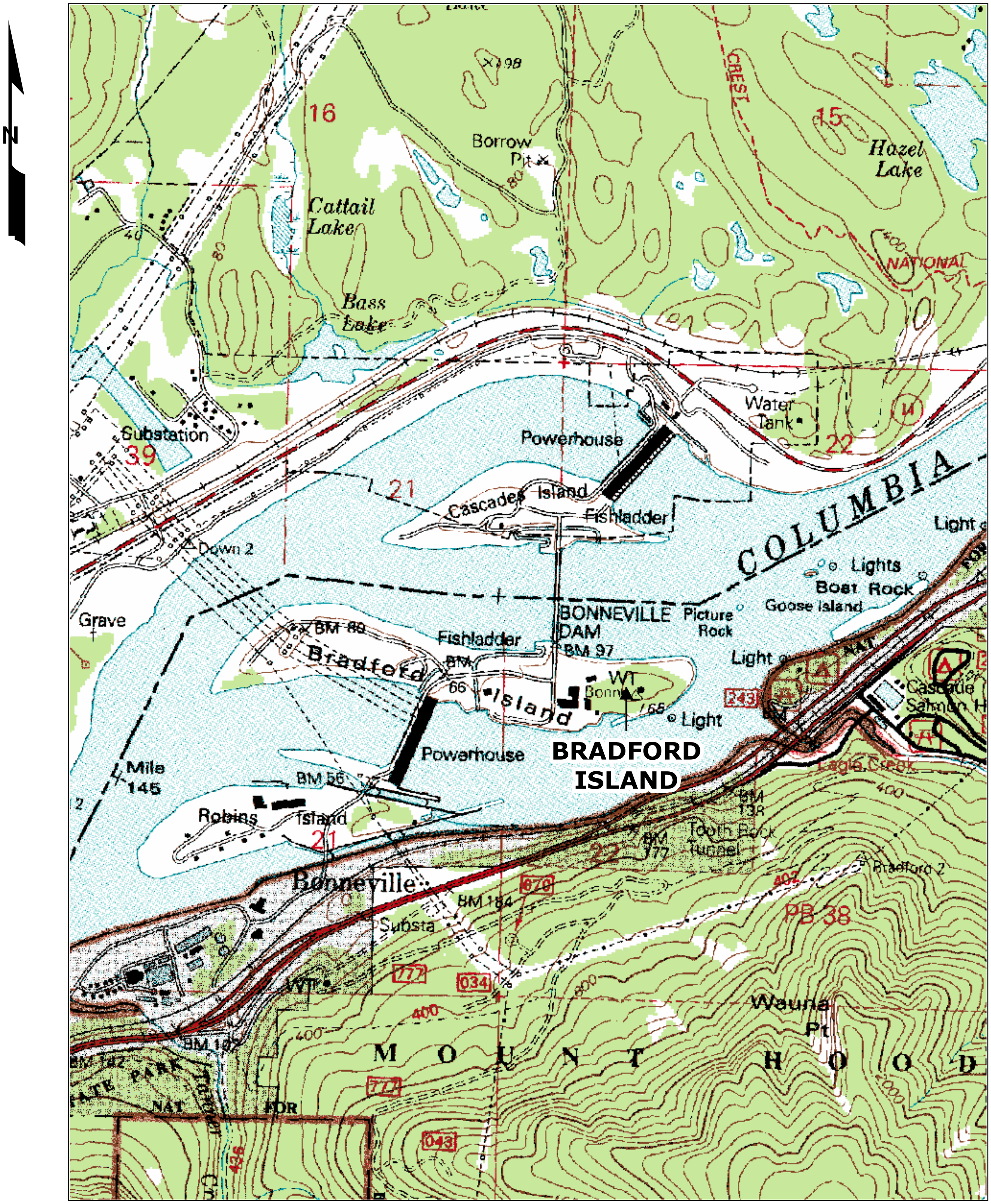
2= RLs are from Air Toxics Ltd. (California) and do not take into account sample dilution due to canister pressurization.

3 = Risk Based Concentrations (RBC_{air}) for Air Inhalation for Occupational Worker, *Oregon Department of Environmental Quality (ODEQ) Risk Based Decision Making for the Remediation of Petroleum Contaminated Sites* , revision 3, October 2008. These values have been multiplied by an attenuation faction (AF) of 500 to obtain appropriate soil gas screening criteria based on conversations with Paul Seidel at ODEQ.

(N) = If ODEQ RBCs are not established for an analyte, the national EPA risk-based screening levels (RSLs) for Industrial Air (x 500 AF) are indicated if criteria are establisted. *EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites* , updated September 12, 2008.

4 = Project-specific QC criteria was established using QSM limits when available and Air Toxics Ltd (Folsom, California) laboratory limits when QSM limits were not available.

FIGURES



SOURCE: BONNEVILLE DAM (45121f8) 7.5 MINUTE USGS TOPOGRAPHIC MAP

1,000 0 1,000 2,000

SCALE IN FEET

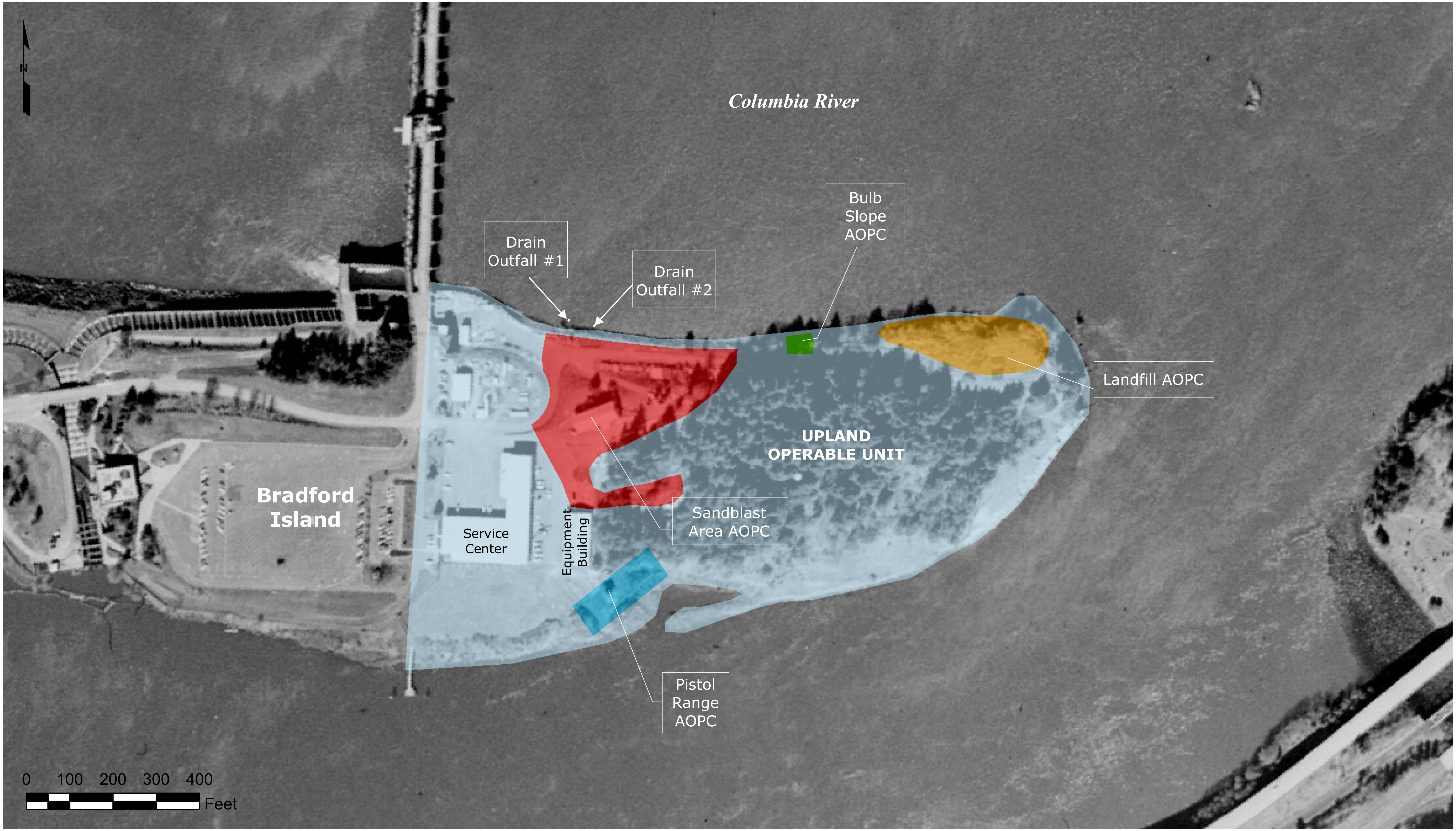
URS

VICINITY MAP

OCTOBER 2008
25696679

USACE
BRADFORD ISLAND RI/FS
CASCADE LOCKS, OREGON

FIGURE 1

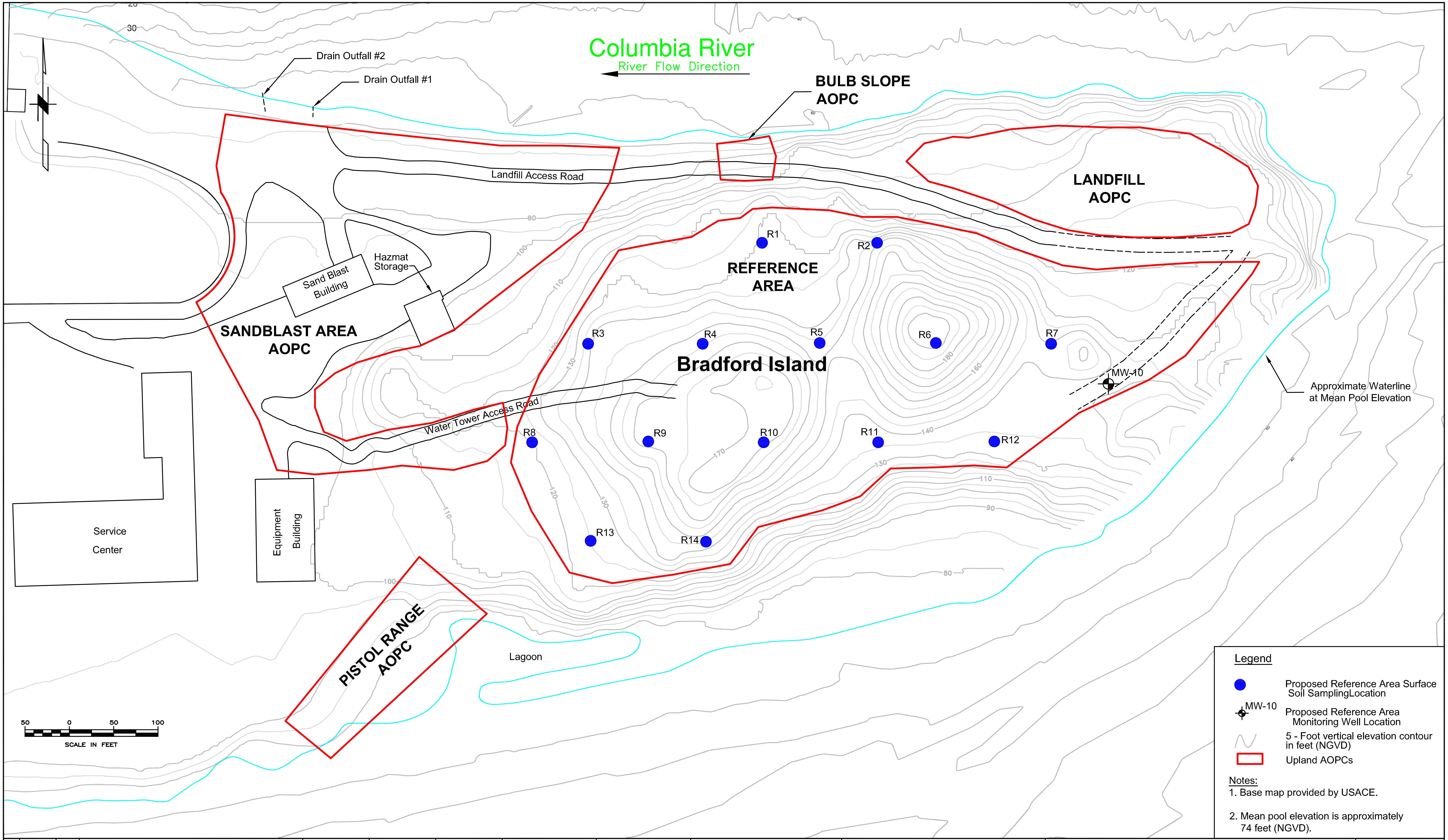


Map Features

🟦 Upland OU
🟩 Bulb Slope AOPC
🟧 Landfill AOPC
🟦 Pistol Range AOPC
🟥 Sandblast AOPC

JOB No. 25696679	DESIGNED: LSM	PROJ. ENGINEER: –	URS	BRADFORD ISLAND	Upland Operable Unit Overview	DRAWING NUMBER: FIGURE 2
Base Map provided by USACE	DRAWN BY: SB	APPROVED BY: JTW	111 S.W. Columbia, Suite 1500 Portland, Oregon 97201 (tel) 503-222-7200 (fax) 503-222-4292	CASCADE LOCKS, OREGON		GIS FILE NUMBER: Fig 2.mxd
	CHECKED BY: LSM	DATE: OCT 2008				SHEET: REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Omaha DT-07\Upland QAPP\Figures\FIG 2 Upland Operable Unit Overview.mxd



Notes:
1. Base map provided by USACE.

2. Mean pool elevation is approximately 74 feet (NGVD).

No.	DATE	BY	REVISION

JOB No.	DESIGNED:	PROJ. MANAGER:
25696679	LSM	JTW
SCALE:	DRAWN BY:	APPROVED BY:
1"=100'	SPB	LSM
	CHECKED BY:	DATE:
		OCT 08

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BRADFORD ISLAND

CASCADE LOCKS, OREGON

REFERENCE AREA
SAMPLING LOCATIONS

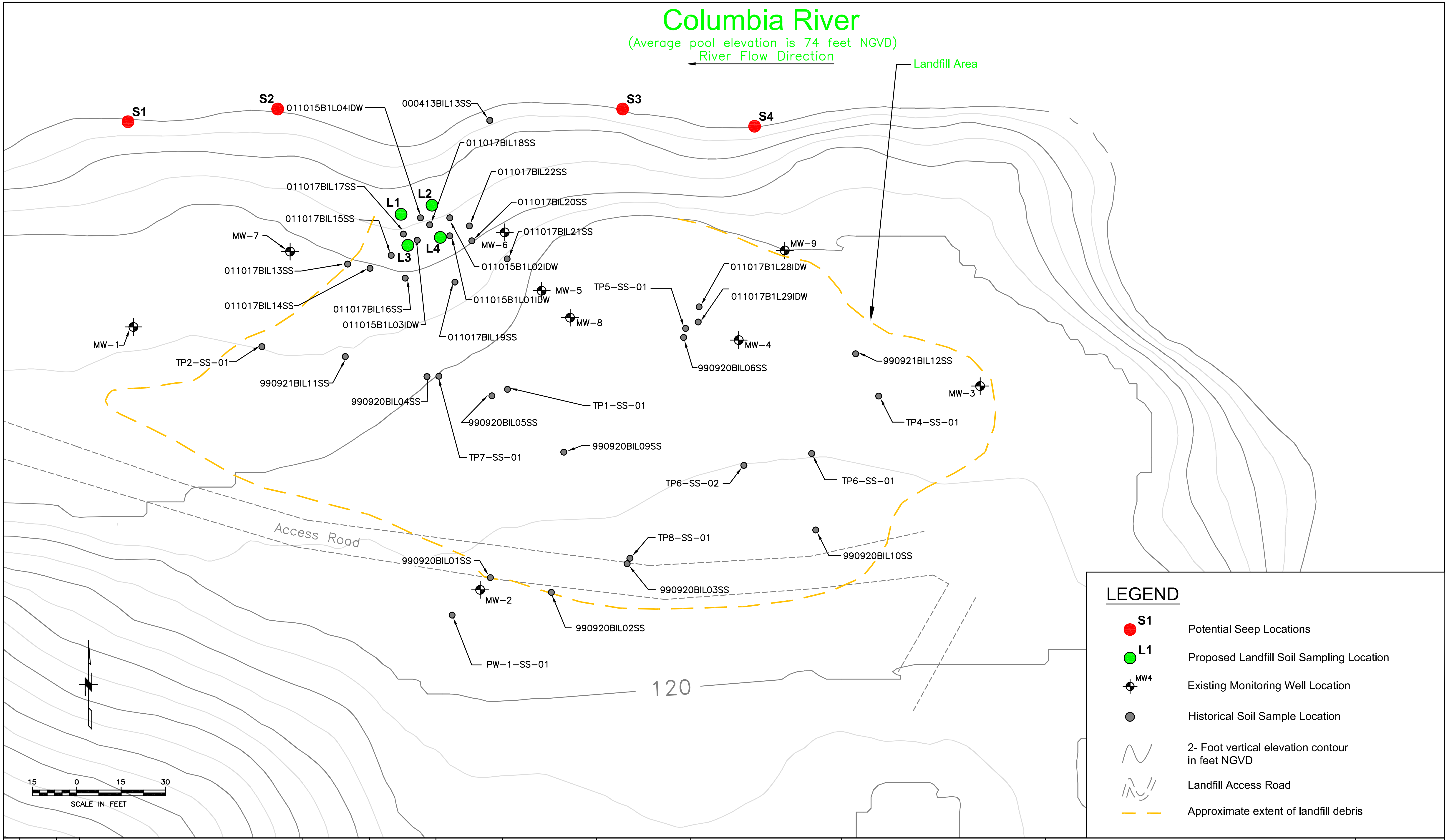
DRAWING NUMBER:
FIGURE 3

CAD FILE NUMBER:
FIG 3

SHEET:
OF

REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Omaha DT-07\Upland QAPP\CAD\FIG 3 Reference Area Sampling Locations.dwg Oct 14, 2008 - 3:54pm



No.	DATE	BY	REVISION

JOB No.: 25696679
SCALE: 1"=30'
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. ENGINEER:
APPROVED BY: JTW
DATE: OCT 2008

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(fax) 503-222-4292

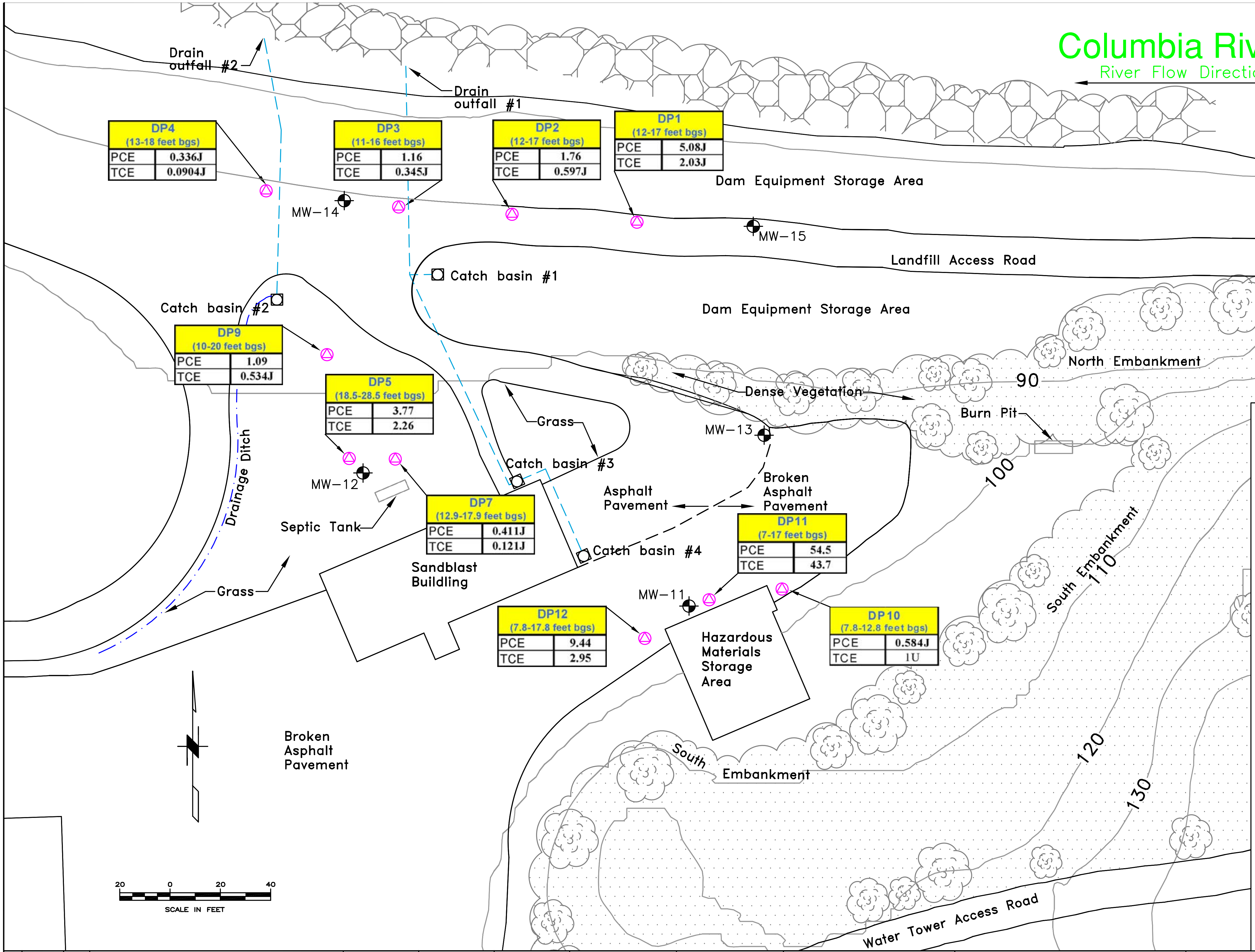
BRADFORD ISLAND

CASCADE LOCKS, OREGON

LANDFILL AOPC
SAMPLING LOCATIONS

DRAWING NUMBER: FIGURE 4
CAD FILE NUMBER: FIG 4
SHEET: OF
REV.:

O:\25692709 USACE\53-F0072173.00 Brdford1\Omaha DT-07\Upland QAPP\CAD\FIG 4.dwg Oct 14, 2008 - 3:56pm



LEGEND

MW−15 ⊕ Proposed Monitoring Well Location

△ Historical Geoprobe Boring Location

10-foot vertical contour in feet (NGVD)

Groundwater concentrations in micrograms per liter ($\mu g/L$) measured November 2004.

(12-17 feet bgs) = temporary screen interval in feet below ground surface

PCE = Tetrachloroethene

TCE = Trichloroethene

Detections are in **bold**

J = The associated value is estimated

U = The analyte was not detected above the reported sample quantitation limit.

2004 Sample Location
Sample Depth

Analyte	Concentration

Base map source: Final Site Inspection Report Bradford Island Landfill, Cascade Locks, Oregon (Tetra Tech, 1998); base map overlaid on 2001 aerial photograph (USACE, 2001)

No.	DATE	BY	REVISION
A	XX/XX/XX	XXX	

JOB No.: 25696679
DESIGNED: LSM
PROJ. MANAGER: JTW
SCALE: 1"=40'
DRAWN BY: SB
APPROVED BY: LSM
CHECKED BY: LSM
DATE: OCT 2008

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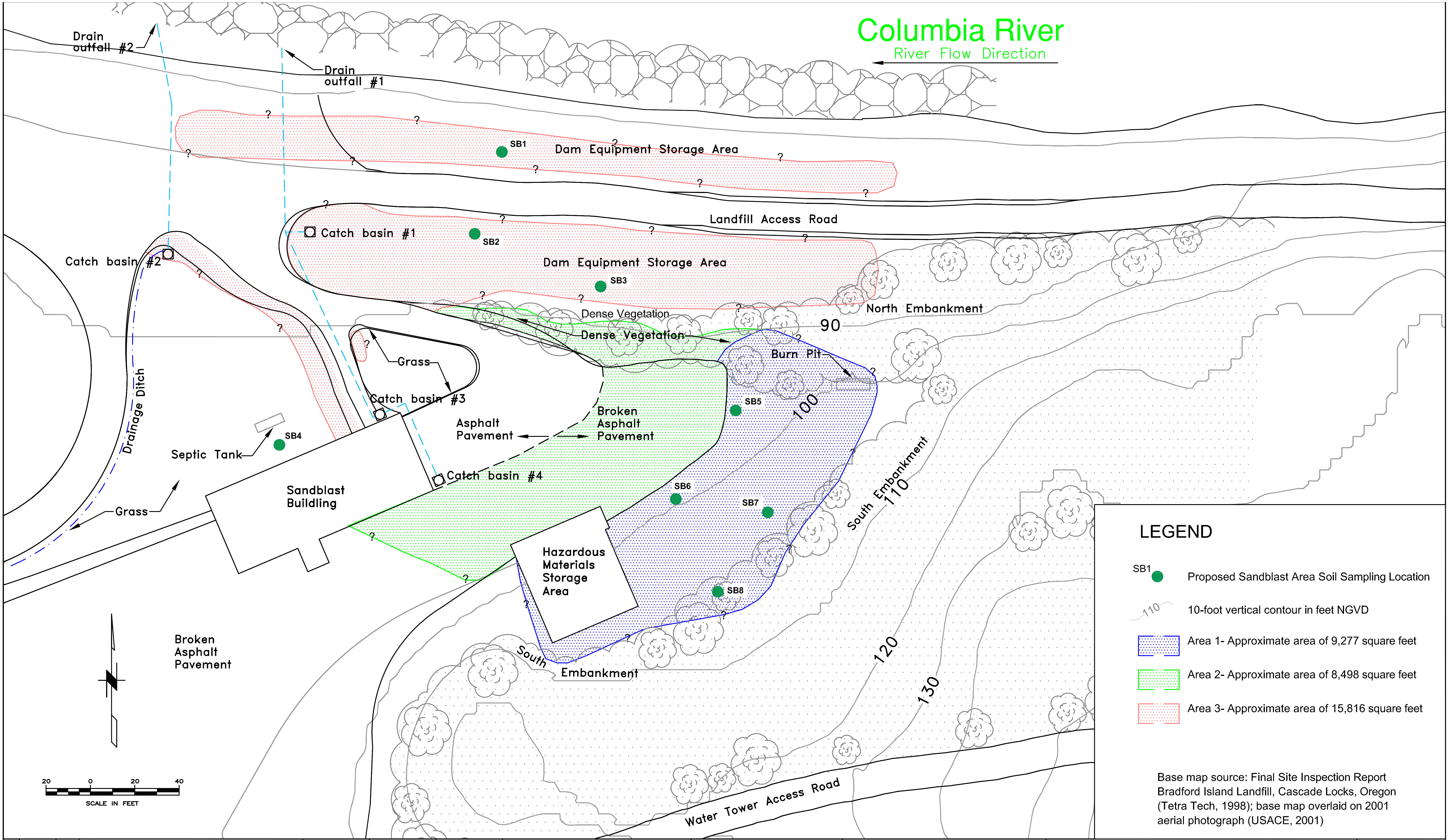
BRADFORD ISLAND

CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC
GROUNDWATER SAMPLING LOCATIONS

DRAWING NUMBER: FIGURE 5
CAD FILE NUMBER: FIG 5
SHEET: OF
REV.:

O:\25692709 USACE\53-F0072173.00 Bradford\Omaha DT-07\Upland QAPP\CAD\FIG 5.dwg Oct 14, 2008 - 3:57pm



Base map source: Final Site Inspection Report
Bradford Island Landfill, Cascade Locks, Oregon
(Tetra Tech, 1998); base map overlaid on 2001
aerial photograph (USACE, 2001)

No.	DATE	BY	REVISION
A	XX/XX/XX	XXX	

JOB No.: 25696679
DESIGNED: LSM
PROJ. MANAGER: JTW
SCALE: 1"=40'
DRAWN BY: SB
APPROVED BY: LSM
CHECKED BY: LSM
DATE: OCT 2008

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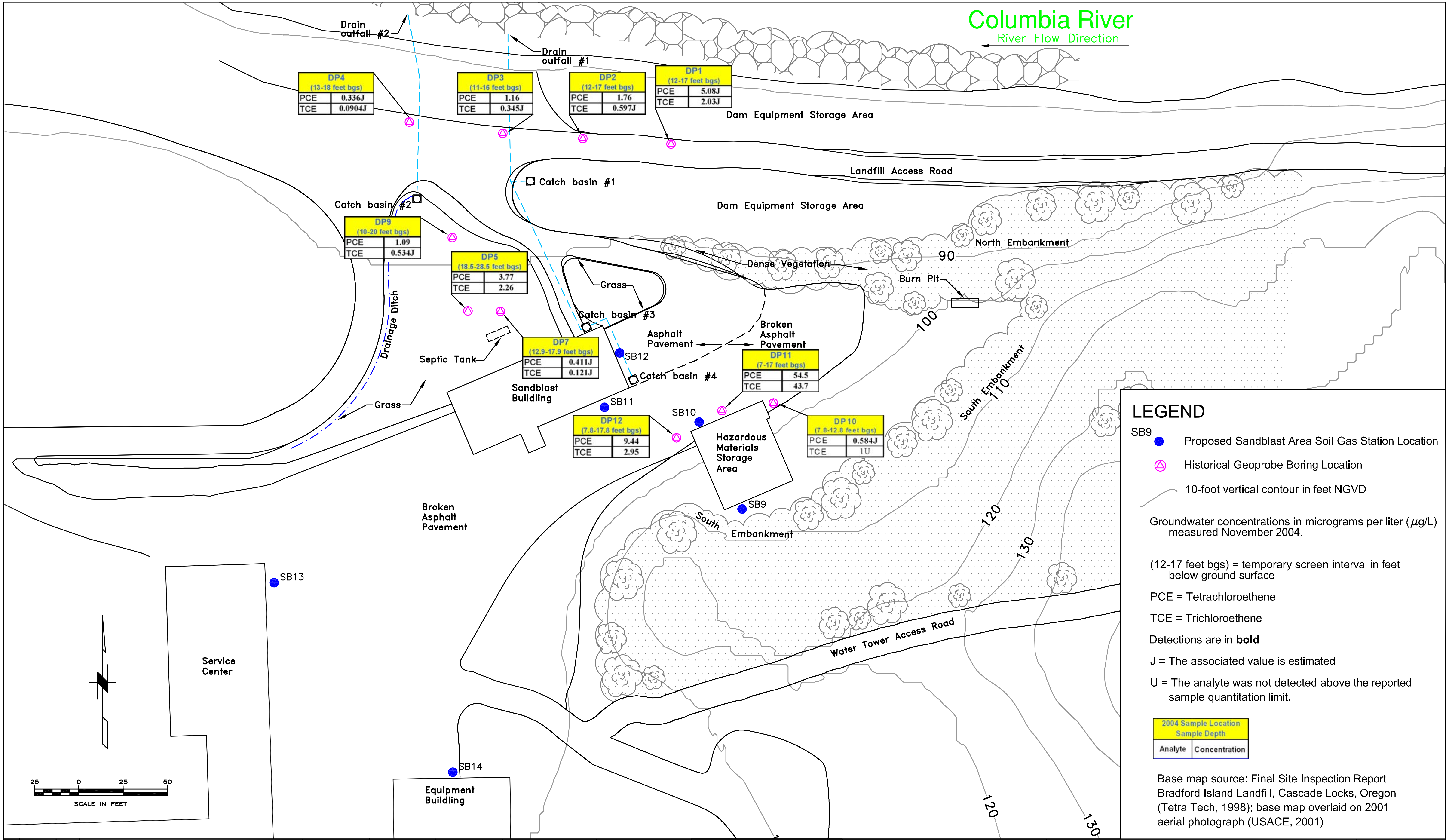
BRADFORD ISLAND

CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC
SOIL SAMPLING LOCATIONS

DRAWING NUMBER: FIGURE 6
CAD FILE NUMBER: FIG 6
SHEET: OF
REV.

O:\25692709 USACE\53-F0072173.00 Bradford1\Omaha DT-07\Upland QAPP\CAD\FIG 6.dwg Oct 14, 2008 - 3:58pm



LEGEND

SB9 ● Proposed Sandblast Area Soil Gas Station Location

△ Historical Geoprobe Boring Location

10-foot vertical contour in feet NGVD

Groundwater concentrations in micrograms per liter ($\mu g/L$) measured November 2004.

(12-17 feet bgs) = temporary screen interval in feet below ground surface

PCE = Tetrachloroethene

TCE = Trichloroethene

Detections are in **bold**

J = The associated value is estimated

U = The analyte was not detected above the reported sample quantitation limit.

2004 Sample Location Sample Depth	
Analyte	Concentration

Base map source: Final Site Inspection Report Bradford Island Landfill, Cascade Locks, Oregon (Tetra Tech, 1998); base map overlaid on 2001 aerial photograph (USACE, 2001)

No.	DATE	BY	REVISION
A	XX/XX/XX	XXX	

JOB No.: 25696679
SCALE: 1"=50'
DESIGNED: LSM
DRAWN BY: SB
CHECKED BY: LSM
PROJ. MANAGER: JTW
APPROVED BY: LSM
DATE: OCT 2008

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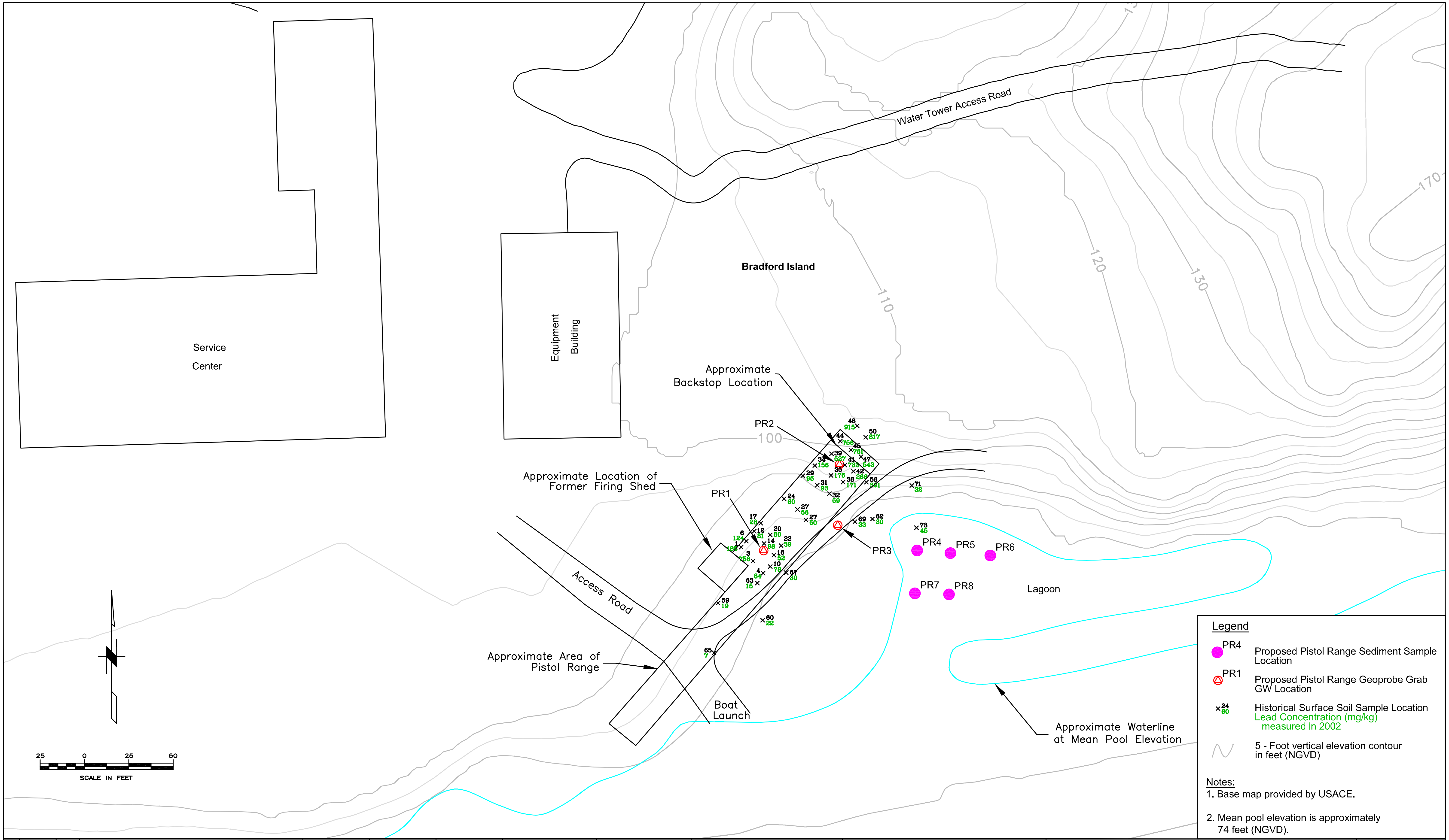
BRADFORD ISLAND

CASCADE LOCKS, OREGON

SANDBLAST AREA AOPC
SOIL GAS SAMPLING LOCATIONS

DRAWING NUMBER: FIGURE 7
CAD FILE NUMBER: FIG 7
SHEET: OF
REV.:

O:\25692709 USACE\53-F0072173.00 Bradford\Omaha DT-07\Upland QAPP\CAD\FIG 7.dwg Oct 14, 2008 - 3:59pm



Notes:

1. Base map provided by USACE.

2. Mean pool elevation is approximately 74 feet (NGVD).

No.	DATE	BY	REVISION

JOB No.: 25696679

DESIGNED: LSM

PROJ. MANAGER: JTW

SCALE: 1"=50'

DRAWN BY: SB

APPROVED BY: LSM

CHECKED BY:

DATE: OCT 2008

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BRADFORD ISLAND

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PISTOL RANGE AOPC
SAMPLING LOCATIONS

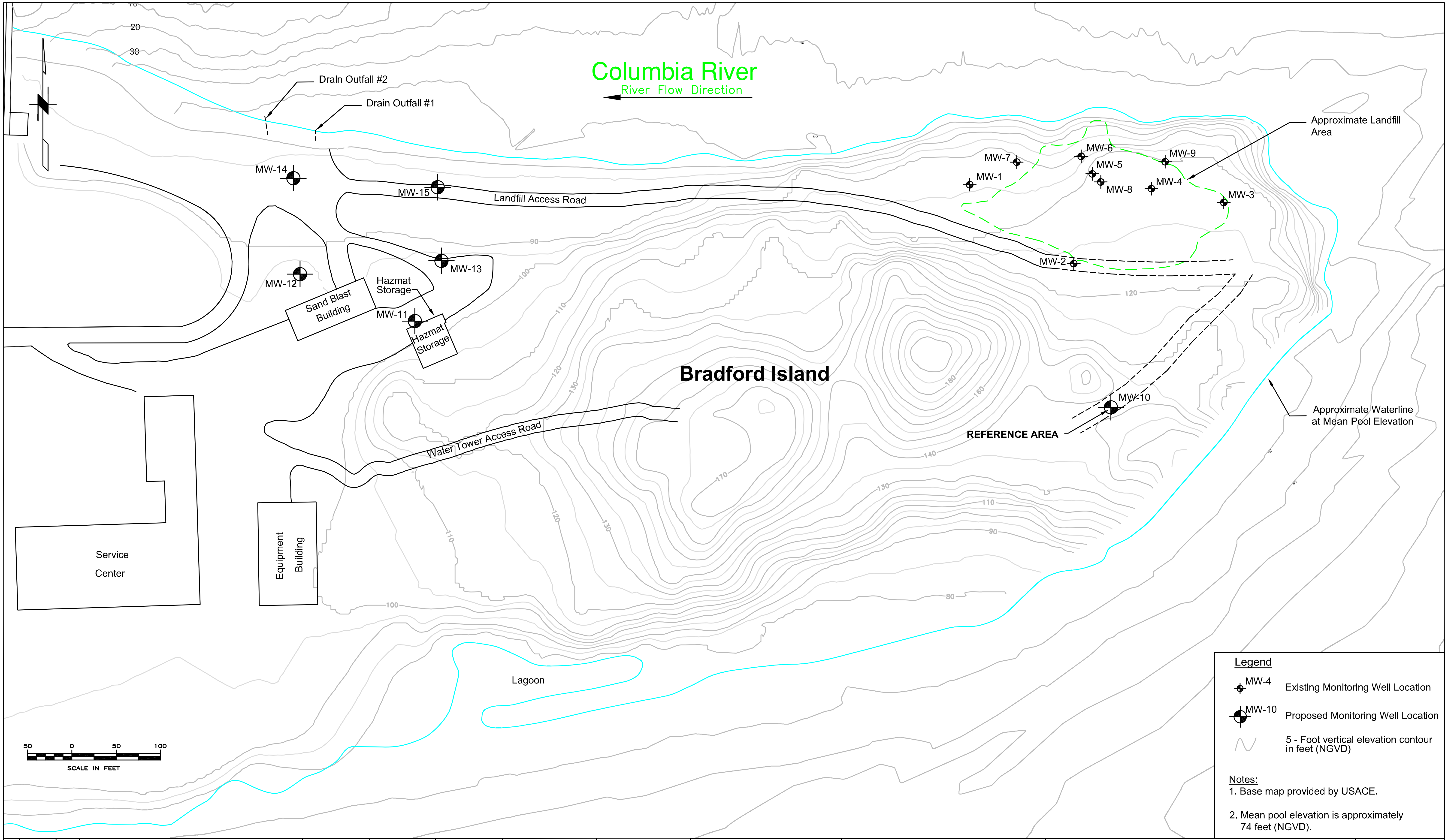
DRAWING NUMBER: FIGURE 8

CAD FILE NUMBER: FIG 8

SHEET: OF

REV.

O:\25692709 USACE\53-F0072173.00 Brdford1\Omaha DT-07\Upland QAPP\CAD\FIG 8.dwg Oct 14, 2008 - 4:00pm



Notes:
1. Base map provided by USACE.

2. Mean pool elevation is approximately 74 feet (NGVD).

No.	DATE	BY	REVISION

JOB No.: 25696679
DESIGNED: LSM
PROJ. MANAGER: JTW
SCALE: 1"=100'
DRAWN BY: SB
APPROVED BY: LSM
CHECKED BY: LSM
DATE: OCT 2008

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BRADFORD ISLAND
MONITORING WELL LOCATIONS

DRAWING NUMBER: FIGURE 9
CAD FILE NUMBER: FIG 9
SHEET: OF
REV.:

O:\25692709 USACE\53-F0072173.00 Brdford1\Omaha DT-07\Upland QAPP\CAD\FIG 9.dwg Oct 14, 2008 - 4:01pm

APPENDIX A
Sampling Forms

URS

DATE ____________________

DAY	S	M	T	W	TH	F	S

PROJECT MANAGER ____________________

PROJECT ____________________

JOB NO. ____________________

CONTRACT NO. ____________________

WEATHER	BRIGHT SUN	CLEAR	OVERCAST	RAIN	SNOW
TEMP	To 32	32-50	50-70	70-85	85 up
WIND	Still	Moder	High	Report No.	
HUMIDITY	Dry	Moder	Humid		

SUB-CONTRACTOR ON SITE:
EQUIPMENT ON SITE:
WORK PERFORMED (INCLUDING SAMPLES COLLECTED):

SHEET _____ OF _____

DAILY QUALITY CONTROL REPORT

PROJECT ______________________ REPORT NO. ______________

JOB NO. ______________________ DATE ______________

QUALITY CONTROL ACTIVITIES (INCLUDING FIELD CALIBRATIONS):
HEALTH AND SAFETY LEVELS AND ACTIVITIES:
PROBLEMS ENCOUNTERED/CORRECTION ACTION TAKEN:
SPECIAL NOTES:
TOMORROW'S EXPECTATIONS:

BY ______________________ TITLE ______________________

SHEET _____ OF _____

DAILY QUALITY CONTROL REPORT

PROJECT ____________________ REPORT NO. ____________________

JOB NO. ____________________ DATE ____________________

ADDITIONAL COMMENTS:

BY ____________________ TITLE ____________________

SHEET ______ OF ______

DAILY QUALITY CONTROL REPORT

Instrument Calibration Log

Date	Time	Instrument	Battery OK?	Calibration Type and Concentration	Instrument Reading	Calibration Adequate to Use Instrument?	Calibrated By

Project: ______	**Log of Boring / Well ______**
Project Location: ______	Sheet 1 of ____
Project Number: ______	

Date(s) Drilled and Installed	Logged By	Reviewed By
Drilling Method	Drilling Contractor	Total Depth of Borehole
Sampling Method	Groundwater Level(s)	Top of Casing Elevation
Size and Type of Well Casing	Screen Perforation	Ground Surface Elevation
Seal or Backfill	Location	

Depth, feet	SAMPLES			USCS Code	MATERIAL DESCRIPTION	Well Completion Schematic	FIELD NOTES AND WELL DETAILS
	Type and Number	Recovery, %	Headspace PID, ppm				
0							
5							
10							
15							
20							
25							
30							

URS

Report: ENV_12AS/W_PORT_FIELD; File: WC_CORP2.GPJ; 3/24/2004 -

Project: ______________________________
Project Location: ______________________________
Project Number: ______________________________

Log of Boring / Well ______

Sheet 2 of ____

Depth, feet	SAMPLES			USCS Code	MATERIAL DESCRIPTION	Well Completion Schematic	FIELD NOTES AND WELL DETAILS
	Type and Number	Recovery, %	Headspace PID, ppm				
30							
35							
40							
45							
50							
55							
60							
65							

URS

Project: ______________________________

Project Location: ______________________________

Project Number: ______________________________

Log of Boring / Well ______

Sheet 3 of ____

Depth, feet	SAMPLES			USCS Code	MATERIAL DESCRIPTION	Well Completion Schematic	FIELD NOTES AND WELL DETAILS
	Type and Number	Recovery, %	Headspace PID, ppm				
65							
70							
75							
80							
85							
90							
95							
100							

URS

Project: ______________________________
Project Location: __________________________
Project Number: __________________________

Log of Boring / Well ______

Sheet 4 of ____

Depth, feet	SAMPLES			USCS Code	MATERIAL DESCRIPTION	Well Completion Schematic	FIELD NOTES AND WELL DETAILS
	Type and Number	Recovery, %	Headspace PID, ppm				
105							
110							
115							
120							
125							
130							
135							

Monitoring Well Development Field Log

Well Number:

Page 1 of ____

Date:

Project Information

Project Name:

URS Project Number:

General Information

Field Team:

Purge Method:

Pump Intake Depth (ft btc):

Flow-Through Cell:

Decontamination Method:

Well Volume Calculation

Stick-up or Flush (circle one)

Well Depth (ft bgs)	Well Depth (ft btc)	DTW (ft btc)	Water Column (ft)	Convert Factor (gal/ft)	One Well Volume (gal)

3/4"=0.023 gal/ft 2"=0.17 gal/ft 4"=0.66 gal/ft 6"=1.5 gal/ft

General Information

Purge Water Disposition:

Field Conditions:

Comments:

Well Purge Data **Total Volume to Purge (gal) =**

Time	Volume Purged (gallons)	Purge Rate (gpm)	DTW (ft btc)	Temp. (^{0}C)	Conductivity (uS/cm)	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTUs)	Clarity/Color/ Remarks
	Pump On		Initial	-	±3%	±greater of 10% or 0.2mg/L	±0.1	±10mv	±10%	**<= Stabilization Criteria**
	Pump Off		Final							

Note: bgs= below ground surface btc=below top of casing DTW=depth to water gpm=gallons per minute

Clarity: VC=very cloudy Cl=cloudy SC=slightly cloudy AC=almost clear C=clear CC=crystal clear

File: Form 4_Well Development Form.xls (Updated 05/25/04) URS Corporation

Well Development Field Log

Well Number: __________

Page 2 of 2

Date: __________

URS Project Number: ________________

Well Purge Data (continued from Page 1)

Time	Volume Purged (gallons)	Purge Rate (gpm)	DTW (ft btc)	Conductivity (uS/cm)	Temp. (^{0}C)	pH	ORP (mV)	D.O. (mg/L)	Turbidity (NTUs)	Clarity/Color/ Remarks
Pump Off			Final							

Comments

Note: bgs= below ground surface btc=below top of casing DTW=depth to water gpm=gallons per minute
Clarity: VC=very cloudy Cl=cloudy SC=slightly cloudy AC=almost clear C=clear CC=crystal clear

Bradford Island

Slug Test Data Form

Project Site ______________________

Well ID __________________

Test Date ________________________

Measuring Point __________________

Type of Test _____________________

Transducer Make/Model __________

Data Logger Test Run No. _________

Test Start Time __________________

Test End Time ___________________

Sampling Team_________________________________

Groundwater Elevation Before Test _____________

Total Casing Depth ____________________________

Borehole Diameter _____________________________

Casing Diameter _______________________________

Screened Interval ______________________________

Sand Pack Interval _____________________________

Depth to Water ________________________________

Reference Depth _______________________________

Lithology Tested ____

Bradford Island

Surface Soil Sampling Form

Sample Number: Date:

Weather Conditions: Time:

Analyses

_____PCB – Aroclors
_____PCB – Congeners
_____Metals
_____SVOCs
_____PAHs
_____VOCs
_____Pesticides
_____Butyltins
_____Diesel/Heavy Range Organics
_____Archive
_____% Moisture
_____Grain Size
_____pH
_____TOC

Sample Collection

Sampling Method:

QC Samples Collected:

Water Sample Collected:

Decontamination Method: Soap wash, water rinse, acetone & nitric acid wash, water rinse

Sample Team:

Sample Location

Latitude: ____________________ N
Longitude: ____________________W

Description of Location:

Soil Sample Depth:

Soil Description

Color:

Texture:

UCSC Classification:

Odor/sheen:

Bradford Island

Sediment Sampling Form

Sample Number: Date:

Weather Conditions: Time:

Analyses

_____PCB – Aroclors
_____PCB – Congeners
_____Metals
_____SVOCs
_____PAHs
_____VOCs
_____Pesticides
_____Butyltins
_____Diesel/Heavy Range Organics
_____Archive
_____% Moisture
_____Grain Size
_____pH
_____TOC

Sample Collection

Sampling Method:

QC Samples Collected:

Water Sample Collected:

Decontamination Method: Soap wash, water rinse, acetone & nitric acid wash, water rinse

Sample Team:

Sample Location

Latitude: _____________________ N

Longitude: ____________________W

Description of Location:

Description of Sediment Surface:

Water Depth:

Sediment Depth:

Sediment Description

Color:

Texture:

UCSC Classification:

Odor/sheen:

Benthic Organisms:

Vegetation:

Bradford Island

Seep and Surface Water Sampling Form

Sample Number: Date:

Weather Conditions: Time:

Analyses

_____PCB-Aroclors
_____PCB – Congeners
_____Metals
_____SVOCs
_____PAHs
_____VOCs
_____Pesticides
_____Butyltins
_____Diesel/Heavy Range Organics
_____TSS
_____Hardness
_____pH
_____TOC
_____DOC

Sample Collection

Seep Sampling Method:

QC Samples Collected:

Surface Water Sample Method:

Decontamination Method:

Sample Team:

Sample Location

Latitude: _____________________ N
Longitude: ____________________W

Description of Location:

Seep flow rate:

Field Water Quality Measurements

pH

Turbidity

Dissolved Oxygen

Conductivity

Reduction-Oxidation Potential

Temperature

Other Comments

Bradford Island

Soil Gas Sampling Form

Sample Number:	Date:
Weather Conditions:	Time:

Analyses

_____PCB – Aroclors
_____PCB – Congeners
_____Metals
_____SVOCs
_____PAHs
_____VOCs
_____Pesticides
_____Butyltins
_____Diesel/Heavy Range Organics
_____Archive
_____% Moisture
_____Grain Size
_____pH
_____TOC

Calculation of Purge Volume

Length of Tubing:	Inside Diameter of Tubing:
Volume of Tubing:	Estimated Annular Volume Around Probe Tip:

Target purge volume (3 x total estimated volume):

Sample Collection

Purge Flow Rate:	Volume of Soil Gas Purged:
Initial Canister Vacuum:	Final Canister Vacuum:

Sampling Flow Rate:

QC Samples Collected:

Odors or Other Observations:

Sample Location

Latitude: _____________________ N
Longitude: ____________________W

Description of Location:

Soil Gas Sample Depth:

Sample Team:

Monitoring Well Sampling Field Log

Well Number:

Page 1 of ____

Date:

Project Information

Project Name:

URS Project Number:

Sampling Information

Field Team:

Purge Method:

Pump Intake Depth (ft btc):

Flow-Through Cell:

Sampling Method:

Decontamination Method:

Purge Water Disposition:

Field Conditions:

Comments:

PID reading upon opening well cap:

Initial DTW =

Total Well Depth =

Feet of Water in Casing =

Well Storage Volume =

Well Information Stick-up or Flush (circle one)

Well Diameter (in)	Drilled Well Depth		Top of Screen		Screen Interval (ft bgs)
	(ft bgs)	(ft btc)	(ft bgs)	(ft btc)	
					-

Sample Containers

Number	Type	Preservative	Analytical Parameters	Filtered?

Well Purge Data

Time	Volume Purged (L)	Purge Rate (mL/m)	DTW (ft btc)	Temp. (^{0}C)	Conductivity (uS/cm)	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTUs)	Clarity / Color / Remarks
	Pump On		Initial	-	±3%	±greater of 10% or 0.2mg/L	±0.1	±10mv	±10%	**<= Stabilization Criteria**
	Start Sampling									
	End Sampling			**Sample Number:**					**Sample Time:**	
			Final							

Notes:	AC = almost clear	btc = below top of casing	DTW = depth to water	VC = very cloudy
	bgs = below ground surface	Cl = cloudy	C = clear	SC = slightly cloudy

Monitoring Well Sampling Field Log

Well Number:

Page 2 of ____

Date:

URS Project Number:

Well Purge Data (continued from Page 1)

Time	Volume Purged (L)	Purge Rate (mL/m)	DTW (ft btc)	Temp. (^{0}C)	Conductivity (uS/cm)	D.O. (mg/L)	pH	ORP (mV)	Turbidity (NTUs)	Clarity / Color / Remarks
			Stabilization Criteria =>	-	±3%	±10%	±0.1	±10mv	±10%	
	Start Sampling									
	End Sampling			**Sample Number:**						
			Final							

Comments

Notes:
AC = almost clear
bgs = below ground surface
btc = below top of casing
Cl = cloudy
DTW = depth to water
C = clear
VC = very cloudy
SC = slightly cloudy

APPENDIX B
Standard Operating Procedures

STANDARD OPERATING PROCEDURE 1.1
FIELD LOGBOOK USE AND MAINTENANCE

1.0 SUMMARY

This procedure establishes a standard format for recording field observations and describes the methods for use and maintenance of field logbooks. Examples of proper field logbook data entry are also presented.

Field logbooks provide a means for recording all activities performed at a site and are intended to provide sufficient data and observations to enable reconstruction of events that occurred during performance of field activities. As such, all entries are to be as factual, detailed, and descriptive as appropriate so that a particular situation can be reconstructed without reliance on the author's memory. Field logbooks can be used to compare and check other field documents.

2.0 EQUIPMENT

- Waterproof bound field logbook with numbered pages
- Waterproof/indelible marking pen
- Ruler/straight edge
- Clipboard

3.0 PROCEDURE

3.1 Logbook Setup

The field team provides a permanent record of daily activities, observations, and measurements through the use of a field logbook. Individuals performing specific tasks associated with a field project may keep a separate logbook; however, these logbooks must conform to this procedure and will become a permanent part of the project file. The Task Manager is responsible for reviewing all field logbooks associated with the project.

Field logbooks are hardbound (typically 4-inch by 7-inch to 8-inch by 10.5-inch) books with water-resistant or waterproof pages. Data will be recorded using pens with permanent waterproof ink

The inside cover page of each logbook will contain the following information:

- Book number
- Project name
- Project number

- Site name
- Start date
- End date
- Company name
- Company address
- Company phone number
- Project manager

3.2 Logbook Entries

Daily entries will be made during field activities by, at a minimum, one field team member to provide daily records of all significant events, observations, and measurements during field operations. Notes will start at the beginning of the first blank page and extend through as many pages as necessary. All page numbers will be consecutively numbered as the logbook is filled.

All logbook entries will be made in indelible black or blue ink. No erasures are permitted. If an incorrect entry is made, the data will be crossed out with a single line and initialed and dated by the originator. Entries can be organized into easily understood tables if necessary.

All logbook pages will be signed and dated at the bottom. Times will be recorded next to each entry. If a full page is not used during the course of a workday, a diagonal line will be drawn through the unused portion of the page and signed (in this case, it would not be necessary to sign the bottom of the page). If the project is completed and the logbook has not been completely filled, a diagonal line will be drawn across the first blank page after the last entry, and “no further entries” written before the page is signed and dated.

All entries in the logbook will be chronological, using a 24-hour clock. Field personnel will start a new page at the beginning of each new workday, with project name and number at top in case the page is ripped out. If more than one person makes entries in a logbook, each person will provide a signature at the end of the section that the person is responsible for authoring.

If specific information is being compiled in another log or other type of form (e.g., health and safety meeting log, borehole log, sample tracking sheets), the field logbook document control number and page number from which the specific information is compiled should be referenced on the form.

Copies or duplicate backups of logbook entries should be made daily if possible or, at a minimum, once a week to avoid loss of information that may be costly to replace or reconstruct.

If appropriate, a hand-sketched map of the site should be included in the logbook. Important information such as a directional arrow indicating north, any discernible gradient, wind direction, vegetation, manmade structures, surrounding facilities (gas stations, storage tanks, etc.), water flow, a scale, sampling and/or well locations, a legend if symbols are used, and anything else that may be considered important should be included.

At a minimum, logbook entries will include the following information at the beginning of each day as appropriate to the activities:

- Date
- Project name and number in case page is accidentally ripped out and found
- Start time
- Weather
- Daily health and safety meeting notes
- Field activities to be performed
- Field observations
- Field measurements (pH, temperature, conductivity, etc.)
- Methods used for equipment decontamination
- Procedures used for containerization of investigation-derived waste
- All field personnel present and directly involved
- Visitors to the site (including times)
- Level of personal protective equipment used on the site
- Equipment used and procedures followed
- Signature of the person making the entry

When samples are collected, the following information must be included:

- Location of sample
- Samplers’ printed names and signatures
- Date and time of sample collection
- Sample identification/number
- Description of sample matrix
- Sample depth
- Sampling methods
- Sample handling, including filtration and preservation
- Analysis required

4.0 DOCUMENTATION

None.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 1.2
SAMPLE HANDLING, LABELING, PACKAGING, AND SHIPPING

1.0 SUMMARY

This procedure defines the standard protocols for sample handling, labeling, packaging, and shipping of environmental samples prior to their delivery to an analytical laboratory.

2.0 EQUIPMENT

Equipment and materials used for sample labeling, packaging, and shipping include the following:

- Waterproof coolers (hard plastic or metal)
- Custody seals
- Field forms such as *Chain-of-Custody (COC)* and *Field Measurement Data*
- Weatherproof bound field logbook with numbered pages
- Ice or blue icepack
- Packing material such as bubble wrap, bubble bags, skirts, and vermiculite
- Clear tape for labels and duct tape to seal coolers
- Zipper-locking plastic bags (quart and gallon size)
- Garbage bags (33-45 gallon)
- Sample containers
- Sample labels
- Waterproof and permanent marking pens

3.0 PROCEDURES

The field logbook is used to document all pertinent information regarding sample handling, labeling, packaging and shipping.

3.1 Sample Handling

Certified commercially clean sample containers are obtained from the contract analytical laboratory. The laboratory will indicate the type of sample to be collected in each bottle type and add chemical preservatives, if necessary, to the sample containers prior to shipment to the field. Store preserved samples on ice in coolers and maintain the sample temperature at 4 degrees Celsius (± 2 degrees) (4°C ± 2°C). Samples should not be overcooled (i.e., should not be frozen).

3.2 Sample Labeling

Prepare a label for each sample collected and apply the label to the sample container. Labels require some or all of the following information:

- Project name
- Project number

- Location/Site ID
- Date of sampling
- Time of sample collection
- Analyses to be performed (be specific as possible)
- Whether filtered or unfiltered (water sample only)
- Preservatives (water sample only)
- The number of containers for the sample (such as1 of 2, 2 of 2)
- Sample matrix (such as soil, water, sediment, etc.)

3.3 Sample Packaging and Shipping

Except for the soil gas Suma canisters, the samples will be packed in coolers using bubble wrap and ice packs or crushed ice to maintain samples at 4 degrees Celsius during transport to the laboratory. Suma canisters will be packed in laboratory-supplied shipping boxes.

In order to ensure that samples arrive at the laboratory intact and at the proper temperature (4°C ± 2°C) the following steps should be followed:

1. Check the cap tightness and affix a custody seal to each sample container.

2. Completely encircle the sample label and container with clear tape.

3. For glass sample containers, wrap the container in protective packing material such as bubble wrap, bubble bags, and/or vermiculite (VOC vial foam container for VOC vials only).

4. When applicable, enclose individual sample containers in a zipper-locking plastic bag (i.e. low-level metal analyses).

5. Line the cooler with an open garbage bag. Place the samples right side up in the bag. Remove as much air as possible and seal the garbage bag.

6. Place bags of ice in the cooler, on the outside of the garbage bag containing the samples.

7. Ensure that there is no void space remaining in the cooler. Add additional packing material to prevent movement or breakage of the sample jars during shipment. Gently bounce the cooler to ensure that the cooler contents have settled.

8. Make copies of all documents being sent to the laboratory or remove and retain carbonless copies. Enclose the completed COC form, or other documents required by the contract in a zipper-locking plastic bag and tape the bag to the underside of the cooler lid. It is imperative that the samples contained in the cooler and the samples listed on the COC form are identical.

9. Seal the cooler with tape and affix at least two signed and dated custody seals so that if the cooler were opened, the custody seals would be broken. Place clear tape over the custody seals to prevent damage to the seals.

Samples will be hand delivered via laboratory courier or shipped overnight express to the laboratory. All samples must be delivered to the laboratory within the specific holding times. Daily shipment of samples with short holding times may be required.

Special shipping requirements may apply to sample containers containing certain preservatives. Follow laboratory guidelines for conforming with International Air Transport Association requirements.

4.0 DOCUMENTATION

Complete copies of shipping receipts and associated COC form are retained in the field. A copy of each completed sample collection information form, COC form and shipping receipt will be forwarded to the main project file within 5 days of the sample shipment.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 1.3
SAMPLE CONTROL, DOCUMENTATION, AND TRACKING

1.0 PURPOSE

The purpose of this procedure is to describe the proper sample control, documentation, and tracking methods to be followed for environmental projects. This procedure outlines the documentation necessary to trace sample possession and shipment.

This procedure provides guidance for routine field operations. Site-specific deviations from the methods presented herein must be approved by the Task Manager.

2.0 EQUIPMENT

Chain of custody form.

3.0 PROCEDURES

Field personnel (samplers) are responsible for performing the tasks in accordance with this procedure. These personnel are responsible for the care and custody of the collected samples until the samples are transferred or dispatched properly. All activities and data collected shall be recorded in the field logbook.

The Task Manager or an approved designee is responsible for checking all work performance and verifying that the work satisfies the applicable tasks required in this procedure. This will be accomplished by reviewing all documents and data produced.

3.1 Sample Custody

Written documentation of sample custody from the time of sample collection through the generation of data by analysis of that sample is a vital aspect of an environmental study. Offical custody of samples must be maintained from the time of sample collection until the time the samples are introduced as evidence in the event of litigation. Field personnel are responsible for the care and custody of the samples until sample shipment. The chain-of-custody (COC) form is used as physical evidence of sample custody. A sample or evidence file is under custody if it is in:

- The possession of the sampler/analyst
- View of the sampler/analyst
- A designated secure area

Sample custody consists of three parts: sample collection, laboratory analysis, and final evidence files. The chain of custody of the physical sample and its corresponding documentation must be maintained throughout the handling of the sample. Through accurate accounting of the sample custody, the record of the physical sample (location and time of sampling) can be joined with the analytical results.

As a part of the procedure to ensure the integrity of the resulting data, the field personnel must identify, label, and log onto a COC form all samples. The COC form documents samples that are shipped to laboratories under contract to URS (Exhibit 1). Use waterproof ink unless prohibited by weather conditions. For example, a logbook notation will explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

3.2 Samples and Sample Name

Samples are collected as described in the Project Plans. In general, a sample is defined by matrix (such as air, sludge, water, soil). The sample is further defined as consisting of all the sample aliquots (for multiple analyses) from one station location, for each matrix. All sample containers collected from a single location for a single matrix have the same sample name.

REMEMBER:

- COC forms must be used with every shipment of samples to each laboratory.

3.3 Transfer of Custody and Sample Tracking Procedures

All samples must be accompanied by a properly completed COC form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person or to the laboratory.

Properly package samples for shipment and dispatch to the designated laboratory for analysis. Include a copy of the COC form (signed by the person releasing the samples) in a waterproof container (e.g. ziplock bag) on top of the samples in the cooler. Secure shipping containers with strapping tape. Place custody seals on the shipping container for shipment to the laboratory. The preferred procedure is the attachment of a custody seal to the front right and back left of the cooler. Cover the custody seals with clear plastic tape. Strap the cooler shut with strapping tape in at least two locations.

If the samples are sent by common carrier, follow appropriate federal regulations (i.e., IATA). Commercial carriers are not required to sign off on the COC form as long as the form is sealed inside the sample cooler and the custody seals remain intact.

3.4 Review

The field personnel are responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples. The sampler is also responsible for reviewing (or for having a second sampler review) the custody forms for completeness and accuracy before relinquishing custody.

The Task Manager or an approved designee must review all field activities to determine whether proper chain of custody procedures were followed during the field work and to decide if additional samples are required. The sampler should notify the Site Manager of a breach or irregularity in chain of custody procedures. The Site Manager will notify the client, as required.

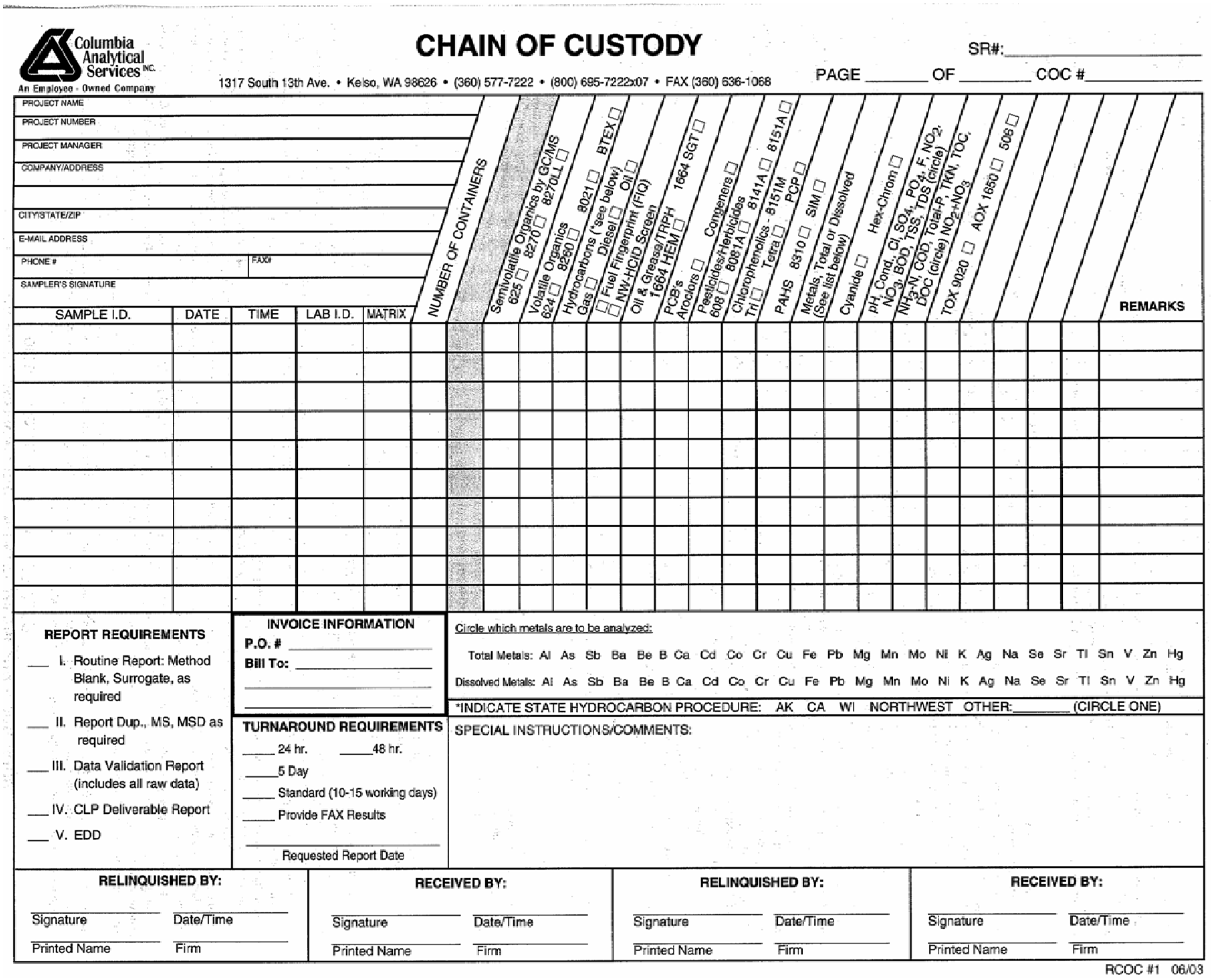
4.0 DOCUMENTATION

The Site Manager will retain the appropriate copies of the COC forms and requests for analyses forms as marked on the bottom of each of the forms.

5.0 ATTACHMENTS

Exhibit 1	Example Laboratory Chain-of-Custody

Exhibit 1
Example Laboratory Chain-of-Custody



Columbia Analytical Services INC.
An Employee - Owned Company

CHAIN OF CUSTODY

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222x07 • FAX (360) 636-1068

SR#:________

PAGE ______ OF ______ COC #________

PROJECT NAME

PROJECT NUMBER

PROJECT MANAGER

COMPANY/ADDRESS

CITY/STATE/ZIP

E-MAIL ADDRESS

PHONE # FAX#

SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS		Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ 8021 ☐ BTEX ☐	☐ Fuel Fingerprint (FIQ) Oil ☐ ☐ NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐ Hex-Chrom ☐	pH, Cond., Cl, SO4, PO4, F, NO$_2$, NO$_3$, BOD, TSS, TDS (circle)	NH$_3$-N, COD, Total-P, TKN, TOC, DOC (circle) NO$_2$+NO$_3$	TOX 9020 ☐ AOX 1650 ☐ 506 ☐					REMARKS

REPORT REQUIREMENTS
___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. Data Validation Report (includes all raw data)
___ IV. CLP Deliverable Report
___ V. EDD

INVOICE INFORMATION
P.O. # ________
Bill To: ________

TURNAROUND REQUIREMENTS
____ 24 hr. ____ 48 hr.
____ 5 Day
____ Standard (10-15 working days)
____ Provide FAX Results
____
Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER:______ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:		**RECEIVED BY:**		**RELINQUISHED BY:**		**RECEIVED BY:**	
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time	Signature	Date/Time
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

RCOC #1 06/03

STANDARD OPERATING PROCEDURE 1.4
EQUIPMENT CALIBRATION, OPERATION, AND MAINTENANCE

1.0 SUMMARY

This procedure describes the calibration, adjustment, maintenance, operation, and documentation of monitoring equipment used to collect environmental data. Reliable measurements of environmental parameters are necessary because decisions concerning remedial actions and responses are based on these data.

2.0 EQUIPMENT

Field monitoring equipment is designed for use in the field during sampling activities and includes, but is not limited to the following:

- Photoionization detectors (PID)
- Organic vapor analyzers (OVA)
- LEL/O_2 meters
- Multiparameter water quality meter with flow-through cell for pH, temperature, turbidity, Oxidation-Reduction Potential (ORP), dissolved oxygen, and conductivity (e.g., HORIBA U-10, U-22, YSI 6820)

Monitoring equipment supplies include the following:

- Distilled water
- Dry, clean paper towels
- Gloves
- Manufacturer’s guide for each meter used
- Calibration solutions/gases for specific instrument
- Containers of appropriate volume

3.0 PROCEDURES

3.1 Equipment Calibration

All instruments and equipment used are calibrated with and adjusted to operate within manufacturers' specifications and with a frequency stipulated by the maintenance schedule or by the analytical method. To determine if recalibration is necessary during the sampling event, a single point calibration check will be performed at the beginning of each day (i.e. the multiparameter meter will be placed in the standard solutions and a reading will be taken). If the calibration check shows unacceptable deviation from the standard the instrument will be recalibrated. Calibration checks may be performed at planned intervals, when sampling conditions change, when the sample matrix changes, and/or if the instrument readings are unstable. A final calibration check is conducted at the end of the day, after the last field sample has been collected. Special attention is paid to instruments that drift with a change in ambient temperature or humidity. If an instrument is found to be out of compliance during a calibration, it may be necessary to reanalyze all samples collected after the most recent successful calibration check. Auto-calibration solutions can be used for calibration checks at the beginning and end of each day, provided a two-point manual calibration is included at least once during each field mobilization to confirm that the auto-calibration is within specified limits.

3.2 Equipment Maintenance

All field monitoring equipment, field sampling equipment, and accessories are maintained in accordance with the manufacturer's recommendations and specifications and established field practice. All maintenance is performed by qualified project personnel and documented by a qualified URS representative.

Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation is repaired or removed from service and segregated. Malfunctions or equipment deficiencies are reported to the Field Team Leader immediately and the rental company or the equipment manufacturer is called for technical assistance. Before placing repaired equipment back into service, the repair and/or recalibration must be approved by the Field Team Leader or Site Health and Safety Officer.

A permanent record of maintenance events is kept for each piece of company-owned equipment, and a copy of this record is available for each piece of equipment. The Instrument Calibration Log is completed to report maintenance events and any equipment malfunctions.

Particulate matter (e.g., soil, dust) and liquid should be removed from all surfaces of the instrument after each use. If an instrument is equipped with a sampling pump, it may occasionally aspirate fluids. If this occurs, disassemble and clean the instrument according to the manufacturer's recommendations.

3.3 Equipment Operation

Equipment should only be used for applications consistent with the manufacturer's recommendations. If possible, the equipment is placed in a protective plastic bag during use. This reduces the chance of contamination and the need to decontaminate sensitive equipment. If equipment is contaminated during use, it is cleaned according to SOP 1.6.

Field equipment must be carefully handled and stored. Efforts must be made to protect sensitive components from moisture and damage (e.g., physical shock, extreme temperatures, drying out of the electrolyte). Equipment decontamination and maintenance are performed at the end of each day in preparation for the next day's sampling activities.

3.4 Shipping

Care must be taken to ensure that electronic field equipment and fragile supplies that must be shipped to and from the site are not damaged. Individual pieces of equipment may be packaged in separate containers filled with protective packaging material (e.g., foam pellets) or placed in the carrying case or protective packaging supplied by the manufacturer.

All equipment and hazardous materials (e.g., pressurized air tanks, calibration gases, decontamination solvents, preservatives) must be shipped in compliance with U.S. Department of Transportation (DOT) regulations as published in 49 CFR Parts 171, 172, and 173.

4.0 DOCUMENTATION

Each field activity is documented to facilitate a timely and accurate reconstruction of events in the field. All field equipment calibration, maintenance, and operation information is recorded daily in the field logbook to document that appropriate procedures have been followed and that the equipment is operating as intended. All entries in the field logbook must be printed in black ink and legible, following the guidelines presented in SOP 1.2.

Logbook entries for equipment calibration contain, but are not necessarily limited to, the following information:

- Equipment model
- Date and time of calibration or maintenance
- Name of person doing calibration or maintenance
- Type of equipment being serviced
- Reference standard used for calibration (e.g., pH of buffer solutions)
- Calibration and/or maintenance procedure used
- Any problems or other pertinent information

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 1.5
WATER QUALITY MONITORING EQUIPMENT

1.0 SUMMARY

This procedure describes the standard protocols for operating, calibrating, and maintaining equipment commonly used during water quality monitoring. This procedure also defines the documentation necessary when using this equipment.

2.0 EQUIPMENT

Water quality monitoring equipment includes:

- Water level indicator
- Multiparameter water quality meter with flow-through cell for pH, temperature, turbidity, Oxidation-Reduction Potential (ORP), dissolved oxygen, and conductivity (e.g., HORIBA U-10, U-22, YSI 6820)
- Field test kits (ferrous iron)

Additional items needed include:

- Distilled water
- Dry, clean paper towels
- Gloves
- Weatherproof, bound field logbook with numbered pages
- Manufacturer’s guide for each meter used
- pH paper
- Calibration solutions for specific instrument
- Beakers or cups of appropriate volume

3.0 PROCEDURES

3.1 Equipment Calibration

All water quality monitoring equipment will be calibrated with and adjusted to operate within manufacturers’ specifications. To determine if recalibration is necessary during the sampling event, a single point calibration check will be performed at the beginning of each day (i.e. the multiparameter meter will be placed in the standard solutions and a reading will be taken). If the calibration check shows unacceptable deviation from the standard the instrument will be recalibrated. Calibration checks may be performed at planned intervals, when sampling conditions change, when the sample matrix changes, and/or if the instrument readings are unstable. A final calibration check is conducted at the end of the day, after the last field sample has been collected. Special attention is paid to instruments that drift with a change in ambient temperature or humidity. Auto-calibration solutions can be used for calibration checks at the beginning and end of each day, provided a two-point manual calibration check is included at least once during each field mobilization to confirm that the auto-calibration is within specified limits.

If an instrument is found to be out of compliance during a calibration check, water quality instruments will be calibrated if necessary with standard solutions appropriate to the instrument and analytical methods (discussed in SOP 1.4). In such cases, it may be necessary to reanalyze all samples collected after the most recent successful calibration check.

Water quality monitoring equipment calibration is recorded in the field logbook to document that appropriate procedures have been followed and that the equipment is operating as intended.

3.2 Equipment Maintenance

All water quality monitoring equipment, water sampling equipment, and accessories will be maintained in accordance with the manufacturer’s recommendations and specifications and established field practice. All maintenance will be performed by qualified project personnel and will be documented by a qualified URS representative.

Water quality monitoring equipment must be carefully handled and stored. Efforts must be made to protect sensitive components from moisture and the elements and from damage (e.g., physical shock, extreme temperature, drying out of the electrolyte). Equipment decontamination and maintenance should be performed at the end of each day in preparation for the next day’s sampling activities.

Equipment that fails calibration and/or becomes otherwise inoperable during the field investigation is repaired or removed from service and segregated. Equipment that cannot be repaired is returned to the manufacturer or the rental vendor. Prior to placement of repaired equipment back into service, the repair and/or recalibration must be approved by the Field Team Leader or Site Health and Safety Officer.

3.1 Water Quality Measurements

Equipment should only be used for applications consistent with the manufacturer’s recommendations. A flow-through cell with the appropriate measuring probes inserted at the proper depth should be used to measure the below listed parameters. The below listed water quality parameters should be recorded on the appropriate the field log form (i.e. Groundwater Sampling Field Form). Continue monitoring water quality parameters until they meet the stabilization criteria listed below (information on groundwater sample collection is available in SOP 4.2).

The following list provides guidelines for water quality equilibration (the below listed order is the preferred order of stabilization for these parameters):

pH	± 0.1 pH units
Conductivity	± 3 %
ORP	± 10 mV
Turbidity	± 10 % (if above 5 NTU)
Dissolved oxygen	greater of ± 10% or ± 0.2 mg/L
Temperature	± 1 degree Celsius

4.0 FIELD TESTING FOR FERROUS IRON

Ferrous iron (Fe^{+2}) will be measured in the field by Hach Method #8146 according to the following procedure:

1. Fill a 25 mL vial with sample water.
2. Add one ferrous iron reagent powder pillow (containing 1,10-phenanthroline and sodium bicarbonate); shake vigorously.
3. Pour a portion of the mixture into a 5 mL plastic vial.
4. Fill a second 5 mL plastic vial with laboratory-supplied deionized (DI) water.
5. Place both 5 mL vials into color-comparator. Lift toward light source and rotate color disc until color matches and read mg/L in scale window. If ferrous iron is present the sample, the mixture will turn a reddish-pink color.
6. Record mg/L ferrous iron concentration.
7. Clean vials between samples by rinsing with laboratory-supplied DI water.

5.0 DOCUMENTATION

Each field activity is documented to facilitate a timely and accurate reconstruction of events in the field. All field equipment calibration, maintenance, and operation information is recorded daily in the field logbook (SOP 1.2) to document that appropriate procedures have been followed and that the equipment is operating as intended. Calibration and maintenance activities are also recorded on the Instrument Calibration Log. All entries in the field logbook or on field forms must be printed in black ink and legible.

Logbook entries contain, but are not necessarily limited to, the following information:

- Equipment model and serial number

- Date and time of calibration or maintenance
- Name of person doing calibration or maintenance
- Type of equipment being serviced
- Reference standard used for calibration (e.g., pH of buffer solutions).
- Reference standard lot number if available
- Calibration and/or maintenance procedure used
- Any problems or other pertinent information

In addition to calibration and maintenance documentation, each reading taken for a particular sample will be recorded in the field logbook and the applicable sample log. Entries include, but are not limited to, the following:

- Model and serial number of equipment used to take reading
- Date, time, and location of reading
- Field parameter (e.g., temperature, pH)
- Value of reading with units
- Any problems or other pertinent information

6.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 1.6
EQUIPMENT DECONTAMINATION

1.0 SUMMARY

This procedure describes the techniques used to decontaminate equipment prior to collecting samples or taking measurements. Proper decontamination ensures that cross-contamination (of both equipment and sample) and off-site contaminant migration do not occur.

2.0 EQUIPMENT

- Four 3-gal plastic tubs - soil sampling tools only
- Three PVC tubes (in 5-gallon buckets) - groundwater pump only
- 5-gal plastic container, potable tap water
- 5-gal carboy laboratory-grade distilled/deionized (DS/DI) water (organic/analyte-free)
- Alconox® (or equivalent)
- Pesticide-grade methanol
- Hard-bristle brushes
- Plastic sheeting or garbage bags
- Personal protective equipment as specified in the Site Safety and Health Plan (SSHP)
- 55-gal drum(s)
- Drum labels

3.0 PROCEDURE

The following decontamination procedures apply to non-dedicated sampling equipment and field measurement equipment.

3.1 Field Equipment Decontamination

The specific procedures for decontaminating sampling equipment include the following:

1. Immediately after sampling, brush each piece of sampling equipment with either a bristle brush or steel wire brush to remove particulate contamination.
2. Soap wash (dilute solution of a detergent such as Alconox® in potable water solution). Only a small volume (0.5 teaspoon) of Alconox® is necessary, and all Alconox® crystals should be completely dissolved (Station No. 1).
3. Potable or DS/DI water rinse (Station No. 2).
4. Rinse with 10% methanol (Station No.3).
5. Rinse with DS/DI water (Station No.4).
6. Remove the equipment from the decontamination area and cover with plastic.

When pumps are submerged below the water surface to collect water samples, they should be both cleaned and flushed in the same step process. The procedure should be repeated after sampling from each monitoring well location. The pump and hose should always be placed on clean polyethylene sheeting or in a plastic bag to avoid contact with the ground surface.

After decontaminating all the sampling equipment, the disposable gloves, and used plastic will be placed in garbage bags and disposed of. The wash and rinse water will be containerized for proper disposal. At the end of each day, all sampling equipment will be stored in large plastic bags.

For equipment heavily contaminated with metals, rinse with dilute nitric acid followed by a thorough rinse with deionized water.

3.2 Field Measurement Equipment Decontamination

Decontaminate field measurement equipment such as pH and conductivity meters by double rinsing with distilled water only and blotting dry.

3.3 Equipment Rinsate Collection

Collect equipment rinsate samples according to the specifications in the quality assurance project plan (QAPP). Collect rinsate water only following the final decontamination rinse of the sampling equipment (such as a bailer, sampling pump, or mixing bowl). For organics analysis, pour manufacturer-certified organic-free water over the equipment and dispense the water into sample containers. For low-level metals analyses, use water that is certified by the manufacturer to be low in metals. Collect sample volumes for each type of analysis to be conducted by the laboratory. Collect, label, handle and analyze equipment decontamination rinsates in the same manner as all other environmental samples.

4.0 DOCUMENTATION

In the field logbook record:

- Decontamination procedures
- Equipment that must be decontaminated

This information may be listed once for a sampling event if the procedures and equipment remain constant.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 1.7
FIELD AND LABORATORY QUALITY CONTROL SAMPLE COLLECTION

1.0 PURPOSE

The purpose of this procedure is to define the field quality control (QC) and laboratory QC samples that will be employed to evaluate data quality. Quality control samples are controlled samples introduced into the analysis stream, whose results are used to review data quality and to calculate the accuracy and precision of the chemical analysis program. The purpose of each type of QC sample collection and typical analysis frequency is described in this procedure. Collection and analysis frequency for quality control samples is summarized in the quality assurance project plan (QAPP).

2.0 EQUIPMENT

The equipment required for the collection of QC samples is identical to the equipment required for the collection of environmental samples.

- Laboratory issued trip blanks
- Multiple glass liter bottles containing laboratory issued water

3.0 PROCEDURES

3.1 Field Quality Control Samples

The types of QC samples that are sent to the laboratory from the field are field blanks, trip blanks, rinsate (equipment) blanks, field replicates, standard reference samples, and temperature blanks.

3.1.1 Field Blanks

Field blanks are used to determine if contamination is introduced into samples by general field procedures. Field blanks are prepared on site during the sampling event by pouring laboratory issued water into randomly selected sample containers. Typically, at least one field blank is analyzed for each group of 20 samples of a similar matrix type and concentration.

3.1.2 Trip Blanks

Trip blanks are used to assess contamination introduced into the sample containers by the diffusion of volatile organic compounds (VOCs) during sample transport and storage. One trip blank is prepared off site (preferably at the contracted analytical laboratory) and included in each shipping container with samples scheduled for analysis of VOCs, regardless of the environmental medium. When sample bottles are provided by the laboratory, trip blanks are prepared at the laboratory, transported to the sampling site with the other sample containers, and returned to the testing laboratory for analysis, along with the samples collected during the sampling event. The trip blanks remain unopened throughout the transportation and storage processes and are analyzed along with the associated environmental samples. Trip blanks are analyzed and reported as water samples, even though the associated environmental samples may be from a matrix such as soil, tissue, or product.

3.1.3 Rinsate Blanks

Rinsate blanks (equipment decontamination rinsates) are used to assess the adequacy of the practices for preventing cross-contamination between sampling locations and samples. Rinsate blanks are collected daily for sampling equipment used repetitively to collect environmental samples and not for dedicated sampling equipment or drilling equipment. Rinsate blanks for soil, sediment, groundwater, seep, and surface water samples are collected by passing laboratory issued water over all sampling equipment (such as a bailer, sampling pump, or mixing bowl) following the final decontamination rinse and collecting the water into the sample containers specified for each analysis. Typically, at least 1 rinsate blank is analyzed for each group of 20 samples of a similar matrix type and concentration. Rinsate blanks are preserved, handled, and analyzed in the same manner as all environmental samples.

Equipment blanks for soil gas sampling are analogous to the rinsate blanks described above, except that the blank sample is collected by passing laboratory-supplied nitrogen gas through the sampling apparatus and collecting it in an empty Suma canister. The equipment blank sample is handled and analyzed in the same manner as the soil gas samples.

3.1.4 Field Duplicates

Field duplicates (or replicates) are collected at selected locations to provide estimates of the total sampling and analytical precision. Typically, at least 1 duplicate sample is analyzed from each group of 20 samples of a similar matrix type and concentration. Field duplicate samples should generally be collected from areas most likely to be contaminated and are preserved, handled, and analyzed in the same manner as all environmental samples. Field duplicates have the same location identification, sampling time, and depth interval as the associated environmental sample, but are assigned a unique sample number that is indistinguishable from the associated environmental sample number. Field duplicates are submitted blind to the laboratory.

3.1.5 Standard Reference Samples

Standard reference samples are used to assess the accuracy of the analytical methods specified and to assess the performance of the laboratory sample analysis. Standard reference samples are used when required by project data quality objectives or by client request. Standard reference samples are used when required by project data quality objectives or by client request. These samples are prepared with a known composition and analyte concentration by an independent laboratory and are submitted to the analytical laboratory as unknown samples ("blind" or "double-blind"). The reference samples contain specific analytes at concentrations that are anticipated in the various environmental media and are analyzed in the same manner as all environmental samples.

3.1.6 Temperature Blanks

Temperature blanks are used to measure cooler temperatures upon receipt of the coolers at the laboratory. One temperature blank will be prepared and submitted to the project laboratory with each cooler. The temperature blank will consist of a sample jar containing water, which will be packed in the cooler in the same manner as the rest of the samples and labeled "temperature blank."

3.2 Laboratory Quality Control Samples

The analytical laboratory uses a series of QC samples specified in each standard analytical method and laboratory SOP to assess laboratory performance. Analyses of laboratory QC samples are performed for samples of similar matrix type and concentration and for each sample batch. The types of laboratory QC samples are matrix spike/matrix spike duplicates, laboratory control samples, laboratory duplicates, method blanks, and surrogate spikes. In addition, there may be other project-specific technical QC requirements.

3.2.1 Matrix Spike/Matrix Spike Duplicate

Matrix spike/matrix spike duplicates (MS/MSDs) are used to assess sample matrix interferences and analytical errors, as well as to measure the accuracy and precision of the analysis. For MS or MSD samples, known concentrations of analytes are added to the environmental samples; the samples are then processed through the entire analytical procedure and the recovery of the analytes is calculated. Results are expressed as percent recovery of the known spiked amount for MSs and the relative percent difference (RPD) for MS/MSDs. The MS/MSDs will be collected and analyzed at a rate of 5 percent of the field samples for each matrix and analytical method or at least one for each analytical batch, whichever frequency is greater.

Generally, a single sampling location is used to collect field QC samples; however, it may not be possible to collect MS/MSD samples for all analyses at the same sampling location because of a limited volume of available material. In those instances, MS/MSD samples designated for various analyses will be collected from different locations (for example a MS/MSD for metals is collected at location X and an MS/MSD for PCBs is collected at location Y). Additionally, samples designated for MS/MSD analyses will not be collected from locations with potentially high concentrations of target analytes that may mask the added spike compounds. MS/MSD samples have the same location identification, sampling time, depth interval, and sample number as the associated environmental sample.

3.2.2 Laboratory Control Samples

Laboratory control samples (LCSs) are used to monitor the laboratory's day-to-day performance of routine analytical methods, independent of matrix effects. The LCSs are prepared by spiking reagent water with standard solutions prepared independently of the standard solutions used in establishing instrument calibration. The LCSs are extracted and analyzed with each batch of samples. Results are compared on a per-batch basis and used to evaluate laboratory performance for accuracy. LCSs may also be used to identify any background contamination of the analytical system that may lead to the reporting of elevated concentrations or false-positive measurements.

3.2.3 Laboratory Duplicates

Laboratory duplicates are used to determine the precision of the analytical system. Laboratory duplicates are two portions of a single homogeneous sample analyzed for the same parameter. Laboratory duplicates are prepared and analyzed with each analytical batch of project samples that do not require MSDs (normally metals and conventionals analyses). Metals and other inorganic analyses typically require an MS sample and a laboratory duplicate sample.

3.2.4 Method Blanks

Method blanks are used to check for laboratory contamination and instrument bias. Laboratory method blanks are typically analyzed at a minimum frequency of 5 percent or one per analytical batch for all chemical parameter groups. Blank samples are analyzed for the same parameters as the associated field samples. Concentrations of analytes detected in the method blanks are not subtracted from the concentrations detected in the samples.

3.2.5 Surrogate Spikes

Surrogate spikes are used to evaluate the accuracy of an analytical measurement. Surrogate compounds are compounds that are not expected to be found in environmental samples; however, they are chemically similar to several compounds analyzed by the methods and behave similarly in extracting solvents. Samples are spiked with surrogate compounds consistent with the requirements described in the analytical methods and in the laboratory SOPs. Because sample characteristics affect the percent recovery of the surrogate compounds, the percent recovery is a measure of the accuracy of the overall analytical method on each individual sample.

4.0 DOCUMENTATION

The collection of quality control samples is documented in the field logbook.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 1.8
INVESTIGATION-DERIVED WASTE CONTAINERIZATION

1.0 SUMMARY

This standard operating procedure (SOP) provides guidelines for containerizing investigation-derived waste (IDW) materials. This SOP is provided so that field personnel are aware of the issues surrounding the handling of IDW in the field. However, all IDW generated at Bradford Island will be transferred to the US Army Corps of Engineers (USACE) for handling, management, and disposal. USACE Bonnille Dam procedures take precedence in the event that there are inconsistancies between those proceedures and this SOP. Mr. Carlton Morris is the Bonneville Dam Project Environmental Compliance Coordinator (ECC) and is responsible for the characterization and disposal of IDW. Mr. Morris will be contacted prior to commencing fieldwork where IDW is expected to be generated.

Investigation-derived wastes are considered to be any byproduct of the field investigation that is suspected of being contaminated with hazardous substances, including but not limited to drill cuttings, purge water, decontamination fluids, and disposable equipment and clothing. Procedures for documenting the contents of each drum and proper labeling techniques are presented. These procedures are necessary to ensure proper handling and identification of drummed materials remaining at sites following field investigations.

2.0 EQUIPMENT

- Bound and paginated weatherproof field logbook/indelible pens
- Permanent marking pens and labels for storage drums
- Storage drums

3.0 PROCEDURES

Under no circumstances mix or store two or more matrices in a single container or stockpile. (The only exception to this is mixing rubbish with discarded personal protective equipment [PPE].)

Use indelible pens to label IDW drums using IDW labels (Exhibit 1 or similar). Label each drum as soon as it is put into service. Indelible paint pens may be used in lieu of the IDW label, but all information that would be included on an IDW label must be included on the IDW drum. Store drums in a secured area before, during, and after use. Maintain an inventory of all drums and drum contents for a given site. If soil cuttings from borings are stockpiled, ensure that all stockpiles are properly constructed and covered, and that each stockpile location is clearly recorded in the field logbook.

Complete a label for each drum and an inventory of all drums. Field staff will, in completing Exhibit 1, describe the known contents of each container. If specific contaminants are known, each will be listed under "Container Contents." An inventory of the IDW will be prepared, listing the information from each IDW label on the inventory form shown in Exhibit 2.

Following completion of fieldwork and receipt of analytical results, a report detailing the contaminant levels for the contents of each applicable container will be issued to the client contact identified on the container.

All entries in the field logbook must be printed in black ink and legible.

3.1 Types of IDW

Typical types of IDW include, but are not limited to, the following:

- Soil cuttings, drill mud and well development waters from soil borings and the installation of monitoring wells
- Purge water removed from wells before groundwater samples are collected
- Water, solvents, or other fluids used to decontaminate field equipment and PPE
- PPE and disposable equipment

3.2 Identification, Characterization and Disposal of Investigation Derived Wastes

All IDW generated at Bradford Island will be transferred to the US Army Corps of Engineers (USACE) for handling, management, and disposal.

4. 0 REFERENCES

USACE 2008. Bonneville Lock and Dam Project Safety Plan: Section K, Hazardous Waste Handling and Disposal Policy. US Army Corps of Engineers, Portland District, May 2008.

5.0 ATTACHMENTS

None

4.0 EXHIBITS

Exhibit 1	Investigation-Derived Waste Label
Exhibit 2	Investigation-Derived Waste Inventory

Exhibit 1
Investigation-Derived Waste Label

Site Name	**URS**	Drum I.D. Date Containerized
Field Staff	Project No.	Site No.

Location I.D.s ____

____

Sample Nos. ____

____

Container Contents ____

____

Client Contact	Phone

Exhibit 2
Investigation-Derived Waste Inventory

Investigation- Derived Waste Inventory				Page of
Site Name		Project No.		Site No.
Field Staff				
Date	**Container No.**	**Location I.D.**	**Sample Nos.**	**Contents**
Client Contact			Phone No.	

STANDARD OPERATING PROCEDURE 2.1
BOREHOLE LOGGING AND SAMPLING

1.0 SUMMARY

This procedure describes the methods for geological borehole logging. The boring log is the basic record for subsurface drilling activities. It is important that a detailed record of all aspects of subsurface exploration be maintained.

2.0 PROCEDURE

2.1 Introduction

A major portion of the work produced at an environmental site is concerned with characterizing the physical subsurface and the geologic and hydrologic processes operating at the site. A properly prepared borehole log serves as an essential tool in making these assessments and correlations. This standard operating procedure (SOP) defines the methodology of collecting pertinent data so that all borehole logs made at a site can create a consistent, uniform database from which interpretive conclusions can be made with confidence. Large-scale inferences such as vertical and horizontal extent of strata, facies changes, attitude of bedding or layering, structural features (faults, folds, fractures, dikes, etc.), location of the water table, lithologic characterizations, and the extent of subsurface contamination are made from small-scale observations recorded on the borehole log. These observations include bedding, grain size, degree of sorting, shape of grains, color, hardness, organic vapor levels, and other observable physical characteristics including visible evidence of contamination.

Logging should document both general and specific lithologic information about the borehole. In all cases, the lithologic log should be identified by the specific site number, well/boring number, drilling method, location, date of drilling, individual logger (geologist), drilling contractor, significant organic vapor reading, visible evidence of contamination, depth to water first encountered, final depth of water level, well/boring elevation (if data are available), total depth in feet, graphic log, and lithologic description. An example of a completed borehole log is provided as Exhibit 1.

Lithologic descriptions will be made using the Unified Soil Classification System (USCS), according to ASTM Methods D2487 and D4288.

Lithologic descriptions of unconsolidated material should contain the following characteristics when possible:

- Soil or formation name

- Gradation (degree of sorting)
- Principal constituent
- Specific descriptors for principal constituents (e.g., plasticity, grain size, and shape)
- Firmness/hardness
- Minor constituents
- Moisture content
- Color
- Particle morphology
- Other descriptors (e.g., visible evidence of contamination, specific on-site monitoring equipment readings)
- Particle size distribution

2.2 Classification System

The following sections describe in detail the parameters and descriptive terminology that should be used to classify each sample for the borehole log.

2.2.1 Soil or Formation Name

The soil or formation name will include the major constituent(s) and may be preceded by a single-word modifier indicating the subordinate constituent. Percentages of each constituent should be used to classify the material without actually recording constituent percentage.

2.2.2 Gradation (Degree of Sorting)

Size sorting describes the extent to which grain size is uniform. The comparison chart listed in Exhibit 1, Comparison Chart for Estimating Degree of Sorting, should be used to describe soils being logged from a borehole.

2.2.3 Principal Constituent

Principal constituents recorded during borehole logging include an identification of the following unconsolidated material types:

- Clay
- Sand
- Cobbles

- Silt
- Gravel
- Boulders

If known, an identification of the potential source of the material should be made (e.g., alluvium, colluvium, artificial fill, or residual material).

2.2.4 Principal Constituent Descriptors

Additional descriptors for the principal material constituents may be added to the log to further delineate or accurately record subtle changes in the lithologic structure. Modifiers such as grain size, shape, and plasticity of materials (e.g., high, medium, and low plasticity) may also be added.

2.2.5 Consistency/Density/Rock Hardness

The characteristics of unconsolidated material may be determined by the Standard Penetration Test (SPT) in accordance will ASTM Method D1586-99. The SPT involves driving a split-spoon sampler into the material by dropping a 140–pound weight from a height of 30 inches. The resistance of the material is reported in the number of blows of the weight required to drive the spoon 1 foot and translates into the descriptors listed in Table 1. The results of such SPT tests should be recorded in the field notes and/or boring log.

Table 1

Determination of Characteristics of Unconsolidated Material

Number of Blows/Foot	Description of CohesiveConsistency or Hardness
Clay	
0-2	Very soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very stiff
30+	Hard

Number of Blows/Foot	Description of CohesiveConsistency or Hardness
Gravel	
0-4	Very loose
4-10	Loose
10-30	Medium dense
30-50	Dense
50+	Very dense
Rock	
<20	Weathered
20-30	Firm
30-50	Medium hard
50-80	Hard
80+	Very hard

Source: ASTM D1586-99

2.2.6 Minor Constituents

Constituents not previously described in the principal constituent description may be described as a percentage or by weight. Typically, modifiers for minor constituents conform to the following standards:

- Use no modifier when the constituent is less than 5 percent.
- Use *slightly* when the constituent is 5 to 12 percent.
- Use *moderately* (and add *y* or *ey* [e.g., *moderately* silty clay]) when the constituent is 13 to 40 percent.
- Use *very* when the constituent is 41 to 50 percent.

2.2.7 Moisture Content

A wide range of terms (from *dry* to *saturated)* are used to describe the relative moisture content of a field soil sample. These terms are described as follows:

- Dry – The sample is completely without moisture. Dry, silty sands, for example, will produce suspended particles when dropped by hand.

- Damp – The sample contains a very slight amount of water.

- Moist – Soils in this range are near the maximum water content for their maximum compactibility or density. Moist soils will form a ball when compressed in the hand.

- Wet – Soil samples are wet enough to produce free water upon shaking but still contain unoccupied air voids. Fine-grained soils close to the liquid limit would be termed wet.

- Saturated – Soils have zero air voids. Samples placed in sample jars or bags will probably have standing water after a short period of time.

2.2.8 Color

The color of soil and associated materials should be recorded on the borehole log. Color descriptors should include but are not limited to the following: black, gray-black, brown, olive, mottled, streaked, etc. Color charts should be used to provide general logging guidance but specific use is not necessary for adequately described lithology.

2.2.9 Particle Morphology

The key elements of particle morphology are roundness and sphericity. Roundness is a measure of the curvature of grain corners. Sphericity is a measure of how equal the three axial lengths (x, y, z) of an object are. Determination of both properties is facilitated by the use of a hand lens. Grain roundness and sphericity should be estimated by using the Comparison Chart for Estimating Roundness and Sphericity, Exhibit 2.

2.2.10 Other Descriptors

Field-screening data collected during the drilling process may help further characterize site conditions during subsurface investigations. Readings from on-site monitoring equipment such as photoionization detectors, organic vapor analyzers, and oxygen/explosimeters should be recorded at each sample interval. Other useful information includes the organic content and the presence or absence of waste material in samples.

2.2.11 Particle Size Distribution

An estimate of particle sorting by grain size is often useful for borehole logging purposes. Precise estimates of percent composition of the sample are not necessary. Exhibit 3,Comparison Chart for Estimating Percentage Composition, can be used to estimate the percentage of various grain sizes present in a sample. However, visual estimates usually provide sufficient information for characterizing site lithology.

2.3 Borehole Logs

Field staff should record data collected during exploratory soil boring and subsurface sampling operations in the field logbook and on a borehole log form.

Geological correlation and aquifer properties prediction are dependent on good descriptions of exploratory boring samples. Rotary drilling with fluids is generally unacceptable since the drilling fluids may potentially contaminate the aquifer under investigation. High-quality borehole data are generally acquired with a split-spoon or pitcher core barrel. This method of sampling provides detailed logging. The lithofacies interpreted from cuttings logs may lack the accuracy necessary for detailed correlation. Where possible, techniques such as geophysical borehole logging can be used to supplement cuttings descriptions. Field staff should note on the log any geologic description determined from borehole cuttings.

In bedrock formations, cuttings may be acquired from a reverse circulation, air rotary boring or from a dual-wall rotary boring. These cuttings do not provide information on the *in situ* properties of the materials, but do provide adequate sample description information.

In summary, close sample spacing or continuous sampling in a boring provides the best material for descriptive geology. Field staff should use traditional geological terminology and supplement with the USCS descriptive system when appropriate. Staff should provide sufficient data on layering and other sedimentary structures and undisturbed textures. Sample numbers, depths, and analytes should be included in each description.

2.4 Review

Field staff conducting borehole logging of soil should record field data on a borehole log, and record a chronological summary in the field logbook. The applicable methods outlined in this procedure shall be used to record the data on this log. The personnel conducting these operations will sign and date the “logged by” and “date” blanks on the borehole log form.

The Site Manager or designee should check all field-generated data and the borehole log for completeness and accuracy. Any discrepancies should be noted and the logs returned to the originator for correction. The reviewer should acknowledge that corrections have been incorporated by signing and dating the “reviewed by” and “date” blanks on the borehole log.

3.0 REFERENCES

American Geological Institute (AGI). 1982. *AGI Data Sheets.* Falls Church, Virginia.

American Society for Testing and Materials (ASTM). 1999. *D1586-99 Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.*

ASTM Method D2487. *Standard Recommended Practice for Classification of Soils for Engineering Purposes.*

ASTM Method D2488. *Standard Recommended Practice for Description of Soils (Visual-Manual Procedure).*

Compton, R.R. 1962. *Manual of Field Geology*. John Wiley and Sons, Inc., New York, New York.

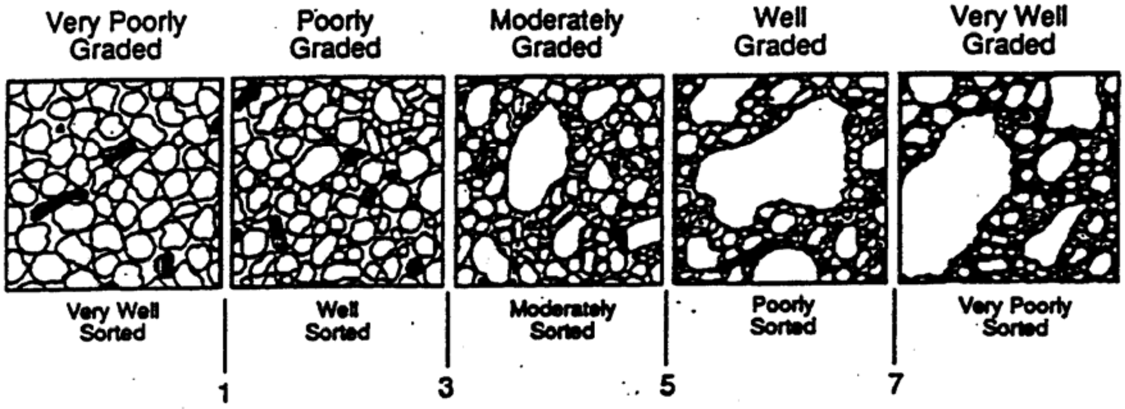
4.0 ATTACHMENTS

Exhibit 1 Comparison Chart for Estimating Degree of Sorting

Exhibit 2 Comparison Chart for Estimating Roundness and Sphericity

Exhibit 3 Comparison Chart for Estimating Percentage Composition

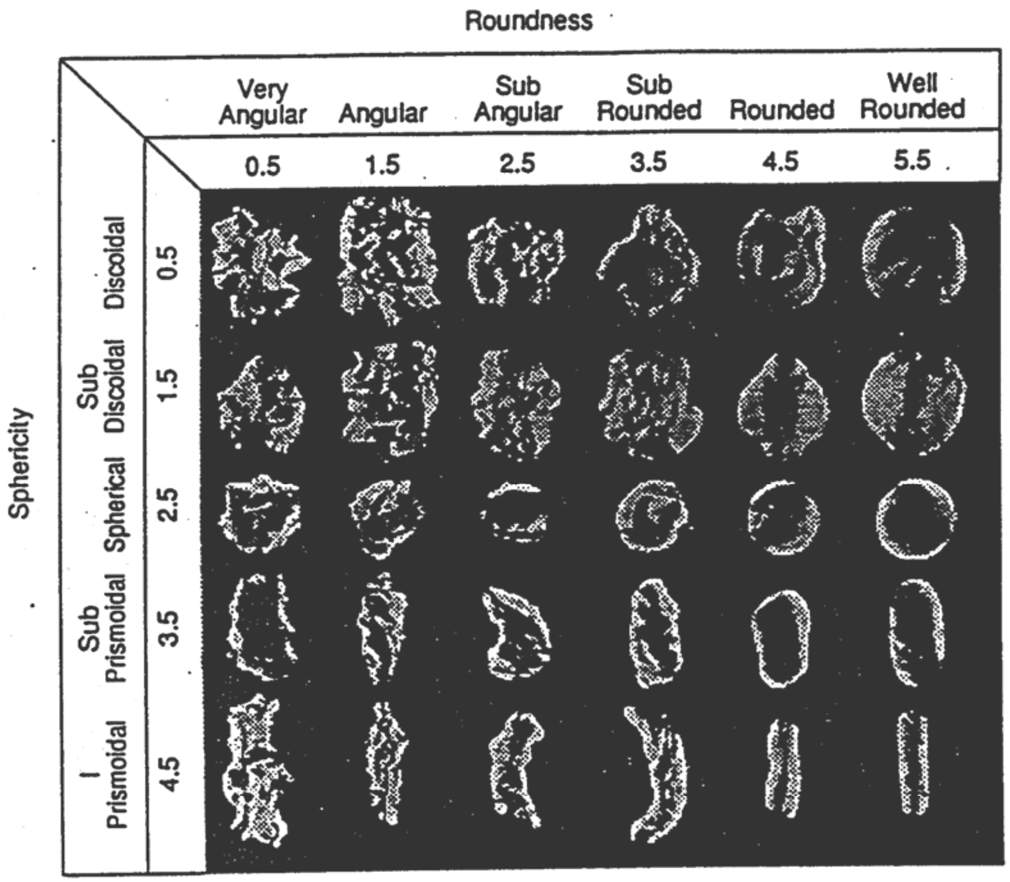
Exhibit 1
Comparison Chart for Estimating Degree of Sorting



Terms for degrees of sorting. The numbers indicate the number of size-classes included by the bulk (80 percent) of the material. The drawings represent sandstones as seen with a hand lens. Silt and clay-size materials are shown diagrammatically by the fine stipple.

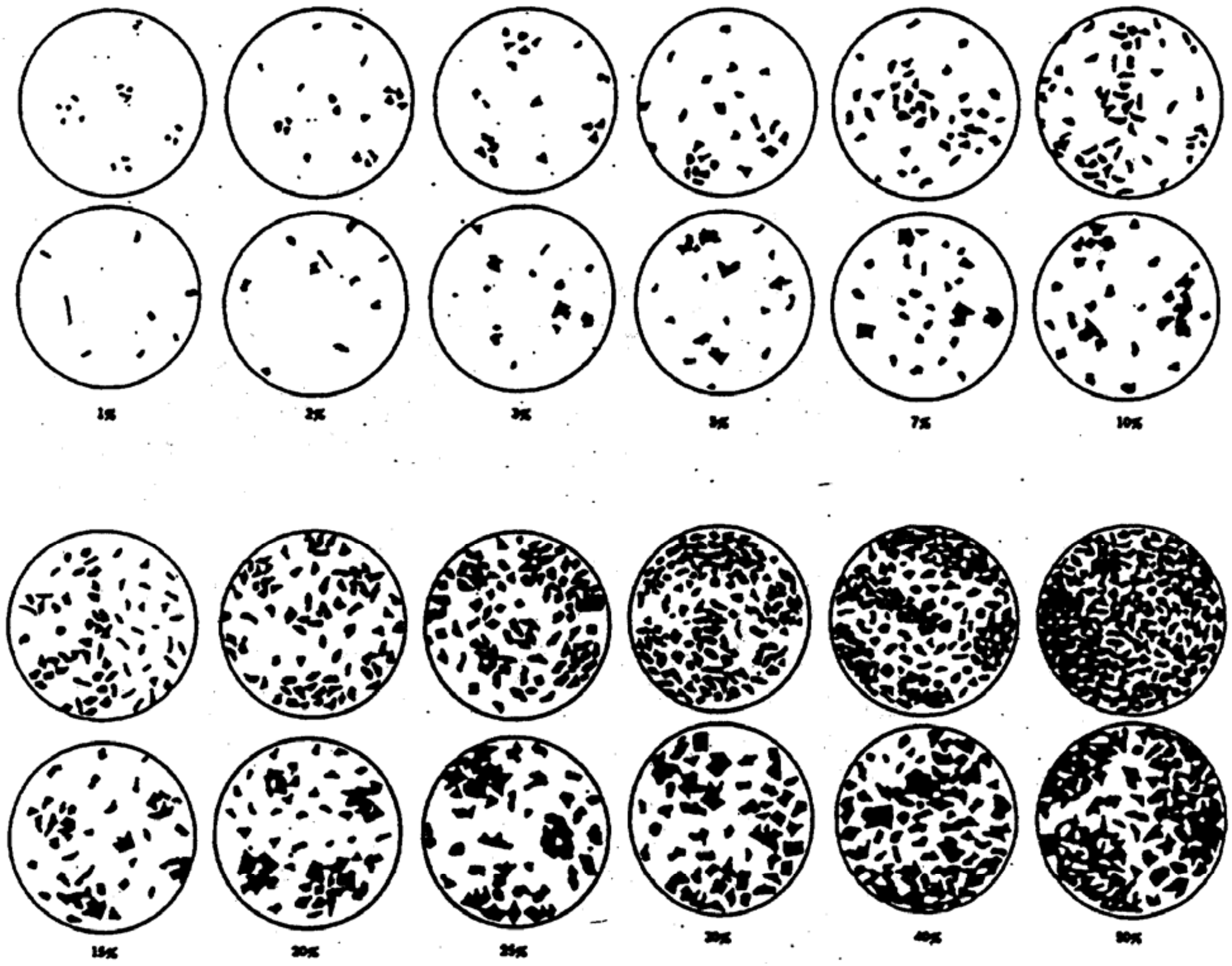
Reference: Compton, R.R. 1962. *Manual of Geology.* John Wiley & Sons, Inc. New York, N p. 214

Exhibit 2
Comparison Chart for Estimating Roundness and Sphericity



Reference:American Geological Institute. 1982. "AGI Data Sheet 18.1" in *AGI Data Sheets*. Fall Church, VA

Exhibit 3
Comparison Chart for Estimating Percentage Composition



Reference: Compton, R.R. 1962. *Manual of Geology*. John Wiley & Sons, Inc. New York, NY p. 332-333

STANDARD OPERATING PROCEDURE 2.2
BOREHOLE ABANDONMENT

1.0 SUMMARY

This procedure describes the protocol for borehole abandonment. The procedure provides descriptions of equipment, field procedures, and documentation necessary to properly abandon a borehole.

The primary objective of borehole abandonment is to ensure that the abandoned boring does not provide a conduit for the vertical migration of contamination to greater depths.

The term "borings" as used in this procedure applies to any hole made during the course of an investigation that is not completed as a well. This includes soil test borings, Geoprobe® borings, soil sampling borings, and deep stratigraphic borings. Whether completed to the planned depth or aborted for any reason prior to reaching that depth, borings will be grouted and will normally be closed within 4 hours or at completion of logging.

Field staff should obtain the proper permits and follow all applicable regulations.

2.0 EQUIPMENT

Equipment and materials used during borehole abandonment may include:

- Drill rig
- Wheelbarrow or drum
- Filter pack material
- Bentonite pellets (seal) or chips
- Portland cement, Type II
- Water from an approved source
- Weighted tape measure
- Tremie pipe (small-diameter, rigid PVC pipe)
- Weatherproof bound field logbook with numbered pages
- Indelible/permanent marking pens
- Appropriate health and safety equipment as required by the Site Safety and Health Plan (SSHP)

- Appropriate equipment for managing investigation-derived waste

3.0 PROCEDURES

The procedures used in boring abandonment should ideally accomplish two objectives: (1) protect aquifers from cross-contamination by sealing the borehole, and (2) restore the strata in the borehole to nearly original conditions by selective placement of fill material.

Field staff are required to be familiar with applicable state regulations concerning borehole abandonment. The work plan should be consulted for project-specific requirements. The following sections discuss various types of abandonment procedures.

3.1 Closing Boreholes

The following procedures should be used for the closure of boreholes:

1. Pull, drill out, or thoroughly pierce any temporary casing.
2. Dry, poured bentonite chips (greater than ¼ inch) maybe used to seal the boring if the depth to the bottom of the required seal is less than 50 feet, and the standing water column is less than 25 feet deep at the time of placement. A sounding or tamping tool shall be used during pouring to measure fill rate and break up possible bridges or cake formation. The bentonite chips shall be hydrated with potable water in two foot lifts to ensure activation.
3. Include all boring logs, samples, completion records, and abandonment procedures in the records of work on the site.

3.2 Shallow Borings NOT Penetrating Water Table

Shallow borings made for the collection of subsurface soil samples should be abandoned by backfilling the hole with cuttings from the hole, if and only if the boring does not penetrate the water table. Clean sand should be used to make up any volume not filled by the cuttings.

4.0 DOCUMENTATION

The following information should be logged in the field logbook:

General

- Date
- Time

- Boring location
- Personnel/subcontractor on site
- Visitors

Specific to abandonment

- Start/end times
- Depth of boring
- Materials used to seal each stratum
- Detailed description of procedure
- Date/time of return visit(s)
- Activities performed on return visit(s)

All entries in the field logbook must be legibly printed in indelible ink.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 2.3
MONITORING WELL AND PIEZOMETER INSTALLATION

1.0 SUMMARY

This procedure establishes the protocols and necessary equipment for installation of groundwater monitoring wells and piezometers. A piezometer is simply a small-diameter monitoring well. Therefore, the equipment and procedures for building a piezometer are the same as those used to install any monitoring well. The step-by-step procedures described herein are sufficiently detailed to allow field personnel to properly install any size monitoring well.

2.0 EQUIPMENT

This section details the required equipment for the drilling and installation of groundwater monitoring wells.

The following is an equipment list for well drilling and installation:

- Drill rig capable of installing wells to the desired depth in the expected formation materials and conditions
- Well casing and well screen
- Bentonite pellets
- Filter pack sand
- Portland Type I or II cement and powdered bentonite for grouting (or bentonite chips)
- Protective well casing with locking cap
- High-pressure steamer/cleaner
- Long-handled bristle brushes
- Wash/rinse tubs
- Appropriate decontamination supplies as specified in the SOP for decontamination procedures
- Location map
- Plastic bags (resealable)
- Self-adhesive labels
- Weighted tape measure

- Water level probe
- Deionized water
- Appropriate health and safety equipment as specified in the site safety and health plan (SSHP)
- Logbook
- Boring log sheets
- Well construction form
- Plastic sheeting
- Drums for containment of cuttings and decontamination and/or development water (if necessary)

3.0 PROCEDURES

3.1 Decontamination

Before drilling or well installation begins, all drilling and well installation material should be decontaminated according to the protocols in the SOP for decontamination procedures. Drilling equipment should be decontaminated between well locations.

3.2 Instrument Calibration

Before going into the field, the sampler should verify that field instruments are operating properly. Calibration times and readings should be recorded in a notebook to be kept by the field sampler. Specific instructions for calibrating the instruments are provided in the respective SOPs.

3.3 Drilling and Well Installation Procedures

3.3.1 Drilling Technique

If soil sampling is required, all soil samples should be collected according to the subsurface soil sampling procedures. The hole should be logged according to the methods specified in the SOP for borehole logging and sampling.

Boreholes should be advanced via conventional continuous-flight hollow-stem auger, water rotary, mud rotary, or sonic drilling methods and a drill rig capable of completing the monitoring well(s) to the depth(s) specified in the project plans. Before drilling begins, well locations should be numbered and staked. The necessary permits and utility clearances should be obtained in accordance with permits and utility clearance procedures. Appropriate health and safety measures should be followed during drilling and well installation activities as specified in the SSHP.

During the drilling operation, the cuttings from the boring should be placed on the ground, on plastic sheeting, or into 55-gallon drums as specified in the project plans. Disposal of cuttings should be in accordance with the project plans and the SOP for investigation-derived waste (IDW) management procedures.

3.3.2 Monitoring Well Drilling Operations

The procedure for drilling is as follows:

- Set up drilling rig at staked and cleared borehole location.
- Record location, date, time, and other pertinent information in the field logbook.
- Drill hole of appropriate size diameter.
- Collect split-spoon samples at the predetermined intervals, if appropriate, for sample description and/or chemical analysis as specified in the project plans. See borehole logging SOP for instruction.
- Complete the borehole to the depth specified in the project plans.

3.3.3 Well Design Specifications

The general specifications for wells are as follows:

Boring Diameter. The boring should be of sufficient diameter to permit at least 2 inches of annular space between the boring wall and all sides of the centered riser and screen. The boring diameter should be of sufficient size to allow for the accurate placement of the screen, riser, filter pack, seal, and grout.

Well Casing. The well riser should consist of new flush-threaded, PVC or stainless steel. The well diameter and thickness should be specified in the project plans. The risers should extend approximately 2 feet above the ground surface, except in the case of flush-mount surface casings. The tops of all well casings should be fitted with undersized PVC plugs, oversized PVC caps, or locking caps.

Well Screens. The screen length for each well should be specified in the project plans. Well screens should consist of new threaded pipe with factory-machine slots or wrapped screen with an inside diameter equal to or greater than that of the well casing. The slot size should be indicated in the project plans and designed to be compatible with aquifer and sand pack material. The schedule thickness of PVC screen should be the same as that of the well casing.

All screen bottoms should be fitted with a cap or plug of the same composition as the screen and should be within 0.5 foot of the open part of the screen. Traps may be used.

3.3.4 Well Installation Procedure

The following procedure should be initiated within 12 hours of boring completion for uncased holes or partially cased holes and within 48 hours for fully cased holes. Once installation has begun, if no unusual conditions are encountered, there should be no breaks in the installation procedure until the well has been grouted and the drill casing has been removed.

The procedure for monitoring well installation is as follows:

1. Decontaminate all well materials according to the SOP for decontamination procedures. After decontamination, all personnel who handle the casing should put on a clean pair of rubber or surgical gloves.
2. Measure each section of casing and screen to nearest 0.10 foot.
3. Assemble screen and casing as it is lowered into the open boring or boring inside the hollow-stem augers.
4. Lower screen and casing to about 6 inches above the bottom of the boring.
5. Record the level of top of casing and calculate the screened interval. Adjust screen interval by raising assembly to desired interval, if necessary, and add sand to raise the bottom of the boring.
6. Calculate and record the volume of the filter pack, filter pack seal, and annular seal required for existing boring conditions.
7. Filter Pack: Begin adding filter pack sand (10-20 size quartz sand preferable) around the annulus of the casing a few feet at a time. Repeated depth soundings should be taken to monitor the level of the sand. The filter pack should consist of a clean, washed silica sand sized to perform as a filter between the formation material and the well screen. The final depth to the top of the filter pack should be measured directly with the use of a weighted tape measure or rod and not by volumetric calculation methods. The grain size of the filter pack should be shown on the well construction log.
8. Allow sufficient time for the filter sand to settle through the water column outside the casing before measuring the sand level.
9. Filter Pack Seal: Extend the filter pack sand to at least 2 to 5 feet above the top of the well screen. After placing the sand filter pack in the shallow wells, fill the annulus successive lifts of bentonite pellets (either ¼- or 3/8-inch). The bentonite will be installed in 1-foot lifts, adding approximately 2 gallons of water per lift to hydrate the bentonite pellets.

10. After the seal sets for 24 hours the concrete pad and bollards, should be installed according to the specifications in this SOP. The protective casing and posts should be painted a highly visible color.
11. Optional: Personnel should affix to the outer steel protective casing of each well a permanent, noncorrosive tag that clearly identifies the well number, the client's name, and/or the adjusted top of casing elevation.

3.3.5 Well Installation Specifications

Personnel should take precautions to prevent tampering with the wells or the entry of foreign material into them. Upon completion of a well, a suitable cap should be installed to prevent foreign material from entering the well. The wells should be enclosed in a protective steel casing. Steel casings should be a minimum of 6 inches in diameter and should be provided with locking caps and locks. All locks should be keyed alike. If the well is specified in project plans as a stickup, a 1/4-inch drainage hole should be drilled in the protective steel casing, centered approximately 1/8-inch above the internal mortar collar. The well designation should be painted on the protective casing prior to well development. If specified in the project plans, a concrete pad should be constructed around the protective casing at the final ground level elevation and sloping away from the well. The concrete pad should measure at least 3 by 3 feet, with a thickness of 6 to 8 inches. Three 2-inch diameter or larger steel posts should be equally spaced around the well and embedded in separate concrete-filled holes just outside the concrete pad. The protective steel posts should extend approximately 1 foot above the well riser. Any well that is to be temporarily removed from service or left incomplete due to a delay in construction should be capped with a watertight cap and equipped with a "vandal-proof" cover that satisfies applicable state or local regulations or recommendations.

4.0 DOCUMENTATION

Observations and data acquired in the field during the drilling and installation of wells should be recorded to establish a permanent record. A boring log should be completed for each boring, according to the procedures outlined in the SOP for sedimentological logging procedures.

Additional documentation of well construction in the field logbook will include the following:

- Date
- Time
- Personnel
- Weather
- Subcontractors
- Health and safety monitoring equipment and readings

- Grout, sand, and bentonite volume calculations prior to well installation
- Quantity and composition of grout, seals, and filter pack actually used during construction
- Screen slot size (in inches), slot configuration, outside diameter, nominal inside diameter, schedule/thickness, composition, and manufacturer
- Coupling/joint design and composition
- Protective casing composition and nominal inside diameter
- Start and completion dates
- Discussion of all procedures and any problems encountered during drilling and well construction

In addition, the well installation details should be shown in a diagram drawn in the field logbook and/or borehole log. Each well diagram should consist of the following (denoted in order of decreasing depth from the ground surface):

- Reference elevation for all depth measurements
- Project and site names
- Well number
- Date(s) of installation
- Depth at which the hole diameter changes (if appropriate)
- Depth of the static water level and date of measurement(s)
- Total depth of completed well
- Depth of any grouting or sealing
- Nominal hole diameter(s)
- Amount of cement used for grouting or sealing
- Depth and type of well casing
- Description of screened interval (to include length, internal diameter, slot size, and well screen material)
- Any sealing off of water-bearing strata
- Static water level upon completion of the well and after development
- Drilling date(s)
- Other construction details of monitoring well including grain size of well filter pack material and location of all seals and casing joints

All entries in the field logbook should be legibly printed in indelible ink.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 2.4
AQUIFER SLUG TESTING

1.0 SUMMARY

This procedure establishes the protocol for performing slug tests. The procedure provides descriptions of equipment, field procedures and documentation necessary to estimate the hydraulic conductivity of the aquifer from single-well drawdown and recovery tests (slug tests).

2.0 EQUIPMENT

Equipment and materials used when performing slug tests include:

- Electronic water level indicator
- Slug of known volume
- Pressure transducer
- Data logger and operation manual
- Weighted measuring tape
- Polypropylene, Nylon, or other rope
- Keys to well locks
- Knife
- Decontamination equipment as required
- Appropriate health and safety equipment as required by the Site Safety and Health Plan (SSHP)
- PPE as required by the SSHP
- Paper towels
- Waterproof bound field logbook with numbered pages
- Field forms such as slug test data forms or air monitoring logs
- Permanent/indelible ink pens

3.0 PROCEDURES

3.1 Pre-Test Data Recording

Prior to starting any work in the field, the following information should be recorded in the field logbook.

- Well identifier
- Casing diameter
- Borehole diameter
- Location of surveyed measuring point
- Total casing depth
- Static water level (prior to introducing slug)
- Screen depth and interval
- Location of gravel pack
- Lithology of screened interval
- Volume of slug
- Test identifier
- Data logger type and serial number
- Pressure transducer serial number
- Water level elapsed time and measurement intervals

3.2 TESTING PROCEDURES

The person performing the slug test must be familiar with the operating procedures outlined in the data logger manual, as well as the properties of the pressure transducers and must have at least one day of field instruction. The transducers may be damaged or destroyed if subjected to too much pressure.

1. Select an appropriate transducer for the range of water level change anticipated in the slug test (see operations manual).

2. Determine and record the depth to groundwater with water level indicator and the depth to well bottom with weighted measuring tape.

   Insert the transducer into the well and connect it to the data logger. Be sure to place the transducer deep enough so that it the slug will not hit it when it is introduced into the well. Also, take into account the transducer's range and do not place it too deep (refer to the operations manual).

3. Set up the test on the data logger according to the instructions in the manual. At a minimum, program the data logger to record water level information using the following time intervals:

Elapsed Time	Water Level Measurement Interval
0-30 sec.	1.0 sec.
30-120 sec.	3.0 sec.
2-10 min	5.0 sec.
10-100 min.	2 min.
100-1000 min.	10 min.
1,000-10,000 min.	100 min.

4. Start the test and "instantaneously" introduce the slug into the well, taking care to fully submerge the slug. It is important to insert the slug as quickly as possible, because the analysis assumes an instantaneous change in volume in the well. This is called the "falling head test."

5. The pressure transducer will monitor water level change. Care must be taken to ensure that the elevation of the transducer does not change once the test has begun. Measure the water level periodically with the electronic water level indicator to verify the data logger is functioning properly.

6. The test will continue until the water level recovers to at least 90 percent of its original level. Stop the test when this occurs.

7. Now the "rising head test" can be performed by starting a new test and "instantaneously" removing the slug. Stop this test when the water level recovers to at least 90 percent of its original level.

8. Remove the transducer and decontaminate the slug and transducer.

4.0 DOCUMENTATION

In addition to the information cited in Section 3.1, the following information should be recorded in the field logbook:

- Date and time
- Weather

- Field personnel
- Well location
- Water level
- Equipment used

Depending upon project-specific documentation requirements, a slug test data form may be completed for each well tested. A slug test data form should include:

- Date and personnel
- Monitoring well identification number
- Location and elevation (if known) of the reference point from which water depth measurements are made (e.g., top of PVC well casing)
- Date and time of test
- Well depth, screen length, riser pipe radius, well screen radius, borehole radius, and filter pack length (from well construction logs)
- Aquifer or groundwater zone (lithology) being tested (from well construction logs)
- Start time of test
- End time of test
- Data collected during test

All entries in the field logbook must be printed legibly in ink.

5.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 3.1
SURFACE AND SUBSURFACE SOIL SAMPLING

1.0 SUMMARY

This procedure describes the protocols for collecting a surface or subsurface soil sample. The procedure will provide descriptions of equipment, field procedures, and documentation necessary to collect representative surface and subsurface soil samples.

2.0 SURFACE SOIL SAMPLING EQUIPMENT

Equipment and materials that may be used to collect surface soil samples include:

- Stainless steel spoon, trowel, knife, spatula
- Stainless steel bowl
- Personal protective equipment (PPE) as required by the site safety and health plan (SSHP)
- Decontamination equipment as required
- Aluminum foil
- Paper towels
- Laboratory supplied sample jars
- Packing tape
- Cooler and blue ice or ice
- Zipper-locking plastic bags (if ice is used)
- Stakes for marking sampling location
- Field forms such as chain of custody, sample collection log, air monitoring log, other necessary health and safety documentation
- Field logbook
- Appropriate health and safety equipment as required by the SSHP

3.0 SUBSURFACE SOIL SAMPLING EQUIPMENT

Equipment and materials used during the collection of subsurface soil samples include:

- Drill rig, hollow-stem auger, mud rotary, sonic, or direct-push sampling device

- Sampling device (split-barrel sampler, split-spoon sampler, modified California sampler, thin-wall tub sampler, Shelby tube continuous core sampler)
- Stainless steel spoons, trowels, putty knife
- Stainless steel bowl(s)
- Measuring tape
- Sample jars, plastic bags with labels, and marking pens
- Laboratory sample jars
- Plastic sheeting
- Decontamination equipment
- Health and safety equipment and personal protective equipment (PPE)
- Field logbook and writing instruments
- Boring log forms

4.0 GENERAL

Homogenizing is the mixing of a sample to provide a uniform distribution of the contaminants. Proper homogenization ensures that the containerized samples are representative of the total soil sample collected. All samples to be composited or split should be homogenized after all aliquots have been combined. DO NOT HOMOGENIZE (MIX OR STIR) SAMPLES FOR VOLATILE COMPOUND ANALYSIS.

Compositing is the process of physically combining and homogenizing several individual soil aliquot of the same volume or weight. Compositing samples provides an average concentration of contaminants over a certain number of sampling points.

Splitting samples (after preparation) is performed when multiple portions of the same samples are required to be analyzed separately. Fill the sample containers for the same analyses one after another in a consistent manner (i.e., fill the first lab’s container, then fill the second lab’s container; then go on to the next analysis and fill the first lab’s container and then the second lab’s container).

4.1 VOC Sample Collection using EPA Method 5035A

1. VOC samples should be collected immediately after the soil is brought to the surface using a syringe-type collection device as stipulated by EPA Method 5035A.

2. Push the syringe sampler into the freshly exposed soil until the sample chamber is filled. The sample chamber when filled should deliver approximately 5g of soil.

3. Wipe all soil or debris from outside of sampler, making sure the soil plug is flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

4. Place the mouth of the sampler into the laboratory provided sampling container, extrude the sample and quickly place the lid on the vial. When capping the vial be sure to remove any soil or debris from the vial threads.

5. Repeat steps 2 through 4 to fill each of the sample containers (one preserved with methanol and the other two with sodium bicarbonate).

4.2 Soil Sample Compositing

If a representative sample is desired over a depth interval or several samples are to be taken to represent an area, composite the samples as follows:

1. As each sample is collected, place the soil in a decontaminated stainless steel bowl.
2. After all samples from each hole or area are collected in the bowl, stir the sample thoroughly with a decontaminated stainless steel trowel or spatula.
3. For organics analyses, a sheet of aluminum foil may be used instead of a stainless steel bowl.

5.0 SURFACE SOIL

5.1 Surface Soil Sample Collection

The soil samples will be collected from the top six inches (or other interval as indicated) of native soil (below any leaf litter, twigs, or other detritus) using a decontaminated stainless steel scoop. The following steps describe the procedures used to collect surface soil samples:

1. Decontaminate sampling equipment.

2. Clear and remove vegetation and any surface debris such as rocks using a decontaminated trowel.
3. Don a clean pair of powderless nitrile gloves and the appropriate level of protection as specified in the SSHP.
4. Collect the sample from the top interval (as specified) of native soil using a decontaminated stainless steel scoop/trowel.
5. Homogenize the sample in a decontaminated stainless steel bowl (Section 4.2) and fill the remainder of the prelabeled lab jars for sample analysis.

6. Replace the vegetative mat over the disturbed area.
7. Pack and preserve samples.
8. Record observations in the field logbook. Describe the homogenized soil following the Unified Soil Classification System (USCS) in accordance with SOP 2.1 Record applicable information on the sampling and chain-of-custody forms.
9. Record the sampling location on a site map.
10. Discard any unused soil (see the SOP on Investigation-Derived Waste Containerization for proper storage and disposal procedures).
11. Decontaminate sampling device for collection of next sample.

5.2 Surface Soil Sampling Documentation

Documentation of observations and data acquired in the field will provide information on the proper acquisition of samples and also provide a permanent record. These observations and data will be recorded with indelible ink in a bound weatherproof field logbook with consecutively numbered pages, and/or on the surface soil sampling form. Notes will be recorded daily when in the field. At a minimum, the surface soil sampling information in the field logbook will include the following:

- Project number/name
- Date
- Weather
- Personnel on site (samplers' names)
- Sample location
- Sample number and depth
- Time sample is collected
- Laboratory sample number and analytical parameters
- Air monitoring readings taken during sample collection
- Decontamination procedures
- PPE level
- Presence of free product or unusual observations
- Sample description the Unified Soil Classification System (USCS) in accordance with SOP 2.1.

6.0 SUBSURFACE SOIL

Please note: You may need a permit or other form of approval from regulatory agencies overseeing your site before you begin any drilling operations, especially if you are working in a wetland or other sensitive area or are installing wells. Always check with utility companies to verify the locations of underground materials before beginning drilling operations.

Subsurface soil samples can be collected using one of several different sampling methods described in this section.

6.1 Collection of Subsurface Soil Samples during Drilling Operations

The following procedures should be followed when collecting a subsurface soil sample during drilling operations:

1. Decontaminate all equipment including drill rig and all associated equipment, sampling devices, and stainless steel spoons/trowels. Place equipment on clean, plastic sheeting until it is needed.
2. Clear sampling location of all objects and utilities. Stake out sampling location.
3. Inspect, clean, and put on appropriate PPE.
4. Advance boring using selected drilling method.
5. Retrieve sample using selected sampling device.
6. Upon opening sampler or extruding sample, immediately screen soil for VOCs using either a photoionization detector or a flame ionization detector.
7. Observe the soil, measure and record the following: (1) the amount of soil recovered in the sampler, (2) the presence of any free product, (3) any unusual odors, and (4) any stratigraphic changes. Begin to form a description before disturbing the soil.
8. All sample jars should be prelabeled with appropriate information including project number, date, boring and sample number, and depth.
9. Collect a sample using a decontaminated stainless steel spoon or trowel. If sampling for VOCs, use a syringe-type collection device as stipulated by EPA Method 5035A (see Section 4.1 above) to place soil directly into the labeled laboratory provided sample containers. Next, place the remaining soil in a stainless steel bowl and collect a homogeneous sample to be analyzed for other parameters. After the laboratory samples are collected, fill a separate sample jar or plastic bag to be used for soil classification. If there is a change in the stratigraphy, set aside some soil from each and place into jars to be used for the soil classification. If the amount of soil is not sufficient, collect another sample

immediately below the prior sample interval and homogenize the two samples prior to filling laboratory sample jars.

10. Place sample jars for laboratory analysis into a cooler, being careful that they remain upright, and preserve with ice.
11. If collecting samples using Shelby Tubes (ASTM D1587), seal the ends, being careful not to disturb the sample.
12. Fill in a detailed description of the soil(s) on a boring log form as described in the SOP for borehole logging and sampling.
13. Take notes in field logbook. Record applicable information on the chain-of-custody forms.
14. Discard any unused soil. See the SOP on Investigation-Derived Waste Containerization for proper storage and disposal procedures.
15. Decontaminate sampling device for collection of next sample.

6.2 Procedure for Subsurface Soil Sample Collection by Hand Auger

1. Decontaminate all equipment including sampling devices, and stainless steel spoons/trowels. Place equipment on clean, plastic sheeting until it is needed.
2. Clear vegetation and surface debris from a predetermined sample location.
3. Advance auger in 6 or 12 inch intervals.
4. Retrieve and extrude on plastic sheeting.
5. Log the description of the soil sample and fill out a boring log form.
6. Compositing based on sample depth can be performed if required. Compositing is previously described in Section 5.2.
7. Record observations in the field logbook, following the guidelines provided in the SOP for borehole logging and sampling. Record applicable information on the applicable sampling and chain-of-custody forms.
8. Place soil back in hole and replace the vegetative mat over the disturbed area.
9. Decontaminate the sampling device between each sampling location.

6.3 Procedure for Subsurface Soil Sample Collection by Excavator

Due to the rocky nature of the soils, hand augering may not be possible; an alternative is to collect samples using a small track-mounted excavator.

The following procedures should be followed when collecting a subsurface soil sample using an excavator:

1. Clear vegetation and surface debris from a predetermined sample location.

2. The excavator will then be carefully positioned to collect a sample at each of the four corners of the cleared area (approaching the area from the perimeter). An intact scoop of soil extending from 0 to 3 ft bgs will be collected in the excavator bucket and the bucket will be placed on the ground.

3. If applicable, VOC samples will be collected immediately after the subsurface soil is brought to the surface using a syringe-type collection device as stipulated by EPA Method 5035A (see Section 4.1 above).

4. After VOC collection (if applicable) the field geologist can then collect the remaining samples from the intact soil volume within the excavator, taking care to avoid any soils in contact with the excavator bucket.

5. Compositing based on sample depth can be performed if required. Compositing is previously described in Section 5.2.

6. Observe the soil and measure and record (1) the amount of soil recovered in the sampler, (2) the presence of any free product, (3) any unusual odors, and (4) any stratigraphic changes. Describe the soil following the Unified Soil Clasification System (USCS) in accordance with SOP 2.1.
7. Label all sample containers with appropriate information including project number, date and sample number.
8. Replace excess soil back into original hole using excavator.
9. Decontaminate sampling device for collection of next sample.

6.4 Procedures for Subsurface Soil Sample Collection Using Direct-Push (Geoprobe®) Technology

There are several different types of direct-push technology. Some direct-push sampling devices may not be able to collect a soil sample from greater than 20 feet below ground surface.

The following procedures should be followed when collecting a subsurface soil using direct-push technology.

1. Decontaminate all equipment including sampling devices, and stainless steel spoons and trowels. Place equipment on clean plastic sheeting until it is needed.
2. Clear sampling location of all objects and utilities. Stake out sampling location.
3. Inspect, clean, and put on appropriate PPE.

4. Instruct subcontractor to set up truck-mounted equipment at a sampling location.
5. Remove any pavement and gravel bed using a cement-coring device mounted on the truck.
6. Inform subcontractor of the depth of sample collection.
7. Subcontractor will advance a four or five-foot long/two-inch diameter stainless steel sampling device (macro-sampler) attached to the bottom of temporary stainless steel rods to the desired depth. The predetermined depth will be reached by connecting rods together. The rod will be pushed below ground surface with a hydraulic level attached to the truck.
8. The sample core will be collected within the macro-samplers lined with new acrylic sleeves.
9. The macro-sampler is opened in half to displace the sample core.
10. If applicable, VOC samples will be collected immediately after the subsurface soil is brought to the surface using a syringe-type collection device as stipulated by EPA Method 5035A (see Section 4.1 above).
11. Next, place remaining soil in a stainless steel bowl and collect a homogenous sample to be analyzed for other parameters. Transfer the sample to laboratory sample containers using a decontaminated stainless steel spoon or trowel and place in cooler for shipment to the laboratory. After the laboratory samples are collected, fill a separate sample jar or plastic bag to be used for soil classification (if applicable). If there is a change in the stratigraphy, set aside some soil from each and place into jars to be used for the soil classification. If recovery is not sufficient, collect another sample immediately below the prior sample interval and homogenize the two samples prior to filling laboratory sample jars.
12. Log the description of the soil sample and fill out a boring log form as described in the SOP for borehole logging and sampling.
13. Record observations in the field logbook. Record applicable information on the applicable sampling and chain-of-custody forms.
14. Decontaminate the stainless steel sample rods and sampling device between each sampling location.

7.0 QA/QC

Quality assurance/quality control (QA/QC) samples are designed to help identify potential sources of sample contamination. Different types of QA/QC samples include field blanks, rinse blanks, trip blanks, and duplicate samples. The frequency of collection and types of QA/QC samples required are indicated in the site-specific sampling plan. All QA/QC samples are labeled with QA/QC identification numbers and sent to the laboratory with the other samples for analysis.

8.0 REFERENCES

ASTM Method D1587-83, Standard Practice for Thin Walled Sampling of Soils

EPA Method 5035A Closed-system Purge and Trap and Extraction for Volatile Organics in Soil and Waste Samples

9.0 ATTACHMENTS

None

STANDARD OPERATING PROCEDURE 3.2
SEDIMENT SAMPLING

1.0 SUMMARY

This procedure establishes the guidelines for both conventional and undisturbed sediment sample collection and containerization with a variety of sampling devices. Methods of preventing sample and equipment cross-contamination are included.

Proper sediment sampling ensures that any evaluations of sediment or catchment contamination are based on actual chemical concentrations and are not an artifact of improper sampling techniques.

2.0 EQUIPMENT

- Dip sampler
- Hand-operated piston core sampler
- Gravity core sampler
- Stainless steel grab sampler (van veen, ponar, etc.)

3.0 PROCEDURES

3.1 Sediment Sampling in Exposed Areas

The sampling procedure for sediment that is not submerged by water is as follows:

1. Insert scoop, trowel, or auger into sediment surface and remove sample.
2. Collect samples for volatile organics analysis from the sampling device or from unmixed sediment placed in a stainless steel bowl.
3. For all samples other than volatile organics analysis, place the sample in a stainless steel bowl and stir thoroughly with a stainless steel spoon or spatula to provide a homogeneous mass prior to placing in the sample containers.
4. Fill the sample containers with the mixed sediment.
5. Store the full sample containers on ice in a cooler chest and maintain at 4ºC.
6. Decontaminate all sampling equipment per the SOP for Equipment Decontamination.

3.2 Sediment Sampling in Submerged Areas

The sampling procedure that will be used in up to three feet of water will by determined by the task Manager or field staff will determine what method of sampling will be used (van veen, ponar, short corer), depending on the nature of the sediments to be sampled.

If the sediment contains fines, insert the stainless steel box sediment sampler or van veen grab sampler into the sediment surface and remove slowly to avoid disturbance of the sample and loss of any fine materials.

Do not include nonrepresentative materials such as twigs or debris in the sample. Sediments contacting the side of the sampler or core liner will not be included in chemistry samples. Aliquot size, container type, storage conditions, and holding times will follow specifications in the project plans.

Carefully label all samples with the location number, analytical method, date, time, and type of sample. Use the appropriate codes established for the project when preparing this information.

Decontaminate all sampling equipment according to the SOP for Equipment Decontamination.

3.3 Stream Sediment Sampling

Obtain the sediment sample as close as possible to any applicable surface water sampling locations. Collect the sediment samples prior to measuring the discharge and collecting the water sample. Collect sediment at a point just downstream of the water sampling point. The sample should be collected in an area of sediment accumulation, such as the inside of stream meanders, quiet willow areas, or low-velocity zones. Avoid areas of net erosion such as high-velocity, turbulent-flow zones.

If possible, remain on the stream bank. If the sample cannot be obtained from the bank, enter the stream from a point downstream of the sediment sampling location. Collect the sediment sample by reaching into the stream with the stainless steel scoop and scoop a sample in an upstream direction. Attempt to minimize the loss of fine material winnowed from the samples by the moving water.

Place the sample in a stainless steel beaker or bowl and gently mix with a stainless steel spoon. Transfer the sediment samples to the appropriate sample containers using the stainless steel spoon. Do not mix samples for volatile organics analysis. If duplicate or split samples are to be obtained, transfer the sediment directly from the stainless steel beaker into the sample containers in the same manner as standard samples.

4.0 DOCUMENTATION

4.1 Field Logbook

A field logbook will be maintained during the course of the investigation. All information relating to field activities will be recorded in indelible ink in a bound notebook with water-resistant and numbered pages. Corrections made in the field logbook will consist of a line drawn through the information to be deleted that the recorder initials and dates. At the end of each sampling day, the recorder will draw a line through the remaining open space on the page and initial and date that line. The following entries will be made in the field logbook during the course of the investigation:

- Date
- Names of field party
- Times of personnel arrivals and departures
- Weather, including changes in weather during the field day
- Vessel traffic in the project area (if applicable)
- Project direction received and project direction given
- Project communications (telephone calls or radio receptions and transmissions)
- Time of grab
- Grab acceptability and sampler penetration
- Sample numbers and location information, including sketch if useful in describing location
- Observations on sediment

4.2 Sediment Logging

Photograph and describe the sediment sample on the Sediment Sampling form, including the following characteristics:

- Station number
- Date and time of collection
- Photograph information (time, direction of photograph, roll number/frame number)
- Station coordinates
- Weather conditions

- Names of persons collecting and logging the ample
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (USCS)
- Odor (e.g., hydrogen sulfide, petroleum)
- Visible stratifications and lenses
- Vegetation
- Debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

5.0 DECONTAMINATION

Decontamination of sediment sampling equipment will follow the SOP for Equipment Decontamination, and the following guidelines.

Decontaminate sampling implements and processing materials by washing the equipment with a laboratory-grade detergent and water solution, rinsing with tap or seawater, and then rinsing with distilled water, 10 percent nitric acid, methanol, and finally distilled water. Because the use of solvents may interfere with volatile organics analyses, utensils for volatile organics subsampling will be washed with laboratory-grade detergent and rinsed with distilled water only. Wrap decontaminated equipment or cover with aluminum foil. Decontaminate subsampling and processing equipment before use at each station, and between depth intervals at a location in order to prevent cross contamination of samples.

6.0 ATTACHMENTS

Exhibit 1	Dip Sampler Technique
Exhibit 2	Hand-Operated Piston Core Sampler Technique
Exhibit 3	Gravity Core Sampler Technique
Exhibit 4	Stainless-Steel Grab Sampler Technique

7.0 REFERENCES

U.S. Environmental Protection Agency (USEPA). 1986. *Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound.* Puget Sound Estuary Program, U.S. Environmental Protection Agency, Seattle, Washington.

U.S. Environmental Protection Agency and Puget Sound Water Quality Authority (USEPA and PSWQA). 1996. *Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound.* Prepared for Region 10, U.S. Environmental Protection Agency, Seattle, Washington, and Puget Sound Water Quality Authority, Olympia, Washington. 30 April 1996.

Exhibit 1
Dip Sampler Technique

Assemble the dip sampler, which consists of a pole to which a beaker or scoop is attached by means of a clamp or other device. The pole can be made of bamboo, wood, aluminum, or nonreactive material, and be either telescoping or fixed length.

1. To obtain a sample, submerge the dip sampler and pull it through the sediments.
2. Transfer the sample into the appropriate sample container by decanting the liquid and retaining the sediments.
3. Repeat the sampling procedure until the required amount of sediment is obtained.

Exhibit 2
Hand-Operated Piston Core Sampler Technique

Assemble the hand corer according to the manufacturer's specifications. If the corer is equipped with a piston, adjust the clearance so that the piston slides in the barrel with only slight resistance, but is tight enough to create ample suction in the barrel. Plastic core sleeves, if used, will be either new or thoroughly decontaminated and placed in the corer according to the manufacturer's specifications.

1. Lower the corer to the sediment surface or into the borehole to the desired depth. Once the sampler is positioned at the interval to be sampled, secure the piston line and manually drive the core barrel into the sediment in one slow, continuous effort. Handles can be attached to the drive rods to apply additional force when necessary.

2. Retrieve the corer by manually lifting the sampler to the surface with the drive rods. Repeat this process for each specified core interval.

3. If the corer is equipped with a plastic sleeve, remove the sleeve when the sampler is retrieved from the sediment and seal and label it. Indicate the top of the core on the sleeve. If the sample is designated for chlorinated organic testing, make special provisions to replace the plastic liners with another nonreactive material.

4. If the corer is not equipped with plastic sleeves, extrude the sediment core onto a clean surface lined with plastic wrap and aluminum foil. First, wrap the core in plastic, being careful not to break or damage the core; then wrap this in aluminum foil so that the ends of the foil are folded over, creating a squared-off end. Tape the foil closed on both ends and along the seam.

5. Affix a piece of tape to the core wrapping and label with the sample interval, date, and sampling personnel. Be sure to indicate the orientation of the core on the label (i.e., top and bottom).

6. If the core is to be sampled in the field, use a stainless steel scoop or spoon to remove the samples from the core at the intervals specified in the project plans, and place the samples in the appropriate containers.

7. Discard any leftover sediment according to the specifications in the project plans.

Exhibit 3
Gravity Core Sampler Technique

Assemble the corer according to the manufacturer's specifications. Install new or thoroughly decontaminated nonreactive core barrel liners per the manufacturer's specifications.

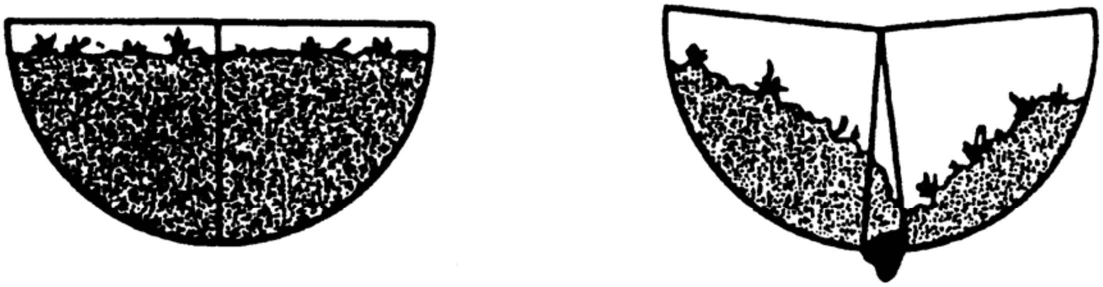
1. Attach a strong retrieval line or wire rope to the sampler and lower the sampler at a controlled descent of approximately 1 foot per second.
2. When the sampler penetrates the sediment (indicated by a slack retrieval line), immediately pull the sampler free of the bottom, using a motorized winch if available. Raise the corer at a controlled ascent rate.
3. Once the corer reaches the water surface, measure the length from the top of the core tube to the surface of the recovered sediment in the core.
4. Bring it on board and, if possible, secure it to the deck.
5. Label the sleeve in such a way as to properly identify the sample orientation, sample designation, date, core interval, and sampling personnel.
6. If the corer is not equipped with plastic sleeves, extrude the sediment core onto a clean surface lined with plastic wrap and aluminum foil. First, wrap the core in the plastic, being careful not to break or damage the core. Then wrap this in aluminum foil so that the ends of the foil are folded over, creating a squared-off end. Tape the foil closed on both ends and along the seam.
7. Affix a piece of tape to the core wrapping and label with the sample interval, date, and sampling personnel. Be sure to indicate the orientation of the core on the label (e.g., top and bottom).

Exhibit 4
Stainless-Steel Grab Sampler Technique

To minimize the loss of fine-grained material during collection in submerged environments, collect subsurface sediments using a 0.1-m^2 stainless steel van Veen sediment sampler. Conduct sample collection and handling according to applicable guidance (e.g., USEPA 1986; USEPA). Collect sediments from the 0- to 10-centimeter (cm) horizon. Weights may be added to the sampler to increase penetration and ensure the proper horizon thickness, or removed from the sampler to prevent overfilling in soft sediments.

1. When the survey vessel is positioned, lower the van Veen sampler to the bottom at a rate of 1 foot per second.
2. At the instant the sampler impacts the bottom (detectable when the lowering wire slackens), take a position fix.
3. Retrieve the sampler at a slower speed so as not to disturb the grab.
4. Once the sampler is secure on the processing stand, inspect the grab carefully to determine whether it is acceptable (see Figure 1). The following acceptability criteria (USEPA 1986) should be satisfied:
   - Sediment is not extruded from the upper face of the sampler such that organisms may be lost.
   - Overlying water is present (indicates minimal leakage).
   - The grab surface is relatively flat (indicates minimal disturbance or winnowing).
   - The entire surface of the grab is included in the sampler.
   - The following penetration distances are achieved at a minimum:
     - 4 to 5 centimeters cm for medium-coarse sand
     - 6 to 7 cm for fine sand
     - greater than or equal to 10 cm for muddy sediment
5. Should any of these conditions not be observed, discard the grab and repeat the drop.
6. Prior to further processing of an acceptable grab, remove the overlying water with a siphon tube.
7. Characterize the first (middle) grab of a unit fully, including observations on sediment color, odor, stratification, texture, consistency, presence of organisms, and distinguishing characteristics (debris or other anthropogenic material). Examine other grabs in the unit and note differences, but subsequent grabs need not be fully characterized.
8. Under the direction of the Task Manager, remove any organisms, debris, and other material unrepresentative of sediments and describe such material in the field log.

Figure 1
van Veen Sediment Grab Acceptability



ACCEPTABLE IF MINIMUM PENETRATION REQUIREMENT MET AND OVERLYING WATER IS PRESENT

UNACCEPTABLE (WASHED, ROCK CAUGHT IN JAWS)

UNACCEPTABLE (CANTED WITH PARTIAL SAMPLE)

UNACCEPTABLE (WASHED)

STANDARD OPERATING PROCEDURE 3.3
SOIL GAS SAMPLING

1.0 SUMMARY

This Standard Operating Procedure (SOP) describes the procedures for collecting active soil gas samples using a direct-push (Geoprobe^{TM}) probe, the Post-Run Tubing (PRT) system, and Summa canisters. The SOP will provide methodology, equipment, field procedures, and documentation necessary to collect representative soil gas samples.

2.0 EQUIPMENT

The following types of equipment are generally required to conduct the soil gas sampling:

- Hydraulic Geoprobe^{TM} push probe system capable of perforating the ground surface and boring to the appropriate depth
- PRT expendable point holder, adaptors, o-rings, and fittings
- Teflon or Teflon-lined tubing
- Laboratory-supplied Suma canisters (1L or 6L -10% certified)
- Laboratory-supplied sampling manifolds with pressure gauges and critical orifice set to appropriate sampling flow rate.
- Laboratory-supplied canisters of inert gas (nitrogen)
- Temperature controlled storage (if required by manufacturer)
- Appropriate packing and shipping material provided by laboratory
- Miscellaneous tools (i.e. appropriate wrenches for ¼’’fittings)
- Bentonite clay
- Permeable sand
- Weatherproof, bound field logbook with numbered pages
- Permanent/indelible ink pens

3.0 PROCEDURES

3.1 Soil Gas Point Installation (see Manufacturer's Guide, attached)

1. Decontaminate PRT equipment, as described in the SOP for Decontamination Procedures and install O-rings on the expendable point holder and the PRT adaptor.
2. Test-fit the adaptor with the PRT fitting on the expendable point holder to assure that the threads are compatible and fit together smoothly.
3. Drive stainless steel probe rods with PRT tip-configuration to the desired depth (6-8 ft below ground surface (bgs); above the anticipated capillary fringe) (the goal is to obtain a sample of the soil gas, not the ground water). After the depth has been reached, disengage the expendable point by pulling up on the probe rods.
4. Cut Teflon (or Teflon-lined) tubing to at least 2 foot longer than the depth of the hole. Push the adaptor into the end of the tubing, secure with tape if necessary. New, dedicated tubing will be used for each sample point.
5. Insert the adapter end of the tubing inside the probe rods. Feed the tubing down the rod bore until it hits bottom on the expendable point holder.
6. Grasp the excess tubing and apply downward pressure while turning it in a counterclockwise direction to engage the adapter threads with the expendable point holder. Pull up lightly on the tubing to test engagement of threads.
7. Wait at least *20 minutes* for soil vapor to equilibrate following gas point installation.
8. Take sample (see below).
9. After collecting a sample, pull up on tubing to disconnect it from the adaptor. Remove tubing from the probe rods and dispose of it appropriately.
10. Retrieve the rods from the ground and recover the expendable point holder the with attached PRT adaptor.
11. Inspect the O-ring at the base of the PRT adaptor to verify that proper sealing was achieved. The O-ring should be compressed. The seal can be tested by capping the open end of the point holder and applying vacuum to the PRT adaptor.

3.2 Soil Gas Sample Collection (see Guide, attached)

1. Measure the length of tubing, calculate tubing volume, and estimate annular volume around probe tip. Calculate purge volume/time as three times the estimated volume of dead space (¼" diameter tubing = 5mL/ft).

2. Attach laboratory provided sampling manifold to summa canister using provided swagelok (or similar stainless steel connectors). Note: One manifold should be dedicated to a single sample location.
3. Record manifold and summa canister serial numbers in field log book
4. Verify and record the initial vacuum of the Summa canister.
5. Attach T-valve with flow regulator to the tubing (flow regulator is between the tubing and the T-valve). Attach a Summa sampling canister to one outlet.
6. Attach purging canister (or peristaltic pump) to the second outlet. Open valve to the purging canister (or turn on pump) to draw out sufficient soil gas (a minimum of 2 times, but no more than 4 times, the estimated volume of the probe and tubing) to purge the system. Throughout purging and sampling, flow rates should be maintained between 100 and 200 ml/min. These slow flow rates limit stripping and prevent ambient air from diluting the samples.
7. Turn valve to the Summa canister. Fill canister at a flow rate between 100 and 200 ml/min. Target fill volume for a 6L canister is 5.5L and will require approximately 27 minutes to fill. Target fill volume for a 1L canister is 800mL and will require approximately 4-8 minutes to fill.
8. Close valves and remove canister. Measure the final vacuum of the Summa canister and record.
9. Label Summa canister place in laboratory-supplied shipping box, in the shade, without ice.

3.3 Duplicate Soil Gas Sample Collection

1. Proceed with steps one through 4, above. Before filling the primary sample Summa canister, remove the purging canister and attach the duplicate sample Summa canister to the second outlet of the T-valve. (Don’t forget to record initial vacuum of the second Summa canister).
2. Fill both the primary and duplicate sample canisters concurrently. Then proceed with steps 6 and 7, above.

3.4 Equipment Blank Sample Collection

1. Measure a length of tubing equivalent to that required for the soil gas sampling points. Attached tubing to a laboratory-supplied canister of nitrogen gas. This nitrogen gas will serve as the gas source (in place of the soil gas).
2. Continue with steps 1 through 7 of the Sample collection procedure described above.

4.0 DOCUMENTATION

The field log will contain the following information:

- Date, time, location, and depth of sampling
- Weather
- Personnel on site and performing the survey
- Site location description
- General observations
- Unusual events
- Visitors to the site

All entries in the field logbook must be legibly printed in indelible ink.

5.0 ATTACHMENTS

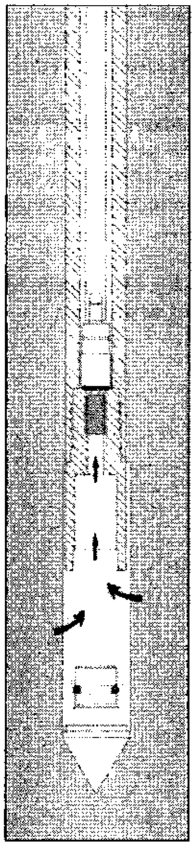
Soil Gas Sampling – PRT System Operation, Geoprobe Systems^{TM}

Guide to Air Sampling and Analysis, Air Toxics LTD.

Soil Gas Sampling – PRT System Operation

from Geoprobe Systems®

www.geoprobe.com
1-800-436-7762



Soil Gas Sampling using the Post-Run Tubing (PRT) System.

Soil Gas Sampling — PRT System Operation

Basics

Using the Post-Run Tubing System, one can drive probe rods to the desired sampling depth, then insert and seal an internal tubing for soil gas sampling. The usual Geoprobe probe rods and driving accessories and the following tools are required:

- PRT Expendable Point Holder
- PRT Adapter
- Selected PRT Tubing

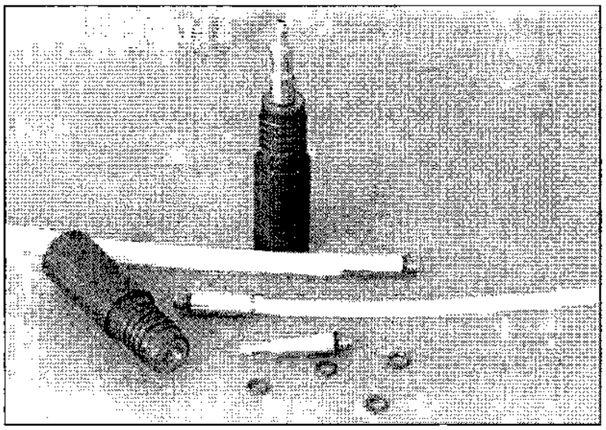
Preparation

1. Clean all parts prior to use. Install O-rings on the PRT Expendable Point Holder and the PRT adapter.
2. Inspect the probe rods and clear them of all obstructions.
3. TEST FIT the adapter with the PRT fitting on the expendable point holder to assure that the threads are compatible and fit together smoothly.

   NOTE: PRT fittings are left-hand threaded.

4. Push the adapter into the end of the selected tubing. Tape may be used on the outside of the adapter and tubing to prevent the tubing from spinning freely around the adapter during connection – especially when using Teflon tubing **(Figure 1)**.

   REMEMBER: The sample will not contact the outside of the tubing or adapter.



PRT SYSTEM PARTS
PRT Expendable Point Holder, PRT Adapters, Tubing, and O-rings.

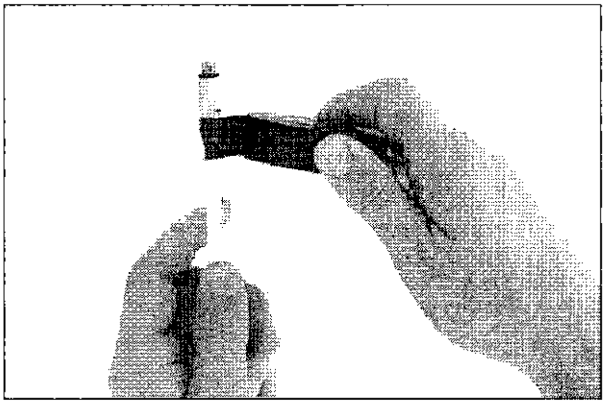


Figure 1. Securing adapter to tubing with tape. NOTE: Tape does not contact soil gas sample.

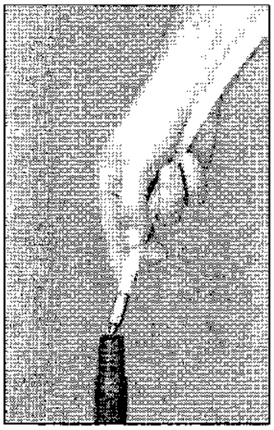


Figure 2. Insertion of tubing and PRT adapter.

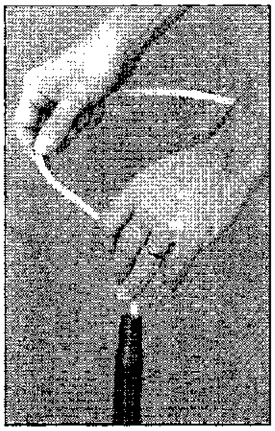


Figure 3. Engaging threads by rotating tubing.

Sampling

1. Connect the outer end of the tubing to the Silicone Tubing Adapter and vacuum hose (or other sampling apparatus).

2. Follow the appropriate sampling procedure for collecting a soil gas sample **(Figure 1)**.

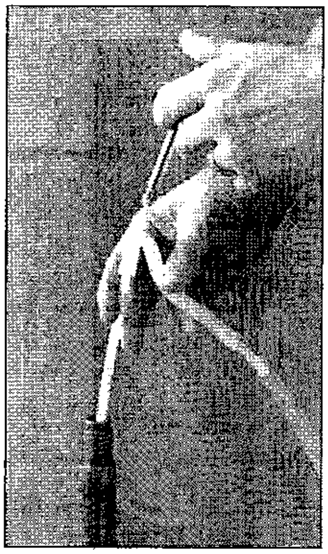


Figure 1. Taking a soil gas sample for direct injection into a GC with the PRT system.

Removal

1. After collecting a sample, disconnect the tubing from the vacuum hose or sampling system.

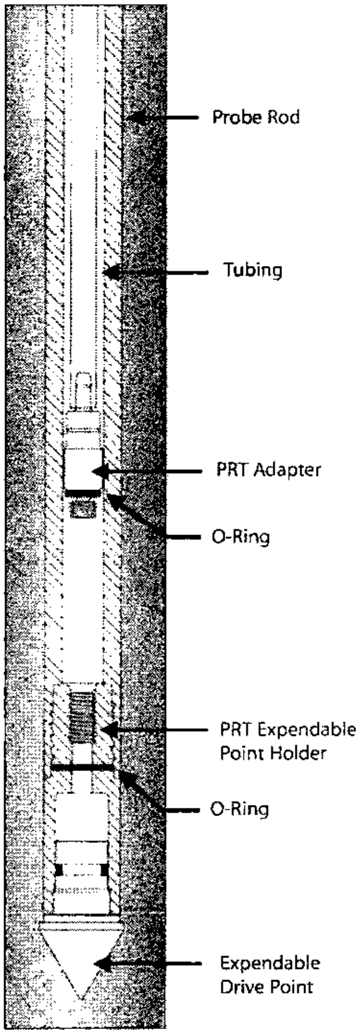
2. Pull up firmly on the tubing until it releases from the adapter at the bottom of the hole. (Taped tubing requires a stronger pull.)

3. Remove the tubing from the probe rods. Dispose of polyethylene tubing or decontaminate Teflon tubing as protocol dictates.

4. Retrieve the probe rods from the ground and recover the expendable point holder with the attached PRT adapter.

5. Inspect the O-ring at the base of the PRT adapter to verify that proper sealing was achieved during sampling. The O-ring should be compressed. This seal can be tested by capping the open end of the point holder applying vacuum to the PRT adapter.

6. Prepare for the next sample.



A cross section of probe rods driven to depth and then retracted to allow for soil gas sampling. The PRT adapter and tubing are now fed through the rods and rotated to form a vacuum-tight connection at the point holder. The result is a continuous run of tubing from the sample level to the surface.

Probing

Drive the PRT tip configuration into the ground. Connect probe rods as necessary to reach the desired depth. After depth has been reached, disengage the expendable point by pulling up on the probe rods. Remove the pull cap from the top probe rod, and position the Geoprobe unit to allow room to work.

Connection

1. Insert the adapter end of the tubing down the inside diameter of the probe rods **(Figure 2)**.

2. Feed the tubing down the rod bore until it hits bottom on the expendable point holder. Allow about 2 ft. (610 mm) of tubing to extend out of the hole before cutting it.

3. Grasp the excess tubing and apply some downward pressure while turning it in a counterclockwise motion to engage the adapter threads with the expendable point holder **(Figure 3)**.

4. Pull up lightly on the tubing to test engagement of the threads. (Failure of adapter to thread could mean that intrusion of soil may have occurred during driving of probe rods or disengagement of drive point.)

Canisters and Tedlar Bags

Air Toxics LTD.
Laboratory Services Since 1989

Guide to Air Sampling & Analysis

Always Air, Always Accurate

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3.2.4 Relationship Between Final Canister Vacuum, Volume Sampled, and Dilution Factor **12**

Section 1.0 Introduction

Air Toxics Ltd. presents this guide as a resource for individuals engaged in air sampling. Air sampling can be more involved than water or soil sampling due to the reactivity of chemical compounds in the gas matrix and sample interaction with the equipment and media used. Ensuring that air samples are collected properly is an important step in acquiring meaningful analytical results. This guide is not a substitute for experience and cannot sufficiently address the multitude of field conditions. Note that this guide is intended for projects involving whole air sampling of volatile organic compounds (VOCs) in canisters and Tedlar® bags. Air Toxics Ltd. provides the "Guide to Sorbent-Based Sampling - Volatiles and Semi-Volatiles" for other types of sampling.

1.1 Whole Air Sampling of VOCs

This guide focuses on collecting a sample in the most common air sampling containers, Summa canisters and Tedlar® bags. The sample may be collected in the container either passively (i.e., by evacuating the canister prior to sampling) or actively (i.e., using a pump). The sample is referred to as a "whole air sample" and the compounds remain in the gas matrix (e.g., ambient air) inside the container.

1.2 Choosing Between Canisters and Tedlar® Bags

Table 1.2 compares the features of canisters and Tedlar® bags. Canisters have superior inertness, hold time to analysis and ruggedness. They also do not require a sampling pump. Tedlar® bags can be purchased inexpensively in bulk, carried to a sampling site in a briefcase, filled in seconds and shipped easily to the laboratory for analysis. Call Client Services at 800-985-5955 if you have questions regarding the appropriate sampling media.

Table 1.2 Comparison of Canisters to Tedlar® Bags

	Canisters	Tedlar® Bags
Common Volumes	1 and 6 L	1, 3, and 5 L
Type of Sampling	Passive (vacuum)	Active (pump required)
Sample Handling	Room temperature	Room temperature
Media Hold Time	Up to 30 days recommended	Indefinite
Hold Time to Analysis	Up to 30 days	Up to 3 days
Surface Inertness	Excellent	Fair
Cleanliness	10% or 100% certified to ppbv/pptv levels	Some VOCs present at 0.5 to 45 ppbv
Sampling Application	Ambient/indoor air, soil/landfill gas, stationary source	Ambient air (fixed gases only), soil/landfill gas, stationary source
Rule of Thumb	“ppbv device”	“ppmv device”
Advantages	Inertness, hold time, ruggedness, no pump	Purchase/shipping cost, availability, convenience

Section 2. Canisters and Associated Media

This section provides a description of air sampling canisters, practical considerations for sampling, and step-by-step sampling instructions. Tables provide detailed information on many operational factors that ultimately influence the quality of the data obtained from a canister sample.

2.1 Introduction to Canisters

The canister is prepared for sampling by evacuating the contents to a vacuum of approximately 29.9 inches of Mercury (in. Hg). Opening the stainless steel bellows valve allows the air sample to enter the canister. When the target volume of sample is collected, the valve is closed and the canister is returned to the laboratory. Canisters range in volume from less than 1 liter (L) to greater than 6 L. At Air Toxics Ltd., 6 L canisters are used for ambient air samples and for taking integrated samples. One liter canisters are generally used for taking high concentration (i.e., greater than 5 ppbv) grab samples, although exceptions to these guidelines are common.

2.1.1 Summa Canister

A Summa canister is a stainless steel container that has had the internal surfaces specially passivated using a "Summa" process. This process combines an electropolishing step with a chemical deactivation step to produce a surface that is nearly chemically inert. A Summa surface has the appearance of a mirror: bright, shiny and smooth. The degree of chemical inertness of a whole air sample container is crucial to minimizing reactions with the sample and maximizing recovery of target compounds from the container.

2.1.2 Canister Cleaning

Air Toxics Ltd. provides two types of canister cleaning certification, 10% and 100%, depending upon the requirements of the project. The 10% certification process is appropriate for routine ambient air applications and high concentration applications such as soil vapor and landfill gas monitoring. The 10% certification process begins by cleaning canisters using a combination of dilution, heat and high vacuum. Canisters are certified for approximately 60 VOCs using GC/MS. As part of our quality control plan we perform a 10% process certification which requires that target compound concentrations be below 0.2 ppbv using GC/MS analysis. Alternatively, the 100% certification (i.e., individual certification) process is appropriate for ambient and indoor air applications driven by risk assessment or litigation requiring pptv (parts per trillion by volume) sensitivity. Similar to the 10% certification, the 100% certification also begins with the canister cleaning process. The difference with the 100% certification is that canisters are individually certified for a client-specific list of target compounds using GC/MS. When the 100% certified canisters are shipped the analytical documentation demonstrating that they are free of the target compounds down to the project reporting limits is emailed to the client. When sampling with certified media it is important to note that all media is certified as a train and must be sampled as such (i.e., a particular flow controller goes with a particular canister and is labeled as such).

Specify whether your project requires
10% or 100% canister cleaning certification

2.1.3 Canister Hold Time

Media Hold Time : Canister sampling differs considerably from collecting a water sample in a VOA vial or a soil sample in an amber jar in that the container (valued at over $500) is cleaned and reused. Air Toxics Ltd. requires that our canisters be returned within 14 days of receipt to effectively manage our inventory. Once a canister is cleaned, certified and evacuated we recommend the canister be used for sample collection within 30 days. Over time, low-level (pptv) concentrations of typical VOCs may off-gas from the canister surface resulting in potential artifacts in the sample results.

Sample Hold Time: Although 30 days is the most commonly cited hold time for a canister sample, the hold time is compound-specific. For example, compounds such as chloroform, benzene, and vinyl chloride are stable in a canister for at least 30 days. In fact, EPA Method TO-15 states, “Fortunately, under conditions of normal usage for sampling ambient air, most VOCs may be recovered from canisters near their original concentrations for after storage times of up to thirty days”. However, some VOCs such as bis(chloromethyl)ether degrade quickly and demonstrate low recovery even after 7 days. The standard VOC list reported by Air Toxics is stable up to 30 days after sample collection. Some projects require a more rigorous 14-day hold time.

2.2 Associated Canister Hardware

Associated hardware used with the canister includes the valve, brass cap, particulate filter and vacuum gauge.

2.2.1 Valve

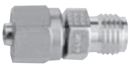
An industry standard, 1/4 in. stainless steel bellows valve (manufactured by Swagelok or Parker Instruments) is mounted at the top of the canister. The valve allows a vacuum to be maintained in the canister prior to sampling and seals off the canister once the sample has been collected. No more than a half turn by hand is required to open the valve. Do not over-tighten the valve after sampling or it may become damaged. A damaged valve can leak, possibly compromising the sample. Some canisters have a metal cage near the top to protect the valve.

2.2.2 Brass Cap

Each canister comes with a brass cap (i.e., Swagelok 1/4 in. plug) secured to the inlet of the valve assembly. The cap serves two purposes: first, it ensures that there is no loss of vacuum due to a leaky valve or a valve that is accidentally opened during handling; second, it prevents dust and other particulate matter from fouling the valve. The cap is removed prior to sampling and replaced following sample collection.

Always replace the brass cap following canister sampling.

7 Micron



2 Micron

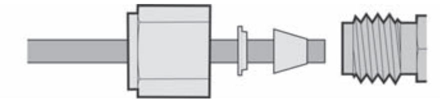
2.2.3 Particulate Filter

Particulate filters should always be used when sampling with a canister. Separate filters are provided to clients taking a grab sample and filters are built into the flow controllers for clients taking integrated samples. Air Toxics Ltd. provides either a 2 micron filter or a 7 micron filter. These devices filter particulate matter greater than 2 and 7 microns in diameter respectively. The shorter 2 micron filter is a fritted stainless steel disk that has been pressed into a conventional Swagelok adapter and is disposed of after each use. This device has a relatively high pressure drop across the fritted disk and restricts the flow into the canister. The 2 micron filter is standard for clients taking integrated samples. The longer 7 micron filter is cleaned in a similar manner as the stainless steel canisters after each single use, and does not significantly restrict the flow rate into the canister. The 7 micron filter is primarily used with grab samples. **Both the 2 and 7 micron filters are not calibrated devices and therefore the flow rates can and do vary for each filter**.

Always use the particulate filter for canister sampling.

2.2.4 Fittings

All fittings on the sampling hardware are 1/4 in. Swagelok; a 9/16 in. wrench is used to assemble the hardware. Compression fittings should be used for all connections; never use tube in tube connections. It is critical to avoid leaks in the sampling train. Leaks of ambient air through fittings between pieces of the sampling train (e.g., tubing to particulate filter) will dilute the sample and cause the canister to fill at a faster rate than desired. Air Toxics can provide the necessary fittings and ferrules if requested.



2.2.5 Vacuum Gauge

A vacuum gauge is used to measure the initial vacuum of the canister before sampling, and the final vacuum upon completion. A gauge can also be used to monitor the fill rate of the canister when collecting an integrated sample. Air Toxics Ltd. provides 2 types of gauges. For grab sampling, a test gauge checks initial and final vacuums only and is not to be sampled through. For integrated sampling a gauge is built into the flow controller and may be used for monitoring initial and final vacuums, as well as monitoring the fill rate of the canister. Both gauges are not calibrated and are considered to be equally rough gauges, which also means they can provide you with differing numbers for the same canister. In special cases a pressure/vacuum gauge can be provided upon request. Air Toxics Ltd.'s gauges are provided only to obtain a relative measure of "change." Individuals with work plans that outline specific gauge reading requirements are strongly encouraged to purchase and maintain their own gauges.

The gauges that Air Toxics Ltd. provides are for rough estimates only. If the project plan requires a certain level of gauge accuracy the use of a calibrated gauge is highly recommended.

Table 2.2.3 Approximate Fill Times for Canisters

CANISTER VOLUME	7 micron filter	2 micron filter
6 L	16 sec	3 min
1 L	3 sec	30 sec

Section 3.0 Sampling with Canisters

There are two basic modes of canister sampling: grab and integrated. A grab sample is taken over a short interval (i.e., 1-5 minutes) while an integrated sample is taken over an extended period (e.g., 0.5-24 hours). In both modes the canister vacuum is used to draw the sample into the canister.

3.1 Considerations for Grab Sampling With Canisters

The following are some considerations for collecting a grab sample in a canister.

- **Verify Initial Vacuum of the Canister:** Prior to shipment, each canister is checked for mechanical integrity. However, it is still important to check the vacuum of the canister prior to use. Air Toxics recommends doing this before going to the field if possible. The initial vacuum of the canister should be greater than 25 in. Hg. If the canister vacuum is less than 25 in. Hg, do not use it. Call Client Services at 800-985-5955 and arrange for a replacement canister. If sampling at altitude there are special considerations for gauge readings and sampling (see Section 5.2). The procedure to verify the initial vacuum of a canister is simple but unforgiving:

1. Confirm the valve is closed (knob should already be tightened clockwise)
2. Remove the brass cap
3. Attach gauge
4. Attach brass cap to side of gauge tee fitting, if one is not already there, to ensure a closed train
5. Open and close valve quickly (a few seconds)
6. Read vacuum on the gauge
7. Record gauge reading on "Initial Vacuum" column of chain-of-custody
8. Verify the canister valve is closed and remove gauge
9. Replace the brass cap

3.1.1 Step-By-Step Procedures for Canister Grab Sampling

These procedures are for a typical ambient air sampling application; actual field conditions and procedures may vary.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, particulate filter, and gauge – if requested)
2. Verify the gauge is working properly
3. Verify the initial vacuum of canister

When ready to sample:

1. Confirm the valve is closed (knob should already be tightened clockwise)
2. Remove brass cap
3. Attach particulate filter to canister
4. Open valve 1/2 turn (6 L canister normally takes about 16 sec to fill)
5. Close valve by hand tightening knob clockwise
6. Verify and record final vacuum of canister (repeat steps used to verify initial vacuum)
7. Replace brass cap
8. Fill out canister sample tag (make sure the sample ID and date of collection recorded on the sample tag matches what is recorded on the COC exactly)
9. Return canister in box provided (unreturned canister charge of $500 each)
10. Return sample media in packaging provided (unreturned equipment charges: $45 per particulate filter; $45 per gauge)
11. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody)
12. Place chain-of-custody in box and retain pink copy
13. Tape box shut and affix custody seal at each opening (if applicable)
14. Ship accordingly to meet method holding times

- **Leave Residual Vacuum**: A grab sample can be collected either by allowing the canister to reach ambient conditions or by leaving some residual vacuum (e.g., 5 in. Hg) in the canister. In either case, the final vacuum should be noted in the "Final Vacuum" column on the chain-of-custody. This will enable the laboratory to compare the final vacuum with the receipt vacuum (i.e., the vacuum measured upon arrival at the laboratory).



3.2 Integrated Sampling with Canisters and Flow Controllers

An air sample collected over more than a few minutes is referred to as an integrated sample and can provide information on compound concentrations in air averaged or composited over time. An 8- or 10-hour integrated sample can be used to determine indoor air quality in the workplace. Similarly, a 24-hour integrated sample may be an economical and practical approach to determine residential exposure to indoor or outdoor air sources. The most common hardware configurations used to take an integrated sample are illustrated above.

Flow controllers are devices that regulate the flow of air during sampling into an evacuated canister. Also known as flow restrictors, these devices enable a sampler to achieve a desired flow rate and thus, a sampling interval. Air Toxics Ltd. provides two general types of flow controllers: mass flow controllers and critical orifice devices. Both devices are driven by differential pressure between ambient conditions and the vacuum in the canister.

3.2.1 Mass Flow Controller

A mass flow controller employs a diaphragm that actively compensates to maintain a constant mass flow rate. As the differential pressure decreases, the flow rate tends to decrease and the diaphragm responds by opening up to allow more air to pass through. Mass flow controllers can provide integrated samples with intervals ranging from hours to days. Air Toxics Ltd. provides a fixed mass flow controller that is calibrated at the laboratory for 24-hour sampling. Adjustable mass flow controllers have a knob that can be adjusted in the field to provide integrated samples with intervals ranging from 1 to 24 hours. The rugged conditions of field sampling are not usually compatible with adjustable mass flow controllers and Air Toxics Ltd. has designed a more reliable flow controller based on a critical orifice design.

3.2.2 Critical Orifice Device

Air Toxics Ltd. designed a critical orifice flow controller to provide time-weighted samples with intervals from 0.5 to 12 hours into a 6 L canister and 4 min. to 2 hrs. in a 1 L canister. The device restricts air flow by forcing the sample to enter a capillary column of minute radius. This device is passive compared to an actively compensating diaphragm and the flow rate decreases as the driving force (differential pressure) decreases. For sampling intervals from 0.5 to 12 hours, however, the flow rate is time weighted. The main advantages of the Air Toxics Ltd. flow controllers are improved ruggedness and cleanliness. With no moving or adjustable parts, the Air Toxics Ltd. design is unlikely to lose its flow setting. In addition, a vacuum gauge is built into the device to monitor sampling progress.

3.2.3 Sampling Interval and Flow Controller Setting

When you request canisters and flow controllers from Air Toxics Ltd., you will be asked for the sampling interval, and the flow controllers will be pre-set prior to shipment according to the table below. The flow controller is set to collect a 5 L sample over the sampling interval. Final canister vacuum is targeted at 5 in. Hg. The flow rate is set at standard atmospheric conditions (approximately sea level). If the air sample is from a process (pressurized or under vacuum) or is collected at elevation, the canister will fill faster or slower depending on sample conditions. If you specify the source at project set-up, we can set the flow controller accordingly. See Section 5.2 for a discussion of collecting a sample at elevation. The 24-hr flow controllers should not be used for process or source samples.

Table 3.2.3 Flow Rates for Selected Sampling Intervals (mL/min)

Sampling Interval (hrs)	4 min.	0.5	1	2	4	8	12	24
6 L Canister	na	167	83.3	41.7	20.8	11.5	7.6	3.8
1 L Canister	166.7	26.6	13.3	6.7	-	-	-	-

Note: Target fill volumes for 6 L and 1 L canisters are 5,000 mL and 800 mL, respectively.

$$\textbf{Flow Rate(mL/min)} = \frac{\textbf{Target Fill Volume (mL)}}{\textbf{Sampling Interval (min)}}$$

3.2.4 Final Canister Vacuum and Flow Controller Performance

Ideally, the final vacuum of a 6 L canister should be between 5-10 in. Hg or greater. As long as the differential pressure is greater than 4 in. Hg ambient pressure, then the flow through the device will remain approximately constant as the canister fills. If there is insufficient differential pressure, the flow through the controller will decrease as the canister pressure approaches ambient. Because of the normal fluctuations in the flow rate (due to changes in ambient temperature, pressure and diaphragm instabilities) during sampling, the final vacuum will range between 2 and 10 in. Hg.

- **If the residual canister vacuum is greater than 5 in. Hg** (i.e., more vacuum), less than 5 L of sample was collected. When the canister is pressurized to 5 psig prior to analysis, sample dilution will be greater than normal. This will result in elevated reporting limits.
- **If the residual canister vacuum is less than 5 in. Hg** (i.e., less vacuum), the initial flow rate was high or there was a leak in the connection. Once the vacuum decreases below 5 in.Hg, the flow rate begins to drop significantly. This scenario indicates that the sample is skewed in favor of the first portion of the sampling interval.
- **If the final vacuum is near ambient** (i.e., less than 1 in. Hg), there is inadequate differential pressure to drive the flow controller. The sampler cannot be certain the desired sampling interval was achieved before the canister arrived at ambient conditions. Although the actual sampling interval is uncertain, the canister still contains a sample from the site.

Table 3.2.4 Relationship Between Final Canister Vacuum, VolumeSampled, and Dilution Factor (6 L Canister)

Final Vacuum (in. Hg)	**0**	**2.5**	**5**	**7.5**	**10**	**12.5**	**15**	**17.5**	**20**
Volume Sampled (L)	**6**	**5.5**	**5.4**	**5**	**4**	**3.5**	**3**	**2.5**	**2**
Dilution Factor*	**1.34**	**1.46**	**1.61**	**1.79**	**2.01**	**2.30**	**2.68**	**3.22**	**4.02**

*** Canister pressurized to 5 psig for analysis**

$$\textbf{Final Reporting Limit} = \textbf{Method Reporting Limit} \times \textbf{Dilution Factor}_{\text{(Canister Pressurization)}} \times \textbf{Dilution Factor}_{\text{(Sample Concentration)}}$$

$$\textbf{Dilution Factor}_{\text{(Canister Pressurization)}} = \frac{\textbf{Pressurization for Analysis}}{\textbf{Receipt Vacuum}} = \frac{\textbf{14.7 psig + Press. for Analysis (psig)}}{\textbf{14.7 psig}\left[1 - \frac{\textbf{Rec. Vac (in Hg)}}{\textbf{29.9 in. Hg}}\right]}$$

3.2.5 Considerations for Integrated Sampling with Canisters

Collecting an integrated air sample is more involved than collecting a grab sample. Sampling considerations include verifying that the sampling train is properly configured, monitoring the integrated sampling progress, and avoiding contamination.

- **Avoid Leaks in the Sampling Train:** See Section 3.1 for instructions on how to securely assemble sampling hardware. A leak in any one of these connections means that some air will be pulled in through the leak and not through the flow controller. A final pressure reading near ambient is one indication that there may have been a leak.
- **Verify Initial Vacuum of Canister:** See Section 3.1 for instructions on verifying initial canister vacuum. If you are using an Air Toxics Ltd. critical orifice flow controller, note that you can use the built-in gauge.
- **Monitor Integrated Sampling Progress:** It's a good idea to monitor the progress of the integrated sampling during the sampling interval. The volume of air sampled is a linear function of the canister vacuum. For example, halfway (4 hours) into an 8-hour sampling interval, the canister should be half filled (2.5 L) and the gauge should read approximately 17 in. Hg. More vacuum than 17 in. Hg indicates that the canister is filling too slowly; less than 17 in. Hg and the canister is filling too quickly. If the canister is filling too slowly, a valid sample can still be collected (see Section 3.2.4). If the canister is filling too quickly because of a leak or incorrect flow controller setting, corrective action can be taken. Ensuring all connections are tight may eliminate a leak. It is possible to take an intermittent sample.
- **Avoid Contamination:** Flow controllers should be cleaned between uses. This is done by returning them to the laboratory.
- **Caution Against Sampling in Extreme Temperatures:** There can be some flow rate drift if the temperature of the controllers is allowed to vary significantly.

3.2.6 Step-by-Step Procedures for Integrated Sampling

These procedures are for a typical ambient air sampling application; actual field conditions and procedures may vary.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, particulate filter and flow controller)
2. Verify the gauge is working properly
3. Verify the initial vacuum of the canister

When ready to sample:

1. Confirm the valve is closed (knob should already be tightened clockwise)
2. Remove brass cap from canister
3. Attach flow controller to canister
4. Place the brass cap at the end of the flow controller creating an air tight train, and quickly open and close the canister valve in order to check for leaks. If the needle on the gauge drops, your train is not airtight. In this case, try refitting your connections and/or tightening them until the needle holds steady
5. Once the sample train is airtight remove the brass cap from the flow controller and open the canister valve, 1/2 turn
6. Monitor integrated sampling progress periodically
7. Verify and record final vacuum of canister (simply read built-in gauge)
8. Close valve by hand tightening knob clockwise
9. Replace brass cap
10. Fill out canister sample tag (make sure the sample ID and date of collection recorded on the sample tag matches what is recorded on the COC exactly)
11. Return canisters in boxes provided (unreturned canister replacement charge of $500 each)
12. Return sample media in packaging provided (unreturned equipment charges: $45 per particulate filter; $50-500 per flow controller)
13. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody)
14. Place chain-of-custody in box and retain pink copy
15. Tape box shut and affix custody seal at each opening (if applicable)
16. Ship accordingly to meet method holding times

Important Information for Canister Sampling

@ DO NOT use canister to collect explosive substances, radiological or biological agents, corrosives, extremely toxic substances or other hazardous materials. It is illegal to ship such substances and you will be liable for damages.

@ ALWAYS use a filter when sampling. NEVER allow liquids (including water) or corrosive vapors to enter canister.

@ DO NOT attach labels to the surface of the canister or write on the canister; you will be liable for cleaning charges.

@ DO NOT over tighten the valve and remember to replace the brass cap.

@ IF the canister is returned in unsatisfactory condition, you will be liable for damages.

For assistance call Client Services at 800-985-5955.

Section 4. Sampling with Tedlar® Bags

This section provides a description of Tedlar® bags, practical considerations for sampling, and step-by-step instructions for collecting a grab sample. A photograph illustrates the correct way to assemble the various sampling components.

4.1 Introduction to Tedlar® Bags

The Tedlar® bag is best suited for projects involving analysis of compounds in the ppmv range. However, Tedlar® bags may be used for other applications such as ambient air monitoring for atmospheric/ fixed gases. They can be used to collect sulfur compounds, but only if the fittings are non-metallic (e.g., polypropylene, Teflon®, or Nylon). A Tedlar® bag is made of two plies of Tedlar® film sealed together at the edges, and features a valve that allows for filling. Sample collection requires a pressurized sampling port, a low flow rate pump or a lung sampler. The bag expands as the sample enters. Air Toxics Ltd. maintains Tedlar® bags in 1, 3 and 5 L volumes.

4.1.1 Tedlar® Film

Tedlar® is a trade name for a polyvinyl fluoride film developed by DuPont Corporation in the 1960's. This patented fluoropolymer has been used in a wide variety of applications including protective surfacing for signs, exterior wall panels and aircraft interiors. Tedlar® film is tough yet flexible and retains its impressive mechanical properties over a wide range of temperatures (from well below freezing to over 200°F). Tedlar® exhibits low permeability to gases, good chemical inertness, good weathering resistance and low off-gassing.

4.1.2 How "Active" is the Surface of a Tedlar® Bag?

The surface of a Tedlar® bag is a work in progress. The surface of a new bag is essentially free of VOCs at the single digit ppbv level. Compounds detected from analyzing new Tedlar® bags include methylene chloride, toluene, acetone, ethanol and 2-propanol. Note that 2-propanol has been detected in some new bags up to 45 ppbv. Once the Tedlar® bag is used, however, the surface has been exposed to moisture and possible

VOCs. It may irreversibly adsorb many VOCs at the low ppbv level. A series of purges with certified gas may not remove the VOCs from the surface. $10 for a new bag is a small price to pay for peace of mind.

Never reuse a Tedlar® bag when sampling for ppbv level compounds.

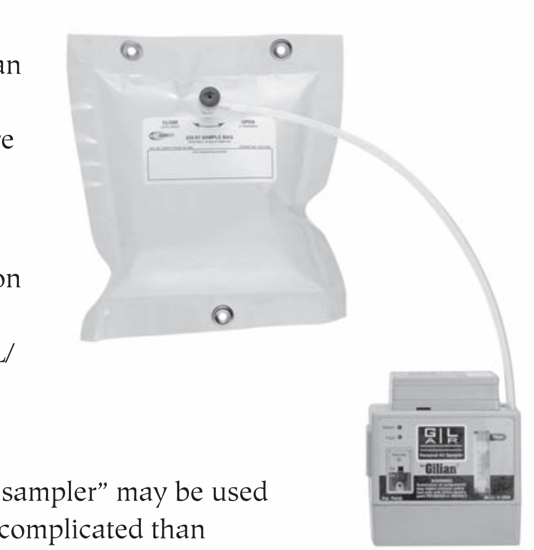
4.1.3 Hold Time for a Tedlar® Bag

The media hold time for a Tedlar® bag is indefinite if stored out of sunlight in a cool, dry location. Tedlar® bags may be used to collect samples containing common solvents, hydrocarbons, chlorinated solvents, sulfur compounds and many other classes of compounds. The sample hold time to analysis varies for different classes of compounds:

- **24 hours:** Sulfur compounds (e.g., hydrogen sulfide and methyl mercaptan) and chemically active compounds (e.g., 1,3-butadiene)
- **72 hours:** Chlorinated solvents, aromatic compounds and atmospheric/fixed gases (oxygen, nitrogen, carbon dioxide)

4.2 Tedlar® Bag Sampling

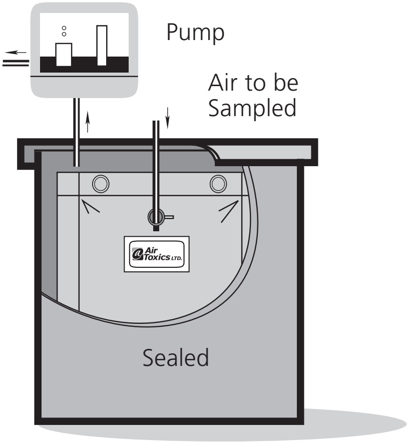
Using a Tedlar® bag to collect an air sample normally involves "active" sampling, unlike an evacuated canister that can be filled "passively" by simply opening the valve. There are two methods commonly used to fill a Tedlar® bag: a pump or a lung sampler.



- **Sampling with a Pump:** The most common method for filling a Tedlar® bag is to use a small pump with low flow rates (50-200 mL/min) and tubing to fill the bag. Air Toxics Ltd. does not provide pumps.

- **Sampling with a Lung Sampler:** A "lung sampler" may be used to fill a Tedlar® bag. Although a little more complicated than simply using a pump, the main advantage to using a lung sampler to fill a Tedlar® bag is that it avoids potential pump contamination.

A Tedlar® bag with attached tubing is placed in a small airtight chamber with the tubing protruding from the chamber. The sealed chamber is then evacuated via a pump, causing the bag to expand and draw the sample into the bag through the protruding tube. The sample air never touches the wetted surfaces of the pump. Air Toxics Ltd. does not provide lung samplers.



4.2.1 Considerations for Tedlar® Bag Sampling

Some considerations for collecting a Tedlar® bag sample:

- **Fill the Tedlar® bag no more than 2/3 full**: Allow for possible expansion due to an increase in temperature or decrease in atmospheric pressure (e.g., the cargo hold of a plane)
- **Keep the Tedlar® bag out of sunlight**: Tedlar® film is transparent to ultraviolet light (although opaque versions are available) and the sample should be kept out of sunlight to avoid any photochemical reactions
- **Protect the Tedlar® bag**: Store and ship the Tedlar® bag samples in a protective box at room temperature. An ice chest may be used, but DO NOT CHILL
- **Fill out the Tedlar® bag label**: It is much easier to write the sample information on the label before the Tedlar® bag is inflated
- **Provide a second Tedlar® bag**: Consider filling two bags per location in the rare occasion that a defective bag deflates before analysis. The "hold" sample does not need to be documented on the Chain-of-Custody and should have an identical sample ID to the original sample indicating that it is the "hold" sample
- **Avoid Contamination**: Care should be taken to avoid contamination introduced by the pump or tubing. Begin sampling at locations with the lowest compound concentrations (e.g., sample the SVE effluent before the influent). Decontaminate the pump between uses by purging with certified air for an extended period; better yet, use a lung sampler. Use the shortest length possible of Teflon® tubing or other inert tubing. DO NOT REUSE TUBING. If long lengths of tubing are used, consider purging the tubing with several volumes worth before sampling. If you are concerned about sampling for trace compounds, you shouldn't be using a Tedlar® bag (see Section 1.2)
- **Don't Sample Dangerous Compounds in a Tedlar® Bag**: Do not ship any explosive substances, radiological or biological agents, corrosives or extremely hazardous materials to Air Toxics Ltd. Tedlar® bag rupture during transit to the laboratory is possible and the sampler assumes full liability

4.2.2 Step-by-Step Procedures for Tedlar® Bag Sampling (Pump)

Note: These procedures are for a typical stationary source (e.g., SVE system) sampling application; actual field conditions and procedures may vary. See additional sampling considerations in Section 5.3 for sampling soil gas or landfill gas.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, Tedlar® bag, and tubing/fittings – if requested)
2. Verify pump cleanliness and operation (Air Toxics Ltd. does not provide pumps)

When ready to sample:

3. Purge sample port
4. Attach new Teflon® tubing from sample port or probe to low flow rate pump
5. Purge tubing
6. Fill out Tedlar® bag sample tag
7. Attach additional new Teflon® tubing from the pump outlet to the Tedlar® bag valve
8. Open Tedlar® bag valve
9. Collect sample (FILL NO MORE THAN 2/3 FULL)
10. Close Tedlar® bag valve by hand tightening valve clockwise
11. Return Tedlar® bag in boxes provided (DO NOT CHILL)
12. Fill out chain-of-custody and relinquish samples properly.
13. Place chain-of-custody in box and retain pink copy
14. Tape box shut and affix custody seal as both openings (if applicable)
15. Ship priority overnight to meet method holding times.

Section 5. Special Sampling Considerations

This section provides considerations for special sampling configurations that a sampler may collect in the field such as field duplicates or an ambient blank. This section also provides considerations for sampling at altitude, as well as soil gas and landfill gas sampling.

5.1 Special Sampling Configurations

Special sampling configurations include a field duplicate, field split, field blank, ambient blank, and a trip blank. Call Client Services at 800-985-5955 if your project involves any of these special sampling configurations.

5.1.1 Field Duplicate

A field duplicate is a second sample collected in the field simultaneously with the primary sample at one sampling location. The results of the duplicate sample may be compared (e.g., calculate relative percent difference) with the primary sample to provide information on consistency and reproducibility of field sampling procedures. Due to the nature of the gas phase, duplicate samples should be collected from a common inlet. The configuration for collecting a field duplicate includes stainless steel or Teflon® tubing connected to a Swagelok "T". If integrated samples are being collected and the sample duration is to be maintained, the sample train should be assembled as follows: each canister should have a flow controller attached, then the duplicate sampling T should be attached to the flow controllers. If the collection flow rate from the sample port is to be maintained then the duplicate sampling T should be connected to the canisters; then the flow controller is connected to the inlet of the sampling T.

5.1.2 Field Blank

A field blank is a sample collected in the field from a certified air source. Analysis of the field blank can provide information on the decontamination procedures used in the field. Clean stainless steel or Teflon® tubing and a certified regulator should be used. It is imperative that individually certified canisters (the sample canister and the source canister/cylinder, if applicable) be used to collect a field blank.

5.1.3 Ambient Blank

An ambient blank is an ambient air sample collected in the field. It is usually used in conjunction with soil gas or stationary source (e.g., SVE system) sampling. Analysis of the ambient blank can provide information on the ambient levels of site contaminants. It is recommended that an individually certified canister be used to collect an ambient blank.

5.1.4 Trip Blank

When sampling for contaminants in water, the laboratory prepares a trip blank by filling a VOA vial with clean, de-ionized water. The trip blank is sent to the field in a cooler with new sample vials. After sampling, the filled sample vials are placed back in the cooler next to the trip blank and returned to the laboratory. Analysis of the trip blank provides information on decontamination and sample handling procedures in the field as well as the cleanliness of the cooler and packaging.

When sampling for compounds in air, a trip blank provides little, if any, of the information above. A trip blank canister can be individually certified, evacuated, and sent to the field in a box with the sample canisters. Since the valve is closed and the brass cap tightened, it is questionable if the trip blank canister contents are ever "exposed" to sampling conditions. **Air Toxics Ltd. does not recommend analyzing a trip blank for air sampling.**

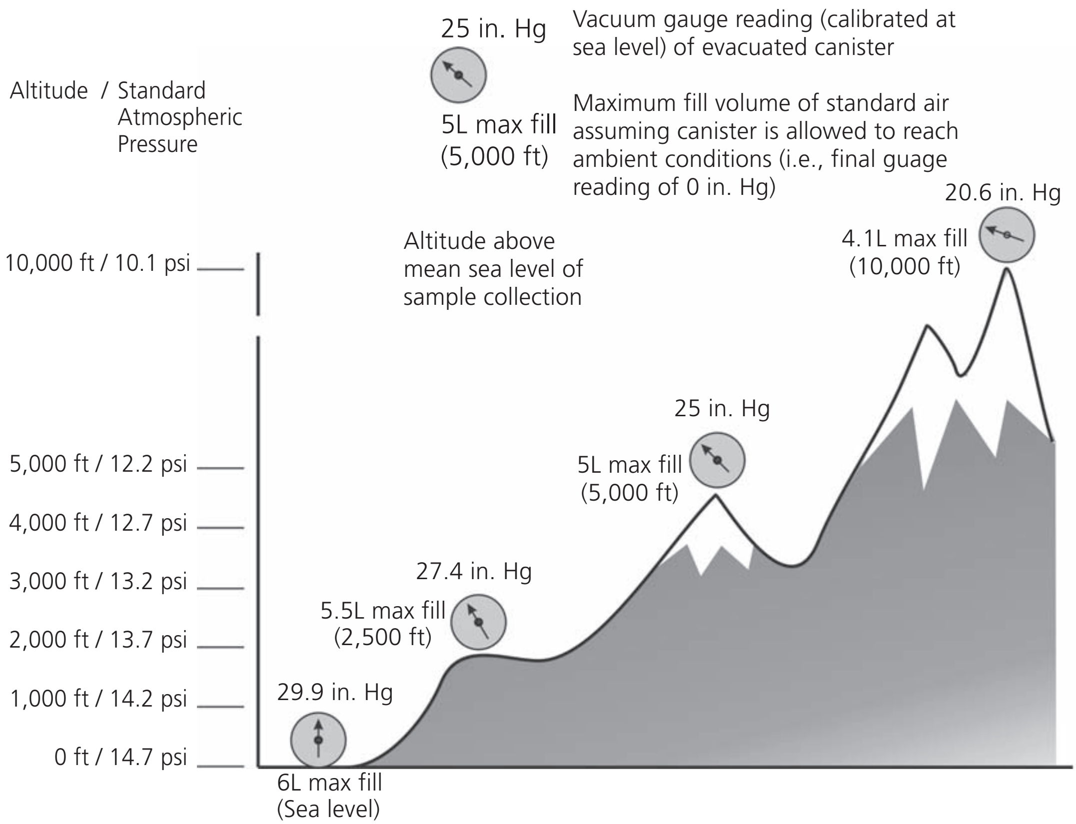
5.2 Considerations for Sampling at Altitude

Sampling at altitudes significantly above sea level is similar to sampling a stationary source under vacuum, in that target fill volumes may be difficult to achieve. The figure below illustrates the relationship between increasing altitude and decreasing atmospheric pressure. Ambient conditions in Denver at 5,000 ft altitude are quite different from ambient conditions at sea level. Canister sampling is driven by the differential pressure between ambient conditions and the vacuum in the canister.

There is less atmospheric pressure in Denver and 5 L is the maximum fill volume of standard air assuming the canister is allowed to reach ambient conditions (i.e., final gauge reading of 0 in. Hg). Theoretically, if you sample high enough (e.g., in space), no sample would enter the canister because there is no pressure difference between the evacuated canister and ambient conditions. To fill a canister to 6 L in Denver, you would need to use an air pump.
Sampling at altitude also affects gauge readings. The gauges supplied by Air Toxics Ltd. (see Section 2.2.4) measure canister vacuum relative to atmospheric pressure and are calibrated at approximately sea level. Before sampling at altitude, the gauges should be equilibrated (see Section 3.1). But even after equilibrating the gauge, verifying the initial vacuum of a canister at altitude is misleading. In Denver at 5,000 ft, expect the gauge to read 25, not 29.9 in. Hg. You do not have a bad canister (i.e., leaking or not evacuated properly). The canister is ready for sampling and the gauge is working properly.

Rule of Thumb: For every 1,000 ft of elevation, the gauge will be off by 1 in. Hg and the fill volume will be reduced by 1/5 L.

If you have questions about sampling at altitude, please call Client Services at 800-985-5955.



5.3 Considerations for Soil Gas / Landfill Gas Sampling

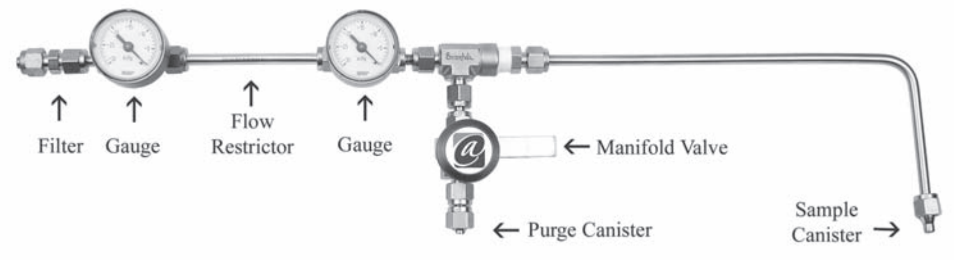
There are some additional sampling considerations for collecting grab samples (canister or Tedlar® bag) from a soil boring, landfill boring, SVE system or landfill gas (LFG) collection system. The general challenge with these samples arises from the need to employ long lengths of tubing to direct the soil gas, landfill gas or process air to the canister or Tedlar® bag. Tubing introduces the potential for contamination and diluting the sample.

5.3.1 Collecting Soil Gas Samples with Sampling Manifolds

Air Toxics provides soil gas sampling manifolds in order to facilitate meeting the numerous quality control guidelines for collecting soil gas data. Two of the most critical aspects of soil gas sampling are purging the lines and preventing leaks. The manifold setup allows for automatic leak-checking of the canister sample train without the application of a leak check compound to the canister fittings. When the purge can is opened and closed, it creates a vacuum within the canister lines and fittings. If this vacuum is maintained, the train is considered leak-free. Because there is only one connection – the probe tubing to sample train – the chance for leaks is greatly reduced.

The manifold's in line gauge system used with a purge canister enables the sampler to determine the appropriate purge volume. Typically, purge volumes of 3 to 5 times the volume of the train tubing are used, and once the purge volume is calculated the lines can be purged by opening the purge canister valve and monitoring the decrease in vacuum. This decrease in vacuum is proportional to the volume purged through the lines. There is a suggested flow rate of between 100 and 200 milliliters per minute, a step thought to prevent ambient air intrusion as a result of taking the sample too quickly. Our manifold has a "built-in" flow restrictor; a frit of stainless steel tubing between the two gauges that is calibrated to 167 milliliters per minute.

The first gauge, located prior to the flow restrictor, is a vacuum gauge that informs the sampler if sufficient vapor is being collected from the soil or if the substrate is too compacted. Because this is not a flow meter but a measure of pressure/vacuum, the gauge should read at zero if there is sufficient flow from the soil. If the gauge begins to read a vacuum, then the flow is being restricted. The second gauge, in line after the flow controller and prior to the purge canister, is a vacuum gauge that indicates to the sampler whether or not the canister is filling properly at the expected rate. This setup enables the sampler to evaluate the lithologic conditions at the site and determine if a valid soil gas sample is being taken. Finally, when duplicate samples are required, the manifold can be used as a duplicate sampling "T" by simply replacing the purge canister with another sample canister.



5.3.2 Step-by-Step Procedures for Soil Gas Sampling Using Sampling Manifolds

These procedures are for a typical soil gas sampling application; actual field conditions and procedures may vary.

Before you get to the field:

1. Verify contents of the shipped package (e.g., chain-of-custody, canister, particulate filter and flow controller)
2. Verify the gauge is working properly
3. Verify the initial vacuum of canister

When ready to sample:

Leak Check Test

1. Confirm that canister valves are closed (knob should already be tightened clockwise)
2. Remove brass caps from both the sample canister and the purge canister (unless using certified media there is no difference between the two)
3. Attach manifold to canisters
4. Confirm that there is a brass cap secured at the inlet of the manifold creating an air tight train, make sure the manifold valve above the purge canister is open, and quickly open and close the purge canister valve in order to check for leaks. If the needle on the gauge drops, your train is not airtight. In this case, try refitting your connections and/or tightening them until the needle holds steady

Purging

5. Once the sample train is airtight remove the brass cap from the manifold inlet, connect the tubing from the sample port using a compression fitting and open the purge canister valve, 1/2 turn
6. Monitor integrated sampling progress periodically. *Please note, because the purge canister is inline after the flow restrictor the line will not purge faster than at a rate of 167mls/min
7. Once the desired purge volume is met close both the manifold valve and the purge canister valve by hand tightening the knobs clockwise
8. If sampling at multiple locations, the purge canister can be disconnected from the manifold and used to begin purging the next sample location without compromising the sample train

Sampling

9. The line is now ready to be sampled. Open the sample canister valve and monitor sampling progress periodically.
10. When the sampling is complete close the valve and replace the brass cap on the canister; record final vacuum of canister (simply read built-in gauge)
11. Fill out canister sample tag (make sure the sample ID and date of collection recorded on the sample tag matches what is recorded on the COC exactly)
12. Return canisters in boxes provided (Unreturned canister replacement charge of $500 each)
13. Return sample media in packaging provided (Unreturned equipment charges: $45 per particulate filter; $50-500 per flow controller)
14. Fill out chain-of-custody and relinquish samples properly (it is important to note the canister serial numbers on the chain-of-custody)
15. Place chain-of-custody in box and retain pink copy
16. Ship accordingly to meet method holding times

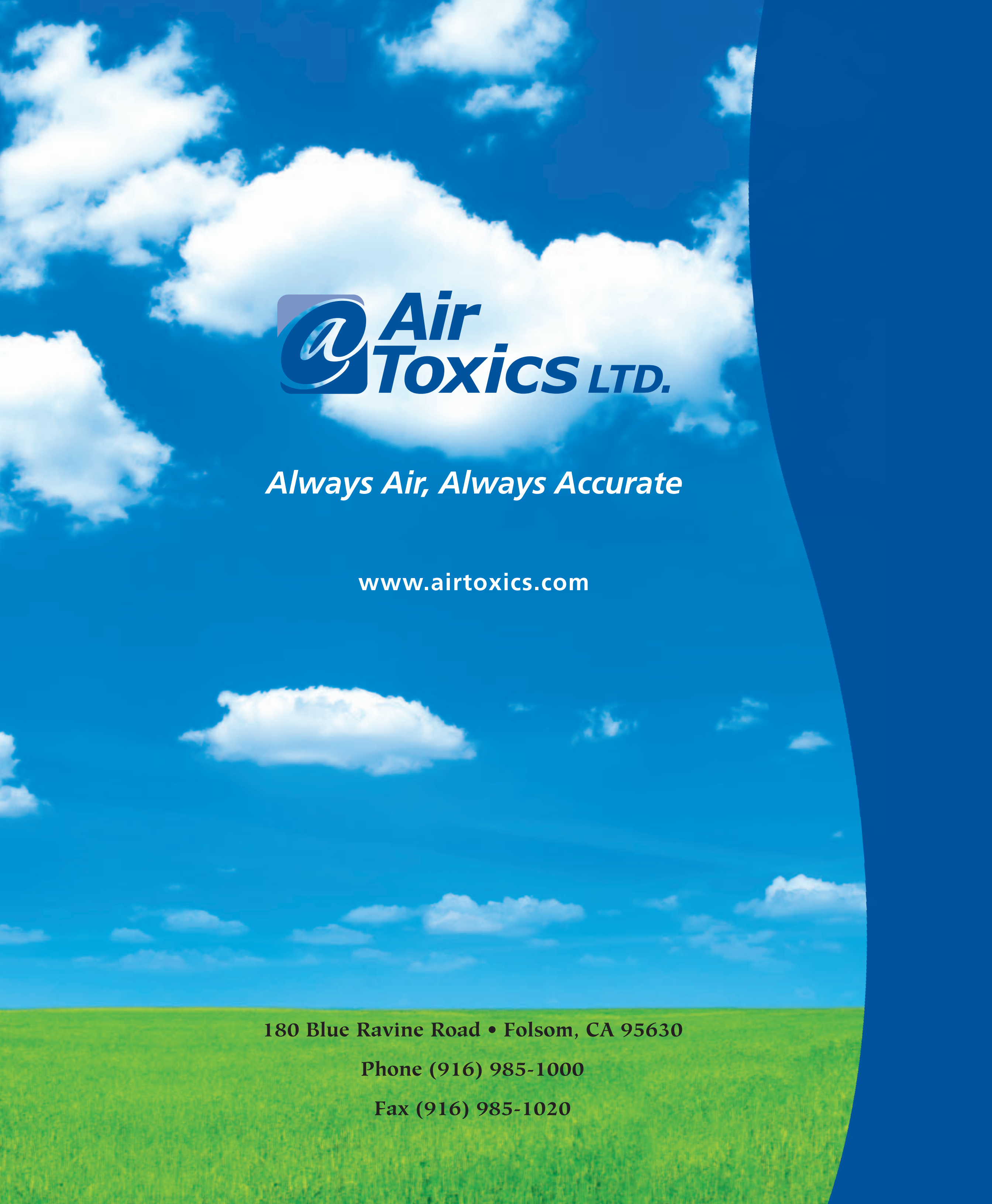
5.3.3 Special Considerations for Soil Gas and Landfill Gas Sampling

- **Use inert tubing**. Teflon® tubing is recommended. Tubing with an outer diameter of 1/4 in. works best with the fittings on the particulate filter.
- **Do not reuse tubing**. $2 per foot for new tubing is a small price to pay for peace of mind.
- **Purge tubing adequately**. A long length of tubing has significant volume of "dead air" inside.

  Without purging, this air will enter the canister and dilute the sample. Consider using a handheld PID/FID to confirm that you have purged the tubing and are drawing sample air through the tubing.
- **Avoid leaks in the sampling train**. Leaks of ambient air through fittings between pieces of the sampling train (e.g., tubing to particulate filter) will dilute the sample. Always use compression fittings for all connections; never use tube in tube connections.
- **Don't sample water**. If moisture is visible in the sample tubing, the soil gas sample may be compromised. Soil gas probes should be at an appropriate depth to avoid reaching the water table. Additionally, subsurface vapor should not be collected immediately after measurable precipitation.
- **Purge the sample port**. A sample port on an SVE system or LFG collection system can accumulate solids or liquids depending upon the location of the port in the process and the orientation of the port. An influent sample port located upstream of a filter or moisture knock-out can be laden with particulates or saturated with water vapor. Heavy particulate matter can clog the particulate filter and foul the canister

valve. It is important to prevent liquids from entering the canister. A sample port oriented downward may have liquid standing in the valve. Purge the sample port adequately before connecting the sampling train.

- **Consider the effects of sampling a process under vacuum or pressure**. When collecting a grab sample from a stationary source such as an SVE system or LFG collection system, some sample ports may be under vacuum or pressure relative to ambient conditions. When the sample port is under vacuum, such as the header pipe from the extraction well network, it may be difficult to fill the canister with the desired volume of sample. A vacuum pump may be used to collect a canister grab sample from a sample port under considerable vacuum. See the related discussion on sampling at altitude in Section 5.2. When the sample port is under pressure, such as the effluent stack downstream of the blower and treatment system, you may inadvertently pressurize the canister. Only a DOT-approved sample cylinder should be used to transport pressurized air samples. Under no circumstances should an Air Toxics Ltd. canister be pressurized more than 5 psig for a 6 L canister and 15 psig for a 1 L canister. Bleed off excess pressure by opening the valve temporarily while monitoring the canister with a pressure gauge.



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STANDARD OPERATING PROCEDURE 4.1
WATER LEVEL MEASUREMENT

1.0 SUMMARY

This procedure provides descriptions of equipment and field procedures necessary to measure liquid levels and well depths. This procedure must be performed prior to any activity that may disturb the water level, such as groundwater sampling or aquifer testing.

2.0 EQUIPMENT

Equipment and materials used during liquid level and well-depth measurements:

- Water level indicator with cable measured at 0.01 foot increments
- Oil-water interface probe
- Weighted tape measure with 0.1 foot increments
- Decontamination equipment
- Weatherproof, bound field logbook with numbered pages
- Field data sheet
- Appropriate health and safety equipment as specified in the Site Safety and Health Plan (SSHP)
- Keys for lock and well covers
- Wire cutters if well has a security tag
- Turkey baster in case flushmount manhole is filled with pooled water
- Bolt cutters for cutting “frozen” or rusted locks. The use of WD-40 may not be appropriate because of possible contamination.
- Extra locks to replace cut locks

3.0 PROCEDURES

3.1 Preliminary Steps

Follow these steps prior to disturbing the liquid level in the well:

1. Locate the well and verify its position on the site map. Record whether positive identification was obtained, including the well number and any identifying marks or codes imprinted on the well casing or protective casing. Gain access to the top of the well casing.
2. Locate the permanent reference mark at the top of the casing. This reference point will be scribed, notched, or otherwise noted on the top of the casing. If no such marks are present, measure to the top of the highest point of the well casing and so note this fact in the field logbook. Determine from the records and record in the logbook the evaluation of this point.
3. Record any observations and remarks regarding the characteristics and condition of the well, such as evidence of cracked casing or surface seals, security of the well (locked cap), or evidence of tampering.
4. Keep all equipment and supplies protected from gross contamination; use clean plastic sheeting. Keep the water level indicator probe in its protective case when not in use.
5. Decontaminate the water level indicator probe before use and in between each well location.

3.2 Operation

Refer to Exhibits 1 through 3 and follow these steps when taking liquid level measurements:

1. Sample the air in the wellhead for gross organic vapors.
2. If non-aqueous phase liquid (NAPL) contamination is suspected, use an oil-water interface probe to determine the existence and thickness of NAPLs.
3. Open probe housing, turn the probe on, and test the alarm. Ground the probe, because the slight electric charge from the probe could set off an explostion of highly flammable air. Slowly lower the probe into the well until the alarm sounds. A continuous alarm indicates light non-aqueous phase liquid (LNAPL) while an intermittent alarm indicates water. If LNAPL is detected, record the initial level (first alarm). Mark the spot by grasping the cable with the thumb and forefingers at the top of the casing. Use the reference point on the casing to determine the level. Withdraw the cable sufficiently to record the depth.
4. Continue to slowly lower the probe until it passes into the water phase. Slowly retract the probe until the NAPL alarm sounds and record that level in the same manner as described above.
5. Record the thickness of the LNAPL by subtracting depth to water from depth to LNAPL.

6. Continue to slowly lower the interface probe through the water column to check for the presence of dense nonaqueous-phase liquid (DNAPL).

7. Measure and record the thickness of the DNAPL layer (if any) as described above.

8. Slowly raise the interface probe, recording the depth to each interface as the probe is withdrawn. If there is a discrepancy in depths, clean the probe sensors and re-check the depths.

9. Always lower and raise the interface probe slowly to prevent undue mixing of media.

10. Always perform a NAPL check in wells installed in areas with suspected NAPL contamination. Always perform a NAPL check if headspace test reveals presence of volatiles. Always perform a NAPL check the first time a well is sampled. If a well has been sampled previously, no NAPLs were present, and none of the preceding conditions are met, the NAPL check may be omitted.

11. If NAPL is not present, use an electronic water level indicator as described below:

    a) Remove the water level indicator probe from the case, turn on the sounder, and test the battery and the sensitivity scale by pushing the red button. Adjust the sensitivity scale until you can hear the buzzer.

    b) Slowly lower the probe and cable into the well, allowing the cable reel to unwind. Continue lowering until the meter buzzes. Very slowly, raise and lower the probe until the point is reached where the meter just buzzes. Mark the spot by grasping the cable with the thumb and forefingers at the top of the casing. If a mark is present on the casing, use the mark as the reference point. If no mark is present, use the highest point on the casing as a reference point. Withdraw the cable and record the depth.

    c) Alternatively, use a steel tape with an attached weight if the aquifer gradients are lower than 0.05 ft/ft. Due to the possibility of adding unknown contaminants from chalk colorants, only white chalk is permitted as a level indicator.

    d) Rub chalk onto the first 1 foot of the steel tape and slowly lower the chalked end onto the well until the weighted end is below the water surface. (A small splash can be heard when the weighted end hits the water surface.)

    e) Mark the spot on the tape by grasping the tape with the thumb and forefingers at the top of the casing as described in subsection (b) above.

    f) Remove the steel tape. The chalk will be wet or absent where the tape was below the water surface. Locate, read, and record this length.

Subtract the wet length from the total length and record the difference. This is the depth to water table.

3.3 Precautions

- Depending upon the device used, correction factors may be required for some measurements.
- Check instrument batteries prior to each use.
- Exercise care not to break the seals at the top of the electric water level indicator probe.
- When measuring well depth, the increments for measure are ticked off from the alarm sensor on the probe. On some meters there is a piece that sticks out beyond the sensor. This needs to be accounted for when reading the measurement (i.e., added on to the reading). A potential problem arises if it is unknown whether this has been done on previous readings or not.

4.0 DOCUMENTATION

This section describes the documentation necessary for liquid level and well-depth measurements.

Complete the water level data form during each measuring event. Field data forms will include date, time, well number, total well depth, water level, and LNAPL and/or DNAPL if appropriate. Also keep a field logbook during liquid level measurement activities describing decontamination procedures, monitoring procedures, and other observations during liquid level measurement. Both the data forms and logbook shall be neat and legible, and shall be signed and dated by the person completing the page.

Record the following information, at a minimum, in the field logbook:

- Date
- Time
- Weather
- Field personnel
- Well location
- Well condition
- Monitoring equipment type and readings

- Liquid levels obtained
- Any other observations

All entries in the field logbook must be printed in black ink and legible.

5.0 REFERENCE

Thornhill, Jerry T. 1989. “Accuracy of Depth to Groundwater Measurements.” In *EPA Superfund Groundwater Issue*. EPA/504/4-89/002.

6.0 ATTACHMENTS

Exhibit 1	Electric Sounder
Exhibit 2	Graduated Steel Tape
Exhibit 3	Interface Probe

Exhibit 1
Electric Sounder

Electric water level probes are usually equipped with a signal light, alarm, or both. Lower the probe into the welll until the signal alarm is activated. This will occur when the probe touches the water.

Raise the probe slowly out of the water until the alarm stops.

Lower the probe very slowly until the tone sounds again.

Read the calibrated tape at the well reference datum when the probe is properly located at the water surface. Record the depth to water from the probe cable to the nearest 0.01 foot. Take a second reading to confirm the original measurement.

Exhibit 2
Graduated Steel Tape

Field personnel should judge whether the conditions in the well warrant the use of this method (e.g., water dripping into the well can obscure the readings from this method).

Attach a small weight to the end of a steel surveyor’s tape.

Coat the first few feet of tape with blue carpenter’s chalk.

Slowly lower the graduated steel tape from the measuring datum until the lower end of the tape is submerged.

Read the tape to the nearest 0.01 foot at the measuring point, and then remove the tape from the well. Read the water mark to the nearest 0.01 foot from the wetted portion of the chalked tape. The difference between these two measurements is the depth to the water surface below the datum.

Exhibit 3
Interface Probe

To detect immiscible product layers, field personnel should employ an interface probe capable of detecting thin layers of product. The manufacturer's instructions should be followed because operating procedures vary for different probes.

Many brands require that the probe be fully submerged through the product layer into the water. Depth to water should be measured first, followed by depth to product as the probe is moved upward in the well.

The depth to the product or water is read directly off the graduated tape when the appropriate signal light or buzzer is activated and should be recorded on the data sheet or logbook. The difference between the measured product/water depth and the height of the measuring datum from the ground surface is the actual depth. The difference in depth between the top of the water and the top of the product is the apparent product thickness.

This same process is applied to a free product that is denser than water and sinks to form a product stratum over a lower permeability sediment layer. In this situation, the instrument first indicates the presence of water and then the presence of product as the probe is lowered through the product layer.

STANDARD OPERATING PROCEDURE 4.2
GROUNDWATER SAMPLING FROM DIRECT-PUSH BORINGS AND MONITORING WELLS

1.0 SUMMARY

This procedure establishes the protocol for sampling groundwater. The goal of the sampling program is to obtain samples that meet acceptable standards of accuracy, precision, comparability, representativeness, and completeness. This procedure is intended to be sufficently detailed so that all sampling personnel following these procedures will deliver samples to the laboratory that are equally reliable and consistent.

This SOP applies to both conventional monitoring wells and temporary wells. Temporary wells differ from conventional groundwater monitoring wells in that they are installed using direct-push technology. Temporary wells will often be 1 to 2 inches in diameter and may not be developed prior to sampling. These differences may present certain challenges in the field, such as difficulty in obtaining sufficient water for sampling and samples that are high in suspended solids.

2.0 EQUIPMENT

The following items are required for sampling groundwater from monitoring and production wells:

- Well keys
- Bolt cutters and extra locks
- Water level indicator (decontaminated)
- Assorted tools, such as a knife and screwdriver
- Twelve volt battery or cigarette lighter plug
- Peristaltic pump or stainless steel, portable submersible pump (decontaminated) with low flow controller/LCD (power converter)
- Multiparameter meter (calibrated) which includes measurements for:
    i) pH
    ii) Specific conductivity in uS/cm
    iii) Temperature in degrees Celsius
    iv) Oxygen reduction potential (ORP) in mV
    v) Dissolved oxygen (DO) in mg/L
- Flow-through cell

- Turbidity meter (calibrated)
- Disposable polyethylene and silicone tubing
- Graduated cylinder / container for determining purge flow rate and volume
- Calibration solutions
- 0.45-µm in-line filter or other appropriate filtering approaches (for dissolved constituents only), if applicable
- Plastic squeeze bottles filled with deionized water and other decontamination chemicals as required for analyses being performed
- Paper towels or other chemically clean wipes such as Kimwipes
- Calculator
- Weatherproof, bound field logbook with numbered pages
- Permanent/indelible black ink pens
- Waterproof and permanent marker
- 55-gallon drum, holding tank, or 5-gallon buckets for storing purged water
- Plastic sheeting (for placing around well)
- Appropriate health and safety equipment as specified in the Site Safety and Health Plan (SSHP).
- Appropriate decontamination equipment as specified in the standard operating procedure (SOP) for sampling equipment decontamination.
- Sample jars, labels, and chain-of-custody forms. Sample bottles with preservatives added will be obtained from the analytical laboratory. Several extra sample bottles will be obtained in case of breakage or other problems.

3.0 PROCEDURES

3.1 Equipment Decontamination

If not using disposable, non-reusable sampling equipment, before any purging or sampling begins, decontaminate purging or sampling equipment following the procedures specified in the SOP for sampling equipment decontamination.

3.2 Instrument Calibration

Before going into the field, verify that field instruments are operating properly (see SOPs 1.4 and 1.5). Record calibration checks and calibration times and readings in a notebook kept by the field sampler. Specific instructions for calibrating the instruments are given in the manufacturer's manual and the SOP for equipment calibration.

3.3 Groundwater Sample Collection Using Direct-Push Technology

The following sequential steps are to be completed when collecting grab groundwater samples from direct-push borings:

1. At the selected sampling interval, the sampler sheath of the direct-push probe will be removed exposing the screen. The screen will consist of an approximately 1- inch outside diameter, and about 41-inches length, and will be of stainless steel construction with a slot interval of approximately 0.010 inches.
2. After deploying the screen, allow the aquifer materials around the screen to re-equilibrate for approximately 15 minutes prior to initiating groundwater sampling.
3. After the temporary well has equilibrated with the aquifer, a depth to water surface, as measured from the ground surface will be gauged. This will be accomplished using the water level indicator.
4. Groundwater purging and sampling will be conducted using a peristaltic pump and new, dedicated polyethylene and silicone tubing. Before collecting samples, sampling personnel will don new clean nitrile or equivalent protective gloves. Groundwater will be transferred from the well point into the appropriate pre-labeled sample bottles using the pump and tubing.
5. Collect samples as discussed in Section 3.4.5.

3.4 Groundwater Sample Collection from Monitoring Wells

The purpose of well purging is to remove stagnant water from the sample collection depth so that a sample of water representative of the aquifer (or portion of aquifer) can be obtained. Handle purged well water according to the protocols outlined in the SOP for handling investigation-derived waste.

3.4.1 Water Level Measurements

1. Conduct water level measurement as per SOP 4.1.
    a. Do not tag bottom of well with water level meter indicator, as this will tend to re-suspend solids that have accumulated in the end cap. If well depth must be measured, do so after sampling is complete.
    b. Do not conduct low flow groundwater monitoring if free product is present unless specifically approved by the Project Manager (PM) and dedicated equipment is available.

2. Record static water level on Monitoring Well Sampling Field Log.

3.4.2 Pump Installation

1. Make sure area around well head is clean and free of debris. If necessary, place a plastic drop cloth around well head to prevent sampling equipment from coming into contact with the ground surface.
2. If a down-hole pump is used, the pump should be decontaminated (as specified in SOP 1.6) before and after introduction to each well. Protective powderless latex or nitrile gloves should be worn during possible water-contact or equipment-contact activities. At a minimum, gloves should be changed between each well or when introduction of potential contaminants to the well is possible.
3. Determine depth of pump or tubing intake placement. Ideal location of the pump intake should be at the middle of the screened interval. However, site specific / well specific conditions may require placement at a different interval (i.e. specific water-bearing zones, low water table, large screen intervals, etc.). If pump limitations do not allow for the intake to be within the screen interval, see the section below titled Calculating Minimum Purge Amount.
4. Measure and cut an appropriate length of polyethylene tubing and secure to the pump discharge nozzle. Use of a tightening ring may be necessary to secure the tubing.
5. Lower the pump or tubing intake into and through the water column SLOWLY in order to avoid mobilizing sediments through physical contact or by “pulsing” the water column. Lower the pump or tubing intake to the desired depth and secure the tubing at the surface.
6. Following pump installation, slowly lower water level indicator until contact with the water table is achieved and secure the indicator at this depth.
7. Insert the multiparameter meter into the appropriate port of the flow-through cell.
8. Connect the pump’s discharge tubing to the flow-through cell, and connect a length of tubing from the effluent end of the flow-through cell to the graduated cylinder / container.

3.4.3 Calculating Minimum Purge Amount

This task is only necessary if pump placement will not be within the screened interval (e.g. extreme well depth); otherwise proceed to Purging the Well. The purpose is to assure removal of the stagnant water column between the top of the screen and the pump intake.

1. Total well depth (TD) minus the static water level (SWL) equals the water column

height (WC)

2. The WC multiplied by the appropriate conversion factor (CF) (well diameter dependent) equals one well volume (WV)
3. In summary: TD - SWL = WC
   WC x CF = WV

1. Install pump at greatest possible depth above the screen
2. Purge one well volume (WV) at low-flow rates. **NOTE**: Do not collect a sample at this time. This now becomes the starting point for low-flow purging as per the next section: Purging the Well.
3. Record calculation results on Monitoring Well Sampling Field Log.

3.4.4 Purging the Well

1. Ensure the pump rate is at the lowest setting, and turn on the pump.
2. Once started, turning the pump on and off should be avoided since this allows the water column in the tubing to surge back into the well, possibly mobilizing particulate material. Similarly, significant variations in flow rate should be avoided as these actions can result in surging.
3. Adjust the flow rate to ensure no more than 0.3 feet of drawdown occurs within the well. EPA (1996) suggests typical flow rates of less than 0.5 L/min, but can be as high as 1 L/min. The lowest possible sustainable flow rate should be achieved. If the water table level cannot be maintained, an alternative low-flow sampling method utilizing pulsed purging may be recommended by the PM.
4. Record the below listed stabilization parameters on the Monitoring Well Sampling Field Log at an appropriate time interval (every 3 to 5 minutes). Continue monitoring water quality parameters until they meet the stabilization criteria listed below (the below listed order is the preferred order of stabilization for these parameters):

• pH	± 0.1 pH units
• Conductivity	± 3 %
• ORP	± 10 mV
• Turbidity	± 10 % (if above 5 NTU)
• Dissolved oxygen	greater of ± 10% or ± 0.2 mg/L
• Temperature	± 1 degree Celsius

5. Stabilization has occurred at the point when the minimum stability criteria has been met across the three consecutive measurements. The stability criteria for each parameter are included on the Monitoring Well Sampling Field Log. Once

stabilization has occurred in the selected parameters, sampling may begin. Should individual parameters not stabilize after a reasonable amount of purging (two to three well volumes), contact the PM to determine an appropriate solution.

6. Remember to verify calibration of multiparameter meter at the end of each day.

3.4.5 Collecting the Groundwater Sample

1. Disconnect the flow-through cell before sample collection.
2. Collect samples at the same flow rate as the purge rate. Do not stop purging the well until the entire sample has been collected.
3. Record the time when collection of sample commenced and was completed.
4. If a filtered sample is required, collect after all other sampling is completed. In general, groundwater samples collected for multiple compounds should be collected in the following order (U.S. EPA 1992):
   - VOCs
   - SVOCs
   - Other Organics
   - Metals and cyanide
   - Major water quality cations and anions
5. When collecting samples for VOCs, direct flow from the pump discharge down the side of the sample container to minimize aeration. Hold caps in hand to minimize contamination of sample. Fill all VOC sample containers to the top. A positive meniscus at the top of the container will help ensure that no air is trapped inside when cap is screwed down on the container. No air bubbles should be trapped in the sample when the container is sealed.
6. If applicable, filtered groundwater samples will be collected using a new, disposable filter cartridge (typically 0.45 µ). Filtered water should be introduced directly into the appropriate sample container. Although not recommended, the laboratory can filter the samples if the samples are NOT preserved and are filtered within 24–48 hours of collection.
7. Collect quality assurance and quality control (QA/QC) samples (i.e., duplicate, equipment rinsate, trip blank, laboratory matrix spike, and laboratory matrix spike duplicate, as applicable) at the same time by filling all bottles from the same flow. The number and types of QA/QC samples are specified in the work plan.
8. Sample bottles must be labeled with date, sample number, time, sampler’s name, and type of preservative, as described in the work plan. Sample bottles must be placed in a cooler or on ice to keep the sample cool (4°C). Samples must be cooled continuously from time of collection to time of receipt at the laboratory.

9. Remove pump or tubing from the well. Close and lock the well. Decontaminate all reusable equipment as per SOP 1.6. Purge, decontamination water should be managed as specified in SOP 1.8.
10. Collect a final static water level reading after sample collection.
11. Complete chain-of-custody form, package samples for shipment, and ship samples or arrange for courier to laboratory.
12. All field observations made and data generated in conjunction with the sample collection will be documented on the Monitoring Well Sampling Field Log.

3.4.6 Special Considerations

Keep in mind the primary purpose of the low-flow sampling method is to collect more representative samples in environments where artificially suspended solids can have a significant adverse effect on sample quality. Thus efforts should be made in all cases to minimize actions that could suspend or mobilize particulates in the well and aquifer. Actions to avoid include dropping or lowering equipment into the water column too quickly, lowering any equipment to the bottom of the well, surging the well, excessive drawdown, irregular or high pumping rates (i.e. greater than 2 liters/minute), or shutdown of the pump during purging or sampling.

If the well is bailed or pumped dry, assume that all stagnant water has been removed and the well is ready to be sampled. If recovery is very slow, obtain samples as soon as sufficient water is available in the well.

The well sampling order depends on expected levels of contamination in each well, if known, determined prior to sampling. Sampling should progress from the least contaminated to the most contaminated well.

3.4.7 References

ASTM Designation: D 6771-02. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. March 2002

US EPA (1996). Low Flow (Minimal Drawdown) Ground-Water Sampling Procedures. EPA/540/S-95/504. April 1996

4.0 DOCUMENTATION

The following information for groundwater sampling is included in the field logbook and/or a groundwater sampling data form (Exhibit 2):

- Date

- Time
- Weather
- Personnel on site
- Site location description
- General observations
- Well designation and well location
- Condition of the well
- Initial static water level and total well depth
- Calculations (e.g., calculation of purged volume)
- Number of well volumes purged
- Volume of water purged before sampling
- Conductivity, temperature, and pH during purging
- Decontamination information
- Date and time of sampling
- Person performing sampling
- Number of samples taken
- Sample identification numbers associated with each well sampled
- Preservation of samples
- Analyses that will be performed by the laboratory
- Record of any QA/QC samples
- Any irregularities or problems that may have a bearing on sampling quality
- Unusual events
- Visitors to the site

All entries in the field logbook must be printed in black ink and legible.

APPENDIX C

Laboratory Certification Record

FLORIDA DEPARTMENT OF HEALTH

State of Florida
Department of Health, Bureau of Laboratories

This is to certify that

E87412
COLUMBIA ANALYTICAL SERVICES, INC. - WA
1317 SOUTH 13TH AVENUE
KELSO, WA 98626

has complied with Florida Administrative Code 64E-1,
for the examination of Environmental samples in the following categories

DRINKING WATER - GROUP I UNREGULATED CONTAMINANTS, DRINKING WATER - GROUP II UNREGULATED CONTAMINANTS, DRINKING WATER - GROUP III UNREGULATED CONTAMINANTS, DRINKING WATER - MICROBIOLOGY, DRINKING WATER - OTHER REGULATED CONTAMINANTS, DRINKING WATER - PRIMARY INORGANIC CONTAMINANTS, DRINKING WATER - SECONDARY INORGANIC CONTAMINANTS, DRINKING WATER - SYNTHETIC ORGANIC CONTAMINANTS, NON-POTABLE WATER - EXTRACTABLE ORGANICS, NON-POTABLE WATER - GENERAL CHEMISTRY, NON-POTABLE WATER - METALS, NON-POTABLE WATER - MICROBIOLOGY, NON-POTABLE WATER - PESTICIDES-HERBICIDES-PCB'S, NON-POTABLE WATER - VOLATILE ORGANICS, SOLID AND CHEMICAL MATERIALS - EXTRACTABLE ORGANICS, SOLID AND CHEMICAL MATERIALS - GENERAL CHEMISTRY, SOLID AND CHEMICAL MATERIALS - METALS, SOLID AND CHEMICAL MATERIALS - PESTICIDES-HERBICIDES-PCB'S, SOLID AND CHEMICAL MATERIALS - VOLATILE ORGANICS, BIOLOGICAL TISSUE - EXTRACTABLE ORGANICS, BIOLOGICAL TISSUE - GENERAL CHEMISTRY, BIOLOGICAL TISSUE - METALS, BIOLOGICAL TISSUE - PESTICIDES-HERBICIDES-PCB'S

Continued certification is contingent upon successful on-going compliance with the NELAC Standards and FAC Rule 64E-1 regulations. Specific methods and analytes certified are cited on the Laboratory Scope of Accreditation for this laboratory and are on file at the Bureau of Laboratories, P. O. Box 210, Jacksonville, Florida 32231. Clients and customers are urged to verify with this agency the laboratory's certification status in Florida for particular methods and analytes.

EFFECTIVE December 11, 2007 THROUGH June 30, 2008

Max Salfinger

Max Salfinger, M.D.
Chief, Bureau of Laboratories
Florida Department of Health
DH Form 1697, 7/04
NON-TRANSFERABLE E87412-10-12/11/2007
Supersedes all previously issued certificates

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,1,1-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,1,2,2-Tetrachloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,1,2-Trichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,1-Dichloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,1-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,1-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2,3-Trichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2,3-Trichloropropane	EPA 504.1	Group II Unregulated Contaminants	NELAP	7/17/2003
1,2,3-Trichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,2,4-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504.1	Synthetic Organic Contaminants	NELAP	7/17/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504.1	Synthetic Organic Contaminants	NELAP	7/17/2003
1,2-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,2-Dichloroethane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,2-Dichloropropane	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
1,3,5-Trimethylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,3-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
2,2-Dichloropropane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
2,4,5-T	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
2,4-D	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
2-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
3-Hydroxycarbofuran	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDD	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDD	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDE	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDE	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDT	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
4,4'-DDT	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
4-Chlorotoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/17/2003
4-Isopropyltoluene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001

Laboratory Scope of Accreditation

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State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

**E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626**

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Acetochlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Acifluorfen	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Alachlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Aldicarb (Temik)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldicarb sulfone	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldicarb sulfoxide	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldrin	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Aldrin	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Alkalinity as CaCO3	SM 2320 B	Primary Inorganic Contaminants	NELAP	10/8/2001
Aluminum	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Aluminum	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001
Antimony	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Antimony	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Arsenic	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Arsenic	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Atrazine	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Barium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Barium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Benzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Benzo(a)pyrene	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Beryllium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Beryllium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Boron	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007
Bromate	EPA 300.1	Primary Inorganic Contaminants	NELAP	7/17/2003
Bromide	EPA 300.1	Primary Inorganic Contaminants	NELAP	7/17/2003
Bromoacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Bromobenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Bromochloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Bromochloromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	7/17/2003
Bromodichloromethane	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Bromoform	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Butachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Butyl benzyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Cadmium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Cadmium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Calcium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Carbaryl (Sevin)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Carbofuran (Furaden)	EPA 531.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Carbon tetrachloride	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Chlorate	EPA 300.1	Secondary Inorganic Contaminants	NELAP	12/23/2005
Chlordane (tech.)	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Chloride	EPA 300.0	Secondary Inorganic Contaminants	NELAP	10/8/2001
Chlorite	EPA 300.1	Primary Inorganic Contaminants	NELAP	7/17/2003
Chloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Chlorobenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Chloroethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Chloroform	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Chromium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Chromium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
cis-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
cis-1,3-Dichloropropene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Color	SM 2120 B	Secondary Inorganic Contaminants	NELAP	7/17/2003
Conductivity	SM 2510 B	Primary Inorganic Contaminants	NELAP	10/8/2001
Copper	EPA 200.7	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	10/8/2001
Copper	EPA 200.8	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	10/8/2001
Copper	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Cyanide	EPA 335.4	Primary Inorganic Contaminants	NELAP	10/8/2001
Dacthal (DCPA)	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Dalapon	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
DCPA di acid degradate	EPA 515.4	Group I Unregulated Contaminants	NELAP	7/17/2003
DCPA mono acid degradate	EPA 515.4	Group I Unregulated Contaminants	NELAP	7/17/2003
Di(2-ethylhexyl)adipate	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Dibromoacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Dibromochloromethane	EPA 524.2	Other Regulated Contaminants,Group II Unregulated Contaminants	NELAP	10/8/2001
Dibromomethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001

Laboratory Scope of Accreditation

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Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Dicamba	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Dichloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Dichlorodifluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Dichloromethane (DCM, Methylene chloride)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Dieldrin	EPA 508.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Dieldrin	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Diethyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
Dimethyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
Di-n-butyl phthalate	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003
Di-n-octyl phthalate	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Diquat	EPA 549.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Endothall	EPA 548.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Endrin	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Endrin	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
EPTC (Eptam, s-ethyl-dipropyl thio carbamate)	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Ethylbenzene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Fluoride	EPA 300.0	Primary Inorganic Contaminants,Secondary Inorganic Contaminants	NELAP	10/8/2001
Fluoride	SM 4500 F-C	Secondary Inorganic Contaminants,Primary Inorganic Contaminants	NELAP	10/8/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Glyphosate	EPA 547	Synthetic Organic Contaminants	NELAP	7/17/2003
Hardness	SM 2340 B	Secondary Inorganic Contaminants	NELAP	10/8/2007
Heptachlor	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Heptachlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Heptachlor epoxide	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Heptachlor epoxide	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Heterotrophic plate count	SM 9215 B	Microbiology	NELAP	7/17/2003
Hexachlorobenzene	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Hexachlorobutadiene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Hexachlorocyclopentadiene	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Iron	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Isophorone	EPA 525.2	Group III Unregulated Contaminants	NELAP	7/17/2003

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1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Isopropylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Lead	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Lead	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Magnesium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Manganese	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Manganese	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001
Mercury	EPA 245.1	Primary Inorganic Contaminants	NELAP	10/8/2001
Methomyl (Lannate)	EPA 531.1	Group I Unregulated Contaminants	NELAP	7/17/2003
Methoxychlor	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Methoxychlor	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Methyl bromide (Bromomethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Methyl chloride (Chloromethane)	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Methyl tert-butyl ether (MTBE)	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Metolachlor	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Metribuzin	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Molinate	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Molybdenum	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007
Naphthalene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
n-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Nickel	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Nickel	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrate	EPA 300.0	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrate	EPA 353.2	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	10/8/2001
Nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	10/8/2001
n-Propylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Orthophosphate as P	SM 4500-P F	Primary Inorganic Contaminants	NELAP	10/8/2001
Oxamyl	EPA 531.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Paraquat	EPA 549.2	Synthetic Organic Contaminants	NELAP	12/23/2005
PCBs	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
Pentachlorophenol	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Pentachlorophenol	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Perchlorate	EPA 314.0	Primary Inorganic Contaminants	NELAP	7/17/2003
pH	EPA 150.1	Secondary Inorganic Contaminants,Primary Inorganic Contaminants	NELAP	10/8/2001
pH	SM 4500-H+-B	Primary Inorganic Contaminants	NELAP	4/11/2007

Laboratory Scope of Accreditation

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Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Picloram	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Potassium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007
Propachlor (Ramrod)	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
sec-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Selenium	EPA 200.8	Primary Inorganic Contaminants	NELAP	10/8/2001
Selenium	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Silica as SiO2	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Silver	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Silver	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001
Silvex (2,4,5-TP)	EPA 515.4	Synthetic Organic Contaminants	NELAP	7/17/2003
Simazine	EPA 525.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Sodium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2001
Styrene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Sulfate	EPA 300.0	Secondary Inorganic Contaminants,Primary Inorganic Contaminants	NELAP	10/8/2001
Terbacil	EPA 525.2	Group I Unregulated Contaminants	NELAP	7/17/2003
tert-Butylbenzene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Tetrachloroethylene (Perchloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Thallium	EPA 200.8	Primary Inorganic Contaminants	NELAP	11/18/2004
Thallium	EPA 200.9	Primary Inorganic Contaminants	NELAP	10/8/2001
Toluene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Total coliforms & E. coli	SM 9223 B	Microbiology	NELAP	10/8/2001
Total dissolved solids	SM 2540 C	Secondary Inorganic Contaminants	NELAP	10/8/2001
Total haloacetic acids	EPA 552.2	Synthetic Organic Contaminants	NELAP	7/17/2003
Total nitrate-nitrite	EPA 300.0	Primary Inorganic Contaminants	NELAP	10/8/2001
Total nitrate-nitrite	EPA 353.2	Primary Inorganic Contaminants	NELAP	10/8/2001
Total organic carbon	SM 5310C	Primary Inorganic Contaminants	NELAP	4/11/2007
Total trihalomethanes	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Toxaphene (Chlorinated camphene)	EPA 508.1	Synthetic Organic Contaminants	NELAP	7/17/2003
trans-1,2-Dichloroethylene	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
trans-1,3-Dichloropropylene	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Trichloroacetic acid	EPA 552.2	Group I Unregulated Contaminants	NELAP	7/17/2003
Trichloroethene (Trichloroethylene)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Trichlorofluoromethane	EPA 524.2	Group II Unregulated Contaminants	NELAP	10/8/2001
Turbidity	EPA 180.1	Secondary Inorganic Contaminants	NELAP	10/8/2001
Vanadium	EPA 200.7	Primary Inorganic Contaminants	NELAP	10/8/2007

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Drinking Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Vinyl chloride	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Xylene (total)	EPA 524.2	Other Regulated Contaminants	NELAP	10/8/2001
Zinc	EPA 200.7	Secondary Inorganic Contaminants	NELAP	10/8/2001
Zinc	EPA 200.8	Secondary Inorganic Contaminants	NELAP	10/8/2001

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E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,1-Trichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2,2-Tetrachloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1,2-Trichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Dichloropropane	EPA 624	Volatile Organics	NELAP	10/8/2001
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003

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E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Dioxane (1,4-Diethyleneoxide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	7/1/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,4,6-Tetrachlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-Trichlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001

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E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4,6-Trichlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4-Dichlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dimethylphenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 625	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 625	Extractable Organics	NELAP	10/8/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2-Chloroethyl vinyl ether	EPA 624	Volatile Organics	NELAP	10/8/2001
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Chloronaphthalene	EPA 625	Extractable Organics	NELAP	10/8/2001
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Hexanone	EPA 8260	Volatile Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001

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E87412
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dichlorobenzidine	EPA 625	Extractable Organics	NELAP	10/8/2001
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3,4,5-Trichlorocatechol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3,4,5-Trichloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3,4,6-Trichlorocatechol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3,4,6-Trichloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
4,4'-DDD	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDE	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDT	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,5,6-Trichloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Bromophenyl phenyl ether	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorophenyl phenylether	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Acenaphthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 625	Extractable Organics	NELAP	10/8/2001
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Acetone	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acetophenone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acidity, as CaCO3	SM 2310 B (4A)	General Chemistry	NELAP	4/11/2007
Acrolein (Propenal)	EPA 624	Volatile Organics	NELAP	7/17/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Acrylonitrile	EPA 624	Volatile Organics	NELAP	7/17/2003
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Adsorbable organic halogens (AOX)	EPA 1650	General Chemistry	NELAP	10/8/2001
Aldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Alkalinity as CaCO3	EPA 310.1	General Chemistry	NELAP	10/8/2001
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	4/11/2007
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	12/23/2005
Aluminum	EPA 200.7	Metals	NELAP	10/8/2001
Aluminum	EPA 200.8	Metals	NELAP	10/8/2001
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Aluminum	EPA 6020	Metals	NELAP	7/1/2003
Amenable cyanide	EPA 335.1	General Chemistry	NELAP	10/8/2001
Amenable cyanide	SM 4500-CN G	General Chemistry	NELAP	4/11/2007
Ammonia as N	EPA 350.1	General Chemistry	NELAP	10/8/2001
Ammonia as N	EPA 350.3	General Chemistry	NELAP	10/8/2001
Ammonia as N	SM 4500-NH3 G	General Chemistry	NELAP	4/11/2007

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Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Ammonia as N	SM 4500-NH3E	General Chemistry	NELAP	10/8/2007
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 625	Extractable Organics	NELAP	10/8/2001
Anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Antimony	EPA 200.7	Metals	NELAP	10/8/2001
Antimony	EPA 200.8	Metals	NELAP	10/8/2001
Antimony	EPA 6010	Metals	NELAP	7/1/2003
Antimony	EPA 6020	Metals	NELAP	7/1/2003
Aramite	EPA 8270	Extractable Organics	NELAP	7/1/2003
Aroclor-1016 (PCB-1016)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1221 (PCB-1221)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1232 (PCB-1232)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1242 (PCB-1242)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1248 (PCB-1248)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1254 (PCB-1254)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1260 (PCB-1260)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Arsenic	EPA 200.7	Metals	NELAP	10/8/2001
Arsenic	EPA 200.8	Metals	NELAP	10/8/2001
Arsenic	EPA 200.9	Metals	NELAP	10/8/2001
Arsenic	EPA 6010	Metals	NELAP	10/8/2001
Arsenic	EPA 6020	Metals	NELAP	7/1/2003
Arsenic	EPA 7060	Metals	NELAP	10/8/2001
Arsenic	EPA 7062	Metals	NELAP	10/8/2007
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Barium	EPA 200.7	Metals	NELAP	10/8/2001
Barium	EPA 200.8	Metals	NELAP	10/8/2001
Barium	EPA 6010	Metals	NELAP	7/1/2003
Barium	EPA 6020	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzene	EPA 624	Volatile Organics	NELAP	10/8/2001
Benzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Benzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Benzidine	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 200.7	Metals	NELAP	10/8/2001
Beryllium	EPA 200.8	Metals	NELAP	10/8/2001
Beryllium	EPA 6010	Metals	NELAP	7/1/2003
Beryllium	EPA 6020	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Biochemical oxygen demand	EPA 405.1	General Chemistry	NELAP	10/8/2001
Biochemical oxygen demand	SM 5210 B	General Chemistry	NELAP	4/11/2007
bis(2-Chloroethoxy)methane	EPA 625	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroethyl) ether	EPA 625	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 625	Extractable Organics	NELAP	10/8/2001

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 625	Extractable Organics	NELAP	10/8/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Boron	EPA 200.7	Metals	NELAP	10/8/2001
Boron	EPA 6010	Metals	NELAP	10/8/2007
Bromide	EPA 300.0	General Chemistry	NELAP	10/8/2001
Bromobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromodichloromethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Bromoform	EPA 624	Volatile Organics	NELAP	10/8/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Butyl benzyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cadmium	EPA 200.7	Metals	NELAP	10/8/2001
Cadmium	EPA 200.8	Metals	NELAP	10/8/2001
Cadmium	EPA 6010	Metals	NELAP	10/8/2001
Cadmium	EPA 6020	Metals	NELAP	7/1/2003
Calcium	EPA 200.7	Metals	NELAP	10/8/2001
Calcium	EPA 6010	Metals	NELAP	10/8/2001
Carbazole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	7/1/2003
Carbon tetrachloride	EPA 624	Volatile Organics	NELAP	10/8/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chemical oxygen demand	EPA 410.1	General Chemistry	NELAP	10/8/2001
Chemical oxygen demand	EPA 410.2	General Chemistry	NELAP	12/23/2005
Chemical oxygen demand	SM 5220 C	General Chemistry	NELAP	4/11/2007
Chlordane (tech.)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chloride	EPA 300.0	General Chemistry	NELAP	10/8/2001
Chloride	EPA 325.3	General Chemistry	NELAP	10/8/2001
Chloride	SM 4500 Cl- C	General Chemistry	NELAP	4/11/2007
Chlorobenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Laboratory Scope of Accreditation

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Columbia Analytical Services, Inc. - WA
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chloroethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroform	EPA 624	Volatile Organics	NELAP	10/8/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chromium	EPA 200.7	Metals	NELAP	10/8/2001
Chromium	EPA 200.8	Metals	NELAP	10/8/2001
Chromium	EPA 6010	Metals	NELAP	7/1/2003
Chromium	EPA 6020	Metals	NELAP	7/1/2003
Chromium	EPA 7191	Metals	NELAP	10/8/2007
Chromium VI	EPA 7195	Metals	NELAP	7/1/2003
Chromium VI	EPA 7196	General Chemistry	NELAP	7/1/2003
Chrysene	EPA 625	Extractable Organics	NELAP	10/8/2001
Chrysene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Chrysene	EPA 8310	Extractable Organics	NELAP	7/1/2003
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,3-Dichloropropene	EPA 624	Volatile Organics	NELAP	10/8/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	7/1/2003
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Cobalt	EPA 200.7	Metals	NELAP	10/8/2001
Cobalt	EPA 200.8	Metals	NELAP	10/8/2001
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Cobalt	EPA 6020	Metals	NELAP	7/1/2003
Color	EPA 110.2	General Chemistry	NELAP	10/8/2001
Color	SM 2120 B	General Chemistry	NELAP	4/11/2007
Conductivity	EPA 120.1	General Chemistry	NELAP	10/8/2001
Copper	EPA 200.7	Metals	NELAP	10/8/2001
Copper	EPA 200.8	Metals	NELAP	10/8/2001
Copper	EPA 6010	Metals	NELAP	10/8/2001
Copper	EPA 6020	Metals	NELAP	7/1/2003
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
delta-BHC	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dibenz(a,h) anthracene	EPA 625	Extractable Organics	NELAP	10/8/2001
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibromochloromethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dibromomethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dieldrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diesel range organics (DRO)	CA-LUFT	Extractable Organics	NELAP	7/1/2003
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/28/2003
Diesel range organics (DRO)	NWTPH-Dx	Extractable Organics	NELAP	7/1/2003
Diethyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dimethyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-butyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-octyl phthalate	EPA 625	Extractable Organics	NELAP	10/8/2001
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan I	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan II	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan sulfate	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003

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Columbia Analytical Services, Inc. - WA
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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin aldehyde	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2007
Enterococci	SM 9223 B /QUANTI-TRAY	Microbiology	NELAP	10/8/2007
Escherichia coli	SM 9223 B /QUANTI-TRAY	Microbiology	NELAP	10/8/2007
Ethanol	EPA 8015	Volatile Organics	NELAP	7/1/2003
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Ethylbenzene	EPA 624	Volatile Organics	NELAP	10/8/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	7/1/2003
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fecal coliforms	SM 9221 E	Microbiology	NELAP	10/8/2001
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fluoranthene	EPA 625	Extractable Organics	NELAP	10/8/2001
Fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluoranthene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 625	Extractable Organics	NELAP	10/8/2001
Fluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Fluoride	EPA 300.0	General Chemistry	NELAP	10/8/2001
Fluoride	EPA 340.2	General Chemistry	NELAP	10/8/2001
Fluoride	SM 4500 F-C	General Chemistry	NELAP	4/11/2007
Formaldehyde	EPA 8315	Extractable Organics	NELAP	7/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	12/23/2005
Gasoline range organics (GRO)	CA-LUFT	Extractable Organics	NELAP	7/1/2003

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Gasoline range organics (GRO)	EPA 8015	Volatile Organics	NELAP	7/17/2003
Gasoline range organics (GRO)	NWTPH-Gx	Extractable Organics	NELAP	7/1/2003
Hardness	EPA 130.2	General Chemistry	NELAP	10/8/2001
Hardness	SM 2340 C	General Chemistry	NELAP	4/11/2007
Hardness (calc.)	EPA 200.7	Metals	NELAP	10/8/2007
Heptachlor	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor epoxide	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Hexachlorobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorocyclopentadiene	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloroethane	EPA 625	Extractable Organics	NELAP	10/8/2001
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Ignitability	EPA 1020	General Chemistry	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Iron	EPA 200.7	Metals	NELAP	10/8/2001
Iron	EPA 6010	Metals	NELAP	7/1/2003
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Isophorone	EPA 625	Extractable Organics	NELAP	10/8/2001
Isophorone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Isosafrole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Kjeldahl nitrogen	ASTM D3590-89A	General Chemistry	NELAP	4/11/2007
Kjeldahl nitrogen - total	EPA 351.4	General Chemistry	NELAP	10/8/2001

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Lead	EPA 200.7	Metals	NELAP	10/8/2001
Lead	EPA 200.8	Metals	NELAP	10/8/2001
Lead	EPA 200.9	Metals	NELAP	10/8/2001
Lead	EPA 6010	Metals	NELAP	10/8/2001
Lead	EPA 6020	Metals	NELAP	7/1/2003
Lead	EPA 7421	Metals	NELAP	10/8/2001
Magnesium	EPA 200.7	Metals	NELAP	10/8/2001
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Manganese	EPA 200.7	Metals	NELAP	10/8/2001
Manganese	EPA 200.8	Metals	NELAP	10/8/2001
Manganese	EPA 6010	Metals	NELAP	7/1/2003
Manganese	EPA 6020	Metals	NELAP	7/1/2003
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Mercury	EPA 1631	Metals	NELAP	10/8/2001
Mercury	EPA 245.1	Metals	NELAP	10/8/2001
Mercury	EPA 7470	Metals	NELAP	10/8/2001
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methanol	NCASI 99.01	Volatile Organics	NELAP	10/8/2001
Methanol	NCASI DI/MEOH-94.03	Volatile Organics	NELAP	10/8/2001
Methapyrilene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Methyl bromide (Bromomethane)	EPA 624	Volatile Organics	NELAP	10/8/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl chloride (Chloromethane)	EPA 624	Volatile Organics	NELAP	10/8/2001
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl mercury	EPA 1630	Metals	NELAP	10/8/2007
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Methylene chloride	EPA 624	Volatile Organics	NELAP	10/8/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

Attachment to Certificate #: E87412-10, expiration date June 30, 2008. This listing of accredited analytes should be used only when associated with a valid certificate.

State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Molybdenum	EPA 200.7	Metals	NELAP	10/8/2001
Molybdenum	EPA 200.8	Metals	NELAP	10/8/2001
Molybdenum	EPA 6010	Metals	NELAP	10/8/2001
Molybdenum	EPA 6020	Metals	NELAP	10/8/2007
Naphthalene	EPA 625	Extractable Organics	NELAP	10/8/2001
Naphthalene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Naphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Naphthalene	EPA 8310	Extractable Organics	NELAP	7/1/2003
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Nickel	EPA 200.7	Metals	NELAP	10/8/2001
Nickel	EPA 200.8	Metals	NELAP	10/8/2001
Nickel	EPA 6010	Metals	NELAP	10/8/2001
Nickel	EPA 6020	Metals	NELAP	7/1/2003
Nitrate as N	EPA 300.0	General Chemistry	NELAP	10/8/2001
Nitrate as N	EPA 353.2	General Chemistry	NELAP	7/17/2003
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	10/8/2001
Nitrite as N	EPA 300.0	General Chemistry	NELAP	10/8/2001
Nitrite as N	EPA 353.2	General Chemistry	NELAP	7/17/2003
Nitrobenzene	EPA 625	Extractable Organics	NELAP	10/8/2001
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	7/1/2003
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodimethylamine	EPA 625	Extractable Organics	NELAP	10/8/2001
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodi-n-propylamine	EPA 625	Extractable Organics	NELAP	10/8/2001
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 625	Extractable Organics	NELAP	10/8/2001
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	7/1/2003

Laboratory Scope of Accreditation

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Oil & Grease	EPA 1664	General Chemistry	NELAP	10/8/2001
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	10/8/2001
o-Toluidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Oxygen, dissolved	SM 4500-O G	General Chemistry	NELAP	4/11/2007
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pentachlorophenol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Pentachlorophenol	EPA 625	Extractable Organics	NELAP	10/8/2001
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
pH	EPA 150.1	General Chemistry	NELAP	10/8/2001
pH	EPA 9040	General Chemistry	NELAP	7/1/2003
pH	SM 4500-H+-B	General Chemistry	NELAP	4/11/2007
Phenacetin	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Phenanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Phenol	EPA 625	Extractable Organics	NELAP	10/8/2001
Phenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	10/8/2001
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Potassium	EPA 200.7	Metals	NELAP	10/8/2001
Potassium	EPA 6010	Metals	NELAP	10/8/2001
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Pyrene	EPA 625	Extractable Organics	NELAP	10/8/2001
Pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyrene	EPA 8310	Extractable Organics	NELAP	7/1/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Residual free chlorine	EPA 330.4	General Chemistry	NELAP	10/8/2001
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	10/8/2001
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	4/11/2007
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	10/8/2001

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Residue-nonfilterable (TSS)	SM 2540 D	General Chemistry	NELAP	4/11/2007
Residue-settleable	EPA 160.5	General Chemistry	NELAP	10/8/2001
Residue-settleable	SM 2540 F	General Chemistry	NELAP	4/11/2007
Residue-total	EPA 160.3	General Chemistry	NELAP	10/8/2001
Residue-total	SM 2540 B	General Chemistry	NELAP	4/11/2007
Residue-volatile	EPA 160.4	General Chemistry	NELAP	10/8/2001
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Safrole	EPA 8270	Extractable Organics	NELAP	7/1/2003
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Selenium	EPA 200.7	Metals	NELAP	10/8/2001
Selenium	EPA 200.8	Metals	NELAP	10/8/2001
Selenium	EPA 200.9	Metals	NELAP	10/8/2001
Selenium	EPA 6010	Metals	NELAP	10/8/2001
Selenium	EPA 6020	Metals	NELAP	10/8/2007
Selenium	EPA 7740	Metals	NELAP	10/8/2001
Selenium	EPA 7742	Metals	NELAP	7/17/2003
Silica as SiO2	EPA 200.7	Metals	NELAP	10/8/2007
Silver	EPA 200.7	Metals	NELAP	10/8/2001
Silver	EPA 200.8	Metals	NELAP	10/8/2001
Silver	EPA 6010	Metals	NELAP	7/1/2003
Silver	EPA 6020	Metals	NELAP	7/1/2003
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Sodium	EPA 200.7	Metals	NELAP	10/8/2001
Sodium	EPA 6010	Metals	NELAP	7/1/2003
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Strontium	EPA 200.7	Metals	NELAP	10/8/2007
Styrene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	10/8/2001
Sulfide	EPA 376.1	General Chemistry	NELAP	10/8/2001
Sulfide	SM 4500-S F (20th Ed.)	General Chemistry	NELAP	4/11/2007
Sulfite-SO3	SM 4500-SO3 B	General Chemistry	NELAP	4/11/2007
Surfactants - MBAS	SM 5540 C	General Chemistry	NELAP	4/11/2007
Tannin & Lignin	SM 5550 B	General Chemistry	NELAP	10/8/2007
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachlorocatechol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Tetrachloroethylene (Perchloroethylene)	EPA 624	Volatile Organics	NELAP	10/8/2001

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Tetrachloroguaiacol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Thallium	EPA 200.7	Metals	NELAP	10/8/2001
Thallium	EPA 200.8	Metals	NELAP	10/8/2001
Thallium	EPA 200.9	Metals	NELAP	10/8/2001
Thallium	EPA 6010	Metals	NELAP	10/8/2007
Thallium	EPA 6020	Metals	NELAP	7/1/2003
Thallium	EPA 7841	Metals	NELAP	7/1/2003
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Tin	EPA 200.7	Metals	NELAP	7/17/2003
Tin	EPA 6010	Metals	NELAP	10/8/2007
Titanium	EPA 200.7	Metals	NELAP	7/17/2003
Titanium	EPA 6010	Metals	NELAP	10/8/2007
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Toluene	EPA 624	Volatile Organics	NELAP	10/8/2001
Toluene	EPA 8021	Volatile Organics	NELAP	7/1/2003
Toluene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Total coliforms	SM 9221 B	Microbiology	NELAP	10/8/2001
Total coliforms	SM 9223 B /QUANTI-TRAY	Microbiology	NELAP	10/8/2007
Total coliforms & E. coli	SM 9223 B	Microbiology	NELAP	10/8/2007
Total cyanide	EPA 335.4	General Chemistry	NELAP	7/17/2003
Total cyanide	EPA 9012	General Chemistry	NELAP	12/23/2005
Total hardness as CaCO3	EPA 200.7	Metals	NELAP	10/8/2001
Total organic carbon	EPA 415.1	General Chemistry	NELAP	10/8/2001
Total organic carbon	EPA 9060	General Chemistry	NELAP	7/1/2003
Total organic carbon	SM 5310C	General Chemistry	NELAP	4/11/2007
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	7/1/2003
Total Petroleum Hydrocarbons (TPH)	EPA 1664	General Chemistry	NELAP	10/8/2001
Total Petroleum Hydrocarbons (TPH)	EPA 8015	Extractable Organics	NELAP	7/1/2003
Total Petroleum Hydrocarbons (TPH)	NWTPH-HCID	Extractable Organics	NELAP	7/1/2003
Total phenolics	EPA 420.1	General Chemistry	NELAP	10/8/2001
Total residual chlorine	SM 4500-Cl F	General Chemistry	NELAP	4/11/2007
Toxaphene (Chlorinated camphene)	EPA 608	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
trans-1,2-Dichloroethylene	EPA 624	Volatile Organics	NELAP	10/8/2001

Laboratory Scope of Accreditation

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Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,3-Dichloropropylene	EPA 624	Volatile Organics	NELAP	10/8/2001
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	7/1/2003
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloroethene (Trichloroethylene)	EPA 624	Volatile Organics	NELAP	10/8/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichlorofluoromethane	EPA 624	Volatile Organics	NELAP	10/8/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	7/1/2003
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Trichlorosyringol	EPA 1653	Extractable Organics	NELAP	10/8/2001
Turbidity	EPA 180.1	General Chemistry	NELAP	10/8/2001
Uranium	EPA 200.8	Metals	NELAP	10/8/2001
Vanadium	EPA 200.7	Metals	NELAP	10/8/2001
Vanadium	EPA 200.8	Metals	NELAP	10/8/2001
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	10/8/2007
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	7/1/2003
Vinyl chloride	EPA 624	Volatile Organics	NELAP	10/8/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 624	Volatile Organics	NELAP	10/8/2001
Xylene (total)	EPA 8021	Volatile Organics	NELAP	7/1/2003
Xylene (total)	EPA 8260	Volatile Organics	NELAP	7/1/2003
Zinc	EPA 200.7	Metals	NELAP	10/8/2001
Zinc	EPA 200.8	Metals	NELAP	10/8/2001
Zinc	EPA 6010	Metals	NELAP	10/8/2001
Zinc	EPA 6020	Metals	NELAP	7/1/2003

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,2,4-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,3,5-Trimethylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	7/17/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	10/8/2001
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
1-Chlorohexane	EPA 8260	Volatile Organics	NELAP	7/17/2003
1-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/17/2003
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	10/8/2001
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4,5-T	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2,4-D	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4-DB	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	10/8/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	10/8/2001
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	10/8/2001

Laboratory Scope of Accreditation

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State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	10/8/2001
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/8/2001
2-Hexanone	EPA 8260	Volatile Organics	NELAP	10/8/2001
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
2-Nitropropane	EPA 8260	Volatile Organics	NELAP	7/17/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/8/2001
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	10/8/2001
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
3,3'-Dimethylbenzidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	7/17/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/8/2001
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	10/8/2001
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Chlorotoluene	EPA 8260	Volatile Organics	NELAP	10/8/2001
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	10/8/2001
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	10/8/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acenaphthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acenaphthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Acetone	EPA 8260	Volatile Organics	NELAP	10/8/2001
Acetonitrile	EPA 8260	Volatile Organics	NELAP	10/8/2001
Acetophenone	EPA 8270	Extractable Organics	NELAP	10/8/2001
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	10/8/2001
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	10/8/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Aluminum	EPA 6010	Metals	NELAP	10/8/2001
Aluminum	EPA 6020	Metals	NELAP	10/8/2001
Ammonia as N	EPA 350.1	General Chemistry	NELAP	10/8/2007
Aniline	EPA 8270	Extractable Organics	NELAP	10/8/2001
Anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Anthracene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Antimony	EPA 6010	Metals	NELAP	10/8/2001
Antimony	EPA 6020	Metals	NELAP	10/8/2001
Aramite	EPA 8270	Extractable Organics	NELAP	10/8/2001
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Arsenic	EPA 6010	Metals	NELAP	7/1/2003
Arsenic	EPA 6020	Metals	NELAP	10/8/2001
Arsenic	EPA 7060	Metals	NELAP	10/8/2001
Arsenic	EPA 7062	Metals	NELAP	10/8/2007

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Azinphos-methyl (Guthion)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Barium	EPA 6010	Metals	NELAP	10/8/2001
Barium	EPA 6020	Metals	NELAP	10/8/2001
Benzene	EPA 8021	Volatile Organics	NELAP	10/8/2001
Benzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Benzoic acid	EPA 8270	Extractable Organics	NELAP	10/8/2001
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	10/8/2001
Beryllium	EPA 6010	Metals	NELAP	10/8/2001
Beryllium	EPA 6020	Metals	NELAP	10/8/2001
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	10/8/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	10/8/2001
Bolstar (Sulprofos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Boron	EPA 6010	Metals	NELAP	10/8/2007
Bromobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	10/8/2001
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Cadmium	EPA 6010	Metals	NELAP	10/8/2001
Cadmium	EPA 6020	Metals	NELAP	10/8/2001
Calcium	EPA 6010	Metals	NELAP	10/8/2001
Carbazole	EPA 8270	Extractable Organics	NELAP	10/8/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	10/8/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Chloride	EPA 300.0	General Chemistry	NELAP	2/17/2006
Chloride	EPA 9056	General Chemistry	NELAP	7/17/2003
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chlorobenzilate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chloroprene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Chlorpyrifos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Chromium	EPA 6010	Metals	NELAP	10/8/2001
Chromium	EPA 6020	Metals	NELAP	10/8/2001
Chromium	EPA 7191	Metals	NELAP	10/8/2007
Chromium VI	EPA 7195	Metals	NELAP	10/8/2001
Chromium VI	EPA 7196	General Chemistry	NELAP	10/8/2001
Chrysene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Chrysene	EPA 8310	Extractable Organics	NELAP	10/8/2001
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	10/8/2001
cis-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Cobalt	EPA 6010	Metals	NELAP	10/8/2001
Cobalt	EPA 6020	Metals	NELAP	10/8/2001
Copper	EPA 6010	Metals	NELAP	10/8/2001
Copper	EPA 6020	Metals	NELAP	10/8/2001
Corrosivity (pH)	EPA 1110	General Chemistry	NELAP	10/8/2001
Coumaphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dalapon	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Demeton-o	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Demeton-s	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Diallate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Diazinon	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	10/8/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Dibromomethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Dicamba	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Dichloroprop (Dichlorprop)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dichlorovos (DDVP, Dichlorvos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Diesel range organics (DRO)	CA-LUFT	Extractable Organics	NELAP	10/8/2001
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	7/17/2003
Diesel range organics (DRO)	NWTPH-Dx	Extractable Organics	NELAP	10/8/2001
Diethyl ether	EPA 8260	Volatile Organics	NELAP	7/17/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Dimethoate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	EPA 8270	Extractable Organics	NELAP	10/8/2001
Disulfoton	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Disulfoton	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2007
EPN	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Ethoprop	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Ethyl acetate	EPA 8260	Volatile Organics	NELAP	7/17/2003
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/8/2001
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	10/8/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	10/8/2001
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Ethylene glycol	EPA 8015	Volatile Organics	NELAP	10/8/2001
Famphur	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Fensulfothion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Fenthion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Fluoranthene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Fluoranthene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Fluorene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Fluorene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Fluoride	EPA 300.0	General Chemistry	NELAP	2/17/2006
Fluoride	EPA 9056	General Chemistry	NELAP	7/17/2003
Formaldehyde	EPA 8315	Extractable Organics	NELAP	10/8/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Gasoline range organics (GRO)	CA-LUFT	Extractable Organics	NELAP	10/8/2001
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	7/17/2003
Gasoline range organics (GRO)	NWTPH-Gx	Extractable Organics	NELAP	10/8/2001
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachlorophene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Ignitability	EPA 1020	General Chemistry	NELAP	10/8/2001
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Iron	EPA 6010	Metals	NELAP	10/8/2001
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Isophorone	EPA 8270	Extractable Organics	NELAP	10/8/2001
Isopropylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Isosafrole	EPA 8270	Extractable Organics	NELAP	10/8/2001
Kepone	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Lead	EPA 6010	Metals	NELAP	10/8/2001
Lead	EPA 6020	Metals	NELAP	10/8/2001

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Lead	EPA 7421	Metals	NELAP	10/8/2001
Magnesium	EPA 6010	Metals	NELAP	10/8/2001
Malathion	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Manganese	EPA 6010	Metals	NELAP	10/8/2001
Manganese	EPA 6020	Metals	NELAP	10/8/2001
MCPA	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
MCPP	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Mercury	EPA 1631	Metals	NELAP	10/8/2007
Mercury	EPA 7470	Metals	NELAP	10/8/2001
Mercury	EPA 7471	Metals	NELAP	10/8/2001
Merphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methapyrilene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methyl mercury	EPA 1630	Metals	NELAP	10/8/2007
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	7/17/2003
Methyl parathion (Parathion, methyl)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	10/8/2001
Mevinphos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Molybdenum	EPA 6010	Metals	NELAP	10/8/2001
Molybdenum	EPA 6020	Metals	NELAP	10/8/2007
Naphthalene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Naphthalene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Naphthalene	EPA 8310	Extractable Organics	NELAP	10/8/2001
n-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Nickel	EPA 6010	Metals	NELAP	10/8/2001
Nickel	EPA 6020	Metals	NELAP	10/8/2001
Nitrate	EPA 9056	General Chemistry	NELAP	7/17/2003
Nitrate as N	EPA 353.2	General Chemistry	NELAP	10/8/2007
Nitrite	EPA 9056	General Chemistry	NELAP	7/17/2003
Nitrite as N	EPA 353.2	General Chemistry	NELAP	10/8/2007

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Columbia Analytical Services, Inc. - WA
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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	10/8/2001
Nitroglycerin	EPA 8332	Extractable Organics	NELAP	7/17/2003
Nitroquinoline-1-oxide	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
n-Propylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
o,o,o-Triethyl phosphorothioate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	10/8/2001
Oil & Grease	EPA 1664	General Chemistry	NELAP	10/8/2001
Oil & Grease	EPA 9071	General Chemistry	NELAP	10/8/2001
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	10/8/2007
o-Toluidine	EPA 8270	Extractable Organics	NELAP	10/8/2001
Parathion, ethyl	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
p-Dioxane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/17/2003
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
pH	EPA 9040	General Chemistry	NELAP	10/8/2001
pH	EPA 9045	General Chemistry	NELAP	7/17/2003
Phenacetin	EPA 8270	Extractable Organics	NELAP	10/8/2001
Phenanthrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Phenanthrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Phenol	EPA 8270	Extractable Organics	NELAP	10/8/2001
Phorate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	10/8/2007
p-Isopropyltoluene	EPA 8260	Volatile Organics	NELAP	10/8/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Potassium	EPA 6010	Metals	NELAP	10/8/2001
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	10/8/2001
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Pyrene	EPA 8270	Extractable Organics	NELAP	10/8/2001
Pyrene	EPA 8310	Extractable Organics	NELAP	10/8/2001
Pyridine	EPA 8270	Extractable Organics	NELAP	10/8/2001
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	10/8/2001
Residue-total	EPA 160.3	General Chemistry	NELAP	10/8/2007
Ronnel	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Safrole	EPA 8270	Extractable Organics	NELAP	10/8/2001
sec-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Selenium	EPA 6010	Metals	NELAP	7/17/2003
Selenium	EPA 6020	Metals	NELAP	10/8/2007
Selenium	EPA 7740	Metals	NELAP	10/8/2001
Selenium	EPA 7742	Metals	NELAP	7/17/2003
Silver	EPA 6010	Metals	NELAP	10/8/2001
Silver	EPA 6020	Metals	NELAP	10/8/2001
Silvex (2,4,5-TP)	EPA 8151	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Sodium	EPA 6010	Metals	NELAP	10/8/2001
Stirofos	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Strontium	EPA 6010	Metals	NELAP	10/8/2007
Strontium	EPA 6020	Metals	NELAP	10/8/2007
Styrene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Sulfate	EPA 300.0	General Chemistry	NELAP	2/17/2006
Sulfate	EPA 9056	General Chemistry	NELAP	7/17/2003
Sulfide	EPA 9030/9034	General Chemistry	NELAP	7/17/2003
Sulfotepp	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	7/17/2003
Synthetic Precipitation Leaching Procedure	EPA 1312	General Chemistry	NELAP	7/17/2003
tert-Butyl alcohol	EPA 8260	Volatile Organics	NELAP	7/17/2003
tert-Butylbenzene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	10/8/2001
Thallium	EPA 6010	Metals	NELAP	7/17/2003
Thallium	EPA 6020	Metals	NELAP	10/8/2001
Thallium	EPA 7841	Metals	NELAP	10/8/2001
Thionazin (Zinophos)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	10/8/2001

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Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Tin	EPA 6010	Metals	NELAP	10/8/2007
Tokuthion (Prothiophos)	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Toluene	EPA 8021	Volatile Organics	NELAP	10/8/2001
Toluene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Total cyanide	EPA 9012	General Chemistry	NELAP	12/23/2005
Total nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	10/8/2007
Total organic carbon	EPA 9060	General Chemistry	NELAP	10/8/2001
Total organic halides (TOX)	EPA 9020	General Chemistry	NELAP	10/8/2001
Total Petroleum Hydrocarbons (TPH)	NWTPH-HCID	Extractable Organics	NELAP	10/8/2001
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	10/8/2001
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	10/8/2001
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	10/8/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	10/8/2001
Trichloronate	EPA 8141	Pesticides-Herbicides-PCB's	NELAP	10/8/2001
Vanadium	EPA 6010	Metals	NELAP	10/8/2001
Vanadium	EPA 6020	Metals	NELAP	10/8/2007
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	10/8/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	10/8/2001
Xylene (total)	EPA 8021	Volatile Organics	NELAP	10/8/2001
Xylene (total)	EPA 8260	Volatile Organics	NELAP	10/8/2001
Zinc	EPA 6010	Metals	NELAP	10/8/2001
Zinc	EPA 6020	Metals	NELAP	10/8/2001

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Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	7/1/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	7/1/2003
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3-Dichlorobiphenyl (BZ 5)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	7/1/2003

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Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
2-Chlorobiphenyl (BZ 1)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	7/1/2003
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	7/1/2003
Acenaphthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Aluminum	EPA 6020	Metals	NELAP	7/1/2003
Aniline	EPA 8270	Extractable Organics	NELAP	7/1/2003
Anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Antimony	EPA 6010	Metals	NELAP	7/1/2003
Antimony	EPA 6020	Metals	NELAP	7/1/2003

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Arsenic	EPA 6010	Metals	NELAP	7/1/2003
Arsenic	EPA 6020	Metals	NELAP	7/1/2003
Arsenic	EPA 7060	Metals	NELAP	7/1/2003
Barium	EPA 6010	Metals	NELAP	7/1/2003
Barium	EPA 6020	Metals	NELAP	7/1/2003
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzoic acid	EPA 8270	Extractable Organics	NELAP	7/1/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Beryllium	EPA 6010	Metals	NELAP	7/1/2003
Beryllium	EPA 6020	Metals	NELAP	7/1/2003
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane))	EPA 8270	Extractable Organics	NELAP	7/1/2003
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	7/1/2003
Boron	EPA 6010	Metals	NELAP	10/8/2007
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cadmium	EPA 6010	Metals	NELAP	7/1/2003
Cadmium	EPA 6020	Metals	NELAP	7/1/2003
Carbazole	EPA 8270	Extractable Organics	NELAP	7/1/2003
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Chromium	EPA 6010	Metals	NELAP	7/1/2003
Chromium	EPA 6020	Metals	NELAP	7/1/2003
Chromium	EPA 7191	Metals	NELAP	10/8/2007
Chromium VI	EPA 7196	Metals	NELAP	7/1/2003

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State Laboratory ID: **E87412** EPA Lab Code: **WA00035** **(360) 577-7222**

E87412
Columbia Analytical Services, Inc. - WA
1317 South 13th Avenue
Kelso, WA 98626

Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Chrysene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Cobalt	EPA 6010	Metals	NELAP	7/1/2003
Cobalt	EPA 6020	Metals	NELAP	7/1/2003
Copper	EPA 6010	Metals	NELAP	7/1/2003
Copper	EPA 6020	Metals	NELAP	7/1/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	7/1/2003
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Fluoranthene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Fluorene	EPA 8270	Extractable Organics	NELAP	7/1/2003
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	7/1/2003
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Iron	EPA 6010	Metals	NELAP	7/1/2003
Isophorone	EPA 8270	Extractable Organics	NELAP	7/1/2003
Lead	EPA 6010	Metals	NELAP	7/1/2003
Lead	EPA 6020	Metals	NELAP	7/1/2003
Lead	EPA 7421	Metals	NELAP	7/1/2003
Manganese	EPA 6010	Metals	NELAP	7/1/2003

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Manganese	EPA 6020	Metals	NELAP	7/1/2003
Mercury	EPA 1631	Metals	NELAP	10/8/2007
Mercury	EPA 7471	Metals	NELAP	7/1/2003
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Molybdenum	EPA 6010	Metals	NELAP	7/1/2003
Molybdenum	EPA 6020	Metals	NELAP	10/8/2007
Naphthalene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nickel	EPA 6010	Metals	NELAP	7/1/2003
Nickel	EPA 6020	Metals	NELAP	7/1/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	7/1/2003
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	7/1/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenanthrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Phenol	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyrene	EPA 8270	Extractable Organics	NELAP	7/1/2003
Pyridine	EPA 8270	Extractable Organics	NELAP	7/1/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Selenium	EPA 6010	Metals	NELAP	7/1/2003
Selenium	EPA 6020	Metals	NELAP	10/8/2007
Selenium	EPA 7740	Metals	NELAP	7/1/2003
Selenium	EPA 7742	Metals	NELAP	7/1/2003
Silver	EPA 6010	Metals	NELAP	7/1/2003
Silver	EPA 6020	Metals	NELAP	7/1/2003
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	7/1/2003
Thallium	EPA 6020	Metals	NELAP	7/1/2003
Thallium	EPA 7841	Metals	NELAP	7/1/2003
Tin	EPA 6010	Metals	NELAP	10/8/2007
Total cyanide	EPA 9012	General Chemistry	NELAP	12/23/2005
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Vanadium	EPA 6010	Metals	NELAP	7/1/2003
Vanadium	EPA 6020	Metals	NELAP	10/8/2007
Zinc	EPA 6010	Metals	NELAP	7/1/2003

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Matrix: **Biological Tissue**

Analyte	Method/Tech	Category	Certification Type	Effective Date
Zinc	EPA 6020	Metals	NELAP	7/1/2003