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# Dewey Tunnel and Blue Gulch Phase 1a Site Characterization and Screening Risk Analysis

Prepared for:

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**Walla Walla District**

**and the**

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# GLOSSARY

**Adit:** a tunnel driven horizontally into a hillside to provide access to a mineral deposit . A nearly horizontal passage from the surface by which a mine is entered and dewatered. A blind horizontal opening into a mountain, with only one entrance

**Alluvial fan**: cone-shaped gravel deposit formed where a stream emerges from mountains onto a lowland.

**Bedrock**: solid rock underlying gold-bearing gravel.

**Beneficiation**: activities that serve to separate and concentrate the mineral values from waste material, remove impurities, or prepare the ores for further refinement (e.g., crushing or grinding).

**Communition:** the breaking, crushing, or grinding of coal, ore, or rock.

**Concentrate:** minerals which have been separated from less valuable materials.

**Fines:** sand or other fine-sized material associated with placer deposits. Usually the last material left during the panning process.

**Gangue**: the portion of the rock matrix that is less valuable.

**Gravity separation:** recovery of gold from crushed rock or gravel using gold's high specific gravity to separate it from lighter material.

**Grizzly** - Course screening or scalping device that prevents oversized bulk material form entering a material transfer system; constructed of rails, bars, beams, etc

**Mine Water**: water entering a surface or underground mine is referred to mine water. Sources of this water are groundwater seepage, surface water inflow, or direct precipitation.

**Mineral**: an inorganic compound occurring naturally in the earth's crust, with a distinctive set of physical properties, and a definite chemical composition.

**Ore**: is an economic term which is used to define an earthen material that contains minerals of sufficient value to be extracted economically.

**Oxidized ore:** the alteration of metalliferous minerals by weathering and the action of surface waters and their conversion, partly or wholly into oxides, carbonates or sulfates

**Patent:** a government deed that conveys legal title of public land to the party to whom the patent is issued.

**Placer deposit**: a glacial or alluvial deposit of sand or gravel containing eroded particles of valuable minerals.

**Portal:** the structure surrounding the immediate entrance to a mine; the mouth of an adit or tunnel.

**Sluice box:** an elongate wooden or metal trough with riffles, over which alluvial gravel is washed to recover gold.

**Tailing**: a waste by-product of the beneficiation process containing reagents.

**Tunnel:** a horizontal, or near-horizontal, underground passage, entry, or haulageway, that is open to the surface at both ends. A tunnel (as opposed to an adit) must pass completely through a hill or mountain.

**Waste Rock:** consists of non-mineralized and low-grade mineralized rock removed from, around or within the ore body during extraction activities.

# EXECUTIVE SUMMARY

The U.S.Army Corps of Engineers (USACE), Walla Walla District and the Idaho Department of Lands (IDL) conducted a site investigation and screening risk analysis for two abandoned mine sites in the Owyhee Mountains of Idaho. The project was undertaken as part of the USACE Assistance to State Planning Program, Water Resource Development Act of 1974, Section 22. The purpose of the study was threefold: first, to characterize the sites to determine the relative level of risk that either of these two sites might pose to the environment and/or human health; second, to determine existence and extent of contamination and identify potential remedies, and three, to place the information into an abandoned mine database to be used to help prioritize where the IDL should undertake abandoned mine reclamation work

The Dewey Tunnel and Blue Gulch Mines are located on Florida Mountain in Owyhee County in Southwestern Idaho. The site investigation was conducted during low-flow conditions in August 2001 and targeted data collection at surface water, stream sediments, and high risk areas to support a screening risk analysis. The objective of the screening risk evaluation was to determine whether the potential human health and ecological risks due to exposure to contaminants is significant. The approach compared metal concentrations to published screening-levels for human health and ecological risk-based concentrations.

The results indicate that Dewey Tunnel and Blue Gulch Mine may pose a public health hazard for persons such as hikers, campers, or site trespassers who drink or come in contact with water from Jordan Creek or Negro Gulch . These persons could experience health effects as a result of ingesting heavy metals such as arsenic, iron, magnesium, manganese, and mercury. Heavy metals, such as arsenic and mercury in Jordan Creek and Blue Gulch, may pose a health hazard for persons who consume fish from these creeks. In addition, persons who eat fish caught further downstream could be potentially exposed to these metals at levels that pose a public health hazard, due to the ability of these metals to bioaccumulate. Heavy metals, including aluminum, copper, zinc, manganese , and cadmium, in water in Jordan Creek and Negro Gulch, could have significant impacts on aquatic biota. Impaired quality at Jordan Creek may serve as a fish barrier to redband trout and other aquatic biota that frequent Jordan Creek and Blue Gulch. Heavy metals in soil or sediment including aluminum, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc could impact biota who live at or frequent these sites, including plants, microbes, invertebrates, and wildlife.

In order to further evaluate public health and ecological hazards that Jordan Creek and Blue Gulch may pose, additional site investigation is needed. Sampling during high-flow conditions may produce different findings than were found during low-flow conditions. Acid mine drainage may mobilize additional metals and minerals from waste rock piles. Biological studies such as site-specific toxicity tests, fish sampling, and bioavailability

studies would provide additional information to more accurately evaluate the impact to human and ecological health.

# 1. INTRODUCTION

## 1.1 PROJECT UNDERSTANDING

The U.S. Army Corps of Engineers (USACE), Walla Walla District and the Idaho Department of Lands (IDL) contracted with David Evans & Associates (DEA) to conduct a site investigation and screening risk analysis for two abandoned mine sites in the Owyhee Mountains of Idaho. DEA collaborated with Limno-Tech, Inc. (LTI), Intertox, and Quadrant Consulting, Inc. to conduct the study. The project was undertaken as part of the USACE Assistance to State Planning and the scope of work for the project was developed by both the USACE and IDL. The USACE is directly managing the project on behalf of the IDL.

It is the Project Team's understanding that the USACE and the IDL desire to complete an initial site characterization and screening risk analysis were conducted for two mining sites on Florida Mountain: Dewey Tunnel and Blue Gulch mines. Although some site characterization has been conducted at the two sites, there has not been sufficient information generated to determine a relative level of risk that either of these two sites might pose to the environment and/or to human health. The purpose of this project is to characterize these sites to determine how extensive the problems are and how they could be remedied. It is also the Project Team's understanding that the information will be placed into an abandoned mine database and used to help prioritize where the IDL should undertake abandoned mine list reclamation work.

It is the Project Team's understanding that the USACE and IDL are requesting that the following deliverables be prepared for each site:

- A base map that will contain the location of all site features and sample locations;
- A report that will summarize the analytical results of all tests and surveys and discuss the potential risks to water quality, aquatic ecosystems, and human health, and
- Evaluation of options for reducing those risks.

In discussions with the USACE, it is also understood that to the extent practicable, USACE staff will support some of the tasks (e.g. report preparation).

The USACE and IDL also have requested that existing site characterizations conducted on the sites be used where relevant and appropriate. Other documents received from the USACE include an untitled document describing the history of the site, some water quality data from an Environmental Impact Statement on the Stone Cabin Mine prepared by CH2M Hill, results of sediment sampling and analysis for metals from the Jordan River, and soil sampling and analysis for mercury near the Dewey Mine site conducted by Ecology and Environment, Inc.

A comprehensive scope of work (refer to Appendix A for complete text) furnished to the Project Team from the USACE include the following tasks:

- GPS map of site and site features (waste rock, adit, foundations, springs, etc.)
- Survey to determine ownership boundaries (Dewey only)
- Collection and analysis of water samples from springs and creeks
- X-ray diffraction analysis of waste rock to determine mineral composition
- Volume determination of waste rock
- Electromagnetic survey of waste rock to find water draining through waste rock pile (Time-domain ElectroMagnetic or TEM)
- Electromagnetic survey of waste rock to find bottom of the waste rock pile (Controlled Source AudioMagneto Tellurics or CSAMT)
- Induced Polarization (IP) survey of waste rock pile to find concentrations of sulfide minerals
- Feasibility study for stopping acid rock drainage (ARD).

In addition, the scope of work included a list of general parameters and constituents that were to be analyzed for both total and dissolved.

**Table 1.1-1 General Parameters and Constituents of Concern**

| General Parameters | | Constituents | | | |
|---|---|---|---|---|---|
| Total Suspended Solids | Alkalinity | Aluminum | Copper | Manganese | Sodium |
| pH | Temperature | Cadmium | Iron | Mercury | Zinc |
| Conductivity | | Calcium | Lead | Nickel | |
| | | Cobalt | Magnesium | Potassium | |

## 1.2 PROJECT OBJECTIVES

This report documents current conditions of the Dewey Tunnel and Blue Gulch Mines through the generation of appropriate data which were used to preliminarily assess environmental and public health risks from the mine sites for the purpose of prioritizing the sites for potential abandoned mine reclamation work. These objectives were achieved through collection of surface water, in-stream sediment, soil and waste rock and mine tailings samples at strategic locations for analysis of parameters of concern. An important goal of this effort is to build upon existing studies where appropriate.

## 1.3 PROJECT BACKGROUND

After review of the comprehensive scope of work, it was agreed to phase the tasks. Considering the late season start, the sampling effort focused on those tasks which would

best support a preliminary site characterization and screening risk analysis. A primary reason for developing a phased approach is to address the question of relative risk for both these sites in a cost-effective manner. If, after evaluating results from the Phase I sampling and analysis effort there is little risk to human health and aquatic and eco-systems, the geophysical exploration effort may not be necessary. Therefore, the Project Team proposed a phased approach to address the most critical issues first.

**Phase I** identifies information on the two mine sites to provide the USACE and IDL with information necessary to evaluate the urgency of further action at these sites and to provide a preliminary estimate of the resources required to address problems at the Dewey Tunnel and Blue Gulch Mine sites. To this end, the Phase I data collection activities were directly targeted to primarily support the risk assessment. Because of the late season start time (August 2001) for this investigation, the Phase I work was conducted in two segments, Phase Ia and Phase Ib. Phase Ia work includes development of a base map and sampling of targeted site media under low flow surface water conditions. The base map information allows identification of important features (e.g., locations of structures, waste piles, boundaries, sampling efforts) and targeted sampling. Targeted sampling and analysis at each of the two sites was limited to surface water, in-stream sediments, soils, mine tailings, and waste rock to support the preliminary risk assessment. The information from Phase Ia studies is used in a screening level risk analysis of exposure to site media for both human health and ecological risks.

The Phase Ib work, if needed, will include targeted sampling and analysis at each site of surface water under high flow conditions (i.e., late spring/early summer 2002) and after evaluation of the Phase Ia results. Upon completion of Phase 1b, data collected from that effort will be incorporated into a final screening level risk analysis that will consider the range of surface water exposure based upon the extremes of flow conditions encountered. The results of these efforts will be used to generate a supplemental report discussing potential risks to water quality, aquatic ecosystems and human health, and containing an analysis of options for reducing identified risks.

**Phase II**, if warranted due to concerns raised by the risk analysis, would require additional site characterization. Phase II activities would include geo-physical investigations and/or additional sampling. Geophysical exploration is likely to be relatively expensive and the results of Phase I will be used to tailor the approach used. Preliminary discussions with geophysical contractors indicate that it is likely that not all the methods specified in the comprehensive scope of work will be required to obtain the necessary results. Additional sampling activities would also be tailored based upon Phase I results. Phase I sampling and analysis and/or sampling at additional areas of concern or additional parameters such as sulfide content of various media, and the mineral content of waste rock, could be warranted based on analytical results from Phase 1.

**Phase III** will include development of feasibility studies for addressing environmental problems and improving the water quality at the sites. This will be followed by development of detailed plans and specifications. Phase III may be combined with Phase II.

## 1.4 SITE DESCRIPTION, HISTORY, AND GEOLOGY

### *1.4.1 Site Description*

The Dewey Tunnel and Blue Gulch mines are located on Florida Mountain in Owyhee County in Southwestern Idaho, approximately 50 miles southwest of Boise, Idaho, and 20 miles east of Jordan Valley, Oregon (refer to Figure 1.4.1-1). Dewey Tunnel is located in Section 36, T4S, R4W, B.M., Owyhee County, Idaho. Section 36 is a mixture of patented mine claims and state land.

Blue Gulch (Humboldt Mine-IGS number BO127, Trade Dollar Mine, Black Jack Mine) is located in Section 1, T5S, R4W, and Section 36, T4S, R4W, B.M., Owyhee County, Idaho. It is located three miles northwest of Silver City, Idaho. Blue Gulch Mine is flanked on its east side by Humboldt Mine. The Trade Dollar and Black Jack Mines are located in Negro Gulch just south of Humboldt Mine. A large waste rock pile is located at the bottom of Negro Gulch and pushes Blue Gulch Creek to the opposite side of the valley.

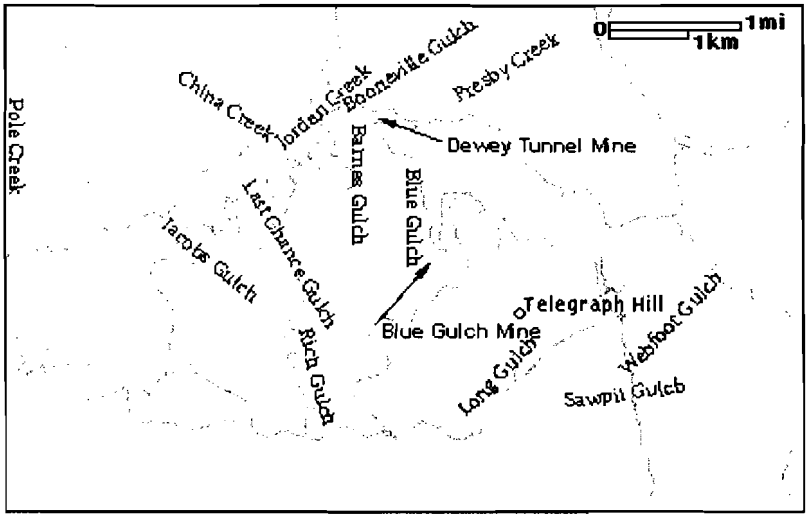



**Figure 1.4.1-1 Location Map**

#### 1.4.1.1 Geology

Based on information provided from historical studies, the mine sites contain primarily rhyolite, granite (granodiorite), and basalt. The main non-metallic mineral in the veins is massive and pseudomorphic quartz. Valencianite is also abundant in the veins as are minor amounts of epidote, chlorite, fluotite, and vivanite. Metallic minerals include gold and silver, argenite ($Ag_2S$, cerargyrite (AgCl), naumannite ($Ag_2Se$), proustite ($3Ag_2S.Ag_2S_3$), pyargyrite ($3Ag_2S.Sb_2S_3$), polybasite, pyrite, chalcopytite, sphalerite, galena, and clausthalite.

### *1.4.2 Site Operations*

**Dewey Tunnel Mine**. Mining for gold and silver began on Florida Mountain in 1871. The Dewey Tunnel Mine was started in 1896 the same year a 20-stamp amalgamation-concentration mill was erected near the portal of the tunnel. In 1899 it and other mines on Florida Mountain were purchased by the Trade Dollar Consolidated Mining Company. By 1903 the mill was processing all ore from the Trade Dollar Mine. This arrangement continued until 1910 when the ore was exhausted. The tunnel that was constructed was 8 ft. wide by 7 ft. high by 8900 feet long, representing about 18.5 thousand bank cubic yards of material. The Florida Mountain Mining Company purchased the mine and did limited excavations between March 1919 and August 1920. In 1920 the transformer house was constructed.

To the east end of the site is a mill named the Palm Beach Inn Mine. However in the context of this project and previous IDL investigations it has been called the Mystery Mill and to preserve continuity the name Mystery Mill will be used in this report. This name is appropriate because little is known about this mill. It appears to have been built after 1929. It may be associated with an operation conducted by Morrison Knudsen in 1939. This mill processed rhyolite ore.

Mining operations may have taken place on the west side of the site during the past 30 years. The mill may have been modified to operate as a grizzly processing placer material from Blue Gulch. The output of the grizzly was placed in a conical pile above the mill. Fine material was processed for gold recovery and deposited in the sand pile to the west side of the site.

Documentation describing operations at Dewey Tunnel Mine was not available. However, based on historical photographs, information furnished to the Project Team by IDL and the USACE, and site observations as to the types of structures and debris present at the sites, operations at the site included extraction and beneficiation. In the absence of specific operational information, the following is a general discussion of mining operations believed to be conducted at the sites.

Mining includes a series of operations: extraction, beneficiation, and mineral processing. It is important to note that the three types of operations may or may not be co-located. For the two mining sites being characterized, more is known about the Dewey Tunnel Mine than the Blue Gulch. However, based on information on historical practices at the Dewey Tunnel Mine, ore was extracted from the ground and milled at the site. Mineral processing by smelting was not conducted at the site.

**Extraction.** The initial step of mining is the removal of the mineral value in ore from the host rock. Extraction processes result in the removal of ore and associated rock in bulk form using various means to break the ore into pieces of manageable size and to separate the ore mineral from waste material. The extraction process is designed to remove ore of a predetermined size leaving behind as much of the lower grade ore and barren rock as possible. This ideal separation is not always practicable, and some lower grade rock is mined with the higher grade ore.

The largest quantity of wastes generated by extraction operations are mine water and waste rock. Note that wastes from extraction and beneficiation are excluded broadly from regulation as hazardous waste, although they are regarded as solid waste (Code of Federal Regulations, Subpart 261.4(b)(7). These waters may become acidic over time when exposed to oxygen, and if present at the site, pyrites or other sulfide minerals may result in acidic conditions. The acidic water may also solubilize metals contained in the mine and mined minerals, creating high concentrations of metals in solution. These acidic metal-laden waters may contaminate down-gradient groundwater and surface water. Neutral and alkaline mine waters may also contain metals in excess of water quality standards and be of significant concern to human health and the environment.

Waste rock includes granular, broken rock and soils ranging in size from fine sand to large boulders. Waste rock at Dewey Tunnel Mine was disposed in large piles adjacent to and/or down-slope of the point of extraction. The waste from the Dewey Tunnel excavation was placed in a longitudinally-shaped dump along the slope below the adit and currently extends about 700 feet to the east and about 300 feet to the west of the former portal. These sites are located in areas of natural drainage where surface water run-on and infiltration may cause natural leaching from the waste rock piles. The mobility of any particular constituent of waste rock is dependent on site conditions. The concentration of sulfide minerals and of neutralizing minerals is an important factor in the potential for waste rock to generate acid drainage. If prone to acid generation, such uses can lead to concern about widespread contamination.

**Beneficiation**: Following the initial mining step, ore is reduced in size by the crushing and/or grinding, and the target mineral is concentrated by various methods. The purpose of ore beneficiation is the separation of minerals from the gangue to yield a product that has a much higher content of the valued material. The separation steps, often conducted in series, utilize the physical differences between the valued mineral and the host rock to achieve separation and produce a concentrate containing the valuable minerals and tailing containing the waste material and reagents. Types of physical properties that affect separation include gravity concentration (coarse/fine separation, amalgamation, sink/float separation) magnetic separation, electrostatic separation, and flotation.

Based on the information available it is difficult to determine if gravity concentration processes were used in conjunction with or in addition to the amalgamation process. However, it is known that the amalgamation process was utilized at the site. If a gravity concentration process was operated at the site to exploit differences in density to separate ore minerals from gangue, coarse-fine concentration process may have been used. This process involves the use of sluices, jigs and screens where heavy minerals settle within the lining material of the sluice, while the lighter material is washed through. It was not uncommon for amalgamation to follow fine concentration.

The amalgamation process used to extract native gold uses liquid mercury which forms an amalgam with the gold. The gold is then recovered by filtering the amalgam through a canvas cone to drain off the excess mercury. Historically, the methods used to obtain the amalgam allowed some of the mercury/amalgam to escape the process. Waste

materials from beneficiation are deposited in the form of tailing piles. The Dewey Tunnel Mine tailings pile is located on the west side of the adit to Dewey Tunnel Mine.

**Blue Gulch Mine.** There is no available history of the Blue Gulch Mine. However, based on site observations and discussions with IDL staff, it appears that the Blue Gulch Mine operated an extraction process only. Beneficiation is most likely to have occurred elsewhere. However, without additional information, this conclusion is speculative. The waste rock pile for Blue Gulch Mine extends into Blue Gulch Creek and upstream to the confluence with Negro Gulch and downstream approximately 200 feet.

#### 1.4.2.1 Current Uses of the Site

The Dewey Tunnel and Blue Gulch mines are located in the Owyhee Mountains, an area of extensive historical mining operations. Although mining has ceased at both the Blue Gulch and Dewey Tunnel Mine sites, tourists, hikers, hunters and people examining the mine to appreciate its historical value and camp in the scenic Owyhee Mountains may frequent both sites. The Dewey Tunnel Mine site is more accessible being on the road to Silver City and may attract curious passersby. People may occasionally camp beside Jordan Creek. Hunting for deer and elk occurs primarily in the fall months.

Currently active mines include the DeLamar Mine directly west and uphill of the Blue Gulch Mine. Mining operations continue year round in the location of both mines. Roads from both sites lead to the DeLamar mining operation.

Silver City, located within three miles of the Dewey Tunnel Mine is a destination "ghost town" attracting tourists to the area. Recreational and tourist activities are common mostly after snow melts and typically begin in April and continue through to the first snow fall (typically in late October). Based on site observations, recreational activities include wading in Jordan Creek, soaking, and possibly swimming. Other activities may include fishing.

## 1.5 Summary of Previous Site Investigations

Based on information provided to the Project Team, there have been three environmental site investigations in the Jordan Creek Valley near the Dewey Tunnel and Blue Gulch mines prior to the current investigation. The investigations include studies conducted by the Environmental Protection Agency (EPA), date unknown; CH2M Hill (1994) Environmental Impact Statement (EIS) for the Stone Cabin Mine, and mercury study conducted by Ecology and Environment in September 2000. In addition to these studies, there have been visual reconnaissance studies conducted by the State in 1997, 1998, and 2000.

### *1.5.1 Environmental Studies*

The EPA performed a screening assessment of Jordan Creek. Based on the information provided to the Project Team it was difficult to determine the exact year the study was conducted. EPA collected and analyzed a water sample from Jordan Creek between Blue Gulch and Booneville Gulch. This sample was analyzed for most of the target analytes list of metals in both total and dissolved form. Only iron and aluminum were detected at levels above detection limits called for in the contract. However, barium, calcium, lead, magnesium, potassium, and sodium were detected. This was a screening level assessment that used higher detection limits than the current study. EPA supported this effort with eight sediment samples collected in the Dewey Tunnel Mine area. Four of these samples were collected near the water sampling station. Of the other four, one each was collected in Boonville and Blue Gulches, and two were collected in Jordan Creek between Blue and Boonville Gulches. Sediment analysis used the X-Ray fluorescence technique. This technique can be deployed in the field and is suited to screening level analyses. However, it does not achieve the accuracy of detection limits of laboratory methods. Of the 17 metals tested for, all were detected in at least one sample (except nickel). Refer to Appendix B for additional information.

In 1994 CH2M Hill completed an environmental impact statement concerning the Stone Cabin Mine. This document was prepared to support a plan by the Kinross DeLamar Mining Company to open an open pit gold and silver mine on Florida Mountain. The proposed site was located above the Dewey Tunnel and Blue Gulch Mines. Water was sampled from Jordan Creek below Blue Gulch and from Blue Gulch (twice per year in June and August) between 1987 and 1992. On seven dates between 1987 and 1990 the discharge from the Blackjack Mine was sampled. In 1988 benthic invertebrates and redband trout from Jordan Creek were sampled in several tributaries including Blue Gulch. Tissue from the redband trout was analyzed for trace metals. Refer to Appendix C for additional information.

In September 2000 Ecology and Environment, Inc. collected soil and sediment samples at the Dewey Tunnel Mine site. Twelve sediment samples were collected and analyzed, eleven from Jordan Creek and 1 from Booneville Gulch. Soil sample collection included ten samples from the waste rock and Mill sites at Dewey Tunnel Mine. Samples were only analyzed for Mercury. Mercury concentrations in the soil were higher than those in the sediment. The soil concentration had large variability, varying from about 1 mg/Kg at the top of the mill structure to 247 mg/Kg near the lowest footing of the mill. Given this distribution, it seems likely the mercury originated from the amalgamation process in the mill. Refer to Appendix D for additional information.

### *1.5.2 Site Reconnaissance*

During 1997, IDL staff conducted a site reconnaissance at the Dewey Tunnel Mine to determine the source of the acid rock drainage reported to the Department from personnel at Kinross-DeLamar Mining Company. Department staff identified a white precipitate on the rocks of Jordan Creek near the mouth of Blue Gulch. It was assumed to be a result of the acid rock drainage. Staff traversed Jordan Creek upstream until the color of the creek

returned to normal. The white precipitate ended at a spring on the left bank of Jordan Creek just above the Dewey Mill. Approximately one half mile of Jordan Creek was discolored. Fish were observed below Blue Gulch, but not in the discolored area between Blue Gulch and Dewey Tunnel Mine. The discoloration was also observed on July 7, 1998 by Department staff. On this day the left side of the creek was white for several hundred feet downstream of the spring. The creek was not discolored above the spring. During a year 2000 inspection, Department staff noted the same discoloration of the acid spring. The toe of the waste rock pile was reported to extend to a point just above the high water line marked by vegetation. The flow rate was difficult to estimate due to the broad zone of discharge (about 15 feet), but was estimated to be tens of gallons per minute and discharges directly into Jordan Creek. Based on site observations at the time, pyrite was present in some of the waste rock pile. It did not appear that the springs or seeps below the waste rock pile were acidic.

It was believed that the spring origin was from the Dewey Tunnel Mine. While no surface drainage is evident at the portal, the healthy vegetation suggests that subsurface water is present. The eroded waste rock dump by the portal also suggests some surface or subsurface drainage in the past. Other potential sources of water may be a small gully uphill from the waste rock pile.

During field reconnaissance of the Blue Gulch Mine site by IDL staff, the Blue Gulch creek was observed to be a bright red color.

# 2. SUMMARY OF SITE INVESTIGATION

## 2.1 APPROACH

The field crew consisted of a representative from the USACE, the project manager from David Evans and Associates, a surveyor from Quadrant Consulting, and three LTI field staff. Quadrant staff recorded locations for key site features and sample locations while LTI, USACE and DEA staff recorded site observations and collected water and soil, waste rock, sediment, and tailings samples. A second purpose of the survey effort was to identify public and private land ownerships for the sites. The project approach is described in detail in Appendix E.

### *2.1.1 Field Survey*

The survey of the sites was designed to establish a base map identifying key features of the sites and locations for sampling events. A second goal was to clearly establish public and private property boundaries. Concurrent with sample collection a surveyor from Quadrant Consulting recorded sampling location using a Trimble Geo Explorer II GPS system. This system provides positions to within +/- 2 m horizontal accuracy and several meters in vertical accuracy. The surveying crew returned on October 11$^{th}$ and October 16$^{th}$ and determined the position of structures and the extent of the waste rock and tailing piles. This work was done using a Sokkia Total Station instrument. Concurrent with the topographic and site surveying on the 11th the survey crew also tied the survey to a an NGS control monument "Florida" using a Sokkia Radian GPS system. This allows more accurate position determination, the new horizontal accuracy is +/- 0.1 foot horizontal and 0.2 foot vertical. Location data was used by Quadrant to produce maps using AutoCAD software.

### *2.1.2 Field Sampling*

Fieldwork was done in accordance with the *Sampling and Analysis Plan* (*SAP*, August 2001, refer to Appendix F) developed for this project. Data collection occurred on August 27, 2001 and August 28, 2001. Work on August 27$^{th}$ centered on the Dewey Tunnel Mine Site. The majority of samples taken at the Blue Gulch Mine site investigation occurred on August 28$^{th}$. Some additional soil samples were taken at the Dewey Tunnel site on August 28$^{th}$ as well.

#### 2.1.2.1 Water Samples

At each water sampling station four water samples were collected. These were designated for analysis for total metals, dissolved metals, mercury and arsenic. Samples were dipped using a plastic cup from pools in the center of streams. Samples came from areas of the stream that had steady flow and were not stagnant. Sample bottles were prepared by Columbia Analytical Services. Sample volumes were:

- Mercury 500 ml
- Arsenic 500 ml
- Total metals 1 liter
- Dissolved Metals 1 liter

The sample bottles were sealed with Teflon tape. Immediately after collection, bottles were placed in zip-loc bags and placed in coolers with ice. The samples were kept in the control of the field crew until the afternoon of August 28, 2001 when they were shipped by airfreight to Columbia Analytical Services in Kelso, Washington.

#### 2.1.2.2 Sediment, Rock, Soil, Tailings Samples

The solid samples included rock, soil, tailings, and sediment. The sampling procedures for each of these solids were essentially identical. Samples were taken using a stainless steel scoop and placed into glass bottles with plastic lids. Scoops were rinsed with distilled water between each sample collection. Surface material was removed prior to sampling so the solid samples came from approximately 5 to 10 cm below the surface. Sample bottles were placed in plastic bags then placed in cooler with ice. During all sampling, personnel wore plastic gloves that were discarded and replaced between each sample collection.

#### 2.1.2.3 Field Measurements

In addition to collecting water samples, some measurements of water properties were made in the field. At each station temperature, conductivity, pH, and turbidity were measured. When flows were large enough to produce meaningful values, flow was also measured. Temperature, conductivity, and pH were measured using a Quanta Water Quality Monitoring System. The Quanta was calibrated with buffered solutions with pH's of 7 and 10. Turbidity was measured using a Hach Model 2100P portable turbidmeter. Because of the inherent variability of stream turbidity, duplicate turbidity samples were collected and two replicate turbidity readings were recorded for each sample. Flow was measured using a Marsh McBirney Flo-Mate model 2000 electromagnetic flow meter. For flow measurements, stream velocity and water depth were measured at one-foot intervals across the stream.

### *2.1.3 Laboratory Analysis.*

All samples arrived at Columbia Analytical Services Laboratory in Kelso, WA on August 29, 2001. Samples were logged in and compared with the chain of custody forms sent with the samples. One cooler had experienced a temperature rise and was at 9 degrees C, which is above the specified temperature of 4 degrees C. It was decided that the impact of this should not be significant and samples were retained and analyzed. Field stream temperatures measurements ranged from 8 degrees C to 25 degrees C.

In both water and solids, metals were analyzed using two methods, EPA 6010B (inductively coupled plasma-atomic emission spectrometry ICP-AES) and EPA 200.8 (inductively coupled plasma – mass spectroscopy ICP/MS). ICP-MS achieves lower detection limits but performs poorly for metals found in higher concentrations. For these metals ICP-AES is the preferred method. Two substances require different techniques for the metals. Cyanide is measured by EPA 335.2 (titrimetric, spectrophotometric method) in water and EPA 9010B (reflux distillation procedure) in solids. Mercury analysis used EPA 1631 (oxidation purge and trap followed by cold-vapor fluorescence spectrometry) in water and EPA 7471A (manual cold vapor technique) in soils.

## 2.2 SITE OBSERVATIONS

Field staff conducted site investigations at the Dewey Tunnel Mine and Blue Gulch Mine on August 28th and 27th 2001. Site investigators entered the sites via Silver City Road and Blue Gulch Road. Silver City Road and Blue Gulch Road are unimproved roads. Field crew consisting of USACE staff, DEA project manager, and LTI staff were tasked with recording site observations and collection of solid materials and water sampling. At the time of the sampling, a forest fire had begun on the west side of Florida Mountain and by the end of the sampling engulfed 6,500 acres outside of Silver City. Recreationists and tourists were being evacuated. Field crews were alerted to leave the site should the fire spread to the ridge just above the mining sites.

### *2.2.1 Dewey Tunnel Mine*

#### 2.2.1.1 Description of Structures

**Dewey Hotel.** A low concrete foundation marks the site of the former Dewey Hotel located southeast of Booneville Gulch Creek and north of the Silver City Road. The building foundation is all that remains.

**Transformer House**. The foundation, floor slab, and walls are located southeast of where the mill access road crosses Jordan Creek. Downhill from the transformer house and near the bank of Jordan Creek there was evidence of a blue-green substance sprayed on plants and the ground. The composition and use of the material were not readily apparent. Campsites were present just in front of the transformer house and to the east side.

**Main Mill Building**. A stone foundation is west of the transformer house and consists of several flat levels stepping up the hill with stone walls at the back of them. Some large concrete footings are present near the bottom of the foundation and north of the mill access road.

**Upper Mill Building.** The lower part of the upper mill building is still partially intact. A grizzly made of cut rail is present at the top of the structure, and a chute from the grizzly dumps out of the middle of the north wall. Historic photos show a trestle leaving the west side of the upper mill building, to transport ore to the lower building. A metal door that slid up and down is present on the outside of the wooden chute. This appears to

be the chute from the original mill operation. A yellow framework and a rough metal trough are present below the upper building. They may be associated with the more recent mining operation.

**Portal of Dewey Tunnel** . The adit is caved in and shut. A collapsed trench about 100 feet long leads uphill from the portal. Timbers are present in the collapsed trench. Willows and sedges are present in the portal area. There appears to be timber remnants located west of the portal.

**Mystery Mill.** The remains of another mill are present at the east end of the main waste rock pile. The structure is just below Blue Gulch Road at the mouth of a tributary to Jordan Creek. The remains of 4 levels built into the mill are evident. Ore appears to be dumped onto the inclined plane in the upper wooden structure. A metal bin was present on the downhill side of the upper structure. A flat landing with concrete footings is present just below the second wood structure. Another flat area is present below the footings. Lots of wooden boards and structural debris are present on the last two levels. Some ceramic insulators and breakers are present suggesting the use of electrical power. Crushed white rhyolite is present throughout the lower part of the mill area. The mill is presumed to have been built after 1929 and is believed to be associated with the work done by Morrison-Knudsen in 1939.

### 2.2.1.2 Description of Waste Materials

**Main Waste Rock Pile.** The main waste rock pile stretches from the upper mill building eastward to an unnamed tributary canyon on the south side of Jordan Creek. The Blue Gulch Road is located on the top of the waste pile. The waste pile is about 1,400 feet long and varies in width from 50 feet to approximately 250 feet. The pile is 60 feet thick on the west end. A color change is apparent in the pile about 100 feet east of the acid spring. Waste material on the east side is overall a gray color, while waste material on the west side is an orange color. About 60 feet west of the acid spring is a deep wash out that starts at the road and extends to the base of the pile. A large debris fan is present at the base of the washout, and it pushes Jordan Creek northward against the Silver City Road. Another washout is present 50 feet west of the first one. If also starts at the road and extends to the base of the waste pile. A low area where water has the potential to accumulate is present on the road and extends to the base of the waste dump. The former portal to the adit is also just south of this low area. Willows and hydrophilic vegetation are present at the end of the collapsed adit. Waste rock is located near Jordan Creek where the acid spring discharges out the base of the waste rock pile. There is sparse vegetation growing from the pile. The pile consists of sand-sized material and smaller as well as bits of rock.

**Cone Shaped Pile.** At the northwest corner of the main waste rock pile is a conical pile of material that appears more refined than that found in the main waste rock pile. The material is believed to have been placed here after 1929. The pile is located just downhill and slightly east of the upper mill building. The material forms a cone about 40 feet high that appears to be placed on top of the main waste rock pile. No vegetation is growing

from this pile while the waste rock pile has sparse vegetation. The conical pile does not contain much sand-sized material. The cone pile contains some rounded rocks, bits of metal and frosted glass shards.

**Mystery Mill Tailings.** This pile is just north of the Mystery Mill near the east end of the main waste rock pile. The material forms a debris fan that starts near the base of the mill foundation and extends to Jordan Creek. The material is white rhyolite crushed to a minus four-inch size, similar to what is found in and around the remains of the mill. Based on the nature of the material and proximity to the mill, this material is believed to be tailings from the mill. Aside from crushing and screening, the milling process is unknown. The tailings have pushed Jordan Creek against the north side of the valley, and the northeast corner of the tailings cone is being actively eroded by the creek. A healthy stand of Douglas fir is present on the tailings and there is no sign of stressed vegetation or staining.

**Sand Pile**. A pile of material is present west of the main mill building south of Jordan Creek. The pile rests at the angle of repose 20 feet above the floodplain of Jordan Creek. The pile contains mostly sand –sized particles of granite and rhyolite. A large erosion cut is present on the west side of the pile. Vegetation on the sandy material does not appear stressed. The northeast corner of the pile is right next to Jordan Creek. The pile of material may be tailings. The elevation of the pile is above the base of the main mill foundation, and the pile is believed to have been placed after 1929 and not related to the mill operation.

### 2.2.1.3 Description of Water Features

**Dewey Tunnel Seeps.** There are four seeps evident from the base of the waste rock pile at Dewey Tunnel Mine. The four seeps are within a seven foot area and each seep was separated by approximately one foot.

**Mystery Mill Spring.** A spring is located at the east end of the main waste rock pile and below the mill building. Vegetation appears healthy and there is no staining or precipitates.

**Jordan Creek**. Recreational use of Jordan Creek was not observed at the time of the site visit. However, rocks were placed in circles in the creek to retain water possibly for swimming, wading and/or bathing. The first "circular" rock feature is near Mystery Mill and the second "circular" rock feature is located near Dewey Tunnel Mine just upstream from the seeps. Upstream from Mystery Mill a single red-band trout was observed prior to the Silver City Road crossing. Downstream from the 4 seeps there is present a white milky substance. The concentration of the milky substance increases approximately 20 feet downstream from the seeps and is evidenced on in-stream rocks and debris. Approximately 25 feet downstream from the seeps, there is a natural pool created by a small debris pile at the west end which allows the pool to become stagnant with brackish water and increased milky material. Grazing is permitted in the area and 5 cows were observed entering Jordan Creek to drink near the stagnant pool. Approximately 1.5 miles

downstream from the stagnant pool there is a small homestead that appears to provide year-round housing for adults, children and domestic pets.

### *2.2.2 Blue Gulch Mine*

The Blue Gulch mine is located in a draw on the east side of Blue Gulch called Negro Gulch. Very little is known about the history of mining at Blue Gulch Mine. Extraction appears to be the primary operation at the site as evidenced by a large waste rock pile and several small dilapidated structures. There was no evidence of beneficiation associated with the structures at Blue Gulch Mine; only a waste rock pile resulting from extraction was present.

#### 2.2.2.1 Description of Structures

**Portal of Blue Gulch.** The portal is located at the top of the waste rock pile The adit is partially collapsed and timbers are present in the collapsed adit.

**Unnamed Structure.** A small building is located adjacent to the collapsed adit.

**Unnamed Structure.** A structure comprised of timbers and metal sheeting is partially collapsed to the north of the adit. The use of this structure is unknown.

**Unnamed Structure.** A partially collapsed structure is located above the Blue Gulch Mine tunnel and is believed to be the remnants of an old office building.

#### 2.2.2.2 Description of Waste Materials

**Waste Rock Pile.** The waste rock pile is located on the west side of the adit and its tip extends into the confluence of Blue Gulch Creek and Negro Creek. It is approximately 200 feet long and 100 feet high.

#### 2.2.2.3 Description of Water Features

**Springs and Seeps.** There are no springs that were evident at Blue Gulch Mine nor were seeps observed from the waste rock pile.

**Negro Gulch.** Negro Gulch is located to the north and east of Blue Gulch Mine. The streambed was primarily dry except for a low flow approximately half-way up the creek .

**Blue Gulch.** Blue Gulch is located to the west of Blue Gulch Mine. A low flow was observed. The water appeared clear and presence of "red" rocks in the streambed gave the appearance of a red stream.

**Cow Pond.** The cow pond is located above Blue Gulch Mine and just below the DeLamar Mine. There are no apparent inlets and outlets. The pond was approximately 25 feet in diameter and contained brackish water. Based on observed cow piles near the pond, it was apparent that cows drank from the pond.

## 2.3 SAMPLE LOCATIONS AND RATIONALE FOR SELECTION

Field sampling was conducted in accordance with the SAP. Specific sample locations were based on site conditions during the site investigation. Site hydrology and historical mine operations primarily drove sampling location selection. Selection of water sampling locations considers that precipitation on Florida Mountain either enters streams directly as runoff or infiltrates into the ground then comes to surface again through springs and seeps before entering Jordan Creek. Tributaries to Jordan Creek such as Blue and Negro Gulches alternately flow submerged and on the surface depending on streambed conditions. Phase 1 conditions were considered during the development of the SAP. Discussion of each sampling location references sample names and locations follows. Table 2.3-1 summarizes the samples collected and analytes evaluated.

## Table 2.3-1: Samples Collected, August 2001, Dewey Tunnel and Blue Gulch Mines

| Soil Samples | Sample Type | Composited Samples | Date | Location | Cyanide[a] |
|---|---|---|---|---|---|
| **Dewey Tunnel** | | | | | |
| WDES1 | R | | 8/27/2001 | East side of waste dump | N |
| WDES2 | R | | 8/27/2001 | East side of waste dump | N |
| WDES3 | R | | 8/27/2001 | East side of waste dump | N |
| WDWS1 | R | | 8/27/2001 | West side of waste dump | N |
| WDWS2 | R | | 8/27/2001 | West side of waste dump | N |
| WDWS3 | R | | 8/27/2001 | West side of waste dump | N |
| CONEP | R | CONEP & CONEP2 | 8/27/2001 | Cone Pile | Y |
| CONEP2 | R | | 8/27/2001 | Cone Pile | |
| MMTPAU | R | | 8/27/2001 | Mystery Mill above upper | N |
| MMTPU | R | | 8/27/2001 | Mystery Mill upper | N |
| MMTP-BL | S | | 8/27/2001 | Mystery Mill below lower | Y |
| MMTP-M | S | MMTP-M & MMTP-L | 8/27/2001 | Mystery Mill middle | Y |
| MMTL-L | R | | 8/27/2001 | Mystery Mill lower | |
| SANDP | R | | 8/27/2001 | Sand Pile | |
| MF03 | S | | 8/28/2001 | Main Mill | Y |
| DTJCUS - SED | Sd | | 8/27/2001 | Jordan Creek upstream | N |
| DTJCSEEP2 SED | Sd | | 8/27/2001 | Seep 2 | N |
| DTJCDS-SED | Sd | | 8/27/2001 | Jordan Creek downstream | N |
| | | | | | |
| **Blue Gulch** | | | | | |
| BGR11 | R | BGR11& BGR12 & BGR13 | 8/27/2001 | Upper rock pile | N |
| BGR12 | R | | 8/27/2001 | Upper rock pile | |
| BGR13 | R | | 8/27/2001 | Upper rock pile | |
| BGR21 | R | | 8/27/2001 | Lower rock pile | N |
| BGR22 | R | | 8/27/2001 | Lower rock pile | N |
| BGSD1-b | Sd | | 8/28/2001 | Blue Gulch upstream | N |
| BGSD1-a | Sd | | 8/27/2001 | Wash above lower rock pile | N |
| BGSD4 | Sd | | 8/28/2001 | Blue Gulch downstream | N |
| | | | | | |
| **Water Samples** | | | | | |
| **Dewey Tunnel** | | | | | |
| DTJCUS | W | | 8/27/2001 | Jordan Creek upstream | Y |
| MMSEEP | W | | 8/27/2001 | Mystery Mill Seep | Y |
| DTSEEP1 | W | DTSEEP1 & DTSEEP2 | 8/27/2001 | Seep below rock pile | Y |
| DTSEEP2 | W | | 8/27/2001 | Seep below rock pile | Y |
| DTSEEP2+100 | W | | 8/27/2001 | Jordan Creek near seep | Y |
| DTJCDS | W | | 8/27/2001 | Jordan Creek downstream | Y |
| | | | | | |
| **Blue Gulch** | | | | | |
| NG2 | W | | 8/28/2001 | Negro Gulch between piles | Y |
| NG3 | W | | 8/28/2001 | Blue Gulch at Negro Gulch | |
| BGC1 | W | | 8/28/2001 | Blue Gulch upstream | Y |
| BGC3 | W | | 8/28/2001 | Blue Gulch downstream | Y |
| COWP | W | | 8/28/2001 | Cow Pond | Y |

*Note: R = rock; S = soil; Sd = sediment; W = water.*

***a Analytes other than CN were the same for all samples. The samples with a "Y" in the Cyanide column were analyzed for Cyanide while the ones with the "N" in that column were not. Total but not dissolved Cyanide was analyzed for in water samples. Water samples were analyzed for total and dissolved Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc. Dissolved potassium values are corrupted (see Appendix J)***

### 2.3.1 Dewey Tunnel Mine

At the Dewey Tunnel Mine site the only flowing water located on August 27th and 28th was close to Jordan Creek. Therefore, water samples were collected from Jordan Creek upstream (sample DTJCUS, the upper blue star on Figure G-1 in Appendix G) from the mine and downstream (sample DTJCDS the blue star on the lower right corner of Figure G-2 in Appendix G) of the mine. These samples bracket Dewey Tunnel Mine and provide an overall view of potential impact to Jordan Creek from the area disturbed by the historic mine operations. One seep located downhill from the Mystery Mill Mine site appeared to come from the Mystery Mill Area (MMSEEP, the blue star in the lower left corner of Figure G-1 in Appendix G). A discreet sample was taken at the Mystery Mill seep. In order to capture a quantity of water necessary for analysis, a small pit was dug. As water from the seep accumulated in the pit, samples were taken. A wash above the Mystery Mill may have carried water that fed the Mystery Mill seep during high flow conditions. However, it was dry during August 27th and 28th 2001.

Water samples were taken from two of the four seeps at the base of the waste rock pile directly in front of the adit to determine potential impacts from water flowing into Jordan Creek from the seeps. Two samples were collected from a series of four seeps from below the waste rock pile (DTSEEP1 and DTSEEP2, the two blue stars that are close together in Figure G-2 in Appendix G) . The two samples were taken about 7 ft apart from the seeps in front of the waste rock pile were composited prior to analysis to form sample DTSEEP1&2Comp. No surface water was present uphill from the waste rock pile. Water flowing into the series of DTSEEPseeps may have come from the mine adit but, again, no water source was observed. A final water sample was taken from Jordan Creek about 100' downstream from the seeps (DTSEEP2+100, the leftmost blue star in Figure G-2 in Appendix G). This area was identified as being a milky color by the survey performed by the State of Idaho in 2000. At the time of sampling, the milky substance was evident and increased in concentration as the Jordan Creek entered into a stagnant pool. The water sample was taken just upstream from the stagnant pool.

Stream sediments were collected in Jordan Creek upstream (DTJDUS-SED, the yellow star in Figure G-2 in Appendix G), downstream (DTJDUS-SED, the yellow star in the lower right corner of Figure G-2 in Appendix G), and at the site near the seeps (DTJCSEEP2-SED, the yellow star in the center of Figure G-2 in Appendix G).

Soil and rock were collected from each material group: waste rock pile, mine tailings, and soils. A waste pile extending from the mill complex on the west to the Mystery Mill on the east dominates the site. This waste pile appears as two sections of exposed earth with a vegetated region separating them. The eastern section is grayer in color. The western section is reddish orange in color which may be due to greater oxidation of the exposed waste rock. The color change may also be due to a change in rock type encountered during the Dewey tunnel excavation. Three samples were collected from each section but only the middle sample from each side was analyzed (samples WDES3, WDES2, WDES1, WDWS3, WDWS2, WDWS1 are the row of 6 stars extending from left to right across the upper center of Figure G-2 in Appendix G).

The sampling plan for the eastern side of the site near the Mystery Mill considered the milling process. Ore enters a mill at the uphill end and waste rock exits from the downhill end. Different sections may produce different waste products. Five soil/rock samples were collected from above to below the Mystery Mill (MMTP-BL MMTP-L MMTP-M MMTP-U MMTP-AU) and are shown by the orange and brown stars that extend from left to right across Figure G-1 in Appendix G). The two samples from lower center region of the mill (MMTP–M and MMTP-L) were composited to create MMTP-M&L.

Sample collection on the west side targeted areas containing identifiable materials. These areas included a cone shaped pile, a sand pile, and the area where the mill stood. Two samples were collected from a cone shaped pile above the mill (CONEP and CONEP2 depicted by the two smaller orange stars in the center right of Figure G-2 in Appendix G). These were composited to create sample CONEP Comp. One sample was collected from the sand pile closer (SANDP, the orange star on the extreme right side of Figure G-2 in Appendix G) to the river at the far eastern end of the site. A sample from the mill site was collected on the river side of the lowest footing of the mill where high levels of mercury were detected during summer 2000 by Ecology and Environment (MF03, the red star in the center of Figure G-2 in Appendix G)

### *2.3.2 Blue Gulch Mine*

Sample location identification in the Blue Gulch mine followed the same conceptual process. Figure G-3 in Appendix F shows Blue Gulch which flows from right to left. Negro Gulch is the draw that extends up the center of the picture. The highest water source located is a small pond apparently used for watering livestock (COWP the highest blue star on Figure G-3 in Appendix G) . There is no evident inlet or outlet to this pond but water appeared intermittently in Negro Gulch further downhill from the cow pond. The small amount of water in Negro Gulch (NG2 the blue star closest to the center of Figure G-3 in Appendix G) provided the only sample location. The sampling plan called for a water sample to be collected from Negro Gulch where it enters Blue Gulch. Because no water was flowing in Negro Gulch at this location, a sample was collected at its confluence with Blue Gulch (NG3, The blue star in the lower right corner of Figure G-3 in Appendix G that is furthest away from the yellow star). This sample was not analyzed because it was not believed to be representative of the conditions on Negro Gulch.

Blue Gulch contained flowing surface water to just above the confluence with Negro Gulch. Extensive placer mining activity has disrupted Blue Gulch's creek bed beyond the furthest extent of where surface water was present in August 2001. A water sample was collected at the furthest upstream location in Blue Gulch where surface water was present (BGC1, the rightmost blue star in Figure G-3 in Appendix G although the actual sampling location was probably to the right of the area shown in the picture). Placer mining activity has divided Blue Gulch into two channels. Water samples BGC1 and NG3 were collected from the channel on the east side, into which Negro Gulch flows. The final water sample in Blue Gulch was collected downstream of likely local impacts

for the Negro Gulch mining activity (BGC3, the leftmost blue star in Figure G-3 in Appendix G). The downstream location was immediately upstream of an old road crossing to facilitate access yet avoid impacts from the road.

Soil and sediment samples in Negro Gulch attempted to characterize solid material that might affect water quality. Three samples were collected from the waste pile directly below the cow pond and above the adit to the mine (BGR11, BGR12, BGR13. Samples are indicated by the three orange stars that are close together in the upper center of Figure G-3 in Appendix G. BGR11 is to the left in Figure G-3 in Appendix G and BGR13 is to the right). Water flows over this area to reach Negro Gulch. These three samples were composited before analysis to create sample BGR 11,12,13 Comp. Above the lower waste pile a flat area has a dilapidated structure. Although this area was dry, it contained a wash where water had flowed in front of the structure. A sediment sample was collected from this wash to identify potential impacts arising from the structure area (BGSD1 the yellow star in the center of Figure G-3 in Appendix G). Two soil samples were collected from the waste pile above Blue Gulch. BGR21 and BGR22 are shown by the two orange stars in the center of Figure G-3 in Appendix F with BGR21 the rightmost in Figure G-3 in Appendix G) Two sediment samples were collected from Blue Gulch, one above Negro Gulch and one below. (BGSD1 is the rightmost yellow star in Figure G-3 Appendix G and BGSD4 is the leftmost yellow star in Figure G-3 in Appendix G)

## 2.4 RESULTS

### *2.4.1 Survey Results*

#### 2.4.1.1 Property Ownership

Based on an initial review of survey results the following land ownerships (refer to Figures H-1 and H-2 in Appendix H) were determined:

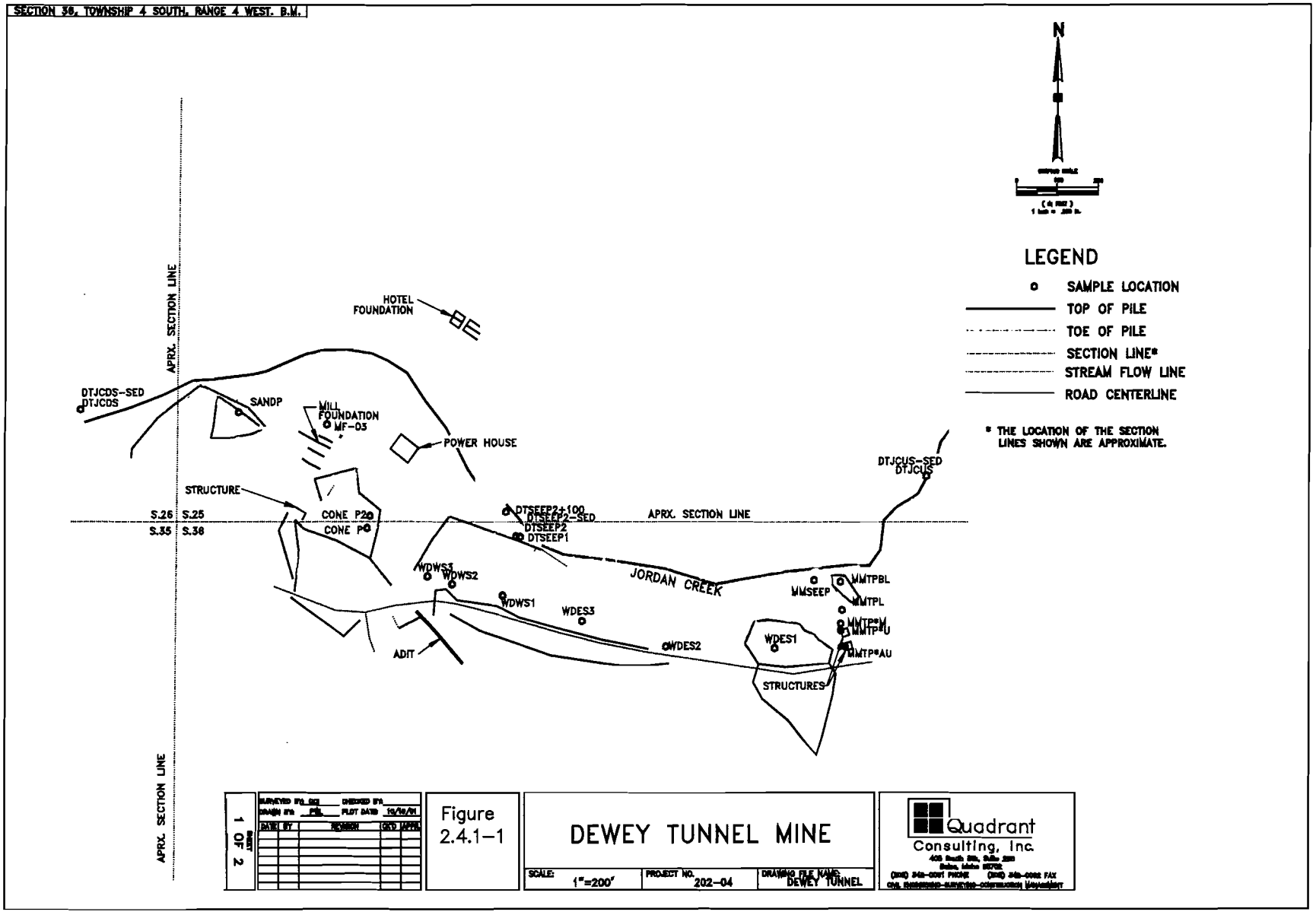
Dewey Tunnel Mine mill is located on private land (Rough and Ready Claim), and a large waste rock pile is located on both private land (Gordon Claim, Seventy-Nine Claim, and Palm Beach Inn Claim), and state land. The east and west ends of the waste rock pile are on private land. The center section of the pile, including some of the orange waste rock, is on state land. The collapsed adit appears to be on private land (Gordon Claim). The Dewey Hotel is located on private land as is the transformer house (Rough and Ready Claim, Seventy-Nine Claim). The portal of Dewey Tunnel also is located on private land (Gordon Claim). The cone shaped pile material is also on private land (Gordon Claim). The west half of the sand pile at Dewey Tunnel Mine is on BLM land and the east half is on private land (Caliph of Baghdad Claim).

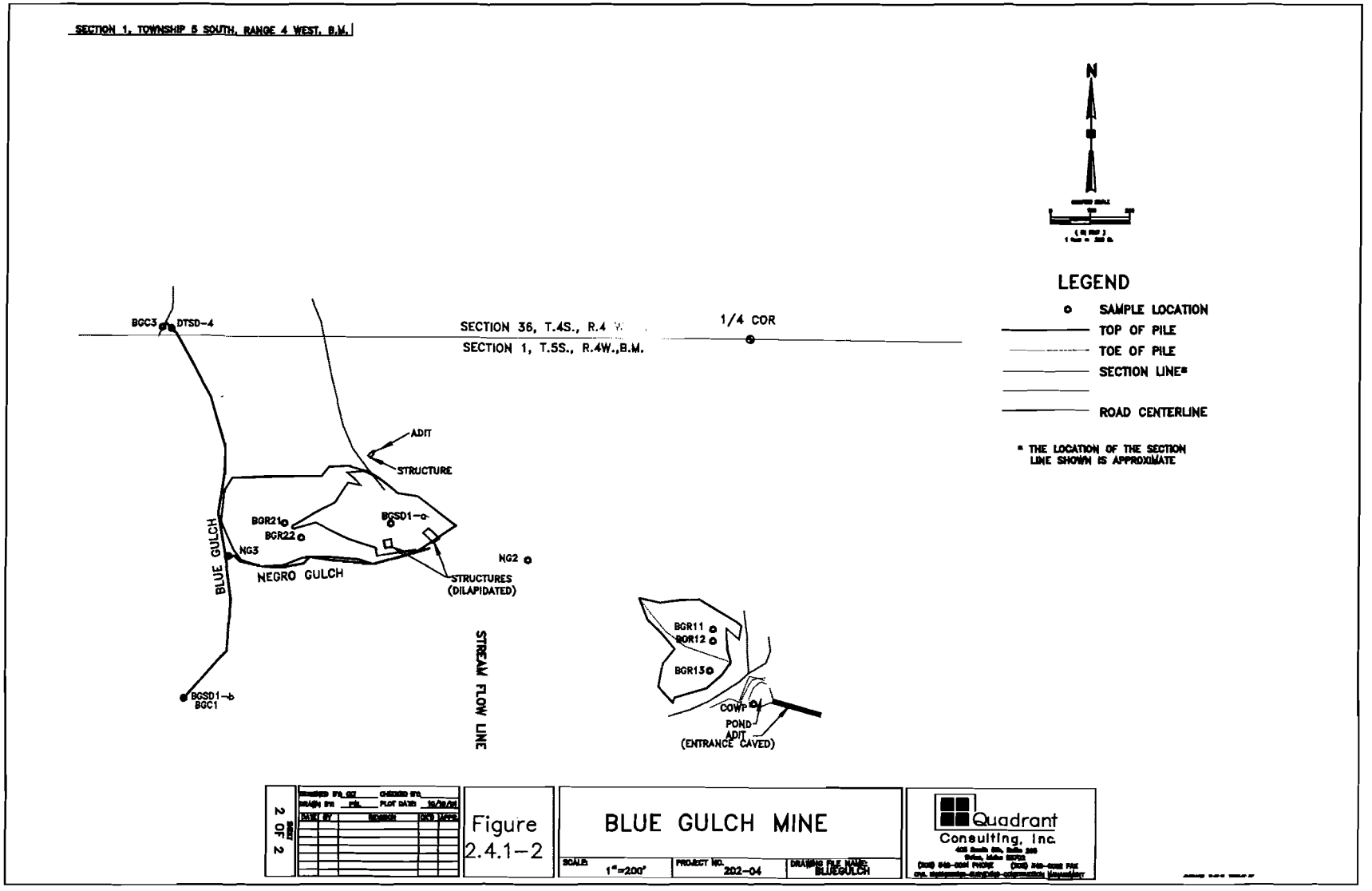
The Mystery Mill is located on a patented claim separate from the Dewey Tunnel Mine site. The building is located on private land (Palm Beach Inn Claim). The Mystery Mill spring appears to be on private land.

The cow pond above Blue Gulch Mine is on private land (Independence Claim). The Blue Gulch Mine structures are located on private land (Economy Claim). It appears that the adit to Blue Gulch Mine is located on BLM land as is a portion of the waste rock pile. The majority of the waste rock pile is located on private land (Industry Claim). It appears that Blue Gulch mine is not located on state land.

### 2.4.1.2 Base Map

The data generated by the surveying effort to indicate sample locations and significant site features were integrated into AutoCAD files to develop a base map. Plates 1 and 2 (refer to Appendix I) depict sample locations overlaid onto aerial photos for the two sites. Figures 2.4.1.2-1 and 2.4.1.2-2 identify sample locations.


SECTION 36, TOWNSHIP 4 SOUTH, RANGE 4 WEST. B.M.
N
LEGEND
SAMPLE LOCATION
TOP OF PILE
TOE OF PILE
SECTION LINE*
STREAM FLOW LINE
ROAD CENTERLINE
* THE LOCATION OF THE SECTION LINES SHOWN ARE APPROXIMATE.
APRX. SECTION LINE
HOTEL FOUNDATION
DTJCDS-SED
DTJCDS
SANDP
MILL FOUNDATION MF-03
POWER HOUSE
STRUCTURE
CONE P2
CONE P
S.26
S.25
S.35
S.36
DTSEEP2+100
DTSEEP2-SED
DTSEEP2
DTSEEP1
APRX. SECTION LINE
DTJCUS-SED
DTJCUS
JORDAN CREEK
WDWS3
WDWS2
WDWS1
WDES3
WDES2
ADIT
WMSEEP
WMTPBL
WMTPL
WMTP*W
WMTP*U
WMTP*AU
WDES1
STRUCTURES
APRX. SECTION LINE
SHEET 1 OF 2
Figure 2.4.1-1
DEWEY TUNNEL MINE
SCALE: 1"=200'
PROJECT NO. 202-04
DRAWING FILE NAME: DEWEY TUNNEL
Quadrant Consulting, Inc.


SECTION 1, TOWNSHIP 5 SOUTH, RANGE 4 WEST, B.M.
N
LEGEND
SAMPLE LOCATION
TOP OF PILE
TOE OF PILE
SECTION LINE*
ROAD CENTERLINE
* THE LOCATION OF THE SECTION LINE SHOWN IS APPROXIMATE
BGC3
DTSD-4
SECTION 36, T.4S., R.4 W.
SECTION 1, T.5S., R.4W.,B.M.
1/4 COR
ADIT
STRUCTURE
BGR21
BGR22
BGSD1-a
NG3
NG2
BLUE GULCH
NEGRO GULCH
STRUCTURES
(DILAPIDATED)
STREAM FLOW LINE
BGSD1-b
BGC1
BGR11
BGR12
BGR13
COWP
POND
ADIT
(ENTRANCE CAVED)
2 OF 2
Figure
2.4.1-2
BLUE GULCH MINE
SCALE
1"=200'
PROJECT NO.
202-04
DRAWING FILE NAME
BLUEGULCH
Quadrant
Consulting, Inc.

### 2.4.2 Field Measurements

Measurement of parameters in the field includes pH, conductivity, temperature, flow and turbidity. Table 2.4.2-1 presents data on pH, conductivity, temperature, flow, and turbidity collected concurrently with sample collection. The pH is defined as the negative of the logarithm of the concentration of hydronium ions. Lower pH indicates more acidic conditions and higher pH indicates more basic conditions. A neutral solution has a pH of 7. Acid water can be harmful to aquatic life and also effective at mobilizing metals. Acid mine water may therefore have higher concentrations of pollutant metals. Conductivity increases as more ions become dissolved in water. The ions may or may not be harmful. Lower temperature has been found to be important to the survival of several species of Salmonids. Turbidity is a measure of the optical clarity of water, which is a strong function of the concentration of suspended solids. Pollutants can attach to suspended solids.

**Table 2.4.2-1. Water Quality Parameters – Field Measurements**

| Sample | pH | Conductivity umho | T °C | Flow cfs | Turbidity NTU |
|---|---|---|---|---|---|
| DTJCUS | 7.5 | 0.042 | 18.0 | 0.04 | 2.08 |
| MMSEEP | 6.9 | 0.070 | 25.6 | a | 232.75 |
| DTSEEP1 | 4.7 | 0.792 | 11.1 | a | 0.32 |
| DTSEEP2 | 5.3 | 0.789 | 10.8 | a | 0.37 |
| DTJC SEEP2-SED | 5.1 | 0.785 | 11.0 | a | 0.27 |
| DTJCSEEP1+100 | 5.5 | 0.381 | 18.1 | 0.06 | 3.56 |
| DTJCDS | 4.9 | 0.497 | 22.3 | 0.07 | 1.09 |
| | | | | | |
| NG-2 | 5.5 | 0.141 | 8.2 | a | 3.25 |
| NG-3 | 4.8 | 0.012 | 13.4 | a | 1.85 |
| BGC3 | 4.8 | 0.182 | 12.2 | a | 1.23 |
| BGC1 | 4.7 | 0.111 | 15.4 | a | 7.49 |
| COWP | 9.0 | 0.008 | 16.8 | a | b |

*Note: (a) Flows were too small to be measured; (b) the COWP turbidity reading was not made because sampling at this site was expedited due to an approaching forest fire.*

Observation of the field data collected at Dewey Tunnel Mine reveals acid conditions coming from the seeps below the waste rock pile. The upstream station in Jordan Creek has a pH greater than 7 but the downstream station has a pH of 4.9. The Mystery Mill seep with a pH of 6.9 does not appear to be contributing acidity to Jordan Creek. However, the Mystery Mill spring was producing very low flow and this low flow appeared to flow through an area rich in organic matter, which may increase the pH of low pH water. Therefore, the pH of the Mystery Mill spring might be lower at higher flow conditions.

The water entering Jordan Creek from the four seeps has high conductivity. The conductivity data shows a pattern of high conductivity water from the location of the seeps and increasing downstream compared to the conductivity of upstream values. Note that the Mystery Mill spring water has low conductivity.

The water entering Jordan Creek from the seeps is significantly colder (11 degrees C) than the Creek water (18 degrees C). Jordan Creek has flow between 0.04 and 0.07 cfs and appears to be increasing in the downstream direction. However the reported increase in flow in the downstream direction may be less than the variability in the measurements. Turbidity measurements can easily be affected by suspended bottom sediments. Care was taken not to suspend bottom sediments in the water collected for turbidity measurements. The seep water is clearer than the creek water but the water from the Mystery Mill spring is very turbid. These measurements present a picture of clear, cold but acidic groundwater from the seeps entering Jordan Creek. The pH and temperature of the water from the Mystery Mill seep are higher when compared to water from the Dewey Tunnel Mine seeps. Conductivity is also significantly less when compared to the Dewey Tunnel Mine seeps. Whether these differences are due to variations when he Mystery Mill seep issues from the ground or whether it is due to the Mystery Mill spring water flowing through a small wetland before sampling is unclear.

Blue Gulch water is acidic although the water from Negro Gulch is a little less acidic. The water from the Cow Pond is quite basic, possible due to processes occurring in the pond. Conductivity of the water from Negro Gulch is less than that in Blue Gulch. Water in Blue Gulch is colder than water in Jordan Creek and turbidity is higher but not excessive.

### *2.4.3 Laboratory Results*

Data results and conclusions are discussed in the context of the Screening Risk Analysis in Section 3. Tables summarizing data results are located in Appendix J together with the CAS laboratory data sheets and the CAS Case Narrative.

# 3. SCREENING RISK ANALYSIS

The results of the screening-level risk analysis are presented below. In general, the following procedures were followed:

- For each environmental medium sampled at the Dewey and Blue Gulch mine sites (*i.e.*, surface water and soil/sediment), maximum-detected concentrations of each metal were compared to screening-level values for human health and ecological endpoints. Metals that exceeded at least one screening level were evaluated further.
- For the human health evaluations, *total* metal concentrations in surface water were compared to the human health criteria, since humans are typically exposed to the total metal concentration in the water column.
- For the ecological evaluations, *dissolved* metal concentration in surface water were used, since the ecological criteria based on effects to aquatic biota are based on dissolved metal concentrations.
- For the human health evaluations, soil and sediment samples were evaluated together since only limited criteria for sediment are available.
- For the ecological evaluations, soil and sediment were evaluated separately.

The following sections summarize the results of the screening risk analysis.

## 3.1 RESULTS OF THE SCREENING ANALYSIS FOR WATER

Table 3.1.1-1 compares the maximum-detected water concentrations (total concentrations) to the minimum (*i.e.*, most conservative) human health-risk based screening levels for water for all risk assessment methods used and described in Appendix K for water. Table 3.1.1-2 compares the maximum-detected water concentrations (dissolved concentrations) to the minimum ecological screening levels for water. Tables 3.1.1-3 and 3.1.1-4 identify specific surface water samples that exceeded criteria for human health and ecological endpoints, respectively, and which criteria were exceeded. Tables K-1 and K-2 (Appendix K) show how the maximum-detected water concentrations compare to all of the screening level values considered in this assessment.

## Table 3.1.1-1. Comparison of Water Concentrations (Total) to Human Health Risk-Based Screening Levels

| | Summary of Water Samples (total) | | | | | | |
|---|---|---|---|---|---|---|---|
| Metal | Detection Frequency | Detection Limit (µg/L) | Minimum Detected (µg/L) | Maximum Detected (µg/L) | Minimum Human Health Criterion (µg/L) | Source of Minimum Human Health Criterion | Minimum Criterion Exceeded? |
| Aluminum | 8/9 | 40 | 478 | 17,100 | 36,000 | Region IX PRG[a] | No |
| Antimony | 9/9 | 0.006 - 0.03 | 0.013 | 0.534 | 50 | MCL[b] | No |
| Arsenic | 9/9 | 0.006 - 0.3 | 0.38 | 15.2 | 0.018 | NRWQC- Water + Organism[c] | Yes |
| Barium | 9/9 | 0.008 - 0.04 | 12.5 | 283 | 1,000 | NRWQC- Water + Organism[c] | No |
| Beryllium | 9/9 | 0.005 - 0.025 | 0.014 | 19.6 | 4 | MCL[b] | Yes |
| Cadmium | 9/9 | 0.005 | 0.009 | 7.59 | 5 | MCL[b] | Yes |
| Calcium | 9/9 | 9 | 3,980 | 89,500 | --- | --- | No |
| Chromium | 6/9 | 0.1 - 0.5 | 0.11 | 11.6 | 100 | MCL[b] | No |
| Cobalt | 9/9 | 0.005 - 0.025 | 0.052 | 64.7 | 2,200 | Region IX PRG[a] | No |
| Copper | 9/9 | 0.04 - 0.2 | 1.01 | 117 | 1,300[d] | MCL[b] | No |
| Cyanide | 0/11 | 3 | ND | ND | 200[e] | MCL[b] | No |
| Iron | 9/9 | 5 | 56.2 | 23,300 | 50 | BLM Camper/Boater/Swimmer RMC[f] | Yes |
| Lead | 9/9 | 0.007 - 0.035 | 0.145 | 67.3 | 15[d] | MCL[b] | No |
| Magnesium | 9/9 | 9 | 664 | 20,600 | 1,500 | BLM Camper RMC[g] | Yes |
| Manganese | 9/9 | 0.4 | 10.1 | 4,010 | 50 | NRWQC- Water + Organism[c] | Yes |
| Mercury | 9/9 | 0.0002 - 0.02 | 0.0052 | 3.92 | 0.05 | NRWQC- Water + Organism[c] | Yes |
| Nickel | 9/9 | 0.1 - 0.5 | 0.27 | 60.5 | 610 | NRWQC- Water + Organism[c] | No |
| Potassium | 9/9 | 40 | 903 | 9,580 | --- | BLM Camper RMC[f] | No |
| Selenium | 1/9 | 1 | 1.1 | 1.1 | 6 | MCL[b] | No |
| Silver | 9/9 | 0.003 - 0.015 | 0.015 | 12.2 | 180 | Region IX PRG[a] | No |
| Sodium | 9/9 | 30 | 2,960 | 9,780 | --- | --- | No |
| Thallium | 9/9 | 0.003 - 0.015 | 0.005 | 0.275 | 2 | MCL[b] | No |
| Vanadium | 1/9 | 5 | 33.6 | 33.6 | 260 | Region IX PRG[a] | No |
| Zinc | 9/9 | 1 | 1.5 | 2,150 | 9,100 | NRWQC- Water + Organism[c] | No |

a US EPA Region IX, 2000
b Maximum Contaminant Level (U.S. EPA, 2001)
c National Recommended Water Quality Criteria (NRWQC) (U.S. EPA, 1999)
d "Action Level" (U.S. EPA, 2001)
e Free cyanide
f Ford, 1996
ND Nondetect

## Table 3.1.1-2. Comparison of Water Concentrations (Dissolved) to Ecological Risk-Based Screening Levels

Summary of Water Samples (dissolved)

| Metal | Detection Frequency | Detection Limit (µg/L) | Minimum Detected (µg/L) | Maximum Detected (µg/L) | Minimum Ecological Risk Criterion (µg/L) | Source of Minimum Ecological Risk Criterion | Minimum Criterion Exceeded? |
|---|---|---|---|---|---|---|---|
| Aluminum | 8/9 | 44 | 108 | 10,700 | 87 | NRWQC CCC[a] | Yes |
| Antimony | 9/9 | 0.006 | 0.074 | 0.346 | 30 | Tier II SCV[b] | No |
| Arsenic | 9/9 | 0.06 | 0.2 | 1.39 | 3.1 | Tier II SCV[b] | No |
| Barium | 9/9 | 0.008 | 10.6 | 176 | 4 | Tier II SCV[b] | Yes |
| Beryllium | 9/9 | 0.005 | 0.011 | 16.7 | 0.66 | Tier II SCV[b] | Yes |
| Cadmium | 8/9 | 0.005 | 0.017 | 5.54 | 2.2[c] | NRWQC CCC[a] | Yes |
| Calcium | 9/9 | 10 | 3,930 | 81,900 | --- | --- | No |
| Chromium | 4/9 | 0.1 | 0.15 | 1.02 | 11[d] | NRWQC CCC[a] | No |
| Cobalt | 9/9 | 0.005 | 0.018 | 61.1 | 23 | Tier II SCV[b] | Yes |
| Copper | 9/9 | 0.04 | 0.86 | 89.1 | 9[c] | NRWQC CCC[a] | Yes |
| Iron | 9/9 | 5.6 | 44.3 | 474 | --- | --- | No |
| Lead | 9/9 | 0.007 | 0.035 | 2.38 | 2.5[c] | NRWQC CCC[a] | No |
| Magnesium | 9/9 | 10 | 652 | 18,100 | --- | --- | No |
| Manganese | 9/9 | 0.4 | 3 | 3,560 | 120 | Tier II SCV[b] | Yes |
| Mercury | 9/9 | 0.0002 - 0.002 | 0.0007 | 0.248 | 0.77 | NRWQC CCC[a] | No |
| Nickel | 9/9 | 0.1 | 0.22 | 52.4 | 52[c] | NRWQC CCC[a] | Yes |
| Potassium | 9/9 | 44 | 15,100 | 22,600 | --- | --- | No |
| Selenium | 1/9 | 1 | 1.7 | 1.7 | 5 | NRWQC CCC[a] | No |
| Silver | 9/9 | 0.003 | 0.006 | 0.615 | 0.36 | Tier II SCV[b] | Yes |
| Sodium | 9/9 | 33 | 2,650 | 8,950 | --- | --- | No |
| Thallium | 9/9 | 0.003 | 0.007 | 0.191 | 12 | Tier II SCV[b] | No |
| Vanadium | 1/9 | 5.6 | 7 | 7 | 20 | Tier II SCV[b] | No |
| Zinc | 9/9 | 1.1 | 4 | 2,000 | 120[c] | NRWQC CCC[a] | Yes |

a *National Recommended Water Quality Criteria (NRWQC) Criteria Continuous Concentration (CCC); "...an estimate of the highest continuous concentration of a material in surface water to which an aquatic community can be exposed indefinitelywithout resulting in an unacceptable effect." (U.S. EPA, 1999)*

b *Tier II SCV: Secondary Chronic Value (Suter and Tsao, 1996)*

c Hardness dependent criterion normalized to 100 mg/L

d Chromium VI

## Table 3.1.1-3. Water Samples (Total Concentrations) that Exceeded Human Health Risk-Based Screening Levels

| Sample ID | Location | Type | Result (µg/L) | Minimum Criterion (µg/L) | Exceedence Factor | Human Health Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Arsenic** | | | | | | |
| DTSEEP1 & 2 Comp | Dewey | Seep | 0.38 | 0.018 | 21 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| NG2 | Blue Gulch | Stream (Downstream) | 0.43 | 0.018 | 24 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| DT JCDS | Dewey | Stream (Downstream) | 0.61 | 0.018 | 34 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| BGC1 | Blue Gulch | Stream (Upstream) | 0.78 | 0.018 | 43 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| BGC3 | Blue Gulch | Stream (Downstream) | 0.82 | 0.018 | 46 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 1.06 | 0.018 | 59 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| DTJCUS | Dewey | Stream (Upstream) | 1.32 | 0.018 | 73 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| COWP | Blue Gulch | Pond | 2.65 | 0.018 | 147 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| MM SEEP | Dewey | Seep | 15.2 | 0.018 | 844 | NRWQC Water + Organism; NRWQC Organism Only; Region IX PRG |
| **Beryllium** | | | | | | |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 11 | 4 | 3 | MCL |
| DT JCDS | Dewey | Stream (Downstream) | 12.1 | 4 | 3 | MCL |
| DTSEEP1 & 2 Comp | Dewey | Seep | 19.6 | 4 | 5 | MCL |
| **Cadmium** | | | | | | |
| DTSEEP1 & 2 Comp | Dewey | Seep | 7.59 | 5 | 2 | MCL |
| **Iron** | | | | | | |
| DT JCDS | Dewey | Stream (Downstream) | 56.2 | 50 | 1 | BLM RMCs (all) |
| NG2 | Blue Gulch | Stream (Downstream) | 61.5 | 50 | 1 | BLM RMCs (all) |
| DTSEEP1 & 2 Comp | Dewey | Seep | 80.5 | 50 | 2 | BLM RMCs (all) |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 81.2 | 50 | 2 | BLM RMCs (all) |
| DTJCUS | Dewey | Stream (Upstream) | 82 | 50 | 2 | BLM RMCs (all) |
| BGC3 | Blue Gulch | Stream (Downstream) | 322 | 50 | 6 | BLM RMCs (all); NRWQC Water + Organism |
| COWP | Blue Gulch | Pond | 441 | 50 | 9 | BLM RMCs (all); NRWQC Water + Organism |
| BGC1 | Blue Gulch | Stream (Upstream) | 594 | 50 | 12 | BLM RMCs (all); NRWQC Water + Organism |
| MM SEEP | Dewey | Seep | 23,300 | 50 | 466 | BLM RMCs (all); NRWQC Water + Organism; Region IX PRG |
| **Lead** | | | | | | |
| MM SEEP | Dewey | Seep | 67.3 | 15 | 4 | MCL |
| **Magnesium** | | | | | | |
| COWP | Blue Gulch | Pond | 2,140 | 1,500 | 1 | BLM Camper RMC |
| BGC3 | Blue Gulch | Stream (Downstream) | 3,560 | 1,500 | 2 | BLM Camper & Swimmer RMCs |
| NG2 | Blue Gulch | Stream (Downstream) | 3,570 | 1,500 | 2 | BLM Camper & Swimmer RMCs |
| MM SEEP | Dewey | Seep | 4,160 | 1,500 | 3 | BLM Camper & Swimmer RMCs |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 9,840 | 1,500 | 7 | BLM RMCs (all) |
| DT JCDS | Dewey | Stream (Downstream) | 12,600 | 1,500 | 8 | BLM RMCs (all) |
| DTSEEP1 & 2 Comp | Dewey | Seep | 20,600 | 1,500 | 14 | BLM RMCs (all) |

## Table 3.1.1-3. Water Samples (Total Concentrations) that Exceeded Human Health Risk-Based Screening Levels (Page 2 of 2)

| Sample ID | Location | Type | Result (µg/L) | Minimum Criterion (µg/L) | Exceedence Factor | Human Health Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Manganese** | | | | | | |
| BGC1 | Blue Gulch | Stream (Upstream) | 263 | 50 | 5 | NRWQC Water + Organism; NRWQC Organism Only; BLM Camper & Swimmer RMCs |
| NG2 | Blue Gulch | Stream (Downstream) | 358 | 50 | 7 | NRWQC Water + Organism; NRWQC Organism Only; BLM RMCs (all) |
| BGC3 | Blue Gulch | Stream (Downstream) | 481 | 50 | 10 | NRWQC Water + Organism; NRWQC Organism Only; BLM RMCs (all) |
| MM SEEP | Dewey | Seep | 1,020 | 50 | 20 | NRWQC Water + Organism; NRWQC Organism Only; BLM RMCs (all); Region IX PRG |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 1,750 | 50 | 35 | NRWQC Water + Organism; NRWQC Organism Only; BLM RMCs (all); Region IX PRG |
| DT JCDS | Dewey | Stream (Downstream) | 1,750 | 50 | 35 | NRWQC Water + Organism; NRWQC Organism Only; BLM RMCs (all); Region IX PRG |
| DTSEEP1 & 2 Comp | Dewey | Seep | 4,010 | 50 | 80 | NRWQC Water + Organism; NRWQC Organism Only; BLM RMCs (all); Region IX PRG |
| **Mercury** | | | | | | |
| COWP | Blue Gulch | Pond | 0.0567 | 0.05 | 1 | NRWQC Water + Organism; NRWQC Organism Only |
| DT JCDS | Dewey | Stream (Downstream) | 0.0914 | 0.05 | 2 | NRWQC Water + Organism; NRWQC Organism Only |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 0.193 | 0.05 | 4 | NRWQC Water + Organism; NRWQC Organism Only |
| DTJCUS | Dewey | Stream (Upstream) | 0.48 | 0.05 | 10 | NRWQC Water + Organism; NRWQC Organism Only |
| MM SEEP | Dewey | Seep | 3.92 | 0.05 | 78 | NRWQC Water + Organism; NRWQC Organism Only; MCL |

## Table 3.1.1-4. Water Samples (Total Concentrations) that Exceeded Human Ecological Risk-Based Screening Levels (Page 1of 2)

| Sample ID | Location | Type | Result (µg/L) | Minimum Criterion (µg/L) | Exceedence Factor | Ecological Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Aluminum** | | | | | | |
| COWP | Blue Gulch | Pond | 108 | 87 | 1 | NRWQC Freshwater CCC |
| MM SEEP | Dewey | Seep | 161 | 87 | 2 | NRWQC Freshwater CCC |
| BGC1 | Blue Gulch | Stream (Upstream) | 706 | 87 | 8 | NRWQC Freshwater CCC |
| NG2 | Blue Gulch | Stream (Downstream) | 1,760 | 87 | 20 | NRWQC Freshwater CCC and CMC |
| BGC3 | Blue Gulch | Stream (Downstream) | 2,340 | 87 | 27 | NRWQC Freshwater CCC and CMC |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 3,790 | 87 | 44 | NRWQC Freshwater CCC and CMC |
| DT JCDS | Dewey | Stream (Downstream) | 4,210 | 87 | 48 | NRWQC Freshwater CCC and CMC |
| DTSEEP1 & 2 Comp | Dewey | Seep | 10,700 | 87 | 123 | NRWQC Freshwater CCC and CMC |
| **Barium** | | | | | | |
| DTJCUS | Dewey | Stream (Upstream) | 10.6 | 4 | 3 | Tier II SCV |
| DTSEEP1 & 2 Comp | Dewey | Seep | 19.4 | 4 | 5 | Tier II SCV |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 21.6 | 4 | 5 | Tier II SCV |
| MM SEEP | Dewey | Seep | 30.3 | 4 | 8 | Tier II SCV |
| DT JCDS | Dewey | Stream (Downstream) | 44.9 | 4 | 11 | Tier II SCV |
| BGC3 | Blue Gulch | Stream (Downstream) | 82.8 | 4 | 21 | Tier II SCV |
| NG2 | Blue Gulch | Stream (Downstream) | 94.3 | 4 | 24 | Tier II SCV |
| COWP | Blue Gulch | Pond | 95.1 | 4 | 24 | Tier II SCV |
| BGC1 | Blue Gulch | Stream (Upstream) | 176 | 4 | 44 | Tier II SCV; Tier II SAC |
| **Beryllium** | | | | | | |
| NG2 | Blue Gulch | Stream (Downstream) | 0.845 | 0.66 | 1 | Tier II SCV |
| MM SEEP | Dewey | Seep | 0.884 | 0.66 | 1 | Tier II SCV |
| BGC3 | Blue Gulch | Stream (Downstream) | 1.1 | 0.66 | 2 | Tier II SCV |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 8.69 | 0.66 | 13 | Tier II SCV |
| DT JCDS | Dewey | Stream (Downstream) | 10.4 | 0.66 | 16 | Tier II SCV |
| DTSEEP1 & 2 Comp | Dewey | Seep | 16.7 | 0.66 | 25 | Tier II SCV |
| **Cadmium** | | | | | | |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 2.85 | 2.2 | 1 | NRWQC Freshwater CCC |
| DT JCDS | Dewey | Stream (Downstream) | 3.34 | 2.2 | 2 | NRWQC Freshwater CCC |
| DTSEEP1 & 2 Comp | Dewey | Seep | 5.54 | 2.2 | 3 | NRWQC Freshwater CCC and CMC |
| **Cobalt** | | | | | | |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 28.1 | 23 | 1 | Tier II SCV |
| DTSEEP1 & 2 Comp | Dewey | Seep | 61.1 | 23 | 3 | Tier II SCV |

## Table 3.1.1-4. Water Samples (Total Concentrations) that Exceeded Human Ecological Risk-Based Screening Levels (Page 2 of 2)

| Sample ID | Location | Type | Result (µg/L) | Minimum Criterion (µg/L) | Exceedence Factor | Ecological Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Copper** | | | | | | |
| BGC3 | Blue Gulch | Stream (Downstream) | 27.6 | 9 | 3 | NRWQC Freshwater CCC and CMC |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 43.2 | 9 | 5 | NRWQC Freshwater CCC and CMC |
| DT JCDS | Dewey | Stream (Downstream) | 50.6 | 9 | 6 | NRWQC Freshwater CCC and CMC |
| NG2 | Blue Gulch | Stream (Downstream) | 55.9 | 9 | 6 | NRWQC Freshwater CCC and CMC |
| DTSEEP1 & 2 Comp | Dewey | Seep | 89.1 | 9 | 10 | NRWQC Freshwater CCC and CMC |
| **Manganese** | | | | | | |
| BGC1 | Blue Gulch | Stream (Upstream) | 146 | 120 | 1 | Tier II SCV |
| MM SEEP | Dewey | Seep | 150 | 120 | 1 | Tier II SCV |
| BGC3 | Blue Gulch | Stream (Downstream) | 230 | 120 | 2 | Tier II SCV |
| NG2 | Blue Gulch | Stream (Downstream) | 315 | 120 | 3 | Tier II SCV |
| DT JCDS | Dewey | Stream (Downstream) | 1,390 | 120 | 12 | Tier II SCV; Tier II SAC |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 1,430 | 120 | 12 | Tier II SCV; Tier II SAC |
| DTSEEP1 & 2 Comp | Dewey | Seep | 3,560 | 120 | 30 | Tier II SCV; Tier II SAC |
| **Nickel** | | | | | | |
| DTSEEP1 & 2 Comp | Dewey | Seep | 52.4 | 52 | 1 | NRWQC Freshwater CCC |
| **Silver** | | | | | | |
| NG2 | Blue Gulch | Stream (Downstream) | 0.372 | 0.36 | 1 | Tier II SCV |
| COWP | Blue Gulch | Pond | 0.404 | 0.36 | 1 | Tier II SCV |
| DTSEEP1 & 2 Comp | Dewey | Seep | 0.615 | 0.36 | 2 | Tier II SCV |
| **Zinc** | | | | | | |
| NG2 | Blue Gulch | Stream (Downstream) | 126 | 120 | 1 | NRWQC Freshwater CCC and CMC |
| BGC3 | Blue Gulch | Stream (Downstream) | 242 | 120 | 2 | NRWQC Freshwater CCC and CMC |
| JC SEEP 2+100 | Dewey | Stream (Downstream) | 907 | 120 | 8 | NRWQC Freshwater CCC and CMC |
| DT JCDS | Dewey | Stream (Downstream) | 1,170 | 120 | 10 | NRWQC Freshwater CCC and CMC |
| DTSEEP1 & 2 Comp | Dewey | Seep | 2,000 | 120 | 17 | NRWQC Freshwater CCC and CMC |

### 3.1.1 Human Health Risk Evaluation for Water

As shown in Table 3.1.1-3, the maximum-detected total concentrations of the following metals exceeded at least one human health risk-based screening level value for water:

- Arsenic
- Beryllium
- Cadmium
- Iron
- Lead
- Magnesium
- Manganese
- Mercury

Table 3.1.1-3 summarizes the water samples with metal concentrations (total concentration) that exceeded at least one human health risk-based criterion. Evaluation of these results shows the following:

- For all of these metals, the highest total metal concentrations were measured in seeps at the Dewey Mine site. Human contact with water from these seeps is likely to be minimal. Upon dilution in the stream, concentrations near these seeps are lower.
- For three metals (beryllium, cadmium, and lead), all exceedences were associated with drinking water criteria only. These criteria essentially assume that 100% of a person's drinking water contains the metal at this concentration. This is a highly conservative assumption since long-term consumption of drinking water from the Jordan Creek or Negro Gulch Creek is highly unlikely, and these concentrations would be significantly diluted downstream.
- For the remaining five metals (arsenic, iron, magnesium, manganese, and mercury), concentrations measured in Jordan Creek or Negro Gulch Creek ranged from 8 to 73 times non-drinking water-based criteria (*i.e.*, criteria based on consumption of fish, or based on relatively infrequent exposure by recreators). The most significant exceedences were for arsenic measured in samples from both Jordan Creek and Negro Gulch Creek.
- Concentrations of arsenic, iron, manganese, and mercury in stream samples (*i.e.*, excluding seep or pond samples) in some cases exceed human health risk-based criteria based on consumption of fish by several fold. Arsenic and mercury in particular are known to bioaccumulate in fish, such that very small concentrations in surface water can be associated with fish concentrations that may pose a health

concern. Arsenic is a suspected human carcinogen, whereas methylmercury (the organic form of mercury present in fish) has been associated with neurological effects in children whose mothers were exposed during pregnancy.

### *3.1.2 Ecological Risk Evaluation for Water*

As shown in Table 3.1.1-2, the maximum-detected dissolved concentrations of the following metals exceeded at least one ecological risk-based screening level value for water:

- Aluminum
- Barium
- Beryllium
- Cadmium
- Cobalt
- Copper
- Manganese
- Nickel
- Silver
- Zinc

Table 3.1.1-4 summarizes the water samples with metal concentrations (dissolved concentration) that exceeded at least one ecological risk-based criterion. Evaluation of these results shows the following:

- For all of these metals, the highest total metal concentrations were measured in seeps at the Dewey Mine site. Contact of aquatic life with undiluted water from these seeps is likely to be minimal. Upon dilution in the stream, concentrations near these seeps are lower.
- Excluding concentrations measured in seeps, concentrations of three metals (aluminum, copper, and zinc) measured in Jordan Creek or Negro Gulch Creek exceeded U.S. EPA NRWQC based on both acute and chronic exposure durations. Concentrations of one additional metal (manganese) measured in Jordan Creek exceeded Tier II values based on both acute and chronic exposure durations—these criteria were derived using less rigorous data requirements than the U.S. EPA NRWQC values.
- Excluding concentrations measured in seeps, concentrations of one additional metal (cadmium) measured in Jordan Creek slightly exceeded U.S. EPA NRWQC values for chronic exposure durations only. Concentrations of three additional

metals (barium, beryllium, silver) exceeded Tier II values based on chronic exposure durations only.

- The most significant exceedences (excluding seep samples) were for aluminum measured in samples from both Jordan Creek and Negro Gulch Creek (up to 48 times criteria based on chronic exposures). However, according to Suter and Tsao (1996), the toxicity of aluminum to aquatic biota has been shown to vary widely with water hardness and pH.

## 3.2 Results of the Screening Risk Analysis for Soil and Sediment

Table 3.2-1 compares the maximum-detected soil and sediment concentrations to the minimum (*i.e.*, most conservative) human health-risk based screening levels for soil/sediment. In presenting a summary of sample concentrations, concentrations and health risk-based screening levels for both soil and sediment are presented in this table. Table 3.2-2 compares the maximum-detected soil concentrations to the minimum ecological screening levels for soil, and Table 3.2-3 compares the maximum-detected sediment concentrations to the minimum ecological screening levels for sediment. Tables 3.2-4, 3.2-5, and 3.2-6 identify specific soil or sediment samples that exceeded criteria for human health soil/sediment, ecological soil, and ecological sediment endpoints, respectively, and which criteria were exceeded. Tables K-3, K-4, and K-5 (Appendix K) show how the maximum soil/sediment concentrations compare to all of the screening level values considered in this assessment.

## Table 3.2-1. Comparison of Soil/Sediment Concentrations to Human Health Risk-Based Screening Levels

### Summary of Soil/ Sediment Samples

| Metal | Detection Frequency | Detection Limit (mg/kg) | Minimum Detected (mg/kg) | Maximum Detected (mg/kg) | Minimum Human Health Criterion (mg/kg) | Source of Minimum Human Health Criterion | Minimum Criterion Exceeded? |
|---|---|---|---|---|---|---|---|
| Aluminum | 22/22 | 7 - 8.4 | 1,980 | 30,100 | 76,000 | Region IX Soil PRG[a] | No |
| Antimony | 20/22 | 0.01 | 0.05 | 3.52 | 3 | BLM Resident Soil RMC[b] | Yes |
| Arsenic | 22/22 | 0.1 - 0.5 | 1.7 | 540 | 0.39 | Region IX Soil PRG[a] | Yes |
| Barium | 22/22 | 0.01 | 8.3 | 188 | 5,400 | Region IX Soil PRG[a] | No |
| Beryllium | 22/22 | 0.01 | 0.14 | 9.22 | 150 | Region IX Soil PRG[a] | No |
| Cadmium | 22/22 | 0.01 | 0.05 | 1.14 | 3 | BLM Resident Soil RMC[b] | No |
| Calcium | 22/22 | 4 - 5 | 107 | 21,000 | 100,000 | Calculated from RDI[c] | No |
| Chromium | 22/22 | 0.04 – 0.1 | 0.59 | 57.2 | 210[d] | Region IX Soil PRG[a] | No |
| Cobalt | 22/22 | 0.01 | 0.25 | 32.8 | 4,700 | Region IX Soil PRG[a] | No |
| Copper | 22/22 | 0.1 – 2.2 | 3.1 | 180 | 250 | BLM Resident Soil RMC[b] | No |
| Cyanide | 0/5 | 0.2 | ND | ND | 11 | Region IX Soil PRG[a] | No |
| Iron | 22/22 | 0.7 - 0.8 | 3,370 | 64,300 | 23,000 | Region IX Soil PRG[a] | Yes |
| Lead | 22/22 | 0.04 - 0.41 | 2.6 | 204 | 400 | BLM Resident Soil RMC[b] | No |
| Magnesium | 22/22 | 2 - 2.4 | 112 | 29,000 | 100,000 | Calculated from RDI[c] | No |
| Manganese | 22/22 | 0.1 | 20.5 | 1,200 | 960 | BLM Resident Soil RMC[b] | Yes |
| Mercury | 22/22 | 0.01 - 1.95 | 0.11 | 91.8 | 2 | BLM Resident Soil RMC[b] | Yes |
| Nickel | 22/22 | 0.2 | 0.6 | 99.4 | 135 | BLM Resident Soil RMC[b] | No |
| Potassium | 22/22 | 10 - 12 | 283 | 2,810 | 100,000 | Calculated from RDI[c] | No |
| Selenium | 12/22 | 0.5 – 2.2 | 1.6 | 29.3 | 35 | BLM Resident Soil RMC[b] | No |
| Silver | 22/22 | 0.002 - 11 | 0.251 | 385 | 35 | BLM Resident Soil RMC[b] | Yes |
| Sodium | 22/22 | 4 - 4.8 | 13.4 | 701 | 100,000 | Calculated from RDI[c] | No |
| Thallium | 22/22 | 0.002 – 0.01 | 0.021 | 0.303 | 5 | Region IX Soil PRG[a] | No |
| Vanadium | 22/22 | 0.7 - 1.2 | 1.5 | 108 | 550 | Region IX Soil PRG[a] | No |
| Zinc | 22/22 | 0.3 - 0.4 | 8 | 328 | 2,000 | BLM Resident Soil RMC[b] | No |

a U.S. EPA Region IX, 2000
b Ford, 1996
c Calculated from FDA Reference Daily Intake (RDI) using U.S. EPA Region IX PRG calculations
d Assumes 1:6 ratio of Chromium(VI) to Chromium (III)

## Table 3.2-2. Comparison of Soil Concentrations to Ecological Risk-Based Screening Levels for Soil

Summary of Soil Samples

| Metal | Detection Frequency | Detection Limit (mg/kg) | Minimum Detected (mg/kg) | Maximum Detected (mg/kg) | Minimum Soil Criterion | Source of Minimum Soil Criterion | Minimum Criterion Exceeded? |
|---|---|---|---|---|---|---|---|
| Aluminum | 16/16 | 7 - 8.2 | 3,020 | 30,100 | 50 | Phytotoxicity Benchmark[a] | Yes |
| Antimony | 16/16 | 0.01 | 0.06 | 3.52 | 5 | Phytotoxicity Benchmark[a] | No |
| Arsenic | 16/16 | 0.1 - 0.5 | 5.5 | 241 | 4 | BLM Robin Soil RMC[b] | Yes |
| Barium | 16/16 | 0.01 | 8.3 | 187 | 500 | Phytotoxicity Benchmark[a] | No |
| Beryllium | 16/16 | 0.01 | 0.2 | 9.22 | 10 | Phytotoxicity Benchmark[a] | No |
| Cadmium | 16/16 | 0.01 | 0.07 | 1.14 | 0.3 | BLM Robin Soil RMC[b] | Yes |
| Calcium | 16/16 | 4 - 5 | 447 | 21,000 | --- | --- | No |
| Chromium | 16/16 | 0.04 – 0.1 | 1.32 | 57.2 | 0.4 | Earthworm Toxicity Benchmark[c] | Yes |
| Cobalt | 16/16 | 0.01 | 0.25 | 32.8 | 20 | Phytotoxicity Benchmark[a] | Yes |
| Copper | 16/16 | 0.1 – 2.2 | 3.2 | 131 | 7 | BLM Robin Soil RMC[b] | Yes |
| Cyanide | 0/5 | 0.2 | ND | ND | --- | --- | No |
| Iron | 16/16 | 0.7 - 0.8 | 3,650 | 64,300 | 200 | Microbe Toxicity Benchmark[c] | Yes |
| Lead | 16/16 | 0.04 - 0.41 | 13.8 | 204 | 6 | BLM Robin Soil RMC[b] | Yes |
| Magnesium | 16/16 | 2 - 2.3 | 271 | 29,000 | --- | --- | No |
| Manganese | 16/16 | 0.1 | 20.5 | 1,200 | 100 | Microbe Toxicity Benchmark[c] | Yes |
| Mercury | 16/16 | 0.01 - 1.95 | 0.25 | 91.8 | 0.1 | Earthworm Toxicity Benchmark[c] | Yes |
| Nickel | 16/16 | 0.2 | 0.6 | 99.4 | 30 | Phytotoxicity Benchmark[a] | Yes |
| Potassium | 16/16 | 10 - 12 | 283 | 2,810 | --- | --- | No |
| Selenium | 11/16 | 1 - 1.2 | 1.6 | 54.1 | 1 | Phytotoxicity Benchmark[a] | Yes |
| Silver | 16/16 | 0.002 - 11 | 0.633 | 385 | 2 | Phytotoxicity Benchmark[a] | Yes |
| Sodium | 16/16 | 4 - 4.7 | 13.8 | 701 | --- | --- | No |
| Thallium | 16/16 | 0.002 – 0.01 | 0.04 | 0.303 | 1 | Phytotoxicity Benchmark[a] | No |
| Vanadium | 16/16 | 0.7 - 1.2 | 4.8 | 108 | 2 | Phytotoxicity Benchmark[a] | Yes |
| Zinc | 16/16 | 0.3 - 0.4 | 11.7 | 328 | 43 | BLM Robin Soil RMC[b] | Yes |

a Efroymson *et al.*, 1997a
b Ford, 1996
c Will and Suter, 1995
ND Nondetect

## Table 3.2-3. Comparison of Sediment Concentrations to Ecological Risk-Based Screening Levels for Sediment

Summary of Soil Samples

| Metal | Detection Frequency | Detection Limit (mg/kg) | Minimum Detected (mg/kg) | Maximum Detected (mg/kg) | Minimum Sediment Criterion | Source of Minimum Sediment Criterion | Minimum Criterion Exceeded? |
|---|---|---|---|---|---|---|---|
| Aluminum | 6/6 | 7.1 - 8.4 | 1,980 | 21,000 | 58,030 | EPA ARCS PEC[a] | No |
| Antimony | 4/6 | 0.01 | 0.05 | 1.18 | 12 | EPA Region IV[b] | No |
| Arsenic | 6/6 | 0.1 - 0.5 | 1.7 | 540 | 7.24 | EPA Region IV[b] | **Yes** |
| Barium | 6/6 | 0.01 | 9.99 | 188 | --- | --- | No |
| Beryllium | 6/6 | 0.01 | 0.14 | 1.13 | --- | --- | No |
| Cadmium | 6/6 | 0.01 | 0.05 | 0.33 | 0.592 | EPA ARCS TEC[c] | No |
| Calcium | 6/6 | 4 - 5 | 107 | 861 | --- | --- | No |
| Chromium | 6/6 | 0.04 | 0.59 | 8.24 | 52.3 | EPA Region IV[b] | No |
| Cobalt | 6/6 | 0.01 | 0.49 | 4.21 | --- | --- | No |
| Copper | 6/6 | 0.1 | 3.1 | 180 | 18.7 | EPA Region IV[b] | **Yes** |
| Iron | 6/6 | 0.7 - 0.8 | 3,370 | 27,400 | --- | --- | No |
| Lead | 6/6 | 0.04 - 0.05 | 2.6 | 193 | 30.2 | EPA Region IV[b] | **Yes** |
| Magnesium | 6/6 | 2 - 2.4 | 112 | 2,680 | --- | --- | No |
| Manganese | 6/6 | 0.1 | 32.7 | 320 | 819 | EPA ARCS NEC[d] | No |
| Mercury | 6/6 | 0.01 - 0.05 | 0.11 | 1.83 | 0.13 | EPA Region IV[b] | **Yes** |
| Nickel | 6/6 | 0.2 | 1 | 7.8 | 15.9 | EPA Region IV[b] | No |
| Potassium | 6/6 | 10 - 12 | 318 | 2,490 | --- | --- | No |
| Selenium | 1/6 | 1 - 1.2 | 5.4 | 5.4 | --- | --- | No |
| Silver | 6/6 | 0.002 - 0.015 | 0.251 | 61.1 | 2 | EPA Region IV[b] | **Yes** |
| Sodium | 6/6 | 4 - 4.8 | 13.4 | 146 | --- | --- | No |
| Thallium | 6/6 | 0.002 | 0.021 | 0.217 | --- | --- | No |
| Vanadium | 6/6 | 1 - 1.2 | 1.5 | 28.1 | --- | --- | No |
| Zinc | 6/6 | 0.3 - 0.4 | 8 | 81.1 | 124 | EPA Region IV[b] | No |

a U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) Probable Effect Concentration (PEC)(Jones *et al.*, 1997)
b Jones *et al.*, 1997
c U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) Threshold Effect Concentration (TEC)(Jones *et al.*, 1997)
d U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) high No Effect Concentration (NEC) (Jones *et al.*, 1997)

## Table 3.2-4. Soil and Sediment Samples that Exceeded Human Health Risk-Based Screening Levels (Page 1 of 2)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Human Health Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Antimony** | | | | | | |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 3.52 | 3 | 1 | BLM Resident Soil RMC |
| **Arsenic** | | | | | | |
| DTJC DS-SED | Dewey | Sediment | 1.7 | 0.39 | 4 | Region IX Soil PRG; BLM Resident Soil RMC |
| DTJCUS-SED | Dewey | Sediment | 2.2 | 0.39 | 6 | Region IX Soil PRG; BLM Resident Soil RMC |
| DTJC SEEP2-SED | Dewey | Sediment | 3.9 | 0.39 | 10 | Region IX Soil PRG; BLM Resident Soil RMC |
| WDES1 | Dewey | Soil (Rock Fines) | 5.5 | 0.39 | 14 | Region IX Soil PRG; BLM Resident Soil RMC |
| WDWS2 | Dewey | Soil (Rock Fines) | 6.5 | 0.39 | 17 | Region IX Soil PRG; BLM Resident Soil RMC |
| MF03 | Dewey | Soil (Rock Fines) | 10.1 | 0.39 | 26 | Region IX Soil PRG; BLM Resident Soil RMC |
| WDES3 | Dewey | Soil (Rock Fines) | 10.9 | 0.39 | 28 | Region IX Soil PRG; BLM Resident Soil RMC |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 12.3 | 0.39 | 32 | Region IX Soil PRG; BLM Resident & Worker Soil RMCs |
| MMTP-BL | Dewey | Soil (Rock Fines) | 12.3 | 0.39 | 32 | Region IX Soil PRG; BLM Resident & Worker Soil RMCs |
| WDES2 | Dewey | Soil (Rock Fines) | 15.9 | 0.39 | 41 | Region IX Soil PRG; BLM Resident & Worker Soil RMCs |
| WDWS3 | Dewey | Soil (Rock Fines) | 18.1 | 0.39 | 46 | Region IX Soil PRG; BLM Resident & Worker Soil RMCs |
| MMTP-AU | Dewey | Soil (Rock Fines) | 26.6 | 0.39 | 68 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 30.8 | 0.39 | 79 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs |
| SANDP | Dewey | Soil | 38.2 | 0.39 | 98 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs |
| WDWS1 | Dewey | Soil (Rock Fines) | 41.6 | 0.39 | 107 | Region IX Soil PRG; BLM Resident, Worker & Camper Soil RMCs |
| BGSD1-a | Blue Gulch | Sediment | 45.3 | 0.39 | 116 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs |
| BGSD1-b | Blue Gulch | Sediment | 69.2 | 0.39 | 177 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs; BLM Camper Sediment RMC |
| CONEP COMP | Dewey | Soil (Rock Fines) | 93.9 | 0.39 | 241 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs; BLM Camper & Swimmer Sediment RMC |
| MMTP-U | Dewey | Soil (Rock Fines) | 118 | 0.39 | 303 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs; BLM Camper, Swimmer, & Surveyor Sediment RMCs |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 123 | 0.39 | 315 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs; BLM Camper, Swimmer, & Surveyor Sediment RMCs |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 241 | 0.39 | 618 | Region IX Soil PRG; BLM Resident, Worker, & Camper Soil RMCs; BLM Camper, Swimmer, Surveyor, & Boater Sediment RMCs |
| BGSD4 | Blue Gulch | Sediment | 540 | 0.39 | 1385 | Region IX Soil PRG; BLM Resident, Worker, Camper, & ATV Driver Soil RMCs; BLM Camper, Swimmer, Surveyor, & Boater Sediment RMCs |
| **Iron** | | | | | | |
| MMTP-U | Dewey | Soil (Rock Fines) | 24,900 | 23,000 | 1 | Region IX Soil PRG |
| BGSD1-a | Blue Gulch | Sediment | 27,400 | 23,000 | 1 | Region IX Soil PRG |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 27,400 | 23,000 | 1 | Region IX Soil PRG |
| CONEP COMP | Dewey | Soil (Rock Fines) | 28,200 | 23,000 | 1 | Region IX Soil PRG |
| WDES1 | Dewey | Soil (Rock Fines) | 29,900 | 23,000 | 1 | Region IX Soil PRG |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 30,000 | 23,000 | 1 | Region IX Soil PRG |
| WDES3 | Dewey | Soil (Rock Fines) | 33,800 | 23,000 | 1 | Region IX Soil PRG |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 41,300 | 23,000 | 2 | Region IX Soil PRG |
| WDES2 | Dewey | Soil (Rock Fines) | 43,000 | 23,000 | 2 | Region IX Soil PRG |
| MF03 | Dewey | Soil (Rock Fines) | 46,300 | 23,000 | 2 | Region IX Soil PRG |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 60,300 | 23,000 | 3 | Region IX Soil PRG |

| | | | | | | |
|---|---|---|---|---|---|---|
| WDWS2 | Dewey | Soil (Rock Fines) | 64,300 | 23,000 | 3 | Region IX Soil PRG |

## Table 3.2-4. Soil and Sediment Samples that Exceeded Human Health Risk-Based Screening Levels (Page 2 of 2)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Human Health Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Manganese** | | | | | | |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 1200 | 960 | 1 | BLM Resident Soil RMC |
| **Mercury** | | | | | | |
| SANDP | Dewey | Soil | 3.23 | 2 | 2 | BLM Resident Soil RMC |
| CONEP COMP | Dewey | Soil (Rock Fines) | 4.2 | 2 | 2 | BLM Resident Soil RMC |
| MMTP-AU | Dewey | Soil (Rock Fines) | 6.98 | 2 | 3 | BLM Resident Soil RMC |
| MF03 | Dewey | Soil (Rock Fines) | 8.19 | 2 | 4 | BLM Resident Soil RMC |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 91.8 | 2 | 46 | BLM Resident, Camper, & Worker Soil RMC; BLM Camper & Swimmer Sediment RMCs; Region IX Soil PRG |
| **Silver** | | | | | | |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 38.7 | 35 | 1 | BLM Resident Soil RMC |
| WDWS3 | Dewey | Soil (Rock Fines) | 46.1 | 35 | 1 | BLM Resident Soil RMC |
| WDWS1 | Dewey | Soil (Rock Fines) | 47 | 35 | 1 | BLM Resident Soil RMC |
| BGSD1-a | Blue Gulch | Sediment | 61.1 | 35 | 2 | BLM Resident Soil RMC |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 64.9 | 35 | 2 | BLM Resident Soil RMC |
| MMTP-U | Dewey | Soil (Rock Fines) | 82.4 | 35 | 2 | BLM Resident Soil RMC |
| WDES1 | Dewey | Soil (Rock Fines) | 97.5 | 35 | 3 | BLM Resident Soil RMC |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 120 | 35 | 3 | BLM Resident Soil RMC |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 218 | 35 | 6 | BLM Resident Soil RMC |
| WDES3 | Dewey | Soil (Rock Fines) | 385 | 35 | 11 | BLM Resident Soil RMC |

## Table 3.2-5. Soil Samples that Exceeded Ecological Risk-Based Screening Levels for Soil (Page 1 of 5)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Soil Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Aluminum** | | | | | | |
| MMTP-BL | Dewey | Soil (Rock Fines) | 3,020 | 50 | 60 | Phyto-and Microbe Toxicity Benchmarks |
| MMTP-U | Dewey | Soil (Rock Fines) | 4,040 | 50 | 81 | Phyto-and Microbe Toxicity Benchmarks |
| WDWS3 | Dewey | Soil (Rock Fines) | 4,990 | 50 | 100 | Phyto-and Microbe Toxicity Benchmarks |
| SANDP | Dewey | Soil | 5,740 | 50 | 115 | Phyto-and Microbe Toxicity Benchmarks |
| MMTP-AU | Dewey | Soil (Rock Fines) | 6,390 | 50 | 128 | Phyto-and Microbe Toxicity Benchmarks |
| WDWS1 | Dewey | Soil (Rock Fines) | 8,300 | 50 | 166 | Phyto-and Microbe Toxicity Benchmarks |
| CONEP COMP | Dewey | Soil (Rock Fines) | 9,980 | 50 | 200 | Phyto-and Microbe Toxicity Benchmarks |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 11,700 | 50 | 234 | Phyto-and Microbe Toxicity Benchmarks |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 13,700 | 50 | 274 | Phyto-and Microbe Toxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 14,200 | 50 | 284 | Phyto-and Microbe Toxicity Benchmarks |
| WDES1 | Dewey | Soil (Rock Fines) | 16,300 | 50 | 326 | Phyto-and Microbe Toxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 19,100 | 50 | 382 | Phyto-and Microbe Toxicity Benchmarks |
| WDES2 | Dewey | Soil (Rock Fines) | 23,300 | 50 | 466 | Phyto-and Microbe Toxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 24,400 | 50 | 488 | Phyto-and Microbe Toxicity Benchmarks |
| MF03 | Dewey | Soil (Rock Fines) | 27,900 | 50 | 558 | Phyto-and Microbe Toxicity Benchmarks |
| WDWS2 | Dewey | Soil (Rock Fines) | 30,100 | 50 | 602 | Phyto-and Microbe Toxicity Benchmarks |
| **Arsenic** | | | | | | |
| WDES1 | Dewey | Soil (Rock Fines) | 5.5 | 4 | 1 | BLM Robin Soil RMC |
| WDWS2 | Dewey | Soil (Rock Fines) | 6.5 | 4 | 2 | BLM Robin Soil RMC |
| MF03 | Dewey | Soil (Rock Fines) | 10.1 | 4 | 3 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| WDES3 | Dewey | Soil (Rock Fines) | 10.9 | 4 | 3 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 12.3 | 4 | 3 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| MMTP-BL | Dewey | Soil (Rock Fines) | 12.3 | 4 | 3 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| WDES2 | Dewey | Soil (Rock Fines) | 15.9 | 4 | 4 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| WDWS3 | Dewey | Soil (Rock Fines) | 18.1 | 4 | 5 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| MMTP-AU | Dewey | Soil (Rock Fines) | 26.6 | 4 | 7 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 30.8 | 4 | 8 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| SANDP | Dewey | Soil | 38.2 | 4 | 10 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| WDWS1 | Dewey | Soil (Rock Fines) | 41.6 | 4 | 10 | BLM Robin Soil RMC; Phyotoxicity Benchmark |
| CONEP COMP | Dewey | Soil (Rock Fines) | 93.9 | 4 | 23 | BLM Robin Soil RMC; Phyto- and Earthworm Toxicity Benchmarks |
| MMTP-U | Dewey | Soil (Rock Fines) | 118 | 4 | 30 | BLM Robin Soil RMC; Phyto-, Earthworm, and Microbe Toxicity Benchmarks |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 123 | 4 | 31 | BLM Robin Soil RMC; Phyto-, Earthworm, and Microbe Toxicity Benchmarks |

| | | | | | | |
|---|---|---|---|---|---|---|
| BGR21 | Blue Gulch | Soil (Rock Fines) | 241 | 4 | 60 | BLM Robin, Mallard, Mule Deer, and Deer Mouse Soil RMCs; Phyto-, Earthworm, and Microbe Toxicity Benchmarks |
| **Cadmium** | | | | | | |
| WDES3 | Dewey | Soil (Rock Fines) | 0.35 | 0.3 | 1 | BLM Robin Soil RMC |
| WDES2 | Dewey | Soil (Rock Fines) | 0.36 | 0.3 | 1 | BLM Robin Soil RMC |
| WDWS2 | Dewey | Soil (Rock Fines) | 0.38 | 0.3 | 1 | BLM Robin Soil RMC |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 0.44 | 0.3 | 1 | BLM Robin Soil RMC |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 0.45 | 0.3 | 2 | BLM Robin Soil RMC |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 1.14 | 0.3 | 4 | BLM Robin and Mallard Soil RMC |

## Table 3.2-5. Soil Samples that Exceeded Ecological Risk-Based Screening Levels for Soil (Page 2 of 5)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Soil Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Chromium** | | | | | | |
| MMTP-BL | Dewey | Soil (Rock Fines) | 1.32 | 0.4 | 3 | Earthworm and Phytotoxicity Benchmarks |
| MMTP-U | Dewey | Soil (Rock Fines) | 1.47 | 0.4 | 4 | Earthworm and Phytotoxicity Benchmarks |
| SANDP | Dewey | Soil | 1.81 | 0.4 | 5 | Earthworm and Phytotoxicity Benchmarks |
| WDWS3 | Dewey | Soil (Rock Fines) | 1.90 | 0.4 | 5 | Earthworm and Phytotoxicity Benchmarks |
| MMTP-AU | Dewey | Soil (Rock Fines) | 2.55 | 0.4 | 6 | Earthworm and Phytotoxicity Benchmarks |
| CONEP COMP | Dewey | Soil (Rock Fines) | 2.78 | 0.4 | 7 | Earthworm and Phytotoxicity Benchmarks |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 3.93 | 0.4 | 10 | Earthworm and Phytotoxicity Benchmarks |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 13.7 | 0.4 | 34 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| WDWS1 | Dewey | Soil (Rock Fines) | 13.9 | 0.4 | 35 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 14.4 | 0.4 | 36 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| MF03 | Dewey | Soil (Rock Fines) | 28.5 | 0.4 | 71 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| WDES1 | Dewey | Soil (Rock Fines) | 30.2 | 0.4 | 76 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 30.9 | 0.4 | 77 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 32.2 | 0.4 | 81 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| WDES2 | Dewey | Soil (Rock Fines) | 38.8 | 0.4 | 97 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| WDWS2 | Dewey | Soil (Rock Fines) | 57.2 | 0.4 | 143 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| **Cobalt** | | | | | | |
| WDWS2 | Dewey | Soil (Rock Fines) | 23.3 | 20 | 1 | Phytotoxicity Benchmark |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 32.8 | 20 | 2 | Phytotoxicity Benchmark |
| **Copper** | | | | | | |
| MMTP-AU | Dewey | Soil (Rock Fines) | 8.9 | 7 | 1 | BLM Robin Soil RMC |
| CONEP COMP | Dewey | Soil (Rock Fines) | 9.5 | 7 | 1 | BLM Robin Soil RMC |
| MMTP-U | Dewey | Soil (Rock Fines) | 24.5 | 7 | 4 | BLM Robin Soil RMC |
| WDWS3 | Dewey | Soil (Rock Fines) | 40.1 | 7 | 6 | BLM Robin Soil RMC |
| WDWS1 | Dewey | Soil (Rock Fines) | 42.7 | 7 | 6 | BLM Robin Soil RMC |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 60.3 | 7 | 9 | BLM Robin Soil RMC; Earthworm Toxicity Benchmark |
| MF03 | Dewey | Soil (Rock Fines) | 61.8 | 7 | 9 | BLM Robin Soil RMC; Earthworm Toxicity Benchmark |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 63.7 | 7 | 9 | BLM Robin Soil RMC; Earthworm Toxicity Benchmark |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 83.8 | 7 | 12 | BLM Robin Soil RMC; Earthworm Toxicity Benchmark |
| WDES1 | Dewey | Soil (Rock Fines) | 89.7 | 7 | 13 | BLM Robin Soil RMC; Earthworm Toxicity Benchmark |
| WDWS2 | Dewey | Soil (Rock Fines) | 92.4 | 7 | 13 | BLM Robin Soil RMC; Earthworm Toxicity Benchmark |
| WDES2 | Dewey | Soil (Rock Fines) | 100 | 7 | 14 | BLM Robin and Mule Deer Soil RMCs; Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 126 | 7 | 18 | BLM Robin and Mule Deer Soil RMCs; Earthworm, Phyto-, and Microbe Toxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 131 | 7 | 19 | BLM Robin and Mule Deer Soil RMCs; Earthworm, Phyto-, and Microbe Toxicity |

| | | | | | Benchmarks | |
|---|---|---|---|---|---|---|
| **Iron** | | | | | | |
| MMTP-BL | Dewey | Soil (Rock Fines) | 3,650 | 200 | 18 | Microbe Toxicity Benchmark |
| MMTP-AU | Dewey | Soil (Rock Fines) | 6,640 | 200 | 33 | Microbe Toxicity Benchmark |
| SANDP | Dewey | Soil | 9,340 | 200 | 47 | Microbe Toxicity Benchmark |
| WDWS3 | Dewey | Soil (Rock Fines) | 10,300 | 200 | 52 | Microbe Toxicity Benchmark |
| WDWS1 | Dewey | Soil (Rock Fines) | 18,800 | 200 | 94 | Microbe Toxicity Benchmark |
| MMTP-U | Dewey | Soil (Rock Fines) | 24,900 | 200 | 125 | Microbe Toxicity Benchmark |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 27,400 | 200 | 137 | Microbe Toxicity Benchmark |
| CONEP COMP | Dewey | Soil (Rock Fines) | 28,200 | 200 | 141 | Microbe Toxicity Benchmark |

## Table 3.2-5. Soil Samples that Exceeded Ecological Risk-Based Screening Levels for Soil (Page 3 of 5)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Soil Criteria Exceeded |
|---|---|---|---|---|---|---|
| WDES1 | Dewey | Soil (Rock Fines) | 29,900 | 200 | 150 | Microbe Toxicity Benchmark |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 30,000 | 200 | 150 | Microbe Toxicity Benchmark |
| WDES3 | Dewey | Soil (Rock Fines) | 33,800 | 200 | 169 | Microbe Toxicity Benchmark |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 41300 | 200 | 207 | Microbe Toxicity Benchmark |
| WDES2 | Dewey | Soil (Rock Fines) | 43,000 | 200 | 215 | Microbe Toxicity Benchmark |
| MF03 | Dewey | Soil (Rock Fines) | 46,300 | 200 | 232 | Microbe Toxicity Benchmark |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 60,300 | 200 | 302 | Microbe Toxicity Benchmark |
| WDWS2 | Dewey | Soil (Rock Fines) | 64,300 | 200 | 322 | Microbe Toxicity Benchmark |
| **Lead** | | | | | | |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 13.8 | 6 | 2 | BLM Robin Soil RMC |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 21.2 | 6 | 4 | BLM Robin Soil RMC |
| WDES1 | Dewey | Soil (Rock Fines) | 39.4 | 6 | 7 | BLM Robin Soil RMC |
| WDES2 | Dewey | Soil (Rock Fines) | 52.2 | 6 | 9 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 53.6 | 6 | 9 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| WDES3 | Dewey | Soil (Rock Fines) | 61.6 | 6 | 10 | BLM Robin and Soil RMCs; Phytotoxicity Benchmark |
| MMTP-BL | Dewey | Soil (Rock Fines) | 63 | 6 | 11 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| MMTP-U | Dewey | Soil (Rock Fines) | 65.5 | 6 | 11 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| WDWS3 | Dewey | Soil (Rock Fines) | 66.4 | 6 | 11 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| MMTP-AU | Dewey | Soil (Rock Fines) | 76.4 | 6 | 13 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| WDWS1 | Dewey | Soil (rock Fines) | 78.2 | 6 | 13 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| SANDP | Dewey | Soil | 82.4 | 6 | 14 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| CONEP COMP | Dewey | Soil (Rock Fines) | 82.9 | 6 | 14 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| WDWS2 | Dewey | Soil (Rock Fines) | 87.5 | 6 | 15 | BLM Robin and Mallard Soil RMCs; Phytotoxicity Benchmark |
| MF03 | Dewey | Soil (Rock Fines) | 188 | 6 | 31 | BLM Robin, Mallard, Mule Deer, Deer Mouse, and Cottontail Soil RMCs; Phytotoxicity Benchmark |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 204 | 6 | 34 | BLM Robin, Mallard, Mule Deer, Deer Mouse, and Cottontail Soil RMCs; Phytotoxicity Benchmark |
| **Manganese** | | | | | | |
| WDWS3 | Dewey | Soil (Rock Fines) | 151 | 100 | 2 | Microbe Toxicity Benchmark |
| WDWS1 | Dewey | Soil (Rock Fines) | 155 | 100 | 2 | Microbe Toxicity Benchmark |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 195 | 100 | 2 | Microbe Toxicity Benchmark |
| CONEP COMP | Dewey | Soil (Rock Fines) | 319 | 100 | 3 | Microbe Toxicity Benchmark |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 465 | 100 | 5 | Microbe Toxicity Benchmark |
| WDES1 | Dewey | Soil (Rock Fines) | 546 | 100 | 5 | Microbe and Phytotoxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 601 | 100 | 6 | Microbe and Phytotoxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 751 | 100 | 8 | Microbe and Phytotoxicity Benchmarks |
| WDES2 | Dewey | Soil (Rock Fines) | 839 | 100 | 8 | Microbe and Phytotoxicity Benchmarks |

| | | | | | | |
|---|---|---|---|---|---|---|
| WDWS2 | Dewey | Soil (Rock Fines) | 878 | 100 | 9 | Microbe and Phytotoxicity Benchmarks |
| MF03 | Dewey | Soil (Rock Fines) | 890 | 100 | 9 | Microbe and Phytotoxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 1,200 | 100 | 12 | Microbe and Phytotoxicity Benchmarks |
| **Mercury** | | | | | | |
| WDWS2 | Dewey | Soil (Rock Fines) | 0.25 | 0.1 | 3 | Earthworm and Phytotoxicity Benchmarks |
| MMTP-BL | Dewey | Soil (Rock Fines) | 0.33 | 0.1 | 3 | Earthworm and Phytotoxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 0.37 | 0.1 | 4 | Earthworm and Phytotoxicity Benchmarks |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 0.38 | 0.1 | 4 | Earthworm and Phytotoxicity Benchmarks |
| WDES2 | Dewey | Soil (Rock Fines) | 0.39 | 0.1 | 4 | Earthworm and Phytotoxicity Benchmarks |

## Table 3.2-5. Soil Samples that Exceeded Ecological Risk-Based Screening Levels for Soil (Page 4 of 5)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Soil Criteria Exceeded |
|---|---|---|---|---|---|---|
| WDES3 | Dewey | Soil (Rock Fines) | 0.41 | 0.1 | 4 | Earthworm and Phytotoxicity Benchmarks |
| WDES1 | Dewey | Soil (Rock Fines) | 0.60 | 0.1 | 6 | Earthworm and Phytotoxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 0.61 | 0.1 | 6 | Earthworm and Phytotoxicity Benchmarks |
| WDWS3 | Dewey | Soil (Rock Fines) | 0.76 | 0.1 | 8 | Earthworm and Phytotoxicity Benchmarks |
| WDWS1 | Dewey | Soil (Rock Fines) | 1.28 | 0.1 | 13 | Earthworm and Phytotoxicity Benchmarks |
| MMTP-U | Dewey | Soil (Rock Fines) | 1.5 | 0.1 | 15 | Earthworm and Phytotoxicity Benchmarks; BLM Robin Soil RMC |
| SANDP | Dewey | Soil | 3.23 | 0.1 | 32 | Earthworm and Phytotoxicity Benchmarks; BLM Robin and Deer Mouse Soil RMCs |
| CONEP COMP | Dewey | Soil (Rock Fines) | 4.2 | 0.1 | 42 | Earthworm and Phytotoxicity Benchmarks; BLM Robin, Deer Mouse, and Mallard Soil RMCs |
| MMTP-AU | Dewey | Soil (Rock Fines) | 6.98 | 0.1 | 70 | Earthworm and Phytotoxicity Benchmarks; BLM Robin, Deer Mouse, and Mallard Soil RMCs |
| MF03 | Dewey | Soil (Rock Fines) | 8.19 | 0.1 | 82 | Earthworm and Phytotoxicity Benchmarks; BLM Robin, Deer Mouse, and Mallard Soil RMCs |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 91.8 | 0.1 | 918 | Earthworm, Phyto-, and Microbe Toxicity Benchmarks; BLM Robin, Deer Mouse, and Mallard Soil RMCs |
| **Nickel** | | | | | | |
| WDES1 | Dewey | Soil (Rock Fines) | 38.6 | 30 | 1 | Phytotoxicity Benchmark |
| WDES1 | Dewey | Soil (Rock Fines) | 48.3 | 30 | 2 | Phytotoxicity Benchmark |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 53.4 | 30 | 2 | Phytotoxicity Benchmark |
| MF03 | Dewey | Soil (Rock Fines) | 56.4 | 30 | 2 | Phytotoxicity Benchmark |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 60.7 | 30 | 2 | Phytotoxicity Benchmark |
| WDES2 | Dewey | Soil (Rock Fines) | 75 | 30 | 3 | Phytotoxicity Benchmark |
| WDWS2 | Dewey | Soil (Rock Fines) | 99.4 | 30 | 3 | Phyto- and Microbe Toxicity Benchmarks |
| **Selenium** | | | | | | |
| CONEP COMP | Dewey | Soil (Rock Fines) | 1.6 | 1 | 2 | Phytotoxicity Benchmark |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 3 | 1 | 3 | Phytotoxicity Benchmark |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 3.8 | 1 | 4 | Phytotoxicity Benchmark |
| WDES3 | Dewey | Soil (Rock Fines) | 4.7 | 1 | 5 | Phytotoxicity Benchmark |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 6.2 | 1 | 6 | Phytotoxicity Benchmark |
| WDWS1 | Dewey | Soil (Rock Fines) | 7.5 | 1 | 8 | Phtyotoxicity Benchmark |
| WDWS3 | Dewey | Soil (Rock Fines) | 9.8 | 1 | 10 | Phytotoxicity Benchmark |
| MMTP-U | Dewey | Soil (Rock Fines) | 16.8 | 1 | 17 | Phytotoxicity Benchmark |
| WDES2 | Dewey | Soil (Rock Fines) | 23.4 | 1 | 23 | Phytotoxicity Benchmark |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 29.3 | 1 | 29 | Phytotoxicity Benchmark |
| WDES1 | Dewey | Soil (Rock Fines) | 54.1 | 1 | 54 | Phytotoxicity Benchmark |
| **Silver** | | | | | | |
| MMTP-AU | Dewey | Soil (Rock Fines) | 4.51 | 2 | 2 | Phytotoxicity Benchmark |
| SANDP | Dewey | Soil | 5.87 | 2 | 3 | Phytotoxicity Benchmark |
| WDWS2 | Dewey | Soil (Rock Fines) | 6.82 | 2 | 3 | Phytotoxicity Benchmark |

| | | | | | | |
|---|---|---|---|---|---|---|
| CONEP COMP | Dewey | Soil (Rock Fines) | 10.2 | 2 | 5 | Phytotoxicity Benchmark |
| MF03 | Dewey | Soil (Rock Fines) | 23.9 | 2 | 12 | Phytotoxicity Benchmark |
| WDES2 | Dewey | Soil (Rock Fines) | 31.9 | 2 | 16 | Phytotoxicity Benchmark |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 38.7 | 2 | 19 | Phytotoxicity Benchmark |
| WDWS3 | Dewey | Soil (Rock Fines) | 46.1 | 2 | 23 | Phytotoxicity Benchmark |
| WDWS1 | Dewey | Soil (Rock Fines) | 47.0 | 2 | 24 | Phytotoxicity Benchmark |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 64.9 | 2 | 32 | Phyto- and Microbe Toxicity Benchmarks |
| MMTP-U | Dewey | Soil (Rock Fines) | 82.4 | 2 | 41 | Phyto-and Microbe Toxicity Benchmarks |
| WDES1 | Dewey | Soil (Rock Fines) | 97.5 | 2 | 49 | Phyto- and Microbe Toxicity Benchmarks |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 120 | 2 | 60 | Phyto- and Microbe Toxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 218 | 2 | 109 | Phyto- and Microbe Toxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 385 | 2 | 193 | Phyto- and Microbe Toxicity Benchmarks |

## Table 3.2-5. Soil Samples that Exceeded Ecological Risk-Based Screening Levels for Soil (Page 5 of 5)

| Sample ID | Location | Type | Result (mg/kg) | Minimum Soil Criterion (mg/kg) | Exceedence Factor | Soil Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Vanadium** | | | | | | |
| WDWS3 | Dewey | Soil (Rock Fines) | 4.8 | 2 | 2 | Phytotoxicity Benchmark |
| MMTP-BL | Dewey | Soil (Rock Fines) | 4.8 | 2 | 2 | Phytotoxicity Benchmark |
| MMTP-U | Dewey | Soil (Rock Fines) | 6.8 | 2 | 3 | Phytotoxicity Benchmark |
| SANDP | Dewey | Soil | 9 | 2 | 5 | Phytotoxicity Benchmark |
| MMTP-AU | Dewey | Soil (Rock Fines) | 9.4 | 2 | 5 | Phytotoxicity Benchmark |
| WDWS1 | Dewey | Soil (Rock Fines) | 24.2 | 2 | 12 | Phyto- and Microbe Toxicity Benchmarks |
| BGR 11,12,13 COMP | Blue Gulch | Soil (Rock Fines) | 31.3 | 2 | 16 | Phyto- and Microbe Toxicity Benchmarks |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 46.5 | 2 | 23 | Phyto- and Microbe Toxicity Benchmarks |
| CONEP COMP | Dewey | Soil (Rock Fines) | 53.3 | 2 | 27 | Phyto- and Microbe Toxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 53.9 | 2 | 27 | Phyto- and Microbe Toxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 56.8 | 2 | 28 | Phyto- and Microbe Toxicity Benchmarks |
| WDES1 | Dewey | Soil (Rock Fines) | 60.1 | 2 | 30 | Phyto- and Microbe Toxicity Benchmarks |
| WDES2 | Dewey | Soil (Rock Fines) | 89.4 | 2 | 45 | Phyto- and Microbe Toxicity Benchmarks |
| MF03 | Dewey | Soil (Rock Fines) | 96.5 | 2 | 48 | Phyto- and Microbe Toxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 99.9 | 2 | 50 | Phyto- and Microbe Toxicity Benchmarks |
| WDWS2 | Dewey | Soil (Rock Fines) | 108 | 2 | 54 | Phyto-and Microbe Toxicity Benchmarks |
| **Zinc** | | | | | | |
| WDWS3 | Dewey | Soil (Rock Fines) | 45.3 | 43 | 1 | BLM Robin Soil RMC |
| WDWS1 | Dewey | Soil (Rock Fines) | 51.4 | 43 | 1 | BLM Robin Soil RMC; Phytotoxicity Benchmark |
| WDES1 | Dewey | Soil (Rock Fines) | 106 | 43 | 2 | BLM Robin Soil RMC; Phyto- and Microbe Toxicity Benchmarks |
| MMTP-M & L Comp | Dewey | Soil (Rock Fines) | 158 | 43 | 4 | BLM Robin Soil RMC; Phyto- and Microbe Toxicity Benchmarks |
| WDES2 | Dewey | Soil (Rock Fines) | 164 | 43 | 4 | BLM Robin Soil RMC; Phyto- and Microbe Toxicity Benchmarks |
| MF03 | Dewey | Soil (Rock Fines) | 181 | 43 | 4 | BLM Robin Soil RMC; Phyto- and Microbe Toxicity Benchmarks |
| BGR22 | Blue Gulch | Soil (Rock Fines) | 198 | 43 | 5 | BLM Robin Soil RMC; Phyto- and Microbe Toxicity Benchmarks |
| BGR21 | Blue Gulch | Soil (Rock Fines) | 202 | 43 | 5 | BLM Robin and Mallard Soil RMCs; Phyto-, Microbe, and Earthworm Toxicity Benchmarks |
| WDES3 | Dewey | Soil (Rock Fines) | 228 | 43 | 5 | BLM Robin, Mallard, and Mule Deer Soil RMCs; Phyto-, Microbe, and Earthworm Toxicity Benchmarks |
| WDWS2 | Dewey | Soil (Rock Fines) | 328 | 43 | 8 | BLM Robin, Mallard, and Mule Deer Soil RMCs; Phyto-, Microbe, and Earthworm Toxicity Benchmarks |

## Table 3.2-6. Sediment Samples that Exceeded Ecological Risk-Based Screening Levels for Sediment

| Sample ID | Location | Type | Result (mg/kg) | Minimum Sediment Criterion (mg/kg) | Exceedence Factor | Sediment Criteria Exceeded |
|---|---|---|---|---|---|---|
| **Arsenic** | | | | | | |
| BGSD1-a | Blue Gulch | Sediment | 45.3 | 7.24 | 6 | EPA Region IV; EPA OSWER Ecotox Threshold; EPA ARCS TEC |
| BGSD1-b | Blue Gulch | Sediment | 69.2 | 7.24 | 10 | EPA Region IV; EPA OSWER Ecotox Threshold; EPA ARCS TEC and PEC |
| BGSD4 | Blue Gulch | Sediment | 540 | 7.24 | 75 | EPA Region IV; EPA OSWER Ecotox Threshold; EPA ARCS TEC, PEC, and NEC |
| **Copper** | | | | | | |
| BGSD1-a | Blue Gulch | Sediment | 180 | 18.7 | 10 | EPA Region IV; EPA OSWER Ecotox Threshold; EPA ARCS TEC, PEC, and NEC |
| **Lead** | | | | | | |
| BGSD1-a | Blue Gulch | Sediment | 193 | 30.2 | 6 | EPA Region IV; EPA OSWER Ecotox Threshold; EPA ARCS TEC and NEC |
| **Mercury** | | | | | | |
| DTJC DS-SED | Dewey | Sediment | 0.44 | 0.13 | 3 | EPA Region IV; EPA OSWER Ecotox Threshold |
| DTJCUS-SED | Dewey | Sediment | 1.15 | 0.13 | 9 | EPA Region IV; EPA OSWER Ecotox Threshold |
| DTJC SEEP2-SED | Dewey | Sediment | 1.41 | 0.13 | 11 | EPA Region IV; EPA OSWER Ecotox Threshold |
| BGSD1-a | Blue Gulch | Sediment | 1.79 | 0.13 | 14 | EPA Region IV; EPA OSWER Ecotox Threshold |
| BGSD4 | Blue Gulch | Sediment | 1.83 | 0.13 | 14 | EPA Region IV; EPA OSWER Ecotox Threshold |
| **Silver** | | | | | | |
| BGSD1-a | Blue Gulch | Sediment | 61.1 | 2 | 31 | EPA Region IV |

### 3.2.1 Human Health Risk Evaluation for Soil/Sediment

As shown in Table 3.2-1, the maximum-detected concentrations of the following metals in soil or sediment exceeded at least one human health risk-based screening level value for soil or sediment:

- Antimony
- Arsenic
- Iron
- Manganese
- Mercury
- Silver

Table 3.2-4 summarizes the soil or sediment samples with metal concentrations that exceeded at least one human health risk-based criterion. Evaluation of these results shows the following:

- For four metals (antimony, iron, manganese, and silver), all exceedences were associated with criteria based on residential exposure only. These criteria essentially assume that a person lives at the site, day after day, year after year (for 30 years), and has daily contact with soil at this site. However, long-term residence at the Dewey Mine or Blue Gulch Mine sites is extremely unlikely. Risks to infrequent site visitors associated with contact with these metals in soil or sediment are likely to be insignificant.
- For mercury, only one sample (a rock fines sample collected at the Dewey Mine site) had concentrations that exceeded a nonresidential exposure-based criterion. However, a number of studies (Davis *et al.*, 1997; Revis *et al.*, 1989; Paustenbach *et al.*, 1997; Schoof and Nielsen, 1997) have shown that mercury in soil is not highly bioavailable (*i.e.*, present in a form that is likely to desorb from soil and be available for absorption into the body where it can cause health effects). By contrast, most studies that have assessed the toxicity of the inorganic mercury (the form of mercury present in soil) to humans have used highly bioavailable (*i.e.*, soluble) forms of mercury administered directly to laboratory animals (U.S. EPA, 2001a). Because of the likely low relative bioavailability of mercury in soil at the mine sites, concentrations of mercury in soil are not likely to pose significant health risks.
- All measured concentrations of the remaining metal, arsenic, in soil or sediment exceeded at least one human health risk-based criterion, and most samples had concentrations that exceeded criteria based on infrequent site visitor scenarios. The maximum detected arsenic concentration (540 mg/kg, measured in a sediment sample in Blue Gulch), was more than 1,300 times higher than the most

conservative human health risk-based soil/sediment criterion (the U.S. EPA Region IX Residential Soil PRG), and nearly 12 times higher than the most conservative human health risk-based sediment criterion for infrequent exposure (the BLM Camper RMC for sediment). Similar to mercury, a number of studies have shown that arsenic in soil, particularly at mining sites, is not typically present in a form that is highly bioavailable (Ruby *et al.*, 1993, 1996). However, no data are available to assess the bioavailability of arsenic in soils at the Dewey Tunnel and Blue Gulch mine sites.

### *3.2.2 Ecological Risk Evaluation for Soil/Sediment*

As shown in Table 3.2-2, the maximum-detected concentrations of the following metals measured in soil exceeded at least one ecological risk-based screening level value for soil:

- Aluminum
- Arsenic
- Cadmium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Silver
- Vanadium
- Zinc

Table 3.2-5 summarizes the soil samples with metal concentrations that exceeded at least one ecological risk-based criterion for soil. Evaluation of these results shows the following:

- Fifteen metals were measured at concentrations that exceeded ecological risk-based concentrations for soil.
- For nine metals (aluminum, chromium, cobalt, iron, manganese, nickel, selenium, silver, and vanadium), all exceedences were for criteria based on phytotoxicity, microbe toxicity, and/or earthworm toxicity. Similar to many human studies, most of the soil concentrations used in these toxicity tests are based on concentrations of a soluble (*i.e.*, highly bioavailable) form of the metal added to

soil. Consequently, these values are likely to be highly conservative, particularly for comparison to metals in soils at mining sites.

- For six of these metals (arsenic, cadmium, copper, lead, mercury, and zinc), wildlife screening levels were exceeded in addition to phytotoxicity, microbe toxicity, and/or earthworm toxicity criteria.
- The most significant exceedences of non phyto-, microbe, or earthworm toxicity benchmark values were for arsenic and mercury measured in samples from both the Dewey and Blue Gulch Mine sites (up to 60 times and 92 times, respectively, criteria based on exposures of wildlife). However, as for the other criteria, these wildlife screening values do not take into account the differences in bioavailability of these metals in soil relative to the bioavailability of the metals used in the toxicity studies.

As shown in Table 3.2-3, the maximum-detected concentrations of the following metals measured in sediment exceeded at least one ecological risk-based screening level for sediment:

- Arsenic
- Copper
- Lead
- Mercury
- Silver

Table 3.2-6 summarizes the sediment samples with metal concentrations that exceeded at least one ecological risk-based criterion for sediment. Evaluation of these results shows the following:

- Five metals (arsenic, copper, lead, mercury, and silver) were measured in samples from either Jordan Creek or Negro Gulch Creek, or both, at concentrations that exceeded ecological risk-based criteria for sediment.
- The most significant exceedences of sediment screening values were for arsenic, mercury, and silver measured in samples from Negro Gulch Creek (up to 75, 14, and 31times, respectively, criteria based on survival or viability of sediment-based organisms). However, as for the other criteria, these wildlife screening criteria do not take into account differences in the bioavailability of these metals in soil versus the bioavailability of the metals used in the toxicity studies.
- For arsenic, all three sediment samples collected in Negro Gulch Creek had concentrations that exceeded numerous sediment criteria. Samples from Negro Gulch Creek also exceeded criteria for copper, lead, mercury, and silver.
- All three sediment samples collected in Jordan Creek exceeded sediment criteria for mercury; none of the sediment samples collected in Jordan Creek exceeded sediment criteria for any other metal.

# 4. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

## 4.1 FINDINGS AND CONCLUSIONS

As discussed previously, the risk-based values used in this screening-level risk analysis are intended to provide a conservative assessment of potential health risks to sensitive population groups. Consequently, if concentrations at the site do not exceed these values, then health risks are unlikely. If concentrations do exceed these values, it does not necessarily mean that health risks exist; rather, more focused investigation may be necessary to characterize actual site-related exposures and health risks.

Several agencies and organizations provide additional guidance for interpreting the results of such screening level risk evaluations. In evaluating comparisons to PRGs, U.S. EPA Region IX states (U.S. EPA Region IX, 2000):

> "Chemical concentrations above these levels would not automatically designate a site as 'dirty' or trigger a response action. However, exceeding a PRG suggests that further evaluation of the potential risks that may be posed by site contaminants is appropriate. Further evaluation may include additional sampling, consideration of ambient levels in the environment, or a reassessment of the assumptions contained in these screening-level estimates (*e.g.*, appropriateness of route-to-route extrapolations, appropriateness of using chronic toxicity values to assess childhood exposures, appropriateness of generic exposure factors for a specific site use, etc.)."

Ford (1996) provides the following suggested interpretation of the BLM Risk Management Criteria:

- Less than criteria: low risk
- 1-10 times the criteria: moderate risk
- 10-100 times the criteria: high risk
- >100 times the criteria: extremely high risk

In evaluating the results of comparisons to ecological criteria, Jones *et al.* (1997) suggest, "Exceedence of only one conservatively estimated benchmark may provide weak evidence of real effects, whereas exceedence of multiple benchmarks of varying conservatism may provide strong evidence of real effects" (Jones *et al.*, 1997).

Based on these guidelines and the results of this screening-level risk analysis described above, the following general conclusions were made:

- The Dewey and Blue Gulch Mine sites may pose a public health hazard for persons, such as hikers, campers, or site trespassers, who drink or come in contact

with water from Jordan or Negro Gulch Creeks. These persons could experience health effects as a result of ingesting or coming into contact with heavy metals such as arsenic, iron, magnesium, manganese, and mercury.

- Heavy metals, particularly arsenic and mercury, in Jordan or Negro Gulch may pose a public health hazard for persons who consume fish from these creeks because of the potential for these metals to bioaccumulate in fish. In addition, persons who eat fish caught further downstream could also be at risk. The significance of this potential exposure pathway cannot be fully evaluated, however, because sampling data for fish from the creeks are limited.
- Heavy metals, including aluminum, copper, zinc, manganese, and cadmium, in water in Jordan and Negro Gulch Creeks, could have significant impacts on aquatic biota in these creeks.
- Heavy metals in soil or sediment at the Dewey Tunnel and Blue Gulch mine sites are not likely to pose a public health hazard to persons who infrequently come in contact with these materials, such as campers or other recreators.
- Heavy metals in soil or sediment at the Dewey and Blue Gulch mine sites, including aluminum, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, and zinc, could significantly impact biota that live at or frequent these sites, including plants, microbes, invertebrates, and wildlife.

In assessing the significance of these conclusions, several limitations and uncertainties should be considered. These include the following:

- Limited water, soil, and sediment samples were collected at the Dewey Tunnel Mine and Blue Gulch Mine sites. However, the results of this assessment assume that measured concentrations are representative of concentrations to which humans or ecological receptors could be exposed. Average site concentrations could be significantly higher or lower.
- The risk-based screening concentrations to which measured site concentrations were compared, particularly human health criteria, are in general based on highly conservative exposure assumptions that will likely overestimate actual exposures. For example, the PRGs assume that for 7 days per week, 50 weeks per year for 30 years, a person will drink water or contact soil from the sites. Fish consumption scenarios assume that a person eats approximately 30 meals of fish from Jordan or Negro Gulch Creek per year.
- Metals in site soils and sediments were assumed to be 100% bioavailable. However, most metals in natural soils or present as contaminants in soils at mining waste sites are in poorly available forms.
- Fish consumption scenarios are based on estimates of fish concentrations in fish calculated from surface water concentrations and bioaccumulation factors. However, a number of site-specific parameters including water temperature, water chemistry, and fish size and species can significantly impact bioaccumulation of metals in fish.

## 4.2 RECOMMENDATIONS

### *4.2.1 Additional Field Sampling - Phase 1b*

The Project Team has recommended that due to the late seasonal site investigation, that Phase 1 be divided into two subparts: Phase 1a, representing low flow conditions, and Phase 1b, representing high flow conditions. Based on site observations and comparison of those observations to previous studies and site inspections by IDL staff, it is evident that certain water features were not present during the low flow conditions and other flows were drastically reduced. For example, of the 6 Dewey Tunnel Mine seeps that were observed in the late spring, only four were evident in August. The Mystery Mill spring was present but in order to obtain a sufficient volume of water for analysis, field staff dug a small pit into which the spring water seeped. Samples were taken from accumulated water. The water passing through organic material may have altered the pH between the free-flowing spring and the small pit. There was also increased turbidity in this sample compared to other seep samples, which may have led to higher contaminant levels e.g., mercury. The MMSEEP should be sampled again during high flow conditions.

In addition, high flow conditions from the acidic seeps may mobilize additional metals and minerals from the waste rock pile and result in different findings that are found during the low flow conditions. The Project Team recommends that a focused Phase 1b sampling be conducted during high flow conditions. No additional sampling of rock, soils, tailings, and sediments is recommended at this time.

### *4.2.2 Additional Literature Review*

The Phase 1a site investigation and characterization was designed to determine relative risk that these two sites might pose to human health and the environment. The Project Team reviewed materials provided to them from the USACE and the IDL. Depending on the level of effort required by agency staff to procure additional background information and its completeness, it may be beneficial to conduct a focused literature search which could further reveal the nature of the exact operations at the Dewey Tunnel Mine and Blue Gulch Mine. There may be additional information collected by the U.S. Geological Survey (USGS) and the U.S. Bureau of Mines. Further records review at state geologic or mining divisions may provide additional information.

### *4.2.3 Methods to Reduce Metal Loadings to Site Creeks*

Metal loadings to the site creeks may pose a public health hazard for persons who drink water from the creek such as hikers, campers, and hunters. Methods to reduce metal loadings to the site creeks should be considered. In order to better evaluate methods to reduce metal loadings, a better understanding is needed as to the location of the source of

the Dewey Tunnel seeps as well as the depth and materials through which they pass. Therefore, it is recommended that the geo-physical study that was included in the original scope of work be considered to determine the source and nature of the acid mine seeps.

### *4.2.4 Biological Studies*

Although some biological studies have been conducted at Jordan Creek, these studies were limited in their scope and purpose. Additional studies to be considered are listed below:

- Consider correlating the potential for fish barriers and migration of fish with impacts from water quality in Jordan Creek and Blue Gulch.
- Consider sampling fish in Jordan Creek downstream of the Dewey Mine site and the confluence of BlueGulch Creek, to ensure that fish tissues do not contain metals at unsafe levels.
- Consider conducting site-specific toxicity tests to assess the toxicity of surface water and sediment contaminants to aquatic biota.
- Consider conducting tests (*e.g.*, laboratory extraction studies) to assess the impact of site specific variables on the bioavailability of metals in site soils and sediments.
- Consider gathering site-specific data on key ecological species and human activities at these sites.

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# APPENDIX A

# Assessment in Support of Site Characterization And Screening Risk Analysis of Dewey Tunnel and Blue Gulch Mines For the Walla Walla District, U. S. Army Corps of Engineers June 1, 2001 Rev. August 6, 2001

## Project Understanding and Purpose

Based on discussions with the US Army Corp of Engineers (USACE), it is the Project Team's understanding that the Walla Walla District of the U. S. Army Corps of Engineers (USACE) and the Idaho Department of Lands (IDL) desire to complete an initial site characterization and screening risk analysis for two mining sites. Although some site characterization has been conducted at the two sites, there has not been sufficient information generated to determine a relative level of risk that either of these two sites might pose to the environmental and/or to human health. The purpose of this project is to characterize these sites to determine how extensive the problems are and how they could be remedied. The information will be placed into an abandoned mine database and used to help prioritize where the IDL should do reclamation work.

The following information was obtained from the USACE and IDL and was used to develop the scope of work for this project. The Dewey Tunnel and Blue Gulch mines are located in Owyhee County in southwestern Idaho. They are located approximately 3 miles northwest of Silver City, Idaho. The Dewey Tunnel mining site includes sites of former structures (Dewey Hotel, Dewey House, Transformer House, and Main Mill and Upper Mill Buildings, and a Mystery Mill). There are 4 waste rock dumps and mill tailings (main waste rock dump, cone shaped pile, mystery mill tailings, and sand pile). State personnel discovered acid rock drainage in 1997. A white precipitate was observed on the rocks of Jordan Creek near the mouth of Blue Gulch. The source of the water from the area near the waste rock dump flowing into the Creek is not known. Another spring is present below the mill building at the east end of the main waste rock dump. The spring may be on private land.

Blue Gulch mine site is located in a steep draw on the east side of Blue Gulch. The Trade Dollar and Black Jack Mines are located in Negro Gulch just south of Humboldt Mine. A large waste dump at the bottom of Negro Gulch pushes Blue Gulch Creek to the opposite side of the valley. The waste dump may be on private land. The creek was bright red color at the time of the state inspection. Soon after leaving the waste rock dump, the creek enters state land.

It is the Project Team's understanding that the USACE and IDL are requesting that the following deliverables be prepared for each site: a base map that will contain the location

of all site features and sample locations; a report that will summarize the analytical results of all tests and surveys and discuss the potential risks to water quality, aquatic ecosystems, and human health, and evaluate options for reducing those risks. In discussions with the USACE, it is also understood that to the extent practicable, USACE staff will support some of the tasks e.g. report preparation.

The level of effort was discussed in a document supplied to the Project Team by the USACE. The document entitled *Scope of Work – Appendix A* specified the following tasks:

- GPS map of site and site features (waste rock, adit, foundations, springs, etc.)
- Survey to determine ownership boundaries (Dewey only)
- Collection and analysis of water samples from springs and creeks
- X-ray diffraction analysis of waste rock to determine mineral composition
- Volume determination of waste rock
- Electromagnetic survey of waste dump to find water draining through dump (Time-domain ElectroMagnetic or TEM)
- Electromagnetic survey of waste dump to find bottom of the dump (Controlled Source AudioMagneto Tellurics or CSAMT)
- Induced Polarization (IP) survey of waste dump to find concentrations of sulfide minerals
- Feasibility study for stopping acid rock drainage (ARD).

The USACE and IDL also have requested that existing site characterization conducted on the sites be used where relevant and appropriate. Other documents received from the USACE include an untitled document describing the history of the site, some water quality data from an Environmental Impact Statement on the Stone Cabin Mine prepared by CH2M Hill, results of sediment sampling and analysis for metals from the Jordan River, and soil sampling and analysis for mercury near the Dewey Mine site conducted by Ecology and Environment, Inc.

## Project Approach

The project management structure will have David Evans and Associates (DEA) serving as the primary contact for the USACE and performing the project management function. Subconsultants supporting the effort include: Limno – Tech, Inc. (LTI), Intertox, Inc. (Intertox), Quadrant Engineering (Quadrant), and Columbia Analytical Services, Inc. (Columbia).

The goal of this effort will be to build upon existing studies where appropriate in order to characterize the sites and conduct a screening level risk assessment. The Project Team recommends that the scope of work developed for the two sites are divided into a phased approach. The primary reason for developing a phased approach is to address the question of relative risk for both these sites in a cost-effective manner. After discussions with experts in geophysical explorations ( TEM, IP, CSAMT), the budget estimates ranged from $20,000 - $50,000 depending on the level of analysis. If there is little risk to

human health, aquatic and eco-systems from these sites, this effort may not be necessary. Therefore, the Project Team proposes a phased approach to address the most critical issues first.

**Phase I** would develop information on the two mines to provide the USACE and IDL with information necessary to evaluate the urgency of further action at these sites and to provide a preliminary estimate of the resources required to address problems at these sites. This will include development of a base map. Sampling and analysis will include water quality, rock, in-stream sediment, and soils. The information from these studies will be used in a screening level risk analysis for both human health and ecological risks. Based on the results of this effort, a report will be prepared discussing potential risks to water quality, aquatic ecosystems, and human health, and analyze options for reducing those risks.

**Phase II**, if warranted due to concerns raised by the risk analysis, will provide geo-physical investigations. Geophysical exploration is likely to be relatively expensive and results of Phase I will be used to tailor the approach used. Preliminary discussions with geophysical contractors indicate that it is likely that not all the methods specified in the scope of work will be required to obtain the necessary results.

**Phase III** will include development of feasibility studies for addressing environmental problems and improving the water quality at the sites. This will be followed by development of detailed plans and specifications. Phase III may be combined with Phase II.

## Scope of Work

### Task 1 Mapping and Surveying

Locations of notable geographic features will be recorded using a Global Positioning System (GPS) instrument to determine positions accurate to better than plus or minus 1m. Positions of locations important to the analysis will be determined. These are likely to include

- Changes in courses of streams.
- Confluence of tributaries.
- Springs
- Signs of notable contamination
- Signs of running water
- Outlines of waste piles
- Obvious changes or rock type in waste piles
- Mine entrances/ adit
- Structures and foundations

Results of survey will be drafted into figures for use in further engineering analysis and decision-making. The figures will include sampling locations used in Task 3.

At the Dewey Tunnel site there is uncertainty about positions of property boundaries with respect to the mine. Property boundaries will be identified with respect to the mine adit, mill site, waste dump, spring, and Jordan Creek. A search will be made of county records to locate deeds and plans. Using this information, property boundaries will be marked. Monuments will be established to allow rapid reestablishment of markings, and tied in with state plane if feasible. The results of the survey will be drawn to standards. Surveying and mapping will be done under the supervision of a surveyor licensed in the State of Idaho.

Deliverables: Figures showing locations of relevant features at the two sites. A plan showing the property boundaries relevant to the Dewey Mine site.

**Task 2 Development of Sampling analysis (SAP) Plan and Supporting Documents.**
The sampling plan will specify where, when, and how sample collection and analysis will be performed. During sampling plan development particular attention will be paid to insuring optimal allocation of sampling effort. The plan will insure that sampling is conducted in a documented and reproducible manner, and follow EPA approved protocols. Plan development will also insure that cost expended toward sample collection and analysis is expended in the most efficient manner. As part of the sampling plan a Quality Assurance/ Quality Control (QA/QC) plan will insure all aspects of sampling and analysis are properly documented, chains of custody are maintained, and proper procedures are followed during sampling and analysis.

The remote and rugged terrain found at the site combined with dangers inherent in abandoned mine sites will dictate that detailed safety procedures be developed to insure the safety of field personnel. The safety plan will address hazards arising from both possible toxic material at the site and physical features of the site.

Deliverable: Sampling Plan, Health and Safety Plan, QA/QC Plan

**Task 3 Sample Collection at Dewey Tunnel and Blue Gulch Mines**
The first water sampling will be conducted in August 2001. This will describe dry season conditions. Proper site characterization also requires sampling during high-flow conditions. Therefore, a second sampling will occur in spring or early summer 2002. The exact sampling time selected will depend on the amount of snow during the winter of 2001/2002 and weather conditions during spring 2001. Rock, sediment, and soil samples will be collected in the August sampling effort to allow maximum time for analysis. Characteristics of these materials are not expected to vary with sampling time.

Water and rock will be sampled from selected locations following protocols specified in the sampling plan. Because the mines are in remote areas and to insure safety, field crew will include at least two persons. In addition to collecting samples, measurements will be

made in the field. These will include temperature, pH, and others as may be specified in the sampling plan. Chain of custody procedures and detailed notes will be taken as specified in the sampling plan. Positions of samples will be determined to an accuracy of at least plus or minus one meter. Locations will be determined either by a GPS carried by the sampling crew.

It is anticipated that 6 rock samples, 6 soil samples, 6 sediment samples, and 30 water samples (13 low flow conditions, 13 high flow conditions) will be collected from each of the two mine sites. However, the exact number could vary as the sampling plan is developed. Number of samples collected in the spring 2002 sampling effort may be adjusted based on results obtained in the August 2001 effort. The purpose of conducting two sampling efforts at different times in the season is to evaluate potential changes in water quality during high and low stream flows.

Deliverables: Samples will be collected as specified in the sampling plan and delivered to a laboratory.

**Task 4 Water Quality Analysis**

Water samples will be promptly delivered to the lab following protocols in the sampling plan. The water will be subjected to the analyses listed below. Additional analyses for organic materials, herbicides or pesticides may be added if information is obtained indicating that these tests are warranted; the Project Team, based on current information, does not anticipate that these additional tests will be required.

Metals will be detected using ICP/MS (Inductively Coupled Plasma/ Mass Spectrometry), a highly sensitive technique used to measure trace elements in a variety of solid and liquid materials. In ICP-MS, digested samples are dispersed into a stream of argon gas and carried to an ICP where they are ionized at very high temperature. A mass spectrometer coupled to the ICP separates the ions according to their mass, after which the abundance of each ion is counted and quantified. The proposed ICP/MS technique (EPA 200.8) will detect AL, Cd, Ca, Co, Cu, Fe, Pb, Mg, Ni, K, Na, Zn and EPA 245.1 detects Hg. The test will be run essentially twice on each water sample, once on the whole water sample and once on the filtered sample. This procedure determines the amount of metal dissolved in the water and the amount carried by the water as particulates.

Several other less equipment intensive tests will also be run. Total suspended solids analysis measures the concentration of suspended particles. The pH test is done in the field but will also be done in the lab. It measures the concentration of hydronium ions and thus the acidity. Conductivity tests measure concentration of ions and the alkalinity tests measure the ability of the water to receive acid without large changes in pH.

Proposed tests for the water include:

- Total suspended solids by EPA 160.2
- pH by EPA 150.1

- Conductivity by EPA 120.1
- Alkalinity by EPA 310.1
- Total metals by ICP/MS and CVAA
- Dissolved metals by ICP/MS and CVAA

Deliverables: Results of analysis for both dissolved and suspended metals for 13 samples at each of the two sites and each of the two sampling site visits (52 samples, 104 analyses). The samples will also be tested for TSS, pH, Conductivity, and alkalinity.

**Task 5: Rock, Soil, and Sediment Analysis**
Solids to be analyzed include rock, soils, and in-stream sediment. Rock will be analyzed in two manners. Extraction using the synthetic precipitate leaching procedure (SPLP, EPA 1312) extracts metals the rock is likely to leach into the water. The leachate is analyzed for metals. X-Ray diffraction measures the chemical composition of the rock.

Soils and in-stream sediment are also analyzed using ICP/MS. These samples will come from approximately 6 locations on each of the two sites. The locations will be designated in the sampling plan.

- SPLP EPA 1312
- Leachate analysis for metals (As, Ba, Cd, Cr, Pb, Hg, Se, Ag)
- X ray diffraction
- ICP/MS analysis of soils
- ICP/MS analysis of sediment

Deliverables: Results of metals analysis of 12 soil samples;
Results of metal analysis of 12 sediment samples;
Results of leaching and leachate analysis of 12 rock samples;
X-ray analysis of 12 rock samples.

**Task 6 Data Analysis**
The results of the GPS survey, and water, rock, sediment and soils analysis will be validated in accordance with USACE and IDL requirements. Validation insures the data is internally consistent and identifies possibly erroneous data. Results will then be integrated into a memo giving a picture of the extent of contamination at the sites. The data will also be placed in a format consistent with the IDL abandoned mine database. This report will provide risk assessors and other investigators a presentation of the data. It will also allow decision makers a convenient access to data gathered in the fieldwork. Efforts will insure that users of the data are consulted throughout the data collection process to insure documents produced in this task meet user needs.

Deliverables: A presentation of the data and supporting information in an organized accessible form consistent with requirements of the abandoned mine database.

**Task 7 Risk Assessment.**

The objective of this task is to determine whether the potential human health and environmental risks due to exposure to contaminants originating in waste piles or surface water seeps at the Dewey and Blue Gulch Mines may be significant. The approach will be to compare the upperbound (*e.g.*, maximum) metal concentrations in the site environmental samples against published screening level health (*e.g.*, recreational or resident) and environmental risk-based values for standard exposure scenarios. Since these risk-based values are developed by regulatory agencies to provide a conservative assessment of potential health risks to sensitive population groups, if appropriately collected upperbound concentrations do not exceed these values, then health risks are unlikely. If upperbound concentrations do exceed these values, it does not necessarily mean that health risks exist; rather, most regulatory agencies recommend that further, more focused investigation to characterize actual site-related exposures and health risks may be necessary. The environmental assessment will be limited by the absence of information on key species in the area.

Comparison concentrations for human health assessment may come from USEPA's soil screening guidance (USEPA 1996), USEPA ambient water quality criteria, USEPA regional criteria, and BLM risk management criteria (Ford, 1996). Comparison concentrations for environmental assessment may come from Suter and Tsao (1996) and Efroymson, et al. (1997).

Deliverables: A summary memo will provide a table of comparisons between upperbound concentrations and screening guidance concentrations. The memo will identify the areas, pathways, or contaminants that may pose a significant risk based on the results of this assessment, and provide recommendations for further investigation, if necessary

**Task 8 Report Preparation**

Working together with the USACE, a draft report will be developed. This report will present results from this investigation so they are readily accessible to decision makers and future phases of the project. Comments to the draft report will be received and a final version will be prepared.

Deliverables: Draft Report; Final Report.

**Task 9 Project Management**

Members of the DEA team will meet with the USACE and IDL at the initiation of the work to review the SAP, midway through the project and at the project conclusion to communicate project achievements and insure the project is fulfilling objectives. The project manager will all closely monitor and direct progress made by the entire team and insure the team has the proper direction. A minimum of 3 project meetings is anticipated.

## Schedule

The initial sampling will proceed within one month after the notice to proceed. The second sampling will occur as early as feasible in spring 2002. The field collection date will depend on how soon the snow melts and the site becomes accessible by vehicles. Analysis and report preparation is expected to be completed not more than four months after completion of the second sampling. It is anticipated this will be in September 2002.

Schedule for Dewey Tunnel and Blue Gulch Mines

| | Weeks | | | | | | | | Weeks | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | No | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| T 1 Survey | | x | x | | | | | Sampling | | | | | | | | | | | | | | |
| T 2 Planning | x | | | | | | | During | | | | | | | | | | | | | | |
| T 3 Sampling | | x | | | | | | Winter | x | | | | | | | | | | | | | |
| T 4 Water Analysis | | | x | x | | | | Season | | x | x | | | | | | | | | | | |
| T 5 Rock Analysis | | | x | x | | | | | | | | | | | | | | | | | | |
| T 6 Data Analysis | | | | | x | x | | | | | | x | x | | | | | | | | | |
| T 7 Risk assessment | | | | | | | x | | | | | | | x | x | x | | | | | | |
| T 8 Report Prep. | | | | | | | | | | | | | | | | | x | x | x | x | x | x |
| T 9 Project Mgt | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |

# APPENDIX B

**Appendix B**

**Table B-2 : Results of Sediment Samples, Jordan Creek, Using XRF Screening ( Source: EPA, 1998, 2000)**

| | Jordan Creek at Dewey Site | | | | | | | | Jordan Creek | | Jordan Creek | | Mouth of | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Subaqueous | | Dry Bank | | Cut Bank Gulch | | Sieved | | Below Dewey | | Above Blue Gulch | | Blue Gulch | |
| Antimony | 25 | U | 1 | B | 1 | B | 2 | B | 1 | B | 2 | B | 6 | B |
| Arsenic | 13 | | 8 | | 14 | | 48 | | 10 | | 16 | | 18 | |
| Barium | 1849 | | 1378 | | 1105 | | 135 | | 1640 | | 1669 | | 823 | |
| Cadmium | 2 | U | 2 | U | 2 | U | 2 | | 1 | B | 2 | U | 1 | B |
| Calcium | 1075 | | 13020 | | 9360 | | 8970 | | 8500 | | 11804 | | 3068 | |
| Chromium | 16 | U | 16 | U | 7 | B | 16 | U | 16 | U | 16 | U | 16 | U |
| Copper | 158 | | 30 | | 11 | | 631 | | 126 | | 27 | | 10 | |
| Iron | 14650 | | 21710 | | 17880 | | 27850 | | 14100 | | 20930 | | 4289 | |
| Lead | 22 | | 28 | | 30 | | 27 | | 19 | | 27 | | 8 | |
| Manganese | 2947 | | 934 | | 377 | | 3653 | | 2142 | | 568 | | 64 | |
| Mercury | 1.3 | U | 1.3 | U | 5.2 | | 4.1 | | 1.3 | U | 3.7 | | 0.2 | B |
| Nickel | 4 | | 4 | U | 4 | U | 4 | U | 4 | U | 4 | U | 4 | U |
| Potassium | 18780 | | 26600 | | 22760 | | 13400 | | 15900 | | 21923 | | 25941 | |
| Selenium | 7 | U | 7 | U | 1 | B | 3 | B | 1 | B | 7 | U | 7 | U |
| Silver | 2 | | 2 | | 4 | | 8 | | 2 | | 3 | | 3 | |
| Titanium | 2143 | | 3181 | | 2702 | | 3625 | | 1855 | | 2885 | | 2579 | |
| Zinc | 522 | | 352 | | 83 | | 1337 | | 510 | | 156 | | 18 | |

*Note: units are mg/Kg. U denote substance not detected; B denotes concentration between detection and reporting limits .*

**Appendix B**

**Table B-1: Summary Data of Water Samples From Jordan Creek, Dewey Mine Site. (Source: EPA, 1998, 2000)**

| | Total | | Dissolved | |
|---|---|---|---|---|
| Aluminum | 293 | | 226 | |
| Antimony | 4 | U | 4 | U |
| Arsenic | 2 | U | 2 | U |
| Barium | 29.8 | | 19.2 | |
| Beryllium | 0.6 | U | 0.6 | U |
| Cadmium | 0.4 | U | 0.4 | U |
| Calcium | 1740 | | 1660 | |
| Chromium | 0.9 | U | 0.9 | U |
| Cobalt | 3.2 | U | 3.2 | U |
| Copper | 2.3 | U | 7.8 | |
| Iron | 210 | | 56.2 | U |
| Lead | 3 | | 3.6 | |
| Magnesium | 259 | | 248 | |
| Manganese | 13.4 | U | 2.8 | U |
| Mercury | 0.1 | U | 0.1 | U |
| Nickel | 3.4 | U | 3.4 | U |
| Potassium | 1810 | | 1900 | |
| Selenium | 1.9 | U | 1.9 | U |
| Silver | 1.1 | U | 1.1 | U |
| Sodium | 1710 | | 1730 | |
| Thallium | 4.2 | U | 3.6 | U |
| Vanadium | 2.9 | U | 2.9 | U |
| Zinc | 5.7 | U | 12.6 | U |
| Cyanide | 1.4 | U | 1.4 | U |
| | | | | |
| Alkalinity (mg/l) | 10.4 | | | |
| TSS (mg/l) | 13.7 | | | |
| Temperature C | 28.4 | | | |
| pH | 8.3 | | | |

*Note: Unless otherwise noted, units are ug/l. U denotes substance was not detected and concentration given is the detection limit*

# APPENDIX C

**Appendix C**

**Table C-3: Water Quality Data (Source: CH2M Hill, Stone Cabin Mine EIS, 1994)**

| | Jordan Creek below Blue Gulch | | | | Blue Gulch at Jordan Creek | | | | Blackjack Mine Discharge | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Mean** | | **Max** | | **Mean** | | **Max** | | **Mean** | | **Max** | |
| Discharge cfs | 6.9 | | 7.3 | | 0.1 | U | 0.7 | | 0.1 | U | 0.01 | U |
| Temperature C | 13 | | 22 | | 14 | | 22 | | 5 | | 7 | |
| | | | | | | | | | | | | |
| pH | 6.8 | | 7.3 | | 6.6 | | 7.2 | | 5.3 | | 6.5 | |
| conductivity umho | 116.3 | | 281 | | 73.3 | | 130 | | 82.2 | | 167 | |
| Dissolved solids | 102 | U | 254 | | 69.5 | | 108 | | 67.3 | U | 110 | |
| Turbidity NTU | 1.5 | U | 3.3 | | 1.8 | | 4.5 | | 9.4 | | 25 | |
| Alkalinity | 12.3 | U | 27 | | 8.8 | U | 20 | | 3.5 | U | 15 | |
| Total Cyanide | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| Free Cyanide | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| WAD Cyanide | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| Ammonia | 0.06 | U | 0.09 | | 0.05 | U | 0.05 | U | 0.05 | U | 0.05 | U |
| Hardness | 54.3 | | 167.2 | | 38.7 | | 160 | | 43.8 | | 160 | |
| Suspended Sediment | 4.3 | | 8 | | 8.5 | U | 35 | | 23.5 | | 52 | |
| | | | | | | | | | | | | |
| Bicarbonate as $CaCO_3$ | 12.2 | U | 27 | | 8.8 | U | 20 | | 3.5 | U | 15 | |
| Carbonate as $CaCO_3$ | 0.2 | U | 1 | U | 0.1 | U | 1 | U | 1 | U | 1 | U |
| Chloride | 1.6 | U | 4.3 | | 2.1 | U | 7 | | 1.8 | U | 4.3 | |
| Fluoride | 0.3 | U | 0.86 | | 0.17 | | 0.44 | | 0.24 | U | 0.63 | |
| Nitrate as N | 0.24 | U | 1.24 | | 0.21 | U | 1.43 | | 1 | | 2 | |
| Sulfate | 44.3 | | 129 | | 24.5 | | 43 | | 28.3 | | 65 | |
| Sum of Anions (meq) | 1.125 | | 2.962 | | 0.783 | | 1.24 | | 0.781 | | 1.532 | |
| | | | | | | | | | | | | |
| Calcium | 16.4 | | 47.6 | | 7.9 | | 11.1 | | 6.8 | | 10.2 | |
| Magnesium | 3.1 | | 10.7 | | 1.9 | | 3.2 | | 1.9 | | 4.3 | |
| Potassium | 1.5 | | 2.8 | | 1.1 | | 1.5 | | 1.3 | | 1.5 | |
| Sodium | 3.9 | | 8.6 | | 3.5 | | 6 | | 2.6 | | 4 | |
| Sum of Cations (meq) | 1.207 | | 3.803 | | 0.781 | | 1.239 | | 0.784 | | 1.499 | |
| Percent Diff. | 6.8 | | 22.1 | | 0.1 | U | 0.1 | U | 0.4 | | 2.2 | |
| | | | | | | | | | | | | |
| Aluminum | 0.17 | U | 0.53 | | 0.11 | U | 0.25 | | 0.9 | | 3.6 | |
| Arsenic | 0.008 | U | 0.041 | | 0.006 | U | 0.006 | | 0.005 | U | 0.005 | U |
| Barium | 0.12 | U | 0.2 | | 0.13 | U | 0.46 | | 0.11 | U | 0.15 | |
| Cadmium | 0.047 | U | 0.016 | | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U |
| Chromium | 0.07 | U | 0.1 | U | 0.07 | U | 0.1 | U | 0.06 | U | 0.09 | |
| Copper | 0.02 | U | 0.02 | | 0.02 | U | 0.04 | | 0.04 | U | 0.14 | |
| Iron | 0.07 | U | 0.18 | | 0.14 | U | 0.35 | | 0.17 | U | 1 | |
| Lead | 0.07 | U | 0.1 | U | 0.07 | U | 0.1 | U | 0.05 | U | 0.05 | U |
| Manganese | 0.09 | U | 0.25 | | 0.06 | U | 0.11 | | 0.17 | U | 0.56 | |
| Mercury | 0.0007 | U | 0.0014 | | 0.0007 | U | 0.0016 | | 0.001 | U | 0.0022 | |
| Selenium | 0.005 | U | 0.009 | | 0.005 | U | 0.008 | | 0.005 | U | 0.005 | U |
| Silver | 0.005 | U | 0.005 | U | 0.005 | U | 0.005 | U | 0.006 | U | 0.006 | |
| Zinc | 0.121 | | 0.397 | | 0.032 | | 0.083 | | 0.113 | | 0.282 | |

*Note: Data in mg/l unless otherwise noted.*

**Appendix C**

**Table C-1: Fish Tissue Concentrations**
**(Source: CH2M Hill, Stone Cabin Mine EIS, 1994.**

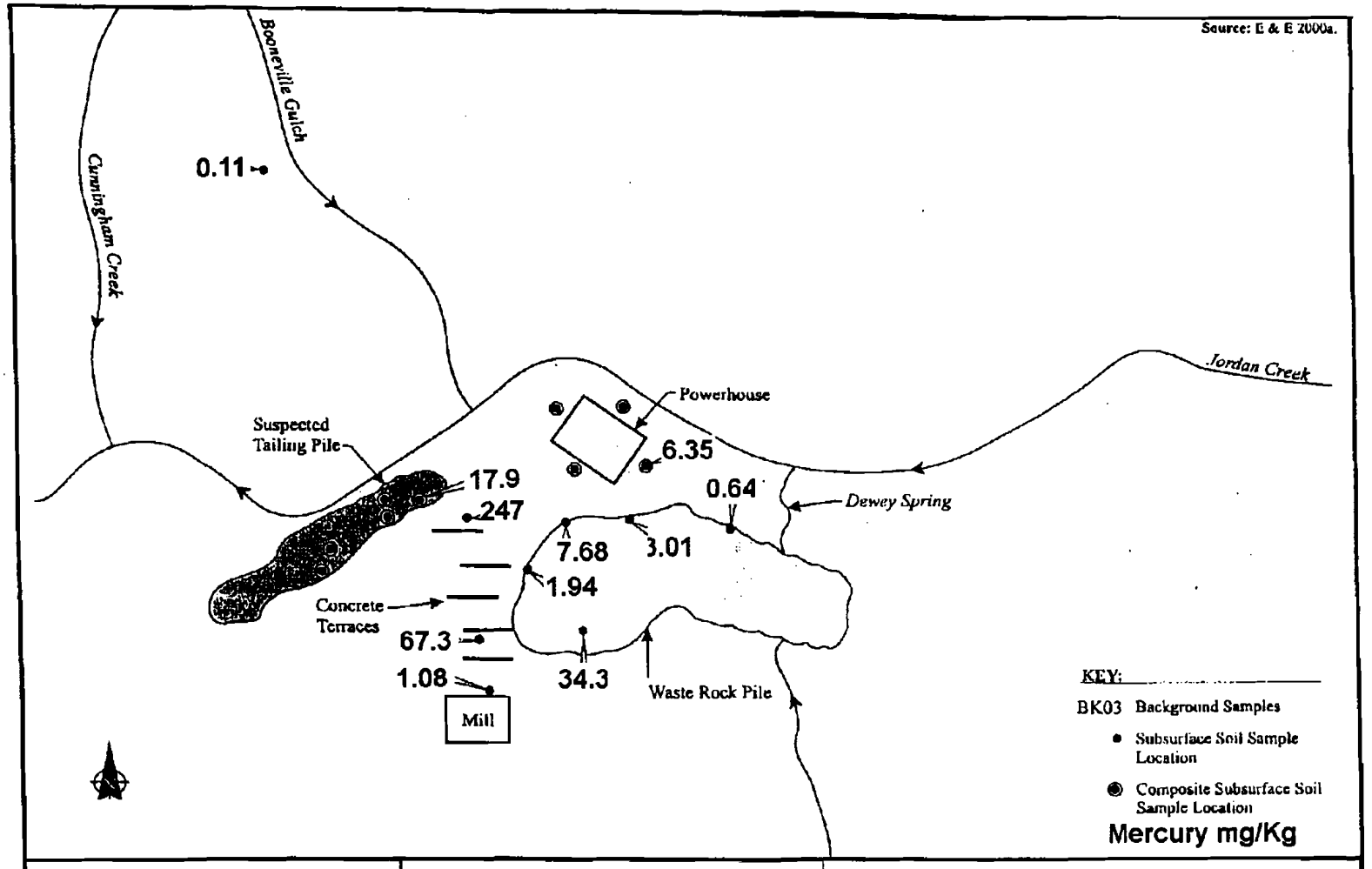
| | Fish Length mg/Kg | Arsenic mg/Kg | Cadmium mg/Kg | Copper mg/Kg | Lead mg/Kg | Mercury mg/Kg | Selenium mg/Kg | Zinc mg/Kg |
|---|---|---|---|---|---|---|---|---|
| Jordan Creek | 147 | <0.4 | <.05 | 0.94 | <0.07 | 0.46 | 0.2 | 11.6 |
| | 172 | <0.4 | 0.07 | 1.05 | <0.07 | 0.89 | 0.8 | 13.5 |
| | 211 | <0.4 | 0.1 | 0.68 | <0.07 | 0.58 | 0.7 | 8.2 |
| | 165 | <0.4 | 0.08 | 0.79 | <0.07 | 0.56 | 0.3 | 14 |
| | 203 | <0.4 | <.05 | 0.77 | <0.07 | 0.66 | 0.8 | 13.2 |
| | 208 | <0.4 | <.05 | 0.62 | <0.07 | 0.47 | 0.8 | 8.8 |
| | 213 | <0.4 | <.05 | 0.85 | <0.07 | 0.59 | 0.4 | 11.1 |
| | 218 | <0.4 | 0.06 | 1.05 | <0.07 | 1.1 | 0.6 | 13 |
| | 200 | <0.4 | 0.05 | 0.9 | <0.07 | 0.33 | 0.9 | 10.2 |
| | 207 | <0.4 | <.05 | 0.79 | <0.07 | 0.33 | 0.8 | 9.7 |
| | 241 | <0.4 | 0.05 | 0.74 | <0.07 | 0.42 | 1.1 | 9.2 |
| Blue Gulch | | | | | | | | |
| | 155 | <0.4 | 0.12 | 1.76 | <0.07 | 0.65 | 0.7 | 13.8 |
| | 185 | 0.5 | 0.27 | 1.24 | <0.07 | 0.43 | 0.6 | 19 |

**Table C-2: Benthic Invertebrate Species Composition**
**(Source: CH2M Hill, Stone Cabin Mine EIS, 1994)**

| Blue Gulch | | Jordan Creek | |
|---|---|---|---|
| no/sq ft | 6.98 | | 117.29 |
| | % | | % |
| Baetis | 19.1 | Glossosoma | 27.9 |
| Hesperophylax | 14.3 | Neophylax | 13.6 |
| Hesperoperla | 9.6 | Brachycentrus | 11.4 |
| Simulium | 9.6 | Epeorus | 11.4 |
| Zapada | 9.6 | Elmidea | 7.7 |

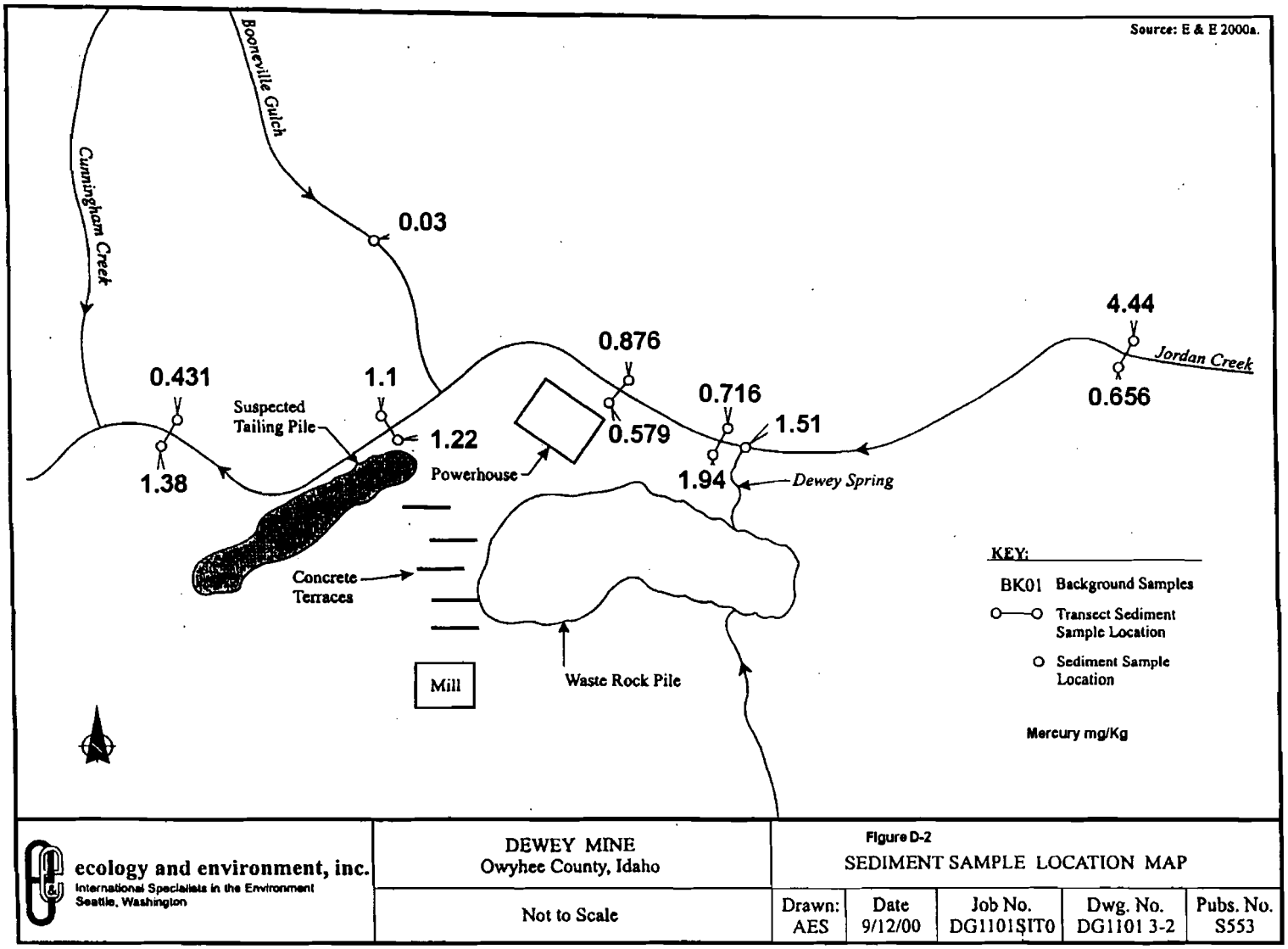
# APPENDIX D

Appendix D




| | | | | | | |
|---|---|---|---|---|---|---|
| ecology and environment, inc. International Specialists in the Environment Seattle, Washington | DEWEY MINE Owyhee County, Idaho | Figure D-1 SUBSURFACE SOIL SAMPLE LOCATION MAP | | | | |
| | Not to Scale | Drawn: AES | Date 9/12/00 | Job No. DG1101SIT0 | Dwg. No. DG1101 3-1 | Pubs. No. S553 |

Appendix D




| | | | | | | |
|---|---|---|---|---|---|---|
| ecology and environment, inc. International Specialists in the Environment Seattle, Washington | DEWEY MINE Owyhee County, Idaho | Figure D-2 SEDIMENT SAMPLE LOCATION MAP | | | | |
| | Not to Scale | Drawn: AES | Date 9/12/00 | Job No. DG1101SIT0 | Dwg. No. DG1101 3-2 | Pubs. No. S553 |

# APPENDIX E

# 1. PROJECT APPROACH

## 1.1 PROJECT MANAGEMENT

The project management structure for Phase 1 has David Evans and Associates (DEA) serving as the project manager and primary point of contact for the USACE. Subconsultants supporting the effort include: Limno-Tech, Inc. (LTI), Intertox, Inc. (Intertox), Quadrant Engineering (Quadrant), and Columbia Analytical Services, Inc. (CAS). Methodology is consistent with EPA approved protocols for all sample collection and analysis.

## 1.2 METHODOLOGY

The methodology used is consistent with the *Sampling and Analysis Plan*, August 2001 (refer to Appendix F) and consists of field survey, field samples as well as on-site monitoring for pH, turbidity, conductivity, flow, and temperature. Survey crews documented location of mine structures and sample locations.

## 1.3 CHEMICALS OF CONCERN AND RATIONALE FOR SELECTION

The objective of the screening risk evaluation is to determine whether contaminants originating in waste piles or surface water seeps at the Dewey Tunnel and Blue Gulch Mines are present at concentrations that may pose potential human health and ecological risks. The primary emphasis of a screening assessment of this type is to identify all potential hazards, while eliminating clearly insignificant ones. Consequently, to prevent any potential hazards from being overlooked, assumptions made in this assessment are conservative.

The chemicals of concern were identified from historical information about mining activities at the Dewey Tunnel and Blue Gulch Mine sites and similar sites. Based on discussions and documents supplied to the Project Team by the USACE, both silver and gold mining were conducted at the sites. Considering the time of operation of the mines, it is believed that mining operations involved amalgamation processes where free gold is extracted using liquid mercury. Amalgamation processes since about the 1930's have been superseded in recent years by a cyanidation leaching procedure. In addition, chemicals of concern were also selected based on knowledge about chemical releases that have been shown to be of greatest concern in risk evaluations conducted for other similar Idaho mining sites (e.g., ATSDR 2000a,b). Based on this information, the following metals were selected as chemicals of concern for the screening level human health and ecological risk evaluations for the Dewey and Blue Gulch Mine sites:

- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
- Copper
- Cyanide

- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc

Several additional parameters were recommended for evaluating water chemistry, as follows:

- Aluminum
- Calcium
- Iron
- Magnesium
- Manganese
- Potassium
- Sodium

## 1.4 METHODOLOGY FOR SCREENING RISK ANALYSIS

The objective of the screening risk evaluation is to determine whether the potential human health and ecological risks due to exposure to contaminants originating in waste piles or surface water seeps at the Dewey and Blue Gulch Mines may be significant. The approach was to compare metal concentrations measured in the site environmental samples to published screening-level human health and ecological risk-based concentrations. These risk-based concentrations correspond to concentrations that are not likely to be associated with significant adverse human health effects or ecological risks. In order to avoid underestimating potential risks, these concentrations are intended to be conservative; that is, they incorporate assumptions that likely overestimate how much a person or ecological receptor would be exposed to the metal, as well as health-protective assumptions about the metal's toxicity.

Since these risk-based values are developed to provide a conservative assessment of potential health risks to sensitive population groups, if concentrations at the site do not exceed these values, then health risks are unlikely. If concentrations do exceed these values, it does not necessarily mean that health risks exist; rather, more focused investigation may be necessary to characterize actual site-related exposures and health risks (*e.g.*, using exposure assumptions that more realistically reflect how much time people or wildlife actually spend at the site, or assessing how much of a particular metal in soil is in a form that can be taken up into a receptor and have the potential to impact its health or viability).

A number of different agencies and organizations have published screening-level risk-based values. Comparison concentrations for the human health assessment were taken from U.S. EPA National Primary Drinking Water Standards (U.S. EPA, 2001b), U.S. EPA recommended water quality criteria (U.S. EPA, 1999), U.S. EPA regional criteria (U.S. EPA Region IX, 2000), and U.S. Department of the Interior Bureau of Land Management (BLM) risk management criteria (Ford, 1996). Comparison concentrations for environmental assessment were taken from U.S. EPA recommended water quality criteria (U.S. EPA, 1999), BLM risk management criteria (Ford, 1996), and compilations of water, sediment, and soil criteria published by Suter and Tsao (1996), Efroymson *et al.* (1997a), and Jones *et al.* (1997).

### *1.4.1 Screening-Level Values for Human Health*

Screening-level values for human health published by several regulatory agencies are presented in this assessment. The sources of human health risk-based screening-level values are as follows:

- U.S. EPA National Primary Drinking Water Standards (Maximum Contaminant Levels (MCLs)) (U.S. EPA, 2001b);
- U.S. EPA National Recommended Water Quality Criteria (NRWQC) for exposure to surface water and consumption of organisms from surface water (U.S. EPA, 1999);
- U.S. EPA Region IX Preliminary Remediation Goals (PRGs) (U.S. EPA Region IX, 2000); and
- U.S. Department of the Interior Bureau of Land Management (BLM) Risk Management Criteria for metals in surface soils, sediments, and water at BLM mining sites (Ford, 1996).

These values incorporate assumptions about the chemical's toxicity and the rate of human exposure, and correspond to generally recognized acceptable levels of health risk.

The U.S. EPA and BLM values incorporate published U.S. EPA toxicity criteria that reflect what is known about a chemical's potential to cause noncarcinogenic or carcinogenic health effects. In general, the U.S. EPA values correspond to an excess cancer risk of one in a million ($1 \times 10^{-6}$) or a noncancer hazard level of 1.0. The BLM values correspond to an excess cancer risk of one in one hundred thousand ($1 \times 10^{-5}$) or a noncancer hazard level of 1.0. An excess cancer risk of $1 \times 10^{-6}$ means that for an individual exposed to a site-related metal at these concentrations under the described exposure conditions, there is only a 1 in 1,000,000 chance that they would develop any type of cancer in a lifetime as a result. Similarly, an excess cancer risk of $1 \times 10^{-5}$ means that for an individual exposed at these concentrations under these exposure conditions, there is only a 1 in 100,000 chance that they would develop any type of cancer in a lifetime as a result of the exposure. A hazard level of 1.0 means that the dose of noncancer metals assumed to be received is lower than, or the same as, a dose that would not result in any adverse noncancer health effects.

Although there is no universally accepted cancer risk standard, the U.S. EPA Superfund program established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) generally considers risks less than $1\times10^{-6}$ (1 in 1,000,000) to be acceptable in nearly all circumstances and risks within the range of $1\times10^{-4}$ to $1\times10^{-6}$ (1 in 10,000 to 1 in 1,000,000) to be acceptable depending on specific site and exposure characteristics (U.S. EPA, 1989; U.S. EPA, 1991). For noncarcinogens, hazards are established by dividing the estimated average daily dose of a chemical by its "reference dose"[1] to yield a hazard quotient. According to U.S. EPA (1989) guidance, if the resulting hazard quotient is below unity (1.0), then adverse health effects are not expected.

The human health-risk based screening levels used in this assessment are based on assumptions about the extent of human exposure to the metal in different environmental media. For example, U.S. EPA values are based on standard U.S. EPA assumptions about the number of liters of water a person drinks in a day and the average number of years spent in one residence. U.S. EPA and BLM residential scenarios assume that contamination may migrate from the site to adjoining residential property. BLM recreational scenarios assume a person could be exposed while camping, swimming, boating, or ATV driving.

#### 1.4.1.1 Human-Health Screening Values for Metals in Water

The following types of human health screening values were identified for metals in water:

- U.S. EPA National Primary Drinking Water Standards (Maximum Contaminant Levels (MCLs)) (U.S. EPA, 2001b);
- U.S. EPA National Recommended Water Quality Criteria (NRWQC) for exposure to surface water and consumption of organisms from the surface water (U.S. EPA, 1999);
- U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for residential exposure to drinking water (U.S. EPA Region IX, 2000); and
- U.S. Department of the Interior Bureau of Land Management (BLM) Risk Management Criteria for metals in water at BLM mining sites (Ford, 1996).

The assumptions upon which each of these values is based are described more fully in the following sections.

*U.S. EPA National Primary Drinking Water Standards—Maximum Contaminant Levels (MCLs)*

MCLs (U.S. EPA, 2001b) are implemented to protect public health by limiting the levels of contaminants in drinking water, and are based in large part on Maximum Contaminant

[1] A reference dose (RfD) is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (U.S. EPA, 2001a). Reference doses are established and published by the U.S. EPA.

Level Goals (MCLGs). An MCLG is the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MCLGs are non-enforceable public health goals. Since they consider only public health and not the limits of detection and treatment technology, sometimes they are set at a level that water systems cannot meet. When determining an MCLG, U.S. EPA considers the risk to sensitive subpopulations (*e.g.*, infants, children, the elderly, and those with compromised immune systems) of experiencing a variety of adverse health effects. An MCL is a legally enforceable standard set as close to the MCLG as feasible, assuming availability of the best available treatment technology and taking cost into consideration.

*U.S. EPA National Recommended Water Quality Criteria (NRWQC)*

NRWQC values for human health (U.S. EPA, 1999) are published pursuant to Section 304(a) of the Clean Water Act (CWA) and are recommended values for ambient water based on human consumption of water and organisms taken from the water (*e.g.*, fish) or on human consumption of organisms only. They are based on information on the potential for environmental and human health effects and do not reflect consideration of economic impacts or the technical feasibility of meeting the chemical concentrations in ambient water. For carcinogens (*i.e.*, arsenic), these levels are based on a $1 \times 10^{-6}$ lifetime excess cancer risk level, and for noncarcinogens they are based on a hazard index of 1.0. Concentrations in fish are calculated using published U.S. EPA bioaccumulation factors (BAFs) that estimate the concentration in fish based on the ambient water concentration.

For consumption of fish, the NRWQC assume consumption of 17.8 g (0.628 ounces) of fish per day (cooked weight), equivalent to approximately 29 8-ounce fish meals per year (U.S. EPA, 1998). This fish consumption rate represents the 90th percentile consumption rate for the entire adult population (and approximates the average consumption rate for sport anglers, nationally) (U.S. EPA, 1998). For consumption of drinking water, these values assume consumption of 2 liters per day.

*U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for Drinking Water*

U.S. EPA Region IX PRGs for drinking water (U.S. EPA Region IX, 2000) are risk-based screening levels for contaminants in drinking water that combine U.S. EPA toxicity values with "standard" exposure factors to estimate concentrations of contaminants that are considered protective of human health (including sensitive populations). These guidelines are used for screening purposes and as initial cleanup goals if applicable.

For the current evaluation, the values used assume residential exposure (generally considered the "maximum beneficial use" of any site area) through consumption of drinking water. These values essentially assume that 100% of a person's drinking water (*i.e.*, 2 liters per day, everyday for 30 years) contains this concentration. While these values do not explicitly consider exposure to contaminants in water through other pathways such as dermal exposure while bathing, the contribution of dermal exposure to the total intake of metals per day is expected to be insignificant. For carcinogens (*i.e.*, arsenic), PRGs are based on a $1 \times 10^{-6}$ lifetime excess cancer risk level, and for noncarcinogens they are based on a hazard index of 1.0.

*Bureau of Land Management (BLM) Risk Management Criteria (RMC) for Metals in Water at BLM Mining Sites*

BLM Risk Management Criteria (RMC) for human exposure scenarios were developed to provide realistic estimates of the types and extent of exposure that individuals might experience to metals in surface water (*e.g.*, streams) at mining sites (Ford, 1996). It is assumed that such exposures might occur to individuals who use BLM lands for camping, boating, or swimming. The BLM guidance (Ford, 1996) does not provide information on the frequency and duration of contact with surface water that is assumed in the development of values for these recreator scenarios. However, back calculation of screening levels using the BLM methodology and standard U. S. EPA methodologies suggest that they are based on exposure frequencies of between 6 and 40 days per year.

For carcinogens (*i.e.*, arsenic), RMC values are based on a $1 \times 10^{-5}$ lifetime excess cancer risk level, and for noncarcinogens they are based on a hazard index of 1.0.

### 1.4.1.2 Human Health Screening Values for Metals in Soil or Sediment

The following types of human health screening values were identified for metals in soil or sediment:

- U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for residential exposure to soil (U.S. EPA Region IX, 2000); and
- U.S. Department of the Interior Bureau of Land Management (BLM) Risk Management Criteria for metals in surface soils or sediment at BLM mining sites (Ford, 1996).

The assumptions upon which each of these values is based are described more fully in the following sections.

*U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for Residential Soil*

U.S. EPA Region IX PRGs for residential soil (U.S. EPA Region IX, 2001) are generated in a similar fashion to the values described previously for drinking water. They assume exposure through direct ingestion (a number of studies have shown that inadvertent soil ingestion through "hand-to-mouth" behaviors is common in children, in particular). For metals, these values do not consider dermal contact with the soil and inhalation of airborne soil particulates, since the contribution of these pathways to the total risk is expected to be insignificant. For carcinogens (*i.e.*, arsenic, chromium (VI)), residential soil PRGs are based on a $1 \times 10^{-6}$ lifetime excess cancer risk level, and for noncarcinogens they are based on a hazard index of 1.0.

Some PRGs (calcium, magnesium, potassium, and sodium) were calculated using U.S. Food and Drug Administration (FDA) Reference Daily Intake (RDI) values or Daily Values combined with U.S. EPA Region IX PRG calculations. The equation used to calculate acceptable soil levels (based on ingestion of soil by children) was as follows (U.S. EPA Region IX, 2000):

$$C\,(mg/kg) = \frac{HQ \times BW \times AT}{EF \times ED \times (\frac{1}{RDI} \times \frac{IR}{10^6\ mg/kg})}$$

Where:

| | | |
|---|---|---|
| C | = | Soil concentration (mg/kg) |
| HQ | = | Acceptable Hazard Quotient (1) |
| BW | = | Body weight, child (15 kg) |
| AT | = | Averaging time (ED × 365 days) |
| EF | = | Exposure frequency (350 days/year) |
| ED | = | Exposure duration, child (6 years) |
| RDI | = | Recommended daily intake (mg/kg-day) |
| IR | = | Soil ingestion rate, child (200 mg/day) |

FDA RDIs or RDAs for these metals are as follows:

- Calcium: 1,200 mg/day (RDA; U.S. FDA, 1990)
- Magnesium: 280 mg/day (RDA; U.S. FDA, 1990)
- Potassium: 3,500 mg/day (Daily Value; U.S. FDA, 2000)
- Sodium: 2,400 mg/day (Daily Value; U.S. FDA, 1999)

Application of these values results in PRGs for all four metals that exceed 100,000 mg/kg soil. Consequently, a "maximum" PRG of 100,000 mg/kg was applied.

*Bureau of Land Management (BLM) Risk Management Criteria (RMC) for Metals in Surface Soils and Sediments at BLM Mining Sites*

BLM Risk Management Criteria (RMC) for human exposure scenarios were developed to provide realistic estimates of the types and extent of exposure that individuals might experience to metals in soils and sediment at mining sites (Ford, 1996). It is assumed that such exposures might occur to individuals living on properties adjacent to BLM lands; to individuals who use BLM lands for camping, boating, or all-terrain-vehicle driving; or to individuals who work on BLM lands. The BLM guidance (Ford, 1996) does not provide information on the frequency and duration of contact with soils that is assumed in the development of values for these recreator scenarios. However, back calculation of screening levels using the BLM methodology and standard U.S. EPA methodologies suggest that they are based on exposure frequencies of between 6 and 40 days per year.

For carcinogens (*i.e.*, arsenic), RMC values are based on a $1 \times 10^{-5}$ lifetime excess cancer risk level, and for noncarcinogens they are based on a hazard index of 1.0.

### 1.4.2 Screening-Level Values for Ecological Receptors

Screening-level values for ecological receptors published by several regulatory agencies are presented in this assessment. The sources of environmental screening-level values are as follows:

- U.S. EPA National Recommended Water Quality Criteria (NRWQC) for protection of aquatic organisms (U.S. EPA, 1999);

- U.S. EPA Tier II Water Quality Values for protection of aquatic organisms (Suter and Tsao, 1996);
- Toxicological benchmarks for soil based on phyto-, invertebrate, or microbe toxicity (Efroymson *et al.*, 1997a; Will and Suter, 1995);
- U.S. EPA Tier II Values for protection of aquatic organisms (Suter and Tsao, 1996);
- Bureau of Land Management (BLM) Risk Management Criteria for protection of wildlife exposed to metals in surface soils and sediments at BLM mining sites (Ford, 1996);
- U.S. EPA Great Lakes National Program Office Assessment and Remediation of Contaminated Sediment (ARCS) Project sediment effect concentrations (Jones *et al.*, 1997);
- U.S. EPA Region IV Ecological Screening Values for sediments (Jones *et al.*, 1997); and
- U.S. EPA Office of Solid Water and Emergency Response (OSWER) Ecotox Thresholds for sediments (Jones *et al.*, 1997).

These values correspond to minimal and acceptable levels of effects on ecological endpoints, including survivability, growth, and reproductive effects on aquatic biota, plants, invertebrates, and wildlife. In general, they correspond to levels that can cause small effects on individual organisms but that would be expected to cause minimal effects on populations and communities (Efroymson *et al.*, 1997b).

#### 1.4.2.1 Ecological Screening Values for Metals in Water

The following types of ecological screening values were identified for metals in water:

- U.S. EPA National Recommended Water Quality Criteria (NRWQC) for protection of aquatic organisms (U.S. EPA, 1999); and
- U.S. EPA Tier II Values for protection of aquatic organisms (Suter and Tsao, 1996).

The assumptions upon which each of these groups of values are based are described more fully in the following sections.

*U.S. EPA National Recommended Water Quality Criteria (NRWQC) for Aquatic Organisms*

NRWQC values for protection of freshwater aquatic organisms (U.S. EPA, 1999) are published pursuant to Section 304(a) of the Clean Water Act (CWA) and are estimates of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly (Criteria Maximum Concentration or CMC values) or indefinitely (Criteria Continuous Concentration or CCC values). They do not reflect considerations of economic impacts or the technological feasibility of meeting the chemical concentrations in ambient water (U.S. EPA, 1999). Because 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the

aquatic communities in the United States. For aquatic organisms, criteria are expressed in terms of the dissolved metal in the water column. For metals, some values are hardness-dependent. The values presented by U.S. EPA assume a hardness of 100 mg/L (as $CaCO_3$), and would be lower for lower hardness levels.

Both acute (CMC) and chronic (CCC) values are calculated using toxicity data for fish and invertebrates such as daphnids. Acute values (CMCs) are calculated from standard acute aquatic toxicity tests of 48 or 96 hours duration. These tests use juvenile or adult organisms, and assess the median lethal concentration (LC50) or median effective concentration (EC50) for death or some equivalent effect (*e.g.*, immobilization). The CMCs are generally based on one-half of Final Acute Value (FAV), which is the fifth percentile of the distribution of 48- to 96-hour LC50 values or equivalent median effective concentration (EC50) values for each chemical (Suter and Tsao, 1996). They are intended to correspond to concentrations that would cause less than 50% mortality in 5% of exposed populations in a brief exposure, and are recommended for use as a "reasonable upper screening benchmark" because waste site assessments are concerned with sublethal effects and largely with continuous exposure (Suter and Tsao, 1996). Chronic values are the FAVs divided by the Final Acute-Chronic Ratio (FACR), which is the geometric mean of quotients of at least three LC50/Chronic Value ratios from tests of different families of aquatic organisms. They are intended to prevent significant toxic effects in chronic exposures and are considered lower screening benchmarks (Suter and Tsao, 1996).

*U.S. EPA Tier II Water Quality Values for Aquatic Organisms*

Tier II values are calculated in accordance with U.S. EPA's Proposed Water Quality Guidance for the Great Lakes System (U.S. EPA, 1993). They were developed so that aquatic benchmarks could be established with fewer data than are required for the NRWQC (Suter and Tsao, 1996). Thus, they are in principal similar to the NRWQC values, but are not based on as rigorous data collection procedures. In general, they are calculated for chemicals that do not have NRWQC, and are concentrations that would be expected to be higher than NRWQC in no more than 20% of cases (Suter and Tsao, 1996). For aquatic organisms, criteria are expressed in terms of the dissolved metal in the water column. Secondary Acute Values (SAVs) are approximately equivant to NRWQC CMC values, and Secondary Chronic Values (SCVs) are approximately equivalent to NRWQC CCC values.

### 1.4.2.2 Ecological Screening Values for Metals in Soil/ Sediment

The following types of ecological screening values were identified for metals in soil/sediment:

- Toxicological benchmarks for soil based on phyto-, invertebrate, or microbe toxicity (Efroymson *et al.*, 1997a; Will and Suter, 1995);
- U.S. EPA Tier II Values for protection of aquatic organisms (Suter and Tsao, 1996);

- Bureau of Land Management (BLM) Risk Management Criteria for protection of wildlife exposed to metals in surface soils and sediments at BLM mining sites (Ford, 1996);
- U.S. EPA Great Lakes National Program Office Assessment and Remediation of Contaminated Sediment (ARCS) Project sediment effect concentrations (Jones *et al.*, 1997);
- U.S. EPA Region IV Ecological Screening Values for sediments (Jones *et al.*, 1997); and
- U.S. EPA Office of Solid Waster and Emergency Response (OSWER) Ecotox Thresholds for sediments (Jones *et al.*, 1997).

The assumptions upon which each of these groups of values are based are described more fully in the following sections.

*Toxicological Benchmarks for Soil Based on Phytotoxicity*

Efroymson *et al.* (1997a) have published soil screening benchmark values based on phytotoxicity, specifically reduction in growth or yield of plants. Benchmarks are based on data provided by toxicity studies in the field or more commonly in greenhouse and growth chamber studies. Twenty percent reduction in growth or yield was used as the Lowest Observed Effect Concentration (LOEC) for significant effects (Efroymson *et al.*, 1997a). Benchmarks were derived by rank-ordering LOEC values from a variety of studies, and selecting a number that approximated the $10^{th}$ percentile. Most concentrations reported in these studies are based on concentrations of metals added to soil in a soluble form (*i.e.*, a highly bioavailable form). In contrast, most metals in natural soils and contaminants of waste sites are in poorly available forms (Efroymson *et al.*, 1997a).

*Toxicological Benchmarks for Soil Based on Toxicity to Soil and Litter Invertebrates and Soil Microbes*

Will and Suter (1995) have published soil screening benchmarks based on toxicity to earthworms and other soil invertebrates and to soil microbes. Benchmarks were established in a similar manner to those established for phytotoxicity. For specific studies, LOECs were identified as the concentration yielding a twenty percent reduction in a measured response. LOEC values from a variety of studies were then rank-ordered and a concentration approximating the $10^{th}$ percentile was selected. For earthworms, effects assessed included lethality, change in body weight, cocoon production, hatching rates, and juvenile survival (Will and Suter, 1995). For microbes, effects assessed included growth, respiration, nitrogen transformation reactions, oxidation of hydrogen gas, alpha-glucosidase synthesis, and other enzyme activities (Will and Suter, 1995). Like the phytotoxicity studies, most concentrations reported in these studies are based on concentrations of metals added to soil in a soluble form (*i.e.*, a highly bioavailable form).

*Bureau of Land Management (BLM) Risk Management Criteria (RMC) for Metals in Surface Soils at BLM Mining Sites*

BLM Risk Management Criteria (RMC) for metals in surface soils were developed to protect wildlife receptors at mining sites (Ford, 1996). The potential exposure pathways assumed to contribute to exposure include soil and sediment ingestion and ingestion of plants. Benchmark concentrations in soil applicable to different wildlife species were calculated using species-specific ecotoxicological effects data, body weights, and soil and plant ingestion rates, and soil-plant uptake factors. In this screening evaluation, values are presented for the deer mouse, cottontail, mule deer, mallard, and robin.

*Assessment and Remediation of Contaminated Sediment (ARCS) Project Sediment Effect Concentrations*

As part of the Assessment and Remediation of Contaminated Sediment (ARCS) Project for the U.S. EPA Great Lakes National Program Office, the National Biological Service prepared a set of sediment benchmarks using laboratory data on the toxicity of contaminants associated with sediment samples collected from predominantly freshwater sites (Jones *et al.*, 1997). Test organisms and measured endpoints included reduction in survival, growth, or sexual maturation of the amphipod *Hyalella azteca* or reduction in survival or growth of the midge *Chironomus riparius*. Based on the results of these tests, three different effect levels were identified: the Threshold Effect Concentration (TEC), the Probable Effect Concentration (PEC), and a high No Effect Concentration (NEC). The TEC is intended to be a relatively conservative screening value below which effects are rarely expected to occur. The NEC (alternatively identified as the apparent effects threshold (AEC)) is the sediment concentration of a chemical above which statistically significant biological effects always occur. PECs and NECs are intended to discriminate chemicals that may contribute to toxicity from those that probably contribute to toxicity (*i.e.*, effects are more likely than not) (Jones *et al.*, 1997).

*U.S. EPA Region IV Ecological Screening Values for Sediments*

U.S. EPA Region IV has published ecological screening values for sediments. These values are based on the lower of the Effects Range-Low (ER-L) and the Threshold Effects Level (TEL) (Jones *et al.*, 1997). ER-Ls and TELs are compiled by different authors, and generally reflect a concentration associated with the lower limit of the range of effect levels (effects measured included reduction in survival, growth, or sexual maturation, etc.). ER-Ls were developed by ranking sediment toxicity benchmarks established using a variety of different methods, and selecting the lower $10^{th}$ percentile effect level (ER-L). TELs were developed in a similar manner except that the dataset included concentrations observed or predicted to be associated with no adverse biological effects; the TEL was set as the geometric mean of the $15^{th}$ percentile of the effects data set and the $50^{th}$ percentile of the no effects dataset (Jones *et al.*, 1997).

*U.S. EPA Office of Solid Waster and Emergency Response (OSWER) Ecotox Thresholds*

U.S. EPA's OSWER has published Ecotox Thresholds (ETs) intended to be used for screening contaminants in sediment at CERCLA sites (Jones *et al.*, 1997). For metals, these values are equivalent to ER-Ls selected from a dataset of studies identified by U.S. EPA.

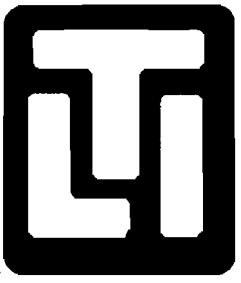
# APPENDIX F

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# and
# SAMPLING AND ANALYSIS PLAN
# for
# PHASE I ACTIVITIES
# associated with the

# Mine Site Characterization and Screening Risk Analysis of Dewey Tunnel and Blue Gulch Mines for the Walla Walla District, U.S. Army Corps of Engineers


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# 1.0 INTRODUCTION

This Phase I work plan and sampling and analysis plan (WSAP) was prepared by Limno-Tech, Inc. (LTI), in cooperation with Intertox and David Evans and Associates (DEA), and supports the first phase of the mine site characterization activities for the Dewey Tunnel and Blue Gulch Mines in Owyhee County in southwestern Idaho. The mines are located in the Silver City Range near Florida Mountain, about 50 miles southwest of Boise, Idaho and about 20 miles east of Jordan Valley, Oregon. The WSAP presents the objectives, rationale and procedures that will be followed during the Phase I investigations to ensure that the data generated is useable for the intended purpose of conducting a screening risk analysis for impacts to the environment and human health to assist in the prioritization of these mine sites for reclamation.

The WSAP provides details on project background, sampling objectives, sampling locations and field sampling procedures for each matrix being investigated, including sample handling, documentation and field QA/QC. The WSAP also specifies analytical methods and procedures and provides guidance and specifications to assure that:

- Proper preventive maintenance, equipment calibration, and approved analytical protocols will be implemented so that all field measurements and sampling analytical results will be valid;

- Sampling is conducted using sample tracking systems and chain-of-custody procedures which properly identify samples being collected and insure the control of those samples from field collection through analysis and data reduction;

- Records are produced and retained to document the quality of samples collected and analyzed, the validity of applied procedures, and the completeness of the investigation in relation to the approved scope of the project;

- Generated data is validated;

- Calculations, evaluations, and decisions completed or deduced during the execution of the investigation are accurate, appropriate, and consistent with the project objectives.

The WSAP is subject to modification resulting from changes in the scope of work or where unforeseen difficulties present themselves, and will be updated to reflect collection of any additional data not covered by the current version of this plan, if necessary.

This document is organized into nine sections. Section 1 includes project background information. Sections 2 through 6 include the information pertinent to the sampling and analysis activities (objectives, sampling rationale, methods, procedures, sample and document custody, equipment calibration). Sections 7 and 8 include information pertinent to quality assurance and quality control (internal quality checks, data reduction, validation

and reporting). The project Health and Safety Plan has been prepared under separate cover.

## 1.1 PROJECT BACKGROUND

Based on discussions with the US Army Corp of Engineers (USACE), it is the Project Team's understanding that the Walla Walla District of the U. S. Army Corps of Engineers (USACE) and the Idaho Department of Lands (IDL) desire to complete an initial site characterization and screening risk analysis for two mining sites. Although some site characterization has been conducted at the two sites, there has not been sufficient information generated to determine a relative level of risk that either of these two sites might pose to the environmental and/or to human health. The purpose of this project is to characterize these sites to determine how extensive the problems are and how they could be remedied. The information will be placed into an abandoned mine database and used to help prioritize where the IDL should do reclamation work.

The following information was obtained from the USACE and IDL and was used to develop the scope of work for this project. The Dewey Tunnel and Blue Gulch mines are located in Owyhee County in southwestern Idaho. They are located approximately 3 miles northwest of Silver City, Idaho. The Dewey Tunnel mining site includes sites of former structures (Dewey Hotel, Dewey House, Transformer House, and Main Mill and Upper Mill Buildings, and a Mystery Mill). There are 4 waste rock dumps and mill tailings (main waste rock dump, cone shaped pile, mystery mill tailings, and sand pile). State personnel discovered acid rock drainage in 1997. A white precipitate was observed on the rocks of Jordan Creek near the mouth of Blue Gulch. The source of the water from the area near the waste rock dump flowing into the Creek is not known. Another spring is present below the mill building at the east end of the main waste rock dump. The spring may be on private land.

Blue Gulch mine site is located in a steep draw on the east side of Blue Gulch. The Trade Dollar and Black Jack Mines are located in Negro Gulch just south of Humboldt Mine. A large waste dump at the bottom of Negro Gulch pushes Blue Gulch Creek to the opposite side of the valley. The waste dump may be on private land. The creek was bright red color at the time of the state inspection. Soon after leaving the waste rock dump, the creek enters state land.

It is the Project Team's understanding that the USACE and IDL are requesting that the following deliverables be prepared for each site: a base map that will contain the location of all site features and sample locations; a report that will summarize the analytical results of all tests and surveys and discuss the potential risks to water quality, aquatic ecosystems, and human health, and evaluate options for reducing those risks. In discussions with the USACE, it is also understood that to the extent practicable, USACE staff will support some of the tasks (e.g. report preparation).

The level of effort described in the previous paragraph was discussed in a more comprehensive scope of work supplied to the Project Team by the USACE. The document entitled *Scope of Work – Appendix A* specified the following tasks:

- GPS map of site and site features (waste rock, adit, foundations, springs, etc.)
- Survey to determine ownership boundaries (Dewey only)
- Collection and analysis of water samples from springs and creeks
- X-ray diffraction analysis of waste rock to determine mineral composition
- Volume determination of waste rock
- Electromagnetic survey of waste dump to find water draining through dump (Time-domain ElectroMagnetic or TEM)
- Electromagnetic survey of waste dump to find bottom of the dump (Controlled Source AudioMagneto Tellurics or CSAMT)
- Induced Polarization (IP) survey of waste dump to find concentrations of sulfide minerals
- Feasibility study for stopping acid rock drainage (ARD).

The USACE and IDL also have requested that existing site characterization conducted on the sites be used where relevant and appropriate. Other documents received from the USACE include an untitled document describing the history of the site, some water quality data from an Environmental Impact Statement on the Stone Cabin Mine prepared by CH2M Hill, results of sediment sampling and analysis for metals from the Jordan River, and soil sampling and analysis for mercury near the Dewey Mine site conducted by Ecology and Environment, Inc.

After review of the more comprehensive scope of work supplied to the Project Team by USACE, it was agreed to phase the tasks. Considering the late season start, the sampling effort would focus on those tasks which would best support a preliminary site characterization and screening risk analysis. The project approach, goals, and phasing are discussed below.

### 1.1.1 Project Approach, Goals and Phasing

The project management structure will have David Evans and Associates (DEA) serving as the primary contact for the USACE and performing the project management function. Subconsultants supporting the effort include: Limno-Tech, Inc. (LTI), Intertox, Inc. (Intertox), Quadrant Engineering (Quadrant), and Columbia Analytical Services, Inc. (Columbia).

The goal of this effort will be to build upon existing studies where appropriate in order to characterize the sites and conduct a screening level risk assessment. The Project Team recommends that the scope of work developed for the two sites are divided into a phased

approach. The primary reason for developing a phased approach is to address the question of relative risk for both these sites in a cost-effective manner. After discussions with experts in geophysical explorations (TEM, IP, CSAMT), the budget estimates for this portion of the work alone ranged from $20,000 - $50,000 depending on the level of analysis. If, after evaluating results from the Phase I sampling and analysis of site media to which potential human and ecological exposure exists, there is little risk to human health and aquatic and eco-systems from these sites, the geophysical exploration effort may not be necessary. Therefore, the Project Team proposes a phased approach to address the most critical issues first.

- **Phase I** will develop information on the two mines to provide the USACE and IDL with information necessary to evaluate the urgency of further action at these sites and to provide a preliminary estimate of the resources required to address problems at the Dewey Tunnel and Blue Gulch sites. To this end, the Phase I data collection activities will be directly targeted to primarily support the risk assessment. Because of the late season start time (August 2001) for this investigation, the Phase I work will be conducted in two segments, Phase Ia and Phase Ib. Phase Ia work will include development of a base map and sampling of targeted site media under low flow surface water conditions. The base map information will allow identification of important features (e.g., locations of structures, waste piles, boundaries, sampling efforts) and preliminary assessment of waste rock quantity. Targeted sampling and analysis at each of the two sites will be limited to surface water, in-stream sediments, soils and waste pile rock that will support the preliminary risk assessment. The Phase Ib work will include targeted sampling and analysis at each site of surface water under high flow conditions (i.e., late spring/early summer 2002) and, if necessary after evaluation of the Phase Ia results, other media as appropriate. The information from these Phase I studies will be used in a screening level risk analysis of exposure to site media for both human health and ecological risks, that will consider the range of surface water exposure based upon the extremes of flow conditions encountered. The results of these efforts will be used to generate a report discussing potential risks to water quality, aquatic ecosystems and human health, and containing an analysis of options for reducing identified risks. Note that the risk assessment will be screening level—that is, maximum concentrations in each medium will be compared to screening level risk-based concentrations, which are based on very conservative exposure assumptions. This will provide information on the relative risks of different contaminants, pathways, media, etc., which can be used to focus subsequent actions, but should not be construed as indicative of actual risks; actual risks are likely to be much lower. If concentrations are below screening levels, then there is no concern. If they are above screening levels, then further investigation (e.g., additional sampling, evaluation of bioavailability, assessment of actual site-specific exposure potential) may be necessary before pursuing more costly measures to reduce risks. The report will identify those contaminants, pathways, media, etc. that are likely to contribute most significantly to risks, and will contain an analysis of options for refining the evaluation to assess whether these contaminants, pathways, media, etc. are actually a concern, in addition to an analysis of options for reducing risks once identified.

- **Phase II**, if warranted due to concerns raised by the risk analysis, would provide additional site characterization information. Phase II activities would include geophysical investigations and/or additional sampling. Geophysical exploration is likely to be relatively expensive and the results of Phase I will be used to tailor the approach used. Preliminary discussions with geophysical contractors indicate that it is likely that not all the methods specified in the comprehensive scope of work will be required to obtain the necessary results. Additional sampling activities would also be tailored based upon Phase I results and could include replicate Phase I sampling and analysis and/or sampling at additional areas of concern for the parameters evaluated in Phase I and/or additional parameters such as surface water alkalinity and total suspended solids, the sulfide content of various media, and the mineral content of waste pile rock.
- **Phase III** will include development of feasibility studies for addressing environmental problems and improving the water quality at the sites. This will be followed by development of detailed plans and specifications. Phase III may be combined with Phase II.

# 2.0 DATA OBJECTIVES, SAMPLING RATIONALE AND CONSTITUENTS OF INTEREST

The goal of the Phase I investigation is to generate appropriate data that will be used to preliminarily assess environmental and public health risks from the mine sites for the purpose of prioritizing the sites for potential abandoned mine reclamation work. These objectives will be achieved through collection of surface water, in-stream sediment, soil and rock samples at strategic locations for analysis of parameters of concern, as discussed in further detail in the following sections of this Plan.

The Dewey Tunnel and Blue Gulch sites were mined for gold primarily during the early to middle 1900s. Mining processes, such as crushing or grinding to reduce the size of the mined material, extraction of the ore (gold) through mercury amalgamation or cyanide leaching, and acid runoff resulting from interaction of water with oxidized sulfide-containing rocks exposed during mining operations, can leave impacts that pose a threat to human and ecological health. Based upon the operations conducted at the mine sites, a list of parameters to be investigated was developed.

Constituents of interest for the Phase I investigation at the site include metals (the U.S. EPA Target Analyte List metals plus cobalt), cyanide, the water quality field parameters of temperature, pH, conductivity and turbidity, and surface water flow measurements. Of the parameters of concern selected for analysis, mercury is documented in historical background information as having been used in the site mining processes to extract gold from the ore. It is also possible (though not documented) that a more recent gold extraction process incorporating cyanide could also have been used at the site. The additional metals are important because their release to the environment can have ecological and human health impacts, whether by leaching during contact with normal precipitation or by accelerated leaching from contact with precipitation affected by acidic conditions. Of the water quality field parameters, pH would help to identify areas of or influenced by acid mine runoff, and turbidity and conductivity would provide information on the presence of solids and ionic species present in the water column. Surface water flow measurements will provide information for potential future evaluations of metal loads.

For Phase II sampling activities, potential additional constituents of interest may include sulfides (oxidized sulfides are important parameters of concern because they can generate acidic conditions in surface water runoff), alkalinity (this parameter would help to understand the acid carrying capacity of the water), total suspended solids (this parameter would provide information important to mercury transport, as mercury tends to sorb to particulate matter), and leachable metals (this analysis would help provide information about soil and rock source areas of contaminant migration). In addition, geophysical evaluations such as, in part, determination of rock mineral and sulfide composition, will also aid in determining the source areas of contaminant (metals and acid runoff) impacts.

Manual non-mechanized sampling methods will be used to collect discrete samples of surface water, in-stream sediment, soil and rock at both the Dewey Tunnel and the Blue Gulch mine sites. These samples will be submitted for laboratory analysis to generate data that will be used to support the project goals. In addition, in-situ field data (e.g., surface water pH, temperature, and conductivity readings; physical descriptions of water, soil, sediment and rock samples) will be generated using portable instruments and visual observation to supplement the laboratory analytical data.

The sample locations, designations, rationales and analytical parameters for each medium at each mine site are presented in Tables 1-8 below. The actual number of samples collected and the precise sample locations will be subject to change based upon conditions encountered at the time of sampling. These field decisions will be made by the field supervisor in conjuction with the sampling team and will be documented in the field notes. The sampling locations presented below and those ultimately selected in the field will be selected in an attempt to collect samples at locations where the highest concentrations of contamination might be expected to occur (i.e., "worst case" or high risk locations). If there are signs of locations where recent human activity has been occurring (e.g., camp sites or hunting blinds), samples may also be collected at these locations in addition to those presented in the tables below.

## Table 1. Surface Water Sampling Information for Dewey Tunnel Mine

Number of Samples Anticipated: up to 10 samples (9 samples plus 1 duplicate)

Analytical Parameters: Total metals, dissolved metals, CN, temperature, pH, conductivity, turbidity, flow

QC Samples: Collect 1 duplicate water sample

| | Sample Location | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Jordan Creek upstream of tailings pile | JC1 | Assess water quality upstream of mine and tailings pile |
| 2 | Jordan Creek downstream of tailings pile | JC2 | Assess water quality downstream of mine and tailings pile |
| 3 | Stream or seep flowing into/beneath E end of tailings pile from above | DTATP | Assess water quality prior to contact with tailings pile |
| 4 – 9 | Up to 6 grab samples from springs, including:<br>• Acid spring/seep (~15 feet wide) near Jordan Cr. below main tailings pile and E of Dewey Tunnel adit (collapsed)<br>• Mystery Mill Spring below mill building coming from base of E end of main tailings pile<br>• Seeps below main tailings pile<br>• Springs behind transformer house | DTSeep1, DTSeep2, DTSeep3, DTSeep4, DTSeep5 | Assess quality of water after contact with tailings pile and/or assess water quality of springs behind transformer house depending upon which springs are flowing |

## Table 2. Sediment Sampling Information for Dewey Tunnel Mine

Number of Samples Anticipated: 2 samples

Analytical Parameters: Total metals, CN

| | Sample Location [1] | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Jordan Creek upstream of tailings pile | DTSD1 | Assess sediment quality upstream of mine and tailings piles |
| 2 | Jordan Creek downstream of tailings pile | DTSD2 | Assess sediment quality downstream of mine and tailings piles |

[1] Specific locations for sediment samples will be determined in the field based upon prevalence of sediments (bottoms of pools), proximity to water sample locations, visual signs of impacts, etc.

**Table 3. Soil Sampling Information for Dewey Tunnel Mine**

Number of Samples Anticipated: 3 samples (2 samples plus 1 duplicate)

Analytical Parameters: Total metals, CN

QC Samples: Collect 1 duplicate soil sample

| | Sample Location | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Sand pile W of main mill building location | DTSL1 | Assess soil quality, esp. for Hg; sands and fines tailings were conveyed here after fines were processed for gold<br><br>This location may generally correspond to the past composite sample TP01, collected by Ecology and Environment for Hg analysis |
| 2 | Upper mill building area where placer material fines were processed for gold recovery | DTSL2 | Assess soil quality, esp. for Hg used in the amalgamating process of gold recovery<br><br>This location may generally correspond to the past samples MF01, MF02 and MF03, collected near upper, middle and lower mill foundations by Ecology and Environment for Hg analysis. MF03, collected at the lower foundation, had highest results at 247 mg/kg Hg. |

**Table 4. Rock Sampling Information for Dewey Tunnel Mine**

Number of Samples Anticipated: 4 samples

Analytical Parameters: Total metals, CN

| | Sample Location [1] | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Main tailings pile – gray material from E side (pile stretches 1,400 feet from upper mill building E to an unnamed tributary canyon on S side of Jordan Cr.; Blue Gulch Rd. is located on top of the pile) | DTR1 | Assess rock constituents<br><br>This location may generally correspond to the past sample TW01, collected by Ecology and Environment for Hg analysis |
| 2 | Main tailings pile – orange material from W side of pile | DTR4 | Assess rock constituents |
| 3 | Cone shaped pile at NW corner of main tailings pile (NE and downhill of upper mill building on Blue Gulch Rd.) | DTR2 | Assess rock constituents<br><br>This location may generally correspond to the past samples DP01 (top of pile), and DP02, DP03, DP04 (bottom of pile) collected by Ecology and Environment for Hg analysis |
| 4 | Mystery Mill tailings pile (white ryolite crushed to <4 inch size; debris fan starts near mill foundation and extends to Jordan Cr.; located at E end of main tailings pile, just below Blue Gulch Rd. at mouth of tributary to Jordan Cr. | DTR3 | Assess rock constituents |

[1] Rock samples will be collected from the tailings pile through/under which streams flow. Sample locations will be selected so as to be representative of the spatial distribution of the tailings piles and the variability of physical appearance of the rocks comprising the tailings piles, if possible.

**Table 5. Surface Water Sampling Information for Blue Gulch Mine**

Number of Samples Anticipated: 3 samples

Analytical Parameters: Total metals, dissolved metals, CN, temperature, pH, conductivity, turbidity, flow

| | Sample Location | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Negro Gulch Creek between the 2 tailings piles (upstream and downstream) | NGC2 | Assess water quality in Negro Gulch Creek between tailings piles |
| 2 | Blue Gulch Creek upstream of tailings pile (above confluence with Negro Gulch Creek) | BGC1 | Assess water quality upstream of tailings pile |
| 3 | Blue Gulch Creek downstream of confluence with Negro Gulch Creek | BGC3 | Assess water quality downstream of mine and tailings piles |

**Table 6. Sediment Sampling Information for Blue Gulch Mine**

Number of Samples Anticipated: 3 samples

Analytical Parameters: Total metals, CN

| | Sample Location [1] | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Negro Gulch Creek between the 2 tailings piles (upstream and downstream) | BGSD2 | Assess sediment quality in Negro Gulch Creek between tailings piles |
| 2 | Blue Gulch Creek upstream of tailings pile (above confluence with Negro Gulch Creek) | BGSD1 | Assess sediment quality upstream of tailings pile |
| 3 | Blue Gulch Creek downstream of confluence with Negro Gulch Creek | DTSD4 | Assess sediment quality downstream of mine and tailings pile |

[1] Specific locations for sediment samples will be determined in the field based upon prevalence of sediments (bottoms of pools), proximity to water sample locations, visual signs of impacts, etc.

**Table 7. Soil Sampling Information for Blue Gulch Mine**

Number of Samples Anticipated: 2 samples

Analytical Parameters: Total metals, CN

| | Sample Location | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 - 2 | [1] | BGSL1, BGSL2 | Assess soil quality related to mining operations |

[1] Collect up to 2 soil samples from the mining operations areas in Negro and Blue Gulches based upon field observations indicating historical operations, stained soils, etc.

**Table 8. Rock Sampling Information for Blue Gulch Mine**

Number of Samples Anticipated: 2 samples

Analytical Parameters: Total metals, CN

| | Sample Location [1] | Sample ID | Sample Rationale |
|---|---|---|---|
| 1 | Tailings pile at junction of Negro and Blue Gulches | BGR2 | Assess rock constituents |
| 2 | Tailings pile in Negro Gulch above Blue Gulch | BGR1 | Assess rock constituents |

[1] Rock samples will be collected from the tailings piles through/under which streams flow. Sample locations will be selected so as to be representative of the spatial distribution of the tailings piles and the variability of physical appearance of the rocks comprising the tailings piles, if possible.

# 3.0 QUALITY ASSURANCE OBJECTIVES

## 3.1 GENERAL

The main quality assurance (QA) objective is to develop and implement procedures for defensible field sampling/measurement, laboratory analysis, and data management activities. The QA characteristics of representatives, completeness, precision, accuracy, and comparability will govern the determination of whether quality data is generated from field measurements and laboratory analyses during the investigation. Specific objectives for each characteristic are established to develop sampling protocols and identify applicable documentation, sample handling procedures, and measurement system procedures. These objectives are established based on site conditions described in the Work Plan and knowledge of available measurement systems. The use of procedures, measurements, and data in field activities, calculations, and evaluations is subject to the conditions of this WSAP as described in the following sections.

## 3.2 QUALITATIVE QUALITY ASSURANCE OBJECTIVES

### 3.2.1 Representativeness

Representativeness is the characteristic that indicates the degree to which sample data accurately and precisely represents site conditions, and is dependent on the variability of sampling and analytical procedures. Proper sampling protocols will be used to assure that samples collected are representative of the media present in the field. Sample handling protocols, including such tasks as storage, transportation, and preservation, will be used to protect the representativeness of the samples gathered during the project. Proper documentation in the field and the laboratory will establish that protocols designed to preserve the representativeness of the samples have been followed and that sample identification and integrity has been preserved.

This WSAP describes the rationale for sample collection and analyses. Execution of the WSAP should result in identifying the constituents of concern at the project site.

### 3.2.2 Comparability

Comparability is the characteristic that reflects the degree of confidence with which one set of data can be compared to another. The use of consistent sampling and analytical methodologies as presented in this WSAP will insure that comparability is maintained during the investigation activities. Comparability of data collection, measurement, and analysis procedures will also be assessed if data gathered from previous investigations is to be used reliably with data generated from this investigation.

Split samples can be provided to the regulatory agency, upon request, for independent laboratory analysis. The results from the split analyses could then be compared to provide an assessment of sample handling techniques, analytical methods, and laboratory performance.

Comparison of data sets often indicates that certain values are not consistent with the data as a whole. These values will be evaluated using statistical analysis, if necessary, to determine if the data should be included in the decision-making process.

## 3.3 QUANTITATIVE QUALITY ASSURANCE OBJECTIVES

### 3.3.1 Precision

Precision is the characteristic that reflects the ability to replicate a previously obtained value using identical testing procedures. Precision will be measured as the degree of agreement between duplicate analysis results. Precision will be maximized by using consistent sampling and analytical procedures as established in this WSAP.

Field precision will be evaluated by collected and analyzing at least one duplicate sample per group of ten samples gathered for analytical evaluation during each sampling event. Since standard sampling procedures will be used, no additional duplicates are required due to changes in sampling team composition. Laboratory precision will be evaluated by analyzing one replicate sample for each group of ten samples of each matrix. Duplicate and replicate samples will be chosen at random.

True duplicates of soil samples are not typically possible because chemical constituents are rarely distributed uniformly in the media, even within small distances in the soil matrix, and discrete grab samples are preferred over composite samples. Discrete duplicate soil samples are more correctly termed co-located samples. This is especially true for samples collected for volatile organic analysis, since mixing is not appropriate and the length of time between collection of the sample from the soil matrix and final capping and sealing of the sample container for shipment must be minimized to prevent volatilization of organics from the sample. Therefore, some differences can be expected from "duplicate" soil samples taken for volatile organic analysis.

Measurement precision for all field instrumentation will be assessed by periodically (1 per 20 samples) completing duplicate testing of samples in the field.

Precision of calculations and evaluations performed with the data generated during the project (i.e., the comparability of calculation techniques between various tasks) is assured through review by the project staff.

### 3.3.2 Accuracy

Accuracy is the characteristic that reflects the degree to which a measured value agrees with the expected or true value associated with the application of concern.

Field data accuracy will be assured through proper calibration of field instruments. Portable field instruments will be calibrated daily to establish the accuracy of the data collected. The readings obtained using field instrumentation will be considered as 100 percent accurate if the instrument is calibrated each day according to manufacturers' instructions in the operation manual. Instruments that are factory calibrated will be considered accurate if the most recent calibration occurred within the previous 12-month period and the instrument readings do not appear to be in obvious error.

Laboratory data accuracy will be assessed by using reference standards, matrix spikes, blank spikes, and surrogates as a part of the analytical procedures and reviewing the results for compliance with the control limits established for the approved analytical methods.

Accuracy of calculations and evaluations performed with the data generated during the project is assured through review by the project staff.

### 3.3.3 Completeness

Completeness is the characteristic defined as a measure of the amount of valid data obtained compared to the amount that was specified to be obtained under normal conditions. The amount of valid data specified is established based on the measurements required to accomplish project objectives. The extent of completeness must be reviewed on a relative basis for sample collection activities, since the required amount of valid data anticipated prior to sampling events may not accurately define the amount of data necessary to render a correct decision.

# 4.0 FIELD SAMPLING PROCEDURES

Standard field procedures will be performed during the field activities, which include the following:

- Collection of surface water and surface rock grab samples;
- Collection of surface soil and in-stream surface sediment discrete samples; and
- Collection of field instrument measurement data.

Care will be taken to collect samples that are representative of the sample medium at each location and to minimize exposure of samples to other media and disturbances (e.g., significant or prolonged contact with air, direct sunlight, water column turbulence). Samples will be transferred into the properly labeled sample containers and placed in a cool storage container (e.g., cooler) as soon as possible after collection. Samples will not be collected or stored down wind of and near a running internal combustion engine or exhaust system. Fumes from such devices could compromise the integrity and representativeness of a sample.

Requirements for sample containers, preservation techniques and holding times are presented in the Analytical Methods and Procedures section of this plan. The procedures for handling, packing, and shipping the samples are presented in that section of this report.

Appropriate protective clothing (e.g., sampling gloves) will be worn by all personnel in accordance with the Health and Safety Plan (HASP). After each sample is collected, the location will be marked and recorded for future identification.

The following sections present or reference the detailed methods for performing these sampling activities, including related support procedures for equipment cleaning, field water quality measurements, calibration and maintenance of field instruments, sample custody and shipping procedures.

## 4.1 EQUIPMENT CLEANING

All non-disposable sampling equipment and materials used during the field sampling activities will be cleaned prior to collection of each sample to avoid the introduction of any chemical constituents or cross-contamination to the soils or groundwater. Sampling equipment, instrumentation and materials that may be used during the investigation include stainless steel scoops, hand augers, thin walled tube or split core samplers for soil and sediment sampling; dip poles, containers and peristaltic pumps for water sampling; and instruments for field water quality, soil/sediment, rock and survey measurements.

All non-disposable sample collection equipment will be cleaned prior to collection of each sample by using a detergent (e.g., Alconox) solution wash, followed by two separate potable water rinses. If warranted by laboratory requirements or field conditions (as determined by the by the field supervisor), a nitric acid rinse will be added between the two potable water rinses. Field instrument probes for water quality measurements will be rinsed with potable water between measurement locations. If a peristaltic pump is used with disposable sample tubing, cleaning will not be necessary since water does not contact any re-usable parts.

Equipment cleaning will be performed using water from a source approved by the project manager or engineer. A designated cleaning or decontamination area will be used or constructed, if necessary, so that all water generated during sample collection equipment cleaning operations will be contained for proper disposal.

## 4.2 INVESTIGATION DERIVED WASTES

All water and solutions used to clean sample collection equipment and any soil generated soil cuttings will be collected, containerized, and stored on-site until arrangements are made for proper disposal. All disposable personal protective equipment (e.g., sampling gloves) and disposable sampling equipment (e.g., sleeves, tubing) used during the sampling activities will be disposed of at a permitted municipal solid waste disposal facility unless it is determined that they must be handled and disposed in a more restrictive manner, in which case they will be stored on-site until arrangements are made for proper disposal.

## 4.3 SURFACE WATER SAMPLING

Representative surface water grab samples will be obtained by filling a sample collection container (e.g., clean plastic bucket, or bottle on the end of a dip pole) and transferring the sample directly to the laboratory-supplied sample container. The laboratory-supplied sample container may be filled directly if a peristaltic pump is used, if a representative sample can be obtained by placing the sample container beneath an outfall, waterfall or cascade or, ONLY if the sample container is suitable and does not contain a preservative, by immersion directly into the surface water source.

After each sample is collected, the location will be marked and recorded for future identification.

## 4.4 SOIL AND SEDIMENT SAMPLING

Soil and sediment samples will be collected from the surface (upper one foot) horizon. Soil samples will be collected using a clean stainless steel scoop, hand auger, thin walled tube or split-core sampling device. Sediment samples will be collected using a hand auger, thin walled tube or split-core sampling device in such a manner as to preserve sample discreteness, integrity and representativeness. Sediment samples will be collected

in a manner that will minimize or eliminate disturbances to the sample while raising it through the water column. Each sample will be transferred directly to the appropriate sample container specified by the laboratory conducting the analyses.

Discrete soil and sediment samples will be collected in accordance with standard practices and as specified by the field supervisor, or in accordance with ASTM D4700 for vadose zone sampling, ASTM D1586 for split-spoon sampling, or ASTM D1587 for thin-walled tube sampling, as appropriate. Composite soil samples will be avoided unless specified in the work plan.

## 4.5 ROCK SAMPLING

Rock grab samples will be collected and placed into a double zip-lock plastic bag or other suitable container as specified by the laboratory conducting the analyses.

## 4.6 FIELD INSTRUMENT MEASUREMENTS

Representative readings of field parameters and locations survey coordinates will be recorded using properly calibrated and operated instruments in accordance with manufacturer specifications and procedures. Field instruments will be used to record surface water parameters (e.g., pH, temperature, conductivity, turbidity, velocity) and survey locations (e.g., GPS latitude/longitude coordinates).

## 4.7 MAPPING AND SURVEYING

Locations of notable geographic features will be recorded using a Global Positioning System (GPS) instrument to determine positions accurate to better than plus or minus one meter. Positions of locations important to the project will be determined. These are likely to include:

- Sample collection locations;
- Changes in courses of streams;
- Confluence of tributaries;
- Seeps/springs;
- Signs of notable areas of contamination;
- Signs of running water;
- Outlines of waste piles;
- Obvious changes or rock type in waste piles;
- Mine entrances/adits; and
- Structures and foundations.

# 5.0 ANALYTICAL PROCEDURES

All laboratory analytical methods will follow standard U.S. Environmental Protection Agency (EPA) procedures or equivalent and be conducted in accordance with the laboratory's quality assurance manual. Analytical methods will be selected such that laboratory reporting limits will not exceed comparison criteria for human and environmental health, where possible. This primarily affects analyses for arsenic and mercury. The standard method reporting limits are acceptable for other metals having associated water, sediment and soil criteria. The analyses for arsenic and mercury will require extra sample volume and sample preconcentration before analysis to achieve low reporting limits. In the case of arsenic, the low reporting limit (0.02 ug/L) is comparable to the lowest ambient water quality criterion (0.018 ug/L) established by U.S. EPA. The low level reporting limit for mercury (1 ng/L) is much lower than the lowest water quality criterion. Soil and sediment sample analytical results will be reported as dry weight and percent solids will be reported separately.

Table 9 presents the parameters and analytical methods that will be employed for each sample medium. Table 10 presents sample container, preservation, and holding time requirements for each sample matrix.

**Table 9. Analytical Parameters and Methods by Medium**

| Parameter | Analytical Method | | |
|---|---|---|---|
| | Water Samples (all samples will be analyzed for both total and dissolved fractions) | Soil/Sediment Samples | Rock Samples |
| Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc | EPA 200.8 (ICP/MS)<br>Arsenic: 0.02 ug/L reporting limit achievable with extra sample preconcentration/extra sample volume (assuming low-level stream water) | EPA 200.8 (ICP/MS) | EPA 6010 (ICP)/7000 (GFAA)<br>Sample prep: pulverization by Shatter Box technology |
| Mercury | EPA 1631 (low level 1 ng/L reporting limit; extra sample volume) | EPA 7471A (CVAA) | EPA 7470A (CVAA) |
| Cyanide | EPA 335.2 | EPA 9010B | EPA 9010B |
| Sulfides | EPA 376.2M | PSEP Protocols | PSEP Protocols |
| Alkalinity | EPA 310.1 | - - - | - - - |
| Total Suspended Solids | EPA 160.2 | - - - | - - - |
| Conductivity | Field measurement | - - - | - - - |
| PH | Field measurement | - - - | - - - |

**Table 10. Sample Container, Preservation and Holding Time Requirements**

| Parameter | Matrix | Container | Preservation | Maximum Holding Time |
|---|---|---|---|---|
| Aluminum, Arsenic, Barium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Zinc | W | P, G | HNO3 to pH<2 | 6 months |
| | S | G, Teflon-lined Cap | Cool, 4° C | 6 months |
| Mercury | W | P, G | HNO3 to pH<2 | 28 days |
| | S | P, G | Cool, 4° C | 28 days |
| Cyanide | W | P, G | Cool, 4° C, NaOH to pH>12, plus 0.6 g Ascorbic Acid | 14 days |
| Sulfides | W | P, G | Cool, 4° C, Add Zinc Acetate plus Sodium Hydroxide to pH>9 | 7 days |
| Alkalinity | W | P, G | Cool, 4° C | 14 days |
| Total Suspended Solids | W | P, G | Cool, 4° C | 7 days |

W = water, S = soil, P = polyethylene, G = glass

# 6.0 SAMPLE AND DOCUMENT CUSTODY

## 6.1 FIELD SAMPLE CUSTODY

The objective of field sample custody is to assure that samples are traceable and are not tampered with or compromised between sample collection and receipt by the analytical laboratory. A person will have custody of a sample when the samples are:

- In their physical possession;
- In their view after being in their possession;
- In their personal possession and secured to prevent tampering; or
- In a restricted area accessible only to authorized personnel and the person is one of the authorized personnel.

Field custody documentation will consist of both field log books and chain of custody forms.

### 6.1.1 Field Log Books

Field log books serve as a daily record of events, observations, and measurements during field activities. All information pertinent to sampling activities is recorded in the log books. The log books may be bound with the pages sequentially numbered or include separate sheets for field notes and method specific data logs (e.g., soil boring logs, sample collection logs). These separate logs will be placed in a three-ring binder at the end of the day and numbered sequentially. Entries in the log book will include:

- Name and title of author
- Name(s) of field crew
- Name(s) of site visitors
- Date and time of site entry
- Name of site and project code
- Description of sample location
- Number and volume of samples taken
- Date and time of collection
- Sample identification numbers
- Sampling method
- Descriptions of sample appearance and characteristics

- Preservatives used
- Field measurement data (pH, etc.)
- Field equipment calibration and maintenance records
- Date and time of shipment
- Shipment method
- Field observations

### 6.1.2 Chain-of-Custody Forms

Completed chain-of-custody forms will be required for all samples to be analyzed. Chain-of-custody forms will be prepared by the field sampling crew during the sample collection events. The chain-of-custody form will contain the following information about the samples:

- Unique identification number;
- Sample date and time;
- Sample description;
- Sample type;
- Sample preservation (if any) and;
- Analyses required.

The original chain-of-custody form will accompany the samples to the laboratory. Copies will be made prior to shipment for separate field documentation. The chain-of-custody forms will remain with the samples at all times and will be signed by a representative of the sampling crew and by a representative of the laboratory upon receipt of the samples. Copies of the signed forms will be included with the laboratory reports. The samples and signed chain-of-custody form will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., Federal Express).

### 6.1.3 Sample Containers

The sample container, preservation, and holding time requirements for each sample matrix and the anticipated analytical methods are summarized in Table 10. All samples will be transferred to the appropriate sampling containers and placed into a chilled (4° C) transport container for shipment to the laboratory. The chilled transport containers (coolers) will be used for temporary storage of the samples.

### 6.1.4 Sample Labels

A sample label will be attached to each sampling container prior to the sampling event. Information to be included on the label will include the following:

- Sample Identification code (if possible, should reflect site name, sample location and sample interval);
- Project code;
- Analysis required;
- Date sampled;
- Time sampled;
- Name or initials of person who collected the sample;
- Mode of collection (composite or grab); and
- Preservation added, if applicable.

### 6.1.5 Sample Packing and Shipping Requirements

Sample packaging and shipping procedures are designed to ensure that the samples and the chain-of-custody forms will arrive at the laboratory intact and together. Samples will be properly labeled and packaged for shipment using the following procedures:

- Sample container caps will be checked to make sure that they are tightly sealed;
- Each sample container will be placed in sealable plastic bag and placed upright into the sample shipping container (cooler);
- Cushioning material (e.g., vermiculite, bubble wrap) will be placed around the sides, bottom and top of each sample container;
- Frozen gel cold packs or ice repackaged in sealed plastic bags will be placed on top of sample containers. Do not pack cold packs or ice so tightly that it may prevent the addition of sufficient cushioning material to fill any remaining space in the cooler;
- The chain-of-custody forms will signed by the relinquisher, placed in a large sealed plastic bag and taped to the inside of the cooler lid;
- The cooler lid and drain plug will be secured and adequately fastened with packaging tape for shipment to the laboratory;
- If the cooler is being shipped to the laboratory, the outside of the cooler will be marked with the following information: return address, "Fragile" labels on the top and on one side, and arrows indicating "This Side Up" on two adjacent sides;

Environmental samples will be shipped according to 40 CFR 761.65 (i)(3) and in accordance with current and applicable DOT standards;

All samples will be delivered by an express carrier or by staff, allowing for sufficient time for analysis to be performed within the applicable holding time periods.

All shipments will be accompanied by the chain-of-custody form identifying the contents. It is preferred that a separate chain-of-custody form be completed for and placed in each shipping container. The original form will accompany the shipment and copies will be retained by the sampler for the sampling office records.

If sample containers are sent by common carrier (i.e., by Federal Express or United Parcel Service), the carrier need not sign the chain-of-custody form. In such cases, the chain-of-custody form will be sealed inside the sample container. The bill of lading (i.e., Federal Express label) serves as the custody documentation for the shipment so long as the container remains unopened until arrival at the laboratory. Copies of the bill of lading will be retained as part of the permanent documentation of the project.

## 6.2 LABORATORY SAMPLE CUSTODY

Laboratory sample custody will be performed in accordance with the laboratory's Quality Assurance Manual and will be consistent with the guidelines set forth in this section of the WSAP.

The laboratory must have and follow written standard operating procedures (SOPs) for sample custody including:

- Sample receipt and maintenance of custody;
- Sample storage; and
- Sample tracking.

When samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by signing and dating to acknowledge receipt of samples. The internal temperature of the shipping container will be measured and recorded. The sample identification numbers on the containers are then checked to insure that they are consistent with the chain of custody forms.

# 7.0 EQUIPMENT CALIBRATION AND PREVENTIVE MAINTENANCE PROCEDURES

## 7.1 FIELD PROCEDURES

All field equipment will be maintained and calibrated prior to use according to the manufacturer's instructions. In order to maintain field precision and accuracy, meters will be calibrated daily to known standards. The results of calibrations and any records of field maintenance or repair will be recorded in the project field notes. Field analytical equipment that will be used during this project includes meters for measuring conductivity, pH, temperature, turbidity and velocity.

## 7.2 LABORATORY PROCEDURES

Instrument calibration for selected parameters will follow accepted procedures associated with the analytical methods. The laboratory's quality assurance manual includes a more detailed discussion of calibration and maintenance procedures for laboratory analytical equipment.

# 8.0 INTERNAL QUALITY CONTROL CHECKS

## 8.1 FIELD PROCEDURES

The overall quality of field activities (collected samples and field measurements) will be maintained through use of standard field procedures as presented or referenced in this WSAP.

### 8.1.1 Field Measurements

The accuracy of field measurements will be maintained through calibration of the field instruments in accordance with manufacturer specifications. The precision of field measurements will be assessed through comparison of replicate measurements.

### 8.1.2 Field Duplicates

Blind field duplicates will be collected and analyzed, for soil and water samples, to check the precision or reproducibility of sampling and analytical procedures. Blind field duplicates are defined as two separate samples collected at a single location and labeled with separate identification codes so that the laboratory will not be able to identify the samples as duplicates. The frequency of duplicate collection will be at least one duplicate per every 20 samples collected. The duplicate samples will be analyzed for the same parameters at the laboratory.

### 8.1.3 Rinse Blanks

Rinse blanks will be collected and analyzed to check the effectiveness of equipment cleaning procedures if reusable sampling equipment that comes into contact with sample media is used. A rinse blank will be prepared by rinsing a cleaned sampling device with analyte-free water (deionized or distilled) and collecting the rinse water in an appropriate sample container. The frequency of rinse blank collection will be one rinse blank per each group of 20 samples collected.

## 8.2 LABORATORY PROCEDURES

Internal laboratory quality control checks will be performed consistent with the required procedures and frequencies of the analytical methods used and the laboratory's Quality Assurance Manual. Quality control checks will include, as applicable, analyses of:

- Laboratory duplicates for measurement of analytical precision;
- Method and laboratory blanks for assessment of reagent quality, background from analytical instruments, and analytical variability;
- Method or surrogate spikes for measurement of accuracy,
- Matrix spikes and duplicates for measurement of accuracy and precision;
- Interval and calibration standard for measurement of analytical accuracy; and
- Laboratory control chart to evaluate instrument performance trends.

# 9.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data obtained from field measurements and laboratory analysis results will be processed as follows:

- Reduction of the data into meaningful and useful forms using mathematical manipulation or other techniques, where necessary;
- Validation of the data to verify soundness and fitness for use; and
- Reporting of the data in a form that is organized and presentable.

## 9.1 FIELD DATA

The field data will be reduced and validated by reviewing field calculations and transcriptions made from the original data sheets. Suspect data will be discussed with the sampler. The field notes and data will be reviewed for:

- Consistency (significant figures, outliners);
- Completeness;
- Readability and interpretation of field notes;
- Field instrument performance (calibration, maintenance);
- Appropriate field procedures;
- Adherence to work plan.

Final review of field data in report format will be performed by the Project Manager designee.

## 9.2 LABORATORY DATA

Laboratory data reduction, validation, and reporting will be performed according to the procedures specified in each of the analysis methods referenced previously in this WSAP and according to the laboratory's Quality Assurance Manual. The analytical results will be reported to LTI, after being reviewed for completeness and correctness and including the following information, as applicable:

- Laboratory name and address;
- Field and laboratory sample identification codes;
- Dates of sample receipt, extraction, and analysis;
- Analytical method;
- Sample results;
- Surrogate spike recoveries, and control limits;

- Matrix spike/matrix spike duplicate recoveries, relative percent difference, and control limits;
- QC check sample result recoveries, and control limits;
- Duplicate sample results;
- Blank results;
- Internal standard area data (GC/MS); and
- Chain-of-custody forms.

Sample results will be corrected for dilutions and all soil samples reported on a dry weight basis along with percent solids.

The laboratory report data will be reviewed and validated by an LTI Project Engineer/Scientist for the following:

- Completeness of data;
- Proper execution of chain-of-custody forms;
- Compliance with QA/QC guidelines (duplicates, blanks, spikes, holding times);
- Presence of system contaminants or other interferences,
- Analysis according to methods specified in this WSAP.

Suspect data and deficiencies discovered during the validation process will be discussed with the Project Manager and/or Laboratory Manager for appropriate resolution.

# 10.0 DATA ASSESSMENT FOR ACCURACY, PRECISION, AND COMPLETENESS

Data assessment will be performed by both laboratory and field personnel prior to reporting. Accuracy, precision, and completeness will be assessed by project quality assurance staff.

## 10.1 FIELD DATA

Field data will be reviewed for compliance with the established QC criteria that are specified in this WSAP. Accuracy of the field measurements will be assessed using daily instrument calibration, calibration check, and analysis of blanks, where applicable. Precision will be assessed by comparing results from replicate measurements of a single sample. Completeness will be evaluated based upon the work done compared with that scheduled in the work plan.

## 10.2 LABORATORY DATA

Laboratory data will be reviewed for accuracy, precision, and completeness.

The accuracy of laboratory data will be assessed for compliance with the established QC criteria that are described in the laboratory methods using the analytical results of matrix spike and matrix spike duplicate samples, surrogates, and blanks. The percent recovery (%R) of matrix spike samples will be calculated using the following equation:

$$\%R = \frac{A-B}{C} X100$$

Where:

A = The analyte concentration determined experimentally from the spiked sample.

B = The background level determined by a separate analysis of the unspiked sample.

C = The amount of the spike added.

The precision of laboratory data will be assessed by comparing matrix spike and matrix spike duplicate (MS/MSD) results for organic analyses, laboratory duplicate results for inorganic analysis, and feild duplicate results for all analyses. The relative percent difference (%RPD) will be calculated for each pair of duplicate results using the following equation:

$$\%RPD\frac{S-D}{(S+D)/2}=100$$

Where:

S = First Sample value (initial or MS value)

D = Second sample value (duplicate or MSD value).

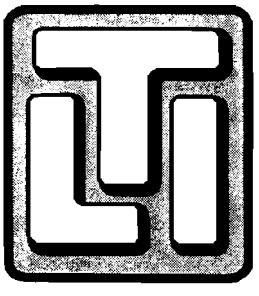
The completeness of the data set will be assessed according to the amount of valid data obtained compared with that planned or expected. The completeness is calculated using the following equation.

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} X100$$

# HEALTH and SAFETY PLAN

**for the**

**Mine Site Characterization and Screening Risk Analysis of Dewey Tunnel and Blue Gulch Mines for the Walla Walla District, U.S. Army Corps of Engineers**



**Limno-Tech, Inc.**

**Portland, Oregon**

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## *1.0 INTRODUCTION*

This section of the Site Health and Safety Plan (HASP) document defines general applicability and general responsibilities with respect to compliance with Health and Safety programs.

### *1.1 Scope and Applicability of the Site Health and Safety Plan*

The purpose of this Site Health and Safety Plan is to define the requirements and designate protocols to be followed at the Site during investigation and/or remediation activities. Applicability extends to all LTI employees, contractors, subcontractors, and visitors.

All personnel on site, contractors and subcontractors included, shall be informed of the site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation. This HASP summarizes those hazards in Table 1 and Appendix A, and defines protective measures planned for the site.

This plan must be reviewed by all personnel prior to entering the site.

During development of this plan consideration was given to current safety standards as defined by EPA/OSHA/NIOSH, health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to unknown substances. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR 1910.120 and EPA 40 CFR 311
- EPA, OERR ERT Standard Operating Safety Guides
- OSHA/NIOSH/EPA/USCG Occupational Health and Safety Guidelines
- NIOSH Pocket Guide to Chemical Hazards

### *1.2 Visitors*

All visitors entering the Site will be required to read and verify compliance with the provisions of this HASP. In addition, visitors will be expected to comply with relevant OSHA requirements such as medical monitoring (Sec. 6.0), training (Sec. 4.0), and respiratory protection (if applicable). Visitors will also be expected to provide their own protective equipment.

In the event that a visitor does not adhere to the provisions of the HASP, he/she will be requested to leave the work area.

## *2.0 ORGANIZATIONAL RESPONSIBILITY/KEY PERSONNEL*

**Technical Project Director: Dana Siegfried, DEA**

The technical project director is responsible for staffing and the overall administration of all aspects of the project.

**Project Manager: Kathi Futornick, LTI**
**Frank Groznik, LTI**

The project manager is responsible for oversight of all aspects of the project including health and safety, quality assurance and on-site activities.

**Project Engineer/Site Safety Officer: Robert Betz, LTI**

The project engineer/SSO is responsible for on-site activities including: sampling, quality assurance, implementing the health and safety plan and the air monitoring program. The project engineer/SSO reports to the project manager.

**QA/QC Officer: Robert Betz, LTI**

The QA/QC officer is responsible for the development, implementation and oversight of the QA/QC program for the site, and reports to the project manager.

**Health and Safety Manager: Robert Betz, LTI**

The HSO is responsible for providing corporate health and safety support/oversight for on-site health and safety and employee exposure meeting.

**Regulatory Agency Project Managers/Site Representatives: Ron White, U.S.ACOE**
**Rich Young, U.S.ACOE**
**Eric Wilson, IDL**

The regulatory agency project manager/site representative has responsibility for regulatory oversight, review and approval of the project work plans and report as well as the responsibility for addressing the legal and environmental requirements of the regulatory agency.

## *3.0 SAFETY AND HEALTH RISK ANALYSIS*

### *3.1 Site Background*

This HASP defines the hazards and methods to protect personnel from those hazards as identified in previous site work or background information. The evaluation of hazards is based

upon the knowledge of site background. For an overview of historical information concerning the Site see:

- Phase I Work Plan and Sampling and Analysis Plan Mine Site Characterization and Screening Risk Analysis of Dewey Tunnel and Blue Gulch Mines for the Walla Walla District, U.S. Army Corps of Engineers, Limno-Tech, Inc., August 2001.
- An undated comprehensive Scope of Work document supplied to the project team by the U.S. Army Corps of Engineers.

The current or upcoming site activities will involve:

- Collection of surface water, in-stream sediment, soil and rock samples using manual or power equipment (e.g., dip pole, hand auger, sampling pump)
- Survey of site features/sampling locations and elevations.

The following subsections describe the chemical and physical hazards associated with activities at the site. In addition, the protective measures to be implemented during these activities are identified.

### *3.2 Chemical/Physical Hazards*

Table 1 provides a list of chemicals believed to be present on-site either in the surface waters, in-stream sediments, soils or rocks. Table 2 lists the available chemical/physical hazards for the chemicals listed in Table 1 and available NIOSH/OSHA recommended exposure limits and protective/response actions to be taken. These chemicals may pose possible exposure hazards through ingestion, inhalation, and/or skin contact. Some materials may be known or suspected carcinogens.

Appendix A lists hazards and preventative actions for the work tasks at the site. Possible exposures to chemicals at the site during the work activities will be controlled and minimized through the use of personal protective equipment and proper standard operating procedures.

It is possible that some work tasks could be implemented in confined spaces. Appendix C presents the confined space entry procedures.

## *4.0 PERSONNEL TRAINING REQUIREMENTS*

Consistent with the OSHA 29 CFR 1910.120 regulations covering Hazardous Waste Operations and Emergency Response, all site personnel are required to be trained in accordance with the standard. At a minimum, all personnel are required to be trained to recognize the hazards on-site, the provisions of this HASP, and the responsible personnel.

### *4.1 Preassignment and Annual Refresher Training*

Prior to arrival on-site, each employer will be responsible for certifying that his/her employees meet the requirements of preassignment training. Consistent with OSHA 29 CFR 1910.120 paragraph (e)(3), each employee should be able to provide a document certifying dates of 24 hours of training for workers occasionally on-site for a specific task, or 40 hours of training for general site workers. An employee may also grandfather experienced personnel. Personnel must receive 8 hours of annual refresher training.

### *4.2 Site Supervisors Training*

Consistent with OSHA 29 CFR 1910.120 paragraph (e)(8), individuals designated as site supervisors require an additional 8 hours of training. The following individuals are identified as site supervisors:

- Robert Betz, LTI

## *5.0 PERSONAL PROTECTIVE EQUIPMENT TO BE USED*

This section describes the general requirements of the EPA designated Levels of Protection (A-D) and the specific levels of protection required for each task at the Site.

### *5.1 Levels of Protection*

Personnel wear protective equipment when response activities involve known or suspected atmospheric contamination, when vapors, gases, or particulates may be generated by site activities, or when direct contact with skin-affecting substances may occur. Full facepiece respirators protect lungs, gastrointestinal tract, and eyes against airborne toxicants. Chemical-resistant clothing protects the skin from contact with skin-destructive and absorbable chemicals.

The specific levels of protection and necessary components for each have been divided into four categories according to the degrees of protection afforded:

Level A: Should be worn when the highest level of respiratory, skin, and eye protection is needed.

Level B: Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection. Level B is the primary level of choice when encountering unknown environments.

Level C: Should be worn when the criteria for using air-purifying respirators are met, and a lesser level of skin protection is needed.

Level D: Should be worn only as a work uniform and not in any area with respiratory or skin hazards. It provides minimal protection against

chemical hazards.

Modifications of these levels are permitted, and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task. Likewise the type of chemical protective ensemble (i.e., material, format) will depend upon contaminants and degrees of contact.

The Level of Protection selected is based upon the following:

- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity.
- Potential for exposure to substances in air, splashes of liquids, or other direct contact with material due to work being done.
- Knowledge of chemicals on-site along with properties such as toxicity, route of exposure, and contaminant matrix.

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate Level of Protection must be selected based on professional experience and judgment until the hazards can be better identified. Standard operating procedures for inspecting personal protective equipment are presented in Appendix B.

## *5.2 Selected Level of Protection*

For all activities conducted at this site, Level D protection is appropriate. Level D personal protective equipment (PPE) includes:

- Coveralls: cotton and/or rain gear
- Gloves: cotton, leather, rubber, or vinyl, as necessary
- Boots/shoes: supportive work shoes or leather boots (steel toe optional)
- Safety glasses, if necessary
- Hardhat, if necessary

## *5.3 Reassessment of Protection Program*

The Level of Protection provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions or findings of investigations. When a significant change occurs, the hazards should be reassessed. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as the start of drum sampling or work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- Change of season/weather.

- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Contaminants other than those previously identified are encountered.
- Change in ambient levels of contaminants.
- Change in work scope which effects the degree of contact with contaminants.

### *5.4 Work Mission Duration*

Work mission duration limitations related to wearing PPE are variable and dependent upon:

- Air supply consumption with a Level A or B SCBA unit - air supply will be monitored and work will be halted prior to consumption of the entire supply.
- Permeation and penetration of protective clothing - work duration will be limited to permeation or "breakthrough" times associated with the protective clothing equipment materials used so that new protective clothing/equipment may be donned. Penetration through leakage of fasteners or valves on PPE will be inspected for and if found indicate stoppage of all work until the situation is remedied.
- Ambient temperature extremes - heat or cold stress will be monitored by each worker so that sufficient means (use of appropriate PPE heating/cooling packs, rest breaks, etc.) can be implemented to avoid these conditions.
- Segments of work while wearing SCBA will generally have a shorter work duration. However, at all times conditions will be monitored by all site workers so that work task duration can be adjusted to appropriate and safe periods of time. Before the workers actually begin work in their PPE ensembles, the anticipated duration of the work mission should be established.

## *6.0 MEDICAL SURVEILLANCE REQUIREMENTS*

Medical monitoring programs are designed to track the physical condition of employees on a regular basis as well as survey preemployment or baseline conditions prior to potential exposures.

The medical surveillance program is a part of each employers Health and Safety program.

### *6.1 Baseline or Preassignment Monitoring*

Prior to being assigned to a hazardous or a potentially hazardous activity involving exposure to toxic materials, each employee must receive a preassignment or baseline physical. The contents of the physical is to be determined by the employers medical consultant. As suggested by the NIOSH/OSHA/USCG/EPA Occupational Safety & Health Guidance Manual for Hazardous

Waste Site Activities, the minimum medical monitoring requirements for work at the Site is as follows:

- Complete medical and work histories.
- Physical examination.
- Pulmonary function tests (FVC and FEV1).
- Chest X-ray (every 2 years).
- EKG.
- Eye examination and visual acuity.
- Audiometry.
- Urinalysis.
- Blood chemistry, including hematology, serum analyses, and heavy metals toxicology.

The preassignment physical should categorize employees as fit-for-duty and able to wear respiratory protection.

### *6.2 Periodic Monitoring*

In addition to a baseline physical, all employees assigned to a hazardous or a potentially hazardous activity involving exposure to toxic materials require a periodic physical within the last 12 months unless the advising physician believes a shorter or longer interval is appropriate. The employers medical consultant should prescribe an adequate medical which fulfills OSHA 29 CFR 1910.120 requirements. The preassignment medical outlined above may be applicable.

All personnel working in contaminated or potentially contaminated areas at the Site will verify currency (within 12 months) with respect to medical monitoring. This is done by indicating date of last physical on the safety plan agreement form.

### *6.3 Site Specific Medical Monitoring*

No site specific medical monitoring will be implemented.

### *6.4 Exposure/Injury/Medical Support*

As a follow-up to an injury or possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow-up testing within 24-48 hours. It will be up to the employers medical consultant to advise the type of test required to accurately monitor for exposure effects.

### *6.5 Exit Physical*

At termination of employment or reassignment to an activity or location which does not represent a risk of exposure to hazardous substances, an employee shall require an exit physical. If his/her last physical was within the last 6 months, the advising medical consultant has the right to determine adequacy and necessity of exit exam.

## *7.0 FREQUENCY AND TYPES OF PERSONAL AIR MONITORING/SAMPLING*

Personal air monitoring will be performed for any necessary confined space entry activities according to the Confined Space Entry procedures of Appendix C.

## *8.0 NEAREST MEDICAL ASSISTANCE*

Figure 1 provides a map of the route to the nearest medical facility which can provide emergency care for individuals who may experience an injury or exposure on-site. The route to the hospital should be verified by the HSO, and should be familiar to all site personnel.

## *9.0 DECONTAMINATION PLAN*

Decontamination procedures for equipment and materials are specified in the applicable Site Work Plans. Decontamination procedures for the personnel contact with chemicals is provided in Table 2.

## *10.0 EMERGENCY RESPONSE/CONTINGENCY PLAN*

This section describes contingencies and emergency planning procedures to be implemented at the Site. This plan is compatible with local, state and federal disaster and emergency management plans as appropriate.

### *10.1 Pre-Emergency Planning*

During the site briefings held periodically/daily, all employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes. Appendix A identifies the hazardous conditions associated with specific site activities. The plan will be reviewed and revised if necessary, on a regular basis by the HSO. This will ensure that the plan is adequate and consistent with prevailing site conditions.

### *10.2 Personnel Roles and Lines of Authority*

The Site Supervisor has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measure to ensure the safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area, and evacuation

of adjacent residents. He/she is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed. The HSO may be called upon to act on the behalf of the site supervisor, and will direct responses to any medical emergency. The individual contractor organizations are responsible for assisting the project manager in his/her mission within the parameters of their scope of work.

### *10.3 Emergency Recognition/Prevention*

Table 2 and Appendix A provide a listing of chemical and physical hazards onsite. Additional hazards as a direct result of site activities are listed in Table 3, as are prevention and control techniques/mechanisms. Personnel will be familiar with techniques of hazard recognition from preassignment training and site specific briefings. The HSO is responsible for ensuring that prevention devices or equipment is available to personnel.

### *10.4 Emergency Contact/Notification System*

The following list provides names and telephone numbers for emergency contact personnel. In the event of a medical emergency, personnel will take direction from the HSO and notify the appropriate emergency organization. In the event of a fire or spill, the site supervisor will notify the appropriate local, state, and federal agencies.

| Organization | Telephone |
|---|---|
| David Evans and Associates (DEA) | 503/223-6663 |
| Limno-Tech, Inc., Environmental Engineering | 503/248-1768 (Portland, OR)or 734/332-1200 (Ann Arbor, MI) |
| Owyhee County Sherriff, Murphy, ID | 208/495-1154 or 208/337-4222 |
| Hospitals: | |
| St. Alphonsus Regional Medical Center, Boise | 208/367-2890, 208/367-2121 |
| Mercy Medical Center, Nampa, ID | 208/466-2661 |
| Poison Control Center (Illinois) | 800/942-5969 |
| National Response Center | 800/424-8802 |

### *10.5 Emergency Medical Treatment Procedures*

For any person who becomes ill or injured, first aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must be reported immediately to the project manager.

Any person being transported to a clinic or hospital for treatment should take with them information on the chemical(s) they have been exposed to at the site. This information is included in Tables 1 and 2.

Any vehicle used to transport contaminated personnel will be treated and cleaned as necessary.

### *10.6 Fire or Explosion*

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the project manager or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials onsite.

If it is safe to do so, site personnel may:

- Use fire fighting equipment available onsite to control or extinguish the fire; and,
- Remove or isolate flammable or other hazardous materials which may contribute to the fire.

### *10.7 Spill or Leaks*

In the event of a spill or a leak, site personnel will:

- Inform their supervisor immediately;
- Locate the source of the spillage and stop the flow if it can be done safely; and,
- Begin containment and recovery of the spilled materials.

The spill containment program procedures are presented in Appendix D.

### *10.8 Emergency Equipment/Facilities*

Figure 2 is a map of the site facilities. The following emergency equipment is located in the main office onsite and where otherwise specified.

| Emergency Equipment | Location |
|---|---|
| Telephone: | Personal cell phones |
| Fire Extinguisher: | None needed at site |
| First Aid Kit: | Field vehicle |
| Emergency Eye Wash: | Field vehicle |

## *10.9 Encountering Contamination*

If an employee notices visibly obvious contamination that was not anticipated prior to conducting the work activities, he/she should notify his/her supervisor immediately. The site supervisor will then confer with the project manager or other appropriate personnel.

## TABLE 1

### Constituents Detected in the vicinity of the Dewey Mine Site and Blue Gulch Creek

***Maximum Detected Levels***

| Chemical | Water from Blue Gulch Cr. at Jordan Cr.(1987-1992) (ug/L) [1] | Jordan Cr. Sediments (mg/kg? or as noted) [2] | Dewey Mine Source Tailings, Waste Rock & Soil (mg/kg) [2] |
|---|---|---|---|
| Aluminum | 250 | | |
| Antimony | | 6 B | |
| Arsenic | 6 | 48 | |
| Barium | 460 | 1,849 | |
| Cadmium | nd (5) | 2 | |
| Calcium | 11,100 | 13,020 | |
| Chromium | nd (70-100) | 7 B | |
| Copper | 40 | 631 | |
| Iron | 35 | 27,850 | |
| Lead | nd (70-100) | 30 | |
| Magnesium | 3,200 | | |
| Manganese | 110 | 3,651 | |
| Mercury | 1.6 | 6.1 | 247 |
| Nickel | | nd (4) | |
| Potassium | 1,500 | 26,600 | |
| Selenium | 8 | 3 B | |
| Silver | nd (5) | 6 | |
| Sodium | 6,000 | | |
| Titianium | | 3,625 | |
| Zinc | 83 | 1,337 | |
| Cyanide (total, free & WAD) | nd (5) | | |

[1] Source: Stone Cabin Mine, Vol. 1 of 2, Final Environmental Impact Statement, CH2MHILL, August, 1994

[2] Source and date unknown

nd (5) = not detected at a detection limit of 5

## TABLE 2

## Health Hazards for Detected Constituents

| Chemical | Exposure Limit[a] (ppm) | IDLH (ppm) | Symptoms and Effects of Exposure |
|---|---|---|---|
| Antimony | | | |
| Arsenic | | | |
| Barium | | | |
| Cadmium | | | |
| Calcium | | | |
| Chromium | | | |
| Copper | | | |
| Iron | | | |
| Lead | | | |

**TABLE 2 Continued**

| Chemical | Exposure Limit[a] (ppm) | IDLH (ppm) | Symptoms and Effects of Exposure |
|---|---|---|---|
| Manganese | | | |
| Mercury | | | |
| Nickel | | | |
| Potassium | | | |
| Selenium | | | |
| Silver | | | |
| Titianium | | | |
| Zinc | | | |

Table 2 Notes:

a -Time weighted average (TWA) concentrations for up to a 10-hour workday during a 40-hour workweek unless noted otherwise

IDLH – Immediately Dangerous to Life and Health

REL - NIOSH Recommended Exposure Limit

PEL – OSHA Permissible Exposure Limit

ST - Short Term Exposure Limit (STEL) for 15 minutes unless noted otherwise; not to be exceeded anytime during the workday

C – Ceiling Limit; not to be exceeded at any time during the workday

Ca – Potential occupational carcinogen

CNS – central nervous system

## TABLE 3
## EMERGENCY RECOGNITION/CONTROL MEASURES

| Specific Hazard | Prevention/Control |
|---|---|
| Fire/Explosion | Call Owyhee County Sheriff |
| Spill/Leak | Berms/Dikes,<br>Absorbent Material,<br>Foams |

# APPENDIX A:

# TASK HAZARD DESCRIPTIONS AND GENERAL SAFETY RULES

## GENERAL MINE SITE HAZARDS

Mine sites can pose a unique set of hazards to workers, who must take extra care to identify and avoid dangerous conditions associated with mine sites, such as:

- Terrain and climate - mine sites are often in remote regions and rugged terrain.
- Slope failure and structural instabilities of tailings piles/impoundments - naturally steep slopes and waste rock piles may be unstable.
- Mining subsidence – ground surface movement, sinkholes and troughs can occur resulting from the collapse of overlying strata into underground mine voids.
- Mining structures – structures at mining and mineral processing sites can contain physical and chemical hazards resulting from dilapidation and decay or residual chemicals from mining processes.
- Mine openings – vertical and horizontal mine openings may be evident and obvious, hidden by vegetation, collapsed mining structures or earth and contain physical hazards such as unstable ground that could collapse, air with insufficient oxygen or poisonous gases (e.g., carbon monoxide), and threat of falling great distances into vertical shaft openings.

### *HAZARD PREVENTION*

To minimize exposure to these hazards, a thorough review of site background information regarding the physical nature and organization of the site and historical site operations is desirable, including site layout plans, topographical maps, aerial photos, operations logs and interviews with former workers or people knowledgeable about the site.

## SURFACE AND SUBSURFACE SOIL SAMPLING

For the purposes of hazard identification, surface and subsurface soil sampling will be considered any soil sampling completed by hand using a trowel, split spoon, shovel, auger or other type of handheld tool. Hazards generally associated with soil and tailings/spoils sampling include:

- Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
- Back strain and muscle fatigue due to lifting, shoveling and augering techniques.
- Contact with or inhalation of decontamination solutions.

### *HAZARD PREVENTION*

- To minimize exposure to chemical contaminants, a thorough review of suspected contaminants should be completed along with implementation of an adequate protection program.
- Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slow easy motions when shoveling, augering and digging to decrease muscle strain.

- Material Safety Data Sheets for all decontamination solutions should be included with each Site Health and Safety Plan.
- First aid equipment should be available based on MSDS requirements.

## SOIL BORINGS AND MONITORING WELL INSTALLATION

Hazards generally associated with drilling operations include the following:

- Noise levels exceeding the OSHA PEL of 90 dBA are both a hazard and a hindrance to communication.
- Fumes (carbon monoxide) from the drill rig.
- Overhead utility wires, i.e. electrical and telephone, can be hazardous when the drill rig boom is in the upright position.
- Underground pipelines and utility lines can be ruptured or damaged during active drilling operations.
- Moving parts, i.e. augers, on the drill rig may catch clothing. Free or falling parts from the cat head may cause head injury.
- Moving the drill rig over uneven terrain may cause the vehicle to roll over or get stuck in a rut or mud. Be aware of hazards associated with moving heavy machinery and other associated injury.
- High pressure hydraulic lines and air lines used on drill rigs are hazardous when they are in ill repair or incorrectly assembled.
- Vehicular traffic may excessive, particularly on small sites or on public property.

### *HAZARD PREVENTION*

- Review the contaminants suspected to be onsite and perform air monitoring as required. Shut down the drill rig and/or divert exhaust fumes.
- All chains, lines, cables should be inspected daily for weak spots, frays, etc.
- Ear muffs and ear plugs effectively reduce noise levels.
- Hardhats should be worn at all times when working around a drill rig. Secure loose clothing. Check boom prior to approaching the drill rig.
- To avoid contact with any overhead lines, the drill rig boom should be lowered prior to moving the rig. Overhead utilities should be considered "live" until determined otherwise.
- The rig mast should not be erected within 30 feet of an overhead electrical line until the line is deenergized, grounded, or shielded and an electrician has certified that arcing cannot occur.
- Minimum working distances around "live" overhead power lines are:

| Voltage Range (kilovolt) | Minimum Working Distance |
|---|---|
| 2.1 to 15 | 2 ft. 0 in |
| 15.1 to 35 | 2 ft. 4 in |
| 35.1 to 46 | 2 ft. 6 in |
| 46.1 to 72.5 | 3 ft. 0 in |
| 72.6 to 121 | 3 ft. 0 in |
| 138 to 145 | 3 ft. 6 in |
| 161 to 169 | 3 ft. 8 in |
| 230 to 242 | 5 ft. 0 in |
| 345 to 362 | 7 ft. 0 in |
| 500 to 552 | 11 ft. 0 in |
| 700 to 765 | 15 ft. 0 in |

- A thorough underground utilities search should be conducted before the commencement of a drilling project.
- All high pressure lines should be checked prior to and during use.
- Caution tape, safety cones and signs should delineate clearly those areas where work will be performed. Only authorized personnel should be allowed to enter demarcated zones.

## SURFACE WATER SAMPLING

Both physical and chemical hazards are associated with water sampling, and they include the following:

- Contact with contaminated water.
- Drowning due to slipping, tripping, or falling while sampling. The use of personal protective clothing can increase the likelihood of drowning and accidents, due to the added weight and cumbersome nature of PPE.

### *HAZARD PREVENTION*

- Sampling should be done on the bank and the samplers should be secured with a line. The sampler should wear chemical resistant hip waders, and not stand in water deeper than his/her knee.
- If a boat must be used, a row boat in good condition and complete with floating oars should be employed. Two samplers should be in the boat, seated on opposite ends, and each should wear a life preserver. Samplers should remain seated while in the boat, and if feasible, the boat should be connected to the shore by a rope. A safety watch should be positioned on shore.
- The buddy system should be used at all times.

## GROUNDWATER SAMPLING

Hazards generally encountered during groundwater sampling include the following:

- Exposure to vapors of volatile organics when the well head is initially opened.
- Back strain due to lifting bailers or pumps from down-well depths and moving equipment (generators) to well locations.
- Electrical hazards associated with use of electrical equipment around water or wet surfaces.
- Possible water splashing in eyes during sampling.
- Vehicular traffic may excessive, particularly on small sites or on public property.

### *HAZARD PREVENTION*

- To minimize exposure to volatiles when the well head is initially opened, a monitor instrument (HNU, OVA) should be placed near the opening to monitor organic levels. The breathing zone should also be monitored. The action levels on the instruments should be chosen according to the health and safety plan. To prevent contact with contaminated groundwater, or product material, provide adequate protective equipment.
- Back strain can be prevented by employing proper lifting and bailing techniques. Heavy equipment, such as pumps and generators, should only be lifted with the legs, preferable using two or three personnel.
- Slipping on wet surfaces can be prevented by placing all purged water in drums for removal. Also, if the area is wet wear boots with good treads and be alert of where personnel are walking to decrease the chance of slipping.
- Ground fault interrupter should be used in the absence of properly grounded circuitry or when pumps are used around wet conditions.
- Electrical extension cords should be protected or guarded from damage (i.e. cuts from other machinery) and be maintained in good condition.
- Eye protection should be worn as appropriate to prevent water splashing into eyes.
- Caution tape, safety cones and signs should delineate clearly those areas where work will be performed. Only authorized personnel should be allowed to enter demarcated zones.

## STORAGE TANK CLEANING, REMOVAL, OR DISPOSAL

Hazards encountered during of underground or above ground storage tank cleaning, removal, or disposal include the following:

- Contact or inhalation exposure to volatile/semivolatile organics, pesticides, PCBs, or petroleum hydrocarbon liquids, vapors, or wastes.
- Potential for exposure to explosive and low oxygen atmospheres inside and around the tank.
- Contact with or inhalation of decontamination solutions.
- Back strain and muscle fatigue due to lifting, shoveling, or swabbing.
- Electrical hazards associated with use of electrical equipment around water or wet surfaces.
- Little or no ventilation.
- Small access or egress openings.

***HAZARD PREVENTION***

- Avoid skin contact and inhaling vapors through correct selection and use of PPE.
- Keep liquids and wastes away from eyes, skin, and mouth; they can be fatal or harmful if inhaled, absorbed through skin, or ingested.
- Use soap and water or waterless hand cleaner to remove any petroleum product that contacts skin. Do not use gasoline or similar solvents to remove oil and grease from skin.
- Promptly and properly wash or dispose of chemical or petroleum soaked clothes or rags and avoid using soaked leather goods.
- To minimize exposure to volatile or combustible vapors when the tank is opened, the proper monitoring instrument (OVA, HNu-volatiles; CGI - combustible vapors) should be placed near the opening to monitor dangerous levels. The breathing zone should also be monitored. The action levels on the instruments should be chosen according to the health and safety plan.
- Eliminate all potential sources of ignition from the area (e.g. smoking materials, nonexplosion-proof electrical and internal combustion equipment).
- Prevent the discharge of static electricity during venting of flammable vapors.
- Prevent the accumulation of vapors at ground level.
- Back strain can be prevented by employing proper lifting and bailing techniques. Heavy equipment, such as pumps and generators, should only be lifted with the legs, preferable using two or three personnel.
- Slipping on wet surfaces can be prevented by placing all purged cleaning water in drums for removal. Also, if the area is wet wear boots with good treads and be alert of where personnel are walking to decrease the chance of slipping.
- Ground fault interrupter should be used in the absence of properly grounded circuitry or when pumps are used around wet conditions.
- Electrical extension cords should be protected or guarded from damage (i.e. cuts from other machinery) and be maintained in good condition.

- Eye protection should be worn as appropriate to prevent water splashing into eyes.
- For confined space work, use adequate ventilation and lighting systems and proper confined space entry permits and procedures.

# GENERAL SAFETY RULES

## *General Activities*

- Each employee shall comply with the safety rules, regulations, and orders which apply to his own actions and conduct, and shall not interfere with any method or process adopted for protection of any employee on any company property or project.
- On sites involving hazardous materials, eating, drinking, chewing gum and chewing tobacco will be allowed only in designated areas. All personnel are required to wash their hands and face immediately after completing work activities in an exclusionary zone.
- Never work alone in an isolated area unless arrangements have been made for periodic contact with another employee.
- Keep out of areas that are barricaded or marked restricted. There may be work going on or conditions that expose you to danger.
- Do not enter any confined space until the area has been cleared by a supervisor or safety officer. Confined spaces may include, but are not limited to, sewers, sumps, manholes and trenches.
- If you are in doubt about the safe or proper way to do any job, get instructions from your supervisor.
- Any condition which you feel is unsafe should be reported to your supervisor or other responsible person. Unsafe conditions, acts, or equipment must be promptly corrected and/or reported to your supervisor so that corrective action may be taken.
- Report all accidents and injuries to the supervisor or project manager. Even minor injuries requiring only on-site first aid must be reported.
- USE GOOD JUDGEMENT IN DOING YOUR WORK. DO NOT TAKE UNNECESSARY CHANCES.

## *Housekeeping*

- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffold and emergency equipment free from obstructions.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, material and supplies shall be stored in an orderly manner.

- As work proceeds, scrap lumber and other unessential items must be neatly stored or removed from the work area.
- Containers should be provided for collection of trash and other debris and shall be removed at regular intervals.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the project site.
- Flammable/combustible liquids must be kept in approved containers and must be stored in an approved storage area.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

***Illumination***

- Site work will be performed during daylight hours whenever possible. Work conducted during hours of darkness will require enough illumination intensity "to read a newspaper without difficulty".

***Personal Protective Equipment***

- ANSI approved eye and face protection must be worn when exposed to hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation.
- ANSI approved hard-hats must be worn when there is potential of head injury form impact, falling or flying objects, or electrical shock and burns.
- Appropriate protective footwear must be worn when working in areas where there is a danger of foot injuries due to falling or rolling objects, objects piercing the sole, or when the feet are exposed to electrical hazards.
- Appropriate hand protection must be worn when exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns and harmful temperature extremes.
- Hearing protection must be worn when working around heavy equipment or other noisy machinery. The following general rule of thumb should be used to determine if hearing protection is required in a specific area. If you must raise your voice to be heard while communicating with persons near you, hearing protection is required.

***Fire Extinguishers***

- Watch for fire hazards. Know the location and operation for the fire extinguisher in your area. Check with your supervisor if in doubt. Report any fire extinguishers that are partly empty or otherwise inoperative.

***Electrical Safety***

- All temporary wiring, including extension cords, shall have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must also be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching.
- Electrical power tools and equipment must be effectively grounded or double-insulated and UL approved.
- Electrical power tools, equipment and cords are to be inspected for damage before use. If damaged, they must be tagged and removed from service.
- Only qualified personnel are to work on energized electrical circuits and equipment. Only authorized personnel are permitted to enter high-voltage areas.

***Tools, Machinery and Other Equipment***

- Do not use defective handtools. Watch for broken or loose handles and mushroomed heads and report them to your supervisor. Always use the right tool for the job.
- Use the guards provided for all power tools. Do not use any equipment if the guard is broken, inoperative, or missing.
- Employees must not tamper with or attempt any unauthorized repair to any equipment.
- Do not start any machinery without first personally making certain that no one can be injured by the operation.
- Never move any piece of equipment without first checking completely around it to see that it is safe to do so.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.
- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment. Remain outside of the swing and turning radius.
- Maintain a safe distance from pinch points of operating equipment.
- Never turn your back on operating heavy equipment in case reverse signal alarms are not present or properly functional.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.

- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers (e.g., equipped with firmly attached passenger seat). Getting on or off any vehicle while it is in motion is prohibited.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift unless it is specifically designed for this purpose. Riding on excavator/loader buckets, crane hooks or material hoists is prohibited.

***Manual Lifting***

- Practice lifting properly. Lift with your legs, not your back. Do not try to lift more than you can handle. Get help or use mechanical lifting aids if the load is too heavy or awkward to handle safely. Make sure the path of travel is clear prior to lifting.

***Ladders***

- Ladders must be inspected by a competent person for visible defects prior to each days use. Defective ladders must be tagged and removed from service.
- Personnel must face the ladder when climbing, keeping the belt buckle between side rails. Personnel must use both hands to climb. Use rope to raise and lower equipment and materials.
- Use ladders at an angle such that horizontal distances from top support to foot of the ladder is one-fourth of the working length of the ladder. Ladders must extend at least three feet above top support/landing surface.
- Ladders which may be displaced by work activities or traffic must be secured or barricaded.
- Stepladders are to be used in the fully opened and locked position. Personnel are not to stand on the top two steps of a stepladder and are not to sit on top or straddle a stepladder.

# APPENDIX B:

# STANDARD OPERATING PROCEDURES FOR PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

# I. STANDARD OPERATING PROCEDURES FOR PERSONAL PROTECTIVE CLOTHING

Proper inspection of PPE features several sequences of inspection depending upon specific articles of PPE and its frequency of use. The different levels of inspection are as follows:

- Inspection and operational testing of equipment received from the factory or distributor.
- Inspection of equipment as it is issued to workers.
- Inspection after use or training and prior to maintenance.
- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise.

The primary inspection of PPE in use for activities at the Site will occur prior to immediate use and will be conducted by the user. This ensures that the specific device or article has been checked out by the user, and that the user is familiar with its use.

## SAMPLE PPE INSPECTION CHECKLISTS

### *CLOTHING*

Before use:

- Determine that the clothing material is correct for the specified task at hand.
- Visually inspect for:
  - imperfect seams
  - non-uniform coatings
  - tears
  - malfunctioning closures
- Hold up to light and check for pinholes.
- Flex product
  - observe for cracks
  - observe for other signs of shelf deterioration
- If the product has been used previously, inspect inside and out for signs of chemical attack:
  - discoloration
  - swelling
  - stiffness

During the work task, periodically inspect for:

- Evidence of chemical attack such as discoloration, swelling, stiffening, and softening. Keep in mind, however, that chemical permeation can occur without any visible defects.
- Closure failure
- Tears
- Punctures
- Seam Discontinuities

### *GLOVES*

Before use:

- Visually inspect for:
  - imperfect seams
  - tears, abrasions
  - non-uniform coating
  - pressurize glove with air, listen for pinhole leaks.

## II. STANDARD OPERATING PROCEDURES FOR RESPIRATORY PROTECTION DEVICES

The following subsections define standard operating procedures for air purifying respirators and self-contained breathing apparatus.

### A. Cleaning and Disinfecting Self Contained Breathing Apparatus (SCBA)

Cleaning procedures for Self Contained Breathing Apparatus facepieces are identical to those for Air Purifying Respirators (APRs). The backpiece is cleaned with cleaning solution and a brush. Following cleaning, the facepiece is combined with the regulator and an operational check is performed.

### B. SCBA Inspection and Checkout

Monthly Inspection:

1. Check cylinder label for current hydrostatic test date.
2. Inspect cylinder for large dents or gouges.
3. Inspect cylinder gauge for damage.
4. Complete routine inspection.
5. Fill out the appropriate records with results and recommendations.

Routine Inspection (Perform immediately prior to donning or after cleaning):

1. Before proceeding, check that the high-pressure hose connector is tight on cylinder fitting.

2. Backpack and harness assembly:
   - Visually inspect straps for wear, damage, and completeness.
   - Check wear and function of belt
   - Check backplate and cylinder holder for damage.

3. Cylinder and high pressure hose assembly:
   - Check cylinder to assure that it is firmly attached to backplate.
   - Open cylinder valve; listen or feel for leakage around packing and hose connection.
   - Check high pressure hose for damage or leaks.

4. Regulator
   - Cover regulator outlet with palm of hand.
   - Open mainline valve.
   - Note stoppage of air flow after positive pressure builds.
   - Close mainline valve.
   - Remove hand from regulator outlet.
   - Open by-pass valve slowly to assure proper function.
   - Close by-pass valve.
   - Open mainline valve.
   - Note pressure reading on regulator gauge.
   - Close cylinder valve while keeping hand over regulator outlet.
   - Slowly remove hand from outlet and allow air to flow.
   - Note pressure when low-pressure warning alarm sounds; it should be between 550-650 psi.
   - Remove hand from regulator outlet.
   - Close mainline valve.
   - Check regulator for leaks by blowing air into regulator for 5-10 seconds. Draw air from outlet for 5-10 seconds. If a positive pressure or vacuum cannot be maintained there is a leak. DO NOT USE SCBA.

5. Facepiece and corrugated breathing hose:
   - Inspect hand harness and facepiece for damage, serrations, and deteriorated rubber.
   - Inspect lens for damage and proper seal in facepiece. Inspect exhalation valve for damage and dirt build-up.
   - Stretch breathing hose and carefully inspect for holes and deterioration.
   - Inspect connector for damage and presence of washer.
   - Perform negative pressure test with facepiece donned.
   - Tightly connect high pressure hose to cylinder.
   - Bleed pressure from high pressure hose by opening mainline valve.
   - Close by-pass valve.
   - Close mainline valve.
   - Fully extend all straps.
   - Store facepiece in a clean plastic bag for protection.

# APPENDIX C:

# CONFINED SPACE ENTRY PROCEDURES

A confined space provides the potential for unusually high concentrations of contaminants, explosive atmospheres, limited visibility, and restricted movement. This section will establish requirements for safe entry into, continued work in, and safe exit from confined spaces. Additional information regarding confined space entry can be found in 29 CFR 1926.21,29 CFR 1910 and NIOSH80-106.

## DEFINITIONS

*Confined Space*: A space or work area not designed or intended for normal human occupancy, having limited means of egress and poor natural ventilation; and/or any structure, including buildings or rooms, which have limited means of egress.

*Confined Space Entry Permit (CSEP)*: A document to be indicated by the supervisor of personnel who are to enter into or work in a confined space. The Confined Space Entry Permit (CSEP) will be completed by the personnel who will be permitted to enter the confined space. The CSEP shall be valid only for the performance of the work identified and for the location and time specified. The beginning of a new shift with change of personnel will require the issuance of a new CSEP.

*Confined Space Observer*: An individual assigned to monitor the activities of personnel working within a confined space. The confined space observer monitors and provides external assistance to those inside the confined space. The confined space observer summons rescue personnel in the event of emergency and assists the rescue team.

## GENERAL PROVISIONS

- When possible, confined spaces should be identified with a posted sign which reads: Caution - Confined Space.
- Only personnel trained and knowledgeable of the requirements of these Confined Space Entry Procedures will be authorized to enter a confined space or be a confined space observer.
- A Confined Space Entry Permit (CSEP) must be issued prior to the performance of any work within a confined space. The CSEP will become a part of the permanent and official record of the site.
- Natural ventilation shall be provided for the confined space prior to initial entry and for the duration of the CSEP. Positive/forced mechanical ventilation may be required. However, care should be taken to not spread contamination outside of the enclosed area.
- If flammable liquids may be contained within the confined space, explosion proof equipment will be used. All equipment shall be positively grounded.
- The contents of any confined space shall, where necessary, be removed prior to entry. All sources of ignition must be removed prior to entry.
- Hand tools used in confined spaces shall be in good repair, explosion proof and spark proof, and selected according to intended use. Where possible, pneumatic power tools are to be used.

- Compressed gas cylinders, except cylinders used for self-contained breathing apparatus, shall not be taken into confined spaces. Gas hoses shall be removed from the space and the supply turned off at the cylinder valve when personnel exit from the confined space.
- If a confined space requires respiratory equipment or where rescue may be difficult, safety belts, body harnesses, and lifelines will be used. The outside observer shall be provided with the same equipment as those working within the confined space.
- A ladder is required in all confined spaces deeper than the employee's shoulders. The ladder shall be secured and not removed until all employees have exited the space.
- Only self-contained breathing apparatus or NIOSH approved airline respirators equipped with a 5-minute emergency air supply (egress bottle) shall be used in untested confined spaces or in any confined space with conditions determined immediately dangerous to life and health.
- Where air-moving equipment is used to provide ventilation, chemicals shall be removed from the vicinity to prevent introduction into the confined space.
- Vehicles shall not be left running near confined space work or near air-moving equipment being used for confined space ventilation.
- Smoking in confined spaces will be prohibited at all times.
- Any deviation from these Confined Space Entry Procedures requires the prior permission of the On-Scene Coordinator.

## PROCEDURE FOR CONFINED SPACE ENTRY

The HSO and Entry Team shall:

- Evaluate the job to be done and identify the potential hazards before a job in a confined space is scheduled.
- Ensure that all process piping, mechanical and electrical equipment, etc. have been disconnected, purged, blanked-off or locked and tagged as necessary.
- If possible, ensure removal of any standing fluids that may produce toxic or air displacing gases, vapors, or dust.
- Initiate a Confined Space Entry Permit (CSEP) in concurrence with the project manager or designated alternative.
- Ensure that any hot work (welding, burning, open flames, or spark producing operation) that is to be performed in the confined space has been approved by the project manager and is indicated on the CSEP.
- Ensure that the space is ventilated before starting work in the confined space and for the duration of the time that the work is to be performed in the space.
- Ensure that the personnel who enter the confined space and the confined space observer helper are familiar with the contents and requirements of this instruction.

- Ensure remote atmospheric testing of the confined space prior to employee entry and before validation/revalidation of a CSEP to ensure the following:

a. Oxygen content between 19.5% - 23.0%

b. No concentration of combustible gas in the space. Sampling will be done throughout the confined space and specifically at the lowest point in the space.

c. The absence of other atmospheric contaminants, if the space has contained toxic, corrosive, or irritant material.

d. If remote testing is not possible, Level B PPE is required as referenced in the health and safety plan.

- Designate whether hot or cold work will be allowed. If all tests in a through c are satisfactory, complete the CSEP listing any safety precautions, protective equipment, or other requirements.
- Ensure that a copy of the CSEP is posted at the work site, a copy is filed with the project supervisor, and a copy is furnished to the project manager.

The CSEP shall be considered void if work in the confined space does not start within one hour after the tests in a through c above are performed or if significant changes within the confined space atmosphere or job scope occurs.

The CSEP posted at the work site shall be removed at the completion of the job or the end of the shift, whichever is first.

## CONFINED SPACE OBSERVER

- While personnel are inside the confined space, a confined space observer will monitor the activities and provide external assistance to those in the space. The observer will have no other duties which may take his attention away from the work or require him to leave the vicinity of the confined space at any time while personnel are in the space.
- The confined space observer shall maintain at least voice contact with all personnel in the confined space. Visual contact is preferred, if possible.
- The observer shall be instructed by his supervisor in the method for contacting rescue personnel in the event of an emergency.
- If irregularities within the space are detected by the observer, personnel within the space will be ordered to exit.
- In the event of an emergency, the observer must NEVER enter the confined space prior to contacting and receiving assistance from a helper. Prior to this time, he should attempt to remove personnel with the lifeline and to perform all other rescue functions from outside the space.
- A helper shall be designated to provide assistance to the confined space observer in case the observer must enter the confined space to retrieve personnel.

## CONFINED SPACE ENTRY PERMIT

SITE NAME AND ADDRESS _____ DATE _____ TIME _____

_____ PROJECT ID _____

_____

DESCRIPTION OF CONFINED SPACE _____

PURPOSE OF ENTRY _____

DESCRIPTION OF MATERIALS OR CHEMICALS IN SPACE _____

ATMOSPHERIC SCREENING

| TIME | OXYGEN (%) | LEL (%) | CO (ppm) | TOTAL ORGANIC VAPORS (ppm) | TESTED BY |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

CHECKLIST

| | Initials | |
|---|---|---|
| | Yes | N/A |
| All lines to & from confined space have been blinded or disconnected | | |
| All lighting extension cords, monitoring equipment, compressors, etc. are approved explosion-proof | | |
| Electrical service locked out/tagged out | | |
| Ground fault circuit interrupters in place and functioning | | |
| All grounding & bonding cables in place | | |
| All ignition sources isolated | | |
| All ventilation equipment in place | | |
| All safety harnesses, lifelines, & retrieval systems checked & in place | | |
| Outside standby trained in emergency procedures and CPR | | |
| Air-supply respiratory system checked & in proper condition | | |
| Employees have been trained in the use, care & limitation of respiratory equipment | | |
| Required protective clothing, gloves, boots, hard hats, etc. being used | | |
| All emergency equipment (SCBA, fire extinguishers, first aid kits, etc.) ready for use | | |
| Warning/Caution signs, barricades, etc. posted & in place | | |
| Provisions for personnel & equipment decontamination established | | |

**THIS CONFINED SPACE ENTRY PERMIT IS VALID ONLY FOR THE EMPLOYEES DESIGNATED BELOW AND ONLY FOR ONE WORK SHIFT AS INDICATED**

| | Print Names | Signature |
|---|---|---|
| ENTRY PERSONNEL | _____ | _____ |
| | _____ | _____ |
| EMERGENCY STANDBY | _____ | _____ |

AMBULANCE PHONE NUMBER _____

FIRE DEPARTMENT PHONE NUMBER _____

# APPENDIX D:

# SPILL CONTAINMENT PROGRAM

## SPILL CONTAINMENT

The procedures defined in this section comprise the spill containment program in place for activities at the site.

- All drums and containers used during the clean-up shall meet the appropriate DOT, OSHA and EPA regulations for the waste that they will contain.
- Drums and containers shall be inspected and their integrity assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions, shall be positioned in an accessible location and inspected prior to further handling.
- Operations onsite will be organized so as to minimize the amount of drum or container movement.
- Employees involved in the drum or container operations shall be warned of the hazards associated with the containers.
- Where spills, leaks, or ruptures may occur, adequate quantities of spill containment equipment will be stationed in the immediate area. The spill containment program must be sufficient to contain and isolate the entire volume of hazardous substances being transferred.
- Drums or containers that cannot be moved without failure shall be emptied into a sound container.

# APPENDIX G

**Appendix G**

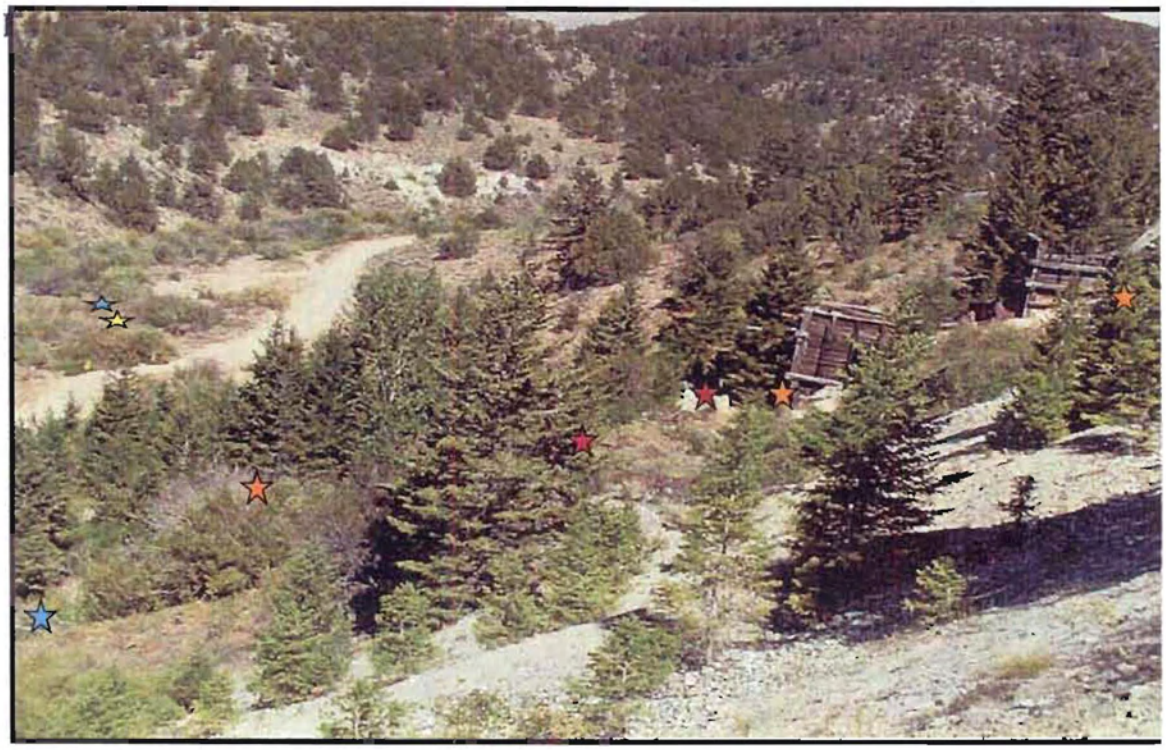



**Figure G-1. Dewey Tunnel Sampling Locations - East End**

Appendix G

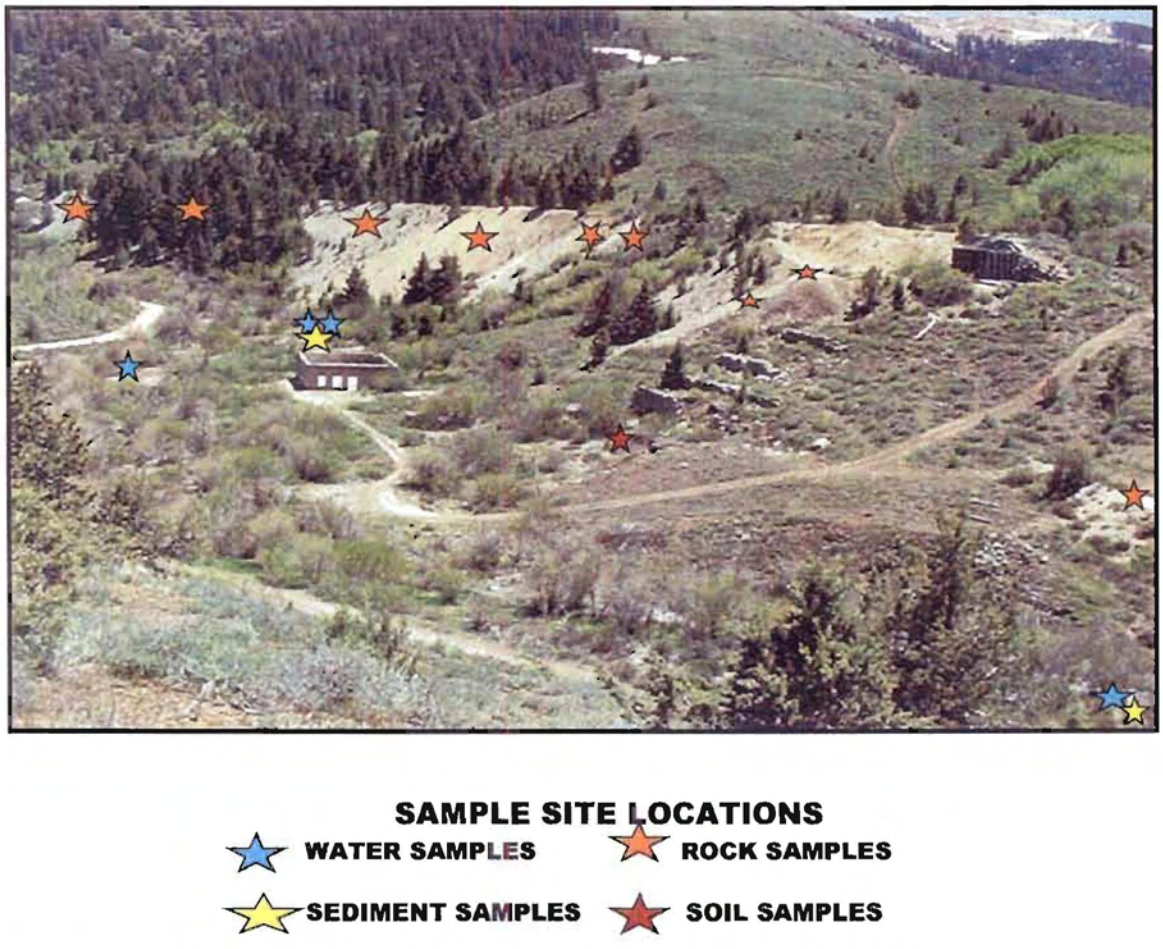



Figure G-2. Dewey Tunnel Sample Locations – West End

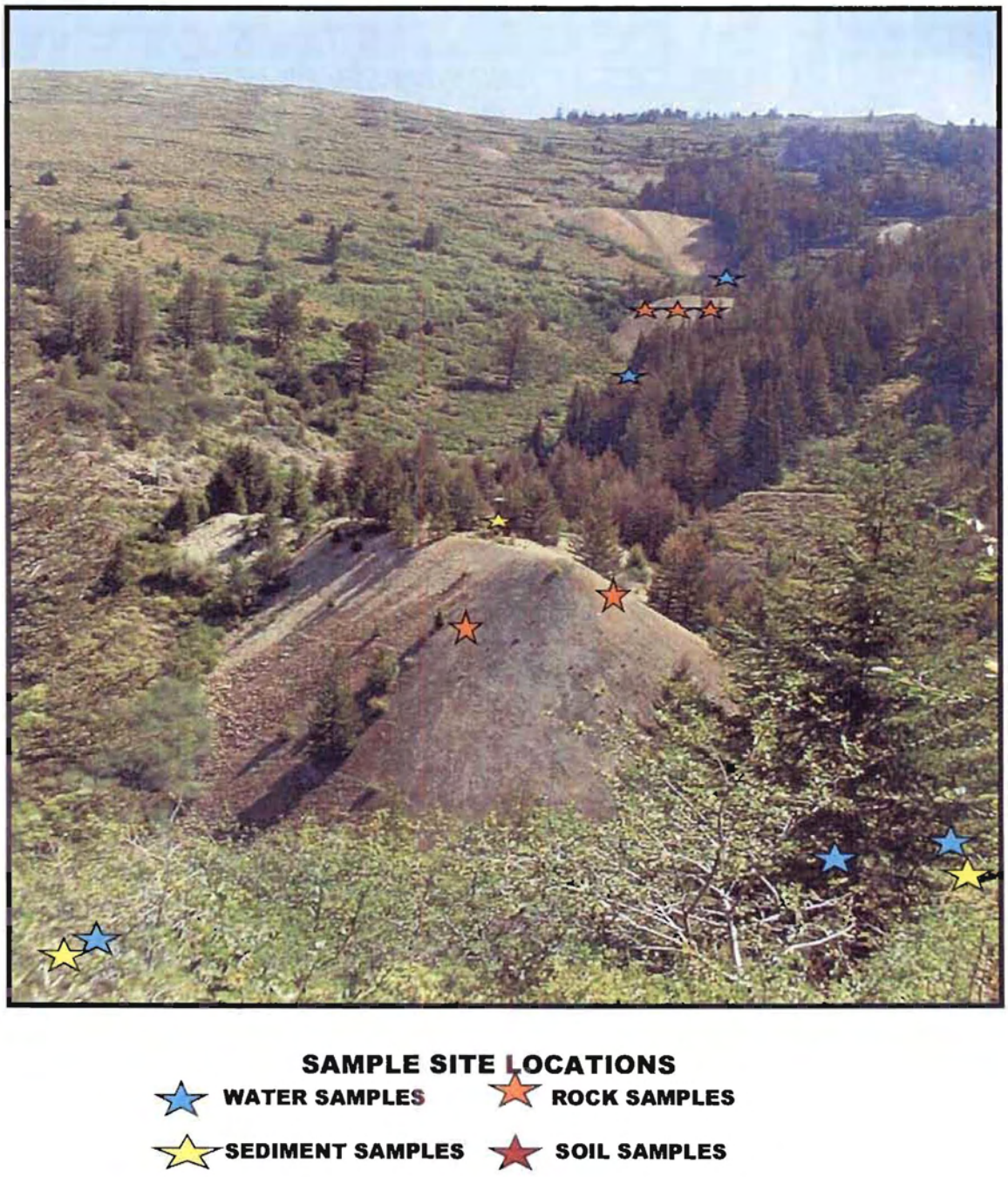
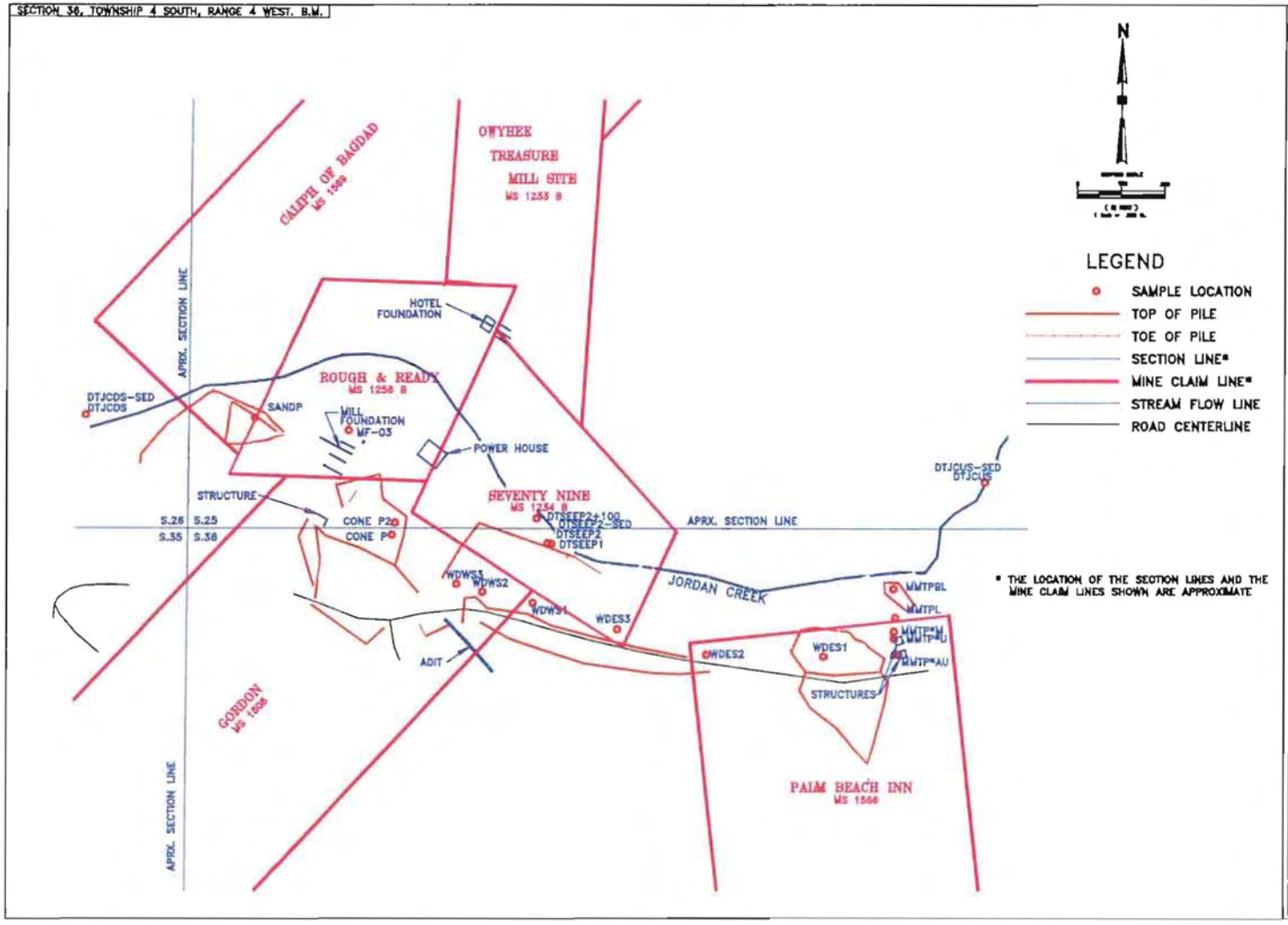
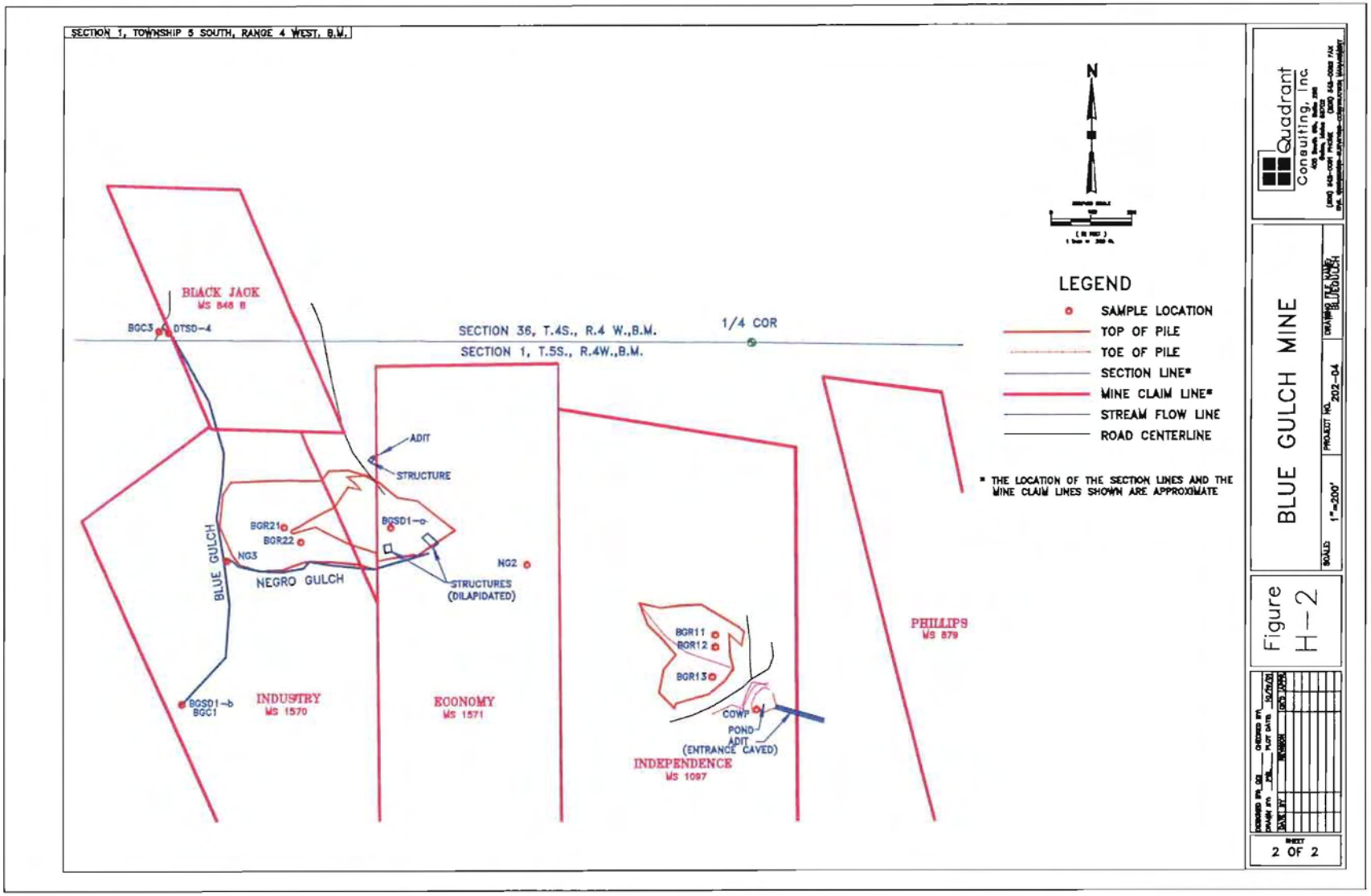



Figure G-3. Blue Gulch Sample Locations

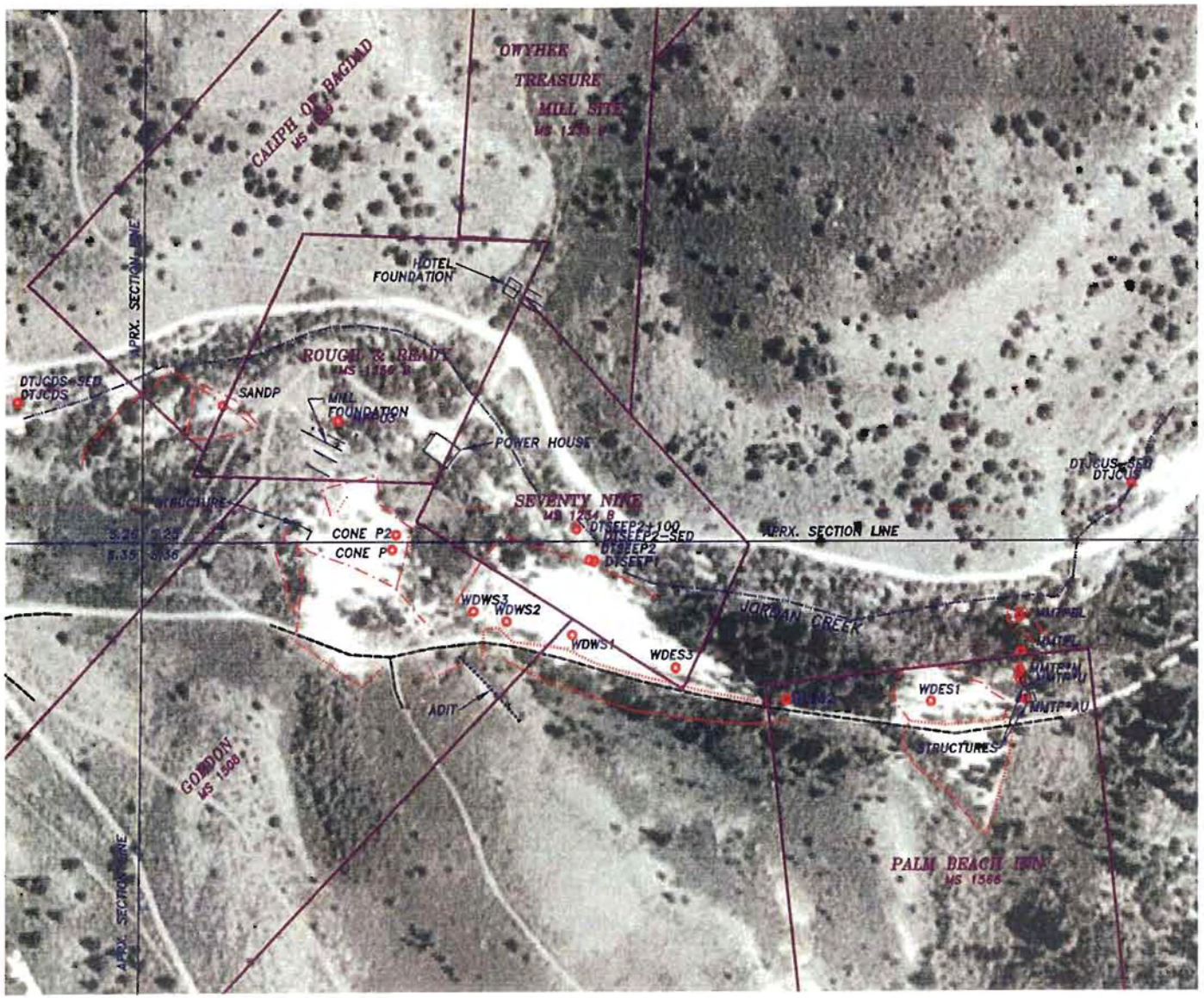
# APPENDIX H


SECTION 36, TOWNSHIP 4 SOUTH, RANGE 4 WEST, B.M.
CALIPH OF BAGDAD
MS 1566
OWYHEE
TREASURE
MILL SITE
MS 1253 B
APRX. SECTION LINE
HOTEL
FOUNDATION
ROUGH & READY
MS 1256 B
DTJCDS-SED
DTJCDS
SANDP
MILL
FOUNDATION
MF-03
POWER HOUSE
STRUCTURE
SEVENTY NINE
MS 1254 B
DTJCUS-SED
DTJCUS
S.26
S.25
S.35
S.36
CONE P2
CONE P
DTSEEP24-100
DTSEEP2-SED
DTSEEP2
DTSEEP1
APRX. SECTION LINE
WDWS3
WDWS2
WDWS1
WDES3
JORDAN CREEK
WMTPBL
WMTPL
WMTP*M
WMTP*U
WMTP*AU
WDES2
WDES1
ADIT
STRUCTURES
GORDON
MS 1508
PALM BEACH INN
MS 1566
APRX. SECTION LINE
N
LEGEND
SAMPLE LOCATION
TOP OF PILE
TOE OF PILE
SECTION LINE*
MINE CLAIM LINE*
STREAM FLOW LINE
ROAD CENTERLINE
* THE LOCATION OF THE SECTION LINES AND THE MINE CLAIM LINES SHOWN ARE APPROXIMATE
Quadrant
Consulting Inc
DEWEY TUNNEL MINE
SCALE: 1"=200'
PROJECT NO. 202-04
DRAWING FILE NAME: DEWEY_TUNNEL
Figure H-1
SURVEYED BY: SEL
DRAWN BY: PSL
CHECKED BY:
PLOT DATE: 10/26/05
DATE
INITIALS
SHEET
1 OF 2


SECTION 1, TOWNSHIP 5 SOUTH, RANGE 4 WEST, B.M.
N
LEGEND
SAMPLE LOCATION
TOP OF PILE
TOE OF PILE
SECTION LINE*
MINE CLAIM LINE*
STREAM FLOW LINE
ROAD CENTERLINE
* THE LOCATION OF THE SECTION LINES AND THE MINE CLAIM LINES SHOWN ARE APPROXIMATE
BLACK JACK
MS 848 B
BGC3
DTSD-4
SECTION 36, T.4S., R.4 W.,B.M.
SECTION 1, T.5S., R.4W.,B.M.
1/4 COR
ADIT
STRUCTURE
BGR21
BGR22
BGSD1-a
NG3
NG2
BLUE GULCH
NEGRO GULCH
STRUCTURES
(DILAPIDATED)
BGSD1-b
BGC1
INDUSTRY
MS 1570
ECONOMY
MS 1571
BGR11
BGR12
BGR13
COMP
POND
ADIT
(ENTRANCE CAVED)
INDEPENDENCE
MS 1097
PHILLIPS
MS 879
Quadrant Consulting, Inc
BLUE GULCH MINE
SCALE: 1"=200'
PROJECT NO. 202-04
DRAWING FILE NAME: BLUEGULCH
Figure H-2
SHEET 2 OF 2

# APPENDIX I

SECTION 34, TOWNSHIP 4 SOUTH, RANGE 4 WEST, B.M.




N

LEGEND

- SAMPLE LOCATION
- TOP OF PILE
- TOE OF PILE
- SECTION LINE*
- MINE CLAIM LINE*
- STREAM FLOW LINE
- ROAD CENTERLINE

* THE LOCATION OF THE SECTION LINES AND THE MINE CLAIM LINES SHOWN ARE APPROXIMATE

Quadrant Consulting, Inc.

# DEWEY TUNNEL MINE

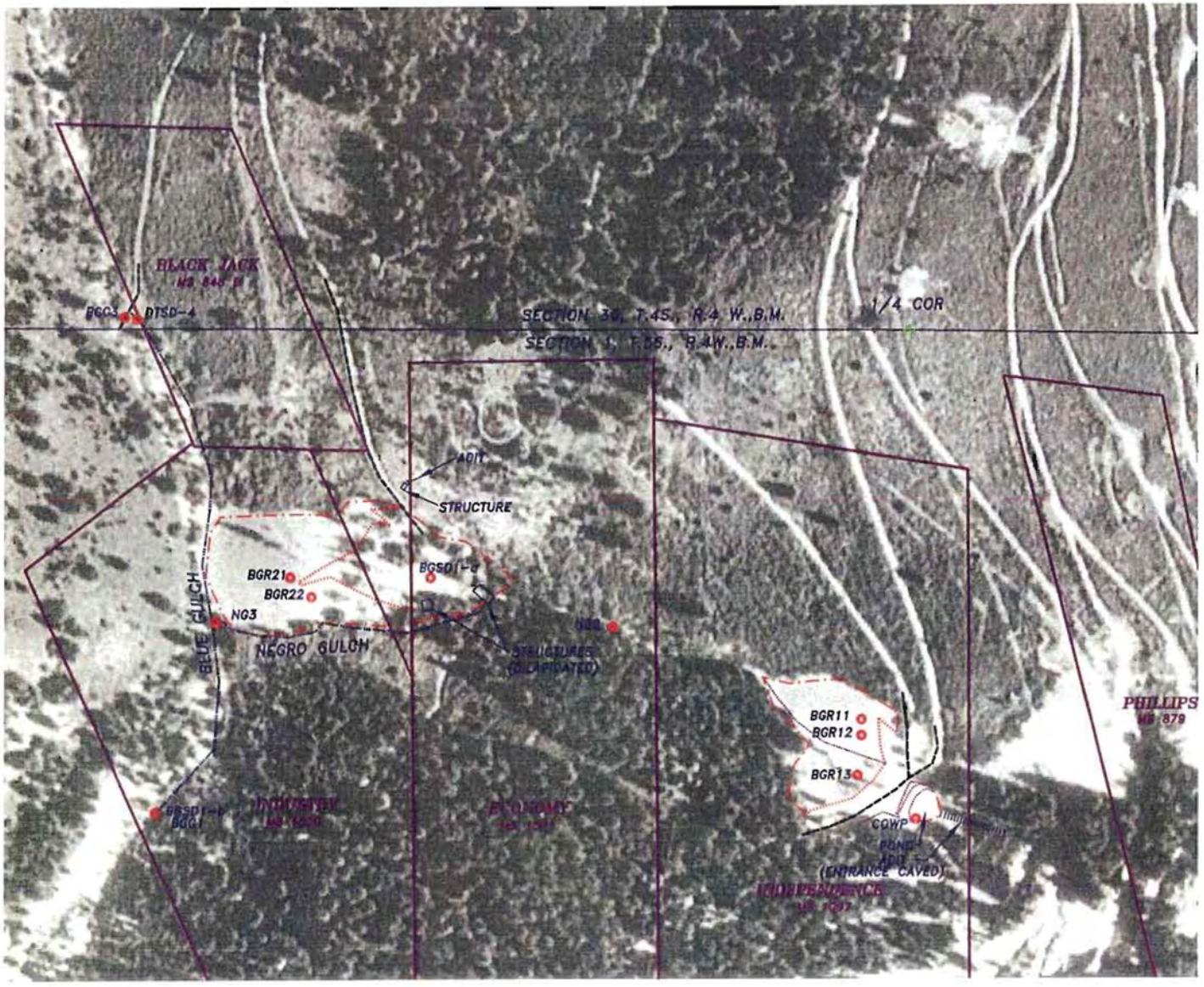
SCALE: 1"=200'

PROJECT NO. 2002-04

DRAWING NO. (MAP) DEWEY TUNNEL

SHEET 1 OF 2

SECTION 1, TOWNSHIP 5 SOUTH, RANGE 4 WEST, B.M.




N

LEGEND

- SAMPLE LOCATION
- TOP OF PILE
- TOE OF PILE
- SECTION LINE*
- MINE CLAIM LINE*
- STREAM FLOW LINE
- ROAD CENTERLINE

* THE LOCATION OF THE SECTION LINES AND THE MINE CLAIM LINES SHOWN ARE APPROXIMATE

Quadrant Consulting, Inc

# BLUE GULCH MINE

SCALE: 1"=200'

PROJECT NO. 202-04

DRAWING NO. BLUEGULCH

SHEET 2 OF 2

# APPENDIX J

SECTION 1, TOWNSHIP 5 SOUTH, RANGE 4 WEST, B.M.

| Ecological Risk Based Screening Levels for Water | |
|---|---|
| | Minimum Criterion (ug/L) |
| Aluminum | 87 |
| Barium | 4 |
| Beryllium | 0.66 |
| Copper | 9 |
| Manganese | 120 |
| Silver | 0.36 |
| Zinc | 120 |

| Ecological Risk Based Screening Levels for Soils/Sediments | |
|---|---|
| | Minimum Criterion (mg/kg) |
| Aluminum | 50 |
| Arsenic | 4 |
| Cadmium | 0.3 |
| Chromium | 0.4 |
| Cobalt | 20 |
| Copper | 7 |
| Iron | 200 |
| Lead | 6 |
| Manganese | 100 |
| Mercury | 0.1 |
| Nickel | 30 |
| Selenium | 1 |
| Silver | 2 |
| Vanadium | 2 |
| Zinc | 43 |

N

GRAPHIC SCALE
0 100 200
( IN FEET )

## LEGEND

- SAMPLE LOCATION
- TOP OF PILE
- TOE OF PILE
- SECTION LINE*
- MINE CLAIM LINE*
- STREAM FLOW LINE
- ROAD CENTERLINE

| BGC3 | |
|---|---|
| pH | 4.8 |
| Aluminum | 2,340 ug/L |
| Barium | 82.8 ug/L |
| Beryllium | 1.1 ug/L |
| Copper | 27.6 ug/L |
| Manganese | 230 ug/L |
| Zinc | 242 ug/L |

BLACK JACK
MS 848 B

BGC3
BGSD-4

SECTION 36, T.4S., R.4 W.,B.M.
SECTION 1, T.5S., R.4W.,B.M.

1/4 COR

| NG2 | |
|---|---|
| pH | 5.5 |
| Aluminum | 1,760 ug/L |
| Barium | 94.3 ug/L |
| Beryllium | 0.845 ug/L |
| Copper | 55.9 ug/L |
| Manganese | 315 ug/L |
| Silver | 0.372 ug/L |
| Zinc | 126 ug/L |

ADIT
STRUCTURE

| BGR21 | |
|---|---|
| Aluminum | 24,400 mg/kg |
| Arsenic | 241 mg/kg |
| Cadmium | 1.14 mg/kg |
| Chromium | 14.4 mg/kg |
| Cobalt | 32.8 mg/kg |
| Copper | 126 mg/kg |
| Iron | 60,300 mg/kg |
| Lead | 13.8 mg/kg |
| Manganese | 1,200 mg/kg |
| Mercury | 0.61 mg/kg |
| Selenium | 3 mg/kg |
| Silver | 38.7 mg/kg |
| Vanadium | 99.9 mg/kg |
| Zinc | 202 mg/kg |

BGR21
BGR22
NG3
BLUE GULCH
NEGRO GULCH
BGSD1-a
NG2
STRUCTURES
(DILAPIDATED)

| BGR 11, 12, 13 Comp | |
|---|---|
| Aluminum | 11,700 mg/kg |
| Arsenic | 123 mg/kg |
| Chromium | 3.93 mg/kg |
| Copper | 83.8 mg/kg |
| Iron | 41,300 mg/kg |
| Lead | 21.2 mg/kg |
| Manganese | 195 mg/kg |
| Mercury | 0.38 mg/kg |
| Selenium | 29.3 mg/kg |
| Silver | 120 mg/kg |
| Vanadium | 31.3 mg/kg |

PHILLIPS
MS 879

BGR11
BGR12
BGR13
COWP
POND
ADIT
(ENTRANCE CAVED)

INDEPENDENCE
MS 1097

BGSD1-b
BGC1

INDUSTRY
MS 1570

ECONOMY
MS 1571

| BGC1 | |
|---|---|
| pH | 4.7 |
| Aluminum | 706 ug/L |
| Barium | 176 ug/L |
| Manganese | 146 ug/L |

| BGR22 | |
|---|---|
| Aluminum | 14,200 mg/kg |
| Arsenic | 12.3 mg/kg |
| Cadmium | 0.44 mg/kg |
| Chromium | 32.2 mg/kg |
| Copper | 63.7 mg/kg |
| Iron | 27,400 mg/kg |
| Lead | 53.6 mg/kg |
| Manganese | 601 mg/kg |
| Mercury | 0.37 mg/kg |
| Nickel | 53.4 mg/kg |
| Selenium | 3.8 mg/kg |
| Silver | 218 mg/kg |
| Vanadium | 53.9 mg/kg |
| Zinc | 198 mg/kg |

| COWP | |
|---|---|
| pH | 9.0 |
| Aluminum | 108 ug/L |
| Barium | 95.1 ug/L |
| Silver | 0.404 ug/L |

* THE LOCATION OF THE SECTION LINES AND THE MINE CLAIM LINES SHOWN ARE APPROXIMATE

Basemap provided by:

Quadrant Consulting, Inc.
406 South 8th, Suite 256
Boise, Idaho 83702
(208) 342-0001 PHONE (208) 342-0002 FAX
CIVIL ENGINEERING-SURVEYING-CONSTRUCTION MANAGEMENT

# BLUE GULCH SAMPLE LOCATIONS EXCEEDING ECOLOGICAL RISK-BASED SCREENING LEVELS

LTI Environmental Engineering
A Division of Limno-Tech, Inc.
501 Avis Drive, Ann Arbor, MI 48108

SECTION 1, TOWNSHIP 5 SOUTH, RANGE 4 WEST. B.M.

| Human Health Risk Based Screening Levels for Water | |
|---|---|
| | Minimum Criterion (ug/L) |
| Arsenic | 0.018 |
| Iron | 50 |
| Magnesium | 1,500 |
| Manganese | 50 |
| Mercury | 0.05 |

| Human Health Risk Based Screening Levels for Soils/Sediments | |
|---|---|
| | Minimum Criterion (mg/kg) |
| Arsenic | 0.39 |
| Iron | 23,000 |
| Manganese | 960 |
| Silver | 35 |

| BGC3 | |
|---|---|
| pH | 4.8 |
| Arsenic | 0.82 ug/L |
| Iron | 322 ug/L |
| Magnesium | 3,560 ug/L |
| Manganese | 481 ug/L |

BLACK JACK
MS 848 B

| BGSD4 | |
|---|---|
| Arsenic | 540 mg/kg |

BGC3
BGSD-4

SECTION 36, T.4S., R.4 W.,B.M.
SECTION 1, T.5S., R.4W.,B.M.

1/4 COR

| BGR21 | |
|---|---|
| Arsenic | 241 mg/kg |
| Iron | 60,300 mg/kg |
| Manganese | 1,200 mg/kg |
| Silver | 38.7 mg/kg |

| BGSD1-a | |
|---|---|
| Arsenic | 45.3 mg/kg |
| Iron | 27,400 mg/kg |
| Silver | 61.1 mg/kg |

ADIT
STRUCTURE
BGSD1-a
BGR21
BGR22
NG3
BLUE GULCH
NEGRO GULCH
STRUCTURES (DILAPIDATED)

| BGR22 | |
|---|---|
| Arsenic | 12.3 mg/kg |
| Iron | 27,400 mg/kg |
| Silver | 218 mg/kg |

| NG2 | |
|---|---|
| pH | 5.5 |
| Arsenic | 0.43 ug/L |
| Iron | 61.5 ug/L |
| Magnesium | 3,570 ug/L |
| Manganese | 358 ug/L |

NG2

| BGR 11, 12, 13 Comp | |
|---|---|
| Arsenic | 123 mg/kg |
| Iron | 41,300 mg/kg |
| Silver | 120 mg/kg |

BGR11
BGR12
BGR13
COWP
POND
ADIT (ENTRANCE CAVED)

PHILLIPS
MS 879

INDUSTRY
MS 1570

ECONOMY
MS 1571

INDEPENDENCE
MS 1097

BGSD1-b
BGC1

| BGSD1-b | |
|---|---|
| Arsenic | 69.2 mg/kg |

| BGC1 | |
|---|---|
| pH | 4.7 |
| Arsenic | 0.78 ug/L |
| Iron | 594 ug/L |
| Manganese | 263 ug/L |

| COWP | |
|---|---|
| pH | 9.0 |
| Arsenic | 2.65 ug/L |
| Iron | 441 ug/L |
| Magnesium | 2,140 ug/L |
| Mercury | 0.0567 ug/L |

N

GRAPHIC SCALE
0 100 200
( IN FEET )

## LEGEND

- SAMPLE LOCATION
- TOP OF PILE
- TOE OF PILE
- SECTION LINE*
- MINE CLAIM LINE*
- STREAM FLOW LINE
- ROAD CENTERLINE

* THE LOCATION OF THE SECTION LINES AND THE MINE CLAIM LINES SHOWN ARE APPROXIMATE

Basemap provided by:

Quadrant Consulting, Inc.
405 South 8th, Suite 205
Boise, Idaho 83702
(208) 342-0691 PHONE (208) 342-0693 FAX
CIVIL ENGINEERING-SURVEYING-CONSTRUCTION MANAGEMENT

# BLUE GULCH SAMPLE LOCATIONS EXCEEDING HUMAN HEALTH RISK-BASED SCREENING LEVELS

LTI Environmental Engineering
A Division of Limno-Tech, Inc.
501 Avis Drive, Ann Arbor, MI 48108

SECTION 36, TOWNSHIP 4 SOUTH, RANGE 4 WEST. B.M.

| SANDP | |
|---|---|
| Aluminum | 5,740 mg/kg |
| Arsenic | 38.2 mg/kg |
| Chromium | 1.81 mg/kg |
| Iron | 9,340 mg/kg |
| Lead | 82.4 mg/kg |
| Mercury | 3.23 mg/kg |
| Silver | 5.87 mg/kg |
| Vanadium | 9 mg/kg |

| MF03 | |
|---|---|
| Aluminum | 27,900 mg/kg |
| Arsenic | 10.1 mg/kg |
| Chromium | 28.5 mg/kg |
| Copper | 61.8 mg/kg |
| Iron | 46,300 mg/kg |
| Lead | 188 mg/kg |
| Manganese | 890 mg/kg |
| Mercury | 8.19 mg/kg |
| Nickel | 56.4 mg/kg |
| Silver | 23.9 mg/kg |
| Vanadium | 96.5 mg/kg |
| Zinc | 181 mg/kg |

| DTSEEP1&2 Comp | |
|---|---|
| pH | 4.7 - 5.3 |
| Aluminum | 10,700 ug/L |
| Barium | 19.4 ug/L |
| Beryllium | 16.7 ug/L |
| Cadmium | 5.54 ug/L |
| Cobalt | 61.1 ug/L |
| Copper | 89.1 ug/L |
| Manganese | 3,560 ug/L |
| Nickel | 52.4 ug/L |
| Silver | 0.615 ug/L |
| Zinc | 2,000 ug/L |

| JC SEEP 2+100 | |
|---|---|
| pH | 5.5 |
| Aluminum | 3,790 ug/L |
| Barium | 21.6 ug/L |
| Beryllium | 8.69 ug/L |
| Cadmium | 2.85 ug/L |
| Cobalt | 28.1 ug/L |
| Copper | 43.2 ug/L |
| Manganese | 1,430 ug/L |
| Zinc | 907 ug/L |

| CONEP COMP | |
|---|---|
| Aluminum | 9,980 mg/kg |
| Arsenic | 93.9 mg/kg |
| Chromium | 2.78 mg/kg |
| Copper | 9.5 mg/kg |
| Iron | 28,200 mg/kg |
| Lead | 82.9 mg/kg |
| Manganese | 319 mg/kg |
| Mercury | 4.2 mg/kg |
| Selenium | 1.6 mg/kg |
| Silver | 10.2 mg/kg |
| Vanadium | 53.3 mg/kg |

| WDES3 | |
|---|---|
| Aluminum | 19,100 mg/kg |
| Arsenic | 10.9 mg/kg |
| Cadmium | 0.35 mg/kg |
| Chromium | 30.9 mg/kg |
| Copper | 131 mg/kg |
| Iron | 33,800 mg/kg |
| Lead | 61.6 mg/kg |
| Manganese | 751 mg/kg |
| Mercury | 0.41 mg/kg |
| Nickel | 48.3 mg/kg |
| Selenium | 4.7 mg/kg |
| Silver | 385 mg/kg |
| Vanadium | 56.8 mg/kg |
| Zinc | 228 mg/kg |

| MMTP-M & L Comp | |
|---|---|
| Aluminum | 13,700 mg/kg |
| Arsenic | 30.8 mg/kg |
| Cadmium | 0.45 mg/kg |
| Chromium | 13.7 mg/kg |
| Copper | 60.3 mg/kg |
| Iron | 30,000 mg/kg |
| Lead | 204 mg/kg |
| Manganese | 465 mg/kg |
| Mercury | 91.8 mg/kg |
| Selenium | 6.2 mg/kg |
| Silver | 64.9 mg/kg |
| Vanadium | 46.5 mg/kg |
| Zinc | 158 mg/kg |

| DTJCUS | |
|---|---|
| pH | 7.5 |
| Barium | 10.6 ug/L |

| MMTP-BL | |
|---|---|
| Aluminum | 3,020 mg/kg |
| Arsenic | 12.3 mg/kg |
| Chromium | 1.32 mg/kg |
| Iron | 3,650 mg/kg |
| Lead | 63 mg/kg |
| Mercury | 0.33 mg/kg |
| Vanadium | 4.8 mg/kg |

| DT JCDS | |
|---|---|
| pH | 4.9 |
| Aluminum | 4,210 ug/L |
| Barium | 44.9 ug/L |
| Beryllium | 10.4 ug/L |
| Cadmium | 3.34 ug/L |
| Copper | 50.6 ug/L |
| Manganese | 1,390 ug/L |
| Zinc | 1,170 ug/L |

| WDWS3 | |
|---|---|
| Aluminum | 4,990 mg/kg |
| Arsenic | 18.1 mg/kg |
| Chromium | 1.9 mg/kg |
| Copper | 40.1 mg/kg |
| Iron | 10,300 mg/kg |
| Lead | 66.4 mg/kg |
| Manganese | 151 mg/kg |
| Mercury | 0.76 mg/kg |
| Selenium | 9.8 mg/kg |
| Silver | 46.1 mg/kg |
| Vanadium | 4.8 mg/kg |
| Zinc | 45.3 mg/kg |

| WDWS2 | |
|---|---|
| Aluminum | 30,100 mg/kg |
| Arsenic | 6.5 mg/kg |
| Cadmium | 0.38 mg/kg |
| Chromium | 57.2 mg/kg |
| Cobalt | 23.3 mg/kg |
| Copper | 92.4 mg/kg |
| Iron | 64,300 mg/kg |
| Lead | 87.5 mg/kg |
| Manganese | 878 mg/kg |
| Mercury | 0.25 mg/kg |
| Nickel | 99.4 mg/kg |
| Silver | 6.82 mg/kg |
| Vanadium | 106 mg/kg |
| Zinc | 328 mg/kg |

| WDWS1 | |
|---|---|
| Aluminum | 8,300 mg/kg |
| Arsenic | 41.6 mg/kg |
| Chromium | 13.9 mg/kg |
| Copper | 42.7 mg/kg |
| Iron | 18,800 mg/kg |
| Lead | 78.2 mg/kg |
| Manganese | 155 mg/kg |
| Mercury | 1.28 mg/kg |
| Selenium | 7.5 mg/kg |
| Silver | 47.0 mg/kg |
| Vanadium | 24.2 mg/kg |
| Zinc | 51.4 mg/kg |

| WDES2 | |
|---|---|
| Aluminum | 23,300 mg/kg |
| Arsenic | 15.9 mg/kg |
| Cadmium | 0.36 mg/kg |
| Chromium | 38.8 mg/kg |
| Copper | 100 mg/kg |
| Iron | 43,000 mg/kg |
| Lead | 52.2 mg/kg |
| Manganese | 839 mg/kg |
| Mercury | 0.39 mg/kg |
| Nickel | 75 mg/kg |
| Selenium | 23.4 mg/kg |
| Silver | 31.9 mg/kg |
| Vanadium | 89.4 mg/kg |
| Zinc | 164 mg/kg |

| WDES1 | |
|---|---|
| Aluminum | 16,300 mg/kg |
| Arsenic | 5.5 mg/kg |
| Cadmium | 0.40 mg/kg |
| Chromium | 30.2 mg/kg |
| Copper | 89.7 mg/kg |
| Iron | 29,900 mg/kg |
| Lead | 39.4 mg/kg |
| Manganese | 546 mg/kg |
| Mercury | 0.60 mg/kg |
| Nickel | 38.6 mg/kg |
| Selenium | 54.1 mg/kg |
| Silver | 97.5 mg/kg |
| Zinc | 106 mg/kg |

| MMTP-U | |
|---|---|
| Aluminum | 4,040 mg/kg |
| Arsenic | 118 mg/kg |
| Chromium | 1.47 mg/kg |
| Copper | 24.5 mg/kg |
| Iron | 24,900 mg/kg |
| Lead | 65.5 mg/kg |
| Mercury | 1.5 mg/kg |
| Selenium | 16.8 mg/kg |
| Silver | 82.4 mg/kg |
| Vanadium | 6.8 mg/kg |

| MMTP-AU | |
|---|---|
| Aluminum | 6,390 mg/kg |
| Arsenic | 26.6 mg/kg |
| Chromium | 2.55 mg/kg |
| Copper | 8.9 mg/kg |
| Iron | 6,640 mg/kg |
| Lead | 76.4 mg/kg |
| Mercury | 6.98 mg/kg |
| Silver | 4.51 mg/kg |
| Vanadium | 9.4 mg/kg |

| MM SEEP | |
|---|---|
| pH | 6.9 |
| Aluminum | 161 ug/L |
| Barium | 30.3 ug/L |
| Beryllium | 0.884 ug/L |
| Manganese | 150 ug/L |

| Ecological Risk Based Screening Levels for Soils/Sediments | Minimum Criterion (mg/kg) |
|---|---|
| Aluminum | 50 |
| Arsenic | 4 |
| Cadmium | 0.3 |
| Chromium | 0.4 |
| Cobalt | 20 |
| Copper | 7 |
| Iron | 200 |
| Lead | 6 |
| Manganese | 100 |
| Mercury | 0.1 |
| Nickel | 30 |
| Selenium | 1 |
| Silver | 2 |
| Vanadium | 2 |
| Zinc | 43 |

| Ecological Risk Based Screening Levels for Water | Minimum Criterion (ug/L) |
|---|---|
| Aluminum | 87 |
| Barium | 4 |
| Beryllium | 0.66 |
| Cadmium | 2.2 |
| Cobalt | 23 |
| Copper | 9 |
| Manganese | 120 |
| Nickel | 52 |
| Silver | 0.36 |
| Zinc | 120 |

N

GRAPHIC SCALE
0 100 200
( IN FEET )

## LEGEND

- SAMPLE LOCATION
- TOP OF PILE
- TOE OF PILE
- SECTION LINE*
- STREAM FLOW LINE
- ROAD CENTERLINE

* THE LOCATION OF THE SECTION LINES SHOWN ARE APPROXIMATE.

Basemap provided by:

Quadrant Consulting, Inc.

# DEWEY TUNNEL SAMPLE LOCATIONS EXCEEDING ECOLOGICAL RISK-BASED SCREENING LEVELS

LTI Environmental Engineering
A Division of Limno-Tech, Inc.
501 Avis Drive, Ann Arbor, MI 48108

SECTION 36, TOWNSHIP 4 SOUTH, RANGE 4 WEST. B.M.

| Human Health Risk Based Screening Levels for Water | Minimum Criterion (ug/L) |
|---|---|
| Arsenic | 0.018 |
| Beryllium | 4 |
| Cadmium | 5 |
| Iron | 50 |
| Lead | 15 |
| Magnesium | 1,500 |
| Manganese | 50 |
| Mercury | 0.05 |

| Human Health Risk Based Screening Levels for Soils/Sediments | Minimum Criterion (mg/kg) |
|---|---|
| Antimony | 3 |
| Arsenic | 0.39 |
| Iron | 23,000 |
| Mercury | 2 |
| Silver | 35 |

| DTJCUS | |
|---|---|
| pH | 7.5 |
| Arsenic | 1.32 ug/L |
| Iron | 82 ug/L |
| Mercury | 0.48 ug/L |

| DTJCUS-SED | |
|---|---|
| Arsenic | 2.2 mg/kg |

| SANDP | |
|---|---|
| Arsenic | 38.2 mg/kg |
| Mercury | 3.23 mg/kg |

| DTJC DS-SED | |
|---|---|
| Arsenic | 1.7 mg/kg |

| DTJC SEEP 2+100 | |
|---|---|
| Arsenic | 1.06 ug/L |
| Beryllium | 11 ug/L |
| Iron | 81.2 ug/L |
| Magnesium | 9,840 ug/L |
| Manganese | 1,750 ug/L |
| Mercury | 0.193 ug/L |

| DTJC SEEP2-SED | |
|---|---|
| Arsenic | 3.9 mg/kg |

| DTSEEP1 & 2 Comp. | |
|---|---|
| Arsenic | 0.38 ug/L |
| Beryllium | 19.6 ug/L |
| Cadmium | 7.59 ug/L |
| Iron | 80.5 ug/L |
| Magnesium | 20,600 ug/L |
| Manganese | 4,010 ug/L |

| MMTP-M&L Comp | |
|---|---|
| Antimony | 3.52 mg/kg |
| Arsenic | 30.8 mg/kg |
| Iron | 30,000 mg/kg |
| Mercury | 91.8 mg/kg |
| Silver | 64.9 mg/kg |

| DTJCDS | |
|---|---|
| pH | 4.9 |
| Arsenic | 0.61 ug/L |
| Beryllium | 12.1 ug/L |
| Iron | 56.2 ug/L |
| Magnesium | 12,600 ug/L |
| Manganese | 1,750 ug/L |
| Mercury | 0.0914 ug/L |

| MF03 | |
|---|---|
| Arsenic | 10.1 mg/kg |
| Iron | 46,300 mg/kg |
| Mercury | 8.19 mg/kg |

| CONEP COMP | |
|---|---|
| Arsenic | 93.9 mg/kg |
| Iron | 28,200 mg/kg |
| Mercury | 4.2 mg/kg |

| WDWS3 | |
|---|---|
| Arsenic | 18.1 mg/kg |
| Silver | 46.1 mg/kg |

| WDWS2 | |
|---|---|
| Arsenic | 6.5 mg/kg |
| Iron | 64,300 mg/kg |

| WDWS1 | |
|---|---|
| Arsenic | 41.6 mg/kg |
| Silver | 47 mg/kg |

| WDES3 | |
|---|---|
| Arsenic | 10.9 mg/kg |
| Iron | 33,800 mg/kg |
| Silver | 385 mg/kg |

| WDES2 | |
|---|---|
| Arsenic | 15.9 mg/kg |
| Iron | 43,000 mg/kg |

| WDES1 | |
|---|---|
| Arsenic | 5.5 mg/kg |
| Iron | 29,900 mg/kg |
| Selenium | 54.1 mg/kg |
| Silver | 97.5 mg/kg |

| MMTP-BL | |
|---|---|
| Arsenic | 12.3 mg/kg |

| MMTP-U | |
|---|---|
| Arsenic | 118 mg/kg |
| Iron | 24,900 mg/kg |
| Silver | 82.4 mg/kg |

| MMTP-AU | |
|---|---|
| Arsenic | 26.6 mg/kg |
| Mercury | 6.98 mg/kg |

| MM SEEP | |
|---|---|
| pH | 6.9 |
| Arsenic | 15.2 ug/L |
| Iron | 23,300 ug/L |
| Lead | 67.3 ug/L |
| Magnesium | 4,160 ug/L |
| Manganese | 1,020 ug/L |
| Mercury | 3.92 ug/L |

HOTEL FOUNDATION
APRX. SECTION LINE
DTJCDS-SED
DTJCDS
SANDP
MILL FOUNDATION
MF-03
POWER HOUSE
STRUCTURE
CONE P2
CONE P
JCSEEP2+100
DTSEEP2-SED
DTSEEP2
DTSEEP1
APRX. SECTION LINE
DTJCUS-SED
DTJCUS
JORDAN CREEK
WDWS3
WDWS2
WDWS1
WDES3
WDES2
WDES1
ADIT
MMTPBL
MMTPL
MMTP*M
MMTP*U
MMTP*AU
STRUCTURES
APRX. SECTION LINE
S.26
S.25
S.35
S.36

N

GRAPHIC SCALE
0 100 200
( IN FEET )

## LEGEND

- SAMPLE LOCATION
- TOP OF PILE
- TOE OF PILE
- SECTION LINE*
- STREAM FLOW LINE
- ROAD CENTERLINE

* THE LOCATION OF THE SECTION LINES SHOWN ARE APPROXIMATE.

Basemap provided by:

Quadrant Consulting, Inc.

# DEWEY TUNNEL SAMPLE LOCATIONS EXCEEDING HUMAN HEALTH RISK-BASED SCREENING LEVELS

LTI Environmental Engineering
A Division of Limno-Tech, Inc.
501 Avis Drive, Ann Arbor, MI 48108

Columbia Analytical Services INC.
An Employee-Owned Company

October 17, 2001 Service Request No: K2106294

Tom Chisholm
Limno-Tech, Inc.
4640 SW Macadam Ste. 60
Portland, OR 97201

**Re: PDXMIN**

Dear Tom:

Enclosed are the results of the sample(s) submitted to our laboratory on August 29, 2001. For your reference, these analyses have been assigned our service request number K2106294.

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3280.

Respectfully submitted,

**Columbia Analytical Services, Inc.**

Les Kennedy
Project Chemist

LK/afs



317 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 360/ 577-7222 • Fax 360/636-1068

## Acronyms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| A2LA | American Association for Laboratory Accreditation |
| CARB | California Air Resources Board |
| CAS Number | Chemical Abstract Service registry Number |
| CFC | Chlorofluorocarbon |
| CFU | Colony-Forming Unit |
| DEC | Department of Environmental Conservation |
| DEQ | Department of Environmental Quality |
| DHS | Department of Health Services |
| DOE | Department of Ecology |
| DOH | Department of Health |
| EPA | U. S. Environmental Protection Agency |
| ELAP | Environmental Laboratory Accreditation Program |
| GC | Gas Chromatography |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| LUFT | Leaking Underground Fuel Tank |
| M | Modified |
| MCL | Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA. |
| MDL | Method Detection Limit |
| MPN | Most Probable Number |
| MRL | Method Reporting Limit |
| NA | Not Applicable |
| NC | Not Calculated |
| NCASI | National Council of the Paper Industry for Air and Stream Improvement |
| ND | Not Detected |
| NIOSH | National Institute for Occupational Safety and Health |
| PQL | Practical Quantitation Limit |
| RCRA | Resource Conservation and Recovery Act |
| SIM | Selected Ion Monitoring |
| TPH | Total Petroleum Hydrocarbons |
| tr | Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL. |

## Inorganic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result. |
| E | The result is an estimate amount because the value exceeded the instrument calibration range. |
| J | The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. |
| U | The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. |
| i | The MRL/MDL has been elevated due to a matrix interference. |
| X | See case narrative. |

## Metals Data Qualifiers

| | |
|---|---|
| # | The control limit criteria is not applicable. See case narrative. |
| B | The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. |
| E | The reported value is estimated because of the presence of matrix interference. |
| M | The duplicate injection precision was not met. |
| N | The Matrix Spike sample recovery is not within control limits. See case narrative. |
| S | The reported value was determined by the Method of Standard Additions (MSA). |
| U | The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. |
| W | The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance. |
| i | The MRL/MDL has been elevated due to a matrix interference |
| X | See case narrative. |
| * | The duplicate analysis not within control limits. See case narrative. |
| + | The correlation coefficient for the MSA is less than 0.995. |

## Organic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| A | A tentatively identified compound, a suspected aldol-condensation product. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result. |
| C | The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data. |
| D | The reported result is from a dilution. |
| E | The result is an estimate amount because the value exceeded the instrument calibration range. |
| J | The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. |
| N | The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed. |
| P | The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for CLP Pesticides). |
| U | The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. |
| i | The MRL/MDL has been elevated due to a chromatographic interference. |
| X | See case narrative. |

## Additional Petroleum Hydrocarbon Specific Qualifiers

| | |
|---|---|
| F | The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard. |
| L | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard. |
| H | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard. |
| O | The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard. |
| Y | The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard. |
| Z | The chromatographic fingerprint does not resemble a petroleum product. |

# Case Narrative

**COLUMBIA ANALYTICAL SERVICES, INC.**

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request No.:** | K2106294 |
| **Project:** | PDXMIN | **Date Received:** | 8/29/01 |
| **Sample Matrix:** | Water/Solid | | |

## CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include Laboratory Duplicate (DUP), Matrix Spike (MS), and Laboratory Control Sample (LCS).

### Sample Receipt

Thirty-nine aqueous and solid samples were received for analysis at Columbia Analytical Services on 8/29/01. The following discrepancies were noted upon initial sample inspection. The cooler temperature of one of the four coolers received was 9.0°C upon receipt. The exceptions are also noted on the cooler receipt and preservation form included in this data package. The samples were put on hold until notification from the project manager was received on how to proceed with the samples. The samples were logged in for the tests noted in the e-mail attachment received on 9/7/01 (included in the COC documentation section of the report). As instructed in the facsimile, some discreet samples were composited at the laboratory to create composite samples for analysis (see notation below). The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

**Sample Compositing:**
Samples DT SEEP 1 and DT SEEP 2 were composited to create DT SEEP 1 & 2 Comp.
Samples CONEP and CONEP 2 were composited to create CONEP Comp.
Samples BGR11, BGR12, and BGR13 were composited to create BGR 11, 12, 13 Comp.
Samples MMTP-M and MMTP-L were composited to create MMTP-M & L Comp.

### Inorganic Parameters

No anomalies associated with the analysis of this batch were observed.

### Total Metals (Water Samples)

No anomalies associated with the analysis of this batch were observed.

### Dissolved Metals

**Discussion:**
Due to a laboratory oversight, the sample aliquots submitted for dissolved metals were not filtered and preserved upon receipt by the laboratory. However, the sample aliquots received for Hg by 1631 (preserved with HCL and BrCl) were filtered and preserved upon receipt. The analysis of dissolved metals was performed using the HCL-BrCl preserved sample aliquots.

**Dissolved Potassium:**
As indicated in the previous paragraph, the analysis of the dissolved metals was performed using the HCL-BrCl preserved sample aliquots. The preservative BrCl is made from a KBr salt. As a result, the dissolved potassium values are not applicable due to the contribution of potassium from the preservative. No further corrective action was feasible.



**Approved by** _____ **Date** 10/17/01

The recoveries of Aluminum, Copper Manganese and Zinc in the MS performed on sample DT SEEP 1 & 2 Comp are not applicable. The analyte concentrations in the sample were significantly higher than the added spike concentrations, preventing accurate evaluation of the spike recoveries. No further corrective action was feasible.

**Total Metals (Soil Samples)**

**Holding Time Exceptions:**
Due to an analyst oversight, sample BGR 11, 12, 13 Comp was analyzed past the recommended holding time of 28 days for Hg. The sample was analyzed as soon as possible after the error was discovered. No further corrective action was feasible.

**Matrix Spike (MS) Exceptions:**
The low recovery of Antimony in the MS performed on sample WDES2 is the result of a method defect in the EPA 3050B-digestion procedure, which can be magnified by certain matrix components. The associated Laboratory Control Sample (LCS) was within control limits indicating the analysis was in control. No further corrective action was feasible.

The recoveries of Aluminum, Iron, and Manganese in the MS performed on sample WDES2 are not applicable. The native concentration of these analytes in the sample was significantly higher than the added spike concentration, preventing an accurate evaluation of the spike recovery. No further corrective action was feasible.

The recovery of Beryllium in the MS performed on sample WDES2 was below normal CAS control limits because of suspected matrix interference. The associated LCS was within control limits indicating the analysis was in control. No further corrective action was feasible.

The elevated recoveries of Copper and Zinc in the MS performed on sample WDES2 are suspected to be a result of non-homogenous distribution of these analytes in the sample. Although the replicates samples showed fairly good agreement, the native concentration of these analytes in the sample were relatively high compared to the amount spiked. The associated LCS was within control limits indicating the analysis was in control. No further corrective action was taken.

**Relative Percent Difference (RPD) Exceptions:**
The Relative Percent Difference (RPD) for the replicate analysis of Barium in sample WDES2 (K2106294-009) was outside the normal CAS control limits. The variability in the results is attributed to the heterogeneous character of the sample. Mixing techniques within the scope of the EPA methodology were used, but were not sufficient for complete homogenization of this sample.

**Approved by** _____ **Date** 10/17/01

# Chain of Custody Documentation

# CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

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

DATE 8/28/01 PAGE 1 OF 3

PROJECT NAME PDXMIN #

PROJECT MANAGER Tom Chisholm

COMPANY/ADDRESS Limno-Tech, Inc.
4640 SW Macadam ste. 60
Portland, OR 97201 PHONE 503-248-1768

SAMPLERS SIGNATURE Robert Bty

011006

| SAMPLE I.D. | DATE | TIME | LAB I.D. | SAMPLE MATRIX | NUMBER OF CONTAINERS | Base/Neu/Acid Organics GC/MS 625/8270 | Volatile Organics GC/MS 624/8240 | Halogenated or Aromatic Volatiles 601/8010 ☐ 602/8020 ☐ | Pesticides/PCBs 608/8080 | Total Petroleum Hydrocarbons EPA/418.1 ☐ OR/418.1 ☐ WA/418.1 ☐ | TPH/Gas/BTEX 5030/8015/8020 Gas ☐ BTEX ☐ | TPH/8015 Modified Diesel ☐ Hydrocarbon Scan ☐ | TPH/HCID ☐ OR/HCID ☐ WA/HCID ☐ | TCLP Metals ☐ VOA ☐ Semi Pest/ VOA ☐ Herb ☐ | Metals (total ~~unfiltered~~ TAL+Co List Below) | Cyanide | pH, Cond. Cl, $SO_4$, $PO_4$, F, Br $NO_2$, $NO_3$ (circle) | $NH_3$-N, COD, Total-P, TKN, TOC (circle) | Total Organic Halides (TOX) 9020 ☐ (AOX) 1650 ☐ | Dissolved TAL metals+Co * | Total +Diss. Hg (1631-low level) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DTJC US | 8/27/01 | 1315 | 1 | Water | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | Hg collected at 13:20 |
| MM Seep | | 1420 | 2 | | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | CN collected at 15:00 Hg " " 15:20 |
| DT Seep 1 | | 1525 | 3 | | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | |
| DT Seep 2 | | 1530 | 4 | | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | |
| JC Seep 2+100 | | 1900 | 5 | | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | |
| DT JCDS | ↓ | 1855 | 6 | | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | Total metals collected at 20:20 |
| Duplicate 1 | — | — | 7 | | 4 | | | | | | | | | | 1 | 1 | | | | 1 | 1 | |
| | 8/28/01 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | |

**RELINQUISHED BY:**
Signature: Robert Bty
Printed Name: Robert J. Bete
Firm: Limno-Tech
Date/Time: 8/28/01 15:00

**RECEIVED BY:**
Signature: Tom Fisher
Printed Name: Tom Fisher
Firm: 8/29/01 1000
Date/Time

**TURNAROUND REQUIREMENTS**
___ 24 hr ___ 48 hr. ___ 5 day
X Standard (10-15 working days)
___ Provide Verbal Preliminary Results
___ Provide FAX preliminary Results
Requested Report Date ___

**REPORT REQUIREMENTS**
___ I. Routine Report
X II. Report (includes DUP.MS. MSD, as required, may be charged as samples)
___ III. Data Validation Report (includes All Raw Data)
___ IV. CLP Deliverable Report

**INVOICE INFORMATION:**
P.O.# ___
Bill To ___

**SAMPLE RECEIPT:**
Shipping VIA: ___
Shipping #: ___
Condition: ___
Lab No: IC21062944

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

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

**SPECIAL INSTRUCTIONS/COMMENTS:**
* CAL must filter Diss metals samples at lab!
Please report results in normal hardcopy format and electronic (MS Excel) format.

Columbia Analytical Services, INC.
An Employee-Owned Company

# CHAIN OF CUSTODY

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

SR#: 1210 4294

PAGE 2 OF 3 COC #

PROJECT NAME: PDXMIN
PROJECT NUMBER:
PROJECT MANAGER: Tom Chisholm
COMPANY/ADDRESS: Limno-Tech, Inc
4640 SW Macadam, Ste. 60, Portland, OR 97201
PHONE #: 503-248-1768 FAX #: 503-248-1959
SAMPLER'S SIGNATURE: Robert Betz

| SAMPLE I.D. | DATE | TIME | LAB I.D. | MATRIX | NUMBER OF CONTAINERS | Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ | Volatile Organics 624 ☐ 8260 ☐ | Hydrocarbons (*see below) Gas ☐ 8021 ☐ BTEX ☐ Diesel ☐ Oil ☐ Fuel Fingerprint (FIQ) ☐ NW-HCID Screen | Oil & Grease/TRPH 413.1 ☐ 418.1 ☐ 1664 SGT ☐ 1664 HEM ☐ | PCB's Aroclors ☐ Congeners ☐ | Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐ | Chlorophenolics Tri ☐ Tetra ☐ - 8151M PCP ☐ | PAHS 8310 ☐ SIM ☐ | GC/MS-SIM PAH ☐ Phenol ☐ Phthalates ☐ | Metals, Total or Dissolved (See list below) | Cyanide ☐ | Hex-Chrom ☐ | pH, Cond., Cl, $SO_4$, $PO_4$, F, $NO_2$, $NO_3$, BOD, TSS, TDS (circle) | $NH_3$-N, COD, Total-P, TKN, TOC, DOC (circle) | TOX 9020 ☐ AOX 1650 ☐ 506 ☐ | Total TAL Metals +Co | Dissolved +Total Hg (1631 w/low) | Dissolved TAL Metals +Co* | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WDES1 | 8/27/01 | 1415 | 8 | Solid | 4 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| WDES2 | | 1407 | 9 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| WDES3 | | 1406 | 10 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| WDWS1 | | 1420 | 11 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| WDWS2 | | 1440 | 12 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| WDWS3 | | 1445 | 13 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| CONEP | | 1515 | 14 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| CONEP2 | | 1515 | 15 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| SANDP | | — | 16 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| BGR11 | | 1720 | 17 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| BGR12 | | 1720 | 18 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| BGR13 | | 1715 | 19 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| BGR21 | | 1800 | 20 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| BGR22 | | 1800 | 21 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| BGSD1-a MS 9/6/01 | | 1800 | 22 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| DTJCus-Sed | | 1445 | 23 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| DTJC Seep2-Sed | | 1550 | 24 | | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |
| DTJC DS-Sed | ↓ | 1900 | 25 | ↓ | 1 | | | | | | | | | | X | | | | | X | | | | | | | | | | | | |

**REPORT REQUIREMENTS**

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

**INVOICE INFORMATION**

P.O. #
Bill To:

**TURNAROUND REQUIREMENTS**

- ___ 24 hr. ___ 48 hr.
- ___ 5 Day
- X Standard (10-15 working days)
- ___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed: = TAL + Co

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

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

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORHTWEST OTHER:_____ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

* CAL must fitted Diss. metals samples at lab!.
Please report results in normal hardcopy format and electronic (MS Excel) format
Hold all solid samples - Do not analyze until released by Limno-Tech.

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| Signature: Robert Betz | Signature: [illegible] | Signature | Signature |
| Date/Time: 8/28/01 15:00 | Date/Time: 8/29/01 1000 | Date/Time | Date/Time |
| Printed Name: Robert J Betz | Printed Name: [illegible] | Printed Name | Printed Name |
| Firm: Limno-Tech | Firm: CAS | Firm | Firm |

Columbia Analytical Services INC
An Employee-Owned Company

# CHAIN OF CUSTODY

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

SR#: C2106294

PAGE 3 OF 3 COC #

PROJECT NAME: PDXMIN
PROJECT NUMBER:
PROJECT MANAGER: Tom Chisholm
COMPANY/ADDRESS: Limno-Tech, Inc, Portland, OR 97201
4640 SW Macadam Ste 60
PHONE #: 503-248-1768 FAX #: 503-248-1959
SAMPLER'S SIGNATURE: Robert J Betz

| SAMPLE I.D. | DATE | TIME | LAB I.D. | MATRIX | NUMBER OF CONTAINERS | Cyanide X | Total TAL Metals +Co | Dissolved TAL Metals +Co* | Total+Dissolved Hg (1631-low) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| MMTP-AU | 8-27-01 | 1220 | 26 | Solid | 1 | X | X | | | |
| MMTP-U | | 1200 | 27 | | 1 | X | X | | | |
| MMTP-M | | 1205 | 28 | | 1 | X | X | | | |
| MMTP-L | | 1210 | 29 | | 1 | X | X | | | |
| MMTP-BL | | 1230 | 30 | | 1 | X | X | | | |
| NG2 | 8-28-01 | 1045 | 31 | Water | 4 | 1 | 1 | 1 | 1 | |
| NG3 | | 1125 | 32 | | 4 | 1 | 1 | 1 | 1 | |
| BGC1 | | 1150 | 33 | | 4 | 1 | 1 | 1 | 1 | |
| BGC3 | | 1035 | 34 | | 4 | 1 | 1 | 1 | 1 | |
| COMP | | 1310 | 35 | | 4 | 1 | 1 | 1 | 1 | |
| BGSD1-b | | 1200 | 36 | Solid | 1 | X | X | | | |
| BGSD4 | | 1045 | 37 | | 1 | X | X | | | |
| MFO3 DUPLICATE 2 | | 1430 | 38/39 | | 1 | X | X | | | |

01008

**REPORT REQUIREMENTS**

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

**INVOICE INFORMATION**

P.O. #
Bill To:

**TURNAROUND REQUIREMENTS**

- ___ 24 hr. ___ 48 hr.
- ___ 5 Day
- X Standard (10-15 working days)
- ___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed: = TAL +Co

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

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

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORHTWEST OTHER: ___ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:
* CAL must filter Diss. metals samples at lab!
Please report results in normal hardcopy format and electronic (MS Excel) format
Hold all solid samples - Do not analyze until released by Limno-Tech

| RELINQUISHED BY: | RECEIVED BY: | RELINQUISHED BY: | RECEIVED BY: |
|---|---|---|---|
| Signature: Robert J Betz | Signature: | Signature | Signature |
| Date/Time: 8/28/01 15:00 | Date/Time: 8/29/01 1020 | Date/Time | Date/Time |
| Printed Name: Robert J. Betz | Printed Name: | Printed Name | Printed Name |
| Firm: Limno-Tech | Firm: CAS | Firm | Firm |

**Columbia Analytical Services Inc.**
**Cooler Receipt And Preservation Form**

Fed Ex

Project/Client Kimno-Tech Work Order K21 K6294

Cooler received on 8/29/01 and opened on 8/29/01 by

1. Were custody seals on outside of cooler? YES NO
   If yes, how many and where?
2. Were seals intact and signature & date correct? YES NO
3. COC #

| | | | | | |
|---|---|---|---|---|---|
| Temperature of cooler(s) upon receipt: | 3.4 | 9.0 | -1.0 | 5.7 | 0.3 |
| Temperature Blank: | 2.3 | 10.1 | 00 | NP | 4.0 |

4. Were custody papers properly filled out (ink, signed, etc.)? YES NO
5. Type of packing material present Ice, Plastic
6. Did all bottles arrive in good condition (unbroken)? YES NO
7. Were all bottle labels complete (*i.e.* analysis, preservation, etc.)? YES NO
8. Did all bottle labels and tags agree with custody papers? YES NO
9. *Were the correct types of bottles used for the tests indicated?* YES NO
10. Were all of the preserved bottles received at the lab with the appropriate pH? YES NO
11. Were VOA vials checked for absence of air bubbles, and if present, noted below? YES NO
12. Did the bottles originate from CAS/K or a branch laboratory? YES NO

Explain any discrepancies 1 500ml Blue labeled PDX mm-on COC as mm Seep- mm SEEP on label as Project name, AND times match.

Samples that required preservation or received out of temperature:

| Sample ID | Reagent | Volume | Lot Number | Bottle Type | Rec'd out of Temperature | Initials |
|---|---|---|---|---|---|---|
| PT JC DS | | | | 500m. Blue | yes | KM |
| PT Seep 2 | | | | " | yes | KM |
| JC Seep 2+100 | | | | " | yes | KM |
| Duplicate 1 | | | | " | yes | KM |
| DT Seep 2 | | | | 1L Red | yes | KM |
| JC Seep 2+100 | | | | " | yes | KM |
| DT JC DS | | | | 1L Red | yes | KM |
| DT Seep 2 | | | | 1L Red | yes | KM |
| 2 Duplicate 1 | | | | " | yes | KM |
| JC Seep 2+100 | | | | 1L Red | yes | KM |
| DT Seep 2 | | | | 1L Green | yes | KM |
| JC Seep 2 +100 | | | | " | | |
| DT JC DS | | | | 1L Green | yes | KM |
| Duplicate 1 | | | | 1L Green | yes | KM |

00009

Notified client via phone 8/30 & fax 8/30. KM 8/30/01

# Total Solids

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Results

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Solid

**Service Request:** K2106294

## Total Solids

**Prep Method:** NONE
**Analysis Method:** 160.3M
**Test Notes:**

**Units:** PERCENT
**Basis:** WET

| Sample Name | Lab Code | Date Collected | Date Received | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|
| WDES2 | K2106294-009 | 08/27/2001 | 08/29/2001 | 09/20/2001 | 97.1 | |
| WDWS2 | K2106294-012 | 08/27/2001 | 08/29/2001 | 09/20/2001 | 68.3 | |

00012

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 08/27/2001 |
| **Sample Matrix:** | Solid | **Date Received:** | 08/29/2001 |
| | | **Date Analyzed:** | 09/20/2001 |

**Duplicate Sample Summary**
**Total Solids**

| | | | |
|---|---|---|---|
| **Prep Method:** | NONE | **Units:** | PERCENT |
| **Analysis Method:** | 160.3M | **Basis:** | WET |
| **Test Notes:** | | | |

| Sample Name | Lab Code | Sample Result | Duplicate Sample Result | Average | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|
| WDES2 | K2106294-009 | 97.1 | 97.4 | 97.3 | <1 | |

00013

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Results

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Solid

**Service Request:** K2106294

## Total Solids

**Prep Method:** NONE
**Analysis Method:** 160.3M
**Test Notes:**

**Units:** PERCENT
**Basis:** WET

| Sample Name | Lab Code | Date Collected | Date Received | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|
| SANDP | K2106294-016 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 98.6 | |
| BGR21 | K2106294-020 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 95.6 | |
| BGR22 | K2106294-021 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 97.8 | |
| BGSD1-a | K2106294-022 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 98.3 | |
| DTJCUS-SED | K2106294-023 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 83.1 | |
| DTJC SEEP2-SED | K2106294-024 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 84.1 | |
| DTJC DS-SED | K2106294-025 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 83.4 | |
| MMTP-AU | K2106294-026 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 98.5 | |
| MMTP-U | K2106294-027 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 98.5 | |
| MMTP-BL | K2106294-030 | 08/27/2001 | 08/29/2001 | 09/07/2001 | 97.6 | |
| BGSD1-b | K2106294-036 | 08/28/2001 | 08/29/2001 | 09/07/2001 | 74.4 | |
| BGSD4 | K2106294-037 | 08/28/2001 | 08/29/2001 | 09/07/2001 | 77.5 | |
| MF03 | K2106294-038 | 08/28/2001 | 08/29/2001 | 09/07/2001 | 85.7 | |
| Duplicate 2 | K2106294-039 | 08/28/2001 | 08/29/2001 | 09/07/2001 | 96.4 | |

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 08/27/2001 |
| **Sample Matrix:** | Solid | **Date Received:** | 08/29/2001 |
| | | **Date Analyzed:** | 09/07/2001 |

## Duplicate Sample Summary
## Total Solids

| | | | |
|---|---|---|---|
| **Prep Method:** | NONE | **Units:** | PERCENT |
| **Analysis Method:** | 160.3M | **Basis:** | WET |
| **Test Notes:** | | | |

| Sample Name | Lab Code | Sample Result | Duplicate Sample Result | Average | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|
| SANDP | K2106294-016 | 98.6 | 98.6 | 98.6 | <1 | |

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Solid

**Service Request:** K2106294
**Date Collected:** 08/27/2001
**Date Received:** 08/29/2001
**Date Analyzed:** 09/07/2001

## Duplicate Sample Summary
## Total Solids

**Prep Method:** NONE
**Analysis Method:** 160.3M
**Test Notes:**

**Units:** PERCENT
**Basis:** WET

| Sample Name | Lab Code | Sample Result | Duplicate Sample Result | Average | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|
| MMTP-U | K2106294-027 | 98.5 | 98.6 | 98.6 | <1 | |

00016

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Results

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Solid

**Service Request:** K2106294

## Total Solids

**Prep Method:** NONE
**Analysis Method:** 160.3M
**Test Notes:**

**Units:** PERCENT
**Basis:** WET

| Sample Name | Lab Code | Date Collected | Date Received | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|
| MMTP-M & L Comp | K2106294-041 | 08/27/2001 | 08/29/2001 | 09/14/2001 | 98.0 | |
| CONEP COMP | K2106294-042 | 08/27/2001 | 08/29/2001 | 09/14/2001 | 99.6 | |

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**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 08/27/2001 |
| **Sample Matrix:** | Solid | **Date Received:** | 08/29/2001 |
| | | **Date Analyzed:** | 09/14/2001 |

**Duplicate Sample Summary**
**Total Solids**

| | | | |
|---|---|---|---|
| **Prep Method:** | NONE | **Units:** | PERCENT |
| **Analysis Method:** | 160.3M | **Basis:** | WET |
| **Test Notes:** | | | |

| Sample Name | Lab Code | Sample Result | Duplicate Sample Result | Average | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|
| MMTP-M & L Comp | K2106294-041 | 98.0 | 98.0 | 98.0 | <1 | |

00018

# Inorganic Parameters

## COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Water

**Service Request:** K2106294
**Date Collected:** 8/27/01
**Date Received:** 8/29/01

Cyanide, Total

Prep Method: NONE
Analysis Method: 335.2
Test Notes:

Units: mg/L (ppm)
Basis: NA

| Sample Name | Lab Code | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|
| DTJCUS | K2106294-001 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| MM SEEP | K2106294-002 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| DT SEEP 1 | K2106294-003 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| DT SEEP 2 | K2106294-004 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| JC SEEP 2+100 | K2106294-005 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| DT JCDS | K2106294-006 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| Duplicate 1 | K2106294-007 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| NG2 | K2106294-031 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| NG3 | K2106294-032 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| BGC1 | K2106294-033 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| BGC3 | K2106294-034 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| COWP | K2106294-035 | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |
| Method Blank | K2106294-MB | 0.01 | 0.003 | 1 | NA | 9/5/01 | ND | |

Approved By: [signature] Date: 9/6/01

1A/020597p

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Water

**Service Request:** K2106294
**Date Collected:** 8/27/01
**Date Received:** 8/29/01
**Date Extracted:** NA
**Date Analyzed:** 9/5/01

Duplicate Summary
Inorganic Parameters

Sample Name: DTJCUS
Lab Code: K2106294-001DUP
Test Notes:

Units: mg/L (ppm)
Basis: NA

| Analyte | Prep Method | Analysis Method | MRL | Sample Result | Duplicate Sample Result | Average | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|---|---|
| Cyanide, Total | NONE | 335.2 | 0.01 | ND | ND | ND | - | |

Approved By: MMK Date: 9/12/01

DUP/020597p

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 8/27/01 |
| **Sample Matrix:** | Water | **Date Received:** | 8/29/01 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 9/5/01 |

Matrix Spike Summary
Inorganic Parameters

| | | | |
|---|---|---|---|
| Sample Name: | DTJCUS | Units: | mg/L (ppm) |
| Lab Code: | K2106294-001MS | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | Spike Level | Sample Result | Spiked Sample Result | Percent Recovery | CAS Percent Recovery Acceptance Limits | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Cyanide, Total | NONE | 335.2 | 0.01 | 0.10 | ND | 0.10 | 100 | 75-125 | |

Approved By: _____ Date: 9/6/01

MS/020597p

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 08/27/01 |
| **Sample Matrix:** | Solid | **Date Received:** | 08/29/01 |

Cyanide, Total

| | | | |
|---|---|---|---|
| Prep Method: | NONE | Units: | mg/Kg (ppm) |
| Analysis Method: | 9010B | Basis: | Dry |
| Test Notes: | | | |

| Sample Name | Lab Code | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|
| SANDP | K2106294-016 | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |
| MMTP-BL | K2106294-030 | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |
| MF03 | K2106294-038 | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |
| Duplicate 2 | K2106294-039 | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |
| MMTP-M & L Comp | K2106294-041 | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |
| CONEP COMP | K2106294-042 | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |
| Method Blank | K2106294-MB | 0.5 | 0.2 | 1 | NA | 09/11/01 | ND | |

Approved By: _____ Date: 9/13/01

1A/020597p

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

**Client:** Limno-Tech, Inc.
**Project:** PDXMIN
**Sample Matrix:** Solid

**Service Request:** K2106294
**Date Collected:** 8/27/2001
**Date Received:** 8/29/2001
**Date Extracted:** NA
**Date Analyzed:** 9/11/2001

Duplicate Summary
Inorganic Parameters

Sample Name: SANDP
Lab Code: K2106294-016DUP
Test Notes:

Units: mg/Kg (ppm)
Basis: Dry

| Analyte | Prep Method | Analysis Method | MRL | Sample Result | Duplicate Sample Result | Average | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|---|---|
| Cyanide, Total | NONE | 9010B | 0.5 | ND | ND | ND | - | |

Approved By: _____ Date: 10/17/01

DUP/020597p

00023

## COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 8/27/2001 |
| **Sample Matrix:** | Solid | **Date Received:** | 8/29/2001 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 9/11/2001 |

Matrix Spike Summary
Inorganic Parameters

| | | | |
|---|---|---|---|
| Sample Name: | SANDP | Units: | mg/Kg (ppm) |
| Lab Code: | K2106294-016MS | Basis: | Dry |

Test Notes:

| Analyte | Prep Method | Analysis Method | MRL | Spike Level | Sample Result | Spiked Sample Result | Percent Recovery | CAS Percent Recovery Acceptance Limits | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Cyanide, Total | NONE | 9010B | 0.5 | 4.9 | ND | 4.6 | 94 | 75-125 | |

Approved By: _____ Date: 10/17/01

MS/020597p

00024

# Metals
# (Water)

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 8/27/01 |
| **Sample Matrix:** | Water | **Date Received:** | 8/29/01 |

Mercury, Total

| | | | |
|---|---|---|---|
| Prep Method: | METHOD | Units: | ng/L |
| Analysis Method: | 1631 | Basis: | NA |
| Test Notes: | | | |

| Sample Name | Lab Code | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|
| DTJCUS | K2106294-001 | 20.0 | 4.0 | 20 | 9/19/01 | 9/20/01 | 480 | |
| MM SEEP | K2106294-002 | 100 | 20.0 | 100 | 9/19/01 | 9/20/01 | 3920 | |
| JC SEEP 2+100 | K2106294-005 | 4.0 | 0.8 | 4 | 9/19/01 | 9/20/01 | 193 | |
| DT JCDS | K2106294-006 | 2.0 | 0.4 | 2 | 9/19/01 | 9/20/01 | 91.4 | |
| Duplicate 1 | K2106294-007 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 3.8 | |
| NG2 | K2106294-031 | 1.0 | 0.2 | 1 | 9/20/01 | 9/21/01 | 11.5 | |
| BGC1 | K2106294-033 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 6.3 | |
| BGC3 | K2106294-034 | 2.0 | 0.4 | 2 | 9/19/01 | 9/20/01 | 37.0 | |
| COWP | K2106294-035 | 2.0 | 0.4 | 2 | 9/19/01 | 9/20/01 | 56.7 | |
| DTSEEP1 & 2 Comp | K2106294-040 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 5.2 | |
| Method Blank | K2106294-MB | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | ND | |
| Method Blank 2 | K2106294-MB2 | 1.0 | 0.2 | 1 | 9/20/01 | 9/21/01 | ND | |

Approved By: _____ Date: 10/16/01

00025

1A/052595

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 8/27/01 |
| **Sample Matrix:** | Water | **Date Received:** | 8/29/01 |
| | | **Date Extracted:** | 9/19/01 |
| | | **Date Analyzed:** | 9/20/01 |

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | Duplicate 1 | Units: | ng/L |
| Lab Code: | K2106294-007S, K2106294-007DS | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | Spike Level MS | Spike Level DMS | Sample Result | Spike Result MS | Spike Result DMS | Percent Recovery MS | Percent Recovery DMS | CAS Acceptance Limits | Relative Percent Difference | Result Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | METHOD | 1631 | 1.0 | 10.0 | 10.0 | 3.8 | 14.8 | 14.7 | 110 | 109 | 71-125 | <1 | |

Approved By: _____ Date: 10/16/01

DMS/052595

00026

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |
| | | **Date Extracted:** | 9/20/01 |
| | | **Date Analyzed:** | 9/21/01 |

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

| | | | | |
|---|---|---|---|---|
| Sample Name: | Batch QC | | Units: | ng/L |
| Lab Code: | K2106603-006S | K2106603-006DS | Basis: | NA |

Test Notes:

| | | | | | | | | | Percent Recovery | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike Level | | Sample | Spike Result | | | | CAS | Relative | |
| **Analyte** | **Prep Method** | **Analysis Method** | **MRL** | MS | DMS | **Result** | MS | DMS | MS | DMS | Acceptance Limits | **Percent Difference** | **Result Notes** |
| Mercury | METHOD | 1631 | 1.0 | 10.0 | 10.0 | 5.7 | 15.0 | 16.4 | 93 | 107 | 71-125 | 9 | |

Approved By: _____ Date: 10/16/01

DMS/052595

00027

**COLUMBIA ANALYTICAL SERVICES, INC.**

Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 8/27/01 |
| **Sample Matrix:** | Water | **Date Received:** | 8/29/01 |

Mercury, Dissolved

| | | | |
|---|---|---|---|
| Prep Method: | METHOD | Units: | ng/L |
| Analysis Method: | 1631 | Basis: | NA |
| Test Notes: | | | |

| Sample Name | Lab Code | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|
| DTJCUS | K2106294-001 | 10.0 | 2.0 | 10 | 9/19/01 | 9/20/01 | 248 | |
| MM SEEP | K2106294-002 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 11.1 | |
| JC SEEP 2+100 | K2106294-005 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 4.2 | |
| DT JCDS | K2106294-006 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 10.2 | |
| Duplicate 1 | K2106294-007 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 0.6 | B |
| NG2 | K2106294-031 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 5.0 | |
| BGC1 | K2106294-033 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 1.5 | |
| BGC3 | K2106294-034 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 17.5 | |
| COWP | K2106294-035 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 23.6 | |
| DTSEEP1 & 2 Comp | K2106294-040 | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | 0.7 | B |
| Method Blank | K2106294-MB | 1.0 | 0.2 | 1 | 9/19/01 | 9/20/01 | ND | |

Approved By: _____ Date: 10/16/01

**COLUMBIA ANALYTICAL SERVICES, INC.**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request:** | K2106294 |
| **Project:** | PDXMIN | **Date Collected:** | 8/27/01 |
| **Sample Matrix:** | Water | **Date Received:** | 8/29/01 |
| | | **Date Extracted:** | 9/19/01 |
| | | **Date Analyzed:** | 9/20/01 |

Matrix Spike/Duplicate Matrix Spike Summary
Dissolved Metals

| | | | | |
|---|---|---|---|---|
| Sample Name: | NG2 | | Units: | ng/L |
| Lab Code: | K2106294-031S, | K2106294-031DS | Basis: | NA |
| Test Notes: | | | | |

| | | | | Spike Level | | Sample | Spike Result | | Percent Recovery | | CAS Acceptance | Relative Percent | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Prep Method** | **Analysis Method** | **MRL** | MS | DMS | **Result** | MS | DMS | MS | DMS | Limits | **Difference** | **Result Notes** |
| Mercury | METHOD | 1631 | 1.0 | 10.0 | 10.0 | 5.0 | 16.2 | 16.2 | 112 | 112 | 75-125 | <1 | |

Approved By: _____ Date: 10/16/01

DMS/052595

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# METALS

## - Cover Page -
## INORGANIC ANALYSIS DATA PACKAGE

Client: Limno-Tech, Inc. Service Request: K2106294

Project No.:

Project Name: PDXMIN

| Sample No. | Lab Sample ID. |
|---|---|
| DTJCUS | K2106294-001 |
| DTJCUS | K2106294-001 DISS |
| DTJCUSD | K2106294-001D |
| DTJCUSS | K2106294-001S |
| MM SEEP | K2106294-002 |
| MM SEEP | K2106294-002 DISS |
| JC SEEP 2+100 | K2106294-005 |
| JC SEEP 2+100 | K2106294-005 DISS |
| DT JCDS | K2106294-006 |
| DT JCDS | K2106294-006 DISS |
| Duplicate 1 | K2106294-007 |
| Duplicate 1 | K2106294-007 DISS |
| NG2 | K2106294-031 |
| NG2 | K2106294-031 DISS |
| BGC1 | K2106294-033 |
| BGC1 | K2106294-033 DISS |
| BGC3 | K2106294-034 |
| BGC3 | K2106294-034 DISS |
| COWP | K2106294-035 |
| COWP | K2106294-035 DISS |

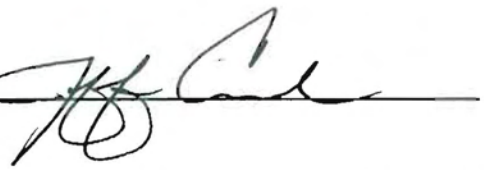
Were ICP interelement corrections applied? Yes/No YES

Were ICP background corrections applied? Yes/No YES

If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature:  Date: 10/17/01

00030

# METALS

## - Cover Page -
## INORGANIC ANALYSIS DATA PACKAGE

Client: Limno-Tech, Inc. Service Request: K2106294

Project No.:

Project Name: PDXMIN

| Sample No. | Lab Sample ID. |
|---|---|
| DTSEEP1 & 2 Comp | K2106294-040 |
| DTSEEP1 & 2 Comp | K2106294-040 DISS |
| DTSEEP1 & 2 CompD | K2106294-040D DISS |
| DTSEEP1 & 2 CompS | K2106294-040S DISS |
| Method Blank | K2106294-MB |
| Method Blank | K2106294-MB2 |

Were ICP interelement corrections applied? Yes/No YES

Were ICP background corrections applied? Yes/No YES

If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Date:

00031

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: DTJCUS
Lab Code: K2106294-001

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 40 | U | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.139 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 1.32 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 12.5 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.014 | B | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.009 | B | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 3980 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.15 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.052 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 1.72 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 82.0 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 0.145 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 664 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 10.1 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 0.27 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 903 | B | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.269 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 3070 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.005 | B | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 1.5 | B | |

% Solids: 0.0

Comments:

00032

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: DTJCUS
Lab Code: K2106294-001 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 44 | U | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.285 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 1.19 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 10.6 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.011 | B | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.005 | U | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 3930 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.39 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.018 | B | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 1.48 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 49.5 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.035 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 652 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 3.0 | B | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.22 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 15100 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.180 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 2970 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.007 | B | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 4.0 | B | |

% Solids: 0.0

Comments:

00033

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: MM SEEP
Lab Code: K2106294-002

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 17100 | | |
| Antimony | 200.8 | 0.250 | 0.030 | 1 | 10/1/01 | 10/10/01 | 0.534 | | |
| Arsenic | 200.8 | 2.50 | 0.30 | 1 | 10/1/01 | 10/10/01 | 15.2 | | |
| Barium | 200.8 | 0.250 | 0.040 | 1 | 10/1/01 | 10/10/01 | 153 | | |
| Beryllium | 200.8 | 0.100 | 0.025 | 1 | 10/1/01 | 10/10/01 | 3.130 | | |
| Cadmium | 200.8 | 0.250 | 0.025 | 1 | 10/1/01 | 10/10/01 | 1.820 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 17600 | | |
| Chromium | 200.8 | 10.00 | 0.50 | 1 | 10/1/01 | 10/12/01 | 11.6 | | |
| Cobalt | 200.8 | 0.100 | 0.025 | 1 | 10/1/01 | 10/10/01 | 7.450 | | |
| Copper | 200.8 | 0.50 | 0.20 | 1 | 10/1/01 | 10/10/01 | 35.1 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 23300 | | |
| Lead | 200.8 | 0.100 | 0.035 | 1 | 10/1/01 | 10/10/01 | 67.3 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 4160 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 1020 | | |
| Nickel | 200.8 | 1.00 | 0.50 | 1 | 10/1/01 | 10/10/01 | 20.6 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 3590 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.100 | 0.015 | 1 | 10/1/01 | 10/11/01 | 12.2 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 5370 | | |
| Thallium | 200.8 | 0.100 | 0.015 | 1 | 10/1/01 | 10/11/01 | 0.275 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 33.6 | | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 144 | | |

% Solids: 0.0

Comments:

00034

# METALS
## -1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: MM SEEP
Lab Code: K2106294-002 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 161 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.346 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.35 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 30.3 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.884 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.230 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 10700 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.71 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 1.030 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 2.73 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 149 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 2.380 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 1210 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 150 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 2.12 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 15600 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.024 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 4740 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.011 | B | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 7.0 | B | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 18.5 | | |

% Solids: 0.0

Comments:

00035

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: JC SEEP 2+100
Lab Code: K2106294-005

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 5520 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.094 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 1.06 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 26.1 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 11.0 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 3.830 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 46700 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.17 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 27.8 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 51.0 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 81.2 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 1.090 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 9840 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 1750 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 31.8 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 4550 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.1 | B | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.462 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 6200 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.069 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 995 | | |

% Solids: 0.0

Comments:

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: JC SEEP 2+100
Lab Code: K2106294-005 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 3790 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.099 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.36 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 21.6 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 8.690 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 2.850 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 45500 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 28.1 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 43.2 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 44.3 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.610 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 9400 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 1430 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 28.5 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 18700 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.017 | B | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 6040 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.070 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 907 | | |

% Solids: 0.0

Comments:

00037

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: DT JCDS
Lab Code: K2106294-006

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 4790 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.077 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.61 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 53.6 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 12.1 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 4.560 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 60000 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 13.2 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 57.5 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 56.2 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 0.690 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 12600 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 1750 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 39.0 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 5170 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.099 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 7200 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.039 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 1170 | | |

% Solids: 0.0

Comments:

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: DT JCDS
Lab Code: K2106294-006 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 4210 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.102 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.46 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 44.9 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 10.4 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 3.340 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 60700 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 13.6 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 50.6 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 45.8 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.558 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 12500 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 1390 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 34.3 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 20000 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.006 | B | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 7260 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.039 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 1170 | | |

% Solids: 0.0

Comments:

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: Duplicate 1
Lab Code: K2106294-007

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 11400 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.015 | B | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.40 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 23.4 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 20.0 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 7.780 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 86800 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.24 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 61.3 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 125 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 109 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 2.150 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 20100 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 3860 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 62.3 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 9150 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.4 | B | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 1.050 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 9580 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.155 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 2050 | | |

% Solids: 0.0

Comments:

00040

# METALS
## -I-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: Duplicate 1
Lab Code: K2106294-007 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 10800 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.088 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.47 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 19.8 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 17.3 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 5.870 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 85800 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 57.4 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 94.3 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 54.8 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 1.490 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 18400 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 3350 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 54.4 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 22900 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.1 | B | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.436 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 9260 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.161 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 2030 | | |

% Solids: 0.0

Comments:

00041

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: NG2
Lab Code: K2106294-031

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 1840 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.048 | B | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.43 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 110 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.992 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 1.770 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 9080 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.11 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 7.580 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 76.3 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 61.5 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 1.340 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 3570 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 358 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 9.19 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 1900 | B | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.812 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 3030 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.039 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 133 | | |

% Solids: 0.0

Comments:

00042

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: NG2
Lab Code: K2106294-031 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 1760 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.103 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.28 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 94.3 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.845 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 1.340 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 8770 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 9.540 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 55.9 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 59.2 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.996 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 3440 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 315 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 8.06 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 15300 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.7 | B | W |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.372 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 2760 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.035 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 126 | | |

% Solids: 0.0

Comments:

00043

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: BGC1
Lab Code: K2106294-033

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 675 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.043 | B | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.78 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 283 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.446 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.374 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 4250 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 2.640 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 1.01 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 594 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 0.738 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 1040 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 263 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 1.94 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 3830 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.015 | B | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 2960 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.137 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 63.4 | | |

% Solids: 0.0

Comments:

00044

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: BGC1
Lab Code: K2106294-033 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 706 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.075 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.20 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 176 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.386 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.239 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 4110 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 3.480 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 1.19 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 474 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.540 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 1030 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 146 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 1.79 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 17600 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.007 | B | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 2810 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.124 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 61.1 | | |

% Solids: 0.0

00045

Comments:

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: BGC3
Lab Code: K2106294-034

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 2420 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.082 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.82 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 95.8 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 1.250 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 1.620 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 8540 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 7.930 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 31.0 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 322 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 1.770 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 3560 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 481 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 11.1 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 3950 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.165 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 3390 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.207 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 248 | | |

% Solids: 0.0

Comments:

00046

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: BGC3
Lab Code: K2106294-034 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 2340 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.081 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.56 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 82.8 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 1.100 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 1.270 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 8440 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 10.1 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 27.6 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 284 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 1.350 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 3500 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 230 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 9.97 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 18100 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.104 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 3220 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.191 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 242 | | |

% Solids: 0.0

Comments:

00047

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: COWP
Lab Code: K2106294-035

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 478 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.133 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 2.65 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 211 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.106 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.256 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 6970 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.23 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.389 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 1.74 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 441 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 1.320 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 2140 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 33.8 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 1.13 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 2490 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 1.910 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 3000 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.038 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 10.2 | | |

% Solids: 0.0

Comments:

00048

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: COWP
Lab Code: K2106294-035 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 108 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.183 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 1.39 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 95.1 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.026 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.017 | B | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 6280 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 1.02 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.159 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 0.86 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 52.0 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.086 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 1900 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 5.0 | B | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.55 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 15800 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.404 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 2650 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.018 | B | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 5.5 | B | |

% Solids: 0.0

Comments:

00049

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: DTSEEP1 & 2 Comp
Lab Code: K2106294-040

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 11700 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.013 | B | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.38 | B | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 22.2 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 19.6 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 7.590 | | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 89500 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.21 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 64.7 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 117 | | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 80.5 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 2.170 | | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 20600 | | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 4010 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 60.5 | | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 9580 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.754 | | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 9780 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.164 | | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 2150 | | |

% Solids: 0.0

Comments:

00050

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: µG/L
Basis: NA

Sample Name: DTSEEP1 & 2 Comp
Lab Code: K2106294-040 DISS

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 10700 | | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.074 | | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.52 | | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 19.4 | | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 16.7 | | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 5.540 | | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 81900 | | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.15 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 61.1 | | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 89.1 | | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 79.2 | | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 1.990 | | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 18100 | | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 3560 | | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 52.4 | | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 22600 | | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.615 | | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 8950 | | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.166 | | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 2000 | | |

% Solids: 0.0

Comments:

00051

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: WATER

Service Request: K2106294
Date Collected:
Date Received:
Units: µG/L
Basis: NA

Sample Name: Method Blank
Lab Code: K2106294-MB

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 50 | 40 | 1 | 10/1/01 | 10/9/01 | 40 | U | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/1/01 | 10/10/01 | 0.009 | B | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/1/01 | 10/10/01 | 0.06 | U | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/1/01 | 10/10/01 | 0.011 | B | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.005 | U | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.005 | U | |
| Calcium | 6010B | 50 | 9 | 1 | 10/1/01 | 10/9/01 | 9 | B | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/1/01 | 10/12/01 | 0.10 | U | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/1/01 | 10/10/01 | 0.005 | U | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/1/01 | 10/10/01 | 0.04 | U | |
| Iron | 6010B | 20.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/1/01 | 10/10/01 | 0.007 | U | |
| Magnesium | 6010B | 20.0 | 9.0 | 1 | 10/1/01 | 10/9/01 | 9.0 | U | |
| Manganese | 6010B | 5.0 | 0.4 | 1 | 10/1/01 | 10/9/01 | 0.4 | U | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/1/01 | 10/10/01 | 0.10 | U | |
| Potassium | 6010B | 2000 | 40 | 1 | 10/1/01 | 10/9/01 | 40 | U | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/1/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.003 | U | |
| Sodium | 6010B | 100 | 30 | 1 | 10/1/01 | 10/9/01 | 63.8 | B | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/1/01 | 10/11/01 | 0.003 | U | |
| Vanadium | 6010B | 10.0 | 5.0 | 1 | 10/1/01 | 10/9/01 | 5.0 | U | |
| Zinc | 6010B | 10.0 | 1.0 | 1 | 10/1/01 | 10/9/01 | 1.0 | U | |

% Solids: 0.0

Comments:

00052

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.: NA
Date Collected:
Project Name: PDXMIN
Date Received:
Matrix: WATER
Units: µG/L
Basis: NA

Sample Name: Method Blank
Lab Code: K2106294-MB2

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 56 | 44 | 1 | 10/12/01 | 10/15/01 | 44 | U | |
| Antimony | 200.8 | 0.050 | 0.006 | 1 | 10/12/01 | 10/13/01 | 0.006 | U | |
| Arsenic | 200.8 | 0.50 | 0.06 | 1 | 10/12/01 | 10/16/01 | 0.06 | U | |
| Barium | 200.8 | 0.050 | 0.008 | 1 | 10/12/01 | 10/13/01 | 0.011 | B | |
| Beryllium | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.005 | U | |
| Cadmium | 200.8 | 0.050 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.005 | U | |
| Calcium | 6010B | 56 | 10 | 1 | 10/12/01 | 10/15/01 | 10 | U | |
| Chromium | 200.8 | 2.00 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.48 | B | |
| Cobalt | 200.8 | 0.020 | 0.005 | 1 | 10/12/01 | 10/13/01 | 0.005 | U | |
| Copper | 200.8 | 0.10 | 0.04 | 1 | 10/12/01 | 10/13/01 | 0.04 | U | |
| Iron | 6010B | 22.2 | 5.6 | 1 | 10/12/01 | 10/15/01 | 7.1 | B | |
| Lead | 200.8 | 0.020 | 0.007 | 1 | 10/12/01 | 10/13/01 | 0.007 | U | |
| Magnesium | 6010B | 22.2 | 10.0 | 1 | 10/12/01 | 10/15/01 | 13.6 | B | |
| Manganese | 6010B | 5.6 | 0.4 | 1 | 10/12/01 | 10/15/01 | 0.4 | U | |
| Nickel | 200.8 | 0.20 | 0.10 | 1 | 10/12/01 | 10/13/01 | 0.10 | U | |
| Potassium | 6010B | 2220 | 44 | 1 | 10/12/01 | 10/15/01 | 44 | U | |
| Selenium | 7740 | 5.0 | 1.0 | 1 | 10/12/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.003 | U | |
| Sodium | 6010B | 111 | 33 | 1 | 10/12/01 | 10/15/01 | 33 | U | |
| Thallium | 200.8 | 0.020 | 0.003 | 1 | 10/12/01 | 10/13/01 | 0.003 | U | |
| Vanadium | 6010B | 11.1 | 5.6 | 1 | 10/12/01 | 10/15/01 | 5.6 | U | |
| Zinc | 6010B | 11.1 | 1.1 | 1 | 10/12/01 | 10/15/01 | 1.1 | U | |

% Solids: 0.0

Comments:

00053

# METALS
## - 5a -
## SPIKE SAMPLE RECOVERY

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: µG/L
Project Name: PDXMIN
Basis: NA
Matrix: WATER
% Solids: 0.0

Sample Name: DTJCUSS
Lab Code: K2106294-001S

| Analyte | Control Limit %R | Spike Result | C | Sample Result | C | Spike Added | %R | Q | Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 75 - 125 | 2160 | | 40.0 | U | 2000 | 108 | | 6010B |
| Antimony | 75 - 125 | 19.5 | | 0.139 | | 20.0 | 97 | | 200.8 |
| Arsenic | 75 - 125 | 20.4 | | 1.32 | | 20.0 | 95 | | 200.8 |
| Barium | 75 - 125 | 31.8 | | 12.5 | | 20.0 | 97 | | 200.8 |
| Beryllium | 75 - 125 | 19.5 | | 0.014 | B | 20.0 | 97 | | 200.8 |
| Cadmium | 75 - 125 | 19.5 | | 0.009 | B | 20.0 | 97 | | 200.8 |
| Chromium | 75 - 125 | 20.1 | | 0.15 | B | 20.0 | 100 | | 200.8 |
| Cobalt | 75 - 125 | 19.1 | | 0.052 | | 20.0 | 96 | | 200.8 |
| Copper | 75 - 125 | 20.5 | | 1.72 | | 20.0 | 94 | | 200.8 |
| Iron | 75 - 125 | 1180 | | 82.0 | | 1000 | 110 | | 6010B |
| Lead | 75 - 125 | 20.2 | | 0.145 | | 20.0 | 100 | | 200.8 |
| Manganese | 75 - 125 | 537 | | 10.1 | | 500 | 105 | | 6010B |
| Nickel | 75 - 125 | 19.3 | | 0.27 | | 20.0 | 95 | | 200.8 |
| Selenium | 75 - 125 | 18.2 | | 1.0 | U | 20.0 | 91 | | 7740 |
| Silver | 75 - 125 | 20.2 | | 0.269 | | 20.0 | 100 | | 200.8 |
| Thallium | 75 - 125 | 20.4 | | 0.005 | B | 20.0 | 102 | | 200.8 |
| Vanadium | 75 - 125 | 498 | | 5.0 | U | 500 | 100 | | 6010B |
| Zinc | 75 - 125 | 498 | | 1.5 | B | 500 | 99 | | 6010B |

Comments:

# METALS
## - 5a -
## SPIKE SAMPLE RECOVERY

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: µG/L
Project Name: PDXMIN
Basis: NA
Matrix: WATER
% Solids: 0.0

Sample Name: DTSEEP1 & 2 CompS
Lab Code: K2106294-040S DISS

| Analyte | Control Limit %R | Spike Result | C | Sample Result | C | Spike Added | %R | Q | Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | | 12700 | | 10700 | | 2000 | 105 | | 6010B |
| Antimony | 75 - 125 | 19.0 | | 0.074 | | 20.0 | 95 | | 200.8 |
| Arsenic | 75 - 125 | 20.4 | | 0.52 | | 20.0 | 99 | | 200.8 |
| Barium | 75 - 125 | 42.1 | | 19.4 | | 20.0 | 114 | | 200.8 |
| Beryllium | 75 - 125 | 32.3 | | 16.7 | | 20.0 | 78 | | 200.8 |
| Cadmium | 75 - 125 | 22.5 | | 5.540 | | 20.0 | 85 | | 200.8 |
| Chromium | 75 - 125 | 18.9 | | 0.15 | B | 20.0 | 94 | | 200.8 |
| Cobalt | 75 - 125 | 79.2 | | 61.1 | | 20.0 | 90 | | 200.8 |
| Copper | | 109 | | 89.1 | | 20.0 | 100 | | 200.8 |
| Iron | 75 - 125 | 1160 | | 79.2 | | 1000 | 108 | | 6010B |
| Lead | 75 - 125 | 24.8 | | 1.990 | | 20.0 | 114 | | 200.8 |
| Manganese | | 4140 | | 3560 | | 500 | 116 | | 6010B |
| Nickel | 75 - 125 | 72.8 | | 52.4 | | 20.0 | 102 | | 200.8 |
| Selenium | 75 - 125 | 15.2 | | 1.0 | U | 20.0 | 76 | | 7740 |
| Silver | 75 - 125 | 18.5 | | 0.615 | | 20.0 | 89 | | 200.8 |
| Thallium | 75 - 125 | 23.5 | | 0.166 | | 20.0 | 117 | | 200.8 |
| Vanadium | 75 - 125 | 520 | | 5.6 | U | 500 | 104 | | 6010B |
| Zinc | | 2490 | | 2000 | | 500 | 98 | | 6010B |

Comments:

# METALS
## - 6 -
## DUPLICATES

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: µG/L
Project Name: PDXMIN
Basis: NA
Matrix: WATER
% Solids: 0.0

Sample Name: DTJCUSD
Lab Code: K2106294-001D

| Analyte | Control Limit | Sample (S) | C | Duplicate (D) | C | RPD | Q | Method |
|---|---|---|---|---|---|---|---|---|
| Aluminum | | 40 | U | 40 | U | | | 6010B |
| Antimony | 0.1 | 0.139 | | 0.126 | | 10 | | 200.8 |
| Arsenic | 0.5 | 1.32 | | 1.37 | | 4 | | 200.8 |
| Barium | | 12.5 | | 12.6 | | 1 | | 200.8 |
| Beryllium | | 0.014 | B | 0.013 | B | 8 | | 200.8 |
| Cadmium | | 0.009 | B | 0.008 | B | 11 | | 200.8 |
| Calcium | | 3980 | | 3930 | | 1 | | 6010B |
| Chromium | | 0.15 | B | 0.11 | B | 25 | | 200.8 |
| Cobalt | 0.0 | 0.052 | | 0.051 | | 3 | | 200.8 |
| Copper | | 1.72 | | 1.71 | | 1 | | 200.8 |
| Iron | 20.0 | 82.0 | | 84.7 | | 3 | | 6010B |
| Lead | | 0.145 | | 0.146 | | 1 | | 200.8 |
| Magnesium | | 664 | | 653 | | 2 | | 6010B |
| Manganese | 5.0 | 10.1 | | 10.2 | | 1 | | 6010B |
| Nickel | 0.2 | 0.27 | | 0.25 | | 8 | | 200.8 |
| Potassium | | 903 | B | 877 | B | 3 | | 6010B |
| Selenium | | 1.0 | U | 1.0 | U | | | 7740 |
| Silver | | 0.269 | | 0.264 | | 2 | | 200.8 |
| Sodium | | 3070 | | 3020 | | 2 | | 6010B |
| Thallium | | 0.005 | B | 0.004 | B | 25 | | 200.8 |
| Vanadium | | 5.0 | U | 5.0 | U | | | 6010B |
| Zinc | | 1.5 | B | 2.1 | B | 30 | | 6010B |

00056

# METALS
## - 6 -
## DUPLICATES

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: µG/L
Project Name: PDXMIN
Basis: NA
Matrix: WATER
% Solids: 0.0

Sample Name: DTSEEP1 & 2 CompD
Lab Code: K2106294-040D DISS

| Analyte | Control Limit | Sample (S) | C | Duplicate (D) | C | RPD | Q | Method |
|---|---|---|---|---|---|---|---|---|
| Aluminum | | 10700 | | 11200 | | 6 | | 6010B |
| Antimony | 0.1 | 0.074 | | 0.076 | | 3 | | 200.8 |
| Arsenic | 0.5 | 0.52 | | 0.51 | | 2 | | 200.8 |
| Barium | | 19.4 | | 20.4 | | 5 | | 200.8 |
| Beryllium | | 16.7 | | 17.0 | | 2 | | 200.8 |
| Cadmium | | 5.540 | | 5.500 | | 1 | | 200.8 |
| Calcium | | 81900 | | 84600 | | 3 | | 6010B |
| Chromium | | 0.15 | B | 0.15 | B | 3 | | 200.8 |
| Cobalt | | 61.1 | | 62.8 | | 3 | | 200.8 |
| Copper | | 89.1 | | 90.0 | | 1 | | 200.8 |
| Iron | 22.2 | 79.2 | | 84.1 | | 6 | | 6010B |
| Lead | | 1.990 | | 2.060 | | 3 | | 200.8 |
| Magnesium | | 18100 | | 18700 | | 3 | | 6010B |
| Manganese | | 3560 | | 3730 | | 4 | | 6010B |
| Nickel | | 52.4 | | 53.8 | | 3 | | 200.8 |
| Potassium | | 22600 | | 23100 | | 2 | | 6010B |
| Selenium | | 1.0 | U | 1.0 | U | | | 7740 |
| Silver | | 0.615 | | 0.636 | | 3 | | 200.8 |
| Sodium | | 8950 | | 9160 | | 2 | | 6010B |
| Thallium | | 0.166 | | 0.175 | | 5 | | 200.8 |
| Vanadium | | 5.6 | U | 5.6 | U | | | 6010B |
| Zinc | | 2000 | | 2070 | | 3 | | 6010B |

00057

# Metals
# (Soil)

# METALS

## - Cover Page -
## INORGANIC ANALYSIS DATA PACKAGE

Client: Limno-Tech, Inc. Service Request: K2106294

Project No.:

Project Name: PDXMIN

| Sample No. | Lab Sample ID. |
|---|---|
| WDES2 | K2106294-009 |
| WDES2D | K2106294-009D |
| WDES2S | K2106294-009S |
| WDWS2 | K2106294-012 |
| SANDP | K2106294-016 |
| BGR21 | K2106294-020 |
| BGR22 | K2106294-021 |
| BGSD1-a | K2106294-022 |
| DTJCUS-SED | K2106294-023 |
| DTJC SEEP2-SED | K2106294-024 |
| DTJC DS-SED | K2106294-025 |
| MMTP-AU | K2106294-026 |
| MMTP-U | K2106294-027 |
| MMTP-BL | K2106294-030 |
| BGSD1-b | K2106294-036 |
| BGSD4 | K2106294-037 |
| MF03 | K2106294-038 |
| Duplicate 2 | K2106294-039 |
| MMTP-M & L Comp | K2106294-041 |
| MMTP-M & L CompD | K2106294-041D |

Were ICP interelement corrections applied? Yes/No YES

Were ICP background corrections applied? Yes/No YES

If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Date: 10/16/01

00058

# METALS

## - Cover Page -
## INORGANIC ANALYSIS DATA PACKAGE

Client: Limno-Tech, Inc. Service Request: K2106294

Project No.:

Project Name: PDXMIN

| Sample No. | Lab Sample ID. |
|---|---|
| MMTP-M & L CompS | K2106294-041S |
| CONEP COMP | K2106294-042 |
| BGR 11,12,13 COMP | K2106294-043 |
| BGR 11,12,13 COMPD | K2106294-043D |
| BGR 11,12,13 COMPS | K2106294-043S |
| Method Blank | K2106294-MB |
| Method Blank | K2106294-MB2 |

Were ICP interelement corrections applied? Yes/No YES

Were ICP background corrections applied? Yes/No YES

If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Date: 10/6/01

# METALS
## -1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: WDES2
Lab Code: K2106294-009

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.3 | 7.2 | 2 | 10/2/01 | 10/15/01 | 23300 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.15 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 15.9 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 15.9 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 2.66 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.36 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 11400 | | |
| Chromium | 200.8 | 0.21 | 0.04 | 5 | 10/2/01 | 10/12/01 | 38.8 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 19.9 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 100 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 43000 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 52.2 | | |
| Magnesium | 6010B | 4.1 | 2.1 | 2 | 10/2/01 | 10/15/01 | 21200 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 839 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.39 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 75.0 | | |
| Potassium | 6010B | 412 | 10 | 2 | 10/2/01 | 10/15/01 | 283 | B | |
| Selenium | 7740 | 5.2 | 1.0 | 10 | 10/2/01 | 10/13/01 | 23.4 | | |
| Silver | 200.8 | 0.206 | 0.015 | 50 | 10/2/01 | 10/11/01 | 31.9 | | |
| Sodium | 6010B | 20.6 | 4.1 | 2 | 10/2/01 | 10/15/01 | 99.7 | | |
| Thallium | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.074 | | |
| Vanadium | 6010B | 2.1 | 1.0 | 2 | 10/2/01 | 10/15/01 | 89.4 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/2/01 | 10/15/01 | 164 | | N |

% Solids: 97.1

Comments:

00060

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: WDWS2
Lab Code: K2106294-012

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.5 | 7.3 | 2 | 10/2/01 | 10/15/01 | 30100 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.06 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 6.5 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 56.4 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 9.22 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.38 | | |
| Calcium | 6010B | 11 | 4 | 2 | 10/2/01 | 10/15/01 | 10600 | | |
| Chromium | 200.8 | 0.21 | 0.04 | 5 | 10/2/01 | 10/12/01 | 57.2 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 23.3 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 92.4 | | N |
| Iron | 6010B | 4.2 | 0.7 | 2 | 10/2/01 | 10/15/01 | 64300 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 87.5 | | |
| Magnesium | 6010B | 4.2 | 2.1 | 2 | 10/2/01 | 10/15/01 | 29000 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/2/01 | 10/15/01 | 878 | | |
| Mercury | 7471A | 0.01 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.25 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 99.4 | | |
| Potassium | 6010B | 418 | 11 | 2 | 10/2/01 | 10/15/01 | 336 | B | |
| Selenium | 7740 | 5.2 | 1.1 | 10 | 10/2/01 | 10/13/01 | 1.1 | U | |
| Silver | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/11/01 | 6.820 | | |
| Sodium | 6010B | 20.9 | 4.2 | 2 | 10/2/01 | 10/15/01 | 701 | | |
| Thallium | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.165 | | |
| Vanadium | 6010B | 2.1 | 1.1 | 2 | 10/2/01 | 10/15/01 | 108 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/2/01 | 10/15/01 | 328 | | N |

% Solids: 68.3

Comments:

00061

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: SANDP
Lab Code: K2106294-016

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.1 | 7.1 | 2 | 10/2/01 | 10/15/01 | 5740 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.88 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 38.2 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 50.8 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.36 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.10 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 552 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 1.81 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.96 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 6.3 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 9340 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 82.4 | | |
| Magnesium | 6010B | 4.1 | 2.0 | 2 | 10/2/01 | 10/15/01 | 431 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 81.8 | | |
| Mercury | 7471A | 0.16 | 0.08 | 10 | 9/20/01 | 9/21/01 | 3.23 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 2.0 | | |
| Potassium | 6010B | 406 | 10 | 2 | 10/2/01 | 10/15/01 | 2180 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/11/01 | 5.870 | | |
| Sodium | 6010B | 20.3 | 4.1 | 2 | 10/2/01 | 10/15/01 | 20.3 | B | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.127 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 9.0 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 23.6 | | N |

% Solids: 98.6

Comments:

00062

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: BGR21
Lab Code: K2106294-020

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.5 | 7.3 | 2 | 10/2/01 | 10/15/01 | 24400 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.19 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 241 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 21.1 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.73 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.14 | | |
| Calcium | 6010B | 11 | 4 | 2 | 10/2/01 | 10/15/01 | 21000 | | |
| Chromium | 200.8 | 0.21 | 0.04 | 5 | 10/2/01 | 10/12/01 | 14.4 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 32.8 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 126 | | N |
| Iron | 6010B | 4.2 | 0.7 | 2 | 10/2/01 | 10/15/01 | 60300 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 13.8 | | |
| Magnesium | 6010B | 4.2 | 2.1 | 2 | 10/2/01 | 10/15/01 | 9610 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/2/01 | 10/15/01 | 1200 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.61 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 60.7 | | |
| Potassium | 6010B | 418 | 11 | 2 | 10/2/01 | 10/15/01 | 1180 | | |
| Selenium | 7740 | 5.2 | 1.1 | 10 | 10/2/01 | 10/13/01 | 3.0 | B | |
| Silver | 200.8 | 0.209 | 0.016 | 50 | 10/2/01 | 10/11/01 | 38.7 | | |
| Sodium | 6010B | 20.9 | 4.2 | 2 | 10/2/01 | 10/15/01 | 69.7 | | |
| Thallium | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.144 | | |
| Vanadium | 6010B | 2.1 | 1.1 | 2 | 10/2/01 | 10/15/01 | 99.9 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/2/01 | 10/15/01 | 202 | | N |

% Solids: 95.6

Comments:

00063

# METALS
## -1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: BGR22
Lab Code: K2106294-021

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.2 | 7.2 | 2 | 10/2/01 | 10/15/01 | 14200 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.16 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 12.3 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 23.6 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 2.20 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.44 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 4060 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 32.2 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 17.7 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 63.7 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 27400 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 53.6 | | |
| Magnesium | 6010B | 4.1 | 2.0 | 2 | 10/2/01 | 10/15/01 | 13900 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 601 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.37 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 53.4 | | |
| Potassium | 6010B | 409 | 10 | 2 | 10/2/01 | 10/15/01 | 529 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 3.8 | B | |
| Silver | 200.8 | 1.020 | 0.077 | 250 | 10/2/01 | 10/11/01 | 218 | | |
| Sodium | 6010B | 20.4 | 4.1 | 2 | 10/2/01 | 10/15/01 | 47.9 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.075 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 53.9 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 198 | | N |

% Solids: 97.8

Comments:

00064

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: BGSD1-a
Lab Code: K2106294-022

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.2 | 7.1 | 2 | 10/2/01 | 10/15/01 | 21000 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.48 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 45.3 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 188 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.13 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.33 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 861 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 8.24 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 2.37 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 180 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 27400 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 193 | | |
| Magnesium | 6010B | 4.1 | 2.0 | 2 | 10/2/01 | 10/15/01 | 2680 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 153 | | |
| Mercury | 7471A | 0.10 | 0.05 | 5 | 9/20/01 | 9/21/01 | 1.79 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 7.8 | | |
| Potassium | 6010B | 407 | 10 | 2 | 10/2/01 | 10/15/01 | 2490 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 5.4 | | |
| Silver | 200.8 | 0.203 | 0.015 | 50 | 10/2/01 | 10/11/01 | 61.1 | | |
| Sodium | 6010B | 20.3 | 4.1 | 2 | 10/2/01 | 10/15/01 | 146 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.217 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 28.1 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 81.1 | | N |

% Solids: 98.3

Comments:

00065

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: DTJCUS-SED
Lab Code: K2106294-023

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 12.0 | 8.4 | 2 | 10/2/01 | 10/15/01 | 1980 | | |
| Antimony | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.01 | U | N |
| Arsenic | 200.8 | 0.6 | 0.1 | 5 | 10/2/01 | 10/10/01 | 2.2 | | |
| Barium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 27.7 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.14 | | N |
| Cadmium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.05 | B | |
| Calcium | 6010B | 12 | 5 | 2 | 10/2/01 | 10/15/01 | 400 | | |
| Chromium | 200.8 | 0.24 | 0.04 | 5 | 10/2/01 | 10/12/01 | 2.62 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.34 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 3.1 | | N |
| Iron | 6010B | 4.8 | 0.8 | 2 | 10/2/01 | 10/15/01 | 3380 | | |
| Lead | 200.8 | 0.06 | 0.05 | 5 | 10/2/01 | 10/11/01 | 2.60 | | |
| Magnesium | 6010B | 4.8 | 2.4 | 2 | 10/2/01 | 10/15/01 | 417 | | |
| Manganese | 6010B | 1.2 | 0.1 | 2 | 10/2/01 | 10/15/01 | 86.9 | | |
| Mercury | 7471A | 0.04 | 0.02 | 2 | 9/20/01 | 9/21/01 | 1.15 | | |
| Nickel | 200.8 | 0.4 | 0.2 | 5 | 10/2/01 | 10/10/01 | 2.5 | | |
| Potassium | 6010B | 481 | 12 | 2 | 10/2/01 | 10/15/01 | 393 | B | |
| Selenium | 7740 | 6.0 | 1.2 | 10 | 10/2/01 | 10/13/01 | 1.2 | U | |
| Silver | 200.8 | 0.024 | 0.002 | 5 | 10/2/01 | 10/11/01 | 0.682 | | |
| Sodium | 6010B | 24.1 | 4.8 | 2 | 10/2/01 | 10/15/01 | 16.7 | B | |
| Thallium | 200.8 | 0.024 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.032 | | |
| Vanadium | 6010B | 2.4 | 1.2 | 2 | 10/2/01 | 10/15/01 | 1.5 | B | |
| Zinc | 6010B | 2.4 | 0.4 | 2 | 10/2/01 | 10/15/01 | 17.1 | | N |

% Solids: 83.1

Comments:

00066

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: DTJC SEEP2-SED
Lab Code: K2106294-024

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 11.9 | 8.3 | 2 | 10/2/01 | 10/15/01 | 3220 | | |
| Antimony | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.05 | B | N |
| Arsenic | 200.8 | 0.6 | 0.1 | 5 | 10/2/01 | 10/10/01 | 3.9 | | |
| Barium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 12.6 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.39 | | N |
| Cadmium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.09 | | |
| Calcium | 6010B | 12 | 5 | 2 | 10/2/01 | 10/15/01 | 638 | | |
| Chromium | 200.8 | 0.24 | 0.04 | 5 | 10/2/01 | 10/12/01 | 1.47 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 3.27 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 7.6 | | N |
| Iron | 6010B | 4.8 | 0.8 | 2 | 10/2/01 | 10/15/01 | 6510 | | |
| Lead | 200.8 | 0.06 | 0.05 | 5 | 10/2/01 | 10/11/01 | 7.76 | | |
| Magnesium | 6010B | 4.8 | 2.4 | 2 | 10/2/01 | 10/15/01 | 712 | | |
| Manganese | 6010B | 1.2 | 0.1 | 2 | 10/2/01 | 10/15/01 | 179 | | |
| Mercury | 7471A | 0.09 | 0.04 | 5 | 9/20/01 | 9/21/01 | 1.41 | | |
| Nickel | 200.8 | 0.4 | 0.2 | 5 | 10/2/01 | 10/10/01 | 1.7 | | |
| Potassium | 6010B | 476 | 12 | 2 | 10/2/01 | 10/15/01 | 442 | B | |
| Selenium | 7740 | 6.0 | 1.2 | 10 | 10/2/01 | 10/13/01 | 1.2 | U | |
| Silver | 200.8 | 0.024 | 0.002 | 5 | 10/2/01 | 10/11/01 | 1.050 | | |
| Sodium | 6010B | 23.8 | 4.8 | 2 | 10/2/01 | 10/15/01 | 24.4 | | |
| Thallium | 200.8 | 0.024 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.048 | | |
| Vanadium | 6010B | 2.4 | 1.2 | 2 | 10/2/01 | 10/15/01 | 6.2 | | |
| Zinc | 6010B | 2.4 | 0.4 | 2 | 10/2/01 | 10/15/01 | 32.3 | | N |

% Solids: 84.1

Comments:

00067

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: DTJC DS-SED
Lab Code: K2106294-025

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 12.0 | 8.4 | 2 | 10/2/01 | 10/15/01 | 2190 | | |
| Antimony | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.01 | U | N |
| Arsenic | 200.8 | 0.6 | 0.1 | 5 | 10/2/01 | 10/10/01 | 1.7 | | |
| Barium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 9.99 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.49 | | N |
| Cadmium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.14 | | |
| Calcium | 6010B | 12 | 5 | 2 | 10/2/01 | 10/15/01 | 373 | | |
| Chromium | 200.8 | 0.24 | 0.04 | 5 | 10/2/01 | 10/12/01 | 0.59 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 4.21 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 10.9 | | N |
| Iron | 6010B | 4.8 | 0.8 | 2 | 10/2/01 | 10/15/01 | 3370 | | |
| Lead | 200.8 | 0.06 | 0.05 | 5 | 10/2/01 | 10/11/01 | 2.94 | | |
| Magnesium | 6010B | 4.8 | 2.4 | 2 | 10/2/01 | 10/15/01 | 477 | | |
| Manganese | 6010B | 1.2 | 0.1 | 2 | 10/2/01 | 10/15/01 | 320 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.44 | | |
| Nickel | 200.8 | 0.4 | 0.2 | 5 | 10/2/01 | 10/10/01 | 1.6 | | |
| Potassium | 6010B | 480 | 12 | 2 | 10/2/01 | 10/15/01 | 318 | B | |
| Selenium | 7740 | 6.0 | 1.2 | 10 | 10/2/01 | 10/13/01 | 1.2 | U | |
| Silver | 200.8 | 0.024 | 0.002 | 5 | 10/2/01 | 10/11/01 | 0.251 | | |
| Sodium | 6010B | 24.0 | 4.8 | 2 | 10/2/01 | 10/15/01 | 21.8 | B | |
| Thallium | 200.8 | 0.024 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.021 | B | |
| Vanadium | 6010B | 2.4 | 1.2 | 2 | 10/2/01 | 10/15/01 | 3.0 | | |
| Zinc | 6010B | 2.4 | 0.4 | 2 | 10/2/01 | 10/15/01 | 53.9 | | N |

% Solids: 83.4

Comments:

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: MMTP-AU
Lab Code: K2106294-026

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.2 | 7.1 | 2 | 10/2/01 | 10/15/01 | 6390 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.26 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 26.6 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 46.1 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.41 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.11 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 2220 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 2.55 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.04 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 8.9 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 6640 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 76.4 | | |
| Magnesium | 6010B | 4.1 | 2.0 | 2 | 10/2/01 | 10/15/01 | 672 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 76.6 | | |
| Mercury | 7471A | 0.18 | 0.09 | 10 | 9/20/01 | 9/21/01 | 6.98 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 2.4 | | |
| Potassium | 6010B | 406 | 10 | 2 | 10/2/01 | 10/15/01 | 2630 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/11/01 | 4.510 | | |
| Sodium | 6010B | 20.3 | 4.1 | 2 | 10/2/01 | 10/15/01 | 39.2 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.130 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 9.4 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 22.2 | | N |

% Solids: 98.5

Comments:

00069

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: MMTP-U
Lab Code: K2106294-027

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.2 | 7.1 | 2 | 10/2/01 | 10/15/01 | 4040 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 1.80 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 118 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 94.2 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.20 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.07 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 537 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 1.47 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.25 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 24.5 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 24900 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 65.5 | | |
| Magnesium | 6010B | 4.1 | 2.0 | 2 | 10/2/01 | 10/15/01 | 271 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 20.5 | | |
| Mercury | 7471A | 0.09 | 0.05 | 5 | 9/20/01 | 9/21/01 | 1.50 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 0.6 | | |
| Potassium | 6010B | 406 | 10 | 2 | 10/2/01 | 10/15/01 | 2810 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 16.8 | | |
| Silver | 200.8 | 0.203 | 0.015 | 50 | 10/2/01 | 10/11/01 | 82.4 | | |
| Sodium | 6010B | 20.3 | 4.1 | 2 | 10/2/01 | 10/15/01 | 108 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.303 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 6.8 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 16.2 | | N |

% Solids: 98.5

Comments:

00070

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: MMTP-BL
Lab Code: K2106294-030

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.2 | 7.2 | 2 | 10/2/01 | 10/15/01 | 3020 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.23 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 12.3 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 28.0 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.21 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.07 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 447 | | |
| Chromium | 200.8 | 0.21 | 0.04 | 5 | 10/2/01 | 10/12/01 | 1.32 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.72 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 3.2 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 3650 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 63.0 | | |
| Magnesium | 6010B | 4.1 | 2.1 | 2 | 10/2/01 | 10/15/01 | 331 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 40.4 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.33 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 2.0 | | |
| Potassium | 6010B | 410 | 10 | 2 | 10/2/01 | 10/15/01 | 1910 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/11/01 | 0.633 | | |
| Sodium | 6010B | 20.5 | 4.1 | 2 | 10/2/01 | 10/15/01 | 13.8 | B | |
| Thallium | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.078 | | |
| Vanadium | 6010B | 2.1 | 1.0 | 2 | 10/2/01 | 10/15/01 | 4.8 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/2/01 | 10/15/01 | 11.7 | | N |

% Solids: 97.6

Comments:

00071

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: BGSD1-b
Lab Code: K2106294-036

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 11.2 | 7.8 | 2 | 10/2/01 | 10/15/01 | 2490 | | |
| Antimony | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/11/01 | 1.18 | | N |
| Arsenic | 200.8 | 0.6 | 0.1 | 5 | 10/2/01 | 10/10/01 | 69.2 | | |
| Barium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 60.3 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.30 | | N |
| Cadmium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.08 | | |
| Calcium | 6010B | 11 | 4 | 2 | 10/2/01 | 10/15/01 | 107 | | |
| Chromium | 200.8 | 0.22 | 0.04 | 5 | 10/2/01 | 10/12/01 | 0.91 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.67 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 3.9 | | N |
| Iron | 6010B | 4.5 | 0.8 | 2 | 10/2/01 | 10/15/01 | 17900 | | |
| Lead | 200.8 | 0.06 | 0.04 | 5 | 10/2/01 | 10/11/01 | 9.62 | | |
| Magnesium | 6010B | 4.5 | 2.2 | 2 | 10/2/01 | 10/15/01 | 112 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/2/01 | 10/15/01 | 32.7 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.11 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 1.1 | | |
| Potassium | 6010B | 448 | 11 | 2 | 10/2/01 | 10/15/01 | 1070 | | |
| Selenium | 7740 | 5.6 | 1.1 | 10 | 10/2/01 | 10/13/01 | 1.1 | U | |
| Silver | 200.8 | 0.022 | 0.002 | 5 | 10/2/01 | 10/11/01 | 1.360 | | |
| Sodium | 6010B | 22.4 | 4.5 | 2 | 10/2/01 | 10/15/01 | 13.4 | B | |
| Thallium | 200.8 | 0.022 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.108 | | |
| Vanadium | 6010B | 2.2 | 1.1 | 2 | 10/2/01 | 10/15/01 | 4.6 | | |
| Zinc | 6010B | 2.2 | 0.3 | 2 | 10/2/01 | 10/15/01 | 8.0 | | N |

% Solids: 74.4

Comments:

00072

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: BGSD4
Lab Code: K2106294-037

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.8 | 7.5 | 2 | 10/2/01 | 10/15/01 | 3190 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 1.12 | | N |
| Arsenic | 200.8 | 5.4 | 0.5 | 50 | 10/2/01 | 10/10/01 | 540 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 44.6 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.54 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.30 | | |
| Calcium | 6010B | 11 | 4 | 2 | 10/2/01 | 10/15/01 | 210 | | |
| Chromium | 200.8 | 0.22 | 0.04 | 5 | 10/2/01 | 10/12/01 | 2.03 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.49 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 8.1 | | N |
| Iron | 6010B | 4.3 | 0.8 | 2 | 10/2/01 | 10/15/01 | 15500 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 15.8 | | |
| Magnesium | 6010B | 4.3 | 2.2 | 2 | 10/2/01 | 10/15/01 | 254 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/2/01 | 10/15/01 | 49.1 | | |
| Mercury | 7471A | 0.09 | 0.04 | 5 | 9/20/01 | 9/21/01 | 1.83 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 1.0 | | |
| Potassium | 6010B | 430 | 11 | 2 | 10/2/01 | 10/15/01 | 1210 | | |
| Selenium | 7740 | 5.4 | 1.1 | 10 | 10/2/01 | 10/13/01 | 1.1 | U | |
| Silver | 200.8 | 0.022 | 0.002 | 5 | 10/2/01 | 10/11/01 | 1.300 | | |
| Sodium | 6010B | 21.5 | 4.3 | 2 | 10/2/01 | 10/15/01 | 25.2 | | |
| Thallium | 200.8 | 0.022 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.115 | | |
| Vanadium | 6010B | 2.2 | 1.1 | 2 | 10/2/01 | 10/15/01 | 8.1 | | |
| Zinc | 6010B | 2.2 | 0.3 | 2 | 10/2/01 | 10/15/01 | 15.0 | | N |

% Solids: 77.5

Comments:

00073

# METALS
## -1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: MF03
Lab Code: K2106294-038

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 11.7 | 8.2 | 2 | 10/2/01 | 10/15/01 | 27900 | | |
| Antimony | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.61 | | N |
| Arsenic | 200.8 | 0.6 | 0.1 | 5 | 10/2/01 | 10/10/01 | 10.1 | | |
| Barium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 61.5 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 3.37 | | N |
| Cadmium | 200.8 | 0.06 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.21 | | |
| Calcium | 6010B | 12 | 5 | 2 | 10/2/01 | 10/15/01 | 8210 | | |
| Chromium | 200.8 | 0.23 | 0.04 | 5 | 10/2/01 | 10/12/01 | 28.5 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 15.4 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 61.8 | | N |
| Iron | 6010B | 4.7 | 0.8 | 2 | 10/2/01 | 10/15/01 | 46300 | | |
| Lead | 200.8 | 0.06 | 0.05 | 5 | 10/2/01 | 10/11/01 | 188 | | |
| Magnesium | 6010B | 4.7 | 2.3 | 2 | 10/2/01 | 10/15/01 | 19600 | | |
| Manganese | 6010B | 1.2 | 0.1 | 2 | 10/2/01 | 10/15/01 | 890 | | |
| Mercury | 7471A | 0.38 | 0.19 | 20 | 9/20/01 | 9/21/01 | 8.19 | | |
| Nickel | 200.8 | 0.4 | 0.2 | 5 | 10/2/01 | 10/10/01 | 56.4 | | |
| Potassium | 6010B | 467 | 12 | 2 | 10/2/01 | 10/15/01 | 740 | | |
| Selenium | 7740 | 5.8 | 1.2 | 10 | 10/2/01 | 10/13/01 | 1.2 | U | |
| Silver | 200.8 | 0.233 | 0.018 | 50 | 10/2/01 | 10/11/01 | 23.9 | | |
| Sodium | 6010B | 23.3 | 4.7 | 2 | 10/2/01 | 10/15/01 | 659 | | |
| Thallium | 200.8 | 0.023 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.069 | | |
| Vanadium | 6010B | 2.3 | 1.2 | 2 | 10/2/01 | 10/15/01 | 96.5 | | |
| Zinc | 6010B | 2.3 | 0.4 | 2 | 10/2/01 | 10/15/01 | 181 | | N |

% Solids: 85.7

Comments:

00074

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/28/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: Duplicate 2
Lab Code: K2106294-039

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.4 | 7.3 | 2 | 10/2/01 | 10/15/01 | 28700 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.58 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 9.8 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 98.4 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 3.64 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.23 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 9030 | | |
| Chromium | 200.8 | 0.21 | 0.04 | 5 | 10/2/01 | 10/12/01 | 29.2 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 17.6 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 71.0 | | N |
| Iron | 6010B | 4.2 | 0.7 | 2 | 10/2/01 | 10/15/01 | 51200 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 178 | | |
| Magnesium | 6010B | 4.2 | 2.1 | 2 | 10/2/01 | 10/15/01 | 22500 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 1080 | | |
| Mercury | 7471A | 0.20 | 0.10 | 10 | 9/20/01 | 9/21/01 | 5.24 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 65.1 | | |
| Potassium | 6010B | 415 | 10 | 2 | 10/2/01 | 10/15/01 | 716 | | |
| Selenium | 7740 | 5.2 | 1.0 | 10 | 10/2/01 | 10/13/01 | 1.0 | U | |
| Silver | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/11/01 | 10.0 | | |
| Sodium | 6010B | 20.7 | 4.2 | 2 | 10/2/01 | 10/15/01 | 727 | | |
| Thallium | 200.8 | 0.021 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.082 | | |
| Vanadium | 6010B | 2.1 | 1.0 | 2 | 10/2/01 | 10/15/01 | 103 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/2/01 | 10/15/01 | 212 | | N |

% Solids: 96.4

Comments:

00075

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: MMTP-M & L Comp
Lab Code: K2106294-041

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.2 | 7.1 | 2 | 10/2/01 | 10/15/01 | 13700 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 3.52 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 30.8 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 127 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.87 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.45 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 3950 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 13.7 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 8.17 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 60.3 | | N |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/2/01 | 10/15/01 | 30000 | | |
| Lead | 200.8 | 0.51 | 0.41 | 50 | 10/2/01 | 10/11/01 | 204 | | |
| Magnesium | 6010B | 4.1 | 2.0 | 2 | 10/2/01 | 10/15/01 | 3880 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 465 | | |
| Mercury | 7471A | 3.91 | 1.95 | 200 | 9/20/01 | 9/21/01 | 91.8 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 16.9 | | |
| Potassium | 6010B | 408 | 10 | 2 | 10/2/01 | 10/15/01 | 1950 | | |
| Selenium | 7740 | 5.1 | 1.0 | 10 | 10/2/01 | 10/13/01 | 6.2 | | |
| Silver | 200.8 | 0.204 | 0.015 | 50 | 10/2/01 | 10/11/01 | 64.9 | | |
| Sodium | 6010B | 20.4 | 4.1 | 2 | 10/2/01 | 10/15/01 | 68.8 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.096 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 46.5 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 158 | | N |

% Solids: 98.0

Comments:

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: CONEP COMP
Lab Code: K2106294-042

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.0 | 7.0 | 2 | 10/2/01 | 10/15/01 | 9980 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 2.27 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 93.9 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 187 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.24 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.08 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 1860 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 2.78 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.45 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 9.5 | | N |
| Iron | 6010B | 4.0 | 0.7 | 2 | 10/2/01 | 10/15/01 | 28200 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 82.9 | | |
| Magnesium | 6010B | 4.0 | 2.0 | 2 | 10/2/01 | 10/15/01 | 3080 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 319 | | |
| Mercury | 7471A | 0.19 | 0.10 | 10 | 9/20/01 | 9/21/01 | 4.20 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 3.0 | | |
| Potassium | 6010B | 402 | 10 | 2 | 10/2/01 | 10/15/01 | 1030 | | |
| Selenium | 7740 | 5.0 | 1.0 | 10 | 10/2/01 | 10/13/01 | 1.6 | B | |
| Silver | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/11/01 | 10.2 | | |
| Sodium | 6010B | 20.1 | 4.0 | 2 | 10/2/01 | 10/15/01 | 28.9 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.077 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 53.3 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 38.0 | | N |

% Solids: 99.6

Comments:

00077

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2106294
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: BGR 11,12,13 COMP
Lab Code: K2106294-043

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.0 | 7.0 | 2 | 10/2/01 | 10/15/01 | 11700 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.70 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 123 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 49.3 | | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.36 | | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.08 | | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 608 | | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 3.93 | | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 1.25 | | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 83.8 | | N |
| Iron | 6010B | 4.0 | 0.7 | 2 | 10/2/01 | 10/15/01 | 41300 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/11/01 | 21.2 | | |
| Magnesium | 6010B | 4.0 | 2.0 | 2 | 10/2/01 | 10/15/01 | 1200 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 195 | | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 10/15/01 | 10/15/01 | 0.38 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 3.8 | | |
| Potassium | 6010B | 400 | 10 | 2 | 10/2/01 | 10/15/01 | 2290 | | |
| Selenium | 7740 | 5.0 | 1.0 | 10 | 10/2/01 | 10/13/01 | 29.3 | | |
| Silver | 200.8 | 0.200 | 0.015 | 50 | 10/2/01 | 10/11/01 | 120 | | |
| Sodium | 6010B | 20.0 | 4.0 | 2 | 10/2/01 | 10/15/01 | 124 | | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.170 | | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 31.3 | | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 39.2 | | N |

% Solids: 100.0

Comments:

00078

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Service Request: K2106294

Project No.: NA
Date Collected:

Project Name: PDXMIN
Date Received:

Matrix: SOIL
Units: MG/KG

Basis: Dry

Sample Name: Method Blank
Lab Code: K2106294-MB

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.0 | 7.0 | 2 | 10/2/01 | 10/15/01 | 7.0 | U | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/11/01 | 0.01 | U | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/2/01 | 10/10/01 | 0.1 | B | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.05 | B | * |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.01 | U | N |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.01 | U | |
| Calcium | 6010B | 10 | 4 | 2 | 10/2/01 | 10/15/01 | 4 | U | |
| Chromium | 200.8 | 0.20 | 0.04 | 5 | 10/2/01 | 10/12/01 | 0.04 | U | |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/2/01 | 10/10/01 | 0.01 | U | |
| Copper | 200.8 | 0.1 | 0.1 | 5 | 10/2/01 | 10/10/01 | 0.1 | U | N |
| Iron | 6010B | 4.0 | 0.7 | 2 | 10/2/01 | 10/15/01 | 0.7 | U | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/2/01 | 10/10/01 | 0.08 | | |
| Magnesium | 6010B | 4.0 | 2.0 | 2 | 10/2/01 | 10/15/01 | 3.2 | B | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/2/01 | 10/15/01 | 0.1 | U | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 9/20/01 | 9/21/01 | 0.01 | U | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/2/01 | 10/10/01 | 0.2 | U | |
| Potassium | 6010B | 400 | 10 | 2 | 10/2/01 | 10/15/01 | 10 | U | |
| Selenium | 7740 | 2.5 | 0.5 | 5 | 10/2/01 | 10/13/01 | 0.5 | U | |
| Silver | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/11/01 | 0.002 | B | |
| Sodium | 6010B | 20.0 | 4.0 | 2 | 10/2/01 | 10/15/01 | 4.0 | U | |
| Thallium | 200.8 | 0.020 | 0.002 | 5 | 10/2/01 | 10/12/01 | 0.002 | U | |
| Vanadium | 6010B | 2.0 | 1.0 | 2 | 10/2/01 | 10/15/01 | 1.0 | U | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/2/01 | 10/15/01 | 0.3 | U | N |

% Solids: 100.0

Comments:

00079

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.: NA
Date Collected:
Project Name: PDXMIN
Date Received:
Matrix: SOIL
Units: MG/KG
Basis: Dry

Sample Name: Method Blank
Lab Code: K2106294-MB2

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Mercury | 7471A | 0.02 | 0.01 | 1 | 10/15/01 | 10/15/01 | 0.01 | U | |

% Solids: 100.0

Comments:

00080

# METALS
## - 5a -
## SPIKE SAMPLE RECOVERY

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: MG/KG
Project Name: PDXMIN
Basis: Dry
Matrix: SOLID
% Solids: 100.0

Sample Name: BGR 11,12,13 COMPS
Lab Code: K2106294-043S

| Analyte | Control Limit %R | Spike Result | C | Sample Result | C | Spike Added | %R | Q | Method |
|---|---|---|---|---|---|---|---|---|---|
| Mercury | 60 - 130 | 0.82 | | 0.38 | | 0.46 | 98 | | 7471A |

Comments:

# METALS
## - 5a -
## SPIKE SAMPLE RECOVERY

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: MG/KG
Project Name: PDXMIN
Basis: Dry
Matrix: SOLID
% Solids: 98.0

Sample Name: MMTP-M & L CompS
Lab Code: K2106294-041S

| Analyte | Control Limit %R | Spike Result | C | Sample Result | C | Spike Added | %R | Q | Method |
|---|---|---|---|---|---|---|---|---|---|
| Mercury | | 73.4 | | 91.8 | | 0.46 | -3974 | | 7471A |

Comments:

# METALS
## - 5a -
## SPIKE SAMPLE RECOVERY

Client: Limno-Tech, Inc.
Service Request: K2106294
Project No.:
Units: MG/KG
Project Name: PDXMIN
Basis: Dry
Matrix: SOLID
% Solids: 97.1

Sample Name: WDES2S
Lab Code: K2106294-009S

| Analyte | Control Limit %R | Spike Result | C | Sample Result | C | Spike Added | %R | Q | Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | | 27700 | | 23300 | | 412 | 1068 | | 6010B |
| Antimony | 70 - 130 | 18.7 | | 0.15 | | 103 | 18 | N | 200.8 |
| Arsenic | 70 - 130 | 214 | | 15.9 | | 206 | 96 | | 200.8 |
| Barium | 70 - 130 | 449 | | 15.9 | | 412 | 105 | | 200.8 |
| Beryllium | 70 - 130 | 9.17 | | 2.66 | | 10.3 | 63 | N | 200.8 |
| Cadmium | 70 - 130 | 10.1 | | 0.36 | | 10.3 | 95 | | 200.8 |
| Chromium | 70 - 130 | 70.7 | | 38.8 | | 41.2 | 77 | | 200.8 |
| Cobalt | 70 - 130 | 97.1 | | 19.9 | | 103 | 75 | | 200.8 |
| Copper | 70 - 130 | 173 | | 100 | | 51.5 | 142 | N | 200.8 |
| Iron | | 48700 | | 43000 | | 206 | 2767 | | 6010B |
| Lead | 70 - 130 | 126 | | 52.2 | | 103 | 72 | | 200.8 |
| Manganese | | 1060 | | 839 | | 103 | 215 | | 6010B |
| Nickel | 70 - 130 | 190 | | 75.0 | | 103 | 112 | | 200.8 |
| Selenium | 60 - 130 | 113 | | 23.4 | | 103 | 87 | | 7740 |
| Silver | 70 - 130 | 36.9 | | 31.9 | | 10.3 | 50 | | 200.8 |
| Thallium | 70 - 130 | 18.7 | | 0.074 | | 20.6 | 90 | | 200.8 |
| Vanadium | 75 - 125 | 208 | | 89.4 | | 103 | 115 | | 6010B |
| Zinc | 75 - 125 | 306 | | 164 | | 103 | 138 | N | 6010B |

Comments:

Columbia Analytical Services INC.
An Employee-Owned Company

November 5, 2001 Service Request No: K2107852

Tom Chisholm
Limno-Tech, Inc.
4640 S.W. Macadam, Suite 60
Portland, OR 97201

**Re: PDXMIN**

Dear Tom:

Enclosed are the results of the rush sample(s) submitted to our laboratory on 8/29/01. Preliminary results were transmitted via facsimile on 11/2/01. For your reference, these analyses have been assigned our service request number K2107852.

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3280.

Respectfully submitted,

**Columbia Analytical Services, Inc.**

Les Kennedy
Project Chemist

LK/dj



317 South 13th Avenue • P.O. Box 479 • Kelso, Washington 98626 • Telephone 360/ 577-7222 • Fax 360/636-1068

## Inorganic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result. |
| E | The result is an estimate amount because the value exceeded the instrument calibration range. |
| J | The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. |
| U | The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. |
| i | The MRL/MDL has been elevated due to a matrix interference. |
| X | See case narrative. |

## Metals Data Qualifiers

| | |
|---|---|
| # | The control limit criteria is not applicable. See case narrative. |
| B | The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. |
| E | The reported value is estimated because of the presence of matrix interference. |
| M | The duplicate injection precision was not met. |
| N | The Matrix Spike sample recovery is not within control limits. See case narrative. |
| S | The reported value was determined by the Method of Standard Additions (MSA). |
| U | The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. |
| W | The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance. |
| i | The MRL/MDL has been elevated due to a matrix interference |
| X | See case narrative. |
| * | The duplicate analysis not within control limits. See case narrative. |
| + | The correlation coefficient for the MSA is less than 0.995. |

## Organic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| A | A tentatively identified compound, a suspected aldol-condensation product. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result. |
| C | The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data |
| D | The reported result is from a dilution. |
| E | The result is an estimate amount because the value exceeded the instrument calibration range. |
| J | The result is an estimated concentration that is less than the MRL but greater than or equal to the MDL. |
| N | The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed. |
| P | The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results (25% for CLP Pesticides). |
| U | The compound was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL. |
| i | The MRL/MDL has been elevated due to a chromatographic interference |
| X | See case narrative. |

## Additional Petroleum Hydrocarbon Specific Qualifiers

| | |
|---|---|
| F | The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard. |
| L | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard. |
| H | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard. |
| O | The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard. |
| Y | The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard. |
| Z | The chromatographic fingerprint does not resemble a petroleum product. |

## Acronyms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| A2LA | American Association for Laboratory Accreditation |
| CARB | California Air Resources Board |
| CAS Number | Chemical Abstract Service registry Number |
| CFC | Chlorofluorocarbon |
| CFU | Colony-Forming Unit |
| DEC | Department of Environmental Conservation |
| DEQ | Department of Environmental Quality |
| DHS | Department of Health Services |
| DOE | Department of Ecology |
| DOH | Department of Health |
| EPA | U. S. Environmental Protection Agency |
| ELAP | Environmental Laboratory Accreditation Program |
| GC | Gas Chromatography |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| LUFT | Leaking Underground Fuel Tank |
| M | Modified |
| MCL | Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA. |
| MDL | Method Detection Limit |
| MPN | Most Probable Number |
| MRL | Method Reporting Limit |
| NA | Not Applicable |
| NC | Not Calculated |
| NCASI | National Council of the Paper Industry for Air and Stream Improvement |
| ND | Not Detected |
| NIOSH | National Institute for Occupational Safety and Health |
| PQL | Practical Quantitation Limit |
| RCRA | Resource Conservation and Recovery Act |
| SIM | Selected Ion Monitoring |
| TPH | Total Petroleum Hydrocarbons |
| tr | Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL. |

COLUMBIA ANALYTICAL SERVICES, INC.

| | | | |
|---|---|---|---|
| **Client:** | Limno-Tech, Inc. | **Service Request No.:** | K2107852 |
| **Project:** | PDXMIN | **Date Received:** | 8/29/01 |
| **Sample Matrix:** | Solid | | |

## CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Laboratory Control Sample (LCS).

### Sample Receipt

These four solid samples were received for analysis at Columbia Analytical Services on 8/29/01. Discrepancies were noted upon initial sample inspection and are included in a previous report submitted under service request number K2106294. Exceptions are noted on the cooler receipt and preservation form included that data package.

### Metals

**Matrix Spike (MS) Exceptions**
The low recovery of antimony in the MS performed on sample WDES1 is a result of a method defect in the EPA 3050B-digestion procedure, which can be magnified by certain matrix components. The associated Laboratory Control Sample (LCS) was within control limits, indicating the analysis was in control. No further corrective action was feasible.

The low recoveries of Chromium and Silver in the MS performed on sample WDES1 are a result of the heterogeneous character of the sample. Mixing techniques within the scope of the EPA methodology were used, but were not sufficient for complete homogenization of this sample. The associated LCS was within control limits indicating the analysis was in control. No further corrective action was taken.

The recoveries of Aluminum, Iron and Manganese in the MS performed on sample WDES1 are not applicable. The analyte concentrations in the sample were significantly higher than the added spike concentrations, preventing accurate evaluation of the spike recoveries.

**Relative Percent Difference (RPD) Exceptions**
The RPD for the replicate analysis of Cadmium, Lead, Selenium and Silver in sample WDES1 were outside the normal CAS control limits. The variability in the results is attributed to the heterogeneous character of the sample. Mixing techniques within the scope of the EPA methodology were used, but were not sufficient for complete homogenization of this sample.

**Approved by** MC **Date** 11/2/01

# METALS

## - Cover Page -
## INORGANIC ANALYSIS DATA PACKAGE

Client: Limno-Tech, Inc. Service Request: K2107852

Project No.:

Project Name: PDXMIN

| Sample No. | Lab Sample ID. |
|---|---|
| WDES1 | K2107852-001 |
| WDES1D | K2107852-001D |
| WDES1S | K2107852-001S |
| WDES3 | K2107852-002 |
| WDWS1 | K2107852-003 |
| WDWS3 | K2107852-004 |
| Method Blank | K2107852-MB |

Were ICP interelement corrections applied? Yes/No YES

Were ICP background corrections applied? Yes/No YES

If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Date: 11/26/01

00005

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2107852
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: WDES1
Lab Code: K2107852-001

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.8 | 7.5 | 2 | 10/26/01 | 10/30/01 | 16300 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/29/01 | 0.10 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/26/01 | 10/30/01 | 5.5 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 11.8 | | |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.87 | | |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.40 | | * |
| Calcium | 6010B | 10.8 | 4.3 | 2 | 10/26/01 | 10/30/01 | 17800 | | |
| Chromium | 200.8 | 0.2 | 0.1 | 5 | 10/26/01 | 10/30/01 | 30.2 | | N |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 13.6 | | |
| Copper | 6010B | 2.2 | 2.2 | 2 | 10/26/01 | 10/30/01 | 89.7 | | |
| Iron | 6010B | 4.3 | 0.8 | 2 | 10/26/01 | 10/30/01 | 29900 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/26/01 | 10/30/01 | 39.4 | | * |
| Magnesium | 6010B | 4.3 | 2.2 | 2 | 10/26/01 | 10/30/01 | 13300 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/26/01 | 10/30/01 | 546 | | |
| Mercury | 7471A | 0.03 | 0.01 | 2 | 10/24/01 | 10/25/01 | 0.60 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/26/01 | 10/30/01 | 38.6 | | |
| Potassium | 6010B | 431 | 11 | 2 | 10/26/01 | 10/30/01 | 503 | | |
| Selenium | 7740 | 4.3 | 2.2 | 20 | 10/26/01 | 10/31/01 | 54.1 | | * |
| Silver | 6010B | 11 | 11 | 2 | 10/31/01 | 11/1/01 | 97.5 | | *N |
| Sodium | 6010B | 21.6 | 4.3 | 2 | 10/26/01 | 10/30/01 | 70.8 | | |
| Thallium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.04 | | |
| Vanadium | 6010B | 2.2 | 0.8 | 2 | 10/26/01 | 10/30/01 | 60.1 | | |
| Zinc | 6010B | 2.2 | 0.3 | 2 | 10/26/01 | 10/30/01 | 106 | | |

% Solids: 92.8

Comments:

00006

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2107852
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: WDES3
Lab Code: K2107852-002

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.7 | 7.5 | 2 | 10/26/01 | 10/30/01 | 19100 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/29/01 | 0.21 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/26/01 | 10/30/01 | 10.9 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 25.5 | | |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 2.40 | | |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.35 | | * |
| Calcium | 6010B | 10.7 | 4.3 | 2 | 10/26/01 | 10/30/01 | 5660 | | |
| Chromium | 200.8 | 0.2 | 0.1 | 5 | 10/26/01 | 10/30/01 | 30.9 | | N |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 16.2 | | |
| Copper | 6010B | 2.1 | 2.1 | 2 | 10/26/01 | 10/30/01 | 131 | | |
| Iron | 6010B | 4.3 | 0.7 | 2 | 10/26/01 | 10/30/01 | 33800 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/26/01 | 10/30/01 | 61.6 | | * |
| Magnesium | 6010B | 4.3 | 2.1 | 2 | 10/26/01 | 10/30/01 | 16700 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/26/01 | 10/30/01 | 751 | | |
| Mercury | 7471A | 0.01 | 0.01 | 1 | 10/24/01 | 10/25/01 | 0.41 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/26/01 | 10/30/01 | 48.3 | | |
| Potassium | 6010B | 427 | 11 | 2 | 10/26/01 | 10/30/01 | 407 | B | |
| Selenium | 7740 | 1.1 | 0.5 | 5 | 10/26/01 | 10/31/01 | 4.7 | | * |
| Silver | 6010B | 11 | 11 | 2 | 10/31/01 | 11/1/01 | 385 | | *N |
| Sodium | 6010B | 21.4 | 4.3 | 2 | 10/26/01 | 10/30/01 | 93.5 | | |
| Thallium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.11 | | |
| Vanadium | 6010B | 2.1 | 0.7 | 2 | 10/26/01 | 10/30/01 | 56.8 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/26/01 | 10/30/01 | 228 | | |

% Solids: 93.6

Comments:

00007

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2107852
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: WDWS1
Lab Code: K2107852-003

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.7 | 7.5 | 2 | 10/26/01 | 10/30/01 | 8300 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/29/01 | 0.26 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/26/01 | 10/30/01 | 41.6 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 17.7 | | |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.44 | | |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.05 | B | * |
| Calcium | 6010B | 10.7 | 4.3 | 2 | 10/26/01 | 10/30/01 | 867 | | |
| Chromium | 200.8 | 0.2 | 0.1 | 5 | 10/26/01 | 10/30/01 | 13.9 | | N |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 3.31 | | |
| Copper | 6010B | 2.1 | 2.1 | 2 | 10/26/01 | 10/30/01 | 42.7 | | |
| Iron | 6010B | 4.3 | 0.7 | 2 | 10/26/01 | 10/30/01 | 18800 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/26/01 | 10/30/01 | 78.2 | | * |
| Magnesium | 6010B | 4.3 | 2.1 | 2 | 10/26/01 | 10/30/01 | 5070 | | |
| Manganese | 6010B | 1.1 | 0.1 | 2 | 10/26/01 | 10/30/01 | 155 | | |
| Mercury | 7471A | 0.07 | 0.04 | 5 | 10/24/01 | 10/25/01 | 1.28 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/26/01 | 10/30/01 | 11.8 | | |
| Potassium | 6010B | 427 | 11 | 2 | 10/26/01 | 10/30/01 | 574 | | |
| Selenium | 7740 | 1.1 | 0.5 | 5 | 10/26/01 | 10/31/01 | 7.5 | | * |
| Silver | 6010B | 11 | 11 | 2 | 10/31/01 | 11/1/01 | 47.0 | | *N |
| Sodium | 6010B | 21.3 | 4.3 | 2 | 10/26/01 | 10/30/01 | 36.1 | | |
| Thallium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.07 | | |
| Vanadium | 6010B | 2.1 | 0.7 | 2 | 10/26/01 | 10/30/01 | 24.2 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/26/01 | 10/30/01 | 51.4 | | |

% Solids: 93.7

Comments:

00008

# METALS

-1-

## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOLID

Service Request: K2107852
Date Collected: 08/27/01
Date Received: 08/29/01
Units: MG/KG
Basis: Dry

Sample Name: WDWS3
Lab Code: K2107852-004

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.3 | 7.2 | 2 | 10/26/01 | 10/30/01 | 4990 | | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/29/01 | 0.14 | | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/26/01 | 10/30/01 | 18.1 | | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 8.30 | | |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.27 | | |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.07 | | * |
| Calcium | 6010B | 10.3 | 4.1 | 2 | 10/26/01 | 10/30/01 | 1050 | | |
| Chromium | 200.8 | 0.2 | 0.1 | 5 | 10/26/01 | 10/30/01 | 1.9 | | N |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 1.05 | | |
| Copper | 6010B | 2.1 | 2.1 | 2 | 10/26/01 | 10/30/01 | 40.1 | | |
| Iron | 6010B | 4.1 | 0.7 | 2 | 10/26/01 | 10/30/01 | 10300 | | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/26/01 | 10/30/01 | 66.4 | | * |
| Magnesium | 6010B | 4.1 | 2.1 | 2 | 10/26/01 | 10/30/01 | 1760 | | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/26/01 | 10/30/01 | 151 | | |
| Mercury | 7471A | 0.03 | 0.01 | 2 | 10/24/01 | 10/25/01 | 0.76 | | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/26/01 | 10/30/01 | 2.8 | | |
| Potassium | 6010B | 410 | 10 | 2 | 10/26/01 | 10/30/01 | 446 | | |
| Selenium | 7740 | 1.0 | 0.5 | 5 | 10/26/01 | 10/31/01 | 9.8 | | * |
| Silver | 6010B | 10 | 10 | 2 | 10/31/01 | 11/1/01 | 46.1 | | *N |
| Sodium | 6010B | 20.5 | 4.1 | 2 | 10/26/01 | 10/30/01 | 49.8 | | |
| Thallium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.04 | | |
| Vanadium | 6010B | 2.1 | 0.7 | 2 | 10/26/01 | 10/30/01 | 4.8 | | |
| Zinc | 6010B | 2.1 | 0.3 | 2 | 10/26/01 | 10/30/01 | 45.3 | | |

% Solids: 97.5

Comments:

00009

# METALS
-1-
## INORGANIC ANALYSIS DATA SHEET

Client: Limno-Tech, Inc.
Project No.: NA
Project Name: PDXMIN
Matrix: SOIL

Service Request: K2107852
Date Collected: NA
Date Received: NA
Units: MG/KG
Basis: Dry

Sample Name: Method Blank
Lab Code: K2107852-MB

| Analyte | Analysis Method | MRL | MDL | Dil. | Date Extracted | Date Analyzed | Result | C | Q |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | 6010B | 10.0 | 7.0 | 2 | 10/26/01 | 10/30/01 | 7.0 | U | |
| Antimony | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/29/01 | 0.01 | U | N |
| Arsenic | 200.8 | 0.5 | 0.1 | 5 | 10/26/01 | 10/30/01 | 0.1 | U | |
| Barium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.04 | B | |
| Beryllium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.01 | U | |
| Cadmium | 200.8 | 0.05 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.01 | U | * |
| Calcium | 6010B | 10.0 | 4.0 | 2 | 10/26/01 | 10/30/01 | 4.0 | U | |
| Chromium | 200.8 | 0.2 | 0.1 | 5 | 10/26/01 | 10/30/01 | 0.1 | U | N |
| Cobalt | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.01 | U | |
| Copper | 6010B | 2.0 | 2.0 | 2 | 10/26/01 | 10/30/01 | 2.0 | U | |
| Iron | 6010B | 4.0 | 0.7 | 2 | 10/26/01 | 10/30/01 | 0.7 | U | |
| Lead | 200.8 | 0.05 | 0.04 | 5 | 10/26/01 | 10/30/01 | 0.04 | U | * |
| Magnesium | 6010B | 4.0 | 2.0 | 2 | 10/26/01 | 10/30/01 | 2.0 | B | |
| Manganese | 6010B | 1.0 | 0.1 | 2 | 10/26/01 | 10/30/01 | 0.1 | U | |
| Mercury | 7471A | 0.02 | 0.01 | 1 | 10/24/01 | 10/25/01 | 0.01 | U | |
| Nickel | 200.8 | 0.3 | 0.2 | 5 | 10/26/01 | 10/30/01 | 0.2 | U | |
| Potassium | 6010B | 400 | 10 | 2 | 10/26/01 | 10/30/01 | 10 | U | |
| Selenium | 7740 | 1.0 | 0.5 | 5 | 10/26/01 | 10/31/01 | 0.5 | U | * |
| Silver | 6010B | 10 | 10 | 2 | 10/31/01 | 11/1/01 | 10 | U | *N |
| Sodium | 6010B | 20.0 | 4.0 | 2 | 10/26/01 | 10/30/01 | 4.0 | U | |
| Thallium | 200.8 | 0.02 | 0.01 | 5 | 10/26/01 | 10/30/01 | 0.01 | U | |
| Vanadium | 6010B | 2.0 | 0.7 | 2 | 10/26/01 | 10/30/01 | 0.7 | U | |
| Zinc | 6010B | 2.0 | 0.3 | 2 | 10/26/01 | 10/30/01 | 0.9 | B | |

% Solids: 100.0

Comments:

00010

# METALS
## - 5a -
## SPIKE SAMPLE RECOVERY

Client: Limno-Tech, Inc.
Service Request: K2107852
Project No.:
Units: MG/KG
Project Name: PDXMIN
Basis: Dry
Matrix: SOLID
% Solids: 92.8

Sample Name: WDES1S
Lab Code: K2107852-001S

| Analyte | Control Limit %R | Spike Result | C | Sample Result | C | Spike Added | %R | Q | Method |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | | 15900 | | 16300 | | 431 | -93 | | 6010B |
| Antimony | 70 - 130 | 22.2 | | 0.10 | | 108 | 20 | N | 200.8 |
| Arsenic | 70 - 130 | 187 | | 5.5 | | 216 | 84 | | 200.8 |
| Barium | 70 - 130 | 404 | | 11.8 | | 431 | 91 | | 200.8 |
| Beryllium | 70 - 130 | 9.34 | | 0.87 | | 10.8 | 78 | | 200.8 |
| Cadmium | 70 - 130 | 9.55 | | 0.40 | | 10.8 | 85 | | 200.8 |
| Chromium | 70 - 130 | 58.2 | | 30.2 | | 43.1 | 65 | N | 200.8 |
| Cobalt | 70 - 130 | 101 | | 13.6 | | 108 | 80 | | 200.8 |
| Copper | 75 - 125 | 154 | | 89.7 | | 53.9 | 119 | | 6010B |
| Iron | | 27700 | | 29900 | | 216 | -1019 | | 6010B |
| Lead | 70 - 130 | 126 | | 39.4 | | 108 | 80 | | 200.8 |
| Manganese | | 617 | | 546 | | 108 | 66 | | 6010B |
| Mercury | 60 - 130 | 0.92 | | 0.60 | | 0.31 | 104 | | 7471A |
| Nickel | 70 - 130 | 151 | | 38.6 | | 108 | 104 | | 200.8 |
| Selenium | 60 - 130 | 137 | | 54.1 | | 108 | 77 | | 7740 |
| Silver | 75 - 125 | 92.4 | | 97.5 | | 53.9 | -9 | N | 6010B |
| Thallium | 70 - 130 | 20.6 | | 0.04 | | 21.6 | 95 | | 200.8 |
| Vanadium | 75 - 125 | 158 | | 60.1 | | 108 | 91 | | 6010B |
| Zinc | 75 - 125 | 237 | | 106 | | 108 | 121 | | 6010B |

Comments:

0011

# METALS

- 6 -

## DUPLICATES

Client: Limno-Tech, Inc.
Service Request: K2107852
Project No.:
Units: MG/KG
Project Name: PDXMIN
Basis: Dry
Matrix: SOLID
% Solids: 92.8

Sample Name: WDES1D
Lab Code: K2107852-001D

| Analyte | Control Limit | Sample (S) | C | Duplicate (D) | C | RPD | Q | Method |
|---|---|---|---|---|---|---|---|---|
| Aluminum | | 16300 | | 15500 | | 5 | | 6010B |
| Antimony | 0.1 | 0.10 | | 0.11 | | 6 | | 200.8 |
| Arsenic | | 5.5 | | 4.1 | | 29 | | 200.8 |
| Barium | | 11.8 | | 11.3 | | 4 | | 200.8 |
| Beryllium | | 0.87 | | 0.74 | | 16 | | 200.8 |
| Cadmium | 0.1 | 0.40 | | 0.20 | | 64 | * | 200.8 |
| Calcium | | 17800 | | 17500 | | 2 | | 6010B |
| Chromium | | 30.2 | | 25.7 | | 16 | | 200.8 |
| Cobalt | | 13.6 | | 11.8 | | 14 | | 200.8 |
| Copper | | 89.7 | | 103 | | 14 | | 6010B |
| Iron | | 29900 | | 28900 | | 3 | | 6010B |
| Lead | | 39.4 | | 28.8 | | 31 | * | 200.8 |
| Magnesium | | 13300 | | 12100 | | 9 | | 6010B |
| Manganese | | 546 | | 527 | | 4 | | 6010B |
| Mercury | | 0.60 | | 0.58 | | 3 | | 7471A |
| Nickel | | 38.6 | | 34.0 | | 13 | | 200.8 |
| Potassium | 431.0 | 503 | | 509 | | 1 | | 6010B |
| Selenium | 4.3 | 54.1 | | 8.4 | | 146 | * | 7740 |
| Silver | | 97.5 | | 69.8 | | 33 | * | 6010B |
| Sodium | 21.6 | 70.8 | | 72.2 | | 2 | | 6010B |
| Thallium | 0.0 | 0.04 | | 0.03 | | 16 | | 200.8 |
| Vanadium | | 60.1 | | 56.8 | | 6 | | 6010B |
| Zinc | | 106 | | 121 | | 13 | | 6010B |

00012

# METALS

- 7 -

## LABORATORY CONTROL SAMPLE

Client: Limno-Tech, Inc. Service Request: K2107852

Project No.:

Project Name: PDXMIN

Aqueous LCS Source: Inorganic Ventures Solid LCS Source: ERA Lot 246

| Analyte | Aqueous mg/L True | Found | %R | Solid (mg/kg) True | Found | C | Limits | | %R |
|---|---|---|---|---|---|---|---|---|---|
| Aluminum | | | | 8270 | 10900 | | 4200 | 12300 | 132 |
| Antimony | | | | 12.7 | 24.7 | | 0.0500 | 39.5 | 194 |
| Arsenic | | | | 187 | 210 | | 139 | 235 | 112 |
| Barium | | | | 172 | 177 | | 132 | 212 | 103 |
| Beryllium | | | | 45.7 | 46.5 | | 36.0 | 55.6 | 102 |
| Cadmium | | | | 67.9 | 71.8 | | 52.0 | 83.6 | 106 |
| Calcium | | | | 10500 | 11500 | | 7840 | 13200 | 110 |
| Chromium | | | | 144 | 142 | | 115 | 173 | 99 |
| Cobalt | | | | 221 | 205 | | 176 | 266 | 93 |
| Copper | | | | 92.7 | 96.0 | | 75.9 | 109 | 104 |
| Iron | | | | 12700 | 15900 | | 7470 | 17900 | 125 |
| Lead | | | | 125 | 115 | | 95.2 | 155 | 92 |
| Magnesium | | | | 2750 | 3010 | | 2070 | 3430 | 109 |
| Manganese | | | | 388 | 429 | | 311 | 465 | 111 |
| Mercury | | | | 1.49 | 1.48 | | 0.852 | 2.12 | 99 |
| Nickel | | | | 78.0 | 80.6 | | 61.1 | 94.9 | 103 |
| Potassium | | | | 3580 | 4240 | | 2620 | 4540 | 118 |
| Selenium | | | | 154 | 154 | | 114 | 194 | 100 |
| Silver | | | | 90.0 | 91.0 | | 67.0 | 113 | 101 |
| Sodium | | | | 1020 | 1090 | | 692 | 1350 | 107 |
| Thallium | | | | 84.5 | 81.0 | | 48.4 | 121 | 96 |
| Vanadium | | | | 173 | 186 | | 118 | 228 | 108 |
| Zinc | | | | 273 | 311 | | 211 | 335 | 114 |

00013

# APPENDIX K

## Table K-1. Comparison of Water Concentrations (Total) to Human Health-Risk Based Screening Levels

| | Summary of Water Samples (total) | | | | Human Health Risk-Based Concentrations in Water (µg/L) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metal | Detection Frequency | Detection Limit (µg/L) | Minimum Detected (µg/L) | Maximum Detected (µg/L) | MCL[a] | EPA Water + Organism NRWQC[b] | EPA Organism NRWQC[b] | EPA Region IX PRG[c] | BLM Camper RMC[d] | BLM Boater RMC[d] | BLM Swimmer RMC[d] | Minimum Criterion Exceeded? |
| Aluminum | 8/9 | 40 | 478 | 17,100 | --- | --- | --- | 36,000 | --- | --- | --- | No |
| Antimony | 9/9 | 0.006 - 0.03 | 0.013 | 0.534 | 50 | 170 | 11,000 | 180 | 120 | 440 | 190 | No |
| Arsenic | 9/9 | 0.006 - 0.3 | 0.38 | 15.2 | 50 | **0.018** | **0.14** | **0.045** | 93 | 81 | 140 | **Yes** |
| Barium | 9/9 | 0.008 - 0.04 | 12.5 | 283 | 2,000 | 1,000 | --- | 2,600 | --- | --- | --- | No |
| Beryllium | 9/9 | 0.005 - 0.025 | 0.014 | 19.6 | **4** | --- | --- | 73 | --- | --- | --- | **Yes** |
| Cadmium | 9/9 | 0.005 | 0.009 | 7.59 | **5** | --- | --- | 18 | 160 | 550 | 240 | **Yes** |
| Calcium | 9/9 | 9 | 3,980 | 89,500 | --- | --- | --- | --- | --- | --- | --- | No |
| Chromium | 6/9 | 0.1 - 0.5 | 0.11 | 11.6 | 100 | --- | --- | 110[g] | --- | --- | --- | No |
| Cobalt | 9/9 | 0.005 - 0.025 | 0.052 | 64.7 | --- | --- | --- | 2,200 | --- | --- | --- | No |
| Copper | 9/9 | 0.04 - 0.2 | 1.01 | 117 | 1,300[e] | 1,300 | --- | 1,400 | 11,000 | 41,000 | 18,000 | No |
| Cyanide | 0/11 | 3 | ND | ND | 200[f] | 700 | 220,000 | 6,200 | --- | --- | --- | No |
| Iron | 9/9 | 5 | 56.2 | 23,300 | --- | **300** | --- | **11,000** | **50** | **50** | **50** | **Yes** |
| Lead | 9/9 | 0.007 - 0.035 | 0.145 | 67.3 | **15**[e] | --- | --- | --- | --- | --- | --- | **Yes** |
| Magnesium | 9/9 | 9 | 664 | 20,600 | --- | --- | --- | --- | **1,500** | **5,500** | **2,400** | **Yes** |
| Manganese | 9/9 | 0.4 | 10.1 | 4,010 | --- | **50** | **100** | **880** | **93** | **330** | **140** | **Yes** |
| Mercury | 9/9 | 0.0002 - 0.02 | 0.0052 | 3.92 | **2** | **0.05** | **0.051** | 11 | 6,200 | 22,000 | 9,600 | **Yes** |
| Nickel | 9/9 | 0.1 - 0.5 | 0.27 | 60.5 | --- | 610 | 4,600 | 730[h] | --- | --- | --- | No |
| Potassium | 9/9 | 40 | 903 | 9,580 | --- | --- | --- | --- | --- | --- | --- | No |
| Selenium | 1/9 | 1 | 1.1 | 1.1 | 6 | 14 | 4,300 | 15 | 1,500 | 5,500 | 2,400 | No |
| Silver | 9/9 | 0.003 - 0.015 | 0.015 | 12.2 | --- | --- | --- | 180 | 1,500 | 5,500 | 2,400 | No |
| Sodium | 9/9 | 30 | 2,960 | 9,780 | --- | --- | --- | --- | --- | --- | --- | No |
| Thallium | 9/9 | 0.003 - 0.015 | 0.005 | 0.275 | 2 | 1.7 | 6.3 | 2.4 | --- | --- | --- | No |
| Vanadium | 1/9 | 5 | 33.6 | 33.6 | --- | --- | --- | 260 | 93,000 | 330,000 | 140,000 | No |
| Zinc | 9/9 | 1 | 1.5 | 2,150 | --- | 9,100 | 69,000 | 11,000 | --- | --- | --- | No |

[a] Maximum Contaminant Level (U.S. EPA, 2001)

[b] National Recommended Water Quality Criteria (NRWQC) (U.S. EPA, 1999)

[c] US EPA Region IX, 2000

[d] Ford, 1996

[e] "Action Level" (U.S. EPA, 2001)

[f] Free cyanide

[g] Chromium III value

[h] Soluble salts

ND Nondetect

Criteria that are exceeded are bolded

## Table K-2. Comparison of Water Concentrations (Dissolved) to Ecological-Risk Based Screening Levels

| | Summary of Water Samples (dissolved) | | | | Aquatic Life Risk-Based Concentrations in Water (µg/L) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Metal | Detection Frequency | Detection Limit (µg/L) | Minimum Detected (µg/L) | Maximum Detected (µg/L) | NRWQC Freshwater CMC[a] | NRWQC Freshwater CCC[b] | U.S. EPA Tier II SAC[e] | U.S. EPA Tier II SCV[f] | Minimum Criterion Exceeded? |
| Aluminum | 8/9 | 44 | 108 | 10,700 | **750** | **87** | --- | --- | Yes |
| Antimony | 9/9 | 0.006 | 0.074 | 0.346 | --- | --- | 180[g] | 30[g] | No |
| Arsenic | 9/9 | 0.06 | 0.2 | 1.39 | 340[h] | 150[h] | 66[i] | 3.1[i] | No |
| Barium | 9/9 | 0.008 | 10.6 | 176 | --- | --- | **110** | **4** | **Yes** |
| Beryllium | 9/9 | 0.005 | 0.011 | 16.7 | --- | --- | 35 | **0.66** | Yes |
| Cadmium | 8/9 | 0.005 | 0.017 | 5.54 | **4.3**[j] | **2.2**[j] | --- | --- | **Yes** |
| Calcium | 9/9 | 10 | 3,930 | 81,900 | --- | --- | --- | --- | No |
| Chromium | 4/9 | 0.1 | 0.15 | 1.02 | 16[k] | 11[k] | --- | --- | No |
| Cobalt | 9/9 | 0.005 | 0.018 | 61.1 | --- | --- | 1,500 | **23** | **Yes** |
| Copper | 9/9 | 0.04 | 0.86 | 89.1 | **13**[j] | **9**[j] | --- | --- | Yes |
| Iron | 9/9 | 5.6 | 44.3 | 474 | --- | --- | --- | --- | No |
| Lead | 9/9 | 0.007 | 0.035 | 2.38 | 65[j] | 2.5[j] | --- | --- | No |
| Magnesium | 9/9 | 10 | 652 | 18,100 | --- | --- | --- | --- | No |
| Manganese | 9/9 | 0.4 | 3 | 3,560 | --- | --- | **2,300** | **120** | **Yes** |
| Mercury | 9/9 | 0.0002 - 0.002 | 0.0007 | 0.248 | 1.4 | 0.77 | --- | 1.3[m] | No |
| Nickel | 9/9 | 0.1 | 0.22 | 52.4 | 470[j] | **52**[j] | --- | --- | **Yes** |
| Potassium | 9/9 | 44 | 15,100 | 22,600 | --- | --- | --- | --- | No |
| Selenium | 1/9 | 1 | 1.7 | 1.7 | --- | 5 | --- | --- | No |
| Silver | 9/9 | 0.003 | 0.006 | 0.615 | 3.4[j] | --- | --- | **0.36** | **Yes** |
| Sodium | 9/9 | 33 | 2,650 | 8,950 | --- | --- | --- | --- | No |
| Thallium | 9/9 | 0.003 | 0.007 | 0.191 | --- | --- | 110 | 12 | No |
| Vanadium | 1/9 | 5.6 | 7 | 7 | --- | --- | 280 | 20 | No |
| Zinc | 9/9 | 1.1 | 4 | 2,000 | **120**[j] | **120**[j] | --- | --- | **Yes** |

[a] National Recommended Water Quality Criteria (NRWQC) Criteria Maximum Concentration (CMC); "...an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect." (U.S. EPA, 1999)

[b] National Recommended Water Quality Criteria (NRWQC) Criteria Continuous Concentration (CCC); "...an estimate of the highest continuous concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect." (U.S. EPA, 1999)

[c] National Ambient Water Quality Criteria for acute exposure (Suter and Tsao, 1996)

[d] National Ambient Water Quality Criteria for chronic exposure (Suter and Tsao, 1996)

[e] Tier II SAC: Secondary Acute Value (Suter and Tsao, 1996)

[f] Tier II SCV: Secondary Chronic Value (Suter and Tsao, 1996)

[g] Draft Final Acute Value (FAV) and Final Chronic Value (FCV) (EPA, 1988b)

[h] Arsenic III

[i] Arsenic IV

[j] Hardness dependent criterion normalized to 100 mg/L

[k] Chromium VI

[l] Inorganic or total mercury

Criteria that are exceeded are bolded

## Table K-3. Comparison of Soil/Sediment Concentrations to Human Health-Risk Based Screening Levels

| | Summary of Soil/ Sediment Samples | | | | Human Health Risk-Based Concentrations in Soil/Sediment (mg/kg) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metal | Detection Frequency | Detection Limit (mg/kg) | Minimum Detected (mg/kg) | Maximum Detected (mg/kg) | EPA Region IX PRG[a] | BLM Resident-Soil[b] | BLM Camper-Soil[b] | BLM ATV Driver-Soil[b] | BLM Worker-Soil[b] | BLM Surveyor-Soil[b] | BLM Camper-Sediment[b] | BLM Boater-Sediment[b] | BLM Swimmer-Sediment[b] | Minimum Criterion Exceeded? | Minimum Infrequent Site Visitor Criterion Exceeded? |
| Aluminum | 18/18 | 7 - 8.4 | 1,980 | 30,100 | 76,000 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Antimony | 16/18 | 0.01 | 0.05 | 3.52 | 31 | 3 | 50 | 750 | 100 | 600 | 62 | 221 | 96 | **Yes** | No |
| Arsenic | 18/18 | 0.1 - 0.5 | 1.7 | 540 | **0.39**[c] | 1 | **20** | **300** | **12** | **100** | **46** | **170** | **72** | **Yes** | **Yes** |
| Barium | 18/18 | 0.01 | 9.99 | 188 | 5,400 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Beryllium | 18/18 | 0.01 | 0.14 | 9.22 | 150 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Cadmium | 18/18 | 0.01 | 0.05 | 1.14 | 37 | 3 | 70 | 950 | 100 | 800 | 160 | 550 | 240 | No | No |
| Calcium | 18/18 | 4 - 5 | 107 | 21,000 | 100,000[d] | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Chromium | 18/18 | 0.04 | 0.59 | 57.2 | 210[e] | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Cobalt | 18/18 | 0.01 | 0.25 | 32.8 | 4,700 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Copper | 18/18 | 0.1 | 3.1 | 180 | 2,900 | 250 | 5,000 | 70,000 | 7,400 | 59,000 | 5,700 | 21,000 | 8,900 | No | No |
| Cyanide | 0/5 | 0.2 | ND | ND | 11 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Iron | 18/18 | 0.7 - 0.8 | 3,370 | 64,300 | **23,000** | --- | --- | --- | --- | --- | --- | --- | --- | **Yes** | --- |
| Lead | 18/18 | 0.04 - 0.41 | 2.6 | 204 | 400 | 400 | 1,000 | 1,000 | 2,000 | 2,000 | 1,000 | 1,000 | 1,000 | No | No |
| Magnesium | 18/18 | 2 - 2.4 | 112 | 29,000 | 100,000[d] | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Manganese | 18/18 | 0.1 | 20.5 | 1,200 | 1,800 | **960** | 19,000 | 250,000 | 28,000 | 220,000 | 22,000 | 77,000 | 34,000 | **Yes** | No |
| Mercury | 18/18 | 0.01 - 1.95 | 0.11 | 91.8 | **23** | **2** | **40** | 550 | **60** | 480 | **46** | 170 | **72** | **Yes** | **Yes** |
| Nickel | 18/18 | 0.2 | 0.6 | 99.4 | 1,600 | 135 | 2,700 | 38,000 | 4,000 | 32,000 | 3,100 | 11,000 | 4,800 | No | No |
| Potassium | 18/18 | 10 - 12 | 283 | 2,810 | 100,000[d] | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Selenium | 8/18 | 1 - 1.2 | 1.6 | 29.3 | 390 | 35 | 700 | 9,600 | 1,000 | 8,000 | 770 | 2,800 | 1,200 | No | No |
| Silver | 18/18 | 0.002 - 0.077 | 0.251 | 218 | 390 | **35** | 700 | 9,600 | 1,000 | 8,000 | 770 | 2,800 | 1,200 | **Yes** | No |
| Sodium | 18/18 | 4 - 4.8 | 13.4 | 701 | 100,000[d] | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Thallium | 18/18 | 0.002 | 0.021 | 0.303 | 5.2 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Vanadium | 18/18 | 1 - 1.2 | 1.5 | 108 | 550 | --- | --- | --- | --- | --- | --- | --- | --- | No | --- |
| Zinc | 18/18 | 0.3 - 0.4 | 8 | 328 | 23,000 | 2,000 | 4,000 | 550,000 | 6,000 | 480,000 | 46,000 | 170,000 | 72,000 | No | No |

[a] U.S. EPA Region IX, 2000, unless otherwise indicated

[b] Ford, 1999

[c] Cancer endpoint - most conservative

[d] Calculated from FDA Reference Daily Intake (RDI) using U.S. EPA Region IX PRG calculations

[e] Assumes 1:6 ratio of Cr VI to Cr III

ND Nondetect

Criteria that are exceeded are bolded

## Table K-4. Comparison of Soil/Sediment Concentrations to Ecological-Risk Based Screening Levels for Soil

| | Summary of Soil Samples | | | Terrestrial Biota Health Risk-Based Concentrations in Soil (mg/kg) | | | BLM Wildlife Health Risk-Based Concentrations in Soil (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Metal | Detection Frequency | Detection Limit (mg/kg) | Minimum Detected (mg/kg) | Maximum Detected (mg/kg) | Phyto-toxicity[a] | Earthworm Toxicity[b] | Microbe Toxicity[b] | RMC-Deer Mouse[c] | RMC-Cotton-tail[c] | RMC-Mule Deer[c] | RMC-Mallard[c] | RMC-Robin[c] | Minimum Criterion Exceeded? |
| Aluminum | 12/12 | 7 - 8.2 | 3,020 | 30,100 | **50** | --- | **600** | --- | --- | --- | --- | --- | Yes |
| Antimony | 12/12 | 0.01 | 0.06 | 3.52 | 5 | --- | --- | --- | --- | --- | --- | --- | No |
| Arsenic | 12/12 | 0.1 - 0.5 | 6.5 | 241 | **10** | 60 | **100** | **230** | 440 | 200 | 120 | 4 | Yes |
| Barium | 12/12 | 0.01 | 15.9 | 187 | 500 | --- | 3,000 | --- | --- | --- | --- | --- | No |
| Beryllium | 12/12 | 0.01 | 0.2 | 9.22 | 10 | --- | --- | --- | --- | --- | --- | --- | No |
| Cadmium | 12/12 | 0.01 | 0.07 | 1.14 | 4 | 20 | 20 | 7 | 6 | 3 | 1 | **0.3** | Yes |
| Calcium | 12/12 | 4 - 5 | 447 | 21,000 | --- | --- | --- | --- | --- | --- | --- | --- | No |
| Chromium | 12/12 | 0.04 | 1.32 | 57.2 | 1 | **0.4** | **10** | --- | --- | --- | --- | --- | Yes |
| Cobalt | 12/12 | 0.01 | 0.25 | 32.8 | **20** | --- | 1,000 | --- | --- | --- | --- | --- | Yes |
| Copper | 12/12 | 0.1 | 3.2 | 126 | **100** | **50** | **100** | 640 | 360 | 100 | 140 | 7 | Yes |
| Cyanide | 0/5 | 0.2 | ND | ND | --- | --- | --- | --- | --- | --- | --- | --- | No |
| Iron | 12/12 | 0.7 - 0.8 | 3,650 | 64,300 | --- | --- | **200** | --- | --- | --- | --- | --- | Yes |
| Lead | 12/12 | 0.04 - 0.41 | 13.8 | 204 | **50** | 500 | 900 | **140** | **170** | **110** | **59** | 6 | Yes |
| Magnesium | 12/12 | 2 - 2.3 | 271 | 29,000 | --- | --- | --- | --- | --- | --- | --- | --- | No |
| Manganese | 12/12 | 0.1 | 20.5 | 1,200 | **500** | --- | **100** | --- | --- | --- | --- | --- | Yes |
| Mercury | 12/12 | 0.01 - 1.95 | 0.25 | 91.8 | **0.3** | **0.1** | 30 | 2 | **15** | 9 | 4 | 1 | Yes |
| Nickel | 12/12 | 0.2 | 0.6 | 99.4 | **30** | --- | 90 | --- | --- | --- | --- | --- | Yes |
| Potassium | 12/12 | 10 - 12 | 283 | 2,810 | --- | --- | --- | --- | --- | --- | --- | --- | No |
| Selenium | 7/12 | 1 - 1.2 | 1.6 | 29.3 | **1** | 70 | 100 | --- | --- | --- | --- | --- | Yes |
| Silver | 12/12 | 0.002 - 0.077 | 0.633 | 218 | **2** | --- | **50** | --- | --- | --- | --- | --- | Yes |
| Sodium | 12/12 | 4 - 4.7 | 13.8 | 701 | --- | --- | --- | --- | --- | --- | --- | --- | No |
| Thallium | 12/12 | 0.002 | 0.069 | 0.303 | 1 | --- | --- | --- | --- | --- | --- | --- | No |
| Vanadium | 12/12 | 1 - 1.2 | 4.8 | 108 | **2** | --- | 20 | --- | --- | --- | --- | --- | Yes |
| Zinc | 12/12 | 0.3 - 0.4 | 11.7 | 328 | **50** | **200** | **100** | 420 | 370 | **220** | 200 | 43 | Yes |

[a] Efroymson *et al*., 1997a

[b] Will and Suter, 1995

[c] Ford, 1996

Criteria that are exceeded are bolded

## Table K-5. Comparison of Sediment Concentrations to Ecological-Risk Based Screening Levels for Sediment

| | Summary of Sediment Samples | | | | Aquatic Biota Health Risk-Based Concentrations in Sediment | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Metal | Detection Frequency | Detection Limit (mg/kg) | Minimum Detected (mg/kg) | Maximum Detected (mg/kg) | EPA ARCS TEC[a] | EPA ARCS PEC[b] | EPA ARCS NEC[c] | EPA Region IV Screening Level[d] | EPA OSWER Ecotox Threshold[d] | Minimum Criterion Exceeded? |
| Aluminum | 6/6 | 7.1 - 8.4 | 1,980 | 21,000 | --- | 58,030 | 73,160 | --- | --- | No |
| Antimony | 4/6 | 0.01 | 0.05 | 1.18 | --- | --- | --- | 12 | --- | No |
| Arsenic | 6/6 | 0.1 - 0.5 | 1.7 | 540 | **12.1** | **57** | **92.9** | **7.24** | **8.2** | **Yes** |
| Barium | 6/6 | 0.01 | 9.99 | 188 | --- | --- | --- | --- | --- | No |
| Beryllium | 6/6 | 0.01 | 0.14 | 1.13 | --- | --- | --- | --- | --- | No |
| Cadmium | 6/6 | 0.01 | 0.05 | 0.33 | 0.592 | 11.7 | 41.1 | 1 | 1.2 | No |
| Calcium | 6/6 | 4 - 5 | 107 | 861 | --- | --- | --- | --- | --- | No |
| Chromium | 6/6 | 0.04 | 0.59 | 8.24 | 56 | 159 | 312 | 52.3 | 81 | No |
| Cobalt | 6/6 | 0.01 | 0.49 | 4.21 | --- | --- | --- | --- | --- | No |
| Copper | 6/6 | 0.1 | 3.1 | 180 | **28** | **77.7** | **54.8** | **18.7** | **34** | **Yes** |
| Iron | 6/6 | 0.7 - 0.8 | 3,370 | 27,400 | --- | --- | --- | --- | --- | No |
| Lead | 6/6 | 0.04 - 0.05 | 2.6 | 193 | **34.2** | 396 | **68.7** | **30.2** | **47** | **Yes** |
| Magnesium | 6/6 | 2 - 2.4 | 112 | 2,680 | --- | --- | --- | --- | --- | No |
| Manganese | 6/6 | 0.1 | 32.7 | 320 | 1,673 | 1,081 | 819 | --- | --- | No |
| Mercury | 6/6 | 0.01 - 0.05 | 0.11 | 1.83 | --- | --- | --- | **0.13** | **0.15** | **Yes** |
| Nickel | 6/6 | 0.2 | 1 | 7.8 | 39.6 | 38.5 | 37.9 | 15.9 | 21 | No |
| Potassium | 6/6 | 10 - 12 | 318 | 2,490 | --- | --- | --- | --- | --- | No |
| Selenium | 1/6 | 1 - 1.2 | 5.4 | 5.4 | --- | --- | --- | --- | --- | No |
| Silver | 6/6 | 0.002 - 0.015 | 0.251 | 61.1 | --- | --- | --- | **2** | --- | **Yes** |
| Sodium | 6/6 | 4 - 4.8 | 13.4 | 146 | --- | --- | --- | --- | --- | No |
| Thallium | 6/6 | 0.002 | 0.021 | 0.217 | --- | --- | --- | --- | --- | No |
| Vanadium | 6/6 | 1 - 1.2 | 1.5 | 28.1 | --- | --- | --- | --- | --- | No |
| Zinc | 6/6 | 0.3 - 0.4 | 8 | 81.1 | 159 | 1,532 | 541 | 124 | 150 | No |

[a] U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) Threshold Effect Concentration (TEC)(Jones *et al*., 1997)

[b] U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) Probable Effect Concentration (PEC)(Jones *et al*., 1997)

[c] U.S. EPA Assessment and Remediation of Contaminated Sediments Program (ARCS) high No Effect Concentration (NEC) (Jones *et al*., 1997)

[d] Jones *et al*., 1997

Criteria that are exceeded are bolded