ROUX

Background Investigation Sampling and Analysis Plan

Columbia Falls Aluminum Company
Superfund Site
Columbia Falls, Flathead County
Montana

September 14, 2018

Prepared for:

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

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, New York 11749

2476.0001Y207/CV

Environmental Consulting
& Management
+1.800.322.ROUX
rouxinc.com

Table of Contents

Tables

Figures

Table of Contents (Continued)

Appendices

Acronym List

Acronym:	**Definition**:
AOC	Administrative Settlement Agreement and Order on Consent
ASTM	American Society for Testing and Materials
BERA WP	Baseline Ecological Risk Assessment Work Plan
BHHRA WP	Baseline Human Health Risk Assessment Work Plan
BMA	Block Management Area
BSB	Background Soil Boring
BSDP	Background Sediment Point
BSWP	Background Surface Water Point
BTV	Background Threshold Value
CEM	Conceptual Exposure Model
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFAC	Columbia Falls Aluminum Company, LLC
COC	Chain of Custody
COPC	Contaminants of Potential Concern
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DQO	Data Quality Objectives
DSR	Data Summary Report
DUP	Field Duplicate
EB	Equipment Blank
FB	Field Blank
FS	Feasibility Study
FSP	Field Sampling Plan
FT-BLS	Feet Below Land Surface
GIS	Geographic Information System
GPS	Global Positioning System
GW	Groundwater
LL	Low Level
MBSI	Montana Background Soils Investigation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ORP	Oxygen Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbon
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Protection Plan
RI	Remedial Investigation

Table of Contents (Continued)

Acronym:	**Definition**:
SAB	Suspended and Bedded Sediment
SAP	Sampling and Analysis Plan
SD	Sediment
SLERA	Screening Level Ecological Risk Assessment
SO	Soil
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compounds
SW	Surface Water
TAL	Target Analyte List
TCL	Target Compound List
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UCL_{mean}	Upper Confidence Limit of the Mean
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compounds

1. INTRODUCTION

On behalf of Columbia Falls Aluminum Company, LLC (CFAC), Roux Environmental Engineering and Geology, D.P.C. (Roux), has prepared this Background Investigation Sampling and Analysis Plan (Background SAP) as part of the Phase II Site Characterization and ongoing Remedial Investigation/Feasibility Study (RI/FS) of the Superfund Site referred to as Anaconda Aluminum Co. Columbia Falls Reduction Plant (a/k/a Columbia Falls Aluminum Company Superfund Site), located two miles northeast of Columbia Falls in Flathead County, Montana (hereinafter, "the Site"). The RI/FS is being conducted pursuant to the Administrative Settlement Agreement and Order on Consent (AOC) dated November 30, 2015, between CFAC and the United States Environmental Protection Agency (USEPA) (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. 08-2016-0002). The RI/FS Site Boundary is presented as Figure 1. This Background SAP was developed in accordance with the Scope of Work included with the RI/FS Work Plan for the Site (Roux Associates, 2015a) and the Phase II Site Characterization Sampling and Analysis Plan (Phase II SAP) (Roux Associates, 2018). A detailed description of the Site, its operational history, and the results of historical investigations and the Phase I Site Characterization was provided in previous documents prepared as part of the RI/FS, including but not limited to the RI/FS Work Plan (Roux Associates, 2015a), Phase I Site Characterization Sampling and Analysis Plan (Phase I SAP) (Roux Associates, 2015b), Phase I Site Characterization Data Summary Report (Phase I DSR) (Roux Associates, 2017a), Screening Level Ecological Risk Assessment (SLERA) (Roux Associates, 2017b), and the Groundwater and Surface Water Data Summary Report (GW/SW DSR) (Roux Associates, 2017c).

The term "background" as used in this document refers to concentrations of chemicals at locations that are unaffected by any current or past Site activities. Background includes concentrations of both naturally occurring and anthropogenic chemicals. Concentrations of chemicals may be naturally occurring in the environment in forms that have not been influenced by human activity; while anthropogenic background concentrations may be natural and human-made substances present in the environment as a result of human activities (USEPA, 2002a, b, c).

The purpose of the Background Investigation is to characterize the concentrations of contaminants of potential concern and contaminants of potential ecological concern (collectively referred to as COPCs) in areas outside the Site that are unaffected by historic Site operations or other readily identifiable, anthropogenic sources of contamination.

The goals and data quality objectives (DQOs) specific to the Background Investigation are provided in Section 2.0. The Field Sampling Plan (FSP) that describes the data gathering and sampling activities such as sample location and rationale, and the associated fieldwork procedures is provided in Section 4.1. The work will be performed in accordance with the Quality Assurance Project Plan (QAPP) that was provided as Part 2 of the Phase II SAP (Roux Associates, 2018).

This Background 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). This Background SAP also considers USEPA guidance regarding background studies including the OSWER Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (USEPA, 2002b), OSWER Role of Background in the CERCLA Cleanup Program (USEPA, 2002c), and OSWER Selecting and Using Reference Information in Superfund Ecological Risk Assessments (USEPA, 1994).

2. DATA QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The Background Investigation will be performed in general accordance with the QAPP provided in the Phase II SAP (Roux Associates, 2018). DQOs specific to the Background Investigation are provided in the remainder of this Section 2.0. DQOs for this Background Investigation were not provided in the Phase II SAP (Roux Associates, 2018) and thus are being provided as part of this Background SAP.

The Scope of Work described in this Background SAP and the Phase II SAP was developed in a manner consistent with USEPA's "Guidance on Systematic Planning Using the Data Quality Objective Process" (USEPA, 2006). The 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; and
7. Develop the Plan for Obtaining Data.

The remainder of this element summarizes the DQO process as it relates to the Background Investigation.

2.1 Step 1: Define the Problem

The RI/FS Work Plan and the results of the Phase I Site Characterization completed in 2017 provide the background information and relevant existing Site data to define the problem. The Phase I Site Characterization program was designed to identify and/or confirm source areas and broadly characterize the nature and extent of associated COPCs across the Site and around Site features. Site features are presented on Figure 2.

Results of the Phase I Site Characterization indicated that cyanide, fluoride, polycyclic aromatic hydrocarbons (PAHs), metals, dioxins, and furans are COPCs found within the Site. Cyanide, fluoride, and PAHs were identified as Site-related COPCs in Phase I, based upon knowledge of historical Site operations and the distribution of concentrations observed in the various media around source areas and Site features. Metals were also frequently detected across the Site in most soil, surface water, and sediment samples and identified as COPCs. Additionally, dioxins and furans were detected in soil within the Rectifier Yards.

Although cyanide, fluoride, PAHs, some metals, and dioxins/furans were determined to be COPCs, these constituents may also be present within the background environment. Cyanide, fluoride, and PAHs can be found as naturally occurring substances within the environment; however, as specified in the conceptual site model for the Site, these constituents are COPCs at the Site, based upon knowledge of historical Site operations and the results of prior investigations. This presumption has been further confirmed based upon the concentrations of these COPCs detected in soil within Site features at various locations across the Site. However, cyanide, fluoride, and PAHs will be evaluated to determine background concentrations of these COPCs, which will allow for the proper framing of the risk assessment results.

With respect to metals and dioxins/furans, Montana Department of Environmental Quality (MDEQ) conducted state-wide studies to determine at what concentrations each of these COPCs were occurring at background concentrations throughout Montana. During the preparation of the Phase I DSR (Roux Associates, 2017a), the Phase I results were compared to existing Montana surface soil metals data from the Montana Background Soils Investigation (MBSI), as reported in "Background Concentrations of Inorganic Constituents in Montana Surface Soils" (Hydrometrics, 2013). Based on the results of the Phase I, concentrations of some metals are consistent with regional estimates of background concentrations. The comparison of soil concentrations of metals selected as COPCs to the background concentrations indicated that several of the metals may be representative of the concentrations of naturally occurring metals in the regional environment. Metals may occur naturally in the environment but can be related to anthropogenic sources including industrial processes, fertilizers, aerial deposition, and many other sources.

The Montana Dioxin Background Investigation Report (MDEQ, 2011) was also reviewed to gain insight on quantified regional estimates of background concentrations. The MDEQ study indicated that dioxins and furans were detected frequently throughout the state, and a comparison of the CFAC Site data collected inside and outside the Rectifier Yards to the Montana background values revealed that the majority of CFAC samples contained dioxins and furans at concentrations less than the Montana background upper tolerance limit (UTL) for rural and urban data. These data suggest that there could be a background contribution to dioxin and furan concentrations being detected at the Site. Dioxins and furans may occur naturally in the environment from forest fires and are also an anthropogenic by-product of many industrial processes (USEPA, 2005).

The results of the Phase I Site Characterization were used in the development of the draft Baseline Human Health Risk Assessment Work Plan (BHHRA WP) and draft Baseline Ecological Risk Assessment Work Plan (BERA WP) (EHS Support, 2017a, b) to perform a preliminary screening to identify the COPCs that may pose a potential threat to human health and the environment. Based upon the results of the preliminary screening, it is recognized that several of the COPCs at the Site have the potential to occur in the background environment. Therefore, developing an understanding of the occurrence and concentrations of these COPCs in background reference areas will be necessary to frame the results of the risk assessment with respect to these COPCs.

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

The Phase II Site Characterization program was designed to address outstanding data gaps in order to complete the RI and conduct a risk assessment. The adequacy of Phase I Site Characterization data collected to represent background conditions was identified as an uncertainty in the SLERA (Roux Associates, 2017b), and is further described as a data gap in the BERA WP (EHS Support, 2017b).

As stated in the Phase II SAP, the results of the Phase II Site Characterization, including the Background Investigation, will be used to refine the CSM/Conceptual Exposure Model (CEM) provided in the BHHRA WP and BERA WP (EHS Support, 2017a, b), as necessary. At the conclusion of the Phase II Site

Characterization, the risk assessment will be completed in accordance with the procedures outlined in Section 6.0 of the RI/FS Work Plan (Roux Associates, 2015a) and in accordance with the BHHRA WP and BERA WP (EHS Support, 2017a, b).

The following objectives were established for the Background Investigation and were derived from the DQO process.

- Identification of reference locations that will be suitable for characterization of background concentrations of COPCs in soil, sediment, and surface water; and
- The collection of a sufficient number of soil, sediment, and surface water samples from the reference locations to develop a statistically-robust background data set for use in framing the results of risk assessment with respect to COPCs that also exist in background areas.

The Phase II Site Characterization has been designed to fill data gaps as necessary to complete the BHHRA, BERA, and FS. The absence of an adequate background dataset was identified as a data gap, and therefore, the goal of this Background Investigation is to develop a statistically-robust background dataset in order to frame the results of the risk assessment with respect to COPCs found to exist within the background environment. This goal forms the basis for development of the following decision questions and statements.

- *Question 1*: What are the concentrations of select COPCs in reference area surface soil, surface water, and sediment?

  Estimation Statement: Develop an adequate sample dataset to calculate the mean of the background ($Mean_{Background}$) and the background threshold value (BTV) of COPCs in each background reference area.

- *Question 2*: Are the COPC concentrations in soil, surface water, and sediment within the Site associated with a Site-related source or are they associated with background?

  Decision Statement: Determine if the COPC concentrations in Site soil, surface water, and sediment exceed the COPC concentrations in the reference areas; and therefore, are at least in part, attributable to a Site-related source.

A goal of this Background Investigation is to ascertain $Mean_{Background}$ and BTV values before decision-making in the risk assessment, and also to better frame the results of the risk assessment. Estimating these statistics of interest are discussed in detail in Section 2.5 (Develop the Analytical Approach) and included in Figure 3.

For each COPC, the UCL_{mean} concentration of onsite samples for each exposure area will be compared to the $Mean_{Background}$ concentration of the respective background samples. The $Mean_{Background}$ provides a conservative estimate of the central tendency of each dataset. If the Site UCL_{mean} concentration exceeds the $Mean_{Background}$ concentration, then the COPC will be treated as potentially Site-related. Otherwise, if the Site UCL_{mean} concentration does not exceed the $Mean_{Background}$ concentration, the COPC will be treated as background-related. This comparison is presented as a flow chart in Figure 3.

For all COPCs determined to be potentially Site-related, one-sided two-sample hypothesis testing will be performed comparing background data to onsite data by exposure area. Where appropriate, background reference areas will be combined to increase the background sample size and, in turn, the power of the analysis if two-sided hypothesis testing shows the background reference areas to be equivalent and comparable with respect to that COPC.

Mirroring the Figure 3 flow chart, for each COPC determined by hypothesis testing to be potentially Site-related, onsite data from individual samples will be compared to the BTVs (which represent an upper bound statistic of the background dataset). The results of this comparison will identify specific locations within the Site that appear to be impacted.

To control the false positive error rate (Type I Error Rate), the Upper Tolerance Limit (UTL) 95-95 will be utilized for the BTV. This value represents a 95% UCL of the 95th percentile of the background data distribution. In other words, 95% of all potential observations (current and future) from the background population will be encompassed by the UTL95-95 with a confident coefficient of 0.95. As per the ProUCL Technical Guidance dated May 30, 2016, the UTL95-95 is an appropriate BTV for comparison of numerous onsite values.

If COPC concentrations at the Site are not significantly different from background concentrations, the COPC concentrations may represent regional conditions that are not related to Site activities. Background sample reference areas should have similar characteristics as the Site, but should not have been affected by activities on the Site. A discussion of the considerations in selection of the background reference area sampling locations and a preliminary identification of the area proposed for sampling is provided in Section 3.0.

2.3 Step 3: Identify Information Inputs

A description of the new data required to address each of the DQO questions and statements provided in Section 2.2 is summarized below.

- *Estimation Statement: Develop an adequate sample dataset to calculate the $Mean_{Background}$ and the BTV of COPCs in each background reference area.*

  In order to estimate $Mean_{Background}$ and BTV COPC concentrations, soil, surface water, and sediment samples will be collected within the background reference locations. Background sample reference areas should have similar characteristics as the Site but should not have been affected by activities on the Site. Considerations for background reference areas and the rationale for the Background Investigation proposed reference areas are provided in Section 3.0.

  DQO Sections 2.1 (Define the Problem) and 2.3 (Identify Information Inputs) discuss that the results of the Phase I Site Characterization indicated that cyanide, fluoride, and PAHs are COPCs found within the Site, and metals were detected frequently across the Site in most soil, surface water, and sediment samples. Developing an understanding of the occurrence and concentrations of these COPCs in background reference areas will be necessary to frame the results of the risk assessment with respect to these COPCs.

  The soil samples will be analyzed for cyanide, fluoride, semivolatile organic compounds (SVOCs) (including PAHs), metals, dioxins/furans, and total organic carbon (TOC); the surface water samples will be analyzed for cyanide, fluoride, chloride, sulfate, sulfide, alkalinity, hardness, nitrogen, nitrate-nitrite, ammonia, orthophosphate, SVOCs, and metals; and the sediment samples will be analyzed for cyanide, fluoride, SVOCs, metals, TOC, moisture content, bulk density, and grain size analysis, which are the constituents of interest for the background study (as described in Section 4.4).

  Although the results of the Phase I determined that cyanide, fluoride, PAHs, and select metals were considered COPCs at the Site, background surface water samples will be analyzed for full suites of SVOCs and metals, as it is not yet known whether additional SVOCs or metals may be identified as COPCs within the Site as part of the Phase II. Section 4.4 (Laboratory Analytical Methods) describes that surface water samples will be analyzed for total target analyte list (TAL) metals via USEPA Methods 6020A / 7470A; and dissolved TAL metals via USEPA Methods 6020A / 7470A.

  In addition to the analysis of potential COPCs, further general chemistry and fate and transport parameters (as listed in Section 4.4) are also being collected. The rationale for the additional general chemistry and fate and transport parameters is provided below.

- Hardness: Chronic surface water quality criteria for many metals are based on exposure to the dissolved phase and are a function of surface water hardness (as mg/L CaCO3).
- Surface water biotic ligand model (BLM) parameters: Ancillary parameters to support the evaluation of the BLM for copper (temperature, pH, dissolved organic carbon [DOC], calcium, magnesium, sodium, potassium, sulfate, chloride, and alkalinity) were collected in the final round of four surface water sampling events conducted as part of the Phase I Site Characterization. Exposure characterization for copper in surface water in the BERA will include analyses of the necessary ancillary parameters to support the evaluation of the BLM.
- COPEC bioavailability: Analytical parameters for surface water include total recoverable (unfiltered) and recoverable results to evaluate COPEC bioavailability.
- Organic carbon content: Influences the partitioning and bioavailability of metals and organic COPECs in soil and sediment.
- Fate and transport analytes including grain size distribution (sieve and hydrometer), moisture content, total organic carbon, and bulk density, will be analyzed on sediment samples to support future fate and transport assessment and modeling efforts, if necessary as part of the RI/FS.

Section 4.4 describes the laboratory analytical methods for each media to be sampled as part of the Background Investigation.

- *Decision Statement: Determine if the COPC concentrations in Site soil, surface water, and sediment exceed the COPC concentrations in the reference areas; and therefore, are at least in part, attributable to a Site-related source.*

  As stated in Section 2.2, the UCL_{mean} of COPC concentrations within the Site will be compared against the $Mean_{Background}$ of COPC concentrations in background reference locations. Hypothesis testing will be performed utilizing ProUCL. Details regarding the hypothesis testing and the statistical approach are provided in Section 2.5. BTVs will also be developed utilizing ProUCL.

Background sampling and analytical methods will need to be comparable to the sampling and analytical methods used for the Phase II sampling, and those methods are defined in Section 4.0.

2.4 Step 4: Define the Study Boundaries

Background reference area sampling for soil, surface water, and sediment will occur outside of the RI/FS Site boundary. The locations were selected such that Site-related impacts and potential impacts due to other historic industrial or commercial operations are not expected to occur in the reference locations. The proposed locations and considerations in selecting the locations are described in Sections 3.3, 3.5, and 3.7.

Candidate background locations will be distal to industrial operations at the Site and have no known waste materials present. Based on data collected by the Western Regional Climate Center (WRCC, 2018), prevailing winds in the area, as measured at Glacier Park International Airport, are generally from the south and south-southeast. A wind rose diagram generated from Midwestern Regional Climate Center for Kalispell/Glacier Park Airport (Mean Wind Direction, 1948 – 2018) is provided as Figure 4. Due to the potential for historical atmospheric deposition of suspected COPCs, identified candidate background locations will target areas upwind of the Site based upon the prevailing wind direction in the vicinity of the Site. Soil type and soils derived from similar geologic sources are the primary consideration when choosing soil background reference locations. Surface water and sediment sampling locations will target areas hydraulically upgradient of the Site. Sections 3.2., 3.4, and 3.6 describe the proposed soil, surface water, and sediment reference areas that were selected based on the DQO process.

Soil sampling will be conducted in four background reference areas that demonstrate similar chemical and physical properties as the soil types on Site. Based on the review of surficial geology and surface soil type reviews for the Flathead Valley and the Site described in Section 3.2, the following three primary soil types will be utilized for background soil reference areas: 1) Glacial Till and Alluvium, 2) Fluvial Deposits and Riverwash, and 3) Mountainous Land with Glacial Deposits. These three major soil types were generated based on review of the maps presented as Figures 5 and 6. Figure 5 was generated based on the Geologic and Structure Maps of the Kalispell Quadrangle, Montana, and Alberta and British Columbia (Whipple, et al., 1992). Figure 6 was generated based on review of United States Department of Agriculture Natural Resources Conservation Service Web Soil Service. Details regarding the considerations for these three primary soil types are included in Section 3.

Figure 5 presents a geologic map of the Flathead Valley in the vicinity of the Site. As shown on this map, there are three primary soil types: 1) glacial and fluvioglacial deposits (soils deposited by glacial activity) (Pleistocene) (Qgr); 2) alluvial deposits (soils deposited by river activity) (Holocene) (Qal); and 3) the Revett Formation (Middle Proterozoic) (Yr), which is expressed at the surface as Teakettle Mountain (soil interaction between the glacial outwash and bedrock).

Figure 6 presents the surface soil types within and surrounding the Site, based on review of the United States Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Service (https://websoilsurvey.nrcs.usda.gov). These soil types are more detailed than the generalized map presented on Figure 5 and can vary based on slight changes in grain size (for example, 27-7 and Mh). Although there are numerous surface soil types onsite based on the NRCS survey, these soil types can be grouped together into the three major soil types previously described due to their similar geology. Tables 1 and 2 present soil code definitions included on Figures 5 and 6. The below summary table presents the descriptions of the primary soil types within the Site:

USGS Surface Soil Types (Figure 5)		**NRCS Soil Types and Descriptions (Figure 6)**				
General Soil Code	**Primary Soil Type**	**Detailed Soil Code**	**Description**	**Landform**	**Parent Material**	**Typical Profile**
Qgr	Glacial and Fluvoiglacial Deposits	27-7	Dystric Eutrochrepts, till substratum	Kames, kettles, terraces	Till	3 to 9 inches: very gravelly silt loam 9 to 18 inches: extremely cobbly sandy loam 18 to 31 inches: extremely cobbly sandy loam 31 to 60 inches: very cobbly loamy sand, very gravelly loamy sand, extremely gravelly sandy loam
Qgr	Glacial and Fluvoiglacial Deposits	Mh	Mires gravelly loam	Terraces, outwash fans	Outwash	0 to 8 inches: gravelly loam 8 to 18 inches: very gravelly loam 18 to 60 inches: very gravelly loamy sand
Qal	Alluvial Deposits	Rc	Riverwash	Flood plains	Flooded and ponded soils	Not available
Qal	Alluvial Deposits	16	Fluvents, alluvial fans	Alluvial fans	Alluvium	29 to 60 inches: extremely gravelly sand
Yr	Revett Formation (Teakettle Mountain)	Mr	Mountainous Land	Moraines	Glacial till	5 to 18 inches: loam 18 to 26 inches: gravelly silt loam 26 to 60 inches: gravelly loam

Yr	Revett Formation (Teakettle Mountain)	75	Rock outcrop, structural breaklands	Not available	Not available	100% bedrock

Outside of the Site boundary, it is expected at COPC concentrations are highest at the surface and decrease with increasing depth. Generally, aerial deposition is the primary mechanism for contamination of soil within background areas impacted by anthropogenic sources; therefore, the Background Investigation is focused on sampling soils at the surface. The surface layer (0-6 in) would be the interval most likely impacted by the deposition of airborne pollutants, especially recently deposited pollutants and also pollutants that do not move downward because of attachment to soil particles.

Based on the results of the Phase I Site Characterization, Site boundary concentrations in the undeveloped areas for cyanide, fluoride, and PAHs were generally below the USEPA Protection of Groundwater RSLs or non-detect, and concentrations decreased with increasing depth suggesting that the highest concentrations are at the surface. Site boundary concentrations for metals, where detected, were at concentrations above USEPA Protection of Groundwater RSLs in the surface, shallow, and intermediate-depth soil samples.

Background soil data generated as part of the Background Investigation will be compared to other background soil datasets, and any subsequent documents (i.e., Phase II Data Summary Report) will include a discussion of the outcome of comparisons to other background datasets, including the dataset from the Montana Background Soils Investigation (MBSI) (Hydrometrics, 2013), and the native soil data presented in Smith et al. (2016), for perspective on how the Site-specific background dataset compares to the range of the regional datasets. Surface water and sediment will be collected from upgradient locations of the Flathead River and Cedar Creek. In order to best represent background conditions for surface water and sediment, surface water and sediment samples will be collected upgradient of the Site in the Flathead River and upgradient of the Site within the headwaters north of Cedar Creek. Surface water samples will be collected at a depth of approximately 60 percent of the total water column depth and no greater than a maximum water depth of two feet. Sediment will be collected from 0-0.5 ft immediately beneath the sediment-surface water interface. Soil, surface water, and sediment sampling details are included in Section 4.2.2, 4.2.3, and 4.2.4.

Temporal variability in the data will be considered when planning for surface water sample collection to collect a representative range of data. The background sampling activities are anticipated to occur from June 2018 to October/November 2018. Background surface soil sampling will occur in June 2018 coinciding with onsite soil sampling. As discussed in Section 3.3 and further described in the Phase II SAP (Roux Associates, 2018), surface water conditions vary in the Flathead Valley depending on seasonal fluctuations. Two rounds of background surface water sampling will occur; one during high water season in June 2018, and one during low water season in October/November 2018 to evaluate temporal variability. Background sediment samples will be collected during the low water conditions in October/November 2018, such that the Flathead River is receiving groundwater input during this time period. These sampling events correspond to the same timeframe as the onsite surface water and sediment sampling events.

Background datasets will be compared to corresponding Site data using the conceptual approach proposed in Figure 3. For sediment and surface water, background datasets collected from upstream areas of the Flathead River and Cedar Creek will be compared to downstream exposure areas within each respective waterbody.

Background datasets representative of the three primary soil types identified on site (Alluvial Deposits [Qal], Glacial and Fluvioglacial [Qgr], and Revett Formation [Yr]) will be compared to soil datasets from human health and ecological exposure areas with corresponding soil types. The spatial distribution of the three primary surficial soil types identified within the Site was compared to the spatial distribution of ecological and human health exposure areas presented in the BERA WP and BHHRA WP, respectively (EHS Support, 2017 a,b) to identify appropriate comparisons of Site datasets to proposed background datasets. A summary of primary soil types identified within each ecological and human health exposure area (terrestrial and transitional ecological exposure areas) is provided below:

Exposure Areas	USGS Surficial Geology/Soil Types (Figure 5)		
	Alluvial Deposits (Qal)	Glacial and Fluvioglacial (Qgr)	Revett Formation (Yr)
Ecological Exposure Areas			
Main Plant Area		●	
North Percolation Pond Area		●	
Central Landfills Area		●	●
Industrial Landfill Area		●	
Eastern Undeveloped Area		●	●
North-Central Undeveloped Area		●	●
Western Undeveloped Area		●	
Flathead River Riparian Area	●		
South Percolation Pond	●		
Cedar Creek Reservoir Overflow		●	
Northern Surface Water Feature		●	
Human Health Exposure Areas			
Main Plant Area		●	
North Percolation Pond Area		●	
Central Landfills Area		●	●
Industrial Landfill Area		●	
Eastern Undeveloped Area		●	●
North-Central Undeveloped Area		●	●
Western Undeveloped Area		●	
South Percolation Pond Area	●		
Flathead River Area	●		
Backwater Seep Sampling Area	●		

Prior to comparisons with Site datasets, background datasets will be evaluated to assess potential differences in COPC concentrations between the three primary soil types. Background datasets from primary soil types with COPC concentrations that are not statistically different will be pooled to: 1) minimize the number of representative background statistics to compare with site exposure area datasets; and 2) to increase the power and confidence of hypothesis testing between exposure area and background datasets due to increased sample size.

Background comparisons to evaluate human health exposure will be based on comparisons of Site data from within human health exposure areas to representative background concentrations from corresponding soils types. Comparisons of Site exposure area datasets to corresponding background datasets will be conducted using the general approach presented in Figure 3.

Background comparisons to evaluate ecological exposure will be based on the potential use of exposure areas by ecological receptors. The evaluation of exposure to large home range wildlife that may forage randomly across entire ecological exposure areas will be based on comparisons of site exposure area datasets to background datasets using the general approach presented in Figure 3. Potential exposure to small home range receptors will be evaluated within each exposure area based on comparison of the maximum COPC EPC within an exposure area to the BTV estimated from the corresponding background dataset, consistent with comparisons to risk-based soil benchmarks presented in the BERA WP (Section 5.2.1). The small home range size at the Site is approximately 1-acre, based upon the short-tailed shrew, which has a mean home range size of 0.96-acres (Buckner, C.H. 1966), and the meadow vole, which can have a mean home range size as small as 0.13-acres (McCann, S.A., 1976). If the maximum EPC within an exposure area exceeds the corresponding BTV, point-by-point comparisons of EPCs to the BTVs will be conducted to identify areas where small home range receptors may be exposed to COPC concentrations exceeding background concentrations. Sampling points exceeding the corresponding background BTV will be presented concurrently with sampling points exceeding risk-based soil benchmarks for the protection of small ranging receptors (see Section 5.2.1 of the BERA WP).

Given the judgmental study design biases sampling to areas of known or suspected sources or pathways, the incorporation of maximum and point-by-point exposure scenarios will provide conservative estimates of potential exposures to small home range receptors that exceed background exposure. The area use assumption will be 100% area use for both receptors in each exposure area.

2.5 Step 5: Develop the Analytical Approach

The activities described in Section 4.2 were developed to generate the types and quantity of data required to address the decision statement and estimation statements specified in Sections 2.2 and 2.3. Analytical data collected during the background investigation will be validated, compiled, and tabulated in the project database for comparison and statistical analysis. The analytical approach to address each decision and estimation statement is described below.

- <u>Estimation Statement</u>: *Develop an adequate sample dataset to calculate the $Mean_{Background}$ and the BTV of COPCs in each background reference area.*

  The $Mean_{Background}$ for the COPCs in various media and reference areas, and the BTV for the background dataset, will be calculated using the most recent version of USEPA's ProUCL software, version 5.1.002 (5.1) and in accordance with the ProUCL guidance document. All aspects of data evaluation, data transformation, data identification, and the data treatment of outliers will be documented and included within the Phase II Site Characterization Data Summary Report, along with the ProUCL output as an appendix to each data report.

  As stated in the Phase II SAP, although judgmental sampling designs have been used for both the Phase I and Phase II programs, random samples have been placed throughout the Site in each exposure area to obtain better spatial representativeness across each area, and to characterize COPC and COPEC concentrations near the Site boundary. Therefore, the background samples and the onsite samples are appropriate to compare.

- <u>Decision Statement</u>: *Determine if the COPC concentrations in Site soil, surface water, and sediment exceed the COPC concentrations in the reference areas; and therefore, are at least in part, attributable to a Site-related source.*

  For each COPC, the UCL_{mean} concentration of onsite samples for each exposure area will be compared to the $Mean_{Background}$ concentration of the respective background samples. If the Site UCL_{mean} concentrations exceed the $Mean_{Background}$ concentrations, then the COPC will be treated as potentially Site-related. Otherwise, if the Site UCL_{mean} concentrations do not exceed the $Mean_{Background}$ concentrations, the COPC will be treated as background-related. Only the results of the parent sample (and not duplicate samples) will be used when performing this comparison as well as during the hypothesis testing described below.

For all COPCs determined to be potentially Site-related, one-sided two-sample hypothesis testing will be performed comparing background data to onsite data by exposure area. Background Test Form 2 will be utilized for these analyses. The null hypothesis and alternative hypothesis will be as follows:

The null hypothesis, H0: The mean COPC concentration in samples from the exposure area is greater than the sum of the mean concentration in the respective background area and the substantial difference.

The alternative hypothesis, HA: The mean COPC concentration in samples from the exposure area is less than or equal to the sum of the mean concentration in the respective background area and the substantial difference.

The *substantial difference*, S, will be based upon a proportion of the background sample variability.

The existing Phase I dataset was utilized to confirm the approach for establishing the substantial differences in the hypothesis tests. The proposed proportion of the background sample variability (i.e., standard deviation) for these analyses is 1.3, which is the optimal value for minimizing the substantial difference while ensuring the desired confidence and power are achieved when conducting the two-sample hypothesis testing using Background Test Form 2 (USEPA, 2002b). Using this proportion, analyses performed using the Phase I data from the Western Undeveloped Area yielded substantial differences less than the Residential RSLs for most analytes.

To determine which hypothesis test will be utilized for each COPC, normality tests will be conducted. If a COPC within an exposure area and its respective background data are normally distributed, a student t-test will be performed; if both sample sets are not normally distributed, a nonparametric test, such as the Gehan test, will be performed. Outliers identified on a statistical basis will be evaluated to determine if there is a location specific reason, which would provide evidence for the anomalous value. The most recent version of ProUCL (currently ProUCL 5.1) will be utilized for all calculations, plots, and hypothesis testing.

ISM samples will not be compared to background data and ISM sampling is not proposed for the background investigation, therefore, onsite samples previously collected using ISM will not be utilized in the hypothesis testing. If the hypothesis testing concludes a COPC is potentially Site-related, the BTV calculated from the background data for that COPC will be used for comparison of all onsite samples. The distribution of sampling locations will not be adversely affected by excluding the ISM samples from the hypothesis testing, since discrete samples were collected throughout the entire site.

2.6 Step 6: Specify Performance or Acceptance Criteria

Performance or acceptance criteria is addressed by an assessment of potential decision error and uncertainty evaluation; as well as by the Quality Assurance/Quality Control (QA/QC) aspects of the project.

2.6.1 Decision Error Limits and Uncertainty Evaluation

As described in Section 2.5, the sampling plan for the background study was developed based on a probabilistic design, which is one of the accepted methods described in USEPA guidance on sampling design (USEPA, 2002b). With a probabilistic sampling design, decision error limits and uncertainty are evaluated through the use of hypothesis testing and confidence levels.

The potential Type I decision error to be avoided in this instance is falsely concluding that the mean concentration of a COPC on the Site does not exceed the background mean by more than the substantial difference, when in fact it does. A Type I error results from rejecting the null hypothesis when in fact the null hypothesis is true (a false positive). A Type II error results from failure to reject the null hypothesis when the null hypothesis is in fact false (a false negative). As detailed in the ProUCL Technical Guide, when using the Background Test Form 2, a Type I error is the more serious offense because it threatens the protection of human health and the environment. Therefore, the upper bounds on the decision error rates are 10% and 20% for Type I and Type II errors, respectively; the confidence level of the test must be greater than or equal to 90%, and the power must be greater than or equal to 80%.

By using Background Test Form 2 and following the Figure 3 flow chart, additional analyses will be performed for each COPC determined by hypothesis testing to be potentially Site-related. For soil areas, this may include combining background reference areas if two-sided hypothesis testing to compare the reference areas to each other shows them to be equivalent and comparable with respect to that COPC. For analytes retained as potentially Site-related COPCs, point by point comparisons of individual samples to the COPC BTV will be performed to identify Site-impacted locations.

Following preliminary analyses, the data will be reviewed for outliers utilizing Dixon's or Rosner's outlier tests (dependent on sample size) as well as visual aids including box plots and Q-Q plots. ProUCL utilizes the Dixon's Extreme Value test for data with fewer than 25 samples and the Rosner's outlier test for data with 25 or more samples. Outliers identified on a statistical basis will be evaluated to determine if there is a location specific reason that would provide evidence for the anomalous value. The hypothesis testing will be repeated excluding outliers, and any difference in results will be noted. The project team will assess the influence of outliers and use best judgement to decide the proper disposition of outliers.

ProUCL 5.1 will be utilized for all calculations, plots, and hypothesis testing. Roux's statistician will review all underlying assumptions and data output by ProUCL to ensure the recommended values are appropriate for use.

2.6.2 Additional Performance or Acceptance Criteria

Quality assurance/quality control, precision, accuracy, sensitivity, completeness, representativeness, and comparability will all be consistent with the performance or acceptance criteria outlined in the Phase II SAP (Roux Associates, 2018).

2.7 Step 7: Develop the Plan for Obtaining Data

The field sampling plan generated to collect the necessary data to meet the DQOs described above is presented in Section 4 of this Background SAP. The locations and numbers of sampling points associated with each type of sampling activity were selected to be able to satisfy the decision and estimation statements presented in Sections 2.2 and 2.3.

Ten samples are proposed for each reference area to facilitate statistical evaluation of the data, as recommended by ProUCL. The sample size was determined in accordance with the USEPA Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites (USEPA, 2002) for one-sided two-sample hypothesis tests with confidence level 90% ($\alpha = 0.10$). The power of the test was selected to be 90% ($\beta = 0.10$) at the relative difference of 1.5. The relative difference is the ratio of the minimum detectable difference (MDD) to the natural variability (standard deviation, σ). The value of 1.5 falls within the USEPA-recommended range of 1 to 3 (USEPA, 2002), and yields an approximate minimum sample size of seven (7) samples using the ProUCL DQOs Based Sample Sizes tool. This value was rounded up to ten

(10) samples to be conservative and to ensure sufficient data are available to calculate reasonably reliable estimates of BTVs and $Mean_{Background}$ concentrations. A minimum sample size of ten corresponds to a relative difference less than 1.2 as determined by the ProUCL tool.

Based on the existing Phase I surface soil dataset, a coefficient of variation ranging from 10% to 120% is expected. The coefficient of variation is different for each COPC, but on average was found to be 45%. These estimates are expected to be the upper bounds of the coefficients of variation since the background reference areas are expected to be variable from the Site dataset.

Where appropriate, background reference areas will be combined to increase the background sample size and, in turn, the power of the analysis if two-sided hypothesis testing shows them to be equivalent and comparable with respect to that COPC. Point by point comparisons of Site data to the BTVs will then be conducted for all COPCs determined by hypothesis testing to be potentially Site-related. The results of this comparison will identify specific locations within the Site that appear to be impacted.

As per the risk assessment work plans, the background analysis will not be used to eliminate COPCs from the risk assessment, but rather to better frame the outcome of the risk assessment and assess whether and to what extent background conditions may be contributing to the overall risk at the Site.

Soil data collection will occur in four reference areas to evaluate background concentrations in varying types of soil conditions that are similar to the Site. Based on the review of surficial geology and surface soil type reviews for the Flathead Valley and the Site described in Section 3.1, glacial till and alluvium, fluvial deposits and riverwash, and mountainous land with glacial deposits are the primary soil types onsite, and soil reference areas will be selected based on these soil types. A minimum of ten soil samples will be collected in each reference area in an effort to ensure the sample size is sufficient to calculate $Mean_{Background}$ and BTV concentrations in each reference area, as recommended by ProUCL guidance. Soil sampling locations in each reference area will be randomly generated in a Geographic Information System (GIS) to meet the probabilistic sampling design.

Surface water and sediment data collection will occur in two reference areas; upstream within the Flathead River and upstream within Cedar Creek to evaluate background concentrations in conditions that are similar to surface water features at the Site. The rationale for these sample locations are further described in Section 3.4 and 3.6. A minimum of ten surface water and sediment samples will be collected in each reference area in an effort to ensure the sample size is sufficient to calculate $Mean_{Background}$ and BTV concentrations in each reference area, as recommended by ProUCL guidance. Surface water samples will be collected during high and low water season to evaluate seasonal changes. As described in the Phase I DSR (Roux Associates, 2017a) and in Section 3.4, the high-flow and rocky substrates of the Flathead River do not allow for frequently identified areas of depositional areas for sediment collection. Therefore, sediment samples will be collected randomly in areas that have depositional sediment within the bounds of the reference areas described in Section 3.4. Surface water and sediment sampling locations in each reference area will be randomly generated in GIS to meet the probabilistic sampling design.

3. REFERENCE AREA CONSIDERATIONS AND SELECTION

Background sample reference areas should have similar characteristics as the Site, but should not have been affected by activities on the Site. The physical, chemical, and biological characteristics at the Site are described in detail in previous Site work plans and reports, including the RI/FS Work Plan (Roux Associates, 2015), Phase I DSR (Roux Associates, 2017), GW/SW DSR (Roux Associates, 2017), Draft Baseline Ecological Risk Assessment Work Plan (Draft BERA WP) (EHS Support, 2017), and Phase II SAP (Roux Associates, 2018).

The following sections provide a summary of the key Site conditions that were considered in the identification, evaluation, and selection of background reference areas for soil across the Site, surface water/sediment in Cedar Creek, and surface water/sediment in the Flathead River. Soil reference area considerations and selections are described in Section 3.1 and 3.2. Surface water and sediment sample reference area considerations and selections are described in Sections 3.3 through 3.5.

3.1 Soil Considerations

The Site is located within the northeast section of the Kalispell Valley, which is part of the larger Northern Rocky Mountain Physiographic Province (Fennemen, 1931). The Kalispell Valley runs northwest to southeast and is approximately 15 miles wide in the northern section near the Site. Based on data collected by the Western Regional Climate Center (WRCC, 2018), prevailing winds in the area, as measured at Glacier Park International Airport, are generally from the south and south-southeast.

The mountains bordering the Kalispell Valley are comprised predominantly of metamorphosed Precambrian sedimentary rock of the Ravalli group, lower belt series (Konizeski et al., 1968). The rock is typically gray to greenish-gray argillite and light gray quartzite. Based on interpretation of the well logs from the Site, depth to bedrock is estimated to vary from 150 feet to greater than 300 feet across the majority of the Site depending on the proximity to the neighboring mountains and the Flathead River. In areas to the east of the Site near Teakettle Mountain, depth to bedrock is likely less than 150 ft. In the southern portion of the Site near the Flathead River, depth to bedrock may be significantly deeper than 300 feet. On a Site-wide scale, the general slope is in the south-south west direction towards the Flathead River.

The stratigraphy immediately beneath the Site varies locally due to the heterogeneous nature of glacial and alluvial deposits. Generalized geologic cross sections depicting the subsurface stratum beneath the Site based on the existing geologic boring logs are provided in the Phase I DSR (Roux Associates, 2017a). Based on the cross sections and Site well logs, glacial till, glaciolacustrine, and glacial outwash deposits are inferred to exist beneath the Site. Recent alluvial deposits overlying the glacial stratigraphy are found to exist near the southern border of the Site, in the vicinity of the Flathead River. The existing geologic logs indicate that glacial till is prevalent in the northeast area near Teakettle Mountain.

Surficial geologic maps were reviewed to refine the understanding of the Flathead Valley geologic formations and surficial soil types and how they relate to the Site. Figure 5 presents a geologic map of the Flathead Valley in the vicinity of the Site. This map was generated based on the Geologic and Structure Maps of the Kalispell Quadrangle, Montana, and Alberta and British Columbia (Whipple, et al., 1992). Figure 5 also presents the Site boundary in reference to surficial geology in the Flathead Valley. Consistent with the findings from the Phase I Site Characterization, the geologic formations occurring at land surface across the Site include mostly: 1) glacial and fluvioglacial deposits (Pleistocene) (Qgr); 2) alluvial deposits (Holocene) (Qal); and 3) the Revett Formation (Middle Proterozoic) (Yr), which is expressed at the surface as Teakettle Mountain.

Surficial soil types within the Flathead Valley were also reviewed using the United States Department of Agriculture Natural Resources Conservation Service Web Soil Service (https://websoilsurvey.nrcs.usda.gov). Figure 6 presents the surface soil type map of the Flathead Valley in the vicinity of the Site. Based on the soil survey map and consistent with the Phase I Site Characterization findings, three major soil types are present at the Site: 1) glacial till (27-7), alluvium, and outwash as gravelly loam (Mh); 2) fluvial deposits and riverwash (Rc); and 3) partially mountainous land combined with glacial till (Mr and 75).

The majority of the soil at the Site has been designated as glacial till and alluvium (presented as Qgr on Figure 5 and 27-7 and Mh based on Figure 6). This soil type extends from the base of Teakettle Mountain along the eastern boundary of the Site through the western boundary of the Site. Fluvial deposits occur along the southern boundary of the Site and within the floodplain of the Flathead River. The Flathead River and other surface water bodies in the Flathead Valley are presented on Figure 7. The mountainous land and glacial till is apparent along Teakettle Mountain on the eastern boundary of the Site.

Based on the above described surficial geology and surface soil type reviews for the Flathead Valley and the Site, and the similarities in extent between the surficial geology and soil type, the following three primary soil types will be utilized for background soil reference areas: glacial till and alluvium, fluvial deposits and riverwash, and mountainous land with glacial deposits.

3.2 Soil Reference Area Selection

Soil type and soils derived from similar geologic sources are the primary consideration when choosing soil background reference locations. Similar soil types in background reference areas should demonstrate similar chemical and physical properties as the soil types on Site. This section describes the identified locations for soil reference areas based on the review of the soil type considerations described in Section 2.4.

Soil sampling will be conducted in four background reference areas, designated as Soil Background Reference Areas 1 through 4 below are presented on Figure 8. The descriptions of each of the proposed soil sampling background reference areas are described below:

<u>Soil Background Reference Area #1: Glacial Till and Alluvium</u>

The glacial till and alluvium soil background reference area is located approximately ¾ of a mile south of the Site boundary and over one mile from the Main Plant area, and is accessed from a driveway Highway 2 East. The reference area is 11 acres of hilly, vegetated open land situated parallel to Highway 2 East. Samples within this area will be collected from a distance greater than 200-feet away (northeast) from the highway in an effort to eliminate the potential for the reference area to be influenced by contaminants from vehicular operations along the highway (Highway 2 East) located adjacent to the reference area. The area is bordered mostly by wooded and unoccupied land, with powerlines to the west and little surrounding commercial activity. The reference area is owned by CFAC, but the areas has remained undeveloped and no commercial/industrial operations or operations related to the aluminum plant took place on this property.

This offsite reference area was selected based on the similar glacial till and alluvium soil types at the Site. The majority of the Site surface soils consist of a layer of glaciofluvial and alluvial coarse-grained soils, varying in vertical extent and grain size, depending on vicinity to Site features (i.e., Teakettle Mountain, Flathead River, etc.). Beneath the alluvium is a layer of dense, poorly sorted glacial till with interbedded deposits of glaciolacustrine clays and silts. The similar soil types should demonstrate similar chemical and physical properties as the soil types onsite. Evaluation of this location based upon aerial photo review and field reconnaissance determined that there is no readily apparent evidence of industrial or commercial activities in this area. This location is upgradient of the prevailing wind direction in this area of the Flathead Valley, and therefore, has little potential to be affected by historic onsite operations.

Soil Background Reference Area #2 and #3: Fluvial Deposits and Riverwash

Two reference areas are proposed for background sampling for the fluvial deposits and riverwash soil type. As presented on Figure 5, Soil Background Reference Area #2 is located in an area downstream of the Site in State of Montana Fish and Game Commission Property; and Soil Background Reference Area #3 is located in an area northeast of the Site, near Blankenship Bridge. A description for each of the locations is provided below.

The Flathead County tax map lists Soil Background Reference Area #2 as State of Montana Fish and Game Commission land. This area is approximately 50 acres of land directly east of the Flathead River in Columbia Falls, and is surrounded by residential property to the east and north and bounded by the river to the west and south. This location is accessed from Kokanee Bend Drive to the east and follows a boat ramp path from the main road. The location also appears relatively undisturbed with the exception of a boat ramp used to access the Flathead River and includes mostly wooded areas and a bank located adjacent to the river. Evaluation of this location based upon aerial photo review determined that there is no readily apparent evidence of industrial or commercial activities in this area; however, in the event that this location is selected, this will be confirmed with reconnaissance of the area. Although this location is downstream of the Site, it is approximately 5 miles southwest and upwind of the former operational plant and therefore has little potential to be Site-impacted.

The Flathead County tax map lists Soil Background Reference Area #3 as National Forest Land. This area is approximately 40 acres of land located northwest of the Blankenship Bridge, and is surrounded by the Flathead River to the east, a private residential area to the north and west, and National Forest Land to the south. The area is located where the North Fork and the Middle Fork of the Flathead River conjoin and is accessed by Blankenship Road in Columbia Falls. The location also appears undisturbed and includes both vegetated and wooded areas. Evaluation of this location based upon aerial photo review determined that there is no readily apparent evidence of industrial or commercial activities in this area; however, in the event that this location is selected, this will be confirmed with reconnaissance of the area. Based upon the prevailing wind direction shown in the wind rose diagram, this location appears to be downwind of the Site (northeast); and the location is not located within the Flathead Valley. However, the location is greater than 5.5 miles from the former operational plant and on the opposite side of Teakettle Mountain and is upstream of the Site.

These offsite reference areas were selected based on the soil being similar to the fluvial deposit soil types at the Site. The reference area contains fluvial deposits and riverwash located within the floodplain of the Flathead River. Evaluation of this location based upon aerial photo review determined that there is no readily apparent evidence of industrial or commercial activities in this area.

Soil Background Reference Area #4: Mountainous Land with Glacial Deposits

The mountainous land with glacial deposits soil background reference area is located approximately ½ mile southeast of the Site boundary and ¾ of a mile southeast of the Main Plant area, and is accessed from Berne Road off of Highway 2 East along the Flathead River between Columbia Falls and Hungry Horse. This reference area is considered the trailhead of Columbia Mountain, and extends approximately 1/8th of a mile into the trail past the parking lot. Background soil samples will be collected from random locations approximately 10 to 20 feet off the worn trail path in the wooded and mountainous areas. The start of the trailhead is relatively flat, and changes in elevation from approximately 3083 ft to 3149 in the first 1/8th of a mile where the reference area is located. The trail also becomes more wooded and rocky with the increase in elevation. This offsite reference area was selected based upon its soil being similar to the mountainous land soil types at the Site along Teakettle Mountain and the eastern Site boundary. Evaluation of this location based upon aerial photo review and field reconnaissance determined that there is no readily apparent evidence of industrial or commercial activities in this area. This location is upgradient of the prevailing wind direction in this area of the Flathead Valley and therefore has little potential to be affected by historic onsite operations.

Proposed surficial soil background reference areas previously described are shown on Figure 8. As discussed further in Section 3.2, surficial soil sample locations in all four soil reference areas will be based upon a probabilistic simple random sample design.

3.3 Flathead River Considerations

The North Fork of the Flathead River originates in British Columbia and the Middle Fork of the Flathead River originates in the Bob Marshall Wilderness located south of Glacier National Park. The North Fork and the Middle Fork border Glacier Park on the western and southern boundaries, respectively, and flow south of Glacier National Park where they meet the South Fork of the Flathead River at the entrance of Badrock Canyon, at which point the river is then called the Flathead River. The Flathead River flows west through Badrock Canyon towards Columbia Falls where its course turns southerly toward Flathead Lake (E&E, 1988). The Site is located within the Flathead Watershed. The Flathead Watershed includes all the land that drains into the Flathead River and Flathead Lake and beyond the lake to the confluence of the Flathead and Clark Fork Rivers (www.flatheadwatershed.org). The watershed covers approximately 200 miles of land from north to south and 90 miles from east to west. All surface water bodies in the Flathead Valley in the vicinity of the Site are presented on Figure 7.

Detailed information regarding the seasonal variability in the Flathead River, including discharge and temporal COPC concentration trends, is described in the Phase II SAP (Roux Associates, 2018). Surface water conditions in the Flathead Watershed vary seasonally. Snow is held as snowpack in the mountains during the winter months and melts in the spring. Annual peak flows in rivers and streams within the Flathead Valley typically occur in May and June, in response to snowmelt and direct precipitation. As the snow melts during the spring months, it recharges soil moisture and groundwater (www.flatheadwatershed.org). 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 high flow, the Flathead River recharges groundwater and acts as a losing stream. In contrast, in the late summer and fall, the dry weather results in a decrease in river stage so that the Flathead River becomes a gaining stream (Konizeski et al., 1968).

A result of the high flow of the Flathead River near the Site is that the shoreline bordering the Site contains little unconsolidated materials that meet the technical definition of sediment. As defined by USEPA, suspended and bedded sediments (SABs) are "particulate organic or inorganic matter that suspends in or are carried by the water, and/or accumulate in a loose, unconsolidated form on the bottom of natural water bodies" (USEPA, 2003). During Phase I sampling, Roux personnel utilized a probing rod and visual inspections to evaluate the presence of sediment. Accumulations of loose, unconsolidated, bedded sediments were only identified within the Backwater Seep Sampling Area and at one other sampling location within Flathead River. In locations where depositional sediment was found in the Flathead River, sediment samples were generally collected beneath the surface water at a distance of approximately three to five feet from the river bank. Samples were generally collected from the top inch of the depositional sediment. Reconnaissance and sampling of the area indicates that much of the shoreline and bottom of the Flathead River consists primarily of gravel and cobbles.

The Flathead River is a unique river it terms of its size, flow, and watershed capture area. A river comparable to the Flathead River is not present in the Flathead Valley; therefore, it was determined the reference area for the Flathead River should be an upstream area within the river. since the surface water and sediments at such locations should not exhibit any impacts that are attributable to the Site. Upgradient Flathead River was also selected as representative surface water and sediment reference location to compare to the Site since this water body is wet year-round (whereas other surface water features at the Site such as the Northern Surface Water Feature are wet seasonally).

3.4 Flathead River Reference Area Selection

Background surface water and sediment samples for the Flathead River are proposed to be collected within the reference location identified on Figure 8. The reference area in the Flathead River is a reach of river beginning approximately ¼ mile upstream (east) of the Site and extending for a distance of approximately ¾ of mile into Badrock Canyon. The reference area is approximately 100 acres; measuring ¾ of a mile long and is 350 to 400 feet wide, similar to the width of the river directly south of the Site. This reach of the river has surface water and sediment characteristics similar to the reach of river within the Site where sediment and surface water samples are collected for the RI/FS. This reference area is not accessible by vehicle or by a road (bordered to the north by the rail line and to the south by Highway 2) and therefore would need to be accessed by boat.

Surface water and sediment sampling reference location #1 is located within the Flathead River and upgradient of the CFAC Site. Evaluation of this location based upon aerial photo review and field reconnaissance determined that there is no readily apparent evidence of industrial or commercial activities in this area. This location is upgradient of the Site along the Flathead River (east of the Site), and therefore has little potential to be affected by historic onsite operations and onsite overland flow. This location was also selected due to the similar physical characteristics of the shoreline between the reference location and the Site, including the presence of a bank and backwater area. As described in Section 2.7, the high-flow and rocky substrate of the Flathead River do not allow for frequently identified areas of depositional areas for sediment collection. Surface water and sediment samples in the Flathead River will be collected using a probabilistic, simple random sampling approach from those areas where sediment is observed. Sample locations will be identified and collected from depositional areas. If depositional areas are not frequently observed throughout the river, multiple sediment samples may be collected from areas of observed deposition.

3.5 Cedar Creek Considerations

Cedar Creek originates north of the Site in the Whitefish Mountains and flows approximately three miles southwest towards Columbia Falls. Cedar Creek Reservoir is located north of the Site. The Cedar Creek Reservoir Overflow Ditch, which flows on the eastern boundary of the Site, flows intermittently in the spring and regulates flow for Cedar Creek and the Cedar Creek Reservoir. Based upon the flat topography of the portion of the Site located within one-half mile of Cedar Creek, there is little potential for surface water runoff from the industrialized portion of the Site into Cedar Creek. In addition, the elevation of Cedar Creek is higher than groundwater elevations within the Site, indicating Cedar Creek is a losing stream rather than a gaining stream. According to the United States Geological Survey (USGS) National Hydrology Dataset, a tributary to Cedar Creek flows, or has flown historically, in the northern area of the Site, joining Cedar Creek approximately ½ mile to the southwest of the Industrial Landfill. Roux personnel conducted field reconnaissance to investigate the potential presence of this tributary and no tributary of Cedar Creek was identified in the northern area of the Site.

Detailed information regarding the seasonal variability in Cedar Creek, including discharge measured during each Phase I sampling event, is described in the GW/SW DSR (Roux Associates, 2017c). Discharge of Cedar Creek was measured utilizing a mechanical current-meter method four times during the Phase I Site Characterization (i.e., August 2016, November 2016, April 2017, and June 2017). The discharge varied from a minimum discharge of 4.52 ft^3/s in August 2016 to a maximum of 19.94 ft^3/s in June 2017. Similar to the Flathead River, sediment depositional areas were not observed throughout the entire stretch of Cedar Creek within the Site. Surface water and sediment samples in upgradient Cedar Creek will be collected using a simple random sampling approach from those areas where sediment is observed. Sample locations will be identified and collected from depositional areas. If depositional areas are not frequently observed throughout the river, multiple sediment samples may be collected from areas of observed deposition. Data collected from the background area for Cedar Creek will be comparable to samples collected from onsite samples in Cedar Creek and the Cedar Creek Reservoir Overflow Ditch.

3.6 Cedar Creek Reference Area Selection

Background surface water and sediment samples for Cedar Creek are proposed to be collected within the reference location identified on Figure 8. The reference area in the headwaters of Cedar Creek is located more than two miles upgradient of the Site and is north of Cedar Creek Reservoir. The reference area spans for approximately 233 acres as the creek flows alongside Route 486 and is accessible in locations where the river and road run parallel or where the river intersects the road. The creek runs through the woods and is not surrounded by any commercial/industrials. The creek was observed to vary between 15 and 25 feet wide and 3 to 5 feet deep in some locations, similar to the width and depth of Cedar Creek during the time of reconnaissance. The creek was also observed to have a similar flow rate to Cedar Creek during reconnaissance (although was not measured with a flow meter). Surface water and sediment were observed throughout the creek.

Surface water and sediment sampling reference location #2 is upstream of the Site within the headwaters of Cedar Creek. This location was selected due to its physical characteristics that are similar to Cedar Creek (as described in Section 3.6) at the Site. Within the reference area location, the stream is also a similar size stream (depth and width) to Cedar Creek adjacent to the Site and is expected to have a similar average discharge during high and low water seasons. The stream was also identified as having headwaters from the mountains and discharges into the Flathead River before Flathead Lake. Evaluation of this location based upon aerial photo review and field reconnaissance determined that there is no readily apparent evidence of industrial or commercial activities in this area. This location is upgradient of the Site and Cedar Creek Reservoir, therefore has little potential to be affected by historic onsite operations and onsite overland flow. Although this area is downgradient of the prevailing wind direction, it is significantly distant from the Site (2 miles from the Site boundary and approximately 3.5 miles from the former operational area of the Site). As described further in Section 2.5 and consistent with the Flathead River background sampling plan, surface water and sediment samples upgradient of Cedar Creek will be based upon a probabilistic, simple random sample design.

4.0 BACKGROUND INVESTIGATION FIELD SAMPLING PLAN

The Background Investigation Scope of Work was developed based on the Background SAP DQOs and objectives described in Sections 2.0, data requirements identified during preparation of the RI/FS Work Plan, the draft BERA and BHHRA Work Plans (EHS Support, 2017a, b), and the Phase II SAP (Roux Associates, 2018). 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 Background Investigation. The DQOs to support the field sampling plan design are provided in Section 2.0.

4.1 Field Sampling Plan Design

The Background Investigation soil, surface water, and sediment sample locations and numbers of sampling points will be selected based upon probabilistic sample design so that statistical inferences may be made about the sampled population. The use of simple random sampling will allow for a representative dataset such that sample locations within a reference area are equally likely to be chosen. Sampling locations in each reference area will be randomly generated in GIS to meet the probabilistic sampling design.

As previously described in Section 3.4, the high-flow and rocky substrate of the Flathead River do not allow for frequently identified areas of depositional areas for sediment collection. Therefore, sediment samples will be collected randomly in areas that have depositional sediment within the bounds of the reference areas described in Sections 3.4 and 3,6.

Although the results of the Phase I determined that cyanide, fluoride, PAHs, and select metals were considered primary COPCs at the Site, Roux is analyzing background soil, sediment, and surface water samples for full suites of SVOCs and metals in addition to cyanide and fluoride to provide a better understanding of these entire analyte groups and since the Phase II Site Characterization and final section of COPCs is not complete.

4.2 Background Investigation Field Activities

Preliminary background sample reference areas were selected considering the characteristics described in Sections 3.1, 3.3, and 3,5 above, and considering the information collected during the Phase I Site Characterization. Preliminary selection of the reference areas was conducted by reviewing maps, aerial photographs, and existing data. The background sample reference areas are shown on Figure 8. The remainder of this Section describes the background sample reference areas and the field sampling plan that will be implemented to collect data from the background reference areas.

4.2.1 Offsite Reference Area Reconnaissance

Prior to conducting field activities associated with the background investigation, a detailed, ground-level reconnaissance of the preliminary selected background sample reference areas was performed. The objectives of the reconnaissance were to:

- Visually inspect the physical conditions of the potential reference areas to evaluate their suitability for the background study;

- Review the proposed sample locations in the field to ensure that the locations are accessible for sampling and determine equipment requirements for access to proposed sampling locations (if any); and
- Photo document the conditions of the sample reference areas.

The ground level field reconnaissance consisted of two Roux geologists visually inspecting and photo-documenting the conditions of each of the preliminary background sample reference areas. Proposed reference area locations were confirmed by the field personnel and georeferenced utilizing a handheld global positioning system (GPS). Field notes and photographs were collected to document all significant observations. Photos of the background reference areas are provided as Appendix A. As discussed in Section 3.4, the proposed reference area located upgradient in the Flathead River was not accessible by vehicle and there are no roads that access the bank. Therefore, photographs of this area in the river are not provided in Appendix A. Photographs of the river upgradient to the proposed reference area are provided for comparison.

As further described in Section 3.6, Cedar Creek north of the Cedar Creek Reservoir and Trumbell Creek west of the Site were initially identified during preparation of the Background SAP as potential surface water background reference areas. Both areas were evaluated during reconnaissance in May 2018 and it was determined that the background reference area in the headwaters of Cedar Creek is preferred due to the size, flow, and vegetation characteristics appearing most similar to the reach of Cedar Creek that traverses the Site. Cedar Creek north of the Cedar Creek Reservoir is also accessible alongside the majority of Route 486 and on National Forest land, whereas much of Trumbell Creek is located within private residential and commercial property. As a result of the reconnaissance, Cedar Creek north of the Reservoir was selected as the background reference area.

4.2.2 Soil Sampling

Ten (10) soil samples are proposed in each background soil reference area to ensure enough samples are collected to calculate representative $Mean_{Background}$ and BTVs for each area. As described in Section 2.5, a probabilistic sampling design in soil was selected for this Background Study. The proposed reference areas for soil sampling is provided as Figure 8. Proposed sampling locations will be selected by randomly generating sampling locations in the reference area using GIS to achieve a probabilistic sampling design. GIS utilizes a tool identified as "Create Random Points," which randomly places a specified number of points within an extent window or inside the features of a polygon, or along the length of line feature (i.e., such as reach of a stream or river).

At each proposed location, a discrete surface soil sample from 0 to 0.5 ft-bls will be collected. This depth interval is consistent with the surface soil samples collected as part of the Phase I Site Characterization and the surface sampling interval to be collected as part of the Phase II Site Characterization.

Surface soil samples will be collected with hand augers and/or other hand tools. All soil samples will be described in accordance with the Unified Soil Classification System (USCS). The samples will be examined for evidence of potential impacts (i.e., staining, odor) and screened for the potential presence of volatile organic carbons (VOCs) using a Photoionization Detector (PID) for consistency with the Phase I and Phase II Site Characterization activities. If the PID measurements indicate the presence of VOCs at a soil sample location, USEPA will be notified and the location will be rejected. A new suitable location will be selected for sample collection in the vicinity of the original sample location. The location of each sample will be logged with GPS technology with sub-meter accuracy. The readings and GPS location will be recorded on a field datasheet and included as part of the Phase II DSR. A list of the analytical methods utilized for soil sample analysis is included in Section 4.4.

Soil samples will be collected in accordance with the soil sampling SOP included in Appendix B of the Phase II SAP. A list of the applicable SOPs for soil sampling is provided below:

- SOP 3.2 — Field Record Keeping and Quality Assurance/Quality Control
- SOP 3.3 — Sample Handling
- SOP 5.1 — Collection of Soil Samples for Laboratory Analysis
- SOP 5.4 — Screening Soil Samples for Volatile Organic Vapors Using a Portable Photoionization Detector
- SOP 5.5 — Soil Classification and Logging Procedures
- SOP 5.14 — Testing Soil pH in the Field Using a Portable pH Meter
- SOP 6.5 — Photo Documentation
- SOP 6.6 — Collection of GPS Information
- SOP 9.1 — Decontamination of Field Equipment

4.2.3 Surface Water Sampling

The proposed reference areas for surface water sampling are presented on Figure 8. Surface water sample collection will coincide with surface water sampling activities planned as part of the Phase II Site Characterization. Ten discrete surface water samples will be collected from each background area. Proposed sampling locations will be selected by randomly generating sampling locations in the reference area using GIS to achieve a probabilistic sampling design, as described in Section 4.2.2.

Surface water samples will be collected once during high water season and once during low water season to evaluate the temporal variability of surface water quality within the reference area. Surface water samples will be collected by taking a grab sample directly from the water body using the sample collection container for each analysis. Surface water samples will be analyzed for both total and dissolved fractions specified in Section 4.4 (total and dissolved metals and total and dissolved organic carbon). Sample aliquots for dissolved analyses will be field filtered through a 0.45 micrometer (micron) membrane filter. Samples will be collected at a depth of approximately 60 percent of the total water column depth and no greater than a maximum water depth of two feet. 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, dissolved oxygen (DO), and oxidation-reduction potential (ORP). The water quality meter will be placed directly in the surface water feature and will be monitored until stable readings are observed. The location of each sample will be logged with GPS technology with sub-meter accuracy. The readings and GPS location will be recorded on a field datasheet and included as part of the Phase II DSR. A list of the analytical methods utilized for surface water sample analysis is included in Section 4.4.

During both background surface water sampling events, the discharge of the stream in surface water and sediment reference area #1 will be measured utilizing a mechanical current-meter method in accordance with Roux Standard Operating Procedure (SOP) 6.7. The discharge data will be used to see the relationship between stream depth and stream velocity based on distance from the initial point. During the Phase I, discharge was evaluated at multiple points along the surface water bodies in an effort to confirm the preliminary conceptual site model, with both Cedar Creek and Cedar Creek Drainage Overflow are acting as losing streams as they flow through the Site. During reconnaissance of the Cedar Creek headwaters, the creek was also observed to have a similar flow rate to Cedar Creek during reconnaissance (although was not measured with a flow meter). The discharge in the headwaters of Cedar Creek will be measured at multiple points to compare discharge between the background reference area and Cedar Creek onsite.

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. Discharge of the Flathead River will continue to be evaluated using the USGS staff gauge (#12363000). Surface water samples will be collected in accordance with the surface water sampling SOP included in Appendix B of the Phase II SAP. A list of the applicable SOPs for surface water sampling is provided below:

- 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 4.5 — Surface-Water Sampling
- SOP 4.6 — Filtration of Ground-Water and Surface-Water Samples for Dissolved Metals Analysis
- 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

4.2.4 Sediment Sampling

Sediment samples will be collected from the same randomly generated reference locations as surface water samples. Ten discrete sediment samples will be collected from each background area with one sample collected at each of the ten different locations placed at random within the background area. The proposed reference areas for sediment sampling are presented on Figure 8. Sediment sample collection will coincide with sampling activities planned as part of the Phase II Site Characterization. Seasonal conditions and river stage will be taken into account when collecting sediment samples. Sediment sampling activities in the two reference locations will be performed in low water season (October/November 2018). During the low water season, the river stage is at a low level and the Flathead River is functioning as a gaining stream.

Sediment will be collected by grab sampling surface sediment from 0-0.5 ft immediately beneath the sediment-surface water interface 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. If any proposed sediment locations are determined not to contain unconsolidated materials that meet the definition of sediment as defined by USEPA as “suspended and bedded sediments” (USEPA, 2003), the sediment sample location and associated surface water sample location will be moved within the vicinity of its originally proposed location, or a surface soil sample will be collected in its absence. Sediment samples will be collected in accordance with the sediment sampling SOP included in Appendix B of the Phase II SAP. A list of the applicable SOPs for sediment sampling is provided below:

- SOP 3.2 — Field Record Keeping and Quality Assurance/Quality Control
- SOP 3.3 — Sample Handling
- SOP 5.2 — Collecting Stream-Bed, Pond, and Lagoon Sediment Samples
- SOP 5.5 — Soil Classification and Logging Procedures
- SOP 6.5 — Photo Documentation
- SOP 6.6 — Collection of GPS Information
- SOP 9.1 — Decontamination of Field Equipment

4.3 Field Sampling Procedures

Field sampling will be performed in accordance with SOPs in the Phase II SAP. This section discusses sample designation procedures that will guide the Background Investigation.

4.3.1 Sample Designation Procedures

Consistent with the Phase I and Phase II Site Characterization 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 chain of custody (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:
   - BSB = Background Soil Boring
   - BSWP = Background Surface Water Point
   - BSDP = Background Sediment Point
3) Sample Location Number
   For Background Investigation sampling locations, each unique sample location will receive a unique numerical ID. Numerical IDs started with “001” for each sample location type.
4) Sample Media Type
   All samples will include an alpha identification code to identify the type of sample media being collected:
   - SO = Soil
   - SW = Surface water
   - SD = Sediment
5) Sample Interval
   Only surficial samples are proposed for the Background Investigation. The sample identification will include the depth interval in feet below land surface from which the unique sample was collected (i.e., 0-0.5).

6) <u>QA/QC Samples</u>
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
- DUP = Field Duplicate

Field duplicates and other QA/QC samples 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 3. Below are example sample designations for various types of hypothetical samples:

An example designation for a background soil sample collected from 0-0.5 ft-bls at soil boring location 001:

CFBSB-001-SO-0-0.5

An example designation for a surface water collected from station 001:

CFBSWP-001-SW

An example designation for a surface water duplicate collected from station 001:

CFBSWP-DUP5-SW

4.4 Laboratory Analytical Methods

The proposed samples at each reference location are summarized on Table 3. Samples will be sent under chain-of-custody to multiple TestAmerica Laboratories, Inc. locations based upon their ability to analyze different analytical parameters. The field teams will be instructed regarding the laboratory management procedures, and chains of custody for each laboratory will be pre-prepared to include only the appropriate analyses for each laboratory. A summary table for the analyses to be run at each laboratory is included below:

Soil Analysis	Laboratory	Sediment Analysis	Laboratory	Surface Water Analysis	Laboratory
SVOCs	Pittsburgh	SVOCs Low Level	Pittsburgh	SVOCs	Pittsburgh
TAL Metals	Edison	TAL Metals	Edison	Total/Dissolved TAL Metals and Hardness	Edison
Total Cyanide	Edison	Total Cyanide	Edison	Total Cyanide	Edison
Fluoride	Edison	Fluoride	Edison	Free Cyanide	Edison
TOC	Edison	TOC	Edison	Fluoride, Chloride, Sulfate, Orthophosphate	Edison
Dioxins/Furans	Sacramento	Grain Size/Sieve and Hydrometer/Bulk Density/Moisture Content	Burlington	Alkalinity	Edison
				Nitrate, Nitrite as N, Ammonia	Edison

Sulfide	Edison
Total Suspended Sediment	Edison
Total Dissolved Sediment	Edison
TOC	Edison

The laboratory method detection limits (MDLs), reporting limits, and the project required limits are included on Tables 4, 5, and 6 of the Phase II SAP. MDLs will achieve both human health and ecological based screening values to the extent feasible, as presented in Tables 7 and 8 in the Phase II SAP (Sample Analyses and MDLs for Soil – Human Health, and Sample Analyses and MDLs for Soil – Ecological, respectively). As documented in the Phase I Data Summary Report (Roux Associates, 2017a, GW/SW Data Summary Report (Roux Associates, 2017c), and Tables 7 and 8 of the Phase II SAP (Roux Associates, 2018), there have been and will be some analytes for which the lowest MDLs achievable by the laboratory exceed the most stringent screening criteria. The actual MDLs achieved by the laboratory will continue to be evaluated in future data summary reports and the risk assessment, and situations where MDLs exceed the most stringent screening criteria will be discussed in the uncertainty section of the risk assessment.

Samples will be analyzed by TestAmerica for a range of analytical parameters utilizing the following methods:

Soil

- Target Compound List (TCL) SVOCs via USEPA Method 8270 Low Level (LL);
- Target Analyte List (TAL) metals via USEPA Method 6020A / 7471B;
- Total cyanide via USEPA Method 9012B;
- Fluoride via USEPA Method 9056A;
- PCDD/PCDF via USEPA Method 8290A;
- TOC via the Lloyd Kahn Method; and
- Soil samples will also be analyzed for pH in the field, in accordance with SOP 5.14.

Surface Water

- TCL total SVOCs via USEPA Method 8270 LL;
- Total TAL metals via USEPA Methods 6020A / 7470A;
- Dissolved TAL metals via USEPA Methods 6020A / 7470A;
- Total cyanide via USEPA Method 335.4;
- Free cyanide via USEPA Method 9016;
- General chemistry including fluoride via USEPA Method 300, alkalinity via USEPA Method 2320B, and total hardness via USEPA Method 2340C;
- Nutrients including total chloride and dissolved sulfate via USEPA Method 300.0, nitrate and nitrite as N via USEPA Method 353.2, ammonia nitrogen via USEPA Method 350.1, sulfide via USEPA Method 4500S2F, and orthophosphate as P via USEPA Method 9056A;
- Total suspended solids (TSS) and total dissolved solids (TDS) via Standard Method 2540D/C; and
- Total organic carbon (TOC) and dissolved organic carbon (DOC) via Lloyd Kahn Method.

Sediment

- TCL SVOCs via USEPA Method 8270 LL;
- TAL metals via USEPA Method 6020A / 7471B;
- Total cyanide via USEPA Method 9014;
- Fluoride via USEPA Method 9056A;
- TOC via the Lloyd Kahn Method;
- Grain size distribution (sieve and hydrometer) via American Society for Testing and Materials (ASTM) Method D422;
- Moisture content via ASTM Method D2216-90; and
- Bulk density via ASTM Method D-2937-04.

4.5. BACKGROUND INVESTIGATION REPORTING

The results of the background study will be compiled and presented as part of the Phase II Site Characterization Data Summary Report. The report will be submitted following completion of the Phase II Site Characterization. The report will include tables and maps to present the data collected as part of the Phase II Site Characterization field activities, including the background study. The report will also present statistical evaluations required to evaluate the decision and estimation statements presented in the Background SAP DQOs.

5. REFERENCES

Administrative Settlement Agreement and Order on Consent between CFAC and the United States Environmental Protection Agency, CERCLA Docket No. 08-2016-0002.

Buckner, C.H. (1966). Populations and ecological relationships of shrews in Tamarack bogs of southeastern Manitoba. J. Mammal. 47: 181-194., as cited in Sample, B.E., Suter, G.W. (1994). Estimating Exposure of Terrestrial Wildlife to Contaminants. September 1994, Prepared by the Risk Assessment Program Health Sciences Research Division Oak Ridge, Tennessee 37831 ES/ER/TM-125.

EHS Support, 2017a. Draft Baseline Human Health Risk Assessment Work Plan, Columbia Falls Aluminum Company, LLC.

EHS Support, 2017b. Draft Baseline Ecological Risk Assessment Work Plan, Columbia Falls Aluminum Company, LLC.

Fenneman, Nevin M., 1931. Physiography of Western Unites States, McCraw-Hill, New York, New York.

Hydrometrics, 2013. Background Concentrations of Inorganic Constituents in Montana Surface Soils.

Konizeski et al., 1968. Geology and Groundwater Resources of the Kalispell Valley, Northwestern Montana. Montana College of Mineral Science and Technology, Butte, Montana.

McCann, S.A. (1976). Home ranges of the meadow vole and deer mouse (on a reclamation test pit in eastern Montana). Proceedings of the Montana Academy of Sciences 36:11-17, as cited in the Montana Field Guide accessed at: http://fieldguide.mt.gov/default.aspx

Roux Associates, 2015a. Remedial Investigation/Feasibility Study Work Plan, Former Primary Aluminum Reduction Facility, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2015b. Phase I Site Characterization Sampling and Analysis Plan, Former Primary Aluminum Reduction Facility, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2016a. Phase I Site Characterization Sampling and Analysis Plan Addendum, Former Primary Aluminum Reduction Facility, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2016b. Site Specific Health and Safety Plan, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2016c. Investigation Derived Waste Management Plan, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2017a. Phase I Site Characterization Data Summary Report, Former Primary Aluminum Reduction Facility, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2017b. Screening Level Ecological Risk Assessment, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2017c. Groundwater and Surface Water Data Summary Report, Columbia Falls Aluminum Company, LLC.

Roux Associates, 2018. Phase II Site Characterization Sampling and Analysis Plan, Former Primary Aluminum Reduction Facility, Columbia Falls Aluminum Company, LLC.

Smith et al., 2016. Geochemical and Mineralogical Data for Soils of the Conterminous United States.

USEPA, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA.

USEPA, 1994. Selecting and Using Reference Information in Superfund Ecological Risk Assessments.

USEPA, 2002a. Guidance for Quality Assurance Project Plans.

USEPA, 2002b. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites.

USEPA, 2002c. Role of Background in the CERCLA Cleanup Program.

USEPA, 2003. Developing Water Quality Criteria for Suspended and Bedded Sediments (Sabs). Office of Water. Office of Science and Technology.

USEPA, 2005. An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000.

USEPA, 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process.

USEPA, 2015. ProUCL Version 5.1.002 Users Guide, Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, Office of Research and Development, Washington D.C.

WRCC, 2018. Western Regional Climate Center. Prevailing Wind Direction. https://wrcc.dri.edu/Climate/comp_table_show.php?stype=wind_dir_avg

TABLES

Table 1. Proposed Background Samples and Sample Designations
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

								PROPOSED SOIL / SEDIMENT ANALYSES								PROPOSED SURFACE WATER ANALYSES																	
Location Type	Station ID	Location ID	Sample Type	Sample Interval	Closest Site Feature	Location Rationale	Proposed Boring Depth (ft)	Soil TCL SVOCs EPA 8270 LL	Soil TAL Metals EPA 6020A/7471B	Soil Total Cyanide EPA 9012B	Soil Fluoride 9056a	Total Organic Carbon via Lloyd Kahn	Field pH	Moisture Content / Bulk Density	Grain Size Distribution Sieve and Hydrometer ASTM D422	AQ TCL Total SVOCs EPA 8270 LL	AQ TAL Total Metals EPA 6020A/ 7470A	AQ TAL Dissolved Metals EPA 6020A/ 7470A	AQ Total Cyanide EPA 335.4	AQ Total Free Cyanide EPA 9016	Fluoride EPA 300	Total/Dissolved Chloride EPA 300	Total/Dissolved Sulfate EPA 300	Total/Dissolved Alkalinity EPA 2320B	Total Hardness EPA 2340C	TDS/TSS 2540D/C	Nitrogen, Amonia EPA 350.1	Nitrogen, Nitrate-Nitrite EPA 353.2	Orthophosphate EPA 9056A	Total/Dissolved Sulfide via EPA 4500S2F	AQ Total Organic Carbon	AQ Dissolved Organic Carbon	AQ Field pH
Background Soil Grab	CFBSB-001	CFBSB-001	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-002	CFBSB-002	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-003	CFBSB-003	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-004	CFBSB-004	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-005	CFBSB-005	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-006	CFBSB-006	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-007	CFBSB-007	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-008	CFBSB-008	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-009	CFBSB-009	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-010	CFBSB-010	Surface Soil	0-0.5	Background Area 1	Corresponds to Glacial Till and Alluvium soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-011	CFBSB-011	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-012	CFBSB-012	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-013	CFBSB-013	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-014	CFBSB-014	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-015	CFBSB-015	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-016	CFBSB-016	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-017	CFBSB-017	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-018	CFBSB-018	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-019	CFBSB-019	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-019	CFBSB-020	Surface Soil	0-0.5	Background Area 2	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-011	CFBSB-021	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-012	CFBSB-022	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-013	CFBSB-023	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-014	CFBSB-024	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-015	CFBSB-025	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-016	CFBSB-026	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-017	CFBSB-027	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-018	CFBSB-028	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-019	CFBSB-029	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-019	CFBSB-030	Surface Soil	0-0.5	Background Area 3	Corresponds to Fluvial Deposits and Riverwash soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-020	CFBSB-031	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-021	CFBSB-032	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-022	CFBSB-033	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-023	CFBSB-034	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-024	CFBSB-035	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-025	CFBSB-036	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-026	CFBSB-037	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-027	CFBSB-038	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-028	CFBSB-039	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Soil Grab	CFBSB-029	CFBSB-040	Surface Soil	0-0.5	Background Area 4	Corresponds to Mountainous Land with Glacial Deposits soil type inside the Site	0.5	1	1	1	1	1	1																				
Background Surface Water/Sediment	CFBSWP-001	CFBSWP-001	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-002	CFBSWP-002	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-003	CFBSWP-003	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-004	CFBSWP-004	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-005	CFBSWP-005	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-006	CFBSWP-006	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-007	CFBSWP-007	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-008	CFBSWP-008	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-009	CFBSWP-009	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-010	CFBSWP-010	Surface Water	Round 1	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-001	CFBSWP-001	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-002	CFBSWP-002	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-003	CFBSWP-003	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-004	CFBSWP-004	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-005	CFBSWP-005	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-006	CFBSWP-006	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-007	CFBSWP-007	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-008	CFBSWP-008	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-009	CFBSWP-009	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-010	CFBSWP-010	Surface Water	Round 2	Cedar Creek	Upgradient of Cedar Creek	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1
Background Surface Water/Sediment	CFBSWP-001	CFBSD-001	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-002	CFBSD-002	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-003	CFBSD-003	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-004	CFBSD-004	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-005	CFBSD-005	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-006	CFBSD-006	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-007	CFBSD-007	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-008	CFBSD-008	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-009	CFBSD-009	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-010	CFBSD-010	Sediment	Round 2	Cedar Creek	Upgradient of Cedar Creek	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-011	CFBSWP-011	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-012	CFBSWP-012	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-013	CFBSWP-013	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-014	CFBSWP-014	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-015	CFBSWP-015	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-016	CFBSWP-016	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-017	CFBSWP-017	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-018	CFBSWP-018	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-019	CFBSWP-019	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-020	CFBSWP-020	Surface Water	Round 1	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-011	CFBSWP-011	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-012	CFBSWP-012	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-013	CFBSWP-013	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-014	CFBSWP-014	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-015	CFBSWP-015	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-016	CFBSWP-016	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-017	CFBSWP-017	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-018	CFBSWP-018	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-019	CFBSWP-019	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-020	CFBSWP-020	Surface Water	Round 2	Flathead River	Upgradient of Flathead River	--									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Background Surface Water/Sediment	CFBSWP-011	CFBSD-011	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-012	CFBSD-012	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-013	CFBSD-013	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-014	CFBSD-014	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-015	CFBSD-015	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-016	CFBSD-016	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-017	CFBSD-017	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-018	CFBSD-018	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-019	CFBSD-019	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		
Background Surface Water/Sediment	CFBSWP-020	CFBSD-020	Sediment	Round 2	Flathead River	Upgradient of Flathead River	--	1	1	1	1	1		1	1																		

Table 2. Soil Descriptions for Onsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

USGS Surface Soil Types (FIGURE 5)		NRCS Soil Types and Descriptions (FIGURE 6)				
General Soil Code	**Primary Soil Type**	**Detailed Soil Code**	**Description**	**Landform**	**Parent Material**	**Typical Profile**
Qgr	Glacial and Fluvoiglacial Deposits	27-7	Dystric Eutrochrepts, till substratum	Kames, kettles, terraces	Till	3 to 9 inches: very gravelly silt loam 9 to 18 inches: extremely cobbly sandy loam 18 to 31 inches: extremely cobbly sandy loam 31 to 60 inches: very cobbly loamy sand, very gravelly loamy sand, extremely gravelly sandy loam
Qgr	Glacial and Fluvoiglacial Deposits	Mh	Mires gravelly loam, 3 to 7 percent slopes	Terraces, outwash fans	Outwash	0 to 8 inches: gravelly loam 8 to 18 inches: very gravelly loam 18 to 60 inches: very gravelly loamy sand
Qal	Alluvial Deposits	Rc	Riverwash	Flood plains	Flooded and ponded soils	Not available
Qal	Alluvial Deposits	16	Fluvents, alluvial fans	Alluvial fans	Alluvium	29 to 60 inches: extremely gravelly sand
Yr	Revett Formation (Teakettle Mountain)	Mr	Mountainous Land	Moraines	Glacial till	5 to 18 inches: loam 18 to 26 inches: gravelly silt loam 26 to 60 inches: gravelly loam
Yr	Revett Formation (Teakettle Mountain)	75	Rock outcrop, structural breaklands	Rock outcrop	Not available	100% bedrock

Source: Geologic and Structure Maps of the Kalispell Quadrangle, Montana, and Alberta and British Columbia (Whipple, et al., 1992).

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	Description	Landform	Parent Material	Typical Profile
12	Borosaprists, depressions	Terraces, flood plains, moraines	Organic material	0 to 8 inches: muck
16	Fluvents, alluvial fans	Alluvial fans	Alluvium	29 to 60 inches: extremely gravelly sand
31	Boralfs-Ochrepts complex, landslide deposits	Benches on landslides	Landslide deposits derived from metasedimentary rocks	0 to 8 inches: silt loam 8 to 17 inches: very gravelly silt loam 17 to 31 inches: very gravelly clay loam 31 to 60 inches: very gravelly silt loam
32	Boralfs-Ochrepts complex, landslide deposits, steep	Benches on landslides	Landslide deposits derived from metasedimentary rocks	0 to 8 inches: silt loam 8 to 17 inches: very gravelly silt loam 17 to 31 inches: very gravelly clay loam 31 to 60 inches: very gravelly silt loam
72	Cirqueland-Entic Cryandepts complex, very steep	Ridges	Metasedimentary rocks	1 to 4 inches: gravelly silt loam 4 to 5 inches: gravelly silt loam 5 to 11 inches: very gravelly silt loam 11 to 18 inches: extremely gravelly silt loam 18 to 21 inches: extremely gravelly silt loam 21 to 41 inches: extremely gravelly silt loam
73	Andic Cryochrepts-Andeptic Cryoboralfs association, glacial trough walls	Troughs	Till and metasedimentary rocks	1 to 5 inches: gravelly ashy silt loam 5 to 13 inches: very gravelly ashy silt loam 13 to 23 inches: extremely gravelly silt loam
74	Ochrepts, very steep	NA	Glacial drift or material derived from metasedimentary rocks	0 to 1 inches: slightly decomposed plant material 1 to 20 inches: gravelly sandy loam 20 to 29 inches: very gravelly sandy loam 29 to 44 inches: extremely cobbly loamy coarse sand
75	Rock outcrop, structural breaklands	Rock outcrop	NA	100% bedrock
76	Rock outcrop: 100 percent	NA	Material derived from metasedimentary rocks	0 to 1 inches: slightly decomposed plant material 1 to 20 inches: gravelly sandy loam 20 to 29 inches: very gravelly sandy loam 29 to 44 inches: extremely cobbly loamy coarse sand
77	Ochrepts-Rock outcrop complex, structural breaklands	NA	Material derived from metasedimentary rocks	0 to 2 inches: slightly decomposed plant material 2 to 5 inches: gravelly sandy loam 5 to 28 inches: very gravelly sandy loam 28 to 43 inches: extremely cobbly loamy coarse sand
78	Ochrepts-Rock outcrop complex, southerly aspects	Troughs	Material derived from metasedimentary rocks	0 to 1 inches: slightly decomposed plant material 1 to 20 inches: gravelly sandy loam 20 to 29 inches: very gravelly sandy loam 29 to 44 inches: extremely cobbly loamy coarse sand
101A	Jurvannah, frequently flooded-Typic Cryaquents, occasionally flooded families, complex, 0 to 2 percent slopes	Flood plains	Alluvium derived from metasedimentary rock	0 to 7 inches: very gravelly coarse sandy loam 7 to 60 inches: extremely gravelly loamy coarse sand
10-2	Fluvents, stream bottoms	Flood plains	Alluvium	29 to 60 inches: very gravelly loamy sand
102B	Broad Canyon, stony-Parkcity-Jurvannah, frequently flooded families, complex, 0 to 4 percent slopes	Stream terraces	Alluvium derived from metasedimentary rock	0 to 7 inches: very gravelly sandy loam 7 to 15 inches: extremely gravelly sandy loam 15 to 60 inches: very gravelly sandy clay loam
10-3	Aquepts, stream bottoms	Flood plains	Alluvium	0 to 7 inches: gravelly loam 7 to 18 inches: very gravelly sandy loam 18 to 60 inches: extremely gravelly sand

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
104C	Broad Canyon, stony-Parkcity-Worock, stony families, complex, 2 to 8 percent slopes	Outwash terraces	Outwash derived from metasedimentary rock	0 to 7 inches: very gravelly sandy loam 7 to 15 inches: extremely gravelly sandy loam 15 to 60 inches: very gravelly sandy clay loam
105B	Sunroad-Cosely-Typic Hapludands family, complex, 0 to 4 percent slopes	Outwash terraces	Volcanic ash over outwash derived from metasedimentary rock	0 to 1 inches: slightly decomposed plant material 1 to 2 inches: moderately decomposed plant material 2 to 7 inches: medial loam 7 to 15 inches: medial loam 15 to 23 inches: gravelly loam 23 to 33 inches: gravelly loam 33 to 60 inches: gravelly loam
120D	Pippin family, gravelly loam, 4 to 15 percent slopes	Alluvial fans	Alluvium derived from metasedimentary rock	0 to 1 inches: slightly decomposed plant material 1 to 5 inches: gravelly loam 5 to 14 inches: very gravelly sandy loam 4 to 60 inches: extremely gravelly coarse sand
14-2	Glossic Cryoboralfs, lacustrine substratum	Flood plains, moraines	Lacustrine deposits	NA
21-8	Andic Cryochrepts-Entic Cryandepts-Rock outcrop complex, cirque basins	Cirques	Glacial till and material derived from metasedimentary rocks	1 to 5 inches: gravelly ashy silt loam 5 to 13 inches: very gravelly ashy silt loam 13 to 60 inches: extremely gravelly silt loam
21-9	Andic Cryochrepts-Entic Cryandepts-Rock outcrop complex, cirque basins, steep	Cirques	Glacial till and material derived from metasedimentary rocks	1 to 5 inches: gravelly ashy silt loam 5 to 13 inches: very gravelly ashy silt loam 13 to 60 inches: extremely gravelly silt loam
23-7	Andeptic Cryoboralfs-Andic Cryochrepts complex, rolling	Mountain slopes	NA	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly clay loam 43 to 60 inches: very gravelly silt loam
23-8	Andeptic Cryoboralfs-Andic Cryochrepts complex, hilly	Mountain slopes	Glacial till and material derived from metasedimentary rocks	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly clay loam 43 to 60 inches: very gravelly silt loam
23-9	Andeptic Cryoboralfs-Andic Cryochrepts complex, steep	Mountain slopes	NA	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly clay loam 43 to 60 inches: very gravelly silt loam
24-8	Dystric Cryochrepts, till substratum-Dystric Cryochrepts, residuum substratum complex, hilly	Mountain slopes	Glacial till and material derived from metasedimentary rocks	0 to 2 inches: moderately decomposed plant material 2 to 8 inches: gravelly loam 8 to 16 inches: very gravelly fine sandy loam 16 to 29 inches: very gravelly fine sandy loam 29 to 60 inches: very gravelly sandy loam
264E	Pasturecreek-Elkridge families, complex, 8 to 35 percent slopes	Lateral moraines	Volcanic ash over till derived from metasedimentary rock	0 to 2 inches: slightly decomposed plant material 2 to 4 inches: gravelly ashy loam 4 to 9 inches: gravelly ashy loam 9 to 13 inches: very gravelly ashy loam 13 to 60 inches: extremely gravelly sandy loam
26A-8	Andeptic Cryoboralfs, silty till substratum, calcareous, hilly	Mountain slopes	Calcareous silty till	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly silt loam 43 to 60 inches: very gravelly silt loam

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
26A-9	Andeptic Cryoboralfs, silty till substratum, calcareous, steep	Mountain slopes	Calcareous silty till	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly silt loam 43 to 60 inches: very gravelly silt loam
26C-7	Andeptic Cryoboralfs, silty till substratum, rolling	Moraines	Silty till	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly silt loam 43 to 60 inches: very gravelly silt loam
26C-8	Andeptic Cryoboralfs, silty till substratum, hilly	Moraines	Silty till	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly silt loam 43 to 60 inches: very gravelly silt loam
26C-9	Andeptic Cryoboralfs, silty till substratum, steep	Moraines	Silty till	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly silt loam 29 to 43 inches: very gravelly silt loam 43 to 60 inches: very gravelly silt loam
26G-7	Typic Eutroboralfs, silty till substratum, rolling	Moraines	Silty till	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: silt loam 6 to 24 inches: gravelly silt loam 24 to 42 inches: very gravelly silt loam 42 to 60 inches: extremely gravelly silt loam
26G-8	Typic Eutroboralfs, silty till substratum, hilly	Mountain slopes	Silty till	2 to 6 inches: silt loam 6 to 24 inches: gravelly silt loam 24 to 42 inches: very gravelly silt loam 42 to 60 inches: extremely gravelly silt loam
26I-7	Typic Eutroboralfs, clayey till substratum, rolling	Moraines	Clayey till	0 to 9 inches: gravelly silt loam 9 to 22 inches: gravelly clay loam 22 to 60 inches: gravelly silty clay loam
26J-8	Andeptic Cryoboralfs, sandy till substratum, hilly	Mountain slopes	Sandy till	0 to 3 inches: silt loam 3 to 11 inches: silt loam 11 to 29 inches: very gravelly sandy loam 29 to 43 inches: very gravelly sandy clay loam 43 to 71 inches: very gravelly sandy loam
26L-7	Glossic Cryoboralfs, till substratum, rolling	Moraines	Till	1 to 7 inches: silt loam 7 to 11 inches: gravelly silt loam 11 to 18 inches: gravelly silt loam 18 to 24 inches: gravelly silty clay loam 24 to 35 inches: gravelly silty clay loam 35 to 67 inches: gravelly silt loam
26L-8	Glossic Cryoboralfs, till substratum, hilly	Mountain slopes	NA	1 to 7 inches: silt loam 7 to 11 inches: gravelly silt loam 11 to 18 inches: gravelly silt loam 18 to 24 inches: gravelly silty clay loam 24 to 35 inches: gravelly silty clay loam 35 to 67 inches: gravelly silt loam

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	Description	Landform	Parent Material	Typical Profile
27-7	Dystric Eutrochrepts, till substratum	Kames, kettles, terraces	Till	3 to 9 inches: very gravelly silt loam 9 to 18 inches: extremely cobbly sandy loam 18 to 31 inches: extremely cobbly sandy loam 31 to 60 inches: very cobbly loamy sand, very gravelly loamy sand, extremely gravelly sandy loam
27-8	Dystric Eutrochrepts, till substratum, steep	Terraces, kames, kettles	Till	3 to 9 inches: very gravelly silt loam 9 to 18 inches: extremely cobbly sandy loam 18 to 31 inches: extremely cobbly sandy loam 31 to 60 inches: very cobbly loamy sand, very gravelly loamy sand, extremely gravelly sandy loam
28-7	Dystric Eutrochrepts, outwash substratum	Terraces	Outwash	3 to 9 inches: silt loam 9 to 18 inches: extremely gravelly loam 18 to 31 inches: extremely gravelly loam 31 to 60 inches: very cobbly loamy sand, very gravelly loamy sand, extremely gravelly sandy loam
310E	Pasturecreek family, bouldery-Elkridge family-Cosely complex, 15 to 35 percent slopes	Glacial-valley walls	Volcanic ash over colluvium and/or till derived from metasedimentary rock	0 to 2 inches: slightly decomposed plant material 2 to 4 inches: gravelly ashy loam 4 to 9 inches: gravelly ashy loam 9 to 13 inches: very gravelly ashy loam 13 to 60 inches: extremely gravelly sandy loam
335F	Garlet family, extremely stony-Risingwolf, dry-Rock outcrop complex, 35 to 60 percent slopes	Mountain slopes	Colluvium derived from metasedimentary rock	2 inches: slightly decomposed plant material 2 to 6 inches: very gravelly sandy loam 6 to 16 inches: very gravelly sandy loam 16 to 60 inches: extremely gravelly sandy loam
57-8	Andic Cryochrepts, glaciated mountain ridges	Ridges	Metasedimentary rocks	1 to 5 inches: gravelly ashy silt loam 5 to 13 inches: very gravelly ashy silt loam 13 to 33 inches: extremely gravelly silt loam
57-9	Andic Cryochrepts, glaciated mountain slopes	Mountain slopes	Till and metasedimentary rocks	1 to 5 inches: gravelly ashy silt loam 5 to 13 inches: very gravelly ashy silt loam 13 to 33 inches: extremely gravelly silt loam
900A	Water-Riverwash association	NA	NA	NA
Aa	lluvial land, poorly drained	NA	NA	20 to 50 inches: stratified gravelly sandy loam to silty clay loam 50 to 60 inches: stratified gravelly loamy sand to coarse sandy loam
Ba	Banks loamy fine sand, 0 to 4 percent slopes	Flood plains	Sandy alluvium	0 to 3 inches: loamy fine sand 3 to 60 inches: loamy fine sand
Bb	Banks very fine sandy loam, 0 to 4 percent slopes	Flood plains	Sandy alluvium	0 to 3 inches: loamy fine sand 3 to 60 inches: loamy fine sand
Bd	Birch gravelly loam, 0 to 3 percent slopes	Terraces	Sandy and gravelly alluvium	0 to 2 inches: slightly decomposed plant material 2 to 8 inches: gravelly loam 8 to 16 inches: very gravelly sandy loam 16 to 60 inches: very gravelly loamy sand
Be	Blanchard fine sand, 0 to 7 percent slopes	Dunes	Eolian deposits	0 to 7 inches: fine sand 7 to 60 inches: fine sand
Bf	Blanchard fine sand, 0 to 7 percent slopes, wind eroded	Dunes	Eolian deposits	0 to 3 inches: fine sand 3 to 60 inches: fine sand
Bh	Blanchard fine sand, 7 to 12 percent slopes, wind eroded	Dunes	Eolian deposits	0 to 3 inches: fine sand 3 to 60 inches: fine sand
Bk	Blanchard fine sand, 12 to 35 percent slopes	Dunes	Eolian deposits	0 to 7 inches: fine sand 7 to 60 inches: fine sand

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
Bm	Blanchard fine sand, 12 to 35 percent slopes, wind eroded	Dunes	Eolian deposits	0 to 3 inches: fine sand 3 to 60 inches: fine sand
Bn	Blanchard loamy fine sand, 0 to 3 percent slopes	Terraces	Wind reworked alluvium	to 7 inches: fine sand 7 to 60 inches: fine sand
Bo	Blanchard loamy fine sand, 3 to 7 percent slopes	Dunes	Eolian deposits	0 to 7 inches: fine sand 7 to 60 inches: fine sand
Bp	Blanchard loamy fine sand, 7 to 20 percent slopes	Dunes	Eolian deposits	0 to 7 inches: fine sand 7 to 60 inches: fine sand
Br	Blanchard loamy fine sand, 20 to 45 percent slopes	Terraces	Wind reworked alluvium	0 to 7 inches: fine sand 7 to 60 inches: fine sand
Ca	Chamokane soils, 0 to 3 percent slopes	Flood plains	Sandy alluvium	0 to 7 inches: fine sandy loam 7 to 24 inches: fine sandy loam 24 to 60 inches: gravelly sand
Cb	Chamokane soils, 3 to 7 percent slopes	Flood plains	Sandy alluvium	0 to 7 inches: loam 7 to 24 inches: fine sandy loam 24 to 60 inches: gravelly sand
Cc	Chamokane and Banks soils, 0 to 4 percent slopes	Flood plains	Sandy alluvium	0 to 3 inches: loamy fine sand 3 to 60 inches: loamy fine sand
Cd	Corvallis silty clay loam, 0 to 3 percent slopes	Flood plains	Silty alluvium	0 to 8 inches: silty clay loam 8 to 11 inches: silty clay loam 11 to 60 inches: stratified loam to clay loam
Ce	Creston silt loam, 0 to 3 percent slopes	Terraces, outwash fans	NA	0 to 12 inches: silt loam 12 to 18 inches: silt loam 18 to 33 inches: silt loam 33 to 60 inches: silt loam
Cf	Creston silt loam, 3 to 7 percent slopes	Outwash fans, terraces	NA	0 to 12 inches: silt loam 12 to 18 inches: silt loam 18 to 33 inches: silt loam 33 to 60 inches: silt loam
Ch	Creston silt loam, 12 to 45 percent slopes	Terraces, outwash fans	NA	0 to 12 inches: silt loam 12 to 18 inches: silt loam 18 to 60 inches: stratified very fine sandy loam to silt loam to silty clay loam
De	Depew silty clay loam, 0 to 3 percent slopes	Terraces	Glaciolacustrine deposits	0 to 11 inches: silty clay loam 11 to 24 inches: silty clay 24 to 60 inches: silty clay
Fe	Flathead very fine sandy loam, 0 to 3 percent slopes	Terraces	Alluvium	0 to 24 inches: very fine sandy loam 24 to 34 inches: fine sandy loam 34 to 44 inches: fine sandy loam 44 to 60 inches: loamy fine sand
Fg	Flathead-Creston loams, 0 to 3 percent slopes	Terraces	Alluvium	0 to 24 inches: loam 24 to 34 inches: fine sandy loam 34 to 44 inches: fine sandy loam 44 to 60 inches: gravelly loamy fine sand
Fh	Flathead-Mires loams, 0 to 3 percent slopes	Terraces	Alluvium	0 to 16 inches: loam 16 to 26 inches: fine sandy loam 26 to 36 inches: fine sandy loam 36 to 60 inches: gravelly loamy fine sand

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
Ha	Half Moon silt loam, 0 to 3 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: silt loam 6 to 13 inches: silt loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
Hc	Half Moon very fine sandy loam, 0 to 3 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: very fine sandy loam 6 to 13 inches: very fine sandy loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
Hd	Half Moon very fine sandy loam, 3 to 7 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: very fine sandy loam 6 to 13 inches: very fine sandy loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
He	Half Moon very fine sandy loam, 7 to 12 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: very fine sandy loam 6 to 13 inches: very fine sandy loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
Hf	Half Moon soils, 12 to 45 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: silt loam 6 to 13 inches: silt loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
Hg	Half Moon-Haskill complex, 0 to 3 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: very fine sandy loam 6 to 13 inches: very fine sandy loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
Hh	Half Moon-Haskill complex, 3 to 7 percent slopes	Terraces	Glaciolacustrine deposits	0 to 2 inches: slightly decomposed plant material 2 to 6 inches: very fine sandy loam 6 to 13 inches: very fine sandy loam 13 to 24 inches: silty clay loam 24 to 33 inches: silty clay loam 33 to 60 inches: stratified very fine sandy loam to silty clay
Hk	Haskill fine sand, 0 to 7 percent slopes	Terraces, outwash fans	Eolian deposits	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: fine sand 12 to 29 inches: loamy fine sand 29 to 34 inches: loam 34 to 72 inches: fine sand
Hm	Haskill fine sand, 7 to 12 percent slopes	Outwash fans, terraces	Eolian deposits	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: fine sand 12 to 29 inches: loamy fine sand 29 to 34 inches: loam 34 to 72 inches: fine sand

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	Description	Landform	Parent Material	Typical Profile
Hn	Haskill fine sand, 12 to 45 percent slopes	Terraces, outwash fans	Eolian deposits	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: fine sand 12 to 29 inches: loamy fine sand 29 to 34 inches: loam 34 to 72 inches: fine sand
Ho	Haskill loamy fine sand, 0 to 7 percent slopes	Terraces, outwash fans	Eolian deposits	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: loamy fine sand 12 to 29 inches: loamy fine sand 29 to 34 inches: loam 34 to 72 inches: fine sand
Hp	Haskill loamy fine sand, 7 to 20 percent slopes	Outwash fans, terraces	Eolian deposits	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: loamy fine sand 12 to 29 inches: loamy fine sand 29 to 34 inches: loam 34 to 72 inches: fine sand
Ka	Kalispell fine sandy loam, moderately deep over sand, 0 to 7 percent slopes	Terraces	Alluvium	0 to 8 inches: fine sandy loam 8 to 13 inches: silt loam 13 to 60 inches: stratified loamy fine sand to silt loam
Kzc	Kalispell-Tuffit silt loams, 7 to 20 percent slopes	Terraces	Alluvium	0 to 8 inches: silt loam 8 to 13 inches: silt loam 13 to 60 inches: stratified loamy fine sand to silt loam
Kzd	Kiwanis fine sandy loam, 0 to 4 percent slopes	Stream terraces	Alluvium	0 to 9 inches: fine sandy loam 9 to 39 inches: fine sandy loam 9 to 70 inches: very gravelly sand
Kze	Kiwanis loam, 0 to 3 percent slopes	Stream terraces	Alluvium	0 to 9 inches: loam 9 to 39 inches: fine sandy loam 39 to 70 inches: very gravelly sand
Kzf	Kiwanis loam, 3 to 9 percent slopes	Stream terraces	Alluvium	0 to 7 inches: loam 7 to 39 inches: fine sandy loam 39 to 70 inches: very gravelly sand
Kzg	Kiwanis-Birch fine sandy loams, 0 to 5 percent slopes	Stream terraces	Alluvium	0 to 9 inches: fine sandy loam 9 to 39 inches: fine sandy loam 39 to 70 inches: very gravelly sand
Kzh	Kiwanis-Birch loams, 0 to 4 percent slopes	Stream terraces	Alluvium	0 to 9 inches: loam 9 to 39 inches: fine sandy loam 39 to 70 inches: very gravelly sand
Kzk	Krause gravelly loam, 0 to 3 percent slopes	Kame terraces, outwash fans	Volcanic ash over outwash	0 to 1 inches: slightly decomposed plant material 1 to 13 inches: gravelly ashy loam 13 to 21 inches: very gravelly sandy loam 21 to 60 inches: very gravelly loamy sand
Kzm	Krause gravelly loam, 3 to 7 percent slopes	Kame terraces, outwash fans	Volcanic ash over outwash	0 to 1 inches: slightly decomposed plant material 1 to 13 inches: gravelly ashy loam 13 to 21 inches: very gravelly sandy loam 21 to 60 inches: very gravelly loamy sand
Mc	McCaffery loamy fine sand, 0 to 3 percent slopes	Terraces	Alluvium	0 to 1 inches: slightly decomposed plant material 1 to 22 inches: loamy fine sand 22 to 60 inches: loamy sand
Me	McCaffery loamy fine sand, 7 to 12 percent slopes	Terraces	Alluvium	0 to 1 inches: slightly decomposed plant material 1 to 22 inches: loamy fine sand 22 to 60 inches: loamy sand

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
Mg	Mires gravelly loam, 0 to 3 percent slopes	Terraces, outwash fans	Outwash	0 to 8 inches: gravelly loam 8 to 18 inches: very gravelly loam 18 to 60 inches: very gravelly loamy sand
Mh	Mires gravelly loam, 3 to 7 percent slopes	Terraces, outwash fans	Outwash	0 to 8 inches: gravelly loam 8 to 18 inches: very gravelly loam 18 to 60 inches: very gravelly loamy sand
Mk	Mires gravelly loam, 7 to 12 percent slopes	Outwash fans, terraces	Outwash	0 to 5 inches: gravelly loam 5 to 15 inches: very gravelly sandy loam 15 to 60 inches: very gravelly loamy sand
Mm	Mires gravelly loam, 12 to 30 percent slopes	Terraces, outwash fans	Outwash	0 to 6 inches: gravelly loam 6 to 15 inches: very gravelly sandy loam 15 to 60 inches: very gravelly loamy sand
Mn	Mires loam, 0 to 3 percent slopes	Terraces, outwash fans	Outwash	0 to 14 inches: loam 14 to 18 inches: very gravelly loam 18 to 60 inches: very gravelly loamy sand
Mo	Mires loam, 3 to 7 percent slopes	Outwash fans, terraces	Outwash	0 to 14 inches: loam 14 to 18 inches: very gravelly loam 18 to 60 inches: very gravelly loamy sand
Mr	Mountainous land	Moraines	Glacial till	5 to 18 inches: loam 18 to 26 inches: gravelly silt loam 26 to 60 inches: gravelly loam
Ms	Muck and peat	Flood plains	NA	0 to 8 inches: peat 8 to 28 inches: peat 8 to 32 inches: loam 32 to 40 inches: gravelly loam 40 to 60 inches: very gravelly loam
NOTCOM	No Digital Data Available	NA	NA	NA
Rb	Radnor silty clay loam, 0 to 3 percent slopes	Depressions	Glaciolacustrine deposits	0 to 5 inches: silt loam 5 to 14 inches: silty clay loam 14 to 30 inches: silty clay loam 30 to 60 inches: stratified silt loam to silty clay loam
Rc	Riverwash	Flood plains	Flooded and ponded soils	Not available
Sk	Stryker silt loam, 0 to 3 percent slopes	Terraces	Glaciolacustrine deposits	0 to 3 inches: slightly decomposed plant material 3 to 12 inches: silt loam 12 to 15 inches: silt loam 15 to 20 inches: silty clay loam 20 to 25 inches: silty clay loam 25 to 60 inches: stratified fine sandy loam to silty clay loam
Sm	Stryker silt loam, sandy subsoil, 0 to 3 percent slopes	Depressions	Glaciolacustrine deposits	0 to 3 inches: slightly decomposed plant material 3 to 12 inches: silt loam 12 to 15 inches: silt loam 15 to 20 inches: silty clay loam 20 to 25 inches: silty clay loam 25 to 60 inches: stratified fine sandy loam to silty clay loam
Sn	Stryker silty clay loam, 0 to 3 percent slopes	Terraces	Glaciolacustrine deposits	0 to 3 inches: slightly decomposed plant material 3 to 12 inches: silty clay loam 12 to 15 inches: silt loam 15 to 20 inches: silty clay loam 20 to 25 inches: silty clay loam 25 to 60 inches: stratified fine sandy loam to silty clay loam

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
So	Swims silt loam, 0 to 3 percent slopes	Terraces	Alluvium	0 to 1 inches: slightly decomposed plant material 1 to 5 inches: silt loam 5 to 12 inches: silty clay loam 12 to 26 inches: silt loam 26 to 55 inches: stratified very fine sandy loam to silty clay loam 55 to 60 inches: loamy fine sand
Sp	Swims silt loam, 3 to 7 percent slopes	Terraces	Alluvium	0 to 1 inches: slightly decomposed plant material 1 to 5 inches: silt loam 5 to 12 inches: silty clay loam 12 to 26 inches: silt loam 26 to 55 inches: stratified very fine sandy loam to silty clay loam 55 to 60 inches: loamy fine sand
Sr	Swims silty clay loam, 0 to 4 percent slopes	Terraces	Alluvium	0 to 1 inches: slightly decomposed plant material 1 to 5 inches: silty clay loam 5 to 12 inches: silty clay loam 12 to 26 inches: silt loam 26 to 55 inches: stratified very fine sandy loam to silty clay loam 55 to 60 inches: loamy fine sand
W	Water	NA	NA	NA
Wk	Waits and Krause stony loams, 0 to 7 percent slopes	Moraines	Volcanic ash over outwash	0 to 1 inches: slightly decomposed plant material 1 to 13 inches: gravelly ashy loam 13 to 21 inches: very gravelly sandy loam 21 to 60 inches: very gravelly loamy sand
Wo	Walters silt loam, 0 to 4 percent slopes	Terraces	Alluvium	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: silt loam 12 to 15 inches: silt loam 15 to 26 inches: fine sandy loam 26 to 38 inches: fine sandy loam 38 to 60 inches: stratified sand to gravelly coarse sand
Wp	Walters very fine sandy loam, 0 to 7 percent slopes	Terraces	Alluvium	0 to 2 inches: slightly decomposed plant material 2 to 12 inches: very fine sandy loam 12 to 15 inches: silt loam 15 to 26 inches: fine sandy loam 26 to 38 inches: fine sandy loam 38 to 60 inches: stratified sand to gravelly coarse sand
Wr	Whitefish cobbly silt loam, 0 to 7 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: cobbly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Ws	Whitefish cobbly silt loam, 7 to 12 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: cobbly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

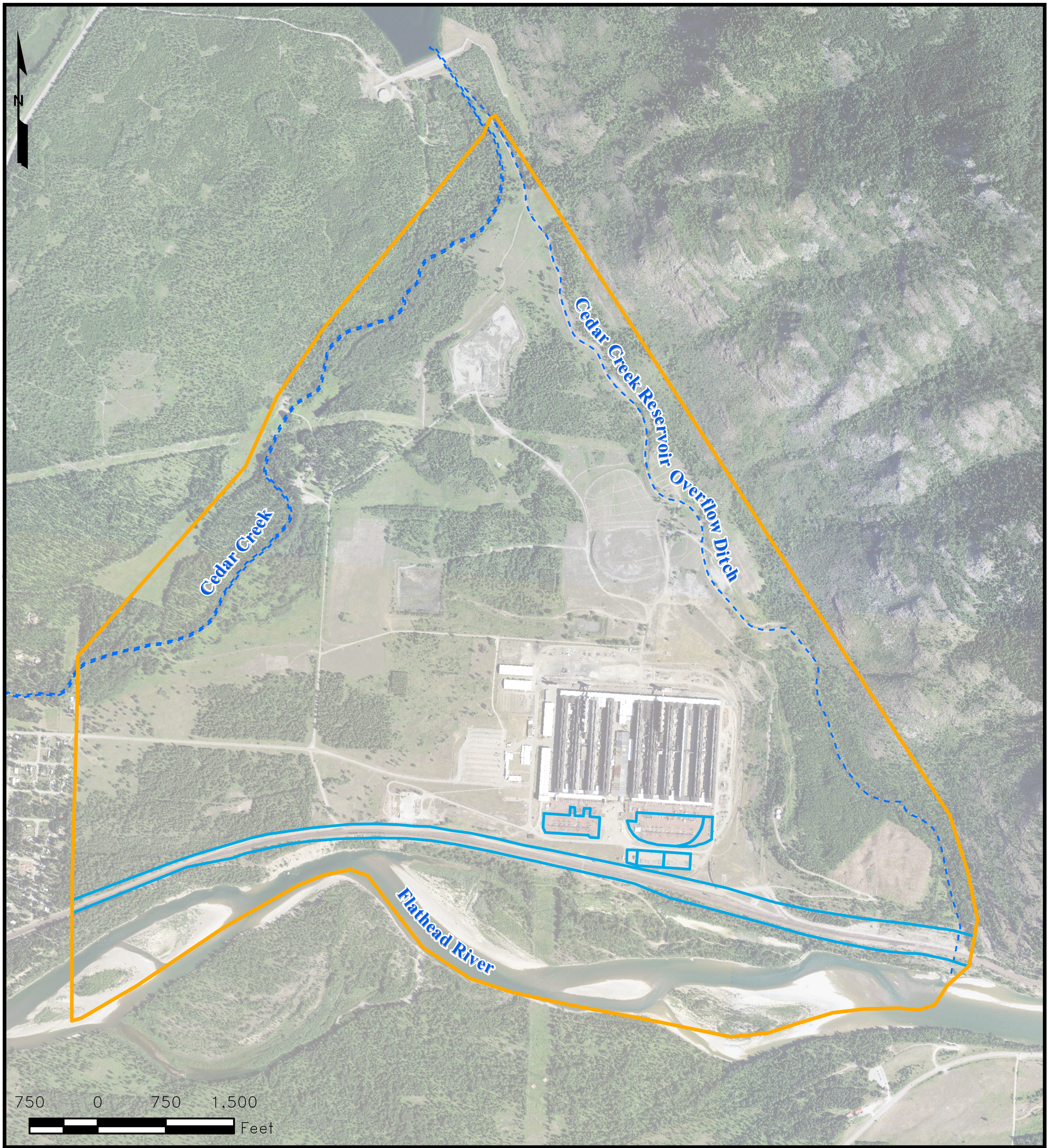
NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	**Description**	**Landform**	**Parent Material**	**Typical Profile**
Wt	Whitefish cobbly silt loam, 12 to 20 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: cobbly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Wu	Whitefish cobbly silt loam, 20 to 45 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: cobbly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Wv	Whitefish gravelly silt loam, 0 to 7 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: gravelly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Wza	Whitefish silt loam, 0 to 3 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Wzb	Whitefish silt loam, 3 to 7 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Wze	Whitefish stony silt loam, 0 to 7 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: cobbly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Wzg	Whitefish stony silt loam, 12 to 20 percent slopes	Moraines	Glacial till	0 to 1 inches: slightly decomposed plant material 1 to 9 inches: cobbly silt loam 9 to 14 inches: gravelly silt loam 14 to 20 inches: gravelly clay loam 20 to 33 inches: gravelly silt loam 33 to 60 inches: gravelly silt loam
Yt	Yeoman silt loam, 0 to 7 percent slopes	Moraines	Glacial till	0 to 10 inches: silt loam 10 to 16 inches: gravelly loam 16 to 26 inches: gravelly loam 26 to 60 inches: gravelly loam
Yu	Yeoman silt loam, 7 to 12 percent slopes	Moraines	Glacial till	0 to 10 inches: silt loam 10 to 16 inches: gravelly loam 16 to 26 inches: gravelly loam 26 to 60 inches: gravelly loam

Table 3. Soil Descriptions for Offsite Soil Types
Columbia Falls Aluminum Company, LLC, Columbia Falls, Montana

NRCS Soil Types and Descriptions (FIGURE 6)				
Detailed Soil Code	Description	Landform	Parent Material	Typical Profile
Yv	Yeoman silt loam, 12 to 20 percent slopes	Moraines	Glacial till	0 to 10 inches: silt loam 10 to 16 inches: gravelly loam 16 to 26 inches: gravelly loam 26 to 60 inches: gravelly loam
Yx	Yeoman stony loam, 7 to 12 percent slopes	Moraines	Glacial till	0 to 10 inches: stony loam 10 to 16 inches: gravelly loam 16 to 26 inches: gravelly loam 26 to 60 inches: gravelly loam

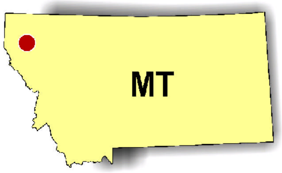
Source: United States Department Of Agriculture Natural Resources Conservation Service Soil Survey

FIGURES



LEGEND

- CREEK FEATURES
- SITE BOUNDARY
- APPROXIMATE THIRD PARTY PROPERTY BOUNDARIES



Title:

RI/FS SITE BOUNDARY

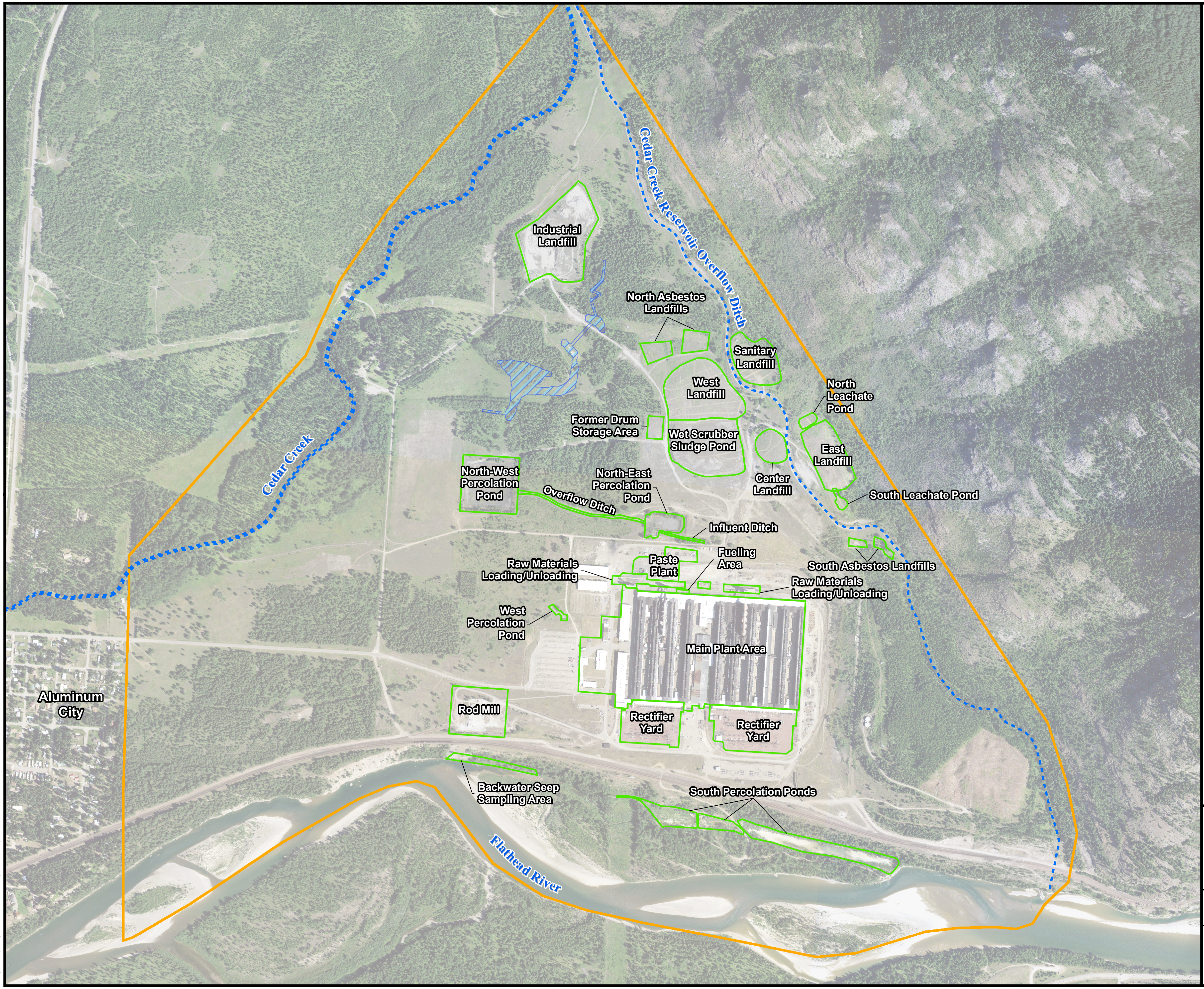
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

Compiled by: MB.L.	Date: 21MAY18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	1
Project Mgr: L.J.	Project: 2476.0001Y207/F1	
File: 2476.0001Y207.1.mxd		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.F1



N

LEGEND

- CREEK FEATURES
- SITE FEATURES
- NORTHERN SURFACE WATER FEATURE EXTENT
- SITE BOUNDARY

530 0 530 1,060 Feet

Title:

SITE FEATURES

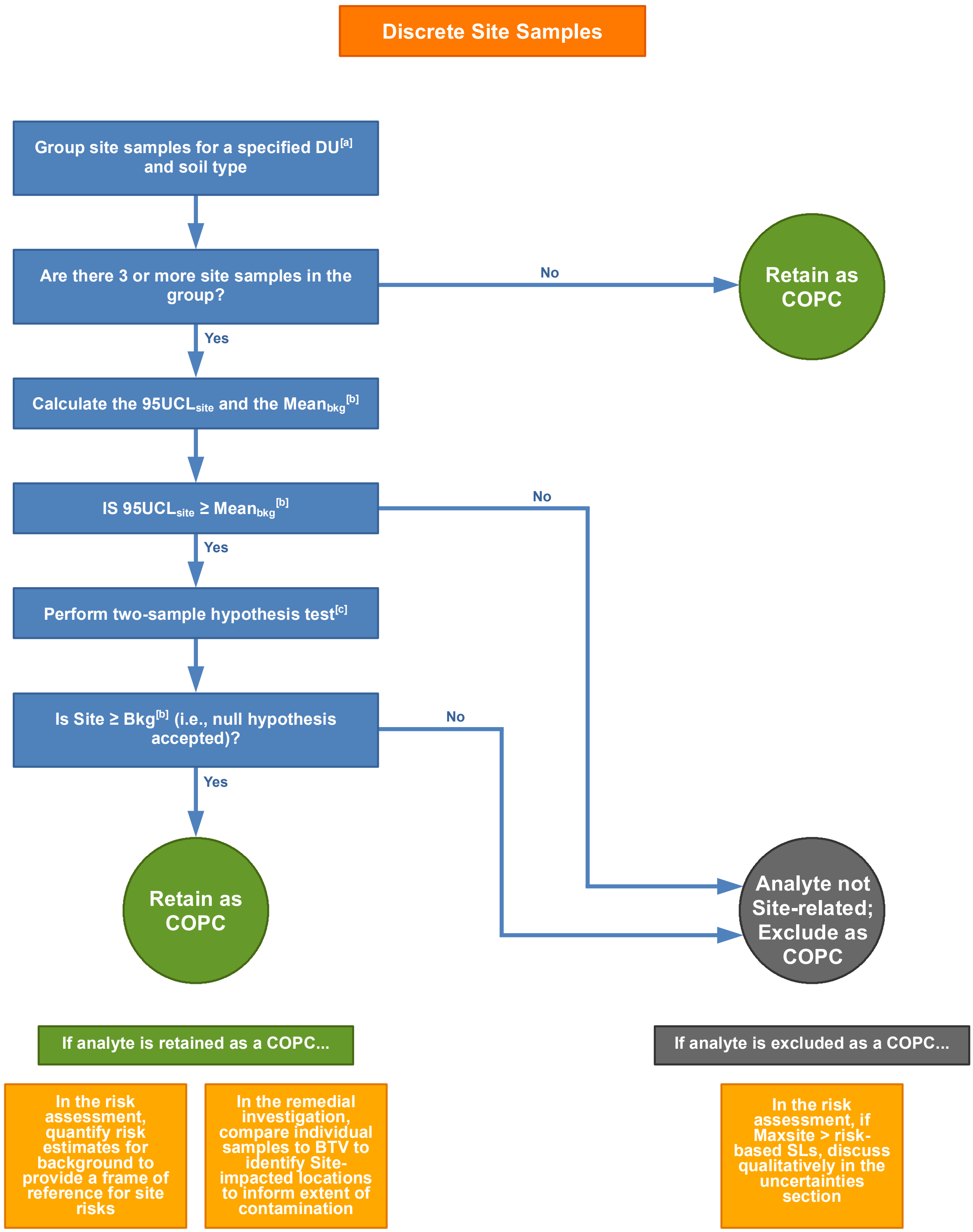
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

Compiled by: L.J.	Date: 21JUN18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	2
Project Mgr: L.J.	Project: 2476.0001Y207/F2	
File: 2476.0001Y207.2.mxd		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.F2.mxd



Notes

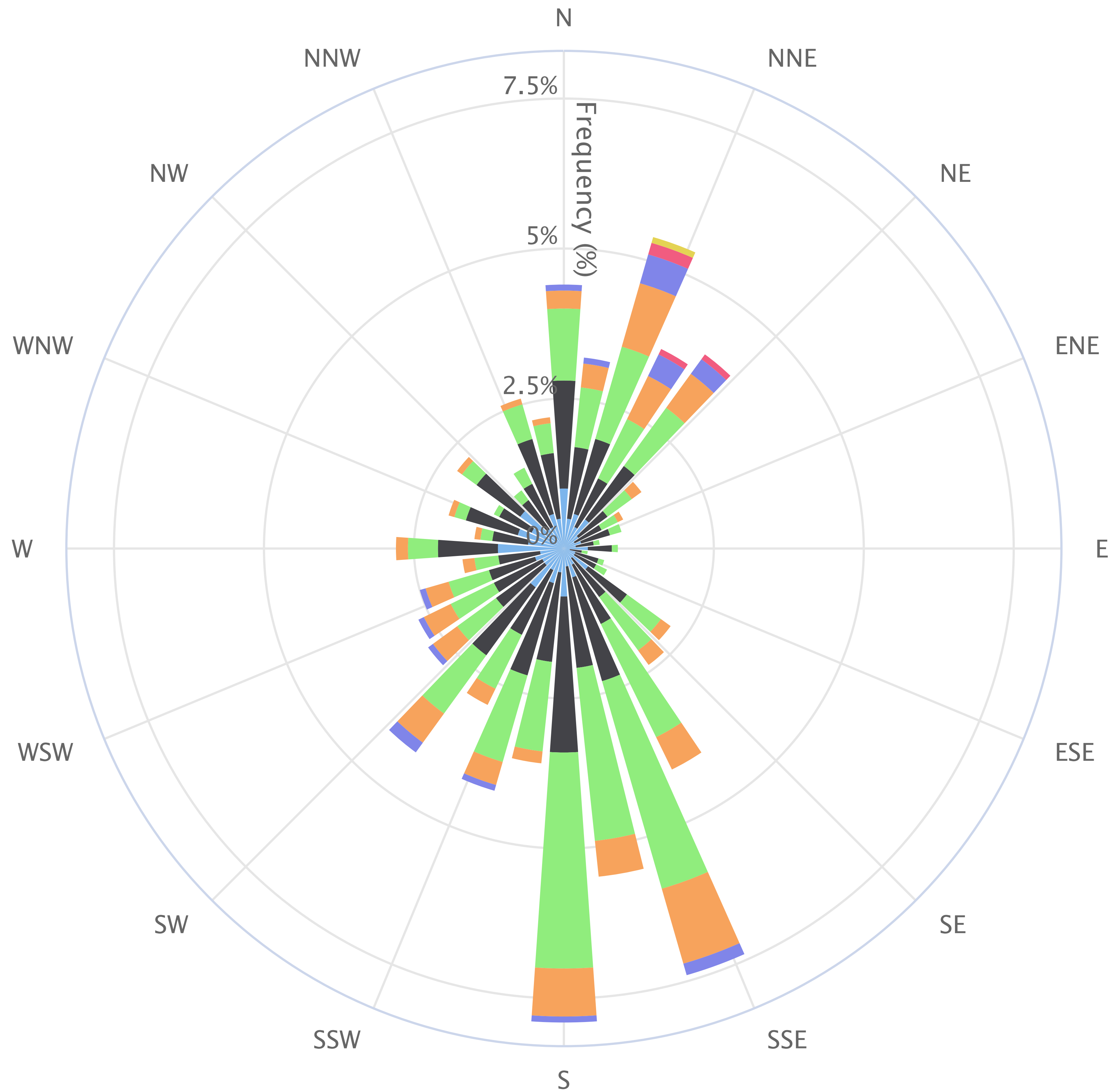
[a] DU is based on exposure area for each receptor; Small home range receptors will be evaluated utilizing the approach described in Section 2.4 of the Background SAP.
[b] Outliers will be excluded from background dataset prior to calculations/hypothesis unless there is a location-specific reason identified for retaining
[c] Background Test, Form 2 at $\alpha = 0.10$

Title: **ILLUSTRATION OF PROPOSED SITE VS. BACKGROUND COMPARISON APPROACH FOR SOIL**

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX	Compiled by: MB.L.	Date: 12SEP18	FIGURE
	Prepared by: M.S.R.	Scale: AS SHOWN	3
	Project Mgr: L.J.	Project: 2476.0001Y207/F3	
	File: 2476.0001Y207.3.mxd		



WIND SPEED (MPH)

- 1.3 – 4
- 4 – 8
- 8 – 13
- 13 – 19
- 19 – 25
- 25 – 32
- 32 – 39

SOURCE

Midwestern Regional Climate Center, cli–MATE: MRCC Application Tools Environment, Jan. 1, 1948 – June 20, 2018

Title: **WIND ROSE FOR KALISPELL/GLACIER PARK AIRPORT (MEAN WIND DIRECTION, 1948 – 2018)**

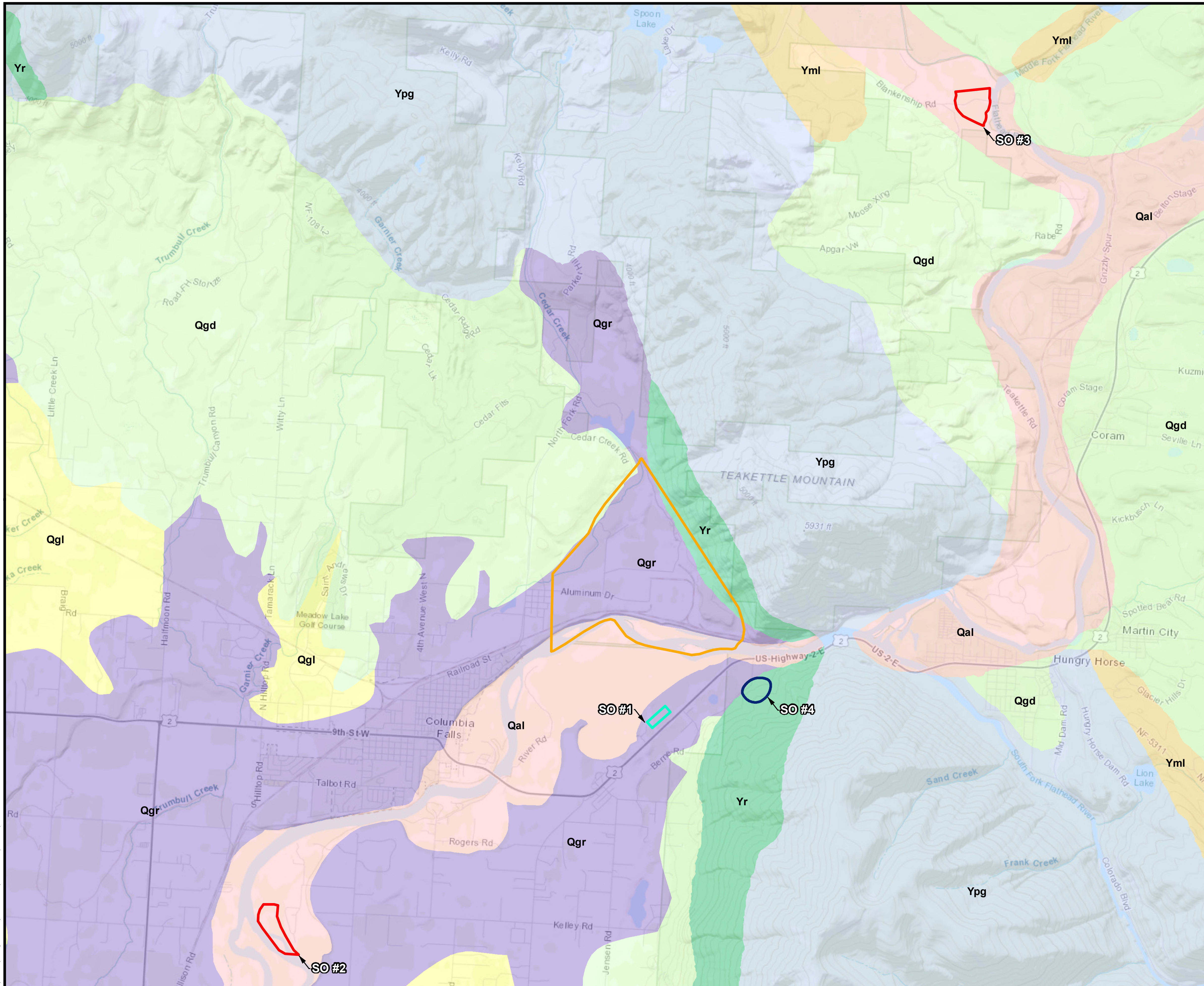
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

Compiled by: L.J.	Date: 21JUN18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	4
Project Mgr: M.R.	Project: 2476.0001Y207/F4	
File: 2476.0001Y207.7.ppt		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.7.ppt



LEGEND

Qal	ALLUVIAL DEPOSITS (HOLOCENE)
Qgl	GLACIAL LAKE DEPOSIT (PLEISTOCENE)
Qgr	GLACIAL AND FLUVIOGLACIAL DEPOSITS (PLEISTOCENE)
Qgd	GLACIAL TILL (QUATERNARY)
Yml	LOWER MISSOULA GROUP (MIDDLE PROTEROZOIC)
Ypg	HELENA AND WALLACE FORMATIONS (MIDDLE PROTEROZOIC)
Yr	REVETT FORMATION (MIDDLE PROTEROZOIC) (TEAKETTLE MOUNTAIN)
SO#1	SOIL BACKGROUND REFERENCE AREA #1: GLACIAL TILL AND ALLUVIUM
SO#2/3	SOIL BACKGROUND REFERENCE AREA #2: FLUVIAL DEPOSITS AND RIVERWASH
SO#4	SOIL BACKGROUND REFERENCE AREA #3: MOUNTAINOUS LAND WITH GLACIAL DEPOSITS
	SITE BOUNDARY

2,500 0 2,500 5,000
Feet

Title:

FLATHEAD VALLEY SURFICIAL GEOLOGY

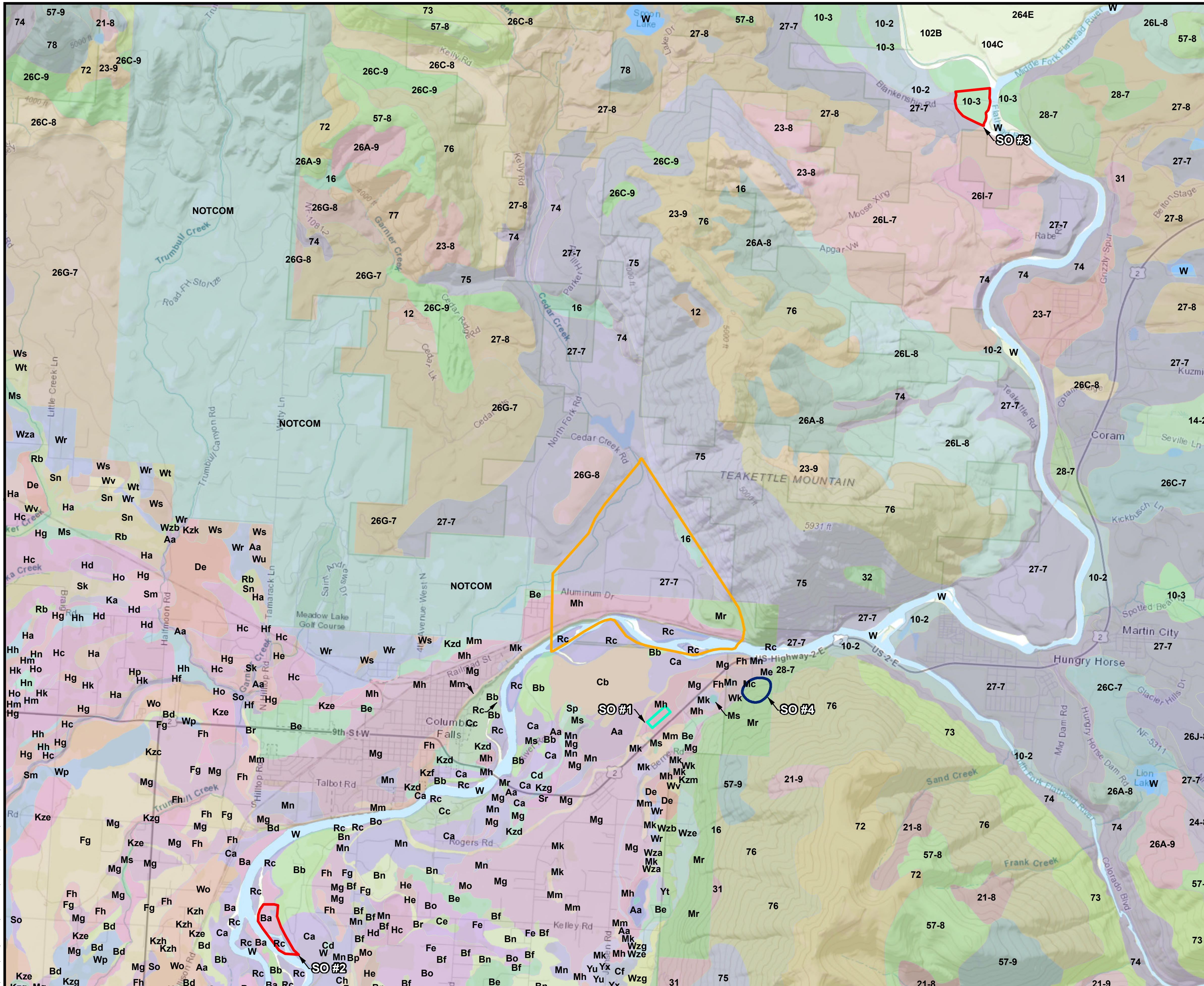
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

Compiled by: L.J.	Date: 10SEP18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	5
Project Mgr: L.J.	Project: 2476.0001Y207/F5	
File: 2476.0001Y207.5.mxd		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.F5.mxd



LEGEND

- SITE BOUNDARY
- SO #1 — SOIL BACKGROUND REFERENCE AREA #1: GLACIAL TILL AND ALLUVIUM
- SO #2 / 3 — SOIL BACKGROUND REFERENCE AREA #2: FLUVIAL DEPOSITS AND RIVERWASH
- SO #4 — SOIL BACKGROUND REFERENCE AREA #3: MOUNTAINOUS LAND WITH GLACIAL DEPOSITS

SOURCE

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE SOIL SURVEY

2,500 0 2,500 5,000 Feet

Title:

FLATHEAD VALLEY SURFACE SOIL TYPES

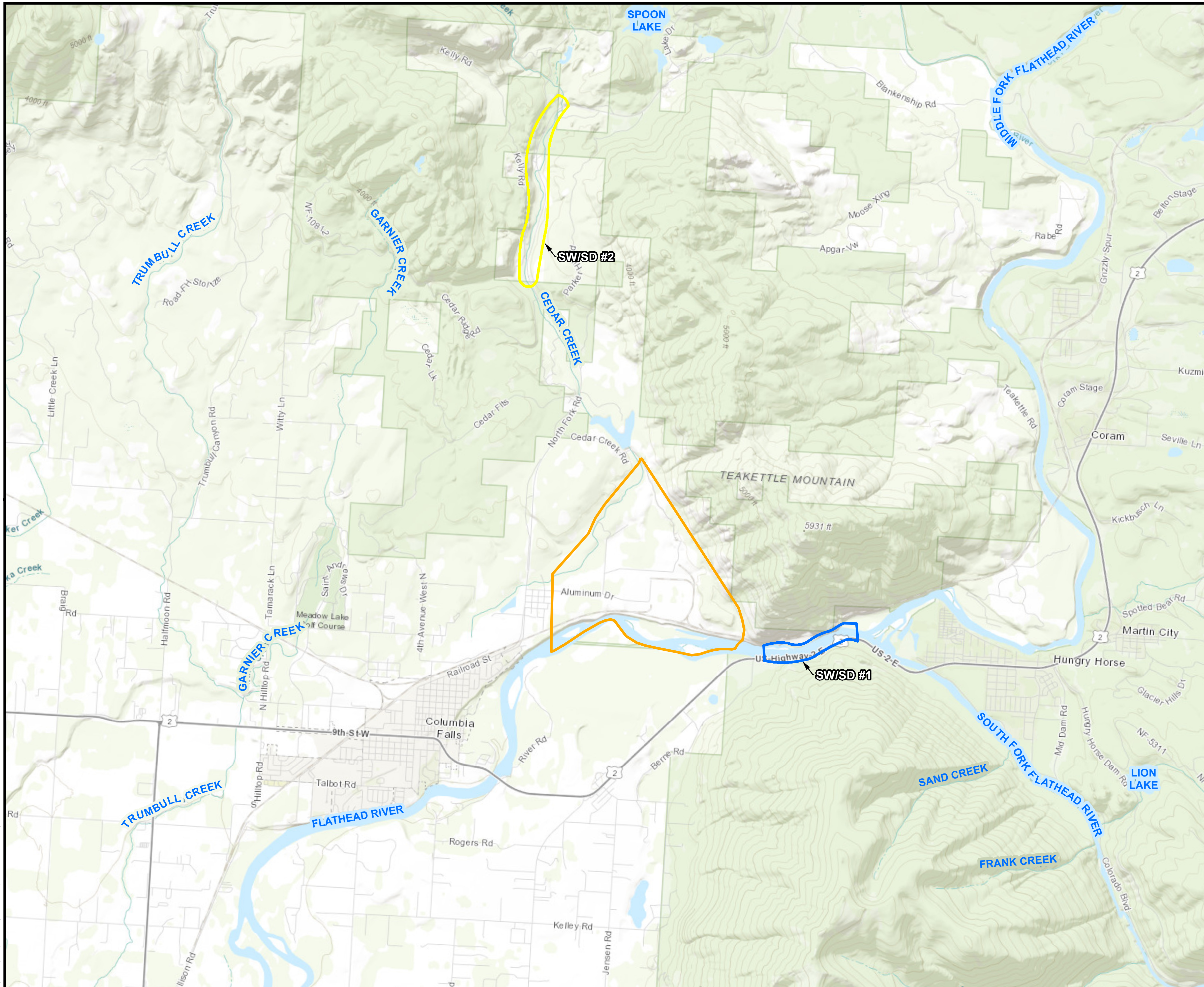
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:

COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX			FIGURE
	Compiled by: L.J.	Date: 10SEP18	6
	Prepared by: M.S.R.	Scale: AS SHOWN	
	Project Mgr: L.J.	Project: 2476.0001Y207/F6	
	File: 2476.0001Y207.6.mxd		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.F6.mxd



LEGEND

- SITE BOUNDARY
- SW/SD #1 — SURFACE WATER/SEDIMENT BACKGROUND REFERENCE AREA #1: UPGRADIENT FLATHEAD RIVER
- SW/SD #2 — SURFACE WATER/SEDIMENT BACKGROUND REFERENCE AREA #2: UPGRADIENT CEDAR CREEK

2,500 0 2,500 5,000 Feet

Title:

FLATHEAD VALLEY SURFACE WATER BODIES

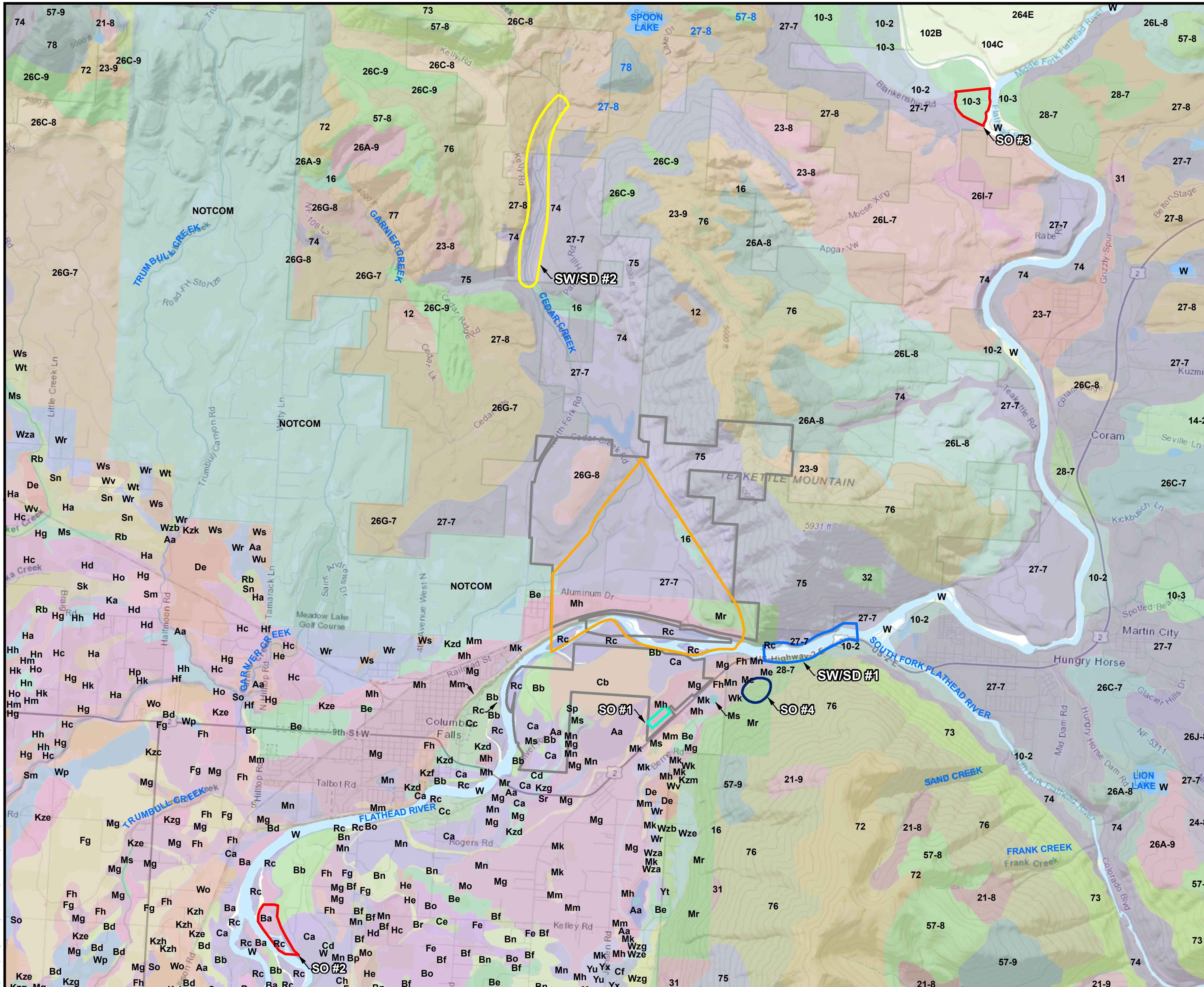
2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:
COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

Compiled by: L.J.	Date: 17AUG18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	7
Project Mgr: L.J.	Project: 2476.0001Y207/F7	
File: 2476.0001Y207.7.mxd		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.F7.mxd



LEGEND

- SITE BOUNDARY
- APPROXIMATE CFAC OWNED PROPERTY
- SW/SD #1 — SURFACE WATER/SEDIMENT BACKGROUND REFERENCE AREA #1: UPGRADIENT FLATHEAD RIVER
- SW/SD #2 — SURFACE WATER/SEDIMENT BACKGROUND REFERENCE AREA #2: UPGRADIENT CEDAR CREEK
- SO #1 — SOIL BACKGROUND REFERENCE AREA #1: GLACIAL TILL AND ALLUVIUM
- SO #2/3 — SOIL BACKGROUND REFERENCE AREA #2: FLUVIAL DEPOSITS AND RIVERWASH
- SO #4 — SOIL BACKGROUND REFERENCE AREA #3: MOUNTAINOUS LAND WITH GLACIAL DEPOSITS

SOURCE

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE SOIL SURVEY

2,500 0 2,500 5,000 Feet

Title:

PROPOSED BACKGROUND REFERENCE SAMPLING AREAS

2000 ALUMINUM DRIVE
COLUMBIA FALLS, MONTANA

Prepared For:

COLUMBIA FALLS ALUMINUM COMPANY, LLC

ROUX

Compiled by: L.J.	Date: 10SEP18	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	8
Project Mgr: L.J.	Project: 2476.0001Y207/F8	
File: 2476.0001Y207.8.mxd		

V:\GIS\Projects\2476Y\0001Y\207\2476.0001Y207.F8.mxd

APPENDICES

A. Background Reference Area Reconnaissance Photographs

APPENDIX A

Background Reference Area Reconnaissance Photographs

Photograph 1: **Soil Background Reference Area #1: Glacial Till and Alluvium. Area is 11 acres of hilly, vegetated open land situated parallel to Highway 2 East; Photograph taken May 2018.**

Photograph 2: **Soil Background Reference Area #1: Glacial Till and Alluvium. Area is 11 acres of hilly, vegetated open land situated parallel to Highway 2 East; Photograph taken May 2018.**

Photograph 3: **Soil Background Reference Area #2: Fluvial Deposits and Riverwash. Area is 68 acres of relatively flat and vegetated land with grass, shrubs, and trees located along River Road. Photograph taken May 2018.**

Photograph 4: **Soil Background Reference Area #2: Fluvial Deposits and Riverwash. Sign posting for Block Management Area (BMA) for hunting. Photograph taken May 2018.**

Photograph 5: **Soil Background Reference Area #3: Mountainous Land with Glacial Deposits. Area is Columbia Mountain Trail Head on Berne Road off of Highway 2 East along the Flathead River between Columbia Falls and Hungry Horse. Approximately 100 feet into trail. Photograph taken May 2018.**

Photograph 6: **Soil Background Reference Area #3: Mountainous Land with Glacial Deposits. Area is Columbia Mountain Trail Head on Berne Road off of Highway 2 East along the Flathead River between Columbia Falls and Hungry Horse. Photograph taken at trailhead in May 2018.**

Photograph 7: **Surface Water and Sediment Sampling Reference Location #1. Flathead River (South Fork of the River). Actual reference area is not accessible by road. Photograph taken May 2018.**

Photograph 8: **Surface Water and Sediment Sampling Reference Location #1. Flathead River (South Fork of the River). Actual reference area is not accessible by road. Photograph taken May 2018.**

Photograph 9: **Surface Water and Sediment Sampling Reference Location #2. Headwaters of Cedar Creek off Route 486.**
Photograph taken May 2018.

Photograph 10: **Surface Water and Sediment Sampling Reference Location #2. Headwaters of Cedar Creek off Route 486.**
Photograph taken May 2018.