November 23, 2015

PHASE I SITE CHARACTERIZATION SAMPLING AND ANALYSIS PLAN

Columbia Falls Aluminum Company Facility
2000 Aluminum Drive, Columbia Falls
Flathead County, Montana

Prepared for

COLUMBIA FALLS ALUMINUM COMPANY, LLC
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2476.0001Y.100/SAP-CV

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LIST OF ACRONYMS

AGI	Amplified Geochemical Imaging
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
CFAC	Columbia Falls Aluminum Company, LLC
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
CoC	Chain of Custody
COPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DQO	Data Quality Objectives
DU	Decision Unit
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
FNU	Formazin Nephelometric Units
FSP	Field Sampling Plan
GC	Gas Chromatography
GIS	Geographic Information System
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HCL	Hydrochloric Acid
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology & Regulatory Council
LCS	Laboratory Control Sample
LNAPL	Light Non-Aqueous Phase Liquids
MCL	Maximum Contaminant Levels
MDEQ	Montana Department of Environmental Quality
MDL	Method Detection Limit
MPDES	Montana Pollutant Discharge Elimination System
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MSW	Municipal Solid Waste
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Units
ORP	Oxygen Reduction Potential

LIST OF ACRONYMS (Continued)

PAH	Polyaromatic Hydrocarbon Compounds
PCB	Polychlorinated Biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PID	Photoionization Detector
PQL	Practical Quantitation Limit
PVC	Polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Protection Plan
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SCDM	Superfund Chemical Data Matrix
SLERA	Screening Level Ecological Risk Assessment
SOP	Standard Operating Procedure
SPL	Spent Potliner
SVOC	Semivolatile Organic Compounds
TAL	Target Analyte List
TBC	To Be Considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

On behalf of Columbia Falls Aluminum Company, LLC (CFAC), Roux Associates, Inc., has prepared this Phase I Site Characterization Sampling and Analysis Plan (Phase 1 SAP) for the Remedial Investigation/Feasibility Study (RI/FS) of the CFAC facility located in Flathead County, Montana (hereinafter, "the Site"). The boundaries of the Site as defined in the Phase 1 SAP are depicted in Plate 1. The SAP consists of two parts: 1) a Field Sampling Plan (FSP) that describes the data gathering and sampling activities and associated fieldwork procedures for the Phase 1 Site Characterization; and 2) a quality assurance project plan (QAPP) that describes the policy, organization, functional activities, and quality assurance (QA) and quality control (QC) protocols necessary to achieve the data quality objectives (DQOs) of the RI/FS Phase 1 Site Characterization Program.

This SAP has been developed in general accordance with the USEPA RI/FS Guidance (USEPA, 1988), USEPA Guidance for Quality Assurance Project Plans (USEPA, 2002a) and the Guidance on Systematic Planning Using the Data Quality Objectives Process (USEPA, 2006). The remainder of the SAP is organized as follows:

<u>PART 1 – Field Sampling Plan (FSP)</u>

Section 2 – Site Background

Section 3 – Data Quality Objectives

Section 4 – Phase 1 Sampling Plan

Section 5 – Field Sampling Procedures

<u>PART 2 – Quality Assurance Project Plan (QAPP)</u>

Section 6 – Group A: Project Management

Section 7 – Group B: Data Generation and Acquisition

Section 8 – Group C: Assessment and Oversight

Section 9 – Group D: Data Validation and Usability

2.0 SITE BACKGROUND

This section provides a description of the Site and pertinent background information about the project.

2.1 Site Description

The facility is located at 2000 Aluminum Drive in Columbia Falls, Flathead County, Montana (Figure 1). The Site is accessed by Aluminum Drive via North Fork Road (County Road 486). The Site is approximately 2.0 miles northeast from the center of Columbia Falls and the Site is accessed by Aluminum Drive via North Fork Road (County Road 486). According to the 2013 Census (www.census.gov), the total population of Columbia Falls is 4,796. The nearest residences are located approximately 0.80 miles west of the Site and the nearest groundwater wells used for drinking water are located within 1 mile from the Site. Existing onsite wells are not used for potable water.

The total property owned by CFAC is approximately 3,196 acres (Figure 1). However, the historic footprint of operations and a peripheral area (collectively referred to hereinafter as the "Site"), consists of approximately 1,340 acres bounded by Cedar Creek Reservoir to the north, Teakettle Mountain to the east, Flathead River to the south, and Cedar Creek to the west (Figure 2). The non-industrial areas of the Site have been previously used for recreational purposes such as hunting and fishing, etc. The remainder of the CFAC owned property is located south of Flathead River and was never used for industrial operations.

Buildings and industrial facilities located at the Site include offices, warehouses, laboratories, mechanical shops, paste plant, coal tar pitch tanks, pump houses, casting garage, and the potline facility. The Site also includes seven closed landfills, one active landfill, material loading and unloading areas, two closed leachate ponds, and several wastewater percolation ponds. A rectifier yard and switchyard owned by Bonneville Power Administration and a right-of-way for the Burlington Northern Railroad are also within the Site boundaries.

A summary of the physical setting of the Site, including a review of the Site topography, climate, geology, hydrogeology, and groundwater flow is provided in Sections 2.0 and 3.0 of the RI/FS Work Plan.

2.2 Site Operational History

Aluminum was produced at the Site from 1955 to 2009. The facility began with two potlines in 1955 and an annual capacity of 67,500 tons per year (using 120 pots per potline). A third potline was added in 1965, and a fourth and fifth potline were added 1968, increasing total aluminum production capacity at the Site to 180,000 tons per year.

During aluminum production, the Hall-Heroult process and the Vertical Stud Soderburg technology was used to reduce alumina into aluminum. In the Hall-Heroult process, aluminum oxide is dissolved into sodium fluoride (cryolite) bath in a carbon-lined pot heated to 960 degrees Celsius. Electric current runs through a carbon anode made of petroleum coke and pitch, to a carbon cathode (the steel pot, firebrick liner, and a layer of carbon paste), reducing the aluminum ion to aluminum metal. The anode is consumed during the reaction, and molten aluminum forms at the bottom of the pot. The molten aluminum is tapped from the pot and was blended to an alloy (depending on the order). The aluminum is then transferred to the casting garage, and cast into ingots as the finished product for offsite shipment.

A Rod Mill, in the southwest corner of the Main Plant Area, was also operated until the late 1960s. The Rod Mill was used to produce aluminum wire and cable. After its use as a Rod Mill, the building was used as a warehouse. The aluminum production process generated several waste products, most notably spent potliner (SPL). The sodium in the cryolite bath gradually penetrates the carbon paste lining of the pot, causing the carbon to swell and eventually fail. The typical lifespan of the carbon cathode is 5-7 years. To re-use the pot, the carbon lining of the pot is removed and replaced with a new carbon lining. The SPL consists of the thick layer of carbon bonded to an insulating brick layer, containing fluoride, sodium, aluminum, and small amounts of cyanide. The fluoride and sodium in the SPL is from the sodium fluoride (cryolite) bath, and the cyanide forms in the cathode as a side chemical reaction during aluminum production.

The aluminum production process generates air emissions, including particulate fluoride, hydrogen fluoride, and polyaromatic hydrocarbon compounds (PAHs). The main sources of air emissions are typically the Paste Plant and the aluminum reduction facility (USEPA, 1998). Air pollution from the smelting process was controlled using wet scrubbers until 1976, and air pollution from the Paste Plant also used a wet scrubber from 1955 to 1999. Waste water from

the wet scrubbers was discharged to the North Percolation Ponds (CFAC, 2003). The wet scrubbers were replaced with dry scrubbers in 1976, and an analysis of the sludge by the Columbia Falls Reduction Plant laboratory staff indicated that the sludge is about 80% calcium fluoride on a dry weight basis, and also contained calcium oxide, magnesium oxide, sodium oxide and iron oxide (Hydrometrics, 1993). The sludge generated from the scrubbers was landfilled on Site.

Raw materials were delivered to the Site predominantly by rail, and include aluminum oxide, petroleum coke, coal tar pitch and fluoride/cryolite. Alumina was delivered to the off-loading buildings, where the alumina was transferred to the silos between the potlines. Petroleum coke and coal tar pitch are delivered to the northeast side of the plant and mixed in the Paste Plant to form briquettes to be used as anodes.

Solid waste generated by the aluminum production process was primarily disposed of in on-site landfills until the mid-1980s, after which SPL was shipped offsite for disposal as hazardous waste. In addition to SPL and wet scrubber sludge, the on-Site landfills were used to dispose of other wastes such as: dross, solvents, potliner refractory wastes (non-hazardous - likely the scrap calcined petroleum coke, ore, cryolite, aluminum fluoride, bath, brick, concrete), scrap metal, wood, used oil and municipal solid waste (MSW). A summary of the years of operation and types of wastes reportedly disposed of at each landfill over time is provided in Section 2.72 of the RI Work Plan.

Liquid waste generated as a result of the aluminum reduction process was discharged to several percolation ponds. The facility discharged to the percolation ponds in accordance with a MPDES permit, first issued in 1994. A summary of the liquid waste disposal areas is provided in Section 2.7.2 of the RI/FS Work Plan.

3.0 DATA QUALITY OBJECTIVES

The DQOs for the RI/FS were developed using the USEPA DQO process (USEPA, 2006), which is designed to clarify the objectives of data collection and maximize efficiency during the data collection process. The DQO process is a multi-step, iterative process that ensures that the type, quantity, and quality of environmental data used in the decision making process are appropriate for its intended application.

The objectives for the RI are:

- Identify and characterize sources of contaminants of potential concern (COPCs);
- Determine the nature and extent of Site-related COPCs in soil, groundwater, surface water, sediment, and sediment porewater;
- Understand the transport and fate of COPCs in environmental media at the Site;
- Identify any complete or potentially complete exposure pathways (considering current and also potential future land use) and evaluate current and future human health and ecological risks posed by the COPCs present at the Site; and
- Support the development and evaluation of remedial alternatives for the Site.

A summary of the step-by-step DQO process followed to develop the Scope of Work for the Phase I Site characterization field activities is provided in Section 6.5. The basis of the sampling design for Phase 1 is described below.

The Phase I Site Characterization program has been designed to identify and/or confirm source areas and associated COPCs, as well as provide a broad characterization of the hydrogeologic conditions and the nature and extent of contamination across the Site. Based on the current understanding of the Site conditions and CSM, the following objectives were established for Phase I Site Characterization Program:

- Evaluate current conditions at all identified RI areas and Site features to determine which RI areas and Site features require further investigation and/or quantitative evaluation in the baseline risk assessment. The RI Areas that will be investigated during Phase I include:
  - Landfills and Leachate Ponds;
  - Percolation Ponds;
  - The Main Plant Area;

- Operational Area Soils;
- Site-wide Groundwater; and
- Surface Water Features.

- Refine the list of COPCs that require further investigation at various RI areas and Site features so lists of laboratory analyses can be reduced during subsequent phases of investigation;
- Refine the understanding of groundwater flow beneath the Site, particularly in the vicinity of potential receptors;
- Develop a more detailed understanding of bedrock topography and the depths, thicknesses and extents of the various hydrogeologic units, both of which may influence groundwater flow and the distribution of COPCs in the subsurface;
- Begin to evaluate seasonal influences on groundwater/surface water interactions and contaminant concentrations in groundwater and surface water;
- Develop data to support the preparation of the baseline risk assessment work plan; and
- Develop data to support identification and screening of remedial technologies as part of the FS.

The results of the Phase 1 Site Characterization will be used to update the preliminary Conceptual Site Model provided in Section 3.0 of the RI/FS Work Plan and prepare the Baseline Risk Assessment Work Plan. This process will enable identification of any outstanding data that still needs to be collected in order to complete the RI Site characterization and conduct a risk assessment. The identified data needs and the scope of work to collect the data will be presented in a Phase II Site Characterization SAP. The Phase II Site Characterization SAP will include updated data quality objectives to evaluate the data needs required to complete the RI and risk assessment.

4.0 PHASE I SAMPLING PLAN

The Phase I Site Characterization Scope of Work was developed based on the data quality objectives and the data requirements identified during preparation of the RI/FS Work Plan. The description of the basis for the sampling plan design is provided below, followed by a description of the sampling plan for the field activities planned for Phase I.

4.1 Sampling Plan Design

As described in Section 4.2, several different types of data gathering and sampling activities are required to achieve the project objectives. The locations and numbers of sampling points associated with each type of activity were typically selected based upon judgmental sample design. As described in USEPA guidance on sampling design (USEPA, 2002b), judgmental sampling design is appropriate when there is reliable historical and physical knowledge about the feature or condition under investigation; or, when the objective of the investigation is to screen an area(s) for the presence or absence of contamination at levels of concern, such as risk-based screening levels. Both of these conditions are generally applicable for the Phase I work. Specifically, there is knowledge about most Site features (i.e., locations and dimensions, historical use) and the goals of the Phase 1 Site Characterization program include use of risk-based screening levels to identify areas for further investigation and/or inclusion in subsequent risk assessment.

Although the sampling plan for known or suspected source areas is judgmental in design, it will be conducted using a systematic phased approach. Field reconnaissance will be conducted first, followed by geophysical surveys and soil gas surveys. The findings from these activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

Judgmental sampling design has also been used to develop the scope of work for investigation of hydrogeologic and groundwater quality conditions at the Site. Per USEPA guidance, judgmental design is appropriate considering the scale of the Site and lack of adequate probabilistic investigation methods.

As discussed in the RI/FS Work Plan, the remedial investigation will be conducted in at least two phases. Following the completion of Phase I, results from the Phase I Site Characterization will be utilized to determine where additional investigations are required during the Phase 2 Site Characterization. The application and use of probability-based sampling designs, in addition to judgmental designs, will be considered and where appropriate implemented within focused areas of the Site as part of the Phase II Site Characterization. The rationale and description of how and where probabilistic-based sampling designs will be used during Phase 2 will be provided within the Phase II SAP.

A stratified random sampling approach will be utilized as per USEPA guidance on sampling design (USEPA, 2002b) and the Interstate Technology & Regulatory Council (ITRC) Incremental Sampling Methodology (ITRC, 2012) to characterize soil quality conditions in the surface soil and shallow subsurface soil (0 to 0.5 ft-bls and 0.5 to 2.0 ft-bls, respectively) within large areas of the Site where there are no specific source areas identified, but aerial photographs or Site knowledge suggests evidence of historical operations activity. As described in Section 4.6.2, an incremental sampling methodology will be utilized in these areas to produce a better estimate of average soil conditions within individual grid cells uniformly distributed across the large area.

As discussed in Section 6.1 and Section 6.2 of the RI/FS Work Plan, COPCs will be evaluated during the Phase I Site Characterization based upon comparison of analytical results to human health screening levels and ecological screening levels drawn from the following sources as indicated for each media type:

Human Health Screening Levels

Soil

- EPA Risk-Based Screening Tables: residential soil RSL, Risk-based soil screening level (SSL) for the protection of groundwater

- Montana Tier 1 Risk-based Corrective Action Guidance for Petroleum Releases (September 2009) for petroleum compounds

Surface Water and Groundwater

- EPA Risk-Based Screening Tables: tapwater RSL, drinking water maximum contaminant level (MCL)
- Montana DEQ Circular DEQ-7: http://www.deq.mt.gov/wqinfo/circulars.mcpx

Sediment

- EPA Risk-Based Screening Tables: residential soil RSL

Ecological Screening Levels

Soil

- EPA Ecological Soil Screening Levels: http://www.epa.gov/ecotox/ecossl/
- Los Alamos National Laboratory (LANL) ECORISK Database, Los Alamos, New Mexico. http://www.lanl.gov/community-environment/environmental-stewardship/protection/eco-risk-assessment.php
- Sample, BE, DM Opresko, GW Suter II. 1996. *Toxicological Benchmarks for Wildlife: 1996 Revision.* Oak Ridge National Laboratory. Document ES/ER/TM-86/R3. June 1996. http://www.esd.ornl.gov/programs/ecorisk/documents/tm86r3.pdf
- *Region 5 RCRA Ecological Screening Levels*, August 22. http://www.epa.gov/Region5/waste/cars/esl.htm

Surface Water and Groundwater

- EPA National Recommended Water Quality Criteria: http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
- Suter II, GW and CL Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision.* Oak Ridge National Laboratory. Document ES/ER/TM-96/R2. June 1996. http://www.esd.ornl.gov/programs/ecorisk/documents/tm96r2.pdf
- Canadian Council of Ministers of the Environment (CCME). *Canadian Water Quality Guidelines, Summary Table,* http://st-ts.ccme.ca/
- Montana Department of Environmental Quality (DEQ) Circular DEQ-7: http://www.deq.mt.gov/wqinfo/circulars.mcpx

Sediment

- MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Archives of Environmental Contamination and Toxicology* 39:20-31.
- Ingersoll, C.G., P.S. Haverland, E.L. Brunson, T.J. Canfield, F.J. Dwyer, C.E. Henke, N.E. Kemble, D.R. Mount, and R.G. Fox. 1996. Calculation and evaluation of sediment effect concentrations for the amphipod *Hyalella azteca* and the midge *Chironomus riparius; and*
- *Region 5 RCRA Ecological Screening Levels*, August 22. http://www.epa.gov/Region5/waste/cars/esl.htm
- USEPA Region 3 Biological Technical Assistance Group Freshwater Sediment Screening Benchmarks (August 2006)

Concentrations of naturally occurring substances will also be compared to concentrations measured at background and upgradient sampling locations to evaluate whether the measured concentrations of those substances are related to the Site. Human health risk-based screening levels (RSLs) provided in the EPA Risk-Based Screening Tables will be based on target cancer risk of 1E-06 and target hazard quotient of 0.1. For the purposes of identifying COPCs, the lowest value, across all sources, should be selected as the screening level.

4.2 Phase 1 Activities

As discussed in Section 4.2 of the RI/FS Work Plan and summarized in Section 3.0 above, the RI will be conducted as an iterative approach and will include at least two phases of investigation work. The following types of data gathering and sampling activities will be conducted as part of the Phase 1 Site Characterization program:

- Site Reconnaissance
- Geophysical Survey
- VOC Focused Passive Soil Gas Sampling and Landfill Gas Investigation
- Soil Boring and Soil Sampling
- Monitoring Well Installation and Gauging
- Groundwater Sampling
- Surface Water Sampling

- Sediment Sampling
- Drywell Sampling
- Waste Characterization Sampling, if needed

Items that are currently planned to be conducted during subsequent phases of investigation include, but are not limited to:

- Topographic survey of the landfills
- Investigation of the physical landfill caps, where present
- Evaluation of the hydraulic properties of the various hydrogeologic units at the Site via slug testing and/or aquifer testing
- Sediment Porewater Sampling

The remainder of this Section describes the locations and sampling rationale for the Phase I field activities. A Site-wide summary of the proposed investigation locations are shown on Plate 1. Additionally, the proposed investigation locations are shown for specific areas of the Site in Figures 3 through 8.

Table 1 provides a summary of the samples defined for collection during the Phase I Site Characterization. The information in Table 1 includes: latitude and longitude (determined from GIS), the sample location type, sample media type, the closest Site feature to the sample, the rationale for each sample, and the proposed analyses for each sample. For the sample rationale, samples labeled as "within feature" were generally selected to characterize quality beneath the feature and samples labeled as "boundary of feature" were generally selected to delineate quality immediately outside the feature and determine aerial extent of potential COPCs. Additionally, samples proposed near the Flathead River and residential areas are generally positioned to evaluate conditions downgradient of the Site features and near potential receptors. As indicated in the RI/FS Work Plan, it is anticipated the number of samples and locations of samples will be modified based upon the results pre-intrusive field activities. The scope of such modifications and the associated rationale will be detailed in a SAP addendum prior to implementation.

Prior to the start of field work, a plan for disposition of investigation derived waste (IDW) will be prepared in accordance with the USEPA Guide to Management of Investigation-Derived Wastes (USEPA, 1992). The options for handing IDW will consider the type and quality waste produced, its relative threat to human health and the environment, and other Site-specific conditions. The IDW Plan will be submitted to the USEPA as an addendum to the SAP prior to the start of the Phase I Site Characterization field work.

4.3 Site Reconnaissance

A detailed Site reconnaissance will be performed prior to conducting other field investigation activities. The objectives of the Site reconnaissance are to:

- Field verify existing base maps and aerial photographs (check for accuracy of map coordinates versus GPS and survey data);
- Refine soil boring locations that are proposed to be biased towards areas of known or suspected areas of contamination;
- Identify any additional areas / site features where COPCs potentially were released, and where samples should be collected, based upon visual indications of waste materials, soil piles, staining, stressed vegetation, etc.;
- Develop a further understanding of drainage / overland flow and document any erosional features at the Site that may be contaminant migration pathways;
- Identify habitat areas for further evaluation in the SLERA; and
- Confirm accessibility and determine equipment requirements for access to proposed sampling locations.

The Site reconnaissance will be conducted using a systematic approach. As a first step of the ground-level Site reconnaissance, a licensed land surveyor will establish coordinates of several fixed locations at the Site. The accuracy of the existing geo-referenced maps and aerial photographs will be evaluated by comparing coordinates obtained from GIS with the coordinates established by the surveyor. Likewise, the accuracy of hand-held GPS will be evaluated by comparing GPS coordinates with coordinates established by the surveyor. Any discrepancies in coordinates between the various locating methods will be resolved prior to proceeding with additional elements of the Site reconnaissance task. The subsequent ground level field reconnaissance will consist of qualified scientists or engineers visually inspecting and photo-documenting the conditions of the Site features within the various RI Areas.

Key selected subcontractors (i.e., surveyor, geophysical survey, drilling, etc.) will take part in selected aspects of the field reconnaissance to confirm equipment requirements for accessibility and to confirm the technical approach for their respective assignments.

Calbag Resources, LLC (Calbag) was recently retained by CFAC to complete the decommissioning and removal of certain structures, machinery, equipment, and waste materials at the Site. Prior to beginning RI/FS field activities, planning meeting(s) will be conducted to ensure that the Calbag activities and the Phase 1 Site Characterization program are properly coordinated. The purpose of this planning will be to determine how best to sequence and/or adjust RI/FS work activities in the vicinity of the ongoing Site decommissioning activities, to ensure that all of the RI/FS objectives are met while also ensuring worker health and safety and allowing for continued progress of the Site decommissioning project.

The Site reconnaissance will also include an inspection of existing Site monitoring wells to evaluate the integrity and accessibility for use during the investigation. Any deficiencies or obstructions will be noted for future consideration when planning sampling activities.

The Site reconnaissance will also include a habitat and biological survey. The Survey will include both terrestrial and aquatic habitats and will allow for a detailed characterization of the environmental setting as it pertains to the SLERA. The survey will be conducted by a team of two biologists over a period of one to two weeks. It will include walking the entire Site, including visual inspection and photo-documentation of all distinct habitat areas and flora and fauna observed within these areas and recording of field notes regarding these observations.

4.4 Geophysical Survey

A geophysical survey will be completed as a screening tool that will allow for initial assessment of subsurface characteristics prior to drilling activities. The geophysical survey will employ electrical resistivity technology with the goal of providing a preliminary understanding of approximate depth to bedrock, approximate depth to groundwater, approximate depth of Site features, potential changes in subsurface hydrogeological conditions and potentially other subsurface anomalies that may contribute to the delineation of source areas.

The initial geophysical survey will be implemented in the vicinity of the West Landfill and the Wet Scrubber Sludge Pond. These two source areas have been previously attributed to the COPCs present at the Site. Additionally, geophysics will be applied to a transect perpendicular to Teakettle mountain with the goal of understanding how bedrock dips away from Teakettle Mountain and to evaluate any other potential hydrogeologic aspects of the subsurface. The actual methodology and scope of the various elements of the geophysical survey will be finalized following the Site reconnaissance meetings with the selected geophysical subcontractor, based upon an evaluation of the potential benefits towards achieving the RI objectives. A summary of the proposed geophysical Scope of Work will be submitted to the USEPA for review prior to conducting the field work. Additionally, the results of the initial geophysical surveys will be evaluated to determine if the technology is applicable and beneficial within the Site and if additional surveys should be conducted.

It is anticipated that ground penetrating radar (GPR) can provide useful information to confirm the horizontal extent of landfills and associated landfill caps, as well as information on cap thickness. Therefore, GPR will be utilized as part of the landfill cap investigation. In addition, GPR will be utilized when appropriate for mark out of subsurface utilities or obstructions in the area of proposed drilling locations.

The results of the geophysical survey will be evaluated prior to conducting intrusive activities and results will be considered when finalizing drilling locations and depths. Any changes to the FSP as a result of the geophysical surveying activities will be described in a Phase 1 SAP Addendum and summarized in the summary report.

4.5 Soil Gas Investigation

The soil gas investigation will consist of two elements: 1) field screening of landfill soil gas; and 2) a passive soil gas investigation at the former hazardous waste drum storage area and the former vehicle fueling area. A description of the work associated with each element is described below.

Field screening of soil gas will be conducted at landfills to evaluate the potential for methane and VOCs. The screening will be conducted under falling barometric pressure conditions

(minimum 12 hours) in order to minimize the potential for false negative results. Prior to the sampling, the barometric pressure will be confirmed using data from the weather station located at Kalispell Glacier Park International Airport, as is further described in Section 7.9.

At each location, a soil gas probe constructed of a 0.5 inch diameter stainless steel pipe with a welded and slotted tip on the end will be pushed into the subsurface to a depth of approximately five feet. After advancing the probe to the final depth, the annular space around the probe will be sealed at the surface with modeling clay or equivalent to minimize potential short-circuiting of ambient air during sampling. A short length of Teflon tubing will be attached to the soil gas probe and a vacuum pump, and then the probe will be purged for five minutes to allow the inflow of vapors. The monitoring point will be tested using a tracer gas (helium), prior to sample collection, to verify that ambient air is not diluting the soil vapor during screening. A GEM 2000+ Landfill Meter will then be attached to the Teflon tubing and readings recorded for methane, carbon monoxide, hydrogen sulfide, oxygen and barometric pressure. A PID will then be attached to screen for VOCs. Once the readings are completed, the soil gas probe will be extracted from the ground and the hole will be sealed.

A passive soil gas investigation will be conducted at the hazardous waste drum storage area and the former vehicle fueling area. The proposed sample locations are shown in Figures 3 through 8. The objective of the passive soil gas investigation is to identify potential VOC hot spots (if any) so that subsequent intrusive sampling can be focused in these areas to determine if VOCs are a COPC.

The passive soil gas investigation will be conducted using Amplified Geochemical Imaging, LLC (AGI) passive sampling devices (AGI, 2015). The AGI passive sampler is a proprietary, passive, sorbent-based sampler which collects volatile and semivolatile compounds present in soil gas. The AGI passive samplers will be installed within a 1/2 to 1-inch (2.5cm) diameter hole and to a depth of approximately five feet below grade; therefore resulting in minimal Site disruption and allowing for a screening of Site features. AGI recommends that for site assessment applications where the primary objective is identification of potential source areas and extent of contamination, the suggested exposure time for soil gas sampling is 7 to 10 days (AGI, 2015).

Following collection, the AGI passive samplers will be shipped under chain of custody to AGI for analysis of VOCs according to a modified USEPA 8260 analytical method.

The passive sampling is meant to provide an initial screening of vapor conditions. Subsequent soil borings will be biased towards the locations that exhibited the highest VOC concentrations, if any. If the passive soil gas investigation results suggest that a source area may exist that extends beyond the investigated area, additional vapor sampling and intrusive activities would be considered to further evaluate the source area conditions.

4.6 Soil Borings and Soil Sampling

This section describes the Phase I soil boring and soil sampling program. The Phase I activities were designed to collect additional geologic data, characterize and delineate potential source areas, and assess soil quality conditions across the Site. The remainder of this section describes the sampling location and procedure rationale.

4.6.1 Source Area Soil Investigation

Soil borings and soil sampling will be conducted in the vicinity of the RI Areas which have been identified as potential source areas in the preliminary CSM. The proposed Phase I source area investigation locations are shown in Figures 3 through 8 and are summarized on Table 1. Proposed Phase I locations around these areas were selected based on a judgmental sampling design (USEPA, 2006) that targets the potential source areas. The number of proposed borings and spacing of proposed borings in Phase I were selected with the goal of providing initial characterization of the nature and extent of contamination associated with individual features.

The proposed locations are typically within the boundaries of the Site feature being investigated in an effort to characterize the soil conditions immediately beneath the feature. In addition, there are proposed borings around the perimeter of most features to assess for impacts to the adjacent areas. For features with engineering controls already in place (e.g., landfill caps), proposed boring locations were placed adjacent to and downgradient of the feature in an effort not to disturb the existing controls. The proposed locations are dependent on Site conditions and may potentially be modified in the field by the RI field manager. As previously discussed, the findings from pre-intrusive investigation activities will be evaluated and used to refine source

area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

Soil borings will be completed utilizing either sonic-rotary drilling or direct-push (e.g., Geoprobe) techniques. Use of the Geoprobe will be limited to borings that are not proposed for completion as monitoring wells, as the depth of these borings will typically be 12 ft. Sonic-rotary drilling methods will be used at all locations where wells are to be installed and at those locations where subsurface conditions prevent the Geoprobe from achieving desired sampling depths.

An experienced drilling subcontractor will be selected prior to mobilization for field activities. All drilling activities will be overseen by the RI Manager and onsite engineers/scientists with experience in oversight of drilling programs.

Prior to drilling, Site plans and drawings will be evaluated and facility personnel consulted to identify whether subsurface utilities or obstructions may be present in the vicinity of the drilling locations. With areas of the Site where subsurface borings or utilities may be present, the drilling locations will be pre-cleared using non-mechanical methods (e.g., hand clearing, air knife, etc.) to a minimum of five ft-bls.

At each proposed location, continuous core samples will typically be collected from land surface to the bottom of the borehole in an effort to obtain lithologic and soil screening data. All of the soil samples will be described in accordance with the Unified Soil Classification System. The core samples will be examined for evidence of potential impacts (i.e., staining, odor) and screened for the potential presence of VOCs using a PID.

The final depth of each soil boring will vary depending on the purpose and location of the boring. It is anticipated that all soil borings will be completed to a minimum depth of 12 ft-bls.

At soil borings locations where both water table and deeper monitoring wells are to be installed, the soil boring for the deeper well will be drilled first. The deeper well will serve as the location of collection of samples for lithologic characterization and analytical laboratory testing.

Three discrete soil samples will typically be collected for laboratory analyses from each soil boring within unpaved areas: a discrete surface soil sample will be collected from the top six inches of soil; a discrete shallow soil sample from the interval of 0.5 to 2 ft-bls; and a discrete deeper sample from a depth of 10 to 12 ft-bls. In paved areas, the surficial sample will be omitted (due to pavement) and shallow sample will be collected from the 2-ft depth interval immediately beneath the pavement materials and deeper sample will be collected from 10 to 12 ft-bls. If contamination is evident in the 10 to 12-foot soil sample interval, drilling and sampling will proceed until contamination is no longer evident in the soil samples, until groundwater is encountered, or the limit of the equipment has been reached. Additional opportunistic soil samples may be collected and sent for laboratory analyses during soil boring activities based on visual observations and/or soil screening results encountered during drilling activities. Opportunistic samples may be collected if contaminants are evident at different depths, including deeper or shallower than 12 ft-bls, subsurface conditions indicate the presence of preferential pathways, or subsurface conditions prevent sampling at the pre-determined depths described above.

Soil samples will be analyzed for the following parameters:

- Target Compound List (TCL) VOCs (excluding surface soil samples) via USEPA Method 8260;
- TCL SVOCs via USEPA Method 8270;
- TAL Metals via USEPA Method 6010;
- TCL PCBs via USEPA Method 8082;
- TCL Pesticides (surface samples only) via USEPA Method 8081;
- Total Cyanide via Method 9012; and
- Fluoride via USEPA method 300.

A soil sample will also be collected from the five to ten feet below the water table at each deep monitoring well location and analyzed for:

- Total Cyanide via USEPA Method 9012; and
- Fluoride via USEPA method 300.

In addition to the sampling listed above, 20% of the soil samples collected from the surface interval (0 – 0.5 ft-bls) will be laboratory analyzed for lead in both sieved (250 microns/No. 60 sieve) and bulk form. The samples selected for both analyses will account for different sources, lithology, or other characteristics that could influence the ratio between sieved and unsieved sample concentrations. Once the two sets of data are available, a ratio of sieved analysis to bulk analysis can be calculated for each sample, and then a 95% upper confidence level (UCL) on the mean of all the ratios can be calculated. The UCL of the ratios may then be used as a factor that can be applied to historic, current, and future bulk samples to estimate lead concentrations.

In addition to the sampling parameters listed above, total organic carbon will be analyzed at each discrete soil sample within the deep monitoring well locations to support the preparation of the risk assessment and perform fate and transport evaluation. Additionally, a number of discrete source area surface and shallow soil samples will be selected for grain size, bulk density and moisture content analysis for use in fate and transport evaluation as per the MDEQ guidance document titled "Technical Guidance General Field Data Needs for Fate and Transport Modeling" (MDEQ, 2008).

The soil samples collected within the Rectifier Yards will be analyzed for polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) via USEPA Method 8290. As described in Sections 2.8.5 and 2.8.8. of the RI/FS Work Plan, historical fires and PCB remedial actions have been documented within the Rectifier Yards. PCDDs and PCDFs are by-products that occur when PCB fluid is partially burned.

The specific soil sampling depths and sampling analyses described above will aid in determining the nature and extent of contamination within the Site. The surface soil samples collected from land surface to a depth of six inches will be utilized to determine if contaminants are present at the surface and to evaluate the ingestion, inhalation, and dermal contact exposure routes for Site visitors / trespassers as well as for Site workers performing routine, non-intrusive work activities. Subsurface soil samples collected from 0.5 to 2 ft and from 10 to 12 ft will allow for an understanding of vertical distribution of COPCs and will be utilized to evaluate the presence of COPCs at depths where exposure would occur for Site workers who perform intrusive work activities, such as excavation. Soil samples collected from beneath the water table will provide

further vertical delineation of potential COPCs in soil that could potentially be acting as a source of groundwater contamination.

Select soil borings are proposed to be completed as monitoring wells as described in Section 4.5. At deep monitoring well locations where potential confining units beneath the water table are encountered during the drilling of soil borings (as evidenced by lithology observed in the continuous core samples), double-cased sonic drilling procedures will be used to hydraulically isolate monitoring wells screened with the deeper glacial aquifer(s) from the overlying groundwater system; thereby minimizing any potential for cross contamination. Double casing will be completed utilizing the following steps: 1) Advancing the inner (smaller diameter) sonic casing ahead of the outer casing to characterize lithology. When a confining layer is encountered, the initial continuous coring within the inner casing establishes the depth of this layer 2) Advancing the outer sonic casing into the confining layer, sealing off the upper aquifer 3) Continuing the advancement of the inner sonic casing to the desired depth where a well may be installed; and 4) After the well is set, the process is reversed by filling the annular space with grout and vibrating and extracting both the inner and outer casing.

Soil borings not completed as monitoring wells will be abandoned using grout or bentonite chips, with the top three feet of each boring backfilled with soil cuttings. If visual impacts are observed during field screening of soils, the cuttings will be drummed for disposal and only clean material will be used for backfill.

4.6.2 Operational Area Soil Investigation

A soil sampling program will be conducted in areas of the Site not currently identified as potential source areas in the preliminary CSM, but where historical operations may have been conducted based on review of aerial photographs and understanding of Site operations. As part of the operational area soil investigation, surface and shallow subsurface soil samples will be collected to assess soil quality conditions, generate data for use in risk assessment, and to screen for the presence of any additional potential source areas that have not been previously identified in the CSM (if any).

The operational area soil investigation will be implemented using an incremental soil sampling method in general accordance with the USEPA guidance for sampling design (USEPA, 2002b) and the Interstate Technology & Regulatory Council (ITRC) Incremental Sampling Methodology (ITRC, 2012). The incremental sampling methodology (ISM) provides representative samples of specific soil volumes defined as decision units (DUs) by collecting numerous increments of soil (typically 30 or more increments) that are combined, processed, and subsampled according to specific protocols. Evaluation of study results has shown that ISM for soil provides a better estimate of the average (mean) concentration within "decision units" (i.e., individual grid cells of specified size), and within the overall area of investigation, than can be obtained from a conventional discrete sampling approach. Decision units that exhibit COPCs at concentrations exceeding ARARs or risk-based criteria may require a more focused investigation during subsequent phases of the RI.

The Operational Soil Area will have two different types of decision units. The entire Operational Soil Area can be treated as a single DU, with 43 individual sampling units (size of approximately one acre) from which incremental soil samples will be collected. This approach is beneficial because there is no specific source area that has been defined within the Operational Soil Area. This approach will allow for calculation of the mean soil concentration and 95% upper confidence limit (UCL) of the mean for all analytes across the area based upon 43 ISM sample locations. These data can be used in comparison to background concentrations, as well as to compare maximum concentrations detected in entire dataset to conservative screening criteria.

Each individual one acre grid cell will also be evaluated as a decision unit. Evaluating the results at individual grid cell level will allow for identification of areas with higher concentrations. Those areas with higher concentrations (exceeding or close to ecological benchmarks) that exhibit higher habitat value (as determined via field inspection as part of the SLERA), can become the primary focus of future investigation, if necessary during Phase 2.

The sampling will be conducted at the frequency of one incremental surface soil sample (0 to 6-inches bls) and one incremental shallow soil sample (0.5 to 2 ft-bls) per one acre DU. Each incremental soil will consist of up to 32 discrete grab samples that are evenly distributed within four quadrants of each DU (i.e., 8 samples per quadrant). Within each quadrant, the 8 locations

will be randomly distributed. The coordinates of the random locations will be established using GIS and a random number generator, and field personnel will utilize a hand-held GPS (with sub-meter accuracy) to navigate to each location for sample collection. The ISM procedure is further described in the Roux SOP 5.12 provided in Appendix A.

Soil samples collected using ISM will be analyzed for the same analyses described in Section 4.6.1, including 20% of the surface samples sieved and analyzed for lead. In addition to the ISM soil sampling described above, approximately 16 soil borings will be completed within the operational soil investigation areas. Soil borings will be completed utilizing the same methods as described in Section 4.4.1. Soil samples collected within the operational areas will be analyzed for the same analyses described in Section 4.4.1.

4.6.3 Background Area Soil Investigation

A soil sampling program will be conducted in background areas of the Site not currently identified as potential source areas in the preliminary CSM. The Background Area was generally defined in the western portion of the Site where aerial photographs show unforested areas and industrial operations were not known to take place. As part of the Background Area soil investigation, soil samples will be collected to assess background soil quality conditions and generate data for use in risk assessment.

Borings proposed within the Background Area are shown on Figure 10. Soil sampling from the borings within the Background Area will be conducted at the same frequency of the source area borings including one surface soil sample (0 to 6-inches bls), one shallow soil sample (0.5 to 2 ft-bls), and one deeper sample from 10-12 ft-bls. Soil samples collected within the Background Area will be analyzed for the same analyses described in Section 4.4.1.

If data collected from the background locations suggest additional source areas of COPCs are present, additional background locations will be selected and sampled in consultation with the USEPA.

4.7 Monitoring Well Installation.

Selected soil borings are proposed to be completed as monitoring wells. The new monitoring wells will be used to supplement the existing monitoring well network at the Site. The proposed locations were selected to provide further evaluation of groundwater quality in potential source areas and in areas that have not previously been monitored while also helping to refine the understanding of Site groundwater flow. The proposed monitoring wells to be installed during Phase I are shown on Figures 3 through 8 and are summarized on Table 1. The proposed locations may be modified based upon the results of the geophysical survey activities as well as the findings from the initial phases of the drilling program.

The majority of the proposed Phase I monitoring wells will be installed immediately below the groundwater table. Screen zones in the water table wells will consist of 10 feet of screen. If field observations suggest the well should be installed to bridge the water table due to the potential presence of light non-aqueous phase liquids (LNAPL), then the well will be installed with 15 feet of screen, including 5 feet above and 10 feet below the water table.

In addition to the water table wells, deep monitoring wells are proposed to evaluate the vertical extent of COPCs in groundwater and to evaluate groundwater flow within deeper hydrogeologic units. Double-cased well drilling and/or other sonic drilling procedures will be used to hydraulically isolate monitoring wells screened with the deeper glacial aquifer(s) from the overlying groundwater system; thereby minimizing any potential for cross contamination. Procedures for installation of double-cased wells are provided in SOP 10.3 discussed in Section 5.1. Additional details regarding well construction will be included in the SAP Addendum.

The deep borings will be advanced until one of the three following criteria are met 1) the top of bedrock is encountered 2) a maximum depth of 300 feet below land surface is reached without encountering bedrock or 3) a shallower depth, at the discretion of the field geologist in consultation with the management team, if a deep hydrogeologic unit is encountered beneath a significant sequence of low permeability material. While drilling deep monitoring wells, undisturbed core samples will be collected for geotechnical analysis within the major water bearing units and low permeability units including grain size, bulk density, and hydraulic

conductivity. The screened intervals of the deep wells will be determined by the RI field manager and the on-Site geologist/scientist/engineer performing oversight of the drilling activities based on results of geophysical surveying and field observations made during drilling. Monitoring wells will be constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing and 2-inch diameter, 20-slot (0.020 inches) PVC screen flush-threaded onto the PVC casing. Surface completion of each well will consist of a protective stick-up enclosure and a locking J-plug and an exterior lockable metal cover. The location of each monitoring well will be logged with GPS technology with sub-meter accuracy. The locations of the monitoring wells will also be surveyed for elevations.

Newly-constructed monitoring wells will be developed and allowed a minimum of one-week to equilibrate with the surrounding formation. The development will be completed using a surge block and submersible pump. The surge block will be used inside the well to flush fine sediments from the sand filter. After the well is surged, a submersible pump will be lowered into the well and groundwater will be withdrawn. Temperature, pH, specific conductance and turbidity readings will be monitored and pumping will proceed until the discharge water meets a field turbidity value to 10 formazin nephelometric units/nephelometric turbidity units (FNU/NTU) or less or until the field turbidity does not improve for a period of two hours during active development.

4.8 Groundwater Gauging and Sampling

Groundwater levels will be measured across the monitoring well network on a quarterly basis for a period of one year following installation of all Phase 1 wells to evaluate Site-wide groundwater elevations and groundwater flow. Groundwater levels will be collected with an electronic water-level meter capable of measuring fluid elevation with an accuracy of 0.01 ft. When conducting comprehensive gauging rounds, all groundwater level measurements will be collected on the same day to provide a snapshot of the Site-wide conditions. At least six monitoring wells will be fitted with pressure transducers to document the seasonal fluctuations of groundwater levels. The pressure transducers will collect automated measurements every 30 minutes.

Groundwater samples will be collected from all newly-constructed monitoring wells and all existing Site monitoring wells that are deemed accessible and in good condition during

Site reconnaissance. The feasibility of sampling the production wells, and whether such sampling will produce representative groundwater data, will be evaluated during Site reconnaissance. Groundwater samples will be collected on a quarterly basis for a period of one year following installation of all Phase 1 wells to characterize groundwater quality beneath the Site during varying seasonal conditions. Existing monitoring wells with dedicated sampling pumps will continue to be sampled with the dedicated pumps to maintain comparability with previous sampling results. Other groundwater samples will be collected using the methods described in the USEPA guidance document titled "Ground Water Sampling Procedure, Low Stress (Low Flow) Purging and Sampling" (USEPA, 2010). During purging, a water quality meter will be used to monitor water quality indicator parameters such as pH, conductivity, dissolved oxygen (DO), oxygen reduction potential (ORP), temperature, and turbidity. The field parameters will be recorded on monitoring well sampling data forms and submitted with the final RI summary report.

During each groundwater sampling event, groundwater samples will be analyzed for the following parameters:

- Dissolved TAL metals via USEPA Methods 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A;
- Total cyanide via USEPA Method 335.4; and
- General chemistry including Fluoride via USEPA method 300, alkalinity via method SM2320B, and hardness via method 2340B;
- Nutrients including Chloride and Sulfate via USEPA method 300.0, Nitrate and Nitrite as N via USEPA method 353.2, ammonia nitrogen via USEPA method 350.1/350.3, and orthophosphate as P via USEPA method 365.1; and
- Total dissolved solids (TDS) and total suspended solids (TSS) via methods SM 2540C/D.

The initial groundwater samples collected adjacent to potential source areas will also be analyzed for the following additional parameters:

- TCL VOCs via USEPA Method 8260; and
- TCL SVOCs via USEPA Method 8270.

All groundwater samples submitted for analysis of dissolved metals will be field filtered using a standard 0.45 micron filter.

PCBs or pesticides in groundwater samples will not be analyzed for unless deemed warranted based upon their detection in source area soil samples or other locations. Similarly, unless warranted based upon the detection of VOCs or SVOCs in source area groundwater samples, the downgradient groundwater samples will not be analyzed for these parameters.

4.9 Surface Water and Sediment Sampling

Surface water samples will be collected from surface water bodies present at the Site to evaluate surface water quality. Samples will be collected from within RI Areas, if water is present in the feature, including:

- North-East Percolation Pond
- North-West Percolation Pond
- South Percolation Ponds
- Seep
- Cedar Creek
- Cedar Creek Reservoir Overflow Drainage
- Flathead River

The proposed surface water sample locations are shown on Figures 3 through 8 and summarized in Table 1. Samples will be collected by taking a grab sample directly from the water body using the sample collection container for each analysis. The location of each sample will be logged with GPS technology with sub-meter accuracy. Surface water samples will be collected on a quarterly basis for one year to evaluate seasonal variations in water quality.

As part of sample collection activities within the surface water features, surface water will be field analyzed with a water quality meter to evaluate water quality parameters including temperature, conductivity, pH, DO, and ORP. The water quality meter will be placed directly in the surface water feature and will be monitored until stable readings are observed. The readings will be recorded on a field datasheet and included as part of the RI Summary Report.

All surface water samples will be analyzed for the following parameters:

- Total recoverable TAL metals via USEPA Methods 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A;
- Total cyanide via USEPA Method 335.4;
- General chemistry including Fluoride via USEPA method 300, alkalinity via method SM2320B, and hardness via method 2340B;
- Nutrients including Chloride and Sulfate via USEPA method 300.0, Nitrate and Nitrite as N via USEPA method 353.2, ammonia nitrogen via USEPA method 350.1/350.3, and orthophosphate as P via USEPA method 365.1; and
- Total dissolved solids (TDS) and total suspended solids (TSS) via methods SM 2540C/D.

The initial surface water samples collected within the percolation ponds will also be analyzed for the following additional parameters:

- TCL VOCs via USEPA Method 8260;
- TCL SVOCs via USEPA Method 8270;
- TCL PCBs via USEPA Method SW8082; and
- TCL Pesticides via USEPA Method 8081.

During each surface water sampling event, the discharge of Cedar Creek and Cedar Creek Drainage Overflow will be measured utilizing a mechanical current-meter method in accordance with Roux SOP 6.7. The stream channel cross section will be divided into numerous vertical subsections. In each subsection, the area will be obtained by measuring the width and depth of the subsection, and the water velocity will be determined using a current flown meter. The discharge in each subsection will be computed by multiplying the subsection area by the measured velocity and the total discharge will be computed by summing the discharge of each subsection.

A temporary staff gauge will be installed within the Flathead River to enable measurement of river level conditions immediately adjacent to the Site. For the Flathead River, the instantaneous discharge measurement from USGS Station 12363000, located down river of the Site, will be recorded. The temporary staff gage will be surveyed and correlated to the USGS station

12363000. River levels measured at the staff gauge will be used in conjunction with measured groundwater elevations to evaluate groundwater / surface water interactions.

Sediment samples will be collected from the same locations as surface water samples. Seasonal conditions and river stage will be taken into account when collecting sediment samples. It is anticipated the sediment sampling activities will be performed in spring conditions when river stage is at a low level and such that the Flathead River is most likely acting as a gaining stream. Sediment will be collected by grab sampling sediment immediately beneath the subsurface and placing in sampling jars for laboratory analysis. Gravel and larger sized grains will be removed from the sample by utilizing a size 10 sieve prior to packaging and shipment for laboratory analysis. The proposed sediment samples will be analyzed with the same analytical methods as soils described in Section 4.4.1 including grain size analysis and total organic carbon. The proposed locations are shown on Figures 3 through 8 and are summarized in Table 1.

4.10 Drywell Sampling

Dry wells and drainage structures associated with the former plant operations are shown on Plate 2. All accessible drains and basins will be inspected visually for potential impacts (staining, odors, etc.). Descriptions of observations will be noted in the field notebook. A sediment sample will be collected from each feature where feasible utilizing hand tools. Sediment will be sent for laboratory analyses and analyzed for the same analytical methods as soils described in Section 4.4.1.

A soil boring will be drilled at the location of Drywell 31, which based on historical Site drawings was potentially used as a discharge location for chemical wastes generated in the Lab Building. In addition, at least three soil borings will be completed to evaluate subsurface soils beneath additional dry well locations. The locations will be selected following evaluation of sediment screening and laboratory data.

4.11 Fate and Transport Evaluation.

As described in the RI/FS Work Plan Section 5.7, fate and transport evaluation will start during Phase I and be continued during Phase II. During the Phase I Site Characterization, analytical data and hydrogeologic data will be collected to facilitate fate and transport evaluation.

Field data recommended for chemical fate and transport modeling is described in Table 3 of the MDEQ guidance document titled "Technical Guidance General Field Data Needs for Fate and Transport Modeling" (MDEQ, 2008).

As described in Section 5.3.2, soil data to be collected in Phase I relevant to fate and transport evaluation and geotechnical analysis includes total organic carbon, grain size, bulk density and moisture content analysis. As described in Sections 5.6.2 and 5.6.3, groundwater and surface water data relevant to fate and transport evaluation include field parameters such as pH, dissolved oxygen, temperature, and ORP, and analytical parameters listed in the nutrient and metal parameter list.

A description of the fate and transport evaluation to be conducted during the Phase I Site Characterization is described in Section 5.7 of the RI/FS Work Plan.

5.0 FIELD SAMPLING PROCEDURES

This section discusses the Standard Operating Procedures (SOPs) and sample designation procedures that will guide the Phase I field activities.

5.1 Standard Operating Procedures

Roux Associates has developed a set of SOPs that are applicable for the proposed Phase I field sampling and data collection program. The SOPs were developed following USEPA and other applicable standard protocols. A list of relevant SOPs is provided below and copies of the SOPs are provided in Appendix A.

- SOP 3.1 – Collection of Quality Control Samples for Water-Quality Data
- SOP 3.2 – Field Record Keeping and Quality Assurance/Quality Control
- SOP 3.3 – Sample Handling
- SOP 4.2 – Measuring Water Levels Using an Electronic Sounding Device
- SOP 4.3 – Purging a Well
- SOP 4.4 – Sampling Ground-Water Monitoring Wells for Dissolved Constituents
- SOP 4.5 – Surface-Water Sampling
- SOP 4.6 – Filtration of Ground-Water and Surface-Water Samples for Dissolved Metals Analysis
- SOP 4.7 – Measuring the Thickness of Separate-Phase Organic Liquids
- SOP 5.1 – Collection of Soil Samples for Laboratory Analysis
- SOP 5.2 – Collecting Stream-Bed, Pond, and Lagoon Sediment Samples
- SOP 5.4 – Screening Soil Samples for Volatile Organic Vapors Using a Portable Photoionization Detector
- SOP 5.5 – Soil Classification and Logging Procedures
- SOP 5.12 – Incremental Soil Sampling
- SOP 6.4 – Measuring Water Quality Parameters
- SOP 6.5 – Photo Documentation
- SOP 6.6 – Collection of GPS Information
- SOP 6.7 – Measuring Stream Discharge
- SOP 9.1 – Decontamination of Field Equipment
- SOP 10.3 – Soil Boring and/or Monitoring or Observation Well Drilling, Formation Sampling and Borehole Abandonment in Unconsolidated Formations

5.2 Sample Designation Procedures

All screening locations and analytical samples, including samples collected for QA/QC purposes, will be given a unique Site-specific sample identification number. The sample identification number will be used to track field-screening data and laboratory analytical results in the project database, as well as for presentation of the data in memoranda and reports. During the investigation, the sample numbers will be recorded in the field logbook and field datasheets, on the sample jars, and on the COC paperwork.

The Site-specific format will include the following structure:

1) Project Identification Code

   All samples collected during the RI will be labeled as "CF", to represent Columbia Falls Aluminum Company.

2) Sampling Location Type

   All samples will include an alpha identification code to identify the type of sample location:

   - SB = Soil boring
   - MW = Monitoring Well
   - SWP = Surface Water Point
   - SDP = Sediment Sampling Point
   - DS = Drainage Structure
   - SGP = Soil Gas Point
   - SGS = Soil Gas Screening
   - WC = Waste Characterization
   - ISS = Operational Area Incremental Soil Sample

3) Sample Location Number

   Each unique sample location will receive a unique numerical ID. Numerical IDs will start with "001" for each sample location type. For clustered monitoring wells (i.e., locations where water table and deeper screened monitoring wells are present) the deeper screened well will receive the letter "a" after the sample location number. Existing monitoring wells will retain their historically used identification.

4) Sample Media Type

   All samples will include an alpha identification code to identify the type of sample media being collected:

   - SO = Soil

- GW = Groundwater
- SW = Surface water
- SD = Sediment
- SG = Soil Gas
- WCS = Waste Characterization Solids
- WCL = Waste Characterization Liquids

5) Sample Interval

Multiple samples may be collected within the same borehole location for vertical delineation purposes. If multiple samples are collected, the sample identification will include the depth interval in feet below land surface from which the unique sample was collected.

6) QA/QC Samples

For samples collected for quality assurance / quality control purposes, the following alpha identification codes will be added to the sample ID:

- MS = Matrix Spike
- MSD = Matrix Spike Duplicate
- FB = Field Blank
- EB = Equipment Blank
- TB = Trip Blank
- DUP = Field Duplicate

Trip blanks and field duplicates will also be given unique identifiers indicating the type of sample and the sample date, but the analytical laboratory will be kept "blind" as to the location of field duplicate pairs to avoid introducing any bias to the analytical process.

The proposed samples and sample designations are provided on Table 1. Below are example sample designations for various types of hypothetical samples:

An example designation for a soil sample collected from 10-12 ft-bls at soil boring location 001:

CFSB-001-SO-10-12

An example designation for a groundwater sample collected from monitoring well 001:

CFMW-001-GW

PART 2 - COLUMBIA FALLS ALUMINUM COMPANY PHASE 1 SITE CHARACTERIZATION QUALITY ASSURANCE PROJECT PLAN

Prepared by Roux Associates
November 2015 - Revision #0

November 23, 2015

Andrew Baris
Vice President / Principal Hydrogeologist
RI/FS Project Manager

Date

November 23, 2015

Michael Ritorto
Senior Hydrogeologist
RI Manager

Date

November 23, 2015

Wai Kwan, Ph.D.
Senior Engineer/
Quality Assurance Manager

Date

6.0 GROUP A – PROJECT MANAGEMENT

This element group, comprising nine elements, addresses project administrative functions and project concerns, goals, and approaches to be followed. The first element (A1) is the title and approval sheet provided above. The second element (A2) is the table of contents provided at the beginning of the SAP. The remaining items included in this element are addressed below.

6.1 Element A3 – Distribution List

This SAP will be distributed to the following organizations/key project personnel associated with the RI/FS activities.

Organization	Individual	Title	Copies
USEPA	Mike Cirian	EPA Project Manager	3 hardcopies and 1 electronic
Montana DEQ	Lisa DeWitt	DEQ State Project Officer	1 hardcopy and 1 electronic
Glencore	John Stroiazzo	Glencore Project Manager	Electronic Only
CFAC	Steve Wright	Project Coordinator	Electronic Only
Roux Associates	Andrew Baris	RI/FS Project Manager	Electronic Only
	Michael Ritorto	RI Manager	Electronic Only
	Wai Kwan	QA Officer	Electronic Only
Primary Laboratory	TBD	Laboratory Project Manager	Electronic Only
Data Validation Firm	TBD	Data Validator	Electronic Only

6.2 Element A4 – Project/Task Organization

A project organization for the RI/FS is shown in Figure 11. The project responsibilities of the various key project team members relevant to the Phase I Site Characterization are discussed below.

<u>RI/FS Project Manager – Andrew Baris, Principal Hydrogeologist, Roux Associates</u>

The RI/FS Project Manager has the responsibility to oversee the overall implementation and completion of the RI/FS Scope of Work. The Project Manager will manage the technical and administrative aspects of the project and will function as Roux Associates primary contact with CFAC and the regulatory agencies (USEPA and MDEQ). The RI/FS Project Manager will direct the activities of the RI Field Manager, FS Manager, and other project staff, and will be supported

by the QA Officer in the implementation of this QAPP. The RI/FS Project Manager is responsible for maintaining the official, approved QAPP.

RI Manager – Michael Ritorto, Senior Hydrogeologist, Roux Associates

The RI Manager will be the manager responsible for overseeing the implementation of the RI Scope of Work. The RI Manager will ensure that data collection is carried out according to the RI/FS Work Plan, and the various components of this SAP (FSP and QAPP). The RI Manager will also oversee any subcontractors for any task where subcontractors may be required (e.g., drilling, geophysical survey, etc.). The RI Manager will be responsible for communicating updates on the status of the RI tasks to the RI/FS Project Manager.

FS Manager – Charlie McGuckin, P.E., Principal Engineer, Roux Associates

The FS Manager is responsible for developing the Scope of Work and overseeing the various parts of the FS. The FS Manager will communicate with the RI/FS Project Manager and RI Manager during the design of the RI to collect data that can be used to support the FS.

QA Officer – Wai Kwan, Ph.D., P.E., Senior Engineer, Roux Associates

The QA Officer is a person independent of technical/data analysis responsibilities on the project that is designated to perform project QA/QC responsibilities. The QA Officer will assist as needed in ensuring compliance with this QAPP and the sampling protocols in the FSP. The QA Officer will be responsible for ensuring that sampling QA/QC audits are conducted to verify that data being collected during the RI meets the DQOs. The QA Officer will also be responsible for communicating with the analytical laboratory about potential QA/QC issues, if any, and managing the data validation subcontractors. The QA Officer will submit reports to the RI/FS Manager on QA activities and will verify that corrective measures are performed, if needed.

Project Health and Safety Officer – Joe Gentile, CIH, Corporate Health & Safety Officer, Roux Associates

Health and safety will be a shared responsibility of all project personnel that visit the Site during the RI/FS activities. The overall health and safety management during field activities will be stewarded by the Project Health and Safety Officer. The Project Health and Safety Officer will be responsible for ensuring that all project personnel, including subcontractors, adhere to the requirements in the HASP.

Laboratory Project Manager – To be determined and specified in SAP Addendum

The Laboratory Project Manager will be responsible for sample container preparation, sample custody in the laboratory, and completion of the required analysis through oversight of the laboratory staff. The Laboratory Project Manager will ensure that all QA/QC protocols specified in this QAPP are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Project Manager will report to Roux Associates' QA Officer and will also communicate directly, as needed, with the Data Validation Manager.

Data Validation Manager - To be determined and specified in SAP Addendum

Roux Associates will coordinate data validation through a third-party Data Validator. The Data Validator will be responsible for validating analytical data received from the laboratory to ensure it meets the DQOs outlined in the QAPP and USEPA data validation guidelines. The Data Validator will provide a summary of the data validation results for inclusion in the summary reports.

6.3 Element A5 – Problem Definition/Background

This element discusses the basis for the RI/FS activities at the CFAC Site, provides pertinent background information, and discusses the intended uses of the information to be developed during implementation of the RI/FS.

6.3.1 Basis for the RI/FS

Roux Associates, Inc., has prepared a RI/FS Work Plan for the CFAC aluminum facility Site located in Columbia Falls, Flathead County, Montana (hereinafter, "the Site"). The Site was operated as a primary aluminum reduction facility (commonly referred to as an aluminum smelter) from 1955 until 2009. Aluminum production at the Site was suspended in 2009 due to a downturn in aluminum market conditions, and CFAC announced the permanent closure of the facility in March 2015. Since that time, CFAC has initiated decommissioning and demolition activities and has commissioned the performance of an RI/FS. The purpose of the RI/FS is to characterize the nature and extent of risks associated with environmental conditions at the Site and to evaluate potential remedial options to address those risks. More specifically, the RI/FS is designed to achieve the following objectives:

1. Identify contaminants of potential concern (COPCs) at the Site and their source(s);

2. Determine the nature and extent of Site-related COPCs in environmental media (soil, soil gas, groundwater, surface water, sediment, and sediment porewater) at the Site;

3. Understand the fate and transport of COPCs in environmental media at the Site;

4. Identify any exposure pathways (considering both current and potential future land use);

5. Evaluate current and potential future human health and ecological risks posed by the COPCs present at the Site; and

6. Conduct an evaluation of remedial alternatives for the Site, including treatability studies where necessary.

6.3.2 Background Information

A Site description is provided in Section 2.1 of this SAP and a summary of Site operations is provided in Section 2.2 of this SAP. A summary of the physical setting of the Site, including a review of the Site topography, climate, geology, hydrogeology, and groundwater flow is provided in Section 2.0 of the RI/FS Work Plan.

Previous investigations conducted at the Site indicate the presence of COPCs (i.e., primarily cyanide and fluoride) in soil, groundwater, surface water and sediment. Additional data will need to be collected as part of the RI/FS is to characterize the nature and extent of the COPCs and further understand the potential environmental impacts, if any.

6.3.3 Intended Use of the Information

The information collected throughout the RI/FS will be utilized to achieve the objectives described in Section 6.3.1. Section 3.6 of the RI/FS Work Plan provides preliminary identification of potentially applicable or relevant and appropriate requirements (ARARs) and any other guidance and criteria "to be considered" (TBC) for the Site during the RI/FS. In addition, Section 6.5.5 discusses screening criteria to which the RI data will be compared for identification and selection of COPCs.

6.4 Element A6 – Project/Task Description

This element provides a description of the activities planned in the Phase I Site Characterization and a preliminary schedule of those tasks.

6.4.1 Phase I Site Characterization

A RI/FS Site Characterization Program will be implemented in a phased approach, anticipated to consist of at least two phases of field work. The Phase 1 Site Characterization will focus on identification and characterization of source areas, and providing broad characterization of conditions across the Site (including at downgradient areas near potential human and ecological receptors).

The Phase I Site Characterization program has been designed to identify and/or confirm source areas and associated COPCs, as well as provide a broad characterization of the hydrogeologic conditions and the nature and extent of contamination across the Site. Based on the current understanding of the Site conditions and CSM, the following objectives were established for Phase I Site Characterization Program:

- Evaluate current conditions at all identified RI areas and Site features to determine which RI areas and Site features require further investigation and/or quantitative evaluation in the baseline risk assessment;
- Refine the list of COPCs that require further investigation at various RI areas and Site features so lists of laboratory analyses can be reduced during subsequent phases of investigation;
- Refine the understanding of groundwater flow beneath the Site, particularly in the vicinity of potential receptors;
- Develop a more detailed understanding of bedrock topography and the depths, thicknesses and extents of the various hydrogeologic units, both of which may influence groundwater flow and the distribution of COPCs in the subsurface;
- Begin to evaluate seasonal influences on groundwater/surface water interactions and contaminant concentrations in groundwater and surface water;
- Develop data to support the preparation of the baseline risk assessment work plan; and
- Develop data to support identification and screening of remedial technologies as part of the FS.

To meet the objectives outlined above, the Phase I RI program will include additional historical data review, coordination of activities with the Site salvage/repurposing contractor (Calbag Resources, LLC), pre-intrusive Site reconnaissance work, and source, operational and background area investigation activities that will include soil gas, soil, groundwater, sediment,

and surface water sampling activities. Each of these tasks are described in greater detail in Section 4.0.

6.4.2 Phase I Site Characterization Preliminary Schedule

A preliminary schedule for implementation of the major RI/FS activities is provided in Section 10.3 of the RI/FS Work Plan. A detailed project schedule outlining the anticipated timing and duration of each Phase 1 Site Characterization field task will be provided to the EPA once the RI/FS Work Plan and this SAP are approved and key subcontractors have been selected. Management of the schedule will be an important focus throughout the duration of all RI/FS activities. The schedule will be periodically reviewed and updated as the work progresses. Many of the tasks in the RI/FS are independent; however, where possible, tasks will be conducted concurrently to facilitate progress. The schedule may require modification throughout the duration of the RI/FS based upon, among other factors, the regulatory review and approval process, the availability of specialized subcontractors for certain aspects the work, adjustments to the scope of work.

6.5 Element A7 – Quality Objectives and Criteria for Measurement Data

The RI/FS Site Characterization Scope of Work was developed in a manner consistent with USEPA's "Guidance on Systematic Planning Using the Data Quality Objective Process" (USEPA, 2006). The data quality objective (DQO) process is designed to clarify the objectives of data collection and maximize efficiency during data collection. It consists of a multi-step, iterative process that ensures that the type, quantity, and quality of environmental data used in the decision making process are appropriate for its intended application. The following steps were completed as part of the DQO process in general accordance with the USEPA guidance:

1. Define the problem
2. Identify the Goals / Decisions of the Study
3. Identify Information Inputs
4. Define the Study Boundaries
5. Develop the Analytical Approach
6. Specify Performance or Acceptance Criteria

7. Develop the Plan for Obtaining Data

The remainder of this element summarizes the step-by-step DQO process.

6.5.1 Step 1: Define the Problem

The RI/FS Work Plan provides the background information and relevant existing Site data to define the problem. In summary, previous investigations indicate that former aluminum smelter operations at the Site have resulted in releases to the environment which may pose a potential threat to human health and the environment. It is necessary to understand the types, extent and concentrations of the COPCs that have resulted from former Site operations for the adequate evaluation of current and future human health and ecological risks. It is also necessary to identify and understand any potential ongoing sources of these COPCs, if any, in order to make informed decisions regarding potential remediation approaches. Additionally, it will be important to understand the Site physical characteristics in order to evaluate contaminant migration pathways and potential remedial action alternatives.

6.5.2 Step 2: Identify the Goals / Decisions of the Study

The overall goal of the RI/FS is to determine:

- Where and to what extent remedial action is warranted to protect human and ecological receptors from contamination at the Site; and
- The remedial action alternative(s) that best satisfies the remedy selection criteria specified within the USEPA guidance and NCP.

In order achieve the above goals, the RI/FS will be conducted in a phased approach starting with the Phase 1 Site Characterization Program that is the focus of this SAP. The objectives of the Phase I Site Characterization are presented in Section 6.5.1, and formed the basis for development of the following decision questions and statements.

- *Question 1*: Do inorganic and organic chemical concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater exceed project screening levels?

  Decision Statement: Determine if concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater are above screening levels and should be identified as COPCs.

- *Question 2*: What is the extent of COPCs in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater?

  Estimation Statement: Estimate the areal and vertical extent of COPC contamination in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater.

- *Question 3*: Do COPC concentrations in Site surface soil, subsurface soil, surface water, sediment, and groundwater exceed reference conditions?

  Decision Statement: Determine if COPC concentrations in Site surface soil, subsurface soil, surface water, , sediment, and groundwater are statistically greater than reference concentrations and are identified as Site-related COPCs.

- *Question 4*: Are there potential source areas present at the Site, beyond those already identified in the CSM (i.e., landfills, percolation ponds, plant drainage system including dry wells, drum storage area, underground storage tanks [USTs], aboveground storage tanks [ASTs], and waste and raw materials storage and handling areas)?

  Decision Statement: Determine if additional source areas/Site features are present at the Site where COPCs potentially were released, based upon visual inspection of waste materials, soil piles, staining, stressed vegetation, etc., which will require additional characterization.

- *Question 5*: How are COPCs in Site surface soil, subsurface soil, and groundwater moving throughout the Site and is there the possible movement of COPCs off-Site?

  Estimation Statement: Evaluate the fate and transport of COPCs throughout Site surface soil, subsurface soil, and groundwater. Parameters needed to inform this assessment include estimates of the depth to groundwater, identification of the aquifer types that are present (e.g., unconfined/confined, alluvial/bedrock), hydraulic gradients, as well as measurements of soil and water quality characteristics (e.g., total organic carbon, soil particle size and bulk density, pH, oxidation potential, alkalinity), the types and concentrations of COPCs across the Site and near downgradient Site boundaries, and the physiochemical properties of the COPCs present.

- *Question 6:* What are the subsurface characteristics and Site features that are important to understand prior to conducting drilling activities?

  Estimation Statement: Evaluate the geophysical nature of the subsurface characteristics and features of the Site. Parameters needed to inform this assessment include estimates of the depth to bedrock, estimates of the depth to groundwater, identify changes in subsurface hydrogeological conditions, identify subsurface anomalies that may contribute to the delineation of source areas, etc.

6.5.3 Step 3: Identify Information Inputs

An evaluation of current Site conditions based upon existing data and an identification of the data needed to complete the RI/FS is provided in Sections 3.0 and 4.1 of the RI/FS Work Plan. While the historical investigation data was useful for development of the preliminary CSM and

scoping of the project, the available QA/QC documentation for the majority of the historical investigations is not sufficient to rely upon the data in future decision making. Therefore, the majority of the data for future decisions will be that which is collected during the RI/FS. This data will be supplemented by use of the validated data from the USEPA Site Reassessment sampling completed in 2013 and the ongoing quarterly residential well monitoring program (described in Section 2.8.14 and 2.8.15 respectively of the RI/FS Work Plan). In addition, the historical MPDES monitoring of historical groundwater quality trends and the ongoing MPDES Permit compliance monitoring will be used as appropriate.

A description of the data required to address each of the DQO questions and statements provided in Section 6.5.2 is summarized below.

- *Decision Statement:* Determine if concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater are above screening levels and should be identified as COPCs.

  In order make this determination, samples of the aforementioned media (with the exception of soil vapor) should be collected where present within, or adjacent to, each of the Site features that have been identified as potential source areas (i.e., landfills and percolation ponds) as well as from potential receptor locations (Site-wide soils, groundwater, surface water bodies). Groundwater samples should be collected adjacent to, and downgradient of, the potential source areas. Soil vapor does not require collection from all Site features, as VOCs have only been detected at trace concentrations to date. Passive soil vapor screening and groundwater data for VOCs can be used to evaluate the potential for soil vapor impacts and determine if additional soil vapor sampling is required.

  The aforementioned samples should be analyzed for a comprehensive suite of analytical parameters to provide a broad screening for potential COPCs at the Site. The maximum concentrations detected should be utilized to make comparisons to conservative screening criteria for the protection of human and ecological receptors.

- *Estimation Statement:* Estimate the areal and vertical extent of COPC contamination in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater.

  In order to estimate the areal and vertical extent of COPCs in the aforementioned media, samples will be collected at locations around, and downgradient of, the various potential source areas that have been identified at the Site. As part of the Phase 1 Site Characterization, the locations should provide a broad distribution of sampling locations across the Site and up to the downgradient Site boundary to assess if the COPCs are limited to within the Site boundary or potentially extend beyond the boundary. Within the groundwater system, installation and sampling of monitoring wells at deeper depths beneath the water table is required to characterize the vertical extent of COPCs.

- *Decision Statement:* Determine if COPC concentrations in Site surface soil, subsurface soil, surface water, , sediment, and groundwater are statistically greater than reference concentrations and are identified as Site-related COPCs.

  Soil samples will be grouped into decision units following review of the Phase I data and during preparation of the Baseline Risk Assessment Work Plan. These decision units will likely correspond to the preliminary exposure areas described in Section 3.2 of the RI/FS Work Plan, which include the Main Plant Area, Landfill Area(s), Northern Percolation Ponds, Operational Soil Area and the Flathead River landside Area (including Southern Percolation Ponds and the Seep area).

  With respect to surface and subsurface soil, a minimum of eight locations will be sampled within the western portion of the Site in areas that have had no evidence of prior industrial activity and that are greater than 500 ft from any known potential source area. The data from these locations will be used to calculate the mean concentration and 95 percent upper confidence limit (UCL) on the mean to establish potential background concentrations for comparison to soil samples collected at locations within the decision units. In addition, the background concentrations from this effort will also be evaluated in the context of the prior background soil sampling at the Site by Weston (2014) and throughout the State of Montana by Hydrometrics (2013).

  With respect to groundwater, monitoring well W2-CFMW1 located within the Site boundary, but upgradient of all potential source areas, will be sampled to establish a background / reference concentration. With respect to surface water and sediment within Cedar Creek and the Cedar Overflow, two locations within the Site boundary but upstream of all potential source areas will be sampled to establish a background / reference concentration. Within the Flathead River, a background / reference location will selected during the field reconnaissance task of the Phase 1 Site Characterization. This location will be identified Phase 1 SAP Addendum described in Section 4.2. Since only one sample location will be used for the aforementioned background / reference stations, statistical analysis will not be performed. The data from these locations will compared directly to results of samples collected within and around the Site features.

- *Decision Statement:* Determine if additional source areas/Site features are present at the Site where COPCs potentially were released, based upon visual inspection of waste materials, soil piles, staining, stressed vegetation, etc., which will require additional characterization.

  A ground level field reconnaissance will be conducted prior to the commencement of sampling activities, as described in Section 4.3. The findings of this reconnaissance, including identification of any additional potential source areas/Site features requiring characterization, as well as any additional sampling proposed based upon those findings, will be documented in the Phase 1 SAP addendum.

- *Estimation Statement:* Evaluate the fate and transport of COPCs throughout Site surface soil, subsurface soil, and groundwater. Parameters needed to inform this assessment include estimates of the depth to groundwater, identification of the aquifer types that are present (e.g., unconfined/confined, alluvial/bedrock), hydraulic gradients, as well as

measurements of soil and water quality characteristics (e.g., total organic carbon, soil particle size and bulk density, pH, oxidation potential, alkalinity), and the physiochemical properties of the COPCs present.

The hydrogeologic investigation has been designed to generate Site-specific data needed to evaluate the fate and transport of COPCs. The drilling program will include continuous coring to characterize formation materials at 43 new monitoring well locations throughout the Site. This will generate information regarding types and physical characteristics of the aquifers and confining units present, as well as collection of representative samples of aquifer materials and low permeability layers for geotechnical laboratory analysis. Monitoring wells will be installed to allow for measurement of depth to groundwater. These data used in conjunction with elevation surveys will be used to estimate hydraulic gradients. Published literature sources will be used to gather information regarding the physiochemical properties of COPCs that is required to evaluate fate and transport.

- *Estimation Statement:* Evaluate the geophysical nature of the subsurface characteristics and features of the Site. Parameters needed to inform this assessment include estimates of the depth to bedrock, estimates of the depth to groundwater, identify changes in subsurface hydrogeological conditions, identify subsurface anomalies that may contribute to the delineation of source areas, etc.

  The existing Site data has been evaluated to provide an initial understanding of subsurface conditions. Prior to initiating the drilling program, this initial understanding will be supplemented by conducting a geophysical survey in the vicinity of the Site landfills and along transects perpendicular to the strike of Teakettle Mountain as described in Section 4.4. In addition, Site topography and existing monitoring wells will be used to estimate the anticipated depth to groundwater and the types of subsurface materials expected to be present at each drilling location.

6.5.4 Step 4: Define the Study Boundaries

This section describes the spatial and temporal bounds of the RI/FS.

Spatial Bounds

As described in Section 2.1 and shown on Figure 1, the property owned by the Columbia Falls Aluminum Company is approximately 3,196 acres. However, the historic footprint of operations and a significant peripheral area consists of approximately 1,340 acres of land bounded by Cedar Creek Reservoir to the north, Teakettle Mountain to the east, Flathead River to the south, and Cedar Creek to the west. Therefore, the Site and horizontal extent of the RI study area is defined as shown on Figure 2, including the 1,340 acres described above. The RI study area will be expanded if required to define the nature and extent of contamination at the Site.

Published literature indicates that the bedrock surface defines the base of the regional groundwater flow system at the CFAC Site (Konizeski *et al*, 1968). Thus, bedrock surface will represent the maximum vertical extent of the RI Study Area beneath the Site. The goal of the vertical investigation will be to refine the hydrogeologic model of the Site including understanding deep regional groundwater flow and identifying potential contaminant pathways to receptors. The vertical extent may vary across the Site area depending on the vicinity to Site features including the Flathead River.

Background / reference sampling locations for soil, groundwater, surface water and sediment are described in Section 6.5.3. The locations have been selected such that Site-related impacts are not expected to occur in the reference locations. Eight background / reference locations for soil sampling have been preliminary identified in the western portion of the Site in an area where there has been no evidence of Site-related industrial activity. During the Site reconnaissance task, these locations will be inspected to document the soil types present and determine if they are sufficiently similar to other Site soils for use as reference locations. The proposed background locations for surface water / sediment in Cedar Creek and the background monitoring well location for groundwater are in the northern area of the Site, upstream / upgradient of any Site-related activities. A background / reference sampling location in the Flathead River will be identified during the Site reconnaissance task.

Temporal Bounds

The potential release and potential migration of COPCs from source areas may vary depending on seasonal influences on groundwater flow. Groundwater in the region is typically recharged from the surface water sources within the watershed including numerous reservoirs, ponds, streams and lakes and additionally through infiltration of precipitation. During spring, the melting of winter snow and increased seasonal precipitation causes a high river stage in the Flathead River. This results in the Flathead River recharging groundwater and acting as a losing stream. In contrast, in the late summer, the dry weather results in a decrease in river stage so that the Flathead River *becomes* a gaining stream (Konizeski *et al*., 1968).

Since most stormwater drainage is directed to the various percolation ponds, the release and potential migration of COPCs from these ponds may be correlated to both individual precipitation events as well as seasonal variation.

As a result of the seasonal and shorter term influences, multiple rounds of water level measurements (including use of water level data logger in select wells) will be conducted. Groundwater and surface water will be conducted on a quarterly basis for one year (four rounds of sampling) to characterize the seasonal variation in water quality. One sediment sampling event will be conducted as part of the Phase 2 Site Characterization. It is anticipated that this event will occur in the spring prior to significant mountain snowmelt, when the Flathead River is expected to be receiving water from the groundwater system.

6.5.5 Step 5: Develop the Analytical Approach

The activities described in Section 4 were developed to collect the types of data identified information inputs required to address the decision statement and estimation statements specified in Sections 6.5.2 and 6.5.3. The analytical approach to address each decision statement is described below.

- *Decision Statement:* Determine if concentrations in Site surface soil, subsurface soil, soil gas, surface water, sediment, and groundwater are above screening levels and should be identified as COPCs.

  This determination will be made by comparison of maximum detected concentration of each potential COPC to human health and ecological screening levels for each media type, within each potential exposure area. For the purposes of identifying COPCs, the lowest value, across all sources, will be selected as the screening level. The screening level sources to be utilized are described in Section 6.1 and 6.2 of the RI/FS Work Plan.

- *Decision Statement:* Determine if COPC concentrations in Site surface soil, subsurface soil, surface water, , sediment, and groundwater are statistically greater than reference concentrations and are identified as Site-related COPCs.

  With respect to surface and subsurface soil, a minimum of eight locations will be sampled within the western portion of the Site in areas that have had no evidence of prior industrial activity and that are greater than 500 ft from any known potential source area. The data from these locations will be used to calculate the mean concentration and the 95 percent upper confidence limit (UCL) on the mean to establish background concentrations for comparison to the maximum concentrations detected in soil samples collected at locations within and around the Site features. COPCs with maximum concentrations in soil exceeding the 95 percent UCL on the mean will be considered to be Site-related.

As described in Section 6.5.3, groundwater, surface water and sediment will not have a sufficient number of background / reference stations to permit a statistical analysis of background concentrations. The concentrations measured at the background / reference stations will be compared directly to the maximum concentrations of COPCs measured at the Site to make an initial assessment of whether the COPCs appear to be Site-related and evaluate if additional background sampling is warranted.

- *Decision Statement:* Determine if additional source areas/Site features are present at the Site where COPCs potentially were released, based upon visual inspection of waste materials, soil piles, staining, stressed vegetation, etc., which will require additional characterization.

  A ground level field reconnaissance will be conducted prior to the commencement of sampling activities, as described in Section 4.3. The findings of this reconnaissance, including identification of any additional potential source areas/Site features requiring characterization, as well as any additional sampling proposed based upon those findings, will be documented in the Phase 1 SAP addendum.

6.5.6 Step 6: Specify Performance or Acceptance Criteria

Performance or Acceptance Criteria is addressed by the QA/QC aspects of the project as well as by an assessment of potential decision error and uncertainty evaluation.

6.5.6.1 Quality Assurance / Quality Control

Quality Assurance and quality control (QA/QC) measures will implemented throughout the course of the Phase 1 Site Characterization as detailed within the QAPP portion of this SAP. These measures will minimize variability, mitigate the potential for false positive and/or false negative error, and increase the accuracy and defensibility of collected data. These measures include, but are not limited to, the following:

- Ensuring that that project personnel have the proper qualifications and training (Section 6.6);
- Establishing a process for management of project documents, data and records (Section 6.7);
- Requirements for testing, inspection, maintenance and calibration of field and laboratory instrumentation (Section 7.6 and 7.7)
- Collection and analysis of field QC samples (Section 7.5.1);
- Analysis of laboratory QC samples (Section 7.5.2);
- Assessment and oversight (Section 8.0)

The analytical results of sampling activities will be evaluated with respect the following data quality indicators: precision, accuracy, representativeness, completeness, sensitivity and comparability. The field and laboratory QC samples that will analyzed, including their frequency of collection/analysis and associated acceptance criteria (where applicable), are summarized in Tables 2 and 3.

The aforementioned data quality indicators are discussed in detail in the remainder of this section. Compliance with these criteria will be evaluated by the laboratory in accordance with laboratory SOPs and quality assurance procedures and any non-conformity identified shall be addressed in the lab reports. These criteria will also be evaluated during data verification and validation processes.

6.5.6.2 Precision

Precision is defined as a measure of the reproducibility of individual measurements under a given set of conditions. Field precision is assessed through the collection and measurement of field duplicates. The variability between field duplicates reflects the combined variation in concentration between nearby samples and the variation due to measurement error.

Precision will be evaluated in terms of relative percent difference (RPD) between two replicate samples. RPD can be calculated using the following equation:

$$RPD = [(C1-C2) / ((C1+C2)/2)] \times 100$$

When: C1 = The larger of the two concentrations.

C2 = The smaller of the two concentrations.

Duplicate soil samples are typically expected to be more variable than results from duplicate water samples due to the physical and chemical heterogeneity of the soil matrix. As a result, a RPD of 50% was selected for soil and sediment field duplicate samples and a RPD of 30% for groundwater and surface water field duplicates to be used as advisory limits for analytes detected in both the original sample and its field duplicate. RPDs greater than these limits will be noted during the data validation process. The objectives for RPDs between the original samples and their field duplicates are shown in Table 2.

6.5.6.3 Accuracy

Accuracy is a measure of the overall agreement of a measurement to a known value, which includes a combination of random error (precision) and systematic error (bias) components of both sampling and analytical operations. Accuracy in the field is assessed through the use of trip blanks and equipment blanks and through the adherence to all sample handling, preservation, and holding time requirements. The objective for trip blanks and equipment blanks is that no target compounds are present above the reporting limits (RLs).

Laboratory accuracy will be evaluated through the analysis of laboratory method blanks, and spiked samples/compounds such as matrix spike and matrix spike duplicates (MS/MSDs), laboratory control samples (LCSs), and surrogate compounds. Method blanks should not contain any target compounds above the RLs which are quantitation limits based on the low point of calibration. For spiked samples/compounds, the accuracy objectives, as measured by percent recoveries (%R) are the control limits provided in Table 3.

6.5.6.4 Sensitivity

Sensitivity is the ability of a laboratory instrument or measurement technique to detect an analyte at certain levels of interest. Sensitivity of the analytical measurement techniques is demonstrated by laboratory method detection limits (MDLs) and Practical Quantification Limits (PQLs). MDLs represent the lowest reportable concentration of an individual compound that meets the analytical method qualitative identification criteria. PQLs refer to a minimum concentration of an analyte that can be measured within specified limits of precision and accuracy; they are generally 5-10 times the detection limit. MDLs and PQL are based on laboratory performance relative to established calibration standards. Compounds detected at concentrations below the PQL are qualified as "J", estimated value.

In order to evaluate the sampling results relative to analytical approach outlined in Section 6.5.5, PQLs will be at or below the most conservative human health or eco-toxicity based benchmark value, to the extent feasible. These values will be specified in Tables 7 through 10, and will be utilized to establish sensitivity requirements for the selected analytical laboratory(s).

Monitoring of instrument sensitivity is performed through the analysis of reagent blanks, near detection limit standards, and response factors. Documentation of laboratory instrument sensitivity can be provided by the laboratory upon request. Sample matrix cleanup (in laboratory) must occur when chemical interferences may be causing elevated reporting limits or inadequate contaminant identification or quantitation.

6.5.6.5 Completeness

Data are considered complete when a prescribed percentage of the total intended measurements and samples are obtained. Analytical completeness is defined as the percentage of valid analytical results requested. Field completeness is a measure of the amount of valid measurement data collected for the project. The percent completeness can be calculated by the following equation:

$$\text{Completeness (percent)} = \frac{\text{(Valid Data Obtained)}}{\text{(Total Data Planned)}} \times 100$$

The target completeness objective for field measurements collected for this sampling program is 95 percent or more. The target completeness objective for laboratory analysis during the RI is a minimum of 90 percent of the planned collection of individual samples.

6.5.6.6 Representativeness

Representativeness is a qualitative parameter, which is dependent upon the proper design of the sampling program and proper laboratory protocol. Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Representativeness of field measurements is dependent upon the proper design of the sampling program. The Phase I RI sampling activities were designed to provide data that are representative of conditions at specific locations and times of sample collection. Representativeness will be verified by ensuring that the FSP and SOPs are followed throughout the RI activities.

In evaluating representativeness, it is important to understand the extent to which bias is incorporated by design into the sampling process. With respect to the Phase 1 source area investigation activities, field reconnaissance will be conducted first, followed by geophysical surveys and soil gas surveys. As described in Section 4.1, the findings from these activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

6.5.6.7 Comparability

Comparability is a qualitative objective, which expresses the confidence with which one data set can be compared with another. The objective for comparability is to ensure that results of analyses can be compared with analyses produced by other laboratories and other projects.

The data from historical investigations was utilized in conducting the initial site evaluation presented in the RI/FS Work Plan. However, the RI/FS is anticipated to generate data of sufficient quantity and quality such that reliance upon data from the prior investigations conducted in the 1980s and 1990s will not be necessary when conducting risk assessment and feasibility study.

Comparison to some more recent data sets may be informative and beneficial when evaluating sampling results and trends. The field sampling procedures and analytical methods proposed for the Phase 1 Site Characterization program are very similar to those used during the USEPA 2014 Site Reassessment as well as for the ongoing quarterly monitoring of residential wells. Therefore, the data collected from similar locations under similar conditions should be comparable. In addition, Phase 1 Site Characterization analytical methods for cyanide and fluoride are consistent with those used to monitor MPDES permit compliance. Therefore, seep, surface water and/or groundwater samples collected from similar locations under similar conditions should be comparable.

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the protocols described in the FSP and QAPP are followed and that proper sampling and analytical techniques are used. The sampling and analysis throughout the Phase 1

Site Characterization will be conducted in accordance with the SOPs and selected analytical methods. Therefore, these procedures and methods will provide comparable data.

6.5.6.8 Decision Error Limits and Uncertainty Evaluation

As described below in Section 6.5.7, the sampling plan for the Phase 1 SAP was developed based upon judgmental sampling design, which is one of the accepted methods described in USEPA guidance on sampling design (USEPA, 2002b). Quantitative analysis of decision error limits and uncertainty is not feasible when implementing a judgmental sampling program. However, as described within the sampling plan, the proposed sample locations are biased to be within and around known or suspected source areas, and at locations downgradient of these areas. The analytical approach calls for using the maximum concentrations detected in these samples for comparison to the most conservative screening criteria or background / reference samples. This approach is overall a conservative approach that should minimize the potential for a Type 1 decision error (i.e., an analyte would be dismissed as a COPC when it could be of potential risk).

6.5.7 Step 7: Develop the Plan for Obtaining Data

As described in Section 4.2, several different types of data gathering and sampling activities are required to achieve the project objectives. The locations and numbers of sampling points associated with each type of activity were typically selected based upon judgmental sample design. As described in USEPA guidance on sampling design (USEPA, 2002b), judgmental sampling design is appropriate when there is reliable historical and physical knowledge about the feature or condition under investigation; or, when the objective of the investigation is to screen an area(s) for the presence or absence of contamination at levels of concern, such as risk-based screening levels. Both of these conditions are generally applicable for the current phase of work. Specifically, there is knowledge about most Site features (i.e., locations and dimensions, historical use) and the goals of the Phase 1 Site Characterization program include use of risk-based screening levels to identify areas for further investigation and/or inclusion in subsequent risk assessment.

Although the sampling plan for known or suspected source areas is judgmental in design, it will be conducted using a systematic phased approach. Field reconnaissance will be conducted first,

followed by geophysical surveys and soil gas surveys. The findings from these activities will be evaluated and used to refine source area sample locations such that they are biased towards areas where COPCs are considered more likely to be present.

Judgmental sampling design has also been used to develop the scope of work for investigation of hydrogeologic and groundwater quality conditions at the Site. Per USEPA guidance, judgmental design is appropriate considering the scale of the Site and lack of adequate probabilistic investigation methods.

A stratified random sampling approach will be utilized as per USEPA guidance on sampling design (USEPA, 2002b) and the Interstate Technology & Regulatory Council (ITRC) Incremental Sampling Methodology (ITRC, 2012) to characterize soil quality conditions in the surface soil and shallow subsurface soil (0 to 0.5 ft-bls and 0.5 to 2.0 ft-bls, respectively) within large areas of the Site where there are no specific source areas identified, but aerial photographs or Site knowledge suggests evidence of historical operations activity. As described in Section 4.6.2, an incremental sampling methodology will be utilized in these areas to produce a better estimate of average soil conditions within individual grid cells uniformly distributed across the large area.

6.6 Element A8 – Special Training Requirements/Certifications

The RI Field Manager will ensure that all field team members have received project-specific training with respect to the various field sampling tasks and equipment operation and are knowledgeable in the applicable SOPs.

Prior to beginning field sampling activities, field planning meeting(s) will be conducted to discuss and clarify the following:

- Objectives and scope of the fieldwork
- Equipment and training needs
- Field operating procedures, schedules of events, and individual assignments
- Required quality control (QC) measures
- Health and safety requirements

It is the responsibility of each field team member to review and understand all applicable governing documents associated with this sampling program, including the FSP, QAPP and HASP.

All individuals involved in the collection, packaging, and shipment of samples must have OSHA 40-hour health and safety training, and respiratory protection training as required by 29 Code of Federal Regulations (CFR) 1910.134. Individuals involved in investigations at the asbestos landfills or other locations where asbestos is suspect must also have asbestos awareness training, as required by 29 CFR 1910.1001. All training documentation will be stored in the project files. It is the responsibility of the Health and Safety officer to ensure that all training documentation is up-to-date and on-file for each field team member.

Subcontractors will be utilized throughout the RI activities to complete various tasks. These tasks include sonic-drilling, geophysical surveying, land surveying, and asbestos characterization. The subcontractors will be selected prior to the completion of Site Reconnaissance and will be discussed in the SAP addendum. The subcontractors will be required to hold licenses/certifications as applicable for their respective tasks.

All analytical laboratories participating in the analysis of samples for the Phase I Site Characterization are subject to national, local, and project-specific certifications and requirements. Each laboratory will meet Environmental Laboratory Accreditation standards as defined by the USEPA. Copies of all proficiency examinations and certifications are maintained by the laboratory coordinator within each laboratory. Each laboratory also maintains appropriate certifications from the state and possibly other certifying bodies for methods and parameters that may also be of interest to the project. These certifications require that each laboratory has all applicable state licenses and employs only qualified personnel.

6.7 Element A9 – Documentation and Records

The following sections provide an overview of the procedures and requirements for recordkeeping and reporting. Field logbooks and field datasheets will provide the means of recording the data collection activities during field activities. All field logbooks and data sheets will be scanned on a weekly basis to create a PDF files for electronic archiving with the central

project file. An SOP for field recordkeeping is provided in the SAP. Some of the specific requirements with respect logbooks and field data are highlighted below. Additionally, reporting of data collected and responsibilities related to reporting are discussed below.

6.7.1 Field Logbooks

Field logbooks will be used to document field activities and observations. The field notes will be clear, with sufficient detail so that events can be reconstructed later if necessary. Field logbooks will document any field deviations from the RI/FS Work Plan and/or SAP, as well as the reasons for the changes. Requirements for logbook entries include the following:

- Separate field activity logbooks will be kept for each task.
- Logbooks will be bound, with consecutively numbered pages.
- Removal of any pages, even if illegible, is prohibited.
- Entries will be made legibly with black (or dark) waterproof ink.
- Unbiased, accurate language will be used.
- Entries will be made while activities are in progress or as soon afterward as possible (the date and time that the notation is made will be noted as well as the time of the observation itself).
- Each consecutive day's first entry will be begun on a new, blank page.
- The date and time, based on a 24-hour clock (e.g., 0900 a.m. for 9 a.m. and 2100 for 9 p.m.), will be recorded on each page.
- When field activity is complete, the logbook will be entered into the permanent project file.

In addition to the preceding requirements, the person recording the information will initial and date each page of the field logbook. If more than one individual makes entries on the same page, each recorder will initial and date each entry. Logbook corrections will be made by drawing a single line through the original entry, allowing the original entry to be read. The corrected entry will be written next to the original entry. Corrections will be initialed and dated. Separate logbooks for each activity may be needed because several field activities may occur at once.

6.7.2 Field Datasheets

Field datasheets will be utilized when appropriate to achieve efficient and standardized recording of field measurements and observations. The type of field data sheet and the information recorded on it may vary by activity. At a minimum, field datasheets will be completed for each sample to document the unique sample identifier assigned, provide information on whether the sample is representative of a field sample or a field-based quality control sample (e.g., field blank, field duplicate), provide information regarding the sample media, sample date, sample location, sample GPS coordinates, and sampling team members for every sample. All datasheets must be entered into electronic format. Datasheets may also be used to document information such as habitat descriptions, sediment sample characteristics (e.g., color, texture, etc.), water level gauging data, surface water and groundwater sample field observations and measurements (e.g., pH, temperature, color, clarity, etc.). A reference date and activity will be entered into the logbook to refer to the field data sheets being generated. The field data sheets will be put into electronic format and become a permanent record within the project file. When field data sheet entries are entered in an electronic format, each sheet will be annotated to indicate who completed the data entry and when.

6.7.3 Data Storage

In addition to data collected during field activities as listed in sections 6.7.2 and 6.7.3, other data that will need to be maintained throughout the RI/FS will include laboratory analytical data, photographs, project correspondence (i.e., letters and emails), and deliverable reports. In general, all project documents will be maintained in electronic format and stored in a project specific folder designated on the Roux Associates network. All electronic files will be backed up in accordance with Roux Associates IT Policy.

All data generated by the laboratories will be requested in electronic data deliverable (EDD) format. The laboratory data will be imported into the project database and managed in accordance with the data management procedures outlined in Section 7.10 of this QAPP.

One copy of all final documents submitted by Roux to a client or regulatory agency is maintained in a central digital repository. Archiving of the digital repository occurs at a minimum daily. All other project files for completed projects will be retained for seven years

from the date of completion of the project, unless a longer period is required by the client or EPA. Project completion refers to completion of all work at the Site, not the completion of individual phases or tasks.

6.7.4 Reporting

A list of project deliverables is provided in Section 9.0 of the RI/FS Work Plan. Reporting will be completed in hardcopy and electronic formats and submitted to the EPA and DEQ in accordance with the deliverable list outlined in Section 6.1. The RI/FS Project Manager will be responsible to ensure all project deliverables are completed on-time and submitted in accordance with the procedures outlined in Section 6.1.

7.0 GROUP B – DATA GENERATION AND ACQUISITION

This element group, comprising ten elements, addresses data generation and data acquisition and management activities.

7.1 Element B1 – Sampling Process Design

The Phase I RI sampling design is summarized in Section 5.0 of the RI/FS Work Plan and Section 4.0 of this SAP. All of the data planned to be collected in the Phase I Site Characterization will be considered critical to the process, and no secondary data is currently planned.

The Phase I Site Characterization is scheduled to begin in the 2nd Quarter of 2016. A general schedule for completion of each field task associated with Phase I will be provided to the USEPA Project Manager at least 30 days before the start of the field work activities. Because the Site is owned by CFAC, it is not anticipated that any of the sampling sites will become inaccessible during the field activities. However, if at any time the sampling locations described in the Phase I Scope of Work become inaccessible, CFAC will communicate with the USEPA Project Manager either orally or written within 24 hours.

7.2 Element B2 – Sampling Methods

Details regarding sampling procedures are presented in Section 5.1 of this SAP, including a summary of the relevant SOPs that will be used to guide the Phase I sampling activities.

If problems arise or field conditions suggest a deviation from the SOPs is required, the RI Manager should be contacted. A plan to adequately address the situation should be developed and documented in the field notebook.

If problems occur related to sampling equipment malfunctions, the RI Manager should be contacted. The RI Manager will be responsible for verifying that corrective actions are completed, such as obtaining backup supplies and equipment to ensure that the field activities will continue until completion. Any equipment malfunctions should be noted in the field notebook with a description of the date, time and problem. When replacement equipment arrive

onsite, it should also be documented in the field notebook, including the source of the equipment and serial number.

7.3 Element B3 – Sample Handling And Custody

This element describes the management approaches that will be implemented to ensure that field samples retain their original physical form and chemical composition through collection to final disposal. Management approaches discussed below include sample designation, handling, and custody.

7.3.1 Sample Designation

All screening locations and analytical samples, including samples collected for QA/QC purposes, will be given a unique Site-specific sample identification number. The Site-specific sample designation is described in Section 5.2 of this SAP.

7.3.2 Sample Handling

The following sections summarize how sample custody will be managed during the course of the RI/FS.

7.3.2.1 Sample Labels

Each sample container will be affixed with a waterproof, adhesive label. The sample labels will contain the following information:

- Project name;
- Sample Date;
- Sample time;
- Sample identification;
- Sampler's initials;
- Requested analysis; and
- Sample preservative.

Preprinted sample labels will typically be prepared prior to sampling tasks. Labels that are not preprinted, and those portions of the label that must be completed in the field (i.e., date, time,

sampler's initials), will be completed using waterproof ink. The label will be covered with clear mailing tape in an effort to prevent it from falling off and to prevent potential water damage during transit.

7.3.2.2 Sample Shipping and Hold Times

Most analytical methods require that samples be kept at an approximate temperature of four degrees Celsius (4°C). Samples requiring this type of preservation will be placed in coolers directly after collection and packed with ice. A temperature blank should be included in each sample cooler. Field personnel are responsible for the security and for maintaining the temperature of the samples before they are transferred to the analytical laboratory.

Sample bottles will be packed snugly with packing material in an effort to protect the containers from potential breakage during shipment. The samples, along with a completed chain of custody (CoC), will be stored inside the coolers at the Site until they are sent to the laboratory for analysis. All samples will either be shipped by overnight courier (e.g., Federal Express) or transported by vehicle to the laboratory for analysis. All containers shipped by courier to the laboratory will be sealed with a custody seal that has been signed and dated. Samples will be shipped or transported with sufficient time to meet all analytical holding standards. Tables 4 and 5 list container types and sizes, preservation, and holding times for the various analyses to be performed.

7.3.3 Sample Custody

The possession and proper transfer of samples and sample-related information must be documented from the time the samples are collected until the analyses have been completed and the data have been accepted. The objective of the sample custody system is to ensure that:

- Samples are uniquely identified and labeled;
- The correct samples are analyzed and are traceable to their records;
- Samples are protected from loss or damage;
- Alteration of samples (e.g., filtration, preservation) is documented;
- A forensic record of sample integrity is established; and
- Client confidentiality is maintained.

The CoC form establishes the documentation and control necessary to identify and trace a sample from collection to final analysis. All field staff responsible for collecting and sending samples to the laboratory will receive a copy of a blank CoC form following selection of the laboratory. The following sections summarize how sample custody will be managed during the course of RI.

7.3.3.1 Field Chain of Custody Procedures

The field sampler(s) is responsible for the care and custody of the samples until they are transferred or properly dispatched. The field sampler(s) will complete the CoC form immediately after collection in an effort to establish sample custody in the field before sample shipment. The following information will be included on the CoC:

- Sample identification and sample container identification number, if applicable;
- Date and time the samples were collected;
- Matrix of the sample;
- The number of containers for each sample;
- Analysis requested and preservation codes;
- Name of sampler(s) and the person shipping the samples and documentation;
- Name, telephone number and email address of the RI Project Manager; and
- Signature of the sampler.

Any corrections to the CoC will be made by putting a single strike through the incorrect entry and initialing and dating it. When the shipping container (i.e., cooler) is packed for shipping, personnel relinquishing the container will sign the CoC. The CoC will accompany the samples to the laboratory and a copy of the CoC will be retained by the RI Field Manager and placed in the project file. The completed CoC will be supplied by the laboratory with the standard data package.

The QA/QC Officer will be responsible for reviewing all sampling activities to verify whether proper custody procedures were followed during the field work. Any deviations in the custody procedures will be noted in the RI Summary Report.

7.3.3.2 Transfer of Custody and Shipment Procedures

Samples will be sent to the laboratory for analysis with a signed CoC. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the CoC. This record documents transfer of custody of samples from the sampler to the laboratory. The original CoC form will accompany the shipment, and a copy will be retained by the field manager to be placed in the project files. Photocopies of the original CoC should be made before shipment, if possible, in an effort to ensure that clean copies can be made later.

Shipping coolers will be locked and secured with tape and custody seals for shipment to the laboratory. If the samples are sent by common carrier, a bill of lading (air bill) must be used. Receipts of bills of lading will be retained in the project files. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside or on the outside of the sample container and the custody seals remain intact.

7.3.3.3 Laboratory Chain of Custody Procedures

The Laboratory project manager will verify that CoC records are filled out upon receipt of the samples and will note questions or observations concerning sample integrity, if any. The name of the person receiving the samples and the date and time the samples were received by the laboratory should be noted on the CoC.

The laboratory project manager will verify that sample-tracking records are maintained. These records will follow each sample through all stages of laboratory processing. The sample tracking records must show the date of sample extraction or preparation and the date of instrument analysis. These records will be used, in part, in an effort to determine compliance with holding time requirements. Laboratory custody procedures for sample receiving and log-in, sample storage, tracking during sample preparation and analysis, and storage of data are described in the Laboratory QAPP.

7.4 Element B4 – Analytical Methods

All field and laboratory analytical methods to be employed during implementation of the RI/FS were chosen based on one or more of the following criteria:

- the ability to meet the DQOs for the project;

- the validity and reproducibility of the methods; and
- conformance of the methods to industry-standard or USEPA-published methods and practices.

The remainder of this Section describes the field and laboratory methods selected for the Phase I RI Site Characterization activities.

7.4.1 Field Analyses

Field instruments and equipment are those pieces of equipment used to gather or generate environmental data. The primary field instrumentation that is expected to be used during the RI includes:

- Multi-parameter meters to measure water quality parameters, including water temperature, specific conductance, dissolved oxygen concentration, pH, ORP, and turbidity;
- Oil/water interface and water-level probes to measure fluid levels;
- Submersible groundwater pumps and/or bladder pumps for use during groundwater sampling activities;
- PIDs for air monitoring, soil gas screening and soil screening;
- Methane meter for landfill soil gas screening;
- Multi-gas meter for air monitoring; and
- Handheld GPS for geo-referencing sampling locations.

A summary of the field instrumentation that is expected to be used during the RI/FS is provided in Table 6.

7.4.2 Laboratory Analyses

The selected analyses for the Phase I sampling activities are described for each media in Section 4.0.

The laboratory's SOPs specify equipment, method-specific performance criteria, and corrective actions for each method. A summary of methods for each media is also provided in Tables 7 through 10. These tables include the desired maximum PQL expected for each analyte that has

an established human health or eco-toxicity benchmark / criteria value. The expected MDLs and PQLs that can be achieved by the laboratory will be provided following selection of the laboratory. Any methods that cannot meet the desired quantitation limits, if any, will be discussed in the SAP addendum.

7.5 Element B5 – Quality Control

Overall data usability is influenced by variability (error) introduced into and/or inherent with both field (sampling) and laboratory (analytical) processes. QC checks are tools with which to measure or estimate the overall effect of this variability on a sample collection effort. During implementation of the RI/FS, a variety of QC checks will be performed by both field and laboratory staff to assess compliance with project DQOs and the SOPs for the various analytical methods. These QC checks are discussed below.

7.5.1 Field QC Checks

This section provides a description of field QC procedures. QC samples will be collected in the field to estimate precision and accuracy of the analytical results and to examine the sources of error introduced by the field practices. The results of the QC checks are used during data validation in an effort to evaluate the precision, accuracy, sensitivity, and representativeness of the overall sampling and analytical program. The following sections describe the QC checks that will be applied to the RI and their definition and purpose. The frequencies of field QC samples for the RI field activities are specified in Table 2.

7.5.1.1 Field Duplicates

A field duplicate is a field sample that is collected at the same place and time as an original field sample. However, because of potential variation in field duplicate samples (even those from similar locations, especially for media such as soil, surface water, sediment, etc.), it is not appropriate to assume that field duplicate pairs must necessarily have the same concentration values. Rather, field duplicates help to evaluate variability due to small-scale media heterogeneity, along with analytical precision. During the RI, duplicate samples will be collected at a minimum frequency of one per twenty samples and one per sample delivery group.

7.5.1.2 Trip Blanks

Trip blanks are used to assess the potential for bias (inaccuracy) through the introduction of volatile contaminants into the sample or sample containers during transport, handling, and/or storage. Trip blanks determine if any cross-contamination between sample containers occurs from the proximity of sample containers to one another during transport or storage. Trip blanks consist of sample containers filled with analyte-free water that are preserved with hydrochloric acid (HCL) and prepared by the laboratory prior to the sampling event. The trip blanks are then transported to the field along with the containers used for sample collection and are kept with the samples throughout the sampling event, but are not exposed to the sampling process. Once sampling is complete, the trip blanks are then packaged for shipment with the other samples and sent for analysis. The trip blank sample containers are not opened before they reach the laboratory to be analyzed. There should be at least one trip blank included in each shipping container that contains samples for VOC analysis.

7.5.1.3 Equipment Blanks

Equipment blanks (also referred to as decontamination rinsate blanks) are samples that are obtained by running de-ionized water through decontaminated sampling equipment as a check that the decontamination procedure has been adequately carried out and that there is no cross contamination of samples occurring due to the equipment itself. Equipment blanks must be analyzed for the same parameters as the associated samples. One equipment blank will be taken per day as needed when reusable sampling equipment is utilized.

7.5.1.4 Temperature Blanks

Temperature blanks ensure that samples arrive to the laboratory at the correct preservation temperature. Temperature blanks typically consist of de-ionized water and will be included in each cooler when it is shipped to the laboratory. The laboratory sample custodian will record the temperature of the blank upon receipt of the samples.

7.5.1.5 Matrix Spikes and Matrix Spike Duplicates

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples are designed to evaluate the effect of the sample matrix on analytical data, by measuring precision and accuracy from a known concentration of a target analyte that has been added to a particular sample matrix.

MS/MSD samples are prepared by spiking environmental field samples with a standard solution containing known concentrations of representative target analytes. Percent recovery of each of the spiked compounds or analytes reflects the ability of the laboratory and method to accurately determine the quantity of the analyte in that particular sample (i.e., is a measure of accuracy in the specific sample matrix).

For the MSD samples, a second aliquot of the same field sample used for the MS is combined with the same quantity of the spiking compounds and is processed in an identical manner. The results for the MS/MSD pair provide a measure of the precision during laboratory analysis.

Additional sample volumes for MS/MSD QA/QC samples will be collected in the field at a minimum frequency of one per twenty samples. MS and MSD samples will be identified on the CoC for the analytical laboratory.

7.5.1.6 Field Blanks

A field blank is a sample of the same medium as field samples, but which does not contain any contaminant. Field blanks are normally collected for air and water samples, but not for soil or sediment. A field blank for surface water will be prepared by placing an appropriate volume of analyte-free reagent water (e.g., ASTM Type II) into a sample collection container. Field blanks must be analyzed for the same set of parameters as the surface water samples. Field blanks will be collected at a rate of 1 field blank per 20 field samples or 1 per sample batch, whichever is greater.

7.5.2 Laboratory QC Checks

The analytical laboratories have a QA/QC program in place to ensure the reliability and validity of the analysis performed at the laboratory. All analytical procedures are documented in writing in laboratory SOPs and each SOP includes the minimum requirements for the procedure. The internal QA/QC checks differ slightly for each individual procedure.

Laboratory QC check samples serve as checks on the laboratory sampling and measurement systems and assist in determining the data quality with regard to laboratory accuracy and precision. The number and type of laboratory QC check samples varies with the intended

data use. Laboratory control samples fall into two basic categories: samples run through the entire sample allocation, preparation, and analysis method (method or matrix controls) and samples run through only the analysis method (analysis or instrument controls). In either case, control samples are samples of known or certified concentration that are introduced at either the pre-preparation or post-preparation step of the method and carried from that point on through the rest of the method as a routine sample.

Control samples are used in an effort to define either method (preparation plus instrument) or instrument accuracy. Method (preparation) performance check samples collectively measure the entire laboratory analytical data generation process, from sample allocation in the laboratory through the analysis and data reduction. Instrument (analysis) check samples measure the laboratory performance from the point where analysis begins, generally excluding any preparation/extraction effects, through the analysis and data reduction.

Laboratory analytical QC will be monitored through internal laboratory QC checks such as the analysis of blanks, matrix spikes, matrix spike duplicates, surrogate spike, laboratory control samples, and initial and continuing calibration checks. The frequency, acceptance criteria, and corrective action for these laboratory QC checks per analysis will be in accordance with method requirements and the individual laboratory QAPPs.

7.5.2.1 Method and Analytical Blanks

Method blanks are generated within the laboratory during the processing of the field samples. These blanks are processed using the sample reagents and procedures at the same time as the samples being analyzed. Contamination found in the method blank would indicate that similar contamination found in associated samples may have been introduced in the laboratory, and not actually be present in the samples.

Analytical blanks, such as initial calibration blanks and continuing calibration blanks are required by inorganic test methods. These blanks are laboratory reagent-grade water and acid solutions to match samples analyzed at the beginning, intervals during, and the end of an analytical sequence in an effort to assess contamination and instrument drift. The initial calibration blank is analyzed at the beginning of the analytical run following the calibration and

initial calibration verification. The continuing calibration blank is analyzed prior to sample analyses, throughout the analytical run and at the end of the analytical sequence, or as stipulated in each analytical method.

7.5.2.2 Surrogate Spikes

Surrogate spike analyses are used to determine target analyte recovery during sample preparation and analysis. A surrogate spike is prepared by adding a known amount of surrogate compound to an environmental sample before extraction. Surrogates are similar to matrix spikes and apply only to organic parameters. The surrogate compound is chosen to exhibit an analytical response similar to the response displayed by a target compound during sample analysis. The recovery of these surrogates aids the analysts in determining matrix effects on recovery of compounds in each sample and is a measure of accuracy. Surrogate spikes generally do not affect the routine sample results because the surrogate compounds are isotopically labeled. Surrogate spike analyses will be conducted in accordance with the referenced method protocols. Acceptance criteria and corrective action procedures for out-of-control surrogate spike results are listed in the laboratory QAPPs.

7.5.2.3 Internal Standards

Internal Standards are compounds of known concentrations that are added in a constant amount to samples, blanks, and calibration standards and are used to correct for the loss of analyte during sample preparation. The internal standard is a compound that is very similar, but not identical to the chemical species of interest in the samples, as the effects of sample preparation should, relative to the amount of each species, be the same for the signal from the internal standard as for the signal(s) from the species of interest in the ideal case. Acceptance criteria and corrective action procedures for out-of-control internal standard spike results are listed in the laboratory QAPPs.

7.6 Element B6 – Instrument/Equipment Testing, Inspection and Maintenance

This section describes the instrument testing, inspection and maintenance procedures.

7.6.1 Field Instruments

All measuring equipment must be calibrated and maintained on a periodic basis dependent on the manufacturer's maintenance schedule. The purpose of preventative maintenance is to address potential problems before they occur and to verify that equipment/measurement systems operate adequately when used to collect environmental data. Specific preventative maintenance procedures to be followed for the field equipment are those recommended by the manufacturer and those described in the applicable SOPs. Documentation of equipment maintenance shall be maintained by the field notebook.

Proper equipment cleaning and field decontamination procedures are necessary to prevent cross contamination of samples. Sampling equipment will be decontaminated prior to the start of activities and between sampling locations. Decontamination of equipment may involve the use of a laboratory grade, phosphate-free detergent such as Alconox or Liquinox. Equipment will be rinsed with tap water obtained from a local municipal supply or commercial source. Distilled, de-ionized water will be used as the final water rinse.

Field personnel performing the sample collection activities and handling of equipment will don a new pair of nitrile gloves prior to use of the equipment, between sampling and between decontamination procedures.

A summary of the maintenance requirements for field equipment used at the Site is provided in Table 6.

7.6.2 Laboratory Instruments

As part of their QA/QC program, the laboratory will conduct a routine preventative maintenance program in an effort to minimize the potential occurrence of instrument failure and other system malfunctions. These procedures will be documented by the laboratory and will be verified through laboratory audits conducted by the laboratory QA/QC Officer.

Appropriate documentation of all equipment/instrument maintenance shall be maintained by the laboratory personnel and shall include what was done, date, time (if appropriate), next scheduled maintenance, equipment status, anomalies, and personnel performing maintenance. This

documentation shall be entered into specific maintenance log forms for laboratory maintenance activities as described in the laboratory QAPPs and SOPs.

7.7 Element B7 – Instrument/Equipment Calibration and Frequency

This section describes the instrument calibration procedures.

7.7.1 Field Instruments

Field instruments and equipment will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications. Calibration of field instruments will be performed at the intervals specified by the manufacturer, or more frequently as conditions dictate. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be removed from service until the problem is resolved. Any field equipment that fails to calibrate should be documented in the field notebook, including the date and reason for calibration failure. Additionally, when the field equipment problem is resolved it should also be documented in the field notebook.

Field instruments that are rented from third-party rental services should be calibrated prior to being delivered to the Site. Documentation of calibration should be provided by the rental service or onsite calibration will need to be performed. A summary of the calibration requirements for equipment used at the Site is provided in Table 6.

7.7.2 Laboratory Instruments

Calibration of laboratory equipment for analyses will be based upon approved written procedures in accordance with the requirements of the various analytical methods. Specific instrument calibration information should be provided in each laboratory QAPP.

Analytical instruments will be calibrated in accordance with the referenced analytical methods. Calibration standards are prepared in the laboratory by dissolving or mixing a known amount of nominally pure analyte in the appropriate matrix using volumetric containers. Calibration standards must be prepared from a standard source that is traceable to a certified primary reference material. All calibration standards must be prepared so that the types and concentration of the reagents used in the standard preparation are equivalent to the types and

concentration of the reagents used in preparing the samples to be analyzed. Records of standard preparation and instrument calibration will be maintained by the laboratory.

Initial calibration and continuing calibration verification checks will be performed in an effort to determine that the instrument is capable of producing acceptable qualitative and quantitative data for the particular method being analyzed. Initial calibration is performed to demonstrate acceptable performance at the beginning of the analytical run and to verify the linearity of the instrument response within a specific concentration range. The continuing calibration is performed to ensure that the initial calibration is still valid for the instrument. Calibration protocols, including calibration frequencies, conditions, and acceptance criteria, are described in the laboratory QAPP.

7.8 Element B8 – Inspection/Acceptance of Supplies and Consumables

Certain supplies and consumables associated with the field sampling program are considered "critical", (i.e., which may directly or indirectly affect the quality of the results). These include sample containers, tubing, and filters. The RI Field Manager will be responsible for ensuring that an adequate supply of the critical supplies and consumables is available and that consumables are certified clean. The employees conducting the field activities will be responsible for receiving all supplies / consumables and verifying that all materials are stored in a safe location until being used. The employees conducting the field work should communicate with the RI Manager if supplies need to be replaced or additional supplies need to be procured.

Sample containers will be provided by the laboratory, pre-cleaned and with appropriate preservative added. The laboratory has a control procedure in place to ensure cleanliness of sample containers, as described in its QAPP. In addition, there are other laboratory-related critical consumables such as reagent water and reference standards. The adequacy of these materials will be ensured and documented in accordance with the laboratory's QAPP.

7.9 Element B9 – Non-Direct Measurements

This element is intended to address data obtained from existing sources rather than directly measured or generated during the RI/FS.

During the RI/FS, discharge of the Flathead River will be automatically measured at the closest USGS gauging station, which is located approximately three miles southwest of the Site near Columbia Falls (USGS Station #12363000). The USGS data will be used in conjunction with data collected from a temporary staff gauge that will be installed within the Flathead River to develop a relationship of the Flathead River discharge immediately adjacent to the Site. River levels measured at the staff gauge will be used in conjunction with measured groundwater elevations to evaluate groundwater / surface water interactions.

Also during the RI/FS, meteorological data may be used to evaluate the potential impacts of precipitation events. Meteorological data will be downloaded from the National Oceanic & Atmospheric Administration (NOAA) website for the weather station located at Kalispell Glacier Park International Airport, located in Kalispell, Montana (Station ID# 244560).

No additional outside data sources are expected to be used during the RI/FS.

7.10 Element B10 – Data Management

The RI/FS will generate an extensive amount of information that needs to be properly documented and managed in order to support risk assessment, remedy selection decisions and any legal or cost recovery actions. Therefore, data management procedures will be followed to ensure the quality, validity and security of the RI/FS data.

Roux Associates is the custodian of the project files and will maintain all relevant records, reports, logs, field notebooks, pictures, and subcontractor reports in a secured area and under custody of the RI Project Manager. Access will be restricted to project personnel, and the ability to view and/or add or change data will be granted to only those individuals identified and trained to perform those tasks. To the extent practical, data will be obtained and archived electronically. When electronic data collection is not practical, data will be archived in the project files. The non-electronic data (and reports that are evaluated including reports received for the Historical Data Review) will also be scanned for electronic archiving.

A variety of data will be generated during the RI/FS field program, including photos, manual field measurements, data collected and logged automatically by field instruments, and results of chemical analyses. Management of these data will vary from type to type, as discussed below.

Photo Documentation

Field personnel are encouraged to use digital photography to document Site features or field activities. Photos will be collected and stored within the project file in accordance with Roux SOP 6.5.

Manual Field Measurements

Manual field measurements will be recorded in field logbooks or activity-specific field datasheets. Entries in the field logbooks will be photocopied as soon as practicable following each Site visits to ensure that a backup copy of the field measurements exists in the event the field logbook is lost, stolen, or destroyed. Photocopies of field logbooks will be kept in the project file. Field datasheets will also be returned to the office as soon as practicable following each site visit. Field datasheets will be digitized and kept in the project file. Field datasheets are described in Section 6.7.2 and example datasheets are attached to this QAPP in Appendix B.

Laboratory Results

The analytical laboratory will provide a summary report, electronic data deliverables (EDDs), and a CLP-Level IV equivalent data package. The Level IV data package will contain data to perform a data validation to evaluate whether the data meets the performance and acceptance criteria as described in Section 6.5.

Level IV data packages will include the following:

- sample results
- forms and checklists summarizing all QC measurement parameters specified in the method
- all associated raw data generated in support of the reported results

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

- instrument tuning summary and associated sample summary

- initial and continuing calibration data summaries
- internal standard response and retention time summaries
- laboratory control sample (LCS) data summaries
- MS results
- surrogate standard results
- laboratory duplicate summaries

Raw data will include copies of all associated instrument printouts and laboratory notebook records that were generated during sample preparation and analysis.

Laboratory EDDs delivered to Roux Associates will be uploaded into Roux Associates' EQuIS™ project database described below.

Project Database

A database will be created to organize, analyze, and store project information and data. EQuIS™, a relational database system based on Microsoft Access, is the system currently planned for use at the Site. EQuIS™, or an alternative system will similar capabilities, will be used to:

- Provide a single centralized repository for field measurement data and laboratory analytical results (soil, soil gas, groundwater, surface water, sediment and).
- Provide a user-friendly interface for database queries and generation of data summary tables.
- Allow the data to be viewed and displayed in a GIS compatible format, along with other GIS data layers.
- Provide detailed information about sampling locations, sample types, sampling and analytical methods, results, and QA information.
- Provide simple comparisons to regulatory standards or risk-based screening levels, along with calculations of descriptive statistics.
- Generate export files to spreadsheets, data analysis software, or other databases according to their requirements.

Laboratory analytical data will be added to the database using standardized formats and a QA program. The QA program checks the format and completeness of chemical data. Most data

will be transferred directly from the laboratories via electronic files to eliminate the potential for error during keyboard data entry.

All data that is manual input into the database will be printed, 100% verified against the original source documents, and corrected if necessary within the EQuIS system. The hard copies will be initialed as they are checked during verification of electronic versions of the original source documents.

All validated results of sampling and tests and all other validated data received by CFAC will be made available to the EPA via web access. Access credentials to the web access will be provided following setup of the project database. The validated data will also be provided in progress reports noted in Table 10 of the RI/FS Work Plan. The RI/FS Manager has overall responsibility for the project database. The RI Manager will be responsible for ensuring that the project database is updated during the Phase I Site Characterization.

Roux Associates IT department will provide backup of the electronic database daily. Additionally, the need for any upgrades to the hardware or software required to manage the RI/FS data will be determined jointly by Roux Associates IT department and the RI/FS Manager. Any upgrades needed will be completed as necessary to facilitate the project.

8.0 GROUP C – ASSESSMENT AND OVERSIGHT

The two elements in this group detail the assessments and evaluations that will occur during implementation of the RI/FS to determine whether this QAPP is being implemented as approved, to increase confidence in the information obtained, and ultimately to determine whether the information may be used for its intended purpose.

8.1 Element C1 – Assessments and Response Actions

Five internal field audits will be conducted by the QA Officer or his/her designee during the Phase I Site Characterization Program. The major sampling activities to be audited include soil gas screening/passive soil gas sampling, soil sampling, sediment sampling, groundwater gauging and sampling, and surface water sampling. The audits will focus mainly on measurement and sampling procedures, to ensure that representative data are being generated in the field. The audits will be timed to occur early implementation phase of each activity to allow for timely corrective action, if needed, prior to the generation of a significant amount of data. The field audits will ensure that data being collected during the RI meets the DQOs for the RI. All field audits should be provided to the RI/FS Manager and RI Manager via email for filing in the project records.

If any deviations are noted during the field audit, the QA Officer has full authority to stop work and discuss the deviation with the field personnel. The QA Officer will develop a corrective action plan that will be communicated with the field personnel and the RI/FS Manager, with clear consensus regarding the individual responsible to complete the action. The QA Officer should define a timely schedule and should verify all corrective actions are completed and documented in the project file. Laboratory calibration and checks are discussed in Section 7.5.2. Laboratory corrective actions generally address the need to bring data generating systems back into conformance after some trigger or other criteria have shown the system to be out of conformance. Generally, laboratory functional problems may occur during sample handling, sample preparation, laboratory analysis, and data review. The need for laboratory analysis corrective actions is based upon predetermined limits for accuracy, precision, and completeness. By conducting system and performance audits, the Laboratory QA Officer will determine if the data are acceptable and if corrective actions are necessary. The analytical laboratory will perform internal audits and corrective actions in accordance with its QAPP.

8.2 Element C2 – Reports To Management

As described above, at least five field QA audits are scheduled in addition to any laboratory audits that may be conducted. The field QA reports will be prepared by the QA Manager and submitted to the RI/FS Manager and RI Manager for storage in the project files. In addition, the QA Manager may prepare correspondence and submit to the RI/FS Manager, if needed, to document any corrective actions that may be required.

9.0 GROUP D – DATA VALIDATION AND USABILITY

The three elements in this group address the final project checks to determine whether the data developed conform to the stated objectives of the project and to estimate the effect of any deviations.

9.1 Element D1 – Data Review, Verification, and Validation

This element identifies the criteria for deciding to accept, reject, or qualify project information. Such decisions will be based on the data review, verification, and validation procedures described below in Section 9.2, which will determine whether the data meet the project DQOs.

Analytical data will need to achieve specific criteria in order to minimize the possibility of either making erroneous conclusions or failing to keep uncertainty in estimates to within acceptable levels.

Performance and acceptance criteria, together with the appropriate level of QA practices, will guide the evaluation of existing data relative to the intended use. Section 6.5 of this QAPP provides specific details regarding the precision and accuracy control limits, and MDLs/ PQLs, for each of the target analytes and matrices, and the overall project goals for completeness and representativeness. Data which do not meet one or more performance criteria may still be acceptable for project use, although some degree of qualification may be required. Data grossly failing to meet one or more performance criteria will be rejected, unless substantial other evidence supports use with qualification.

Use of statistical intervals to evaluate decision errors will not be performed as part of the investigation because sampling will be primarily focused on determining conditions around Site features and potential source areas. Measurement error will be the primary factor affecting any decision. Error encountered as a result of sampling procedures will be limited to the extent practicable by following approved EPA methods and applicable standard operating practices.

9.2 Element D2 – Verification and Validation Methods

Field data validation will initially be performed by the field personnel while collecting data/samples. QA/QC of the field data is the responsibility of the RI Manager. Field data

validation includes ensuring that data was properly collected and handled according to the sampling procedures described in this SAP and the SOPs. Decisions to repeat data collection and/or void data may be made by the RI Manager, if necessary, based upon the extent of the deficiencies and their importance in the overall context of the RI. The RI Manager may discuss the results of the field data verification and validation with the RI/FS Manager. The RI/FS Manager will ultimately decide if the data is unusable or if additional validation steps may be required. If data is deemed unusable, either the RI Manager or the RI/FS Manager will discuss with the project staff.

Validation of laboratory data will be performed in accordance with the following USEPA guidance:

- *National Functional Guidelines for Organic Data Review* (USEPA, 2014a);
- *National Functional Guidelines for Inorganic Data Review* (USEPA, 2014b); and
- *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (USEPA, 2009).

All laboratory data packages will be verified and validated using a Stage 4 validation to evaluate whether the data meets the performance and acceptance criteria. The Stage 4 validation will be performed on 100% of the laboratory data generated during the RI/FS to support risk assessment and remedy selection. As described in the guidance (USEPA, 2009), the Stage 4 verification and validation will include completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, and the review of actual instrument outputs.

All data packages will be reviewed by a qualified, third-party data validator. The data validator will document findings by adding appropriate validation qualifiers (as necessary) to the sample results in the laboratory data packages based on the various verification and validation tasks. The following qualifiers will be applied to the data to identify data limitations identified during validation:

U ..... The analyte was analyzed for, but was not detected above the level of the reported sample quantitation limit.

UJ ..... The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

J ..... The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.

J+ ..... The result is an estimated quantity, but the result may be biased high.

J- ..... The result is an estimated quantity, but the result may be biased low.

R ..... The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.

A summary of the data verification and validation processes will be included in a Data Summary Usability Report (DUSR). The verified and validated analytical data will be included in the RI Phase I data summary report. The QA Officer is responsible for communicating with the data validator to ensure the data is validated. It is the ultimate responsibility of the RI/FS Manager to ensure that the entirety of the laboratory data collected during the RI/FS is validated.

9.3 Element D3 – Reconciliation With User Requirements

Once all samples have been collected and analytical data has been generated, data will be evaluated to determine if DQOs were achieved. Only data generated in association with QC results meeting the stated acceptance criteria (i.e., data determined to be valid) will be considered usable for decision making purposes. Rejected data will be clearly indicated during validation and made unavailable for use. The Phase I data summary report will include a qualitative and quantitative review of all QC samples and all deviations from the SAP described in this report, along with conclusions regarding the reliability of the data for their intended use.

Respectfully submitted,

ROUX ASSOCIATES, INC.

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TABLES

1. Summary of Proposed Phase I Sampling
2. Summary of Field Quality Control Samples
3. Summary of Laboratory Quality Control Measures by Analysis
4. Container Size, Preservation, and Shipping – Solid Samples
5. Container Size, Preservation, and Shipping – Aqueous Samples
6. Equipment Calibration and Maintenance Requirements
7. Sampling Analyses – Soil
8. Sampling Analyses – Groundwater
9. Sampling Analyses – Surface Water
10. Sampling Analyses – Sediment

Table 1. Proposed Phase I Site Characterization Sampling
Columbia Falls Aluminum Company, Montana

Latitude	Longitude	Location Type	Proposed Sample ID	Sample Type	Sample Interval	Closest Site Feature	Location Rationale	Soil TCL VOCS 8260	Soil TCL SVOCs 8270	Soil TAL Metals 6010	Soil TCL PCBs 8082	Soil TCL Pesticides 8081	Soil Total Cyanide 9012	Soil Fluoride 300	Soil PCDD/ PCDF 8290	Grain Size Analysis/ bulk density/ moisture content	Total Organic Carbon	AQ TCL VOCS 8260	AQ TCL SVOCs 8270	AQ TAL Metals EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TAL Metals Dissolved EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TCL PCBs 8082	AQ TCL Pesticides 8081	AQ Total Cyanide 335.4	AQ General Chemistry 300, SM2320B, SM2340B	AQ Nutrients 300, 350.1, 353.2, 365.1, SM2540B/C	SV TCL VOCS 8260	Methane/VOC Screening Only
48.39544018	-114.1556887	Surface Water/Sediment	CFSW-016	Sediment	Not Applicable	Cedar Creek	West of North-West Percolation Pond, near previous cyanide detection	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39544018	-114.1556887	Surface Water/Sediment	CFSW-016	Surface Water	Not Applicable	Cedar Creek	West of North-West Percolation Pond, near previous cyanide detection	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.40241184	-114.150627	Surface Water/Sediment	CFSW-015	Sediment	Not Applicable	Cedar Creek	Near former residential parcel within Site	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.40241184	-114.150627	Surface Water/Sediment	CFSW-015	Surface Water	Not Applicable	Cedar Creek	Near former residential parcel within Site	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.40754079	-114.1445952	Surface Water/Sediment	CFSW-014	Sediment	Not Applicable	Cedar Creek	Upgradient, background sample	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.40754079	-114.1445952	Surface Water/Sediment	CFSW-014	Surface Water	Not Applicable	Cedar Creek	Upgradient, background sample	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.40776559	-114.1389923	Surface Water/Sediment	CFSW-013	Sediment	Not Applicable	Cedar Creek Reservoir Overflow	Upgradient, background sample	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.40776559	-114.1389923	Surface Water/Sediment	CFSW-013	Surface Water	Not Applicable	Cedar Creek Reservoir Overflow	Upgradient, background sample	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.40116387	-114.1338951	Surface Water/Sediment	CFSW-012	Sediment	Not Applicable	Cedar Creek Reservoir Overflow	Between Sanitary Landfill and West Landfill	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.40116387	-114.1338951	Surface Water/Sediment	CFSW-012	Surface Water	Not Applicable	Cedar Creek Reservoir Overflow	Between Sanitary Landfill and West Landfill	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.39907865	-114.1313902	Surface Water/Sediment	CFSW-011	Sediment	Not Applicable	Cedar Creek Reservoir Overflow	Between East Landfill and Center Landfill	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39907865	-114.1313902	Surface Water/Sediment	CFSW-011	Surface Water	Not Applicable	Cedar Creek Reservoir Overflow	Between East Landfill and Center Landfill	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.39662065	-114.1267359	Surface Water/Sediment	CFSW-010	Sediment	Not Applicable	Cedar Creek Reservoir Overflow	Near Asbestos Landfill	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39662065	-114.1267359	Surface Water/Sediment	CFSW-010	Surface Water	Not Applicable	Cedar Creek Reservoir Overflow	Near Asbestos Landfill	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38685915	-114.1190913	Surface Water/Sediment	CFSW-009	Sediment	Not Applicable	Flathead River	Flathead River, upgradient of Site	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38685915	-114.1190913	Surface Water/Sediment	CFSW-009	Surface Water	Not Applicable	Flathead River	Flathead River, upgradient of Site	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38689263	-114.1261786	Surface Water/Sediment	CFSW-008	Sediment	Not Applicable	Flathead River	Flathead River, downgradient of South Percolation Ponds	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38689263	-114.1261786	Surface Water/Sediment	CFSW-008	Surface Water	Not Applicable	Flathead River	Flathead River, downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38691853	-114.1309812	Surface Water/Sediment	CFSW-007	Sediment	Not Applicable	Flathead River	Flathead River, downgradient of South Percolation Ponds	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38691853	-114.1309812	Surface Water/Sediment	CFSW-007	Surface Water	Not Applicable	Flathead River	Flathead River, downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38643969	-114.1359655	Surface Water/Sediment	CFSW-006	Sediment	Not Applicable	Flathead River	Flathead River, downgradient of South Percolation Ponds	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38643969	-114.1359655	Surface Water/Sediment	CFSW-006	Surface Water	Not Applicable	Flathead River	Flathead River, downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38937447	-114.1414756	Surface Water/Sediment	CFSW-005	Sediment	Not Applicable	Seep Area	Near Seep Area	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38937447	-114.1414756	Surface Water/Sediment	CFSW-005	Surface Water	Not Applicable	Seep Area	Near Seep Area	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38944222	-114.1423436	Surface Water/Sediment	CFSW-004	Sediment	Not Applicable	Seep Area	Near Seep Area	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38944222	-114.1423436	Surface Water/Sediment	CFSW-004	Surface Water	Not Applicable	Seep Area	Near Seep Area	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38954435	-114.1436681	Surface Water/Sediment	CFSW-003	Sediment	Not Applicable	Seep Area	Near Seep Area	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38954435	-114.1436681	Surface Water/Sediment	CFSW-003	Surface Water	Not Applicable	Seep Area	Near Seep Area	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38818756	-114.1510251	Surface Water/Sediment	CFSW-002	Sediment	Not Applicable	Flathead River	Downgradient Flathead River	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38818756	-114.1510251	Surface Water/Sediment	CFSW-002	Surface Water	Not Applicable	Flathead River	Downgradient Flathead River	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.38689265	-114.1566901	Surface Water/Sediment	CFSW-001	Sediment	Not Applicable	Flathead River	Downgradient Flathead River	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.38689265	-114.1566901	Surface Water/Sediment	CFSW-001	Surface Water	Not Applicable	Flathead River	Downgradient Flathead River	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0
48.3948401	-114.1353469	AGI Passive Sample	CFSG-033	AGI Passive	Not Applicable	Fueling Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39483111	-114.1355599	AGI Passive Sample	CFSG-032	AGI Passive	Not Applicable	Fueling Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39484112	-114.135756	AGI Passive Sample	CFSG-031	AGI Passive	Not Applicable	Fueling Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39924013	-114.1369294	AGI Passive Sample	CFSG-030	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39933968	-114.1371427	AGI Passive Sample	CFSG-029	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39923799	-114.1373465	AGI Passive Sample	CFSG-028	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39946216	-114.1369336	AGI Passive Sample	CFSG-027	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39947078	-114.1373527	AGI Passive Sample	CFSG-026	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39955756	-114.1371258	AGI Passive Sample	CFSG-025	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39968886	-114.1369311	AGI Passive Sample	CFSG-024	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39967985	-114.1373596	AGI Passive Sample	CFSG-023	AGI Passive	Not Applicable	Hazardous Waste Drum Storage Area	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.4046174	-114.142898	Soil Gas Screening	CFSG-022	Gas Screening	Not Applicable	Industrial Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40403003	-114.1423136	Soil Gas Screening	CFSG-021	Gas Screening	Not Applicable	Industrial Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40396208	-114.1412673	Soil Gas Screening	CFSG-020	Gas Screening	Not Applicable	Industrial Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40482303	-114.1416265	Soil Gas Screening	CFSG-019	Gas Screening	Not Applicable	Industrial Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.4056062	-114.1408488	Soil Gas Screening	CFSG-018	Gas Screening	Not Applicable	Industrial Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.39692273	-114.132775	AGI Passive Sample	CFSG-017	AGI Passive	Not Applicable	Operational Grid	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39739065	-114.132829	AGI Passive Sample	CFSG-016	AGI Passive	Not Applicable	Operational Grid	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
48.39890234	-114.1317567	Soil Gas Screening	CFSG-015	Gas Screening	Not Applicable	Center Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.39937127	-114.1323385	Soil Gas Screening	CFSG-014	Gas Screening	Not Applicable	Center Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.39870755	-114.1341473	Soil Gas Screening	CFSG-013	Gas Screening	Not Applicable	Wet Scrubber Sludge Pond	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.3986053	-114.135067	Soil Gas Screening	CFSG-012	Gas Screening	Not Applicable	Wet Scrubber Sludge Pond	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.39940459	-114.1342464	Soil Gas Screening	CFSG-011	Gas Screening	Not Applicable	Wet Scrubber Sludge Pond	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.39930903	-114.1354144	Soil Gas Screening	CFSG-010	Gas Screening	Not Applicable	Wet Scrubber Sludge Pond	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40027917	-114.1338165	Soil Gas Screening	CFSG-009	Gas Screening	Not Applicable	West Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40020487	-114.135073	Soil Gas Screening	CFSG-008	Gas Screening	Not Applicable	West Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40013688	-114.1361692	Soil Gas Screening	CFSG-007	Gas Screening	Not Applicable	West Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40084269	-114.1361026	Soil Gas Screening	CFSG-006	Gas Screening	Not Applicable	West Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40090585	-114.134863	Soil Gas Screening	CFSG-005	Gas Screening	Not Applicable	West Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40120693	-114.1330751	Soil Gas Screening	CFSG-004	Gas Screening	Not Applicable	Sanitary Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40137794	-114.1324619	Soil Gas Screening	CFSG-003	Gas Screening	Not Applicable	Sanitary Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40180388	-114.1328305	Soil Gas Screening	CFSG-002	Gas Screening	Not Applicable	Sanitary Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.40169698	-114.1334935	Soil Gas Screening	CFSG-001	Gas Screening	Not Applicable	Sanitary Landfill	Within feature	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
48.4028695	-114.1508360	Soil Boring	CFSB-133	Shallow Soil	0.5-2	Background Area	Near Former Residence	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4028695	-114.1508360	Soil Boring	CFSB-133	Surface Soil	0-0.5	Background Area	Near Former Residence	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4028695	-114.1508360	Soil Boring	CFSB-133	Vadose Soil	10-12	Background Area	Near Former Residence	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4027570	-114.1506280	Soil Boring	CFSB-132	Shallow Soil	0.5-2	Background Area	Near Former Residence	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4027570	-114.1506280	Soil Boring	CFSB-132	Surface Soil	0-0.5	Background Area	Near Former Residence	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4027570	-114.1506280	Soil Boring	CFSB-132	Vadose Soil	10-12	Background Area	Near Former Residence	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39457239	-114.1343454	Soil Boring	CFSB-131	Shallow Soil	0.5-2	Main Plant Area	Within Cathode Soaking Pit Area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39457239	-114.1343454	Soil Boring	CFSB-131	Surface Soil	0-0.5	Main Plant Area	Within Cathode Soaking Pit Area	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39457239	-114.1343454	Soil Boring	CFSB-131	Vadose Soil	10-12	Main Plant Area	Within Cathode Soaking Pit Area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39457308	-114.1346661	Soil Boring	CFSB-130	Shallow Soil	0.5-2	Main Plant Area	Within Cathode Soaking Pit Area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39457308	-114.1346661	Soil Boring	CFSB-130	Surface Soil	0-0.5	Main Plant Area	Within Cathode Soaking Pit Area	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39457308	-114.1346661	Soil Boring	CFSB-130	Vadose Soil	10-12	Main Plant Area	Within Cathode Soaking Pit Area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3901644	-114.1320872	Soil Boring	CFSB-129	Shallow Soil	0.5-2	Rectifier Yards	Southern boundary of feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3901644	-114.1320872	Soil Boring	CFSB-129	Surface Soil	0-0.5	Rectifier Yards	Southern boundary of feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3901644	-114.1320872	Soil Boring	CFSB-129	Vadose Soil	10-12	Rectifier Yards	Southern boundary of feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3903368	-114.1364852	Soil Boring	CFSB-128	Shallow Soil	0.5-2	Rectifier Yards	Southern boundary of feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3903368	-114.1364852	Soil Boring	CFSB-128	Surface Soil	0-0.5	Rectifier Yards	Southern boundary of feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3903368	-114.1364852	Soil Boring	CFSB-128	Vadose Soil	10-12	Rectifier Yards	Southern boundary of feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3992004	-114.1470032	Soil Boring	CFSB-127	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3992004	-114.1470032	Soil Boring	CFSB-127	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3992004	-114.1470032	Soil Boring	CFSB-127	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3981018	-114.1470032	Soil Boring	CFSB-126	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3981018	-114.1470032	Soil Boring	CFSB-126	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3981018	-114.1470032	Soil Boring	CFSB-126	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3969002	-114.1470032	Soil Boring	CFSB-125	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3969002	-114.1470032	Soil Boring	CFSB-125	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3969002	-114.1470032	Soil Boring	CFSB-125	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3951988	-114.1520004	Soil Boring	CFSB-124	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3951988	-114.1520004	Soil Boring	CFSB-124	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3951988	-114.1520004	Soil Boring	CFSB-124	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3959999	-114.1500015	Soil Boring	CFSB-123	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3959999	-114.1500015	Soil Boring	CFSB-123	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3959999	-114.1500015	Soil Boring	CFSB-123	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4006004	-114.1449966	Soil Boring	CFSB-122	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4006004	-114.1449966	Soil Boring	CFSB-122	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4006004	-114.1449966	Soil Boring	CFSB-122	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3955002	-114.1470032	Soil Boring	CFSB-121	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3955002	-114.1470032	Soil Boring	CFSB-121	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3955002	-114.1470032	Soil Boring	CFSB-121	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4005013	-114.1470032	Soil Boring	CFSB-120	Shallow Soil	0.5-2	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4005013	-114.1470032	Soil Boring	CFSB-120	Surface Soil	0-0.5	Background Area	background/unforested area of Site	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4005013	-114.1470032	Soil Boring	CFSB-120	Vadose Soil	10-12	Background Area	background/unforested area of Site	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38718169	-114.1264874	Soil Boring	CFSB-119	Shallow Soil	0.5-2	South Percolation Ponds	Southern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38718169	-114.1264874	Soil Boring	CFSB-119	Surface Soil	0-0.5	South Percolation Ponds	Southern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38718169	-114.1264874	Soil Boring	CFSB-119	Vadose Soil	10-12	South Percolation Ponds	Southern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38745924	-114.1264252	Soil Boring	CFSB-118	Shallow Soil	0.5-2	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38745924	-114.1264252	Soil Boring	CFSB-118	Surface Soil	0-0.5	South Percolation Ponds	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38745924	-114.1264252	Soil Boring	CFSB-118	Vadose Soil	10-12	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38770314	-114.1289248	Soil Boring	CFSB-116	Shallow Soil	0.5-2	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38770314	-114.1289248	Soil Boring	CFSB-116	Surface Soil	0-0.5	South Percolation Ponds	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38770314	-114.1289248	Soil Boring	CFSB-116	Vadose Soil	10-12	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38798332	-114.1288519	Soil Boring	CFSB-115	Shallow Soil	0.5-2	South Percolation Ponds	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38798332	-114.1288519	Soil Boring	CFSB-115	Surface Soil	0-0.5	South Percolation Ponds	Northern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38798332	-114.1288519	Soil Boring	CFSB-115	Vadose Soil	10-12	South Percolation Ponds	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38779803	-114.1314529	Soil Boring	CFSB-114	Shallow Soil	0.5-2	South Percolation Ponds	Southern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38779803	-114.1314529	Soil Boring	CFSB-114	Surface Soil	0-0.5	South Percolation Ponds	Southern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38779803	-114.1314529	Soil Boring	CFSB-114	Vadose Soil	10-12	South Percolation Ponds	Southern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38806279	-114.1313819	Soil Boring	CFSB-113	Shallow Soil	0.5-2	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38806279	-114.1313819	Soil Boring	CFSB-113	Surface Soil	0-0.5	South Percolation Ponds	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38806279	-114.1313819	Soil Boring	CFSB-113	Vadose Soil	10-12	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38819464	-114.1329358	Soil Boring	CFSB-110	Shallow Soil	0.5-2	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38819464	-114.1329358	Soil Boring	CFSB-110	Surface Soil	0-0.5	South Percolation Ponds	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38819464	-114.1329358	Soil Boring	CFSB-110	Vadose Soil	10-12	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38850647	-114.1330426	Soil Boring	CFSB-109	Shallow Soil	0.5-2	South Percolation Ponds	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1. Proposed Phase I Site Characterization Sampling
Columbia Falls Aluminum Company, Montana

Latitude	Longitude	Location Type	Proposed Sample ID	Sample Type	Sample Interval	Closest Site Feature	Location Rationale	Soil TCL VOCS 8260	Soil TCL SVOCs 8270	Soil TAL Metals 6010	Soil TCL PCBs 8082	Soil TCL Pesticides 8081	Soil Total Cyanide 9012	Soil Fluoride 300	Soil PCDD/ PCDF 8290	Grain Size Analysis/ bulk density/ moisture content	Total Organic Carbon	AQ TCL VOCS 8260	AQ TCL SVOCs 8270	AQ TAL Metals EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TAL Metals Dissolved EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TCL PCBs 8082	AQ TCL Pesticides 8081	AQ Total Cyanide 335.4	AQ General Chemistry 300, SM2320B, SM2340B	AQ Nutrients 300, 350.1, 353.2, 365.1, SM2540B/C	SV TCL VOCS 8260	Methane/VOC Screening Only
48.38850647	-114.1330426	Soil Boring	CFSB-109	Surface Soil	0-0.5	South Percolation Ponds	Northern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38850647	-114.1330426	Soil Boring	CFSB-109	Vadose Soil	10-12	South Percolation Ponds	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3884445	-114.1357259	Soil Boring	CFSB-104	Shallow Soil	0.5-2	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3884445	-114.1357259	Soil Boring	CFSB-104	Surface Soil	0-0.5	South Percolation Ponds	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3884445	-114.1357259	Soil Boring	CFSB-104	Vadose Soil	10-12	South Percolation Ponds	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38870898	-114.1359208	Soil Boring	CFSB-102	Shallow Soil	0.5-2	South Percolation Ponds	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38870898	-114.1359208	Soil Boring	CFSB-102	Surface Soil	0-0.5	South Percolation Ponds	Northern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38870898	-114.1359208	Soil Boring	CFSB-102	Vadose Soil	10-12	South Percolation Ponds	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38885728	-114.1372784	Soil Boring	CFSB-101	Shallow Soil	0.5-2	South Percolation Ponds	Within drainage to feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38885728	-114.1372784	Soil Boring	CFSB-101	Surface Soil	0-0.5	South Percolation Ponds	Within drainage to feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38885728	-114.1372784	Soil Boring	CFSB-101	Vadose Soil	10-12	South Percolation Ponds	Within drainage to feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39061781	-114.1445208	Soil Boring	CFSB-100	Shallow Soil	0.5-2	Rod Mill	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39061781	-114.1445208	Soil Boring	CFSB-100	Surface Soil	0-0.5	Rod Mill	Western boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39061781	-114.1445208	Soil Boring	CFSB-100	Vadose Soil	10-12	Rod Mill	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39108018	-114.1445025	Soil Boring	CFSB-099	Shallow Soil	0.5-2	Rod Mill	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39108018	-114.1445025	Soil Boring	CFSB-099	Surface Soil	0-0.5	Rod Mill	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39108018	-114.1445025	Soil Boring	CFSB-099	Vadose Soil	10-12	Rod Mill	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39060362	-114.1436281	Soil Boring	CFSB-098	Shallow Soil	0.5-2	Rod Mill	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39060362	-114.1436281	Soil Boring	CFSB-098	Surface Soil	0-0.5	Rod Mill	Eastern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39060362	-114.1436281	Soil Boring	CFSB-098	Vadose Soil	10-12	Rod Mill	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39110102	-114.1435707	Soil Boring	CFSB-097	Shallow Soil	0.5-2	Rod Mill	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39110102	-114.1435707	Soil Boring	CFSB-097	Surface Soil	0-0.5	Rod Mill	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39110102	-114.1435707	Soil Boring	CFSB-097	Vadose Soil	10-12	Rod Mill	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39103284	-114.1405946	Soil Boring	CFSB-095	Shallow Soil	0.5-2	Rod Mill	Between Rectifier Yard and Rod Mill	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39103284	-114.1405946	Soil Boring	CFSB-095	Surface Soil	0-0.5	Rod Mill	Between Rectifier Yard and Rod Mill	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39103284	-114.1405946	Soil Boring	CFSB-095	Vadose Soil	10-12	Rod Mill	Between Rectifier Yard and Rod Mill	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39124285	-114.1379506	Soil Boring	CFSB-094	Shallow Soil	0.5-2	Rectifier Yards	Western boundary of feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39124285	-114.1379506	Soil Boring	CFSB-094	Surface Soil	0-0.5	Rectifier Yards	Western boundary of feature, near former USTs	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39124285	-114.1379506	Soil Boring	CFSB-094	Vadose Soil	10-12	Rectifier Yards	Western boundary of feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.391211	-114.1374515	Soil Boring	CFSB-092	Shallow Soil	0.5-2	Rectifier Yards	Within feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.391211	-114.1374515	Soil Boring	CFSB-092	Surface Soil	0-0.5	Rectifier Yards	Within feature, near former USTs	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.391211	-114.1374515	Soil Boring	CFSB-092	Vadose Soil	10-12	Rectifier Yards	Within feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3912165	-114.1371582	Soil Boring	CFSB-088	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3912165	-114.1371582	Soil Boring	CFSB-088	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3912165	-114.1371582	Soil Boring	CFSB-088	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913533	-114.1364312	Soil Boring	CFSB-087	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913533	-114.1364312	Soil Boring	CFSB-087	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913533	-114.1364312	Soil Boring	CFSB-087	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913901	-114.1360879	Soil Boring	CFSB-086	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913901	-114.1360879	Soil Boring	CFSB-086	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913901	-114.1360879	Soil Boring	CFSB-086	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913898	-114.135486	Soil Boring	CFSB-084	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913898	-114.135486	Soil Boring	CFSB-084	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913898	-114.135486	Soil Boring	CFSB-084	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39140329	-114.1338853	Soil Boring	CFSB-082	Shallow Soil	0.5-2	Rectifier Yards	Within feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39140329	-114.1338853	Soil Boring	CFSB-082	Surface Soil	0-0.5	Rectifier Yards	Within feature, near former USTs	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39140329	-114.1338853	Soil Boring	CFSB-082	Vadose Soil	10-12	Rectifier Yards	Within feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.391399	-114.1334838	Soil Boring	CFSB-080	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.391399	-114.1334838	Soil Boring	CFSB-080	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.391399	-114.1334838	Soil Boring	CFSB-080	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913345	-114.1330353	Soil Boring	CFSB-079	Shallow Soil	0.5-2	Rectifier Yards	Within feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913345	-114.1330353	Soil Boring	CFSB-079	Surface Soil	0-0.5	Rectifier Yards	Within feature, near former USTs	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913345	-114.1330353	Soil Boring	CFSB-079	Vadose Soil	10-12	Rectifier Yards	Within feature, near former USTs	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914389	-114.1316033	Soil Boring	CFSB-075	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914389	-114.1316033	Soil Boring	CFSB-075	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914389	-114.1316033	Soil Boring	CFSB-075	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914372	-114.1306578	Soil Boring	CFSB-074	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914372	-114.1306578	Soil Boring	CFSB-074	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914372	-114.1306578	Soil Boring	CFSB-074	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914311	-114.1312342	Soil Boring	CFSB-073	Shallow Soil	0.5-2	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914311	-114.1312342	Soil Boring	CFSB-073	Surface Soil	0-0.5	Rectifier Yards	Within feature	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3914311	-114.1312342	Soil Boring	CFSB-073	Vadose Soil	10-12	Rectifier Yards	Within feature	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39122117	-114.1294892	Soil Boring	CFSB-071	Shallow Soil	0.5-2	Rectifier Yards	East of feature, near railway	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39122117	-114.1294892	Soil Boring	CFSB-071	Surface Soil	0-0.5	Rectifier Yards	East of feature, near railway	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39122117	-114.1294892	Soil Boring	CFSB-071	Vadose Soil	10-12	Rectifier Yards	East of feature, near railway	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39214209	-114.1294237	Soil Boring	CFSB-069	Shallow Soil	0.5-2	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39214209	-114.1294237	Soil Boring	CFSB-069	Surface Soil	0-0.5	Main Plant Area	East of Main Plant, near railway	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39214209	-114.1294237	Soil Boring	CFSB-069	Vadose Soil	10-12	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39282417	-114.1300101	Soil Boring	CFSB-068	Shallow Soil	0.5-2	Main Plant Area	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39282417	-114.1300101	Soil Boring	CFSB-068	Surface Soil	0-0.5	Main Plant Area	Eastern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39282417	-114.1300101	Soil Boring	CFSB-068	Vadose Soil	10-12	Main Plant Area	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39341267	-114.129309	Soil Boring	CFSB-066	Shallow Soil	0.5-2	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39341267	-114.129309	Soil Boring	CFSB-066	Surface Soil	0-0.5	Main Plant Area	East of Main Plant, near railway	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39341267	-114.129309	Soil Boring	CFSB-066	Vadose Soil	10-12	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3938729	-114.1405679	Soil Boring	CFSB-065	Shallow Soil	0.5-2	West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3938729	-114.1405679	Soil Boring	CFSB-065	Surface Soil	0-0.5	West Percolation Pond	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3938729	-114.1405679	Soil Boring	CFSB-065	Vadose Soil	10-12	West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39399887	-114.1411113	Soil Boring	CFSB-064	Shallow Soil	0.5-2	West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39399887	-114.1411113	Soil Boring	CFSB-064	Surface Soil	0-0.5	West Percolation Pond	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39399887	-114.1411113	Soil Boring	CFSB-064	Vadose Soil	10-12	West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39417426	-114.1411121	Soil Boring	CFSB-062	Shallow Soil	0.5-2	West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39417426	-114.1411121	Soil Boring	CFSB-062	Surface Soil	0-0.5	West Percolation Pond	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39417426	-114.1411121	Soil Boring	CFSB-062	Vadose Soil	10-12	West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3950725	-114.1296355	Soil Boring	CFSB-060	Shallow Soil	0.5-2	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3950725	-114.1296355	Soil Boring	CFSB-060	Surface Soil	0-0.5	Main Plant Area	East of Main Plant, near railway	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3950725	-114.1296355	Soil Boring	CFSB-060	Vadose Soil	10-12	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39515838	-114.1320239	Soil Boring	CFSB-059	Shallow Soil	0.5-2	Raw Materials Loading/Unloading Area	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39515838	-114.1320239	Soil Boring	CFSB-059	Surface Soil	0-0.5	Raw Materials Loading/Unloading Area	Eastern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39515838	-114.1320239	Soil Boring	CFSB-059	Vadose Soil	10-12	Raw Materials Loading/Unloading Area	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39508922	-114.1331046	Soil Boring	CFSB-057	Shallow Soil	0.5-2	Raw Materials Loading/Unloading Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39508922	-114.1331046	Soil Boring	CFSB-057	Surface Soil	0-0.5	Raw Materials Loading/Unloading Area	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39508922	-114.1331046	Soil Boring	CFSB-057	Vadose Soil	10-12	Raw Materials Loading/Unloading Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39511852	-114.1342324	Soil Boring	CFSB-055	Shallow Soil	0.5-2	Fueling Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39511852	-114.1342324	Soil Boring	CFSB-055	Surface Soil	0-0.5	Fueling Area	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39511852	-114.1342324	Soil Boring	CFSB-055	Vadose Soil	10-12	Fueling Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39499144	-114.1349169	Soil Boring	CFSB-054	Shallow Soil	0.5-2	Fueling Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39499144	-114.1349169	Soil Boring	CFSB-054	Surface Soil	0-0.5	Fueling Area	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39499144	-114.1349169	Soil Boring	CFSB-054	Vadose Soil	10-12	Fueling Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3948287	-114.1356209	Soil Boring	CFSB-053	Shallow Soil	0.5-2	Fueling Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3948287	-114.1356209	Soil Boring	CFSB-053	Surface Soil	0-0.5	Fueling Area	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3948287	-114.1356209	Soil Boring	CFSB-053	Vadose Soil	10-12	Fueling Area	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3952227	-114.1358186	Soil Boring	CFSB-052	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3952227	-114.1358186	Soil Boring	CFSB-052	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3952227	-114.1358186	Soil Boring	CFSB-052	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39521501	-114.1372355	Soil Boring	CFSB-051	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39521501	-114.1372355	Soil Boring	CFSB-051	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39521501	-114.1372355	Soil Boring	CFSB-051	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39526126	-114.1380355	Soil Boring	CFSB-050	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39526126	-114.1380355	Soil Boring	CFSB-050	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39526126	-114.1380355	Soil Boring	CFSB-050	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39552228	-114.1340513	Soil Boring	CFSB-049	Shallow Soil	0.5-2	Paste Plant	East of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39552228	-114.1340513	Soil Boring	CFSB-049	Surface Soil	0-0.5	Paste Plant	East of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39552228	-114.1340513	Soil Boring	CFSB-049	Vadose Soil	10-12	Paste Plant	East of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39543874	-114.1344952	Soil Boring	CFSB-048	Shallow Soil	0.5-2	Paste Plant	East of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39543874	-114.1344952	Soil Boring	CFSB-048	Surface Soil	0-0.5	Paste Plant	East of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39543874	-114.1344952	Soil Boring	CFSB-048	Vadose Soil	10-12	Paste Plant	East of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3957075	-114.1353154	Soil Boring	CFSB-046	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3957075	-114.1353154	Soil Boring	CFSB-046	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3957075	-114.1353154	Soil Boring	CFSB-046	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39557588	-114.1358873	Soil Boring	CFSB-045	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39557588	-114.1358873	Soil Boring	CFSB-045	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39557588	-114.1358873	Soil Boring	CFSB-045	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39591484	-114.1350936	Soil Boring	CFSB-044	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39591484	-114.1350936	Soil Boring	CFSB-044	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39591484	-114.1350936	Soil Boring	CFSB-044	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39593573	-114.1357857	Soil Boring	CFSB-042	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39593573	-114.1357857	Soil Boring	CFSB-042	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39593573	-114.1357857	Soil Boring	CFSB-042	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39573358	-114.1367751	Soil Boring	CFSB-040	Shallow Soil	0.5-2	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1. Proposed Phase I Site Characterization Sampling
Columbia Falls Aluminum Company, Montana

Latitude	Longitude	Location Type	Proposed Sample ID	Sample Type	Sample Interval	Closest Site Feature	Location Rationale	Soil TCL VOCS 8260	Soil TCL SVOCs 8270	Soil TAL Metals 6010	Soil TCL PCBs 8082	Soil TCL Pesticides 8081	Soil Total Cyanide 9012	Soil Fluoride 300	Soil PCDD/ PCDF 8290	Grain Size Analysis/ bulk density/ moisture content	Total Organic Carbon	AQ TCL VOCS 8260	AQ TCL SVOCs 8270	AQ TAL Metals EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TAL Metals Dissolved EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TCL PCBs 8082	AQ TCL Pesticides 8081	AQ Total Cyanide 335.4	AQ General Chemistry 300, SM2320B, SM2340B	AQ Nutrients 300, 350.1, 353.2, 365.1, SM2540B/C	SV TCL VOCS 8260	Methane/VOC Screening Only
48.39573358	-114.1367751	Soil Boring	CFSB-040	Surface Soil	0-0.5	Paste Plant	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39573358	-114.1367751	Soil Boring	CFSB-040	Vadose Soil	10-12	Paste Plant	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39597008	-114.1399063	Soil Boring	CFSB-038	Shallow Soil	0.5-2	Paste Plant	West of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39597008	-114.1399063	Soil Boring	CFSB-038	Surface Soil	0-0.5	Paste Plant	West of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39597008	-114.1399063	Soil Boring	CFSB-038	Vadose Soil	10-12	Paste Plant	West of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39654958	-114.1307358	Soil Boring	CFSB-037	Shallow Soil	0.5-2	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39654958	-114.1307358	Soil Boring	CFSB-037	Surface Soil	0-0.5	Operational Grid	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39654958	-114.1307358	Soil Boring	CFSB-037	Vadose Soil	10-12	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39664291	-114.1327598	Soil Boring	CFSB-036	Shallow Soil	0.5-2	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39664291	-114.1327598	Soil Boring	CFSB-036	Surface Soil	0-0.5	Operational Grid	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39664291	-114.1327598	Soil Boring	CFSB-036	Vadose Soil	10-12	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39733182	-114.1324371	Soil Boring	CFSB-035	Shallow Soil	0.5-2	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39733182	-114.1324371	Soil Boring	CFSB-035	Surface Soil	0-0.5	Operational Grid	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39733182	-114.1324371	Soil Boring	CFSB-035	Vadose Soil	10-12	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39711259	-114.1330084	Soil Boring	CFSB-034	Shallow Soil	0.5-2	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39711259	-114.1330084	Soil Boring	CFSB-034	Surface Soil	0-0.5	Operational Grid	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39711259	-114.1330084	Soil Boring	CFSB-034	Vadose Soil	10-12	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39683914	-114.1342915	Soil Boring	CFSB-033	Shallow Soil	0.5-2	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39683914	-114.1342915	Soil Boring	CFSB-033	Surface Soil	0-0.5	Operational Grid	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39683914	-114.1342915	Soil Boring	CFSB-033	Vadose Soil	10-12	Operational Grid	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39637978	-114.1358701	Soil Boring	CFSB-030	Shallow Soil	0.5-2	Influent Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39637978	-114.1358701	Soil Boring	CFSB-030	Surface Soil	0-0.5	Influent Ditch	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39637978	-114.1358701	Soil Boring	CFSB-030	Vadose Soil	10-12	Influent Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39679988	-114.1353622	Soil Boring	CFSB-029	Shallow Soil	0.5-2	North-East Percolation Pond	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39679988	-114.1353622	Soil Boring	CFSB-029	Surface Soil	0-0.5	North-East Percolation Pond	Eastern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39679988	-114.1353622	Soil Boring	CFSB-029	Vadose Soil	10-12	North-East Percolation Pond	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39647781	-114.136407	Soil Boring	CFSB-028	Shallow Soil	0.5-2	Influent Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39647781	-114.136407	Soil Boring	CFSB-028	Surface Soil	0-0.5	Influent Ditch	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39647781	-114.136407	Soil Boring	CFSB-028	Vadose Soil	10-12	Influent Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3968023	-114.1376742	Soil Boring	CFSB-027	Shallow Soil	0.5-2	Overflow Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3968023	-114.1376742	Soil Boring	CFSB-027	Surface Soil	0-0.5	Overflow Ditch	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3968023	-114.1376742	Soil Boring	CFSB-027	Vadose Soil	10-12	Overflow Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3968147	-114.1366675	Soil Boring	CFSB-026	Shallow Soil	0.5-2	North-East Percolation pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3968147	-114.1366675	Soil Boring	CFSB-026	Surface Soil	0-0.5	North-East Percolation pond	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3968147	-114.1366675	Soil Boring	CFSB-026	Vadose Soil	10-12	North-East Percolation pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39720777	-114.1368373	Soil Boring	CFSB-022	Shallow Soil	0.5-2	North-East Percolation Pond	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39720777	-114.1368373	Soil Boring	CFSB-022	Surface Soil	0-0.5	North-East Percolation Pond	Northern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39720777	-114.1368373	Soil Boring	CFSB-022	Vadose Soil	10-12	North-East Percolation Pond	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39754675	-114.1380686	Soil Boring	CFSB-021	Shallow Soil	0.5-2	Overflow Ditch	Area of disturbance north of Overflow Ditch	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39754675	-114.1380686	Soil Boring	CFSB-021	Surface Soil	0-0.5	Overflow Ditch	Area of disturbance north of Overflow Ditch	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39754675	-114.1380686	Soil Boring	CFSB-021	Vadose Soil	10-12	Overflow Ditch	Area of disturbance north of Overflow Ditch	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39711545	-114.1411858	Soil Boring	CFSB-019	Shallow Soil	0.5-2	Overflow Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39711545	-114.1411858	Soil Boring	CFSB-019	Surface Soil	0-0.5	Overflow Ditch	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39711545	-114.1411858	Soil Boring	CFSB-019	Vadose Soil	10-12	Overflow Ditch	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3972533	-114.1440975	Soil Boring	CFSB-016	Shallow Soil	0.5-2	North-West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3972533	-114.1440975	Soil Boring	CFSB-016	Surface Soil	0-0.5	North-West Percolation Pond	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3972533	-114.1440975	Soil Boring	CFSB-016	Vadose Soil	10-12	North-West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3979587	-114.1440612	Soil Boring	CFSB-014	Shallow Soil	0.5-2	North-West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3979587	-114.1440612	Soil Boring	CFSB-014	Surface Soil	0-0.5	North-West Percolation Pond	Within feature	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3979587	-114.1440612	Soil Boring	CFSB-014	Vadose Soil	10-12	North-West Percolation Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39760513	-114.1455657	Soil Boring	CFSB-013	Shallow Soil	0.5-2	North-West Percolation Pond	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39760513	-114.1455657	Soil Boring	CFSB-013	Surface Soil	0-0.5	North-West Percolation Pond	Western boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39760513	-114.1455657	Soil Boring	CFSB-013	Vadose Soil	10-12	North-West Percolation Pond	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39853349	-114.1435681	Soil Boring	CFSB-011	Shallow Soil	0.5-2	North-West Percolation Pond	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39853349	-114.1435681	Soil Boring	CFSB-011	Surface Soil	0-0.5	North-West Percolation Pond	Northern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39853349	-114.1435681	Soil Boring	CFSB-011	Vadose Soil	10-12	North-West Percolation Pond	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39759374	-114.128917	Soil Boring	CFSB-009	Shallow Soil	0.5-2	South Leachate Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39759374	-114.128917	Soil Boring	CFSB-009	Surface Soil	0-0.5	South Leachate Pond	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39759374	-114.128917	Soil Boring	CFSB-009	Vadose Soil	10-12	South Leachate Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39829498	-114.1300282	Soil Boring	CFSB-008	Shallow Soil	0.5-2	East Landfill	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39829498	-114.1300282	Soil Boring	CFSB-008	Surface Soil	0-0.5	East Landfill	Western boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39829498	-114.1300282	Soil Boring	CFSB-008	Vadose Soil	10-12	East Landfill	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39810556	-114.1345826	Soil Boring	CFSB-007	Shallow Soil	0.5-2	Wet Scrubber Sludge Pond	Southern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39810556	-114.1345826	Soil Boring	CFSB-007	Surface Soil	0-0.5	Wet Scrubber Sludge Pond	Southern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39810556	-114.1345826	Soil Boring	CFSB-007	Vadose Soil	10-12	Wet Scrubber Sludge Pond	Southern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39986298	-114.1306104	Soil Boring	CFSB-006	Shallow Soil	0.5-2	North Leachate Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39986298	-114.1306104	Soil Boring	CFSB-006	Surface Soil	0-0.5	North Leachate Pond	Within feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39986298	-114.1306104	Soil Boring	CFSB-006	Vadose Soil	10-12	North Leachate Pond	Within feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39976719	-114.1334339	Soil Boring	CFSB-005	Shallow Soil	0.5-2	West Landfill	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39976719	-114.1334339	Soil Boring	CFSB-005	Surface Soil	0-0.5	West Landfill	Eastern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39976719	-114.1334339	Soil Boring	CFSB-005	Vadose Soil	10-12	West Landfill	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39908926	-114.1366931	Soil Boring	CFSB-004	Shallow Soil	0.5-2	Wet Scrubber Sludge Pond	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39908926	-114.1366931	Soil Boring	CFSB-004	Surface Soil	0-0.5	Wet Scrubber Sludge Pond	Western boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39908926	-114.1366931	Soil Boring	CFSB-004	Vadose Soil	10-12	Wet Scrubber Sludge Pond	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.40056959	-114.133468	Soil Boring	CFSB-003	Shallow Soil	0.5-2	West Landfill	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.40056959	-114.133468	Soil Boring	CFSB-003	Surface Soil	0-0.5	West Landfill	Eastern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.40056959	-114.133468	Soil Boring	CFSB-003	Vadose Soil	10-12	West Landfill	Eastern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.40045387	-114.1368442	Soil Boring	CFSB-002	Shallow Soil	0.5-2	West Landfill	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.40045387	-114.1368442	Soil Boring	CFSB-002	Surface Soil	0-0.5	West Landfill	Western boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.40045387	-114.1368442	Soil Boring	CFSB-002	Vadose Soil	10-12	West Landfill	Western boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4013976	-114.1363525	Soil Boring	CFSB-001	Shallow Soil	0.5-2	West Landfill	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4013976	-114.1363525	Soil Boring	CFSB-001	Surface Soil	0-0.5	West Landfill	Northern boundary of feature	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4013976	-114.1363525	Soil Boring	CFSB-001	Vadose Soil	10-12	West Landfill	Northern boundary of feature	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3874942	-114.1289220	Water Table Monitoring Well	CFMW-064	Groundwater	Not Applicable	South Percolation Ponds	Downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3874942	-114.1289220	Water Table Monitoring Well	CFMW-064	Shallow Soil	0.5-2	South Percolation Ponds	Downgradient of South Percolation Ponds	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3874942	-114.1289220	Water Table Monitoring Well	CFMW-064	Surface Soil	0-0.5	South Percolation Ponds	Downgradient of South Percolation Ponds	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3874942	-114.1289220	Water Table Monitoring Well	CFMW-064	Vadose Soil	10-12	South Percolation Ponds	Downgradient of South Percolation Ponds	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38793966	-114.1321917	Existing Monitoring Well	CFMW-062	Groundwater	Not Applicable	South Percolation Ponds	Downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3875246	-114.1331924	Water Table Monitoring Well	CFMW-061	Groundwater	Not Applicable	South Percolation Ponds	Downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3880924	-114.1576925	Deep Monitoring Well	CFMW-059a	Beneath Water Table Soil	5 ft below wt	Off-Site Residential Area	Western boundary of Site	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3880924	-114.1576925	Deep Monitoring Well	CFMW-059a	Groundwater	Not Applicable	Off-Site Residential Area	Western boundary of Site, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3880924	-114.1576925	Deep Monitoring Well	CFMW-059a	Shallow Soil	0.5-2	Off-Site Residential Area	Western boundary of Site	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3880924	-114.1576925	Deep Monitoring Well	CFMW-059a	Surface Soil	0-0.5	Off-Site Residential Area	Western boundary of Site	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3880924	-114.1576925	Deep Monitoring Well	CFMW-059a	Vadose Soil	10-12	Off-Site Residential Area	Western boundary of Site	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3880648	-114.1578541	Water Table Monitoring Well	CFMW-059	Groundwater	Not Applicable	Off-Site Residential Area	Western boundary of Site	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3920030	-114.1581731	Deep Monitoring Well	CFMW-057a	Beneath Water Table Soil	5 ft below wt	Off-Site Residential Area	Western boundary of Site	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3920030	-114.1581731	Deep Monitoring Well	CFMW-057a	Groundwater	Not Applicable	Off-Site Residential Area	Western boundary of Site, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3920030	-114.1581731	Deep Monitoring Well	CFMW-057a	Shallow Soil	0.5-2	Off-Site Residential Area	Western boundary of Site	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3920030	-114.1581731	Deep Monitoring Well	CFMW-057a	Surface Soil	0-0.5	Off-Site Residential Area	Western boundary of Site	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3920030	-114.1581731	Deep Monitoring Well	CFMW-057a	Vadose Soil	10-12	Off-Site Residential Area	Western boundary of Site	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39214368	-114.1582105	Existing Monitoring Well	CFMW-057	Groundwater	Not Applicable	Off-Site Residential Area	Western boundary of Site	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3940195	-114.1493572	Deep Monitoring Well	CFMW-056a	Beneath Water Table Soil	5 ft below wt	Off-Site Residential Area	Western area of Site previously uninvestigated	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3940195	-114.1493572	Deep Monitoring Well	CFMW-056a	Groundwater	Not Applicable	Off-Site Residential Area	Western area of Site previously uninvestigated, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3940195	-114.1493572	Deep Monitoring Well	CFMW-056a	Shallow Soil	0.5-2	Off-Site Residential Area	Western area of Site previously uninvestigated	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3940195	-114.1493572	Deep Monitoring Well	CFMW-056a	Surface Soil	0-0.5	Off-Site Residential Area	Western area of Site previously uninvestigated	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3940195	-114.1493572	Deep Monitoring Well	CFMW-056a	Vadose Soil	10-12	Off-Site Residential Area	Western area of Site previously uninvestigated	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.39407701	-114.1494758	Existing Monitoring Well	CFMW-056	Groundwater	Not Applicable	Off-Site Residential Area	Western area of Site	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3904671	-114.1441099	Water Table Monitoring Well	CFMW-054	Groundwater	Not Applicable	Rod Mill	Downgradient of Rod Mill	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3904671	-114.1441099	Water Table Monitoring Well	CFMW-054	Shallow Soil	0.5-2	Rod Mill	Downgradient of Rod Mill	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3904671	-114.1441099	Water Table Monitoring Well	CFMW-054	Surface Soil	0-0.5	Rod Mill	Downgradient of Rod Mill	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3904671	-114.1441099	Water Table Monitoring Well	CFMW-054	Vadose Soil	10-12	Rod Mill	Downgradient of Rod Mill	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3904832	-114.1423285	Deep Monitoring Well	CFMW-053a	Beneath Water Table Soil	5 ft below wt	Rod Mill	East of Rod Mill	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3904832	-114.1423285	Deep Monitoring Well	CFMW-053a	Groundwater	Not Applicable	Rod Mill	East of Rod Mill, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3904832	-114.1423285	Deep Monitoring Well	CFMW-053a	Shallow Soil	0.5-2	Rod Mill	East of Rod Mill	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3904832	-114.1423285	Deep Monitoring Well	CFMW-053a	Surface Soil	0-0.5	Rod Mill	East of Rod Mill	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3904832	-114.1423285	Deep Monitoring Well	CFMW-053a	Vadose Soil	10-12	Rod Mill	East of Rod Mill	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39051439	-114.1421457	Existing Monitoring Well	CFMW-053	Groundwater	Not Applicable	Rod Mill	Between Rod Mill and Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.38907386	-114.1229127	Existing Monitoring Well	CFMW-052	Groundwater	Not Applicable	South Percolation Ponds	East of Main Plant, North of Flathead Rivernear eastern Site boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.38903598	-114.1258029	Existing Monitoring Well	CFMW-051	Groundwater	Not Applicable	South Percolation Ponds	East of Main Plant, North of Flathead River near eastern Site boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3890373	-114.1282356	Water Table Monitoring Well	CFMW-050	Groundwater	Not Applicable	Main Plant Area	Downgradient of Main Plant, near railway	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3890373	-114.1282356	Water Table Monitoring Well	CFMW-050	Shallow Soil	0.5-2	Main Plant Area	Downgradient of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3890373	-114.1282356	Water Table Monitoring Well	CFMW-050	Surface Soil	0-0.5	Main Plant Area	Downgradient of Main Plant, near railway	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3890373	-114.1282356	Water Table Monitoring Well	CFMW-050	Vadose Soil	10-12	Main Plant Area	Downgradient of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3902018	-114.1291780	Deep Monitoring Well	CFMW-049a	Beneath Water Table Soil	5 ft below wt	Rectifier Yards	East of Retificer Yards and Main Plant	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3902018	-114.1291780	Deep Monitoring Well	CFMW-049a	Groundwater	Not Applicable	Rectifier Yards	East of Retificer Yards and Main Plant, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3902018	-114.1291780	Deep Monitoring Well	CFMW-049a	Shallow Soil	0.5-2	Rectifier Yards	East of Retificer Yards and Main Plant	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3902018	-114.1291780	Deep Monitoring Well	CFMW-049a	Surface Soil	0-0.5	Rectifier Yards	East of Retificer Yards and Main Plant	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3902018	-114.1291780	Deep Monitoring Well	CFMW-049a	Vadose Soil	10-12	Rectifier Yards	East of Retificer Yards and Main Plant	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39030654	-114.1291789	Existing Monitoring Well	CFMW-049	Groundwater	Not Applicable	Rectifier yards	Downgradient of Rectifier Yards and Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0

Table 1. Proposed Phase I Site Characterization Sampling
Columbia Falls Aluminum Company, Montana

Latitude	Longitude	Location Type	Proposed Sample ID	Sample Type	Sample Interval	Closest Site Feature	Location Rationale	Soil TCL VOCS 8260	Soil TCL SVOCs 8270	Soil TAL Metals 6010	Soil TCL PCBs 8082	Soil TCL Pesticides 8081	Soil Total Cyanide 9012	Soil Fluoride 300	Soil PCDD/ PCDF 8290	Grain Size Analysis/ bulk density/ moisture content	Total Organic Carbon	AQ TCL VOCS 8260	AQ TCL SVOCs 8270	AQ TAL Metals EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TAL Metals Dissolved EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TCL PCBs 8082	AQ TCL Pesticides 8081	AQ Total Cyanide 335.4	AQ General Chemistry 300, SM2320B, SM2340B	AQ Nutrients 300, 350.1, 353.2, 365.1, SM2540B/C	SV TCL VOCS 8260	Methane/VOC Screening Only
48.38979359	-114.130005	Existing Monitoring Well	CFMW-048	Groundwater	Not Applicable	Rectifier yards	Downgradient of Rectifier Yards and Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3894744	-114.1315814	Water Table Monitoring Well	CFMW-047	Groundwater	Not Applicable	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3894744	-114.1315814	Water Table Monitoring Well	CFMW-047	Shallow Soil	0.5-2	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3894744	-114.1315814	Water Table Monitoring Well	CFMW-047	Surface Soil	0-0.5	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3894744	-114.1315814	Water Table Monitoring Well	CFMW-047	Vadose Soil	10-12	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3901004	-114.1377219	Deep Monitoring Well	CFMW-045a	Beneath Water Table Soil	5 ft below wt	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3901004	-114.1377219	Deep Monitoring Well	CFMW-045a	Groundwater	Not Applicable	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3901004	-114.1377219	Deep Monitoring Well	CFMW-045a	Shallow Soil	0.5-2	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3901004	-114.1377219	Deep Monitoring Well	CFMW-045a	Surface Soil	0-0.5	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3901004	-114.1377219	Deep Monitoring Well	CFMW-045a	Vadose Soil	10-12	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3901048	-114.1375639	Water Table Monitoring Well	CFMW-045	Groundwater	Not Applicable	Rectifier Yards	Downgradient of Rectifier Yards and Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.39325318	-114.1417749	Existing Monitoring Well	CFMW-044b	Groundwater	Not Applicable	Main Plant Area	West of Main Plant, downgradient of multiple Site features	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3935005	-114.1417816	Deep Monitoring Well	CFMW-044a	Beneath Water Table Soil	5 ft below wt	West Percolation Pond	Downgradient of West Percolation Pond	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3935005	-114.1417816	Deep Monitoring Well	CFMW-044a	Groundwater	Not Applicable	West Percolation Pond	Downgradient of West Percolation Pond, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3935005	-114.1417816	Deep Monitoring Well	CFMW-044a	Shallow Soil	0.5-2	West Percolation Pond	Downgradient of West Percolation Pond	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3935005	-114.1417816	Deep Monitoring Well	CFMW-044a	Surface Soil	0-0.5	West Percolation Pond	Downgradient of West Percolation Pond	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3935005	-114.1417816	Deep Monitoring Well	CFMW-044a	Vadose Soil	10-12	West Percolation Pond	Downgradient of West Percolation Pond	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39370165	-114.1417074	Existing Monitoring Well	CFMW-044	Groundwater	Not Applicable	West Percolation Pond	Downgradient of West Percolation Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3938103	-114.1400928	Water Table Monitoring Well	CFMW-043	Groundwater	Not Applicable	West Percolation Pond	Between West Percolation Pond and Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3938103	-114.1400928	Water Table Monitoring Well	CFMW-043	Shallow Soil	0.5-2	West Percolation Pond	Between West Percolation Pond and Main Plant	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3938103	-114.1400928	Water Table Monitoring Well	CFMW-043	Surface Soil	0-0.5	West Percolation Pond	Between West Percolation Pond and Main Plant	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3938103	-114.1400928	Water Table Monitoring Well	CFMW-043	Vadose Soil	10-12	West Percolation Pond	Between West Percolation Pond and Main Plant	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3916116	-114.1389099	Water Table Monitoring Well	CFMW-042	Groundwater	Not Applicable	Main Plant Area	Downgradient of Main Plant	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3916116	-114.1389099	Water Table Monitoring Well	CFMW-042	Shallow Soil	0.5-2	Main Plant Area	Downgradient of Main Plant	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3916116	-114.1389099	Water Table Monitoring Well	CFMW-042	Surface Soil	0-0.5	Main Plant Area	Downgradient of Main Plant	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3916116	-114.1389099	Water Table Monitoring Well	CFMW-042	Vadose Soil	10-12	Main Plant Area	Downgradient of Main Plant	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3912110	-114.1368880	Water Table Monitoring Well	CFMW-040	Groundwater	Not Applicable	Rectifier Yards	Within Western Rectifier Yard	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3912110	-114.1368880	Water Table Monitoring Well	CFMW-040	Shallow Soil	0.5-2	Rectifier Yards	Within Western Rectifier Yard	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3912110	-114.1368880	Water Table Monitoring Well	CFMW-040	Surface Soil	0-0.5	Rectifier Yards	Within Western Rectifier Yard	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3912110	-114.1368880	Water Table Monitoring Well	CFMW-040	Vadose Soil	10-12	Rectifier Yards	Within Western Rectifier Yard	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913430	-114.1322880	Water Table Monitoring Well	CFMW-038	Groundwater	Not Applicable	Rectifier Yards	Within Eastern Rectifier Yard	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3913430	-114.1322880	Water Table Monitoring Well	CFMW-038	Shallow Soil	0.5-2	Rectifier Yards	Within Eastern Rectifier Yard	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913430	-114.1322880	Water Table Monitoring Well	CFMW-038	Surface Soil	0-0.5	Rectifier Yards	Within Eastern Rectifier Yard	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3913430	-114.1322880	Water Table Monitoring Well	CFMW-038	Vadose Soil	10-12	Rectifier Yards	Within Eastern Rectifier Yard	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3917779	-114.1297773	Water Table Monitoring Well	CFMW-037	Groundwater	Not Applicable	Main Plant Area	East of Main Plant, near railway	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3917779	-114.1297773	Water Table Monitoring Well	CFMW-037	Shallow Soil	0.5-2	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3917779	-114.1297773	Water Table Monitoring Well	CFMW-037	Surface Soil	0-0.5	Main Plant Area	East of Main Plant, near railway	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3917779	-114.1297773	Water Table Monitoring Well	CFMW-037	Vadose Soil	10-12	Main Plant Area	East of Main Plant, near railway	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.38735658	-114.1321917	Existing Monitoring Well	CFMW-036	Groundwater	Not Applicable	South Percolation Ponds	Downgradient of South Percolation Ponds	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3950454	-114.1307552	Water Table Monitoring Well	CFMW-035	Groundwater	Not Applicable	Main Plant Area	North of Main Plant boundary	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3950454	-114.1307552	Water Table Monitoring Well	CFMW-035	Shallow Soil	0.5-2	Main Plant Area	North of Main Plant boundary	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3950454	-114.1307552	Water Table Monitoring Well	CFMW-035	Surface Soil	0-0.5	Main Plant Area	North of Main Plant boundary	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3950454	-114.1307552	Water Table Monitoring Well	CFMW-035	Vadose Soil	10-12	Main Plant Area	North of Main Plant boundary	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3951475	-114.1352509	Water Table Monitoring Well	CFMW-034	Groundwater	Not Applicable	Fueling Area	Near fueling area	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3951475	-114.1352509	Water Table Monitoring Well	CFMW-034	Shallow Soil	0.5-2	Fueling Area	Near fueling area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3951475	-114.1352509	Water Table Monitoring Well	CFMW-034	Surface Soil	0-0.5	Fueling Area	Near fueling area	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3951475	-114.1352509	Water Table Monitoring Well	CFMW-034	Vadose Soil	10-12	Fueling Area	Near fueling area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3953081	-114.1384582	Water Table Monitoring Well	CFMW-033	Groundwater	Not Applicable	Paste Plant	Downgradient of Site features, west of Paste Plant and Raw Materials area	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3953081	-114.1384582	Water Table Monitoring Well	CFMW-033	Shallow Soil	0.5-2	Paste Plant	Downgradient of Site features, west of Paste Plant and Raw Materials area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3953081	-114.1384582	Water Table Monitoring Well	CFMW-033	Surface Soil	0-0.5	Paste Plant	Downgradient of Site features, west of Paste Plant and Raw Materials area	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3953081	-114.1384582	Water Table Monitoring Well	CFMW-033	Vadose Soil	10-12	Paste Plant	Downgradient of Site features, west of Paste Plant and Raw Materials area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3958384	-114.1324922	Deep Monitoring Well	CFMW-032a	Beneath Water Table Soil	5 ft below wt	Raw Materials Loading/Unloading	Center of Site, near Raw Materrals Loading/Unloading Area	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3958384	-114.1324922	Deep Monitoring Well	CFMW-032a	Groundwater	Not Applicable	Raw Materials Loading/Unloading	Center of Site, near Raw Materrals Loading/Unloading Area, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3958384	-114.1324922	Deep Monitoring Well	CFMW-032a	Shallow Soil	0.5-2	Raw Materials Loading/Unloading	Center of Site, near Raw Materrals Loading/Unloading Area	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3958384	-114.1324922	Deep Monitoring Well	CFMW-032a	Surface Soil	0-0.5	Raw Materials Loading/Unloading	Center of Site, near Raw Materrals Loading/Unloading Area	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3958384	-114.1324922	Deep Monitoring Well	CFMW-032a	Vadose Soil	10-12	Raw Materials Loading/Unloading	Center of Site, near Raw Materrals Loading/Unloading Area	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3958133	-114.1327347	Water Table Monitoring Well	CFMW-032	Groundwater	Not Applicable	Raw Materials Loading/ Unloading	Near raw materials loading and unloading area	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3960876	-114.1377391	Existing Monitoring Well	CFMW-031	Groundwater	Not Applicable	North-East Percolation Pond	Downgradient of North-East Percolation Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3968066	-114.1349070	Water Table Monitoring Well	CFMW-029	Groundwater	Not Applicable	North-East Percolation Pond	Downgradient of Site features, east of North-East Percolation Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3963521	-114.1364367	Deep Monitoring Well	CFMW-028a	Beneath Water Table Soil	5 ft below wt	North-East Percolation Pond	Downgradient of North-East Percolation Pond	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3963521	-114.1364367	Deep Monitoring Well	CFMW-028a	Groundwater	Not Applicable	North-East Percolation Pond	Downgradient of North-East Percolation Pond, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3963521	-114.1364367	Deep Monitoring Well	CFMW-028a	Shallow Soil	0.5-2	North-East Percolation Pond	Downgradient of North-East Percolation Pond	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3963521	-114.1364367	Deep Monitoring Well	CFMW-028a	Surface Soil	0-0.5	North-East Percolation Pond	Downgradient of North-East Percolation Pond	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3963521	-114.1364367	Deep Monitoring Well	CFMW-028a	Vadose Soil	10-12	North-East Percolation Pond	Downgradient of North-East Percolation Pond	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3963699	-114.1366135	Water Table Monitoring Well	CFMW-028	Groundwater	Not Applicable	North-East Percolation Pond	Downgradient of North-East Percolation Pond and Influent Ditch	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3969834	-114.1402442	Water Table Monitoring Well	CFMW-027	Groundwater	Not Applicable	Overflow Ditch	Center of Overflow Ditch	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3969834	-114.1402442	Water Table Monitoring Well	CFMW-027	Shallow Soil	0.5-2	Overflow Ditch	Center of Overflow Ditch	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3969834	-114.1402442	Water Table Monitoring Well	CFMW-027	Surface Soil	0-0.5	Overflow Ditch	Center of Overflow Ditch	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3969834	-114.1402442	Water Table Monitoring Well	CFMW-027	Vadose Soil	10-12	Overflow Ditch	Center of Overflow Ditch	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3966481	-114.1440295	Water Table Monitoring Well	CFMW-026	Groundwater	Not Applicable	North-West Percolation Pond	Downgradient of North-West Percolation Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3966481	-114.1440295	Water Table Monitoring Well	CFMW-026	Shallow Soil	0.5-2	North-West Percolation Pond	Downgradient of North-West Percolation Pond	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3966481	-114.1440295	Water Table Monitoring Well	CFMW-026	Surface Soil	0-0.5	North-West Percolation Pond	Downgradient of North-West Percolation Pond	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3966481	-114.1440295	Water Table Monitoring Well	CFMW-026	Vadose Soil	10-12	North-West Percolation Pond	Downgradient of North-West Percolation Pond	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39671254	-114.1455303	Existing Monitoring Well	CFMW-025b	Groundwater	Not Applicable	Norht-West Percolation Pond	Downgradient of North-West Percolation Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3965192	-114.1455214	Deep Monitoring Well	CFMW-025a	Beneath Water Table Soil	5 ft below wt	North-West Percolation Pond	Downgradient of North-West Percolation Pond	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3965192	-114.1455214	Deep Monitoring Well	CFMW-025a	Groundwater	Not Applicable	North-West Percolation Pond	Downgradient of North-West Percolation Pond, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3965192	-114.1455214	Deep Monitoring Well	CFMW-025a	Shallow Soil	0.5-2	North-West Percolation Pond	Downgradient of North-West Percolation Pond	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3965192	-114.1455214	Deep Monitoring Well	CFMW-025a	Surface Soil	0-0.5	North-West Percolation Pond	Downgradient of North-West Percolation Pond	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3965192	-114.1455214	Deep Monitoring Well	CFMW-025a	Vadose Soil	10-12	North-West Percolation Pond	Downgradient of North-West Percolation Pond	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39630894	-114.1455303	Existing Monitoring Well	CFMW-025	Groundwater	Not Applicable	North-West Percolation Pond	Downgradient of North-West Percolation Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3975084	-114.1295196	Deep Monitoring Well	CFMW-023a	Beneath Water Table Soil	5 ft below wt	South Leachate Pond	Downgradient of South Leachate Pond	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3975084	-114.1295196	Deep Monitoring Well	CFMW-023a	Groundwater	Not Applicable	South Leachate Pond	Downgradient of South Leachate Pond, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3975084	-114.1295196	Deep Monitoring Well	CFMW-023a	Shallow Soil	0.5-2	South Leachate Pond	Downgradient of South Leachate Pond	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3975084	-114.1295196	Deep Monitoring Well	CFMW-023a	Surface Soil	0-0.5	South Leachate Pond	Downgradient of South Leachate Pond	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3975084	-114.1295196	Deep Monitoring Well	CFMW-023a	Vadose Soil	10-12	South Leachate Pond	Downgradient of South Leachate Pond	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.39755525	-114.1296105	Existing Monitoring Well	CFMW-023	Groundwater	Not Applicable	South Leachate Pond	Downgradient of South Leachate Pond, near Cedar Creek Overflow Drainage	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3972938	-114.1314076	Water Table Monitoring Well	CFMW-022	Groundwater	Not Applicable	East Landfill	Downgradient of East Landfill and South Leachate Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3972938	-114.1314076	Water Table Monitoring Well	CFMW-022	Shallow Soil	0.5-2	East Landfill	Downgradient of East Landfill and South Leachate Pond	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3972938	-114.1314076	Water Table Monitoring Well	CFMW-022	Surface Soil	0-0.5	East Landfill	Downgradient of East Landfill and South Leachate Pond	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3972938	-114.1314076	Water Table Monitoring Well	CFMW-022	Vadose Soil	10-12	East Landfill	Downgradient of East Landfill and South Leachate Pond	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39757524	-114.1340501	Existing Monitoring Well	CFMW-021	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.39832851	-114.1330331	Existing Monitoring Well	CFMW-020	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Downgradient of Center Landfill, near Wet Scrubber Sludge Pond boundary	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3979796	-114.1357551	Deep Monitoring Well	CFMW-019a	Beneath Water Table Soil	5 ft below wt	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3979796	-114.1357551	Deep Monitoring Well	CFMW-019a	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3979796	-114.1357551	Deep Monitoring Well	CFMW-019a	Shallow Soil	0.5-2	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3979796	-114.1357551	Deep Monitoring Well	CFMW-019a	Surface Soil	0-0.5	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3979796	-114.1357551	Deep Monitoring Well	CFMW-019a	Vadose Soil	10-12	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.39797883	-114.1358577	Existing Monitoring Well	CFMW-019	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3987951	-114.1305623	Water Table Monitoring Well	CFMW-018	Groundwater	Not Applicable	East Landfill	Downgradient of East landfill	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3987951	-114.1305623	Water Table Monitoring Well	CFMW-018	Shallow Soil	0.5-2	East Landfill	Downgradient of East landfill	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3987951	-114.1305623	Water Table Monitoring Well	CFMW-018	Surface Soil	0-0.5	East Landfill	Downgradient of East landfill	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3987951	-114.1305623	Water Table Monitoring Well	CFMW-018	Vadose Soil	10-12	East Landfill	Downgradient of East landfill	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.39905441	-114.1321299	Existing Monitoring Well	CFMW-017	Groundwater	Not Applicable	Center Landfill	Center of landfill	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3989530	-114.1330218	Deep Monitoring Well	CFMW-016a	Beneath Water Table Soil	5 ft below wt	Center Landfill	Downgradient of Center Landfill, near Wet Scrubber Sludge Pond boundary	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3989530	-114.1330218	Deep Monitoring Well	CFMW-016a	Groundwater	Not Applicable	Center Landfill	Downgradient of Center Landfill, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3989530	-114.1330218	Deep Monitoring Well	CFMW-016a	Shallow Soil	0.5-2	Center Landfill	Downgradient of Center Landfill, near Wet Scrubber Sludge Pond boundary	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3989530	-114.1330218	Deep Monitoring Well	CFMW-016a	Surface Soil	0-0.5	Center Landfill	Downgradient of Center Landfill, near Wet Scrubber Sludge Pond boundary	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3989530	-114.1330218	Deep Monitoring Well	CFMW-016a	Vadose Soil	10-12	Center Landfill	Downgradient of Center Landfill, near Wet Scrubber Sludge Pond boundary	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3988731	-114.1329811	Water Table Monitoring Well	CFMW-016	Groundwater	Not Applicable	Center Landfill	Downgradient of Center Landfill, near Wet Scrubber Sludge Pond boundary	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.39840741	-114.1371348	Existing Monitoring Well	CFMW-015	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.39882099	-114.1374502	Existing Monitoring Well	CFMW-014	Groundwater	Not Applicable	Hazardous Waste Drum Storage Area	Downgradient of Hazardous Waste Drum Storage Area	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3992252	-114.1364295	Deep Monitoring Well	CFMW-012a	Beneath Water Table Soil	5 ft below wt	Wet Scrubber Sludge Pond	Between Wet Scrubber Sludge Pond and Drum Storage Area	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3992252	-114.1364295	Deep Monitoring Well	CFMW-012a	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Between Wet Scrubber Sludge Pond and Drum Storage Area, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3992252	-114.1364295	Deep Monitoring Well	CFMW-012a	Shallow Soil	0.5-2	Wet Scrubber Sludge Pond	Between Wet Scrubber Sludge Pond and Drum Storage Area	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3992252	-114.1364295	Deep Monitoring Well	CFMW-012a	Surface Soil	0-0.5	Wet Scrubber Sludge Pond	Between Wet Scrubber Sludge Pond and Drum Storage Area	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.3992252	-114.1364295	Deep Monitoring Well	CFMW-012a	Vadose Soil	10-12	Wet Scrubber Sludge Pond	Between Wet Scrubber Sludge Pond and Drum Storage Area	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.39933241	-114.1364297	Existing Monitoring Well	CFMW-012	Groundwater	Not Applicable	Wet Scrubber Sludge Pond	Downgradient of Wet Scrubber Sludge Pond	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3990204	-114.1398362	Deep Monitoring Well	CFMW-011a	Beneath Water Table Soil	5 ft below wt	North-West Percolation Pond	Downgradient of multiple Site features in center of Site	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3990204	-114.1398362	Deep Monitoring Well	CFMW-011a	Groundwater	Not Applicable	North-West Percolation Pond	Downgradient of multiple Site features in center of Site, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.3990204	-114.1398362	Deep Monitoring Well	CFMW-011a	Shallow Soil	0.5-2	North-West Percolation Pond	Downgradient of multiple Site features in center of Site	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3990204	-114.1398362	Deep Monitoring Well	CFMW-011a	Surface Soil	0-0.5	North-West Percolation Pond	Downgradient of multiple Site features in center of Site	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3990204	-114.1398362	Deep Monitoring Well	CFMW-011a	Vadose Soil	10-12	North-West Percolation Pond	Downgradient of multiple Site features in center of Site	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.3990343	-114.1396656	Water Table Monitoring Well	CFMW-011	Groundwater	Not Applicable	Hazardous Waste Drum Storage Area	Downgradient of multiple Site features in center of Site	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3994740	-114.1371170	Water Table Monitoring Well	CFMW-010	Groundwater	Not Applicable	Hazardous Waste Drum Storage Area	Within Hazardous Waste Drum Storage Area	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.3994740	-114.1371170	Water Table Monitoring Well	CFMW-010	Shallow Soil	0.5-2	Hazardous Waste Drum Storage Area	Within Hazardous Waste Drum Storage Area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3994740	-114.1371170	Water Table Monitoring Well	CFMW-010	Surface Soil	0-0.5	Hazardous Waste Drum Storage Area	Within Hazardous Waste Drum Storage Area	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.3994740	-114.1371170	Water Table Monitoring Well	CFMW-010	Vadose Soil	10-12	Hazardous Waste Drum Storage Area	Within Hazardous Waste Drum Storage Area	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48.4007800	-114.1327431	Deep Monitoring Well	CFMW-008a	Beneath Water Table Soil	5 ft below wt	Sanitary Landfill	Downgradient of Sanitary Landfill, bordering Cedar Creek Reservoir Overflow Drainage	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.4007800	-114.1327431	Deep Monitoring Well	CFMW-008a	Groundwater	Not Applicable	Sanitary Landfill	Downgradient of Sanitary Landfill, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0

Table 1. Proposed Phase I Site Characterization Sampling
Columbia Falls Aluminum Company, Montana

Latitude	Longitude	Location Type	Proposed Sample ID	Sample Type	Sample Interval	Closest Site Feature	Location Rationale	Soil TCL VOCS 8260	Soil TCL SVOCs 8270	Soil TAL Metals 6010	Soil TCL PCBs 8082	Soil TCL Pesticides 8081	Soil Total Cyanide 9012	Soil Fluoride 300	Soil PCDD/ PCDF 8290	Grain Size Analysis/ bulk density/ moisture content	Total Organic Carbon	AQ TCL VOCS 8260	AQ TCL SVOCs 8270	AQ TAL Metals EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TAL Metals Dissolved EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	AQ TCL PCBs 8082	AQ TCL Pesticides 8081	AQ Total Cyanide 335.4	AQ General Chemistry 300, SM2320B, SM2340B	AQ Nutrients 300, 350.1, 353.2, 365.1, SM2540B/C	SV TCL VOCS 8260	Methane/VOC Screening Only
48.4007800	-114.1327431	Deep Monitoring Well	CFMW-008a	Shallow Soil	0.5-2	Sanitary Landfill	Downgradient of Sanitary Landfill, bordering Cedar Creek Reservoir Overflow Drainage	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.4007800	-114.1327431	Deep Monitoring Well	CFMW-008a	Surface Soil	0-0.5	Sanitary Landfill	Downgradient of Sanitary Landfill, bordering Cedar Creek Reservoir Overflow Drainage	0	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.4007800	-114.1327431	Deep Monitoring Well	CFMW-008a	Vadose Soil	10-12	Sanitary Landfill	Downgradient of Sanitary Landfill, bordering Cedar Creek Reservoir Overflow Drainage	1	1	1	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.40086961	-114.1329061	Existing Monitoring Well	CFMW-008	Groundwater	Not Applicable	Sanitary Landfill	Downgradient of Sanitary Landfill	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.40019388	-114.1367884	Existing Monitoring Well	CFMW-007	Groundwater	Not Applicable	West Landfill	Downgradient of West Landfill	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.4032423	-114.1431040	Deep Monitoring Well	CFMW-003a	Beneath Water Table Soil	5 ft below wt	Industrial Landfill	Downgradient of Industrial Landfill	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48.4032423	-114.1431040	Deep Monitoring Well	CFMW-003a	Groundwater	Not Applicable	Industrial Landfill	Downgradient of Industrial Landfill, hydrogeologic characterization	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
48.4032423	-114.1431040	Deep Monitoring Well	CFMW-003a	Shallow Soil	0.5-2	Industrial Landfill	Downgradient of Industrial Landfill	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.4032423	-114.1431040	Deep Monitoring Well	CFMW-003a	Surface Soil	0-0.5	Industrial Landfill	Downgradient of Industrial Landfill	0	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.4032423	-114.1431040	Deep Monitoring Well	CFMW-003a	Vadose Soil	10-12	Industrial Landfill	Downgradient of Industrial Landfill	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
48.4033419	-114.1429711	Water Table Monitoring Well	CFMW-003	Groundwater	Not Applicable	Industrial Landfill	Downgradient of Industrial Landfill	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	1	0	0
48.40772031	-114.1410191	Existing Monitoring Well	CFMW-001	Groundwater	Not Applicable	Industrial Landfill	Background, upgradient of Site features	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0
TBD	TBD	Incremental Soil Sample	CFISS-043	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-043	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-042	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-042	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-041	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-041	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-040	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-040	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-039	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-039	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-038	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-038	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-037	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-037	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-036	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-036	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-035	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-035	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-034	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-034	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-033	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-033	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-032	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-032	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-031	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-031	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-030	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-030	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-029	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-029	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-028	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-028	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-027	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-027	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-026	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-026	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-025	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-025	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-024	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-024	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-023	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-023	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-022	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-022	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-021	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-021	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-020	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-020	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-019	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-019	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-018	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-018	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-017	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-017	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-016	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-016	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-015	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-015	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-014	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-014	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-013	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-013	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-012	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-012	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-011	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-011	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-010	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-010	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-009	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-009	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-008	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-008	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-007	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-007	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-006	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-006	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-005	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-005	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-004	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-004	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-003	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-003	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-002	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-002	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-001	Composite Shallow Soil	0.5-2	Operational Grid	Incremental sampling across operational area of Site	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Incremental Soil Sample	CFISS-001	Composite Surface Soil	0-0.5	Operational Grid	Incremental sampling across operational area of Site	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-013	Drywell Soil	10-12	Drywell	Characterize conditions beneath drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-012	Drywell Soil	10-12	Drywell	Characterize conditions beneath drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-011	Drywell Soil	10-12	Drywell	Characterize conditions beneath drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-010	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-009	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-008	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-007	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-006	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-005	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-004	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-003	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-002	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TBD	TBD	Drywell Sample	CFDW-001	Drywell Soil	10-12	Drywell	Characterize conditions within drywell	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTES
1) Sample coordinates determined using GIS from georeferenced photo. Coordinates in NAD 1983 State Plane, Montana FIPS 2500 Feet Intl. Coordinates displayed in decimal degree units.
2) Proposed samples and locations may be modified based upon results of Site reconnaissance and results of pre-intrusive field activities (i.e., soil-gas investigation, geophysical survey)

Table 2. Summary of Field Quality Control Samples and Frequency
Columbia Falls Aluminum Company, Columbia Falls, Montana

Field QC Sample Type	Sample Media	Minimum Collection Frequency	Analyses to be Performed	Acceptance Criteria	Corrective Action
Trip Blank	Water Samples	1 per cooler of samples for VOC analyses	VOC analyses	Non-detect (<RL) for all target analytes	Qualify results of analyte(s) in samples associated with trip blank (same cooler) according to EPA data validation guidance
	Solid Samples		VOC analyses	Non-detect (<RL) for all target analytes	
Equipment Rinsate Blank	Water Samples	1 per sampling team per day	metals, cyanide, general chemistry and anion analyses	Non-detect (<RL) for all target analytes	Qualify results of analyte(s) in samples associated with equipment rinsate blank (same day, same team) according to EPA data validation guidance
	Solid Samples		VOC, SVOC, pesticide, PCB, metals and cyanide, and fluoride analyses	Non-detect (<RL) for all target analytes	
Field Blank	Surface Water Samples	1 per 20 field samples (5%)	metals, cyanide, general chemistry and anion analyses	Non-detect (<RL) for all target analytes	Qualify results of analyte(s) in samples associated with field blank (surface water samples) according to EPA data validation guidance
Field Duplicate	Water Samples	1 per 20 field samples (5%)	metals, cyanide, general chemistry and anion analyses	≤30% RPD for target analytes	Qualify results of analyte(s) in both parent and field duplicate samples
	Solid Samples		VOC, SVOC, pesticide, PCB, metals, cyanide, and fluoride analyses	≤50% RPD for target analytes	

Notes:
RL: reporting limit
RPD: relative percent difference

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 6010 Metals by Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES)	Initial calibration (a blank and at least five calibration standards)	Each time the instrument is set up and after CCV failure	• Correlation coefficient (r) ≥0.995	• Recalibrate instrument
	Interference check standard (ICS)	Beginning of sample analysis sequence	• Results within ±20% of true value	• Terminate analysis and recalibrate instrument
	Initial calibration verification (ICV) (independent source standard)	Immediately after initial calibration	• Percent recovery (%R) within 90% - 110% of true value	• Terminate analysis and recalibrate instrument
	Continuing calibration verification (CCV) (mid-level standard)	Every two hours, and at beginning and end of analytical sequence	• %R within 90% - 110% of true value	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Calibration blanks - Initial calibration blank (ICB), Continuing calibration blank (CCB)	ICB analyzed after initial calibration verification; CCB analyzed at the beginning of analytical sequence, after every CCV, and after last CCV.	• < reporting limit (RL)	• Reanalyze blank • Clean system • Reanalyze samples back to the last compliant blank
	Method blank	1 per preparation batch (≤20 samples)	• < RL	• Reanalyze method blank • Reprep/reanalyze affected samples as appropriate
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value • Relative percent difference (RPD) ≤20% between MS and MSD results • %R and RPD criteria do not apply when sample concentration ≥4x the spike added	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory duplicate	1 per preparation batch (≤20 samples)	• RPD ≤20% between original and duplicate sample results that are ≥ 5x the RLs	• Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value	• Reanalyze LCS • Reprep/reanalyze LCS and affected samples • Narrate all exceedances
	Post-digestion spike	When MS recovery falls outside control limits and sample result is < 4x the spike added	• %R within ±25% of actual value • (An aliquot of the remaining unspiked sample shall be spiked at 2x the indigenous level)	• Narrate all exceedances
	Serial dilution	1 per preparation batch (≤20 samples)	• Percent difference (%D) ≤10% for sample concentrations >50x the method detection limits (MDLs)	• Matrix interference effect should be suspected • Narrate all exceedances

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Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 6020 Metals by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	Tuning solution	Prior to initial calibration, scan the tuning solution at least 5x consecutively	• Percent relative standard deviation (%RSD) of absolute signals for all analytes ≤5%	• Recalibrate instrument
	Initial calibration (a blank and at least five calibration standards)	Each time the instrument is set up and after CCV failure	• Correlation coefficient (r) ≥0.995	• Recalibrate instrument
	Initial calibration verification (ICV) (independent source standard)	Immediately after initial calibration	• Percent recovery (%R) within 90% - 110% of true value	• Terminate analysis and recalibrate instrument
	Continuing calibration verification (CCV) (mid-level standard)	Every two hours, and at beginning and end of analytical sequence	• %R within 90% - 110% of true value	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Interference check standard (ICS)	Beginning of sample analysis sequence	• Results within ±20% of true value	• Terminate analysis and recalibrate instrument
	Internal Standards (IS)	All samples analyzed during an analytical sequence, with the exception of the tuning solution	• Percent relative intensity (%RI) within 60% - 125% of the response in the calibration blank	• Reanalyze affected sample
	Calibration blanks - Initial calibration blank (ICB), Continuing calibration blank (CCB)	ICB analyzed after initial calibration verification; CCB analyzed at the beginning of analytical sequence, after every CCV, and after last CCV	• < RL	• Reanalyze blank • Clean system • Reanalyze samples back to the last compliant blank
	Method blank	1 per preparation batch (≤20 samples)	• < RL	• Reanalyze method blank. • Reprep/reanalyze affected samples as appropriate
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value • RPD ≤20% between MS and MSD results • %R and RPD criteria do not apply when sample concentration ≥4x the spike added	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory duplicate	1 per preparation batch (≤20 samples)	• RPD ≤20% between original and duplicate sample results that are ≥ 5x the RLs	• Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value	• Reanalyze LCS • Reprep/reanalyze LCS and affected samples • Narrate all exceedances
	Post-digestion spike	When MS recovery falls outside control limits and sample result is < 4x the spike added	• %R within ±25% of actual value • (An aliquot of the remaining unspiked sample shall be spiked at 2x the indigenous level)	• Narrate all exceedances
	Serial dilution	1 per preparation batch (≤20 samples)	• Percent difference (%D) ≤10% for sample concentrations >50x the MDLs	• Matrix interference effect should be suspected • Narrate all exceedances

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Methods 7470A/7471A Mercury by Cold-Vapor Atomic Absorption	Initial calibration (a blank and at least five calibration standards)	Daily, and each time the instrument is set up	• Correlation coefficient (r) ≥0.995	• Recalibrate instrument
	Initial calibration verification (ICV) (independent source standard)	Immediately after initial calibration	• %R within 85% - 115% of true value	• Terminate analysis and recalibrate instrument
	Continuing calibration verification (CCV) (mid-level standard)	Every hour, and at beginning and end of analytical sequence	• %R within 85% - 115% of true value	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Calibration blanks - Initial calibration blank (ICB), Continuing calibration blank (CCB)	ICB analyzed after initial calibration verification; CCB analyzed at the beginning of analytical sequence, after every CCV, and after last CCV.	• < RL	• Reanalyze blank • Clean system • Reanalyze samples back to the last compliant blank
	Method blank	1 per preparation batch (≤20 samples)	• < RL	• Reanalyze method blank. • Reprep/reanalyze affected samples as appropriate
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value	• Reanalyze LCS • Reprep/reanalyze LCS and affected samples • Narrate all exceedances
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value, • RPD ≤20% between MS and MSD results • %R and RPD criteria do not apply when sample concentration ≥4x the spike added	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory duplicate	1 per preparation batch (≤20 samples)	• RPD ≤20% between original and duplicate sample results that are ≥ 5x the RLs	• Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 8260B Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC/MS)	Instrument performance check (using 4-bromofluorobenzene (BFB) standard)	Every 12 hours	• Must meet ion abundance criteria established by method	• Retune instrument • Repeat standard analysis
	Initial calibration (5 point minimum)	At beginning of each analytical sequence, or as necessary if CCV criteria are not met	• Relative response factors (RRFs) must meet criteria established by method (≥0.010 or ≥0.050 depending on compound); • %RSD of the RRFs must meet criteria established by method (≤40% or ≤30% depending on compound)	• Recalibrate instrument
	Continuing calibration verification (CCV)	Every 12 hours	• RRFs must meet criteria established by method (≥0.010 or ≥0.050 depending on compound); • %D between the average initial calibration RRF and CCV RRF must meet criteria established by method (≤40% or ≤30% depending on compound)	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Internal standards (IS)	All project samples, method blank, LCS, and MS/MSD	• Retention time (RT) for each IS within ±20 seconds of RT of IS in the associated CCV; • IS area counts for all samples must not vary more than ±40% from the associated CCV	• Reanalyze sample • If still not in compliance, re-extract/reanalyze sample • Narrate all exceedances
	Method blank	1 per preparation batch (≤20 samples)	• < RL	• Reanalyze method blank. • Re-extract/reanalyze affected samples as appropriate
	Surrogate spike	All project samples, method blank, LCS, and MS/MSD	• Recoveries of surrogates within control limits established by the selected laboratory	• Reanalyze sample • Re-extract and reanalyze if recoveries of more than one surrogates outside control limits • If still out, report both sets of data • Narrate all exceedances
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• Recoveries of target compounds in MS/MSD and RPDs between MS and MSD results within control limits established by the selected laboratory	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Re-extract/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• Recoveries of target compounds in LCS within control limits established by the selected laboratory	• Reanalyze LCS • Re-extract/reanalyze LCS and affected samples • Narrate all exceedances
	Target Compound Identification	All project samples, method blank, LCS, and MS/MSD	• Relative retention times (RRTs) must be within ±0.06 RRT units of standard RRT; • Mass spectra of the sample compound and a current laboratory-generated standard must match according to the criteria established by the method	• Reanalyze sample • Narrate all exceedances

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Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 8270D Semi-Volatile Organic Compounds (SVOCs) by Gas Chromatography/Mass Spectrometry (GC/MS)	Instrument performance check (decafluorotriphenylphosphine (DFTPP) standard)	Every 12 hours	• Must meet ion abundance criteria established by method	• Retune instrument • Repeat standard analysis
	Initial calibration 5 point minimum)	At beginning of each analytical sequence, or as necessary if CCV criteria are not met	• Relative response factors (RRFs) must meet criteria established by method (≥0.010 or ≥0.050 depending on compound); • %RSD of the RRFs must meet criteria established by method (≤40% or ≤20% depending on compound)	• Recalibrate instrument
	Continuing calibration verification (CCV)	Every 12 hours	• RRFs must meet criteria established by method (≥0.010 or ≥0.050 depending on compound); • %D between the average initial calibration RRF and CCV RRF must meet criteria established by method (≤40% or ≤25% depending on compound)	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Internal standards (IS)	All project samples, method blank, LCS, and MS/MSD	• Retention time (RT) for each IS within ±30 seconds of RT of IS in the associated CCV; • IS area counts for all samples must within 50% - 200% of the area counts in the associated CCV	• Reanalyze sample • If still not in compliance, re-extract/reanalyze sample • Narrate all exceedances
	Method blank	1 per preparation batch (≤20 samples)	• < RL	• Reanalyze method blank. • Re-extract/reanalyze analytical batch as appropriate
	Surrogate spike	All project samples, method blank, LCS, and MS/MSD	• Recoveries of surrogates within control limits established by the selected laboratory	• Reanalyze sample • Re-extract and reanalyze if recoveries of more than one surrogates are out • If still out, report both sets of data • Narrate all exceedances
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• Recoveries of target compounds in MS/MSD and RPDs between MS and MSD results within control limits established by the selected laboratory	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Re-extract/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• Recoveries of target compounds in LCS within control limits established by the selected laboratory	• Reanalyze LCS • Re-extract/reanalyze LCS and affected samples • Narrate all exceedances
	Target Compound Identification	All project samples, method blank, LCS, and MS/MSD	• Relative retention times (RRTs) must be within ±0.06 RRT units of standard RRT; • Mass spectra of the sample compound and a current laboratory-generated standard must match according to the criteria established by the method	• Reanalyze sample • Narrate all exceedances

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 8082A Polychlorinated biphenyls (PCBs) by Gas Chromatography	Initial calibration	At beginning of each analytical sequence, or as necessary if CCV criteria are not met	• %RSD <20% for calibration factors (CFs) of the three to five major peaks of each Aroclor; • Five-point calibration using Aroclors 1016 and 1260 to demonstrate linearity; • The other seven Aroclors are calibrated at a single mid-point for pattern recognition	• Recalibrate instrument
	Continuing calibration verification (CCV)	Every 12 hours, and at beginning and end of analytical sequence	• % D ≤15% for CF of Aroclor peaks and surrogates compared with those from initial calibration; • Absolute retention time (RT) of Aroclors and surrogates must be within the RF windows determined from initial calibration	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Target Compound Identification	All project samples, method blank, LCS, and MS/MSD	• RTs of surrogates and detected Aroclors must be within calculated RT windows; • %D for detected Aroclor concentrations between the two GC columns must be within ±25%	• Reanalyze sample • Narrate all exceedances
	Blanks: Method blank (MB) Instrument blank (IB)	MB: 1 per preparation batch (≤20 samples); IB: immediately prior to each CCV, and at beginning and end of analytical sequence	• <RL	• Reanalyze blank • Re-extract /reanalyze blank and associated samples
	Surrogate spike (two surrogates: DCB and TCMX)	All project samples, method blank, LCS, and MS/MSD	• % R = 30% - 150%	• Reanalyze sample • Re-extract and reanalyze sample once if matrix is not a factor • If still out, report both sets of data • Narrate all exceedances
	Matrix spike (MS) and Matrix spike duplicate (MSD) (spike Aroclors 1016 and 1260)	1 per preparation batch (≤20 samples)	• %R for Aroclors 1016 and 1260: 29% -135%; • RPDs between MS and MSD results: ≤15% for Aroclor 1016 ≤20% for Aroclor 1260	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Re-extract/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• %R for Aroclors 1016 and 1260: 50% - 150%	• Reanalyze LCS • Re-extract/reanalyze LCS and affected samples • Narrate all exceedances

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Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 8081B Pesticides by Gas Chromatography	Performance evaluation mixture (PEM)	At beginning and end of the initial calibration sequence, and must bracket one end of each 12-hour analytical period	• Resolution between any two adjacent peaks in initial calibration and CCV PEMs ≥ 90% on each GC column; • Percent breakdown of 4,4'-DDD or Endrin ≤20% on each GC column; • Combined percent breakdown of 4,4'-DDD and Endrin ≤30% on each GC column	• Reanalyze PEM • Recalibrate instrument • Re-extract/reanalyze associated samples
	Initial calibration	At beginning of each analytical sequence, or as necessary if CCV criteria are not met	• %RSD ≤25% for calibration factors (CFs) of alpha-BHC and delta-BHC; • %RSD ≤30% for CFs of each Toxaphene peaks; • %RSD ≤20% for CFs of other compounds; • Initial calibration curve must be linear	• Recalibrate instrument
	Continuing calibration verification (CCV)	Every 12 hours, and at beginning and end of analytical sequence	• % D ≤20% for CFs of target compounds and surrogates compared with CFs from initial calibration; • Absolute retention times (RTs) of target compounds and surrogates must be within the RT windows determined from initial calibration	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Target Compound Identification	All project samples, method blank, LCS, and MS/MSD	• RTs of surrogates and detected target compounds must be within calculated RT windows; • %D for detected target compound concentrations between the two GC columns must be within ±25%	• Reanalyze sample • Narrate all exceedances
	Surrogate spike (DCB and TCMX)	All project samples, method blank, LCS, and MS/MSD	• % R = 30% - 150%	• Reanalyze sample • Re-extract and reanalyze sample once if matrix is not a factor • If still out, report both sets of data • Narrate all exceedances
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• Recoveries of target compounds in MS/MSD and RPDs between MS and MSD results within control limits established by the selected laboratory	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Re-extract/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• Recoveries of target compounds in LCS within control limits established by the selected laboratory	• Reanalyze LCS • Re-extract/reanalyze LCS and affected samples • Narrate all exceedances

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 335.4 **Cyanide by Colorimetric Method**	Initial calibration (a blank and at least five calibration standards)	Daily, and each time the instrument is set up	• Correlation coefficient (r) ≥0.995	• Recalibrate instrument
	Initial calibration verification (ICV) (independent source standard)	Immediately after initial calibration	• %R within 85% - 115% of true value	• Terminate analysis and recalibrate instrument
	Continuing calibration verification (CCV)	Every hour, and at beginning and end of analytical sequence	• %R within 85% - 115% of true value	• Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant CCV
	Calibration blanks - Initial calibration blank (ICB), Continuing calibration blank (CCB)	ICB analyzed after initial calibration verification; CCB analyzed at the beginning of analytical sequence, after every CCV, and after last CCV	• < RL	• Reanalyze blank • Clean system • Reanalyze samples back to the last compliant blank
	Method blank	1 per preparation batch (≤20 samples)	• < RL	• Reanalyze method blank • Reprep/reanalyze analytical batch as appropriate
	Laboratory control sample (LCS)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value	• Reanalyze LCS • Reprep/reanalyze LCS and affected samples • Narrate all exceedances
	Matrix spike (MS) and Matrix spike duplicate (MSD)	1 per preparation batch (≤20 samples)	• %R within ±25% of actual value, • RPD ≤20% between MS and MSD results • %R and RPD criteria do not apply when sample concentration ≥4x the spike added	• If LCS recoveries are within acceptance criteria, matrix interference may be suspected • Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances
	Laboratory duplicate	1 per preparation batch (≤20 samples)	• RPD ≤20% between original and duplicate sample results that are ≥ 5x the RLs	• Reprep/reanalyze once if matrix is not a factor • Narrate all exceedances

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 300.0 Inorganic Anions by Ion Chromatography (Fluoride, Chloride, and Sulfate)	Initial calibration (a blank and at least three concentration levels)	Must be verified each working day, or whenever the anion eluent is charged, and after 20 samples	• Calibration curve must be liner • Response or retention time within ±10% of initial values	• Prepare new calibration curve
	Instrument performance check solution (IPC) (a mid-range check standard)	Immediately following daily calibration, after every tenth sample, and at the end of the sample run	• within ±10% of initial calibration	• Reanalyze IPC • Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant IPC
	Laboratory reagent blank (LRB)	1 per preparation batch (≤20 samples)	• < method detection limit (MDL)	• Reanalyze LRB • Reprep/reanalyze analytical batch as appropriate
	Laboratory fortified blank (LFB)	1 per preparation batch (≤20 samples)	• %R within 90% - 110%	• Reanalyze LFB • Reprep/reanalyze LFB and affected samples
	Laboratory fortified sample matrix (LFM)	A minimum of 10% of the routine samples	• %R within 90% - 110%	• If LFB recoveries are within acceptance criteria, matrix interference may be suspected

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 353.2 **Nitrate-Nitrite Nitrogen by Automated Colorimetry**	Initial calibration (a blank and at least three concentration levels)	Daily, and each time the instrument is set up	• Calibration curve must be liner • Response within ±10% of initial values	• Prepare new calibration curve
	Instrument performance check solution (IPC) (a mid-range check standard)	Immediately following daily calibration, after every tenth sample, and at the end of the sample run	• within ±10% of initial calibration	• Reanalyze IPC • Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant IPC
	Laboratory reagent blank (LRB)	1 per preparation batch (≤20 samples)	• < MDL	• Reanalyze LRB • Reprep/reanalyze analytical batch as appropriate
	Laboratory fortified blank (LFB)	1 per preparation batch (≤20 samples)	• %R within 90% - 110%	• Reanalyze LFB • Reprep/reanalyze LFB and affected samples
	Laboratory fortified sample matrix (LFM)	A minimum of 10% of the routine samples	• %R within 90% - 110%	• If LFB recoveries are within acceptance criteria, matrix interference may be suspected

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 350.1 **Ammonia Nitrogen by Semi-Automated Colorimetry**	Initial calibration (a blank and at least three concentration levels)	Daily, and each time the instrument is set up	• Calibration curve must be liner • Response within ±10% of initial values	• Prepare new calibration curve
	Instrument performance check solution (IPC) (a mid-range check standard)	Immediately following daily calibration, after every tenth sample, and at the end of the sample run	• within ±10% of initial calibration	• Reanalyze IPC • Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant IPC
	Laboratory reagent blank (LRB)	1 per preparation batch (≤20 samples)	• < MDL	• Reanalyze LRB • Reprep/reanalyze analytical batch as appropriate
	Laboratory fortified blank (LFB)	1 per preparation batch (≤20 samples)	• %R within 90% - 110%	• Reanalyze LFB • Reprep/reanalyze LFB and affected samples
	Laboratory fortified sample matrix (LFM)	A minimum of 10% of the routine samples	• %R within 90% - 110%	• If LFB recoveries are within acceptance criteria, matrix interference may be suspected

Table 3. Summary of Laboratory Quality Control Measures, by Analysis
Columbia Falls Aluminum Company, Columbia Falls, Montana

Analytical Method	QC Element	Frequency	Acceptance Criteria	Corrective Action
Method 365.1 Phosphorous by Semi-Automated Colorimetry	Initial calibration (a blank and at least three concentration levels)	Daily, and each time the instrument is set up	• Calibration curve must be liner • Response within ±10% of initial values	• Prepare new calibration curve
	Instrument performance check solution (IPC) (a mid-range check standard)	Immediately following daily calibration, after every tenth sample, and at the end of the sample run	• within ±10% of initial calibration	• Reanalyze IPC • Terminate analysis, recalibrate instrument, and reanalyze samples back to the last compliant IPC
	Laboratory reagent blank (LRB)	1 per preparation batch (≤20 samples)	• < MDL	• Reanalyze LRB • Reprep/reanalyze analytical batch as appropriate
	Laboratory fortified blank (LFB)	1 per preparation batch (≤20 samples)	• %R within 90% - 110%	• Reanalyze LFB • Reprep/reanalyze LFB and affected samples
	Laboratory fortified sample matrix (LFM)	A minimum of 10% of the routine samples	• %R within 90% - 110%	• If LFB recoveries are within acceptance criteria, matrix interference may be suspected

Table 4. Sample Containers, Preservation and Handling Requirements, and Holding Times for Solid Sample Matrices (Soil and Sediment) Columbia Falls Aluminum Company, Columbia Falls, Montana

Container Description	Analyses	Method	Preservation and Handling	Extraction/Analysis Holding Times
8-oz glass jar	Metals	EPA 6010/6020	Cool 4°C ± 2°C	180 days
	Mercury	EPA 7471B	Cool 4°C ± 2°C	28 days
	Total organic carbon (TOC)	EPA 9060A/415.1	Cool 4°C ± 2°C protect from sunlight and atmospheric oxygen	28 days
	pH	EPA 9045	Cool 4°C ± 2°C	As soon as possible
	Fluoride	EPA 300.0	Cool 4°C ± 2°C	28 days
	Total phosphorus	EPA 365.1	Cool 4°C ± 2°C	28 days
	Cyanide	EPA 9012	Cool 4°C ± 2°C	14 days
8-oz glass jar	Pesticides	EPA 8081B	Cool 4°C ± 2°C	14 days/40 days
	Polychlorinated Biphenyls (PCBs)	EPA 8082A	Cool 4°C ± 2°C	14 days/40 days
3 x 40-mL glass vials with Teflon-lined screw cap (2 vials pre-preserved with $NaHSO_4$ and 1 vial pre-preserved with methanol; sample with plastic syringe samplers)	Volatile Organic Compounds (VOCs)	EPA 8260B	Cool 4°C ± 2°C	14 days
4-oz amber glass jar with Teflon-lined screw cap	Semi-volatile Organic Compounds (SVOCs)	EPA 8270D	Cool 4°C ± 2°C	14 days/40 days

Table 5. Sample Containers, Preservation and Handling Requirements, and Holding Times for Aqueous Sample Matrices
Columbia Falls Aluminum Company, Columbia Falls, Montana

Container Description	Analyses	Method	Preservation and Handling	Extraction/ Analysis Holding Times
250-mL plastic (pre-preserved with HNO_3)	Metals	EPA 6010/6020	Cool 4°C ± 2°C HNO_3, pH≤2	180 days
	Mercury	EPA 7470A	Cool 4°C ± 2°C HNO_3, pH≤2	28 days
500-mL plastic (pre-preserved with H_2SO_4)	Nitrite, Nitrate, Ammonia, Total Kjeldahl Nitrogen	EPA 353.2, 350.3/350.1, 351.2	Cool 4°C ± 2°C H_2SO_4, pH≤2	28 days
	Orthophosphate	EPA 365.2	Cool 4°C ± 2°C H_2SO_4, pH≤2	28 days
1-L plastic	Fluoride, Chloride,	EPA 300.0	Cool 4°C ± 2°C	28 days
	Total Suspended Solids (TSS)	SM 2540D	Cool 4°C ± 2°C	7 days
	Total Dissolved Solids (TDS)	SM 2540C	Cool 4°C ± 2°C	7 days
	Alkalinity	SM 2320	Cool 4°C ± 2°C	14 days
2 x 1-L amber glass	Pesticides	EPA 8081B	Cool 4°C ± 2°C	7 days/40 days
	Polychlorinated Biphenyls (PCBs)	EPA 8082A	Cool 4°C ± 2°C	7 days/40 days
2 x 1-L amber glass	Semi-volatile Organic Compounds (SVOCs)	EPA 8270D	Cool 4°C ± 2°C	7 days/40 days
3 x 40 mL vials; no headspace (pre-preserved with HCl)	Volatile Organic Compounds (VOCs)	EPA 8260B	Cool 4°C ± 2°C HCl, pH<2	14 days
500-mL plastic (pre-preserved with NaOH)	Cyanide	EPA 335.4	Cool 4°C ± 2°C NaOH, pH≥10	14 days

Table 6. Equipment Calibration Requirements and Maintenance Schedule
Columbia Falls Aluminum Company, Columbia Falls, Montana

Equipment Type	Calibration Requirements	Maintenance Schedule
Photoionization Detector	Factory calibration per manufacturers recommendations. Field calibration daily prior to use with calibration gas.	Recharge or replace battery as needed. Regulary clean lamp window. Regulary replace filter. Visually inspect after each use to ensure equipment is in good working order.
Multi-Gas Meter	Factory calibration per manufacturers recommendations. Field calibration daily prior to use with calibration gas.	Recharge or replace battery as needed. Regulary clean lamp window. Regulary replace filter. Visually inspect after each use to ensure equipment is in good working order.
Electronic Water-Level Meter	Factory calibration per manufacturers recommendations.	Replace batteries as needed. Decon after each use. Visually inspect after each use to ensure equipment is in good working order.
Multi-parameter water quality meter	Factory calibration per manufacturers recommendations. Field calibration daily prior to use with multi-point calibration solution.	Replace batteries as needed. Clean probes as needed. Visually inspect after each use to ensure equipment is in good working order.
Grundfos Pump	N/A	Maintain gaskets as needed. Clean pump intake as needed. Decon after each use. Visually inspect after each use to ensure equipment is in good working order.
Bladder Pump	N/A	Maintain gaskets as needed. Clean pump intake as needed. Replace bladder after each use. Decon after each use. Visually inspect after each use to ensure equipment is in good working order.
Peristaltic Pump	N/A	Replace masterflex tubing after each use. Visually inspect after each use to ensure equipment is in good working order.
GPS	Factory calibration per manufacturers recommendations. Reference point checks daily prior to use.	Recharge or replace battery as needed. Visually inspect each day to ensure equipment is in good working order.
Landfill Meter	Factory calibration per manufacturers recommendations. Field calibration daily multi-point calibration gas.	Recharge or replace battery as needed. Visually inspect each day to ensure equipment is in good working order.

Table 7. Analyses of Soil Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Human Health Residential Soil	Los Alamos ECORISK Database	Toxicological Benchmarks for Wildlife (Sample 1996)	EPA Region 5 Ecological Screening Levels	Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (residential/ 0-2)
Target Compound List Volatile Organic Compounds (TCL VOCs) (mg/kg)									
Dichlorodifluoromethane	8260B		0.03	0.03	8.7	--	--	39.5	--
Chloromethane	8260B		0.0049	0.0049	11	--	--	--	--
Vinyl chloride	8260B		0.0000065	0.0000065	0.059	0.12	0.623	0.646	--
Bromomethane	8260B		0.00019	0.00019	0.68	--	--	--	--
Chloroethane	8260B		0.59	0.59	1400	--	--	--	--
Trichlorofluoromethane	8260B		0.073	0.073	73	52	--	16.4	--
1,1-Dichloroethene	8260B		8.28	--	--	11	--	8.28	--
1,1,2-Trichloro-1,2,2-trifluoroethane	8260B		--	--	--	--	--	--	--
Acetone	8260B		0.29	0.29	6100	1.2	36.6	2.5	--
Carbon disulfide	8260B		0.024	0.024	77	0.82	--	0.0941	--
Methyl acetate	8260B		0.41	0.41	7800	--	--	--	--
Methylene chloride	8260B		0.00272	0.00272	35	2.6	21.4	4.05	--
trans-1,2-Dichloroethene	8260B		23	--	--	23	--	--	--
Methyl tert-butyl ether	8260B		0.0032	0.0032	47	--	--	--	0.3
1,1-Dichloroethane	8260B		20.1	--	--	210	--	20.1	--
cis-1,2-Dichloroethene	8260B		23	--	--	23	--	--	--
2-Butanone	8260B		0.12	0.12	2700	360	--	--	--
Bromochloromethane	8260B		0.0021	0.0021	15	--	--	--	--
Chloroform	8260B		0.000061	0.000061	0.32	8	55	1.19	--
1,1,1-Trichloroethane	8260B		29.8	--	--	260	2060	29.8	--
Cyclohexane	8260B		1.3	1.3	650	--	--	--	--
Carbon tetrachloride	8260B		0.00018	0.00018	0.65	--	58.6	2.98	--
Benzene	8260B		0.00023	0.00023	1.2	24	52.2	0.255	0.2
1,2-Dichloroethane	8260B		0.04	--	--	0.85	14.2	21.2	0.04
Trichloroethene	8260B		42	--	--	42	--	--	--
Methylcyclohexane	8260B		--	--	--	--	--	--	--
1,2-Dichloropropane	8260B		32.7	--	--	--	--	32.7	--
Bromodichloromethane	8260B		0.000036	0.000036	0.29	--	--	0.54	--
cis-1,3-Dichloropropene	8260B		0.398	--	--	--	--	0.398	--
4-Methyl-2-pentanone	8260B		0.028	0.028	530	13	91.6	443	--
Toluene	8260B		0.076	0.076	490	23	51.5	5.45	60
trans-1,3-Dichloropropene	8260B		0.398	--	--	--	--	0.398	--
1,1,2-Trichloroethane	8260B		28.6	--	--	--	--	28.6	--
Tetrachloroethene	8260B		0.18	--	--	0.18	--	9.92	--
2-Hexanone	8260B		0.00088	0.00088	20	0.36	--	12.6	--
Dibromochloromethane	8260B		0.000045	0.000045	0.75	--	--	2.05	--
1,2-Dibromoethane	8260B		0.0000021	0.0000021	0.036	--	--	1.23	0.0001
Chlorobenzene	8260B		0.0053	0.0053	28	2.4	--	13.1	--
Ethylbenzene	8260B		0.0017	0.0017	5.8	--	--	5.16	6
o-Xylene	8260B		0.019	0.019	65	--	--	--	70

Table 7. Analyses of Soil Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Human Health Residential Soil	Los Alamos ECORISK Database	Toxicological Benchmarks for Wildlife (Sample 1996)	EPA Region 5 Ecological Screening Levels	Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (residential/ 0-2)
m,p-Xylene	8260B		0.019	0.019	55, 56	--	--	--	70
Styrene	8260B		0.13	0.13	600	1.2	--	4.69	--
Bromoform	8260B		0.00087	0.00087	19	--	--	15.9	--
Isopropylbenzene	8260B		--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	8260B		0.00003	0.00003	0.6	--	--	225	--
1,3-Dichlorobenzene	8260B		0.73	--	--	0.73	--	--	--
1,4-Dichlorobenzene	8260B		0.00046	0.00046	2.6	0.88	--	--	--
1,2-Dichlorobenzene	8260B		0.03	0.03	180	0.92	--	--	--
1,2-Dibromo-3-chloropropane	8260B		0.000000144	0.000000144	0.0053	--	--	0.0352	--
1,2,4-Trichlorobenzene	8260B		0.0012	0.0012	5.8	0.27	--	11.1	--
1,2,3-Trichlorobenzene	8260B		0.0021	0.0021	6.3	--	--	--	--
Target Compound List Semi-Volatile Organic Compounds (TCL SVOCs) (mg/kg)									
1.4-Dioxane	8270D		0.000094	0.000094	5.3	--	1.83	2.05	--
Benzaldehyde	8270D		0.043	0.043	780	--	--	--	--
Phenol	8270D		0.33	0.33	1900	0.79	--	120	--
Bis(2-chloroethyl) ether	8270D		--	--	--	--	--	--	--
2-Chlorophenol	8270D		0.0074	0.0074	39	0.39	--	0.243	--
2-Methylphenol	8270D		0.67	--	--	0.67	--	--	--
3-Methylphenol	8270D		--	--	--	--	--	--	--
2,2'-Oxybis(1-choloropropane)	8270D		--	--	--	--	--	--	--
Acetophenone	8270D		0.058	0.058	780	--	--	300	--
4-Methylphenol	8270D		--	--	--	--	--	--	--
N-Nitroso-di-n propylamine	8270D		0.0000081	0.0000081	0.078	--	--	0.544	--
Hexachloroethane	8270D		0.0002	0.0002	1.8	--	--	0.596	--
Nitrobenzene	8270D		0.000092	0.000092	5.1	2.2	--	1.31	--
Isophorone	8270D		0.026	0.026	570	--	--	139	--
2-Nitrophenol	8270D		--	--	--	--	--	--	--
2,4-Dimethylphenol	8270D		0.01	0.042	130	--	--	0.01	--
Bis(2-chloroethoxy) methane	8270D		0.0013	0.0013	19	--	--	0.302	--
2,4-Dichlorophenol	8270D		0.0054	0.0054	19	--	--	87.5	--
Naphthalene	8270D		0.00054	0.00054	3.8	1	--	0.0994	4
4-Chloroaniline	8270D		2	--	--	2	--	--	--
Hexachlorobutadiene	8270D		0.00026	0.00026	1.2	--	--	0.0398	--
Caprolactam	8270D		0.25	0.25	3100	--	--	--	--
4-Chloro-3-methylphenol	8270D		--	--	--	--	--	--	--
2-Methylnaphthalene	8270D		0.019	0.019	24	16	--	3.24	--
Hexachlorocyclopentadiene	8270D		0.00013	0.00013	0.18	--	--	0.755	--
2,4,6-Trichlorophenol	8270D		0.0045	0.0045	6.3	--	--	9.94	--
2,4,5-Trichlorophenol	8270D		0.44	0.44	630	--	--	14.1	--
1,1'-Biphenyl	8270D		0.00087	0.00087	4.7	--	--	--	--
2-Chloronaphthalene	8270D		0.0122	--	--	--	--	0.0122	--

Table 7. Analyses of Soil Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Human Health Residential Soil	Los Alamos ECORISK Database	Toxicological Benchmarks for Wildlife (Sample 1996)	EPA Region 5 Ecological Screening Levels	Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (residential/ 0-2)
2-Nitroaniline	8270D		0.008	0.008	63	5.4	--	--	--
Dimethylphthalate	8270D		--	--	--	--	--	--	--
2,6-Dinitrotoluene	8270D		0.000067	0.000067	0.36	4.1	--	0.0328	--
Acenaphthylene	8270D		120	--	--	120	--	682	--
3-Nitroaniline	8270D		--	--	--	--	--	--	--
Acenaphthene	8270D		0.25	0.55	360	0.25	--	682	400
2,4-Dinitrophenol	8270D		0.0044	0.0044	13	--	--	0.0609	--
4-Nitrophenol	8270D		--	--	--	--	--	--	--
Dibenzofuran	8270D		0.015	0.015	7.3	6.1	--	--	--
2,4-Dinitrotoluene	8270D		0.00032	0.00032	1.7	6	--	1.28	--
Diethylphthalate	8270D		100	--	--	100	9087	--	--
Fluorene	8270D		0.54	0.54	240	3.7	--	122	300
4-Chlorophenyl-phenyl ether	8270D		--	--	--	--	--	--	--
4-Nitroaniline	8270D		0.0016	0.0016	25	--	--	--	--
4,6-Dinitro-2-methylphenol	8270D		--	--	--	--	--	--	--
N-Nitrosodiphenylamine	8270D		0.066	0.066	110	--	--	0.545	--
1,2,4,5-Tetrachlorobenzene	8270D		0.00079	0.00079	2.3	--	--	2.02	--
4-Bromophenyl-phenylether	8270D		--	--	--	--	--	--	--
Hexachlorobenzene	8270D		0.00012	0.00012	0.21	0.079	--	0.199	--
Atrazine	8270D		0.00019	0.00019	2.4	--	--	--	--
Pentachlorophenol	8270D		0.0004	0.0004	1	0.36	0.879	0.119	--
Phenanthrene	8270D		5.5	--	--	5.5	--	45.7	--
Anthracene	8270D		5.8	5.8	1800	6.8	--	1480	2000
Carbazole	8270D		80	--	--	80	--	--	--
Di-n-butylphthalate	8270D		0.011	--	--	0.011	0.09	--	--
Fluoranthene	8270D		8.9	8.9	240	10	--	122	300
Pyrene	8270D		1.3	1.3	180	10	--	78.5	200
Butylbenzylphthalate	8270D		0.239	--	--	90	--	0.239	--
3,3'-Dicholorobenzidine	8270D		0.646	--	--	--	--	0.646	--
Benzo(a)anthracene	8270D		0.2	--	--	0.8	--	5.21	0.2
Chrysene	8270D		1.2	1.2	16	2.4	--	4.73	20
Bis(2-ethylhexyl) phthalate	8270D		0.02	1.3	39	0.02	0.91	0.925	--
Di-n-octylphthalate	8270D		0.91	--	--	0.91	--	--	--
Benzo(b) fluoranthene	8270D		0.041	0.041	0.16	18	--	59.8	0.2
Benzo(k) fluoranthene	8270D		0.4	0.4	1.6	62	--	148	2
Benzo(a) pyrene	8270D		0.004	0.004	0.016	53	1.98	1.52	0.02
Indeno(1,2,3,-cd) pyrene	8270D		0.13	0.13	0.16	62	--	109	0.2
Dibenzo(a,h) anthracene	8270D		0.013	0.013	0.016	12	--	--	0.02
Benzo(g,h,i) perylene	8270D		24	--	--	24	--	119	--
2,3,4,6-Tetrachlorophenol	8270D		0.15	0.15	190	--	--	0.199	--
Pesticides (mg/kg)									

Table 7. Analyses of Soil Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Human Health Residential Soil	Los Alamos ECORISK Database	Toxicological Benchmarks for Wildlife (Sample 1996)	EPA Region 5 Ecological Screening Levels	Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (residential/ 0-2)
alpha-BHC	8081B		0.000041	0.000041	0.086	58	--	0.0994	--
beta-BHC	8081B		0.00014	0.00014	0.3	0.27	1.47	0.00398	--
delta-BHC	8081B		9.94	--	--	--	--	9.94	--
gamma-BHC (Lindane)	8081B		0.00024	0.00024	0.57	0.0094	1.66	0.005	--
Heptachlor	8081B		0.00011	0.00011	0.13	0.059	0.476	0.152	--
Aldrin	8081B		0.00015	0.00015	0.039	0.037	0.733	0.00332	--
Heptachlor epoxide	8081B		0.000028	0.000028	0.07	--	--	0.152	--
Endosulfan I	8081B		0.119	--	--	--	--	0.119	--
Dieldrin	8081B		0.000069	0.000069	0.034	0.0045	0.064	0.00238	--
4,4'-DDE	8081B		0.11	--	--	0.11	--	0.596	--
Endrin	8081B		0.0014	0.0092	1.9	0.0014	0.008	0.0101	--
Endosulfan II	8081B		0.119	--	--	--	--	0.119	--
4,4'-DDD	8081B		0.00488	--	--	0.0063	--	0.00488	--
Endosulfan sulfate	8081B		0.0358	--	--	--	--	0.0358	--
4,4'-DDT	8081B		0.0035	--	--	0.44	--	0.0035	--
Methoxychlor	8081B		0.2	0.2	32	--	--	--	--
Endrin ketone	8081B		--	--	--	--	--	--	--
Endrin aldehyde	8081B		0.0105	--	--	--	--	0.0105	--
cis-Chlordane	8081B		--	--		--	--	--	--
trans-Chlordane	8081B		--	--	--	--	--	--	--
Toxaphene	8081B		0.0024	0.0024	0.49	4.1	--	0.119	--
Polychlorinated Biphenyls (PCBs) (mg/kg)									
Aroclor-1016	8082A		0.013	0.013	0.41	1	6.63	--	--
Aroclor-1221	8082A		0.000079	0.000079	0.17	--	--	--	--
Aroclor-1232	8082A		0.000079	0.000079	0.17	--	--	--	--
Aroclor-1242	8082A		0.0012	0.0012	0.23	0.041	0.329	--	--
Aroclor-1248	8082A		0.0012	0.0012	0.23	0.0072	0.071	--	--
Aroclor-1254	8082A		0.002	0.002	0.12	0.041	0.111	--	--
Aroclor-1260	8082A		0.0055	0.0055	0.24	0.88	--	--	--
Aroclor-1262	8082A		--	--	--	--	--	--	--
Aroclor-1268	8082A		--	--	--	--	--	--	--
Total PCB Aroclors	8082A		--	--	--	--	--	--	--
Target Analyte List Metals (mg/kg)									
Aluminum	6010/6020		90.8	3000	7700		90.8	--	--
Antimony	6010/6020		0.035	0.035	3.1	2.4	0.248	0.142	--
Arsenic	6010/6020		0.0015	0.0015	0.68	6.8	0.25	5.7	--
Barium	6010/6020		1.04	16	1500	110	19.7	1.04	--
Beryllium	6010/6020		1.06	1.9	16	2.5	2.42	1.06	--
Cadmium	6010/6020		0.00222	0.069	7.1	0.27	1.2	0.00222	--
Calcium	6010/6020		--	--	--	--	--	--	--
Chromium	6010/6020		0.4	--	--	40	0.83	0.4	--

Table 7. Analyses of Soil Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Human Health Residential Soil	Los Alamos ECORISK Database	Toxicological Benchmarks for Wildlife (Sample 1996)	EPA Region 5 Ecological Screening Levels	Montana Tier 1 Risk-Based Corrective Action Guidance for Petroleum Releases (residential/ 0-2)
Cobalt	6010/6020		0.027	0.027	2.3	13	--	0.14	--
Copper	6010/6020		2.8	2.8	310	15	38.9	5.4	--
Iron	6010/6020		35	35	5500	--	--	--	--
Lead	6010/6020		0.0537	--	--	14	0.94	0.0537	--
Magnesium	6010/6020		--	--	--	--	--	--	--
Manganese	6010/6020		2.8	2.8	180	220	322	--	--
Nickel	6010/6020		9.7	--	--	9.7	64.08	13.6	--
Potassium	6010/6020		--	--	--	--	--	--	--
Selenium	6010/6020		0.0276	0.052	39	0.52	0.331	0.0276	--
Silver	6010/6020		0.08	0.08	39	2.6	--	4.04	--
Sodium	6010/6020		--	--	--	--	--	--	--
Thallium	6010/6020		0.05	--	--	0.05	0.27	0.0569	--
Vanadium	6010/6020		0.714	--	--	6.7	0.714	1.59	--
Zinc	6010/6020		6.62	--	--	48	12	6.62	--
Mercury	7471B		0.0033	0.0033	0.94 (elemental)	0.013	0.005	0.1	--
Cyanide	9012B		0.0015	0.0015	0.27	0.1	236.5	1.33	--
Other Inorganic Parameters (mg/kg)									
pH	9045		--	--	--	--	--	--	--
Fluoride	300.0		6.5	12	310	170	6.5	--	--
Total phosphorus, as P	365.1		--	--	--	--	--	--	--

Notes:
(1). MDL = Method Detection Limit. Target MDLs will be based on the MDLs provided by the selected laboratory.

(2). PQL = Practical Quantitation Limit. Desired PQLs are maximum quantitation limits based on comparison to screening levels. PQLs given for analytes without risk-based criteria will be based on the reporting limits (RLs) provided by the selected laboratory.

TABLE 8. Analyses of Groundwater Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Volatile Organic Compounds (TCL VOCs) (ug/L)										
Dichlorodifluoromethane	8260B		20	--	1000	--	20	--	--	--
Chloromethane	8260B		19	--	30	--	19	--	--	--
Vinyl chloride	8260B		0.019	--	0.2	2	0.019	--	--	--
Bromomethane	8260B		0.75	--	10	--	0.75	--	--	--
Chloroethane	8260B		2100	--	--	--	2100	--	--	--
Trichlorofluoromethane	8260B		110	--	10000	--	110	--	--	--
1,1-Dichloroethene	8260B		7	--	7	--	--	--	>2800	--
1,1,2-Trichloro-1,2,2-trifluoroethane	8260B		5500	--	5500	--	5500	--	--	--
Acetone	8260B		1400	--	1400	--	1400	--	507640	--
Carbon disulfide	8260B		31	--	81	--	31	--	244	--
Methyl acetate	8260B		2000	--	2000	--	2000	--	--	--
Methylene chloride	8260B		5	--	5	5	11.4	--	42667	--
trans-1,2-Dichloroethene	8260B		100	--	100	--	--	--	--	--
Methyl tert-butyl ether	8260B		14	--	30(21)	--	14	--	--	10000
1,1-Dichloroethane	8260B		2.7	--	2.7	--	2.7	--	14680	--
cis-1,2-Dichloroethene	8260B		70	--	70	--	--	--	--	--
2-Butanone	8260B		560	--	560	--	560	--	282170	--
Bromochloromethane	8260B		8.3	--	8.3	--	8.3	--	--	--
Chloroform	8260B		0.22	--	70	80	0.22	--	1240	--
1,1,1-Trichloroethane	8260B		200	--	200	200	800	--	9400	--
Cyclohexane	8260B		1300	--	1300	--	1300	--	--	--
Carbon tetrachloride	8260B		0.45	--	3	5	0.45	--	1970	--
Benzene	8260B		0.45	--	5	5	0.45	--	525000	370
1,2-Dichloroethane	8260B		0.17	--	4	5	0.17	--	15200	5
Trichloroethene	8260B		5	--	5	--	--	--	7257	--
Methylcyclohexane	8260B		--	--	--	--	--	--	--	--
1,2-Dichloropropane	8260B		0.44	--	5	5	0.44	--	--	--
Bromodichloromethane	8260B		0.13	--	10	80	0.13	--	--	--
cis-1,3-Dichloropropene	8260B		4	--	4	--	--	--	--	--
4-Methyl-2-pentanone	8260B		120	--	120	--	120	--	77400	--
Toluene	8260B		2	--	1000	1000	110	--	1269	2
trans-1,3-Dichloropropene	8260B		2	--	2	--	--	--	--	--
1,1,2-Trichloroethane	8260B		3	--	3	--	--	--	--	--
Tetrachloroethene	8260B		5	--	5	--	--	--	750	--
2-Hexanone	8260B		3.8	--	3.8	--	3.8	--	32783	--
Dibromochloromethane	8260B		0.17	--	4	80	0.17	--	--	100
1,2-Dibromoethane	8260B		0.004	--	0.004	--	--	--	--	--
Chlorobenzene	8260B		7.8	--	100	100	7.8	--	1203	--
Ethylbenzene	8260B		1.5	--	700	700	1.5	--	>440	2.4
o-Xylene	8260B		19	--	10000	--	19	--	--	--
m,p-Xylene	8260B		19	--	10000	--	19	--		--
Styrene	8260B		72	--	100	100	120	--	--	72
Bromoform	8260B		3.3	--	80	80	3.3	--	--	--
Isopropylbenzene	8260B		--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	8260B		2	--	2	--	--	--	2400	--
1,3-Dichlorobenzene	8260B		150	--	600	--	--	--		150
1,4-Dichlorobenzene	8260B		0.48	--	75	75	0.48	--		26
1,2-Dichlorobenzene	8260B		30	--	600	600	30	--		--
1,2-Dibromo-3-chloropropane	8260B		0.00034	--	0.2	0.2	0.00034	--	--	--
1,2,4-Trichlorobenzene	8260B		0.7	--	70	--	0.7	--		24
1,2,3-Trichlorobenzene	8260B		0.4	--	0.7	70.00	0.4	--	--	8

TABLE 8. Analyses of Groundwater Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Semi-Volatile Organic Compounds (TCL SVOCs) (ug/L)										
1,4-Dioxane	8270D		0.46	--	0.78	--	0.46	--	--	--
Benzaldehyde	8270D		190	--	190	--	190	--	--	--
Phenol	8270D		2	--	300	--	580	--	<200	2
Bis(2-chloroethyl) ether	8270D		0.014	--	0.3	--	0.014	--	--	--
2-Chlorophenol	8270D		9.1	--	81	--	9.1	--	--	--
2-Methylphenol	8270D		489	--	--	--	--	--	489	--
3-Methylphenol	8270D		--	--	--	--	--	--	--	--
2,2'-Oxybis(1-choloropropane)	8270D		1400	--	1400	--	--	--	--	--
Acetophenone	8270D		190	--	190	--	190	--	--	--
4-Methylphenol	8270D		--	--	--	--	--	--	--	--
N-Nitroso-di-n propylamine	8270D		0.011	--	0.5	--	0.011	--	332	--
Hexachloroethane	8270D		0.33	--	30	--	0.33	--	--	--
Nitrobenzene	8270D		0.14	--	17	--	0.14	--	--	--
Isophorone	8270D		78	--	400	--	78	--	--	--
2-Nitrophenol	8270D		--	--	--	--	--	--	--	--
2,4-Dimethylphenol	8270D		36	--	380	--	36	--	--	--
Bis(2-chloroethoxy) methane	8270D		5.9	--	5.9	--	5.9	--	--	--
2,4-Dichlorophenol	8270D		4.6	--	77	--	4.6	--	--	--
Naphthalene	8270D		0.17	--	100	--	0.17	--	620	1.1
4-Chloroaniline	8270D		0.36	--	--	--	0.36	--	--	--
Hexachlorobutadiene	8270D		0.14	--	5	--	0.14	--	--	1.3
Caprolactam	8270D		990	--	990	--	990	--	--	--
4-Chloro-3-methylphenol	8270D		3000	--	3000	--	--	--	--	--
2-Methylnaphthalene	8270D		3.6	--	3.6	--	3.6	--	--	--
Hexachlorocyclopentadiene	8270D		0.041	--	3.1	50	0.041	--	--	--
2,4,6-Trichlorophenol	8270D		30	--	30	--	120	--	--	--
2,4,5-Trichlorophenol	8270D		1.2	--	1800	--	1.2	--	--	--
1,1'-Biphenyl	8270D		0.083	--	0.083	--	0.083	--	--	--
2-Chloronaphthalene	8270D		1000	--	1000	--	--	--	--	--
2-Nitroaniline	8270D		19	--	19	--	19	--	--	--
Dimethylphthalate	8270D		270000	--	270000	--	--	--	--	--
2,6-Dinitrotoluene	8270D		0.048	--	0.5	--	0.048	--	--	--
Acenaphthylene	8270D		--	--	--	--	--	--	--	--
3-Nitroaniline	8270D		--	--	--	--	--	--	--	--
Acenaphthene	8270D		5.8	--	670	--	53	--	74	5.8
2,4-Dinitrophenol	8270D		3.9	--	69	--	3.9	--	--	--
4-Nitrophenol	8270D		60	--	60	--	--	--	481	--
Dibenzofuran	8270D		0.79	--	0.79	--	0.79	--	1003	--
2,4-Dinitrotoluene	8270D		0.24	--	1.1	--	0.24	--	--	--
Diethylphthalate	8270D		17000	--	17000	--	--	--	85600	--
Fluorene	8270D		3	--	1100	--	29	--		3
4-Chlorophenyl-phenyl ether	8270D		--	--	--	--	--	--	--	--
4-Nitroaniline	8270D		3.8	--	3.8	--	3.8	--	--	--
4,6-Dinitro-2-methylphenol	8270D		13	--	13	--	--	--	--	--
N-Nitrosodiphenylamine	8270D		12	--	33	--	12	--	332	--
1,2,4,5-Tetrachlorobenzene	8270D		0.17	--	0.97	--	0.17	--	--	--
4-Bromophenyl-phenylether	8270D		--	--	--	--	--	--		--
Hexachlorobenzene	8270D		0.0098	--	0.2	1	0.0098	--	--	0.52
Atrazine	8270D		0.3	--	3	3	0.3	--	--	1.8
Pentachlorophenol	8270D		0.04	4 @ pH of 6.5 (14)	1	1	0.04	15	--	0.5

TABLE 8. Analyses of Groundwater Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Phenanthrene	8270D		0.4	--	--	--	--	--	200	0.4
Anthracene	8270D		0.012	--	2100	--	180	--	0.09	0.012
Carbazole	8270D		--	--	--	--	--	--	--	--
Di-n-butylphthalate	8270D		19	--	2000	--	--	--	697	19
Fluoranthene	8270D		0.04	--	130	--	80	--	15	0.04
Pyrene	8270D		0.025	--	830	--	12	--	--	0.025
Butylbenzylphthalate	8270D		16	--	1500	--	16	--		--
3,3'-Dicholorobenzidine	8270D		0.12	--	0.21	--	0.12	--	--	--
Benzo(a)anthracene	8270D		0.018	--	.5 (29)	--	--	--	0.65	0.018
Chrysene	8270D		3.4	--	50 (29)	--	3.4	--	--	--
Bis(2-ethylhexyl) phthalate	8270D		5.6	--	6	6	5.6	--	912	--
Di-n-octylphthalate	8270D		20	--	20	--	20	--	708	--
Benzo(b) fluoranthene	8270D		0.034	--	.5 (29)	--	0.034	--	--	--
Benzo(k) fluoranthene	8270D		0.34	--	5 (29)	--	0.34	--	--	--
Benzo(a) pyrene	8270D		0.0034	--	0.05	0.2	0.0034	--	--	0.015
Indeno(1,2,3,-cd) pyrene	8270D		0.034	--	.5 (29)	--	0.034	--	--	--
Dibenzo(a,h) anthracene	8270D		0.0034	--	.05 (29)	--	0.0034	--	--	--
Benzo(g,h,i) perylene	8270D		--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	8270D		1	--	24	--	24	--	--	1
Target Analyte List Pesticides (ug/L)										
alpha-BHC	8081B		0.0071	--	0.026	--	0.0071	--	--	--
beta-BHC	8081B		0.025	--	0.091	--	0.025	--	--	--
delta-BHC	8081B		--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	8081B		0.01	0.95	0.2	0.2	0.041	--	3.3	0.01
Heptachlor	8081B		0.0014	0.0038	0.08	0.4	0.0014	0.0038	1.26	0.01
Aldrin	8081B		0.00092	1.5	0.02	--	0.00092	--	--	0.004
Heptachlor epoxide	8081B		0.0014	0.0038	0.04	0.2	0.0014	0.0038	--	--
Endosulfan I	8081B		0.003	0.056	62	--	10	--		0.003
Dieldrin	8081B		0.0017	0.056	0.02	--	0.0017	0.056		--
4,4'-DDE	8081B		0.001	--	0.0022	--	0.046	--	--	0.001
Endrin	8081B		0.0023	0.036	2	2	0.23	0.036		0.0023
Endosulfan II	8081B		0.056	0.056	62	--	--	--		--
4,4'-DDD	8081B		0.001	--	0.0031	--	0.031	--	--	0.001
Endosulfan sulfate	8081B		62	--	62	--	--	--		--
4,4'-DDT	8081B		0.001	0.001	0.0022	--	0.23	0.001	--	0.001
Methoxychlor	8081B		0.03	0.03	40	40	3.7	0.03		--
Endrin ketone	8081B		--	--	--	--	--	--	--	--
Endrin aldehyde	8081B		0.29	--	0.29	--	--	--	--	--
cis-Chlordane	8081B		1	--	1	--	--	--	--	--
trans-Chlordane	8081B		--	--	--	--	--	--	--	--
Toxaphene	8081B		0.0002	0.0002	0.3	3	0.015	0.0002	--	0.008
Target Analyte List Polychlorinated Biphenyls (TAL PCBs) (ug/L)										
Aroclor-1016	8082A		0.014	0.014	0.5	--	0.14	--	--	--
Aroclor-1221	8082A		0.0046	0.014	0.5	--	0.0046	--	60	--
Aroclor-1232	8082A		0.0046	0.014	0.5	--	0.0046	--	124	--
Aroclor-1242	8082A		0.0078	0.014	0.5	--	0.0078	--	4.9	--
Aroclor-1248	8082A		0.0078	0.014	0.5	--	0.0078	--		--
Aroclor-1254	8082A		0.0078	0.014	0.5	--	0.0078	--	0.1	--
Aroclor-1260	8082A		0.0078	0.014	0.5	--	0.0078	--	2.3	--
Aroclor-1262	8082A		--	--	--	--	--	--	--	--
Aroclor-1268	8082A		0.014	0.014	0.5	--	--	--	--	--
Total PCBs (5)	8082A		0.001	--	--	--	--	0.014	0.01	0.001
Target Analyte List Metals and Cyanide (ug/L)										

TABLE 8. Analyses of Groundwater Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Aluminum	6010/6020		87	87	2000	--	2000	(pH 6.5-9.0) 87	460	--
Antimony	6010/6020		0.78	--	6	6	0.78	--	610	--
Arsenic	6010/6020		0.052	150	10	10	0.052	150	--	5
Barium	6010/6020		380	--	1000	2000	380	--		--
Beryllium	6010/6020		2.5	--	4	4	2.5	--	5.3	100
Cadmium	6010/6020		0.09	.097 @ 25 mg/L hardness *(12)	5	diet --, water 5	diet --, water 0.92	0.25	0.15	0.09
Calcium	6010/6020		116000	--	--	--	--	--	116000	1000000
Chromium	6010/6020		100	--	100	100 (total)	--	(III) 74, (VI) 11	--	--
Cobalt	6010/6020		0.6	--	0.6	--	0.6	--	5.1	50
Copper	6010/6020		0.23	2.85 @ 25 mg/L hardness *(12)	1300	1300	80	criteria requires utilizing Biotic Ligand Model (BLM) based on separate guidance	0.23	--
Iron	6010/6020		158	1000	1400	--	1400	1000	158	300
Lead	6010/6020		2.5	.545 @ 25 mg/L hardness *(12)	15	15 (and compounds)	15 (and compounds)	2.5	12.26	100
Magnesium	6010/6020		82000	--	--	--	--	--	82000	--
Manganese	6010/6020		43	--	43	Diet --, non-diet --	diet --, non-diet 43	--	<1100	200
Nickel	6010/6020		16.1	16.1 @ 25 mg/L hardness *(12)	100	--	--	--	--	200
Potassium	6010/6020		53000	--	--	--	--	--	53000	--
Selenium	6010/6020		1	5	50	50	10	5	88.32	1
Silver	6010/6020		0.12	.374 @ 25 mg/L hardness *(12)	100	--	9.4	--	0.12	0.25
Sodium	6010/6020		680000	--	--	--	--	--	680000	--
Thallium	6010/6020		0.02	--	2	2 (soluble salts)	0.02 (soluble salts)	--	57	0.8
Vanadium	6010/6020		8.6	--	--	--	8.6	--	80	100
Zinc	6010/6020		30	37 @ 25 mg/L hardness *(12)	2000	--	600	120	30	30
Mercury	7470A		0.026	0.91	2	2	0.063	0.77	<0.23	0.026
Cyanide	335.4		0.15	5.2	200	200	0.15	5.2	7.8	5
Anions (ug/L)										
Fluoride	300.0		80	--	4000	--	80	--	--	120
Chloride	300.0		120000	--	--	--	--	230000	--	120000
Nitrate, as N	353.2		1000	*(8)	10000	1000	--	--	--	13000
Nitrite, as N	353.2		60	*(8)	1000	1000	--	--	--	60
Ammonia nitrogen	350.3/350.1		--	*(7) (8)	--	--	--	--	--	--
Orthophosphate, as P	365.1		--	--	--	--	--	--	--	--
Alkalinity (carbonate and bicarbonate)	SM 2320B		20000	--	--	--	--	20000	--	6.5-9.0
Sulfate	300.0		--	--	--	--	--	--	--	--
Other (ug/L)										
Total Dissolved Solids (TDS)	SM 2540C		3000000	--	--	--	--	--	--	3000000
Total Suspended Solids (TSS)	SM 2540D		--	--	--	--	--	--	--	--

Notes:
(1) MDL = Method Detection Limit. Target MDLs will be based on the MDLs provided by the selected laboratory
(2) PQL = practical quantitation limit. Desired PQLs are maximum quantitation limits based on comparison to groundwater quality standards and risked based screening levels. PQLs given for analytes without risk-based criteria will be based on the reporting limits (RLs) provided by the selected laboratory
*values are dependent on field conditions and determined based on formulas provided in MT Circular DEQ-7

Table 9. Analyses of Surface Water Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Laboratory MDLs (1)	Desired PQLs (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Volatile Organic Compounds (TCL VOCs) (ug/L)										
Dichlorodifluoromethane	8260B		20	--	--	--	20	--	--	--
Chloromethane	8260B		19	--	30	--	19	--	--	--
Vinyl chloride	8260B		0.019	--	0.25	2	0.019	--	--	--
Bromomethane	8260B		0.75	--	47	--	0.75	--	--	--
Chloroethane	8260B		2100	--	--	--	2100	--	--	--
Trichlorofluoromethane	8260B		110	--	10000	--	110	--	--	--
1,1-Dichloroethene	8260B		7	--	7	--	--	--	>2800	--
1,1,2-Trichloro-1,2,2-trifluoroethane	8260B		5500	--	--	--	5500	--	--	--
Acetone	8260B		1400	--	--	--	1400	--	507640	--
Carbon disulfide	8260B		31	--	--	--	31	--	244	--
Methyl acetate	8260B		2000	--	--	--	2000	--	--	--
Methylene chloride	8260B		5	--	5	5	11.4	--	42667	--
trans-1,2-Dichloroethene	8260B		100	--	100	--	--	--	--	--
Methyl tert-butyl ether	8260B		14	--	30 (21)	--	14	--	--	10000
1,1-Dichloroethane	8260B		2.7	--	--	--	2.7	--	14680	--
cis-1,2-Dichloroethene	8260B		70	--	70	--	--	--	--	--
2-Butanone	8260B		560	--	--	--	560	--	282170	--
Bromochloromethane	8260B		4	--	4	--	8.3	--	--	--
Chloroform	8260B		0.22	--	57	80	0.22	--	1240	--
1,1,1-Trichloroethane	8260B		200	--	200	200	800	--	9400	--
Cyclohexane	8260B		1300	--	--	--	1300	--	--	--
Carbon tetrachloride	8260B		0.45	--	2.3	5	0.45	--	1970	--
Benzene	8260B		0.45	--	5	5	0.45	--	525000	370
1,2-Dichloroethane	8260B		0.17	--	3.8	5	0.17	--	15200	100
Trichloroethene	8260B		5	--	5	--	--	--	7257	--
Methylcyclohexane	8260B		--	--	--	--	--	--	--	--
1,2-Dichloropropane	8260B		0.44	--	5	5	0.44	--	--	--
Bromodichloromethane	8260B		0.13	--	5.5	80	0.13	--	--	--
cis-1,3-Dichloropropene	8260B		3.4	--	3.4	--	--	--	--	--
4-Methyl-2-pentanone	8260B		120	--	--	--	120	--	77400	--
Toluene	8260B		2	--	1000	1000	110	--	1269	2
trans-1,3-Dichloropropene	8260B		2	--	2	--	--	--	--	--
1,1,2-Trichloroethane	8260B		3	--	3	--	--	--	--	--
Tetrachloroethene	8260B		5	--	5	--	--	--	750	--
2-Hexanone	8260B		3.8	--	--	--	3.8	--	32783	--
Dibromochloromethane	8260B		0.17	--	4	80	0.17	--	--	--
1,2-Dibromoethane	8260B		--	--	--	--	--	--	--	--
Chlorobenzene	8260B		7.8	--	100	100	7.8	--	1203	--
Ethylbenzene	8260B		1.5	--	530	700	1.5	--	>440	90
o-Xylene	8260B		19	--	10000	--	19	--	--	--
m,p-Xylene	8260B		19	--	10000	--	19	--		--
Styrene	8260B		72	--	100	100	120	--	--	72
Bromoform	8260B		3.3	--	43	80	3.3	--	--	--
Isopropylbenzene	8260B		--	--	--	--	--	--	--	--

Table 9. Analyses of Surface Water Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Laboratory MDLs (1)	Desired PQLs (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Volatile Organic Compounds (TCL VOCs) (ug/L)										
1,1,2,2-Tetrachloroethane	8260B		1.7	--	1.7	--	--	--	2400	--
1,3-Dichlorobenzene	8260B		150	--	320	--	--	--		150
1,4-Dichlorobenzene	8260B		0.48	--	75	75	0.48	--		26
1,2-Dichlorobenzene	8260B		30	--	420	600	30	--		--
1,2-Dibromo-3-chloropropane	8260B		0.00034	--	0.2	0.2	0.00034	--	--	--
1,2,4-Trichlorobenzene	8260B		0.7	--	35	--	0.7	--		24
1,2,3-Trichlorobenzene	8260B		0.4	--	--	70	0.4	--	--	8
Target Compound List Semi-Volatile Organic Compounds (TCL SVOCs) (ug/L)										
1.4-Dioxane	8270D		0.46	--	--	--	0.46	--	--	--
Benzaldehyde	8270D		190	--	--	--	190	--	--	--
Phenol	8270D		4	--	300	--	580	--	<200	4
Bis(2-chloroethyl) ether	8270D		0.014	--	0.3	--	0.014	--	--	--
2-Chlorophenol	8270D		9.1	--	81	--	9.1	--	--	--
2-Methylphenol	8270D		489	--	--	--	--	--	489	--
3-Methylphenol	8270D		--	--	--	--	--	--	--	--
2,2'-Oxybis(1-choloropropane)	8270D		1400	--	1400	--	--	--	--	--
Acetophenone	8270D		190	--	--	--	190	--	--	--
4-Methylphenol	8270D		--	--	--	--	--	--	--	--
N-Nitroso-di-n propylamine	8270D		0.011	--	0.05	--	0.011	--	332	--
Hexachloroethane	8270D		0.33	--	14	--	0.33	--	--	--
Nitrobenzene	8270D		0.14	--	17	--	0.14	--	--	--
Isophorone	8270D		78	--	350	--	78	--	--	--
2-Nitrophenol	8270D		--	--	--	--	--	--	--	--
2,4-Dimethylphenol	8270D		36	--	380	--	36	--	--	--
Bis(2-chloroethoxy) methane	8270D		5.9	--	--	--	5.9	--	--	--
2,4-Dichlorophenol	8270D		4.6	--	77	--	4.6	--	--	--
Naphthalene	8270D		0.17	--	100	--	0.17	--	620	1.1
4-Chloroaniline	8270D		0.36	--	--	--	0.36	--	--	--
Hexachlorobutadiene	8270D		0.14	--	4.4	--	0.14	--	--	1.3
Caprolactam	8270D		990	--	--	--	990	--	--	--
4-Chloro-3-methylphenol	8270D		3000	--	3000	--	--	--	--	--
2-Methylnaphthalene	8270D		3.6	--	--	--	3.6	--	--	--
Hexachlorocyclopentadiene	8270D		0.041	--	40	50	0.041	--	--	--
2,4,6-Trichlorophenol	8270D		14	--	14	--	120	--	--	--
2,4,5-Trichlorophenol	8270D		1.2	--	1800	--	1.2	--	--	--
1,1'-Biphenyl	8270D		0.083	--	--	--	0.083	--	--	--
2-Chloronaphthalene	8270D		1000	--	1000	--	--	--	--	--
2-Nitroaniline	8270D		19	--	--	--	19	--	--	--
Dimethylphthalate	8270D		270000	--	270000	--	--	--	--	--
2,6-Dinitrotoluene	8270D		0.048	--	0.5	--	0.048	--	--	--
Acenaphthylene	8270D		--	--	--	--	--	--	--	--
3-Nitroaniline	8270D		--	--	--	--	--	--	--	--
Acenaphthene	8270D		5.8	--	670	--	53	--	74	5.8
2,4-Dinitrophenol	8270D		3.9	--	69	--	3.9	--	--	--

Table 9. Analyses of Surface Water Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Laboratory MDLs (1)	Desired PQLs (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Volatile Organic Compounds (TCL VOCs) (ug/L)										
4-Nitrophenol	8270D		60	--	60	--	--	--	481	--
Dibenzofuran	8270D		0.79	--	--	--	0.79	--	1003	--
2,4-Dinitrotoluene	8270D		0.24	--	1.1	--	0.24	--	--	--
Diethylphthalate	8270D		17000	--	17000	--	--	--	85600	--
Fluorene	8270D		3	--	1100	--	29	--		3
4-Chlorophenyl-phenyl ether	8270D		--	--	--	--	--	--	--	--
4-Nitroaniline	8270D		3.8	--	--	--	3.8	--	--	--
4,6-Dinitro-2-methylphenol	8270D		13	--	13	--	--	--	--	--
N-Nitrosodiphenylamine	8270D		0.0069	--	0.0069	--	12	--	332	--
1,2,4,5-Tetrachlorobenzene	8270D		0.17	--	0.97	--	0.17	--	--	--
4-Bromophenyl-phenylether	8270D		--	--	--	--	--	--		--
Hexachlorobenzene	8270D		0.0028	--	0.0028	1	0.0098	--	--	--
Atrazine	8270D		0.3	--	3	3	0.3	--	--	1.8
Pentachlorophenol	8270D		0.04	4 @ pH of 6.5	1	1	0.04	15	--	0.5
Phenanthrene	8270D		0.4	--	--	--	--	--	200	0.4
Anthracene	8270D		0.012	--	8300	--	180	--	0.09	0.012
Carbazole	8270D		--	--	--	--	--	--	--	--
Di-n-butylphthalate	8270D		19	--	2000	--	--	--	697	19
Fluoranthene	8270D		0.04	--	130	--	80	--	15	0.04
Pyrene	8270D		0.025	--	830	--	12	--	--	0.025
Butylbenzylphthalate	8270D		16	--	1500	--	16	--		--
3,3'-Dicholorobenzidine	8270D		0.12	--	0.21	--	0.12	--	--	--
Benzo(a)anthracene	8270D		0.018	--	0.038	--	--	--	0.65	0.018
Chrysene	8270D		0.038	--	0.038	--	3.4	--	--	--
Bis(2-ethylhexyl) phthalate	8270D		5.6	--	6	6	5.6	--	912	--
Di-n-octylphthalate	8270D		20	--	--	--	20	--	708	--
Benzo(b) fluoranthene	8270D		0.034	--	0.038	--	0.034	--	--	--
Benzo(k) fluoranthene	8270D		0.038	--	0.038	--	0.34	--	--	--
Benzo(a) pyrene	8270D		0.0034	--	0.038	0.2	0.0034	--	--	0.015
Indeno(1,2,3,-cd) pyrene	8270D		0.034	--	0.038	--	0.034	--	--	--
Dibenzo(a,h) anthracene	8270D		0.0034	--	0.038	--	0.0034	--	--	--
Benzo(g,h,i) perylene	8270D		--	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	8270D		1	--	--	--	24	--	--	1
Target Analyte List Pesticides (ug/L)										
alpha-BHC	8081B		0.0071	--	0.026	--	0.0071	--	--	--
beta-BHC	8081B		0.025	--	0.091	--	0.025	--	--	--
delta-BHC	8081B		--	--	--	--	--	--	--	--
gamma-BHC (Lindane)	8081B		0.01	0.95	0.2	0.2	0.041	--	3.3	0.01
Heptachlor	8081B		0.00079	0.0038	0.00079	0.4	0.0014	0.0038	1.26	0.01
Aldrin	8081B		0.00049	1.5	0.00049	--	0.00092	--	--	0.004
Heptachlor epoxide	8081B		0.00039	0.0038	0.00039	0.2	0.0014	0.0038	--	--
Endosulfan I	8081B		0.003	0.056	62	--	10	--		0.003
Dieldrin	8081B		0.00052	0.056	0.00052	--	0.0017	0.056		--

Table 9. Analyses of Surface Water Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Laboratory MDLs (1)	Desired PQLs (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Volatile Organic Compounds (TCL VOCs) (ug/L)										
4,4'-DDE	8081B		0.001	--	0.0022	--	0.046	--	--	0.001
Endrin	8081B		0.0023	0.036	0.059	2	0.23	0.036		0.0023
Endosulfan II	8081B		0.056	0.056	62	--	--	--		--
4,4'-DDD	8081B		0.001	--	0.0031	--	0.031	--	--	0.001
Endosulfan sulfate	8081B		62	--	62	--	--	--		--
4,4'-DDT	8081B		0.001	0.001	0.0022	--	0.23	0.001	--	0.001
Methoxychlor	8081B		0.03	0.03	40	40	3.7	0.03		--
Endrin ketone	8081B		--	--	--	--	--	--	--	--
Endrin aldehyde	8081B		0.29	--	0.29	--	--	--	--	--
cis-Chlordane	8081B		0.008	--	0.008	--	--	--	--	--
trans-Chlordane	8081B		--	--	--	--	--	--	--	--
Toxaphene	8081B		0.0002	0.0002	0.0028	3	0.015	0.0002	--	0.008
Target Analyte List Polychlorinated Biphenyls (TAL PCBs) (ug/L)										
Aroclor-1016	8082A		0.00064	0.014	0.00064	--	0.14	--	--	--
Aroclor-1221	8082A		0.00064	0.014	0.00064	--	0.0046	--	60	--
Aroclor-1232	8082A		0.00064	0.014	0.00064	--	0.0046	--	124	--
Aroclor-1242	8082A		0.00064	0.014	0.00064	--	0.0078	--	4.9	--
Aroclor-1248	8082A		0.00064	0.014	0.00064	--	0.0078	--		--
Aroclor-1254	8082A		0.00064	0.014	0.00064	--	0.0078	--	0.1	--
Aroclor-1260	8082A		0.00064	0.014	0.00064	--	0.0078	--	2.3	--
Aroclor-1262	8082A		--	--	--	--	--	--	--	--
Aroclor-1268	8082A		0.00064	0.014	0.00064	--	--	--	--	--
Total PCBs (5)	8082A		0.00064	--	0.00064	--	--	0.014	0.01	0.001
Target Analyte List Metals and Cyanide (ug/L)										
Aluminum	6010/6020		87	87	--	--	2000	(pH 6.5-9.0) 87	460	--
Antimony	6010/6020		0.78	--	5.6	6	0.78	--	610	--
Arsenic	6010/6020		0.052	150	10	10	0.052	150	--	5
Barium	6010/6020		380	--	1000	2000	380	--		--
Beryllium	6010/6020		2.5	--	4	4	2.5	--	5.3	--
Cadmium	6010/6020		0.09	.097 @ 25 mg/L hardness *(12)	5	diet --, water 5	diet --, water 0.92	0.25	0.15	0.09
Calcium	6010/6020		116000	--	--	--	--	--	116000	--
Chromium	6010/6020		11	--	100	100 (total)	--	(III) 74, (VI) 11	--	--
Cobalt	6010/6020		0.6	--	--	--	0.6	--	5.1	--
Copper	6010/6020		0.23	2.85 @ 25 mg/L hardness *(12)	1300	1300	80	utilizing Biotic Ligand Model (BLM) based on separate guidance	0.23	--
Iron	6010/6020		158	1000	--	--	1400	1000	158	300
Lead	6010/6020		0.545	.545 @ 25 mg/L hardness *(12)	15	15 (and compounds)	15 (and compounds)	2.5	12.26	--
Magnesium	6010/6020		82000	--	--	--	--	--	82000	--
Manganese	6010/6020		--	--	--	Diet --, non-diet --	diet --, non-diet 43	--	<1100	--
Nickel	6010/6020		5	16.1 @ 25 mg/L hardness (12)	100	--	--	--	<5	--
Potassium	6010/6020		53000	--	--	--	--	--	53000	--
Selenium	6010/6020		1	5	50	50	10	5	88.32	1

Table 9. Analyses of Surface Water Samples
Columbia Falls Aluminum Company, Montana

Parameter	EPA Analytical Method Reference Number	Laboratory MDLs (1)	Desired PQLs (2)	DEQ-7 Aquatic Life Standard	DEQ-7 Human Health Standards	EPA Risk Based Screening Level Drinking water MCL	EPA Risk Based Screening Level Tapwater RSL	EPA National Recommended Water Quality Criteria	Toxicological Benchmarks for Screening Potential (Suter 1996)	Canadian Water Quality Guidelines (CCME)
Target Compound List Volatile Organic Compounds (TCL VOCs) (ug/L)										
Silver	6010/6020		0.12	.374 @ 25 mg/L hardness *(12)	100	--	9.4	--	0.12	0.25
Sodium	6010/6020		680000	--	--	--	--	--	680000	--
Thallium	6010/6020		0.02	--	0.24	2 (soluble salts)	0.02 (soluble salts)	--	57	0.8
Vanadium	6010/6020		8.6	--	--	--	8.6	--	80	--
Zinc	6010/6020		30	37 @ 25 mg/L hardness *(12)	2000	--	600	120	30	30
Mercury	7470A		0.026	0.91	0.05	2	0.063	0.77	<0.23	0.026
Cyanide	335.4		0.15	5.2	140	200	0.15	5.2	7.8	5
Anions (ug/L)										
Alkalinity (bicarbonate and carbonate	SM 2320		20000	--	--	--	--	20000	--	6.5-9.0
Fluoride	300.0		80	--	4000	--	80	--	--	120
Chloride	300.0		120000	--	--	--	--	230000	--	120000
Nitrate, as N	353.2		1000	*(8)	10000	1000	--	--	--	13000
Nitrite, as N	353.2		60	*(8)	1000	1000	--	--	--	60
Ammonia nitrogen	350.3/350.1		0	*(7) (8)	--	--	--	--	--	--
Total Kjeldahl Nitrogen	351.2		--		--	--	--	--		--
Orthophosphate, as P	365.1		--	--	--	--	--	--	--	--
Sulfate	300.0		--	--	--	--	--	--	--	--
Other (ug/L)										
Hardness	200.7 -calc		--	--	--	--	--	--	--	--
Dissolved organic carbon	415.1 modified/9060A		--	--	--	--	--	--	--	--
Total Dissolved Solids (TDS)	SM 2540C		--	--	--	--	--	--	--	--
Total Suspended Solids (TSS)	SM 2540D		--	--	--	--	--	--	--	--

Notes:

(1). MDL = Method Detection Limit. Target MDLs will be based on the MDLs provided by the selected laboratory.

(2). PQL = practical quantitation limit. Desired PQLs are maximum quantitation limits based on comparison to groundwater quality standards and risked based screening levels. PQLs given for analytes without risk-based criteria will be based on the reporting limits (RLs) provided by the selected laboratory

*values are dependent on field conditions and determined based on formulas provided in MT Circular DEQ-7

Table 10. Analyses of Sediment Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Region 5 RCRA Ecological Screening Levels	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) TEL-HA28	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) Consensus-based TEC	EPA Region III BTAG Freshwater Sediment Screening Benchmarks
Target Compound List Volatile Organic Compounds (TCL VOCs) (mg/kg)								
Dichlorodifluoromethane	8260B		0.03	0.03	--	--	--	--
Chloromethane	8260B		0.0049	0.0049	--	--	--	--
Vinyl chloride	8260B		0.0000065	0.0000065	0.202	--	--	--
Bromomethane	8260B		0.00019	0.00019	--	--	--	--
Chloroethane	8260B		0.59	0.59	--	--	--	--
Trichlorofluoromethane	8260B		0.073	0.073	--	--	--	--
1,1-Dichloroethene	8260B		0.0194	--	0.0194	--	--	0.031
1,1,2-Trichloro-1,2,2-trifluoroethane	8260B		--	--	--	--	--	--
Acetone	8260B		0.0099	0.29	0.0099	--	--	--
Carbon disulfide	8260B		0.000851	0.024	0.0239	--	--	0.000851
Methyl acetate	8260B		0.41	0.41	--	--	--	--
Methylene chloride	8260B		0.00272	0.00272	0.159	--	--	--
trans-1,2-Dichloroethene	8260B		--	--	--	--	--	--
Methyl tert-butyl ether	8260B		0.0032	0.0032	--	--	--	--
1,1-Dichloroethane	8260B		0.000575	--	0.000575	--	--	--
cis-1,2-Dichloroethene	8260B		--	--	--	--	--	--
2-Butanone	8260B		0.12	0.12	--	--	--	--
Bromochloromethane	8260B		0.0021	0.0021	--	--	--	--
Chloroform	8260B		0.000061	0.000061	0.121	--	--	--
1,1,1-Trichloroethane	8260B		0.0302	--	0.213	--	--	0.0302
Cyclohexane	8260B		1.3	1.3	--	--	--	--
Carbon tetrachloride	8260B		0.00018	0.00018	1.45	--	--	0.0642
Benzene	8260B		0.00023	0.00023	0.142	--	--	--
1,2-Dichloroethane	8260B		0.26	--	0.26	--	--	--
Trichloroethene	8260B		0.0969	--	--	--	--	0.0969
Methylcyclohexane	8260B		--	--	--	--	--	--
1,2-Dichloropropane	8260B		0.333	--	0.333	--	--	--
Bromodichloromethane	8260B		0.000036	0.000036	--	--	--	--
cis-1,3-Dichloropropene	8260B		0	--	--	--	--	--
4-Methyl-2-pentanone	8260B		0.0251	0.028	0.0251	--	--	--
Toluene	8260B		0.076	0.076	1.22	--	--	--
trans-1,3-Dichloropropene	8260B		0	--	--	--	--	--
1,1,2-Trichloroethane	8260B		0.518	--	0.518	--	--	1.24
Tetrachloroethene	8260B		0.468	--	0.99	--	--	0.468
2-Hexanone	8260B		0.00088	0.00088	0.0582	--	--	--
Dibromochloromethane	8260B		0.000045	0.000045	--	--	--	--
1,2-Dibromoethane	8260B		0.0000021	0.0000021	--	--	--	--
Chlorobenzene	8260B		0.0053	0.0053	0.291	--	--	0.00842
Ethylbenzene	8260B		0.0017	0.0017	0.175	--	--	1.1
o-Xylene	8260B		0.019	0.019	--	--	--	--
m,p-Xylene	8260B		0.019	0.019	--	--	--	0.0252
Styrene	8260B		0.13	0.13	0.254	--	--	0.559
Bromoform	8260B		0.00087	0.00087	0.492	--	--	0.654
Isopropylbenzene	8260B		0.086	--	--	--	--	0.086
1,1,2,2-Tetrachloroethane	8260B		0.00003	0.00003	--	--	--	1.36
1,3-Dichlorobenzene	8260B		4.43	--	--	--	--	4.43
1,4-Dichlorobenzene	8260B		0.00046	0.00046	--	--	--	0.599
1,2-Dichlorobenzene	8260B		0.0165	0.03	--	--	--	0.0165

Table 10. Analyses of Sediment Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Region 5 RCRA Ecological Screening Levels	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) TEL-HA28	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) Consensus-based TEC	EPA Region III BTAG Freshwater Sediment Screening Benchmarks
1,2-Dibromo-3-chloropropane	8260B		0.000000144	0.000000144	--	--	--	--
1,2,4-Trichlorobenzene	8260B		0.0012	0.0012	5.062	--	--	2.1
1,2,3-Trichlorobenzene	8260B		0.0021	0.0021	--	--	--	0.858
Target Compound List Semi-Volatile Organic Compounds (TCL SVOCs) (mg/kg)								
1.4-Dioxane	8270D		0.000094	0.000094	0.119	--	--	--
Benzaldehyde	8270D		0.043	0.043	--	--	--	--
Phenol	8270D		0.0491	0.33	0.0491	--	--	0.42
Bis(2-chloroethyl) ether	8270D		--	--	--	--	--	--
2-Chlorophenol	8270D		0.0074	0.0074	0.0319	--	--	0.0312
2-Methylphenol	8270D		--	--	--	--	--	--
3-Methylphenol	8270D		--	--	--	--	--	--
2,2'-Oxybis(1-choloropropane)	8270D		--	--	--	--	--	--
Acetophenone	8270D		0.058	0.058	--	--	--	--
4-Methylphenol	8270D		0.67	--	--	--	--	0.67
N-Nitroso-di-n propylamine	8270D		0.0000081	0.0000081	--	--	--	--
Hexachloroethane	8270D		0.0002	0.0002	0.584	--	--	1.027
Nitrobenzene	8270D		0.000092	0.000092	0.145	--	--	--
Isophorone	8270D		0.026	0.026	0.432	--	--	--
2-Nitrophenol	8270D		--	--	--	--	--	--
2,4-Dimethylphenol	8270D		0.029	0.042	0.304	--	--	0.029
Bis(2-chloroethoxy) methane	8270D		0.0013	0.0013	--	--	--	--
2,4-Dichlorophenol	8270D		0.0054	0.0054	0.0817	--	--	0.117
Naphthalene	8270D		0.00054	0.00054	0.176	0.015	0.176	0.176
4-Chloroaniline	8270D		--	--	--	--	--	--
Hexachlorobutadiene	8270D		0.00026	0.00026	0.0265	--	--	--
Caprolactam	8270D		0.25	0.25	--	--	--	--
4-Chloro-3-methylphenol	8270D		--	--	--	--	--	--
2-Methylnaphthalene	8270D		0.019	0.019	0.0202	--	--	0.0202
Hexachlorocyclopentadiene	8270D		0.00013	0.00013	0.901	--	--	--
2,4,6-Trichlorophenol	8270D		0.0045	0.0045	0.208	--	--	0.213
2,4,5-Trichlorophenol	8270D		0.44	0.44	--	--	--	--
1,1'-Biphenyl	8270D		0.00087	0.00087	--	--	--	1.22
2-Chloronaphthalene	8270D		0.417	--	0.417	--	--	--
2-Nitroaniline	8270D		0.008	0.008	--	--	--	--
Dimethylphthalate	8270D		--	--	--	--	--	--
2,6-Dinitrotoluene	8270D		0.000067	0.000067	0.0398	--	--	--
Acenaphthylene	8270D		0.00587	--	0.00587	--	--	0.0059
3-Nitroaniline	8270D		--	--	--	--	--	--
Acenaphthene	8270D		0.0067	0.55	0.00671	--	--	0.0067
2,4-Dinitrophenol	8270D		0.0044	0.0044	0.00621	--	--	--
4-Nitrophenol	8270D		--	--	--	--	--	--
Dibenzofuran	8270D		0.015	0.015	0.449	--	--	0.415
2,4-Dinitrotoluene	8270D		0.00032	0.00032	0.0144	--	--	0.0416
Diethylphthalate	8270D		0.603	--	--	--	--	0.603
Fluorene	8270D		0.01	0.54	0.0774	0.01	0.0774	0.0774
4-Chlorophenyl-phenyl ether	8270D		--	--	--	--	--	--
4-Nitroaniline	8270D		0.0016	0.0016	--	--	--	--
4,6-Dinitro-2-methylphenol	8270D		--	--	--	--	--	--
N-Nitrosodiphenylamine	8270D		0.066	0.066	--	--	--	--

Table 10. Analyses of Sediment Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Region 5 RCRA Ecological Screening Levels	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) TEL-HA28	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) Consensus-based TEC	EPA Region III BTAG Freshwater Sediment Screening Benchmarks
1,2,4,5-Tetrachlorobenzene	8270D		0.00079	0.00079	1.252	--	--	1.09
4-Bromophenyl-phenylether	8270D		1.23	--	1.55	--	--	1.23
Hexachlorobenzene	8270D		0.00012	0.00012	0.02	--	--	0.02
Atrazine	8270D		0.00019	0.00019	--	--	--	0.00662
Pentachlorophenol	8270D		0.0004	0.0004	23	--	--	0.504
Phenanthrene	8270D		0.019	--	0.204	0.019	0.204	0.204
Anthracene	8270D		0.01	5.8	0.0572	0.01	0.0572	0.0572
Carbazole	8270D		--	--	--	--	--	--
Di-n-butylphthalate	8270D		6.47	--	--	--	--	6.47
Fluoranthene	8270D		0.031	8.9	0.423	0.031	0.423	0.423
Pyrene	8270D		0.044	1.3	0.195	0.044	0.195	0.195
Butylbenzylphthalate	8270D		1.97	--	1.97	--	--	10.9
3,3'-Dicholorobenzidine	8270D		0.127	--	0.127	--	--	--
Benzo(a)anthracene	8270D		0.016	--	0.108	0.016	0.108	0.108
Chrysene	8270D		0.027	1.2	0.166	0.027	0.166	0.166
Bis(2-ethylhexyl) phthalate	8270D		0.18	1.3	0.182	--	--	0.18
Di-n-octylphthalate	8270D		--	--	--	--	--	--
Benzo(b) fluoranthene	8270D		0.041	0.041	10.4	--	--	--
Benzo(k) fluoranthene	8270D		0.24	0.4	0.24	--	--	0.24
Benzo(a) pyrene	8270D		0.004	0.004	0.15	0.032	0.15	0.15
Indeno(1,2,3,-cd) pyrene	8270D		0.017	0.13	0.2	--	--	0.017
Dibenzo(a,h) anthracene	8270D		0.01	0.013	--	0.01	0.033	0.033
Benzo(g,h,i) perylene	8270D		0.17	--	0.17	--	--	0.17
2,3,4,6-Tetrachlorophenol	8270D		0.129	0.15	0.129	--	--	0.284
Target Analyte List Pesticides (mg/kg)								
Aldrin	8081B		0.00015	0.00015	0.002	--	--	0.002
alpha-BHC	8081B		0.000041	0.000041	0.006	--	--	0.006
beta-BHC	8081B		0.00014	0.00014	0.005	--	--	0.005
delta-BHC	8081B		6.4	--	71.5	--	--	6.4
gamma-BHC, Lindane	8081B		0.00024	0.00024	0.00237	--	0.00237	0.00237
alpha-Chlordane	8081B		--	--	--	--	--	--
gamma-Chlordane	8081B		--	--	--	--	--	--
cis-Chlordane	8081B		--	--	--	--	--	--
trans-Chlordane	8081B		--	--	--	--	--	--
4,4'-DDD	8081B		0.00488	--	0.00488	--	0.00488	0.00488
4,4'-DDE	8081B		0.00316	--	0.00316	--	0.00316	0.00316
4,4'-DDT	8081B		0.00416	--	0.00416	--	0.00416	0.00416 total
Dieldrin	8081B		0.000069	0.000069	0.0019	--	0.0019	0.0019
Endosulfan I	8081B		0.0029	--	0.00326	--	--	0.0029
Endosulfan II	8081B		0.00194	--	0.00194	--	--	0.014
Endosulfan Sulfate	8081B		0.0054	--	0.0346	--	--	0.0054
Endrin	8081B		0.00222	0.0092	0.00222	--	0.00222	0.00222
Endrin Aldehyde	8081B		0.48	--	0.48	--	--	--
Endrin Ketone	8081B		--	--	--	--	--	--
Heptachlor	8081B		0.00011	0.00011	0.0006	--	--	0.068
Heptachlor Epoxide	8081B		0.000028	0.000028	0.00247	--	0.00247	0.00247
Toxaphene	8081B		0.000077	0.0024	0.000077			0.0001

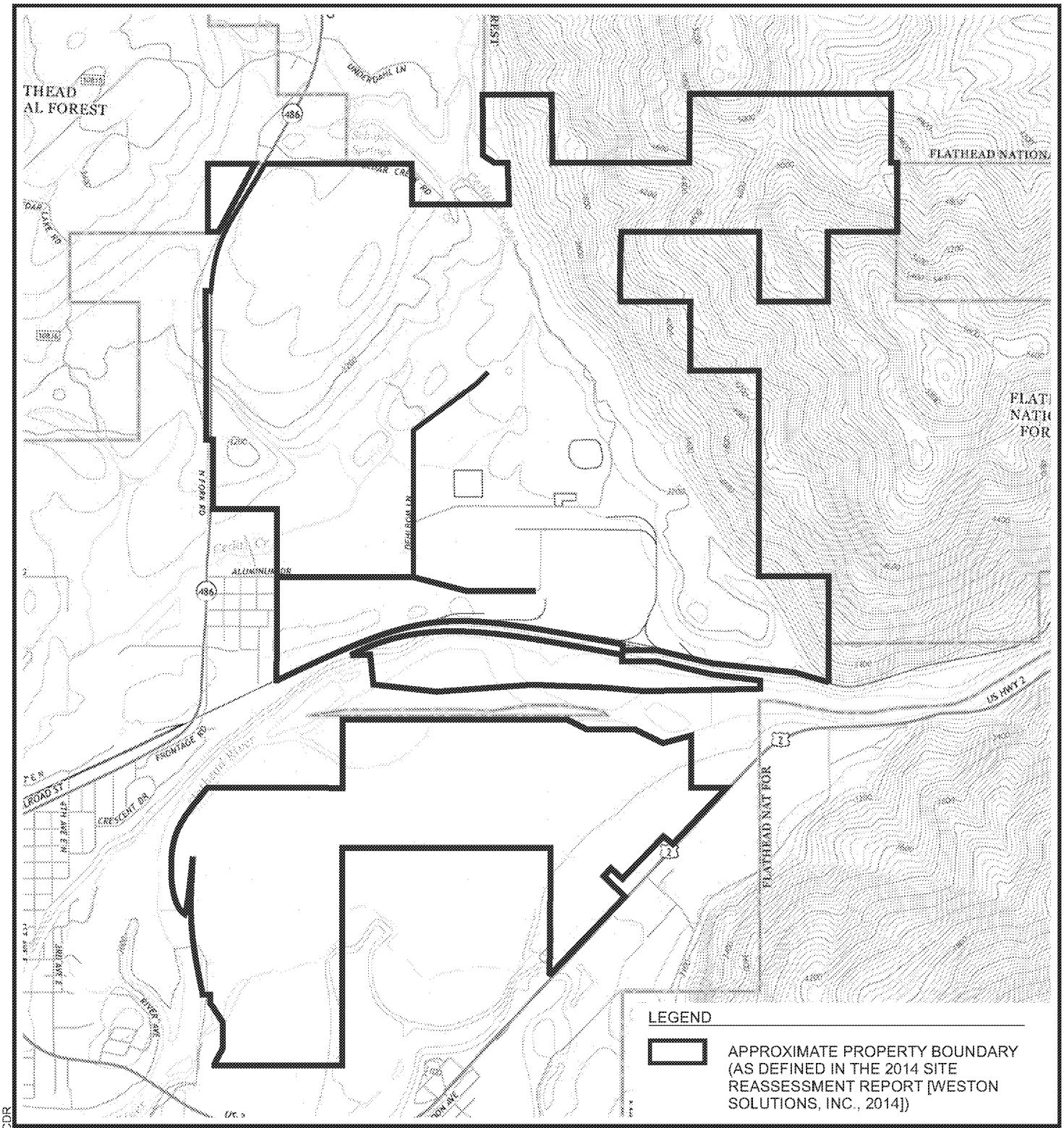
Table 10. Analyses of Sediment Samples
Columbia Falls Aluminum Company, MT

Parameter	EPA Analytical Method Reference Number	Target MDL (1)	Desired PQL (2)	EPA Human Health Protection of GW - Risk-based SSL	EPA Region 5 RCRA Ecological Screening Levels	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) TEL-HA28	Consensus-based sediment quality guidelines for freshwater ecosystems (MacDonald 2000) Consensus-based TEC	EPA Region III BTAG Freshwater Sediment Screening Benchmarks
Target Analyte List Polychlorinated Biphenyls (TAL PCBs) (mg/kg								
Aroclor-1016	8082A		0.013	0.013	--	--	--	--
Aroclor-1221	8082A		0.000079	0.000079	--	--	--	--
Aroclor-1232	8082A		0.000079	0.000079	--	--	--	--
Aroclor-1242	8082A		0.0012	0.0012	--	--	--	--
Aroclor-1248	8082A		0.0012	0.0012	--	--	--	--
Aroclor-1254	8082A		0.002	0.002	--	--	--	--
Aroclor-1260	8082A		0.0055	0.0055	--	--	--	--
Aroclor-1262	8082A		--	--	--	--	--	--
Aroclor-1268	8082A		--	--	--	--	--	--
Total PCBs (5)	8082A		0.032	--	--	0.032	0.0598	0.0598
Target Analyte List Metals and Cyanide (mg/kg)								
Aluminum	6010/6020		3000	3000	--	--	--	--
Antimony	6010/6020		0.035	0.035	--	--	--	2
Arsenic	6010/6020		0.0015	0.0015	9.79	11	9.79	9.8
Barium	6010/6020		16	16	--	--	--	--
Beryllium	6010/6020		1.9	1.9	--	--	--	--
Cadmium	6010/6020		0.069	0.069	0.99	0.58	0.99	0.99
Calcium	6010/6020		--	--	--	--	--	--
Chromium	6010/6020		36	--	43.4	36	43.4	43.4
Cobalt	6010/6020		0.027	0.027	50	--	--	50
Copper	6010/6020		2.8	2.8	31.6	28	31.6	31.6
Iron	6010/6020		35	35	--	--	--	20000
Lead	6010/6020		35.8	--	35.8	37	35.8	35.8
Magnesium	6010/6020		--	--	--	--	--	--
Manganese	6010/6020		460	--	--	--	--	460
Nickel	6010/6020		20	--	22.7	20	22.7	22.7
Potassium	6010/6020		--	--	--	--	--	--
Selenium	6010/6020		0.052	0.052	--	--	--	2
Silver	6010/6020		0.08	0.08	0.5	--	--	1
Sodium	6010/6020		--	--	--	--	--	--
Thallium	6010/6020		--	--	--	--	--	--
Vanadium	6010/6020		--	--	--	--	--	--
Zinc	6010/6020		98	--	121	98	121	121
Mercury	7471B		0.0033	0.0033	0.174	--	0.18	0.18
Cyanide	9012B		0.0001	0.0015	0.0001	--		free 0.1
Other Inorganic Parameters (mg/kg)								
Fluoride	300.0		12	12	--	--	--	--
Total organic carbon	EPA 415.1 or 9060		--	--	--	--	--	--
Total phosphorus, as P	365.1		--	--	--	--	--	--

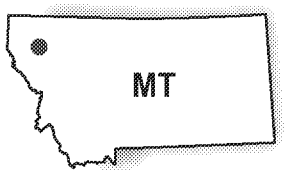
Notes:
(1) MDL = Method Detection Limit. Target MDLs will be based on the MDLs provided by the selected laboratory.
(2) PQL = Practical Quantitation Limit. Desired PQLs are maximum quantitation limits where screening levels or risk based criteria are available. PQLs given for analytes without risk-based criteria will be based on the reporting limits (RLs) provided by the selected laboratory.

FIGURES

1. CFAC Property Map
2. Site Location Map
3. Proposed RI Phase I Sample Locations Main Plant Section
4. Proposed RI Phase I Sample Locations Historic Landfill Section
5. Proposed RI Phase I Sample Locations Northern Section
6. Proposed RI Phase I Sample Locations Southeastern Section
7. Proposed RI Phase I Sample Locations Southwestern Section
8. Proposed RI Phase I Sample Locations Western Section
9. Proposed RI Phase I Surface Soil Sampling Grid
10. Proposed RI Phase I Background Soil Boring Locations
11. Project Organizational Chart



QUADRANGLE LOCATION



SOURCES:
USGS; 2013, Columbia Falls No., MT
USGS; 2013, Columbia Falls So., MT
USGS; 2013, Doris Mountain, MT
USGS; 2013, Hungry Horse, MT
7.5 Minute Topographic Quadrangle

N

0 1500'

Title:

SITE LOCATION MAP

2000 ALUMINUM DR
COLUMBIA FALLS, MONTANA

Prepared for:

COLUMBIA FALLS ALUMINUM COMPANY

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: M.R.	Date: 24FEB15	FIGURE
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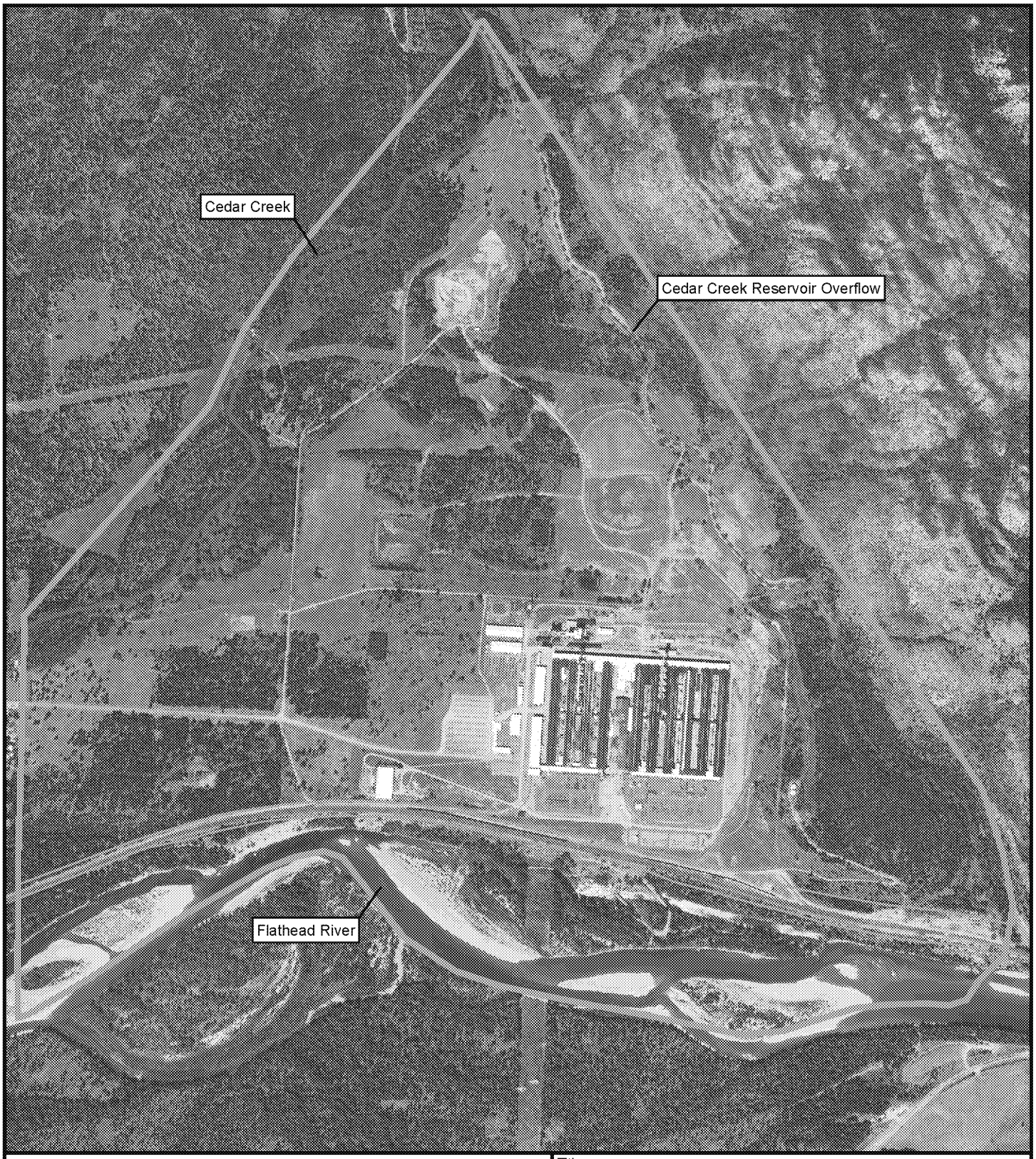
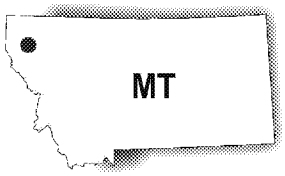


Legend

Site Boundary

Approximate Third-Party Property Boundaries



N

1,000 0 1,000 Feet

Image Source: 2013 National Agriculture Imagery Program

Title:

RI/FS SITE BOUNDARY

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:

COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

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Compiled by: A.M.	Date: 10/21/2015	FIGURE
Prepared by: A.M.	Scale: 1 inch = 1,370 feet	2
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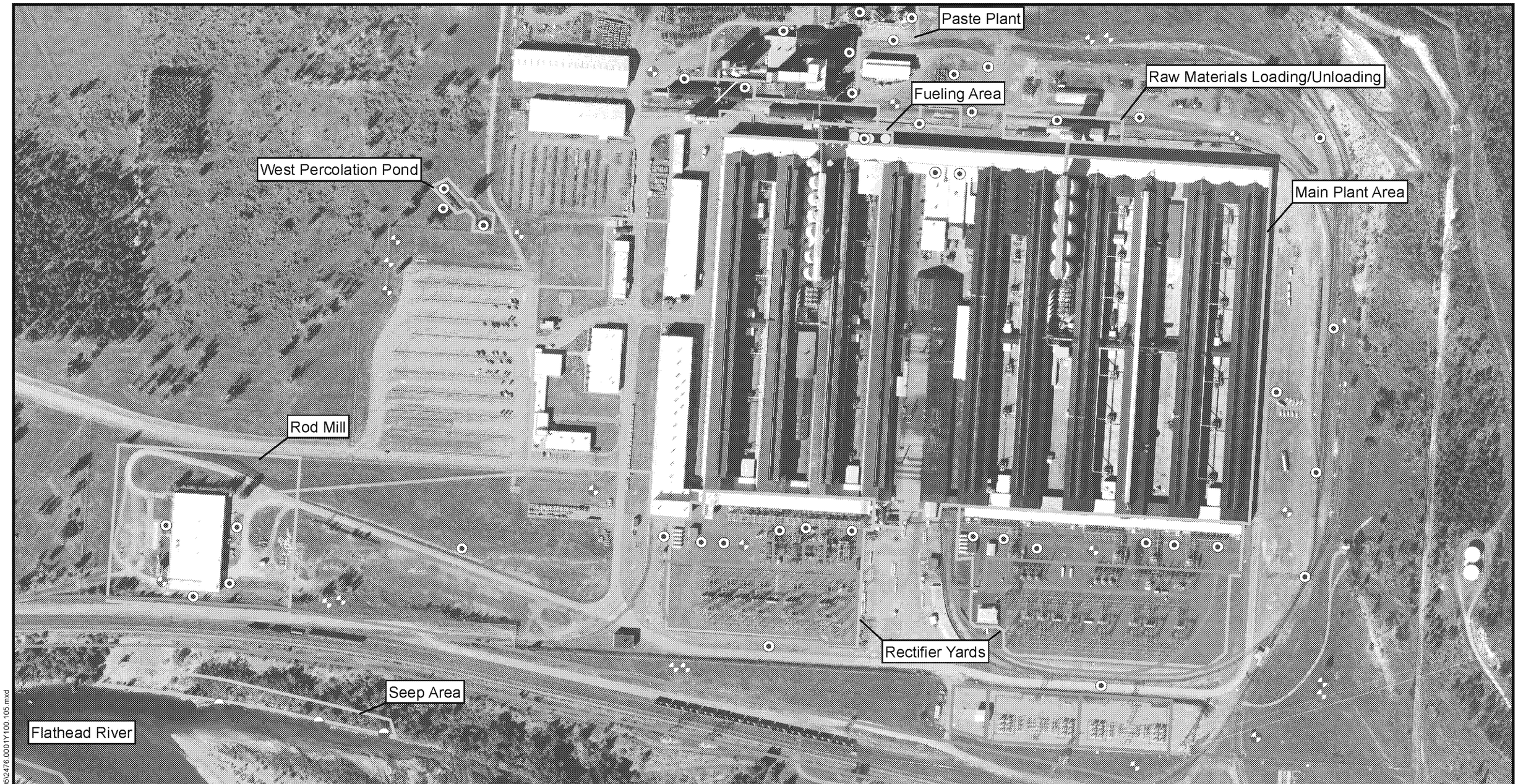

Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Site Features
- Approximate Third-party Property Boundaries

N

300 0 300 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:

PROPOSED RI PHASE I SAMPLE LOCATIONS
MAIN PLANT AREA

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Compiled by: M.A.	Date: 17NOV2015	FIGURE
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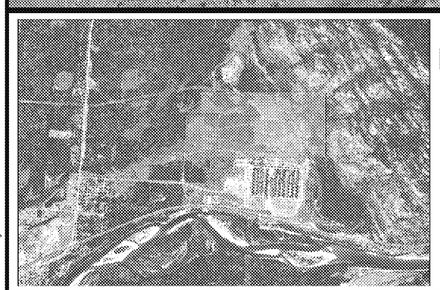

Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Site Features
- Approximate Third-party Property Boundaries

N

300 0 300 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:
PROPOSED RI PHASE I SAMPLE LOCATIONS
HISTORIC LANDFILL AREA

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Compiled by: M.A.	Date: 21OCT2015	FIGURE
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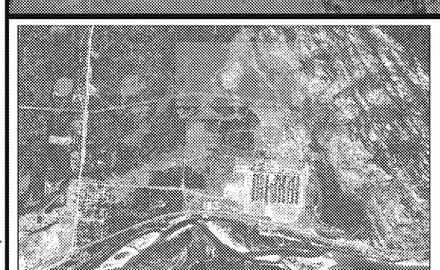

Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Site Features
- Approximate Third-party Property Boundaries

N

300 0 300 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:
PROPOSED RI PHASE I SAMPLE LOCATIONS NORTHERN SECTION

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Compiled by: M.A.	Date: 21OCT2015	FIGURE
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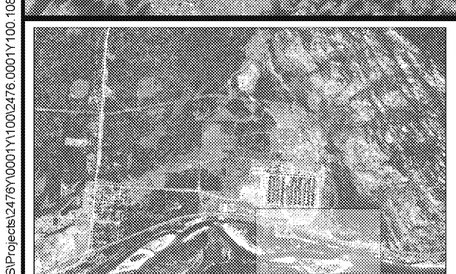

Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Site Features
- Approximate Third-party Property Boundaries

N

300 0 300 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
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Title:
PROPOSED RI PHASE I SAMPLE LOCATIONS
SOUTHEASTERN SECTION

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

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COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Compiled by: M.A.	Date: 21OCT2015	FIGURE
Prepared by: A.M.	Scale: 1 in = 300 ft	6
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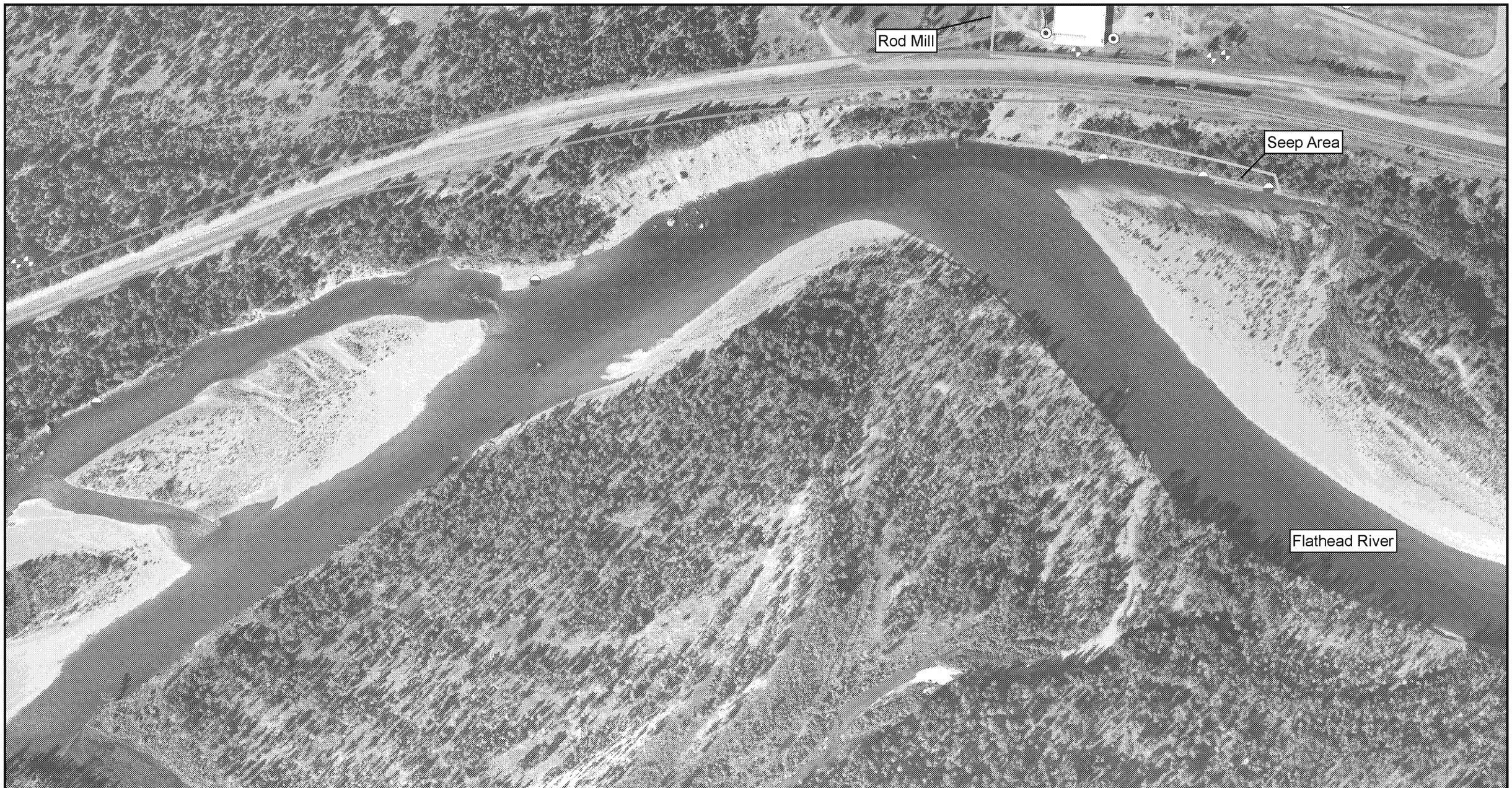

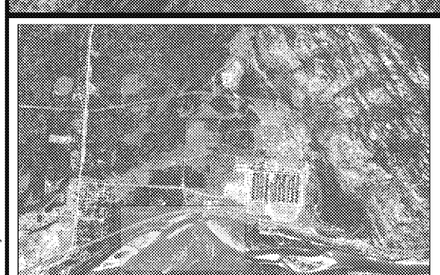

Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Site Features
- Approximate Third-party Property Boundaries

N

300 0 300 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:
PROPOSED RI PHASE I SAMPLE LOCATIONS
SOUTHWESTERN SECTION

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Compiled by: M.A.	Date: 21OCT2015	FIGURE
Prepared by: A.M.	Scale: 1 in = 300 ft	7
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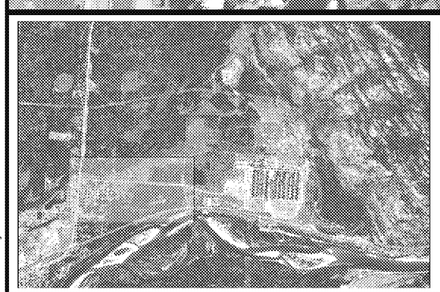

Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Site Features
- Site Boundary
- Approximate Third-party Property Boundaries

N

300 0 300 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:
PROPOSED RI PHASE I SAMPLE LOCATIONS
WESTERN SECTION

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Compiled by: M.A.	Date: 21OCT2015	FIGURE
Prepared by: A.M.	Scale: 1 in = 300 ft	8
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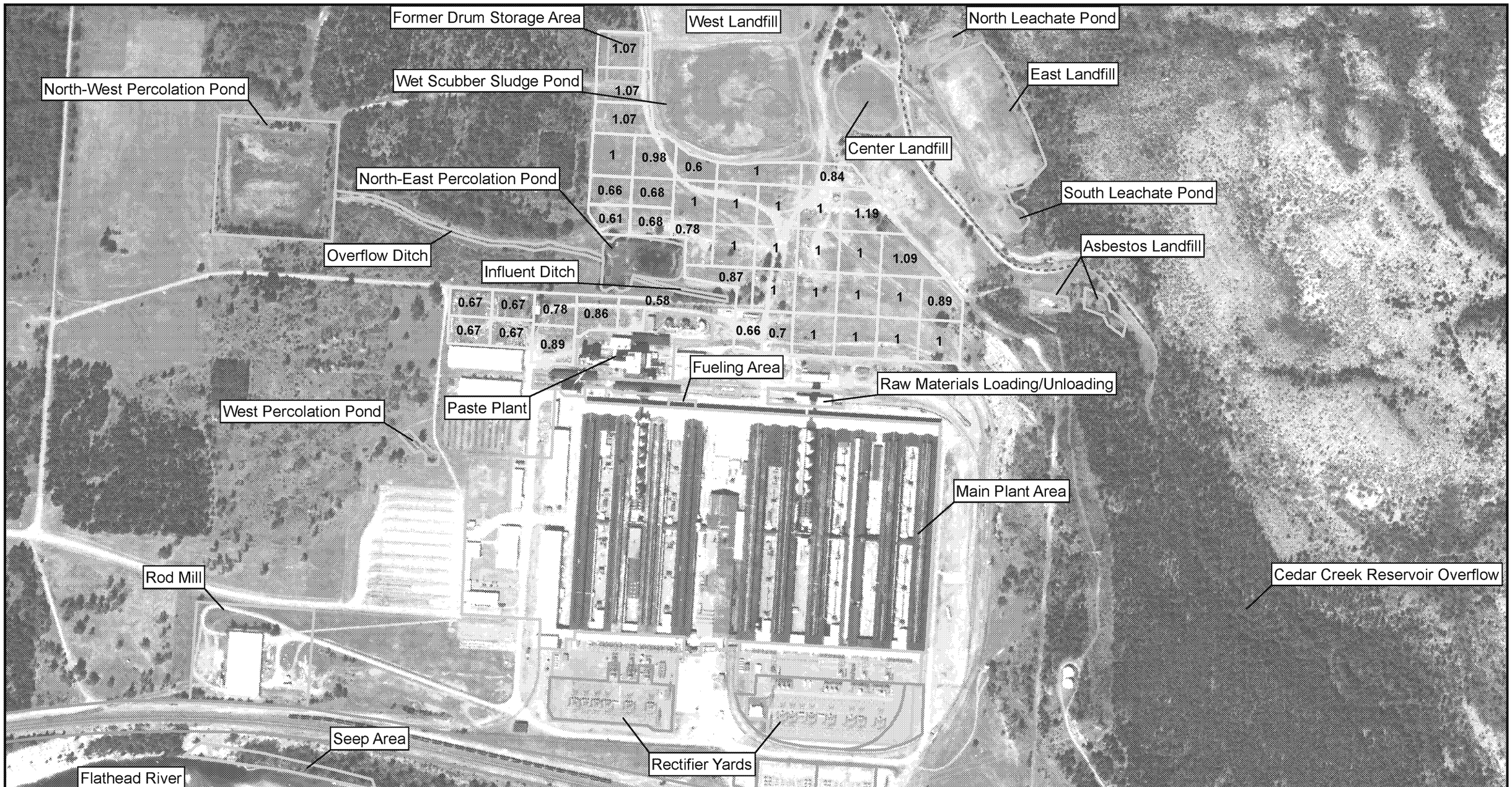

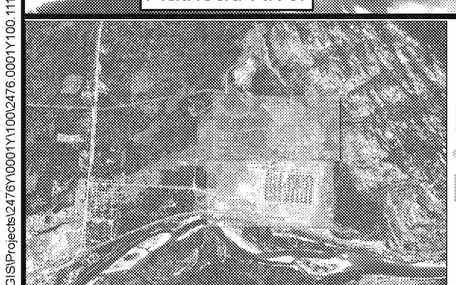

Legend

- Proposed Sampling Grid Within Operational Area
- Site Features
- Approximate Third-party Property Boundaries

N

500 0 500 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:

PROPOSED SAMPLING GRID LOCATIONS

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:

COLUMBIA FALLS ALUMINUM COMPANY, LLC

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Environmental Consulting & Management

Compiled by: M.A.	Date: 21OCT2015	FIGURE
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Legend

- Proposed Soil Boring Within Background Area
- Site Features
- Approximate Third-party Property Boundaries

500 0 500 Feet

Image Source: Flathead Basin 2009 Natural Color Aerial Photos
Montana State Library Geographic Information Services

Title:

PROPOSED SOIL BORING BACKGROUND LOCATIONS

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: M.A.	Date: 28OCT2015	FIGURE
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Figure 11. Remedial Investigation/Feasibility Study Project Organization Chart
Columbia Falls Aluminum Company, Columbia Falls, Montana

APPENDICES

A. Standard Operating Procedures
B. Example Field Datasheets

APPENDIX A

Standard Operating Procedures

Date: May 5, 2000
Revision: April 6, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Valid water-chemistry data are integral to adequately characterize water-quality conditions, therefore, the data will typically be confirmed by the implementation of QC samples to verify the collection of representative samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate (sometimes referred to as a duplicate) and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with, or turned over to, a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a 40-ml vial that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). Two sealed laboratory filled 40-ml vials will be submitted per trip blank set. A trip blank set will be included in each cooler containing VOC samples, or other analyte(s) of interest, per day.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample.

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Additional volume is required for MS/MSD samples. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results and should be collected, when possible, from a location expected to be relatively free from contamination

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

f. Temperature Blank - A temperature blank is a container of water shipped with each cooler of samples requiring preservation by cooling to 6EC (ice). The temperature of the blank is measured at the time of sample receipt by the laboratory.

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).

3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail, by courier or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

END OF PROCEDURE

Date: May 5, 2000
Revision: April 7, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in a bound field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Field notes are considered the legal record of site activities, and as such they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for

other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting environmental field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Appropriate Roux Associates' or project-specific forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).

c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)

d. Approved work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

h. Digital camera.

3.0 DOCUMENTATION

3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information

that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

a. List of Roux Associates personnel on site.

b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.

c. Client and project number.

d. Name and location of study area.

e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.

f. List of non-Roux Associates personnel (e.g. subcontractors, client representatives) on site.

g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.

h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).

i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).

j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).

k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).

l. Task designation and work progress.

m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, facility personnel, the general public, and Roux Associates personnel.

n. Delays, unusual situations, problems and accidents.

o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).

q. Equipment and instrument calibration information, results and/or problems.

r. Decontamination and calibration procedures.

s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.

t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.

u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.). Logbook entries should be objective, factual, and free of personal feelings or other terminology which might prove inappropriate. Avoid using nontechnical or subjective terms (e.g., , oily, strong-smelling).

v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 Pens with permanent ink will be used to record all data. Data or other information that has been entered incorrectly will be corrected by drawing a line through the incorrect entry and **initialing and dating** the linedthrough entry. Under no circumstances should the incorrect material be erased, made illegible or obscured so that it cannot be read.

3.3 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

END OF PROCEDURE

Date: May 5, 2000
Revision: April 16, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling and management which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. This SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be

performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended when not precluded by method requirements. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples for "low-level" volatile analysis should be collected in the same type of vials or using EnCore samplers provided by the laboratory. Non-aqueous volatile organic samples for "mid or high-level" volatile analysis may be collected in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the

container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. This can be achieved by gently tapping the bottom of the voa to dislodge potential air bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. Clear packing tape may also be used to protect the integrity of the sample label. The bottles must be carefully packed to prevent breakage during transport. Use of bubble wrap is recommended. When several bottles have been collected for an

individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory.

Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased.

The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap", and "zip-lock" bags.

f. Overnight (express) mail forms, and laboratory addres or courier contact information

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: March 2, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring water levels using (electronic water-level meter). An m-scope is an electronic sounding device used to measure the depth to ground water below an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow.

M-scopes can be less accurate than a steel tape because the wire can kink, measurement increment marks can shift, and the tip may have been cut off and replaced without proper documentation. Thus, it is mandatory that a m-scope be inspected and calibrated before use.

2.0 DECONTAMINATION

The m-scope must be pre-cleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 CALIBRATION

The m-scope must be calibrated before being used to measure water levels. Calibration is accomplished by measuring the water level with the m-scope followed by a measurement using a steel tape. This dual measurement procedure is continued until the individual is confident that measurements taken using both devices are similar and the m-scope is reliable. The calibration procedure is documented in the field notebook or on an appropriate field form, and initialed and dated. If the probe is not working (i.e., does not detect water), the probe is to be returned to the supplier for repair; It is not to be repaired in the field.

4.0 PROCEDURE

4.1 Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

4.2 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).

4.3 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.

4.4 The 1-foot or 5-foot marked intervals on the electrical line must be checked to ensure that they have not shifted, and the bottom of the probe has not been cut. Check on a periodic basis that the cord has not kinked.

4.5 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

4.6 The electrical line is held at the MP and, using a ruler (e.g., carpenter's folding ruler) or an engineer's scale, the distance from the "held" point to the nearest marked interval is measured. The distance measured is added to, or subtracted from, the marked interval reading. The result is the DTW.

4.7 Measurements will be taken accurately and to the nearest 0.01 foot.

4.8 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure other wells.

4.9 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to determine if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.

4.10 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Re-measure the well(s) where anomalies are found as a check on the initial measurement(s).

4.11 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).

4.12 All pertinent data will be documented in the field notebook, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000
Revision: May 5, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for purging a well prior to the collection of a groundwater sample. Purging (evacuating) a well involves the removal of the standing column of water in the well to allow "fresh" (representative) formation water to enter the well. Two conventionally used methods for well purging include: 1) discharge of a specified number of casing volumes of water (which is more commonly used); and 2) pumping until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. Wells must be purged prior to sampling to ensure the collection of representative formation ground water for water-quality analysis. Note: This SOP is not applicable low-flow sampling. If low-flow sampling is specified within the scope of work refer to SOP 4.4. There are several purging strategies that may be used, depending on specific conditions encountered for given well sampling situations. The same purging method will be used each time to maintain consistency. The selected purge technique will be based on site-specific field conditions, sampling objectives, and Roux Associates, Inc. experience and knowledge, and regulatory agency(ies) guidelines (e.g., some states permit purging a low-yield well to dryness while others insist that some water remains in the well).

2.0 EQUIPMENT AND MATERIALS

2.1 The following equipment may be needed to purge a monitoring well before sampling:

a. Bailers.

b. Appropriate pump(s): centrifugal pumps, electrical submersible pumps, peristaltic pumps, positive gas-displacement devices, bladder pumps, hand-operated diaphragm or bilge pump(s).

c. Teflon™ tape, electrical tape.

d. Interface probe, water level meter or m-scope with with 0.01-foot measurement increments.

e. Appropriate discharge hose and valves.

h. Appropriate discharge tubing (e.g., polypropylene) if using a peristaltic pump.

i. Appropriate compressed gas if using bladder-type or gas-displacement device.

j. Extension cord(s), portable generator (and fuel), or battery pack depending upon the type of equipment

k. Non-absorbent cord (e.g., polypropylene, nylon, etc.), cord.

l. Tripod(s).

m. Field book

n. Multi-gas meter (for sampling locations with vapor concerns)

o. Flow meter.

2.2 Bailers or centrifugal pumps are recommended for shallow, small diameter monitoring wells. For deep wells, or large diameter wells, a submersible pump is recommended.

3.0 DECONTAMINATION

Each piece of equipment that is used to evacuate wells (e.g., bailers, pumps, hoses) will be decontaminated thoroughly prior to the introduction of the equipment into the well and prior to leaving the site. Disposable items (e.g., cord, tubing) will be changed between each well purged and discarded in an appropriate manner. A clean pair of new, disposable nitrile gloves will be worn each time a different location is sampled and the gloves should be donned immediately prior to sampling. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised.

4.0 PROCEDURE

4.1 Prior to initiating the purge, the amount of water standing in the water column (water inside the well riser and screen) should be determined. The depth to water (DTW) is measured and subtracted from the sounded (total) depth of the well to calculate the length of the column of standing water in the well (in feet).

4.2 The volume of the standing water in the well is calculated by multiplying the length of standing water by a coefficient which equates the diameter of the well to gallons per linear foot. (Refer to the attached table from the Water Well Handbook for the coefficient or use the following equation [V=(7.48 gal/ft3)(r2h), where V is volume of water in gallons, r is the radius of the well casing in feet, and h is the height of the water column in the well in feet].)

4.3 With respect to volume, an adequate purge is normally achieved when three to five well volumes have been removed (as per -typical regulatory agency requirements).

4.4 If wells are screened in low permeability formations, then the well may go dry prior to removing the specified volume of water. For wells with slow recovery, attempts should be made to avoid purging the well dry. This can be accompnished by slowing the purge rate. In situations where a well has been

purged dry (evauated) this generally constitutes an adequate purge and the well should be sampled following sufficient recovery.

4.5 Evacuation will occur from the top of the water column to ensure that "fresh" formation water enters the well through the bottom portion of the screen, and replaces the standing water that is being removed (i.e., only representative formation water is in the well).

4.6 The volume of water purged from the well must be measured and can be calculated directly by discharging into containers of known volume or can be calculated by multiplying rate of flow by time.

4.7 If a submersible or centrifugal pump is used, then the intake is set just below the dynamic (pumping) water level in the well. The rate of flow in gallons per minute (gpm) can be measured using a calibrated bucket (e.g., 5-gallon) if the rate is relatively low, or a 55-gallon drum if the rate is relatively high, and a watch capable of measuring time in second intervals. A precalibrated flow meter may also be used if available.

4.8 After the specified number of casing volumes have been evacuated from the well, the pump intake should be lifted slowly until it breaks suction to confirm that any standing water above the intake has been purged.

4.9 If a bailer is used, then the bailer is lowered only deep enough to remove water from the top of the water column and a 5-gallon bucket is used to measure the volume of water evacuated.

4.10 If purging is not executed by evacuating a specified number of well volumes, then purging is performed by pumping or bailing the well until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. The volume of water removed is documented on an appropriate field form or in the field notebook.

4.11 Water purged from the well will be disposed of in accordance with the appropriate method outlined in the site SAP.

4.12 If historic site data indicate that explosive gases could be present and accumulate in the well, then an multi-gas meter (explosimeter) will be used to check vapor concentrations in wells at the site prior to beginning the purging procedure. Vapor concentrations in a well that exceed the 25 percent lower explosive limit (LEL) will require specific precautionary measures to allow purging the well without danger of explosion or fire (e.g., use of cotton cord for bailers or lowering pumping devices, non-electric powered pumps). These conditions will be addressed in the site health and safety plan (HASP) and/or SAP.

END OF PROCEDURE

Date: January 10, 2011
Revision: May 7, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sampling monitoring wells for dissolved constituents in groundwater using low flow (low stress) techniques. Low flow purging and sampling results in the collection of groundwater samples from monitoring wells that are representative of groundwater conditions in the geological formation by minimizing stress on the geological formation, and minimizing the disturbance of sediment in the bottom of the well. This procedure also minimizes aeration of the groundwater during sample collection, which improves the representativeness of the sample for VOC analysis.

As part of the SOP for the sampling of groundwater monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, and purging wells) must be implemented. The sampling objectives will be provided in specific investigation work plans that will be approved by the applicable regulatory agency. Unless otherwise specified in an approved work plan, all groundwater purging and sampling should typically be performed using low stress (low flow) sample collection techniques.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample groundwater from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. Adjustable rate, positive displacement groundwater sampling pump (e.g., low-flow centrifugal submersible pump or bladder pump constructed of stainless steel, Teflon or other inert material).

c. Teflon or Teflon-lined polyethylene tubing with ¼-inch or 3/8-inch inner diameter to collect samples for organic analysis. Teflon or Teflon-lined polyethylene tubing, PVC, Tygon or polyethylene tubing with ¼-inch or 3/8-inch inner diameter to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.

d. Appropriate power source (compressor or compressed gas tank, controller, generator, etc.).

e. Monitoring instrument for water quality indicator parameters (Horiba U-22 or equivalent) including temperature, dissolved oxygen, turbidity, specific conductance, pH and redox potential (Eh).

f. Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).

g. Electronic interface probe with a minimum of 0.01 foot accuracy.

h. Decontamination supplies including Non-phosphate laboratory-grade detergent, distilled/deionized water and potable water.

i. Roux Associates' low flow well sampling/purging data form and field notebook.

j. Well construction data logs, field data from previous sampling event, and site map with well locations.

k. Well security keys.

l. Plastic sheeting.

m. Paper towels, clean rags.

n. Teflon™ tape, .

o. Calculator.

p. Black pen and water-proof marker.

q. Tools (e.g., wrenches, screwdrivers, hammer, pliers, flashlight, etc.) or alternatives recommended in the JSAs.

r. Disposable Nitrile gloves.

s. Laboratory-supplied sample containers with labels.

t. Cooler(s).

u. Ice (wet, blue packs).

v. Masking, duct, and packing tape.

w. Chain-of-custody form(s) and custody seal(s).

x. Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) or equivalent summary.

y. Site health and safety plan (HASP).

z. Packing material (e.g., bubble wrap)

aa. "Zip-lock" plastic bags.

bb. Overnight (express) mail forms (or schedule courier pickup if available).

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the Roux SOP-9.1 for Decontamination of Field Equipment for detailed decontamination methods; a summary of pump decontamination procedures is provided below). Use new, clean materials when decontamination is not appropriate (e.g., tubing, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

A. Before sampling:

The manufacturer recommendations on pump disassembly for cleaning, if any, should take precedence to the disassembly recommendations presented below.

1) Wear disposable Nitrile and cut proof gloves.

2) Pre-rinse: Operate the pump first in an appropriate container with potable water for 5 minutes.

3) Wash: Operate the pump in an appropriate container with a non-phosphate, laboratory-grade detergent such as Alcanox and potable water solution for 5 minutes.

4) Rinse: Operate the pump in an appropriate container for 5 minutes with potable water.

5) Disassemble pump (refer to manufacturer's manual).

6) Wash pump parts: Place the disassembled parts of the pump into an appropriate container with non-phosphate detergent solution. Scrub the disassembled pump parts with an appropriate brush.

7) Rinse pump parts with potable water.

8) Rinse the following parts with distilled/deionized water: inlet screen, shaft, suction interconnector, motor lead assembly, and stator housing.

9) Rinse impeller with potable water.

B. After each sample collection, decontaminate by:

1) Wear disposable Nitrile gloves.

2) Pre-rinse: Operating the pump first with potable water for 5 minutes.

3) Wash: Operate the pump in an appropriate container with a non-phosphate, laboratory-grade detergent such as Alcanox and potable water solution for 5 minutes.

4) Rinse: Operate the pump in an appropriate container for 5 minutes with potable water

5) Final Rinse: Operate the pump in an appropriate container to pump out 1 to 2 gallons of distilled/deionized water

6) Wipe pump-related equipment (e.g., electrical lines, cables) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for pumps are the minimum that must be performed. Check the work plan to determine if additional chemicals specified by individual state regulatory agencies also must be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., water quality meter, photoionization detector, flame ionization detector) according to the Manufacturer's calibration instructions. Document, initial and date the calibration procedures on the appropriate field form and in the field notebook.

5.0 PROCEDURE

5.1 As practicable under field conditions, start at the well that is known or believed to have the least contaminated groundwater and proceed systematically to the well that is known or believed to have the most contaminated groundwater.

5.2 Document, initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.3 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.4 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.5 When vapor concerns are present, measure the VOCs at the rim of the unopened well utilizing a photoionization detector (PID) or flame ionization detector (FID) instrument and record the reading in the field notebook.

5.6 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. Never inhale the vapors.

5.7 Measure the depth to water (DTW) to 0.01 ft from the measuring point (MP) on the well (top of well casing) using an electronic interface probe or water level meter. Calculate the water-level elevation. Document, initial and date the information on the appropriate field form and in the field notebook.

5.9 Decontaminate the interface probe or water level meter with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.10 Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well at midpoint of the immerged well screen or at the most permeable zone within the immerged well screen. The pump intake is to be kept at least two feet above the bottom of the well to prevent disturbance and re-suspension of any sediment or a sinking separate phase product (DNAPL) present in the bottom of the well.

If separate-phase product was identified in a measurable quantity, then the tubing should be installed using PVC with a tethered cap inserted into the well to bypass the LNAPL. The sample tubing should be inserted through the PVC, pushing out the cap at a depth below the LNAPL in order to sample the groundwater below the LNAPL.

5.11 Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the electronic interface probe in the well.

5.12 Purge well: Start pumping the well at 200 to 500 milliliters per minute (mL/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should be, if needed, reduced to the minimum capabilities of the pump to ensure stabilization of the water level. The flow rate should, however, be sufficient to maintain pump suction and to avoid cascading or air bubble formation in the tubing. Record each adjustment made in the pump rate and the water level measured immediately after each adjustment.

5.13 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.14 Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, redox potential, and dissolved oxygen) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows:

±0.1 for pH

±3% for specific conductance and temperature

±10 mV for redox potential

±10% for DO and turbidity

And turbidity to be less than 50 NTU prior to sampling

The pump must not be removed from the well between purging and sampling.

ADDRESSING POTENTIAL PROBLEMS

Insufficient Yield

If the formation cannot produce enough water to sustain purging, then the well should be pumped to "near-dry" conditions (i.e., leaving some water in the well). Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should be avoided to the extent possible in all cases. When preparing to conduct a sampling round, review drilling, well development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented:

1) The well may have to be sampled over a period of more than one day.
2) The well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected.
3) The well may not recover, which will preclude sampling.

Regardless of the option that must be followed, the sampling procedure must be fully documented in the field notebook.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fail to stabilize after 4 hours or after 5 well volumes have been purged, one of four options should be considered:

1) Continue purging in an attempt to achieve stabilization.
2) Discontinue purging, do not collect samples, and document attempts to reach stabilization in the field notebook.
3) Discontinue purging, collect samples, and document attempts to reach stabilization in the field notebook.
4) Secure the well, purge and collect samples the next day (preferred)

The key indicator parameter for VOCs is dissolved oxygen.

The key indicator parameter for all other samples is turbidity.

Regardless of the option that is followed, the sampling procedure must be fully documented in the field notebook.

5.15 Collect Samples: Collect samples at a flow rate between 100 and 250 mL/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft.

VOC samples must be collected first. If a bladder pump is used, best practice would have it to match one compression stroke to the fill one VOC sampling vial.

Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.16 During sample collection, make sure that the pump discharge line or the bailer does not contact the sample container. Fill each appropriate, pre-labeled sample container by allowing the ground water to flow from the tubing gently down the inside of the container to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in an ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.17 Fill containers for VOCs until a convex surface is observed and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.18 Consult the work plan if filtered sampled should also be collected for dissolved metals analysis.

5.19 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance.

5.20 Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.21 Remove pump and tubing.

5.22 Measure the total depth of the well from the MP with an interface probe. Document, initial and date the information on the appropriate field form and in the field notebook.

5.23 Wipe the well cap/j-plug with a clean rag, replace the well cap/j-plug and protective cover. Lock the protective cover.

5.24 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.25 Decontaminate field equipment following Roux SOP-9.1 for Decontamination of Field Equipment. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard rags, gloves, etc. in a manner consistent with site conditions.

5.26 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.27 Samples will be delivered according to the QAPP schedule.

6.0 REFERENCES

U.S. Environmental Protection Agency – Region I. Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. Revised January 19, 2010.

END OF PROCEDURE

Date: May 5, 2000
Revision: May 5, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for surface-water sampling. Project situations for the collection of surface-water samples vary widely. Since there is no universal sampling procedure, the specific procedure and required equipment will be dependent upon the data objectives of the sampling program and should be identified in the work plan or verified with management prior to sampling. Section 7.0 describes a more rigorous procedure for selecting sample locations which may be required in certain situations.

The objective of surface-water sampling is to collect samples which are representative of the entire surface-water body. Frequently this objective can be quite easy and routine such as one "grab" sample for a small stream or pond with uniform conditions. Other times, the nature of the site-specific conditions make collection of a representative sample more difficult. Consideration of such variables as flow velocity, turbulence, access, health and safety, water composition, tidal fluctuation, surface runoff, factory outfalls, tributaries, etc. is essential in the proper work plan design and sample collection procedures.

Surface-water bodies are constantly subjected to hydraulic forces and a changing environment which brings about variations in the chemical character of the water. Where flow is completely controlled by large storage reservoirs or is maintained at a nearly steady rate by large, constant ground-water inflows, a single sample or observation may suffice to characterize the quality for many days, weeks, or longer. Normally, however, one sample cannot be safely extrapolated for more than a day or two and for some streams not more than a few hours. Thus, the frequency of sampling is an important consideration for the sampling procedure.

Theoretically, a sample representing the overall composition of a surface-water body can be obtained by compositing several depth-integrated samples of equal volume taken at places with equal flow across the cross section. Due to the large number of samples which may be required, it is highly desirable to find a location in which the water composition is uniform with depth and cross section. Again, where uniform sections can be found, the sampling procedure may often be simplified to the extent that a single "grab" sample may be obtained that is representative of the surface-water body.

The United States Geological Survey (USGS) has long followed a practice of collecting samples once daily, as this appears to be the minimum frequency necessary to adequately define the water quality for the majority of water uses. Once-daily sampling has been considered as a standard for the usual comprehensive chemical-quality investigation for surface water. Less frequent sampling schedules are often used, however, and the value of weekly, monthly, or quarterly sampling in reconnaissance or unit basin studies should not be minimized. In general, a surface-water sampling schedule that, at a minimum, coincides with the frequency of ground-water sampling allows for continuity over the sampling period.

2.0 CONSIDERATIONS

Collecting samples from surface-water bodies require special considerations regarding sampling location and general safety.

2.1 The location of a surface-water sampling point is the first consideration for a surface-water sampling program. The general sampling location will be selected based on the requirements of the investigation. The specific sampling location should be selected where flow and turbulence are uniform and access is favorable (i.e., a bridge or shallow section for a river or pond, respectively).

The sampling location should avoid tributaries, parking lot runoff, factory outfalls, and obstructions unless these inputs are of specific interest. Sampling from the boundaries of the surface-water body should generally be avoided, except where these regions are of direct interest. Sampling must proceed from downstream locations to upstream locations (unless site-specific conditions preclude this order) in order that disturbance related to sampling does not affect downstream sample quality. If sediment samples will be collected at the same locations as liquid samples, then the liquid samples must be collected first.

2.2 Health and safety is a key aspect of all sampling procedures. The health and safety plan (HASP) must be referred to regarding the implementation of health and safety procedures and the selection of an adequate sampling location. A USGS gauging station or a bridge are often the most desirable sampling locations because they eliminate the need for entering the water body. If entering the water body is necessary, then the water velocity, depth, sediment type and uniformity, tidal stage, and water chemistry must be evaluated. When entering a water body or working from a vessel (e.g. raft, boat) the sampler must use a safety harness and life jacket, and a buddy system must be employed. If sampling lagoons or surface impoundments containing known or suspected hazardous substances, personnel should refer to the HASP to determine the necessary precautions to ensure the safety of sampling personnel. The sampler should not get too close to the edge of the impoundment, where bank failure may cause him/her to lose his/her balance. Depending upon the geographic location and season, considerations such as water temperature, snakes, rats, ticks, etc. may also be important considerations when selecting a suitable sampling location. 3.0 EQUIPMENT AND MATERIALS

In order to sample surface water, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. A work plan which outlines sampling requirements.

b. A health and safety plan.

c. Decontamination supplies (including as necessary: non-phosphate, laboratory-grade detergent; bucket; brushes; distilled/deionized water; potable water; regulatory-required reagents [e.g., acetone, nitric acid, etc.]; aluminum foil; etc.).

d. Field notebook and field form(s).

e. Maps (site map, sampling plan/location map, topographic map).

f. Cooler and ice (wet or blue packs).

g. Sample bottles (including as necessary: appropriate field blanks, trip blanks, duplicates, preservatives, extra bottles for breakage, proper size and type for analyte, labels, etc.).

h. Plastic sheeting.

i. Meters (as necessary: pH, conductivity, turbidity, eH, dissolved oxygen, iron, manganese, etc.), thermometer, and

j. Calibration equipment/materials for all meters or devices.

k. Wading rod and current meter.

l. Sampler (as necessary: , bailer, pond sampler, weighted-bottle sampler, Wheaton dip sampler, Kemmerer depth sampler, Bacon Bomb sampler, etc.).

m. Disposable sampling gloves.

n. Health and safety equipment (as necessary: , rubber boots, hip waders, chest waders, safety harness, rope, life jacket, life preserver, air horn, two-way communication, etc.).

o. Measuring tape (100-foot, weighted).

p. Non-absorbent cord (e.g., polypropylene) to lower samplers.

q. Camera and film.

r. Filtering apparatus, filters, pre-filters.

s. Paper towels, clean rags.

t. Black pen and indelible marker.

u. Tools (e.g., screwdrivers, hammer, pliers, flashlight, pen knife, etc.)

v. Masking and packing tape.

w. Packing material (e.g., "bubble wrap") and "zip-lock" plastic bags.

x. Chain-of-custody form(s) and custody seals.

y. Overnight (express) mail forms.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as cord, tubing, and gloves will be changed between each use and discarded in an appropriate manner. If a non-disposable item is to be reused during a sampling event, it will be thoroughly cleaned according to the field equipment decontamination SOP. Appropriate field, equipment and trip blanks will be collected as outlined in the work plan to demonstrate proper decontamination procedures.

5.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOPs for field analysis for each respective piece of equipment. Equipment such as current meters must have the manufacturer's manual maintained with the instrument and must be referred to for use, repair, maintenance, trouble-shooting, or calibration, if required. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

6.0 PROCEDURE

6.1 Identify each location to be sampled based upon requirements of the work plan. If any of the considerations outlined in Section 2.0 impact the proposed sampling method, then contact the project manager to get authorization to modify as necessary. When possible, use stakes, flags, or buoys to identify and/or mark all sampling location.

6.2 Record the site and sample location, weather conditions, date, and time of the selected sampling point in the field notebook and on any field forms being used, and initial the entry.

6.3 Describe the surface-water body characteristics including as pertinent: width (feet [ft]), depth (ft), flow (none, low, intermediate or flood; or measured velocity, if possible), turbidity (clear, turbid, very turbid), turbidity or flow variations across the surface-water body, tributary locations and distances, surface runoff impacts, and adjacent land use. A photograph of each sampling location should be included as part of the documentation.

6.4

6.5 Prepare sample containers for collection by organizing, labeling, and verifying proper preservation methods.

6.6 Ensure all sampling equipment has been thoroughly decontaminated and is operational and has been calibrated to the manufacturer's specifications.

6.7 Place plastic sheeting on ground to protect sampling materials from potential contamination.

6.9 Collect the sample utilizing the selected sampling method and immediately place into pre-labeled, laboratory-supplied containers. Fill each appropriate, pre-labeled sample container carefully to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

6.10 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that no bubbles are present by turning the container upside down and tapping gently.

6.11 Filter water samples collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering. Refer to the field filtering SOP for specific procedures.

6.12 Add the appropriate preservative to each container, if required, prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added to the container(s) by the laboratory before shipment.

6.13 Collect quality control (QC) samples to monitor sampling and laboratory performance as required in the work plan. Refer to the SOP for collection of QC samples for a detailed discussion of proper methods.

6.14 Field parameters (e.g., temperature, pH, conductivity, turbidity, etc.) will typically be measured immediately prior to collecting samples for laboratory analysis. Whenever possible, sufficient volume should be collected in the initial sample to complete all laboratory and field parameters.

6.15 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

6.16 Thoroughly clean bailers, hoses, and samplers as discussed in the field equipment decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with accepted procedures.

6.17 Complete field forms, field notebook entries, and the chain of custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

6.18 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

7.0 SELECTING SAMPLE LOCATIONS

In certain situations the work plan will require a more rigorous method to determine the number and location of surface-water samples. The following calculations may be used to determine where to sample and how many samples are to be collected:

a. Calculate the mixing length (L), using the following data:

stream velocity (u), in feet per second (ft/sec)

channel width (w), in feet (ft)

channel depth (d), in feet (ft)

with the equation:

$$L = \frac{2.6\,(u)(w^2)}{(d)}$$

$$L = \frac{2.6\,(\ \ ft/sec)(\ \ ft^2)}{(\ \ ft)}$$

b. Respond to the following three questions:

1. Is the mixing length, L, less than 1 mile?

2. Is the mixing length less than the distance to the nearest upstream tributary?

3. Is the stream homogeneous in turbidity?

If all three answers are Yes, then collect only one sample at a depth of 1 foot.

If the answer to any of the above is No, then calculate the width of the mixed zone.

c. Calculate the width of the mixed zone (w) using the following data:

L = 5280 ft or the distance to the nearest upstream tributary (whichever is less)

d = depth, in ft

u = velocity, in ft/second (ft/sec)

with the equation:

$$w^2 = \frac{(L)(d)}{(2.6)(u)}$$

Collect samples at distances across the streams that are less than the mixed zone width, w.

END OF PROCEDURE

ED_002345B_00009969-00179

Date: May 5, 2000
Revision: May 7, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the field filtration of groundwater samples for dissolved metals analysis prior to sample preservation. Filtering is implemented when the water sample contains suspended fine-grained materials (fines) that cannot be prohibited from entering the water sample by well development or well design. However, as fines are not always distinctly visible in the water sample, all water samples to be analyzed for dissolved metals will undergo filtration. Groundwater samples from bedrock formations to be analyzed for dissolved metals must also be filtered.

It should be noted that certain regulatory agencies insist that groundwater samples for metals analysis are not filtered. In this case, the analytical results are actually representative of total metals (i.e., dissolved and suspended). Nevertheless, if it is desired to quantify the concentrations of dissolved metals in groundwater, filtration will need to be performed.

Within this framework, filtration refers to the filtering of water either directly, or at the end of a filtration series, through a 0.45 micrometer (micron) membrane filter. The presence of a large quantity of fines may require the prefiltering of the sample with a larger-size membrane filter prior to the 0.45 micron filter to avoid clogging the 0.45 micron filter.

Filtration must be done as soon as possible after a water sample is collected, preferably at the same time that the water is produced. If there is a delay between the time that the water sample is collected and the time that filtration occurs, then the time lag and reason for the delay must be documented. The filtering equipment and membrane must be suitable for the intended analysis. Where permitted by regulatory agencies, disposable in-line filters and disposable funnel-type filters may be used. Depending upon the sampling needs, sterile disposable filtering devices may be preferable since they eliminate the need for field decontamination. Materials known to adversely affect the analytical procedure must not be used. The site sampling and analysis plan (SAP) must be referred to for these and other site specific filtration conditions.

In the event that surface water is being analyzed for dissolved metals, the filtration process described below should be used.

2.0 MATERIALS AND EQUIPMENT

4.1 To field filter groundwater samples, specific equipment and materials are required. The equipment and materials listed below may be needed in addition to the materials and equipment listed in various sampling SOPs.

a. Non-phosphate, laboratory-grade detergent.

b. Distilled/Deionized water.

c. Potable water.

d. Field forms (e.g., daily log, sampling, etc.) and field notebook.

e. Filtration apparatus (e.g., disposable plastic filtering apparatus, disposable in-line filters, Gelman apparatus, Buchner funnel, etc.), filters, prefilters.

f. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

g. Teflon™ tape.

h. Vacuum pump (e.g., hand-operated or electric).

i. Appropriate tubing and fittings.

j. Disposable gloves.

k. Sample jars with appropriate preservative (e.g., nitric acid) and labels.

3.0 DECONTAMINATION

3.1 Decontamination is not necessary if sterile, disposable plastic filtering equipment is utilized. If applicable, it may be useful to collect a distilled water field blank through a representative disposable filter to demonstrate proper "decontamination." If re-usable filtering equipment is being used, the following is the minimum decontamination procedure:

a. Wear disposable gloves while cleaning filtering equipment to avoid contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and distilled or deionized water in a bucket.

c. Remove vacuum tubing from flask.

d. Remove filter membrane from funnel.

e. Disassemble filtering apparatus (flask and funnel) and scrub each piece of equipment with a brush and solution.

f. Rinse with potable water.

g. Rinse with copious amounts of distilled or deionized water.

h. Allow to dry and wrap equipment with a suitable material (e.g., clean plastic bag) in preparation for the next use.

3.2 The decontamination procedure must consider regulatory agency(ies) specifications which must be provided in the site SAP, and may include decontamination variations such as nitric acid rinses, acetone rinses, etc. For standard decontamination procedures, refer to ROUX-SOP 9.1 Field Equipment Decontamination.

4.0 PROCEDURE

4.1. Ensure that the filtering equipment is disposable and dedicated or is properly decontaminated before each use.

4.2. Assemble the filtering apparatus (funnel and flask), and connect the vacuum pump in case it is needed to augment gravity filtration.

4.3. Place a clean (new) 0.45-micron pore-size filter in the funnel. Use larger, pore-size filters if prefiltering is required (i.e., if significant suspended sediment is present that would quickly clog the 0.45-micron filter and prevent continuous filtration or result in excessive time for filtration).

4.4. Obtain the water sample using an appropriate, decontaminated sample-collection device (e.g., bailer, pump).

4.5. Pass the unpreserved water sample through the 0.45 micron filter into the flask. If the sample contains significant sediment, then pass it through a prefilter before using the 0.45 micron filter. Apply a vacuum using the vacuum pump if needed to facilitate filtering.

4.6. Transfer the filtered water sample to the appropriate, prelabeled sample container containing the preservative (e.g., nitric acid) being careful not to overfill the container and dilute the preservative.

4.7. Follow standard operating procedures for sample documentation, shipping, and tracking (i.e., record keeping).

4.8. Decontaminate all reusable filtering (and sampling) equipment that came in contact with the water sample. Properly disposal of all non-reusable equipment in a manner appropriate with site conditions.

END OF PROCEDURE

Date: May 5, 2000
Revision: April 16, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for measuring the thickness of floating separate-phase organic liquids in monitoring wells, tanks drums, or other containers. Measuring the thickness of floating, separate-phase organic liquids requires special health and safety considerations, equipment, and procedures.

Separate-phase layers can either be "floaters" or "sinkers". "Floaters" (non-aqueous phase liquids [NAPLs]) are separate-phase liquids that are less dense than water and float on the ground-water surface. "Sinkers" (dense non-aqueous phase liquids [DNAPLs]) are separate-phase liquids that are more dense than water and tend to migrate downward through aquifers due to gravitational forces until a low permeability layer is encountered (i.e., they accumulate at the bottom of the aquifer). For the purpose of this SOP, only measuring the thickness of floating (LNAPL) separate-phase liquids will be addressed.

The objectives for measuring separate-phase organic liquids may include the following: 1) determination of the thickness of the free product in a well, tank or drum; 2) estimation of the volume of free product to be removed from a well before sampling, or from a tank or drum before removal; and 3) calculation of the "true" (non-free product depressed) elevation of the water table.

2.0 CONSIDERATIONS

The primary considerations when measuring the thickness of floating separate-phase liquids are health and safety, and proper equipment selection.

2.1 Health and Safety

All separate-phase products must be assumed to possess health and safety hazards equivalent to the most hazardous suspected on-site source. For example, if fuel oil is being measured in wells where polychlorinated biphenyls (PCBs) are known (or suspected) to be present, then the potential for PCBs to be present in the fuel oil must be considered. When measuring the thickness of flammable materials, it is imperative that all possible sources of ignition be eliminated. Minimum requirements (NO EXCEPTIONS) include: no smoking or open flames, use of intrinsically safe downhole monitoring equipment, use of static free bailing cord (e.g., absorbent cord [cotton]), and use of properly vented and grounded product collection containers. When product collection containers will be stored onsite, the local fire code official must be consulted regarding product storage requirements (e.g. venting, grounding, labeling, permits, secondary containment, etc.). A detailed, comprehensive explanation of health and safety procedures must be outlined in the site health and safety plan (HASP).

2.2 Equipment Selection

There are several methods which may be employed to measure the thickness of separate-phase petroleum product in a monitoring well, tank or drum. The actual method to be utilized should be outlined in the work plan. Considerations in selecting a method shall include: the type and consistency of the product; the level of accuracy desired; the expected depth and thickness of the product; and the diameter of the well or port.

Measurements of floating separate-phase product thicknesses can be performed using 1) an electronic oil/water interface probe; 2) a graduated, clear acrylic bailer; or 3) a weighted steel measuring tape (or graduated "stick") in conjunction with oil and water paste.

An oil/water interface probe is capable of providing rapid and accurate (±0.01 foot) results under most field situations. However, viscous product or oil/water emulsions may interfere with performance by coating the probe and/or disguising the interface. In these situations, a clear, acrylic bailer may be used in wells, or oil and water paste in a tank or drum.

A clear, acrylic bailer may be used if simply the presence or absence of product or an approximate product thickness is desired. In certain situations (e.g., viscous product or product/water emulsions) a clear acrylic bailer may be the best available method. However, when product thicknesses are greater than approximately three feet, a bailer will be unable to provide approximate product thickness measurements. If the oil/water interface probe will not work, and the product thickness is too great to be measured by a bailer, then the best available technique may be oil and water paste.

A graduated "stick" or weighted steel tape in conjunction with oil and water paste may be appropriate for measuring residual water or product in a tank or drum. This method is not recommended for use in monitoring wells because of possible cross-contamination from the paste itself. In certain situations where no other method can provide the necessary data, oil and water paste may be used in monitoring wells containing product. This method is less accurate than an oil/water interface probe, but frequently more accurate than a clear, acrylic bailer.

It should be noted that erroneous data may be collected by all three methods when measurements are collected through the fill ports of tanks which are equipped with drop tubes. Whenever possible, product thickness measurements should be collected from ports with unobstructed access to the tank contents. When measurements must be collected from a fill port with a drop tube, it should be understood that there may be significant differences between the drop tube measurements and the actual thicknesses of the water and product in the tank.

3.0 CALIBRATION

3.1 Oil/Water Interface Probe

There is no specific calibration procedure for an oil/water interface probe. However, you should verify that the unit operates properly prior to taking it out in the field by testing it in a jar containing product and water. This jar should be stored in a flammable liquid cabinet and be dedicated to oil/water interface probe testing. Since most oil/water interface probes have a heavy probe assembly and a rigid graduated tape, kinking, stretching or twisting of the tape is not a significant concern. In order to ensure proper operation, the unit should be kept warm prior to use (e.g. cab of truck).

3.2 Clear Acrylic Bailer

There is no specific calibration procedure for an acrylic bailer. However, since you only get one chance to measure the thickness correctly, you should verify that the check valve operates properly with distilled water. Based on previous data, if available, you should ensure that the length of the bailer is sufficient to measure the entire thickness of the product.

3.3 Oil/Water Paste

There is no specific calibration procedure for using oil and water paste. However, these pastes may not behave reliably if they are old or have been exposed to extreme temperatures. The pastes should be tested prior to taking them out in the field to confirm they work. The stick measure or weighted steel tape should be carefully examined to confirm that it is properly graduated and has not been damaged or modified.

4.0 DECONTAMINATION

4.1 Complete decontamination of a clear acrylic bailer which is dedicated to the measurement of separate-phase product thicknesses can be very difficult. Thus, bailers should be used on a one time basis. Decontamination should involve removal of gross contamination before entering and exiting the site or moving to different areas of separate-phase product accumulation. Special care must be taken to make sure that a “product bailer” never enters a “clean” well which does not contain separate-phase product. This can be ensured by measuring separate-phase thickness in all wells before starting bailing operations. The oil/water interface probe must be thoroughly cleaned according to the field equipment decontamination SOP before entering each well. If historical data are available, then the order of measuring separate-phase thickness should be from the cleanest well to the dirtiest well to further reduce the potential for cross-contamination. If samples are also being collected for constituent or characterization analysis, then a disposable, dedicated bailer may be necessary for product collection.

5.0 EQUIPMENT AND MATERIALS

Depending on the method used to measure the thickness of separate-phase organic liquids, both method-specific and general equipment and materials are needed.

5.1 Regardless of the method used, general equipment and materials will include, but may not necessarily be limited to, the following:

a. Site Health and Safety Plan (HASP).

b. Appropriate health and safety equipment, as specified in the HASP.

c. Roux Associates' field forms and field notebook.

d. Non-phosphate, laboratory-grade detergent.

e. Distilled/deionized water.

f. Potable water.

g. Paper towels, clean rags.

h. Plastic sheeting.

i. Sorbent pads.

j. Well location and site map.

k. Well keys.

l. Disposable gloves.

m. Calculator.

n. Black pen and indelible marker.

o. Tools (e.g., pipe wrench, screw drivers, hammer, pliers, flashlight, pen knife, etc.).

p. Buckets and brush for decontamination.

5.2 Clear Acrylic Bailer - the following will also be needed:

a. Clear acrylic bailer

b. Non-static cotton cord

c. Steel tape (10 foot)

5.3 Oil/Water Interface Probe - the following will also be needed:

a. Oil/water interface probe

5.4 Oil/Water Paste - the following will also be needed:

a. Oil paste

b. Water paste

c. Graduated stick or weighted steel tape

6.0 PROCEDURE

6.1 Oil/Water Interface Probe

6.1.1 Make sure the bottom five (5) feet of the probe and measuring tape have been decontaminated according to the field equipment decontamination SOP before entering each well.

6.1.2 Based on previous data, if any, ensure that non-product wells are measured prior to product wells to reduce the possibility of cross-contamination.

6.1.3 Measure VOCs at the rim of the unopened well with a photoionization detector (PID) or flame ionization detector (FID) instrument and record the reading in the field notebook.

6.1.4 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.1.5 Slowly lower the thoroughly decontaminated probe to the product surface. A distinct tone or beep will indicate the presence and level of product. The depth to product (DTP) from the measuring point will be recorded in the field notebook and on appropriate field forms. Continue lowering the probe until the tone or beep indicates the presence of water. The oil/water interface is best measured by lowering the probe about six inches into the water and then raising it to the interface. The depth to water (DTW) from the measuring point will be recorded in the field notebook and on appropriate field forms. The product thickness is the difference between the DTW and DTP.

6.1.6 Replace locking and/or protective caps on the well.

6.1.7 Thoroughly clean the probe and the portion of the tape which entered the product according to the field equipment decontamination SOP.

6.2 Clear Acrylic Bailer

6.2.1 Make sure all equipment is cleaned of gross contamination before entering and exiting the site or moving to different areas of product accumulation.

6.2.2 Measure VOCs at the rim of the unopened well with a photoionization detector (PID) or flame ionization detector (FID) instrument and record the reading in the field notebook.

6.2.3 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.2.4 Slowly lower a clear, decontaminated bottom-filling acrylic bailer into the well until the bottom of the bailer contacts the fluid surface.

6.2.5 Using a reference point on the bailer line, slowly lower the bailer into the fluid a distance less than the bailer length so that at its deepest point the top of the bailer remains above the air/fluid contact.

6.2.6 Slowly raise the bailer out of the well.

6.2.7 The thickness of the floating free product will be approximated by placing a tape measure along side the bailer. The data will be documented in the field notebook and on appropriate field forms.

6.2.8 Dispose of the product in an appropriate manner as specified in the work plan. This may include draining the product back into the well or tank, or containerization if the measurement is in conjunction with bailing for removal purposes.

6.2.9 Replace locking and/or protective caps on the well.

6.2.10 Thoroughly clean the bailer as described in Section 6.2.1. Discard the cotton cord in an appropriate manner. Wrap decontaminated bailer in a suitable material (e.g., clean plastic bag, aluminum foil).

6.2.11 If the free product is extensive or thicker than the height of the bailer, then an electronic interface probe should be used to measure product thickness.

6.3 Oil/Water Paste - (Generally not applicable for monitoring wells)

6.3.1 Make sure all equipment is decontaminated and cleaned before use according to the field equipment decontamination SOP.

6.3.2 Secure access to the tank or drum to be measured only after the contents are known and properly addressed in the HASP. Attempt to estimate the

depth and thickness of product and the depth to water so the entire stick or weighted steel tape does not have to be coated with oil and water paste.

6.3.3 Coat one side of the stick or steel tape with oil paste and the other with water paste. Since these are typically different colors, confusion should not result. Depending upon information needs, lower the tape to just below the water interface or to the bottom of the tank or drum.

6.3.4 If only DTP and DTW data is required, then the top of the tape is held at an even-foot increment at the measuring point (MP). This is called the "held" value, and is recorded as such. If the depth to the bottom of the tank is also required, then the held value can't be specifically selected at an even-foot increment.

6.3.5 The steel tape or graduated stick is removed and the "water cut" and "product cut" levels are recorded. The difference between the "held" value and the "product cut" value is the DTP. The difference between the "held" value and the "water cut" is the DTW. The difference between the "product cut" and the "water cut" is the product thickness. If the diameter of a horizontal tank is desired, then the difference between the "held" value (to the bottom of the tank) and the depth of the fill pipe is required.

6.3.6 All pertinent data will be recorded in the field notebook and on appropriate field forms.

6.3.7 Make sure all equipment is decontaminated before use in the next tank, drum, or container according to the field equipment decontamination SOP. All disposable materials must be discarded in a manner consistent with site conditions.

END OF PROCEDURE

Date: January 9, 2011
Revision: May 12, 2015

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon, Geoprobe™ core samples, and Sonic core samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth, the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths, a Geoprobe™ or other direct push sampling method, or a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. If augering to depth, once the sampling depth is reached a clean bucket auger should be used to collect the sample. To collect samples at depths of greater than approximately six feet, the use of a drill rig (direct push, split spoon, etc) will usually be necessary. In some situations, such as an excavation or trench, sample locations are accessed with the use of a backhoe.

3.0 EQUIPMENT AND MATERIALS

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. A work plan which outlines soil sampling requirements.

c. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

d. Decontamination supplies (including: non-phosphate laboratory grade detergent, buckets, brushes, potable water, distilled water, plastic sheeting, etc.).

e. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

f. Stainless steel spoons or spatulas.

g. Disposable Nitrile sampling gloves and cut-proof gloves.

h. Laboratory-supplied sample containers with labels.

i. Cooler with blue or wet ice.

j. Plastic sheeting.

k. Black pen and indelible marker.

l. Zip-lock bags and packing material.

m. Tape measure.

n. Paper towels or clean rags.

o. Masking and packing tape.

p. Overnight (express) mail forms or schedule courier pickup.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP (ROUX SOP 9.1). Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the ROUX SOP 9.1 decontamination procedures. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used. The gloves should not come in contact with the media being sampled and should be changed any time during sample collection when their cleanliness is compromised

When sampling shallow soils, if a thick, matted root zone, gravel, concrete, etc. is present at or near the surface, it should be removed before the sample is collected. The depth measurement for the sample begins at the top of the soil horizon, immediately following any removed materials.

When using direct push sampling methods, it is important to maintain the proper orientation of the sample when the sampling liners are removed from the sample tubes define precisely the depth at which an aliquot was collected. This is particularly important when multiple sample depths are collected from the same push.

When utilizing a split spoon sampling method, always discard the top several inches of material in the spoon before removing any portion for sampling. This material normally consists of borehole wall material that has sloughed off of the boregole wall after removal of the drill string prior to inserting the split spoon.

When utilizing a backhoe to collect soil samples from a trench or excavation, measures should be taken to ensure that the bucket is decontaminated and that no paint, grease, and rust is present prior to sample collection.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. Cut-proof gloves should be worn at all times when handling glassware. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

If samples are to be analyzed for VOCs, they should be collected in a manner that minimizes disturbance of the sample. ***Samples for VOC analysis must not be homogenized.***

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record physical characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.). Refer to Soil Classification and logging SOP.

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet or in a Zip-lock bag and homogenized. make sure that each composite location (aliquot) consist of equal volumes,(i.e., same number of equal spoonfuls). Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work

plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler with ice, at 4°C. Store the sample cooler in a secure location.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a Zip-lock bag to the laboratory. A signed and dated custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are typically to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to, the following: client name, site location, sample location, sample depth, sample identification, sample date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the ROUX SOP 9.1 decontamination procedures. Following the final decontamination (after all samples are collected), the sampling equipment is wrapped with plastic. Discard any gloves, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

Date: May 5, 2000
Revision: May 5, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for stream-bed, pond, and lagoon sediment samples. The specific procedure and equipment selection will be dependent upon the data objectives of the sampling program. The sampling procedure can range from one grab sample to many samples at different horizontal and vertical locations. The sampling requirements should be carefully designed and fully described in the work plan.

The objective of sediment sampling is to collect samples which are representative of the area of interest. Frequently this objective can be quite easy and routine such as one "grab" sample for a small stream with uniform stream-bed conditions. Other times, the nature of the site-specific conditions make collection of a representative sample more difficult. Consideration of such variables as stream flow velocity, pond depth, lagoon contents, turbulence, access, health and safety, water composition, tidal fluctuation, surface runoff, factory outfalls, tributaries, etc. is essential in the development of the work plan.

In collecting sediment samples, care must be taken to minimize disturbance and sample washing as it is retrieved through the liquid column above. Sediment fines may be carried out of the sample during collection if the liquid above is flowing or deep. This may result in collection of a nonrepresentative sample due to the loss of contaminants associated with these fines. While a sediment sample is usually expected to be a solid matrix, the sampler should avoid placing the sample in the bottle then decanting off the excess liquid. If the sample is collected properly, then any liquid that enters into the bottle is representative of sediment conditions.

As with liquid sampling, a determination of tidal influence on the location being sampled should be made and its effect on the sample collection should be detailed in the work plan. At a minimum, the stage of the tide at the time of sample collection must be recorded. Consideration should be given to sampling at varied tidal stages when appropriate.

2.0 CONSIDERATIONS

Collecting sediment samples from surface-water bodies and impoundments requires special considerations regarding general safety and sampling location.

2.1 Health and safety is a key aspect of all sampling procedures and therefore must be addressed when selecting a sampling location. In most instances sediment sampling will require entering the water. Therefore, the health and safety plan (HASP) must be referred to regarding the implementation of health and safety procedures (for compliance with the Occupational Safety and Health

Administration [OSHA] and for general safety for sampling personnel). If entering the water body is necessary, then the water velocity, depth, sediment type and uniformity, tidal stage, and water chemistry must be evaluated. If any potential hazard is identified, then the sampler must use a safety harness and life jacket, and a buddy system must be employed. A raft or boat (vessel) may be necessary to collect samples. Depending upon the geographic location and season, considerations such as water temperature, snakes, rats, ticks, etc. may be important. Thus, the site-specific HASP must address all possible contingencies and allow flexibility for revision if unanticipated conditions arise.

2.2 The location of a sediment sampling point is the first consideration for a sediment sampling program. The general sampling location will be selected based on the requirements of the investigation. The specific sampling location should be selected where flow and turbulence are uniform, the sediment conditions seem representative, and access is favorable (i.e., shallow section with good footing).

The sampling location should avoid tributaries, parking lot runoff, factory outfalls, and obstructions unless these inputs are of specific interest. Sampling from the boundaries of the surface-water body should generally be avoided, except where these regions are of direct interest. For flowing surface-water bodies sampling should proceed from downstream locations to upstream locations so that disturbance related to sampling does not affect downstream sample quality. If liquid samples will be collected at the same locations as sediment samples, then the liquid samples must be collected first so that sediment sampling does not create turbulence that may alter water-quality conditions at the sampling location.

2.3 The factors that contribute to the selection of a sampling device include: 1) the width, depth, flow and the bed characteristics of the surface-water body to be sampled; 2) the required depth below the sediment surface; 3) whether the sample will be collected from the shore or a vessel; and 4) the objectives of the program. These factors must be addressed in the work plan.

The sampling of stream-bed sediments is generally accomplished through the use of one of the following samplers:

a. Scoop, spoon, or trowel.

b. Bucket auger.

c. Soil coring device.

d. Veihmeyer sampler.

e. Waste pile sampler.

f. Split spoon sampler.

g. Dredge (ponar).

h. Other commercially available sampler of proper construction material.

2.4 Sampling from on-shore or off-shore (wading or vessel) locations will be dependent on the site-specific sampling conditions as follows:

a. If liquid flow and depth is minimal and sediment is easy to reach, then a trowel or scoop may be used to collect the sediment sample. However, where the liquid above the sediment collection point is either flowing or greater than 4 inches in depth, a corer or other device that eliminates sample washing must be used to collect the sample in an attempt to minimize washing the sediment as it is retrieved. One of the coring devices listed above will allow the collection of an undisturbed core of sediment. It may be necessary to decant standing water from the top of the core. This should be done carefully and prior to transfer to the sample bottle. A decontaminated stainless-steel trowel, spoon, or spatula must be utilized to transfer the sample from the sampler directly into the sample container.

b. In some instances, the dimensions of the stream require that a vessel (e.g., a boat, raft, etc.) must be used. The device used for sample collection in this case will, again, depend upon the depth and flow of the liquid above the sample location and the stream-bed characteristics. Generally, trowels or scoops cannot be used in an off-shore situation. Instead, cores or dredges are more efficient means for sample collection. The vessel must be positioned just upstream of the desired sample location. As the corer or dredge is lowered it may be carried slightly downstream, depending upon the force of the flow. Upon retrieval, immediately transfer the contents of the corer or dredge directly into the sample bottle using a decontaminated stainless-steel trowel, spoon, or spatula.

3.0 EQUIPMENT AND MATERIALS

In order to sample stream-bed sediments, specific equipment and materials are required. The equipment and materials list may include, but necessarily be limited to, the following:

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. A work plan which defines sampling requirements.

c. Decontamination supplies (including, as necessary: non-phosphate, laboratory-grade detergent; bucket; brushes; distilled/deionized water; potable water; regulatory-required reagents [e.g., acetone, nitric acid, etc.]; aluminum foil; etc.).

d. Field notebook and appropriate field form(s).

e. Maps (topographic and road/county).

f. Cooler and ice (wet or blue packs).

g. Sample bottles (including as necessary: appropriate field blanks, trip blanks, duplicates, extra bottles for breakage, proper size and type for analyte, labels, etc.).

h. Plastic sheeting.

i. Meters (pH, as modified for soil/sediment analysis), thermometer, and calculator.

j. Wading rod and current meter.

k. Calibration equipment/materials for all meters or devices.

l. Sampling devices (including as necessary: scoop, trowel, spatula, sampling trier, bucket auger, soil-coring device, Veihmeyer sampler, waste-pile sampler, split-spoon sampler, dredge sampler, and Ponar dredge).

m. Disposable sampling gloves.

n. Health and safety equipment (including as necessary: proper level of protection [OSHA], rubber boots, hip waders, chest waders, safety harness, rope, life jacket, life preserver, air horn, two-way communication, etc.).

o. Measuring tapes (100-foot, weighted and 10-foot, steel).

p. Digital camera.

q. Hand sledge hammer.

r. Pipe wrenches (14 inches long, 2 required).

s. Miscellaneous tools (e.g., screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

t. Black pen and indelible marker.

u. Paper towels, clean rags.

v. Masking and packing tape.

w. Packing material (e.g., "bubble wrap") and "zip-lock" plastic bags.

x. Chain-of-custody form(s) and custody seals.

y. Overnight (express) mail forms and/or courier contact information.

4.0 DECONTAMINATION

When possible thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as cord, tubing, and gloves will be changed between each use and discarded in an appropriate manner. If a non-disposable item is to be reused during a sampling event, it will be thoroughly cleaned according to the field equipment decontamination SOP. Appropriate field, equipment and trip blanks will be collected as outlined in the work plan to demonstrate proper decontamination procedures.

5.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers and meters, etc.). Refer to the specific SOPs for field analysis for each respective piece of equipment. All equipment must have the manufacturer's manual maintained with the instrument and must be referred to for use, repair, maintenance, trouble-shooting, or calibration, if required. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

6.0 PROCEDURE

6.1 Identify each location to be sampled based upon requirements of the work plan. If any of the considerations outlined in Section 2.0 impact the proposed sampling method, then contact the Project Manager to get authorization to modify as necessary.

6.2 Record the site and sample location, weather conditions, date, and time of the selected sampling point in the field notebook and on any field forms being used, and initial the entry.

6.3 Describe the surface-water body or impoundment characteristics including: width (feet [ft]), depth (ft), flow (none, low, intermediate or flood; or measured velocity, if possible), turbidity (clear, turbid, very turbid), turbidity or flow variations, tributary locations and distances, surface runoff impacts, and adjacent land use. A photograph of each sampling location should be included as part of the documentation.

6.4 Prepare sample containers for collection by organizing, labeling, and verifying proper preservation methods.

6.5 Ensure all sampling equipment has been thoroughly decontaminated and is operational.

6.6 Place plastic sheeting on the ground or on the floor of the vessel to protect sampling materials from potential cross contamination.

6.7 Collect the sample utilizing the selected sampling method and immediately place into pre-labeled, laboratory-supplied containers. Fill each appropriate, prelabeled sample container carefully and cautiously to prevent: 1) excessive agitating; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling the sample and exposing the sampling team to contaminated sediment. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

6.8 Collect quality control (QC) samples to monitor sampling and laboratory performance as required in the work plan. Refer to the SOP for collection of QC samples for a detailed discussion of proper methods.

6.9 Analyze samples for field parameters (e.g., pH, etc.) immediately after collecting samples for laboratory analysis. Whenever possible, sufficient volume should be collected in the initial sample to complete all laboratory and field parameters.

6.10 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

6.11 Thoroughly clean all reusable sampling equipment as discussed in the field equipment decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with accepted procedures.

6.12 Complete field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

6.13 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

END OF PROCEDURE

FOR SCREENING SOIL SAMPLES FOR VOLATILE ORGANIC VAPORS USING A PORTABLE PHOTOIONIZATION DETECTOR

Date: January 10, 2011
Revision: May 12, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon, Geoprobe™ macro-core, Sonic cores and Shelby tube samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 EQUIPMENT AND MATERIALS

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. A work plan which outlines photoionization screening requirements.

c. Decontamination supplies (including: non-phosphate laboratory grade detergent, buckets, brushes, potable water, distilled water, plastic sheeting, etc.).

d. Field notebook, field form(s), maps, chain-of-custody forms.

e. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

f. Stainless steel spoons or spatulas.

g. Disposable plastic spoons.

h. Plastic sheeting.

i. Gallon size Zip-lock bags.

j. Photoionization detector (PID) with charging unit.

k. Calibration gases with regulator.

l. Indelible marker.

m. Masking tape.

n. Disposable Nitrile sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a non-phosphate laboratory grade detergent and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the ROUX SOP 9.1 for decontamination of field equipment.

5.0 CALIBRATION

5.1 The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted.

5.2 The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log.

5.3 If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

6.1 Allow the temperature of the unit to equilibrate to its surrounding. This should take about five minutes.

6.2 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a 1-Gallon Zip-lock bag (as quickly as possible to avoid loss of VOCs) filling the bag half full, if possible. Seal the bag and ensure an adequate seal has been created by pressing on the bag and observing if air discharges from the bag.

6.3 Label the bag with the boring/ID number, depth of sample, date of collection and sampler's initials. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the soil sampler (i.e., split spoon) is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record physical characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering). Refer to ROUX SOP 5.5 for soil classification and logging procedures.

6.5 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the Zip-lock bag with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.6 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate. All readings should be recorded in parts per million (ppm).

6.7 Dispose of any soil/geologic material/cutting in a designated waste storage container (e.g. drum) consistent with site disposal requirements.

6.8 If only field screening results are to be obtained, then reusable sampling devices may be cleaned with a non-phosphate laboratory grade detergent and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidance to obtain accurate and consistent descriptions of soil characteristics during soil-sampling operations. Consistency with description is essential for creating subsurface interpretations.

This SOP discusses the use of the Unified Soil Classification System (USCS) as a guideline for classifying and describing lithology encountered in boreholes, test pits, and surface sampling.

The Unified Soil Classification System (USCS) is based on numerical values of certain soil properties that are measured by laboratory tests (ASTM D 2487). It is possible, however, to estimate these values in the field with reasonable accuracy using visual-manual procedures (ASTM D 2488). In addition, some elements of a complete soil description, such as the presence of cobbles or boulders, changes in strata, and the relative proportions of soil types in a bedded deposit can be obtained only in the field.

2.0 MATERIALS/EQUIPMENT

a) Indelible pens

b) Tape measure or ruler

c) Field logbook

d) Squirt bottle/Spray bottle with water

e) Rock- or soil-color chart (e.g., Munsell)

f) Grain-size chart

g) Hand lens

h) Unified Soil Classification System index charts and tables to help with soil classification

i) Workplan or event-specific field instructions. Planned borehole depth, proposed well construction/specifications, and field sampling summary table, if available.

3.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination ROUX SOP 9.1. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner consistent with site conditions

4.0 PROCEDURE

This section covers several aspects of the soil characterization: instructions for completing soil boring logs.

4.1 Record the following general site information in the field book:

a. Boring/Well ID. Enter the boring/well number. A numbering system should be chosen that does not conflict with information recorded for previous exploratory work done at the site. Number the sheets consecutively for each boring.

b. Client/Project Name

c. Site Location.

d. Drilling Contractor. Enter the name of the drilling company and the city and state where the company is based.

e. Drilling Method and Equipment. Identify the bit size and type, drilling fluid (if used), and method of drilling (e.g., rotary, hollow-stem auger, sonic). Information on the drilling equipment (e.g., CME 55, Mobile B61) should be noted.

f. Date and Time. Include Start time and End time.

g. Name and/or initials of the field personnel logging the soil.

4.2 Record the following technical data in the field book and/or log forms:

a. Depth Below Surface.

b. Sample Interval.

c. PID readings (if specified by work plan). Refer to ROUX SOP 5.4 for soil screening procedures.

d. Blow Counts.

e. Sample Recovery.

f. Soil Description.

g. Soil Classification.

4.3 Soil Classification

Soil descriptions should be precise and comprehensive without being verbose. The correct overall impression of the soil should not be distorted by excessive emphasis on

insignificant details. In general, similarities rather than differences between consecutive samples should be stressed.

Field descriptions should include as a minimum:

a. Color: The basic color of the soil.

b. Soil name: The basic name of the predominant constituent and a single word modifier indicating the major subordinate constituent.

c. Particle Size Distribution: An estimate of the percentage and grain-size range of each of the soil's subordinate constituents (trace, little, some). This parameter is critical for assessing hydrogeology of the site and should be carefully and fully documented.

d. Gradation or Plasticity: For granular soil (sands or gravels) that should be described as well-graded, poorly graded, uniform, or gap-graded. Cohesive soil (silts or clays) should be described as non-plastic, low plastic, medium plastic, or highly plastic.

e. Other Components: Examine the soil sample to identify other components that may be present including roots and root mass, vegetation, peat, organic matter, shells or fossils, accessory minerals slag, cinder or charcoal, trash, rubbish, fill, bricks, glass.

f. Moisture Content. The amount of soil moisture described as dry, moist, or wet/saturated.

g. Odor: The odor should only be described if it is organic or unusual. An organic odor will have distinctive decaying vegetation smell. Unusual odors, petroleum product, chemical, and the like should be noted.

h. Unusual characteristics: If staining or discoloration of soils is present it should be noted.

4.4 The soil logs should also include a complete description of any tests run in the borehole; placement and construction details of piezometers, wells, and other monitoring equipment; abandonment records; geophysical logging techniques used; and notes on readings obtained by air monitoring instruments.

4.5 Backfilling

When a boring is completed, the boring shall be abandoned with procedures specified in the workplan. The destruction of the hole shall be noted on the log Proper borehole abandonment procedures are documented in ROUX SOP 5.4.

END OF PROCEDURE

STANDARD OPERATING PROCEDURE 5.12 FOR COLLECTION OF SOIL SAMPLES FOR LABORATORY ANALYSIS USING INCREMENTAL SAMPLING METHODOLOGY

Date: May 19, 2015

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis using incremental sampling methodology (ISM). This SOP describes the procedure and equipment needed to collect and ISM soil samples prior to laboratory analysis. This SOP is largely based on the ITRC February 2012 technical and regulatory guidance document titled "*Incremental Sampling Methodology*"

2.0 CONSIDERATIONS

Incremental sampling methodology (ISM) is a structured composite sampling and processing protocol having specific elements designed to reduce data variability and increase sample representativeness for a specified volume of soil under investigation. Variability in measured contaminant concentrations between discrete soil samples is due primarily to the particulate nature of soil and heterogeneity in the distribution of contaminants. The elements of ISM that control data variability are incorporated into (a) the field collection of soil samples and (b) laboratory processing procedures. ISM is designed to obtain a single aliquot for analysis that has all constituents in the same proportion as an explicitly defined volume of soil. Properly executed, the methodology provides reasonably unbiased, reproducible estimates of the mean concentration of analytes in the specified volume of soil.

ISM should be applied within a systematic planning framework. One of the first steps in such a framework is to have the investigation project team establish a working conceptual site model (CSM). Once the CSM has been agreed to, the project team defines the data quality objectives (DQOs) and determines the appropriate decision unit (DU) size(s) and location(s). DUs are based on project-specific needs and site-specific DQOs; both considerations specify and constrain the appropriate end use of the data. The size of a DU is site-specific and represents the smallest volume of soil about which a decision is to be made. The requirement to explicitly and appropriately define the DU that each incremental sample represents is a key component of ISM and is discussed in detail throughout this SOP.

3.0 EQUIPMENT AND MATERIALS

a. Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

b. A work plan which outlines soil sampling requirements including the site-specific DQOs and an explanation of the gridded area to be sampled using ISM.

c. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

d. Decontamination supplies (including: non-phosphate laboratory grade detergent, buckets, brushes, potable water, distilled water, plastic sheeting, etc.).

e. Sampling device (Geoprobe, split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

f. Stainless steel spoons or spatulas.

g. Disposable Nitrile sampling gloves and cut-proof gloves.

h. Laboratory-supplied sample containers with labels.

i. Cooler with blue or wet ice.

j. Plastic sheeting.

k. Black pen and indelible marker.

l. Zip-lock bags and packing material.

m. Tape measure.

n. Paper towels or clean rags.

o. Masking and packing tape.

p. Overnight (express) mail forms or schedule courier pickup.

5.0 PROCEDURE

5.1 Determine the appropriate spatial extent of the decision unit (DU) that ensures total sample mass is sufficient to represent the heterogeneity of soil particles within the DU in proportion to all of the DU soil (i.e., population). Different types of objectives may dictate the dimensions of DUs. For example, the identification and investigation of small source-area DUs may be especially important for highly mobile chemicals that can pose significant vapor intrusion or leaching risks. In other situations, larger exposure-area DUs is appropriate to evaluate risks to specified receptors. The approach selected should be consistent with the understanding of the site reflected in the CSM and should support the objectives of the investigation.

Exposure areas for residential use can vary in size depending on the location of the site and local regulatory requirements. Consideration of lot-size exposure areas is generally adequate to evaluate long-term, chronic health risks. When *exposure* can be assumed to be relatively consistent across the lot, it is not necessary to investigate concentration trends at a property below the scale of the residential lot.

Exposure areas for commercial or industrial properties are site specific and could be an acre or more in size. Certain maintenance or construction activities at these types of properties may influence the depth of the exposure area. Designation of exposure

areas for these sites should be discussed ahead of time with the project risk assessor and should be based on areas of the site where exposure is likely to occur.

5.2 Determine the appropriate vertical extent of the DU. The depth (how far below ground) and interval (vertical dimension of the DU) of each DU must be carefully considered during planning stages. These attributes should be based on the project objectives and the CSM and should not be left to haphazard decisions in the field. It is important to remember that a correctly defined DU includes the requirement that all hypothetical increments within the DU have an equal likelihood of being sampled (e.g., a DU should not be defined to be 5 feet deep when only the first few centimeters are available to the sampling device).

5.3 Determine the sampling pattern strategy.

Systematic random sampling within grids – the DU is divided in a grid pattern, a random sampling location is identified within the first grid cell, and then samples (increments) are obtained from adjacent cells sequentially in a serpentine pattern using the same relative location within each cell.

Random sampling within grids - samples are obtained sequentially from adjacent grid cells, but the location of the sample within each cell is random.

Simple random sampling within the entire DU - the samples are taken from random locations across the DU (without gridding).

While all three sampling options are statistically defensible, collecting increments within the DU using simple random sampling is most likely to generate an unbiased estimate of the mean and variance according to statistical theory. Note that "random" does not mean wherever the sampling team feels like taking a sample: a formal approach to determining the random sample locations must be used.

5.4 Determine the ISM Field Sampling Implementation Method

Select the tool: The selection of the appropriate sampling tool for an ISM sample depends on the cohesiveness and composition of the soil substrate. The sampling tool should obtain cylindrical or core-shaped increments of a constant depth from the presented surface. The diameter of the sampling tool should be a minimum of three times the diameter (d) of the largest particle present in a coarse matrix ($d \geq 3$ mm), and $3d + 10$ mm for a fine material. Caution should be taken to select tools that equally retain all of the particles over the entire depth of interest. In general, sampling tools should have a diameter of at least 16 mm. For less cohesive soils, attempts should be made to retain the entire, complete core increment.

Sampling devices can be used within a DU without decontamination but should be decontaminated or disposed of between DUs. If sampling tools will be used for two or more DUs, they should be cleaned of soil particles, decontaminated with the

appropriate solutions or solvents, and dried between DUs. Typically, rinse (decontamination) blanks can be used to evaluate the potential effects of cross contamination, if needed.

For deeper ISM soil samples, a drilling method may be required to collect soil samples. Direct push methods are preferred (e.g., geoprobe) for ease of sampling and cost.

Determine the number of soil increments:
In general, a minimum of 30 increments is sufficient for most DUs. The number of increments to be collected from each DU of a site investigation should be evaluated during systematic planning as part of the DQO process and documented in the sampling and analysis plan (SAP).

5.5 Establish DU Boundaries in the field. Depending on the size of the DU and terrain features, placement of markers (e.g., pin flags and posts) at the corners and or edges can assist with a visual delineation of the cells or subareas where increments are to be collected. That is, the markers can define lanes, grids, or collection points.

5.6 Collect soil from the decision units based on the ISM sampling plan. Soil collection should occur in two-person teams: ideally one person collects the increments, and the other holds the sample container and keeps track of the number of increments. Each sample increment location should be logged via GPS when possible. Combine all increments to form the complete subsurface ISM sample.

5.7 Place the sample in a laboratory-supplied, pre-cleaned sample container. Cut-proof gloves should be worn at all times when handling glassware.

5.8 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials. The sample should be placed in a cooler and stored with ice, at 4°C. Store the sample cooler in a secure location.

5.9 Using the remaining portion of soil to log the sample in detail and record physical characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.). Refer to Soil Classification and logging SOP.

5.10 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a Zip-lock bag to the laboratory. A signed and dated custody seal is placed on the cooler prior to shipment.

5.11 Samples collected from Monday to Friday are typically to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable,

samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.12 The field notebook and appropriate forms should include, but not be limited to, the following: client name, site location, sample DU designation, sample identification, sample date and time collected, sampler's name, and method of sample collection.

5.13 All reusable sampling equipment must be thoroughly cleaned in accordance with the ROUX SOP 9.1 decontamination procedures. Discard any gloves, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

Date: January 9, 2011
Revision: April 17, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring field parameters of groundwater samples. The parameters are measured in the field using a water quality meter (Horiba U-22 or equivalent). The water quality parameters include pH, temperature, conductivity, ORP, dissolved Oxygen and turbidity. The manufacturer's instrument manual for each water quality meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of the acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Conductivity will be measured and recorded in micromhos/centimeter (µmhos/cm). Some water quality meters measure directly in µmhos/cm while others have to be converted to this unit. The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the water samples. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Temperature will be measured and recorded in degrees Celsius/Centigrade (° C). Temperature data is collected in the field to determine the temperature of the water sample under ambient (in-situ) conditions. Temperature data can be used to evaluate the mobility of compounds in groundwater and flow conditions. In addition, temperature measurements can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

ORP will be measured and recorded in millivolts (mV). ORP data is collected in the field for monitoring and controlling chemical addition of oxidizing or reducing agents. In addition, ORP data can be used during well purging to help determine when sufficient

groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Dissolved Oxygen (DO) will be measured and recorded in mg/L. DO data is collected in the field for monitoring the amount of oxygen dissolved in a unit volume of water. In addition, DO data can be used during well purging to help determine when sufficient groundwater has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer).

Turbidity will be measured and recorded in Nephelometric Turbidity Units (NTU). Turbidity data is collected to measure the presence of suspended particulates in water.

2.0 CALIBRATION

Prior to calibration, all water quality meters must be cleaned and the battery checked according to the manufacturer's instructions. Document, initial and date the pre-calibration procedure on the appropriate field form, and in the field notebook.

2.1 Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

2.2 Calibration of the water quality meter(s) is to be performed at the beginning and end of each day's use in accordance with the manufacturer's specific calibration instructions. At the end of each day, a calibration check is performed to verify that the instrument(s) remained in calibration throughout the day. This check is to be performed while the instrument(s) is in measurement mode, not calibration mode. Usual procedures are given below.

2.3 Recalibration must occur if: 1) the parameter being measured is outside the previous calibration range (if meter readings are zero or a negative number for DO, pH, conductivity or turbidity [negative value only]); 2) the procedure or use conditions warrant frequent calibrations; 3) four or more hours have elapsed; or 4) the instrument has been moved from one area to another (e.g., offsite or out of the study area).

2.4 The volume of the calibration solutions must be sufficient to cover both the probe and temperature sensor (see manufacturer's instructions for the volume to be used). Note that most instrument manual's state there is no calibration for the temperature sensor, but the temperature sensor must be checked to determine its accuracy. If the accuracy check date/information is not included with the instrument or the last check was over a year, the temperature sensor accuracy needs to be checked at the beginning of the water quality measuring event.

2.5 A minimum of two standards should be used to bracket the instruments measurement range for all parameters except ORP (refer to manufacturer's instructions).

2.6 The following information is documented in the calibration logbook and /or field notebook at the time of calibration:

a. Date.

b. Water Quality meter identification.

c. Pre-cleaning and battery check.

d. Calibration results.

e. Initials of the individual performing calibration.

3.0 PROCEDURE

3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.

3.2 See SOPs 4.3 and 4.4 for information regarding well sampling/purging procedures. Follow instruction manual for proper set up and deployment of monitoring device.

3.3 The groundwater quality parameters will be continuously measured by the water quality meter utilizing a flow-through-cell. If the accumulation of sediment buildup in the cell is observed, continue pumping and disconnect the cell for cleaning, then reconnect after cleaning and continue monitoring activities. If air bubbles accumulation is observed in the cell, place the meter at a 45 degree angle with the port facing upward to help evacuate any air bubble buildup.

3.5 Pertinent data are documented in the field notebook and/or appropriate field form, initialed and dated.

3.6 Follow decontamination procedures documented in SOP 9.1 after each use to avoid potential cross contamination. Ensure that the electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

END OF PROCEDURE

ED_002345B_00009969-00213

Date: October 23, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for photographic documentation of project activities conducted by Roux Associates, Inc. (Roux Associates). Field staff are encouraged to use photographic documentation to display site features or ongoing field work. The exact number of still or video images is left to the professional discretion of field staff in consultation with the Project Manager. This instruction addresses how the photgraphic images will be incorporated into the project file documentation.

All photography collected for project use should be in a digital format and only document the field activities and / or site features associated with the specific project. Digital cameras have become the primary means of gathering evidence and this medium has many advantages. These advantages include enhanced image resolution, the capability to immediately view the image after it is collected, and the ability to collect still images using a single piece of equipment. The digital camera reduces printing time and cost because the digital images do not need to be taken to a photo lab for developing; rather, the digital images can be viewed on the computer and printed as needed.

2.0 MATERIALS

In order to provide photo documentation of field activities and site features, specific materials are required. These materials include the following:

a. A bound, waterproof field notebook.

b. Digital camera or camera phone.

c. A standard reference marker (a ruler or other object with a known length).

d. Approved work plan/scope of work.

e. Health and safety plan (HASP).

f. Appropriate Roux Associates' SOPs.

g. Black pens, and indelible markers.

3.0 OPERATION

3.1 General Photographic Activities in the Field: The following sections provide general guidelines that should be followed to visually document field activities

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and site features using digital cameras or cell phone cameras. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

a. The photographer should be prepared to take a variety of shots, from close-up to wide-angle. Many shots will be repetitive in nature or format, especially close-up site feature photographs.

b. The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. A flash may be used to adjust low lighting settings or to prevent shadows.

c. Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store less photographs per digital storage medium. When possible, the camera should be set to the highest resolution.

d. The photograph should include a standard reference marker if scale is difficult to determine in the photograph.

e. If photographs are being collected in unfamiliar locations or of unknown objects, Roux Associates personnel are encouraged to record the photographic activities in their assigned field notebook. The following information would provide the user reference for post-processing of the photo:

- Photographer name
- Date and time the photograph was taken (military time)
- Description of the location where the photo was taken
- A brief description of the activity/ item photographed, and other pertinent information about the photograph.

Pens with permanent ink will be used to record all data. Data or other information that has been entered incorrectly will be corrected by drawing a line through the incorrect entry and initialing and dating the lined through entry. Under no circumstances should the incorrect material be erased, made illegible or obscured so that it cannot be read.

4.0 POST-OPERATION (ARCHIVING PHOTO)

4.1 At the end of each day's photographic session, the field personnel should ensure that the field logbook is complete. At the conclusion of the field day, the field

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personnel should follow these procedures to ensure the proper achival of the digital photographs:

a. Upload the photos to the network drive in a folder that includes the corresponding date of the photographs, located in the proper project folder.

b. If a large amount a photographs are planned to be collected for the project, a log may be usedful in for storing pertinent information about the photos and may facilitate searching the photo database. Information that may be included in the photo log includes photograph date and time, location, photographer, and any other corresponding notes.

c. Once the above steps are completed, double check to save your edits before deleting the photos off the the camera to ensure storage space for future photo documentation.

END OF PROCEDURE

ED_002345B_00009969-00216

Date: October 26, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines and procedures necessary to navigate to waypoints and collect location data using a handheld Global Positioning System (GPS) receiver. A handheld GPS is a satellite-based electronic device that receives data from satellites to calculate a location. Accurate location positioning is required to help ensure quality and consistency in field sample collection and in data interpretation and analysis.

This document is a general use Standard Operating Procedure (SOP) to be used for handheld GPS units and is not to be used as a SOP for specific brands of GPS models.

2.0 EQUIPMENT AND MATERIALS

2.1 The following equipment may be needed to collect location data in the field using a handheld GPS device:

a. Trimble handheld GPS or similar unit

b. System batteries

c. PC interface cable, USB serial converter (if necessary)

d. Operation manual of the specific GPS unit

e. Field notebook and pen

3.0 PROCEDURE

GPS location data is collected for multiple points of interest with different data objectives required for the varying field responsibilities and tasks completed by Roux Associates. In order to properly collect location data, the following procedure should be followed:

3.1 Before entering the field, ensure that the battery is fully charged and that a spare battery is accessible in the field.

3.2 If it is necessary to navigate to previously known locations, be sure to load any shapefiles onto the device before heading into the field.

3.3 Note the manufacturer's model and the date of GPS use in the field book.

3.4 Power on GPS device, be sure to turn on satellite receiver and launch the data collector application that should be loaded onto the GPS. To provide reliable

location information, the receiver must receive good signal strength from at least 4 satellites.

3.5 Be sure to position yourself in an area with a clear view of the sky to provide the best opportunity for optimal satellite signal strength. Trees or tall buildings can interfere with satellite reception.

3.5 Launch the data collector software specific to the GPS receiver. If a previously loaded map exists, open the known map file. If not, open a new quickproject map in the proper coordinate system. The user must be sure the coordinate system and the datum are properly defined in the GPS receiver before data collection begins.

3.6 Collect the GPS data point using the collector software provided with the GPS receiver. Refer to the user manual for the specific software being used for guidance.

3.7 Note any discrepancies in data collection or location information in the field book. (i.e. the deleting of points, or low accuracy location information).

3.8 If an equipment malfunction occurs, consult the operation manual for troubleshooting guidance.

4.0 DATA ARCHIVAL

4.1 After the GPS points have been collected, the data points must be stored and archived on the appropriate network drive. Below is the suggested procedure to ensure all data is stored in the proper format to facilitate a streamlined process for post-processing the field data:

a. Attach the USB cord to the GPS and plug into the computer.

b. Power on the GPS and allow the driver to install on the computer. Once this is complete, navigate to the folder containing the GPS data that was recorded on the field date.

c. Copy and paste the GPS data on the network drive in the respective folder.

d. Include a metadata folder to quickly reference the shapefiles that were transferred into the folder. This metadata file should be a word document that includes information such as:

a. Type of GPS data (point, polygon, or line)

b. Time and date

c. Coordinate system

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d. Other corresponding information pertaining to the location and importance.

END OF PROCEDURE

ED_002345B_00009969-00219

Date: October 27, 2015

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the measurement and calculation of discharge in surface water bodies that can be traversed by wading. Discharge measurements are performed for natural (rivers, streams) and engineered (outfalls, ditches, canals, impounded wetland outlets, etc.) surface water bodies. Flow data is used by Roux Associates scientists and engineers to understand the hydrologic conditions at a site.

2.0 CONSIDERATIONS

2.1 Health and Safety

Field staff working in and around potentially contaminated surface waters should receive annual OSHA training and annual medical monitoring. Personal protective equipment (PPE) must be worn when sampling in known contaminated waters where the potential for adverse health effects exists, or where the potential for contamination exists. All field staff should refer to the site-specific HASP before entering into potentially contaminated waters.

Field personnel safety must be considered when planning the location of discharge transects. Field investigation may occur during all stages of the hydrologic cycle, including high discharge/flood stage conditions. If high discharge conditions are determined unsafe by any field representatives or project managers, reschedule the discharge measuring event. It is recommended that field personnel use personal floatation devices when measuring discharge during high flow conditions.

2.2 Site Conditions

Before collecting discharge data, it is important to select a site with characteristics that support accurate flow measurements. Discharge measurements may be collected at any time of year as long as the guidelines outlined below are met.

The USGS recommends that cross sections with the following characteristics be chosen whenever possible:

a) The channel is reasonably straight, the streambed is stable, the streambed is free of large rocks, weeds, and physical obstructions that would create eddies, slack water, or turbulence that could influence velocity measurements.

b) Cross sections are roughly parabolic, trapezoidal, or rectangular in shape with even flow across the transect - no more than 5% of the total water

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discharge should be in any one cell on the cross section, defined as the distance between two adjacent vertical measurement points on the cross section transect.

c) Ideally the water surface should be smooth, with steady, uniform, non-varying flow conditions.

d) Ideally the cross section should not be located in areas where intervening drainage areas meet.

e) Cross sections should not be immediately downstream of sharp bends or vertical drops.

3.0 EQUIPMENT AND MATERIALS

a. Field notebook

b. Black pen

c. Flexible metal, Kevlar, or fiberglass measuring tape

d. Flowmeter (Price AA, pygmy, Marsh McBirney, or equivalent)

e. Top-setting wading rod

f. Chest waders/ boots

g. Personal floatation devices (PFDs)

5.0 PROCEDURE

5.1 If possible, select a straight reach where the streambed is uniform and relatively free of boulders and aquatic growth. The flow should be uniform and free of eddies, dead water near banks, and excessive turbulence. If necessary and possible, modify the measuring cross section to provide acceptable conditions by building dikes to cut off dead water or removing rocks, weeds, and debris in the reach of the stream 1 to 2 meters upstream from the cross section.

5.2 After modifying the streambed, allow the flow to stabilize before starting the flow measurement.

5.3 Determine the width of the stream by stringing the surveying tape from bank to bank at right angles to the direction of flow.

5.4 Calculate the number and spacing of vertical profiles required for discharge measurement. If the stream width is 5 feet or less, space the profiles at 0.5 foot

increments. If the stream width is greater than 5 feet, divide the width by 21. This will give the spacing for 20 vertical profiles.

5.5 Beginning at the left bank, wade to the first vertical profile location and measure stream depth and velocity.

Depth: Measure the stream depth using the wading rod prior to measurement of velocity. The wading rod will be placed in the stream so the base plate rests on the streambed, and the depth of water will then be read from the graduated main rod.

Velocity: Stand at least 2 feet downstream of the surveying tape and to the side of the flowmeter. The required number of velocity measurements at each profile location is based upon the stream depth at that profile. If the depth is 2.5 feet or less, make a single measurement at 60% of the total depth. If the depth is greater than 2.5 feet, make velocity measurements at 20% and 80% of the total depth and average these two velocities together for the discharge calculation.

Use the vernier scale on the upper handle of the wading rod to position the flowmeter to the proper depth. Keep the wading rod vertical and the flow sensor perpendicular to the tape rather than perpendicular to the flow as velocity measurements are being taken. Record the stream velocity and depth measurements in field book.

5.6 Use survey flagging tape to make the location of the measurement.

5.7 Document time and any other relevant conditions (e.g. weather) in the field book.

5.8 Repeat the procedure steps 5.5 through 5.7 for each vertical profile across the transect.

6.0 CALCULATIONS:

Discharge is calculated using the measured width, depth, and velocity data from each profile. When performing calculations, all assumptions should be clearly listed in the file which the calculation is being performed. Date, site, and individual who collected the data should also be provided in the calculation file.

Use Equations 1 and 2 below to calculate the total discharge across the transect in cubic feet per second (ft^3/s).

6.1 EQUATION 1: Discharge of individual profile section (i.e., cell) (Q)

Discharge of a cell (Q) (ft^3/s) = width of cell (ft) x depth of cell (ft) x velocity (ft/s)

6.2 EQUATION 2: Discharge of a transect (Q_{Total})

Total discharge for transect ft^3/s (Q_{Total}) = (Q1 + Q2 + Q3 + … Qn)

END OF PROCEDURE

Date: January 9, 2011
Revision: May 5, 2015

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during field investigation activities (i.e. drilling, soil and water sampling).

The objective of decontamination is to ensure that all field samplingequipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC).

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

The equipment and materials list for decontamination activities may include, but not necessarily be limited to, the following:

a. A work plan and health and safety plan which outlines decontamination procedures and requirements.

b. Field notebook and field form(s).

c. Decontamination solutions, including as necessary: non-phosphate, laboratory-grade detergent; distilled/deionized water; potable water; cleaning solvents if needed [e.g., hexane, acetone, nitric acid).

d. Long and short handled brushes,

e. Bottle brushes

f. Drop cloth/plastic sheeting

g. Paper towels

h. Plastic or galvanized tubs or buckets

i. Pressure washers or steam cleaners

j. Solvent sprayers

k. Trash / bilge pumps

l. Aluminum foil

m. 55-gallon drums.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures will be documented on an appropriate field form or in the field notebook, especially any variation from the method itemized below:

2.1 Safety first. Obtain the appropriate Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP). Prior to mobilization to a site, the expected types of contamination should be evaluated to determine if the field cleaning and decontamination activities will generate rinsates and other waste waters that might be considered RCRA hazardous waste or may require special handling.

2.2 The drill rig and all associated equipment should be properly decontaminated by the contractor before arriving at the site.

2.3 The augers, drilling casings, rods, samplers, tools, and any piece of equipment that can come in contact (directly or indirectly) with the soil, requires proper decontamination on-site prior to commencing drilling. The project work plan or HASP, and appropriate regulatory requirements, should be consulted to determine site-specific decontamination requirements.

2.4 The same decontamination procedures used prior to drilling will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the investigation.

2.5 All on-site steam cleaning or (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc. and should be performed on a decontamination pad that meets the following specifications:

1. The pad should be constructed in an area known or believed to be free of surface contamination.

2. A temporary pad should be lined with a water impermeable material with no seams within the pad. This material should be either easily replaced disposable) or repairable.The pad should be regularly inspected to ensure there are no leaks.

3. Water should be removed from the decontamination pad frequently.

2.6 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCB oil) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.7 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federalregulatory requirements.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Safety first. Obtain JSA and PPE, as specified in the site HASP.

3.2 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.3 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCB oil) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.4 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.5 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.6 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.7 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.8 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.9 Reassemble the cleaned sampler, as necessary.

3.10 After equipment has been cleaned, all individuals involved in equipment handling should don clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil).

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Safety first. Obtain the JSAs and PPE, as specified in the site HASP.

4.2 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble sampling equipment. Discard all used sampling tubes and cords in an appropriate manner. Disconnect all power sources from electrical equipment (i.e. pumps). Scrub each piece of equipment with a brush and solution.

d. Rinse all sampling equipment with copious amounts of potable, distilled or deionized water, Reassemble equipment as per the manufacturer's instructions.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

4.3 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

END OF PROCEDURE

ED_002345B_00009969-00228

Date: May 5, 2000
Revision: May 10, 2015

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish the guidelines and procedures for drilling (soil borings, wells, or piezometers) and conducting sampling activities in unconsolidated formations. There are several drilling techniques available which include: direct push (Geoprobe® or cone penetrometer testing [CPT]), hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, air rotary, and sonic. Formation (sediment/soil) sample collection techniques include disturbed (drill cuttings), intact (split-spoon), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information and to prepare a borehole for potential completion as a well or piezometer. Consequently, the lithologic data is the all important, most essential information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground-water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and Shelby-tube/Denison-core recovery, etc. must be monitored by the on-site hydrogeologist or geologist.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter (for the anticipated well, if applicable, including the placement of a gravel or sand pack through a tremie pipe and necessary formation sealing material such as bentonite or cement).

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of samples of aquifer fluids during the drilling process and prior to well construction, while at the same time minimizing potential for cross-contamination. The method used should prevent cross-contamination between surface soils and ground water or between different hydrogeologic units.

d. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

e. Completion of the borehole into a well (monitoring or observation) or piezometer during the initial construction process (i.e., constructing a well or piezometer as the borehole is drilled, or constructing a well or piezometer in the borehole immediately after the drilling tools are removed).

f. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

g. Completion of a well or piezometer, if applicable, in the borehole following a time lapse for interpretation of geologic or geophysical data from the borehole.

2.1 Drilling will not commence unless a utility mark-out/one call has been conducted at the drilling location(s) in accordance with state and local requirements.

3.0 DRILLING TECHNIQUE – DESCRIPTION

3.1 Direct Push – The direct push technology includes several types of drilling rigs and drilling equipment that advances a drill string by pushing or hammering without rotating the drill string. Direct push rigs include both Geoprobe® and CPT rigs. Geoprobe® rigs are typically limited to drilling in unconsolidated soil up to approximately 100 feet below ground surface (bgs) under compatible conditions. Formation samples are collected in plastic sleeves. Advantages include: access and maneuverability due to the rig's small size; fluids are not introduced into the subsurface during drilling; and sampling is relatively inexpensive. Disadvantages include: limitation to drilling depth; limitation to unconsolidated or soft rock drilling; and limitation to small diameter wells. CPT rigs also provide a continuous profile of the soil strata as the rig's sensing equipment is advanced.

3.2 Hollow-Stem Auger - This drilling method is used in unconsolidated materials with the exception of very dense, compacted materials and when cobbles or larger materials are present. Penetration may be up to 150 feet below land surface (bls) depending on the size of the rig, drilling conditions, and the diameter of the auger flight; however, depths up to 250 feet bls have been achieved under compatible

conditions. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed, and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in.

3.3 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect, representative formation samples.

3.4 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculating drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud or polymer) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.5 Cased-Hole Rotary - Several new rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which "pulls" the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide "shoe" to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) "sand heave" when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water

out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.6 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

3.7 Sonic - This drilling method uses a rotating bit to drill, and high-frequency resonant vibrations created by a Sonic drill head. The drill head contains the mechanism necessary for rotary motion as well as an oscillator, which causes a high frequency force to be superimposed on the drill string. The frequency can be varied to suit operating conditions and is generally between 50 and 120 hertz (cycles per second). The vibrations are sent down the drill string to the drill bit, magnifying the amplitude of the drill bit, which (in overburden) fluidizes the soil particles at the bit face. The drill bit is physically vibrating up and down in addition to being pushed down and rotated. These three combined forces allow for relatively fast and easy penetration through most geological formations. The oscillator is driven by a hydraulic motor and uses out of balance weights to generate high sinusoidal forces that are transmitted to the drill bit. An internal spring system isolates these vibrational forces from the rest of the drill rig. Typically, Sonic drilling uses a drilling fluid (i.e., potable water) to facilitate the advancement of the drill bit. The amount of drilling fluid used should be limited during soil collection as to minimize wash-out of the sample. The use of Sonic as a drilling technology offers a number of advantages over conventional drilling methods. Since the borehole is cased as it is being drilled, borehole collapse is unlikely and cross contamination between various depths is practically eliminated. In some applications, this may reduce or eliminate the need for formal double casing. The sonic core sampling system is perhaps one of the best in its ability to provide continuous, highly representative and relatively undisturbed core samples. The sonic drilling and sampling system is ideal for use in unconsolidated formations where dense layers of gravel, cobble, and/or boulders may be present. Sonic drilling also offers the benefit of significantly reduced Investigation Derived Waste (IDW) (e.g. drill cuttings), as the sonic cores are the only wastes generated during the drilling process.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Safety first. Obtain the appropriate work permit, Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

5.2 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.3 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole.

5.4 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.5 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.6 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.7 Collect formation samples as described below in Section 6.0. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.8 Record geologic information in the geologic log form and in the field notebook. Refer to ROUX SOP 5.5 for soil classification and logging.

5.9 Refer to ROUX SOP 5.1 for collection of soil samples for laboratory analysis. Handle carefully to avoid breakage. Handle and tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Safety first. Obtain the appropriate work permit, JSA and PPE, as specified in the site HASP.

6.2 Intact formation sampling will be implemented using split-spoon samplers (which are driven), Shelby-tube or core samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in suitable size (e.g., 1-pint or 0.5-pint) jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and freezing. Intact formation samples will be collected as described in the work plan at specified intervals (e.g., at 5-foot increments below land surface) and at each major change in subsurface materials. Hydrogeologic information will be recorded on a geologic log form and in the field notebook. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.3 Disturbed formation samples (drill cuttings) will be examined continuously throughout the entire depth of the borehole. If applicable to the study and/or stated in the work plan, borehole cuttings will be collected from the circulating auger flights which lift cuttings to land surface (hollow-stem auger technique), from the sand bailer (cable-tool technique), from the recirculating drilling fluid (mudflume) which transports cuttings to land surface (mud-rotary and related techniques), or from the compressed air used to carry cuttings to land surface (air-rotary and related techniques). Formation samples will be retained in appropriate size (e.g., 1-pint or 0.5-pint), properly labeled jars and stored in a safe place to avoid breakage, agitation, and freezing. Hydrogeologic data will be recorded on a geologic log form and in the field notebook.

6.4 The soil cores from the wells drilled at the site are used for lithologic identification. Split-spoon samples may be collected continuously from boreholes for cluster wells; single well and/or piezometer boreholes may be split-spooned throughout drilling or at specified intervals or changes in lithology. The conditions for sampling will be specified in the work plan.

6.5 Before collecting and retaining soil and/or sediments collected with the split-spoon sampler, the top several inches will be removed from the sampler and discarded to eliminate any sediment that may have caved into the bottom of the borehole.

6.6 Sediment sampling equipment such as split-spoon samplers, spatulas, etc. (but not including Shelby-tube or Denison-core samplers, which area not re-usable) will be decontaminated before and between uses. (Refer to the SOP 9.1 for Decontamination of Field Equipment for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 MONITORING WELL DESIGN CONSIDERATIONS – DOUBLE CASED WELLS

7.1 When there is reason to believe that interconnection of two aquifers by well construction may cause cross-contamination, the installation of a double cased well may be necessary. In the construction of a double cased well, a highly contaminated soil zone may also be cased off so that drilling may continue below the casing with reduced danger of cross contamination.

a. To install a double cased well, a pilot borehole should be installed through the overburden and/or the contaminated zone into the clay confining layer or bedrock. An outer casing (sometimes called overburden or pilot casing) should then be placed into the borehole and sealed with grout. The

borehole and outer casing should extend into tight clay a minimum of two feet and into competent bedrock a minimum of 1 foot.

b. The total depths into the clay or bedrock will vary, depending on the plasticity of the clay and the extent of weathering and\or fracturing of the bedrock. The size of the outer casing should be of sufficient inside diameter to contain the inner casing.

c. The outer casing should be grouted by the tremie, displacement, grout shoe, or Halliburton method from the bottom to the ground surface. The grout should be pumped into the annular space between the outer casing and the borehole wall. A minimum of 24 hours should be allowed for the grout plug (seal) to cure before attempting to drill through it. The grout mixture should be a cement/bentonite, mixture. The use of a pure bentonite grout for a seal is not acceptable, because the bentonite grout is not rigid enough to withstand the stresses of drilling. When drilling through the seal, care should be taken to avoid cracking, shattering, or washing out the seal.

d. If caving conditions exist so that the outer casing cannot be sufficiently sealed by grouting, the outer casing should be driven into place and a grout seal placed in the bottom of the casing.

8.0 BOREHOLE ABANDONMENT OR CLOSURE

8.1 Safety first. Obtain the appropriate work permit, JSA and PPE, as specified in the site HASP.

8.2 Boreholes must be decommissioned after the completion of sampling if the borehole will not be converted to a soil vapor point or a monitoring well or piezometer. The abandonment of any borehole (or boring) will be in accordance with local, state and/or Federal regulations.

8.3 Boreholes less than 10 feet deep that remain open and do not approach the water table may be decommissioned by pouring 30% solids bentonite grout from the surface or pouring bentonite pellets from the surface, hydrating the pellets in lifts. Boreholes deeper than 10 feet, or any borehole that intercepts groundwater, must be decommissioned by pressure grouting with 30% solids bentonite grout, either through a re-entry tool string or through tremie pipe introduced to within several feet of the borehole bottom

8.4 For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include, where appropriate, the following:

a. Borehole designation.

b. Location with respect to the replacement borehole, if replaced (e.g., 30 ft north and 40 ft west of Borehole B-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Drill casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned borehole using a supplemental geologic log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of abandonment.

j. The level of water or mud prior to grouting and the date and time measured.

k. Any other state or local well abandonment reporting requirements.

END OF PROCEDURE

APPENDIX B

Example Field Datasheets

Well Sampling Sheet

Well ID: _____ **Date:** _____

DTW: _____ **Depth of Pump Intake:** _____

DTB: _____ **Total Volume Purged:** _____

Purge Start:		**Time:**		**CPM:**		**psi:**		**Discharge Rate:**	
Purge End:		**Time:**		**CPM:**		**psi:**		**Discharge Rate:**	

Time	DTW (ft bls) [0.3 ft*]	FR (ml/min) [100-500 ml/min]	T (°C) [3%]	Sp. Cond. (mS/cm) [3%]	DO (mg/L) [10%]	pH (SU) [+/- 0.1 units]	ORP (mV) [+/- 10 mV]	Turb (NTU) [10%]	Volume Purged (gallons)

Purge Water Description:

Sample ID: _____ Sample Time: _____

Labrotory Name: _____

Quality Control (QC) sample	
Field duplicate	
Matrix Spike	
Matrix Spike Duplicate	

NOTES:

Analysis	
AQ TCL VOCS 8260	
AQ TCL SVOCs 8270	
AQ TAL Metals EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	
AQ TAL Metals Dissolved EPA 200.2 / 200.7 / 200.8 / 245.2 / 6010C / 6020A / 7470A	
AQ TCL PCBs 8082	
AQ TCL Pesticides 8081	
AQ Total Cyanide 335.4	
AQ General Chemistry 300, SM2023B, 200.7	
AQ Nutrients 300, 350.1, 353.2, 365.1, SM2540B/C	

Soil / Sediment Sample Sheet

Site Name: _____ Project Number: _____

Date: _____ Sampler: _____

Weather: _____

Latitude: _____ Longitude: _____

Coordinate system: _____

Boring ID: _____ Sample Interval (ft-bls): _____

Grab ☐ Composite ☐

Visual Observations: _____

Laboratory Name: _____

Sample ID: _____

Sample Time: _____

Analysis	
Soil TCL VOCS 8260	
Soil TCL SVOCs 8270	
Soil TAL Metals 6010	
Soil TCL PCBs 8082	
Soil TCL Pesticides 8081	
Soil Total Cyanide 9012	
Soil Fluoride 300	
Soil PCDD/ PCDF 8290	
Grain Size Analysis/ bulk density/ moisture content	
Total Organic Carbon	

Quality Control (QC) sample	
Field duplicate	
Matrix Spike	
Matrix Spike Duplicate	

Additional Notes:

_____

_____

_____

_____

_____

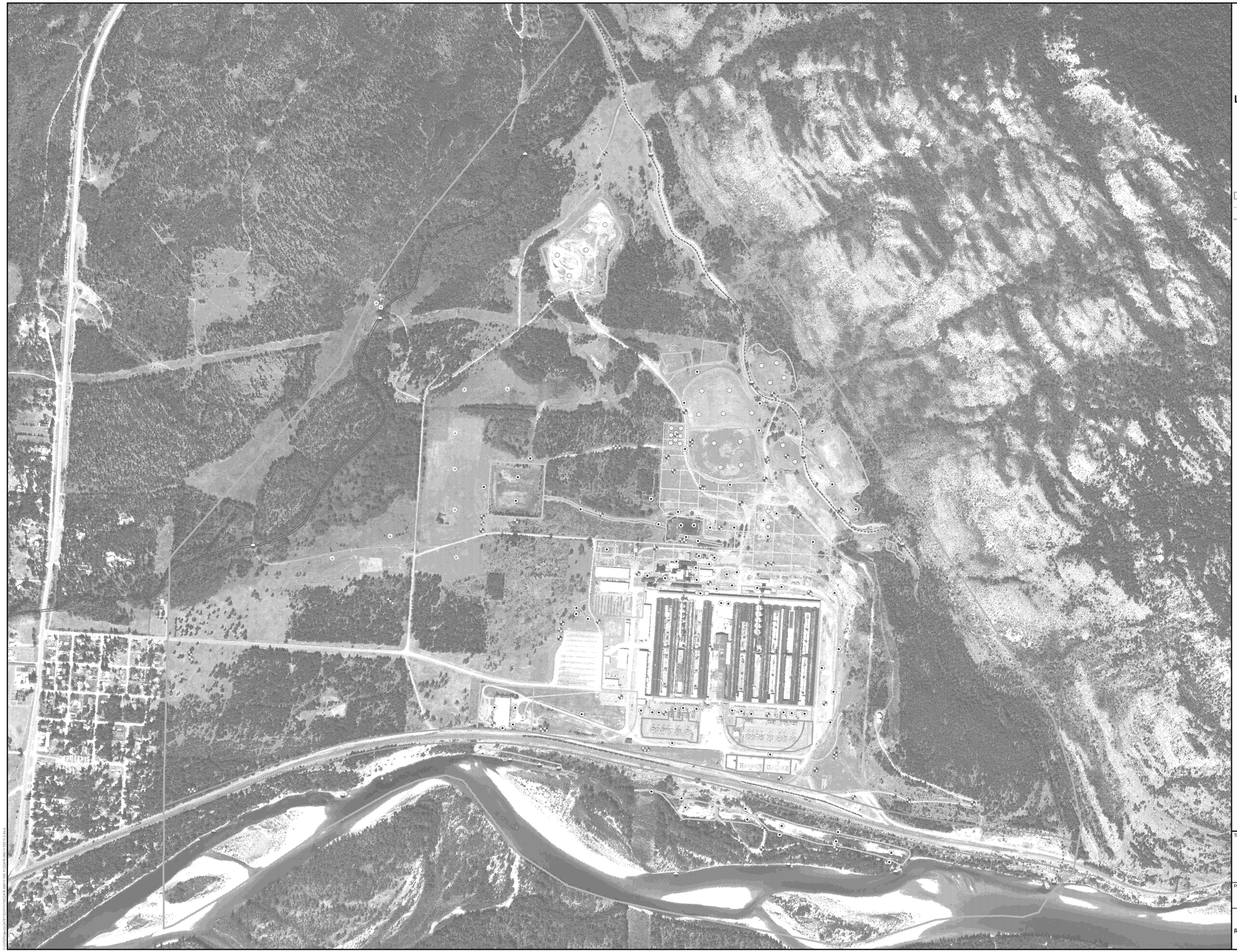
_____

ROUX ASSOCIATES, INC

2476.0001Y000-SAMPLE SHEET

PLATES

1. Proposed RI Phase I Sample Locations Site-wide
2. Main Plant Area Site Plan



Legend

- Existing Groundwater Monitoring Well
- Proposed Deep Monitoring Well
- Proposed Water Table Monitoring Well
- Proposed Soil Boring
- Proposed Surface Water and Sediment Sample
- Proposed Soil Gas Investigation Location
- Proposed Soil Boring Within Background Area
- Approximate Third-party Property Boundaries
- Site Features
- Site Boundary

500 0 500 1,000 Feet

Title: **PROPOSED RI PHASE I SAMPLE LOCATIONS SITE-WIDE**

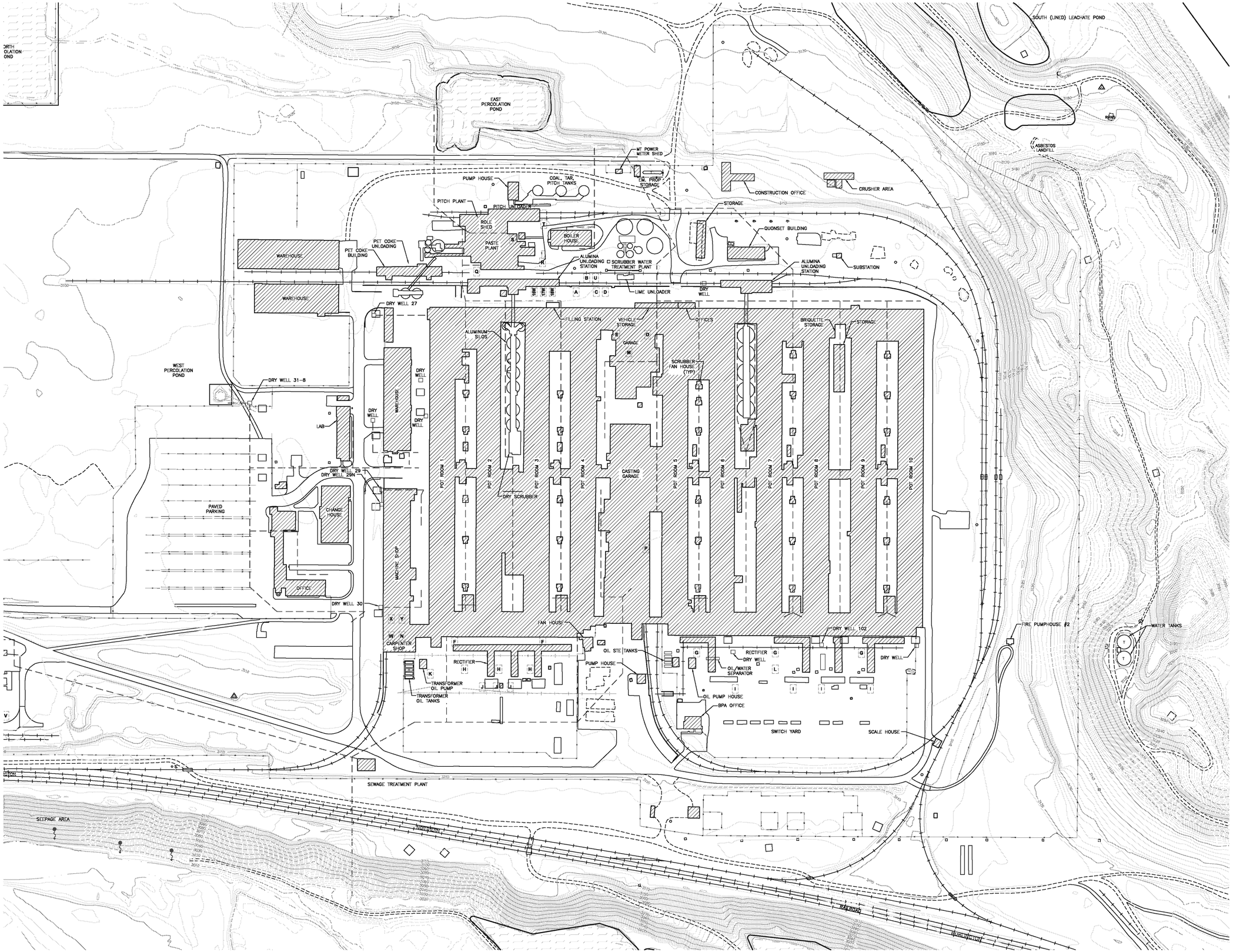
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:

COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: M.A.	Date: 11/17/2015	PLATE
Prepared by: A.M.	Scale: 1 in = 446 ft	1
Project Mgr: A.B.	Office: Islandia, NY	
File No: 2476.0001Y100.112	Project: 2476.0001Y000	



LEGEND

- MAIN PLANT DRAINAGE PIPING
- DRY WELL IDENTIFIED ON SWPPP
- DRY WELL IDENTIFIED ON HISTORICAL SITE DRAWINGS PROVIDED BY CFAF
- UST LOCATION (APPROXIMATE)
- EXISTING BUILDING
- EXISTING TANK
- EXISTING FENCELINE
- EXISTING RAILROAD TRACKS
- EXISTING WATER LINE

REFERENCES

1. DRAINAGE PIPING LAYOUT: CFAC SWPPP, 1999, AUTOCAD DRAWING "SWPPP DWG", FIGURE 1.
2. BASEMAP: AERIAL SURVEY BY WALKER AND ASSOCIATES AND SANDS SURVEYING, DATED NOVEMBER 10, 1997 (DRAWINGS 1-9).
3. LANDFILL (WEST, EAST, CENTER, WET SCRUBBER SLUDGE POND AND LEACHATE PONDS) FROM CFAC SWPPP, 1999.
4. SITE FEATURES (ASBESTOS LANDFILLS, PERCOLATION PONDS) SCALED DRAWING FROM "SITE FEATURES" EPA 2014 SITE REASSESSMENT.
5. UST LOCATIONS APPROXIMATED FROM MCKENZIE, CR TO LOCKHART , HB RE: UNDERGROUND TANKS DATED SEPTEMBER 26, 1985, ATTACHMENT 1 (CFAC 7: 009765).
6. ADDITIONAL UST LOCATIONS (W, 16W, 17W, 18W, X4) APPROXIMATED BASED ON UST REGISTRATION DESCRIPTIONS, 1990.

150' 0 150'

Title:

MAIN PLANT SITE PLAN AND DRAINAGE

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: K.C.	Date: 12MAY15	PLATE
Prepared by: G.M.	Scale: AS SHOWN	2
Project Mgr: K.C.	Project: 2476.0001Y000	
File: 2476.0001Y100.01.DWG		

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