FINAL

SITE INSPECTION REPORT
BLUE LEDGE MINE
ROGUE RIVER-SISKIYOU NATIONAL FOREST

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LIST OF ACRONYMS

ALC	aquatic life criteria
AMD	acid mine drainage
ASARCO	American Smelting and Refining Company
ASTM	American Society of Testing and Materials
ATLs	Acceptable Tissue Levels
B-IBI	Benthic Index of Biotic Integrity
CCC	continuous chronic concentration
COPCs	human health chemicals of potential concern
CPECs	chemicals of potential ecological concern
CRSLs	California regional soil levels
CTLs	Critical Tissue Levels
DEQ	Oregon Department of Environmental Quality
Eco-SSLs	USEPA Ecological Soil Screening Levels
EE/CA	engineering evaluation/cost analysis
HQ	hazard quotient
MCL	Maximum Contaminant Level
mg/kg	milligram per kilogram
mg/L	milligrams per liter
MRL	method reporting limit
PAS	Preassessment Screen
PA/SI	Preliminary Assessment/Site Inspection
PEC	probable effect concentration
PECR	potential excess cancer risk
RFP	request for pricing
RSL	Regional Screening Level
SAP	sampling and analysis plan
SI	site inspection
SL-ERE	screening-level ecological risk evaluation
SL-HHRE	screening-level human health risk evaluation
SLV	screening level value
SPLP	Synthetic Precipitation Leaching Procedure
START	Superfund Technical Assessment and Response Team
SOU	Southern Oregon University
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TEC	threshold effect concentration
TSS	total suspended solids
ug/L	microgram per liter
URS	URS Corporation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

EXECUTIVE SUMMARY

The Blue Ledge Mine site (Site) is an inactive copper mine site located primarily on patented land within the Rogue River-Siskiyou National Forest in Siskiyou County, California. The Site is located approximately three miles south of the Oregon-California border, approximately thirty-three miles southwest of Jacksonville, Oregon as shown on Figure 1. The Site lies at the upper headwaters of the Joe Creek watershed, on a steep, generally north-facing hillslope above the confluence of Joe Creek and an unnamed tributary to Joe Creek. Joe Creek flows north to Elliott Creek, which in turn is a tributary to the Middle Fork of the Applegate River. The Applegate River flows north across the California-Oregon border to Applegate Reservoir, and from there to the Rogue River near Grants Pass, Oregon as shown on Figure 2.

The mine includes at least six adits as well as two large deposits of mine waste rock and two smaller waste rock deposits as shown on Figure 5. These deposits have been estimated to weigh approximately 44,000 tons. One of the two large deposits extends down a north-facing slope to Joe Creek below its confluence with Tributary 4. The other large deposit extends down a northeast-facing slope towards Tributary 4 above its confluence with Joe Creek. The two small deposits are located north and south of the larger deposits, on slopes leading directly to Joe Creek or the tributary. Groundwater discharges from the adits and from seeps. One seep was observed to flow directly into the channel that diverts flow from the lower adit to the settling pond and over the log dam ultimately discharging into Joe Creek.

Prior investigations demonstrated that releases of acid mine drainage (AMD) are a historic and ongoing condition at the mine that have adversely impacted groundwater, surface water, soil, and sediment. URS Corporation (URS) work conducted in 2008 confirms these previous findings. Mine waste rock has been described as being highly productive in terms of creation of AMD and releases of metals and sulfuric acid. Exceedances of primary drinking water standards have been documented previously for cadmium, copper, and acidity, and additional exceedances of secondary drinking water standards have been documented for copper, iron, and zinc. As part of the Blue Ledge Site Investigation (SI) drinking water source samples were collected from residences' nearest the Site in Joe Bar. No parameters exceeded either the Federal or California State regulatory Maximum Contaminant Levels (MCLs). All samples exceeded the conservative United States Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for tap water for arsenic. However, there is not enough data at this time to determine the source of arsenic in these drinking water samples.

Investigations identified numerous exceedances of aquatic life criteria (ALCs). In particular, metals concentrations in Joe Creek and Elliott Creek surface water are much higher than those found to result in adverse affects and high mortality rates in rainbow trout and other fish (Environmental International Ltd., 2002). The adverse affects to aquatic organisms indicated by the surface water chemistry have been confirmed by surveys of fish, amphibians, and macroinvertebrates. Fish survey data confirmed there are no fish in Joe Creek. Macroinvertebrate populations in Joe Creek downstream of the Site are also significantly degraded. Two amphibians were observed in the lowest reaches of Joe Creek during this investigation, near locations where previous surveys also observed them. However, when compared to observations of amphibian populations above the mine, it is apparent that these populations are also significantly impacted due to AMD releases from the Site.

Migration pathways associated with affected media are resulting in risk to human and ecological receptors. The absence of fish in Joe Creek provides conclusive evidence that mine-related impacts to sediment and/or surface water quality are preventing fish species, which are known to be present in Elliott Creek and the Middle Fork of the Applegate River, and all other similar stream classes in the Elliott Creek watershed, from occupying Joe Creek. Significant impact to Joe Creek is also demonstrated by macroinvertebrate surveys which show significant reductions in macroinvertebrates between the Site and the confluence of Joe Creek and Elliott Creek.

The objectives of the SI include addressing data gaps remaining from the previous investigations, assessing risk associated with mine-affected media, and evaluating three potential disposal sites (referred to herein as "repositories") for mine-affected media as part of an Engineering Evaluation/Cost Analysis (EE/CA) of potential removal options. To meet this objective, the SI included the following three major elements:

- Further assessment of ongoing or potential mine-related impacts to upland and freshwater aquatic habitats and their associated media via collection and laboratory analysis of groundwater, surface water, soil, waste rock, sediment, and fish tissue samples.
- Assessment of the ongoing or potential risk to human and ecological receptors from exposure to contaminated media via completion of screening-level human health and ecological risk evaluations.
- Subsurface investigation of the repositories and collection of soil samples from these areas and waste rock samples from the Site for geotechnical laboratory analysis.

The results of the geotechnical analysis of the repository area will be used and presented as part of the EE/CA. Concerning the assessment of mine-related impacts and their associated effects on human and ecological receptors, the SI resulted in the following conclusions:

Groundwater Pathway

Groundwater discharges from seeps and adits at the Site and flows overland as surface water directly into Joe Creek. URS sampled groundwater as it emerges from two adits and two seeps. Dissolved metals in groundwater discharging from seeps and adits are present at high concentrations that result in an unacceptable risk to human and ecological receptors.

In addition to the observed discharge of contaminated groundwater from the adits and seeps directly to surface water, an additional likely complete migration pathway for the discharge of contaminated groundwater to Joe Creek is through the infiltration of precipitation into waste rock. As the precipitation infiltrates through the waste rock it becomes contaminated with metals, the downslope flow of that precipitation as groundwater discharges directly to Joe Creek as base flow. So long as waste rock remains at the Site, discharge of contaminated groundwater to Joe Creek will likely continue into the foreseeable future.

Surface Water Pathway

The surface water pathway is complete for both human and ecological receptors. Plots of cadmium, copper, and zinc concentrations in Joe Creek surface water clearly indicate that the Site is a significant source of these metals in Joe Creek. Surface water at the Site and in Joe Creek downstream of the Site exceeds ecological surface water criteria for copper, cadmium and zinc. Elevated concentrations of cadmium, copper and zinc are also detected in the emerging groundwater below the log dam in the run-off channel that discharges to Joe Creek. Due to these elevated concentrations, these locations should be considered as potential hot spots for ecological risk.

For human health risk from exposure to surface water, only consumption of fish was considered a significant exposure pathway. Fish collected in Elliott Creek, the Middle Fork Applegate River downstream of the mouth of Elliott Creek, and the head of Applegate Reservoir contain unsafe concentrations of arsenic in regard to human consumption, and only arsenic was present in surface water at concentrations that exceeded the related screening criteria at a number of locations.

Soil Pathway

The pathway for riparian soils is complete for both ecological and human receptors. Riparian soils adjacent to Joe Creek contain arsenic at concentrations that result in unacceptable ecological risk. Excess cancer risks, as calculated in the risk evaluation (Appendix B), are present for arsenic in riparian soils

along Joe Creek, Elliott Creek, and the Middle Fork Applegate River. However, surface water and sediment data indicate that the Site is not a source of arsenic.

Waste Rock Pathway

Site workers moving or removing waste rock could be exposed to metals through incidental ingestion of waste rock particles, dermal contact with waste rock materials, and inhalation of fine particles of waste rock or dust containing metals from the waste rock. These same exposures are possible for short-term visitors, although the exposure durations are likely to be less for visitors than for workers.

Sediment Pathway

The sediment pathway is complete for human and ecological receptors. Plots of cadmium, copper, lead, and zinc concentrations in Joe Creek sediment clearly indicate that the Site is a significant source of these metals in Joe Creek. Cadmium, copper, and zinc in Joe Creek sediments are present at concentrations that result in an unacceptable risk to ecological receptors. Copper is also present in Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir sediments at concentrations that result in an unacceptable risk to ecological receptors.

Removal Action Justification

The results of the SI, combined with the results of previous investigations, clearly demonstrate that a removal action is justified. Factors required for consideration in determination of the appropriateness of a removal action as stated in 40 CFR 300.415 (shown in italicized bold font) and the associated justifications are summarized below.

- ***Actual or potential exposure nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.***

  The Site is a historic and ongoing source of AMD from adits and waste rock areas resulting in impacts to groundwater, surface water, and sediment quality. Releases of AMD pose unacceptable human health and ecological risks within the immediate area and downstream to Applegate Reservoir. These impacts are already apparent through the absence of fish and amphibians and significant reductions in the macroinvertebrate populations in Joe Creek, demonstrating the watershed-scale level of impacts that the Site is having. Barring a removal action, fish are unlikely to return to Joe Creek in the foreseeable future.

- ***Actual or potential contamination of drinking water supplies or sensitive ecosystems.***

  Sensitive, threatened and endangered species have been identified in the vicinity of the Site. The northern goshawk is a United States Fish and Wildlife Service (USFWS) candidate species. The Siskiyou Mountain salamander is listed as a United States Forest Service (USFS) sensitive species and a California-endangered species. The northern bald eagle and the northern spotted owl also reside in the area and are both federally listed threatened species.

  Besides those impacts already observed, continued discharge of contaminants from the Site combined with downstream transport of contaminants in surface water and sediment could potentially result in future elevated levels of contamination in aquatic environments and risk to human and ecological receptors as far downstream as Applegate Reservoir.

- ***Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.***

A log dam is located at the bottom of the waste rock covered slopes in the run-off channel that discharges to Joe Creek. Eroded waste rock has settled and accumulated behind this dam, if it were to fail these wastes would be released into Joe Creek.

- ***High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate.***

  Metals are transported from the Site via sediment transport. Cadmium, copper, lead and zinc concentrations in sediments along the segment of Joe Creek between the Site and Elliott Creek are significantly elevated compared to background samples, indicating the Site is a significant source of the metals in Joe Creek sediment. The sediment transport mechanism is further substantiated by the trend of these same metals also increasing in the reach of Joe Creek between the Site and Elliott Creek.

  Barring a removal action, all of the impacts, contamination, and human and ecological risk will continue into the indefinite future due to the discharge of groundwater, surface water, and sediment from the Site.

- ***Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.***

  Periods of high precipitation and surface runoff erode the waste rock and transport waste material as sediment to Joe Creek.

- ***The availability of other appropriate federal or stated response mechanisms to respond to the release.***

  Previous actions by the USEPA have attempted to mitigate the release of metals from the Site, but these actions do not appear to have been fully effective as metals continue to be found in surface water downstream from the Site. These actions included the resurfacing of the waste rock piles, redirection of AMD into a marble lined channel, and creation of a settling pond behind a log dam. Within one year of its' construction, the detention pond behind the dam was filled with sediment.

- ***Other situations or factors that may pose threats to public health or welfare of the United States or the environment.***

  Continued discharge of contaminants from the Site combined with downstream transport of contaminants in surface water and sediment could potentially result in future elevated levels of contamination in aquatic environments and risk to human and ecological receptors as far downstream as Applegate Reservoir. The reservoir was constructed in 1980, and now acts as a trap and accumulation point for contaminated sediments.

1.0 INTRODUCTION AND OBJECTIVES

This report communicates the results of a SI completed by URS at the Site located in northern California about three miles south of the Oregon-California border (Figures 1 and 2). The SI was performed in accordance with the sampling and analysis plan (SAP) prepared by URS and approved by the USFS. The SAP was developed based on the scope of work in the Request for Pricing (RFP) #R6-27-06-113 provided by the USFS and in accordance with the USEPA guidance for conducting Preliminary Assessment/Site Inspections (PA/SIs) (USEPA, 1992a).

The objective of the SI was to address data gaps remaining from the previous investigations at the Site, to assess risk associated with mine-affected media, and to evaluate potential repositories as part of an EE/CA. The objectives of the SI were developed based on issues identified during the PA/SI completed by Weston in 2004, as well as on the results of other previous investigations at the Site. Together these investigations indicate the Site is a historic and ongoing source of contamination that has adversely affected the Joe Creek watershed. To meet these objectives, the SI included the following three major elements:

- Further assessment of mine-related impacts to upland and freshwater aquatic habitats and their associated media via collection and laboratory analysis of groundwater, surface water, soil, waste rock, sediment, and fish tissue samples.
- Assessment of ongoing risk to human and ecological receptors from exposure to contaminated media via completion of screening-level human health and ecological risk evaluations.
- Subsurface investigation of the repositories and collection of soil samples from these areas and waste rock samples from the mine Site for geotechnical laboratory analysis.

2.0 SITE DESCRIPTION, OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

This section provides a summary of the Site location and operational history, and describes the wastes associated with the Site. The Preassessment Screen (PAS) (Environment International Ltd., 2002) and other documents provide detailed descriptions of the Site location and the operational history of the mine. Relevant information provided by these documents is summarized below.

2.1 Location

- The Site includes an inactive mine located approximately three miles south of the Oregon-California border, on privately-owned land within the Rogue River-Siskiyou National Forest, in Siskiyou County, California (Figure 1).
- The latitude/longitude coordinates of the Site are 41˚57'36" North Latitude/123˚05'60" West Longitude.
- The Site is found on the U.S. Geological Survey (USGS) 7 ½ Minute Quadrangle Map – Dutch Creek, California.
- To access the mine from the north, proceed south on Upper Applegate Road (Highway 10), continue south on USFS Road 1040 (Figure 1). USFS 1040 merges with USFS 1050 just south of the Oregon-California border. Turn right at the intersection of USFS 1060 crossing Elliott Creek in the small community of Joe Bar, California. Continue 3.5 miles south on USFS 1060 to the Site.
- The Joe Creek watershed includes four unnamed tributaries referred to previously and herein as Tributaries 1 through 4 (from north to south) as well a fifth tributary called Manzanita Gulch.
- The Site lies at the upper headwaters of the Joe Creek watershed, on a steep, generally north-facing hillslope above the confluence of Joe Creek and Tributary 4.
- The Site is composed of over two miles of underground excavations, at least six adits, and steep slopes covered by accumulations of waste rock that extend down the slope to Joe Creek and Tributary 4 (Figure 2).
- Patented claims at the Site cover approximately 500 acres.

2.2 Operational History

The PAS provides a detailed review of the operational history of the Blue Ledge Mine. The following is a summary of the operational history.

- The ore body was discovered in 1898 by miners panning on Joe Creek.
- Development of the mine started in 1904 and continued until 1930. Over the lifespan of the mine there were several periods of inactivity (mid-1909 until 1917 and 1920 through 1929) before all mining activity ceased in 1930.
- The mine was developed to recover sulfide deposits rich in copper, gold, silver and zinc. Most of the mine's economic value stemmed from the extraction of copper and zinc.
- Ore was not shipped from the Site until 1917 after which it was hauled by wagon to Elliott Creek where it was loaded onto trucks for transport to Medford, Oregon. The ore was then loaded onto railcars for delivery to the smelter in Tacoma, Washington, owned by the American Smelting and Refining Company (ASARCO). Receipts from the smelter show ore shipment from the mine totaled 11,151 tons.
- Waste rock from the mining operations was disposed of on the steep slopes of the Site, as well as within many mine workings.
- Previous estimates of waste rock volumes vary from 50,000 to 60,000 tons.
- The mine has been owned, leased, or operated by at least 14 parties. ASARCO and/or their subsidiaries have been financially involved with the Site since 1913 and throughout the period of ore production.

- Several exploration activities have occurred at the Site since mining operations ceased in 1930.

2.3 Site Description

- The mine Site spans an elevation range of about 4,000 to 4,800 feet above sea level.
- Average annual rainfall exceeds 40 inches, the majority of which falls during the winter months.
- A run-off channel with seasonal flows to Joe Creek cuts through the waste rock. Known sources contributing to the flow in this ravine include groundwater emerging from the lower north adit, AD-01, and the seep west of the Site, SP-02, in addition to precipitation/snowmelt run-off from the waste rock covered slopes. The water flows over a log waste rock dam prior to its discharge to Joe Creek.
- Vegetation in the mine vicinity is a mesic forest consisting of Douglas fir, ponderosa pine, incense-cedar and Oregon white oak. Other species such as sugar pine, yellow pine, and lodge-pole pine have also been reported in the area.
- The adits likely provide nesting and roosting habitat for many bat species.
- Other species within the habitat near the mine include amphibians, reptiles, birds and mammals. The northern goshawk is a U.S. Fish and Wildlife Service (USFWS) candidate species. The Siskiyou Mountain salamander is listed as a USFS sensitive species and a California-endangered species. The northern bald eagle and the northern spotted owl also reside in the area and are both federally listed threatened species.
- The watershed between the mine and Applegate Reservoir hosts resident rainbow and cutthroat trout populations; Pacific lamprey and reticulate sculpin may also inhabit the watershed. Historically, fish such as fall Chinook, Coho salmon, Pacific lamprey, and steelhead migrated to the watershed. Since the Applegate Dam was constructed these migrations have ceased. Currently no fish reside in Joe Creek.
- The small community of Joe Bar is located downstream of the Site just beyond the confluence of Joe Creek with Elliott Creek.

2.4 Summary of Previous Data Collection

- In January 1981 the USFS collected one surface water sample from Joe Creek at the confluence with Elliott Creek. The sample was analyzed for arsenic, chromium and copper. Only copper was detected.
- In 1983 Freeport Exploration Co. conducted a reconnaissance sampling program to explore for precious metal massive sulfide deposits.
- The USFS collected surface water samples from the mine drainage, Joe Creek, and Elliott Creek in April 1992. Samples were analyzed for pH, conductivity, metals, sulfates, fluoride, hardness, and alkalinity. The results confirmed that the mine drainage contained cadmium, copper, and zinc at levels exceeding EPA freshwater criteria. The sample of the mine drainage exhibited an acidic pH of 3.10.
- The USFS conducted three water quality monitoring events in September 2000, April 2001, and August 2001. Samples were collected from Elliott Creek, Joe Creek upstream and downstream of the Site, the run-off channel that flows through the Site, and Park Gulch (a tributary of Elliott Creek). Field parameters (pH, temperature, dissolved oxygen, and conductivity) were collected by field personnel. Water samples were submitted to a laboratory for analysis of total metals, sulfate, and total alkalinity. Results from these investigations demonstrated that concentrations of cadmium, copper, iron, lead, and zinc in Joe Creek increased significantly in surface water downstream of the Site, indicating that the Site was an ongoing and significant source of contamination to Joe Creek.
- A macroinvertebrate survey was conducted by Southern Oregon University (SOU) during the Fall of 2000 and Spring of 2001. The results of the survey documented that ongoing drainage from

the Site was impacting biota in Joe Creek. The survey also concluded that the impacts of the drainage increase during periods of high run-off from the Site.

- The USEPA Superfund Technical Assessment and Response Team (START) conducted a Site screening sampling event in May 2005 followed by a removal assessment. Sample results from the screening sampling event were used to identify contaminants of concern and sample population statistics. During the removal assessment, eight surface samples were collected and eight subsurface samples (1-1.5 feet deep) were collected. All samples were analyzed for the chemicals of concern (COCs) determined during the screening (lead and arsenic). Two of the subsurface samples were additionally analyzed for cadmium, copper, iron, manganese, mercury, and zinc. The sampling event demonstrated that metals concentrations significantly exceeded health-based benchmarks (Region 9 Preliminary Remediation Goals) as well as background concentrations.
- From May 2005 through November 2007 SOU students collected water samples from the Site, Joe Creek, Elliott Creek, and the Middle Fork of the Applegate River. Field parameters (pH, temperature, dissolved oxygen, and total dissolved solids) were measured. All samples were analyzed for total metals (arsenic, calcium, cadmium, copper, iron, sodium, lead, and zinc). The data collected as part of the SOU program indicated that there are slight seasonal trends in metal concentrations of water leaving the Site. Additionally, the data demonstrated that the EPA response actions at the Site were essentially ineffective at improving the quality of water discharging from the Site to Joe Creek.
- In summary, the previous investigations have demonstrated that the waste rock present within the abandoned workings and on the slopes of the Site are a significant historic and ongoing source of cadmium, copper, iron, lead, and zinc, and sulfuric acid to Joe Creek. Data from previous investigations demonstrate that cadmium, copper, iron, and zinc concentrations in surface water detected below the Site are significantly higher than background detections, further confirming that the Site is a significant source of these metals and is releasing these metals to the environment at significant concentration. Based on the work completed to date, releases have been confirmed to have severely impacted the aquatic life of Joe Creek, and Joe Creek would otherwise be a productive native fishery.

2.5 Description of Waste Characteristics

- Previous waste rock volume estimates at the Site range from 50,000 to 60,000 tons.
- The waste rock material is predominately silty gravel with sand and is moderately weathered. Previous investigations, such as the PA/SI (Weston, 2004), documented the presence of ferricrete (a sand and gravel mass that is cemented by iron oxide) at the Site.
- The sulfide deposits, for which the area was developed, are a continuing source of AMD, which results from weathering that oxidizes the mineralized sulfide deposits resulting in sulfate and acidity (including sulfuric acid). The mine workings created during the development of the mine (winzes, adits, and drifts) supply natural ventilation throughout the mine, providing an environment for the continued oxidation of exposed minerals (Hundhausen, 1947).
- Previous investigations have documented increased sulfate concentrations and acidity in water emerging from the mine adits. The AMD is flushed from the adits during periods of higher precipitation where it infiltrates through the waste rock and leaches metals. The finer the waste particle, the more surface area is available for the AMD to leach metals from. It is assumed that the majority of the infiltrated water emerges into the run-off channel and discharges into Joe Creek; infiltrated water that does not leave the Site via the channel is assumed to discharge to Joe Creek as groundwater base flow.
- Periods of high precipitation and surface runoff erode the waste rock and transport waste material as sediment to Joe Creek. In 2006, remediation efforts by USEPA at the Site included grading of waste rock piles below the lowermost adit, redirecting AMD into a marble-lined run-

off channel and creating a settling pond above a log dam to capture sediment eroded from the waste piles. By May 2007, an approximately 90-cm-thick deposit of sediment had accumulated in the pond, nearly filling the capacity of the pond (SOU, undated).

2.6 Summary of SI Data Collection

- The SI field work and data collection were carried out from June 23 to June 28, 2008. A macro-invertebrate survey was also conducted on September 9, 2008. Drinking water samples were collected from sources in Joe Bar on November 8, 2008.
- URS collected solid samples of waste rock, river sediment, and riparian soil. Water samples were collected from seeps, adits, the log dam, tributaries to Joe Creek (Tributary 3, Tributary 4, and Manzanita Gulch), Joe Creek, Elliott Creek, the Middle Fork Applegate River, and Applegate Reservoir. A total of four macroinvertebrate samples were collected from Joe and Elliott Creeks. Fish tissue samples were collected from Elliott Creek, the Middle Fork Applegate River, and Applegate Reservoir. Drinking water samples were collected from three sources in Joe Bar, two wells and one spring.
- Sample locations and types, with the exception of drinking water samples, are shown on Figures 3, 4, 5 and 6.
- Water samples were collected from 32 locations shown on Figures 3 through 5. Field duplicate samples were collected from two locations, EC-04 and JC-07.
    - Surface water samples were collected using clean, disposable, dedicated bailers.
    - Clean, disposable 0.45-micron filters were used to collect field filtered samples analyzed for dissolved metal. Filters were connected directly to a bailer during sampling.
    - In-situ water quality measurements at each water sample location included pH, temperature, and specific conductivity.
    - Water samples from the seeps and the log dam could not be collected directly with a bailer. These samples were collected directly into lab-provided bottles and jars for analyses not requiring field filtering. Samples requiring filtering were collected in an unpreserved 1-liter bottle and transferred to a clean, dedicated bailer with a clean, disposable 0.45-micron filter attached to its outlet, from which sample containers were filled.
    - Of the seven adits observed at the Site, only adit # 1 and adit #2 were discharging groundwater during the field investigation. A water sample was collected from each of these two adits.
    - Two seeps were observed during the field investigation. One, SP-02, is near the former Eileen town site and the other, SP-01, is on the hillside to the west of the main waste rock area, as shown on Figure 5. A water sample was collected from each seep.
    - Water was observed flowing over the log dam from the settling pond created as part of the 2006 EPA removal action. A single water sample, DAM-01, was collected from below the log dam.
    - Two of the tributaries of Joe Creek, Tributary 1 and Tributary 2, were found to be dry during the investigation.
    - Two planned sampling locations within Joe Creek, JC-05 and JC-06, were inaccessible and therefore not sampled.
    - Six of the sample locations on Joe Creek and two sample locations on Elliott Creek have been sampled during previous investigations (JC-01, JC-04, JC-06, JC-07, JC-08, JC-09, EC-06, and EC-07).
    - All water and drinking water samples were analyzed for dissolved metals (arsenic, cadmium, copper, iron, lead, and zinc), sulfate, total suspended solids (TSS), total dissolved solids (TDS), alkalinity, and hardness.

- Sediment samples were collected from 24 locations as shown on Figures 3 through 5. Two field duplicates were collected from sample locations EC-04 and EC-05.
    - Sediment samples were collected from Joe Creek, Elliott Creek, the Applegate Reservoir, and the Middle Fork Applegate River.
    - Sediment was not present at the proposed Joe Creek tributary locations (T1JC, T2JC, T3JC, T4JC and MG), and therefore no sediment samples were collected from these locations.
    - Sediment was collected from stream channels using a shovel. Sediment that did not contact the shovel was then placed in sample jars manually while wearing clean, disposable nitrile gloves.
    - Personnel stood downstream during sampling, and sediment sampling was performed after collection of water samples.
    - Samples from Applegate Reservoir were collected using a hand-held trident box core sampler deployed from an inflatable raft. Sediment was then placed in sample jars manually as above while wearing clean, disposable nitrile gloves.
    - All sediment samples were analyzed for total metals (arsenic, cadmium, copper, iron, lead, and zinc) and particle size.

- Riparian soil samples were collected from 10 locations as shown on Figures 3 through 5. One field duplicate was collected at sample location EC-05.
    - Riparian soil was collected from above the normal high water line alongside Joe and Elliott Creeks and the Middle Fork Applegate River.
    - Samples were collected from the top 12 inches of soil after removal of organic debris present on the ground surface. A stainless steel shovel was used to perform "in-situ homogenization" (i.e., loosening and then mixing the soil in place) prior to placing the homogenized material into the laboratory provided containers. This was performed manually while wearing clean nitrile gloves.
    - An example of shoveled riparian soil before being placed in a sample jar is shown in Appendix A, Photo 25.
    - All riparian soil samples were analyzed for total metals and particle size.

- Fish tissue samples were collected from five locations as shown on Figure 3. A field duplicate was collected from the AR-02 sample location.
    - Fish were collected through electro-fishing and netting, under the supervision of a California Department of Fish & Game representative.
    - Reticulated sculpin, juvenile to 2 years old, were collected in Middle Fork Applegate River and Elliott Creek.
    - A rainbow trout was collected from Applegate Reservoir.
    - Fish collection was attempted in Joe Creek at location JC-01. No fish were observed or collected in Joe Creek.
    - All fish tissue samples were analyzed for total metals (arsenic, cadmium, copper, iron, lead and zinc).

- Waste rock samples were collected from four locations shown on Figure 5. One field duplicate was collected from the WRS-1 location. Results of waste rock analyses are shown in Table 7.
    - All waste rock samples were collected on the north face of the Site.
    - Samples were placed directly into Ziploc plastic bags by hand while wearing clean, disposable nitrile gloves.
    - All waste rock samples were analyzed by the Synthetic Precipitation Leaching Procedure (SPLP) for arsenic, cadmium, copper, iron, lead and zinc, and by the Toxicity

Characteristic Leaching Procedure (TCLP) for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

- A total of two bulk waste rock samples were collected for geotechnical analyses from the waste rock area shown on Figure 5.
    - All waste rock samples were collected on the lower half of the north face of the Site.
    - Samples were placed directly into clean 5-gallon buckets with a shovel.
    - Geotechnical analyses performed on the waste rock included grain size analysis and mechanical testing in general accordance with ASTM Test Methods D 422 and D 1140. Results of these analyses are included in Appendix E.

- A total of 28 bulk soil samples were collected for geotechnical analyses from nine test pits excavated at the three potential repository areas shown on Figure 6.
    - All test pits were excavated with a Case 580 backhoe.
    - 21 samples were collected from six test pits (test pits TP 1 through 6) excavated at the northern repository area.
    - Five samples were collected from two test pits (test pits TP 7 and 8) excavated at the southern repository area.
    - Two samples were collected from a single test pit (TP 9) excavated at the potential repository area at the former Eileen town site.
    - 23 of the 28 samples were placed in Ziploc bags immediately after excavation to maintain in-situ moisture content.
    - Five samples were placed directly into clean 5-gallon buckets with a shovel to perform bulk geotechnical tests.
    - Laboratory testing of the soils included soil classification (ASTM D 2487), moisture content (ASTM D 2216), grain size (ASTM D 422 and D 1140), Atterberg limits (ASTM D 4318), and laboratory compaction characteristics of soil using standard effort (ASTM D 698). Results of the laboratory analyses are not included in this report, the results will be used in the EE/CA.

- A total of four samples were collected for macroinvertebrate inventory from the areas shown on Figure 4.
    - All samples were collected in the reaches of stream near the sample locations shown on the figure.
    - Samples were collected in accordance with the EPA's Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition (Barbour, et al, 1999).
    - Each sample was comprised of the composite of five subsamples (or "kicks"). Kicks were collected in suitable riffle, rapid, or cascade stream habitat types; two kicks each were collected from areas near the right and left streambanks and one subsample was collected from a mid-channel location. The five kicks were combined into a single "composite" sample representing the entire sample location.
    - All samples were captured in a 12-inch diameter, 500-micron mesh size D-net and transferred to sterile 1-liter poly containers. Samples were immediately preserved with 90% ethanol.
    - The laboratory typed specimens to the highest taxonomic classification possible and constructed a Benthic Index of Biotic Integrity (B-IBI) to analyze sample locations against each other and expected conditions, based on watershed disturbance

- Macroinvertebrate Inventory Results
    - The results of the survey indicate that macroinvertebrate communities in Joe Creek downstream of the waste rock piles are significantly degraded, as compared to the upstream control sample. Differences in community are largely between species that are susceptible to metals toxicity and water temperature. Because water temperature was similar between the sample locations, the results indicate that metals contamination from the Site is adversely impacting the macroinvertebrate community in Joe Creek.
    - Macroinvertebrate communities in Elliott Creek varied slightly between samples collected downstream of the confluence with Joe Creek and the control located upstream. Community response gives no clear indication that assemblages were responding to the presence of metals. While this does not rule out an influence from metals, metrics were not sensitive enough to make such a correlation.
- Macroinvertebrate Inventory Conclusions
    - The aquatic macroinvertebrate survey clearly indicates that discharges from the mine (i.e., sediment erosion, surface water discharge, and/or groundwater discharge) are impacting aquatic biota assemblages in Joe Creek. Species composition, total numbers of a species, trophic distribution, and diversity of species all show a response to water quality impairment. Impacts to Elliott Creek are uncertain. Variations within Elliott Creek aquatic macroinvertebrate assemblages were not statistically significant; as such, analytical models were unable to discern if aquatic macroinvertebrate assemblages were responding to water quality contributed by Joe Creek.

3.0 PATHWAY AND ENVIRONMENTAL HAZARD ASSESSMENT

This section describes chemical migration pathways and exposure routes potentially present at the Site in addition to identifying potential receptor populations by media. Analytical results from the Site investigation are summarized for each pathway.

3.1 Groundwater Exposure Pathway

Groundwater at the Site is impacted through direct contact with the waste rock materials. It is also likely impacted as water infiltrates through the mine workings and is exposed to the sulfide deposits present at the Site.

3.1.1 Targets

The screening-level human health and ecological risk evaluations (Appendices B and C) identified the following potentially complete exposure pathways related to surface water:

- Samples of groundwater discharging from adits and seeps were collected to provide a site-specific assessment of groundwater near the mine, since discharge of contaminated groundwater to Joe Creek is the most immediate and obvious ongoing threat to sediment and water quality, and ecological and human health.
- The small enclave of residents living at Joe Bar along Elliott Creek reportedly obtains their drinking water from two wells and one spring near their residences.

3.1.2 Geologic Setting

- The Site geology consists of a sequence of meta-volcanic and meta-sedimentary lithologies known as the Condrey Mountain Schist (Freeport, 1983).
- The Condrey Mountain Schist is predominantly composed of three types of rock: black schist, green schist and serpentinite. Rock at the Site is predominantly north-south striking and steeply west-dipping showing strong deformation.
- The area is highly mineralized primarily with copper-zinc sulfides (pyrrhotite, pyrite, chalcopyrite and sphalerite. Gold and silver are also found within the zones of copper mineralization.

3.1.3 Hydrogeologic Setting

- The source of groundwater at the Site is infiltration of precipitation (rainfall and snowmelt).
- It is likely that the groundwater flows downhill following the topography.
- Groundwater also flows through the preferential pathways of the mine workings, with some discharging from adits onto the waste rock-covered slope. Figure 7 provides detail of the waste rock piles on the slope.
- As groundwater flows through the mine workings to the adjacent surface water features it contacts weathered mineral deposits and waste rock resulting in acidic water that leaches metals from the waste rock. The groundwater flow transports metals from the Site to the adjacent surface water features.
- Groundwater emerges from seeps onto the slope. Seeps also emerge along the banks of Joe Creek near the former Eileen town site.
- Groundwater that does not discharge from the adits or seeps likely continues downslope and discharges as baseflow directly into Joe Creek and Tributary 4.

3.1.4 Groundwater Analytical Summary

Field observations and analytical results of groundwater (that immediately becomes surface water as it discharges at two adits and two seeps) and drinking water samples are summarized below.

- The adit and seep sample locations are shown on Figure 5.
- Analytical data for adit and seeps are provided on Table 2.
- Analytical data for drinking water samples are provided on Table 3.

Field Observations

- One seep, SP-01, was observed on the western edge of the main slope (Figure 2); water from this seep flows over the log dam and into Joe Creek. Another seep, SP-02, was observed flowing from the bank of Joe Creek near the former Eileen town site.
- The flow of water emerging from AD-01 at the time of the SI was so low that the stream infiltrated into the ground surface before reaching the diversion channel below. It is assumed that when flow is higher the flow from this adit would run downhill joining with the flow coming from SP-01, ultimately flowing into Joe Creek.
- The flow of water emerging from AD-02 ran along the access road dispersing back into the tracks of the road. It is possible that when flows are higher that the water from this adit would preferentially flow down the road channels into Tributary 4 at the point where the access road crosses the tributary downslope from the adit.

Overall Trends for Adits and Seeps

- Dissolved concentrations of arsenic, cadmium, copper, iron, lead, and zinc were detected at all four locations, with the exception of arsenic and iron, which were not detected in seep SP-02.
- Overall, the highest dissolved metals concentrations are from AD-01, where the values are about two to four orders of magnitude higher than the other locations, and all detected concentrations exceed the screening criteria. AD-01 is a significant source of dissolved metals.
- AD-02 appears to be a significant source of zinc, and to a lesser extent arsenic, both of which exceed the screening criteria.
- Seep SP-01 is a significant source of copper and zinc, both of which exceeded the screening criteria.
- Seep SP-02 is a significant source of cadmium, copper and zinc, all of which exceeded the screening criteria.

Analytical Results for Adits and Seeps

- Dissolved arsenic was detected in all samples except SP-02. Dissolved arsenic concentrations ranged from 0.10 microgram per liter (ug/L) at SP-01 to 3.19 at AD-01. Only detections at the adit locations exceeded the final screening criterion protective of humans ingesting fish/aquatic organisms.
- Dissolved cadmium was detected in all samples at concentrations ranging from 0.598 ug/L at AD-02 to 70.9 ug/L at AD-01. All detections except that at AD-02 exceeded the final ecological screening criteria.
- Dissolved copper was detected in all samples at concentrations ranging from 4.77 ug/L at AD-02 to 194,000 ug/L in SP-01. All detections except at AD-02 exceeded the final ecological screening criteria.
- Dissolved iron was detected in all samples except SP-02. Concentrations ranged from 53.6 ug/L at AD-02 to 748,000 ug/L at AD-01. Detections at AD-01 and SP-01 exceeded the final ecological screening criteria.

- Dissolved lead was detected in all samples at concentrations ranging from 0.020 ug/L at AD-02 to 8.640 ug/L at AD-01. Only the detection at AD-01 exceeded the final ecological screening criteria.
- Dissolved zinc was detected in all samples. All detections exceeded the final ecological screening criteria; concentrations ranged from 132 ug/L at SP-01 to 300,000 ug/L at AD-01. Only the detection at AD-01 exceeded the final human health criteria protective of humans ingesting fish/aquatic organisms.
- Hardness concentrations ranged from 31 milligrams per liter (mg/L) at SP-01 to 576 mg/L at AD-01.
- All samples had detections for TDS, with concentrations ranging from 23 mg/L at SP-01 to 5,060 mg/L at AD-01.
- The hardness and TDS values at AD-01 are consistent with the significantly elevated metals concentrations at this location, compared to the other locations.
- TSS were detected only at AD-02, at a concentration of 6 mg/L.
- Sulfate was detected at all sample locations at concentrations ranging from 5.7 mg/L at SP-01 to 2770 mg/L at AD-01. The concentration at AD-01 was 1 to 3 orders of magnitude higher than the other locations, and is consistent with the high metals concentrations detected at this location.
- pH ranged from 2.40 at AD-01 to 7.73 at AD-02. The low pH at AD-01 correlates strongly with the highest dissolved metals and sulfate detections.

Drinking Water Summary

- In the fall of 2008, groundwater samples were collected from three residences at the community of Joe Bar, adjacent to Elliott Creek. One residence obtains water from a spring located on the northern side of the valley, and the other two residences have groundwater wells on their properties. This is the only known use of groundwater as drinking water along either Joe or Elliott Creeks.
- Water from these sources is used for drinking, cooking, and showering. Elliott Creek water is also used for watering gardens and as drinking water for dogs and horses.
- Dissolved arsenic, cadmium, copper, lead and zinc were detected at all locations.
- Only detections of dissolved arsenic exceeded associated screening criteria. Dissolved arsenic concentrations ranged from 0.22 ug/L to 6.24 ug/L. These concentrations exceed USEPA RSLs.

3.1.5 Groundwater Pathway Summary

Adits and Seeps

- The adit and seep groundwater samples document and confirm the prior understanding that groundwater from the Site is a significant ongoing source of metals released to Joe Creek.
- Although human receptors could come into contact with groundwater at the adit and seep locations, this is not expected to be a complete exposure pathway for human receptors.
- Groundwater that discharges from the adits and seeps becomes part of the surface water pathway, adversely affects surface water quality, and results in risk to human and ecological receptors. For this reason, the groundwater data was assessed using criteria protective of humans ingesting organisms present in surface water and ecological receptors in direct contact with surface water or consuming lower-trophic level organisms.

Drinking Water

- There are no known uses of groundwater at the Site or vicinity by humans or ecological receptors, with the exception of the few beneficial-use wells located in the community of Joe Bar adjacent to Elliott Creek. Groundwater at this location is not likely to commingle with groundwater at the Site. It is unknown whether these wells were constructed or operated in a

manner that would result in commingling of the groundwater resource with Elliott Creek surface water.

- Although arsenic was present in all three groundwater sources at concentrations that exceed a USEPA Regional Screening Level (RSL, 2008) for arsenic in tapwater of 0.045 ug/L, there is no evidence that these levels are related to concentrations of arsenic detected in surface water in Elliot Creek, but rather may be to naturally high levels of arsenic in local soils.

3.2 Surface Water Exposure Pathway

Surface water present at the Site is groundwater that emerges from seeps and adits in addition to seasonal run-off from precipitation (rain and snowmelt). As previously stated, groundwater emerging from adits and seeps is impacted through direct contact with the waste rock materials or exposure to the weathered sulfide deposits present in the mine workings. Run-off from precipitation is also impacted by exposure to the waste rock on the slopes.

3.2.1 Targets

The screening-level human health and ecological risk evaluations (Appendices B and C, respectively) identified the following potentially complete exposure pathways related to surface water:

- Human receptors coming into contact indirectly with surface water through consumption of fish tissue is considered a complete and potentially significant exposure pathway.
- Human receptors coming into direct contact with metals in surface water is considered to be a minor exposure pathway, and thus was not assessed. Metals present in water are not easily absorbed through dermal contact. Incidental ingestion of surface water during recreational use is expected to be minor.
- Use of surface water as a drinking water is not known to occur based on current information, and thus ingestion of Elliott Creek surface water as drinking water is not considered a complete exposure pathway for human receptors. The drinking water obtained from groundwater at Joe Bar does not appear to be able to commingle with Elliott Creek surface water.
- Freshwater aquatic biota exposure to surface water is considered to be a complete pathway, and can occur through direct uptake and through indirect exposure via consumption of lower-trophic-level organisms.
- Piscivorous birds and mammals, and terrestrial ecological receptors could be exposed to metals in surface water through ingestion and through consumption of lower-trophic-level prey species.

3.2.2 Hydrologic Setting

- The Site is located within the upper headwaters of Joe Creek. Joe Creek is located within the Upper Applegate Watershed within the Rogue River-Siskiyou National Forest.
- The Site is in an area that receives approximately 33 inches of rainfall and 138 inches of snow annually.
- Joe Creek flows past the Site and continues north from the Site about 3.4 miles to its confluence with Elliott Creek.
- A drinking water intake has been reported at Elliott Creek near the confluence with Joe Creek. The presence of this intake could not be confirmed during the URS work. Joe Bar residents indicated they do not obtain their drinking water from Elliott Creek, but rather from wells and springs in the area (Personal Communication, URS, 2008).
- From its confluence with Joe Creek, Elliott Creek continues west and discharges to the Middle Fork Applegate River just upstream of the Applegate Reservoir. The Applegate Reservoir is approximately 8 miles downstream of the Site.

- Stream discharge measurements were collected as part of the Site investigation on June 26, 2008. Discharge measurements were made using the Velocity-Area Procedure wherein the mean velocity and flow cross-sectional areas of many increments across a channel were measured using an impeller-style flow meter, from which subtotals of the stream discharge could be calculated. The sum of these parts is the entire stream discharge; results from the field measurements are as follows:
    - Middle Fork Applegate River (above confluence with Elliott Creek) 286 cubic feet per second (cfs)
    - Elliott Creek (above confluence with the Middle Fork Applegate River) 266 cfs
    - Elliott Creek (near EC-06) 87 cfs
    - Joe Creek (near JC-01) 8.0 cfs

3.2.3 Surface Water Analytical Summary

This section presents the analytical results for surface water grab samples collected from 32 locations in the Applegate Reservoir, the Middle Fork Applegate River, Elliott Creek, Joe Creek, Manzanita Gulch, Joe Creek Tributary 3, Joe Creek Tributary 4, and from where the Site run-off channel flows over the log dam.

- The sample locations are shown on Figures 3, 4, and 5.
- Analytical data are provided on Table 2 and selected data are shown graphically on Charts 1 through 4.

<u>Field Observations</u>

- There is a continuous overland flow path for groundwater discharging from adit AD-01 and seep SP-01 to Joe Creek.
- Groundwater emerging from adit AD-01 and seep SP-01 flows down the Site run-off channel to the settling pond behind the log dam, where it overtops the dam and discharges into Joe Creek.
- A surface water sample, DAM-01, was collected downstream of the dam, and prior to the discharge to Joe Creek.

<u>Overall Trends</u>

- Dissolved cadmium, copper and zinc concentrations in Joe Creek are very low to non-detect upstream of the Site (Charts 1 and 2). The concentrations increase sharply at the Site, confirming the Site is a significant source of these metals to surface water in Joe Creek. The concentrations remain elevated to the confluence of Joe Creek and Elliott Creek, and decrease significantly below the confluence, due to dilution by the larger flow within Elliott Creek.
- Dissolved arsenic does not follow the same trend as the metals above. It was generally not detected along the entire length of Joe Creek, but was detected in Elliott Creek (Chart 2). The Site does not appear to be a source of arsenic to surface water.
- Dissolved lead concentrations increase in surface water samples for a short distance immediately downstream of the Site (Chart 3), indicating the Site is a source of lead in surface water.
- Dissolved iron concentrations in surface water increase slightly downstream of Tributary 3 and Manzanita Gulch (Chart 4).
- Metals concentrations detected in the DAM-01 sample are significantly higher than concentrations in Joe Creek, Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir, with the exception of arsenic which was not detected in the dam sample. These elevated concentrations at DAM-01 reflect the contribution from metals in groundwater discharging from AD-01.

<u>Background</u>

- Six background surface water samples were collected in Joe Creek upstream of the Site.

- Dissolved cadmium, iron, lead, and TSS were not detected in any background surface water samples.
- Dissolved arsenic was detected in only one background surface water sample, JC-11, at a concentration of 0.08 ug/L, and just above the analytical reporting limit.
- Dissolved copper and zinc were detected in all background samples.
- Dissolved metal detections in background surface water samples were below all screening criteria.
- Hardness values of all background surface water samples ranged from 23.9 mg/L at JC-15 to 24.5 mg/L at JC-10.
- TDS in the background surface water samples ranged from 14 mg/L at JC-11 to 33 mg/L at JC-12.
- Sulfate was detected at 2.5 mg/L in all background surface water samples.

Rivers, Creeks and Reservoir

- Seventeen samples were collected from these water bodies, including seven samples from Joe Creek, seven from Elliott Creek, two from the Middle Fork Applegate River, and one from the Applegate Reservoir.
- Dissolved arsenic was detected in nine samples collected from the Applegate Reservoir, the Middle Fork Applegate River, and Elliott Creek. Dissolved arsenic was not detected in any of the Joe Creek surface water samples. Concentrations ranged from 0.22 ug/L at EC-06, to 0.50 ug/L at EC-01. All dissolved arsenic detections only exceeded the 0.14 ug/L final screening criterion protective of humans ingesting fish/aquatic organisms.
- Dissolved cadmium was detected in all river and creek surface water samples except EC-07. Dissolved cadmium concentrations ranged from 0.012 ug/L at ARV-04, to 0.564 ug/L at JC-02. Detections at six of the samples stations, JC-01 through JC-08, exceeded the final ecological screening criterion for cadmium.
- Dissolved copper was detected in all river and creek surface water samples with the exception of AR-01. Detected concentrations ranged from 0.46 ug/L at EC-07 to 62.8 at JC-07. Detections from six of the Joe Creek sample locations, JC-01 through JC-04, JC-07, and JC-08, and two samples from Elliott Creek, EC-01 and EC-06, exceeded the final ecological screening criterion for copper.
- Dissolved iron was detected at only five of the sample locations, JC-04, EC-01, AR-01, AR-02 and ARV-04. Detected concentrations ranged from 5.1 ug/L at JC-04 to 7.9 ug/L at ARV-04. All detected dissolved iron concentrations were below the associated screening criteria.
- Dissolved lead was detected in six surface water sample locations, JC-07, JC-08, EC-01, AR-01, AR-02, and ARV-04. Concentrations ranged from 0.008 ug/L at AR-02 to 0.066 ug/L at JC-07. All dissolved lead concentrations were below the associated screening criteria.
- Dissolved zinc was detected at all surface water sample locations except AR-01. Concentrations ranged from 0.61 ug/L at EC-07 to 88.5 ug/L at JC-07. Zinc detected at locations JC-01through JC-04, and JC-07, slightly exceeded the final ecological screening criterion.
- The hardness of all river and creek surface water samples ranged from 20.6 mg/L at JC-08 to 44.9 mg/L at EC-07.
- TDS were detected at concentrations from 15 mg/L at JC-09 and JC-07 to 81 mg/L at EC-01.
- TSS were not detected in any river or creek samples.
- Sulfate was detected at all river and creek surface sample locations at concentrations ranging from 1.8 mg/L at ARV-04 to 5.1 mg/L at locations JC-01 through JC-04.

Tributaries

- Five tributary surface water samples were collected, including two from Tributary 4 (upstream from the Site), one from the run-off channel that flows through the Site, and one each from Manzanita Gulch and Tributary 3 located downstream from the Site.

- The detected concentrations of cadmium, copper, iron, lead, and zinc from the log dam in the run-off channel (sample DAM-01) are significantly higher (by about three orders of magnitude) than all other tributary samples. As described previously, these higher concentrations reflect the contribution from metals in groundwater discharging from adit AD-01 and seep SP-01.
- Of the tributaries sampled, only sample MG-01 in Manzanita Gulch contained a concentration of dissolved arsenic (0.29 ug/L) that exceeded the screening criterion protective of humans consuming fish/aquatic life. The reporting limit for arsenic in surface water collected from Tributary 3 (sample T3JC-01) exceeds the same human health criterion.
- Dissolved cadmium was detected at two tributary sample locations. At location T3JC-01 the surface water concentration of 0.01 ug/L does not exceed the final screening criterion protective of ecological receptors. At DAM-01, the concentration of 33.7 ug/L exceeds the final screening criterion protective of ecological receptors.
- Dissolved copper was detected at all five tributary sample locations, at concentrations ranging from 0.42 ug/L at T3JC-01 to 4,680 ug/L at DAM-01. Surface water collected from location DAM-01 contained cadmium at a concentration that exceeded the final screening criterion protective of ecological receptors. No other tributary samples contained copper at concentrations that exceeded ecological or human health screening criteria.
- Dissolved iron was detected at all five tributary sample locations except T4JC-01, at concentrations ranging from 7.4 ug/L at T4JC-02 to 1,670 ug/L at DAM-01. The only tributary sample to exceed the screening criteria, DAM-01, did so only slightly.
- Dissolved lead was detected at three tributary sample locations, T4JC-01, DAM-01, and T3JC-01, at concentrations of 0.035 ug/L, 8.370 ug/L, and 0.007 ug/L, respectively. Only the DAM-01 sample detection exceeded the screening criterion protective of ecological receptors.
- Dissolved zinc was detected at four tributary sample locations at concentrations of 1.93 ug/L or less, and below the screening criterion for zinc. At the fifth location, DAM-01, dissolved zinc was detected at a concentration of 6,180 ug/L, exceeding the ecological screening criterion for zinc.
- The hardness ranged from 11.5 mg/L at locations T4JC-01 and T4JC-02 to 82.2 mg/L at MG-01.
- TDS ranged from 23 mg/L T4JC-02 to 160 mg/L at DAM-01.
- TSS were detected at one tributary surface water sample location, T3JC-01, at a concentration of 8 mg/L.
- Sulfate was detected at four sample locations at concentrations of 9.0 mg/L or less. At the fifth location, DAM-01, sulfate was detected at a concentration of 112 mg/L.

3.2.4 Surface Water Exposure Summary

Human Health

- For human health risk from exposure to metals in surface water, only indirect exposure to surface water through consumption of fish was considered a significant exposure pathway. However, as stated above, further consideration should be given to whether Elliott Creek surface water commingles with groundwater used by Joe Bar residents for drinking water purposes.
- Arsenic is the only metal present in surface water at concentrations that exceed the human health screening criteria. The exceedances occur in surface water from Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir, but not from Joe Creek.

Ecological

- Significant surface water exposure pathways for aquatic and terrestrial ecological receptors include ingestion of water through direct uptake, direct contact with surface water, and consumption of lower-trophic-level organisms.
- Copper and cadmium concentrations in Joe Creek surface water significantly exceed ecological screening criteria from where it passes the Site to its confluence with Elliott Creek. Cadmium at

one location in Elliott Creek (upstream of confluence with Joe Creek) exceeded ecological screening criteria, while copper exceeded ecological screening criteria at one location in Elliott Creek, one of which was located upstream of the confluence with Joe Creek and contained the highest concentration of copper in surface water collected from Elliott Creek.

- Tributaries of Joe Creek, with the exception of the water from the seasonal run-off channel at the Site (DAM-01), did not exceed ecological screening criteria. This demonstrates that although the run-off channel from the Site to Joe Creek is only one of many tributaries to Joe Creek, this run-off channel is nevertheless a significant contributor of metals to Joe Creek, so much so that the resulting metals concentrations in Joe Creek surface water are unaffected by dilution from surface water inputs by downstream tributaries.
- Ecological screening criteria were not exceeded in surface water collected from the Middle Fork Applegate River or the Applegate Reservoir.

3.3 Sediment Exposure Pathway

Sediments were found in the creek beds, the bed of the Middle Fork Applegate River, and the bed of Applegate Reservoir. Sediment was also present in the settling pond behind the log dam and in the run-off channel at the Site. Although the log dam and settling pond have been somewhat effective at trapping sediment from the run-off channel, surface water in the run-off channel overtops the log dam and thus there is a complete pathway for discharge of contaminated sediments from the Site to Joe Creek. In addition, as the settling pond fills with sediment (a condition observed during the SI fieldwork), its ability to trap sediment will diminish unless it is maintained (i.e., via the periodic removal of contaminated sediment from the pond). Finally, the log dam and settling pond were only constructed in 2006. During the roughly 78-year period between cessation of mining and construction of the log dam, there were not controls in place for sediments discharging from the Site to Joe Creek. Therefore, risks due to both human health and ecological exposure were assessed to address historical impacts to sediment, as well as ongoing impacts, which are likely to continue into the foreseeable future under the current Site conditions.

3.3.1 Targets

The screening-level human health and ecological risk evaluations (Appendices B and C) identified the following potentially complete exposure pathways related to surface water:

- Aquatic biota in the creeks, river, and reservoir, and piscivirous and/or terrestrial biota can be directly exposed (through contact and ingestion) and indirectly exposed (through aquatic prey consumption) to metals that may be present in sediments.
- Human recreational users and fishermen can be exposed to area sediments through direct contact and through consumption of fish and shellfish species.

3.3.2 Sediment Exposure Setting

- Joe Creek flows through a narrow canyon consisting of rapids, cascades, pocket pools and plunge pools.
- Sediment deposits are typically located along the stream margins and pools.
- Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir contain sediments over a larger and more continuous area than that observed in Joe Creek.
- Grain sizes of sediments ranged from coarse sands to gravels within the entire area of investigation. Only one sample from Applegate Reservoir, ARV-03, contained a significant amount of fine material, demonstrating that the reservoir is a trap for fine-grained sediments that are transported from upstream areas.

3.3.3 Sediment Analytical Summary

This section presents the analytical results for the sediment samples collected from the Applegate Reservoir, the Middle Fork Applegate River, Elliott Creek, and Joe Creek.

- The sample locations are shown on Figures 3, 4, and 5.
- Analytical data are provided on Table 5 and selected data are shown graphically on Charts 9 through 12.

Overall Trends

- Cadmium, copper, lead and zinc concentrations in sediments along the segment of Joe Creek between the Site and Elliott Creek are significantly elevated compared to background samples, or sample in or downstream of Elliott Creek (Charts 10 through 12), indicating the Site is a significant source of the metals in Joe Creek sediment.
- Iron concentrations in sediments along the segment of Joe Creek between the Site and Elliott Creek are at or below concentrations in background samples, and are below concentrations in samples collected from Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir (Chart 9), indicating the Site is not a source of iron in sediment.
- Arsenic concentrations generally show a gradual increase from the background area (upstream of the Site) to Applegate Reservoir, with no trends in the data that would otherwise suggest the Site is a source of arsenic in sediment. (Chart 11).

Background

- Background samples were collected from six locations in Joe Creek upstream of the Site.
- All six metals were detected at all six background locations.
- Arsenic concentrations ranged from 0.74 milligram per kilogram (mg/kg) at JC-14 to 2.68 mg/kg at JC-10. Only sample JC-10 exceeded the screening criteria.
- Cadmium concentrations ranged from 0.093 mg/kg at JC-14 to 0.214 mg/kg at JC-10. There were no exceedances of the screening criteria.
- Copper concentrations ranged from 34.4 mg/kg at JC-14 to 51.7 mg/kg at JC-10. Copper concentrations at samples JC-12 and JC-13 did not exceed the screening criteria.
- Iron concentrations ranged from 14,900 mg/kg at JC-14 to 24,000 mg/kg at JC-10. No screening criteria exist for iron in sediment.
- Lead concentrations ranged from 1.20 mg/kg at JC-14 to 2.67 mg/kg at JC-10. There were no exceedances of the screening criteria.
- Zinc concentrations ranged from 26.9 mg/kg at JC-14 to 55.6 mg/kg at JC-10. There were no exceedances of the screening criteria.

River, Creeks, and Reservoir

- River, creek, and reservoir sediment samples were collected from eighteen locations, including five samples from Joe Creek downstream of the Site, seven samples from Elliott Creek, two samples from the Middle Fork Applegate River, and four samples from the Applegate Reservoir.
- All six metals were detected at all creek, river, and reservoir sample locations.
- Arsenic concentrations ranged from 1.14 mg/kg at JC-02 to 7.59 mg/kg at EC-07. All sample concentrations, except at JC-02, exceeded one or more of the screening criteria.
- Cadmium concentrations ranged from 0.211 mg/kg at EC-04 to 2.93 mg/kg at JC-04, and exceeded the screening criteria only at Joe Creek sample locations JC-01 through JC-04.
- Copper concentrations ranged from 28.0 mg/kg at EC-07 to 978 mg/kg at JC-08, and exceeded the screening criteria at all locations except for three locations in Elliott Creek (EC-04, EC-05, and EC-07).
- Iron concentrations ranged from 11,300 mg/kg at JC-04 to 37,200 mg/kg at EC-02. No screening criteria are available for iron in sediment.

- Lead concentrations ranged from 3.54 mg/kg at EC-05 to 13.8 mg/kg at JC-08, and were below the screening criteria at all locations.
- Zinc concentrations ranged from 59.0 mg/kg at EC-07 to 533 mg/kg at JC-02, and exceeded the screening criteria at all Joe Creek sample locations, and one Applegate Reservoir sample location (ARV-02).

3.3.4 Sediment Pathway Summary

Human Health

- Human receptors can potentially come into direct contact with freshwater sediments through fishing, swimming, and boating.
- Arsenic is the only metal that exceeded human health criteria in sediment. As arsenic concentrations in sediment gradually increase downstream from the Site it is not conclusive that the source of the arsenic is from the Site.

Ecological

- Aquatic and terrestrial ecological receptors can directly contact freshwater sediments.
- Background concentrations of copper exceeded at least one screening criterion; therefore, an average background concentration was used as the most stringent screening value.
- Metals detected in Joe Creek sediments exceeded ecological screening criteria for arsenic, cadmium, copper, and zinc. Concentrations of these metals in sediments along the segment of Joe Creek between the Site and Elliott Creek are significantly elevated compared to background samples, indicating the Site is a significant source of these metals in Joe Creek sediment.
- Copper exceeds ecological screening criteria at six of the seven Elliott Creek sediment sample locations, and all Middle Fork Applegate River, and Applegate Reservoir sediment sample locations, indicating that Site-related impacts to sediment extend from the Site to Applegate Reservoir.

3.4 Soil Exposure Pathway

Overbank flooding of creeks or rivers can result in the deposition of sediment on soils in adjacent riparian areas. If the sediments contain metals at concentrations that present a risk to human and/or ecological receptors, overbank flooding has the potential to extend this risk from aquatic areas to upland areas, via incorporation of contaminated sediments into adjacent riparian soils.

3.4.1 Targets

The screening-level human health and ecological risk evaluations (Appendices B and C) identified the following potentially complete exposure pathways related to riparian soils:

- Terrestrial ecological receptors can be directly exposed (through contact and ingestion) and indirectly exposed (through prey consumption) to metals that may be present in riparian soils. Terrestrial ecological receptors in the area include piscivorous birds and mammals.
- Human receptors can be directly exposed (through contact and incidental ingestion) with these soils.

3.4.2 Soil Exposure Setting

Riparian soil samples were collected from adjacent to the top-of-bank channel of the creeks and river, within a few feet of the ordinary high water line. In a few locations the riparian soils were in vegetated areas where recent sediment deposition was observed. Riparian soils are assumed to be floodplain soils that have migrated from the creek and river bottoms and are currently at least periodically exposed.

3.4.3 Soil Analytical Summary

This section summarizes the analytical results for the soil samples collected from riparian areas along the Middle Fork Applegate River, Elliott Creek, and Joe Creek.

- The sample locations are shown on Figures 3, 4, and 5.
- Analytical data are provided on Table 4 and selected data are shown graphically on Charts 5 through 8.

Overall Trends

- Iron concentrations generally increase downstream with the exception of a spike at JC-03 (Chart 5).
- Cadmium, copper, lead and zinc concentrations in riparian soils generally increase downstream of the Site (Charts 6, 7, and 8) to the confluence of Joe Creek and Elliott Creek, indicating the Site is a source of contamination of riparian soils by these metals. Concentrations decrease in riparian soils downstream of the confluence with Elliott Creek.
- Arsenic concentrations in riparian soil downstream of the Site increase slightly over background concentrations in riparian soil collected upstream of the Site. Arsenic in sample JC-03, collected downstream of Manzanita Gulch and Tributary 3 (Chart 7), is significantly elevated over the other samples. Arsenic concentrations decrease downstream of the confluence with Elliott Creek.

Background

- Two background riparian soil samples were collected along Joe Creek upstream of the Site.
- All six metals were detected at both sample locations.
- Concentrations increased for all metals from the upstream location (JC-14) to the downstream location (JC-12).
- Cadmium and lead did not exceed the screening criteria at both locations.
- Arsenic, copper, and zinc exceeded the screening criteria at the downstream location only.
- Iron exceeded the screening criteria at both locations.

Rivers and Creeks

- All six metals were detected at all creek and river sample locations.
- Arsenic concentrations ranged from 3.29 mg/kg at EC-02 to 17.8 mg/kg at JC-03 and exceeded the screening criteria at all locations.
- Cadmium concentrations ranged from 0.202 mg/kg at JC-03 to 1.09 mg/kg at JC-01. Concentrations at two locations, JC-01 and AR-01, exceeded the screening criteria.
- Copper concentrations ranged from 51.9 mg/kg at EC-07 to 378 mg/kg at JC-01. Screening criteria were not exceeded only at locations EC-07 (upstream of the confluence with Joe Creek) and EC-02.
- Iron concentrations ranged from 23,000 mg/kg at EC-02 to 52,400 mg/kg at JC-03 and exceeded the screening criteria at all locations.
- Lead concentrations ranged from 5.75 mg/kg ay EC-02 to 31.2 mg/kg at JC-01 and exceeded the screening criteria only at the Joe Creek sample locations.
- Zinc concentrations ranged from 64.9 mg/kg at EC-02 to 185 mg/kg at AR-01 and exceeded the screening criteria at all locations.

3.4.4 Soil Pathway Summary

Human Health

- Human receptors can potentially come into direct contact with riparian soils.
- Arsenic exceeded human health criteria in all riparian soils. However, arsenic concentrations generally increase in sediments along Joe Creek and may not be related to the Site.

Ecological

- Terrestrial ecological receptors can be directly exposed and indirectly exposed to metals that may be present in riparian soils.
- Arsenic exceeds ecological screening criteria at one Joe Creek location, JC-03. As stated previously, arsenic data indicate that arsenic concentrations in sediments may not be attributed to the Site.
- Lead exceeds ecological screening criteria in riparian soils between the Site and the confluence of Joe Creek and Elliott Creek.
- Cadmium exceeds ecological screening criteria at only two locations, JC-01 and AR-01.
- Copper and zinc concentrations exceed ecological screening criteria in almost all riparian soils. Two locations, EC-07 and EC-02, are only slightly below the lowest screening criteria based on background concentrations.
- In the segment of Joe Creek between the Site and Elliott Creek concentrations of cadmium, copper, lead, and zinc are elevated above background concentrations in riparian soils, strongly correlating to the trend observed in sediments of Joe Creek, and further confirming the Site is a significant source of the metals in Joe Creek.

4.0 SCREENING LEVEL RISK EVALUATIONS

A summary of the screening-level risk evaluations for human health and ecological receptors is presented in this section. The analytical data obtained during the SI fieldwork were used to assess risk using a screening-level approach. SI data assessed as part of the risk evaluation were obtained from the following locations and media:

- Samples of groundwater discharging from adits and seeps were collected.
- Surface water samples were collected from the log dam, Joe Creek, tributaries of Joe Creek, Elliott Creek, the Middle Fork Applegate River, and Applegate Reservoir.
- Sediment samples were collected from Joe Creek, Elliott Creek, the Middle Fork Applegate River, and Applegate Reservoir.
- Soil samples were collected from riparian areas along Joe Creek, Elliott Creek, and the Middle Fork Applegate River.
- Fish tissue samples were collected from Elliott Creek, the Middle Fork Applegate River and Applegate Reservoir.

The full text of the Screening-Level Human Health Risk Evaluation and Screening-Level Ecological Risk Evaluation are provided in Appendices B and C, respectively.

4.1 Screening-Level Human Health Risk Evaluation

Arsenic, cadmium, copper, iron, lead, and zinc were assumed to be chemicals of potential concern (COPCs) for human receptors based on previous investigations. The human health risk evaluation of Site investigation data was conducted by:

- Comparing analytical results obtained from the Site investigation to literature-based human health screening criteria, and, as appropriate, to site-specific background levels. Literature-based human health screening levels used in the evaluation are discussed in Section 4.1.2. In cases where site-specific background data exceeded literature-based criteria, the site-specific background was used as the final screening criterion. When literature-based criteria exceeded site-specific background concentrations, the most stringent literature-based criterion was used as the final screening criterion.
- Sample-point-by-sample-point screening was conducted to take into account the streamlined sample collection (i.e., statistically representative exposure point concentrations were not generated).
- The final screening criterion chosen for each metal was used to generate carcinogenic or non-carcinogenic human health risk estimates at each sample point (i.e., if a detected concentration exceeded a final screening criterion). Samples having detected concentrations of metals that did not exceed a final screening criterion were not quantified (i.e., no risk estimate values were generated for detected concentrations that did not exceed criteria).

4.1.1 Conceptual Site Model of Human Exposure

The conceptual Site model identified the following incomplete, minor, and potentially complete exposure pathways for human receptors:

<u>Groundwater</u>

- The adit and seep groundwater samples provide an indication of groundwater quality at the Site. It is highly unlikely that human receptors would come into contact with groundwater at the adit

and seep locations, and so this is not expected to be a complete exposure pathway for human receptors.

- Groundwater that discharges from the adits and seeps becomes part of the surface water pathway, with the potential to adversely affect surface water quality and to result in risk to human receptors.
- There are no known uses of groundwater at the Site or the Site vicinity by humans or ecological receptors, with the exception of the two beneficial-use wells located in the community of Joe Bar adjacent to Elliott Creek. Groundwater at this location is not known to commingle with groundwater present at the mine Site. It is unknown at this time whether groundwater at the well locations commingles with Elliott Creek surface water. A screening of groundwater data collected from three residences in Joe Bar indicates that neither Federal nor California drinking water MCLs were exceeded by concentrations of arsenic; but the conservative USEPA RSL for tap water was exceeded by arsenic concentrations in all three groundwater sources tested. However, the detections of arsenic in the three groundwater sources appear likely to be due to regionally high levels of arsenic naturally present in area soils.

Surface Water

- Human receptors coming into contact indirectly with surface water through consumption of fish tissue is considered a complete and potentially significant exposure pathway.
- Human receptors coming into direct contact with metals in surface water is considered to be a minor exposure pathway, and thus was not assessed. Metals present in water are not easily absorbed through dermal contact. Incidental ingestion of surface water during recreational use is expected to be minor.
- Use of surface water as a drinking water is not known to occur based on current information, and thus ingestion of surface water as drinking water is not considered a complete exposure pathway for human receptors.

Sediment

- Human receptors can potentially come into direct contact with freshwater sediments through fishing, swimming, and boating. These activities are highly unlikely to occur in Joe Creek, but are expected to occur in Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir. As discussed previously, the sediments may be impacted due to significant erosion of waste rock that occurs from the waste rock piles into Joe Creek and is then carried downstream.

Riparian Soil

- Human receptors can potentially come into direct contact with riparian soils during recreational use of adjacent creek or river surface water and sediment. Because Joe Creek is relatively isolated from human use due to its remoteness and steep elevation, only Elliott Creek and the Middle Fork Applegate River downstream of the mouth of Elliott Creek might be likely places for human receptors to come into contact with riparian soil.

4.1.2 Identification of Screening Criteria

Site investigation data were compared to the following screening criteria.

- The final screening criterion for each metal in each medium was chosen from among one or more human health criteria and site-specific background concentrations. If a site-specific background concentration (available for surface water, sediment, and riparian soil) was greater than one or more literature-based criteria, then the site-specific background concentration was used as the final screening criterion. If literature-based criteria were greater than the site-specific background concentration, than the most stringent literature-based criterion was used as the final screening criterion.

- Arsenic has both carcinogenic and non-carcinogenic effects, but carcinogenic effects occur at a lower concentration of arsenic than do non-carcinogenic effects. Therefore, only carcinogenic screening criteria were used to assess arsenic. Zinc is documented as having only non-carcinogenic effects.

Groundwater

- Groundwater that discharges from the adits and seeps becomes part of the surface water pathway, with the potential to adversely affect surface water quality and to result in risk to human receptors. For this reason, the groundwater data were assessed using criteria protective of humans ingesting organisms present in surface water.

Surface Water

- California Water Quality Standards, human health criteria for ingestion of organism's only for the Middle Fork Applegate River and Applegate Reservoir (USEPA, 2000).
- Oregon Department of Environmental Quality (DEQ) Water Quality Standards, Tables 33A, 33B, and 33C, human health criteria for ingestion of organism's only for the Middle Fork Applegate River and the Applegate Reservoir (DEQ, 2004).
- USEPA 2006 National Recommended Water Quality Criteria. Human health criteria for ingestion of organism's only for the Middle Fork Applegate River and the Applegate Reservoir (USEPA, 2006).
- No literature-based human health criteria were available for cadmium, copper, iron, and lead. Background concentrations of these metals are available; however, basing risk estimates on the background concentrations is not technically credible when no toxicity criteria are available. Although risk estimates are not quantifiable, detections of these metals must be assumed to be a potential human health problem.

Sediment

- USEPA Region 6 human health medium-specific screening levels for residential soil (2007). Although human contact with sediment would most likely occur to recreational users, the use of criteria protective of residential use is assumed to be a conservative approach that is highly protective of recreational users.
- California Regional Soil Levels (Bradford et al., 1996).
- California Regional Soil Levels (CRSLs) are typically used as background levels for metals; however, site-specific background concentrations were considered more representative of Site conditions.
- No literature-based human health criteria were available for iron. Risk estimates are not quantifiable for iron in sediment and detections must be assumed to be a potential human health problem.

Riparian Soil

- USEPA Region 6 human health medium-specific screening levels for residential soil (USEPA, 2007). Although human contact with riparian soil would most likely occur to recreational users, the use of criteria protective of residential use is assumed to be a conservative approach that is highly protective of recreational users.
- California Regional Soil Levels (Bradford et al., 1996).
- California Regional Soil Levels are typically used as background levels for metals in soils, however, site specific background concentrations were considered more representative of Site conditions.
- No literature-based human health criteria were available for iron. Risk estimates are not quantifiable for iron in riparian soil, detections of iron must be assumed to be a potential human health problem.

Fish Tissue

- DEQ Acceptable Tissue Levels (ATLs) in Fish/Shellfish Consumed by Humans (DEQ, 2007) are available for arsenic, cadmium, and lead.
- No literature-based human health criteria are available to screen iron, copper, and zinc present in fish tissue. Risk estimates for these metals are not quantifiable and detections of these metals in fish tissue must be assumed to be a potential human health problem.

4.1.3 Identification of Background Levels of COPCs in Surface Water, Sediment, and Riparian Soil

Site-specific background concentrations of metals in surface water, sediment, and riparian soil were calculated based on data collected from the background locations upstream of the Site on Joe Creek and Tributary 4. For each media, the background concentration was calculated as the mean of the background sample results for the samples bulleted below. In cases where a metal was undetected, a value of one-half the analytical method reporting limit was assigned as a surrogate value.

- Eight surface water samples from two Tributary 4 locations and six Joe Creek locations upstream of the Site.
- Six sediment samples from Joe Creek locations upstream of the Site.
- Two riparian soil samples from Joe Creek upstream of the Site.

SI data for samples downstream of the Site were compared to background concentrations in addition to the screening criteria identified in Section 4.1.2

4.1.4 Data Evaluation

Data was reviewed by a URS chemist for quality assurance/quality control purposes, and found to be adequate for use in the screening-level risk evaluations (Appendix D).

4.1.5 Identification of Human Health Screening Criteria Exceeded by Site Data

Only metals for which Site data exceeded screening criteria are discussed below.

Groundwater

- Human health criteria were exceeded for arsenic. Arsenic exceeded criteria at both adit locations, zinc only at AD-01. Arsenic concentrations detected in the samples collected from three residential groundwater sources used as drinking water in the Joe Bar community did not exceed Federal or California drinking water MCLs, but did significantly exceed the more conservative USEPA RSLs for tap water. However, it appears that arsenic levels in the sampled groundwater are likely related to naturally high levels of arsenic in the area, rather than any connection to surface water in Elliott Creek.

Surface Water

- Arsenic is the only metal present in surface water at concentrations that exceed the human health screening criteria. Arsenic exceeded criteria in surface water from Elliott Creek, Manzanita Gulch, the Middle Fork Applegate River, and the Applegater Reservoir, but not Joe Creek.
- The method detection limit exceeded the human health criteria for the sample collected from Tribuatry 3.
- Zinc exceeded human health criteria only at the location of the log dam.
- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek surface water in the form of fine particulates and dissolved concentrations.

Sediments

- Arsenic is the only metal that exceeded human health criteria in sediment from Joe Creek, Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir. As arsenic concentrations in sediment gradually increases downstream from the Site it is not conclusive that the source of the arsenic is from the Site.

Riparian Soils

- Arsenic exceeded human health criteria in all riparian soils along Joe Creek, Elliott Creek, and the Middle Fork Applegate River. However, arsenic concentrations generally increase in sediments along Joe Creek and may not be related to the Site.

Fish Tissue

- Arsenic exceeded human health criteria in all fish tissue samples (Table 6); sample collection occurred only in Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir.

4.1.6 Risk and Hazard Estimates Based on Screening Criteria

Following the screening of SI data against the screening criteria, potential excess carcinogenic risk (PECR) values (greater than $1x10^{-6}$) and non-carcinogenic hazard quotient (HQ) values (greater than 1) were calculated; for details of these calculations please refer to Appendix B. Any sample with an associated PECR value that exceeds 1.0E-06 or an HQ value that exceeds 1 indicates potentially unacceptable human health risks. Only calculated risk and hazard estimates that pose a potentially unacceptable human health risk are discussed below.

Groundwater

- Arsenic concentrations in groundwater from both adits resulted in human health PECR values of 2.3E-05 for AD-01 and 1.3E-05 for AD-02. The two seeps did not contain arsenic at concentrations that resulted in unacceptable human health risk.
- Water collected from Adit AD-01 contained zinc at a concentration that resulted in a high human health-related non-carcinogenic HQ of 11.5.
- Groundwater collected from sources used by the Ruetiger, Neilson, and Ziem residences contained concentrations of arsenic that resulted in PECR values of 4.9E-06, 4.5E-05, and 1.4E-04, respectively. Cadmium, copper, iron, lead, and zinc concentrations detected in these groundwater samples did not exceed human drinking water criteria (Table 3).

Surface Water

- Arsenic detected in surface water collected from Manzanita Gulch, a tributary of Joe Creek, had an associated unacceptable human health PECR of 2.1E-06.
- Elliott Creek PECRs for arsenic ranged from 1.6E-06 at location EC-06 (located upstream of the confluence of Elliott Creek and Joe Creek) to 3.6E-06 at location EC-01 (at confluence with the Middle Fork Applegate River).
- AR-02 contained arsenic at a concentration resulting in an unacceptable PECR of 2.1E-06.
- The single surface water sample (ARV-04) collected from Applegate Reservoir contained arsenic at a concentration that resulted in an unacceptable PECR of 2.6E-06.
- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek surface water in the form of fine particulates and dissolved concentrations.

Sediment

- Joe Creek PECRs for arsenic in sediments ranged from 1.7E-06 at location JC-08 to a maximum of 2.8E-06 at location JC-04; all Joe Creek sediment concentrations resulted in unacceptable PECRs with the exception of the sediment from JC-02.
- PECRs for arsenic in sediments collected from Elliott Creek are actually higher overall than those in Joe Creek sediments, ranging from 2.3E-06 to 5.1E-06. The highest PECR of 5.1E-06 is

associated with location EC-07, which is located in Elliott Creek upstream of its confluence with Joe Creek.

- PECRs for arsenic in the Middle Fork Applegate River and the Applegate Reservoir sediments ranged from 2.6E-06 to 3.2E-06, and are considered low-to-moderate exceedances of acceptable human health risk.

Riparian Soils

- The three riparian soil samples collected adjacent to Joe Creek contained concentrations of arsenic that resulted in human health PECRs ranging from 1.6E-06 at location JC-04 up to 8.1E-06 at location JC-03.
- The five samples collected adjacent to Joe Creek ranged from 1.5E-06 at location EC-02 up to 2.7E-06 at location EC-07, all relatively low.
- The two Elliott Creek locations upstream of and at its confluence with Joe Creek had PECRs for arsenic of 2.4E-06 and 2.7E-06. These were approximately the same or slightly higher than the PECRs related to the downstream Elliott Creek riparian soils.
- The single riparian sample collected adjacent to the Middle Fork Applegate River had a related PECR for arsenic of 2.1E-06.

Fish Tissue

- All fish tissue samples resulted in PECRs exceeding acceptable human risk levels.
- Fish tissue PECRs ranged from 2.1E-05 at AR-02 to 3.9E-05 at EC-07 (upstream of the confluence with Joe Creek).

4.1.7 Potential Hot Spots Based on Human Health Risk

From a human health risk perspective, any arsenic concentration that results in a cancer risk estimate that exceeds 1.0E-05 should be considered a potential hot spot. SI sample results that meet this criterion include the following:

- Groundwater discharging from adits 1 and 2.
- Fish tissues collected from Elliott Creek locations EC-02, EC-04, and EC-07, location AR-02 on the Middle Fork Applegate River, and location ARV-02 in the Applegate Reservoir.

For non-carcinogenic chemicals, such as zinc, any HQ value that exceeds 10 can be considered a potential hot spot.

- Groundwater collected as it emerged from adit AD-01 (HQ = 11.5).

4.1.8 Summary

Unacceptable human risk due to metals present in Site and site-vicinity media are summarized below. It should be noted that although dissolved arsenic was detected in groundwater emerging from three locations at the Site, it was not detected in any surface water samples in Joe Creek. Concentrations of arsenic were detected in all background sediment and riparian soil samples collected and concentrations for the remaining Joe Creek samples in both media generally increase downstream, indicating that the source of the arsenic may be naturally occurring in the area and not due to the Site.

Groundwater

- Carcinogenic human health criteria were exceeded for arsenic for groundwater emerging from adits, resulting in unacceptable PECRs and should be considered a potential hot spot.
- Zinc concentrations from AD-01 exceeded non-carcinogenic human health criteria, resulting in an unacceptable HQ value of 11.5 and should be considered a potential hot spot.

Surface Water

- Joe Creek surface water samples did not contain detectable levels of arsenic, while surface water samples from Manzanita Gulch, Elliott Creek, the Middle Fork Applegate River and the Applegate Reservoir contained concentrations of arsenic that resulted in PECR values ranging from 1.6E-06 up to 3.6E-06. These PECR values are below the criterion for designation of a potential hot spot.
- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek surface water in the form of fine particulates and dissolved concentrations.

Sediment

- Sediment samples from Joe Creek, Elliott Creek, the Middle Fork Applegate River and the Applegate Reservoir exceeded human health criteria for arsenic ranging from 2.3E-06 to 5.1E-06. Sediment samples collected from Joe Creek had slightly lower arsenic PECR values than sediment samples collected from Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir. Only the detection from sediment collected at the confluence of Elliott Creek and the Middle Fork Applegate River (EC-07) exceeded acceptable PECR values; this location should be considered a potential hot spot.

Riparian Soil

- Riparian soil samples collected adjacent to Joe Creek had arsenic PECRs that were similar to those for arsenic present in riparian soils collected adjacent to Elliott Creek and the Middle Fork Applegate River, with the exception of riparian soil collected from location JC-03, which had an arsenic PECR value of 8.1E-06. This location should be considered a potential hot spot.

Fish Tissue

- Fish collected in Elliott Creek, the Middle Fork Applegate River downstream of the mouth of Elliott Creek, and the head of the Applegate Reservoir contain unsafe concentrations of arsenic in regard to human consumption.

4.2 Screening-Level Ecological Risk Evaluation

Arsenic, cadmium, copper, iron, lead, and zinc were assumed to be chemicals of potential ecological concern (CPECs) for ecological receptors based on previous investigations. Iron is an essential nutrient metabolically regulated by most organisms and was considered as a CPEC in surface water only. The screening-level ecological risk evaluation of Site data was conducted by:

- Comparing analytical results obtained from the SI to literature-based screening criteria protective of ecological receptors, and, as appropriate, to site-specific background levels. Ecological screening criteria obtained from the literature are discussed in Section 4.2.2. In cases where site-specific background data exceeded literature-based criteria, the site-specific background was used as the final screening criterion. When literature-based criteria exceeded site-specific background concentrations, the most stringent literature-based criterion was used as the final screening criterion.
- Sample-point-by-sample-point screening was conducted to take into account the streamlined sample collection (i.e., statistically representative exposure point concentrations were not generated).
- The final screening criteria chosen for metals in different media were used to generate ecological HQs at each sample point. Samples containing detected concentrations of metals that did not exceed a final screening criterion were not quantified (i.e., no HQs were generated for detected concentrations that did not exceed criteria).

4.2.1 Conceptual Site Model of Ecological Exposure

The conceptual site models identified the following incomplete, minor, and potentially complete exposure pathways for ecological receptors:

Groundwater

- The adit and seep groundwater samples provide an indication of groundwater quality at the Site.
- Ecological receptors are not expected to come into contact with groundwater. It is unlikely that ecological receptors would come into significant contact with the groundwater exiting the surface at the adit and seep locations, and so this is expected to be a minor, or incomplete, exposure pathway for ecological receptors.
- Groundwater that discharges from the adits and seeps becomes part of the surface water pathway, with the potential to adversely affect surface water quality and to result in risk to ecological receptors through contact with surface water. This possibility is more fully assessed through surface water screening.

Surface Water

- Ecological receptors, aquatic and terrestrial, can potentially come into direct contact with surface water.
- Ecological receptors can potentially be indirectly exposed through consumption of aquatic prey species.
- Waste rock containing high levels of metals likely is migrating to the creek bed as fine particles and as dissolved concentrations.

Sediment

- Ecological receptors are expected to come into direct contact with freshwater sediments.

Riparian Soil

- Ecological receptors, piscivorous and/or terrestrial, can potentially come into direct contact with riparian soils.

4.2.2 Identification of Screening Criteria

Site investigation data were compared to the following screening criteria.

- The final screening criterion was chosen from among one or more ecological criteria and site-specific background concentrations. In most cases, the final screening criterion chosen was an ecological criterion obtained from the literature, rather than a site-specific background concentration.
- If a site-specific background concentration (available for surface water, sediment, and riparian soil) was greater than one or more literature-based criteria, then the site-specific background concentration was used as the screening criterion.
- If literature-based criteria were greater than the site-specific background concentration, than the most stringent literature-based criterion was used as the screening criterion.

Groundwater

- California Water Quality Standards, freshwater chronic (CCC) (USEPA, 2000).
- Oregon Department of Environmental Quality Water Quality Standards, Tables 33A, 33B, and 33C, freshwater continuous chronic criteria (CCC) for Protection of Aquatic Life (DEQ, 2004).
- USEPA 2006 National Recommended Water Quality Criteria. Freshwater CCC values (USEPA, 2006).
- Groundwater that discharges from the adits and seeps becomes part of the surface water pathway, with the potential to adversely affect surface water quality and to result in risk to ecological

receptors. For this reason, the groundwater data were assessed using surface water criteria protective of ecological receptors.

Surface Water

- California Water Quality Standards, freshwater chronic (CCC) (USEPA, 2000).
- Oregon Department of Environmental Quality Water Quality Standards, Tables 33A, 33B, and 33C, freshwater continuous chronic criteria (CCC) for Protection of Aquatic Life (DEQ, 2004).
- USEPA 2006 National Recommended Water Quality Criteria. Freshwater CCC values (USEPA, 2006).
- Water quality criteria protective of freshwater aquatic life are presented based on dissolved concentrations of metals.
- In the cases of cadmium, copper, lead, and zinc, the related water quality criteria are based on an assumed water hardness of 100 milligram per liter (mg/L) calcium carbonate (CaCO3). Formulas provided in the federal and state criteria documents are available that allow re-calculation of water quality criteria for these four metals based on site-specific water hardness, and were used here to generate area-specific water quality criteria to use in the screening. Water quality criteria related to differing water hardness data were calculated for surface water collected from 1) the mine adits, 2) the dam location, 3) the seeps, 4) Joe Creek, 5) tributaries to Joe Creek, 6) Elliott Creek, and 7) the Middle Fork Applegate River and the Applegate Reservoir. As water hardness increases, so do the values of the associated water quality criteria. The greater the hardness of the water, the less bioavailable the metals in it become, and so the related water quality criteria become less stringent.
- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek bed in the form of fine particulates and dissolved concentrations.

Sediment

- Consensus-based sediment benchmark values: threshold effect concentrations (TECs) and probable effect concentrations (PECs) (MacDonald et al., 2000)
- DEQ sediment bioaccumulation screening level values (SLVs) (DEQ, 2007)
- Washington State sediment quality standards (SQS) (Ecology, 2003)
- California Regional Soil Levels (CRSLs) are typically used as background levels for metals in soils. Since metals concentrations in area soil and sediment are expected to be somewhat similar, CRSLs are compared against sediment concentrations. However, since site-specific background concentrations for sediment were available and were considered more representative of Site conditions than CRSLs, site-specific background concentrations of metals in sediment were used in the screening. Therefore, CRSLs are presented for information purposes only.

Riparian Soil

- DEQ SLVs for protection of terrestrial receptors (DEQ, 1998 & 2001).
- USEPA Ecological Soil Screening Levels (Eco-SSLs) (USEPA, 2005 & 2007).
- CRSLs are typically used as background levels for metals in soils. However, site-specific background concentrations of riparian soil were considered more representative of Site conditions than CRSLs, and so were used in the screening. CRSLs are presented for information purposes only.

Fish Tissue

- DEQ Critical Tissue Levels (CTLs) protective of Fish, Shellfish, and Other Aquatic Organisms (DEQ, 2007).
- DEQ ATLs in Fish/Shellfish Consumed by Wildlife (DEQ, 2007).
- No literature-based ecological criteria are available to screen copper and zinc present in fish tissue.

4.2.3 Identification of Background Levels of CPECs in Surface Water and Sediment

Site-specific background concentrations of metals in surface water, sediment, and riparian soil were calculated based on data collected from the background locations upstream of the Site on Joe Creek and Tributary 4. For each medium, the site-specific background concentration was calculated as the mean of the background sample results for samples bulleted below. In cases where a metal was undetected, a value of one-half the analytical method reporting limit was assigned as a surrogate value.

- Eight surface water samples from two Tributary 4 locations and six Joe Creek locations upstream of the Site.
- Six sediment samples from Joe Creek locations upstream of the Site.
- Two riparian soil samples from Joe Creek upstream of the Site.

SI data for samples downstream of the Site were compared to site-specific background concentrations in addition to the screening criteria identified in Section 4.1.2.

4.2.4 Data Evaluation

Data was reviewed by a URS chemist for quality assurance/quality control purposes, and found to be adequate for use in the screening-level risk evaluations (Appendix D).

4.2.5 Identification of Ecological Screening Criteria Exceeded by Site Data

<u>Groundwater</u>

- Concentrations of cadmium, copper, iron, and zinc in groundwater significantly exceeded their respective criteria at sample location AD-01; lead slightly exceeded its final screening criterion. Zinc slightly exceeded the final screening criterion in groundwater collected from location AD-02.
- Cadmium, copper, and zinc concentrations exceeded screening criteria at both seep locations.

<u>Surface Water</u>

- The surface water concentrations of cadmium, copper, and zinc from the sample collected at the log dam significantly exceeded ecological criteria. The log dam sample also contained lead and iron at lower concentrations exceeding ecological screening criteria.
- Cadmium, copper, and zinc concentrations exceeded screening criteria at virtually all Joe Creek sample locations.
- Copper concentrations exceeded screening criteria at only two locations in Elliott Creek, EC-06 and EC-01. Only one Elliott Creek location, EC-06, exceeded criteria for cadmium in surface water.
- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek bed in the form of fine particulates and dissolved concentrations.

<u>Sediment</u>

- Cadmium, copper, and zinc concentrations exceeded the most stringent screening level at all Joe Creek sample locations with the exception of cadmium at JC-08 which was only slightly below.
- Copper exceeded the final screening criteria at all Elliott Creek locations except EC-07.
- Arsenic detected in sediment collected from location EC-07 slightly exceeded the lowest criteria for arsenic at EC-07.

<u>Riparian Soil</u>

- Concentrations of copper, lead, and zinc exceeded criteria at all Joe Creek locations. Along Joe Creek there was one exceedance of the arsenic criterion at JC-03 and one exceedance of the cadmium criterion at JC-01.

- Screening criteria for copper and zinc were exceeded at all Elliott Creek riparian soil locations with the exception of copper at locations EC-02 and EC-07.
- Cadmium, copper, and zinc slightly to moderately exceeded criteria in the single Middle Fork Applegate River riparian soil sample collected.

Fish Tissue

- Only two metals exceeded the final screening ecological criteria protective of fish/shellfish themselves or of the predator species that consume them in Elliott Creek: cadmium at location EC-02 and lead at location EC-04.

4.2.6 Ecological Hazard Quotient Estimates Based on Screening Criteria

An ecological HQ is obtained by dividing a detected concentration by an ecological criterion. In Oregon, HQs that exceed 1 are assumed to cause unacceptable risk to individuals of protected species, while HQs that exceed 5 are assumed to also cause unacceptable risks to populations of unprotected species. California regulations identify any HQ that exceeds 1 as unacceptable risk to ecological receptors. Only calculated hazard estimates that pose unacceptable risks are discussed below.

Groundwater

- At AD-01, concentrations of copper, iron, zinc, and cadmium resulted in HQs of 5,511, 748, 633, and 72, respectively. All metals represent a significantly unacceptable risk to ecological receptors.
- AD-02 water did not contain metals at concentrations that exceeded criteria, with the exception of zinc, which was present at a concentration that resulted in an HQ of 2.5.
- Water collected from seep SP-01 contained concentrations of cadmium, copper, and zinc that resulted in unacceptable HQs of 6.5, 19, and 3, respectively. Water collected from Seep SP-02 contained arsenic concentrations that resulted in high and unacceptable HQs for cadmium, copper, and zinc of 42, 200, and 20, respectively.

Surface Water

- The surface water sample from the log dam at the Site contained concentrations of copper, cadmium, and zinc that significantly exceed ecological criteria resulting in HQ values of 793, 153, and 81, respectively. The log dam sample also contained lead and iron at lower concentrations, but their HQs of 5 and 1.7, respectively, represent an excess risk to ecological receptors.
- In Joe Creek, copper HQs ranged from 1.1 at location JC-09 up to 20.3 at location JC-07. Cadmium HQs ranged from 0.3 at location JC-09 up to 4.7 at location JC-01. Zinc HQs ranged from 0.2 to 2.0, the only HQ along Joe Creek not indicating a potentially unacceptable ecological risk (HQ < 1) was at JC-09.
- In Elliott Creek, two surface water samples, EC-01 and EC-06, produced an unacceptable HQ for copper of 1.8 and 3.2, respectively. EC-06 produced a low but unacceptable risk for cadmium with an HQ of 1.1.
- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek bed in the form of fine particulates and dissolved concentrations.

Sediment

- In Joe Creek copper and zinc HQs indicate an unacceptable ecological risk at all sample locations. Copper HQs ranged from 9 at JC-03 and 22.8 at JC-08 while zinc HQs ranged from 1.7 at JC-08 to 4.4 at JC-02.
- Cadmium concentrations in Joe Creek indicated unacceptable ecological risks at all locations except JC-08. HQs ranged from 2.2 at JC-01 to 3.0 at JC-04.

- For concentrations of copper in Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir that exceeded associated screening criteria, the resulting HQs ranged from 1.0 to 2.8.

Riparian Soil

- Riparian soils collected at Joe Creek locations JC-01, JC-03, and JC-04 contained copper, lead, and zinc at concentrations that resulted in unacceptable ecological HQs ranging from 1.1 for lead at JC-03 up to 6.7 for copper at JC-01.
- Riparian soils collected at Elliott Creek also contained copper and zinc concentrations that resulted in unacceptable ecological HQs. Copper HQs ranged from 1.1 to 1.4 and zinc HQs ranged from 1.2 to 1.7.
- Cadmium, copper, and zinc concentrations in the riparian soils collected at the Middle Fork Applegate River resulted in HQs of 1.8, 1.5, and 3.3, respectively.

Fish Tissue

- The only metals exceeding criteria, cadmium and lead in fish tissue, were collected from Elliott Creek at locations EC-02 and EC-04, respectively. Concentrations resulted in a HQ for cadmium of 1.2 and a HQ of 1.6 for lead.

4.2.7 Potential hot spots Based on Ecological Risk

In Oregon guidance, ecological potential hot spots are typically identified as those that exceed an HQ of 10 (DEQ, 1998 & 2001). Potential hot spots based on ecological risk are summarized by pathway below, and associated HQ values are shown in parentheses following each analyte. No ecological potential hot spots were identified in riparian soils or fish tissue.

Groundwater

- Groundwater discharging from AD-01 for cadmium (HQ = 72.3), copper (HQ = 5511.4), iron (HQ = 748.0), and zinc (HQ = 632.9).
- Water from both seep samples for copper (HQ = 18.8 and HQ = 199.7). In addition, water collected from SP-02 should also be considered a potential hot spot for cadmium (HQ = 41.9) and zinc (HQ = 20.1).

Surface Water

- Water at the log dam for cadmium (HQ = 153.2), copper (HQ = 793.2), and zinc (HQ = 80.6).
- Water from all Joe Creek sample locations except JC-09 and JC-08 for copper (HQ = 10.1 to 20.3).
- It is possible that concentrations of metals associated with waste rock could be considered potential hot spots in terms of impacts to Joe Creek. However, quantification of risks associated with the waste rock is difficult, and therefore no risk estimates were attempted under this task work.

Sediment

- Sediment from all Joe Creek locations except JC-03 for copper (HQ = 10.0 to 22.8).

4.2.8 Summary

Unacceptable ecological risks at high levels are present in the water emerging from adits and seeps, and in surface waters and sediment associated with the majority of Joe Creek, and to a lesser degree, in riparian soils adjacent to Joe Creek. As previously stated, it should be noted that although dissolved arsenic was detected in groundwater emerging from three locations at the Site, it was not detected in any surface water samples in Joe Creek. Concentrations of arsenic were detected in all background sediment and riparian soil samples collected, and concentrations for the remaining Joe Creek samples in both media generally

increase downstream, indicating that the source of the arsenic may be naturally occurring in the area and not due to the Site.

Groundwater

- Concentrations of cadmium, copper, iron, lead, and zinc exceeded all screening criteria at sample location AD-01, resulting in unacceptable HQ; that location should be considered a potential hot spot.
- Cadmium, copper, and zinc concentrations exceeded screening criteria at both seep locations. Both seep locations should be considered potential hot spots for copper. Groundwater collected at location SP-02 should additionally be considered a potential hot spot for cadmium and zinc

Surface Water

- It can be assumed that the waste rock, which contains high levels of metals, is adding material to the creek surface water in the form of fine particulates and dissolved concentrations.
- The surface water concentrations of cadmium, copper, and zinc from the sample collected at the log dam significantly exceeded ecological criteria, resulting in unacceptable HQs greater than 10, indicating that surface water at the log dam location should be considered a potential hot spot for these metals. The log dam sample also contained lead and iron at lower concentrations exceeding ecological screening criteria.
- Cadmium, copper, and zinc concentrations exceeded screening criteria at virtually all Joe Creek sample locations. HQ values for copper exceeded an HQ of 10 at a majority of the Joe Creek locations, indicating potential hot spot areas in regard to copper.
- Copper concentrations exceeded screening criteria at only two locations in Elliott Creek, EC-06 and EC-01. Only one Elliott Creek location, EC-06, exceeded criteria for cadmium in surface water. HQ results from these locations were below the hot-spot criteria.

Sediment

- Cadmium, copper, and zinc concentrations exceeded the final screening criteria at all Joe Creek sample locations with the exception of cadmium at JC-08, which was only slightly below criteria. Copper HQ values were above potential hot spot criteria for the majority of Joe Creek.
- Copper exceeded the final screening criteria at all locations except EC-07. EC-07 slightly exceeded the final screening criterion for arsenic at EC-07. Neither exceedance resulted in HQ values above hot-spot criteria.

Riparian Soil

- Ecological criteria were exceeded for copper and zinc in riparian soil samples collected from Joe Creek, Elliott Creek and the Middle Fork Applegate River, with exceedances of criteria for arsenic, cadmium, and lead occurring at some locations in certain reaches. No potential hot spots were identified for metals in any riparian soil collected.

Fish Tissue

- Only two metals, cadmium and lead, slightly exceeded the final ecological screening criteria for fish tissue at two separate locations in Elliott Creek. Neither exceedance resulted in an ecological potential hot spot.

5.0 REMOVAL ACTION JUSTIFICATION

Releases of metals from the Site have been documented in the PA/SI (Weston, 2004), other previous investigations, and this SI. These releases have occurred since the mine was in operation and continue to occur. The metals that are being released from the Site include arsenic, cadmium, copper, iron, lead and zinc.

Metals are released from the Site via groundwater and surface water flow. For example, cadmium, copper and zinc detected in the groundwater emerging from adits and seeps at the Site and in the water flowing over the log dam correlate strongly with the spike in the concentrations of these metals in Joe Creek as it passes the Site. Elevated concentrations of these metals are also detected in Elliott Creek following the confluence with Joe Creek.

Metals are also transported from the Site via sediment transport. Cadmium, copper, lead and zinc concentrations in sediments along the segment of Joe Creek between the Site and Elliott Creek are significantly elevated compared to background samples, indicating the Site is a significant source of the metals in Joe Creek sediment. The sediment transport mechanism is further substantiated by the trend of these same metals also increasing in the reach of Joe Creek between the Site and Elliott Creek.

Previous actions by the EPA have attempted to mitigate the release of metals from the Site, but these actions do not appear to have been fully effective as metals continue to be found in surface water downstream from the Site. Metals such as cadmium, copper and zinc are still detected in surface water at levels that indicate the majority of Joe Creek poses unacceptable ecological risks. The metals concentrations in Joe Creek and Elliott Creek surface water are much higher than those found to result in adverse affects and high mortality rates in rainbow trout and other fish. Copper was detected in the majority of Joe Creek at concentrations resulting in HQ values greater than 10, indicating that Joe Creek is an ecological potential hot spot.

These risks correlate strongly with the results of the aquatic surveys. The macroinvertebrate survey results clearly indicate that discharges from the mine (i.e., sediment erosion, surface water discharge, and/or groundwater discharge) are impacting aquatic biota assemblages in Joe Creek. Species composition, total numbers of a species, trophic distribution, and diversity of species all show a response to water quality impairment. Differences observed between the communities above and below the Site are largely between species that are susceptible to metals toxicity and water temperature. Because water temperature was similar between sample locations, the results lead to the conclusion that metals contamination from the Site is adversely impacting the macroinvertebrate community in Joe Creek.

Fish and amphibian surveys conducted in the area as part of this SI and previous investigations also document that the water quality of Joe Creek is severely impacted below the Site. Amphibians were essentially absent in Joe Creek except for in the lowest reaches. Fish survey data confirmed there are no fish in Joe Creek, even in areas where no natural barriers to fish distribution exist. As shown in Figure 8, fish are present throughout the surrounding watershed except in Joe Creek.

While human health risks associated with metals are mainly encountered in the immediate Site area (arsenic and zinc emerging from adits and seeps) they have also been documented in the fish tissue samples collected from Elliott Creek to the Applegate Reservoir. Ecological risks are present from the Site to the confluence of Joe Creek and Elliott Creek. Without removal action these metals will continue to be released, contributing to ecological risks, including observed impacts to aquatic life downstream, and human health risks at the unsecured Site. These metals will continue to be transported downstream into the Middle Fork Applegate River and the Applegate Reservoir, where the potential for biological accumulation of these contaminants will continue.

The results of the SI combined with the results of previous investigations clearly demonstrate that a removal action is justified. Factors required for consideration in determination of the appropriateness of a

removal action as stated in 40 CFR 300.415 (shown in italicized bold font) and the associated justifications are summarized below.

- ***Actual or potential exposure nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.***

  The Site is a historic and ongoing source of AMD from adits and waste rock areas, resulting in impacts to groundwater, surface water, and sediment quality. Releases of AMD pose unacceptable human health and ecological risks within the immediate area and downstream to Applegate Reservoir. These impacts are already apparent through the absence of fish and amphibians and significant reduction in reductions in the macroinvertebrate populations in Joe Creek, demonstrating the watershed-scale level of impacts that the mine is having. Barring a removal action, fish are unlikely to return to Joe Creek into the foreseeable future.

- ***Actual or potential contamination of drinking water supplies or sensitive ecosystems.***

  Sensitive, threatened and endangered species have been identified in the vicinity of the Site. The northern goshawk is a U.S. Fish and Wildlife Service (USFWS) candidate species. The Siskiyou Mountain salamander is listed as a USFS sensitive species and a California-endangered species. The northern bald eagle and the northern spotted owl also reside in the area and are both federally listed threatened species.

  Besides those impacts already observed, continued discharge of contaminants from the Site combined with downstream transport of contaminants in surface water and sediment could potentially result in future elevated levels of contamination in aquatic environments and risk to human and ecological receptors as far downstream as Applegate Reservoir**.**

- ***Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.***

  A log dam is located at the bottom of the waste rock covered slopes in the run-off channel that discharges to Joe Creek. Eroded waste rock has settled and accumulated behind this dam, if it were to fail these wastes would be released into Joe Creek.

- ***High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate.***

  Metals are also transported from the Site via sediment transport. Cadmium, copper, lead and zinc concentrations in sediments along the segment of Joe Creek between the Site and Elliott Creek are significantly elevated compared to background samples, indicating the Site is a significant source of the metals in Joe Creek sediment. The sediment transport mechanism is further substantiated by the trend of these same metals also increasing in the reach of Joe Creek between the Site and Elliott Creek.

  Barring a removal action, all of the impacts, contamination, and human and ecological risk will continue into the indefinite future due to the discharge of groundwater, surface water, and sediment from the Site.

- ***Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.***

Periods of high precipitation and surface runoff erode the waste rock and transport waste material as sediment to Joe Creek.

- ***The availability of other appropriate federal or stated response mechanisms to respond to the release.***

  Previous actions by the EPA have attempted to mitigate the release of metals from the Site, but these actions do not appear to have been fully effective as metals continue to be found in surface water downstream from the Site. These actions included the resurfacing of the waste rock piles, redirection of AMD into a marble lined channel, and creation of a settling pond behind a log dam. Within one year of its' construction, the detention pond behind the dam was filled with sediment.

- ***Other situations or factors that may pose threats to public health or welfare of the United States or the environment.***

  Continued discharge of contaminants from the Site combined with downstream transport of contaminants in surface water and sediment could potentially result in future elevated levels of contamination in aquatic environments and risk to human and ecological receptors as far downstream as Applegate Reservoir. The reservoir was constructed in 1980, and now acts as a trap and accumulation point for contaminated sediments.

6.0 CONCLUSION

The SI completed by URS at the Blue Ledge Mine has resulted in the following conclusions.

Groundwater Pathway

Groundwater discharges from seeps and adits at the Site and flows overland as surface water directly into Joe Creek. URS sampled groundwater as it emerges from two adits and two seeps. Dissolved metals in groundwater discharging from seeps and adits are present at high concentrations that result in an unacceptable risk to human and ecological receptors.

In addition to the observed discharge of contaminated groundwater from the adits and seeps directly to surface water, an additional likely complete migration pathway for the discharge of contaminated groundwater to Joe Creek is through the infiltration of precipitation into waste rock. As the precipitation infiltrates through the waste rock it becomes contaminated with metals, the downslope flow of that precipitation as groundwater discharges directly to Joe Creek as base flow. So long as waste rock remains at the Site, discharge of contaminated groundwater to Joe Creek will likely continue into the foreseeable future.

Sampling of three residential groundwater sources in the community of Joe Bar indicates that local groundwater contains concentrations of arsenic that do not exceed Federal or California MCLs for drinking water, but do exceed the EPA Regional Screening Level for tap water. However, it is highly unlikely that arsenic concentrations detected in groundwater sources samples at Joe Bar are connected in any way with Elliott Creek.

Surface Water Pathway

The surface water pathway is complete for both human and ecological receptors. Plots of cadmium, copper, and zinc concentrations in Joe Creek surface water clearly indicate that the Site is a significant source of these metals in Joe Creek. Surface water at the Site and in Joe Creek downstream of the Site exceeds ecological surface water criteria for copper, cadmium and zinc. Elevated concentrations of cadmium, copper and zinc are also detected in the emerging groundwater below the log dam in the run-off channel that discharges to Joe Creek. Due to these elevated concentrations, these locations should be considered as potential hot spots for ecological risk.

For human health risk from exposure to surface water, only consumption of fish was considered a significant exposure pathway. Fish collected in Elliott Creek, the Middle Fork Applegate River downstream of the mouth of Elliott Creek, and the head of the Applegate Reservoir contain unsafe concentrations of arsenic in regard to human consumption and only arsenic was present in surface water at concentrations that exceeded the related screening criteria at a number of locations.

Soil Pathway

The pathway for riparian soils is complete for both ecological and human receptors. Riparian soils adjacent to Joe Creek contain arsenic at concentrations posing unacceptable ecological risk. Excess cancer risks, as calculated in the risk evaluation (Appendix B), are present for arsenic in riparian soils along Joe Creek, Elliott Creek, and the Middle Fork Applegate River. However, surface water and sediment data indicate that the Site is not a source of arsenic.

Waste Rock Pathway

Site workers moving or removing waste rock could be exposed to metals through incidental ingestion of waste rock particles, dermal contact with waste rock materials, and inhalation of fine particles of waste rock or dust containing waste rock material. These same exposures are possible for short-term visitors, although the exposure durations are likely to be less for visitors than for workers.

Because waste rock is an uncommon medium to be assessed for potential risk to human receptors (as well as ecological receptors), attempting to quantify or semi-quantify human health risks based on dermal contact with waste rock and inhalation of related waste rock dust would require significant research, as no default exposure factors are available. In light of the fact that the waste rock is located in a remote area, exposure duration times for visitors would be relatively short. If the waste rock is removed, onsite remediation workers should wear appropriate protective clothing and a dust mask at minimum to avoid exposure to metals associated with the waste rock. It is assumed that the bulk of exposure of human and ecological receptors to the waste rock occurs indirectly through contact with abiotic media in Joe Creek located downstream of the mine, which has been impacted by migration of metals from the waste rock.

However, a rough estimate of potential exposure risks to human receptors directly contacting waste rock can be made for arsenic and lead by comparing waste rock results obtained in 2005 to soil criteria used in the SL-HHRA attached to this SI report. Waste rock is not soil, but comparison of waste results to soil criteria will provide a qualitative estimate of potential risks to human receptors that directly contact the waste rock. See Appendix C for the results of this comparison.

As presented in Appendix C, the waste rock concentrations detected in 2005 are much higher than the three types of soil criteria used as screening numbers. California regional soil levels represent typical background concentrations of metals found in California soils; the two USEPA RSL soil criteria are based on residential soil and industrial soil, respectively. Use of the RSLs is highly conservative in regard to assessing potential exposure of human receptors to the Blue Ledge Mine waste rock, which is located in a fairly remote area. However, the comparison does allow for a rough estimation of potential human health risks that might be related to directly contacting the waste rock. Because the mean and maximum concentrations of arsenic and lead significantly exceed the soil criteria used for screening purposes (this is also true for the minimum concentration of arsenic detected), it can be assumed that there is an unacceptable risk to human receptors that come into direct contact with the waste rock.

Sediment Pathway

The sediment pathway is complete for human and ecological receptors. Plots of cadmium, copper, lead, and zinc concentrations in Joe Creek sediment clearly indicate that the Site is a significant source of these metals in Joe Creek. Cadmium, copper, and zinc in Joe Creek sediments are present at concentrations that result in an unacceptable risk to ecological receptors. Copper is also present in Elliott Creek, the Middle Fork Applegate River, and the Applegate Reservoir sediments at concentrations that result in an unacceptable risk to ecological receptors.

Releases of waste rock particles and AMD from the Blue Ledge Mine have and will continue to impact immediate and downstream areas via the pathways described above. It is appropriate to conduct a removal action to mitigate these ongoing impacts to Joe Creek and Elliott Creek. In addition, the threat of future impacts to more populated areas, namely the Middle Fork Applegate River and the Applegate Reservoir, exist and also warrant a removal action to mitigate this future potential risk.

7.0 FOREST SERVICE DISCLAIMER

This abandoned mine/mill site was created under the General Mining Law of 1872 and is located partly on National Forest System (NFS) lands administered by the United States Department of Agriculture (USDA) Forest Service. The United States has taken the position and courts have held that the United States is not liable as "owner" under CERLA Section 107 for mine contamination left behind on NFS lands by miners operating under the 1872 Mining Law. Therefore, USDA Forest Service believes that the portion of this site that is located on NFS land should not be considered a "federal facility" within the meaning of CERCLA Section 120 and should not be listed on the Federal Agency Hazardous Waste Compliance Docket. Instead, this site should be included on EPA's CERCLIS database. Consistent with the June 24, 2003 OECA/FFEO "Policy on Listing Mixed Ownership Mine or Mill Sites Created as a Result of the General Mining Law of 1872 on the Federal Agency Hazardous Waste Compliance Docket," we respectfully request that the EPA Regional Docket Coordinator consult with the Forest Service and EPA Headquarters before making a determination to include any portion of this site on the Federal Agency Hazardous Waste Compliance Docket.

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TABLES

TABLE 1
SAMPLE COLLECTION SUMMARY
BLUE LEDGE MINE

Station Name	Location	Water	Sediment	Riparian Soil	Fish Tissue	Waste Rock
Applegate Reservoir						
ARV-01	Applegate Reservoir		X			
ARV-02	Applegate Reservoir		X		X	
ARV-03	Applegate Reservoir		X			
ARV-04	Applegate Reservoir	X	X			
Rivers/Creeks						
AR-01	Applegate River	X	X	X		
AR-02	Applegate River	X	X		X	
EC-01	Elliott Creek	X	X	X		
EC-02	Elliott Creek	X	X	X	X	
EC-03	Elliott Creek	X	X			
EC-04	Elliott Creek	X	X		X	
EC-05	Elliott Creek	X	X	X		
EC-06	Elliott Creek*	X	X			
EC-07	Elliott Creek*	X	X	X	X	
EC-08	Elliott Creek					
JC-01	Joe Creek *	X	X	X		
JC-02	Joe Creek	X	X			
JC-03	Joe Creek	X	X	X		
JC-04	Joe Creek *	X	X	X		
JC-05	Joe Creek					
JC-06	Joe Creek *					
JC-07	Joe Creek *	X				
JC-08	Joe Creek *	X	X			
JC-09	Joe Creek *	X				
JC-10	Joe Creek *	X	X			
JC-11	Joe Creek	X	X			
JC-12	Joe Creek	X	X	X		
JC-13	Joe Creek	X	X			
JC-14	Joe Creek	X	X	X		
JC-15	Joe Creek	X	X			
T1JC-01	Unnamed tributary 1 to Joe Creek					
T2JC-01	Unnamed tributary 2 to Joe Creek					
MG-01	Manzanita Gulch	X				
T3JC-01	Unnamed tributary 3 to Joe Creek	X				
T4JC-01	Unnamed tributary 4 to Joe Creek	X				
T4JC-02	Unnamed tributary 4 to Joe Creek	X				
Adits/Seeps						
AD-01	Upper North Adit **	X				
AD-02	Lower North Adit **	X				
AD-03	Upper South Adit **					
DAM-01	DAM	X				
SP-01	Seep	X				
SP-02	Seep	X				
Waste Rock Piles						
WR-01	Waste Rock					X
WR-02	Waste Rock					X
WR-03	Waste Rock					X
WR-04	Waste Rock					X
WR-05	Waste Rock					
	Total Number of Unique Samples	32	24	10	5	4
	Number of Duplicates	2	2	1	1	1
	Total Samples	**34**	**26**	**11**	**6**	**5**

Notes:

* = existing sampling station
** = opportunistic sampling if flow is present

TABLE 2
SURFACE WATER AND GROUNDWATER ANALYTICAL SUMMARY AND SCREENING
BLUE LEDGE MINE

	Field Parameters			General Chemistry Parameters - mg/L											Dissolved Metals - ug/L											
Sample Name	pH (SU)	Conductivity (uS/cm)	Temperature (degrees Celsius)	Alkalinity		Hardness		TDS		TSS		Sulfate			Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Background																										
JC-15-SW-080627-URS	7.78	55	11.2	26		23.9		18		5	U	2.5			0.07	U	0.008	U	0.74		4.0	U	0.020	U	0.92	
JC-14-SW-080627-URS	7.76	55	10.8	26		23.8		17		5	U	2.5			0.07	U	0.008	U	0.71		4.0	U	0.020	U	1.10	
JC-13-SW-080627-URS	7.89	56	10.7	25		24		29		5	U	2.5			0.07	U	0.008	U	0.84		4.0	U	0.020	U	0.82	
JC-12-SW-080627-URS	7.93	56	10.1	24		23.6		33		5	U	2.5			0.07	U	0.008	U	0.73		4.0	U	0.020	U	0.75	
JC-11-SW-080627-URS	7.93	54	10.0	25		23.8		14		5	U	2.5			0.08	J	0.008	U	0.75		4.0	U	0.020	U	0.49	J
JC-10-SW-080627-URS	8.13	55	9.7	25		24.5		26		5	U	2.5			0.07	U	0.008	U	0.77		4.0	U	0.020	U	0.65	
Rivers and Creeks																										
JC-09-SW-080627-URS	7.29	48	9.1	22		21.3		15		5	U	2.3			0.07	U	0.031		3.45		4.0	U	0.020	U	6.01	
JC-08-SW-080626-URS	6.94	47	10.5	21		20.6		21		5	U	2.8			0.07	U	0.228		29.0		4.0	U	0.043		42.9	
JC-07-SW-080626-URS	7.45	64	12.8	20		20.8		43		5	U	3.6			0.07	U	0.537		62.8		4.0	U	0.060		88.5	
JC-07-SW-DUP-080626-URS	NA	NA	NA	22		20.9		15		5	U	3.6			0.07	U	0.519		62.4		4.0	U	0.066		87.6	
JC-04-SW-080627-URS	7.19	79	16.9	32		35		40		5	U	5.1			0.07	U	0.504		31.8		5.1	J	0.020	U	61.2	
JC-03-SW-080625-URS	6.97	75	12.2	31		36.4		55		5	U	5.1			0.07	U	0.496		34.9		4.0	U	0.020	U	63.7	
JC-02-SW-080625-URS	6.97	74	11.6	33		37.1		37		5	U	5.1			0.07	U	0.519		35.6		4.0	U	0.020	U	69.3	
JC-01-SW-080625-URS	7.40	75	10.5	35		37		48		5	U	5.1			0.07	U	0.564		31.3		4.0	U	0.020	U	79.4	
EC-07-SW-080625-URS	7.56	91	10.8	47		44.9		71		5	U	2.8			0.35	J	0.008	U	0.46		4.0	U	0.020	U	0.61	
EC-06-SW-080625-URS	6.92	82	10.9	38		40.4		73		5	U	3.1			0.22	J	0.180		13.9		4.0	U	0.020	U	22.3	
EC-05-SW-080625-URS	7.45	90	11.3	42		43.4		66		5	U	3.0			0.39	J	0.042		3.03		4.0	U	0.020	U	3.49	
EC-04-SW-080625-URS	7.51	101	13.5	42		44		64		5	U	3.0			0.37		0.040		3.22		4.0	U	0.020	U	3.82	
EC-04-SW-DUP-080625-URS	NA	NA	NA	44		43.1		82		5	U	2.9			0.40		0.049		3.25		4.0	U	0.020	U	4.73	
EC-03-SW-080625-URS	7.39	103	11.6	41		44.3		76		5	U	3.0			0.31	J	0.046		3.22		4.0	U	0.020	U	4.38	
EC-02-SW-080625-URS	7.50	103	11.1	43		43.9		77		5	U	3.0			0.37	J	0.038		3.62		4.0	U	0.020	U	4.94	
EC-01-SW-080624-URS	7.57	103	14.7	40		42.3		81		5	U	3.0			0.50	J	0.049		7.82		6.0	J	0.023		3.95	
AR-01-SW-080624-URS	7.62	100	14.1	36		41.6		64		5	U	2.5			0.07	U	0.018	J	0.02	U	5.6	J	0.016	J	0.50	U
AR-02-SW-080624-URS	7.65	95	14.2	38		41.1		50		5	U	1.9			0.29	J	0.025		1.61		4.6	J	0.008	J	2.15	
ARV-04-SW-080624-URS	7.47	95	21.2	42		39.3		77		5	U	1.8			0.37	J	0.012	J	1.89		7.9	J	0.011	J	2.2	
Tributaries																										
T4JC-01-SW-08627-URS	6.96	20	13.6	12		11.5		24		5	U	1.0			0.07	U	0.008	U	0.86		4.0	U	0.035		1.90	
T4JC-02-SW-08627-URS	6.62	19	13.3	12		11.5		23		5	U	1.0			0.07	U	0.008	U	0.89		7.4	J	0.020	U	1.93	
DAM-01-080624-URS	3.42	310	16.1	2	U	63.5		160		5	U	112			0.07	U	33.7		4680		1670		8.370		6180	
T3JC-01-SW-080626	7.27	155	19.3	78		74.1		91		8		1.9			0.50	U	0.01		0.42		97.9		0.007		1.75	
MG-01-SW-080626-URS	7.78	164	13.4	77		82.2		120		5	U	9.0			0.29	J	0.008	U	0.51		22.4		0.020	U	1.13	
T2JC-01	Not Sampled - Tributary Dry																									
T1JC-01	Not Sampled - Tributary Dry																									
Adits and Seeps																										
AD-01-080624-URS	2.40	>3999	26	2	U	576		5060		5	U	2770			3.19		70.9		194000		748000		8.640		300000	
AD-02-080624-URS	7.73	435	9.2	134		548		801		6		393			1.81		0.598		4.77		53.6		0.020		1200	
SP-01-080624-URS	6.84	92	19.5	31		31		23		5	U	5.7			0.10	J	0.839		65.9		20.3		0.210		132	
SP-02-080627-URS	5.98	70	7.7	22		36.8		81		5	U	18.3			0.07	U	5.450		699		4.0	U	0.219		913	
Screening Criteria																										
Ecological																										
California Water Quality Standards CCC	--	--	--	--		--		--		--		--			150		2.2		9		NA		2.5		120	
DEQ Table 33A, 33B, and 33C AWQC CCC	--	--	--	20		--		--		--		--			48		b		b		1000		b		b	
EPA NRWQC CCC 2006	--	--	--	--		--		--		--		--			150		0.25		9		NA		2.5		120	
Human Health																										
CalWQS - humans ingesting organisms only	--	--	--	--		--		--		--		--			--		--		--		--		--		--	
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	--	--	--	20		--		--		--		--			0.14		--		--		--		--		26,000	
EPA NRWQC - protective of humans ingesting organisms only	--	--	--	--		--		--		--		--			0.14		--		--		--		--		26,000	

[a] Values are hardness dependent. Values shown for CA WQS and USEPA NRWQC are based on a default hardness of 100 mg/L. Site-specific CCCs are based on hardness values specific to each waterbody.

b Guidance recommends calculation of site-specific criteria using hardness data collected from the site (Table 33B). For calculated hardness dependent values see Appendix C.

U - The analyte was analyzed for, but was not detected above the reported sample method detection limit (MDL).

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

Highlighted results exceed one or more screening level values.

TABLE 3
DRINKING WATER ANALYTICAL SUMMARY AND SCREENING
BLUE LEDGE MINE

		General Chemistry Parameters - mg/L										Dissolved Metals - ug/L											
Sample Name	Sample Location	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
WS-1	Ziem's Residence	244		256		267		5	U	18.2		6.24		0.554		9.67		20	U	2.82		540	
WS-2	Ruetiger's Residence	258		271		276		5	U	21		0.22	J	0.019	J	1.16		4	U	0.092		7	
WS-3	Neilson's Residence	160		246		324		5	U	77.4		2.04		0.062		4		20	U	0.166		43	
Screening Criteria - Human Health																							
USEPA Drinking Water Standards (MCLs)		--		--		--		--		--		10		5		1,300		300		15		--	
Cal MCLS		--		--		--		--		--		10		5		1,300		300		15		--	
USEPA Regional Screening Levels for tap water		--		--		--		--		--		0.045		18		1,500		26,000		--		11,000	

J - The result is an estimated concentration
U - The compound was analyzed for, but was not detected at or above the MDL
Highlighted results exceed one or more screening

TABLE 4
RIPARIAN SOIL ANALYTICAL SUMMARY AND SCREENING
BLUE LEDGE MINE

Sample Name	Arsenic	Cadmium	Copper	Iron[a]	Lead	Zinc
Background						
JC-14-RS-080627-URS	1.24	0.092	45.2	17100	1.83	38.9
JC-12-RS-080627-URS	3.16	0.166	67.1	21800	5.29	73.1
Average of background data	2.2	0.13	56.2	19450	3.6	56
California Regional Soil Levels[b]	3.5	0.36	28.7	--	23.9	149
Rivers and Creeks						
JC-06	Not sampled					
JC-05	Not sampled					
JC-04-RS-080627-URS	3.44	0.354	204	24900	15.1	86.7
JC-03-RS-080626-URS	17.8	0.202	141	52400	11.6	119
JC-01-RS-080626-URS	4.73	1.09	378	26600	31.2	172
EC-08	Not sampled					
EC-07-RS-080625-URS	5.84	0.220	51.9	40400	6.08	84.6
EC-05-RS-080625-URS	5.37	0.281	60.4	28200	6.37	74.0
EC-05-RS-DUP-080625-URS	5.01	0.311	80.0	28000	6.17	74.0
EC-02-RS-080625-URS	3.29	0.191	56.0	23000	5.75	64.9
EC-01-RS-080624-URS	5.61	0.324	74.1	35400	5.99	97.9
AR-01-RS-080624-URS	4.65	0.654	85.0	28600	7.06	185
Screening Criteria						
Ecological						
DEQ SLVs						
Plants	10	4	100	--	50	50
Inverts	60	20	50	--	500	200
Birds	10	6	190	--	16	60
Mammals	29	125	390	--	4000	20000
EPA Eco-SSLs						
Plants	18	32	70	--	120	160
Soil invertebrates	NA	140	80	--	1,700	120
Avian receptors	43	0.77	~~28~~	--	11	~~46~~
Mammalian Receptors	46	0.36	~~49~~	--	56	79
Applicable Ecological Criterion	10	0.36	56.2[c]	--	11	56[c]
Human Health						
EPA R6 HHMSSLs	~~0.39~~	39	2,900	--	400	23,000
Applicable Human Health Criteria	2.2[c]	39	2,900	--	400	23,000

All results are in mg/kg on a dry weight basis unless otherwise noted.
Highlighted results exceed one or more screening level values.
-- = not available.

a = iron results are presented, but iron is considered an essential nutrient.

b - Because site-specific background concentrations are available for riparian soil, the California Regional Soil Levels are presented here for informational purposes only.

c - Because the site-specific background concentration is greater than the flagged screening criteria, the site-specific background concentration is used as the applicable criterion. Criteria lower than the background concentration are shown in strikethrough font.

TABLE 5
SEDIMENT ANALYTICAL SUMMARY AND SCREENING
BLUE LEDGE MINE

Sample Name	Arsenic	Cadmium	Copper	Iron[a]	Lead	Zinc
Background						
JC-15-SD-080627-URS	1.43	0.121	47.2	20000	1.63	44.1
JC-14-SD-080627-URS	0.74	0.093	34.4	14900	1.20	26.9
JC-13-SD-080627-URS	1.19	0.113	37.7	18500	1.63	40.2
JC-12-SD-080627-URS	1.77	0.097	39.0	16500	2.09 J	35.4
JC-11-SD-080627-URS	1.36	0.139	47.5	20700	1.49	36.6
JC-10-SD-080627-URS	2.68	0.214	51.7	24000	2.67	55.6
Average of background data	1.5	0.13	42.9	19100.0	1.8	39.8
California Regional Soil Levels[b]	3.5	0.36	28.7	--	23.9	149
Rivers and Creeks						
JC-08-SD-080627-URS	2.54 J	0.941	978	24700	13.8	208
JC-06	Not sampled					
JC-05	Not sampled					
JC-04-SD-080627-URS	4.27	2.93	558	11300	10.0	317
JC-03-SD-080626-URS	3.22	2.70	386	20400	7.72	423
JC-02-SD-080626-URS	1.14	2.80	536	22400	6.27	533
JC-01-SD-080626-URS	3.01	2.14	430	26200	5.85	440
EC-08	Not sampled					
EC-07-SD-080625-URS	7.59	0.281	28.0	23200	6.91	59.0
EC-06-SD-080625-URS	4.92	0.581	119	33200	10.4	114
EC-05-SD-080625-URS	3.50	0.213	38.5	25500	4.07	74.5
EC-05-SD-DUP-080625-URS	3.61	0.260	47.0	24300	3.54	77.8
EC-04-SD-080625-URS	6.20	0.211	39.9	27700	5.52	77.1
EC-04-SD-DUP-080625-URS	5.20	0.270	51.3	32200	4.72	75.1
EC-03-SD-080625-URS	4.35	0.528	42.9	28500	4.52	72.7
EC-02-SD-080625-URS	4.04	0.315	57.5	37200	5.72	109
EC-01-SD-080624-URS	4.23	0.388	43.1	20400	5.14	75.8
AR-01-SD-080624-URS	3.95	0.416	68.8	31800	5.97	120
AR-02-SD-080624-URS	4.36	0.406	62.7	33200	4.94	107
ARV-01-SD-080624-URS	4.76	0.422	70.8	31000	6.54	111
ARV-02-SD-080624-URS	4.77	0.519	81.8	33400	6.34	128
ARV-03-SD-080624-URS	4.71	0.572	107	36700	8.24	116
ARV-04-SD-080624-URS	3.98	0.434	73.8	27600	6.37	93.1
Screening Criteria						
Ecological						
TECs	9.79	0.99	~~31.6~~	--	35.8	121
PECs	33	4.98	149	--	128	459
DEQ SLVs	7[c]	1[c]	NA	--	17[c]	NA
SQS	57	5.1	390	--	450	410
Applicable Ecological Screening Level	7	0.99	42.9[d]	--	17	121
Human Health						
EPA R6 HHMSSLs	~~0.39~~[d]	39	2,900	--	400	23,000
Applicable Human Health Screening Level	1.5[d]	39	2,900	--	400	23,000

All results are in mg/kg on a dry weight basis unless otherwise noted.

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

Highlighted results exceed one or more screening level values.

-- = not available.

a = iron results are presented, but iron is considered an essential nutrient.

b = Because site-specific background concentrations are available for sediment, the California Regional Soil Levels are presented here for informational purposes only.

c = Default DEQ regional background concentration. DEQ Ecological Risk Assessment Guidance recommends using regional or site-specific background concentration for screening purposes (DEQ 2007).

d = because background concentration was higher than at least one criterion, background concentration is used here as the most stringent criterion. Criterion lower than the background concentration is shown in strikethrough font.

TABLE 6
FISH TISSUE ANALYTICAL SUMMARY AND SCREENING
BLUE LEDGE MINE

Sample Name	Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
JC-01												
EC-07-FT-080626-URS	0.24		0.068		2.32		295		0.065		24.8	
EC-06	Not sampled											
EC-04-FT-080626-URS	0.15		0.134		4.79		1140		0.194		29.2	
EC-02-FT-080626-URS	0.15		0.173		5.73		103		0.062		37.1	
AR-01	Not sampled											
AR-02-FT-080627-URS	0.16		0.145		3.15		69	J	0.017		33.5	
AR-02-FT-DUP-080627-URS	0.13		0.133		3.30		116	J	0.024		30.3	
ARV-02-FT-080627-URS	0.14		0.049		2.29		43		0.027		22.9	
ARV-01	Not sampled											
Screening Criteria												
Ecological												
DEQ CTLs (mg/kg - wet wt)	6.6		0.15		--		--		0.12		--	
DEQ ATLs (mg/kg - wet wt)												
Birds (Individual)	13		8.4		--		--		9.3		--	
Birds (Population)	64		42		--		--		46		--	
Mammals (Individual)	7.6		5.6		--		--		34		--	
Mammals (Population)	38		28		--		--		170		--	
Applicable Ecological Criteria	6.6		0.15		--		--		0.12		--	
Human Health												
Human (Carcinogens General/Recreational)	0.0062		--		--		--		--		--	
Human (Carcinogens Subsistence/Tribal))	0.00076		--		--		--		--		--	
Human Non-carcinogens (General/Recreational)	1.2		4.0		--		--		0.5		--	
Human Non-carcinogens (Subsistence/Tribal)	0.15		0.49		--		--		0.5		--	
Applicable Human Health Criteria	0.0062[a]		0.49		--		--		0.5		--	

mg/Kg - wet weight basis
-- = not available.

J - The result is an estimated quantity. The associated numeric value is the approximate concentration of the analyte in the sample.
Highlighted results exceed one or more screening level values.

a - Because there is no evidence of subsistance/tribal fishing activities in the project area, the criterion based on protection of recreational fishers from carcinogenic effects of arsenic was chosen as the applicable human health criterion for screening.

TABLE 7
WASTE ROCK ANALYTICAL SUMMARY
BLUE LEDGE MINE

	SPLP Metals - mg/L												**TCLP Metals - mg/L**															
Sample Name	Arsenic		Cadmium		Copper		Iron		Lead		Zinc		Arsenic		Barium		Cadmium		Chromium		Lead		Mercury		Selenium		Silver	
WRS-1	0.0005	U	0.00067		0.110		0.04		0.0012		0.26		0.10	U	0.40		0.0010		0.010	U	0.05	U	0.001	U	0.10	U	0.02	U
WRS-1-DUP	0.0005	U	0.00073		0.130		0.06		0.0009		0.26		0.10	U	0.30		0.0008	U	0.002		0.05	U	0.001	U	0.10	U	0.02	U
WRS-2	0.0005	U	0.00010		0.086		0.03		0.0170		0.14		0.10	U	0.30		0.0008	U	0.010	U	0.04		0.001	U	0.10	U	0.02	U
WRS-3	0.0005	U	0.00050		0.230		0.03		0.0210		0.20		0.10	U	0.30		0.0008	U	0.010	U	0.04		0.001	U	0.10	U	0.02	U
WRS-4	0.0005	U	0.00086		0.230		0.06		0.0069		0.20		0.10	U	0.30		0.0008	U	0.010	U	0.05	U	0.001	U	0.10	U	0.02	U
Maximum concentration of contaminants for the toxicity characteristic													5.0		100		1.0		5.0		5.0		0.2		1.0		5.0	

U - The analyte was analyzed for, but was not detected above the reported sample method detection limit (MDL).

FIGURES

Source: Grants Pass, Oregon USGS 100K Topo Quad, 1984.
Happy Camp, California USGS 100K Topo Quad, 1984.

0 1 2 Miles

URS

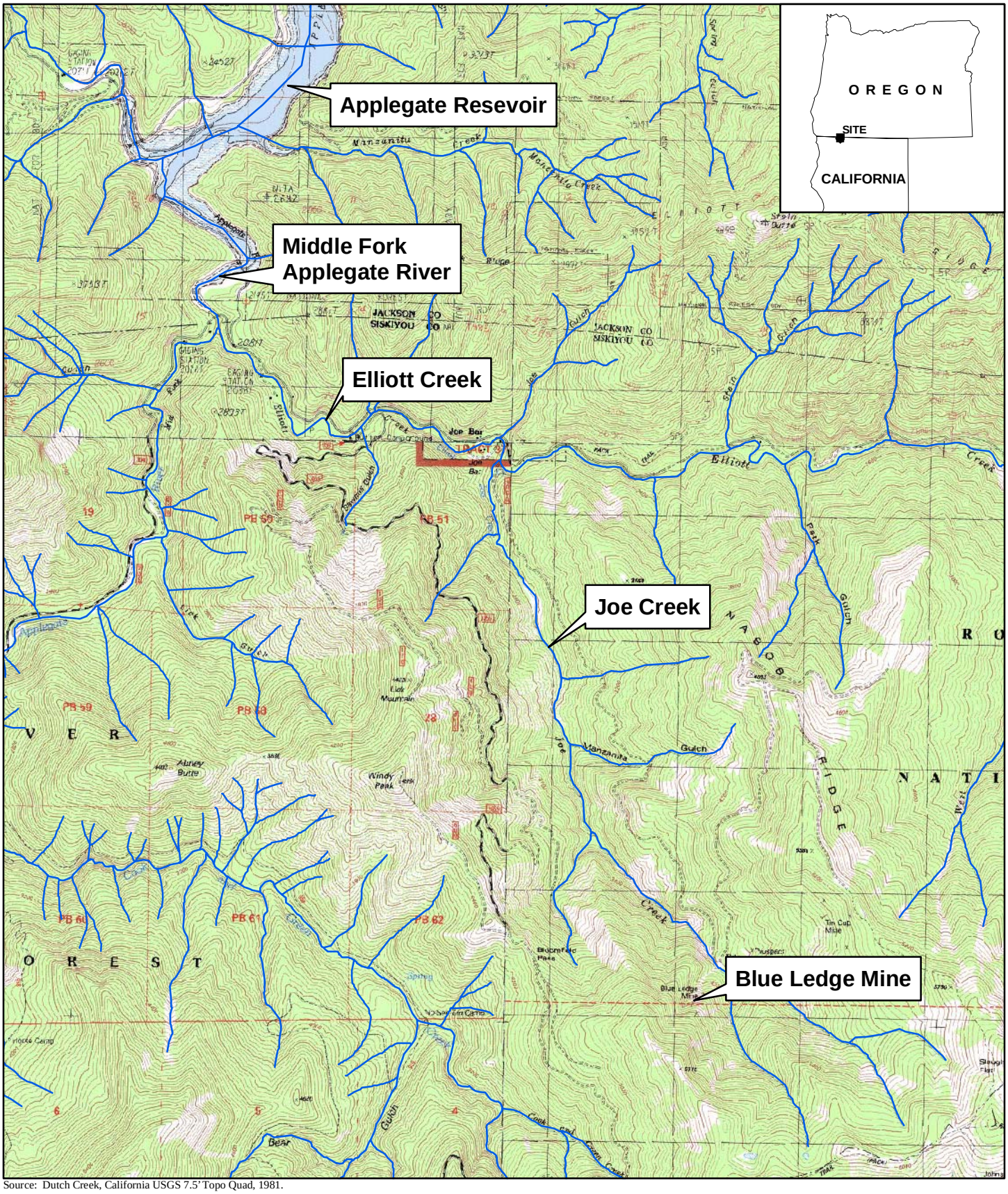
APRIL 2009
25696770

VICINITY MAP

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

FIGURE 1

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Fig1 Vicinity Map.mxd



Source: Dutch Creek, California USGS 7.5' Topo Quad, 1981.
Kangaroo Mountain, California USGS 7.5' Topo Quad, 1981.
Squaw Lakes, Oregon USGS 7.5' Topo Quad, 1983.
Carberry Creek, Oregon USGS 7.5' Topo Quad, 1983.

0 0.5 1 Miles

SITE AREA

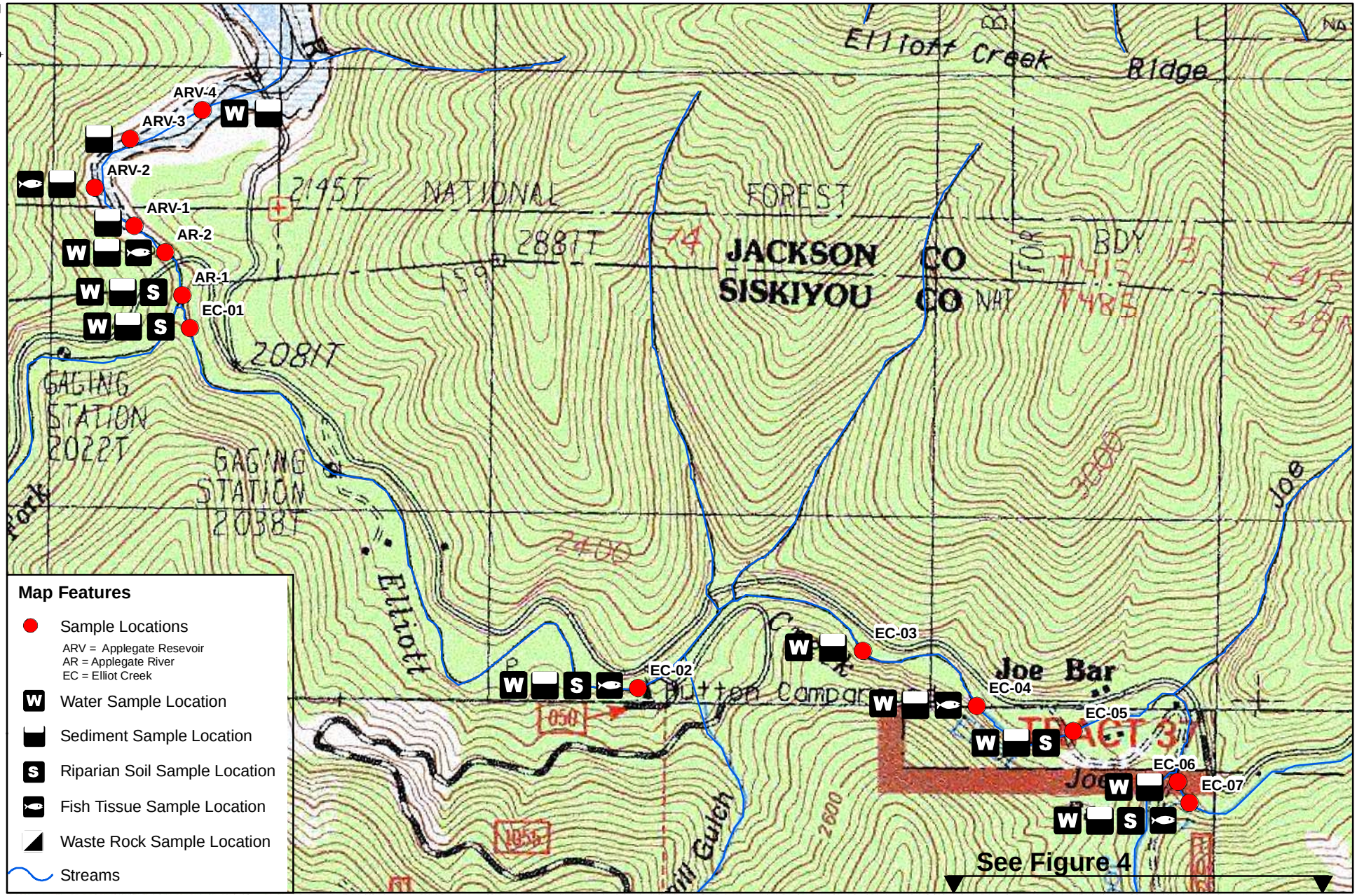
URS

APRIL 2009
25696770

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

FIGURE 2

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Preliminary2\Fig 2 Site Area.mxd



Source: Dutch Creek, California USGS 7.5' Topo Quad, 1981.
Kangaroo Mountain, California USGS 7.5' Topo Quad, 1981.
Squaw Lakes, Oregon USGS 7.5' Topo Quad, 1983.
Carberry Creek, Oregon USGS 7.5' Topo Quad, 1983.

0 500 1,000 2,000 Feet

URS

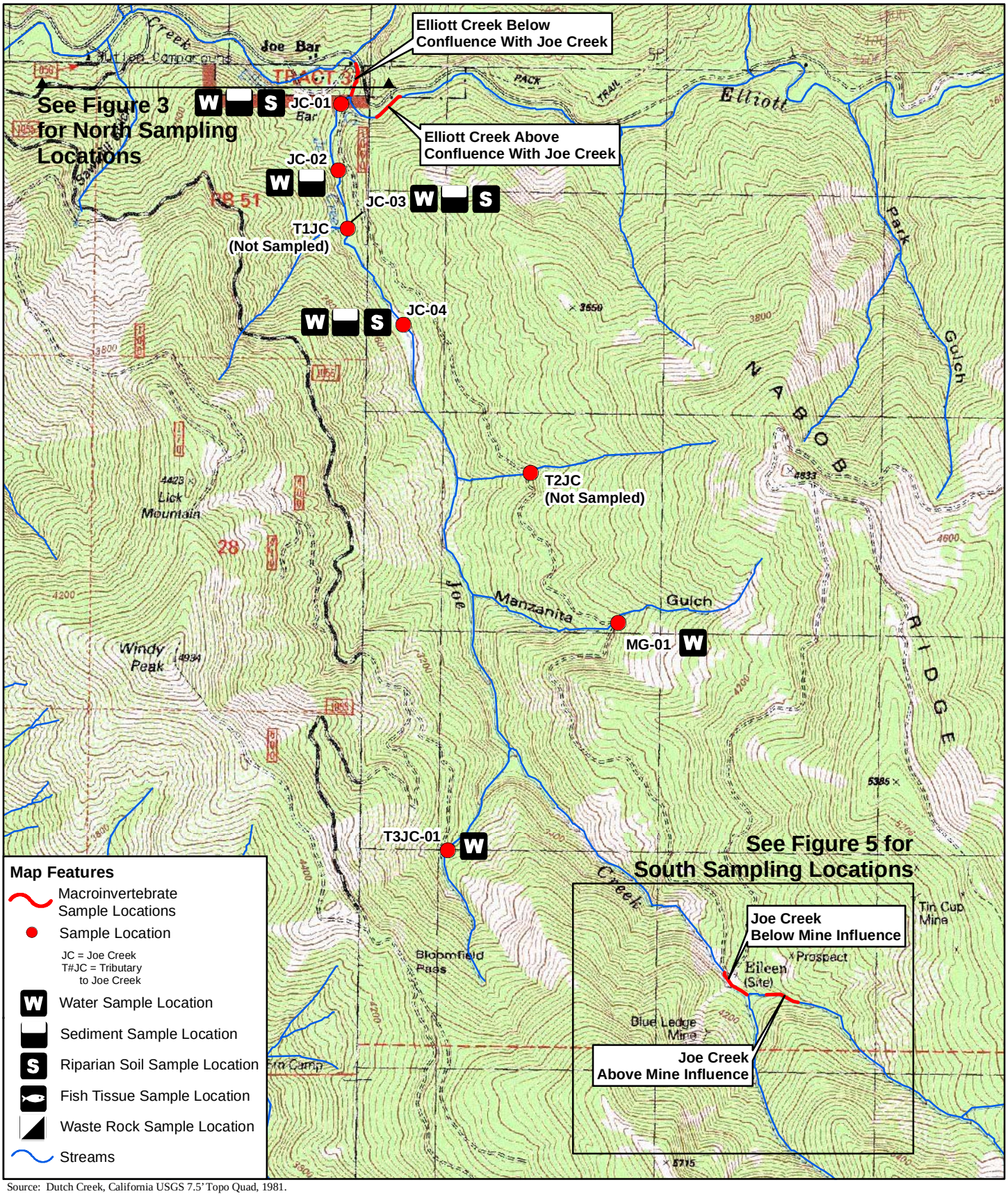
NORTH SAMPLING LOCATIONS

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

APRIL 2009
25696770

FIGURE 3

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Final\Fig 3 Sample Locations N.mxd



Source: Dutch Creek, California USGS 7.5' Topo Quad, 1981.
Kangaroo Mountain, California USGS 7.5' Topo Quad, 1981.

0 500 1,000 2,000 Feet

URS

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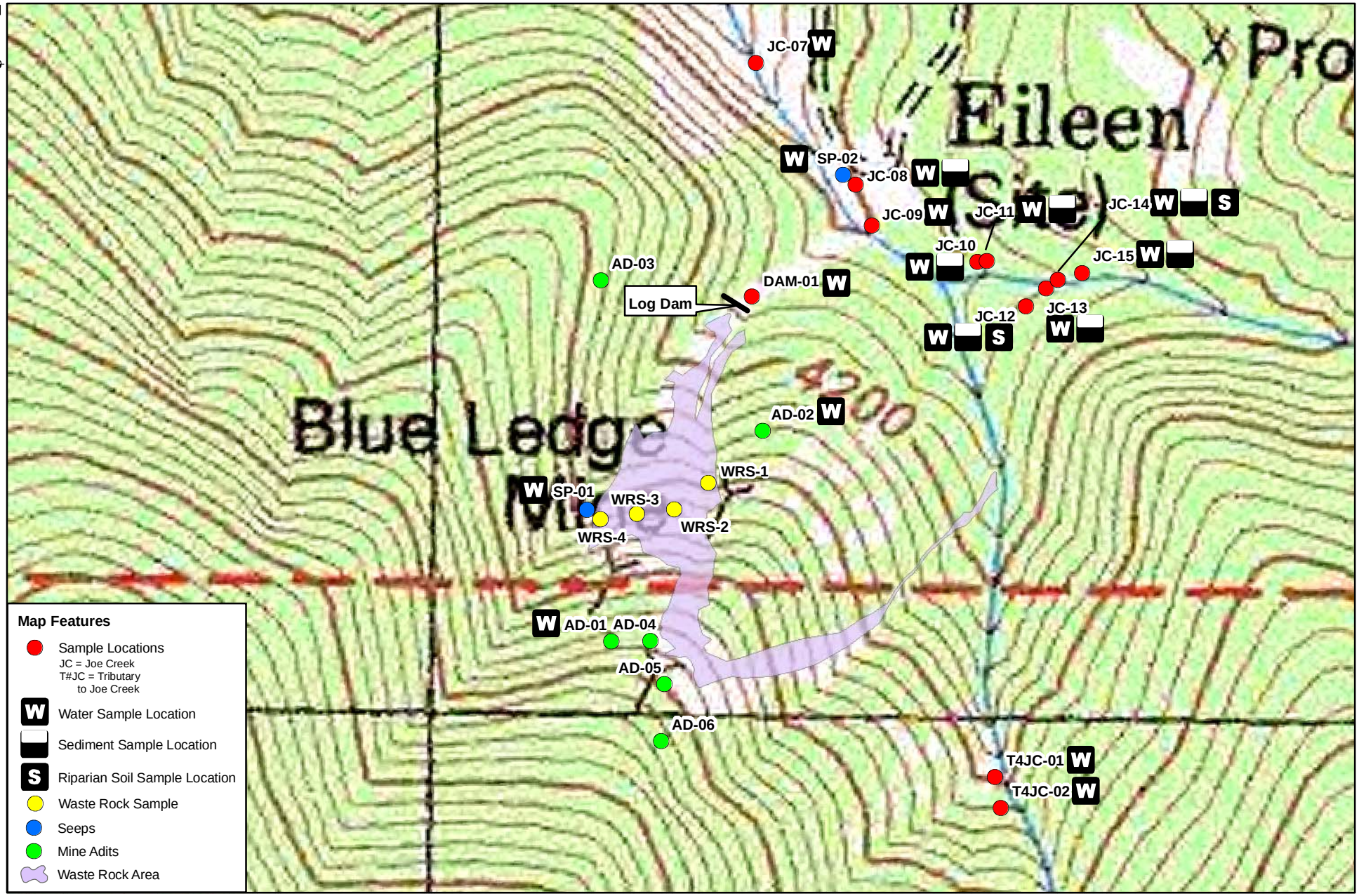
MIDDLE SAMPLING LOCATIONS

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

FIGURE 4

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Final\Fig 4 Middle Sample Locations.mxd



0 125 250 500 Feet

URS

SOUTH SAMPLE LOCATIONS

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

APRIL 2009
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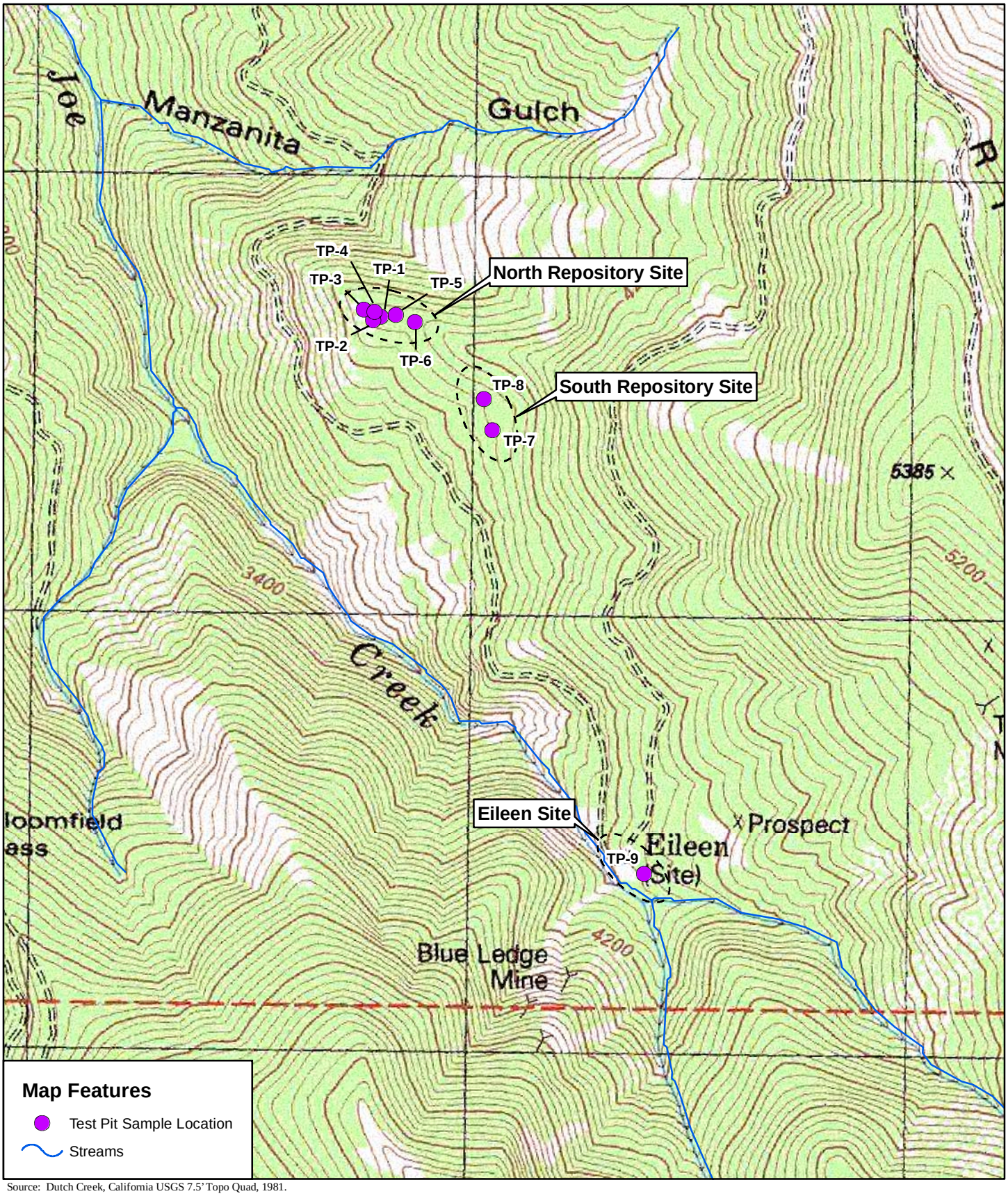
FIGURE 5

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Fig 5-1 Sample Locations S.mxd



Source: Dutch Creek, California USGS 7.5' Topo Quad, 1981.
Kangaroo Mountain, California USGS 7.5' Topo Quad, 1981.

0 250 500 1,000 Feet

URS

APRIL 2009
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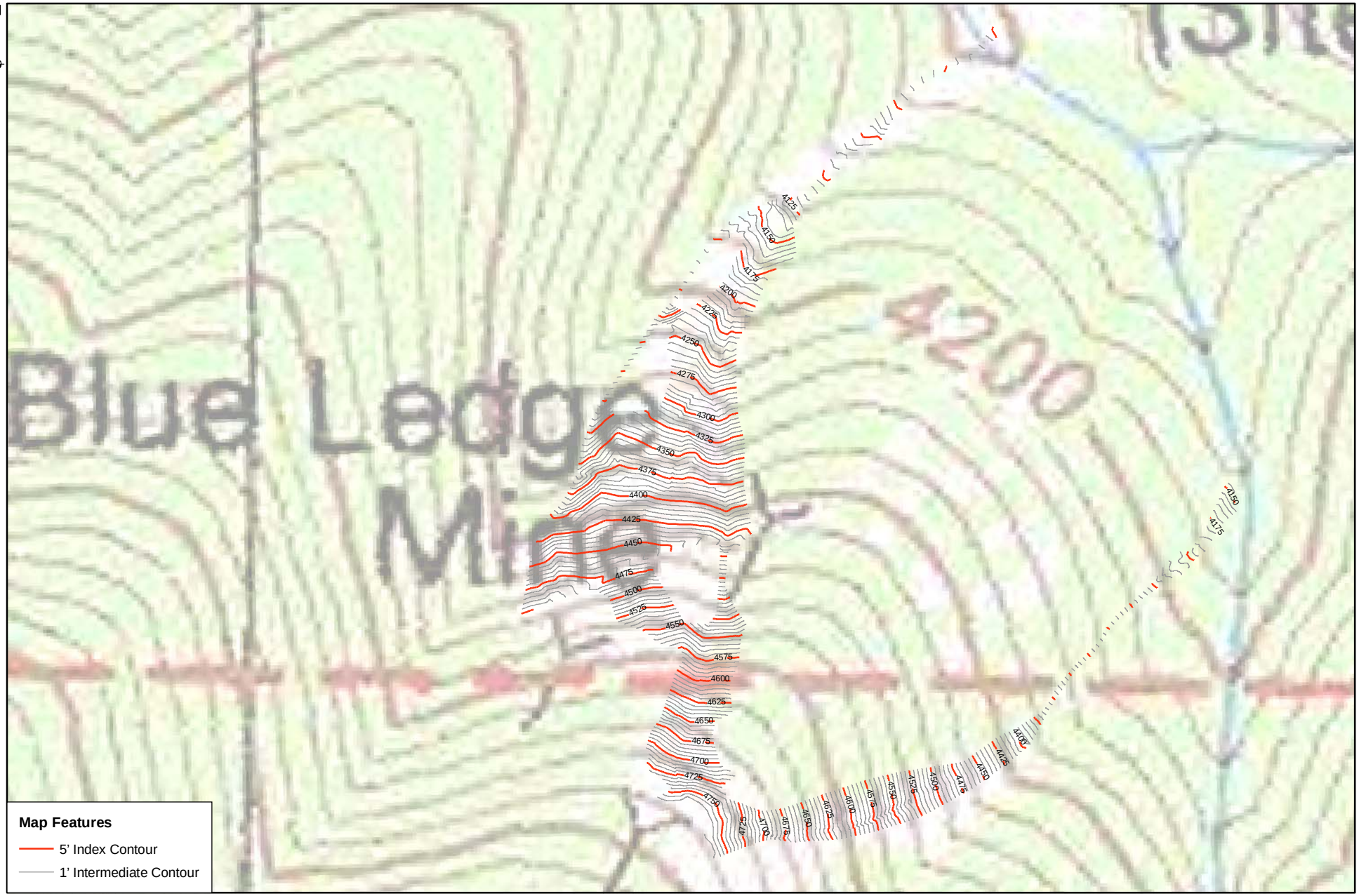
TEST PIT LOCATIONS

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

FIGURE 6

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Final\Fig 6 Test Pit Locations.mxd



0 75 150 300 Feet

URS

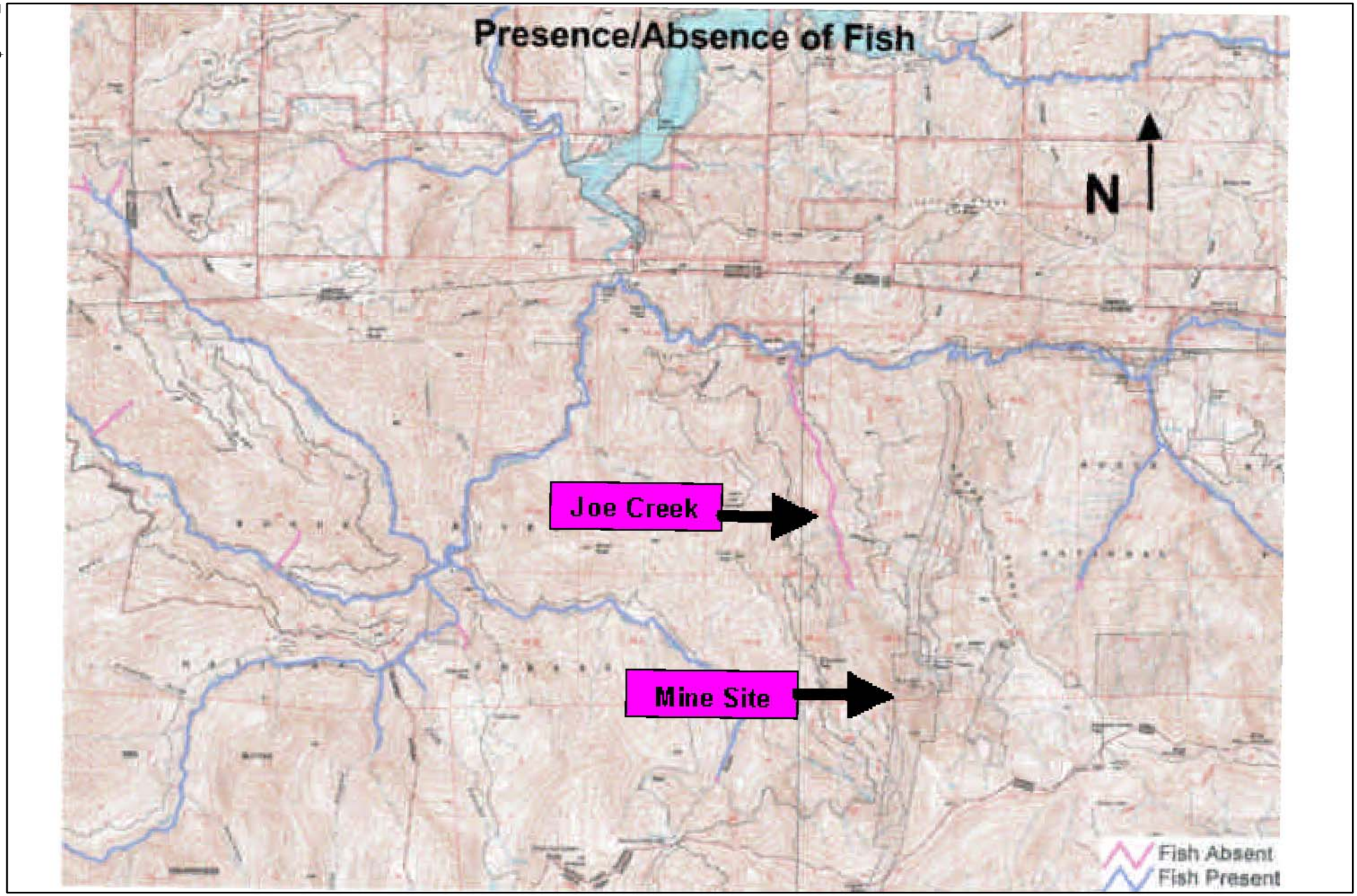
WASTE ROCK PILE DETAIL

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

APRIL 2009
25696770

FIGURE 7

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Final\Fig 7 Waste Rock Pile Detail.mxd



PRESENCE/ABSENCE OF FISH

UNITED STATES FOREST SERVICE
BLUE LEDGE MINE
BLUE LEDGE, CALIFORNIA

APRIL 2009
25696770

URS

FIGURE 8

O:\25696770 Blue Ledge Mine\5000 Technical\GIS\MXD\Final\Fig 8 Presence Absence of Fish.mxd

CHARTS

Chart 1
Dissolved Copper and Zinc in Surface Water

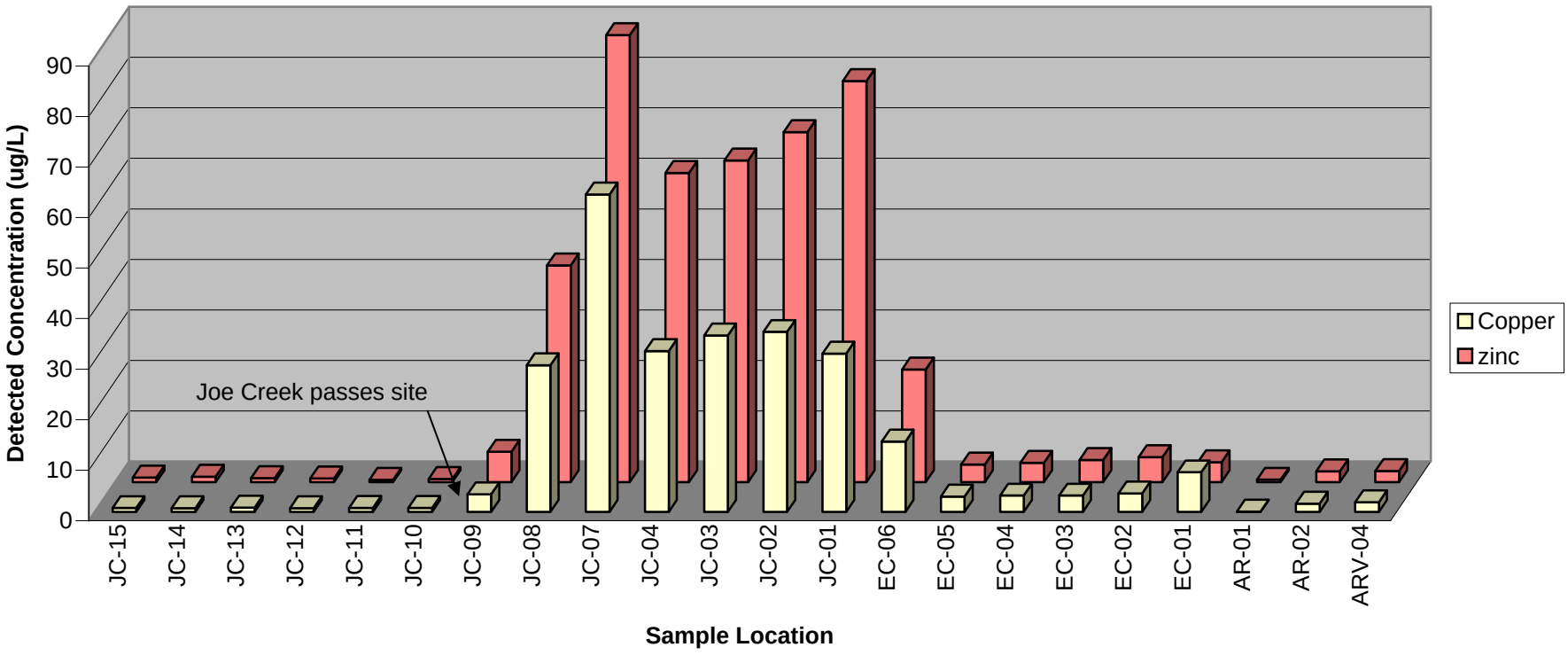


Chart 2
Dissolved Arsenic and Cadmium in Surface Water

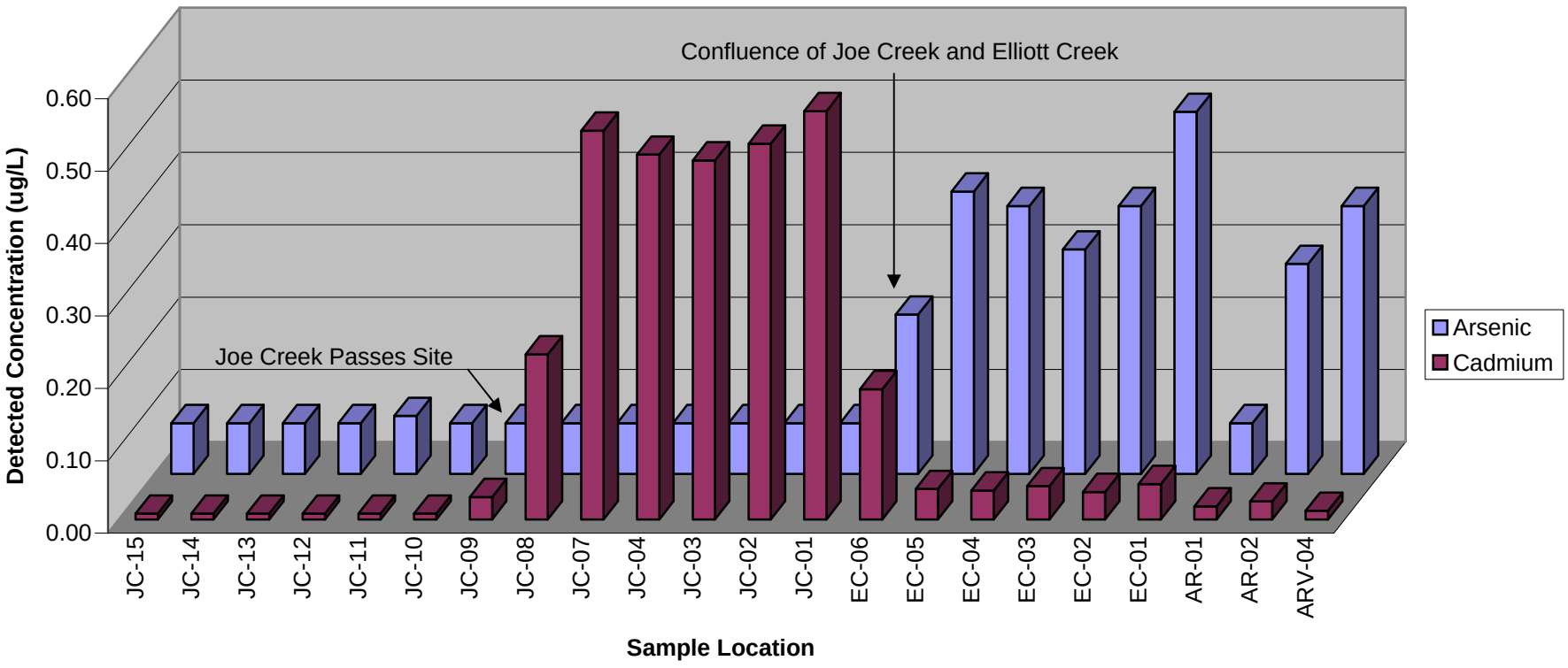


Chart 3
Dissolved Lead in Surface Water

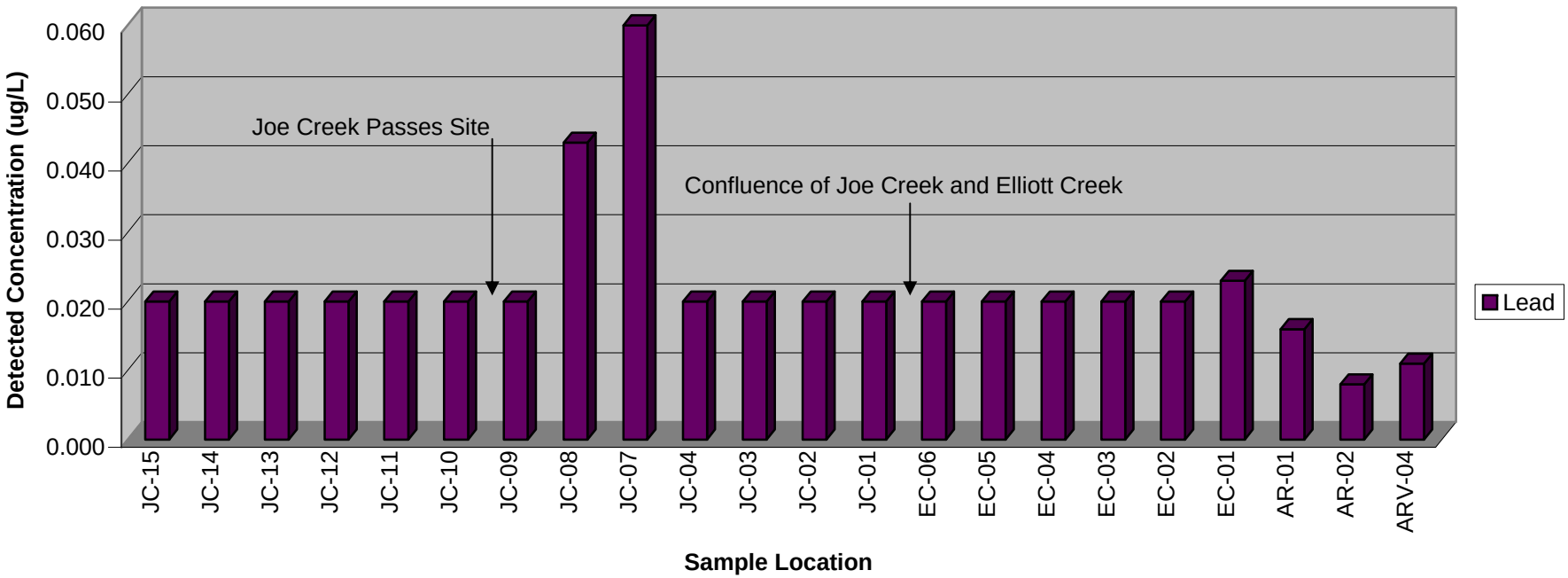


Chart 4
Dissolved Iron in Surface Water

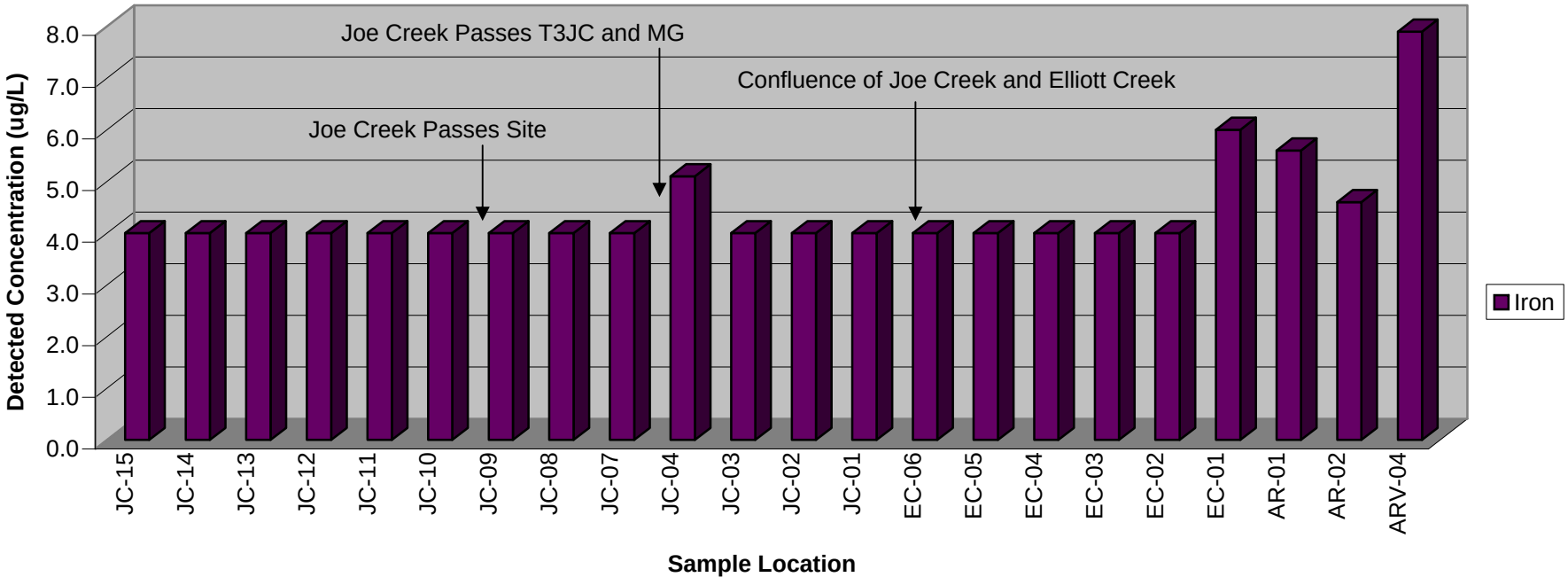


Chart 5
Iron in Riparian Soil

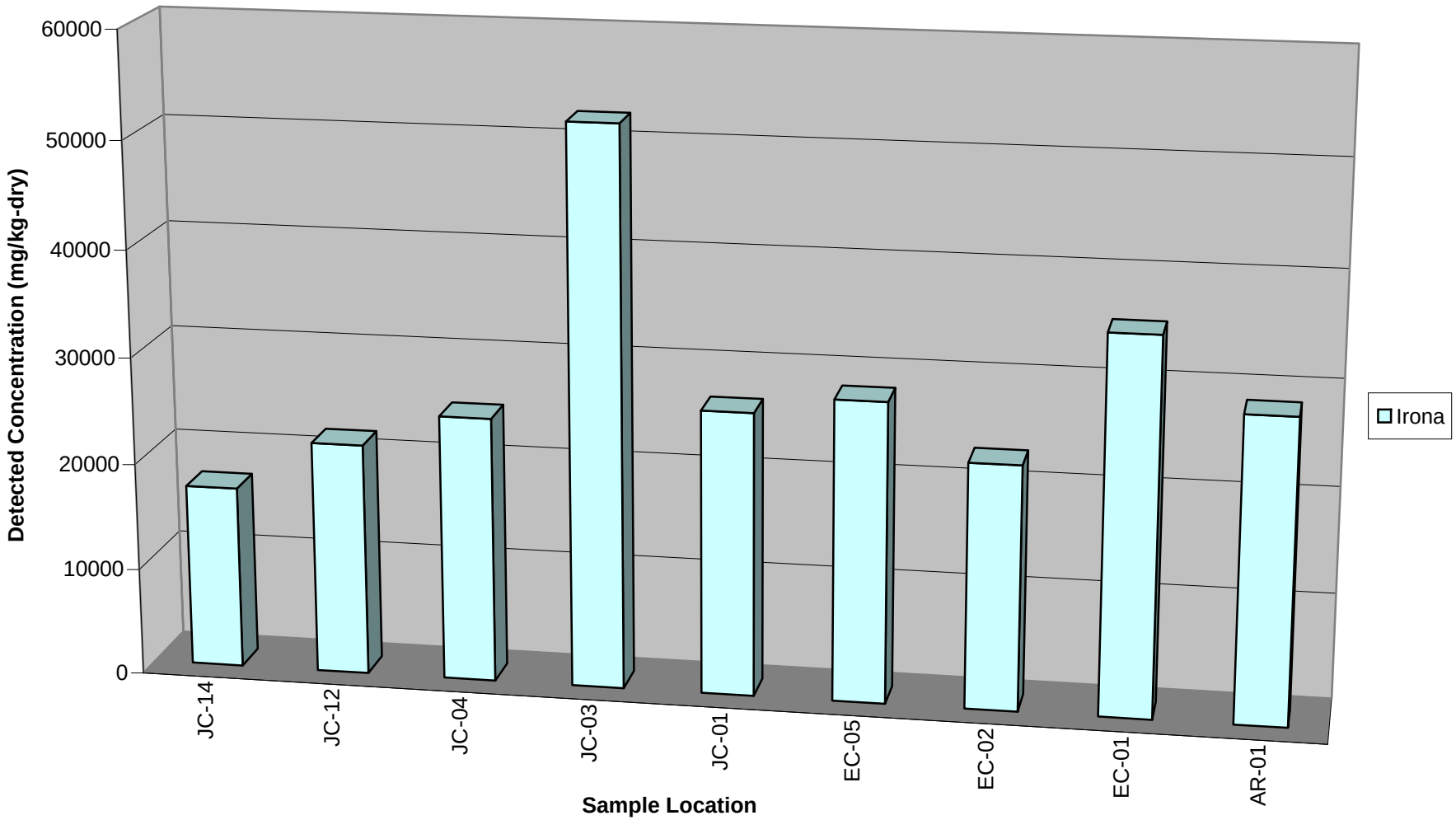


Chart 6
Copper and Zinc in Riparian Soil

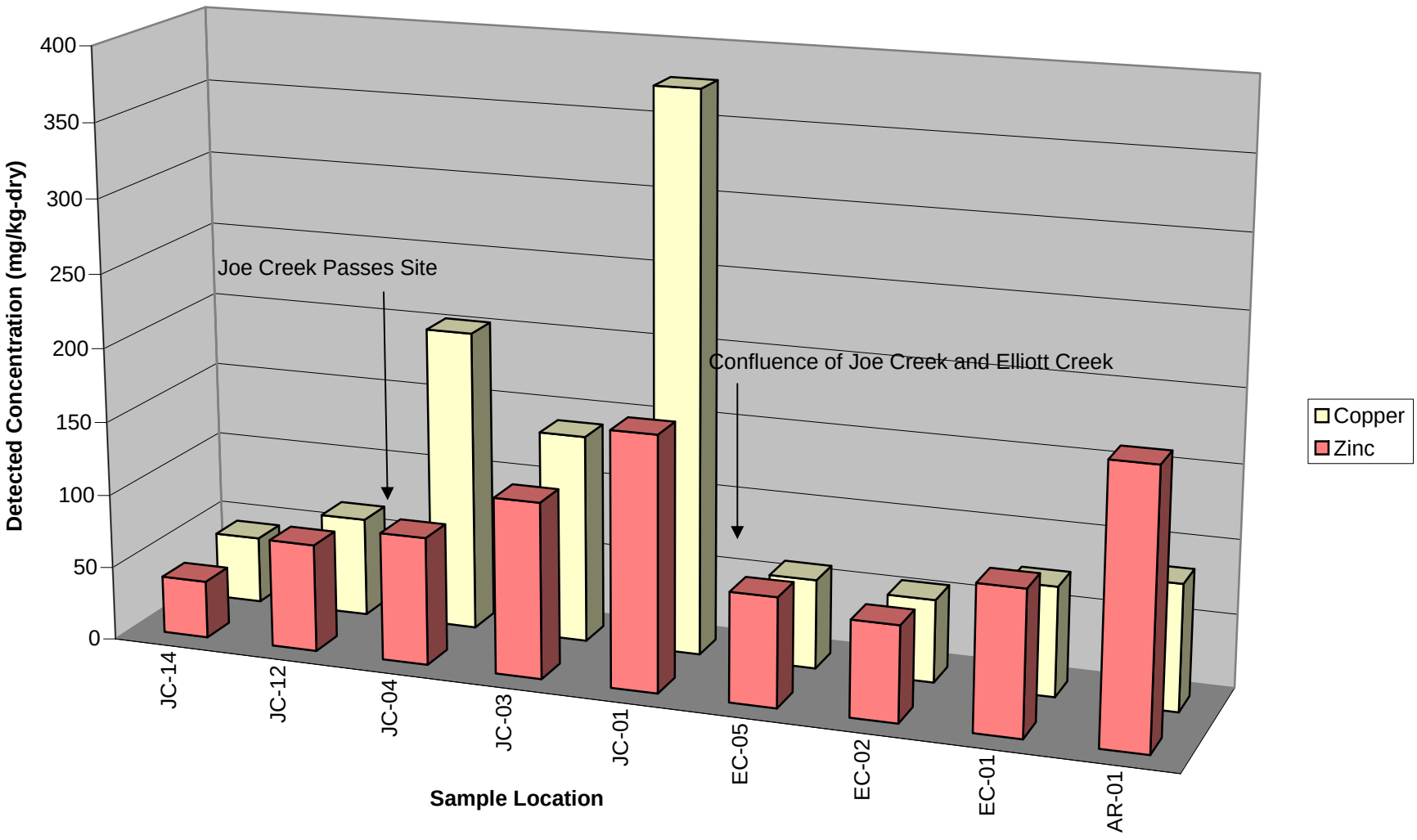


Chart 7
Arsenic and Lead in Riparian Soil

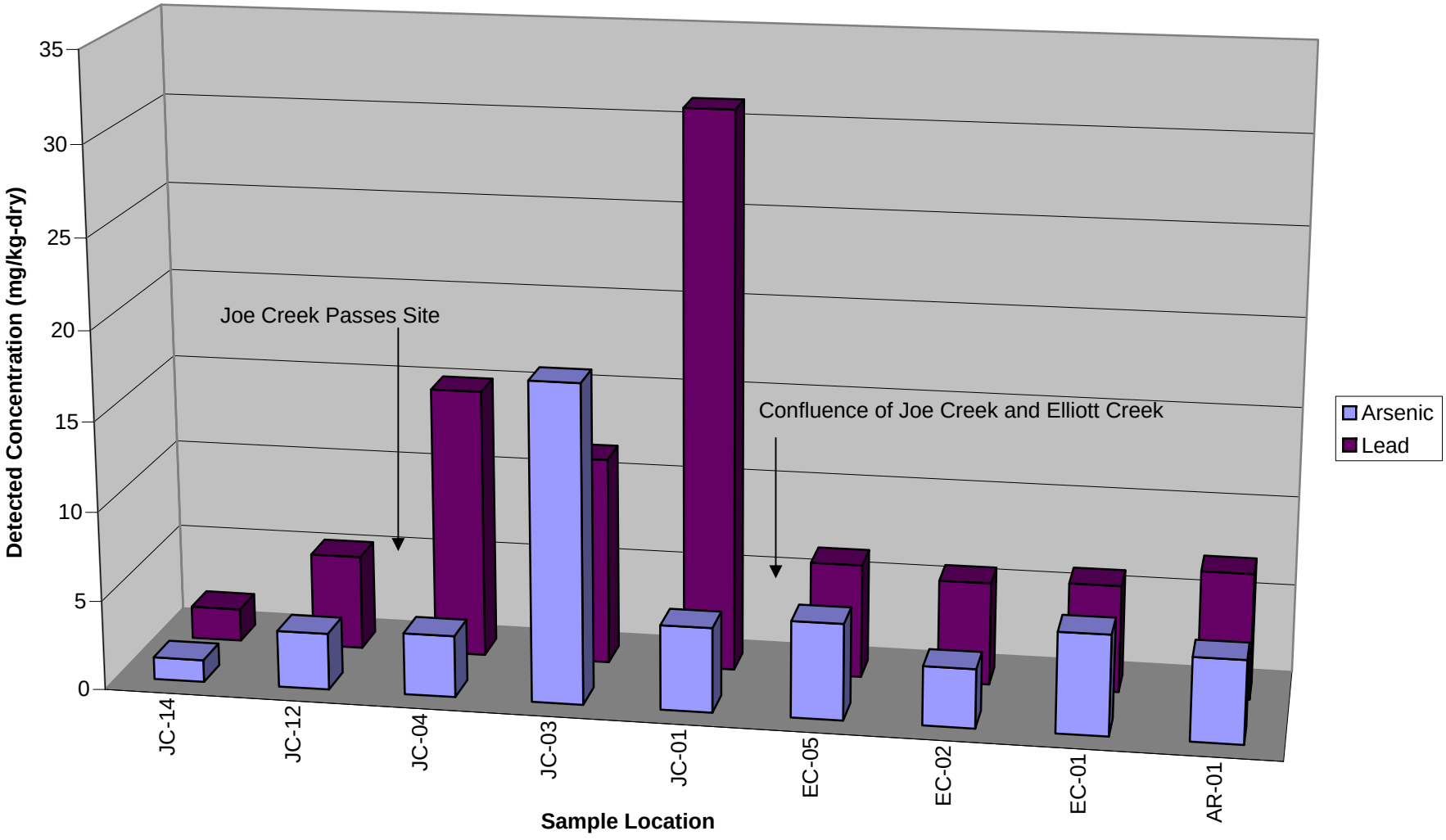


Chart 8
Cadmium in Riparian Soil

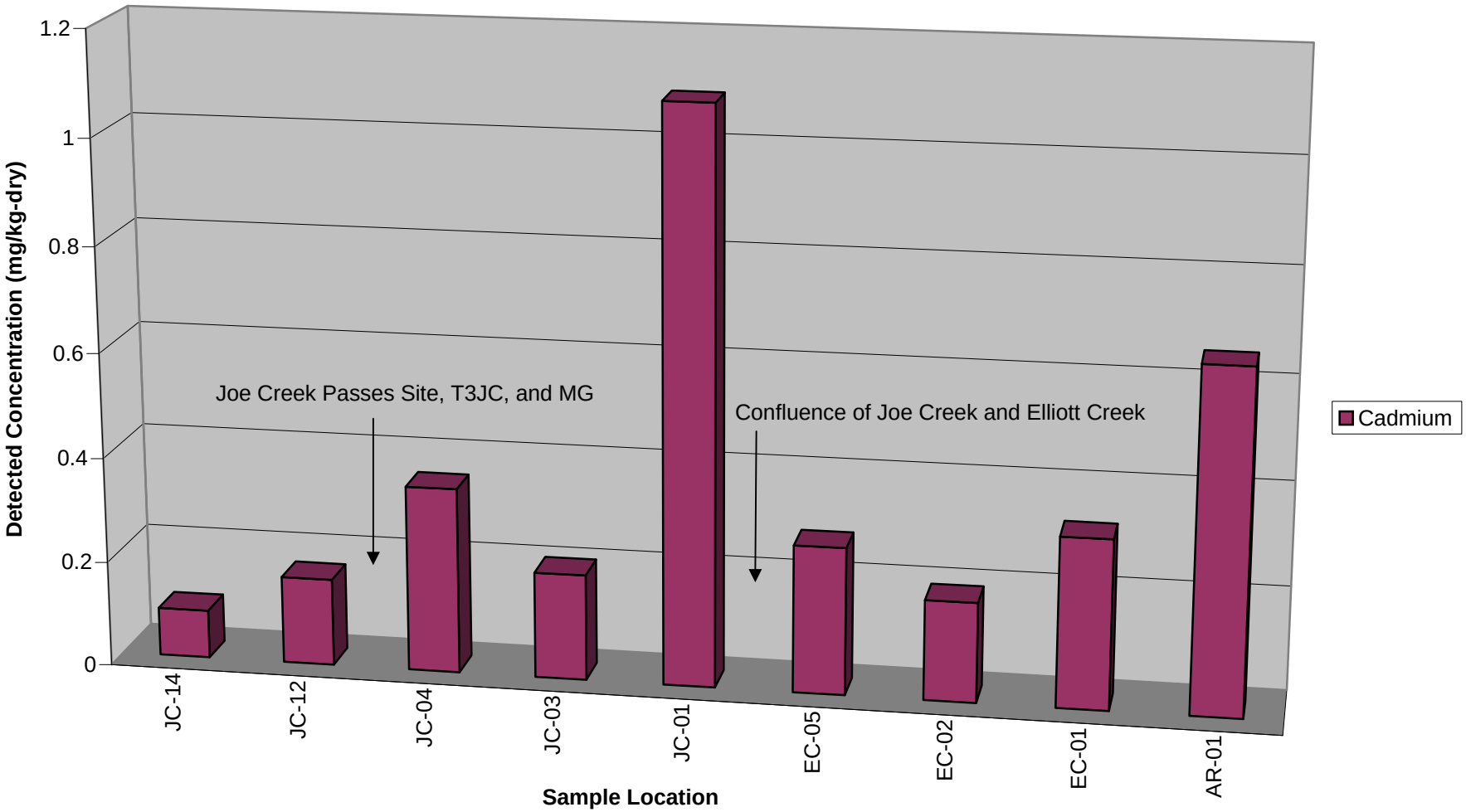


Chart 9
Iron in Sediment

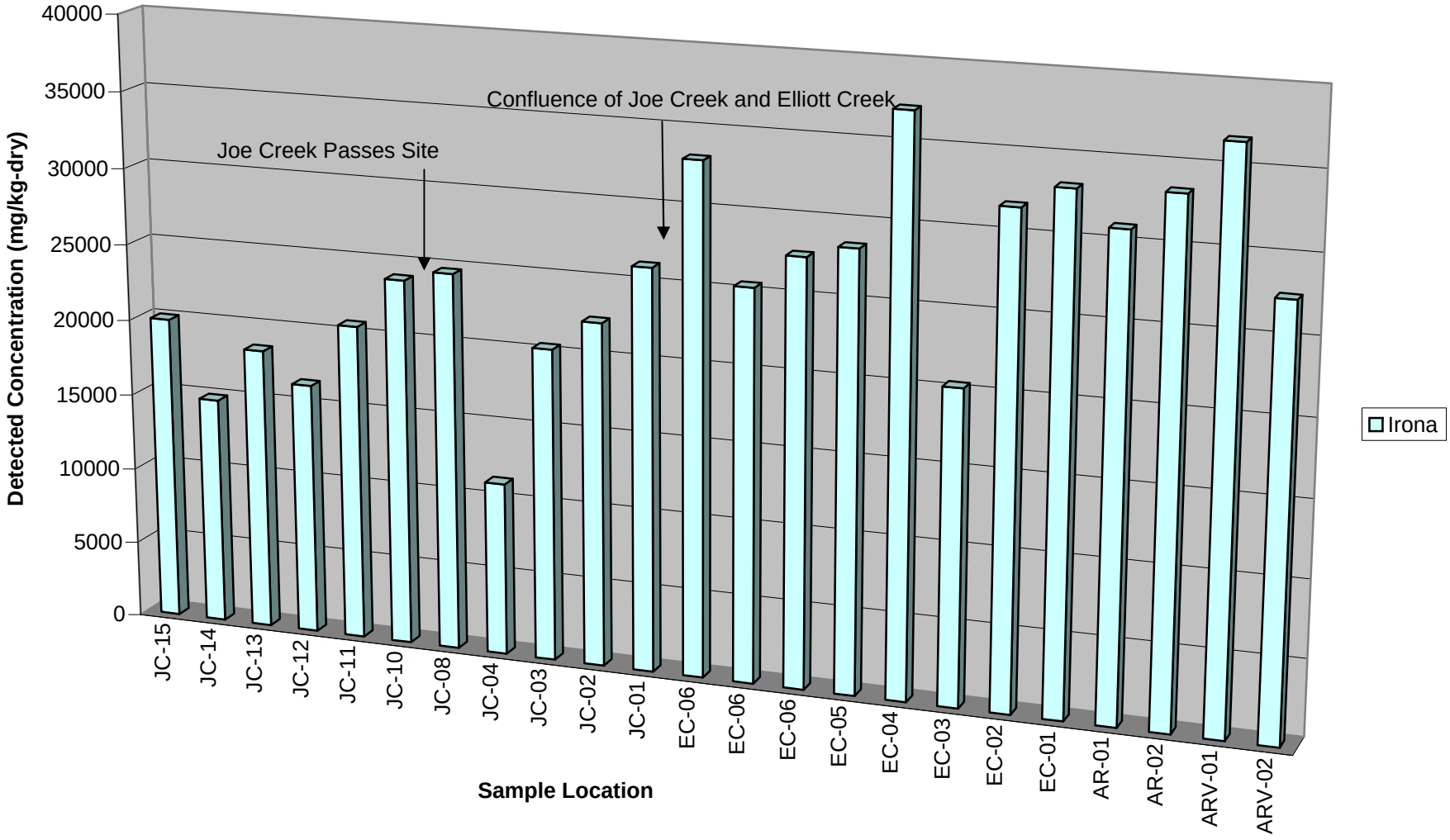


Chart 10
Copper and Zinc in Sediment

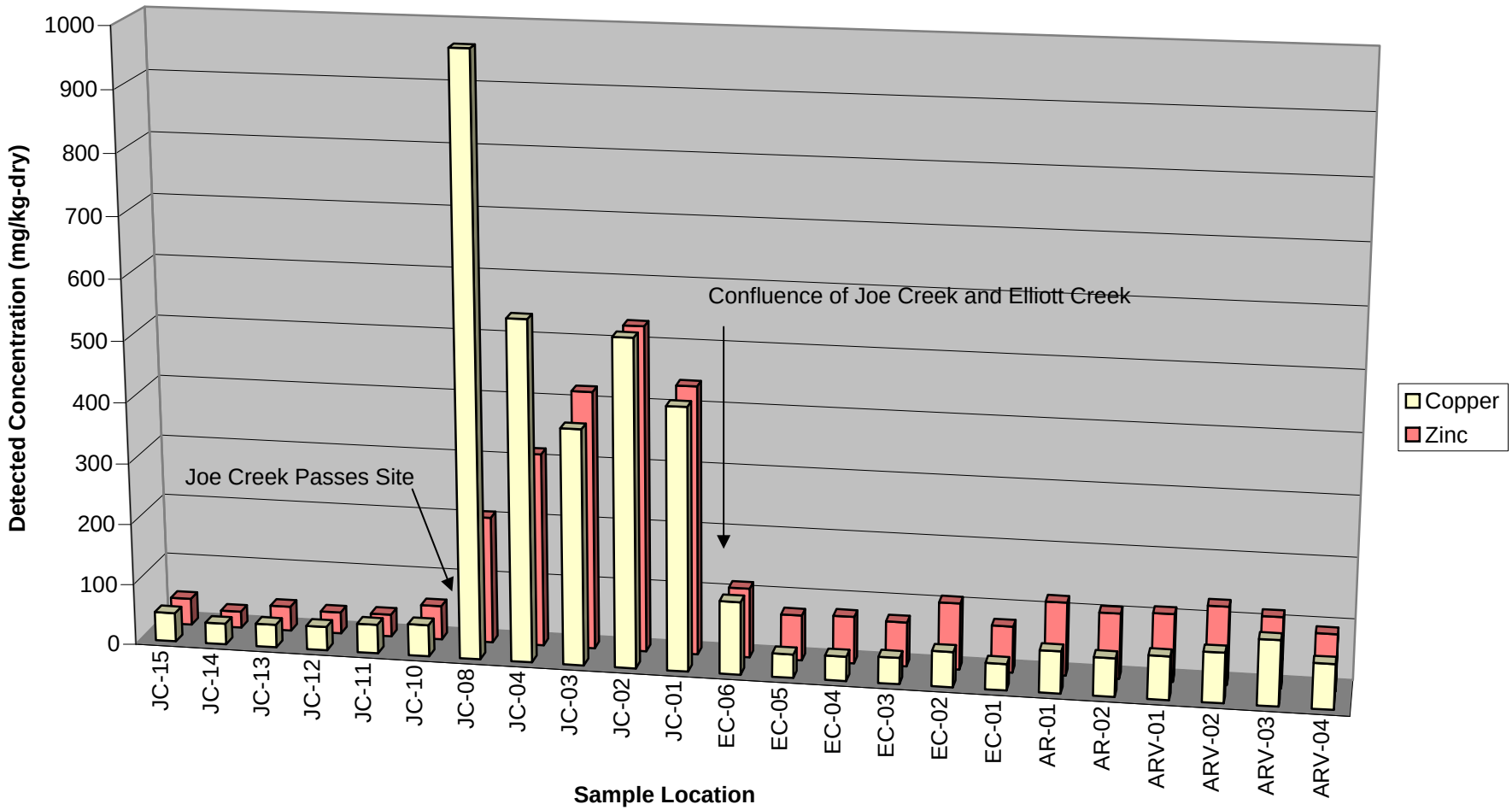


Chart 11
Arsenic and Lead in Sediment

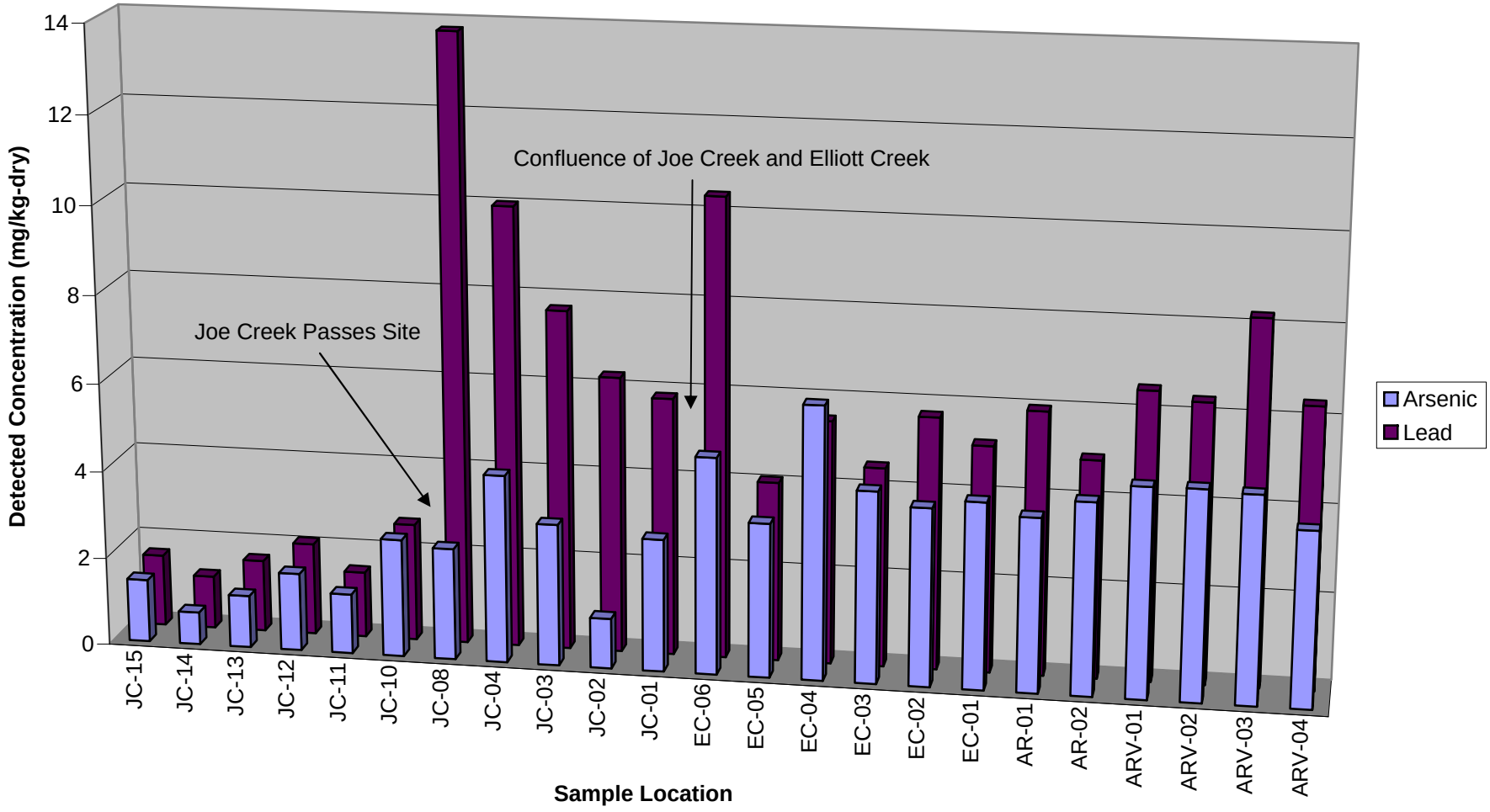
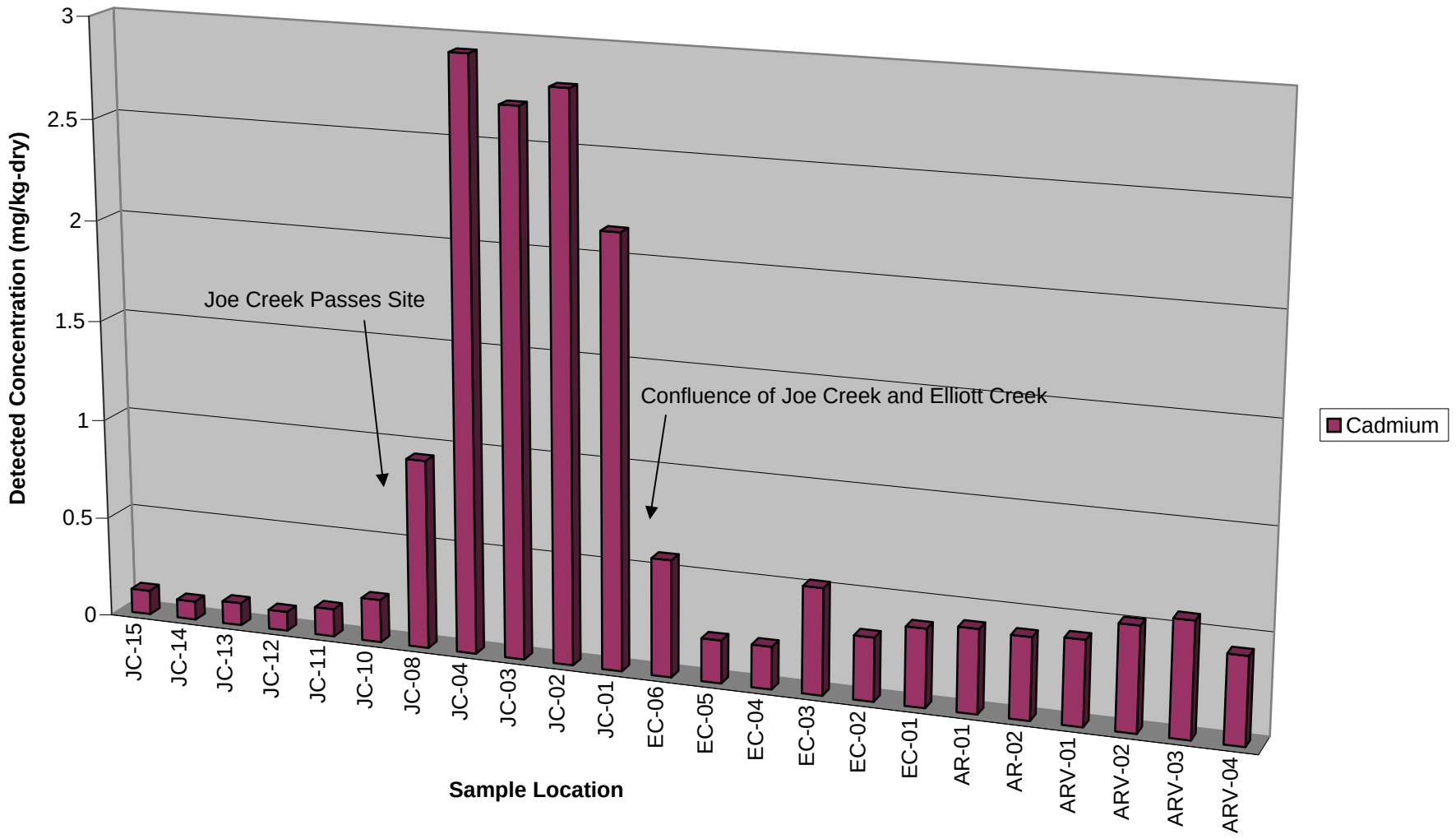


Chart 12
Cadmium in Sediment



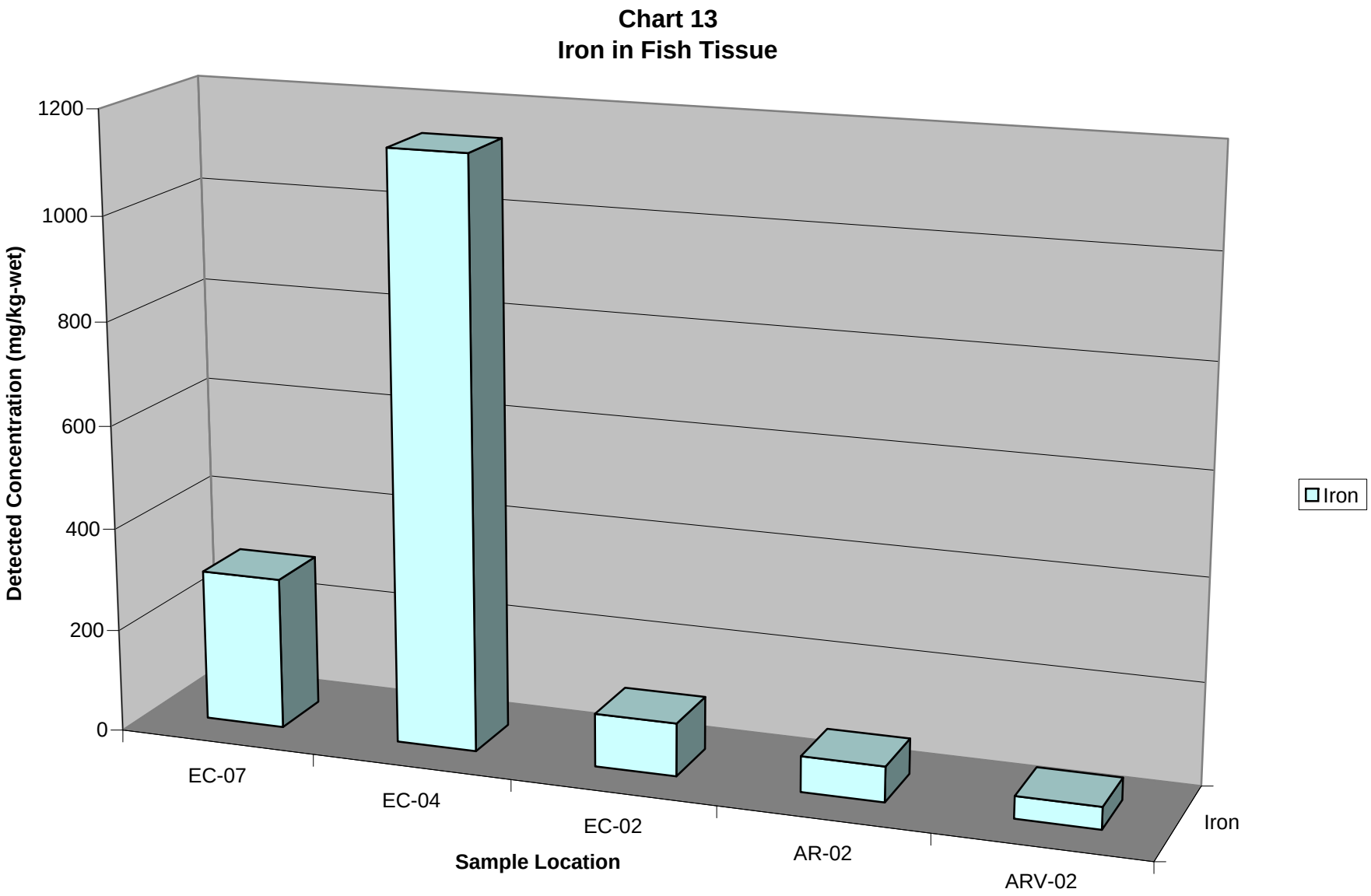
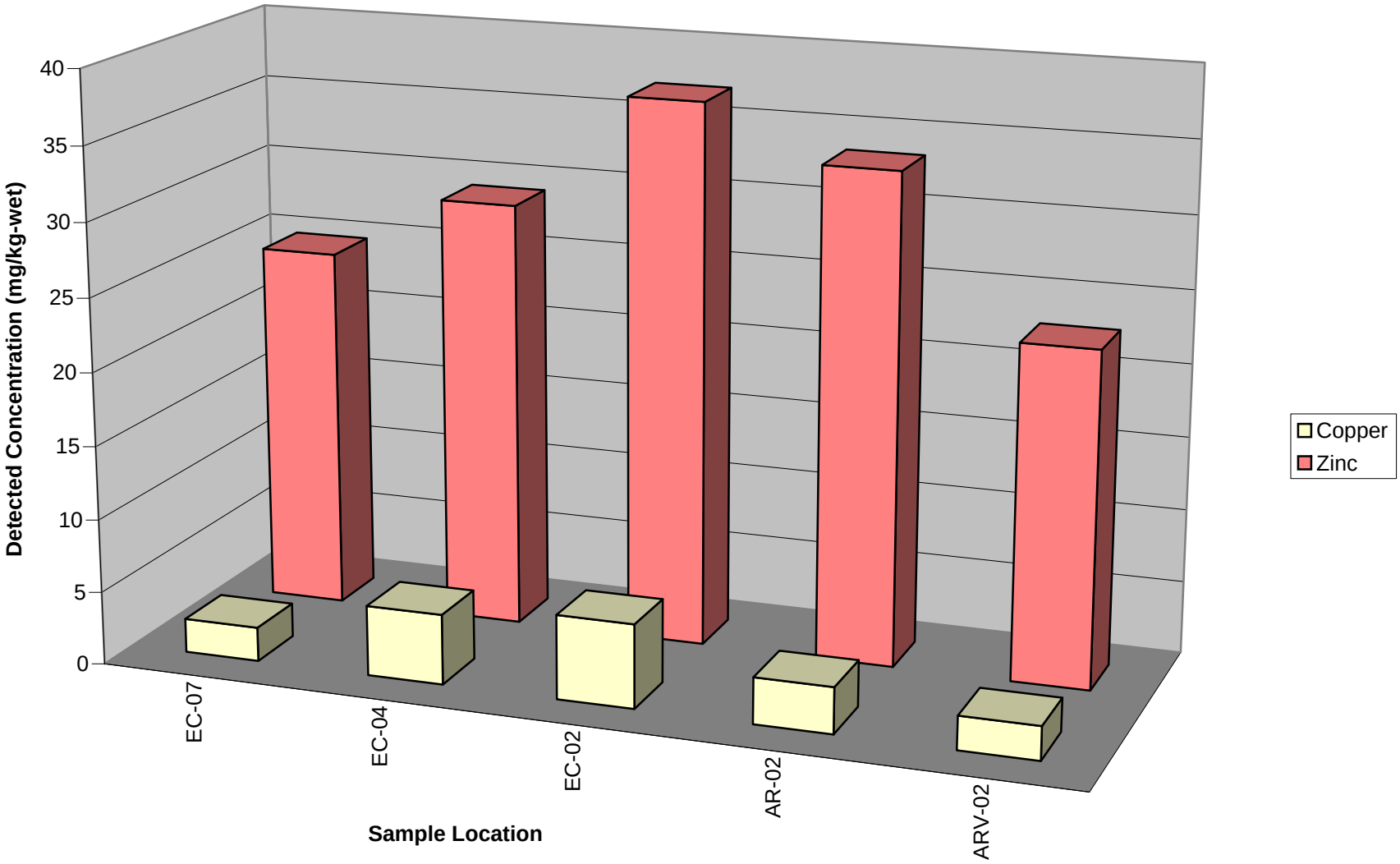


Chart 13
Iron in Fish Tissue
Detected Concentration (mg/kg-wet)
1200
1000
800
600
400
200
0
EC-07
EC-04
EC-02
AR-02
ARV-02
Sample Location
Iron
Iron

Chart 14
Copper and Zinc in Fish Tissue



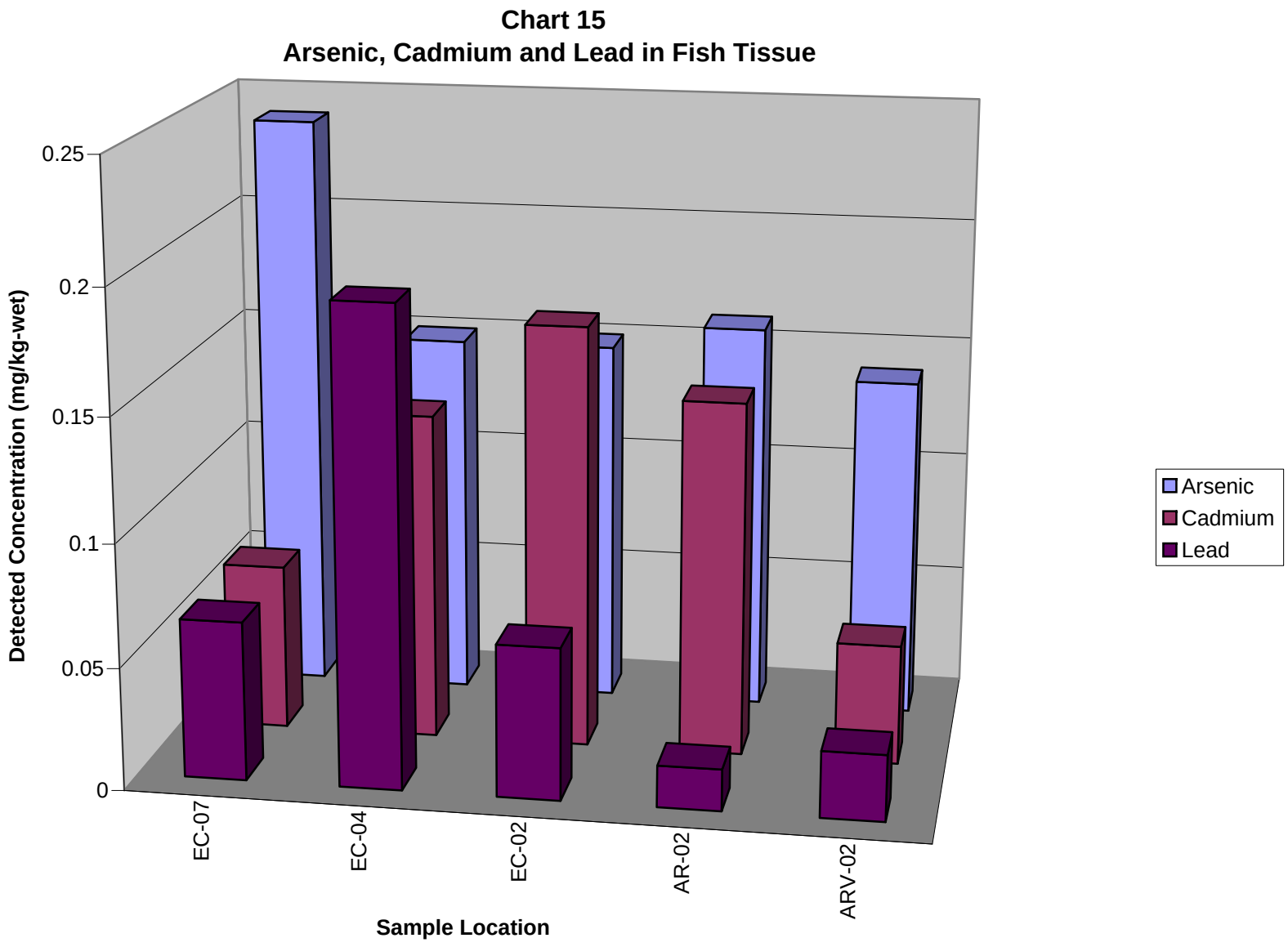


Chart 15
Arsenic, Cadmium and Lead in Fish Tissue
Detected Concentration (mg/kg-wet)
0.25
0.2
0.15
0.1
0.05
0
EC-07
EC-04
EC-02
AR-02
ARV-02
Sample Location
Arsenic
Cadmium
Lead

APPENDIX A

PHOTOGRAPHIC LOG

Photo No. 1	6/23/08	
Description: View of Blue Ledge Mine from the old Eileen town site.		
Photo No. 2	6/24/08	
Description: View from the top of Blue Ledge Mine. Waste rock is visible in the foreground; Adit #3 is present on the opposing hillside (not visible at this scale).		
Photo No. 3	6/25/08	
Description: Limestone boulders below a log dam at the bottom of the main waste rock pile.		

Photo No. 4	6/25/08
Description: Access path for main waste rock pile.	
Photo No. 5	6/24/08
Description: View of main waste rock pile, downhill from access road. The holding pond is visible at the bottom.	
Photo No. 6	6/26/08
Description: The main waste rock pile, viewed from below. The large outcrop at top right borders the access road.	

Photo No. 7	6/24/08	
Description: The main waste rock pile, viewed from the top near adits. Old town site visible in top right corner.		

Photo No. 8	6/26/08	
Description: The second largest waste rock pile. Similar elevation to top of main waste rock, further east.		

Photo No. 9	6/25/08	
Description: Adit #2, along path that leads to waste rock access road. Water was flowing out slowly and down hillside. Sample AD-02 source.		

Photo No. 10	6/25/08	
Description: Notched weir measuring flow from AD-02.		
Photo No. 11	6/24/08	
Description: Adit #4, centrally located above the main waste rock pile.		
Photo No. 12	6/26/08	
Description: Mineralization along edge of adit opening. This is also visible in the above picture, right side.		

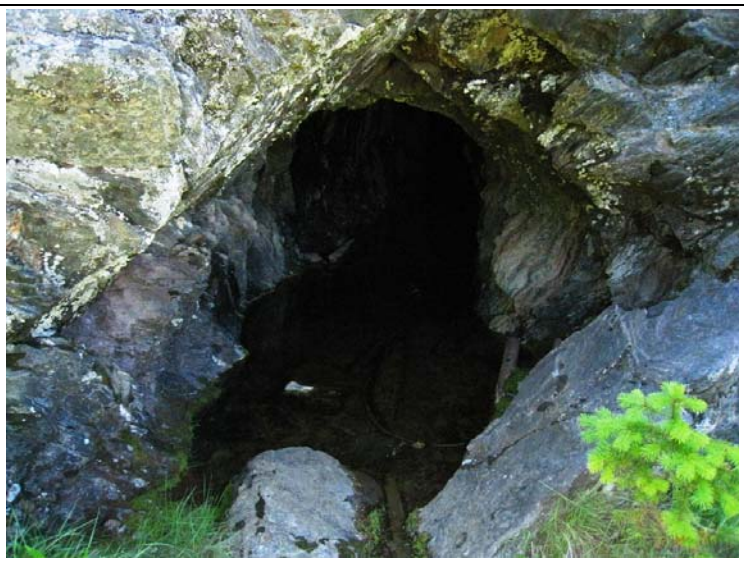
Photo No. 13	6/24/08	
Description: Adit #5, at top of waste rock pile #2.		
Photo No. 14	6/24/08	
Description: Adit #6, possibly used as an access.		
Photo No. 15	6/24/08	
Description: Adit #7, above southern most waste rock pile.		

Photo No. 16	6/25/08	
Description: Opening on slope of main waste rock pile, potentially used to access to Adit #4.		
Photo No. 17	6/24/08	
Description: Adit #1. Southwestern most adit at top of mine. Sample AD-01 source.		
Photo No. 18	6/26/08	
Description: Possible site of North waste rock repository. Geotechnical investigations in this area.		

Photo No. 19	6/26/08
Description: Sample excavations are visible at possible North repository site.	
Photo No. 20	6/25/08
Description: Field filtered surface water sampling through disposable bailers. (Sample EC-02-SW-080625-URS)	
Photo No. 21	6/26/08
Description: Water quality measurements in Joe Creek. Picture taken at sample JC-03 location.	

Photo No. 22	6/25/08	
Description: Sediment sampling in Elliott Creek. Picture taken at sample EC-03 location.		
Photo No. 23	6/25/08	
Description: Sediment sample from Elliott Creek, sample EC-03 location.		
Photo No. 24	6/26/08	
Description: Sediment sample from Joe Creek, sample JC-01 location.		

Photo No. 25	6/25/08

Description:

Dry riparian soil sample from the bank of Elliott Creek. Photo taken at sample EC-02 location.

Photo No. 26	6/27/08

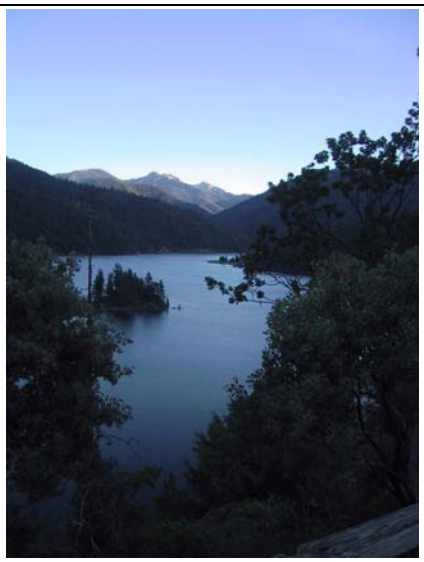
Description:

California Department of Fish and Game employee onsite for electro-fishing.

Photo No. 27	6/27/08

Description:

Sculpin collected for fish tissue sample.

Photo No. 28 — 6/27/08 **Description:** Pooling water from seep, SP-02, post-sampling. Water drains from under former Eileen town site.	
Photo No. 29 — 6/27/08 **Description:** Confluence of the Middle Fork Applegate River (right) and Elliott Creek. Stream flow measurements collected above and below the confluence.	
Photo No. 30 — 6/26/08 **Description:** View of Applegate Reservoir.	

APPENDIX B

SCREENING-LEVEL HUMAN HEALTH RISK EVALUATION

Screening-Level Human Health Risk Evaluation

List of Tables

Table B-1 – Summary of Surface Water Data
Table B-2 – Human Health Criteria for Surface Water
Table B-3 – Screening of Surface Water Data for Adits and Seeps
Table B-4 – Screening of Surface Water Data for Tributaries to Joe Creek downstream of Blue Ledge Mine
Table B-5 – Screening of Surface Water Data for Joe Creek
Table B-6 – Screening of Surface Water Data for Elliot Creek
Table B-7 – Screening of Surface Water Data for Applegate River from its confluence with Elliot Creek to Applegate Reservoir, and Applegate Reservoir
Table B-8 – Estimated Excess Cancer Risk for Surface Water Data
Table B-9 – Summary of Sediment Data
Table B-10 – Human Health Criteria for Sediment
Table B-11 – Screening of Sediment Data for Joe Creek
Table B-12 – Screening of Sediment Data for Elliot Creek
Table B-13 – Screening of Surface Water Data for Applegate River from its confluence with Elliot Creek to Applegate Reservoir
Table B-14 – Estimated Excess Cancer Risk for Sediment Data
Table B-15 – Summary of Riparian Soil Data
Table B-16 – Human Health Criteria for Riparian Soil
Table B-17 – Screening of Riparian Soil Data for Joe Creek
Table B-18 – Screening of Riparian Soil Data for Elliot Creek
Table B-19 – Screening of Riparian Soil Data Adjacent for Applegate River
Table B-20 – Estimated Excess Cancer Risk for Riparian Soil Data
Table B-21 – Summary of Fish Tissue Data
Table B-22 – Human Health Criteria for Fish Tissue
Table B-23 – Screening of Fish Tissue Data for Elliot Creek
Table B-24 – Screening of Fish Tissue Data for Applegate River
Table B-25 – Screening of Fish Tissue Data for Applegate Reservoir
Table B-26 – Estimated Excess Cancer Risk for Fish Tissue

Screening-Level Human Health Risk Evaluation

A screening-level human health risk evaluation (SL-HHRE) was conducted for four aquatic and aquatic-related environments downstream of the Blue Ledge Mine, including 1) Joe Creek, 2) Elliot Creek downstream of its confluence with Joe Creek, 3) a portion of the Middle Fork of the Applegate River between the mouth of Elliot Creek and Applegate Reservoir, and 4) the head of Applegate Reservoir (see Figure 3, SI Report). Forward-calculated risk estimates were obtained using generic human health screening levels from the literature, and in some cases, site-specific background levels obtained from upstream of Blue Ledge Mine. A sample point-by-point screening was conducted to take into account streamlined sample collection. See Tables B-1 through B-26, for details.

Conceptual Site Model of Human Exposure

Water passes through Blue Ledge Mine as surface water that flows over the top of and, to some extent, through the waste rock that forms a steep slope on the downgradient side of Blue Ledge Mine. At the base of the main waste rock slope there is a settling area known as the log dam. From this point, the water from Blue Ledge Mine enters Joe Creek. Joe Creek flows steeply down boulders and passes through plunge pools until its final 200 feet, where the grade is more level. Joe Creek enters Elliot Creek approximately 2 miles upstream of the confluence of Elliot Creek with the Middle Fork of Applegate River. The distance between this confluence and the head of Applegate Reservoir is approximately 1.5 river miles.

Mine water contaminants can be carried in dissolved form or on particulates suspended in the water column of surface water. In depositional areas such as creek areas of lower flow, some of these contaminants can settle into or become bound to bottom sediments. In locations where a creek or river bed turns sharply, and/or where areas of low flow exist, bottom sediments can be washed up into low-lying, riparian areas adjacent to the waterway. For the purposes of this assessment, it is assumed that soil samples collected from riparian areas represent floodplain material that was originally sediment and does not represent upland material that has migrated into the riparian area.

Based on previous investigations and knowledge of site history, six metals were identified as being contaminants of potential concern (COPCs) for humans: arsenic, cadmium, copper, iron, nickel, and zinc. However, because iron is an essential nutrient and is metabolically regulated by most organisms, including humans, it was considered to be a COPC in surface water only, but not a COPC in sediment, riparian soil, or fish tissue. Arsenic, cadmium, and lead are assumed to bioaccumulate, or increase in concentration as they pass up the food chain.

As stated in the Work Plan (URS 2008), potential exposure of human receptors to mine-related releases will be assumed to occur through ingestion of contaminants in fish tissue and direct contact with sediments and/or riparian soil. Direct contact with surface water, such as might occur with swimming, is assumed to be a minor exposure pathway. Based on information from a local resident, Mr. Luke Redecur (Pers. comm. 2008), and on searches for beneficial water use information conducted by URS, the small community of Joe Bar, located on Elliot Creek downstream of its confluence with Joe Creek, does not obtain drinking water from Elliot Creek.

Joe Creek flows from Blue Ledge Mine to its confluence with Elliot Creek through a canyon-like area. The majority of Joe Creek is very steep, comprised of large boulders and plunge pools, likely creating a physical barrier to fish passage. No fish were observed in Joe Creek during the June 2008 sampling event. Therefore, potential human health risks due to fish ingestion will be

assessed for Elliot Creek, the Middle Fork of Applegate River from the mouth of Elliot Creek to the head of Applegate Reservoir, and Applegate Reservoir.

Data Collection

In June of 2008, samples of surface water, sediment, riparian soil (soils from floodplain areas located within approximately 100 feet of the creek or river banks), and fish tissue were collected downstream of the Blue Ledge Mine site. Since no fish were found to be present in Joe Creek during the sampling event, no fish tissue samples were collected from Joe Creek. No riparian soil samples were collected from Applegate Reservoir.

Surface water, sediment, and riparian soil samples were also collected upstream of Blue Ledge Mine for use as site-specific background information. Surface water samples were collected from four tributaries of Joe Creek, including three unnamed tributaries and Manzanita Gulch (see Figure 5). Surface water samples were also collected near Blue Ledge Mine itself, including from two mine adits, the log dam at the downstream base of the Blue Ledge Mine waste rock slope, and two seeps observed in steep areas just downstream of Blue Ledge Mine.

In June 2008, reticulate sculpin (*Cottus perplexus*) were collected at three sampling locations in Elliot Creek and one sampling location in Applegate River downstream of the mouth of Elliot Creek using electrofishing protocols. Attempts to collect rainbow trout (*Onchorhynchus myskiss*) or bass species from among three Applegate Reservoir locations using electrofishing protocols were unsuccessful. Instead, one deceased rainbow trout was discovered in approximately five feet of water at the AR-02 location, and collected for tissue analysis. The fish did not show visible signs of decomposition, but it is unknown if its mortality was related to electrofishing. No fish were found to present in Joe Creek. No fish tissue samples were collected above the Blue Ledge Mine site, and thus no site-specific background concentrations of the six CPEC metals were calculated for fish tissue collected in Elliot Creek, the Middle Fork of the Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir, and the head of Applegate Reservoir.

Reticulate sculpin were selected as a species to be collected due to their ubiquity in Elliot Creek, their trophic niche as a bottom feeder, and their relative intransience within stream segments. Trout were targeted in the reservoir because they are a game species actively collected and consumed by the public and consequently have a direct link to human health.

During a survey of benthic invertebrates conducted in September 2008 for Joe Creek and Elliot Creek, a biologist performed a limited visual survey of the types of benthic invertebrates present (see Appendix F). Types and numbers of benthic invertebrates present help the surveyor to determine how good the water quality is likely to be. Certain types of benthic invertebrates such as caddisflies, mayflies, and in particular, stone flies typically indicate a high-water-quality stream with cooler water temperatures. Benthic invertebrates were visually surveyed and samples collected for in-lab identification from four locations. Sample locations and brief descriptions of what was observed at each are presented below:

1.) Joe Creek above (upstream of) the Blue Ledge Mine
    Description: limited number of caddisflies and mayflies present. Water quality fairly good.
2.) Joe Creek below (downstream of) the main waste rock slope
    Description: limited number of caddisflies and mayflies present; water quality not as good as above Blue Ledge Mine.
3.) Elliot Creek above the confluence of Joe Creek

Description: large numbers of caddisflies, mayflies, and stone flies. Water quality appeared to be very good.

4.) Elliot Creek below the confluence of Joe Creek
Description: large numbers of caddisflies, mayflies, and stone flies, but numbers not as high as those observed in Elliot Creek upstream of the confluence with Joe Creek. Water quality appeared to be good.

Data Evaluation

Data collected in June of 2008 were evaluated as part of this screening-level human health risk assessment. Data from earlier investigations were used to select COPCs, and the type and locations of samples that were collected in June and July of 2008. Earlier investigations are described in detail in the following documents:

- *Survey of Benthic Macroinvertebrates to Assess Effects of the Blue Ledge Mine on Aquatic Biota of Joe and Elliot Creeks*, NW California. Prepared by Michael S. Parker, PhD, Department of Biology, Southern Oregon University. September 2000.

- Joe Creek Level II Stream Survey. Siskiyou Research Group. October 2002.

- *Preassessment Screen for the Blue Ledge Mine Site*. Prepared by Environmental International Ltd. October 28, 2002.

- Preliminary Assessment/Site Inspection Report, Blue Ledge Mine. Prepared by Weston Solutions. April 28, 2004.

- *Technical Memorandum: Draft Preliminary Remediation Cost Estimates for the Blue Ledge Mine*. Prepared by Golder Associates. November 14, 2007.

- *Confidential Memorandum: Blue Ledge Mine Recreational Fishing and Natural Resource Damage Estimate*. To: Peter Jones, USDA Forest Service. From: Stratus Consulting, Inc. December 18, 2007.

- *Acid Mine Drainage and Assessment of Recent Remediation Efforts at the Blue Ledge Mine, Siskiyou County, California*. William S. Elliot, Jr; Jara A. Johnson; Marco A. Wikstrom; and Peter Jones. Department of Environmental Studies, Southern Oregon University. Undated.

- Geochemical Data for the Blue Ledge Mine. Tabulated data from Southern Oregon University, Dr. Bill Elliot. Undated.

Data collected in 2008 was analyzed for metals by Columbia Analytical Services Laboratory. Surface water samples were also analyzed for chemistry parameters including alkalinity, hardness, total dissolved solids (TDS), total suspended solids (TSS), and sulfate. Data validation, including a quality assurance/quality control review, was conducted by a URS chemist. The numbers and types of samples considered to be adequate for use in the risk assessment are listed in Table 1. Tabulated summaries of surface water, sediment, riparian soil, and fish tissue data are presented in Tables B-1, B-9, B-15, and B-21. Sample locations are shown in Figures 4 and 5.

As part of the Data Quality Objective process, human health criteria chosen as screening parameters in the SL-HHRE were used to identify acceptable media-specific analytical method reporting limits (MRLs) for the six metals being assessed prior to any sample analysis. In general, analytical MRLs should be lower than the related criteria that will be used to assess the related analytical data results, in order to determine whether chemicals are present at levels of concern. The only criterion which was exceeded by an analytical MRL was the EPA Region 6 human health medium-specific screening level (HHMSSL) for arsenic (0.045 micrograms per liter [ug/L]), which is based primarily on surface water being used as a drinking water source (USEPA 2007). Based on current information, surface water from Joe Creek and Elliot Creek are not used as sources of drinking water.

Identification of Site-Specific Background Levels of COPC Metals in Surface Water, Sediment, and Riparian Soil

Sample results used to calculate site-specific background concentrations were collected from above (i.e., upstream of) the Blue Ledge Mine site (Figure 5). Eight background surface water samples were collected: six from the two upstream creeks that converge just above Blue Ledge Mine, and two from two tributaries that flow into these creeks above Blue Ledge Mine. Metals data from these eight surface water samples were averaged and the resulting mean concentrations of the six metals were used as site-specific background concentrations for COPCs detected in surface water located downstream of Blue Ledge Mine.

Six background sediment samples were collected upstream of Blue Ledge Mine. As with the background surface water samples, the sediment metal concentrations were averaged and the resulting mean concentrations of the six metals were used as site-specific background concentrations for COPCs detected in sediment located downstream of Blue Ledge Mine.

Two background riparian soil samples were collected. Metals data from these two samples were averaged and the resulting mean concentrations for COPCs in upstream riparian soil were used as site-specific background concentrations for COPCs detected in riparian soil located downstream of Blue Ledge Mine. Site-specific background concentrations for metals detected in surface water, sediment, and riparian soil are presented in the tables for surface water, sediment, and riparian soil (Tables B-1, B-9, and B-15).

Since no fish were collected above the Blue Ledge Mine site, no site-specific background concentrations of the six COPC metals were calculated for fish tissue collected from Elliot Creek, the Middle Fork of the Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir, and the head of Applegate Reservoir.

Human Health Screening Criteria

The screening conducted here was used to determine whether concentrations of the six COPC metals in site media (i.e., surface water, sediment, riparian soil, and fish tissue) are present at concentrations that are potentially harmful to human receptors. For this streamlined screening, applicable screening criteria were used to evaluate which metals were present at concentrations that could potentially cause unacceptable risk to human receptors. The applicable criteria were protective of:

1) recreational users coming into contact with sediment,
2) residential human receptors coming into contact with riparian soils, and
3) recreational human fishers ingesting fish.

Since the site and its potentially affected downstream environments straddle the border between Oregon and California, criteria thought to be applicable in both states were compared to detected concentrations of COPC metals in site media.

In cases where site-specific background concentrations of a metal exceed available literature-based criteria, the site-specific background concentration will be used as the screening criterion. Where literature-based criteria exceed background, the most-stringent literature-based criterion that exceeds the site-specific background concentration will be used as the screening criterion.

In cases where no literature-based criteria are available, no screening of detected concentrations is possible. However, chemicals detected in media that have no applicable screening criteria must be assumed to be a potential human health problem, although risk estimates are not quantifiable in this situation. The primary example of metals without literature-based human health screening criteria involves cadmium, copper, iron, and lead detected in surface water. Although site-specific background concentrations in surface water are available for these four metals, basing a risk estimate on a background concentration alone, when no toxicity criteria have been made available, is not considered technically credible.

Please refer to Tables B-2, B-10, B-16, and B-22 for the criteria used to screen detected concentrations in each of the four media. These criteria are also presented below.

SURFACE WATER:

- California Water Quality Standards, human health criteria for ingestion of organisms only for Applegate River and Applegate Reservoir (USEPA 2000)

- Oregon Department of Environmental Quality Water Quality Standards, Tables 33A, 33B, and 33C, human health criteria for ingestion of organisms only for Applegate River and Applegate Reservoir (DEQ, 2004)

- USEPA 2006 National Recommended Water Quality Criteria. human health criteria for ingestion of organisms only for Applegate River and Applegate Reservoir (USEPA, 2006)

SEDIMENT:

- USEPA Region 6 human health medium-specific screening levels for residential soil (2007)

- California Regional Soil Levels (Bradford et al. 1996)

RIPARIAN SOIL:

- USEPA Region 6 human health medium-specific screening levels for residential soil (2007)

- California Regional Soil Levels (Bradford et al. 1996)

FISH TISSUE:

- DEQ Acceptable Tissue Levels (ATLs) in Fish/Shellfish Consumed by Humans (DEQ 2007). Note that no literature-based criteria are available to screen copper and zinc present in fish tissue.

As previously stated, a sample point-by-point screening was conducted. That is, no statistically representative exposure point concentrations were generated for the different water bodies being assessed. For each metal detected in each medium, the most stringent applicable criterion was chosen and used to generate carcinogenic and non-carcinogenic human health risk estimates at each sample point. In cases where a site-specific background concentration was higher than one or more of the applicable criteria, then the site-specific background concentration, rather than a criterion, was used to human health risk estimates for that metal in that medium.

In the case of background concentrations of riparian soil, site-specific background concentrations are based on the average of metals detected in two samples. The site-specific background concentrations of copper and zinc (approximately 56 mg/kg for both metals) were higher than one or more soil screening criteria, and so the background concentrations were used as the criteria with which corresponding risk estimate values were calculated.

When site-specific background concentrations are not available, California Regional Soil Levels (CRSLs) (Bradford et al., 1996) are often used as acceptable background levels for metals in soil. At Blue Ledge Mine, however, site-specific background concentrations were considered more representative of site conditions than the CRSLs. It is interesting to note that the site-specific riparian soil background concentrations calculated for arsenic, cadmium, lead, and zinc are all significantly lower than the CRSL values for these four metals. Only copper has a calculated site-specific riparian soil background concentration that is higher than its CRSL.

Acceptable levels of human health risk through exposure to a single carcinogenic compound cannot exceed a potential excess carcinogenic risk (PECR) level of 1.0E-06. Acceptable levels of human health risk associated with exposure to a single non-carcinogen cannot exceed a hazard quotient (HQ) of 1 (DEQ, 1998/2000). Estimates of PECRs from exposure to carcinogens (i.e., arsenic at this site) and HQs from exposure to non-carcinogens (zinc at this site) were generated using the simple proportional formulas presented below, and by solving for X in the equation.

For carcinogenic risk:

$$\frac{\text{Detected metal concentration}}{\text{Human health criterion}} = \frac{X}{1E\text{-}06}$$

Solving for X gives:

$$X = \frac{\text{(Detected metal concentration)}}{\text{(Human health criterion)}} * 0.000001$$

For noncarcinogenic risk:

$$\frac{\text{Detected metal concentration}}{\text{Human health criterion}} = \frac{X}{1.0}$$

Solving for X gives:

$$X = \frac{\text{(Detected metal concentration)}}{\text{(Human health criterion)}} * 1.0$$

Note that no estimates of non-carcinogenic risk associated with arsenic were made, since the criterion for the carcinogenic effects of arsenic are more stringent than those for the non-carcinogenic effects. Therefore, the discussion of potential human health risks related to arsenic are limited to carcinogenic effects only. Zinc has only been documented to have toxic, i.e., non-carcinogenic, effects.

Human Health Risk Estimates Based on Screening Criteria

Although screening risk estimates were calculated for each metal in each medium on a sample point-by-sample point basis, the results will be discussed here in terms of each of the media and water bodies assessed. Risk estimate values for each sample result were obtained using the simple formulas presented above and the most stringent applicable criterion identified in each medium.

Arsenic was the only metal present in media samples at concentrations that resulted in unacceptable human health risk (i.e., excess cancer risk estimates greater than 1.0E-06), with the single exception of the zinc concentration detected in water collected from Adit AD-01. Calculation of PECRs for arsenic and the HQ for zinc in surface water was based on comparison to ambient water quality criteria protective of humans ingesting organisms only, while calculation of PECRs for sediment and riparian soil was based on the site-specific average background concentrations in each of these media. No exceedances of human health criteria occurred in site media for cadmium, copper, iron, or lead. Because no literature-based criteria were available for human ingesting fish exposed to cadmium, copper, iron, or lead in surface water, no screening could be conducted for these four metals in surface water.

Groundwater Risk Estimates

Because groundwater exiting the adits and seeps immediately becomes surface water by definition, screening criteria used to assess metals in surface water were also used to assess metals in adits and seeps.

Adits and Seeps –

Two adit samples (AD-01 and AD-02), one dam sample, and two seep samples (SP-01 and SP-01) were collected just downslope/downstream of the Blue Ledge Mine. In these cases, groundwater was present at the surface. Surface water from both adits contained concentrations of arsenic that resulted in excess cancer risk estimates for arsenic of 2.6E-05 and 4.6E-05. The dam location and the two seeps did not contain arsenic at concentrations that resulted in unacceptable human health risk. Water collected from Adit AD-01 contained zinc at a concentration that resulted in a high HQ of 11.5.

Surface Water Risk Estimates

The screening criterion used to compare to detected concentrations of arsenic is meant to be protective of recreational anglers consuming fish exposed to surface water containing arsenic.

Joe Creek –
Seven surface water samples were collected from Joe Creek. None of the samples contained arsenic at concentrations that exceeded criteria.

Tributaries of Joe Creek downstream of Blue Ledge Mine –
Two surface water samples were collected from two different tributaries of Joe Creek downstream of the Blue Ledge Mine. Arsenic concentrations from T3 were non-detect at an analytical method reporting limit of 0.5 ug/L, a concentration which is higher than the screening criterion of 0.14 ug/L. The estimated cancer risk from arsenic present in surface water collected from the Mazanita Gulch tributary is 2.1E-06.

Elliot Creek –
Seven surface water samples were collected. Excess cancer risk estimates for arsenic range from 1.6E-06 at location EC-06 to 3.6E-06 at location EC-01.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
Two surface water samples were collected in Applegate River. Surface water collected from location AR-01 was non-detect for arsenic. At location AR-02, the excess cancer risk estimate for arsenic is 2.1E-06.

Applegate Reservoir -
Concentrations of metals detected in the single surface water sample collected at location ARV-04 resulted in an excess cancer risk estimate for arsenic of 2.6E-06.

<u>Sediment Risk Estimates</u>

The site-specific average background concentration of arsenic present in sediment samples located upstream of the Blue Ledge Mine was used as the screening criterion.

Joe Creek –
Five sediment samples were collected in Joe Creek. Excess cancer risk estimates for arsenic ranged from 2.0E-06 at location JC-01 to 2.8E-06 at location JC-04.

Elliot Creek –
Seven sediment samples were collected in Elliot Creek. Locations EC-06 and EC-07 were collected upstream of the confluence of Joe Creek with Elliot Creek (see Figure 4). Excess cancer risk estimates in the two upstream locations were 3.3E-06 and 5.1E-06, respectively. Excess cancer risk estimates for arsenic in sediment in Elliot Creek downstream of the confluence with Joe Creek range from 2.4E-06 at location EC-05 to 4.1E-06 at location EC-4.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
The two sediment samples collected from Applegate River have excess cancer risk estimates for arsenic of 2.6E-06 and 2.9E-06.

Applegate Reservoir -
The four sediment samples collected from Applegate Reservoir have excess cancer risk estimates ranging from 2.7E-06 to 3.2E-06.

Riparian Soil Risk Estimates

The site-specific average background concentration of arsenic present in two riparian samples collected upstream of the Blue Ledge Mine was used as the screening criterion.

Joe Creek –
Three riparian soil samples were collected adjacent to Joe Creek at locations JC-01, JC-03, and JC-04. These samples have excess cancer risk estimates for arsenic of 1.6E-06, 8.1E-06, and 2.2E-06, respectively.

Elliot Creek –
The four riparian soil samples collected adjacent to Elliot Creek have excess cancer risk estimates for arsenic ranging from 1.5E-06 to 2.7E-06.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
One riparian soil sample was collected adjacent to the Middle Fork of the Applegate River, between the mouth of Elliot Creek and the head of Applegate Reservoir. This sample has an associated excess cancer risk for arsenic of 2.1E-06.

Fish Tissue Risk Estimates

Although surface water criteria that were protective of humans ingesting fish/shellfish were used to screen surface water data, those criteria were based on how low the arsenic concentration has to be in surface water to avoid impacting fish/shellfish tissue at a level that would be dangerous to the humans eating them. However, because fish tissue samples were collected, a more direct comparison can be made to criteria that are protective of humans eating fish/shellfish tissue. A stringent human health criterion protective of recreational fishermen consuming fish and shellfish tissue (i.e.,, Acceptable Tissue Level [DEQ 2007]) was used to screen detected concentrations of arsenic in fish tissue.

Elliot Creek –
Three fish tissue samples were collected in Elliot Creek at locations EC-02, EC-04, and the location upstream of the confluence with Joe Creek, EC-07. These samples have excess cancer risk estimates for arsenic of 2.4E-05 for both downstream samples, and 3.9E-05 for the upstream sample.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
A single fish tissue sample and a duplicate sample were collected at location AR-02. These samples have an excess cancer risk estimate for arsenic of approximately 2.4E-05.

Applegate Reservoir -
The single fish tissue sample collected from Applegate Reservoir has an associated excess cancer risk estimate for arsenic of 2.3E-05.

Summary and Conclusions

Arsenic is the only metal that exceeded criteria protective of human health in any of the media sampled, with the exception of a single detection of zinc in water collected from Adit AD-01. Estimated PECRs for arsenic and the HQ for zinc in surface water were based on ambient water quality criteria protective of humans ingesting organisms only, while estimated PECRS for

arsenic in sediment and riparian soil were based on site-specific background concentrations, which were higher than at least one literature-based criterion.

Generally, it appears that the arsenic concentrations causing unacceptable risk human health risk are not associated with Joe Creek, but rather are typical of conditions in Elliot Creek. It is unclear at this time if arsenic is naturally-occurring, or originates from a source other than Joe Creek. As discussed above, acceptable PECR values cannot exceed a risk of 1.0E-06.

HUMAN HEALTH RISKS RELATED TO METALS DETECTED IN SURFACE WATER

Water collected from the two mine adits contained concentrations of arsenic that were high, resulting in unacceptable PECRs greater than 3E-05. Water collected from Adit AD-01 also contained zinc at a concentration resulting in an unacceptable HQ of 11.5. Arsenic was non-detect in water collected from Seep SP-02 and the dam location, and nearly non-detect in water collected from Seep SP-01. Arsenic was not detected in any of the surface water samples collected from Joe Creek. Surface water collected from tributary T3JC-01 did not contain detectable concentrations of arsenic, while surface water collected from the tributary referred to as Manzanita Gulch contained arsenic at a concentration resulting in an unacceptable PECR of 2.1E-06. Unacceptable PECRs related to Elliot Creek surface water were moderately high, and ranged from 1.6E-06 (location EC-06, upstream of confluence with Joe Creek) to 3.6E-06 (location EC-01). The single surface water sample collected in Applegate River contained arsenic at a concentration resulting in a unacceptable PECR of 2.1E-06, while the arsenic detected in the surface water sample collected from Applegate Reservoir resulted in a unacceptable PECR of 2.6E-06.

HUMAN HEALTH RISKS RELATED TO METALS DETECTED IN SEDIMENT

Arsenic detected in sediments collected from Joe Creek resulted in unacceptable but relatively low PECRs ranging from 1.7E-06 (location JC-08) to 2.8E-06 (location JC-04). Unacceptable PECR estimates for arsenic detected in Elliot Creek sediments ranged from 2.3E-06 (location EC-05) to 5.1E-06 (location EC-07, upstream of confluence with Joe Creek). Unacceptable PECR estimates for arsenic detected in Applegate River sediments were relatively low, ranging from 2.6E-06 to 2.9E-06. Unacceptable PECR estimates in Applegate Reservoir were a little higher than those in Applegate River, and ranged from 2.7E-06 to 3.2E-06.

HUMAN HEALTH RISKS RELATED TO METALS DETECTED IN RIPARIAN SOIL

Unacceptable PECR estimates for arsenic detected in riparian soils adjacent to Joe Creek at locations JC-01 and JC-04, in the five riparian soil samples collected adjacent to Elliot Creek, and the single riparian soil sample collected adjacent to Applegate River, are all similar and relatively low, ranging from 1.5E-06 to 2.7E-06. However, sample location JC-03 in Joe Creek had a relatively high estimated PECR of 8.1E-06..

HUMAN HEALTH RISKS RELATED TO METALS IN FISH TISSUE

Excess cancer risk estimates for fish tissue were relatively high in all water bodies samples (Elliot Creek, Applegate River, and Applegate Reservoir), ranging from 2.1E-05 up to 3.9E-05.

Suggested Risk-Based Human Health Cleanup Criteria

In each case where a detected concentration for arsenic results in an estimated excess cancer risk value that exceeds 1.0E-06, a conservative cleanup criterion would be equal to the "most stringent criterion" identified. In the cases of surface water, sediment, and riparian soil, the background concentration of arsenic, rather than a regulatory criterion, was used as the most stringent screening criterion. In the case of fish tissue, the screening criterion is based on protection of recreational fishers who consume fish.

Concentrations of the most stringent criteria based on type of metal and type of medium can be found in the summary risk estimate tables for surface water, sediment, riparian soil, and fish tissue (Tables B-2, B-10, B-16, and B-21).

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Table B-1
Summary of Surface Water Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L										Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Background																						
T4JC-01-SW-08627-URS	12		11.5		24		5	U	1.0		0.07	U	0.008	U	0.86		4.0	U	0.035		1.90	
T4JC-02-SW-08627-URS	12		11.5		23		5	U	1.0		0.07	U	0.008	U	0.89		7.4	J	0.02	U	1.93	
JC-15-SW-080627-URS	26		23.9		18		5	U	2.5		0.07	U	0.008	U	0.74		4.0	U	0.02	U	0.92	
JC-14-SW-080627-URS	26		23.8		17		5	U	2.5		0.07	U	0.008	U	0.71		4.0	U	0.02	U	1.10	
JC-13-SW-080627-URS	25		24		29		5	U	2.5		0.07	U	0.008	U	0.84		4.0	U	0.02	U	0.82	
JC-12-SW-080627-URS	24		23.6		33		5	U	2.5		0.07	U	0.008	U	0.73		4.0	U	0.02	U	0.75	
JC-11-SW-080627-URS	25		23.8		14		5	U	2.5		0.08	J	0.008	U	0.75		4.0	U	0.02	U	0.49	J
JC-10-SW-080627-URS	25		24.5		26		5	U	2.5		0.07	U	0.008	U	0.77		4.0	U	0.02	U	0.65	
Average	21.9		20.8		23.0		5.0	U	2.1		0.07		0.01		0.79		2.68[a]		0.022		1.07	
Rivers and Creeks																						
JC-09-SW-080627-URS	22		21.3		15		5	U	2.3		0.07	U	0.031		3.45		4.0	U	0.02	U	6.01	
JC-08-SW-080626-URS	21		20.6		21		5	U	2.8		0.07	U	0.228		29.0		4.0	U	0.043	U	42.9	
JC-07-SW-080626-URS	20		20.8		43		5	U	3.6		0.07	U	0.537		62.8		4.0	U	0.060	U	88.5	
JC-07-SW-DUP-080626-URS	22		20.9		15		5	U	3.6		0.07	U	0.519		62.4		4.0	U	0.066	U	87.6	
JC-04-SW-080627-URS	32		35		40		5	U	5.1		0.07	U	0.504		31.8		5.1	J	0.02	U	61.2	
JC-03-SW-080625-URS	31		36.4		55		5	U	5.1		0.07	U	0.496		34.9		4.0	U	0.02	U	63.7	
JC-02-SW-080625-URS	33		37.1		37		5	U	5.1		0.07	U	0.519		35.6		4.0	U	0.02	U	69.3	
JC-01-SW-080625-URS	35		37		48		5	U	5.1		0.07	U	0.564		31.3		4.0	U	0.02	U	79.4	
EC-07-SW-080625-URS	47		44.9		71		5	U	2.8		0.35	J	0.008	U	0.46		4.0	U	0.02	U	0.61	
EC-06-SW-080625-URS	38		40.4		73		5	U	3.1		0.22	J	0.180		13.9		4.0	U	0.02	U	22.3	
EC-05-SW-080625-URS	42		43.4		66		5	U	3.0		0.39	J	0.042		3.03		4.0	U	0.02	U	3.49	
EC-04-SW-080625-URS	42		44		64		5	U	3.0		0.37		0.040		3.22		4.0	U	0.02	U	3.82	
EC-04-SW-DUP-080625-URS	44		43.1		82		5	U	2.9		0.40		0.049		3.25		4.0	U	0.02	U	4.73	
EC-03-SW-080625-URS	41		44.3		76		5	U	3.0		0.31	J	0.046		3.22		4.0	U	0.02	U	4.38	
EC-02-SW-080625-URS	43		43.9		77		5	U	3.0		0.37	J	0.038		3.62		4.0	U	0.02	U	4.94	
EC-01-SW-080624-URS	40		42.3		81		5	U	3.0		0.50	J	0.049		7.82		6.0	J	0.023		3.95	
AR-01-SW-080624-URS	36		41.6		64		5	U	2.5		0.07	U	0.018	J	0.02	U	5.6	J	0.016	J	0.05	U
AR-02-SW-080624-URS	38		41.1		50		5	U	1.9		0.29	J	0.025		1.61		4.6	J	0.008	J	2.15	
ARV-04-SW-080624-URS	42		39.3		77		5	U	1.8		0.37	J	0.012	J	1.89		7.9	J	0.011	J	2.2	
Tributaries																						
T4JC-01-SW-08627-URS	12		11.5		24		5	U	1.0		0.07	U	0.008	U	0.86		4.0	U	0.035		1.90	
T4JC-02-SW-08627-URS	12		11.5		23		5	U	1.0		0.07	U	0.008	U	0.89		7.4	J	0.02	U	1.93	
T3JC-01-SW-080626	78		74.1		91		8		1.9		0.50	U	0.01		0.42		97.9		0.007		1.75	
MG-01-SW-080626-URS	77		82.2		120		5	U	9.0		0.29	J	0.008	U	0.51		22.4		0.020	U	1.13	
T2JC-01	Not Sampled - Tributary Dry																					
T1JC-01	Not Sampled - Tributary Dry																					
Adits and Seeps																						
AD-01-080624-URS	2	U	576		5060		5	U	2770		3.19		70.9		194000		748000		8.640		300000	
AD-02-080624-URS	134		548		801		6		393		1.81		0.598		4.77		53.6		0.020		1200	
SP-01-080624-URS	31		31		23		5	U	5.7		0.10	J	0.839		65.9		20.3		0.210		132	
DAM-01-080624-URS	2	U	63.5		160		5	U	112		0.07	U	33.7		4680		1670		8.370		6180	
SP-02-080627-URS	22		36.8		81		5	U	18.3		0.07	U	5.450		699		4.0	U	0.219		913	

U - analyte was not detected at or above analytical method reporting limit.
J - estimated analytical value.
JC = Joe Creek.
EC = Elliott Creek.
AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.
ARV = Applegate Reservoir.
T1, T2, T3 = tributaries to Joe Creek downstream of Blue Ledge Mine.
T4 = tributaries located upstream of Blue Ledge Mine.
MG = Manzanita Gulch (tributary to Joe Creek).
AD = mine adit.
Dam = dam location at based of waste rock pile adjacent to Blue Ledge Mine.
SP = seep
TDS = total dissolved solids.
TSS = total suspended solids.
a = average was obtained by halving the U-flagged values, summing the data including the estimated value of 7.4, and then dividing by eight.

Table B-2
Surface Water Human Health Criteria
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L										Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Background																						
Site-Specific Average	21.9		20.8		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.022		1.1	
Screening Criteria																						
CalWQS - humans ingesting organisms only	--		--		--		--		--		--		--		--		--		--		--	
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	20		--		--		--		--		0.14		--		--		--		--		26,000	
EPA NRWQC - protective of humans ingesting organisms only	--		--		--		--		--		0.14		--		--		--		--		26,000	
FINAL SCREENING CRITERION											**0.14**		**NA**		**NA**		**NA**		**NA**		**26,000**	

-- indicates that no criterion is available.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

In cases where the background concentration is higher than a criterion or criteria, the background concentration is used as the final screening criterion.

TDS = total dissolved solids.

TSS = total suspended solids.

NA = no surface water criteria protective of human ingesting aquatic organisms are available.

CalWQS = California water quality standards for humans ingesting organisms only, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

DEQ Tables 33A, 33B, and 33C AWQC - Human health: For consumption of organisms only = Tables 33A and 33B, Water Quality Criteria Summary, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

EPA NRWQC = National Recommended Water Quality Criteria for Priority Toxic Pollutants. Protective of humans ingesting organisms only. USEPA, Office of Water, Office of Science and Technology, 2006. http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf.

Table B-3
Screening of Surface Data for Adits and Seeps
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L										Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Background																						
Site-Specific Average	21.9		20.8		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.022		1.1	
Adits and Seeps																						
AD-01-080624-URS	2	U	576		5060		5	U	2770		3.19		70.9		194000		748000		8.640		300000	
AD-02-080624-URS	134		548		801		6		393		1.81		0.598		4.77		53.6		0.020		1200	
SP-01-080624-URS	31		31		23		5	U	5.7		0.10	J	0.839		65.9		20.3		0.210		132	
DAM-01-080624-URS	2	U	63.5		160		5	U	112		0.07	U	33.7		4680		1670		8.370		6180	
SP-02-080627-URS	22		36.8		81		5	U	18.3		0.07	U	5.450		699		4.0	U	0.219		913	
Screening Criteria																						
CalWQS - humans ingesting organisms only	--		--		--		--		--		--		--		--		--		--		--	
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	~~20~~		--		--		--		--		0.14		--		--		--		--		26,000	
EPA NRWQC - protective of humans ingesting organisms only	--		--		--		--		--		0.14		--		--		--		--		26,000	
FINAL SCREENING CRITERION											**0.14**		**NA**		**NA**		**NA**		**NA**		**26,000**	

-- indicates that no criterion is available.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

AD = mine adit.

Dam = dam location at based of waste rock pile adjacent to Blue Ledge Mine.

SP = seep

TDS = total dissolved solids.

TSS = total suspended solids.

NA = no surface water criteria protective of human ingesting aquatic organisms are available.

CalWQS = California water quality standards for humans ingesting organisms only, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

DEQ Tables 33A, 33B, and 33C AWQC - Human health: For consumption of organisms only = Tables 33A and 33B, Water Quality Criteria Summary, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

EPA NRWQC = National Recommended Water Quality Criteria for Priority Toxic Pollutants. Protective of humans ingesting organisms only. USEPA, Office of Water, Office of Science and Technology, 2006. http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf.

Table B-4
Screening of Surface Water Data for Tributaries to Joe Creek downstream of Blue Ledge Mine
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L					Dissolved Metals - ug/L					
Sample Name	Alkalinity	Hardness	TDS	TSS	Sulfate	Arsenic	Cadmium	Copper	Iron	Lead	Zinc
Background											
Site-Specific Average	21.9	20.8	23.0	5.0 U	2.1	0.07	0.008 U	0.8	2.7	0.022	1.1
Tributaries on Joe Creek downstream of Blue Ledge Mine											
T3JC-01-SW-080626	78	74.1	91	8	1.9	0.50 U	0.01	0.42	97.9	0.007	1.75
MG-01-SW-080626-URS	77	82.2	120	5 U	9.0	0.29 J	0.008 U	0.51	22.4	0.020 U	1.13
T2JC-01	Not Sampled - Tributary Dry										
T1JC-01	Not Sampled - Tributary Dry										
Screening Criteria											
CalWQS - humans ingesting organisms only	--	--	--	--	--	--	--	--	--	--	--
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	~~20~~[a]	--	--	--	--	0.14	--	--	--	--	26,000
EPA NRWQC - protective of humans ingesting organisms only	--	--	--	--	--	0.14	--	--	--	--	26,000
FINAL SCREENING CRITERION						**0.14**	**NA**	**NA**	**NA**	**NA**	**26,000**

-- indicates that no criterion is available.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

Highlighted detected concentrations exceed one or more screening level values. Bold numbers indicate the criteria that have been exceeded.

If more than one criterion are exceeded by the same detected concentrations, then both criteria are bolded.

T1, T2, T3 = tributaries to Joe Creek downstream of Blue Ledge Mine.

MG = Mazanita Gulch tributary.

TDS = total dissolved solids.

TSS = total suspended solids.

NA = no surface water criteria protective of human ingesting aquatic organisms are available.

CalWQS = California water quality standards for humans ingesting organisms only, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

DEQ Tables 33A, 33B, and 33C AWQC - Human health: For consumption of organisms only = Tables 33A and 33B, Water Quality Criteria Summary, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

EPA NRWQC = National Recommended Water Quality Criteria for Priority Toxic Pollutants. Protective of humans ingesting organisms only. USEPA, Office of Water, Office of Science and Technology, 2006. http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf.

Table B-5
Screening of Surface Water Data for Joe Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L																							
Sample Name	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Background (upstream of Blue Ledge Mine)																								
Site-Specific Average	21.9		20.8		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.022		1.1	
Joe Creek downstream of Blue Ledge Mine																								
JC-09-SW-080627-URS	22		21.3		15		5	U	2.3		0.07	U	0.031		3.45		4.0	U	0.02	U	6.01	
JC-08-SW-080626-URS	21		20.6		21		5	U	2.8		0.07	U	0.228		29.0		4.0	U	0.043		42.9	
JC-07-SW-080626-URS	20		20.8		43		5	U	3.6		0.07	U	0.537		62.8		4.0	U	0.060		88.5	
JC-07-SW-DUP-080626-URS	22		20.9		15		5	U	3.6		0.07	U	0.519		62.4		4.0	U	0.066		87.6	
JC-04-SW-080627-URS	32		35		40		5	U	5.1		0.07	U	0.504		31.8		5.1	J	0.02	U	61.2	
JC-03-SW-080625-URS	31		36.4		55		5	U	5.1		0.07	U	0.496		34.9		4.0	U	0.02	U	63.7	
JC-02-SW-080625-URS	33		37.1		37		5	U	5.1		0.07	U	0.519		35.6		4.0	U	0.02	U	69.3	
JC-01-SW-080625-URS	35		37		48		5	U	5.1		0.07	U	0.564		31.3		4.0	U	0.02	U	79.4	
Screening Criteria																								
CalWQS - humans ingesting organisms only	--		--		--		--		--		--		--		--		--		--		--	
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	~~20~~[a]		--		--		--		--		0.14		--		--		--		--		26,000	
EPA NRWQC - protective of humans ingesting organisms only	--		--		--		--		--		0.14		--		--		--		--		26,000	
FINAL SCREENING CRITERION											**0.14**		**NA**		**NA**		**NA**		**NA**		**26,000**	

-- indicates that no criterion is available.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

Highlighted detected concentrations exceed one or more screening level values. Bold numbers indicate the criteria that have been exceeded.

If more than one criterion are exceeded by the same detected concentrations, then both criteria are bolded.

TDS = total dissolved solids.

TSS = total suspended solids.

NA = no surface water criteria protective of human ingesting aquatic organisms are available.

CalWQS = California water quality standards for humans ingesting organisms only, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

DEQ Tables 33A, 33B, and 33C AWQC - Human health: For consumption of organisms only = Tables 33A and 33B, Water Quality Criteria Summary, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

EPA NRWQC = National Recommended Water Quality Criteria for Priority Toxic Pollutants. Protective of humans ingesting organisms only. USEPA, Office of Water, Office of Science and Technology, 2006. http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf.

Table B-6
Screening of Surface Water Data for Elliott Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L																					
Sample Name	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Site-Specific Background Average (upstream of Blue Ledge Mine)	21.9		20.8		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.022		1.1	
Elliott Creek																						
EC-07-SW-080625-URS	47		44.9		71		5	U	2.8		0.35	J	0.008	U	0.46		4.0	U	0.02	U	0.61	
EC-06-SW-080625-URS	38		40.4		73		5	U	3.1		0.22	J	0.180		13.9		4.0	U	0.02	U	22.3	
EC-05-SW-080625-URS	42		43.4		66		5	U	3.0		0.39	J	0.042		3.03		4.0	U	0.02	U	3.49	
EC-04-SW-080625-URS	42		44		64		5	U	3.0		0.37		0.040		3.22		4.0	U	0.02	U	3.82	
EC-04-SW-DUP-080625-URS	44		43.1		82		5	U	2.9		0.40		0.049		3.25		4.0	U	0.02	U	4.73	
EC-03-SW-080625-URS	41		44.3		76		5	U	3.0		0.31	J	0.046		3.22		4.0	U	0.02	U	4.38	
EC-02-SW-080625-URS	43		43.9		77		5	U	3.0		0.37	J	0.038		3.62		4.0	U	0.02	U	4.94	
EC-01-SW-080624-URS	40		42.3		81		5	U	3.0		0.50	J	0.049		7.82		6.0	J	0.023		3.95	
Screening Criteria																						
CalWQS - humans ingesting organisms only	--		--		--		--		--		--		--		--		--		--		--	
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	~~20~~[a]		--		--		--		--		0.14		--		--		--		--		26,000	
EPA NRWQC - protective of humans ingesting organisms only	--		--		--		--		--		0.14		--		--		--		--		26,000	
FINAL SCREENING CRITERION											**0.14**		**NA**		**NA**		**NA**		**NA**		**26,000**	

-- indicates that no criterion is available.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

Highlighted detected concentrations exceed one or more screening level values. Bold numbers indicate the criteria that have been exceeded.

If more than one criterion are exceeded by the same detected concentrations, then both criteria are bolded.

TDS = total dissolved solids.

TSS = total suspended solids.

NA = no surface water criteria protective of human ingesting aquatic organisms are available.

CalWQS = California water quality standards for humans ingesting organisms only, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

EPA NRWQC = National Recommended Water Quality Criteria for Priority Toxic Pollutants. Protective of humans ingesting organisms only. USEPA, Office of Water, Office of Science and Technology, 2006. http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf.

Table B-7
Screening of Surface Water Data for Applegate River from its confluence with Elliot Creek to Applegate Reservoir, and Applegate Reservoir
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L																							
	Dissolved Metals - ug/L																							
Sample Name	Alkalinity		Hardness		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Background																								
Site-Specific Average	21.9		20.8		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.022		1.1	
Applegate River downstream of its confluence with Elliott Creek, and Applegate Reservoir																								
AR-01-SW-080624-URS	36		41.6		64		5	U	2.5		0.07	U	0.018	J	0.02	U	5.6	J	0.016	J	0.05	U
AR-02-SW-080624-URS	38		41.1		50		5	U	1.9		0.29	J	0.025		1.61		4.6	J	0.008	J	2.15	
ARV-04-SW-080624-URS	42		39.3		77		5	U	1.8		0.37	J	0.012	J	1.89		7.9	J	0.011	J	2.2	
Screening Criteria																								
CalWQS - humans ingesting organisms only	--		--		--		--		--		--		--		--		--		--		--	
DEQ Tables 33A, 33B, and 33C AWQC - humans ingesting organisms only	~~20~~[a]		--		--		--		--		0.14		--		--		--		--		26,000	
EPA NRWQC - protective of humans ingesting organisms only	--		--		--		--		--		0.14		--		--		--		--		26,000	
FINAL SCREENING CRITERION											**0.14**		**NA**		**NA**		**NA**		**NA**		**26,000**	

-- indicates that no criterion is available.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

Highlighted detected concentrations exceed one or more screening level values. Bold numbers indicate the criteria that have been exceeded.

If more than one criterion are exceeded by the same detected concentrations, then both criteria are bolded.

AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.

ARV = Applegate Reservoir.

TDS = total dissolved solids.

TSS = total suspended solids.

NA = no surface water criteria protective of human ingesting aquatic organisms are available.

CalWQS = California water quality standards for humans ingesting organisms only, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule.

Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

EPA NRWQC = National Recommended Water Quality Criteria for Priority Toxic Pollutants. Protective of humans ingesting organisms only. USEPA, Office of Water, Office of Science and Technology, 2006. http://www.epa.gov/waterscience/criteria/nrwqc-2006.pdf.

Table B-8
Estimated Potential Excess Cancer Risk Estimates for Surface Water Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic[a]		Potential Excess Cancer Risk	Zinc[b]	Non-Carcinogenic Hazard Quotient
Adits and Seeps					
AD-01-080624-URS	3.19		**2.3E-05**	300,000	**11.5**
AD-02-080624-URS	1.81		**1.3E-05**	1200	0.05
SP-01-080624-URS	0.10	J	**7.1E-07**	132	0.005
DAM-01-080624-URS	0.07	U	NA	6180	0.2
SP-02-080627-URS	0.07	U	NA	913	0.04
FINAL SCREENING CRITERION	0.14			26,000	
Tributaries of Joe Creek, downstream of Blue Ledge Mine					
T3JC-01-SW-080626	0.50	U	NA	NE	NA
MG-01-SW-080626-URS	0.29	J	**2.1E-06**	NE	NA
FINAL SCREENING CRITERION	0.14				
Elliott Creek					
EC-07-SW-080625-URS	0.35	J	**2.5E-06**	NE	NA
EC-06-SW-080625-URS	0.22	J	**1.6E-06**	NE	NA
EC-05-SW-080625-URS	0.39	J	**2.8E-06**	NE	NA
EC-04-SW-080625-URS	0.37		**2.6E-06**	NE	NA
EC-04-SW-DUP-080625-URS	0.40		**2.9E-06**	NE	NA
EC-03-SW-080625-URS	0.31	J	**2.2E-06**	NE	NA
EC-02-SW-080625-URS	0.37	J	**2.6E-06**	NE	NA
EC-01-SW-080624-URS	0.50	J	**3.6E-06**	NE	NA
FINAL SCREENING CRITERION	0.14				
Applegate River downstream of its confluence with Elliott Creek, and Applegate Reservoir					
AR-01-SW-080624-URS	0.07	U	NA	NE	NA
AR-02-SW-080624-URS	0.29	J	**2.1E-06**	NE	NA
ARV-04-SW-080624-URS	0.37	J	**2.6E-06**	NE	NA
FINAL SCREENING CRITERION	0.14				

U - analyte was not detected at or above the analytical method reporting limit.
J - estimated analytical concentration.
NE = no exceedances of criterion, so detected concentrations not shown here.
NA = not applicable.
EC = Elliott Creek.
AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.
ARV = Applegate Reservoir.
T3 = tributary 3 on Joe Creek downstream of Blue Ledge Mine.
MG = Manzanita Gulch (tributary of Joe Creek).
AD = mine adit.
Dam = dam location at base of waste rock pile adjacent to Blue Ledge Mine.
SP = seep
Highlighted detected concentrations exceed the most stringent criterion. Bold numbers indicate the excess cancer risk exceeding 1E-06.
Bold numbers indicate Excess Carcinogenic Risks that exceed 1.0E-06.
[a] = Arsenic is a carcinogen. Criteria for arsenic are based on protection of human receptors at a PECR of 1.0E-06. Detected values shown represent dissolved concentrations of arsenic.
[b] = Zinc is a non-carcinogen. A hazard quotient estimate that exceeds 1.0 indicates unacceptable human health risk.
There were no exceedances of criteria for any metal detected in Joe Creek surface water.
Highlighted results exceed one or more screening level values.

Table B-9
Summary of Sediment Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	% solids	Arsenic		Cadmium		Copper		Lead		Zinc	
Background											
JC-15-SD-080627-URS	85.1	1.43		0.121		47.2		1.63		44.1	
JC-14-SD-080627-URS	88.5	0.74		0.093		34.4		1.20		26.9	
JC-13-SD-080627-URS	84.4	1.19		0.113		37.7		1.63		40.2	
JC-12-SD-080627-URS	87.6	1.77		0.097		39.0		2.09	J	35.4	
JC-11-SD-080627-URS	83.9	1.36		0.139		47.5		1.49		36.6	
JC-10-SD-080627-URS	61.4	2.68		0.214		51.7		2.67		55.6	
Average	81.8	1.5		0.13		42.9		1.8		39.8	
Rivers and Creeks											
JC-08-SD-080627-URS	79.2	2.54	J	0.941		978		13.8		208	
JC-06	Not sampled										
JC-05	Not sampled										
JC-04-SD-080627-URS	86.9	4.27		2.93		558		10.0		317	
JC-03-SD-080626-URS	92.3	3.22		2.70		386		7.72		423	
JC-02-SD-080626-URS	94.3	1.14		2.80		536		6.27		533	
JC-01-SD-080626-URS	86.1	3.01		2.14		430		5.85		440	
EC-08	Not sampled										
EC-07-SD-080625-URS	75.6	7.59		0.281		28.0		6.91		59.0	
EC-06-SD-080625-URS	74.5	4.92		0.581		119		10.4		114	
EC-05-SD-080625-URS	82.1	3.50		0.213		38.5		4.07		74.5	
EC-05-SD-DUP-080625-URS	80.9	3.61		0.260		47.0		3.54		77.8	
EC-04-SD-080625-URS	89.9	6.20		0.211		39.9		5.52		77.1	
EC-04-SD-DUP-080625-URS	83.1	5.20		0.270		51.3		4.72		75.1	
EC-03-SD-080625-URS	86.3	4.35		0.528		42.9		4.52		72.7	
EC-02-SD-080625-URS	74.2	4.04		0.315		57.5		5.72		109	
EC-01-SD-080624-URS	85.8	4.23		0.388		43.1		5.14		75.8	
AR-01-SD-080624-URS	73.3	3.95		0.416		68.8		5.97		120	
AR-02-SD-080624-URS	89.0	4.36		0.406		62.7		4.94		107	
ARV-01-SD-080624-URS	72.6	4.76		0.422		70.8		6.54		111	
ARV-02-SD-080624-URS	64.7	4.77		0.519		81.8		6.34		128	
ARV-03-SD-080624-URS	46.9	4.71		0.572		107		8.24		116	
ARV-04-SD-080624-URS	60.3	3.98		0.434		73.8		6.37		93.1	

All results are in mg/kg on a dry weight basis unless otherwise noted.
U - analyte was not detected at or above the analytical method reporting limit.
J - estimated analytical concentration.
JC = Joe Creek.
EC = Elliott Creek.
AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.
ARV = Applegate Reservoir.
TDS = total dissolved solids.
TSS = total soluble solids.

Table B-10
Human Health Criteria for Sediment
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background (Sediments located upstream of Blue Ledge Mine)										
Site-Specific Average	1.5		0.13		42.9		1.8		39.8	
California Regional Soil Levels[a]	3.5		0.36		28.7		23.9		149	
Screening Criteria										
EPA R6 HHMSSLs	~~0.39~~[b]		39		2,900		400		23,000	
FINAL SCREENING CRITERION	**1.5[b]**		**39**		**2,900**		**400**		**23,000**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

[a] Because site-specific background concentrations are available for sediment, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the final screening criterion. The EPA R6 HHMSSL value is less than the background concentration, and is identified as such by strikethrough font.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-11
Screening of Sediment Data for Joe Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
Site-Specific Average	**1.5**[b]		0.13		42.9		1.8		39.8	
California Regional Soil Levels[a]	3.5		0.36		28.7		23.9		149	
Joe Creek										
JC-08-SD-080627-URS	2.54	J	0.941		978		13.8		208	
JC-04-SD-080627-URS	4.27		2.93		558		10.0		317	
JC-03-SD-080626-URS	3.22		2.70		386		7.72		423	
JC-02-SD-080626-URS	1.14		2.80		536		6.27		533	
JC-01-SD-080626-URS	3.01		2.14		430		5.85		440	
Screening Criteria										
EPA R6 HHMSSLs	~~0.39~~[b]		39		2,900		400		23,000	
FINAL SCREENING CRITERION	**1.5**[b]		**39**		**2,900**		**400**		**23,000**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

Highlighted detected concentrations exceed one or more screening level values.

Detected concentrations that exceed the average background concentration are yellow-highlighted.

If more than one criterion is exceeded by different detected concentrations, a different color is assigned to each criterion exceeded.

[a] Because site-specific background concentrations are available for sediment, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the most stringent criterion. The EPA R6 HHMSSL value is less than the background concentration, and is identified as such by strikethrough font.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-12
Screening of Sediment Data for Elliott Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	Cadmium	Copper	Lead	Zinc
Background					
Site-Specific Average	**1.5**[b]	0.13	42.9	1.8	39.8
California Regional Soil Levels[a]	3.5	0.36	28.7	23.9	149
Elliott Creek					
EC-07-SD-080625-URS	7.59	0.281	28.0	6.91	59.0
EC-06-SD-080625-URS	4.92	0.581	119	10.4	114
EC-05-SD-080625-URS	3.50	0.213	38.5	4.07	74.5
EC-05-SD-DUP-080625-URS	3.61	0.260	47.0	3.54	77.8
EC-04-SD-080625-URS	6.20	0.211	39.9	5.52	77.1
EC-04-SD-DUP-080625-URS	5.20	0.270	51.3	4.72	75.1
EC-03-SD-080625-URS	4.35	0.528	42.9	4.52	72.7
EC-02-SD-080625-URS	4.04	0.315	57.5	5.72	109
EC-01-SD-080624-URS	4.23	0.388	43.1	5.14	75.8
Screening Criteria					
EPA R6 HHMSSLs	~~0.39~~[b]	39	2,900	400	23,000
FINAL SCREENING CRITERION	**1.5**[b]	**39**	**2,900**	**400**	**23,000**

All results are in mg/kg on a dry weight basis unless otherwise noted.

Detected concentrations that exceed the average background concentration are yellow-highlighted.

[a] Because site-specific background concentrations are available for sediment, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the final screening criterion. The EPA R6 HHMSSL value is less than the background concentration, and is identified as such by strikethrough font.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-13
Screening of Sediment Data for Applegate River downstream of its confluence with Elliot Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	Cadmium	Copper	Lead	Zinc
Background					
Site-Specific Average	**1.5**[b]	0.13	42.9	1.8	39.8
California Regional Soil Levels[a]	3.5	0.36	28.7	23.9	149
Applegate River downstream of its confluence with Elliott Creek, and Applegate Reservoir					
AR-01-SD-080624-URS	3.95	0.416	68.8	5.97	120
AR-02-SD-080624-URS	4.36	0.406	62.7	4.94	107
ARV-01-SD-080624-URS	4.76	0.422	70.8	6.54	111
ARV-02-SD-080624-URS	4.77	0.519	81.8	6.34	128
ARV-03-SD-080624-URS	4.71	0.572	107	8.24	116
ARV-04-SD-080624-URS	3.98	0.434	73.8	6.37	93.1
Screening Criteria					
EPA R6 HHMSSLs	~~0.39~~[b]	39	2,900	400	23,000
FINAL SCREENING CRITERION	**1.5**[b]	**39**	**2,900**	**400**	**23,000**

All results are in mg/kg on a dry weight basis unless otherwise noted.

Highlighted detected concentrations exceed one or more screening level values.

AR = Applegate River downstream of confluence with Elliott Creek.

ARV = Applegate Reservoir.

[a] Because site-specific background concentrations are available for sediment, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the most stringent criterion. The EPA R6 HHMSSL value is less than the background concentration, and is identified as such by strikethrough font.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-14
Estimated Potential Excess Health Cancer Risk for Sediment Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic[a]		Potential Excess Cancer Risk
Joe Creek			
JC-08-SD-080627-URS	2.54	J	**1.7E-06**
JC-04-SD-080627-URS	4.27		**2.8E-06**
JC-03-SD-080626-URS	3.22		**2.1E-06**
JC-02-SD-080626-URS	1.14		**7.6E-07**
JC-01-SD-080626-URS	3.01		**2.0E-06**
FINAL SCREENING CRITERION	1.5		
Elliott Creek			
EC-08			
EC-07-SD-080625-URS	7.59		**5.1E-06**
EC-06-SD-080625-URS	4.92		**3.3E-06**
EC-05-SD-080625-URS	3.50		**2.3E-06**
EC-05-SD-DUP-080625-URS	3.61		**2.4E-06**
EC-04-SD-080625-URS	6.20		**4.1E-06**
EC-04-SD-DUP-080625-URS	5.20		**3.5E-06**
EC-03-SD-080625-URS	4.35		**2.9E-06**
EC-02-SD-080625-URS	4.04		**2.7E-06**
EC-01-SD-080624-URS	4.23		**2.8E-06**
FINAL SCREENING CRITERION	1.5		
Applegate River downstream of its confluence with Elliot Creek, and Applegate Reservoir			
AR-01-SD-080624-URS	3.95		**2.6E-06**
AR-02-SD-080624-URS	4.36		**2.9E-06**
ARV-01-SD-080624-URS	4.76		**3.2E-06**
ARV-02-SD-080624-URS	4.77		**3.2E-06**
ARV-03-SD-080624-URS	4.71		**3.1E-06**
ARV-04-SD-080624-URS	3.98		**2.7E-06**
FINAL SCREENING CRITERION	1.5		

J - estimated analytical concentration.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.

ARV = Applegate Reservoir.

Highlighted detected concentrations exceed the final screening criterion. Bold numbers indicate the criteria which were exceeded.

Bold numbers indicate Excess Carcinogenic Risks that exceed 1.0E-06.

[a] The only metal detected at concentrations that exceeded criteria is arsenic. The background concentration, rather than a criterion, was used to calculated HQ values. Arsenic is a carcinogen. Since criteria for arsenic are based on protection of human receptors at 1.0E-06, background concentrations will be treated as if they are protective to this level.

Table B-15
Summary of Riparian Soil Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
JC-14-RS-080627-URS	1.24		0.092		45.2		1.83		38.9	
JC-12-RS-080627-URS	3.16		0.166		67.1		5.29		73.1	
Site-Specific Average	2.2		0.13		56.2		3.6		56.0	
Rivers and Creeks										
JC-06	Not sampled									
JC-05	Not sampled									
JC-04-RS-080627-URS	3.44		0.354		204		15.1		86.7	
JC-03-RS-080626-URS	17.8		0.202		141		11.6		119	
JC-01-RS-080626-URS	4.73		1.09		378		31.2		172	
EC-08	Not sampled									
EC-07-RS-080625-URS	5.84		0.220		51.9		6.08		84.6	
EC-05-RS-080625-URS	5.37		0.281		60.4		6.37		74.0	
EC-05-RS-DUP-080625-URS	5.01		0.311		80.0		6.17		74.0	
EC-02-RS-080625-URS	3.29		0.191		56.0		5.75		64.9	
EC-01-RS-080624-URS	5.61		0.324		74.1		5.99		97.9	
AR-01-RS-080624-URS	4.65		0.654		85.0		7.06		185	

All results are in mg/kg on a dry weight basis unless otherwise noted.

U - analyte was not detected at or above the analytical method reporting limit.

J - estimated analytical concentration.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River.

Table B-16
Human Health Criteria for Riparian Soil
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background based on two riparian soils samples adjacent to creek upstream of Blue Ledge Mine										
JC-14-RS-080627-URS	1.24		0.092		45.2		1.83		38.9	
JC-12-RS-080627-URS	3.16		0.166		67.1		5.29		73.1	
Site-Specific Average	2.2		0.13		56.2		3.6		56.0	
California Regional Soil Levels[a]	3.5		0.36		28.7		23.9		149	
Screening Criteria										
EPA R6 HHMSSLs	~~0.39~~[b]		39		2,900		400		23,000	
FINAL SCREENING CRITERION	**2.2**[b]		**39**		**2,900**		**400**		**23,000**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

[a] Because site-specific background concentrations are available for riparian soil, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the final screening criterion. Criterion lower than the background concentration is shown in strikethrough font.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils* . Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-17
Screening of Riparian Soil Data for Joe Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background (upstream of Blue Ledge Mine)										
Site-Specific Average	**2.2**[b]		0.13		56.2		3.6		56.0	
California Regional Soil Levels[a]	3.5		0.36		28.7		23.9		149	
Riparian Areas Adjacent to Joe Creek (downstream of Blue Ledge Mine)										
JC-06	Not sampled									
JC-05	Not sampled									
JC-04-RS-080627-URS	3.44		0.354		204		15.1		86.7	
JC-03-RS-080626-URS	17.8		0.202		141		11.6		119	
JC-01-RS-080626-URS	4.73		1.09		378		31.2		172	
Screening Criteria										
EPA R6 HHMSSLs	~~0.39~~[b]		39		2,900		400		23,000	
FINAL SCREENING CRITERION	**2.2**[b]		**39**		**2,900**		**400**		**23,000**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

[a] Because site-specific background concentrations are available for riparian soil, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the final screening criterion. Criterion lower than the background concentration is shown in strikethrough font.

Highlighted results exceed screening level value.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils*. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-18
Screening of Riparian Soil Data for Elliott Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
Site-Specific Average	**2.2**[b]		0.13		56.2		3.6		56.0	
California Regional Soil Levels[a]	3.5		0.36		28.7		23.9		149	
Riparian Areas Adjacent to Elliott Creek										
EC-07-RS-080625-URS	5.84		0.220		51.9		6.08		84.6	
EC-05-RS-080625-URS	5.37		0.281		60.4		6.37		74.0	
EC-05-RS-DUP-080625-URS	5.01		0.311		80.0		6.17		74.0	
EC-02-RS-080625-URS	3.29		0.191		56.0		5.75		64.9	
EC-01-RS-080624-URS	5.61		0.324		74.1		5.99		97.9	
Screening Criteria										
EPA R6 HHMSSLs	~~0.39~~[b]		39		2,900		400		23,000	
FINAL SCREENING CRITERION	**2.2**[b]		**39**		**2,900**		**400**		**23,000**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

[a] Because site-specific background concentrations are available for riparian soil, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the final screening criterion. Criterion lower than the background concentration is shown in strikethrough font.

Highlighted results exceed screening level value.

Bold background concentrations in combination with a criterion struck through indicates that average background concentration of metal is higher than indicated criterion. In this case, detected concentrations that exceed the average background concentration are yellow-highlighted.

If both the background concentration (that exceeds some criterion) and a 2nd criterion are exceeded by the same detected concentrations, then both the background concentration and the 2nd criterion, as well as the related detected concentrations, are yellow-highlighted.
If more than one criterion is exceeded by different detected concentrations, a different color is assigned to each criterion exceeded.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils*. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-19
Screening of Riparian Soil Data for Applegate River downstream of its confluence with Elliot Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
Site-Specific Average	**2.2**[b]		0.13		56.2		3.6		56.0	
California Regional Soil Levels[a]	3.5		0.36		28.7		23.9		149	
Riparian Soil Adjacent to Applegate River										
AR-01-RS-080624-URS	4.65		0.654		85.0		7.06		185	
Screening Criteria										
EPA R6 HHMSSLs	~~0.39~~[b]		39		2,900		400		23,000	
FINAL SCREENING CRITERION	**2.2**[b]		**39**		**2,900**		**400**		**23,000**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

Highlighted results exceed one or more screening level values.

[a] Because site-specific background concentrations are available for riparian soil, the California Regional Soil Levels are presented here for informational purposes only.

[b] Because the site-specific background concentration is greater than the HHMSSL criterion for arsenic, the site-specific background concentration is used as the final screening criterion. Criterion lower than the background concentration is shown in strikethrough font.

EPA R6 HHMSSLs = USEPA Region 6 Human Health Medium-Specific Screening Levels (for residential soil). December 2007, revised 3-8-08. http://www.epa.gov/Region06/6pd/rcra_c/pd-n/r6screenbackground.pdf.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. Background Concentrations of Trace and Major Elements in California Soils. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table B-20
Estimated Potential Excess Human Health Cancer Risk for Riparian Soil Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic[a]		Potential Excess Cancer Risk
Riparian Areas Adjacent to Joe Creek (downstream of Blue Ledge Mine)			
JC-04-RS-080627-URS	3.44		**1.6E-06**
JC-03-RS-080626-URS	17.8		**8.1E-06**
JC-01-RS-080626-URS	4.73		**2.2E-06**
FINAL SCREENING CRITERION	2.2		
Riparian Areas Adjacent to Elliott Creek			
EC-07-RS-080625-URS	5.84		**2.7E-06**
EC-05-RS-080625-URS	5.37		**2.4E-06**
EC-05-RS-DUP-080625-URS	5.01		**2.3E-06**
EC-02-RS-080625-URS	3.29		**1.5E-06**
EC-01-RS-080624-URS	5.61		**2.6E-06**
FINAL SCREENING CRITERION	2.2		
Riparian Soil Adjacent to Applegate River			
AR-01-RS-080624-URS	4.65		**2.1E-06**
FINAL SCREENING CRITERION	2.2		

All results are in mg/kg on a dry weight basis unless otherwise noted.

Highlighted detected concentrations exceed the final screening criterion. Bold numbers indicate the criteria which were exceeded.

Bold numbers indicate Excess Carcinogenic Risks that exceed 1.0E-06.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.

[a] The only metal detected at concentrations that exceeded criteria is arsenic. The background concentration, rather than a criterion, was used to calculated HQ values. Arsenic is a carcinogen. Since criteria for arsenic are based on protection of human receptors at 1.0E-06, background concentrations will be treated as if they are protective to this level.

Table B-21
Summary of Fish Tissue Data
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
EC-07-FT-080626-URS	0.24		0.068		2.32		0.065		24.8	
EC-04-FT-080626-URS	0.15		0.134		4.79		0.194		29.2	
EC-02-FT-080626-URS	0.15		0.173		5.73		0.062		37.1	
AR-02-FT-080627-URS	0.16		0.145		3.15		0.017		33.5	
AR-02-FT-DUP-080627-URS	0.13		0.133		3.30		0.024		30.3	
ARV-02-FT-080627-URS	0.14		0.049		2.29		0.027		22.9	

Units are in milligrams per kilogram (mg/kg) - wet weight.

J - estimated analytical concentration.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.

ARV = Applegate Reservoir.

Table B-22
Human Health Criteria for Fish Tissue
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

	Arsenic	Cadmium	Copper	Lead	Zinc
Screening Criteria					
DEQ ATLs (mg/kg - wet wt)					
Human (Carcinogens General/Recreational)	0.0062	--	--	--	--
Human (Carcinogens Subsistence/Tribal))	0.00076	--	--	--	--
Human Non-carcinogens (General/Recreational)	1.2	4.0	--	0.5	--
Human Non-carcinogens (Subsistence/Tribal)	0.15	0.49	--	0.5	--
FINAL SCREENING CRITERION	**0.0062**	**4**	**--**	**0.5**	**--**

Units are in milligrams per kilogram (mg/kg) - wet weight.

-- Not available.

DEQ ATLs - Acceptable tissue levels (protective of humans ingesting fish/shellfish), *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* , Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007.

Table B-23
Screening of Fish Tissue Data for Elliott Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Elliott Creek										
EC-07-FT-080626-URS	0.24		0.068		2.32		0.065		24.8	
EC-04-FT-080626-URS	0.15		0.134		4.79		0.194		29.2	
EC-02-FT-080626-URS	0.15		0.173		5.73		0.062		37.1	
Screening Criteria										
DEQ ATLs (mg/kg - wet wt)										
Human (Carcinogens General/Recreational)	0.0062		--		--		--		--	
Human (Carcinogens Subsistence/Tribal))	0.00076		--		--		--		--	
Human Non-carcinogens (General/Recreational)	1.2		4.0		--		0.5		--	
Human Non-carcinogens (Subsistence/Tribal)	0.15		0.49		--		0.5		--	
FINAL SCREENING CRITERION	**0.0062**		**4**		**--**		**0.5**		**--**	

Units are in milligrams per kilogram (mg/kg) - wet weight.

Highlighted results exceed one or more screening level values.

If more than one criterion are exceeded by the same detected concentrations, then the related detected concentrations are yellow-highlighted. Bold numbers represent the criteria that are exceeded by the detected concentrations.

If more than one criterion is exceeded by different detected concentrations, a different color is assigned to each criterion exceeded.

DEQ ATLs - Acceptable tissue levels (protective of humans ingesting fish/shellfish), *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* , Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007.

Table B-24
Screening of Fish Tissue Data for Applegate River downstream of confluence with Elliot Creek
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	Cadmium	Copper	Lead	Zinc
Applegate River downstream of confluence with Elliott Creek					
AR-02-FT-080627-URS	0.16	0.145	3.15	0.017	33.5
AR-02-FT-DUP-080627-URS	0.13	0.133	3.30	0.024	30.3
Screening Criteria					
DEQ ATLs (mg/kg - wet wt)					
Human (Carcinogens General/Recreational)	0.0062	--	--	--	--
Human (Carcinogens Subsistence/Tribal))	0.00076	--	--	--	--
Human Non-carcinogens (General/Recreational)	1.2	4.0	--	0.5	--
Human Non-carcinogens (Subsistence/Tribal)	0.15	0.49	--	0.5	--
FINAL SCREENING CRITERION	**0.0062**	**4**	**--**	**0.5**	**--**

Units are in milligrams per kilogram (mg/kg) - wet weight.

Highlighted detected concentrations exceed one or more screening level values. Bold numbers are criteria that are exceeded.

If more than one criterion are exceeded by the same detected concentrations, then the related detected concentrations are yellow-highlighted. Bold numbers represent the criteria that are exceeded by the detected concentrations.

DEQ ATLs - Acceptable tissue levels (protective of humans ingesting fish/shellfish), *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* , Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007.

Table B-25
Screening of Fish Tissue Data for Applegate Reservoir
Screening-Level Human Health Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Applegate Reservoir										
ARV-02-FT-080627-URS	0.14		0.049		2.29		0.027		22.9	
Screening Criteria										
DEQ ATLs (mg/kg - wet wt)										
Human (Carcinogens General/Recreational)	0.0062		--		--		--		--	
Human (Carcinogens Subsistence/Tribal))	0.00076		--		--		--		--	
Human Non-carcinogens (General/Recreational)	1.2		4.0		--		0.5		--	
Human Non-carcinogens (Subsistence/Tribal)	0.15		0.49		--		0.5		--	
FINAL SCREENING CRITERION	**0.0062**		**4**		**--**		**0.5**		**--**	

Units are in milligrams per kilogram (mg/kg) - wet weight.

Highlighted results exceed one or more screening level values.

If more than one criterion are exceeded by the same detected concentrations, then the related detected concentrations are yellow-highlighted. Bold numbers represent the criteria that are exceeded by the detected concentrations.

DEQ ATLs - Acceptable tissue levels (protective of upper trophic level predators), *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* , Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007.

Table B-26
Estimated Potential Excess Human Health Cancer Risk
Fish Tissue Data
Blue Ledge Mine

Sample Name	Arsenic [a]		Potential Excess Cancer Risk
Elliott Creek			
EC-07-FT-080626-URS	0.24		**3.9E-05**
EC-04-FT-080626-URS	0.15		**2.4E-05**
EC-02-FT-080626-URS	0.15		**2.4E-05**
FINAL SCREENING CRITERION	**0.0062**		
Applegate River downstream of confluence with Elliott Creek			
AR-02-FT-080627-URS	0.16		**2.6E-05**
AR-02-FT-DUP-080627-URS	0.13		**2.1E-05**
FINAL SCREENING CRITERION	**0.0062**		
Applegate Reservoir			
ARV-02-FT-080627-URS	0.14		**2.3E-05**
FINAL SCREENING CRITERION	**0.0062**		

EC = Elliott Creek.

AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.

ARV = Applegate Reservoir.

Highlighted detected concentrations exceed the most stringent criterion. Bold numbers indicate the criteria which were exceeded.

Bold numbers indicate Excess Carcinogenic Risks that exceed 1.0E-06.

[a] The only metal detected at concentrations that exceeded criteria is arsenic. The background concentration, rather than a criterion, was used to calculated HQ values. Arsenic is a carcinogen. Since criteria for arsenic are based on protection of human receptors at 1.0E-06, background concentrations will be treated as if they are protective to this level.

SCREENING LEVEL HHRA ADDENDUM

List of Tables
Table B-27 – Estimated Excess Cancer Risk for Drinking Water
Table B-28 – Comparison of 2005 Waste Rock Data to Soil Screening Criteria

After the draft SL-HHRA and SL-ERA had been prepared, it was discovered that some of the residents of the small community at Joe Bar utilized groundwater as a drinking water source. Therefore, sampling of groundwater sources at Joe Bar was conducted in the fall of 2008. These results can now be included in the SL-HHRA. The only metal present at concentrations that exceeded a human health criterion protective of drinking water is arsenic (Table 1).

Drinking Water Sources at Joe Bar:

Three drinking water sources used by the community in Joe Bar were sampled in the fall of 2008: the spring located on the north side of the valley (unconnected to Elliot Creek) that is used by the Ruetiger residence; and the two groundwater wells located at the Ziem residence and the Neilson residence. These are the only places where groundwater is used as a source of drinking water along Joe and Elliot Creeks.

Groundwater obtained from the well on the Ziem property is approximately 60 feet deep and is located approximately 200 feet from Elliot Creek. The water is used for drinking, cooking, and showering. Mr. Ziem also mentioned that Elliot Creek water is used for watering gardens and as drinking water for dogs and horses.

Groundwater for the Neilson property is obtained from a well located approximately 100 feet from Elliot Creek. No well depth information was available.

Human Health Criteria Used to Assess Risk from Arsenic Present in Groundwater:

Three different types of drinking water criteria were used to compare against groundwater analytical results for arsenic:

1. U.S. EPA 2006 drinking water maximum contaminant levels (MCLs) – MCLs are federal criteria protective of *public* drinking water sources. Some of the MCLs are calculated based on levels that are protective of human health; some are based on best available water-cleaning technology. The MCLs based on human health consider the exposure pathway of ingestion of drinking water. MCLs are directly *applicable* to public drinking water sources and therefore can be legally enforced. However, MCLs are also relevant and appropriate (but not directly applicable) to apply to single-residence groundwater wells, although they cannot be legally enforced in this situation. Thus, the U.S.EPA MCL for arsenic (10 ug/L) is relevant and appropriate to apply to the arsenic results obtained from the two groundwater wells sampled in Joe Bar.

2. California 2009 MCLs – Because Joe Bar is located in California, criteria obtained from the California drinking water regulations must also be compared to results obtained from groundwater wells at Joe Bar. In the case of arsenic, the MCL is 10 ug/L and has the same caveats attached to it as described above for the U.S. EPA MCL for arsenic.

3. U.S. EPA 2008 Regional Screening Levels (RSLs) – RSLs are published by U.S. EPA for the Mid-Atlantic Region, and include risk-based guidance values originally published by U.S. EPA Region 3, 6, and 9. They are considered the most applicable of the EPA risk-based guidance values to apply in California. For arsenic, the tapwater RSL of 0.045 ug/L is significantly more stringent than either of the MCLs discussed above. This is due to the fact that the RSL for arsenic is based on the most-current toxicity information. In addition, RSLs for tapwater take both ingestion and inhalation exposure pathways into account; however the additional pathway of inhalation is irrelevant for arsenic, as arsenic is not a volatile compound.

Calculation of PECR Value for Arsenic in Groundwater:

To obtain a PECR value for arsenic concentrations detected in groundwater, the detected concentration was compared to the RSL of 0.045 ug/L. The RSL is based on a protective level of 1×10^{-6} (1.0E-06) for human exposure to a carcinogen. The formula for this calculation is:

Detected concentration of arsenic in ug/L / X = 0.045 ug/L / 10^{-6}

PECR = X

Solving for X results in a PECR value for the detected concentration of arsenic. Any exceedance of a PECR of 1E-06 represents unacceptable risk to human receptors. Please refer to Table B-27 for the results of this screening.

Results of Screening of Groundwater Data:

The groundwater drawn from a spring on the north side of the valley (used by Ruetiger residence) was found to contain 0.22 ug/L arsenic. This concentration does not exceed either of the MCL values, but does exceed the RSL value for arsenic by nearly an order of magnitude, resulting in a PECR of 4.9E-06. This indicates that local geological and/or hydrogeological conditions probably cause significant background concentrations of arsenic to be present. There is no known way that arsenic present in surface water in Elliot Creek could impact the spring on the north side of the valley.

Groundwater samples collected from the Ziem and Neilson groundwater wells contain concentrations of arsenic (6.24 ug/L and 2.04 ug/L, respectively, resulting in PECRs of 1.4E-04 and 4.4E-05, respectively) that also do not exceed the MCLs for arsenic, but significantly exceed the RSL for arsenic by approximately two orders-of-magnitude.

Because these wells are located 200 and 100 feet from Elliot Creek, respectively, and because the related arsenic concentrations are significantly higher than those detected in surface water samples collected from Joe and Elliot Creeks, it appears likely that arsenic concentrations in groundwater in the area of Joe Bar contain naturally-high levels of arsenic, which is also naturally present area soils at relatively high concentrations.

Note that multiple samples of surface water collected from Joe Creek in June 2008 did not contain detectable levels of arsenic (i.e., less than 0.07 ug/L), but that surface water samples collected from Elliot Creek (both downstream *and* upstream of its confluence with Joe Creek) contained detectable concentrations of arsenic that ranged from 0.22 ug/L to 0.50 ug/L (please see Tables B-5 and B-6 in Appendix B of the SI Report). This is further evidence that concentrations of arsenic exist in surface water in Elliot Creek that appear to be of natural origin, and are not associated with input from Joe Creek. The fact that groundwater concentrations of arsenic present in the two wells at Joe Bar are much higher than those detected in the surface water of Elliot Creek also appears to indicate that regional groundwater contains arsenic derived from local soils, and is not due to migration of Elliot Creek surface water to groundwater at Joe Bar.

Assessing Potential Exposure of Human Receptors to Waste Rock

Waste rock located near the mine adits is assumed to provide two types of exposure to human and/or ecological receptors:

1. Metals associated with waste rock leach out or migrate as runoff into the upper surface waters of Joe Creek, causing unacceptable impacts to aquatic biota in the creek.
2. Site workers moving or removing waste rock could be exposed to metals through incidental ingestion of waste rock particles, dermal contact with waste rock materials, and inhalation of fine particles of waste rock or dust containing waste rock material. These same exposures are possible for short-term site visitors, although the exposure durations are likely to be less for visitors than for workers.

Because waste rock is an uncommon medium to be assessed for potential risk to human receptors (as well as ecological receptors), attempting to quantify or semi-quantify human health risks based on dermal contact with waste rock and inhalation of related waste rock dust would require significant research, as no default exposure factors are available. In light of the fact that the waste rock is located in a remote area, exposure duration times for visitors would be relatively short. If the waste rock is removed, on-site remediation workers should wear appropriate protective clothing and a dust mask at minimum to avoid exposure to metals associated with the waste rock. It is assumed that the bulk of exposure of human and ecological receptors to the waste rock occurs indirectly through contact with abiotic media in Joe Creek located downstream of the mine, which has been impacted by migration of metals from the waste rock.

However, a rough estimate of potential exposure risks to human receptors directly contacting waste rock can be made for arsenic and lead by comparing waste rock results

obtained in 2005 to soil criteria used in the SL-HHRA attached to this SI report. Waste rock is not soil, but comparison of waste results to soil criteria will provide a qualitative estimate of potential risks to human receptors that directly contact the waste rock. Please see Table B-28 for the results of this comparison.

As presented in Table B-28, the waste rock concentrations detected in 2005 are much higher than the three types of soil criteria used as screening numbers. California regional soil levels represent typical background concentrations of metals found in California soils; the two USEPA Regional Screening Level soil criteria are based on residential soil and industrial soil, respectively. Use of the Regional Screening Levels is highly conservative in regard to assessing potential exposure of human receptors to the Blue Ledge Mine waste rock, which is located in a fairly remote area. However, the comparison does allow for a rough estimation of potential human health risks that might be related to directly contacting the waste rock. Because the mean and maximum concentrations of arsenic and lead significantly exceed the soil criteria used for screening purposes (this is also true for the minimum concentration of arsenic detected), it can be assumed that there is an unacceptable risk to human receptors that come into direct contact with the waste rock.

TABLE B-27
ESTIMATED POTENTIAL EXCESS CANCER RISK FOR DRINKING WATER DATA
BLUE LEDGE MINE

Sample Name	Location of Sample Collection	Arsenic[a] (ug/L)		Potential Excess Cancer Risk
WS-1	Ziem's Residence	6.24		1.4E-04
WS-2	Ruetiger's Residence	0.22	J	4.9E-06
WS-3	Neilson's Residence	2.04		4.5E-05
FINAL SCREENING CRITERION		**0.045**		

[a] = arsenic is a carcinogen. Criteria for arsenic are thus based on protection of human receptors at an acceptable risk of 1.0E-06. Detected values represent dissolved concentrations.

ug/L = micrograms of arsenic per liter of groundwater.

J - The result is an estimated concentration

Highlighted results exceed one or more screening criteria.

Bold font = criterion that was exceeded.

TABLE B-28
COMPARISON OF 2005 WASTE ROCK DATA TO SOIL CRITERIA
BLUE LEDGE MINE

Contaminant	Maximum Concentration (mg/kg)	Minimum Concentration (mg/kg)	Mean Soil Concentration (mg/kg)	California Region Soil Level [a] (mg/kg)	USEPA Regional Screening Level for Residential Soil [b] (mg/kg)	USEPA Regional Screening Level for Industrial Soil [c] (mg/kg)
Arsenic	287	62.4	135	3.5	0.39	1.6
Lead	2,710	616	1,349	23.9	400	800

Data results obtained from U.S. EPA Region IX San Francisco CA. Memorandum: *Request for a Time-Critical Removal Action at the Blue Ledge Mine site, Rogue River National Forest, Siskiyou County, California*. From: Harry Allen, Emergency Response Section, To: Daniel Meer, Chief, Response, Planning, and Assessment Branch.

a = Obtained from California Regional Soil Levels - 1996. Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. Background concentrations of trace and major elements in California soils. Kearney Foundation of Soil Science, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

b and c = U.S. EPA Regional Screening Levels. 2008. Obtained at http://www.epa.gov/reg3hwmd/risk/human/rb_concentration_table/sersguide.htm. October 9, 2008.

APPENDIX C

SCREENING-LEVEL ECOLOGICAL RISK EVALUATION

SCREENING-LEVEL ECOLOGICAL RISK EVALUATION

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SCREENING-LEVEL ECOLOGICAL RISK EVALUATION

A screening-level ecological risk evaluation (SL-ERE) was conducted for four aquatic and aquatic-related environments downstream of the Blue Ledge Mine, including 1) Joe Creek, 2) Elliot Creek downstream of its confluence with Joe Creek, 3) a portion of the Middle Fork of the Applegate River between the mouth of Elliot Creek and Applegate Reservoir, and 4) the head of Applegate Reservoir (see Figure 1 of the Site Investigation [SI] Report). Forward-calculated risk estimates were obtained using generic ecological screening levels from the literature. In cases where site-specific background levels were higher than screening levels, site-specific background levels were used to generate risk estimates. A sample point-by-point screening was conducted to take into account streamlined sample collection. Background concentrations of metals in surface water, sediment, and riparian soil were collected from upstream of the Blue Ledge Mine, and were assumed to be related to natural sources or sources other than Blue Ledge Mine. Background concentrations of metals in surface water, sediment, and riparian soil were not assessed for potential ecological risk. Please refer to Tables C-1 through C-32 for all tabulated evaluation details.

Conceptual Site Model of Ecological Exposure

Water has passed through the Blue Ledge Mine site for many years. The water exists as surface water that flows over the top of and, to some extent, through the main waste rock that forms a steep slope on the downstream side of the Blue Ledge Mine. There is a settling area known as the log dam at the base of the main waste rock slope. From this point, the water from the Blue Ledge Mine enters Joe Creek. Joe Creek then flows steeply down boulders and passes through plunge pools until its final 200 feet, where the grade levels somewhat. Joe Creek enters Elliot Creek approximately 2 miles upstream of the confluence of Elliot Creek with the Middle Fork of the Applegate River. The distance between this confluence and the head of Applegate Reservoir is approximately 1.5 river miles.

Mine water contaminants can be carried in dissolved form or on particulates in the water column of surface water. In creek areas of lower flow, some of these contaminants can settle or become bound to bottom sediments. In locations where a creek or river bed turns sharply, and/or where areas of low flow exist, bottom sediments can be washed up into low-lying, riparian areas adjacent to the creek or river. It is assumed for the purposes of this evaluation that soil samples collected from riparian areas represent floodplain material that was originally benthic sediment, and does not represent terrestrial material that has migrated into the riparian area.

Based on previous investigations and knowledge of site history, six metals were identified as being contaminants of potential ecological concern (CPECs): arsenic, cadmium, copper, iron, nickel, and zinc. However, because iron is an essential nutrient and is metabolically regulated by most organisms, it was considered to be a CPEC in surface water only, but not a CPEC in sediment, riparian soil, or fish tissue. Arsenic, cadmium, and lead have the potential to bioaccumulate to some degree in an aquatic environment, i.e., increase in concentration as they pass up the food chain (DEQ 2007).

Ecological receptors such as benthic invertebrates, fish, piscivorous birds, and piscivrous mammals could be exposed to metals through direct contact with surface water and sediment (including gill uptake, dermal absorption, and incidental ingestion), and for the higher-trophic-level receptors, through indirect contact with surface water and sediment via ingestion of benthic invertebrates and fish. Terrestrial receptors could be exposed through these same pathways, with

the exception of gill uptake, but would also be expected to intermittently come into contact with riparian soils.

Due to the streamlined risk evaluation protocols used, a site-specific food web model was not developed to evaluate risk to specific species of ecological receptors that may be present. Rather, a conservative screening process using generic ecological screening criteria was utilized to identify concentrations of chemicals that might cause unacceptable risk to groups of receptors. No database search was conducted to identify whether Federal- and state-protected species might be present in the area, but risk estimates encompass the assumption that protected species may be present.

Data Collection

In June of 2008, samples of surface water, sediment, riparian soil (soils from floodplain areas located within approximately 100 feet of the creek or river banks), and some fish tissue were collected downstream of the Blue Ledge Mine site. Because no fish were found to be present in Joe Creek during the sampling event, no fish tissue samples were collected from Joe Creek. No riparian soil samples were collected from Applegate Reservoir.

In addition, surface water, sediment, and riparian soil samples were collected upstream of Blue Ledge Mine, and used as site-specific background information. Surface water samples were collected from four tributaries of Joe Creek downstream of the mine, including three unnamed tributaries and Manzanita Gulch (see Figure 5, SI Report). Surface water samples were also collected near Blue Ledge Mine itself, including from two mine adits, the log dam at the downstream base of the Blue Ledge Mine waste rock slope, and two seeps observed in steep areas just downstream of Blue Ledge Mine.

In June 2008, reticulate sculpin (*Cottus perplexus*) were collected at three sampling locations in Elliot Creek and one sampling location in Applegate River downstream of the mouth of Elliot Creek using electrofishing protocols. Attempts to collect rainbow trout (*Onchorhynchus myskiss*) or bass species from among three Applegate Reservoir locations using electrofishing protocols were unsuccessful. Instead, one deceased rainbow trout was discovered in approximately five feet of water at the AR-02 location, and collected for tissue analysis. The fish did not show visible signs of decomposition, but it is unknown if its mortality was related to electrofishing. No fish were found to present in Joe Creek. No fish tissue samples were collected above the Blue Ledge Mine site, and thus no site-specific background concentrations of the six CPEC metals were calculated for fish tissue collected in Elliot Creek, the Middle Fork of the Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir, and the head of Applegate Reservoir.

Reticulate sculpin were selected as a species to be collected due to their ubiquity in Elliot Creek, their trophic niche as a bottom feeder, and their relative intransience within stream segments. Trout were targeted in the reservoir because they are a game species actively collected and consumed by the public and consequently have a direct link to human health.

During a survey of benthic invertebrates conducted in September 2008 for Joe Creek and Elliot Creek, a biologist performed a limited visual survey of the types of benthic invertebrates present (see Appendix F). Types and numbers of benthic invertebrates present help the surveyor to determine how good the water quality is likely to be. Certain types of benthic invertebrates such as caddisflies, mayflies, and in particular, stone flies typically indicate a high-water-quality stream with cooler water temperatures. Benthic invertebrates were visually surveyed and samples

collected for in-lab identification from four locations. Sample locations and brief descriptions of what was observed at each are presented below:

1.) Joe Creek above (upstream of) the Blue Ledge Mine
Description: limited number of caddisflies and mayflies present. Water quality fairly good.
2.) Joe Creek below (downstream of) the main waste rock slope
Description: limited number of caddisflies and mayflies present; water quality not as good as above Blue Ledge Mine.
3.) Elliot Creek above the confluence of Joe Creek
Description: large numbers of caddisflies, mayflies, and stone flies. Water quality appeared to be very good.
4.) Elliot Creek below the confluence of Joe Creek
Description: large numbers of caddisflies, mayflies, and stone flies, but numbers not as high as those observed in Elliot Creek upstream of the confluence with Joe Creek. Water quality appeared to be good.

Data Evaluation

Data collected in June of 2008 were evaluated as part of this SL-ERE. Data from earlier investigations were used to choose CPECs, and in the planning of types and locations of samples that were collected in June of 2008, but were not quantitatively included in this risk evaluation. Earlier investigations are described in detail in the following documents:

- *Survey of Benthic Macroinvertebrates to Assess Effects of the Blue Ledge Mine on Aquatic Biota of Joe and Elliot Creeks*, NW California. Prepared by Michael S. Parker, PhD, Department of Biology, Southern Oregon University. September 2000.

- Joe Creek Level II Stream Survey. Siskiyou Research Group. October 2002.

- *Preassessment Screen for the Blue Ledge Mine Site*. Prepared by Environmental International Ltd. October 28, 2002.

- Preliminary Assessment/Site Inspection Report, Blue Ledge Mine. Prepared by Weston Solutions. April 28, 2004.

- *Technical Memorandum: Draft Preliminary Remediation Cost Estimates for the Blue Ledge Mine*. Prepared by Golder Associates. November 14, 2007.

- *Confidential Memorandum: Blue Ledge Mine Recreational Fishing and Natural Resource Damage Estimate*. To: Peter Jones, USDA Forest Service. From: Stratus Consulting, Inc. December 18, 2007.

- *Acid Mine Drainage and Assessment of Recent Remediation Efforts at the Blue Ledge Mine, Siskiyou County, California*. William S. Elliot, Jr; Jara A. Johnson; Marco A. Wikstrom; and Peter Jones. Department of Environmental Studies, Southern Oregon University. Undated.

- Geochemical Data for the Blue Ledge Mine. Tabulated data from Southern Oregon University, Dr. Bill Elliot. Undated.

Data collected in 2008 was analyzed by Columbia Analytical Services Laboratory for metals. Surface water samples were also analyzed for chemistry parameters including alkalinity, hardness, total dissolved solids (TDS), total soluble solids (TSS), and sulfate. Data validation, including a quality assurance/quality control review, was conducted by a URS chemist. The numbers and types of samples considered to be adequate for use in the SL-ERE are listed in Table 1 of the SI Report**.** Tabulated summaries of surface water, sediment, riparian soil, and fish tissue data are presented in Tables C-1, C-11, C-19, and C-27. Sample locations are shown in Figures 4 and 5 of the SI Report.

Identification of Site-Specific Background Levels of CPEC Metals in Surface Water, Sediment, and Riparian Soil

Sample results used to calculate site-specific background concentrations were collected from above (i.e., upstream of) the Blue Ledge Mine site. For surface water, six surface water samples were collected from the two upstream creeks that converge at Blue Ledge Mine, and two surface water samples were collected from two tributaries that flow into these creeks above Blue Ledge Mine. Metals data from these eight surface water samples were averaged, and the resulting mean concentrations of the six metals were used as site-specific background concentrations for CPECs detected in surface water located downstream of Blue Ledge Mine.

For sediment, six sediment samples were collected upstream of Blue Ledge Mine, and as with the background surface water samples, were averaged and the resulting mean concentrations of the six metals were used as site-specific background concentrations for CPECs detected in sediment located downstream of Blue Ledge Mine. Two upstream riparian soil samples were collected. Metals data from these two samples were averaged, and the resulting mean concentrations for CPECs in upstream riparian soil were used as site-specific background concentrations for CPECs detected in riparian soil located downstream of Blue Ledge Mine. Site-specific background concentrations for metals detected in surface water, sediment, and riparian soil are presented in Tables C-1, C-11, and C-19.

Ecological Screening Criteria

The screening conducted here was used to determine whether concentrations of the six CPEC metals in site media are present at concentrations that are potentially harmful to ecological receptors. For this streamlined screening, applicable criteria protective of freshwater aquatic life (i.e., plankton, aquatic plants, water-column invertebrates, and fish) were used to screen detected CPEC metals in surface water samples; applicable criteria protective of the benthic community (i.e., benthic invertebrates and demersal fish) in contact with freshwater sediment samples were used to screen detected CPEC metals in sediment samples; and applicable criteria protective of fish/shellfish and of the upper-trophic-level species that ingest them were used to screen detected CPECs in fish tissue samples. Because the site and potentially affected downstream environments straddle the border between Oregon and California, criteria thought to be applicable in both states were compared to detected concentrations of CPEC metals in site media.

Water quality criteria protective of freshwater aquatic life are presented based on dissolved concentrations of metals. In the cases of cadmium, copper, lead, and zinc, the related water quality criteria are based on an assumed water hardness of 100 milligram per liter (mg/L) calcium carbonate ($CaCO_3$). Formulas provided in the federal and state criteria documents are available that allow re-calculation of water quality criteria for these four metals based on site-specific water hardness, and were used here to generate area-specific water quality criteria to use in the screening (see Table C-2 through Table C-7). Specifically, different water quality criteria related

to differing water hardness data were calculated for surface water collected from 1) the mine adits, 2) the dam location, 3) the seeps, 4) Joe Creek, 5) tributaries to Joe Creek, 6) Elliot Creek, and 7) Applegate River and Applegate Reservoir. As water hardness increases, so do the values of the associated water quality criteria. The greater the hardness of the water, the less bioavailable the metals in it become, and so the related water quality criteria become less stringent.

As stated above, a sample point-by-point screening was conducted – i.e., no statistically representative exposure point concentrations were generated for the different water bodies being assessed. For each metal detected in each medium, the most stringent of the applicable criteria was chosen and used to generate ecological hazard quotients (HQs) at each sample point. In cases where a site-specific background concentration was higher than the most stringent criterion, then the site-specific background concentration, rather than the criterion, was used to generate HQs for that metal in that medium.

In the case of background concentrations of riparian soil, site-specific background concentrations are based on the averages of metals detected in two samples. In the cases of copper and zinc, the site-specific background concentrations (approximately 56 mg/kg for both metals) were higher than the most stringent soil screening criteria, and so the background concentrations were used to calculate HQ values. However, it is important to note that California Regional Soil Levels (CRSLs) (Bradford et al., 1996) are also typically used as acceptable background levels for metals in soil. However, site-specific background concentrations were thought to be more representative of site conditions than the CRSLs. It is interesting to note that the site-specific riparian soil background concentrations calculated for arsenic, cadmium, lead, and zinc are all significantly lower than the CRSL values for these four metals. Only copper has a CRSL that is lower than the calculated site-specific background concentration.

For each medium, a data summary table and a table of applicable ecological criteria are presented (Table C-1, C-2, C-11, C-12, C-19, C-20, C-27, and C-29) followed by screening tables that identify for each water body which of the detected concentrations of metals exceed criteria (Tables C-3 through C-7, C-13 through C-15, C21 through C-23, and C-29 through C-31). In the final tables for each medium, the most stringent criterion is presented, as are the HQ values associated with the detected concentrations that exceed the most stringent criterion (Tables C-8 through C-10, C-16 through C-18, C-24 through C-26, and C- 32). In these HQ tables, only detected concentrations that exceed one or more criteria in the screening tables is presented. No HQ values were calculated for detected concentrations that were below screening criteria.

Ecological HQs that exceed 1 indicate that the related detected concentration has the potential to cause unacceptable risks to ecological receptors that are Federal or state protected species, which typically must be protected at the level of the individual (DEQ, 1998/2001). For protection of ecological populations of non-protected species, HQs that exceed 5 indicate that the related detected concentration has the potential to cause unacceptable exposure risks at the population level (DEQ, 1998/2001). HQ values below 1.5 were rounded down to 1, in keeping with previous DEQ recommendations on similar projects. However, California regulators consider any HQ value that exceeds 1.0 to be an indicator of potentially unacceptable ecological risk.

A list of the screening criteria used for each type of medium is presented below.

SURFACE WATER:

- California Water Quality Standards, freshwater chronic (CCC) (USEPA, 2000)

- Oregon Department of Environmental Quality Water Quality Standards, Tables 33A, 33B, and 33C, freshwater continuous chronic criteria (CCC) for Protection of Aquatic Life (DEQ, 2004)

- USEPA 2006 National Recommended Water Quality Criteria. Freshwater CCC values (USEPA, 2006)

SEDIMENT:

- Consensus-based sediment benchmark values: threshold effect concentrations (TECs) and probable effect concentrations (PECs) (MacDonald et al. 2000)

- DEQ sediment bioaccumulation screening level values (SLVs) (DEQ 2007)

- Washington State sediment quality standards (Ecology 2003)

RIPARIAN SOIL:

- DEQ screening level values (SLVs) for protection of terrestrial receptors (DEQ 1998/2001)

- USEPA Ecological Soil Screening Levels (Eco-SSLs) (USEPA 2005 & 2007)

FISH TISSUE:

- DEQ Critical Tissue Levels (CTLs) protective of Fish, Shellfish, and Other Aquatic Organisms (DEQ 2007)

- DEQ Acceptable Tissue Levels (ATLs) in Fish/Shellfish Consumed by Wildlife (DEQ 2007)

Ecological Hazard Estimates Based on Screening Criteria

Although screening HQs were calculated for each metal in each medium on a sample point-by-sample point basis for those samples containing concentrations of metals that exceeded the most stringent criteria, the results will be discussed here in terms of each of the media and water bodies assessed. HQ values for each sample result were obtained by dividing the detected concentration of a metal in a particular medium by the most stringent applicable criterion or the site-specific background concentration (when available), whichever is higher.

- Surface water from the mine adits, the dam location, the two seeps, Joe Creek, tributaries to Joe Creek, Elliot Creek, the Middle Fork of Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir, and Applegate Reservoir.

- Sediments from Joe Creek, Elliot Creek, Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir, and Applegate Reservoir.

- Riparian soil collected adjacent to Joe Creek, Elliot Creek, and the Middle Fork of Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir.

- Fish tissue collected from Elliot Creek, Applegate River between the mouth of Elliot Creek and the head of Applegate Reservoir, and Applegate Reservoir.

Surface Water HQ Values

Mine adits –
Two adit samples, AD-01 and AD-02, were collected. Surface water hardness in these samples was approximately 562 mg/L. Metals detected in AD-02 were not present at concentrations that exceeded screening criteria, with the exception of zinc, which was present at a concentration that resulted in a low HQ value of 2.5. However, in AD-01, concentrations of copper, iron, zinc, and cadmium significantly exceeded HQ values of both 1 and 5, with HQs of 5511, 748, 633, and 72, respectively.

Dam location –
The single surface water sample collected from the dammed area at the downstream base of the Blue Ledge Mine waste rock slope contained concentrations of copper, cadmium, zinc, and lead with related HQs of 793, 153, 81, and 5. For iron, a low HQ value of 1.7 was calculated. Water hardness in this sample was 63.5 mg/L.

Seeps just downstream of Blue Ledge Mine –
The two seeps (samples SP-01 and SP-02) located in steep canyon areas downstream of Blue Ledge Mine both contained concentrations of copper, zinc, and cadmium that exceeded acceptable HQ values. In surface water collected from SP-02, the copper HQ was 200; the cadmium HQ was 42; and the zinc HQ was 20. In SP-01, the HQ values were much lower, with a copper HQ of 19; a cadmium HQ of 6.5; and a zinc HQ of 2.9. Water hardness in these samples was approximately 33.9 mg/L.

Joe Creek –
Seven surface water samples were collected, with an average water hardness of 28.6. Copper significantly exceeded screening criteria, resulting in HQ values ranging from 9 at location JC-08 to 20 at location JC-07. Cadmium concentrations in this sample resulted in moderate HQ levels ranging from approximately 2 to 5. Zinc concentrations in these samples resulted in slightly elevated HQ levels, ranging from 1.6 to 2.2. No HQ value for any metal was higher than 1 in surface water collected from location JC-09.

Tributaries of Joe Creek –
Concentrations of metals in the four Joe Creek tributary surface water samples resulted in HQ values all lower than 1.

Elliot Creek –
Seven surface water samples were collected, with an average water hardness of 43.3. The only HQ values exceeding 1 occurred in surface water collected from locations EC-01 and EC-06, at 1.8 and 3.2, respectively.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
Concentrations of metals detected in the two surface water samples collected in Applegate River did not result in exceedance of an HQ of 1 for any metal.

Applegate Reservoir -
Concentrations of metals detected in the single surface water sample collected at location ARV-04 did not result in exceedance of an HQ of 1 for any metal.

Sediment HQ Values

Joe Creek –
Five sediment samples were collected in Joe Creek. HQ values that exceeded 1 were moderately high for copper, ranging from 9 at location JC-03 to 23 at location JC-08. Cadmium and zinc HQ values were lower, ranging from 2 to 3 and 2.6 to 4.4, respectively.

Elliot Creek –
Seven sediment samples were collected in Elliot Creek. Locations EC-06 and EC-07 were collected upstream of the confluence of Joe Creek with Elliot Creek (see Figure 4. SI Report). The only exceedance of an HQ value of 1 occurred for copper detected at location EC-07, with a corresponding HQ of 2.8.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
Two sediment samples were collected from Applegate River. The HQ values that exceeded 1 were associated with copper, and were low, at 1.5 and 1.6.

Applegate Reservoir -
Four sediment samples were collected from Applegate Reservoir. Only copper concentrations resulted in any exceedances of screening criteria, with corresponding HQ values that exceeded 1 ranging from 1.7 to 2.5.

Riparian Soil HQ Values

Joe Creek –
Three riparian soil samples were collected adjacent to Joe Creek. Concentrations exceeding criteria resulted in HQs for copper ranging from 2.5 to 6.7; for zinc ranging from 1.5 to 3.1, and for cadmium and lead detected in riparian soil collected from location JC-01, a corresponding HQ value of approximately 3 in each case. Arsenic was present in riparian soil collected from location JC-03 at a concentration resulting in an HQ value of 1.8. Riparian soil collected from location JC-01 contained the highest concentrations of copper, lead, and zinc, compared to riparian soil at locations JC-03 and JC-04.

Elliot Creek –
Four riparian soil samples were collected adjacent to Elliot Creek. The only HQ values exceeding 1 were associated with zinc detected in soil collected from locations EC-01 and EC-07, with corresponding HQ values of 1.7 and 1.5, respectively.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
One riparian soil sample was collected adjacent to the Middle Fork of the Applegate River, between the mouth of Elliot Creek and the head of Applegate Reservoir. This sample contained zinc, cadmium, and copper at concentrations that exceeded criteria, resulting in corresponding HQ values of 3.3, 1.8, and 1.5, respectively.

Fish Tissue HQ Values

Elliot Creek –
Of the three fish tissue samples collected in Elliot Creek, only one, location EC-04 resulted in an HQ that exceeded 1. Lead was detected at a concentration that resulted in a slightly elevated HQ value of 1.6.

Applegate River (between mouth of Elliot Creek and head of Applegate Reservoir) –
No exceedance for any metal of an HQ value of 1 in the single fish tissue sample collected.

Applegate Reservoir -
No exceedance for any metal of an HQ value of 1 in the single fish tissue sample collected.

Summary and Conclusions

Any ecological HQ value greater than 1.0 poses potentially unacceptable risks to threatened and endangered species that may be present in the area, while any HQ value greater than 5.0 also poses unacceptable risks to populations of non-protected species. Under Oregon policy, any HQ value less than 1.4 can be rounded down to 1.0; however, California regulations indicate that any HQ value greater than 1.0 is considered an unacceptable ecological risk. In the discussion below, HQ values less than 1.4 are assumed to be roughly equal to an HQ value of 1.0.

URS recommends that metals concentrations resulting in HQ values greater than 5.0 indicate areas that need to be considered further. Areas with metals concentrations resulting in HQ values between 1.4 and 5.0 should be further assessed to determine what action may be necessary. Areas with metals concentrations resulting in HQ values less than 1.4 may not require further consideration.

Joe Creek surface water and sediments, and to a lesser degree, riparian soils adjacent to Joe Creek, contain copper at unacceptably high concentrations in regard to ecological risk, followed by zinc and cadmium. Elliot Creek abiotic media contain metals at concentrations that range from slight to high exceedances of ecological criteria, while Applegate River and Applegate Reservoir contain metals concentrations that slightly or moderately exceed some metals criteria protective of ecological receptors. It appears that Elliot Creek may contain metals concentrations unrelated to Joe Creek, based on results obtained from the two sampling locations upstream of the confluence with Joe Creek. Of the fish tissue samples collected in Elliot Creek, Applegate River, and Applegate Reservoir, only one contained a metal (lead) at a slightly elevated HQ value of 1.6.

Of the sediment samples collected from Joe Creek, Elliot Creek, Applegate River, and Applegate Reservoir, only copper and zinc in sediments in Joe Creek are of concern, with HQ values ranging from 9 to 23 and from 2.6 to 4.4, respectively. HQs values for cadmium detected in Joe Creek sediments range from 2 to 3. In Elliot Creek sediments, only two metals, copper and arsenic, at a single location in both cases (EC-06 and EC-07, respectively), occurred at concentrations that resulted in an exceedance of an HQ of 1(HQ of 2.8 and HQ of 1.1,

respectively). Both of these detections occurred in Elliot Creek locations upstream of the confluence with Joe Creek, indicating that these concentrations likely originated somewhere in or along Elliot Creek, and not from Joe Creek. Low HQ exceedances occurred for copper in sediment collected from Applegate River and Applegate Reservoir, ranging from 1.5 to 2.5.

A more detailed breakdown of SL-ERE results are provided below:

ADITS AND SEEPS:
As expected, metals concentrations in surface water collected from Adit AD-01 and the dam location are extremely high, especially for copper, zinc, cadmium, lead, and iron. All HQ values associated with these metals were significantly higher than both an HQ of 1 (protective of individuals of protected species), and an HQ of 5 (protective of non-protected ecological populations). Surface water collected from the two seep locations may or may not be related to Blue Ledge Mine drainage, with copper, cadmium, and zinc detections resulting in corresponding with high HQ values of 200, 42, and 20, respectively.

JOE CREEK:
Copper concentrations significantly exceed ecological criteria in Joe Creek surface water at all locations downstream of Blue Ledge Mine, with surface water collected at JC-07 (close to Blue Ledge Mine) containing copper at the highest concentrations. The exception to this statement is surface water collected from location JC-09, which contained copper at a concentration that only slightly exceeded ecological criteria. Cadmium and zinc follow the same general pattern as copper in Joe Creek, but at exceedances that moderately and slightly exceed criteria, respectively. Copper also caused significant exceedances of ecological criteria in Joe Creek sediment, with the highest concentration detected in sediment at location JC-08. Zinc and cadmium concentrations in sediment collected from Joe Creek moderately exceed ecological criteria. Riparian soils adjacent to Joe Creek also had copper as the primary "driver" metal in terms of unacceptable ecological risk, with some moderate-to-minor detections of zinc, lead, cadmium, and arsenic. No fish tissue was collected from Joe Creek.

ELLIOT CREEK, APPLEGATE RIVER, AND APPLEGATE RESERVOIR:
Surface water concentrations of metals in Elliot Creek resulted in relatively low HQ values, occurring at locations EC-01 and EC-06, respectively. Metals detected in surface water samples collected from the Applegate River and Applegate Reservoir did not exceed any surface water screening criteria. These results demonstrate a clear decrease in CPEC concentrations in surface water from the source area to downstream areas; in fact, Elliot Creek, Applegate River, and Applegate Reservoir appear to be virtually unimpacted.

Suggested Risk-Based Ecological Cleanup Criteria

In each case where an HQ for a particular metal in a particular medium is exceeded, a conservative cleanup criterion would be equal to the related "most stringent criterion" or site-specific background concentration – whichever is higher. Note that in the cases of cadmium, copper, lead, and zinc in surface water, screening criteria, including the chosen "most stringent criterion", are based on differing water hardness measurements in the different water bodies.

Concentrations of the most stringent criteria based on type of metal and type of medium can be found in the summary HQ tables for surface water, sediment, riparian soil, and fish tissue (see Tables 8 through 10, 16 through 18, 24 through 26, and 32).

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Table C-1
Summary of Surface Water Data
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L												Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH (SU)		TDS		TSS		Sulfate		Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
Site-Specific Background																								
JC-15-SW-080627-URS	26		23.9		7.78		18		5	U	2.5		0.07	U	0.008	U	0.74		4.0	U	0.02	U	0.92	
JC-14-SW-080627-URS	26		23.8		7.76		17		5	U	2.5		0.07	U	0.008	U	0.71		4.0	U	0.02	U	1.10	
JC-13-SW-080627-URS	25		24		7.89		29		5	U	2.5		0.07	U	0.008	U	0.84		4.0	U	0.02	U	0.82	
JC-12-SW-080627-URS	24		23.6		7.93		33		5	U	2.5		0.07	U	0.008	U	0.73		4.0	U	0.02	U	0.75	
JC-11-SW-080627-URS	25		23.8		7.93		14		5	U	2.5		0.08	J	0.008	U	0.75		4.0	U	0.020	U	0.49	J
JC-10-SW-080627-URS	25		24.5		8.13		26		5	U	2.5		0.07	U	0.008	U	0.77		4.0	U	0.020	U	0.65	
T4JC-01-SW-08627-URS	12		11.5		6.96		24		5	U	1.0		0.07	U	0.008	U	0.86		4.0	U	0.035		1.90	
T4JC-02-SW-08627-URS	12		11.5		6.62		23		5	U	1.0		0.07	U	0.008	U	0.89		7.4	J	0.02	U	1.93	
Average	21.9		20.8		7.6		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7[a]		0.013[a]	J	1.1	
Rivers and Creeks																								
JC-09-SW-080627-URS	22		21.3		7.29		15		5	U	2.3		0.07	U	0.031		3.45		4.0	U	0.02	U	6.01	
JC-08-SW-080626-URS	21		20.6		6.94		21		5	U	2.8		0.07	U	0.228		29.0		4.0	U	0.043		42.9	
JC-07-SW-080626-URS	20		20.8		7.45		43		5	U	3.6		0.07	U	0.537		62.8		4.0	U	0.060		88.5	
JC-07-SW-DUP-080626-URS	22		20.9		NA		15		5	U	3.6		0.07	U	0.519		62.4		4.0	U	0.066		87.6	
JC-04-SW-080627-URS	32		35		NA		40		5	U	5.1		0.07	U	0.504		31.8		5.1	J	0.02	U	61.2	
JC-03-SW-080625-URS	31		36.4		6.97		55		5	U	5.1		0.07	U	0.496		34.9		4.0	U	0.02	U	63.7	
JC-02-SW-080625-URS	33		37.1		6.97		37		5	U	5.1		0.07	U	0.519		35.6		4.0	U	0.02	U	69.3	
JC-01-SW-080625-URS	35		37		7.40		48		5	U	5.1		0.07	U	0.564		31.3		4.0	U	0.02	U	79.4	
EC-07-SW-080625-URS	47		44.9		7.56		71		5	U	2.8		0.35	J	0.008	U	0.46		4.0	U	0.02	U	0.61	
EC-06-SW-080625-URS	38		40.4		6.92		73		5	U	3.1		0.22	J	0.180		13.9		4.0	U	0.02	U	22.3	
EC-05-SW-080625-URS	42		43.4		7.45		66		5	U	3.0		0.39	J	0.042		3.03		4.0	U	0.02	U	3.49	
EC-04-SW-080625-URS	42		44		7.51		64		5	U	3.0		0.37		0.040		3.22		4.0	U	0.02	U	3.82	
EC-04-SW-DUP-080625-URS	44		43.1		NA		82		5	U	2.9		0.40		0.049		3.25		4.0	U	0.02	U	4.73	
EC-03-SW-080625-URS	41		44.3		7.39		76		5	U	3.0		0.31	J	0.046		3.22		4.0	U	0.02	U	4.38	
EC-02-SW-080625-URS	43		43.9		7.50		77		5	U	3.0		0.37	J	0.038		3.62		4.0	U	0.02	U	4.94	
EC-01-SW-080624-URS	40		42.3		7.57		81		5	U	3.0		0.50	J	0.049		7.82		6.0	J	0.023		3.95	
AR-01-SW-080624-URS	36		41.6		7.62		64		5	U	2.5		0.07	U	0.018	J	0.02	U	5.6	J	0.016	J	0.5	U
AR-02-SW-080624-URS	38		41.1		7.65		50		5	U	1.9		0.29	J	0.025		1.61		4.6	J	0.008	J	2.15	
ARV-04-SW-080624-URS	42		39.3		7.47		77		5	U	1.8		0.37	J	0.012	J	1.89		7.9	J	0.011	J	2.2	
Tributaries																								
T3JC-01-SW-080626	78		74.1		7.27		91		8		1.9		0.50	U	0.01		0.42		97.9		0.007		1.75	
MG-01-SW-080626-URS	77		82.2		7.78		120		5	U	9.0		0.29	J	0.008	U	0.51		22.4		0.02	U	1.13	
T2JC-01	Not Sampled - Tributary Dry																							
T1JC-01	Not Sampled - Tributary Dry																							
Adits and Seeps																								
AD-01-080624-URS	2	U	576		2.40		5060		5	U	2770.0		3.19		70.9		194000		748000		8.64		300000	
AD-02-080624-URS	134		548		7.73		801		6		393.0		1.81		0.598		4.77		53.6		0.02		1200	
SP-01-080624-URS	31		31		6.84		23		5	U	5.7		0.10	J	0.839		65.9		20.3		0.21		132	
DAM-01-080624-URS	2	U	63.5		3.42		160		5	U	112.0		0.07	U	33.7		4680		1670.0		8.37		6180	
SP-02-080627-URS	22		36.8		5.98		81		5	U	18.3		0.07	U	5.45		699		4.0	U	0.219		913	

a = The average was calculated by halving the method reporting limit associated with each non-detect value, adding to detected values, and dividing by eight.
U = analyte not detected at or above analytical method reporting limit.
J = estimated analytical value.
JC = Joe Creek.
EC = Elliott Creek.
AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.
ARV = Applegate Reservoir
T4 = tributary number 4
MG = Manzanita Gulch (tributary to Joe Creek)
AD = mine adit
Dam = dam location at based of waste rock pile adjacent to Blue Ledge Mine.
SP = seep
TDS = total dissolved solids
TSS = total soluble solids

Table C-2
Ecological Benchmarks for Surface Water
Blue Ledge Mine

Sample Name	General Chemistry Parameters - mg/L						Dissolved Metals - ug/L					
	Alkalinity	Hardness	pH	TDS	TSS	Sulfate	Arsenic	Cadmium[a]	Copper[a]	Iron	Lead[a]	Zinc[a]
Site-Specific Background Concentrations [d]	21.9	see below	7.6	23.0	5.0 U	2.1	0.07	0.008 U	0.8	2.7	0.01	1.1
Screening Criteria												
California Water Quality Standards CCC	--	--		--	--	--	150	2.2	9	NA	2.5	120
DEQ Tables 33A, 33B, and 33C AWQC CCC	20	--		--	--	--	48	b	b	1000	b	b
USEPA NRWQC CCC 2006	--	--		--	--	--	150	0.25	9	NA	2.5	120
Site-specific CCCs - Joe Creek background		20.8					NA	0.09	2.4	NA	0.42	30.2
- Background tributary		11.5					NA	0.05	1.4	NA	0.17	18.4
- Adits AD-01 and AD-02		562					48	0.98	35.2	1000	6.11	474
- Dam location		63.5					48	0.22	5.9	1000	1.64	76.7
- Seeps SP-01 and SP-02		33.9					48	0.13	3.5	1000	0.81	45.4
- Joe Creek		28.6					NA	0.12	3.1	NA	0.65	39.4
- Tributaries		78.2					NA	0.25	7	NA	2.01	91.2
- Elliott Creek		43.3					NA	0.16	4.3	NA	1.09	55.7
- Applegate River		40.7					NA	0.15	4.1	NA	1.01	52.9
- Applegate Reservoir		40.7					NA	0.15	4.1	NA	1.01	52.9
Lowest Screening Levels per Exposure Unit [c]												
Joe Creek background							48	NAB	NAB	1000	NAB	NAB
Background tributaries							48	NAB	NAB	1000	NAB	NAB
Adits AD-01 and AD-02							48	0.98	35.2	1000	6.11	474
Dam location							48	0.22	5.9	1000	1.64	76.7
Seeps SP-01 and SP-02							48	0.13	3.5	1000	0.81	45.4
Joe Creek							48	0.12	3.1	1000	0.65	39.4
Tributaries							48	0.25	7	1000	2.01	91.2
Elliott Creek							48	0.16	4.3	1000	1.09	55.7
Applegate River							48	0.15	4.1	1000	1.01	52.9
Applegate Reservoir							48	0.15	4.1	1000	1.01	52.9

-- Not applicable.
NA - not available.
NAB = screening criteria not applicable to apply to background concentrations.
U - analyte was not detected at or above analytical method reporting limit.
J - estimated analytical value.
CCC - Criterion Continuous Concentration
AWQC - ambient water quality criteria.
DEQ - Oregon Department of Environmental Quality.
NRWQC - National recommended water quality criteria.

[a] Values are hardness dependent. Values shown for CA WQS and USEPA NRWQC are based on a default hardness of 100 mg/L. Site-specific CCCs are based on hardness values specific to each waterbody.
[b] Guidance recommends calculation of site-specific criteria using hardness data collected from the site (Table 33B).
[c] Represents higher of two values: lowest risk-based criterion and site-specific background level.
[d] Represents average of all background data presented in Table 1.

California water quality standards CCC = freshwater criterion continuous concentrations, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Criteria are based on dissolved concentrations of metals.

DEQ Tables 33A, 33B, and 33C AWQC - FW CCC = Tables 33A and 33B, Water Quality Criteria Summary, freshwater continuous chronic criteria for Protection of Aquatic Life, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Based on dissolved concentrations of metals. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

NRWQC = USEPA National Recommended Water Quality Criteria for freshwater CCC. USEPA, Office of Water, Office of Science and Technology. 2006.

Table C-3
Screening of Surface Water Data for Seeps and Adits
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L											Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH		TDS		TSS		Sulfate	Arsenic		Cadmium[a]		Copper[a]		Iron		Lead[a]		Zinc[a]	
Site-Specific Background Concentration																							
Average	21.9		20.8		7.6		23.0		5.0	U	2.1	0.07		0.008	U	0.8		2.7		0.01		1.1	
Adits and Seeps																							
AD-01-080624-URS	2.0	U	576.0				5060.0		5.0	U	2770.0	3.19		70.900		194000.0		748000.0		8.64		300000.0	
AD-02-080624-URS	134.0		548.0				801.0		6.0		393.0	1.81		0.598		4.8		53.6		0.02		1200.0	
SP-01-080624-URS	31.0		31.0				23.0		5.0	U	5.7	0.10	J	0.839		65.9		20.3		0.21		132.0	
DAM-01-080624-URS	2.0	U	63.5				160.0		5.0	U	112.0	0.07	U	33.700		4680.0		1670.0		8.37		6180.0	
SP-02-080627-URS	22.0		36.8				81.0		5.0	U	18.3	0.07	U	5.450		699.0		4.0	U	0.22		913.0	
Average hardness of SP-01 and SP-02			33.9																				
Average hardness of AD-01 and AD-02			562.0																				
DAM-01-080624-URS			63.5																				

Seeps SP-01 and SP-02	General Chemistry Parameters - mg/L											Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH		TDS		TSS		Sulfate	Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
SP-01-080624-URS	31		31		6.84		23		5	U	5.7	0.10	J	0.839		65.9		20.3		0.210		132	
SP-02-080627-URS	22		36.8		5.98		81		5	U	18.3	0.07	U	5.450		699		4.0	U	0.219		913	
Screening Criteria																							
California Water Quality Standards CCC	--		--		--		--		--		--	150		0.13		3.5		NA		0.81		45.4	
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~		--		--		--		--		--	48		0.13		3.5		1000		0.81		45.4	
USEPA NRWQC CCC 2006	--		--		--		--		--		--	150		0.13		3.5		NA		0.81		45.4	
Lowest Screening Level												**48**		**0.13**		**3.5**		**1000**		**0.81**		**45.4**	

Dam	General Chemistry Parameters - mg/L											Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH		TDS		TSS		Sulfate	Arsenic		Cadmium		Copper		Iron		Lead		Zinc	
DAM-01-080624-URS	2	U	63.5		3.42		160		5	U	112	0.07	U	33.7		4680		1670		8.370		6180	
Screening Criteria																							
California Water Quality Standards CCC	--		--		--		--		--		--	150		0.22		5.9		NA		1.64		76.7	
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~		--		--		--		--		--	48		0.22		5.9		1000		1.64		76.7	
USEPA NRWQC CCC 2006	--		--		--		--		--		--	150		0.22		5.9		NA		1.64		76.7	
Lowest Screening Level												**48**		**0.22**		**5.9**		**1000**		**1.64**		**76.7**	

Adits Ad-01 and Ad-02	General Chemistry Parameters - mg/L											Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH		TDS		TSS		Sulfate	Arsenic		Cadmium[a]		Copper[a]		Iron		Lead[a]		Zinc[a]	
AD-01-080624-URS	2	U	576		2.4		5060		5	U	2770	3.19		70.9		194000		748000		8.640		300000	
AD-02-080624-URS	134		548		7.73		801		6		393	1.81		0.598		4.77		53.6		0.020		1200	
Screening Criteria																							
California Water Quality Standards CCC	--		--		--		--		--		--	150		0.98		35.2		NA		6.11		474	
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~		--		--		--		--		--	48		0.98		35.2		1000		6.11		474	
USEPA NRWQC CCC 2006	--		--		--		--		--		--	150		0.98		35.2		NA		6.11		474	
Lowest Screening Level												**48**		**0.98**		**35.2**		**1000**		**6.11**		**474**	

U - analyte was not detected at or above analytical method reporting limit.
J - estimated analytical value.
NA - not available.
CCC - criterion continuous concentration.
AWQC - ambient water quality criteria.
DEQ - Oregon Department of Environmental Quality.
NRWQC - National recommended water quality criteria.
Yellow highlighting indicates a detected concentration that is higher than a particular criterion.
Criteria shown in "strike-out" format indicate these are below the site-specific background concentration and were not used for screening purposes in the table.
Bold font - indicates criteria exceeded.
[a] Screening criteria for these metals are hardness-dependent, and were adjusted based on site-specific hardness.
California water quality standards CCC = freshwater criterion continuous concentrations, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Criteria are based on dissolved concentrations of metals.
DEQ Tables 33A, 33B, and 33C AWQC - FW CCC = Tables 33A and 33B, Water Quality Criteria Summary, freshwater continuous chronic criteria for Protection of Aquatic Life, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Based on dissolved concentrations of metals. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.
NRWQC = USEPA National Recommended Water Quality Criteria for freshwater CCC. USEPA, Office of Water, Office of Science and Technology. 2006.

Table C-4
Screening of Surface Water Data for Joe Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L											Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH		TDS		TSS		Sulfate		Arsenic		Cadmium[a]		Copper[a]		Iron		Lead[a]		Zinc[a]	
Site-Specific Background Concentration																								
Average hardness	21.9		20.8		7.6		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.01		1.1	
Joe Creek downstream of Blue Ledge Mine																								
JC-09-SW-080627-URS	22		21.3		7.29		15		5	U	2.3		0.07	U	0.031		3.45		4.0	U	0.02	U	6.01	
JC-08-SW-080626-URS	21		20.6		6.94		21		5	U	2.8		0.07	U	0.228		29.0		4.0	U	0.043		42.9	
JC-07-SW-080626-URS	20		20.8		7.45		43		5	U	3.6		0.07	U	0.537		62.8		4.0	U	0.06		88.5	
JC-07-SW-DUP-080626-URS	22		20.9		NA		15		5	U	3.6		0.07	U	0.519		62.4		4.0	U	0.066		87.6	
JC-04-SW-080627-URS	32		35		NA		40		5	U	5.1		0.07	U	0.504		31.8		5.1	J	0.02	U	61.2	
JC-03-SW-080625-URS	31		36.4		6.97		55		5	U	5.1		0.07	U	0.496		34.9		4.0	U	0.02	U	63.7	
JC-02-SW-080625-URS	33		37.1		6.97		37		5	U	5.1		0.07	U	0.519		35.6		4.0	U	0.02	U	69.3	
JC-01-SW-080625-URS	35		37		7.40		48		5	U	5.1		0.07	U	0.564		31.3		4.0	U	0.02	U	79.4	
Average hardness			28.6																					
Screening Criteria																								
California Water Quality Standards CCC	--		--		--		--		--		--		150		0.12		3.1		NA		0.65		39.4	
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~		--		--		--		--		--		48		0.12		3.1		1000		0.65		39.4	
USEPA NRWQC CCC 2006	--		--		--		--		--		--		150		0.12		3.1		NA		0.65		39.4	
Lowest Screening Level													**48**		**0.12**		**3.1**		**1000**		**0.65**		**39.4**	

U - analyte was not detected at or above analytical method reporting limit.

J - estimated analytical value.

NA - not available.

CCC - criterion continuous concentration.

AWQC - ambient water quality criteria.

DEQ - Oregon Department of Environmental Quality.

NRWQC - National recommended water quality criteria.

Yellow highlighting indicates a detected concentration that is higher than a particular criterion.

Criteria shown in "strike-out" format indicate these are below the site-specific background concentration and were not used for screening purposes in the table.

Bold font - indicates criteria exceeded.

[a] Screening criteria for these metals are hardness-dependent, and were adjusted based on site-specific hardness.

California water quality standards CCC = freshwater criterion continuous concentrations, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Criteria are based on dissolved concentrations of metals.

DEQ Tables 33A, 33B, and 33C AWQC - FW CCC = Tables 33A and 33B, Water Quality Criteria Summary, freshwater continuous chronic criteria for Protection of Aquatic Life, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Based on dissolved concentrations of metals. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

NRWQC = USEPA National Recommended Water Quality Criteria for freshwater CCC. USEPA, Office of Water, Office of Science and Technology. 2006.

Table C-5
Screening of Surface Water Data for Tributaries of Joe Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L						Dissolved Metals - ug/L					
Sample Name	Alkalinity	Hardness	pH	TDS	TSS	Sulfate	Arsenic	Cadmium[a]	Copper[a]	Iron	Lead[a]	Zinc[a]
Site-Specific Background Concentration												
Average	21.9	20.8	7.6	23.0	5.0 U	2.1	0.07	0.008 U	0.8	2.7	0.01	1.1
Tributaries												
T3JC-01-SW-080626	78	74.1	7.27	91	8	1.9	0.50 U	0.01	0.42	97.9	0.007	1.75
MG-01-SW-080626-URS	77	82.2	7.78	120	5 U	9.0	0.29 J	0.008 U	0.51	22.4	0.020 U	1.13
Average	77.5	78.2	7.53	106	7 U	5.5	NA	0.009	0.465	60.2	0.009	1.44
Screening Criteria												
California Water Quality Standards CCC	--	--	--	--	--	--	150	0.25	7	NA	2.01	91.2
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~	--	--	--	--	--	48	0.25	7	1000	2.01	91.2
USEPA NRWQC CCC 2006	--	--	--	--	--	--	150	0.25	7	NA	2.01	91.2
Lowest Screening Level							**48**	**0.25**	**7**	**1000**	**2.01**	**91.2**

U - analyte was not detected at or above analytical method reporting limit.

J - estimated analytical value.

NA - not available.

CCC - criterion continuous concentration.

AWQC - ambient water quality criteria.

DEQ - Oregon Department of Environmental Quality.

NRWQC - National recommended water quality criteria.

Criteria shown in "strike-out" format indicate these are below the site-specific background concentration and were not used for screening purposes in the table.

[a] Screening criteria for these metals are hardness-dependent, and were adjusted based on site-specific hardness.

California water quality standards CCC = freshwater criterion continuous concentrations, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Criteria are based on dissolved concentrations of metals.

DEQ Tables 33A, 33B, and 33C AWQC - FW CCC = Tables 33A and 33B, Water Quality Criteria Summary, freshwater continuous chronic criteria for Protection of Aquatic Life, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Based on dissolved concentrations of metals. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

NRWQC = USEPA National Recommended Water Quality Criteria for freshwater CCC. USEPA, Office of Water, Office of Science and Technology. 2006.

Table C-6
Screening of Surface Water Data for Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	General Chemistry Parameters - mg/L												Dissolved Metals - ug/L											
	Alkalinity		Hardness		pH		TDS		TSS		Sulfate		Arsenic		Cadmium[a]		Copper[a]		Iron		Lead[a]		Zinc[a]	
Site-Specific Background Concentration																								
Average hardness	21.9		20.8		7.6		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.01		1.1	
Elliott Creek																								
EC-07-SW-080625-URS	47		44.9		7.56		71		5	U	2.8		0.35	J	0.008	U	0.46		4.0	U	0.02	U	0.61	
EC-06-SW-080625-URS	38		40.4		6.92		73		5	U	3.1		0.22	J	0.180		13.9		4.0	U	0.02	U	22.3	
EC-05-SW-080625-URS	42		43.4		7.45		66		5	U	3.0		0.39	J	0.042		3.03		4.0	U	0.02	U	3.49	
EC-04-SW-080625-URS	42		44		7.51		64		5	U	3.0		0.37		0.04		3.22		4.0	U	0.02	U	3.82	
EC-04-SW-DUP-080625-URS	44		43.1		NA		82		5	U	2.9		0.40		0.049		3.25		4.0	U	0.02	U	4.73	
EC-03-SW-080625-URS	41		44.3		7.39		76		5	U	3.0		0.31	J	0.046		3.22		4.0	U	0.02	U	4.38	
EC-02-SW-080625-URS	43		43.9		7.50		77		5	U	3.0		0.37	J	0.038		3.62		4.0	U	0.02	U	4.94	
EC-01-SW-080624-URS	40		42.3		7.57		81		5	U	3.0		0.50	J	0.049		7.82		6.0	J	0.023		3.95	
Average hardness			43.3																					
Screening Criteria																								
California Water Quality Standards CCC	--		--		--		--		--		--		150		0.16		4.3		NA		1.1		55.7	
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~		--		--		--		--		--		48		0.16		4.3		1000		1.1		55.7	
USEPA NRWQC CCC 2006	--		--		--		--		--		--		150		0.16		4.3		NA		1.1		55.7	
Lowest Screening Level													**48**		**0.16**		**4.3**		**1000**		**1.1**		**55.7**	

U - analyte was not detected at or above analytical method reporting limit.

J - estimated analytical value.

NA - not available.

CCC - criterion continuous concentration.

AWQC - ambient water quality criteria.

DEQ - Oregon Department of Environmental Quality.

NRWQC - National recommended water quality criteria.

Yellow highlighting indicates a detected concentration that is higher than a particular criterion.

Criteria shown in "strike-out" format indicate these are below the site-specific background concentration and were not used for screening purposes in the table.

Bold font - indicates criteria exceeded.

[a] Screening criteria for these metals are hardness-dependent, and were adjusted based on site-specific hardness.

California water quality standards CCC = freshwater criterion continuous concentrations, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Criteria are based on dissolved concentrations of metals.

DEQ Tables 33A, 33B, and 33C AWQC - FW CCC = Tables 33A and 33B, Water Quality Criteria Summary, freshwater continuous chronic criteria for Protection of Aquatic Life, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Based on dissolved concentrations of metals. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.

NRWQC = USEPA National Recommended Water Quality Criteria for freshwater CCC. USEPA, Office of Water, Office of Science and Technology. 2006.

Table C-7
Screening of Surface Water Data for Applegate River downstream of confluence with Elliot Creek, and Applegate Reservoir
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

	General Chemistry Parameters - mg/L												Dissolved Metals - ug/L											
Sample Name	Alkalinity		Hardness		pH		TDS		TSS		Sulfate		Arsenic		Cadmium[a]		Copper[a]		Iron		Lead[a]		Zinc[a]	
Site-Specific Background Concentration																								
Average hardness	21.9		20.8		7.6		23.0		5.0	U	2.1		0.07		0.008	U	0.8		2.7		0.01		1.1	
Applegate River downstream of its confluence with Elliott Creek, and Applegate Reservoir																								
AR-01-SW-080624-URS	36		41.6		7.62		64		5	U	2.5		0.07	U	0.018	J	0.02	U	5.6	J	0.016	J	0.50	U
AR-02-SW-080624-URS	38		41.1		7.65		50		5	U	1.9		0.29	J	0.025		1.61		4.6	J	0.008	J	2.15	
ARV-04-SW-080624-URS	42		39.3		7.47		77		5	U	1.8		0.37	J	0.012	J	1.89		7.9	J	0.011	J	2.2	
Average hardness			40.7																					
Screening Criteria																								
California Water Quality Standards CCC	--		--		--		--		--		--		150		0.15		4.1		NA		1.01		52.9	
DEQ Tables 33A, 33B, and 33C AWQC CCC	~~20~~		--		--		--		--		--		48		0.15		4.1		1000		1.01		52.9	
USEPA NRWQC CCC 2006													150		0.15		4.1		NA		1.01		52.9	
Lowest Screening Level													**48**		**0.15**		**4.1**		**1000**		**1.01**		**52.9**	

U - analyte was not detected at or above analytical method reporting limit.
J - estimated analytical value.
NA - not available.
CCC - criterion continuous concentration.
AWQC - ambient water quality criteria.
DEQ - Oregon Department of Environmental Quality.
NRWQC - National recommended water quality criteria.
Yellow highlighting indicates detected concentrations that exceed a criterion.
Criteria shown in "strike-out" format indicate these are below the site-specific background concentration and were not used for screening purposes in the table.
Bold font - indicates criteria exceeded.
[a] Screening criteria for these metals are hardness-dependent, and were adjusted based on site-specific hardness.
California water quality standards CCC = freshwater criterion continuous concentrations, Federal Register, Thursday, May 18, 2000. Part III. Environmental Protection Agency. 40 CFR Part 131 - Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Criteria are based on dissolved concentrations of metals.
DEQ Tables 33A, 33B, and 33C AWQC - FW CCC = Tables 33A and 33B, Water Quality Criteria Summary, freshwater continuous chronic criteria for Protection of Aquatic Life, Oregon Administrative Rules, Chapter 340, Division 41 - Department of Environmental Quality. Based on dissolved concentrations of metals. Oregon Environmental Quality Commission adopted these criteria on May 20, 2004. However, as of 8-25-08, EPA still has not approved the criteria.
NRWQC = USEPA National Recommended Water Quality Criteria for freshwater CCC. USEPA, Office of Water, Office of Science and Technology. 2006.

Table C-8
Ecological Hazard Quotients for Metals Detected in Surface Water from Adits and Seeps
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Seeps SP-01 and SP-02	**Dissolved Metals - ug/L**									
Sample Name	Cadmium	**HQs**	Copper	**HQs**	Iron	**HQs**	Lead	**HQs**	Zinc	**HQs**
SP-01-080624-URS	0.839	**6.5**	65.9	**18.8**	20.3	0.020	0.210	0.3	132	**2.9**
SP-02-080627-URS	5.450	**41.9**	699	**199.7**	4 U	NA	0.219	0.3	913	**20.1**
Lowest Screening Level [a]	0.13		3.5		1000		0.81		45.4	

Dam	**Dissolved Metals - ug/L**									
Sample Name	Cadmium	**HQs**	Copper	**HQs**	Iron	**HQs**	Lead	**HQs**	Zinc	**HQs**
DAM-01-080624-URS	33.7	**153.2**	4680	**793.2**	1670	**1.7**	8.370	**5.1**	6180	**80.6**
Lowest Screening Level [a]	0.22		5.9		1000		1.64		76.7	

Adits Ad-01 and Ad-02	**Dissolved Metals - ug/L**									
Sample Name	Cadmium	**HQs**	Copper	**HQs**	Iron	**HQs**	Lead	**HQs**	Zinc	**HQs**
AD-01-080624-URS	70.9	**72.3**	194,000	**5511.4**	748000	**748.0**	8.640	1.4	300,000	**632.9**
AD-02-080624-URS	0.598	0.6	4.77	0.1	53.6	0.1	0.020	0.003	1200	**2.5**
Lowest Screening Level [a]	0.98		35.2		1000		6.11		474	

HQs = hazard quotients.

Bold font - indicates hazard quotient equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-9
Ecological Hazard Quotients for Metals Detected in Surface Water of Joe Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Cadmium	**HQ**	Copper	**HQ**	Zinc	**HQ**
Joe Creek downstream of Blue Ledge Mine						
JC-09-SW-080627-URS	0.031	0.3	3.45	1.1	6.01	0.2
JC-08-SW-080626-URS	0.228	**1.9**	29.0	**9.4**	42.9	1.1
JC-07-SW-080626-URS	0.537	**4.5**	62.8	**20.3**	88.5	**2.2**
JC-07-SW-DUP-080626-URS	0.519	**4.3**	62.4	**20.1**	87.6	**2.2**
JC-04-SW-080627-URS	0.504	**4.2**	31.8	**10.3**	61.2	**1.6**
JC-03-SW-080625-URS	0.496	**4.1**	34.9	**11.3**	63.7	**1.6**
JC-02-SW-080625-URS	0.519	**4.3**	35.6	**11.5**	69.3	**1.8**
JC-01-SW-080625-URS	0.564	**4.7**	31.3	**10.1**	79.4	**2.0**
Lowest Screening Level [a]	0.12		3.1		39.4	

Units: micrograms per liter.

HQs = hazard quotients.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-10
Ecological Hazard Quotients for Metals Detected in Surface Water in Elliott Creek
Blue Ledge Mine

Sample Name	Cadmium		**HQ**	Copper		**HQ**
Elliott Creek						
EC-07-SW-080625-URS	0.008	U	0.1	0.46		0.1
EC-06-SW-080625-URS	0.180		1.1	13.9		**3.2**
EC-05-SW-080625-URS	0.042		0.3	3.03		0.7
EC-04-SW-080625-URS	0.040		0.3	3.22		0.7
EC-04-SW-DUP-080625-URS	0.049		0.3	3.25		0.8
EC-03-SW-080625-URS	0.046		0.3	3.22		0.7
EC-02-SW-080625-URS	0.038		0.2	3.62		0.8
EC-01-SW-080624-URS	0.049		0.3	7.82		1.8
Lowest Screening Level [a]	0.16			4.3		

HQs = hazard quotients.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-11
Summary of Sediment Data
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
JC-15-SD-080627-URS	1.43		0.121		47.2		1.63		44.1	
JC-14-SD-080627-URS	0.74		0.093		34.4		1.20		26.9	
JC-13-SD-080627-URS	1.19		0.113		37.7		1.63		40.2	
JC-12-SD-080627-URS	1.77		0.097		39.0		2.09	J	35.4	
JC-11-SD-080627-URS	1.36		0.139		47.5		1.49		36.6	
JC-10-SD-080627-URS	2.68		0.214		51.7		2.67		55.6	
Average	1.5		0.13		42.9		1.8		39.8	
Rivers and Creeks										
JC-08-SD-080627-URS	2.54	J	0.941		978		13.8		208	
JC-06	Not sampled									
JC-05	Not sampled									
JC-04-SD-080627-URS	4.27		2.93		558		10.0		317	
JC-03-SD-080626-URS	3.22		2.70		386		7.72		423	
JC-02-SD-080626-URS	1.14		2.80		536		6.27		533	
JC-01-SD-080626-URS	3.01		2.14		430		5.85		440	
EC-08	Not sampled									
EC-07-SD-080625-URS	7.59		0.281		28.0		6.91		59.0	
EC-06-SD-080625-URS	4.92		0.581		119		10.4		114	
EC-05-SD-080625-URS	3.50		0.213		38.5		4.07		74.5	
EC-05-SD-DUP-080625-URS	3.61		0.260		47.0		3.54		77.8	
EC-04-SD-080625-URS	6.20		0.211		39.9		5.52		77.1	
EC-04-SD-DUP-080625-URS	5.20		0.270		51.3		4.72		75.1	
EC-03-SD-080625-URS	4.35		0.528		42.9		4.52		72.7	
EC-02-SD-080625-URS	4.04		0.315		57.5		5.72		109	
EC-01-SD-080624-URS	4.23		0.388		43.1		5.14		75.8	
AR-01-SD-080624-URS	3.95		0.416		68.8		5.97		120	
AR-02-SD-080624-URS	4.36		0.406		62.7		4.94		107	
ARV-01-SD-080624-URS	4.76		0.422		70.8		6.54		111	
ARV-02-SD-080624-URS	4.77		0.519		81.8		6.34		128	
ARV-03-SD-080624-URS	4.71		0.572		107		8.24		116	
ARV-04-SD-080624-URS	3.98		0.434		73.8		6.37		93.1	

All results are in mg/kg on a dry weight basis unless otherwise noted.

U = analyte not detected at or above analytical method reporting limit.

J = estimated analytical value.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River between mouth of Elliot Creek and head of Applegate Reservoir.

ARV = Applegate Reservoir.

Table C-12
Ecological Benchmarks for Sediment
Screening-Level Ecological Risk Assesment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
Average	1.5		0.13		42.9		1.8		39.8	
Screening Criteria										
TECs	9.79		0.99		31.6		35.8		121	
PECs	33		4.98		149		128		459	
DEQ SLVs	7[a]		1[a]		NA		17[a]		NA	
SQS	57		5.1		390		450		410	
Lowest Screening Level [c]	**7**		**0.99**		**42.9[b]**		**17**		**121**	

All criteria are in mg/kg on a dry weight basis unless otherwise noted.

a = Default DEQ regional background concentration. DEQ Guidance recommends using regional or site-specific background concentration for screening purposes (DEQ 2007).

b = because background concentration was higher than at least one criterion, background concentration is used here as the most stringent criterion.

c = Represents higher of two values: lowest risk-based criterion and site-specific background level.

TECs and PECs = consensus-based sediment threshold effect concentrations and probable effect concentrations. MacDonald, et al., 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Archives of Environmental Contamination and Toxicology 39: 20-31.

SLVs = Sediment Bioaccumulation Screening Level Values, *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*, Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007. Note that the values shown are DEQ default sediment background levels, and thus are not risk-based.

SQS = Sediment Quality Standards. *Development of Freshwater Sediment Quality Values for Use in Washington State. Phase II Report: Development and Recommendation of SQVs for Freshwater Sediments in Washington State*. Washington Department of Ecology, Toxics Cleanup Program. Publication # 03-09-008. September 2003.

Table C-13
Screening of Sediment Data for Joe Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Site-Specific Background Concentration										
Average	1.5		0.13		42.9		1.8		39.8	
Joe Creek										
JC-08-SD-080627-URS	2.54	J	0.941		978		13.8		208	
JC-04-SD-080627-URS	4.27		2.93		558		10.0		317	
JC-03-SD-080626-URS	3.22		2.70		386		7.72		423	
JC-02-SD-080626-URS	1.14		2.80		536		6.27		533	
JC-01-SD-080626-URS	3.01		2.14		430		5.85		440	
Lowest Screening Level	**7**		**0.99**		**42.9**		**17**		**121**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

Yellow-highlighted results exceed lowest screening criteria shown.

Table C-14
Screening of Sediment Data for Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Site-Specific Background Concentration										
Average	1.5		0.13		42.9		1.8		39.8	
Elliott Creek										
EC-07-SD-080625-URS	7.59		0.281		28.0		6.91		59.0	
EC-06-SD-080625-URS	4.92		0.581		119		10.4		114	
EC-05-SD-080625-URS	3.50		0.213		38.5		4.07		74.5	
EC-05-SD-DUP-080625-URS	3.61		0.260		47.0		3.54		77.8	
EC-04-SD-080625-URS	6.20		0.211		39.9		5.52		77.1	
EC-04-SD-DUP-080625-URS	5.20		0.270		51.3		4.72		75.1	
EC-03-SD-080625-URS	4.35		0.528		42.9		4.52		72.7	
EC-02-SD-080625-URS	4.04		0.315		57.5		5.72		109	
EC-01-SD-080624-URS	4.23		0.388		43.1		5.14		75.8	
Lowest Screening Level	**7**		**0.99**		**42.9**		**17**		**121**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

Yellow-highlighted results exceed lowest screening criteria shown.

Table C-15
Screening of Sediment Data for Applegate River downstream of confluence with Elliot Creek, and Applegate Reservoir
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	Cadmium	Copper	Lead	Zinc
Site-Specific Background Concentration					
Average	1.5	0.13	42.9	1.8	39.8
Applegate River downstream of its confluence with Elliott Creek, and Applegate Reservoir					
AR-01-SD-080624-URS	3.95	0.416	68.8	5.97	120
AR-02-SD-080624-URS	4.36	0.406	62.7	4.94	107
ARV-01-SD-080624-URS	4.76	0.422	70.8	6.54	111
ARV-02-SD-080624-URS	4.77	0.519	81.8	6.34	128
ARV-03-SD-080624-URS	4.71	0.572	107	8.24	116
ARV-04-SD-080624-URS	3.98	0.434	73.8	6.37	93.1
Lowest Screening Level	**7**	**0.99**	**42.9**	**17**	**121**

All results are in mg/kg on a dry weight basis unless otherwise noted.

Yellow-highlighted results exceed lowest screening criteria shown.

Table C-16
Ecological Hazard Quotients for Metals Detected in Sediment from Joe Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Cadmium	**HQs**	Copper	**HQs**	Zinc	**HQs**
Joe Creek						
JC-08-SD-080627-URS	0.941	1.0	978	**22.8**	208	**1.7**
JC-04-SD-080627-URS	2.93	**3.0**	558	**13.0**	317	**2.6**
JC-03-SD-080626-URS	2.70	**2.7**	386	**9.0**	423	**3.5**
JC-02-SD-080626-URS	2.80	**2.8**	536	**12.5**	533	**4.4**
JC-01-SD-080626-URS	2.14	**2.2**	430	**10.0**	440	**3.6**
Lowest Screening Level [a]	0.99		42.9[a]		121	

All results are in mg/kg on a dry weight basis unless otherwise noted.

HQs = hazard quotients.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-17
Ecological Hazard Quotients for Metals Detected in Sediment from Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	**HQs**	Copper	**HQs**
Elliott Creek				
EC-07-SD-080625-URS[a]	7.59	**1.1**	28.0	0.65
EC-06-SD-080625-URS[a]	4.92	0.7	119	**2.8**
EC-05-SD-080625-URS	3.50	0.5	38.5	0.90
EC-05-SD-DUP-080625-URS	3.61	0.5	47.0	**1.1**
EC-04-SD-080625-URS	6.20	0.9	39.9	0.93
EC-04-SD-DUP-080625-URS	5.20	0.7	51.3	**1.2**
EC-03-SD-080625-URS	4.35	0.6	42.9	1.0
EC-02-SD-080625-URS	4.04	0.6	57.5	**1.3**
EC-01-SD-080624-URS	4.23	0.6	43.1	1.0
Lowest Screening Level [b]	7		42.9[a]	

All results are in mg/kg on a dry weight basis unless otherwise noted.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Locations EC-06 and EC-07 in Elliott Creek are located upstream of the confluence of Joe Creek with Elliott Creek.

[b] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-18
Ecological Hazard Quotients for Metals Detected in Sediment from Applegate River and Applegate Reservoir
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Copper	**HQs**	Zinc	**HQs**
Applegate River downstream of its confluence with Elliott Creek, and Applegate Reservoir				
AR-01-SD-080624-URS	68.8	**1.6**	120	1.0
AR-02-SD-080624-URS	62.7	**1.5**	107	0.9
ARV-01-SD-080624-URS	70.8	**1.7**	111	0.9
ARV-02-SD-080624-URS	81.8	**1.9**	128	**1.1**
ARV-03-SD-080624-URS	107	**2.5**	116	1.0
ARV-04-SD-080624-URS	73.8	**1.7**	93.1	0.8
Lowest Screening Level [a]	42.9[a]		121	

All results are in mg/kg on a dry weight basis unless otherwise noted.

HQ = hazard quotient.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-19
Summary of Riparian Soil Data
Screening-Level Ecological Risk Asessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
JC-14-RS-080627-URS	1.24		0.092		45.2		1.83		38.9	
JC-12-RS-080627-URS	3.16		0.166		67.1		5.29		73.1	
Average	2.2		0.13		56.2		3.6		56.0	
Rivers and Creeks										
JC-06	Not sampled									
JC-05	Not sampled									
JC-04-RS-080627-URS	3.44		0.354		204		15.1		86.7	
JC-03-RS-080626-URS	17.8		0.202		141		11.6		119	
JC-01-RS-080626-URS	4.73		1.09		378		31.2		172	
EC-08	Not sampled									
EC-07-RS-080625-URS	5.84		0.220		51.9		6.08		84.6	
EC-05-RS-080625-URS	5.37		0.281		60.4		6.37		74.0	
EC-05-RS-DUP-080625-URS	5.01		0.311		80.0		6.17		74.0	
EC-02-RS-080625-URS	3.29		0.191		56.0		5.75		64.9	
EC-01-RS-080624-URS	5.61		0.324		74.1		5.99		97.9	
AR-01-RS-080624-URS	4.65		0.654		85.0		7.06		185	

All results are in mg/kg on a dry weight basis unless otherwise noted.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River between mouth of Applegate River and head of Applegate Reservoir.

Table C-20
Ecological Benchmarks for Riparian Soil
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background										
Site-Specific Average[a]	2.2		0.13		56.2		3.6		56.0	
California Regional Soil Levels [c]	3.5		0.36		28.7		23.9		149	
Screening Criteria										
DEQ SLVs										
Plants	10		4		100		50		~~50~~	
Inverts	60		20		~~50~~		500		200	
Birds	10		6		190		16		60	
Mammals	29		125		390		4000		20000	
EPA Eco-SSLs										
Plants	18		32		70		120		160	
Soil invertebrates	NA		140		80		1,700		120	
Avian receptors	43		0.77		~~28~~		11		~~46~~	
Mammalian Receptors	46		0.36		~~49~~		56		79	
Lowest Screening Levels [b]	**10**		**0.36**		**56.2[d]**		**11**		**56[d]**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

a = average is based on only two samples.

b = Represents higher of two values: lowest risk-based criterion and site-specific background level.

c = Only shown for informational purposes. The site-specific background concentrations are used for screening purposes.

d = because background concentration was higher than at least one criterion, background concentration is used here as the most stringent criterion.

In cases where site-specific background concentration is greater than one or more criteria, those criteria are shown in strikethrough font.

DEQ SLVs = Oregon Department of Environmental Quality Guidance for Ecological Risk Assessment - Level II Screening Level Values. April 1998, SLVs revised December 2001.

EPA Eco-SSLs =- USEPA 2005 and 2007. Interim Ecogical Soil Screening Levels (Eco-SSLs) - Rrevised. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-60 through 75, OSWER. March 2005. Last updates to a subset of Eco-SSLs, February 2007.

California Regional Soil Levels are the Average Concentration from the following report: Bradford, G.R., A.L. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils*. Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table C-21
Screening of Riparian Soil Data Adjacent to Joe Creek
Screening-Level Ecological Risk Asessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background Concentration										
Site-Specific Average [a]	2.2		0.13		56.2[b]		3.6		56[b]	
Joe Creek (downstream of Blue Ledge Mine)										
JC-04-RS-080627-URS	3.44		0.354		204		15.1		86.7	
JC-03-RS-080626-URS	17.8		0.202		141		11.6		119	
JC-01-RS-080626-URS	4.73		1.09		378		31.2		172	
Lowest Screening Level	**10**		**0.36**		**56.2**		**11**		**56**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

a = The average concentrations presented here are based on only two samples.

b = in this case, the average background concentration was higher than one or more of the screening criteria. Therefore, this background concentration will be identified as the "most stringent criterion", rather than one of the SLVs or Eco-SSLs..

Yellow highlighting indicates detected concentrations that exceed the lowest criteria presented.

DEQ SLVs = Oregon Department of Environmental Quality Guidance for Ecological Risk Assessment - Level II Screening Level Values. April 1998, SLVs revised December 2001.

EPA Eco-SSLs =- USEPA 2005 and 2007. Interim Ecogical Soil Screening Levels (Eco-SSLs) - Rrevised. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-60 through 75, OSWER. March 2005. Last updates to a subset of Eco-SSLs, February 2007.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils* . Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table C-22
Screening of Riparian Soil Data Adjacent to Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Background Concentration										
Site-Specific Average [a]	2.2		0.13		56.2[b]		3.6		56[b]	
Elliott Creek										
EC-07-RS-080625-URS	5.84		0.220		51.9		6.08		84.6	
EC-05-RS-080625-URS	5.37		0.281		60.4		6.37		74.0	
EC-05-RS-DUP-080625-URS	5.01		0.311		80.0		6.17		74.0	
EC-02-RS-080625-URS	3.29		0.191		56.0		5.75		64.9	
EC-01-RS-080624-URS	5.61		0.324		74.1		5.99		97.9	
Lowest Screening Level	**10**		**0.36**		**56.2**		**11**		**56**	

All results are in mg/kg on a dry weight basis unless otherwise noted.

a = The average concentrations presented here are based on only two samples.

b = in this case, the average background concentration was higher than one or more of the screening criteria. Therefore, this background concentration will be identified as the lowest screening level.

NA - not available.

Yellow-highlighted results exceed lowest screening level.

Table C-23
Screening of Riparian Soil Data Adjacent to Applegate River downstream of confluence with Elliot Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	Cadmium	Copper	Lead	Zinc
Background Concentration					
Site-Specific Average [a]	2.2	0.13	56.2[b]	3.6	56[b]
Applegate River downstream of confluence with Joe Creek					
AR-01-RS-080624-URS	4.65	0.654	85.0	7.06	185
Screening Criteria					
Lowest Screening Level	**10**	**0.36**	**56.2**	**11**	**56**

All results are in mg/kg on a dry weight basis unless otherwise noted.

NA - not available.

Highlighted results exceed one or more screening level values.

Bold background concentrations in combination with a strike-through criterion indicates that average background concentration of metal is higher than indicated criterion. In this case, detected concentrations that exceed the average background concentrations are yellow-highlighted.

If more than one criterion are exceeded by the same detected concentrations, then both criteria, as well as the related detected concentrations, are yellow-highlighted.

If more than one criterion is exceeded by different detected concentrations, a different color is assigned to each criterion exceeded.

a = The average concentrations presented here are based on only two samples.

b = in this case, the average background concentration was higher than some of the screening criteria. Therefore, this background concentration will be identified as the "most stringent criterion", rather than one of the SLVs or Eco-SSLs..

DEQ SLVs = Oregon Department of Environmental Quality Guidance for Ecological Risk Assessment - Level II Screening Level Values. April 1998, SLVs revised December 2001.

EPA Eco-SSLs =- USEPA 2005 and 2007. Interim Ecogical Soil Screening Levels (Eco-SSLs) - Rrevised. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response (OSWER) Directive 9285.7-60 through 75, OSWER. March 2005. Last updates to a subset of Eco-SSLs, February 2007.

California Regional Soil Levels -- Bradford, G.R., A.C. Chang, A.L. Page, D. Bakhtar, J.A. Frampton, and H. Wright. 1996. *Background Concentrations of Trace and Major Elements in California Soils* . Kearney Foundation of Soil Science, Division of Agriculture and Natural Resources, University of California Special Report, U.C. Riverside and Cal/EPA, DTSC.

Table C-24
Ecological Hazard Quotients for Metals Detected in Riparian Soil Adjacent to Joe Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	**HQs**	Cadmium	**HQs**	Copper	**HQs**	Lead	**HQs**	Zinc	**HQs**
Joe Creek (downstream of Blue Ledge Mine)										
JC-04-RS-080627-URS	3.44	0.3	0.354	1.0	204	**3.6**	15.1	**1.4**	86.7	**1.5**
JC-03-RS-080626-URS	17.8	**1.8**	0.202	0.6	141	**2.5**	11.6	**1.1**	119	**2.1**
JC-01-RS-080626-URS	4.73	0.5	1.09	**3.0**	378	**6.7**	31.2	**2.8**	172	**3.1**
Lowest Screening Level [a]	10		0.36		56.2		11		56	

HQs = hazard quotients.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-25
Ecological Hazard Quotients for Metals Detected in Riparian Soil Adjacent to Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Copper	**HQs**	Zinc	**HQs**
Elliott Creek				
EC-07-RS-080625-URS	51.9	0.9	84.6	**1.5**
EC-05-RS-080625-URS	60.4	**1.1**	74.0	**1.3**
EC-05-RS-DUP-080625-URS	80.0	**1.4**	74.0	**1.3**
EC-02-RS-080625-URS	56.0	1.0	64.9	**1.2**
EC-01-RS-080624-URS	74.1	**1.3**	97.9	**1.7**
Lowest Screening Level [a]	56.2		56	

HQs = hazard quotients.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-26
Ecological Hazard Quotients for Metals Detected in Riparian Soils Adjacent to Applegate River
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Cadmium	**HQs**	Copper	**HQs**	Zinc	**HQs**
Applegate River downstream of confluence with Joe Creek						
AR-01-RS-080624-URS	0.654	**1.8**	85.0	**1.5**	185	**3.3**
Lowest Screening Level [a]	0.36		56.2		56	

HQs = hazard quotients.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

[a] Represents higher of two values: lowest risk-based criterion and site-specific background level.

Table C-27
Summary of Fish Tissue Data
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Rivers and Creeks										
EC-07-FT-080626-URS	0.24		0.068		2.32		0.065		24.8	
EC-04-FT-080626-URS	0.15		0.134		4.79		0.194		29.2	
EC-02-FT-080626-URS	0.15		0.173		5.73		0.062		37.1	
AR-02-FT-080627-URS	0.16		0.145		3.15		0.017		33.5	
AR-02-FT-DUP-080627-URS	0.13		0.133		3.30		0.024		30.3	
ARV-02-FT-080627-URS	0.14		0.049		2.29		0.027		22.9	

Units are in milligrams per kilogram (mg/kg) - wet weight basis.

JC = Joe Creek.

EC = Elliott Creek.

AR = Applegate River between mouth of Elliott Creek and head of Applegate Reservoir.

ARV = Applegate Reservoir.

Table C-28
Ecological Benchmarks for Fish Tissue
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

	Arsenic		Cadmium		Copper		Lead		Zinc	
Screening Criteria										
DEQ CTLs (mg/kg - wet wt)	6.6		0.15		NA		0.12		NA	
DEQ ATLs (mg/kg - wet wt)										
Birds (Individual)	13		8.4		NA		9.3		NA	
Birds (Population)	64		42		NA		46		NA	
Mammals (Individual)	7.6		5.6		NA		34		NA	
Mammals (Population)	38		28		NA		170		NA	
Lowest Screening Level	**6.6**		**0.15**		**NA**		**0.12**		**NA**	

Units are in milligrams per kilogram (mg/kg) - wet weight basis.

NA - not available.

DEQ CTLs - Critical tissue levels (protective of fish and shellfish), *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*, Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007.
DEQ ATLs - Acceptable tissue levels (protective of upper trophic level predators), *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*, Oregon Department of Environmental Quality Environmental Cleanup Program. January 31, 2007; updated April 3, 2007.

Table C-29
Screening of Fish Tissue Data for Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic	Cadmium	Copper	Lead	Zinc
Elliott Creek					
EC-07-FT-080626-URS	0.24	0.068	2.32	0.065	24.8
EC-04-FT-080626-URS	0.15	0.134	4.79	0.194	29.2
EC-02-FT-080626-URS	0.15	0.173	5.73	0.062	37.1
Lowest Screening Level	**6.6**	**0.15**	**NA**	**0.12**	**NA**

Units are in milligrams per kilogram (mg/kg) - wet weight basis.

NA - not available.

Highlighted results exceed lowest screening level value.

Table C-30
Screening of Fish Tissue Data for Applegate River downstream of confluence with Elliot Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Applegate River										
AR-02-FT-080627-URS	0.16		0.145		3.15		0.017		33.5	
AR-02-FT-DUP-080627-URS	0.13		0.133		3.30		0.024		30.3	
Lowest Screening Level	**6.6**		**0.15**		**NA**		**0.12**		**NA**	

Units are in milligrams per kilogram (mg/kg) - wet weight basis.
NA -not available.
Highlighted results exceed lowest screening level value.

Table C-31
Screening of Fish Tissue Data for Applegate Reservoir
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Arsenic		Cadmium		Copper		Lead		Zinc	
Applegate Reservoir										
ARV-02-FT-080627-URS	0.14		0.049		2.29		0.027		22.9	
Lowest Screening Level	**6.6**		**0.15**		**NA**		**0.12**		**NA**	

Units are in milligrams per kilogram (mg/kg) - wet weight basis.
NA - not available.
Highlighted results exceed lowest screening level value.

Table C-32
Ecological Hazard Quotients for Metals Detected in Fish Tissue in Elliott Creek
Screening-Level Ecological Risk Assessment
Blue Ledge Mine

Sample Name	Cadmium	**HQ**	Lead	**HQ**
Elliott Creek				
EC-07-FT-080626-URS	0.068	0.5	0.065	0.5
EC-04-FT-080626-URS	0.134	0.9	0.194	**1.6**
EC-02-FT-080626-URS	0.173	**1.2**	0.062	0.5
Lowest Screening Level	0.15		0.12	

Units are in milligrams per kilogram (mg/kg) - wet weight basis.

HQ = hazard quotient.

Yellow highlighting indicates detected concentrations that exceed the lowest screening level.

Bold font indicates HQ values equal to 1.5 or greater. Note that based on previous Oregon DEQ recommendation, any HQ less than 1.5 is rounded down to 1. California regulatory agencies assume that any HQ greater than 1.0 in a screening level assessment indicates a potential unacceptable ecological risk.

APPENDIX D

LABORATORY ANALYTICAL REPORTS

1317 South 13th Avenue Kelso, Washington 98626 (360) 577-7222 (360) 636-1068 fax

Columbia Analytical Services INC.
An Employee - Owned Company

July 18, 2008 Analytical Report for Service Request No: K0805778

Christina Wheeler
URS Corporation
111 SW Columbia
Suite 1500
Portland, OR 97201-5850

RE: Blue Ledge Mine

Dear Christina:

Enclosed are the results of the samples submitted to our laboratory on June 26, 2008. For your reference, these analyses have been assigned our service request number K0805778.

All analyses were performed according to our laboratory's quality assurance program. Where applicable, the methods cited conform to the Methods Update Rule (effective 4/11/2007), which relates to the use of analytical methods for the drinking water and waste water programs. The test results meet requirements of the NELAC standards. Exceptions are noted in the case narrative report where applicable. 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 3358. You may also contact me via Email at LHuckestein@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda Huckestein
Client Services Manager

LH/lb

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

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 percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
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.

Columbia Analytical Services, Inc.
Kelso, WA
State Certifications, Accreditations, and Licenses

Program	Number
Alaska DEC UST	UST-040
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2286
Colorado DPHE	-
Florida DOH	E87412
Hawaii DOH	-
Idaho DHW	-
Indiana DOH	C-WA-01
Louisiana DEQ	3016
Louisiana DHH	LA050010
Maine DHS	WA0035
Michigan DEQ	9949
Minnesota DOH	053-999-368
Montana DPHHS	CERT0047
Nevada DEP	WA35
New Jersey DEP	WA005
New Mexico ED	-
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon - DHS	WA200001
South Carolina DHEC	61002
Utah DOH	COLU
Washington DOE	C1203
Wisconsin DNR	998386840
Wyoming (EPA Region 8)	-

Case Narrative

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	URS Corporation	**Service Request No.:**	K0805778
Project:	Blue Ledge Mine	**Date Received:**	6/26/2008
Sample Matrix:	Water		

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

Eight water samples were received for analysis at Columbia Analytical Services on 6/26/2008. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

Total Metals

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recovery of Iron for the Batch QC is not applicable. The Iron concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

Approved by _____ **Date** 7/21/08

Chain of Custody Documentation

Columbia Analytical Services INC.
An Employee - Owned Company

CHAIN OF CUSTODY

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

SR#: K0805778

PAGE 1 OF 1 COC # 01

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER:
PROJECT MANAGER: MIKE EDWARDS
COMPANY/ADDRESS: URS CORPORATION
111 SW COLUMBIA, SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR. 97201
E-MAIL ADDRESS:
PHONE #: 503 222 7200 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐ ☐ Fuel Fingerprint (FIQ) ☐ NW-HCID Screen	Oil & Grease/TRPH 1664 SGT ☐ 1664 HEM ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or (Dissolved) (See list below)	Cyanide ☐	Hex-Chrom ☐	pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS (DS circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	ALKALINITY (SM2320B)	HARDNESS (SM2340B)			REMARKS
AL-01-SW-080624-URS	6/24/08	1640		W	3									X		X			X	X				
EC-01-SW-080624-URS	6/24/08	1725		W	3									X		X			X	X				
ARV-04-SW-080624-URS		1250		W	3									X		X			X	X				
AIC-02-SW-080624-URS		1558		W	3									X		X			X	X				
DAM-01-080624-URS		1815		W	3									X		X			X	X				
AD-02-080624-URS		1645		W	3									X		X			X	X				
SP-01-080624-URS		1600		W	3									X		X			X	X				
AD-01-080624-URS		1430		W	3									X		X			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
X 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:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:
AD-01-080624-URS 1L UNPRESERVED CONTAINER ONLY ½ FULL. CONTACT PM IF NOT ENOUGH VOLUME TO RUN ALL REQUESTED ANALYSES.

Container Supply Number
9160

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature] Date/Time: 6/25/08 1000	Signature: Tracy Black Date/Time: 6/26/08 0930	Signature: Date/Time:	Signature: Date/Time:
Printed Name: JENNIFER RAY Firm: URS	Printed Name: T Black Firm: CAS	Printed Name: Firm:	Printed Name: Firm:

RCOC #1 06/03

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC CH

Client / Project: URS Service Request K08 05778

Received: 6/26/08 Opened: 6/26/08 By: A.J

1. Samples were received via? *US Mail* *Fed Ex* *UPS* *DHL* *GH* *GS* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? 1F, 1B, 1S
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA Y N
5. Temperature of cooler(s) upon receipt (°C): 0.6
   Temperature Blank (°C): 2.5
6. If applicable, list Chain of Custody Numbers:
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Packing material used. *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Sleeves* *Other* _____
9. **Did all bottles arrive in good condition (unbroken)?** *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* Y N
12. **Were appropriate bottles/containers and volumes received for the tests indicated?** NA Y N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials and 1631 Mercury bottles received without headspace? *Indicate in the table below.* NA Y N
15. **Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection?** NA Y N
16. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

*Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions:

General Chemistry Parameters

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 06/24/08
Date Received : 06/26/08

Alkalinity as CaCO3, Total

Analysis Method : SM 2320 B
Test Notes :

Units : mg/L
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
AR-01-SW-080624-URS	K0805778-001	2	1	1	06/26/08	36	
EC-01-SW-080624-URS	K0805778-002	2	1	1	06/26/08	40	
ARV-04-SW-080624-URS	K0805778-003	2	1	1	06/26/08	42	
AR-02-SW-080624-URS	K0805778-004	2	1	1	06/26/08	38	
DAM-01-080624-URS	K0805778-005	2	1	1	06/26/08	ND	
AD-02-080624-URS	K0805778-006	2	1	1	06/26/08	134	
SP-01-080624-URS	K0805778-007	2	1	1	06/26/08	31	
AD-01-080624-URS	K0805778-008	2	1	1	06/26/08	ND	
Method Blank	K0805778-MB	2	1	1	06/26/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 6/24/2008
Date Received : 6/26/2008
Date Prepared : NA
Date Analyzed : 06/26/08

Duplicate Summary
Inorganic Parameters

Sample Name : AR-02-SW-080624-URS
Lab Code : K0805778-004DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Alkalinity as CaCO3, Total	SM 2320 B	2	38	41	40	8	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805778
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	NA	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	06/26/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805778-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Alkalinity as CaCO3, Total	NONE	SM 2320 B	110	109	99	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 06/24/08
Date Received : 06/26/08

Sulfate

Analysis Method : 300.0
Test Notes :

Units : mg/L
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
AR-01-SW-080624-URS	K0805778-001	0.2	0.012	2	07/01/08	2.5	
EC-01-SW-080624-URS	K0805778-002	0.2	0.012	2	07/01/08	3.0	
ARV-04-SW-080624-URS	K0805778-003	0.2	0.012	2	07/01/08	1.8	
AR-02-SW-080624-URS	K0805778-004	0.2	0.012	2	07/01/08	1.9	
DAM-01-080624-URS	K0805778-005	4.0	0.12	20	06/30/08	112	
AD-02-080624-URS	K0805778-006	20	0.60	100	07/01/08	393	
SP-01-080624-URS	K0805778-007	0.2	0.012	2	07/01/08	5.7	
AD-01-080624-URS	K0805778-008	200	6.0	1000	07/01/08	2770	
Method Blank	K0805778-MB	0.2	0.006	1	07/01/08	ND	
Method Blank	K0805778-MB	0.2	0.006	1	06/30/08	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 6/24/2008
Date Received : 6/26/2008
Date Prepared : NA
Date Analyzed : 07/01/08

Duplicate Summary
Inorganic Parameters

Sample Name : AR-01-SW-080624-URS
Lab Code : K0805778-001DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Sulfate	300.0	0.2	2.5	2.5	2.5	<1	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 6/24/2008
Date Received : 6/26/2008
Date Prepared : NA
Date Analyzed : 07/01/08

Matrix Spike Summary
Inorganic Parameters

Sample Name : AR-01-SW-080624-URS
Lab Code : K0805778-001MS
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	300.0	0.2	4.0	2.5	6.3	95	80-120	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805778
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	NA	**Date Received :**	NA
Sample Matrix :	DRINKING WATER	**Date Prepared :**	NA
		Date Analyzed :	06/30/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805778-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	NONE	300.0	5.0	4.5	90	90-110	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805778
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	NA	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/01/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805778-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	NONE	300.0	5.0	4.6	92	90-110	

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 06/24/08
Date Received : 06/26/08

Solids, Total Dissolved

Analysis Method : SM 2540 C
Test Notes :

Units : mg/L
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
AR-01-SW-080624-URS	K0805778-001	5	5	1	06/30/08	64	
EC-01-SW-080624-URS	K0805778-002	5	5	1	06/30/08	81	
ARV-04-SW-080624-URS	K0805778-003	5	5	1	06/30/08	77	
AR-02-SW-080624-URS	K0805778-004	5	5	1	06/30/08	50	
DAM-01-080624-URS	K0805778-005	5	5	1	06/30/08	160	
AD-02-080624-URS	K0805778-006	5	5	1	06/30/08	801	
SP-01-080624-URS	K0805778-007	5	5	1	06/30/08	23	
AD-01-080624-URS	K0805778-008	5	5	1	06/30/08	5060	
Method Blank	K0805778-MB	5	5	1	06/30/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 6/24/2008
Date Received : 6/26/2008
Date Prepared : NA
Date Analyzed : 06/30/08

Duplicate Summary
Inorganic Parameters

Sample Name : AD-02-080624-URS
Lab Code : K0805778-006DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Dissolved	SM 2540 C	5	801	839	820	5	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805778
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	NA	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	06/30/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805778-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Dissolved	NONE	SM 2540 C	718	778	108	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : 06/24/08
Date Received : 06/26/08

Solids, Total Suspended (TSS)

Analysis Method : SM 2540 D
Test Notes :

Units : mg/L
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
AR-01-SW-080624-URS	K0805778-001	5	5	1	06/30/08	ND	
EC-01-SW-080624-URS	K0805778-002	5	5	1	06/30/08	ND	
ARV-04-SW-080624-URS	K0805778-003	5	5	1	06/30/08	ND	
AR-02-SW-080624-URS	K0805778-004	5	5	1	06/30/08	ND	
DAM-01-080624-URS	K0805778-005	5	5	1	06/30/08	ND	
AD-02-080624-URS	K0805778-006	5	5	1	06/30/08	6	
SP-01-080624-URS	K0805778-007	5	5	1	06/30/08	ND	
AD-01-080624-URS	K0805778-008	5	5	1	06/30/08	ND	
Method Blank	K0805778-MB	5	5	1	06/30/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : NA
Sample Matrix : WATER

Service Request : K0805778
Date Collected : NA
Date Received : NA
Date Prepared : NA
Date Analyzed : 06/30/08

Duplicate Summary
Inorganic Parameters

Sample Name : Batch QC
Lab Code : K0805824-005DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Suspended (TSS)	SM 2540 D	5	ND	ND	ND	-	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805778
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	NA	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	06/30/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805778-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Suspended (TSS)	NONE	SM 2540 D	209	192	92	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Metals

Columbia Analytical Services

- Cover Page -
INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.:

Service Request: K0805778

Sample Name:	Lab Code:
Batch QC1D	K0805397-016D
Batch QC1S	K0805397-016S
Batch QC2D	K0805397-019D
Batch QC2S	K0805397-019S
AR-01-SW-080624-URS	K0805778-001 DISS
EC-01-SW-080624-URS	K0805778-002 DISS
ARV-04-SW-080624-URS	K0805778-003 DISS
AR-02-SW-080624-URS	K0805778-004 DISS
DAM-01-080624-URS	K0805778-005 DISS
AD-02-080624-URS	K0805778-006 DISS
SP-01-080624-URS	K0805778-007 DISS
AD-01-080624-URS	K0805778-008 DISS
Method Blank	K0805778-MB

Comments:

Approved By: SC **Date:** 7/18/08

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: AR-01-SW-080624-URS
Lab Code: K0805778-001 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.018	B	
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	0.02	U	
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	5.6	B	
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.016	B	
Zinc	6020	0.50	0.06	1.0	07/01/08	07/03/08	0.06	B	

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: EC-01-SW-080624-URS
Lab Code: K0805778-002 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.50	B	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.049		
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	7.82		
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	6.0	B	
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.023		
Zinc	6020	0.50	0.06	1.0	07/01/08	07/03/08	3.95		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: ARV-04-SW-080624-URS
Lab Code: K0805778-003 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.37	B	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.012	B	
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	1.89		
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	7.9	B	
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.011	B	
Zinc	6020	0.50	0.06	1.0	07/01/08	07/03/08	2.20		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: AR-02-SW-080624-URS
Lab Code: K0805778-004 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.29	B	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.025		
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	1.61		
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	4.6	B	
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.008	B	
Zinc	6020	0.50	0.06	1.0	07/01/08	07/03/08	2.15		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: DAM-01-080624-URS
Lab Code: K0805778-005 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	33.7		
Copper	6010B	10.0	0.8	1.0	07/01/08	07/03/08	4680		
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	1670		
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	8.370		
Zinc	6010B	10.0	0.6	1.0	07/01/08	07/03/08	6180		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: AD-02-080624-URS
Lab Code: K0805778-006 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	1.81		
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.598		
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	4.77		
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	53.6		
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.020		
Zinc	6010B	10.0	0.6	1.0	07/01/08	07/03/08	1200		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: SP-01-080624-URS
Lab Code: K0805778-007 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.10	B	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.839		
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	65.9		
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	20.3		
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.210		
Zinc	6020	0.50	0.06	1.0	07/01/08	07/03/08	132		

% Solids: 0.0

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: 6/24/08
Date Received: 6/26/08
Units: ug/L
Basis: N/A

Sample Name: AD-01-080624-URS
Lab Code: K0805778-008 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	3.19		
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	70.9		
Copper	6010B	1000	80.0	100.0	07/01/08	07/03/08	194000		
Iron	6010B	2000	400	100.0	07/01/08	07/03/08	748000		
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	8.640		
Zinc	6010B	1000	60.0	100.0	07/01/08	07/03/08	300000		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: NA
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805778
Date Collected: N/A
Date Received: N/A
Units: ug/L
Basis: N/A

Sample Name: Method Blank
Lab Code: K0805778-MB

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/01/08	07/03/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/01/08	07/03/08	0.008	U	
Copper	6010B	10.0	0.8	1.0	07/01/08	07/03/08	0.8	U	
Copper	6020	0.10	0.02	1.0	07/01/08	07/03/08	0.02	U	
Iron	6010B	20.0	4.0	1.0	07/01/08	07/03/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/01/08	07/03/08	0.003	U	
Zinc	6010B	10.0	0.6	1.0	07/01/08	07/03/08	0.9	B	
Zinc	6020	0.50	0.06	1.0	07/01/08	07/03/08	0.10	B	

% Solids: 0.0

Comments:

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Service Request: K0805778

Project No.: NA

Units: UG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: WATER

% Solids: 0.0

Sample Name: Batch QC1S

Lab Code: K0805397-016S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Copper	88 - 117	267		9.8	B	250.00	102.9		6010B
Iron		15100		13900		1000.00	120.0		6010B
Zinc	88 - 113	546		51.7		500.00	98.9		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Columbia Analytical Services

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client:	URS Corporation	Service Request:	K0805778
Project No.:	NA	Units:	UG/L
Project Name:	Blue Ledge Mine	Basis:	N/A
Matrix:	WATER	% Solids:	0.0

Sample Name: Batch QC2S Lab Code: K0805397-019S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	74 - 126	26.4		7.12		20.00	96.4		6020
Cadmium	84 - 113	20.5		0.258		20.00	101.2		6020
Copper	63 - 126	32.9		15.1		20.00	89.0		6020
Lead	71 - 119	39.1		18.3		20.00	104.0		6020
Zinc	62 - 126	78.5		59.0		20.00	97.5		6020

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0805778

Project No.: NA

Units: UG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: WATER

% Solids: 0.0

Sample Name: Batch QC1D

Lab Code: K0805397-016D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Copper		9.8	B	9.8	B	0.0		6010B
Iron	20	13900		13900		0.0		6010B
Zinc	20	51.7		52.0		0.6		6010B

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0805778

Project No.: NA

Units: UG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: WATER

% Solids: 0.0

Sample Name: Batch QC2D

Lab Code: K0805397-019D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic	20	7.12		6.93		2.7		6020
Cadmium	20	0.258		0.242		6.4		6020
Copper	20	15.1		14.8		2.0		6020
Lead	20	18.3		18.1		1.1		6020
Zinc	20	59.0		59.0		0.0		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

LABORATORY CONTROL SAMPLE

Client: URS Corporation **Service Request:** K0805778

Project No.: NA

Project Name: Blue Ledge Mine

Aqueous LCS Source: Inorganic Ventures **Solid LCS Source:**

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Arsenic	20	20.0	100.0						
Cadmium	20	19.1	95.5						
Calcium	12500	12200	97.6						
Copper	625	617	98.7						
Copper	20	19.8	99.0						
Iron	2500	2460	98.4						
Lead	20	19.6	98.0						
Magnesium	12500	12500	100.0						
Zinc	1250	1200	96.0						
Zinc	20	19.5	97.5						

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	URS Corporation	**Service Request:**	K0805778
Project:	Blue Ledge Mine	**Date Collected:**	06/24/08
Sample Matrix:	Water	**Date Received:**	06/26/08

Hardness as CaCO3

Prep Method:	CLAA	Units:	mg/L (ppm)
Analysis Method:	6010B/SM 2340B	Basis:	NA
Test Notes:			

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
AR-01-SW-080624-URS	K0805778-001	0.4	1	07/01/08	07/03/08	41.6	
EC-01-SW-080624-URS	K0805778-002	0.4	1	07/01/08	07/03/08	42.3	
ARV-04-SW-080624-URS	K0805778-003	0.4	1	07/01/08	07/03/08	39.3	
AR-02-SW-080624-URS	K0805778-004	0.4	1	07/01/08	07/03/08	41.1	
DAM-01-080624-URS	K0805778-005	0.4	1	07/01/08	07/03/08	63.5	
AD-02-080624-URS	K0805778-006	0.4	1	07/01/08	07/03/08	548	
SP-01-080624-URS	K0805778-007	0.4	1	07/01/08	07/03/08	31.0	
AD-01-080624-URS	K0805778-008	0.4	1	07/01/08	07/03/08	576	
Method Blank	K0805778-MB	0.4	1	07/01/08	07/03/08	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Blue Ledge Mine
Sample Matrix: Water

Service Request: K0805778
Date Collected: NA
Date Received: NA
Date Extracted: 07/01/08
Date Analyzed: 07/03/08

Duplicate Summary
Metals

Sample Name: Batch QC
Lab Code: K0805397-016D
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
Hardness as CaCO3	CLAA	6010B/SM 2340B	0.4	80.1	79.6	79.8	<1	

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Columbia Analytical Services INC.
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July 24, 2008 Analytical Report for Service Request No: K0805893

Christina Wheeler
URS Corporation
111 SW Columbia
Suite 1500
Portland, OR 97201-5850

RE: Blue Ledge Mine/25696770.00001

Dear Christina:

Enclosed are the results of the samples submitted to our laboratory on June 30, 2008. For your reference, these analyses have been assigned our service request number K0805893.

All analyses were performed according to our laboratory's quality assurance program. Where applicable, the methods cited conform to the Methods Update Rule (effective 4/11/2007), which relates to the use of analytical methods for the drinking water and waste water programs. The test results meet requirements of the NELAC standards. Exceptions are noted in the case narrative report where applicable. 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 3358. You may also contact me via Email at LHuckestein@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda Huckestein
Client Services Manager

LH/lb

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

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 percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
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.

Columbia Analytical Services, Inc.
Kelso, WA
State Certifications, Accreditations, and Licenses

Program	Number
Alaska DEC UST	UST-040
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2286
Colorado DPHE	-
Florida DOH	E87412
Hawaii DOH	-
Idaho DHW	-
Indiana DOH	C-WA-01
Louisiana DEQ	3016
Louisiana DHH	LA050010
Maine DHS	WA0035
Michigan DEQ	9949
Minnesota DOH	053-999-368
Montana DPHHS	CERT0047
Nevada DEP	WA35
New Jersey DEP	WA005
New Mexico ED	-
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon - DHS	WA200001
South Carolina DHEC	61002
Utah DOH	COLU
Washington DOE	C1203
Wisconsin DNR	998386840
Wyoming (EPA Region 8)	-

Case Narrative

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	URS Corporation	**Service Request No.:**	K0805893
Project:	Blue Ledge Mine	**Date Received:**	6/30/2008
Sample Matrix:	Water		

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

Twenty five water samples were received for analysis at Columbia Analytical Services on 6/30/2008. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

Dissolved Metals

No anomalies associated with the analysis of these samples were observed.

Approved by LAN **Date** 7/24/08

Chain of Custody Documentation

Columbia Analytical Services INC.
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CHAIN OF CUSTODY

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SR#: KC805543

PAGE 1 OF 3 COC #

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: VRS
111 SW COLUMBIA SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR. 97201
E-MAIL ADDRESS:
PHONE #: 503222-7200 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐	Hydrocarbons (*see below) Gas ☐ 8021 ☐ BTEX ☐ Diesel ☐ Oil ☐ ☐ Fuel Fingerprint (FIQ) ☐ NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	Hex-Chrom ☐	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	ALKALINITY (SM2320B)	HARDNESS (SM2340B)			REMARKS
EC-02-SW-080625-VRS	6/25/08	1115		W	3									X		X			X	X				
EC-03-SW-080625-VRS		1210		W	3									X		X			X	X				
EC-04-SW-080625-VRS		1350		W	3									X		X			X	X				
EC-04-SW-DUP-080625-VRS		1435		W	3									X		X			X	X				
EC-05-SW-080625-VRS		1530		W	6									X		X			X	X				①
EC-06-SW-080625-VRS		1650		W	3									X		X			X	X				
EC-07-SW-080625-VRS		1725		W	3									X		X			X	X				
JC-01-SW-080626-VRS	6/26/08	0811		W	3									X		X			X	X				
JC-02-SW-080626-VRS		1220		W	3									X		X			X	X				
JC-03-SW-080626-VRS		1340		W	3									X		X			X	X				

6/26/08

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
X V. EDD

INVOICE INFORMATION
P.O. # 25696770.00001
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:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:
① USE EXTRA VOLUME FOR MS/MSD
② 250 ml UNPRESERVED CONTAINERS + 500 ml HNO_3 CONTAINERS HAVE ALL BEEN FIELD FILTERED (FF).
[redacted]
4 COOLERS TOTAL

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [illegible]	Signature: [illegible]	Signature: [illegible]	Signature: [illegible]
Date/Time: 6/30/08	Date/Time: 6-30-08 10:20	Date/Time: 6-30-08 1230	Date/Time: 6/30/08 1235
Printed Name: EDWARD RAY	Printed Name: [illegible]	Printed Name: [illegible]	Printed Name: [illegible]
Firm: VRS	Firm: [illegible]	Firm: [illegible]	Firm: CAS

RCOC #1 06/03

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PAGE 2 OF 3 SR#: 1265893 COC #

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: VRS, 111 SW COLUMBIA, SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR. 97201
E-MAIL ADDRESS:
PHONE #: 5032227200 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (FIQ) ☐ NW-HCID Screen ☐	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	pH Cond.; Cl, SO_4, PO_4; F, NO_2; NO_3; BOD, CBOD, TSS, TDS (circle)	Hex-Chrom ☐	NH_3-N, COD, Total-P, TKN, TOC; DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	ALKALINITY (SM2320B)	HARDNESS (SM2340B)			REMARKS
JC-04-SW-080627-VRS	6/27/08	1630		W	3										X		X			X	X				
JC-07-SW-080626-VRS	6/26/08	1920		W	3										X		X			X	X				
JC-07-SW-DUP-080626-VRS	6/26/08	1922		W	3										X		X			X	X				
JC-08-SW-080626-VRS	6/26/08	1815		W	9										X		X			X	X				(1) see p. 1
JC-09-SW-080627-VRS	6/27/08	1105		W	3										X		X			X	X				
JC-10-SW-080627-VRS		1133		W	3										X		X			X	X				
JC-11-SW-080627-VRS		1150		W	3										X		X			X	X				
JC-12-SW-080627-VRS		1212		W	3										X		X			X	X				
JC-13-SW-080627-VRS		1240		W	3										X		X			X	X				
JC-14-SW-080627-VRS		1300		W	3										X		X			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
X V. EDD

INVOICE INFORMATION
P.O. # 25696770.00001
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:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:

[redacted]

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [illegible]	Signature: [illegible]	Signature: [illegible]	Signature: [illegible]
Date/Time: 6/30/08 1020	Date/Time: 6/30/08 10:20	Date/Time: 6/30/08 12:30	Date/Time: 6/30/08 1231
Printed Name: ENDLEE RAY	Printed Name: [illegible]	Printed Name: [illegible]	Printed Name: [illegible]
Firm: VRS	Firm: VRS	Firm: VRS	Firm: CAS

RCOC #1 06/03

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SR#: KC 805843

PAGE 3 OF 3 COC #

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25896770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: URS
111 SW COLUMBIA, SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR. 97201
E-MAIL ADDRESS:
PHONE #: 503 222 7200 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (FIQ) ☐ NW-HCID Screen ☐	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total & (Dissolved) (See list below)	Cyanide ☐	Hex-Chrom ☐	pH, Cond., Cl, SO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	ALKALINITY (SM2320B)	HARDNESS (SM2340B)			REMARKS
SC-15-SW-080627-URS	6/27/08	1325		W	3										X		X			X	X				
SP-02-080627-URS	↓	1705		W	3										X		X			X	X				
MG-01-SW-080627-URS	6/27/08	1625		W	3										X		X			X	X				
T45C-01-SW-080627-URS	6/27/08	1545		W	3										X		X			X	X				
T45C-02-SW-080627-URS	↓	1610		W	3										X		X			X	X				
																									~~TOTAL METALS~~ PM 6/30/08

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
X V. EDD

INVOICE INFORMATION
P.O. # 25896770.00001
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:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:

[redacted]

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature: [signature]	Signature: [signature]	Signature: [signature]
Date/Time: 6/30/08 / 1020	Date/Time: 6-30-08 10:20	Date/Time: 6/30/08 / 12:30	Date/Time: 6/30/08 1235
Printed Name: [signature]	Printed Name: [signature]	Printed Name: [signature]	Printed Name: [signature]
Firm: URS	Firm: CAS	Firm: CAS	Firm: CAS

BCOC #1 06/03

Columbia Analytical Services, Inc.

PC CH

Cooler Receipt and Preservation Form

Client / Project: URS Service Request K08 05843

Received: 6/30/08 Opened: 6/30/08 By: KSmith

1. Samples were received via? *US Mail* *Fed Ex* *UPS* *DHL* *GH* *GS* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA Y N
5. Temperature of cooler(s) upon receipt (°C): 6.5C .1C 7.4C 7.0C
   Temperature Blank (°C): 5.9C 6.4C 6.4C 6.5C
6. If applicable, list Chain of Custody Numbers: _____
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Packing material used. *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Sleeves* *Other* _____
9. **Did all bottles arrive in good condition (unbroken)?** *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* Y N
12. **Were appropriate bottles/containers and volumes received for the tests indicated?** NA Y N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials and 1631 Mercury bottles received without headspace? *Indicate in the table below.* NA Y N
15. **Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection?** NA Y N
16. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

*Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions: _____

General Chemistry Parameters

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0805893
Date Collected : 06/25-27/08
Date Received : 06/30/08

Alkalinity as CaCO3, Total

Units : mg/L
Basis : NA

Analysis Method : SM 2320 B
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
EC-02-SW-080625-URS	K0805893-001	2	1	1	07/01/08	43	
EC-03-SW-080625-URS	K0805893-002	2	1	1	07/02/08	41	
EC-04-SW-080625-URS	K0805893-003	2	1	1	07/02/08	42	
EC-04-SW-DUP-080625-URS	K0805893-004	2	1	1	07/02/08	44	
EC-05-SW-080625-URS	K0805893-005	2	1	1	07/02/08	42	
EC-06-SW-080625-URS	K0805893-006	2	1	1	07/02/08	38	
EC-07-SW-080625-URS	K0805893-007	2	1	1	07/02/08	47	
JC-01-SW-080625-URS	K0805893-008	2	1	1	07/02/08	35	
JC-02-SW-080625-URS	K0805893-009	2	1	1	07/02/08	33	
JC-03-SW-080625-URS	K0805893-010	2	1	1	07/02/08	31	
JC-04-SW-080627-URS	K0805893-011	2	1	1	07/02/08	32	
JC-07-SW-080626-URS	K0805893-012	2	1	1	07/02/08	20	
JC-07-SW-DUP-080626-URS	K0805893-013	2	1	1	07/02/08	22	
JC-08-SW-080626-URS	K0805893-014	2	1	1	07/02/08	21	
JC-09-SW-080627-URS	K0805893-015	2	1	1	07/02/08	22	
JC-10-SW-080627-URS	K0805893-016	2	1	1	07/02/08	25	
JC-11-SW-080627-URS	K0805893-017	2	1	1	07/02/08	25	
JC-12-SW-080627-URS	K0805893-018	2	1	1	07/02/08	24	
JC-13-SW-080627-URS	K0805893-019	2	1	1	07/02/08	25	
JC-14-SW-080627-URS	K0805893-020	2	1	1	07/02/08	26	
JC-15-SW-080627-URS	K0805893-021	2	1	1	07/02/08	26	
SP-02-080627-URS	K0805893-022	2	1	1	07/02/08	22	
MG-01-SW-080626-URS	K0805893-023	2	1	1	07/02/08	77	
T4JC-01-SW-080627-URS	K0805893-024	2	1	1	07/02/08	12	
T4JC-02-SW-080627-URS	K0805893-025	2	1	1	07/02/08	12	
Method Blank	K0805893-MB	2	1	1	07/02/08	ND	
Method Blank	K0805893-MB	2	1	1	07/02/08	ND	
Method Blank	K0805893-MB	2	1	1	07/01/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/25/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Duplicate Summary
Inorganic Parameters

Sample Name : EC-05-SW-080625-URS
Lab Code : K0805893-005DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Alkalinity as CaCO3, Total	SM 2320 B	2	42	42	42	<1	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/26/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Duplicate Summary
Inorganic Parameters

Sample Name : JC-08-SW-080626-URS
Lab Code : K0805893-014DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Alkalinity as CaCO3, Total	SM 2320 B	2	21	21	21	<1	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/01/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Alkalinity as CaCO3, Total	NONE	SM 2320 B	110	112	102	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Laboratory Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Alkalinity as CaCO3, Total	NONE	SM 2320 B	110	110	100	85-115	
Alkalinity as CaCO3, Total	NONE	SM 2320 B	110	108	98	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0805893
Date Collected : 06/25-27/08
Date Received : 06/30/08

Sulfate

Units : mg/L
Basis : NA

Analysis Method : 300.0
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
EC-02-SW-080625-URS	K0805893-001	0.2	0.012	2	07/02/08	3.0	
EC-03-SW-080625-URS	K0805893-002	0.2	0.012	2	07/02/08	3.0	
EC-04-SW-080625-URS	K0805893-003	0.2	0.012	2	07/02/08	3.0	
EC-04-SW-DUP-080625-URS	K0805893-004	0.2	0.012	2	07/02/08	2.9	
EC-05-SW-080625-URS	K0805893-005	0.2	0.012	2	07/02/08	3.0	
EC-06-SW-080625-URS	K0805893-006	0.2	0.012	2	07/02/08	3.1	
EC-07-SW-080625-URS	K0805893-007	0.2	0.012	2	07/02/08	2.8	
JC-01-SW-080625-URS	K0805893-008	0.2	0.012	2	07/02/08	5.1	
JC-02-SW-080625-URS	K0805893-009	0.2	0.012	2	07/02/08	5.1	
JC-03-SW-080625-URS	K0805893-010	0.2	0.012	2	07/02/08	5.1	
JC-04-SW-080627-URS	K0805893-011	0.2	0.012	2	07/02/08	5.1	
JC-07-SW-080626-URS	K0805893-012	0.2	0.012	2	07/02/08	3.6	
JC-07-SW-DUP-080626-URS	K0805893-013	0.2	0.012	2	07/02/08	3.6	
JC-08-SW-080626-URS	K0805893-014	0.2	0.012	2	07/03/08	2.8	
JC-09-SW-080627-URS	K0805893-015	0.2	0.012	2	07/02/08	2.3	
JC-10-SW-080627-URS	K0805893-016	0.2	0.012	2	07/02/08	2.5	
JC-11-SW-080627-URS	K0805893-017	0.2	0.012	2	07/02/08	2.5	
JC-12-SW-080627-URS	K0805893-018	0.2	0.012	2	07/02/08	2.5	
JC-13-SW-080627-URS	K0805893-019	0.2	0.012	2	07/03/08	2.5	
JC-14-SW-080627-URS	K0805893-020	0.2	0.012	2	07/03/08	2.5	
JC-15-SW-080627-URS	K0805893-021	0.2	0.012	2	07/03/08	2.5	
SP-02-080627-URS	K0805893-022	1.0	0.030	5	07/03/08	18.3	
MG-01-SW-080626-URS	K0805893-023	0.2	0.012	2	07/03/08	9.0	
T4JC-01-SW-080627-URS	K0805893-024	0.2	0.012	2	07/03/08	1.0	
T4JC-02-SW-080627-URS	K0805893-025	0.2	0.012	2	07/03/08	1.0	
Method Blank	K0805893-MB	0.2	0.006	1	07/02/08	ND	
Method Blank	K0805893-MB	0.2	0.006	1	07/03/08	ND	
Method Blank	K0805893-MB	0.2	0.006	1	07/02/08	ND	

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/25/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Duplicate Summary
Inorganic Parameters

Sample Name :	EC-05-SW-080625-URS	Units :	mg/L
Lab Code :	K0805893-005DUP	Basis :	NA
Test Notes :			

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Sulfate	300.0	0.2	3.0	3.0	3.0	<1	

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/26/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/03/08

Duplicate Summary
Inorganic Parameters

Sample Name :	JC-08-SW-080626-URS	Units :	mg/L
Lab Code :	K0805893-014DUP	Basis :	NA
Test Notes :			

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Sulfate	300.0	0.2	2.8	2.7	2.8	4	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0805893
Date Collected : 6/25/2008
Date Received : 6/30/2008
Date Prepared : NA
Date Analyzed : 07/02/08

Matrix Spike Summary
Inorganic Parameters

Sample Name : EC-05-SW-080625-URS
Lab Code : K0805893-005MS
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	300.0	0.2	4.0	3.0	6.9	97	80-120	

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/26/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/03/08

Matrix Spike Summary
Inorganic Parameters

Sample Name :	JC-08-SW-080626-URS	Units :	mg/L
Lab Code :	K0805893-014MS	Basis :	NA
Test Notes :			

Analyte	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	300.0	0.2	4.0	2.8	6.7	98	80-120	

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	NONE	300.0	5.0	4.6	92	90-110	
Sulfate	NONE	300.0	5.0	4.6	92	90-110	

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/03/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	NONE	300.0	5.0	4.6	92	90-110	

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0805893
Date Collected : 06/25-27/08
Date Received : 06/30/08

Solids, Total Dissolved

Units : mg/L
Basis : NA

Analysis Method : SM 2540 C
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
EC-02-SW-080625-URS	K0805893-001	5	5	1	07/01/08	77	
EC-03-SW-080625-URS	K0805893-002	5	5	1	07/01/08	76	
EC-04-SW-080625-URS	K0805893-003	5	5	1	07/01/08	64	
EC-04-SW-DUP-080625-URS	K0805893-004	5	5	1	07/01/08	82	
EC-05-SW-080625-URS	K0805893-005	5	5	1	07/01/08	66	
EC-06-SW-080625-URS	K0805893-006	5	5	1	07/01/08	73	
EC-07-SW-080625-URS	K0805893-007	5	5	1	07/01/08	71	
JC-01-SW-080625-URS	K0805893-008	5	5	1	07/02/08	48	
JC-02-SW-080625-URS	K0805893-009	5	5	1	07/02/08	37	
JC-03-SW-080625-URS	K0805893-010	5	5	1	07/02/08	55	
JC-04-SW-080627-URS	K0805893-011	5	5	1	07/02/08	40	
JC-07-SW-080626-URS	K0805893-012	5	5	1	07/02/08	43	
JC-07-SW-DUP-080626-URS	K0805893-013	5	5	1	07/02/08	15	
JC-08-SW-080626-URS	K0805893-014	5	5	1	07/02/08	21	
JC-09-SW-080627-URS	K0805893-015	5	5	1	07/02/08	15	
JC-10-SW-080627-URS	K0805893-016	5	5	1	07/02/08	26	
JC-11-SW-080627-URS	K0805893-017	5	5	1	07/02/08	14	
JC-12-SW-080627-URS	K0805893-018	5	5	1	07/02/08	33	
JC-13-SW-080627-URS	K0805893-019	5	5	1	07/02/08	29	
JC-14-SW-080627-URS	K0805893-020	5	5	1	07/02/08	17	
JC-15-SW-080627-URS	K0805893-021	5	5	1	07/02/08	18	
SP-02-080627-URS	K0805893-022	5	5	1	07/02/08	81	
MG-01-SW-080626-URS	K0805893-023	5	5	1	07/02/08	120	
T4JC-01-SW-080627-URS	K0805893-024	5	5	1	07/02/08	24	
T4JC-02-SW-080627-URS	K0805893-025	5	5	1	07/02/08	23	
Method Blank	K0805893-MB	5	5	1	07/01/08	ND	
Method Blank	K0805893-MB	5	5	1	07/02/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/25/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/01/08

Duplicate Summary
Inorganic Parameters

Sample Name :	EC-05-SW-080625-URS	Units :	mg/L
Lab Code :	K0805893-005DUP	Basis :	NA
Test Notes :			

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Dissolved	SM 2540 C	5	66	61	64	8	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/26/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Duplicate Summary
Inorganic Parameters

Sample Name : JC-08-SW-080626-URS
Lab Code : K0805893-014DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Dissolved	SM 2540 C	5	21	21	21	<1	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/01/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Dissolved	NONE	SM 2540 C	718	770	107	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Dissolved	NONE	SM 2540 C	718	742	103	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0805893
Date Collected : 06/25-27/08
Date Received : 06/30/08

Solids, Total Suspended (TSS)

Units : mg/L
Basis : NA

Analysis Method : SM 2540 D
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
EC-02-SW-080625-URS	K0805893-001	5	5	1	07/01/08	ND	
EC-03-SW-080625-URS	K0805893-002	5	5	1	07/01/08	ND	
EC-04-SW-080625-URS	K0805893-003	5	5	1	07/01/08	ND	
EC-04-SW-DUP-080625-URS	K0805893-004	5	5	1	07/01/08	ND	
EC-05-SW-080625-URS	K0805893-005	5	5	1	07/01/08	ND	
EC-06-SW-080625-URS	K0805893-006	5	5	1	07/01/08	ND	
EC-07-SW-080625-URS	K0805893-007	5	5	1	07/01/08	ND	
JC-01-SW-080625-URS	K0805893-008	5	5	1	07/02/08	ND	
JC-02-SW-080625-URS	K0805893-009	5	5	1	07/02/08	ND	
JC-03-SW-080625-URS	K0805893-010	5	5	1	07/02/08	ND	
JC-04-SW-080627-URS	K0805893-011	5	5	1	07/02/08	ND	
JC-07-SW-080626-URS	K0805893-012	5	5	1	07/02/08	ND	
JC-07-SW-DUP-080626-URS	K0805893-013	5	5	1	07/02/08	ND	
JC-08-SW-080626-URS	K0805893-014	5	5	1	07/02/08	ND	
JC-09-SW-080627-URS	K0805893-015	5	5	1	07/02/08	ND	
JC-10-SW-080627-URS	K0805893-016	5	5	1	07/02/08	ND	
JC-11-SW-080627-URS	K0805893-017	5	5	1	07/02/08	ND	
JC-12-SW-080627-URS	K0805893-018	5	5	1	07/02/08	ND	
JC-13-SW-080627-URS	K0805893-019	5	5	1	07/02/08	ND	
JC-14-SW-080627-URS	K0805893-020	5	5	1	07/02/08	ND	
JC-15-SW-080627-URS	K0805893-021	5	5	1	07/02/08	ND	
SP-02-080627-URS	K0805893-022	5	5	1	07/02/08	ND	
MG-01-SW-080626-URS	K0805893-023	5	5	1	07/02/08	ND	
T4JC-01-SW-080627-URS	K0805893-024	5	5	1	07/02/08	ND	
T4JC-02-SW-080627-URS	K0805893-025	5	5	1	07/02/08	ND	
Method Blank	K0805893-MB	5	5	1	07/01/08	ND	
Method Blank	K0805893-MB	5	5	1	07/02/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/25/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/01/08

Duplicate Summary
Inorganic Parameters

Sample Name :	EC-05-SW-080625-URS	Units :	mg/L
Lab Code :	K0805893-005DUP	Basis :	NA
Test Notes :			

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Suspended (TSS)	SM 2540 D	5	ND	ND	ND	-	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	6/26/2008
Project Number :	25696770.00001	**Date Received :**	6/30/2008
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Duplicate Summary
Inorganic Parameters

Sample Name :	JC-08-SW-080626-URS	Units :	mg/L
Lab Code :	K0805893-014DUP	Basis :	NA
Test Notes :			

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Suspended (TSS)	SM 2540 D	5	ND	ND	ND	-	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By:CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/01/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Suspended (TSS)	NONE	SM 2540 D	209	216	103	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0805893
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/02/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0805893-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Suspended (TSS)	NONE	SM 2540 D	209	210	100	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

Report By: CMIHAI-LAZAR

Metals

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Water

Service Request: K0805893
Date Collected: 06/25/08
Date Received: 06/30/08

Hardness as CaCO3

Prep Method: CLAA
Analysis Method: 6010B/SM 2340B
Test Notes:

Units: mg/L (ppm)
Basis: NA

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
EC-02-SW-080625-URS	K0805893-001	0.4	1	07/08/08	07/10/08	43.9	
EC-03-SW-080625-URS	K0805893-002	0.4	1	07/08/08	07/10/08	44.3	
EC-04-SW-080625-URS	K0805893-003	0.4	1	07/08/08	07/10/08	44.0	
EC-04-SW-DUP-080625-URS	K0805893-004	0.4	1	07/08/08	07/10/08	43.1	
EC-05-SW-080625-URS	K0805893-005	0.4	1	07/08/08	07/10/08	43.4	
EC-06-SW-080625-URS	K0805893-006	0.4	1	07/08/08	07/10/08	40.4	
EC-07-SW-080625-URS	K0805893-007	0.4	1	07/08/08	07/10/08	44.9	
JC-01-SW-080625-URS	K0805893-008	0.4	1	07/08/08	07/10/08	37.0	
JC-02-SW-080625-URS	K0805893-009	0.4	1	07/08/08	07/10/08	37.1	
JC-03-SW-080625-URS	K0805893-010	0.4	1	07/08/08	07/10/08	36.4	
JC-04-SW-080627-URS	K0805893-011	0.4	1	07/08/08	07/10/08	35.0	
JC-07-SW-080626-URS	K0805893-012	0.4	1	07/08/08	07/10/08	20.8	
JC-07-SW-DUP-080626-URS	K0805893-013	0.4	1	07/08/08	07/10/08	20.9	
JC-08-SW-080626-URS	K0805893-014	0.4	1	07/08/08	07/10/08	20.6	
JC-09-SW-080627-URS	K0805893-015	0.4	1	07/08/08	07/10/08	21.3	
JC-10-SW-080627-URS	K0805893-016	0.4	1	07/08/08	07/10/08	24.5	
JC-11-SW-080627-URS	K0805893-017	0.4	1	07/08/08	07/10/08	23.8	
JC-12-SW-080627-URS	K0805893-018	0.4	1	07/08/08	07/10/08	23.6	
JC-13-SW-080627-URS	K0805893-019	0.4	1	07/08/08	07/10/08	24.0	
JC-14-SW-080627-URS	K0805893-020	0.4	1	07/08/08	07/10/08	23.8	
JC-15-SW-080627-URS	K0805893-021	0.4	1	07/08/08	07/10/08	23.9	
SP-02-080627-URS	K0805893-022	0.4	1	07/08/08	07/10/08	36.8	
MG-01-SW-080626-URS	K0805893-023	0.4	1	07/08/08	07/10/08	82.2	
T4JC-01-SW-080627-URS	K0805893-024	0.4	1	07/08/08	07/10/08	11.5	
T4JC-02-SW-080627-URS	K0805893-025	0.4	1	07/08/08	07/10/08	11.5	
Method Blank	K0805893-MB1	0.4	1	07/08/08	07/10/08	ND	
Method Blank	K0805893-MB2	0.4	1	07/08/08	07/10/08	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Water

Service Request: K0805893
Date Collected: 06/25/08
Date Received: 06/30/08
Date Extracted: 07/08/08
Date Analyzed: 07/10/08

Duplicate Summary
Metals

Sample Name: EC-05-SW-080625-URS
Lab Code: K0805893-005D
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
Hardness as CaCO3	CLAA	6010B/SM 2340B	0.4	43.4	43.5	43.4	<1	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Water

Service Request: K0805893
Date Collected: 06/26/08
Date Received: 06/30/08
Date Extracted: 07/08/08
Date Analyzed: 07/10/08

Duplicate Summary
Metals

Sample Name: JC-08-SE-080626-URS
Lab Code: K0805893-014D
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
Hardness as CaCO3	CLAA	6010B/SM 2340B	0.4	20.6	20.1	20.4	2	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Water

Service Request: K0805893
Date Collected: 06/27/08
Date Received: 06/30/08
Date Extracted: 07/08/08
Date Analyzed: 07/10/08

Duplicate Summary
Metals

Sample Name: JC-15-SE-080627-URS
Lab Code: K0805893-021D
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
Hardness as CaCO3	CLAA	6010B/SM 2340B	0.4	23.9	23.6	23.8	1	

Columbia Analytical Services

- Cover Page -
INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.: 25696770.00001

Service Request: K0805893

Sample Name:	Lab Code:
Batch QC1D	K0805868-008D
Batch QC1S	K0805868-008S
EC-02-SW-080625-URS	K0805893-001 DISS
EC-03-SW-080625-URS	K0805893-002 DISS
EC-04-SW-080625-URS	K0805893-003 DISS
EC-04-SW-DUP-080625-URS	K0805893-004 DISS
EC-05-SW-080625-URS	K0805893-005 DISS
EC-05-SW-080625-URSD	K0805893-005D DISS
EC-05-SW-080625-URSS	K0805893-005S DISS
EC-06-SW-080625-URS	K0805893-006 DISS
EC-07-SW-080625-URS	K0805893-007 DISS
JC-01-SW-080625-URS	K0805893-008 DISS
JC-02-SW-080625-URS	K0805893-009 DISS
JC-03-SW-080625-URS	K0805893-010 DISS
JC-04-SW-080627-URS	K0805893-011 DISS
JC-07-SW-080626-URS	K0805893-012 DISS
JC-07-SW-DUP-080626-URS	K0805893-013 DISS
JC-08-SW-080626-URS	K0805893-014 DISS
JC-08-SW-080626-URSD	K0805893-014D DISS
JC-08-SW-080626-URSS	K0805893-014S DISS
JC-09-SW-080627-URS	K0805893-015 DISS
JC-10-SW-080627-URS	K0805893-016 DISS
JC-11-SW-080627-URS	K0805893-017 DISS
JC-12-SW-080627-URS	K0805893-018 DISS
JC-13-SW-080627-URS	K0805893-019 DISS
JC-14-SW-080627-URS	K0805893-020 DISS
JC-15-SW-080627-URS	K0805893-021 DISS
JC-15-SW-080627-URSD	K0805893-021D DISS
JC-15-SW-080627-URSS	K0805893-021S DISS
SP-02-080627-URS	K0805893-022 DISS
MG-01-SW-080626-URS	K0805893-023 DISS
T4JC-01-SW-080627-URS	K0805893-024 DISS
T4JC-02-SW-080627-URS	K0805893-025 DISS
Method Blank	K0805893-MB
Method Blank	K0805893-MB2

Comments:

Approved By: _____ **Date:** 7/22/08

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-02-SW-080625-URS
Lab Code: K0805893-001 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.37	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.038		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	3.62		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.008	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	4.94		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-03-SW-080625-URS
Lab Code: K0805893-002 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.31	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.046		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	3.22		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	B	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.015	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	4.38		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-04-SW-080625-URS
Lab Code: K0805893-003 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.37	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.040		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	3.22		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.012	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	3.82		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-04-SW-DUP-080625-URS
Lab Code: K0805893-004 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.40	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.049		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	3.25		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.013	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	4.73		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-05-SW-080625-URS
Lab Code: K0805893-005 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.39	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.042		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	3.03		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.008	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	3.49		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-06-SW-080625-URS
Lab Code: K0805893-006 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.22	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.180		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	13.9		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.016	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	22.3		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/25/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: EC-07-SW-080625-URS
Lab Code: K0805893-007 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.35	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.46		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.011	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.61		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/26/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-01-SW-080625-URS
Lab Code: K0805893-008 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.564		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	31.3		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.014	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	79.4		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/26/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-02-SW-080625-URS
Lab Code: K0805893-009 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.519		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	35.6		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.014	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	69.3		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/26/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-03-SW-080625-URS
Lab Code: K0805893-010 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.496		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	34.9		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.017	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	63.7		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-04-SW-080627-URS
Lab Code: K0805893-011 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.504		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	31.8		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	5.1	B	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.014	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	61.2		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/26/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-07-SW-080626-URS
Lab Code: K0805893-012 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.537		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	62.8		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.060		
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	88.5		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/26/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-07-SW-DUP-080626-URS **Lab Code:** K0805893-013 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.519		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	62.4		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.066		
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	87.6		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/26/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-08-SW-080626-URS
Lab Code: K0805893-014 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.228		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	29.0		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.043		
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	42.9		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-09-SW-080627-URS
Lab Code: K0805893-015 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.031		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	3.45		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.014	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	6.01		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-10-SW-080627-URS
Lab Code: K0805893-016 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.77		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.007	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.65		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-11-SW-080627-URS
Lab Code: K0805893-017 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.08	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.75		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.010	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.49	B	

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-12-SW-080627-URS
Lab Code: K0805893-018 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.73		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.007	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.75		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-13-SW-080627-URS
Lab Code: K0805893-019 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.84		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.008	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.82		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-14-SW-080627-URS
Lab Code: K0805893-020 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.71		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.013	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	1.10		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: JC-15-SW-080627-URS
Lab Code: K0805893-021 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.74		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.012	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.92		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: SP-02-080627-URS
Lab Code: K0805893-022 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	5.450		
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	699		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.219		
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	913		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: MG-01-SW-080626-URS
Lab Code: K0805893-023 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.29	B	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.51		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	22.4		
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.010	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	1.13		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: T4JC-01-SW-080627-URS
Lab Code: K0805893-024 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.86		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.035		
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	1.90		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected: 6/27/08
Date Received: 6/30/08
Units: ug/L
Basis: N/A

Sample Name: T4JC-02-SW-080627-URS
Lab Code: K0805893-025 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.89		
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	7.4	B	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.009	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	1.93		

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected:
Date Received:
Units: ug/L
Basis: N/A

Sample Name: Method Blank
Lab Code: K0805893-MB

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.02	U	
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.003	U	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.06	U	

% Solids: 0.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0805893
Date Collected:
Date Received:
Units: ug/L
Basis: N/A

Sample Name: Method Blank
Lab Code: K0805893-MB2

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/18/08	07/10/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/18/08	07/10/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/18/08	07/10/08	0.02	U	
Iron	6010B	20.0	4.0	1.0	07/18/08	07/10/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/18/08	07/10/08	0.009	B	
Zinc	6020	0.50	0.06	1.0	07/18/08	07/10/08	0.06	U	

% Solids: 0.0

Comments:

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0805893

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: EC-05-SW-080625-URSS

Lab Code: K0805893-005S DISS

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	74 - 126	20.8		0.39	B	20.00	102.0		6020
Cadmium	84 - 113	20.6		0.042		20.00	102.8		6020
Copper	63 - 126	23.3		3.03		20.00	101.4		6020
Iron	68 - 135	1020		4.0	U	1000.00	102.0		6010B
Lead	71 - 119	20.3		0.008	B	20.00	101.5		6020
Zinc	62 - 126	24.1		3.49		20.00	103.0		6020

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0805893

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: JC-08-SW-080626-URSS

Lab Code: K0805893-014S DISS

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	74 - 126	20.3		0.07	U	20.00	101.5		6020
Cadmium	84 - 113	21.2		0.228		20.00	104.9		6020
Copper	63 - 126	48.0		29.0		20.00	95.0		6020
Iron	68 - 135	1040		4.0	U	1000.00	104.0		6010B
Lead	71 - 119	21.1		0.043		20.00	105.3		6020
Zinc	62 - 126	63.2		42.9		20.00	101.5		6020

An empty field in the Control Limit column indicates the control limit is not applicabl

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0805893

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: JC-15-SW-080627-URSS

Lab Code: K0805893-021S DISS

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Iron	68 - 135	1010		4.0	U	1000.00	101.0		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0805893

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: Batch QC1S

Lab Code: K0805868-008S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	74 - 126	20.5		0.43	B	20.00	100.4		6020
Cadmium	84 - 113	20.4		0.131		20.00	101.3		6020
Copper	63 - 126	19.7		0.50		20.00	96.0		6020
Lead	71 - 119	20.0		0.164		20.00	99.2		6020
Zinc	62 - 126	23.9		4.99		20.00	94.6		6020

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0805893

Project No.: 25696770.00001

Units: UG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: WATER

% Solids: 0.0

Sample Name: EC-05-SW-080625-URSD

Lab Code: K0805893-005D DISS

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.39	B	0.35	B	10.8		6020
Cadmium		0.042		0.040		4.9		6020
Copper	20	3.03		3.06		1.0		6020
Iron		4.0	U	4.0	U			6010B
Lead		0.008	B	0.007	B	13.3		6020
Zinc	20	3.49		4.05		14.9		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0805893

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: JC-08-SW-080626-URSD

Lab Code: K0805893-014D DISS

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.07	U	0.07	U			6020
Cadmium	20	0.228		0.246		7.6		6020
Copper	20	29.0		27.9		3.9		6020
Iron		4.0	U	4.0	U			6010B
Lead		0.043		0.046		6.7		6020
Zinc	20	42.9		42.9		0.0		6020

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0805893

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: JC-15-SW-080627-URSD

Lab Code: K0805893-021D DISS

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Iron		4.0	U	4.0	U			6010B

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0805893

Project No.: 25696770.00001

Units: UG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: WATER

% Solids: 0.0

Sample Name: Batch QC1D

Lab Code: K0805868-008D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.43	B	0.36	B	17.7		6020
Cadmium	20	0.131		0.132		0.8		6020
Copper		0.50		0.48		4.1		6020
Lead	20	0.164		0.159		3.1		6020
Zinc	20	4.99		4.72		5.6		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

Metals

- 7 -

LABORATORY CONTROL SAMPLE

Client: URS Corporation

Service Request: K0805893

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source: Inorganic Ventures

Solid LCS Source:

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits	Solid (mg/kg) %R
Arsenic	20	20.5	102.5					
Cadmium	20	20.4	102.0					
Calcium	12500	12600	100.8					
Copper	20	20.3	101.5					
Iron	2500	2510	100.4					
Lead	20	20.3	101.5					
Magnesium	12500	13300	106.4					
Zinc	20	20.3	101.5					

Metals

LABORATORY CONTROL SAMPLE

Client: URS Corporation

Service Request: K0805893

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source: Inorganic Ventures

Solid LCS Source:

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits	%R
Arsenic	20	20.1	100.5					
Cadmium	20	20.7	103.5					
Calcium	12500	13000	104.0					
Copper	20	20.4	102.0					
Iron	2500	2560	102.4					
Lead	20	20.7	103.5					
Magnesium	12500	13700	109.6					
Zinc	20	20.4	102.0					

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Columbia Analytical Services INC.
An Employee - Owned Company

July 24, 2008 Analytical Report for Service Request No: K0805944

Christina Wheeler
URS Corporation
111 SW Columbia
Suite 1500
Portland, OR 97201-5850

RE: Blue Ledge Mine/25696770.00001

Dear Christina:

Enclosed are the results of the samples submitted to our laboratory on July 01, 2008. For your reference, these analyses have been assigned our service request number K0805944.

All analyses were performed according to our laboratory's quality assurance program. Where applicable, the methods cited conform to the Methods Update Rule (effective 4/11/2007), which relates to the use of analytical methods for the drinking water and waste water programs. The test results meet requirements of the NELAC standards. Exceptions are noted in the case narrative report where applicable. 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 3358. You may also contact me via Email at LHuckestein@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda Huckestein
Client Services Manager

LH/lb

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

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 percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
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.

Columbia Analytical Services, Inc.
Kelso, WA
State Certifications, Accreditations, and Licenses

Program	Number
Alaska DEC UST	UST-040
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2286
Colorado DPHE	-
Florida DOH	E87412
Hawaii DOH	-
Idaho DHW	-
Indiana DOH	C-WA-01
Louisiana DEQ	3016
Louisiana DHH	LA050010
Maine DHS	WA0035
Michigan DEQ	9949
Minnesota DOH	053-999-368
Montana DPHHS	CERT0047
Nevada DEP	WA35
New Jersey DEP	WA005
New Mexico ED	-
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon - DHS	WA200001
South Carolina DHEC	61002
Utah DOH	COLU
Washington DOE	C1203
Wisconsin DNR	998386840
Wyoming (EPA Region 8)	-

Case Narrative

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	URS Corporation	**Service Request No.:**	K0805944
Project:	Blue Ledge Mine	**Date Received:**	7/1/2008
Sample Matrix:	Sediment		

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 seven sediment samples were received for analysis at Columbia Analytical Services on 7/1/2008. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

Total Metals

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recoveries of Iron for samples EC-07-RS-080625-URS, JC-08-SD-080626-URS, and JC-12-SD-080627-URS are not applicable. The analyte concentration in the samples was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recoveries.

Relative Percent Difference Exceptions:
The Relative Percent Difference (RPD) for the replicate analysis of Arsenic in sample JC-08-SD-080626-URS was outside the normal CAS control limits. The variability in the results is attributed to the heterogeneous character of the sample. Standard mixing techniques were used, but were not sufficient for complete homogenization of this sample.

The control criteria for matrix spike recovery of Lead for sample JC-12-SD-080627-URS is not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

Approved by _____ **Date** 7/24/08

Chain of Custody Documentation

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CHAIN OF CUSTODY

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SR#: N080 5944

PAGE 21 OF _____ COC # _____

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: URS
CITY/STATE/ZIP: 111 SW COLUMBIA, SUITE 180
E-MAIL ADDRESS:
PHONE #: 503 222 7200 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐ Fuel Fingerprint (FIQ) NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	pH, Cond, Cl, SO4, PO4, F, NO2, NO3, BOD, TSS, TDS (circle)	Hex-Chrom ☐	NH3-N, COD, Total-P, TKN, TOC, DOC (circle) NO2+NO3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	% Moisture	Particle Size (PSD/Hydro)			REMARKS
ARC-01-RS-080624-URS	6/24/08	1658		S	2									X						X	X			
ARC-01-SD-080624-URS		1645		S	2									X						X	X			
ARC-02-SD-080624-URS		1558		S	2									X						X	X			
ARV-01-SD-080624-URS		1533		S	2									X						X	X			
~~ARV-02-080624-URS~~		1520		S	2									X						X	X			
ARV-02-SD-080624-URS																								
ARV-03-SD-080624-URS		1225		S	2									X						X	X			
ARV-04-SD-080624-URS		1250		S	2									X						X	X			
ER-01-RS-080624-URS		1745		S	2									X						X	X			
ER-01-SD-080624-URS		1735		S	2									X						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
X V. EDD

INVOICE INFORMATION
P.O. # 25696770.00001
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:
Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg
Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

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

SPECIAL INSTRUCTIONS/COMMENTS:
SOIL + SEDIMENT RESULTS SHOULD BE REPORTED ON A DRY WEIGHT BASIS

Container Supply Number
9160

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature] Date/Time: 7/11/08 1025	Signature: [signature] Date/Time: 7/08 1025	Signature: Date/Time:	Signature: Tracy Black Date/Time: 7/11/08
Printed Name: JENNIFER BAKER Firm: URS	Printed Name: [signature] Firm: MS	Printed Name: Firm:	Printed Name: Tracy Black Firm: TAI

BCOC #1 06/03

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SR#: K0805944

PAGE 32 OF _____ COC # _____

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696.770.0001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: ORS
111 SW COLUMBIA, SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR. 97201
E-MAIL ADDRESS:
PHONE #: 503 222 7700 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐ Fuel Fingerprint (FIQ) NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	Hex-Chrom ☐	pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	% MOISTURE	PARTICLE SIZE (PSD PLOTS)			REMARKS
EC-02-RS-080625-UNS	6/25/08	1136		S	2									X						X	X			
EC-02-SD-080625-UNS		1120		S	2									X						X	X			
EC-03-SD-080625-UNS		1215		S	2									X						X	X			
EC-04-SD-080625-UNS		1355		S	2									X						X	X			
EC-04-SD-DUP-080625-UNS		1400		S	2									X						X	X			
EC-05-RS-080625-UNS		1550		S	2									X						X	X			
EC-05-RS-DUP-080625-UNS		1553		S	2									X						X	X			
EC-05-SD-080625-UNS		1540		S	~~2~~ 2									X						X	X			
EC-06-SD-080625-UNS		1650		S	2									X						X	X			
EC-07-RS-080625-UNS		1730		S	4									X						X	X			①

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
X V. EDD

INVOICE INFORMATION
P.O. # 25696.770.0001
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:
Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg
Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

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

SPECIAL INSTRUCTIONS/COMMENTS:
① USE EXTRA VOLUME FOR MS/MSD

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [illegible]	Signature: [illegible]	Signature:	Signature: Tracy Black
Date/Time: 7/1/08 1025	Date/Time: 7/1/08 1025	Date/Time:	Date/Time: 7/1/08 1410
Printed Name: [illegible]	Printed Name: [illegible]	Printed Name:	Printed Name: Tracy Black
Firm: ORS	Firm: ORS	Firm:	Firm: ORS

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SR#: K0805944

PAGE 43 OF _____ COC # _____

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: URS
111 SW Columbia
CITY/STATE/ZIP: Suite 1500
97201
E-MAIL ADDRESS:
PHONE #: 503-222-7200
FAX#:
SAMPLER'S SIGNATURE: [signature]

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (FIO) NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals (Total or Dissolved) (See list below)	Cyanide ☐ Hex-Chrom ☐	pH, Cond, Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	% Moisture	Particle Size (PSEP 10/22)			REMARKS
EC-07-SD-080625-URS	6/25	1730		S	2										X						X	X			
JC-01-SD-080626-URS	6/26	1115		S	2										X						X	X			
JC-01-RS-080626-URS	6/26	1120		S	2										X						X	X			
JC-02-SD-080626-URS	6/26	1225		S	2										X						X	X			
JC-03-RS-080626-URS	↓	1350		S	2										X						X	X			
JC-03-SD-080626-URS	↓	1345		S	2										X						X	X			
JC-04-RS-080627-URS	6/27	1640		S	2										X						X	X			
JC-04-SD-080627-URS	↓	1635		S	2										X						X	X			
JC-08-SD-080626-URS	6/26	1825		S	4										X						X	X			① see p2
JC-10-SD-080627-URS	6/27	1133		S	2										X						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
X V. EDD

INVOICE INFORMATION
P.O. # 25696770.00001
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:
Total Metals: Al (As) Sb Ba Be B Ca (Cd) Co Cr (Cu) (Fe) (Pb) Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V (Zn) Hg
Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

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

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature: [signature]	Signature:	Signature: Tracy Black
Date/Time: 7/1/08 1025	Date/Time: 7/1/08 1825	Date/Time:	Date/Time: 7/1/08 1410
Printed Name: Scott Ploy	Printed Name: [signature]	Printed Name:	Printed Name: Tracy Black
Firm: URS	Firm: URS	Firm:	Firm: OAI

10

Columbia Analytical Services
An Employee - Owned Company

CHAIN OF CUSTODY

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

SR#: K0805944

PAGE 4 OF ____ COC #____

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: URS
CITY/STATE/ZIP: 111 SW COLUMBIA, SUITE 1500
E-MAIL ADDRESS:
PHONE #: 5032227200 FAX#:
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (FIQ) NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total or Dissolved (See list below)	Cyanide ☐	Hex-Chrom ☐	pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS (circle)	NH_3-N, COD, Total-P, TKN, TOC, DOC (circle) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	% Moisture	Particle Size (Sieve)			REMARKS
CC-05-SD-DUP-080627-UVS	6/27/08	1545			2										X						X	X			
SC-11-SD-080627-UVS	6/27/08	1200			2										X						X	X			
SC-12-RS-080627-UVS		1225			2										X						X	X			
SC-12-SD-080627-UVS		1215			4										X						X	X			(1) see p2
SC-13-SD-080627-UVS		1245			2										X						X	X			
SC-14-RS-080627-UVS		1310			2										X						X	X			
SC-14-SD-080627-UVS		1305			2										X						X	X			
SC-15-SD-080627-UVS		1330			2										X						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
X V. EDD

INVOICE INFORMATION
P.O. # 25696770.00001
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:
Total Metals: Al (As) Sb Ba Be B Ca (Cd) Co Cr (Cu) (Fe) (Pb) Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V (Zn) Hg
Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

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

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [illegible]	Signature: [illegible]	Signature:	Signature: Tony Black
Date/Time: 7/1/08 1025	Date/Time: 7/1/08 10:25	Date/Time:	Date/Time: 7/1/08 1410
Printed Name: [illegible]	Printed Name: [illegible]	Printed Name:	Printed Name: Tony Black
Firm: URS	Firm: CAS	Firm:	Firm: CAS

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC LH

Client / Project: URS Service Request K08 05944

Received: 07/01/08 Opened: 07/01/08 By: SB

1. Samples were received via? *US Mail* *Fed Ex* *UPS* *DHL* *GH* *GS* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA Y N
5. Temperature of cooler(s) upon receipt (°C): 1.2 5.2
   Temperature Blank (°C): 7.1 3.1
6. If applicable, list Chain of Custody Numbers:
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Packing material used. *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Sleeves* *Other* _____
9. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* Y N
12. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials and 1631 Mercury bottles received without headspace? *Indicate in the table below.* NA Y N
15. Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection? NA Y N
16. Was Cl2/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC
ARV-02	ARV-02-SD-080624-URS		
EC-05-SD-080625-URS	EC-05-SD-DUP-080625-URS		

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions: _____

Total Solids

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944

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
AR-01-RS-080624-URS	K0805944-001	06/24/2008	07/01/2008	07/03/2008	86.1	
AR-01-SD-080624-URS	K0805944-002	06/24/2008	07/01/2008	07/03/2008	73.3	
AR-02-SD-080624-URS	K0805944-003	06/24/2008	07/01/2008	07/03/2008	89.0	
ARV-01-SD-080624-URS	K0805944-004	06/24/2008	07/01/2008	07/03/2008	72.6	
ARV-02-SD-080624-URS	K0805944-005	06/24/2008	07/01/2008	07/03/2008	64.7	
ARV-03-SD-080624-URS	K0805944-006	06/24/2008	07/01/2008	07/03/2008	46.9	
EC-01-SD-080624-URS	K0805944-007	06/24/2008	07/01/2008	07/03/2008	85.8	
EC-02-RS-080625-URS	K0805944-008	06/25/2008	07/01/2008	07/03/2008	78.8	
EC-02-SD-080625-URS	K0805944-009	06/25/2008	07/01/2008	07/03/2008	74.2	
EC-03-SD-080625-URS	K0805944-010	06/25/2008	07/01/2008	07/03/2008	86.3	
EC-04-SD-080625-URS	K0805944-011	06/25/2008	07/01/2008	07/03/2008	89.9	
EC-04-SD-DUP-080625-URS	K0805944-012	06/25/2008	07/01/2008	07/03/2008	83.1	
EC-05-RS-080625-URS	K0805944-013	06/25/2008	07/01/2008	07/03/2008	84.0	
EC-05-RS-DUP-080625-URS	K0805944-014	06/25/2008	07/01/2008	07/03/2008	80.4	
EC-05-SD-080625-URS	K0805944-015	06/25/2008	07/01/2008	07/03/2008	82.1	
EC-06-SD-080625-URS	K0805944-016	06/25/2008	07/01/2008	07/03/2008	74.5	
EC-07-RS-080625-URS	K0805944-017	06/25/2008	07/01/2008	07/03/2008	74.8	
EC-07-SD-080625-URS	K0805944-018	06/25/2008	07/01/2008	07/03/2008	75.6	
JC-01-SD-080626-URS	K0805944-019	06/26/2008	07/01/2008	07/03/2008	86.1	
JC-01-RS-080626-URS	K0805944-020	06/26/2008	07/01/2008	07/03/2008	78.9	
JC-02-SD-080626-URS	K0805944-021	06/26/2008	07/01/2008	07/03/2008	94.3	
JC-03-RS-080626-URS	K0805944-022	06/26/2008	07/01/2008	07/03/2008	99.3	
JC-03-SD-080626-URS	K0805944-023	06/26/2008	07/01/2008	07/03/2008	92.3	
JC-04-RS-080627-URS	K0805944-024	06/27/2008	07/01/2008	07/03/2008	96.7	
JC-04-SD-080627-URS	K0805944-025	06/27/2008	07/01/2008	07/03/2008	86.9	
JC-08-SD-080626-URS	K0805944-026	06/26/2008	07/01/2008	07/03/2008	79.2	
JC-10-SD-080627-URS	K0805944-027	06/27/2008	07/01/2008	07/03/2008	61.4	
EC-05-SD-DUP-080625-URS	K0805944-028	06/25/2008	07/01/2008	07/03/2008	80.9	
JC-11-SD-080627-URS	K0805944-029	06/27/2008	07/01/2008	07/03/2008	83.9	
JC-12-RS-080627-URS	K0805944-030	06/27/2008	07/01/2008	07/03/2008	94.5	
JC-12-SD-080627-URS	K0805944-031	06/27/2008	07/01/2008	07/03/2008	87.6	
JC-13-SD-080627-URS	K0805944-032	06/27/2008	07/01/2008	07/03/2008	84.4	
JC-14-RS-080627-URS	K0805944-033	06/27/2008	07/01/2008	07/03/2008	80.9	
JC-14-SD-080627-URS	K0805944-034	06/27/2008	07/01/2008	07/03/2008	88.5	
JC-15-SD-080627-URS	K0805944-035	06/27/2008	07/01/2008	07/03/2008	85.1	
ARV-04-SD-080624-URS	K0805944-036	06/24/2008	07/01/2008	07/03/2008	60.3	
EC-01-RS-080624-URS	K0805944-037	06/24/2008	07/01/2008	07/03/2008	80.7	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	K0805944
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/24/2008
Sample Matrix:	Sediment	**Date Received:**	07/01/2008
		Date Analyzed:	07/03/2008

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
AR-01-RS-080624-URS	K0805944-001	86.1	84.0	85.1	2	

Client:	URS Corporation	**Service Request:**	K0805944
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/25/2008
Sample Matrix:	Sediment	**Date Received:**	07/01/2008
		Date Analyzed:	07/03/2008

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
EC-07-RS-080625-URS	K0805944-017	74.8	74.8	74.8	<1	

Client:	URS Corporation	**Service Request:**	K0805944
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/26/2008
Sample Matrix:	Sediment	**Date Received:**	07/01/2008
		Date Analyzed:	07/03/2008

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
JC-08-SD-080626-URS	K0805944-026	79.2	78.6	78.9	<1	

Client:	URS Corporation	**Service Request:**	K0805944
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/27/2008
Sample Matrix:	Sediment	**Date Received:**	07/01/2008
		Date Analyzed:	07/03/2008

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
JC-12-SD-080627-URS	K0805944-031	87.6	86.6	87.1	1	

General Chemistry Parameters

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: AR-01-RS-080624-URS
Lab Code: K0805944-001

Sand Fraction: Weight (Grams)	62.9648
Sand Fraction: Weight Recovered (Grams)	63.1097
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	79.1868
Percent Solids	86.1
Weight Oven-Dried (Grams)	68.1798

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.2941	1.90
Gravel, Fine	2.00 mm	10	1.6449	2.41
Sand, Very Coarse	0.850 mm	20	3.0826	4.52
Sand, Coarse	0.425 mm	40	4.3204	6.34
Sand, Medium	0.250 mm	60	17.6646	25.9
Sand, Fine	0.106 mm	140	28.7832	42.2
Sand, Very Fine	0.075 mm	200	4.3341	6.36
Silt			5.4700	8.02
Clay			0.2800	0.41
		Total	66.8739	98.1

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: AR-01-SD-080624-URS
Lab Code: K0805944-002

Sand Fraction: Weight (Grams)	74.8421
Sand Fraction: Weight Recovered (Grams)	74.9577
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	100.1216
Percent Solids	73.3
Weight Oven-Dried (Grams)	73.3891

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.6683	0.91
Gravel, Fine	2.00 mm	10	1.5384	2.10
Sand, Very Coarse	0.850 mm	20	7.8370	10.7
Sand, Coarse	0.425 mm	40	17.2860	23.6
Sand, Medium	0.250 mm	60	21.5701	29.4
Sand, Fine	0.106 mm	140	21.3246	29.1
Sand, Very Fine	0.075 mm	200	3.7680	5.13
Silt			3.5500	4.84
Clay			0.0500	0.07
		Total	77.5924	106

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: AR-02-SD-080624-URS
Lab Code: K0805944-003

Sand Fraction: Weight (Grams)	84.1149
Sand Fraction: Weight Recovered (Grams)	84.1414
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	91.1346
Percent Solids	89.0
Weight Oven-Dried (Grams)	81.1098

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	14.6284	18.0
Gravel, Fine	2.00 mm	10	19.7187	24.3
Sand, Very Coarse	0.850 mm	20	31.9851	39.4
Sand, Coarse	0.425 mm	40	10.9635	13.5
Sand, Medium	0.250 mm	60	4.8222	5.95
Sand, Fine	0.106 mm	140	1.6912	2.09
Sand, Very Fine	0.075 mm	200	0.2600	0.32
Silt			0.4100	0.51
Clay			-0.0016	0.00
		Total	84.4775	104

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: ARV-01-SD-080624-URS
Lab Code: K0805944-004

Sand Fraction: Weight (Grams)	63.5412
Sand Fraction: Weight Recovered (Grams)	63.4998
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	89.8499
Percent Solids	72.6
Weight Oven-Dried (Grams)	65.2310

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0770	0.12
Gravel, Fine	2.00 mm	10	0.0442	0.07
Sand, Very Coarse	0.850 mm	20	1.7103	2.62
Sand, Coarse	0.425 mm	40	17.7086	27.1
Sand, Medium	0.250 mm	60	24.5321	37.6
Sand, Fine	0.106 mm	140	16.1859	24.8
Sand, Very Fine	0.075 mm	200	2.5096	3.85
Silt			3.7150	5.70
Clay			0.0350	0.05
		Total	66.5177	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: ARV-02-SD-080624-URS
Lab Code: K0805944-005

Sand Fraction: Weight (Grams)	54.8390
Sand Fraction: Weight Recovered (Grams)	54.9334
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	86.5707
Percent Solids	64.7
Weight Oven-Dried (Grams)	56.0112

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.0765	1.92
Gravel, Fine	2.00 mm	10	0.7147	1.28
Sand, Very Coarse	0.850 mm	20	6.7972	12.1
Sand, Coarse	0.425 mm	40	13.8069	24.7
Sand, Medium	0.250 mm	60	17.8249	31.8
Sand, Fine	0.106 mm	140	12.3342	22.0
Sand, Very Fine	0.075 mm	200	1.8985	3.39
Silt			2.2950	4.10
Clay			0.0100	0.02
		Total	56.7579	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: ARV-03-SD-080624-URS
Lab Code: K0805944-006

Sand Fraction: Weight (Grams)	25.6388
Sand Fraction: Weight Recovered (Grams)	25.5137
Sand Fraction: Percent Recovery	99.5

Weight as received (Grams)	55.0286
Percent Solids	64.6
Weight Oven-Dried (Grams)	35.5485

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0915	0.26
Gravel, Fine	2.00 mm	10	0.1058	0.30
Sand, Very Coarse	0.850 mm	20	0.1373	0.39
Sand, Coarse	0.425 mm	40	0.2823	0.79
Sand, Medium	0.250 mm	60	1.3776	3.88
Sand, Fine	0.106 mm	140	13.1483	37.0
Sand, Very Fine	0.075 mm	200	6.8790	19.4
Silt			13.4200	37.8
Clay			0.0000	0.00
		Total	35.4418	99.7

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-01-SD-080624-URS
Lab Code: K0805944-007

Sand Fraction: Weight (Grams)	75.9438
Sand Fraction: Weight Recovered (Grams)	75.9600
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	92.7925
Percent Solids	85.8
Weight Oven-Dried (Grams)	79.6160

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	3.0550	3.84
Gravel, Fine	2.00 mm	10	17.2662	21.7
Sand, Very Coarse	0.850 mm	20	25.6141	32.2
Sand, Coarse	0.425 mm	40	6.7672	8.50
Sand, Medium	0.250 mm	60	11.4101	14.3
Sand, Fine	0.106 mm	140	10.2816	12.9
Sand, Very Fine	0.075 mm	200	1.1898	1.49
Silt			1.2350	1.55
Clay			-0.0012	0.00
		Total	76.8178	96.5

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-02-RS-080625-URS
Lab Code: K0805944-008

Sand Fraction: Weight (Grams)	67.2815
Sand Fraction: Weight Recovered (Grams)	65.8024
Sand Fraction: Percent Recovery	97.8

Weight as received (Grams)	85.1105
Percent Solids	80.9
Weight Oven-Dried (Grams)	68.8544

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	14.0269	20.4
Gravel, Fine	2.00 mm	10	14.2219	20.7
Sand, Very Coarse	0.850 mm	20	19.9045	28.9
Sand, Coarse	0.425 mm	40	12.3226	17.9
Sand, Medium	0.250 mm	60	3.8106	5.53
Sand, Fine	0.106 mm	140	1.2778	1.86
Sand, Very Fine	0.075 mm	200	0.1049	0.15
Silt			7.4950	10.9
Clay			0.3200	0.46
		Total	73.4842	107

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-02-SD-080625-URS
Lab Code: K0805944-009

Sand Fraction: Weight (Grams)	76.8134
Sand Fraction: Weight Recovered (Grams)	75.8976
Sand Fraction: Percent Recovery	98.8

Weight as received (Grams)	99.9564
Percent Solids	74.2
Weight Oven-Dried (Grams)	74.1676

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	5.5547	7.49
Gravel, Fine	2.00 mm	10	0.3255	0.44
Sand, Very Coarse	0.850 mm	20	21.5979	29.1
Sand, Coarse	0.425 mm	40	17.1049	23.1
Sand, Medium	0.250 mm	60	18.1348	24.5
Sand, Fine	0.106 mm	140	11.4992	15.5
Sand, Very Fine	0.075 mm	200	1.3931	1.88
Silt			2.9300	3.95
Clay			-0.0022	0.00
		Total	78.5379	106

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-03-SD-080625-URS
Lab Code: K0805944-010

Sand Fraction: Weight (Grams)	85.8535
Sand Fraction: Weight Recovered (Grams)	85.2231
Sand Fraction: Percent Recovery	99.3

Weight as received (Grams)	99.5315
Percent Solids	86.3
Weight Oven-Dried (Grams)	85.8957

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	11.5709	13.5
Gravel, Fine	2.00 mm	10	12.8163	14.9
Sand, Very Coarse	0.850 mm	20	36.8542	42.9
Sand, Coarse	0.425 mm	40	18.9742	22.1
Sand, Medium	0.250 mm	60	3.8614	4.50
Sand, Fine	0.106 mm	140	0.9963	1.16
Sand, Very Fine	0.075 mm	200	0.1173	0.14
Silt			0.2100	0.24
Clay			-0.0018	0.00
		Total	85.4006	99.4

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-04-SD-080625-URS
Lab Code: K0805944-011

Sand Fraction: Weight (Grams)	84.6790
Sand Fraction: Weight Recovered (Grams)	84.7395
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	99.9716
Percent Solids	82.8
Weight Oven-Dried (Grams)	82.7765

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	13.6113	16.4
Gravel, Fine	2.00 mm	10	11.4745	13.9
Sand, Very Coarse	0.850 mm	20	34.2064	41.3
Sand, Coarse	0.425 mm	40	16.0044	19.3
Sand, Medium	0.250 mm	60	6.4436	7.78
Sand, Fine	0.106 mm	140	2.3598	2.85
Sand, Very Fine	0.075 mm	200	0.4911	0.59
Silt			0.8600	1.04
Clay			-0.0013	0.00
		Total	85.4511	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-04-SD-DUP-080625-URS
Lab Code: K0805944-012

Sand Fraction: Weight (Grams)	77.8808
Sand Fraction: Weight Recovered (Grams)	77.7828
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	99.8088
Percent Solids	79.6
Weight Oven-Dried (Grams)	79.4478

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	7.0935	8.93
Gravel, Fine	2.00 mm	10	7.6337	9.61
Sand, Very Coarse	0.850 mm	20	22.0732	27.8
Sand, Coarse	0.425 mm	40	22.3860	28.2
Sand, Medium	0.250 mm	60	10.6988	13.5
Sand, Fine	0.106 mm	140	6.5755	8.28
Sand, Very Fine	0.075 mm	200	1.1173	1.41
Silt			1.6400	2.06
Clay			-0.0016	0.00
		Total	79.2164	99.7

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-05-RS-080625-URS
Lab Code: K0805944-013

Sand Fraction: Weight (Grams)	64.6129
Sand Fraction: Weight Recovered (Grams)	64.6468
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	79.9775
Percent Solids	84.0
Weight Oven-Dried (Grams)	67.1811

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	4.9266	7.33
Gravel, Fine	2.00 mm	10	2.4407	3.63
Sand, Very Coarse	0.850 mm	20	2.8067	4.18
Sand, Coarse	0.425 mm	40	8.5914	12.8
Sand, Medium	0.250 mm	60	25.1913	37.5
Sand, Fine	0.106 mm	140	17.3399	25.8
Sand, Very Fine	0.075 mm	200	2.4166	3.60
Silt			4.8550	7.23
Clay			0.0150	0.02
		Total	68.5832	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-05-RS-DUP-080625-URS
Lab Code: K0805944-014

Sand Fraction: Weight (Grams)	70.3805
Sand Fraction: Weight Recovered (Grams)	70.4287
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	79.721
Percent Solids	90.8
Weight Oven-Dried (Grams)	72.3867

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0442	0.06
Gravel, Fine	2.00 mm	10	0.1173	0.16
Sand, Very Coarse	0.850 mm	20	1.6490	2.28
Sand, Coarse	0.425 mm	40	15.5647	21.5
Sand, Medium	0.250 mm	60	30.8811	42.7
Sand, Fine	0.106 mm	140	19.4909	26.9
Sand, Very Fine	0.075 mm	200	2.2292	3.08
Silt			3.1500	4.35
Clay			-0.0006	0.00
		Total	73.1258	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-05-SD-080625-URS
Lab Code: K0805944-015

Sand Fraction: Weight (Grams)	67.8352
Sand Fraction: Weight Recovered (Grams)	67.7328
Sand Fraction: Percent Recovery	99.8

Weight as received (Grams)	80.5227
Percent Solids	82.1
Weight Oven-Dried (Grams)	66.1091

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	10.4529	15.8
Gravel, Fine	2.00 mm	10	20.2405	30.6
Sand, Very Coarse	0.850 mm	20	19.6527	29.7
Sand, Coarse	0.425 mm	40	8.6578	13.1
Sand, Medium	0.250 mm	60	5.7513	8.70
Sand, Fine	0.106 mm	140	2.5686	3.89
Sand, Very Fine	0.075 mm	200	0.2595	0.39
Silt			0.6350	0.96
Clay			-0.0019	0.00
		Total	68.2164	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-06-SD-080625-URS
Lab Code: K0805944-016

Sand Fraction: Weight (Grams)	81.5109
Sand Fraction: Weight Recovered (Grams)	81.3182
Sand Fraction: Percent Recovery	99.8

Weight as received (Grams)	95.4176
Percent Solids	87.1
Weight Oven-Dried (Grams)	83.1087

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	7.6071	9.15
Gravel, Fine	2.00 mm	10	20.9527	25.2
Sand, Very Coarse	0.850 mm	20	28.8274	34.7
Sand, Coarse	0.425 mm	40	13.8923	16.7
Sand, Medium	0.250 mm	60	6.5936	7.93
Sand, Fine	0.106 mm	140	2.9789	3.58
Sand, Very Fine	0.075 mm	200	0.3791	0.46
Silt			0.5250	0.63
Clay			-0.0026	0.00
		Total	81.7535	98.4

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-07-RS-080625-URS
Lab Code: K0805944-017

Sand Fraction: Weight (Grams)	75.3209
Sand Fraction: Weight Recovered (Grams)	75.6843
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	79.9677
Percent Solids	95.8
Weight Oven-Dried (Grams)	76.6091

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.8363	1.09
Gravel, Fine	2.00 mm	10	1.8871	2.46
Sand, Very Coarse	0.850 mm	20	15.2816	19.9
Sand, Coarse	0.425 mm	40	22.9913	30.0
Sand, Medium	0.250 mm	60	23.1493	30.2
Sand, Fine	0.106 mm	140	10.0634	13.1
Sand, Very Fine	0.075 mm	200	1.1234	1.47
Silt			1.4550	1.90
Clay			-0.0006	0.00
		Total	76.7868	100

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-07-SD-080625-URS
Lab Code: K0805944-018

Sand Fraction: Weight (Grams)	75.9980
Sand Fraction: Weight Recovered (Grams)	75.8370
Sand Fraction: Percent Recovery	99.8

Weight as received (Grams)	99.8497
Percent Solids	75.6
Weight Oven-Dried (Grams)	75.4864

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	2.7702	3.67
Gravel, Fine	2.00 mm	10	1.0390	1.38
Sand, Very Coarse	0.850 mm	20	20.1381	26.7
Sand, Coarse	0.425 mm	40	39.0266	51.7
Sand, Medium	0.250 mm	60	11.4748	15.2
Sand, Fine	0.106 mm	140	1.3693	1.81
Sand, Very Fine	0.075 mm	200	0.0031	0.00
Silt			0.0850	0.11
Clay			-0.0037	0.00
		Total	75.9024	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-01-SD-080626-URS
Lab Code: K0805944-019

Sand Fraction: Weight (Grams)	98.5345
Sand Fraction: Weight Recovered (Grams)	98.5147
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	109.0153
Percent Solids	86.1
Weight Oven-Dried (Grams)	93.8622

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	38.4714	41.0
Gravel, Fine	2.00 mm	10	19.8829	21.2
Sand, Very Coarse	0.850 mm	20	20.3878	21.7
Sand, Coarse	0.425 mm	40	10.9389	11.7
Sand, Medium	0.250 mm	60	4.8609	5.18
Sand, Fine	0.106 mm	140	3.1976	3.41
Sand, Very Fine	0.075 mm	200	0.5236	0.56
Silt			1.2000	1.28
Clay			-0.0003	0.00
		Total	99.4628	106

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-01-RS-080626-URS
Lab Code: K0805944-020

Sand Fraction: Weight (Grams)	29.6997
Sand Fraction: Weight Recovered (Grams)	29.1111
Sand Fraction: Percent Recovery	98.0

Weight as received (Grams)	50.2803
Percent Solids	77.5
Weight Oven-Dried (Grams)	38.9672

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	2.4760	6.35
Gravel, Fine	2.00 mm	10	1.6081	4.13
Sand, Very Coarse	0.850 mm	20	2.4754	6.35
Sand, Coarse	0.425 mm	40	3.4223	8.78
Sand, Medium	0.250 mm	60	4.9212	12.6
Sand, Fine	0.106 mm	140	9.7019	24.9
Sand, Very Fine	0.075 mm	200	3.4125	8.76
Silt			9.3950	24.1
Clay			0.1300	0.33
		Total	37.5424	96.3

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-02-SD-080626-URS
Lab Code: K0805944-021

Sand Fraction: Weight (Grams)	95.8330
Sand Fraction: Weight Recovered (Grams)	96.2594
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	103.0347
Percent Solids	94.3
Weight Oven-Dried (Grams)	97.1617

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	26.7381	27.5
Gravel, Fine	2.00 mm	10	28.3317	29.2
Sand, Very Coarse	0.850 mm	20	26.4906	27.3
Sand, Coarse	0.425 mm	40	9.2937	9.57
Sand, Medium	0.250 mm	60	4.0327	4.15
Sand, Fine	0.106 mm	140	1.1100	1.14
Sand, Very Fine	0.075 mm	200	0.1644	0.17
Silt			0.7600	0.78
Clay			-0.0021	0.00
		Total	96.9191	99.8

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-03-RS-080626-URS
Lab Code: K0805944-022

Sand Fraction: Weight (Grams)	40.4835
Sand Fraction: Weight Recovered (Grams)	40.5399
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	50.3672
Percent Solids	99.3
Weight Oven-Dried (Grams)	50.0146

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	14.0406	28.1
Gravel, Fine	2.00 mm	10	8.4670	16.9
Sand, Very Coarse	0.850 mm	20	6.9323	13.9
Sand, Coarse	0.425 mm	40	2.5671	5.13
Sand, Medium	0.250 mm	60	2.4691	4.94
Sand, Fine	0.106 mm	140	3.0430	6.08
Sand, Very Fine	0.075 mm	200	1.4768	2.95
Silt			9.9700	19.9
Clay			0.3200	0.64
		Total	49.2859	98.5

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-03-SD-080626-URS
Lab Code: K0805944-023

Sand Fraction: Weight (Grams)	93.6447
Sand Fraction: Weight Recovered (Grams)	93.8590
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	102.0995
Percent Solids	92.3
Weight Oven-Dried (Grams)	94.2378

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	28.4166	30.2
Gravel, Fine	2.00 mm	10	29.7863	31.6
Sand, Very Coarse	0.850 mm	20	27.5530	29.2
Sand, Coarse	0.425 mm	40	6.6339	7.04
Sand, Medium	0.250 mm	60	1.0660	1.13
Sand, Fine	0.106 mm	140	0.2968	0.31
Sand, Very Fine	0.075 mm	200	0.0530	0.06
Silt			0.2600	0.28
Clay			-0.0033	0.00
		Total	94.0623	99.8

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-04-RS-080627-URS
Lab Code: K0805944-024

Sand Fraction: Weight (Grams)	64.9375
Sand Fraction: Weight Recovered (Grams)	64.9283
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	79.5973
Percent Solids	96.7
Weight Oven-Dried (Grams)	76.9706

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0550	0.07
Sand, Very Coarse	0.850 mm	20	0.0635	0.08
Sand, Coarse	0.425 mm	40	0.8273	1.07
Sand, Medium	0.250 mm	60	7.8956	10.3
Sand, Fine	0.106 mm	140	37.7302	49.0
Sand, Very Fine	0.075 mm	200	12.6196	16.4
Silt			16.0750	20.9
Clay			0.1600	0.21
		Total	75.4262	98.0

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-04-SD-080627-URS
Lab Code: K0805944-025

Sand Fraction: Weight (Grams)	98.3548
Sand Fraction: Weight Recovered (Grams)	98.5673
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	111.012
Percent Solids	86.9
Weight Oven-Dried (Grams)	96.4694

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	62.2336	64.5
Gravel, Fine	2.00 mm	10	20.5708	21.3
Sand, Very Coarse	0.850 mm	20	10.5305	10.9
Sand, Coarse	0.425 mm	40	1.6151	1.67
Sand, Medium	0.250 mm	60	1.0165	1.05
Sand, Fine	0.106 mm	140	1.4464	1.50
Sand, Very Fine	0.075 mm	200	0.4647	0.48
Silt			1.9500	2.02
Clay			-0.0007	0.00
		Total	99.8269	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-08-SD-080626-URS
Lab Code: K0805944-026

Sand Fraction: Weight (Grams)	92.7197
Sand Fraction: Weight Recovered (Grams)	92.8137
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	110.5566
Percent Solids	84.0
Weight Oven-Dried (Grams)	92.8675

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	29.5509	31.8
Gravel, Fine	2.00 mm	10	20.3076	21.9
Sand, Very Coarse	0.850 mm	20	17.7563	19.1
Sand, Coarse	0.425 mm	40	9.3335	10.1
Sand, Medium	0.250 mm	60	8.8147	9.49
Sand, Fine	0.106 mm	140	5.6699	6.11
Sand, Very Fine	0.075 mm	200	0.9446	1.02
Silt			1.9550	2.11
Clay			-0.0016	0.00
		Total	94.3309	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-10-SD-080627-URS
Lab Code: K0805944-027

Sand Fraction: Weight (Grams)	48.6512
Sand Fraction: Weight Recovered (Grams)	48.7341
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	82.5341
Percent Solids	67.9
Weight Oven-Dried (Grams)	56.0407

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0928	0.17
Gravel, Fine	2.00 mm	10	0.8150	1.45
Sand, Very Coarse	0.850 mm	20	4.7395	8.46
Sand, Coarse	0.425 mm	40	10.7540	19.2
Sand, Medium	0.250 mm	60	11.1954	20.0
Sand, Fine	0.106 mm	140	14.7560	26.3
Sand, Very Fine	0.075 mm	200	4.3834	7.82
Silt			9.1700	16.4
Clay			0.1250	0.22
		Total	56.0311	100

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-05-SD-DUP-080625-URS
Lab Code: K0805944-028

Sand Fraction: Weight (Grams)	83.8013
Sand Fraction: Weight Recovered (Grams)	83.8360
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	99.7852
Percent Solids	80.9
Weight Oven-Dried (Grams)	80.7262

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	2.8561	3.54
Gravel, Fine	2.00 mm	10	16.8697	20.9
Sand, Very Coarse	0.850 mm	20	28.9386	35.8
Sand, Coarse	0.425 mm	40	16.1324	20.0
Sand, Medium	0.250 mm	60	11.6604	14.4
Sand, Fine	0.106 mm	140	6.0659	7.51
Sand, Very Fine	0.075 mm	200	1.0222	1.27
Silt			1.3400	1.66
Clay			-0.0016	0.00
		Total	84.8837	105

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-11-SD-080627-URS
Lab Code: K0805944-029

Sand Fraction: Weight (Grams)	95.8442
Sand Fraction: Weight Recovered (Grams)	95.9639
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	112.1503
Percent Solids	83.9
Weight Oven-Dried (Grams)	94.0941

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	37.4507	39.8
Gravel, Fine	2.00 mm	10	30.9959	32.9
Sand, Very Coarse	0.850 mm	20	20.4305	21.7
Sand, Coarse	0.425 mm	40	5.4430	5.78
Sand, Medium	0.250 mm	60	0.9461	1.01
Sand, Fine	0.106 mm	140	0.3425	0.36
Sand, Very Fine	0.075 mm	200	0.0988	0.11
Silt			0.3050	0.32
Clay			-0.0015	0.00
		Total	96.0110	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-12-RS-080627-URS
Lab Code: K0805944-030

Sand Fraction: Weight (Grams)	53.7820
Sand Fraction: Weight Recovered (Grams)	53.7250
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	88.7764
Percent Solids	70.8
Weight Oven-Dried (Grams)	62.8537

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	13.3340	21.2
Gravel, Fine	2.00 mm	10	13.3636	21.3
Sand, Very Coarse	0.850 mm	20	10.0555	16.0
Sand, Coarse	0.425 mm	40	6.0709	9.66
Sand, Medium	0.250 mm	60	3.4539	5.50
Sand, Fine	0.106 mm	140	4.6012	7.32
Sand, Very Fine	0.075 mm	200	1.6854	2.68
Silt			8.9100	14.2
Clay			0.5650	0.90
		Total	62.0395	98.7

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-12-SD-080627-URS
Lab Code: K0805944-031

Sand Fraction: Weight (Grams)	91.7128
Sand Fraction: Weight Recovered (Grams)	91.8623
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	112.6029
Percent Solids	80.8
Weight Oven-Dried (Grams)	90.9831

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	19.3965	21.3
Gravel, Fine	2.00 mm	10	34.0182	37.4
Sand, Very Coarse	0.850 mm	20	24.0281	26.4
Sand, Coarse	0.425 mm	40	8.0921	8.89
Sand, Medium	0.250 mm	60	3.4474	3.79
Sand, Fine	0.106 mm	140	2.3256	2.56
Sand, Very Fine	0.075 mm	200	0.3930	0.43
Silt			1.1100	1.22
Clay			-0.0014	0.00
		Total	92.8095	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/18/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-13-SD-080627-URS
Lab Code: K0805944-032

Sand Fraction: Weight (Grams)	84.7304
Sand Fraction: Weight Recovered (Grams)	84.8257
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	108.4095
Percent Solids	81.3
Weight Oven-Dried (Grams)	88.1369

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Medium Gravel	4.75 mm	4	24.5331	27.8
Fine Gravel	2.00 mm	10	22.8081	25.9
Very Coarse Sand	0.850 mm	20	13.9288	15.8
Coarse Sand	0.425 mm	40	7.6743	8.71
Medium Sand	0.250 mm	60	6.0237	6.83
Fine Sand	0.106 mm	140	7.4191	8.42
Very Fine Sand	0.075 mm	200	1.8964	2.15
Clay			0.1450	0.16
Silt			4.1500	4.71
		Total	88.5785	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/18/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-13-SD-080627-URS
Lab Code: K0805944-032DUP

Sand Fraction: Weight (Grams)	83.1716
Sand Fraction: Weight Recovered (Grams)	83.2435
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	108.1071
Percent Solids	81.3
Weight Oven-Dried (Grams)	87.8911

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Medium Gravel	4.75 mm	4	20.2803	23.1
Fine Gravel	2.00 mm	10	23.5858	26.8
Very Coarse Sand	0.850 mm	20	14.2860	16.3
Coarse Sand	0.425 mm	40	8.1432	9.27
Medium Sand	0.250 mm	60	6.5021	7.40
Fine Sand	0.106 mm	140	7.8611	8.94
Very Fine Sand	0.075 mm	200	1.9890	2.26
Clay			0.2450	0.28
Silt			4.2200	4.80
		Total	87.1125	99.1

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-14-RS-080627-URS
Lab Code: K0805944-033

Sand Fraction: Weight (Grams)	67.2341
Sand Fraction: Weight Recovered (Grams)	67.2117
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	80.4893
Percent Solids	88.0
Weight Oven-Dried (Grams)	70.8306

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	17.4974	24.7
Gravel, Fine	2.00 mm	10	18.2379	25.7
Sand, Very Coarse	0.850 mm	20	12.4999	17.6
Sand, Coarse	0.425 mm	40	5.1992	7.34
Sand, Medium	0.250 mm	60	4.8898	6.90
Sand, Fine	0.106 mm	140	5.5480	7.83
Sand, Very Fine	0.075 mm	200	2.1808	3.08
Silt			5.3850	7.60
Clay			0.0350	0.05
		Total	71.4730	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-14-SD-080627-URS
Lab Code: K0805944-034

Sand Fraction: Weight (Grams)	99.0322
Sand Fraction: Weight Recovered (Grams)	99.1949
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	109.6806
Percent Solids	88.5
Weight Oven-Dried (Grams)	97.0673

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	39.6383	40.8
Gravel, Fine	2.00 mm	10	46.4484	47.9
Sand, Very Coarse	0.850 mm	20	11.5839	11.9
Sand, Coarse	0.425 mm	40	1.0272	1.06
Sand, Medium	0.250 mm	60	0.2916	0.30
Sand, Fine	0.106 mm	140	0.1050	0.11
Sand, Very Fine	0.075 mm	200	0.0361	0.04
Silt			0.1700	0.18
Clay			-0.0024	0.00
		Total	99.2981	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: JC-15-SD-080627-URS
Lab Code: K0805944-035

Sand Fraction: Weight (Grams)	91.4385
Sand Fraction: Weight Recovered (Grams)	91.4844
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	116.5465
Percent Solids	80.1
Weight Oven-Dried (Grams)	93.3537

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	21.3755	22.9
Gravel, Fine	2.00 mm	10	19.1483	20.5
Sand, Very Coarse	0.850 mm	20	20.9826	22.5
Sand, Coarse	0.425 mm	40	11.9647	12.8
Sand, Medium	0.250 mm	60	7.5522	8.09
Sand, Fine	0.106 mm	140	8.0456	8.62
Sand, Very Fine	0.075 mm	200	1.7556	1.88
Silt			2.9650	3.18
Clay			-0.0002	0.00
		Total	93.7893	100

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/18/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: ARV-04-SD-080624-URS
Lab Code: K0805944-036

Sand Fraction: Weight (Grams)	67.2676
Sand Fraction: Weight Recovered (Grams)	66.7611
Sand Fraction: Percent Recovery	99.2

Weight as received (Grams)	99.9619
Percent Solids	71.4
Weight Oven-Dried (Grams)	71.3728

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Medium Gravel	4.75 mm	4	4.1606	5.83
Fine Gravel	2.00 mm	10	13.5130	18.9
Very Coarse Sand	0.850 mm	20	30.9271	43.3
Coarse Sand	0.425 mm	40	7.7797	10.9
Medium Sand	0.250 mm	60	1.1670	1.64
Fine Sand	0.106 mm	140	4.3179	6.05
Very Fine Sand	0.075 mm	200	2.9753	4.17
Clay			0.2800	0.39
Silt			8.0250	11.24
		Total	73.1456	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-01-RS-080624-URS
Lab Code: K0805944-037

Sand Fraction: Weight (Grams)	75.2267
Sand Fraction: Weight Recovered (Grams)	75.3082
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	88.8096
Percent Solids	85.2
Weight Oven-Dried (Grams)	75.6658

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	9.4804	12.5
Gravel, Fine	2.00 mm	10	2.9868	3.95
Sand, Very Coarse	0.850 mm	20	7.7767	10.3
Sand, Coarse	0.425 mm	40	13.5440	17.9
Sand, Medium	0.250 mm	60	21.5743	28.5
Sand, Fine	0.106 mm	140	18.1372	24.0
Sand, Very Fine	0.075 mm	200	1.4727	1.95
Silt			2.0500	2.71
Clay			-0.0009	0.00
		Total	77.0212	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-07-RS-080625-URS
Lab Code: K0805944-017DUP

Sand Fraction: Weight (Grams)	75.8235
Sand Fraction: Weight Recovered (Grams)	75.7906
Sand Fraction: Percent Recovery	100.0

Weight as received (Grams)	80.2697
Percent Solids	95.8
Weight Oven-Dried (Grams)	76.8984

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.3137	0.41
Gravel, Fine	2.00 mm	10	1.4836	1.93
Sand, Very Coarse	0.850 mm	20	15.4597	20.1
Sand, Coarse	0.425 mm	40	23.2952	30.3
Sand, Medium	0.250 mm	60	23.8961	31.1
Sand, Fine	0.106 mm	140	10.0183	13.0
Sand, Very Fine	0.075 mm	200	1.0699	1.39
Silt			1.2900	1.68
Clay			-0.0018	0.00
		Total	76.8247	99.9

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-08-SD-080626-URS
Lab Code: K0805944-026DUP

Sand Fraction: Weight (Grams)	93.0091
Sand Fraction: Weight Recovered (Grams)	93.0184
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	111.9843
Percent Solids	84.0
Weight Oven-Dried (Grams)	94.0668

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	26.4392	28.1
Gravel, Fine	2.00 mm	10	22.1667	23.6
Sand, Very Coarse	0.850 mm	20	18.8674	20.1
Sand, Coarse	0.425 mm	40	11.9965	12.8
Sand, Medium	0.250 mm	60	6.5300	6.94
Sand, Fine	0.106 mm	140	5.6442	6.00
Sand, Very Fine	0.075 mm	200	1.0513	1.12
Silt			2.1650	2.30
Clay			-0.0005	0.00
		Total	94.8598	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Sediment

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Date Analyzed: 7/8/2008

Particle Size Determination
ASTM Method D422 Modified

Sample Name: EC-12-SD-080627-URS
Lab Code: K0805944-031DUP

Sand Fraction: Weight (Grams)	91.3679
Sand Fraction: Weight Recovered (Grams)	91.4337
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	110.4102
Percent Solids	80.8
Weight Oven-Dried (Grams)	89.2114

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	27.6307	31.0
Gravel, Fine	2.00 mm	10	31.4009	35.2
Sand, Very Coarse	0.850 mm	20	20.1325	22.6
Sand, Coarse	0.425 mm	40	5.3924	6.04
Sand, Medium	0.250 mm	60	3.8199	4.28
Sand, Fine	0.106 mm	140	2.3579	2.64
Sand, Very Fine	0.075 mm	200	0.4899	0.55
Silt			1.1300	1.27
Clay			0.0350	0.04
		Total	92.3892	104

Metals

Columbia Analytical Services

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.: 25696770.00001

Service Request: K0805944

Sample Name:	Lab Code:
AR-01-RS-080624-URS	K0805944-001
AR-01-SD-080624-URS	K0805944-002
AR-02-SD-080624-URS	K0805944-003
ARV-01-SD-080624-URS	K0805944-004
ARV-02-SD-080624-URS	K0805944-005
ARV-03-SD-080624-URS	K0805944-006
EC-01-SD-080624-URS	K0805944-007
EC-02-RS-080625-URS	K0805944-008
EC-02-SD-080625-URS	K0805944-009
EC-03-SD-080625-URS	K0805944-010
EC-04-SD-080625-URS	K0805944-011
EC-04-SD-DUP-080625-URS	K0805944-012
EC-05-RS-080625-URS	K0805944-013
EC-05-RS-DUP-080625-URS	K0805944-014
EC-05-SD-080625-URS	K0805944-015
EC-06-SD-080625-URS	K0805944-016
EC-07-RS-080625-URS	K0805944-017
EC-07-RS-080625-URSD	K0805944-017D
EC-07-RS-080625-URSS	K0805944-017S
EC-07-SD-080625-URS	K0805944-018
JC-01-SD-080626-URS	K0805944-019
JC-01-RS-080626-URS	K0805944-020
JC-02-SD-080626-URS	K0805944-021
JC-03-RS-080626-URS	K0805944-022
JC-03-SD-080626-URS	K0805944-023
JC-04-RS-080627-URS	K0805944-024
JC-04-SD-080627-URS	K0805944-025
JC-08-SD-080626-URS	K0805944-026
JC-08-SD-080626-URSD	K0805944-026D
JC-08-SD-080626-URSS	K0805944-026S
JC-10-SD-080627-URS	K0805944-027
EC-05-SD-DUP-080625-URS	K0805944-028
JC-11-SD-080627-URS	K0805944-029
JC-12-RS-080627-URS	K0805944-030
JC-12-SD-080627-URS	K0805944-031
JC-12-SD-080627-URSD	K0805944-031D
JC-12-SD-080627-URSS	K0805944-031S
JC-13-SD-080627-URS	K0805944-032
JC-14-RS-080627-URS	K0805944-033

Comments:

Approved By: _____ **Date:** 7/23/08

Columbia Analytical Services

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.: 25696770.00001

Service Request: K0805944

Sample Name:	Lab Code:
JC-14-SD-080627-URS	K0805944-034
JC-15-SD-080627-URS	K0805944-035
ARV-04-SD-080624-URS	K0805944-036
EC-01-RS-080624-URS	K0805944-037
Method Blank	K0805944-MB1
Method Blank	K0805944-MB2

Comments:

Approved By: _____ **Date:** 7/23/08

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: AR-01-RS-080624-URS
Lab Code: K0805944-001

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.48	0.05	5.0	07/09/08	07/10/08	4.65		
Cadmium	6020	0.019	0.004	5.0	07/09/08	07/10/08	0.654		
Copper	6010B	19.4	1.9	20.0	07/09/08	07/14/08	85.0		
Iron	6010B	38.7	19.4	20.0	07/09/08	07/14/08	28600		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	7.06		
Zinc	6010B	19.4	2.90	20.0	07/09/08	07/14/08	185		

% Solids: 86.1

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: AR-01-SD-080624-URS **Lab Code:** K0805944-002

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.48	0.05	5.0	07/09/08	07/10/08	3.95		
Cadmium	6020	0.019	0.004	5.0	07/09/08	07/10/08	0.416		
Copper	6010B	19.5	2.0	20.0	07/09/08	07/14/08	68.8		
Iron	6010B	39.0	19.5	20.0	07/09/08	07/14/08	31800		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	5.97		
Zinc	6010B	19.5	2.92	20.0	07/09/08	07/14/08	120		

% Solids: 73.3

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: AR-02-SD-080624-URS **Lab Code:** K0805944-003

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.56	0.06	5.0	07/09/08	07/10/08	4.36		
Cadmium	6020	0.022	0.004	5.0	07/09/08	07/10/08	0.406		
Copper	6010B	22.2	2.2	20.0	07/09/08	07/14/08	62.7		
Iron	6010B	44.5	22.2	20.0	07/09/08	07/14/08	33200		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	4.94		
Zinc	6010B	22.2	3.34	20.0	07/09/08	07/14/08	107		

% Solids: 89.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: ARV-01-SD-080624-URS **Lab Code:** K0805944-004

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.49	0.05	5.0	07/09/08	07/10/08	4.76		
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/10/08	0.422		
Copper	6010B	19.7	2.0	20.0	07/09/08	07/14/08	70.8		
Iron	6010B	39.4	19.7	20.0	07/09/08	07/14/08	31000		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	6.54		
Zinc	6010B	19.7	2.95	20.0	07/09/08	07/14/08	111		

% Solids: 72.6

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: ARV-02-SD-080624-URS **Lab Code:** K0805944-005

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.48	0.05	5.0	07/09/08	07/10/08	4.77		
Cadmium	6020	0.019	0.004	5.0	07/09/08	07/10/08	0.519		
Copper	6010B	19.2	1.9	20.0	07/09/08	07/14/08	81.8		
Iron	6010B	38.4	19.2	20.0	07/09/08	07/14/08	33400		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	6.34		
Zinc	6010B	19.2	2.88	20.0	07/09/08	07/14/08	128		

% Solids: 64.7

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: ARV-03-SD-080624-URS **Lab Code:** K0805944-006

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.59	0.06	5.0	07/09/08	07/10/08	4.71		
Cadmium	6020	0.023	0.005	5.0	07/09/08	07/10/08	0.572		
Copper	6010B	23.6	2.4	20.0	07/09/08	07/14/08	107		
Iron	6010B	47.1	23.6	20.0	07/09/08	07/14/08	36700		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	8.24		
Zinc	6010B	23.6	3.53	20.0	07/09/08	07/14/08	116		

% Solids: 46.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-01-SD-080624-URS **Lab Code:** K0805944-007

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.57	0.06	5.0	07/09/08	07/10/08	4.23		
Cadmium	6020	0.023	0.005	5.0	07/09/08	07/10/08	0.388		
Copper	6010B	23.3	2.3	20.0	07/09/08	07/14/08	43.1		
Iron	6010B	46.6	23.3	20.0	07/09/08	07/14/08	20400		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	5.14		
Zinc	6010B	23.3	3.50	20.0	07/09/08	07/14/08	75.8		

% Solids: 85.8

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-02-RS-080625-URS **Lab Code:** K0805944-008

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.39	0.04	5.0	07/09/08	07/10/08	3.29		
Cadmium	6020	0.016	0.003	5.0	07/09/08	07/10/08	0.191		
Copper	6010B	15.9	1.6	20.0	07/09/08	07/14/08	56.0		
Iron	6010B	31.7	15.9	20.0	07/09/08	07/14/08	23000		
Lead	6020	0.04	0.02	5.0	07/09/08	07/10/08	5.75		
Zinc	6010B	15.9	2.38	20.0	07/09/08	07/14/08	64.9		

% Solids: 78.8

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-02-SD-080625-URS **Lab Code:** K0805944-009

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.48	0.05	5.0	07/09/08	07/10/08	4.04		
Cadmium	6020	0.019	0.004	5.0	07/09/08	07/10/08	0.315		
Copper	6010B	19.0	1.9	20.0	07/09/08	07/14/08	57.5		
Iron	6010B	38.0	19.0	20.0	07/09/08	07/14/08	37200		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	5.72		
Zinc	6010B	19.0	2.85	20.0	07/09/08	07/14/08	109		

% Solids: 74.2

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-03-SD-080625-URS **Lab Code:** K0805944-010

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.57	0.06	5.0	07/09/08	07/10/08	4.35		
Cadmium	6020	0.023	0.005	5.0	07/09/08	07/10/08	0.528		
Copper	6010B	22.9	2.3	20.0	07/09/08	07/14/08	42.9		
Iron	6010B	45.9	22.9	20.0	07/09/08	07/14/08	28500		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	4.52		
Zinc	6010B	22.9	3.44	20.0	07/09/08	07/14/08	72.7		

% Solids: 86.3

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-04-SD-080625-URS **Lab Code:** K0805944-011

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.55	0.06	5.0	07/09/08	07/10/08	6.20		
Cadmium	6020	0.022	0.004	5.0	07/09/08	07/10/08	0.211		
Copper	6010B	22.0	2.2	20.0	07/09/08	07/14/08	39.9		
Iron	6010B	44.1	22.0	20.0	07/09/08	07/14/08	27700		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	5.52		
Zinc	6010B	22.0	3.30	20.0	07/09/08	07/14/08	77.1		

% Solids: 89.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-04-SD-DUP-080625-URS **Lab Code:** K0805944-012

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.60	0.06	5.0	07/09/08	07/10/08	5.20		
Cadmium	6020	0.024	0.005	5.0	07/09/08	07/10/08	0.270		
Copper	6010B	24.1	2.4	20.0	07/09/08	07/14/08	51.3		
Iron	6010B	48.1	24.1	20.0	07/09/08	07/14/08	32200		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	4.72		
Zinc	6010B	24.1	3.61	20.0	07/09/08	07/14/08	75.1		

% Solids: 83.1

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-05-RS-080625-URS **Lab Code:** K0805944-013

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.49	0.05	5.0	07/09/08	07/10/08	5.37		
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/10/08	0.281		
Copper	6010B	19.7	2.0	20.0	07/09/08	07/14/08	60.4		
Iron	6010B	39.4	19.7	20.0	07/09/08	07/14/08	28200		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	6.37		
Zinc	6010B	19.7	2.95	20.0	07/09/08	07/14/08	74.0		

% Solids: 84.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-05-RS-DUP-080625-URS **Lab Code:** K0805944-014

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.51	0.05	5.0	07/09/08	07/10/08	5.01		
Cadmium	6020	0.021	0.004	5.0	07/09/08	07/10/08	0.311		
Copper	6010B	20.7	2.1	20.0	07/09/08	07/14/08	80.0		
Iron	6010B	41.5	20.7	20.0	07/09/08	07/14/08	28000		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	6.17		
Zinc	6010B	20.7	3.11	20.0	07/09/08	07/14/08	74.0		

% Solids: 80.4

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-05-SD-080625-URS **Lab Code:** K0805944-015

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.60	0.06	5.0	07/09/08	07/10/08	3.50		
Cadmium	6020	0.024	0.005	5.0	07/09/08	07/10/08	0.213		
Copper	6010B	24.4	2.4	20.0	07/09/08	07/14/08	38.5		
Iron	6010B	48.7	24.4	20.0	07/09/08	07/14/08	25500		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	4.07		
Zinc	6010B	24.4	3.65	20.0	07/09/08	07/14/08	74.5		

% Solids: 82.1

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-06-SD-080625-URS **Lab Code:** K0805944-016

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.41	0.04	5.0	07/09/08	07/10/08	4.92		
Cadmium	6020	0.016	0.003	5.0	07/09/08	07/10/08	0.581		
Copper	6010B	16.7	1.7	20.0	07/09/08	07/14/08	119		
Iron	6010B	33.3	16.7	20.0	07/09/08	07/14/08	33200		
Lead	6020	0.04	0.02	5.0	07/09/08	07/10/08	10.4		
Zinc	6010B	16.7	2.50	20.0	07/09/08	07/14/08	114		

% Solids: 74.5

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-07-RS-080625-URS **Lab Code:** K0805944-017

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.55	0.06	5.0	07/09/08	07/10/08	5.84		
Cadmium	6020	0.022	0.004	5.0	07/09/08	07/10/08	0.220		
Copper	6010B	22.1	2.2	20.0	07/09/08	07/14/08	51.9		
Iron	6010B	44.2	22.1	20.0	07/09/08	07/14/08	40400		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	6.08		
Zinc	6010B	22.1	3.31	20.0	07/09/08	07/14/08	84.6		

% Solids: 74.8

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-07-SD-080625-URS **Lab Code:** K0805944-018

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.54	0.05	5.0	07/09/08	07/10/08	7.59		
Cadmium	6020	0.022	0.004	5.0	07/09/08	07/10/08	0.281		
Copper	6010B	21.7	2.2	20.0	07/09/08	07/14/08	28.0		
Iron	6010B	43.4	21.7	20.0	07/09/08	07/14/08	23200		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	6.91		
Zinc	6010B	21.7	3.25	20.0	07/09/08	07/14/08	59.0		

% Solids: 75.6

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-01-SD-080626-URS **Lab Code:** K0805944-019

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.58	0.06	5.0	07/09/08	07/10/08	3.01		
Cadmium	6020	0.023	0.005	5.0	07/09/08	07/10/08	2.14		
Copper	6010B	23.0	2.3	20.0	07/09/08	07/14/08	430		
Iron	6010B	46.0	23.0	20.0	07/09/08	07/14/08	26200		
Lead	6020	0.06	0.02	5.0	07/09/08	07/10/08	5.85		
Zinc	6010B	23.0	3.45	20.0	07/09/08	07/14/08	440		

% Solids: 86.1

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-01-RS-080626-URS
Lab Code: K0805944-020

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.52	0.05	5.0	07/09/08	07/10/08	4.73		
Cadmium	6020	0.021	0.004	5.0	07/09/08	07/10/08	1.09		
Copper	6010B	20.9	2.1	20.0	07/09/08	07/14/08	378		
Iron	6010B	41.9	20.9	20.0	07/09/08	07/14/08	26600		
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	31.2		
Zinc	6010B	20.9	3.14	20.0	07/09/08	07/14/08	172		

% Solids: 78.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-02-SD-080626-URS **Lab Code:** K0805944-021

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.53	0.05	5.0	07/09/08	07/11/08	1.14		*
Cadmium	6020	0.021	0.004	5.0	07/09/08	07/11/08	2.80		
Copper	6010B	21.2	2.1	20.0	07/09/08	07/14/08	536		
Iron	6010B	42.4	21.2	20.0	07/09/08	07/14/08	22400		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	6.27		*
Zinc	6010B	21.2	3.18	20.0	07/09/08	07/14/08	533		

% Solids: 94.3

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-03-RS-080626-URS **Lab Code:** K0805944-022

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.49	0.05	5.0	07/09/08	07/11/08	17.8		*
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/11/08	0.202		
Copper	6010B	20.1	2.0	20.0	07/09/08	07/14/08	141		
Iron	6010B	40.3	20.1	20.0	07/09/08	07/14/08	52400		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	11.6		*
Zinc	6010B	20.1	3.02	20.0	07/09/08	07/14/08	119		

% Solids: 99.3

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-03-SD-080626-URS **Lab Code:** K0805944-023

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.54	0.05	5.0	07/09/08	07/11/08	3.22		*
Cadmium	6020	0.022	0.004	5.0	07/09/08	07/11/08	2.70		
Copper	6010B	21.7	2.2	20.0	07/09/08	07/14/08	386		
Iron	6010B	43.3	21.7	20.0	07/09/08	07/14/08	20400		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	7.72		*
Zinc	6010B	21.7	3.25	20.0	07/09/08	07/14/08	423		

% Solids: 92.3

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-04-RS-080627-URS **Lab Code:** K0805944-024

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.52	0.05	5.0	07/09/08	07/11/08	3.44		*
Cadmium	6020	0.021	0.004	5.0	07/09/08	07/11/08	0.354		
Copper	6010B	20.7	2.1	20.0	07/09/08	07/14/08	204		
Iron	6010B	41.4	20.7	20.0	07/09/08	07/14/08	24900		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	15.1		*
Zinc	6010B	20.7	3.10	20.0	07/09/08	07/14/08	86.7		

% Solids: 96.7

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-04-SD-080627-URS **Lab Code:** K0805944-025

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.58	0.06	5.0	07/09/08	07/11/08	4.27		*
Cadmium	6020	0.023	0.005	5.0	07/09/08	07/11/08	2.93		
Copper	6010B	22.6	2.3	20.0	07/09/08	07/14/08	558		
Iron	6010B	45.1	22.6	20.0	07/09/08	07/14/08	11300		
Lead	6020	0.06	0.02	5.0	07/09/08	07/11/08	10.0		*
Zinc	6010B	22.6	3.38	20.0	07/09/08	07/14/08	317		

% Solids: 86.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/26/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-08-SD-080626-URS **Lab Code:** K0805944-026

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.39	0.04	5.0	07/09/08	07/11/08	2.54		*
Cadmium	6020	0.016	0.003	5.0	07/09/08	07/11/08	0.941		
Copper	6010B	15.6	1.6	20.0	07/09/08	07/14/08	978		
Iron	6010B	31.2	15.6	20.0	07/09/08	07/14/08	24700		
Lead	6020	0.04	0.02	5.0	07/09/08	07/11/08	13.8		*
Zinc	6010B	15.6	2.34	20.0	07/09/08	07/14/08	208		

% Solids: 79.2

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-10-SD-080627-URS **Lab Code:** K0805944-027

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.51	0.05	5.0	07/09/08	07/11/08	2.68		*
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/11/08	0.214		
Copper	6010B	20.4	2.0	20.0	07/09/08	07/14/08	51.7		
Iron	6010B	40.7	20.4	20.0	07/09/08	07/14/08	24000		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	2.67		*
Zinc	6010B	20.4	3.05	20.0	07/09/08	07/14/08	55.6		

% Solids: 61.4

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/25/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-05-SD-DUP-080625-URS **Lab Code:** K0805944-028

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.61	0.06	5.0	07/09/08	07/11/08	3.61		*
Cadmium	6020	0.024	0.005	5.0	07/09/08	07/11/08	0.260		
Copper	6010B	24.2	2.4	20.0	07/09/08	07/14/08	47.0		
Iron	6010B	48.5	24.2	20.0	07/09/08	07/14/08	24300		
Lead	6020	0.06	0.02	5.0	07/09/08	07/11/08	3.54		*
Zinc	6010B	24.2	3.64	20.0	07/09/08	07/14/08	77.8		

% Solids: 80.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-11-SD-080627-URS **Lab Code:** K0805944-029

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.49	0.05	5.0	07/09/08	07/11/08	1.36		*
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/11/08	0.139		
Copper	6010B	19.7	2.0	20.0	07/09/08	07/14/08	47.5		
Iron	6010B	39.4	19.7	20.0	07/09/08	07/14/08	20700		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	1.49		*
Zinc	6010B	19.7	2.96	20.0	07/09/08	07/14/08	36.6		

% Solids: 83.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-12-RS-080627-URS **Lab Code:** K0805944-030

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.53	0.05	5.0	07/09/08	07/11/08	3.16		*
Cadmium	6020	0.021	0.004	5.0	07/09/08	07/11/08	0.166		
Copper	6010B	21.0	2.1	20.0	07/09/08	07/14/08	67.1		
Iron	6010B	41.9	21.0	20.0	07/09/08	07/14/08	21800		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	5.29		*
Zinc	6010B	21.0	3.14	20.0	07/09/08	07/14/08	73.1		

% Solids: 94.5

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-12-SD-080627-URS **Lab Code:** K0805944-031

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.57	0.06	5.0	07/09/08	07/11/08	1.77		*
Cadmium	6020	0.023	0.005	5.0	07/09/08	07/11/08	0.097		
Copper	6010B	22.8	2.3	20.0	07/09/08	07/14/08	39.0		
Iron	6010B	45.7	22.8	20.0	07/09/08	07/14/08	16500		
Lead	6020	0.06	0.02	5.0	07/09/08	07/11/08	2.09		*
Zinc	6010B	22.8	3.42	20.0	07/09/08	07/14/08	35.4		

% Solids: 87.6

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-13-SD-080627-URS
Lab Code: K0805944-032

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.49	0.05	5.0	07/09/08	07/11/08	1.19		*
Cadmium	6020	0.019	0.004	5.0	07/09/08	07/11/08	0.113		
Copper	6010B	19.4	1.9	20.0	07/09/08	07/14/08	37.7		
Iron	6010B	38.8	19.4	20.0	07/09/08	07/14/08	18500		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	1.63		*
Zinc	6010B	19.4	2.91	20.0	07/09/08	07/14/08	40.2		

% Solids: 84.4

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-14-RS-080627-URS **Lab Code:** K0805944-033

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.51	0.05	5.0	07/09/08	07/11/08	1.24		*
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/11/08	0.092		
Copper	6010B	20.3	2.0	20.0	07/09/08	07/14/08	45.2		
Iron	6010B	40.5	20.3	20.0	07/09/08	07/14/08	17100		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	1.83		*
Zinc	6010B	20.3	3.04	20.0	07/09/08	07/14/08	38.9		

% Solids: 80.9

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-14-SD-080627-URS **Lab Code:** K0805944-034

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.55	0.06	5.0	07/09/08	07/11/08	0.74		*
Cadmium	6020	0.022	0.004	5.0	07/09/08	07/11/08	0.093		
Copper	6010B	22.6	2.3	20.0	07/09/08	07/14/08	34.4		
Iron	6010B	45.2	22.6	20.0	07/09/08	07/14/08	14900		
Lead	6020	0.06	0.02	5.0	07/09/08	07/11/08	1.20		*
Zinc	6010B	22.6	3.39	20.0	07/09/08	07/14/08	26.9		

% Solids: 88.5

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/27/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: JC-15-SD-080627-URS
Lab Code: K0805944-035

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.48	0.05	5.0	07/09/08	07/11/08	1.43		*
Cadmium	6020	0.019	0.004	5.0	07/09/08	07/11/08	0.121		
Copper	6010B	19.3	1.9	20.0	07/09/08	07/14/08	47.2		
Iron	6010B	38.5	19.3	20.0	07/09/08	07/14/08	20000		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	1.63		*
Zinc	6010B	19.3	2.89	20.0	07/09/08	07/14/08	44.1		

% Solids: 85.1

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: ARV-04-SD-080624-URS **Lab Code:** K0805944-036

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.46	0.05	5.0	07/09/08	07/11/08	3.98		*
Cadmium	6020	0.018	0.004	5.0	07/09/08	07/11/08	0.434		
Copper	6010B	18.2	1.8	20.0	07/09/08	07/14/08	73.8		
Iron	6010B	36.4	18.2	20.0	07/09/08	07/14/08	27600		
Lead	6020	0.05	0.02	5.0	07/09/08	07/11/08	6.37		*
Zinc	6010B	18.2	2.73	20.0	07/09/08	07/14/08	93.1		

% Solids: 60.3

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected: 6/24/2008
Date Received: 7/1/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-01-RS-080624-URS **Lab Code:** K0805944-037

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.62	0.06	5.0	07/09/08	07/11/08	5.61		*
Cadmium	6020	0.025	0.005	5.0	07/09/08	07/11/08	0.324		
Copper	6010B	24.5	2.5	20.0	07/09/08	07/14/08	74.1		
Iron	6010B	49.1	24.5	20.0	07/09/08	07/14/08	35400		
Lead	6020	0.06	0.03	5.0	07/09/08	07/11/08	5.99		*
Zinc	6010B	24.5	3.68	20.0	07/09/08	07/14/08	97.9		

% Solids: 80.7

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected:
Date Received:
Units: mg/Kg
Basis: DRY

Sample Name: Method Blank
Lab Code: K0805944-MB1

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.05	5.0	07/09/08	07/10/08	0.05	U	
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/10/08	0.004	U	
Copper	6010B	2.0	0.2	2.0	07/09/08	07/14/08	0.2	U	
Iron	6010B	4.0	2.0	2.0	07/09/08	07/14/08	2.0	U	
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	0.02	B	
Zinc	6010B	2.00	0.3	2.0	07/09/08	07/14/08	0.3	U	

% Solids: 100.0

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SEDIMENT

Service Request: K0805944
Date Collected:
Date Received:
Units: mg/Kg
Basis: DRY

Sample Name: Method Blank
Lab Code: K0805944-MB2

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.05	5.0	07/09/08	07/10/08	0.05	U	*
Cadmium	6020	0.020	0.004	5.0	07/09/08	07/10/08	0.004	U	
Copper	6010B	2.0	0.2	2.0	07/09/08	07/14/08	0.3	B	
Iron	6010B	4.0	2.0	2.0	07/09/08	07/14/08	2.3	B	
Lead	6020	0.05	0.02	5.0	07/09/08	07/10/08	0.02	U	*
Zinc	6010B	2.00	0.3	2.0	07/09/08	07/14/08	0.3	U	

% Solids: 100.0

Comments:

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Service Request: K0805944

Project No.: 25696770.00001

Units: MG/KG

Project Name: Blue Ledge Mine

Basis: DRY

Matrix: SEDIMENT

% Solids: 74.8

Sample Name: EC-07-RS-080625-URSS

Lab Code: K0805944-017S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	56 - 136	108		5.84		109.58	93.2		6020
Cadmium	68 - 136	11.5		0.220		10.96	102.9		6020
Copper	45 - 148	108		51.9		55.24	101.6		6010B
Iron		40900		40400		220.97	226.3		6010B
Lead	31 - 178	119		6.08		109.58	103.0		6020
Zinc	31 - 160	190		84.6		110.49	95.4		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: SEDIMENT

Service Request: K0805944

Units: MG/KG

Basis: DRY

% Solids: 79.2

Sample Name: JC-08-SD-080626-URSS

Lab Code: K0805944-026S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	56 - 136	77.6		2.54		78.91	95.1		6020
Cadmium	68 - 136	8.96		0.941		7.89	101.6		6020
Copper		1120		978		39.21	362.2		6010B
Iron		25800		24700		156.85	701.3		6010B
Lead	31 - 178	93.8		13.8		78.91	101.4		6020
Zinc	31 - 160	295		208		78.42	110.9		6010B

An empty field in the Control Limit column indicates the control limit is not applicabl

Columbia Analytical Services

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: SEDIMENT

Service Request: K0805944

Units: MG/KG

Basis: DRY

% Solids: 87.6

Sample Name: JC-12-SD-080627-URSS

Lab Code: K0805944-031S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	56 - 136	108		1.77		114.16	93.1		6020
Cadmium	68 - 136	11.7		0.097		11.42	101.6		6020
Copper	45 - 148	106		39.0		56.51	118.6		6010B
Iron		19400		16500		226.05	1282.9		6010B
Lead	31 - 178	116		2.09		114.16	99.8		6020
Zinc	31 - 160	140		35.4		113.03	92.5		6010B

An empty field in the Control Limit column indicates the control limit is not applicabl

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0805944

Project No.: 25696770.00001

Units: MG/KG

Project Name: Blue Ledge Mine

Basis: DRY

Matrix: SEDIMENT

% Solids: 74.8

Sample Name: EC-07-RS-080625-URSD

Lab Code: K0805944-017D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic	20	5.84		5.49		6.2		6020
Cadmium	20	0.220		0.231		4.9		6020
Copper		51.9		57.4		10.1		6010B
Iron	30	40400		38700		4.3		6010B
Lead	20	6.08		6.74		10.3		6020
Zinc		84.6		77.4		8.9		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

lient:	URS Corporation	Service Request:	K0805944
oject No.:	25696770.00001	Units:	MG/KG
oject Name:	Blue Ledge Mine	Basis:	DRY
trix:	SEDIMENT	% Solids:	79.2

Sample Name: JC-08-SD-080626-URSD Lab Code: K0805944-026D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic	20	2.54		3.67		36.4	*	6020
Cadmium	20	0.941		0.978		3.9		6020
Copper	30	978		1040		6.1		6010B
Iron	30	24700		25200		2.0		6010B
Lead	20	13.8		14.4		4.3		6020
Zinc	30	208		206		1.0		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

- 6 -

DUPLICATES

Client: URS Corporation
Service Request: K0805944
Project No.: 25696770.00001
Units: MG/KG
Project Name: Blue Ledge Mine
Basis: DRY
Matrix: SEDIMENT
% Solids: 87.6

Sample Name: JC-12-SD-080627-URSD
Lab Code: K0805944-031D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		1.77		1.71		3.4		6020
Cadmium		0.097		0.116		17.8		6020
Copper		39.0		49.5		23.7		6010B
Iron	30	16500		21300		25.4		6010B
Lead	20	2.09		4.22		67.5	*	6020
Zinc		35.4		41.6		16.1		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

LABORATORY CONTROL SAMPLE

Client: URS Corporation

Service Request: K0805944

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source:

Solid LCS Source: ERA D045540

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits		Solid (mg/kg) %R
Arsenic				146	150		74	126	102.7
Cadmium				92.8	102		77	133	109.9
Copper				70	65.2		85	121	93.1
Iron				13900	14100		60	165	101.4
Lead				67.5	73.6		75	138	109.0
Zinc				402	363		89	125	90.3

Metals

LABORATORY CONTROL SAMPLE

'lient: URS Corporation

Service Request: K0805944

'roject No.: 25696770.00001

'roject Name: Blue Ledge Mine

.queous LCS Source:

Solid LCS Source: ERA D045540

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits		Solid (mg/kg) %R
Arsenic				146	135		74	126	92.5
Cadmium				92.8	91.9		77	133	99.0
Copper				70	60.5		85	121	86.4
Iron				13900	14100		60	165	101.4
Lead				67.5	66.7		75	138	98.8
Zinc				402	368		89	125	91.5

1317 South 13th Avenue Kelso, Washington 98626 (360) 577-7222 (360) 636-1068 fax

Columbia Analytical Services INC.
An Employee - Owned Company

July 31, 2008 Analytical Report for Service Request No: K0806006

Christina Wheeler
URS Corporation
111 SW Columbia
Suite 1500
Portland, OR 97201-5850

RE: Blue Ledge Mine/25696770.00001

Dear Christina:

Enclosed are the results of the samples submitted to our laboratory on July 02, 2008. For your reference, these analyses have been assigned our service request number K0806006.

All analyses were performed according to our laboratory's quality assurance program. Where applicable, the methods cited conform to the Methods Update Rule (effective 4/11/2007), which relates to the use of analytical methods for the drinking water and waste water programs. The test results meet requirements of the NELAC standards. Exceptions are noted in the case narrative report where applicable. 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 3358. You may also contact me via Email at LHuckestein@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda Huckestein
Client Services Manager

LH/ll

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

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 percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
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.

Columbia Analytical Services, Inc.
Kelso, WA
State Certifications, Accreditations, and Licenses

Program	Number
Alaska DEC UST	UST-040
Arizona DHS	AZ0339
Arkansas - DEQ	88-0637
California DHS	2286
Colorado DPHE	-
Florida DOH	E87412
Hawaii DOH	-
Idaho DHW	-
Indiana DOH	C-WA-01
Louisiana DEQ	3016
Louisiana DHH	LA050010
Maine DHS	WA0035
Michigan DEQ	9949
Minnesota DOH	053-999-368
Montana DPHHS	CERT0047
Nevada DEP	WA35
New Jersey DEP	WA005
New Mexico ED	-
North Carolina DWQ	605
Oklahoma DEQ	9801
Oregon - DHS	WA200001
South Carolina DHEC	61002
Utah DOH	COLU
Washington DOE	C1203
Wisconsin DNR	998386840
Wyoming (EPA Region 8)	-

Case Narrative

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	URS Corporation	**Service Request No.:**	K0806006
Project:	Blue Ledge Mine	**Date Received:**	7/2/2008
Sample Matrix:	Tissue, Solid, Water		

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. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), and Laboratory Control Sample (LCS).

Sample Receipt

Six tissue, five solid and one water sample were received for analysis at Columbia Analytical Services on 7/2/2008. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

SPLP Metals

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recoveries of Copper and Zinc for sample WRS-1-DUP are not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

Total and Dissolved Metals

No anomalies associated with the analysis of these samples were observed.

Approved by _____ **Date** 9/1/08

Chain of Custody Documentation

CHAIN OF CUSTODY

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SR#: K0806006

PAGE 1 OF 2 COC #

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: URS
111 SW COLUMBIA, SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR 97201
E-MAIL ADDRESS:
PHONE #: 503 222 7200 FAX #: 503 222 4292
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐ 8270LL ☐	Volatile Organics 624 ☐ 8260 ☐ 8021 ☐ BTEX ☐	Hydrocarbons (*see below) Gas ☐ Diesel ☐ Oil ☐ ☐ Fuel Fingerprint (FIQ) ☐ NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M TH ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	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) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	% Moisture	SPLP Metals			REMARKS
ARV-02-FT-080627-ULS	6/27/08	1130		Tiss.	1									T					X				T=TOTAL
AR-02-FT-DUP-080627-ULS	6/27/08	1800		Tiss.	1									T					X				" "
AR-02-FT-080627-ULS	6/27/08	1800		Tiss	1									T					X				" "
EC-02-FT-080626-ULS	6/26/08	1015		Tiss	1									T					X				" "
EC-04-FT-080626-ULS	↓	1145		Tiss	1									T					X				" "
EC-07-FT-080626-ULS	↓	1245		Tiss	1									T					X				" "
WR-1 ULS-1	6/24/08	1700		S	1									D						X			D=DISS.
ULS-1-DUP	↓	1705		S	1									D						X			" "
ULS-2	↓	1710		S	2									D						X			" "
ULS-3	↓	1715		S	2									D						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
- X V. EDD

INVOICE INFORMATION

P.O. # 25696770.00001

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:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:

TISSUE RESULTS SHOULD BE REPORTED ON A WET WEIGHT BASIS.

RUN SPLP EXTRACTION, THEN FILTER AND ANALYZE FOR DISSOLVED METALS (FOR SOIL SAMPLES)

Container Supply Number

9160

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature]	Signature: Tracy Black	Signature	Signature
Date/Time: 7/2/08 1130	Date/Time: 7/2/08 1230	Date/Time	Date/Time
Printed Name: JENNIFER KAY	Printed Name: Tracy Black	Printed Name	Printed Name
Firm: URS	Firm: CAS	Firm	Firm

RCOC #1 06/03

07/02/08 11:03 9035224292 URS PORTLAND PAGE 03

CHAIN OF CUSTODY

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SR#: 10806006

PAGE 2 OF 2 COC #

PROJECT NAME: BLUE LEDGE MINE
PROJECT NUMBER: 25696770.00001
PROJECT MANAGER: M. EDWARDS
COMPANY/ADDRESS: URS
111 SW COLUMBIA SUITE 1500
CITY/STATE/ZIP: PORTLAND, OR 97201
E-MAIL ADDRESS:
PHONE #: 503 222 7200 FAX#: 503 222 4292
SAMPLER'S SIGNATURE:

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	Semivolatile Organics by GC/MS 625 ☐ 8270 ☐	Volatile Organics 624 ☐ 8260 ☐ 8270LL ☐	Hydrocarbons (*see below) Gas ☐ 8021 ☐ BTEX ☐ Diesel ☐ Oil ☐	Fuel Fingerprint (FIQ) NW-HCID Screen	Oil & Grease/TRPH 1664 HEM ☐ 1664 SGT ☐	PCB's Aroclors ☐ Congeners ☐	Pesticides/Herbicides 608 ☐ 8081A ☐ 8141A ☐ 8151A ☐	Chlorophenolics - 8151M Tri ☐ Tetra ☐ PCP ☐	PAHS 8310 ☐ SIM ☐	Metals, Total & 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) NO_2+NO_3	TOX 9020 ☐ AOX 1650 ☐ 506 ☐	SPLP MERCURY	ALKALINITY (SM2320B)	HARDNESS (SM2340B)	REMARKS
WLS-4	6/24/08	1720		S	2										D				X			D=DISS
T3JC-01-SW-0802-2 URS	6/24/08	1830		W	3										X			X		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
- X V. EDD

INVOICE INFORMATION
P.O. # 25696770.00001
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:

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

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

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

SPECIAL INSTRUCTIONS/COMMENTS:
See p. 1
500 ml HNO_3 + 250 ml Poly HAVE BEEN FIELD FILTERED

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature] Date/Time: 7/2/08 1150	Signature: Tracy Black Date/Time: 7/2/08 1230	Signature: Date/Time:	Signature: Date/Time:
Printed Name: JENNIFER FOX Firm: URS	Printed Name: Black Firm: CAS	Printed Name: Firm:	Printed Name: Firm:

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC UH

Client / Project: URS Service Request K08 06006

Received: 7/2/08 Opened: 7/2/08 By: A.J.

1. Samples were received via? *US Mail* *Fed Ex* *UPS* *DHL* *GH* *GS* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? _____
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? If not, record air-bill number: _____ NA Y N
5. Temperature of cooler(s) upon receipt (°C): -0.6
   Temperature Blank (°C): Broken
6. If applicable, list Chain of Custody Numbers:
7. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
8. Packing material used. *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Sleeves* *Other* _____
9. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* Y N
12. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials and 1631 Mercury bottles received without headspace? *Indicate in the table below.* NA Y N
15. Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection? NA Y N
16. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count	Bottle Type	Out of Temp	Head-space	Broken	pH	Reagent	Volume added	Reagent Lot Number	Initials

Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).

Additional Notes, Discrepancies, & Resolutions: _____

Total Solids

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Results

Client: URS Corporation
Project: Blue Ledge Mine/25696770.00001
Sample Matrix: Solid

Service Request: K0806006

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
WRS-1	K0806006-007	06/24/2008	07/02/2008	07/08/2008	78.0	
WRS-1-DUP	K0806006-008	06/24/2008	07/02/2008	07/08/2008	98.6	
WRS-2	K0806006-009	06/24/2008	07/02/2008	07/08/2008	94.5	
WRS-3	K0806006-010	06/24/2008	07/02/2008	07/08/2008	88.4	
WRS-4	K0806006-011	06/24/2008	07/02/2008	07/08/2008	92.4	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	K0806006
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/24/2008
Sample Matrix:	Solid	**Date Received:**	07/02/2008
		Date Analyzed:	07/08/2008

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
WRS-1	K0806006-007	78.0	83.8	80.9	7	

General Chemistry Parameters

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 06/26/08
Date Received : 07/02/08

Alkalinity as CaCO3, Total

Units : mg/L
Basis : NA

Analysis Method : SM 2320 B
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
T3JC-01-SW-080626	K0806006-012	2	1	1	07/03/08	78	
Method Blank	K0806006-MB	2	1	1	07/03/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 6/26/2008
Date Received : 7/2/2008
Date Prepared : NA
Date Analyzed : 07/03/08

Duplicate Summary
Inorganic Parameters

Sample Name : T3JC-01-SW-080626
Lab Code : K0806006-012DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Alkalinity as CaCO3, Total	SM 2320 B	2	78	76	77	3	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0806006
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/03/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0806006-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Alkalinity as CaCO3, Total	NONE	SM 2320 B	110	109	99	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 06/26/08
Date Received : 07/02/08

Sulfate

Analysis Method : 300.0
Test Notes :

Units : mg/L
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
T3JC-01-SW-080626	K0806006-012	0.2	0.012	2	07/07/08	1.9	
Method Blank	K0806006-MB	0.2	0.006	1	07/07/08	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 6/26/2008
Date Received : 7/2/2008
Date Prepared : NA
Date Analyzed : 07/07/08

Duplicate Summary
Inorganic Parameters

Sample Name : T3JC-01-SW-080626
Lab Code : K0806006-012DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Sulfate	300.0	0.2	1.9	1.8	1.9	5	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 6/26/2008
Date Received : 7/2/2008
Date Prepared : NA
Date Analyzed : 07/07/08

Matrix Spike Summary
Inorganic Parameters

Sample Name : T3JC-01-SW-080626
Lab Code : K0806006-012MS
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	300.0	0.2	4.0	1.9	5.7	96	80-120	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0806006
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/07/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0806006-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Sulfate	NONE	300.0	5.0	4.6	92	90-110	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project : Blue Ledge Mine

Service Request : K0806006
Date Collected : NA
Date Received : NA

Sulfate
300.0
Units: mg/L

CONTINUING CALIBRATION VERIFICATION (CCV)

	Date Analyzed	True Value	Measured Value	Percent Recovery
CCV1 Result	7/7/2008	5.0	4.8	96
CCV2 Result	7/7/2008	5.0	4.8	96
CCV3 Result	7/7/2008	5.0	4.7	94
CCV4 Result	7/7/2008	5.0	4.7	94

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project : Blue Ledge Mine

Service Request : K0806006
Date Collected : NA
Date Received : NA

Sulfate
300.0
Units: mg/L

CONTINUING CALIBRATION BLANK (CCB)

	Date Analyzed	MRL	Blank Value
CCB1 Result	7/7/2008	0.2	ND
CCB2 Result	7/7/2008	0.2	ND
CCB3 Result	7/7/2008	0.2	ND
CCB4 Result	7/7/2008	0.2	ND

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 06/26/08
Date Received : 07/02/08

Solids, Total Dissolved

Units : mg/L
Basis : NA

Analysis Method : SM 2540 C
Test Notes :

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
T3JC-01-SW-080626	K0806006-012	5	5	1	07/03/08	91	
Method Blank	K0806006-MB	5	5	1	07/03/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : NA
Date Received : NA
Date Prepared : NA
Date Analyzed : 07/03/08

Duplicate Summary
Inorganic Parameters

Sample Name : Batch QC
Lab Code : K0805877-018DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Dissolved	SM 2540 C	5	185	189	187	2	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0806006
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/03/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0806006-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Dissolved	NONE	SM 2540 C	805	728	90	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : 06/26/08
Date Received : 07/02/08

Solids, Total Suspended (TSS)

Analysis Method : SM 2540 D
Test Notes :

Units : mg/L
Basis : NA

Sample Name	Lab Code	MRL	MDL	Dilution Factor	Date Analyzed	Result	Result Notes
T3JC-01-SW-080626	K0806006-012	5	5	1	07/03/08	8	
Method Blank	K0806006-MB	5	5	1	07/03/08	ND	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client : URS Corporation
Project Name : Blue Ledge Mine
Project Number : 25696770.00001
Sample Matrix : WATER

Service Request : K0806006
Date Collected : NA
Date Received : NA
Date Prepared : NA
Date Analyzed : 07/03/08

Duplicate Summary
Inorganic Parameters

Sample Name : Batch QC
Lab Code : K0805877-017DUP
Test Notes :

Units : mg/L
Basis : NA

Analyte	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total Suspended (TSS)	SM 2540 D	5	ND	ND	ND	-	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client :	URS Corporation	**Service Request :**	K0806006
Project Name :	Blue Ledge Mine	**Date Collected :**	NA
Project Number :	25696770.00001	**Date Received :**	NA
Sample Matrix :	WATER	**Date Prepared :**	NA
		Date Analyzed :	07/03/08

Laboratory Control Sample Summary
Inorganic Parameters

Sample Name :	Lab Control Sample	Units :	mg/L
Lab Code :	K0806006-LCS	Basis :	NA
Test Notes :			

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Solids, Total Suspended (TSS)	NONE	SM 2540 D	215	214	100	85-115	

SM Standard Methods for the Examination of Water and Wastewater, 20th Ed., 1998.

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	URS Corporation	**Service Request:**	K0806006
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/27/08
Sample Matrix:	Tissue	**Date Received:**	07/02/08

Solids, Total

Prep Method:	NONE	Units:	PERCENT
Analysis Method:	Freeze Dry	Basis:	Wet
Test Notes:			

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
ARV-02-FT-080627-URS	K0806006-001	07/15/08	21.5	
AR-02-FT-DUP-080627-URS	K0806006-002	07/15/08	23.9	
AR-02-FT-080627-URS	K0806006-003	07/15/08	23.2	
EC-02-FT-080626-URS	K0806006-004	07/15/08	23.6	
EC-04-FT-080626-URS	K0806006-005	07/15/08	25.7	
EC-07-FT-080626-URS	K0806006-006	07/15/08	24.9	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	K0806006
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/27/08
Sample Matrix:	Tissue	**Date Received:**	07/02/08
		Date Extracted:	NA
		Date Analyzed:	07/15/08

Duplicate Summary
Total Metals

Sample Name:	ARV-02-FT-080627-URS	Units:	PERCENT
Lab Code:	K0806006-001D	Basis:	Wet
Test Notes:			

Analyte	Prep Method	Analysis Method	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Solids, Total	NA	Freeze Dry	21.5	22.1	21.8	3	

Metals

Columbia Analytical Services

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.: 25696770.00001

Service Request: K0806006

Sample Name:	Lab Code:
ARV-02-FT-080627-URS	K0806006-001
ARV-02-FT-080627-URSD	K0806006-001D
ARV-02-FT-080627-URSS	K0806006-001S
AR-02-FT-DUP-080627-URS	K0806006-002
AR-02-FT-080627-URS	K0806006-003
EC-02-FT-080626-URS	K0806006-004
EC-04-FT-080626-URS	K0806006-005
EC-07-FT-080626-URS	K0806006-006
Method Blank	K0806006-MB

Comments:

Approved By: _____ **Date:** 7/31/08

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/27/2008
Date Received: 7/2/2008
Units: mg/Kg
Basis: DRY

Sample Name: ARV-02-FT-080627-URS **Lab Code:** K0806006-001

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.48	0.08	5.0	07/18/08	07/24/08	0.63		
Cadmium	200.8	0.019	0.005	5.0	07/18/08	07/24/08	0.228		
Copper	200.8	0.10	0.05	5.0	07/18/08	07/24/08	10.7		
Iron	6010B	1.9	0.7	1.0	07/18/08	07/23/08	198		
Lead	200.8	0.019	0.004	5.0	07/18/08	07/24/08	0.126		
Zinc	200.8	0.48	0.08	5.0	07/18/08	07/24/08	107		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/27/2008
Date Received: 7/2/2008
Units: mg/Kg
Basis: DRY

Sample Name: AR-02-FT-DUP-080627-URS **Lab Code:** K0806006-002

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.49	0.08	5.0	07/18/08	07/24/08	0.55		
Cadmium	200.8	0.020	0.005	5.0	07/18/08	07/24/08	0.555		
Copper	200.8	0.10	0.05	5.0	07/18/08	07/24/08	13.8		
Iron	6010B	2.0	0.7	1.0	07/18/08	07/23/08	487		
Lead	200.8	0.020	0.004	5.0	07/18/08	07/24/08	0.099		
Zinc	200.8	0.49	0.08	5.0	07/18/08	07/24/08	127		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/27/2008
Date Received: 7/2/2008
Units: mg/Kg
Basis: DRY

Sample Name: AR-02-FT-080627-URS
Lab Code: K0806006-003

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.43	0.07	5.0	07/18/08	07/24/08	0.70		
Cadmium	200.8	0.017	0.004	5.0	07/18/08	07/24/08	0.623		
Copper	200.8	0.09	0.04	5.0	07/18/08	07/24/08	13.6		
Iron	6010B	1.7	0.6	1.0	07/18/08	07/23/08	298		
Lead	200.8	0.017	0.003	5.0	07/18/08	07/24/08	0.074		
Zinc	200.8	0.43	0.07	5.0	07/18/08	07/24/08	144		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/26/2008
Date Received: 7/2/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-02-FT-080626-URS **Lab Code:** K0806006-004

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.49	0.08	5.0	07/18/08	07/24/08	0.63		
Cadmium	200.8	0.019	0.005	5.0	07/18/08	07/24/08	0.734		
Copper	200.8	0.10	0.05	5.0	07/18/08	07/24/08	24.3		
Iron	6010B	2.0	0.7	1.0	07/18/08	07/23/08	436		
Lead	200.8	0.019	0.004	5.0	07/18/08	07/24/08	0.265		
Zinc	200.8	0.49	0.08	5.0	07/18/08	07/24/08	157		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/26/2008
Date Received: 7/2/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-04-FT-080626-URS **Lab Code:** K0806006-005

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.47	0.08	5.0	07/18/08	07/24/08	0.58		
Cadmium	200.8	0.019	0.005	5.0	07/18/08	07/24/08	0.521		
Copper	200.8	0.10	0.05	5.0	07/18/08	07/24/08	18.6		
Iron	6010B	1.9	0.7	1.0	07/18/08	07/23/08	4430		
Lead	200.8	0.019	0.004	5.0	07/18/08	07/24/08	0.756		
Zinc	200.8	0.47	0.08	5.0	07/18/08	07/24/08	114		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/26/2008
Date Received: 7/2/2008
Units: mg/Kg
Basis: DRY

Sample Name: EC-07-FT-080626-URS **Lab Code:** K0806006-006

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.49	0.08	5.0	07/18/08	07/24/08	0.98		
Cadmium	200.8	0.019	0.005	5.0	07/18/08	07/24/08	0.274		
Copper	200.8	0.10	0.05	5.0	07/18/08	07/24/08	9.32		
Iron	6010B	2.0	0.7	1.0	07/18/08	07/23/08	1180		
Lead	200.8	0.019	0.004	5.0	07/18/08	07/24/08	0.261		
Zinc	200.8	0.49	0.08	5.0	07/18/08	07/24/08	99.6		

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected:
Date Received:
Units: mg/Kg
Basis: DRY

Sample Name: Method Blank
Lab Code: K0806006-MB

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.50	0.08	5.0	07/18/08	07/24/08	0.08	U	
Cadmium	200.8	0.020	0.005	5.0	07/18/08	07/24/08	0.005	U	
Copper	200.8	0.10	0.05	5.0	07/18/08	07/24/08	0.06	B	
Iron	6010B	2.0	0.7	1.0	07/18/08	07/23/08	0.7	U	
Lead	200.8	0.020	0.004	5.0	07/18/08	07/24/08	0.004	U	
Zinc	200.8	0.50	0.08	5.0	07/18/08	07/24/08	0.18	B	

Comments:

Metals

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SPIKE SAMPLE RECOVERY

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Units: MG/KG

Project Name: Blue Ledge Mine

Basis: DRY

Matrix: TISSUE

Sample Name: ARV-02-FT-080627-URSS

Lab Code: K0806006-001S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	70 - 130	16.9		0.63		14.74	110.4		200.8
Cadmium	70 - 130	5.210		0.228		4.41	113.0		200.8
Copper	70 - 130	33.2		10.7		22.06	102.0		200.8
Iron	70 - 130	281		198		88.24	94.1		6010B
Lead	70 - 130	43.7		0.126		44.12	98.8		200.8
Zinc	70 - 130	147		107		44.12	90.7		200.8

An empty field in the Control Limit column indicates the control limit is not applicabl

Metals

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DUPLICATES

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Units: MG/KG

Project Name: Blue Ledge Mine

Basis: DRY

Matrix: TISSUE

% Solids: 100.0

Sample Name: ARV-02-FT-080627-URSD

Lab Code: K0806006-001D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.63		0.64		1.6		200.8
Cadmium	30	0.228		0.234		2.6		200.8
Copper	30	10.7		10.7		0.0		200.8
Iron	20	198		192		3.1		6010B
Lead	30	0.126		0.110		13.6		200.8
Zinc	30	107		127		17.1		200.8

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

LABORATORY CONTROL SAMPLE

Client: URS Corporation **Service Request:** K0806006

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source: Inorganic Ventures **Solid LCS Source:**

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits	%R
Arsenic	167	174	104.2					
Cadmium	50	54.1	108.2					
Copper	250	261	104.4					
Iron	1000	1080	108.0					
Lead	500	506	101.2					
Zinc	500	511	102.2					

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: URS Corporation
Project: Blue Ledge Mine
LCS Matrix: Tissue

Service Request: K0806006
Date Collected: NA
Date Received: NA
Date Extracted: 7/18/2008
Date Analyzed: 7/23/2008-7/24/2008

Laboratory Control Sample Summary
Total Metals

Sample Name: Laboratory Control Sample
Lab Code: K0806006-LCS
Test Notes:

Units: mg/Kg (ppm)
Basis: Dry

Source: N.R.C.C. Dorm-2

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	200.8	18	20	111	13.5-22.9	
Cadmium	PSEP Tissue	200.8	0.043	0.0610	142	0.028-0.0612	
Copper	PSEP Tissue	200.8	2.34	2.45	105	1.74-3.00	
Iron	PSEP Tissue	6010B	142	171	120	106-182	
Lead	PSEP Tissue	200.8	0.065	0.063	97	0.020-0.091	
Zinc	PSEP Tissue	200.8	25.6	30.4	119	20.3-31.0	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	K0806006
Project:	Blue Ledge Mine	**Date Collected:**	NA
LCS Matrix:	Tissue	**Date Received:**	NA
		Date Extracted:	7/18/2008
		Date Analyzed:	7/23/2008-7/24/2008

Laboratory Control Sample Summary
Total Metals

Sample Name:	Laboratory Control Sample	Units:	mg/Kg (ppm)
Lab Code:	K0806006-LCS	Basis:	Dry
Test Notes:			

Source: N.R.C.C. Tort-2

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	Control Limits	Result Notes
Arsenic	PSEP Tissue	200.8	21.6	24.2	112	15.8-28.1	
Cadmium	PSEP Tissue	200.8	26.7	29.4	110	20.9-32.8	
Copper	PSEP Tissue	200.8	106	107	101	77-139	
Iron	PSEP Tissue	6010B	105	111	106	74-142	
Lead	PSEP Tissue	200.8	0.35	0.4	114	0.18-0.58	
Zinc	PSEP Tissue	200.8	180	199	111	139-223	

TCLP METALS

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Sample No.	Lab Sample ID.
WRS-1	K0806006-007
WRS-1D	K0806006-007D
WRS-1S	K0806006-007S
WRS-1-DUP	K0806006-008
WRS-2	K0806006-009
WRS-3	K0806006-010
WRS-4	K0806006-011
Method Blank	K0806006-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:

Signature: [illegible]

Date: 7/31/08

TCLP METALS

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INORGANIC ANALYSIS DATA SHEET

Client:	URS Corporation	Service Request:	K0806006
Project No.:	25696770.00001	Date Collected:	06/24/08
Project Name:	Blue Ledge Mine	Date Received:	07/02/08
Matrix:	TCLP	Units:	MG/L
		Basis:	NA

Sample Name: WRS-1 Lab Code: K0806006-007

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6010B	0.10	0.02	1	7/15/08	7/15/08	0.02	U	
Barium	6010B	1.0	0.1	1	7/15/08	7/15/08	0.4	B	
Cadmium	6010B	0.0100	0.0008	1	7/15/08	7/15/08	0.0010	B	
Chromium	6010B	0.010	0.002	1	7/15/08	7/15/08	0.002	U	
Lead	6010B	0.05	0.02	1	7/15/08	7/15/08	0.02	U	
Mercury	7470A	0.0010	0.0002	1	7/15/08	7/16/08	0.0002	U	
Selenium	6010B	0.10	0.03	1	7/15/08	7/15/08	0.03	U	
Silver	6010B	0.020	0.003	1	7/15/08	7/15/08	0.003	U	

% Solids: 0.0

Comments:

TCLP METALS

-1-

INORGANIC ANALYSIS DATA SHEET

Client:	URS Corporation	Service Request:	K0806006
Project No.:	25696770.00001	Date Collected:	06/24/08
Project Name:	Blue Ledge Mine	Date Received:	07/02/08
Matrix:	TCLP	Units:	MG/L
		Basis:	NA

Sample Name: WRS-1-DUP Lab Code: K0806006-008

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6010B	0.10	0.02	1	7/15/08	7/15/08	0.02	U	
Barium	6010B	1.0	0.1	1	7/15/08	7/15/08	0.3	B	
Cadmium	6010B	0.0100	0.0008	1	7/15/08	7/15/08	0.0008	U	
Chromium	6010B	0.010	0.002	1	7/15/08	7/15/08	0.002	B	
Lead	6010B	0.05	0.02	1	7/15/08	7/15/08	0.02	U	
Mercury	7470A	0.0010	0.0002	1	7/15/08	7/16/08	0.0002	U	
Selenium	6010B	0.10	0.03	1	7/15/08	7/15/08	0.03	U	
Silver	6010B	0.020	0.003	1	7/15/08	7/15/08	0.003	U	

% Solids: 0.0

Comments:

TCLP METALS

-1-

INORGANIC ANALYSIS DATA SHEET

Client:	URS Corporation	Service Request:	K0806006
Project No.:	25696770.00001	Date Collected:	06/24/08
Project Name:	Blue Ledge Mine	Date Received:	07/02/08
Matrix:	TCLP	Units:	MG/L
		Basis:	NA

Sample Name: WRS-2 Lab Code: K0806006-009

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6010B	0.10	0.02	1	7/15/08	7/15/08	0.02	U	
Barium	6010B	1.0	0.1	1	7/15/08	7/15/08	0.3	B	
Cadmium	6010B	0.0100	0.0008	1	7/15/08	7/15/08	0.0008	U	
Chromium	6010B	0.010	0.002	1	7/15/08	7/15/08	0.002	U	
Lead	6010B	0.05	0.02	1	7/15/08	7/15/08	0.04	B	
Mercury	7470A	0.0010	0.0002	1	7/15/08	7/16/08	0.0002	U	
Selenium	6010B	0.10	0.03	1	7/15/08	7/15/08	0.03	U	
Silver	6010B	0.020	0.003	1	7/15/08	7/15/08	0.003	U	

% Solids: 0.0

Comments:

TCLP METALS

-1-

INORGANIC ANALYSIS DATA SHEET

Client:	URS Corporation	Service Request:	K0806006
Project No.:	25696770.00001	Date Collected:	06/24/08
Project Name:	Blue Ledge Mine	Date Received:	07/02/08
Matrix:	TCLP	Units:	MG/L
		Basis:	NA

Sample Name: WRS-3 Lab Code: K0806006-010

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6010B	0.10	0.02	1	7/15/08	7/15/08	0.02	U	
Barium	6010B	1.0	0.1	1	7/15/08	7/15/08	0.3	B	
Cadmium	6010B	0.0100	0.0008	1	7/15/08	7/15/08	0.0008	U	
Chromium	6010B	0.010	0.002	1	7/15/08	7/15/08	0.002	U	
Lead	6010B	0.05	0.02	1	7/15/08	7/15/08	0.04	B	
Mercury	7470A	0.0010	0.0002	1	7/15/08	7/16/08	0.0002	U	
Selenium	6010B	0.10	0.03	1	7/15/08	7/15/08	0.03	U	
Silver	6010B	0.020	0.003	1	7/15/08	7/15/08	0.003	U	

% Solids: 0.0

Comments:

TCLP METALS

-1-

INORGANIC ANALYSIS DATA SHEET

Client:	URS Corporation	Service Request:	K0806006
Project No.:	25696770.00001	Date Collected:	06/24/08
Project Name:	Blue Ledge Mine	Date Received:	07/02/08
Matrix:	TCLP	Units:	MG/L
		Basis:	NA

Sample Name: WRS-4 Lab Code: K0806006-011

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6010B	0.10	0.02	1	7/15/08	7/15/08	0.02	U	
Barium	6010B	1.0	0.1	1	7/15/08	7/15/08	0.3	B	
Cadmium	6010B	0.0100	0.0008	1	7/15/08	7/15/08	0.0008	U	
Chromium	6010B	0.010	0.002	1	7/15/08	7/15/08	0.002	U	
Lead	6010B	0.05	0.02	1	7/15/08	7/15/08	0.02	U	
Mercury	7470A	0.0010	0.0002	1	7/15/08	7/16/08	0.0002	U	
Selenium	6010B	0.10	0.03	1	7/15/08	7/15/08	0.03	U	
Silver	6010B	0.020	0.003	1	7/15/08	7/15/08	0.003	U	

% Solids: 0.0

Comments:

TCLP METALS

-1-

INORGANIC ANALYSIS DATA SHEET

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: TCLP

Service Request: K0806006

Date Collected:

Date Received:

Units: MG/L

Basis: NA

Sample Name: Method Blank

Lab Code: K0806006-MB

Analyte	Analysis Method	MRL	MDL	Dil.	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6010B	0.10	0.02	1	7/15/08	7/15/08	0.02	U	
Barium	6010B	1.0	0.1	1	7/15/08	7/15/08	0.1	U	
Cadmium	6010B	0.0100	0.0008	1	7/15/08	7/15/08	0.0008	U	
Chromium	6010B	0.010	0.002	1	7/15/08	7/15/08	0.002	U	
Lead	6010B	0.05	0.02	1	7/15/08	7/15/08	0.02	U	
Mercury	7470A	0.0010	0.0002	1	7/15/08	7/16/08	0.0003	B	
Selenium	6010B	0.10	0.03	1	7/15/08	7/15/08	0.03	U	
Silver	6010B	0.020	0.003	1	7/15/08	7/15/08	0.003	U	

% Solids: 0.0

Comments:

TCLP METALS
- 5a -
SPIKE SAMPLE RECOVERY

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TCLP

Service Request: K0806006
Units: mg/L
Basis: NA
% Solids: 0.0

Sample Name: WRS-1S
Lab Code: K0806006-007S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	75 - 125	5.01		0.02	U	5.00	100		6010B
Barium	75 - 125	10.7		0.4	B	10.0	103		6010B
Cadmium	75 - 125	1.0300		0.0010	B	1.0000	102		6010B
Chromium	75 - 125	4.970		0.002	U	5.000	99		6010B
Lead	75 - 125	4.69		0.02	U	5.00	94		6010B
Mercury	75 - 125	0.0049		0.0002	U	0.0050	98		7470A
Selenium	75 - 125	1.04		0.03	U	1.00	104		6010B
Silver	75 - 125	0.941		0.003	U	1.000	94		6010B

An empty field in the Control Limit column indicates the control limit is not applicabl

TCLP METALS

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DUPLICATES

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TCLP

Service Request: K0806006
Units: mg/L
Basis: NA
% Solids: 0.0

Sample Name: WRS-1D
Lab Code: K0806006-007D

Analyte	Control Limit (%)	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.02	U	0.02	U			6010B
Barium		0.4	B	0.4	B	1		6010B
Cadmium		0.0010	B	0.0010	B	5		6010B
Chromium		0.002	U	0.002	U			6010B
Lead		0.02	U	0.02	U			6010B
Mercury		0.0002	U	0.0002	U			7470A
Selenium		0.03	U	0.03	U			6010B
Silver		0.003	U	0.003	U			6010B

An empty field in the Control Limit column indicates the control limit is not applicabl

TCLP METALS

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LABORATORY CONTROL SAMPLE

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source: Inorganic Ventures

Solid LCS Source:

Analyte	Aqueous mg/L True	Aqueous mg/L Found	Aqueous mg/L %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits (%)		Solid (mg/kg) %R
Arsenic	5.00	5.07	101						
Barium	10.0	10.4	104						
Cadmium	1.00	1.02	102						
Chromium	5.00	4.95	99						
Lead	5.00	4.67	93						
Mercury	0.00500	0.00540	108						
Selenium	1.00	1.07	107						
Silver	1.00	0.948	95						

Columbia Analytical Services

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.: 25696770.00001

Service Request: K0806006

Sample Name:	Lab Code:
WRS-1	K0806006-007
WRS-1D	K0806006-007D
WRS-1S	K0806006-007S
WRS-1-DUP	K0806006-008
WRS-1-DUPD	K0806006-008D
WRS-1-DUPS	K0806006-008S
WRS-2	K0806006-009
WRS-3	K0806006-010
WRS-4	K0806006-011
Method Blank	K0806006-MB

Comments:

Approved By: _____ **Date:** 7/31/08

SPLP Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SPLP

Service Request: K0806006
Date Collected: 6/24/08
Date Received: 7/2/08
Units: mg/L
Basis: N/A

Sample Name: WRS-1
Lab Code: K0806006-007

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.0005	1.0	07/14/08	07/18/08	0.0005	U	
Cadmium	6020	0.00005	1.0	07/14/08	07/18/08	0.00067		
Copper	6020	0.005	1.0	07/14/08	07/18/08	0.11		
Iron	6010B	0.02	1.0	07/08/08	07/09/08	0.04		
Lead	6020	0.0002	1.0	07/14/08	07/18/08	0.0012		
Zinc	6020	0.005	1.0	07/14/08	07/18/08	0.26		

% Solids: 0.0

Comments:

SPLP Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SPLP

Service Request: K0806006
Date Collected: 6/24/08
Date Received: 7/2/08
Units: mg/L
Basis: N/A

Sample Name: WRS-1-DUP
Lab Code: K0806006-008

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.0005	1.0	07/14/08	07/18/08	0.0005	U	
Cadmium	6020	0.00005	1.0	07/14/08	07/18/08	0.00073		
Copper	6020	0.005	1.0	07/14/08	07/18/08	0.13		
Iron	6010B	0.02	1.0	07/08/08	07/09/08	0.06		
Lead	6020	0.0002	1.0	07/14/08	07/18/08	0.0009		
Zinc	6020	0.005	1.0	07/14/08	07/18/08	0.26		

% Solids: 0.0

Comments:

SPLP Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SPLP

Service Request: K0806006
Date Collected: 6/24/08
Date Received: 7/2/08
Units: mg/L
Basis: N/A

Sample Name: WRS-2
Lab Code: K0806006-009

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.0005	1.0	07/14/08	07/18/08	0.0005	U	
Cadmium	6020	0.00005	1.0	07/14/08	07/18/08	0.00010		
Copper	6020	0.005	1.0	07/14/08	07/18/08	0.086		
Iron	6010B	0.02	1.0	07/08/08	07/09/08	0.03		
Lead	6020	0.0002	1.0	07/14/08	07/18/08	0.017		
Zinc	6020	0.005	1.0	07/14/08	07/18/08	0.14		

% Solids: 0.0

Comments:

SPLP Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SPLP

Service Request: K0806006
Date Collected: 6/24/08
Date Received: 7/2/08
Units: mg/L
Basis: N/A

Sample Name: WRS-3
Lab Code: K0806006-010

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.0005	1.0	07/14/08	07/18/08	0.0005	U	
Cadmium	6020	0.00005	1.0	07/14/08	07/18/08	0.00050		
Copper	6020	0.005	1.0	07/14/08	07/18/08	0.23		
Iron	6010B	0.02	1.0	07/08/08	07/09/08	0.03		
Lead	6020	0.0002	1.0	07/14/08	07/18/08	0.021		
Zinc	6020	0.005	1.0	07/14/08	07/18/08	0.20		

% Solids: 0.0

Comments:

SPLP Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SPLP

Service Request: K0806006
Date Collected: 6/24/08
Date Received: 7/2/08
Units: mg/L
Basis: N/A

Sample Name: WRS-4
Lab Code: K0806006-011

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.0005	1.0	07/14/08	07/18/08	0.0005	U	
Cadmium	6020	0.00005	1.0	07/14/08	07/18/08	0.00086		
Copper	6020	0.005	1.0	07/14/08	07/18/08	0.23		
Iron	6010B	0.02	1.0	07/08/08	07/09/08	0.06		
Lead	6020	0.0002	1.0	07/14/08	07/18/08	0.0069		
Zinc	6020	0.005	1.0	07/14/08	07/18/08	0.20		

% Solids: 0.0

Comments:

SPLP Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: SPLP

Service Request: K0806006
Date Collected:
Date Received:
Units: mg/L
Basis: N/A

Sample Name: Method Blank
Lab Code: K0806006-MB

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.0005	1.0	07/14/08	07/18/08	0.0005	U	
Cadmium	6020	0.00005	1.0	07/14/08	07/18/08	0.00005	U	
Copper	6020	0.005	1.0	07/14/08	07/18/08	0.005	U	
Iron	6010B	0.02	1.0	07/08/08	07/09/08	0.02	U	
Lead	6020	0.0002	1.0	07/14/08	07/18/08	0.0002	U	
Zinc	6020	0.005	1.0	07/14/08	07/18/08	0.005	U	

% Solids: 0.0

Comments:

SPLP Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Units: MG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: SPLP

% Solids: 0.0

Sample Name: WRS-1S

Lab Code: K0806006-007S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Iron	75 - 125	9.09		0.02	U	10.00	91		6010B

An empty field in the Control Limit column indicates the control limit is not applicable

SPLP Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation
Service Request: K0806006
Project No.: 25696770.00001
Units: MG/L
Project Name: Blue Ledge Mine
Basis: N/A
Matrix: SPLP
% Solids: 0.0

Sample Name: WRS-1-DUPS
Lab Code: K0806006-008S

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	75 - 125	0.0184		0.0005	U	0.02	92		6020
Cadmium	75 - 125	0.01993		0.00073		0.02	96		6020
Copper		0.146		0.127		0.02	95		6020
Lead	75 - 125	0.0205		0.0009		0.02	98		6020
Zinc		0.285		0.259		0.02	130		6020

An empty field in the Control Limit column indicates the control limit is not applicable

SPLP Metals

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DUPLICATES

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Units: MG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: SPLP

% Solids: 0.0

Sample Name: WRS-1D

Lab Code: K0806006-007D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Iron		0.04		0.04		0.0		6010B

An empty field in the Control Limit column indicates the control limit is not applicable.

SPLP Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Units: MG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: SPLP

% Solids: 0.0

Sample Name: WRS-1-DUPD

Lab Code: K0806006-008D

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.0005	U	0.0005	U			6020
Cadmium	20	0.00073		0.00077		5.33		6020
Copper	20	0.127		0.128		0.78		6020
Lead		0.0009		0.0009		0.00		6020
Zinc	20	0.259		0.264		1.91		6020

An empty field in the Control Limit column indicates the control limit is not applicable.

SPLP Metals

LABORATORY CONTROL SAMPLE

Client: URS Corporation **Service Request:** K0806006

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source: CAS MIXED **Solid LCS Source:**

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits	Solid (mg/kg) %R
Arsenic	0.02	0.02	100					
Cadmium	0.02	0.02	100					
Copper	0.02	0.02	100					
Iron	10.00	8.90	89					
Lead	0.02	0.02	100					
Zinc	0.02	0.02	100					

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	URS Corporation	**Service Request:**	K0806006
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/26/08
Sample Matrix:	Water	**Date Received:**	07/02/08

Hardness as CaCO3

Prep Method:	CLAA	Units:	mg/L (ppm)
Analysis Method:	6010B/SM 2340B	Basis:	NA
Test Notes:			

Sample Name	Lab Code	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
T3JC-01-SW-080626	K0806006-012	0.4	1	07/21/08	07/22/08	74.1	
Method Blank	K0806006-MB	0.4	1	07/21/08	07/22/08	ND	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	URS Corporation	**Service Request:**	K0806006
Project:	Blue Ledge Mine/25696770.00001	**Date Collected:**	06/26/08
Sample Matrix:	Water	**Date Received:**	07/02/08
		Date Extracted:	07/21/08
		Date Analyzed:	07/22/08

Duplicate Summary
Metals

Sample Name:	T3JC-01-SW-080626	Units:	mg/L (ppm)
Lab Code:	K0806006-012	Basis:	NA
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Hardness as CaCO3	CLAA	6010B/SM 2340B	0.4	74.1	71.8	73.0	3	

Columbia Analytical Services

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project Name: Blue Ledge Mine
Project No.: 25696770.00001

Service Request: K0806006

Sample Name:	Lab Code:
T3JC-01-SW-080626	K0806006-012 DISS
T3JC-01-SW-080626D	K0806006-012D DISS
T3JC-01-SW-080626S	K0806006-012S DISS
Method Blank	K0806006-MB

Comments:

Approved By: _____ **Date:** 7/31/08

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0806006
Date Collected: 6/26/2008
Date Received: 7/2/2008
Units: ug/L
Basis: N/A

Sample Name: T3JC-01-SW-080626
Lab Code: K0806006-012 DISS

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/16/08	07/18/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/16/08	07/18/08	0.010	B	
Copper	6020	0.10	0.02	1.0	07/16/08	07/18/08	0.42		
Iron	6010B	20.0	4.0	1.0	07/21/08	07/22/08	97.9		
Lead	6020	0.020	0.003	1.0	07/16/08	07/18/08	0.007	B	
Zinc	6020	0.50	0.06	1.0	07/16/08	07/18/08	1.75		

% Solids: 0.0

Comments:

Metals

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INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: WATER

Service Request: K0806006
Date Collected:
Date Received:
Units: ug/L
Basis: N/A

Sample Name: Method Blank
Lab Code: K0806006-MB

Analyte	Analysis Method	MRL	MDL	Dil. Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	6020	0.50	0.07	1.0	07/16/08	07/18/08	0.07	U	
Cadmium	6020	0.020	0.008	1.0	07/16/08	07/18/08	0.008	U	
Copper	6020	0.10	0.02	1.0	07/16/08	07/18/08	0.05	B	
Iron	6010B	20.0	4.0	1.0	07/21/08	07/22/08	4.0	U	
Lead	6020	0.020	0.003	1.0	07/16/08	07/18/08	0.003	U	
Zinc	6020	0.50	0.06	1.0	07/16/08	07/18/08	0.34	B	

% Solids: 0.0

Comments:

Columbia Analytical Services

Metals

- 5A -

SPIKE SAMPLE RECOVERY

Client: URS Corporation

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Matrix: WATER

Service Request: K0806006

Units: UG/L

Basis: N/A

% Solids: 0.0

Sample Name: T3JC-01-SW-080626S

Lab Code: K0806006-012S DISS

Analyte	Control Limit %R	Spike Result	C	Sample Result	C	Spike Added	%R	Q	Method
Arsenic	74 - 126	19.7		0.50	U	20.00	98.5		6020
Cadmium	84 - 113	19.5		0.010	B	20.00	97.4		6020
Copper	63 - 126	19.1		0.42		20.00	93.4		6020
Iron	68 - 135	1090		97.9		1000.00	99.2		6010B
Lead	71 - 119	19.5		0.007	B	20.00	97.5		6020
Zinc	62 - 126	20.7		1.75		20.00	94.8		6020

An empty field in the Control Limit column indicates the control limit is not applicabl

Metals

- 6 -

DUPLICATES

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Units: UG/L

Project Name: Blue Ledge Mine

Basis: N/A

Matrix: WATER

% Solids: 0.0

Sample Name: T3JC-01-SW-080626D

Lab Code: K0806006-012D DISS

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	Method
Arsenic		0.07	U	0.09	B	200.0		6020
Cadmium		0.010	B	0.008	U	200.0		6020
Copper		0.42		0.39		7.4		6020
Iron		97.9		93.8		4.3		6010B
Lead		0.007	B	0.003	U	200.0		6020
Zinc		1.75		1.75		0.0		6020

An empty field in the Control Limit column indicates the control limit is not applicable

Metals

LABORATORY CONTROL SAMPLE

Client: URS Corporation

Service Request: K0806006

Project No.: 25696770.00001

Project Name: Blue Ledge Mine

Aqueous LCS Source: CAS MIXED

Solid LCS Source:

Analyte	Aqueous (ug/L) True	Aqueous (ug/L) Found	Aqueous (ug/L) %R	Solid (mg/kg) True	Solid (mg/kg) Found	Solid (mg/kg) C	Solid (mg/kg) Limits	Solid (mg/kg) %R
Arsenic	20	19.7	98.5					
Cadmium	20	19.9	99.5					
Calcium	12500	12700	101.6					
Copper	20	19.5	97.5					
Iron	2500	2520	100.8					
Lead	20	20.1	100.5					
Magnesium	12500	12300	98.4					
Zinc	20	20.0	100.0					

1317 South 13th Avenue Kelso, Washington 98626 (360) 577-7222 (360) 636-1068 fax

Columbia Analytical Services INC.
An Employee - Owned Company

August 13, 2008 Analytical Report for Service Request No: K0806006

Christina Wheeler
URS Corporation
111 SW Columbia
Suite 1500
Portland, OR 97201-5850

RE: Blue Ledge Mine/25696770.00001

Dear Christina:

Enclosed are the revised pages for the samples submitted to our laboratory on July 02, 2008. For your reference, these analyses have been assigned our service request number K0806006.

The results have been revised to reflect a wet weight basis.

All analyses were performed according to our laboratory's quality assurance program. Where applicable, the methods cited conform to the Methods Update Rule (effective 4/11/2007), which relates to the use of analytical methods for the drinking water and waste water programs. The test results meet requirements of the NELAC standards. Exceptions are noted in the case narrative report where applicable. 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 3358. You may also contact me via Email at LHuckestein@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda Huckestein
Client Services Manager

LH/afs

NELAP Accredited ACIL Seal of Excellence Award 100% Recycled

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/27/08
Date Received: 7/2/08
Units: mg/Kg
Basis: WET

Sample Name: ARV-02-FT-080627-URS **Lab Code:** K0806006-001

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.10	0.02	5.0	07/18/08	07/24/08	0.14		
Cadmium	200.8	0.004	0.001	5.0	07/18/08	07/24/08	0.049		
Copper	200.8	0.02	0.01	5.0	07/18/08	07/24/08	2.29		
Iron	6010B	0.4	0.1	1.0	07/18/08	07/23/08	43		
Lead	200.8	0.004	0.001	5.0	07/18/08	07/24/08	0.027		
Zinc	200.8	0.10	0.02	5.0	07/18/08	07/24/08	22.9		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/27/08
Date Received: 7/2/08
Units: mg/Kg
Basis: WET

Sample Name: AR-02-FT-DUP-080627-URS **Lab Code:** K0806006-002

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.12	0.02	5.0	07/18/08	07/24/08	0.13		
Cadmium	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.133		
Copper	200.8	0.02	0.01	5.0	07/18/08	07/24/08	3.30		
Iron	6010B	0.5	0.2	1.0	07/18/08	07/23/08	116		
Lead	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.024		
Zinc	200.8	0.12	0.02	5.0	07/18/08	07/24/08	30.3		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/27/08
Date Received: 7/2/08
Units: mg/Kg
Basis: WET

Sample Name: AR-02-FT-080627-URS
Lab Code: K0806006-003

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.10	0.02	5.0	07/18/08	07/24/08	0.16		
Cadmium	200.8	0.004	0.001	5.0	07/18/08	07/24/08	0.145		
Copper	200.8	0.02	0.01	5.0	07/18/08	07/24/08	3.15		
Iron	6010B	0.4	0.1	1.0	07/18/08	07/23/08	69		
Lead	200.8	0.004	0.001	5.0	07/18/08	07/24/08	0.017		
Zinc	200.8	0.10	0.02	5.0	07/18/08	07/24/08	33.5		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/26/08
Date Received: 7/2/08
Units: mg/Kg
Basis: WET

Sample Name: EC-02-FT-080626-URS
Lab Code: K0806006-004

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.12	0.02	5.0	07/18/08	07/24/08	0.15		
Cadmium	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.173		
Copper	200.8	0.02	0.01	5.0	07/18/08	07/24/08	5.73		
Iron	6010B	0.5	0.2	1.0	07/18/08	07/23/08	103		
Lead	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.062		
Zinc	200.8	0.12	0.02	5.0	07/18/08	07/24/08	37.1		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/26/08
Date Received: 7/2/08
Units: mg/Kg
Basis: WET

Sample Name: EC-04-FT-080626-URS
Lab Code: K0806006-005

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.12	0.02	5.0	07/18/08	07/24/08	0.15		
Cadmium	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.134		
Copper	200.8	0.02	0.01	5.0	07/18/08	07/24/08	4.79		
Iron	6010B	0.5	0.2	1.0	07/18/08	07/23/08	1140		
Lead	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.194		
Zinc	200.8	0.12	0.02	5.0	07/18/08	07/24/08	29.2		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected: 6/26/08
Date Received: 7/2/08
Units: mg/Kg
Basis: WET

Sample Name: EC-07-FT-080626-URS
Lab Code: K0806006-006

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.12	0.02	5.0	07/18/08	07/24/08	0.24		
Cadmium	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.068		
Copper	200.8	0.02	0.01	5.0	07/18/08	07/24/08	2.32		
Iron	6010B	0.5	0.2	1.0	07/18/08	07/23/08	295		
Lead	200.8	0.005	0.001	5.0	07/18/08	07/24/08	0.065		
Zinc	200.8	0.12	0.02	5.0	07/18/08	07/24/08	24.8		

Comments:

Metals

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: URS Corporation
Project No.: 25696770.00001
Project Name: Blue Ledge Mine
Matrix: TISSUE

Service Request: K0806006
Date Collected:
Date Received:
Units: mg/Kg
Basis: WET

Sample Name: Method Blank
Lab Code: K0806006-MB

Analyte	Analysis Method	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Arsenic	200.8	0.15	0.02	5.0	07/18/08	07/24/08	0.02	U	
Cadmium	200.8	0.006	0.002	5.0	07/18/08	07/24/08	0.002	U	
Copper	200.8	0.03	0.02	5.0	07/18/08	07/24/08	0.02	B	
Iron	6010B	0.6	0.2	1.0	07/18/08	07/23/08	0.2	U	
Lead	200.8	0.006	0.001	5.0	07/18/08	07/24/08	0.001	U	
Zinc	200.8	0.15	0.02	5.0	07/18/08	07/24/08	0.05	B	

Comments:

DATA QUALITY QA/QC REPORT

The data quality review of thirty-three primary water samples, two field duplicate water samples, twenty-four primary sediment samples, two duplicate sediment samples, ten riparian soil samples, one duplicate riparian soil samples, five primary fish tissue samples, one duplicate fish tissue sample, four primary waste rock samples and one duplicate waste rock sample collected as part of the Summer 2008 Field Investigation at the Blue Ledge Mine has been completed. The sampling occurred from June 24th to June 27th, 2008. The samples were submitted to Columbia Analytical Services, Inc (CAS) located in Kelso, Washington. All analyses were performed in general accordance with methods specified in EPA's *Test Methods for Evaluating Solid Waste (SW-846*), Update IIIB, June 2005 and *Methods for Chemical Analysis of Water and Wastes,* March 1983. Samples were analyzed for one or more of the following parameters:

Method	Analytical Parameter
EPA 6010B/6020	Total and Dissolved Metals[1]
EPA 1312	SPLP Metals[1]
EPA 1311	TCLP Metals[2]
SM 2540D	Total Suspended Solids (TSS)
SM 2540C	Total Dissolved Solids (TDS)
EPA 300.0	Sulfate
SM 2340B	Hardness
SM 2320B	Alkalinity
ASTM D422 mod.	Particle Size Determination
Freeze Dry (Tissue) 160.3M (Soil/Sediment)	Percent Solids

[1]Arsenic, Cadmium, Copper, Iron, Lead and Zinc
[2]Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium and Silver

The project samples were divided into four sample delivery groups (SDGs) and assigned CAS SDG numbers K0805778, K0805893, K0805944 and K0806006. CAS provided data packages for these four SDGs consisting of summarized sample and QC results. The analytical review of this data included the evaluation of hold times, method blanks, surrogate recoveries, laboratory control sample (LCS) results, laboratory and field duplicate results (DUP), and matrix spike/matrix spike duplicate (MS/MSD) results. Additionally verification of the reported electronic data with the hard copy deliverable was reviewed at a frequency of 15% or greater. Specific sample identifications and requested analyses are presented in Table 1. The data were reviewed based on *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, October 2004 and laboratory quality control criteria per the project *Work Plan and Sampling Analysis Plan* (WSAP) (URS, 2008). Data qualifiers assigned to sample results are presented in Table 2 and have been incorporated into the data tables attached to the main body of this report.

The cooler temperatures were recorded as part of the check-in procedure by CAS. Coolers associated with SDG K0805893 were received by the laboratory at temperatures ranging from

6.0°C to 7.0°C, slightly above the EPA recommended temperature range of 4 ± 2°C. The samples were packed into coolers with fresh ice just prior to the lab courier pick-up; therefore, the coolers did not have sufficient time to reach the EPA recommended temperature range. No qualification due to the temperature exceedance was necessary.

INORGANIC ANALYSES

Samples were analyzed for total and dissolved metals, TCLP and SPLP metals by the methods identified in the introduction to this report.

1. Holding Times – Acceptable
2. Blanks – Acceptable with the following exceptions:

   Dissolved Metals by EPA Method 6020 – Zinc (dissolved) was detected at 0.10 ug/L in the method blank associated with batch K0805778. All associated sample results were greater than ten times the blank result with the exception of sample AR-01-SW-080624-URS (K0805778-001). This result was qualified as non-detect at the reporting limit, 0.50 U.

   Dissolved Metals by EPA Method 6020 – Lead (dissolved) was detected at 0.0009 ug/L in the method blank, MB2, associated with batch K0805893. All associated sample results less than ten times the blank result were qualified as non-detect at the reporting limit, 0.020 U.

   Dissolved Metals by EPA Method 6020 – Lead (dissolved), copper (dissolved), and zinc were detected in the method blank associated with batch K0806006. All associated sample results were greater than 10 times the blank concentration, therefore, no qualification was necessary.
3. Laboratory Control Samples (LCS or Blank Spike) – Acceptable
4. Laboratory Duplicate – Acceptable with the following exceptions:

   Total Metals by EPA Method 6020 – The relative percent difference (RPD) for arsenic of 36.4% exceeded the laboratory control limit of 20% in the laboratory duplicate analysis of sample JC-08-SD-080626-URS. Upon comparison of physical and chemical results of other samples in the investigation, it was determined that qualification of only the parent sample was required. The arsenic result for the parent sample was qualified as estimated and flagged ‘J’.

   Total Metals by EPA Method 6020 – The relative percent difference (RPD) for lead of 67.5% exceeded the laboratory control limit of 20% in the laboratory duplicate analysis of sample JC-12-SD-080627-URS. Upon comparison of physical and chemical results of other samples in the investigation, it was determined that qualification of only the parent sample was required. The arsenic result for the parent sample was qualified as estimated and flagged ‘J’.
5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – Acceptable
6. Laboratory Qualifiers

   The laboratory flagged results detected at concentrations between the method detection

limit (MDL) and the method-reporting limit (MRL) with a 'B' to indicate that the concentration is estimated. This qualifier was amended to a 'J' as a result of this data review.

CONVENTIONAL CHEMISTRY PARAMETERS

Samples were analyzed for sulfate, total suspended solids, total dissolved solids, hardness and alkalinity by the methods identified in the introduction to this report.

1. Holding Times – Acceptable
2. Blanks – Acceptable
3. Laboratory Control Samples (LCS or Blank Spike) – Acceptable
4. Duplicate – Acceptable
5. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – Acceptable

FIELD DUPLICATE

Samples submitted for field duplicate analysis and the associated parent sample are summarized below:

Field Duplicate Sample ID	Parent Sample ID	Matrix
AR-02-FT-DUP-080627-URS	AR-02-FT-080627-URS	Fish Tissue
WRS-1-DUP	WRS-1	Waste Rock
EC-04-SD-DUP-080625-URS	EC-04-SD-080625-URS	Sediment
EC-05-SD-DUP-080625-URS	EC-05-SD-080625-URS	Sediment
EC-05-RS-DUP-080625-URS	EC-05-RS-080625-URS	Riparian Soil
EC-04-SW-DUP-080625-URS	EC-04-SW-080625-URS	Surface Water
JC-07-SW-DUP-080626-URS	JC-07-SW-080625-URS	Surface Water

Field duplicates were collected at the appropriate frequency of one per twenty samples per matrix as required by the WSAP. RPDs were calculated for all results greater than five times the reporting limit. Project-specific criteria for field duplicate precision was not specifically delineated in the WSAP, however recommend criteria of 30% for solid matrices and 20% for water were applied. All calculated RPDs between the parent sample and field duplicate for all parameters were with these recommended limits with one exception. The RPD for iron in the analysis of AR-02-FT-DUP-080627-URS and AR-02-FT-080627-URS of 50% exceeded the recommended control limit. The total iron sample results for the parent/duplicate pair were qualified as estimated and flagged 'J'.

OVERALL ASSESSMENT OF DATA

The completeness of the CAS reports for the 2008 Site Investigation sampling events is 100%. The laboratory originally submitted the fish tissue results on a dry weight basis when results had

been requested on a wet weight basis. The laboratory promptly supplied the revised results for these analyses. The usefulness of this data is based on USEPA guidance documents referenced in the introduction to this report. Upon consideration of the information presented above, the data are considered usable. Data qualifiers assigned by the laboratory are shown on the laboratory reports.

DATA QUALIFIER DEFINITIONS:

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

J The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria.

Table 1

Client Sample ID	Sample Location	Sample Date	Laboratory Sample ID	Requested Analyses
DAM-01-080624-URS	DAM-01	6/24/08	K0805778-005	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
AD-01-080624-URS	AD-01	6/24/08	K0805778-008	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
AD-02-080624-URS	AD-02	6/24/08	K0805778-006	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
SP-01-080624-URS	SP-01	6/24/08	K0805778-007	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
SP-02-080627-URS	SP-02	6/27/08	K0805893-022	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
WRS-1	Waste Rock Pile	6/24/08	K0806006-007	SPLP Metals and TCLP Metals
WRS-1-DUP	Waste Rock Pile	6/24/08	K0806006-008	SPLP Metals and TCLP Metals
WRS-2	Waste Rock Pile	6/24/08	K0806006-009	SPLP Metals and TCLP Metals
WRS-3	Waste Rock Pile	6/24/08	K0806006-010	SPLP Metals and TCLP Metals
WRS-4	Waste Rock Pile	6/24/08	K0806006-011	SPLP Metals and TCLP Metals
JC-01-SD-080626-URS	JC-01	6/26/08	K0805944-019	Total Metals, Particle Size
JC-01-SW-080626-URS	JC-01	6/26/08	K0805893-008	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-01-RS-080626-URS	JC-01	6/26/08	K0805944-020	Total Metals, Particle Size
JC-02-SD-080626-URS	JC-02	6/26/08	K0805944-021	Total Metals, Particle Size
JC-02-SW-080626-URS	JC-02	6/26/08	K0805893-009	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-03-RS-080626-URS	JC-03	6/26/08	K0805944-022	Total Metals, Particle Size
JC-03-SD-080626-URS	JC-03	6/26/08	K0805944-023	Total Metals, Particle Size
JC-03-SW-080626-URS	JC-03	6/26/08	K0805893-010	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-04-RS-080627-URS	JC-04	6/27/08	K0805944-024	Total Metals, Particle Size
JC-04-SD-080627-URS	JC-04	6/27/08	K0805944-025	Total Metals, Particle Size
JC-04-SW-080627-URS	JC-04	6/27/08	K0805893-011	Dissolved Metals, Sulfate, Alkalinity. Hardness, TDS, TSS
JC-07-SW-080626-URS	JC-07	6/26/08	K0805893-012	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-07-SW-DUP-080626-URS	JC-07	6/26/08	K0805893-013	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-08-SD-080626-URS	JC-08	6/26/08	K0805944-026	Total Metals, Particle Size
JC-08-SW-080626-URS	JC-08	6/26/08	K0805893-014	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-09-SW-080627-URS	JC-09	6/27/08	K0805893-015	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-10-SD-080627-URS	JC-10	6/27/08	K0805944-027	Total Metals, Particle Size
JC-10-SW-080627-URS	JC-10	6/27/08	K0805893-016	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-11-SD-080627-URS	JC-11	6/27/08	K0805944-029	Total Metals, Particle Size
JC-11-SW-080627-URS	JC-11	6/27/08	K0805893-017	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-12-RS-080627-URS	JC-12	6/27/08	K0805944-030	Total Metals, Particle Size
JC-12-SD-080627-URS	JC-12	6/27/08	K0805944-031	Total Metals, Particle Size

Client Sample ID	Sample Location	Sample Date	Laboratory Sample ID	Requested Analyses
JC-12-SW-080627-URS	JC-12	6/27/08	K0805893-018	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-13-SD-080627-URS	JC-13	6/27/08	K0805944-032	Total Metals, Particle Size
JC-13-SW-080627-URS	JC-13	6/27/08	K0805893-019	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-14-RS-080627-URS	JC-14	6/27/08	K0805944-033	Total Metals, Particle Size
JC-14-SD-080627-URS	JC-14	6/27/08	K0805944-034	Total Metals, Particle Size
JC-14-SW-080627-URS	JC-14	6/27/08	K0805893-020	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
JC-15-SD-080627-URS	JC-15	6/27/08	K0805944-035	Total Metals, Particle Size
JC-15-SW-080627-URS	JC-15	6/27/08	K0805893-021	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
MG-01-SW-080626-URS	MG-01	6/26/08	K0805893-023	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
T3JC-01-SW-080626-URS	T3JC-01	6/26/08	K0806006-012	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
T4JC-01-SW-080627-URS	T4JC-01	6/27/08	K0805893-024	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
T4JC-02-SW-080627-URS	T4JC-02	6/27/08	K0805893-025	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-01-SW-080624-URS	EC-01	6/24/08	K0805778-002	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-01-RS-080624-URS	EC-01	6/24/08	K0805944-037	Total Metals, Particle Size
EC-01-SD-080624-URS	EC-01	6/24/08	K0805944-007	Total Metals, Particle Size
EC-02-RS-080625-URS	EC-02	6/25/08	K0805944-008	Total Metals, Particle Size
EC-02-SD-080625-URS	EC-02	6/25/08	K0805944-009	Total Metals, Particle Size
EC-03-SD-080625-URS	EC-03	6/25/08	K0805944-010	Total Metals, Particle Size
EC-04-SD-080625-URS	EC-04	6/25/08	K0805944-011	Total Metals, Particle Size
EC-04-SD-DUP-080625-URS	EC-04	6/25/08	K0805944-012	Total Metals, Particle Size
EC-05-RS-080625-URS	EC-05	6/25/08	K0805944-013	Total Metals, Particle Size
EC-05-RS-DUP-080625-URS	EC-05	6/25/08	K0805944-014	Total Metals, Particle Size
EC-05-SD-080625-URS	EC-05	6/25/08	K0805944-015	Total Metals, Particle Size
EC-05-SD-DUP-080625-URS	EC-05	6/25/08	K0805944-028	Total Metals, Particle Size
EC-06-SD-080625-URS	EC-06	6/25/08	K0805944-016	Total Metals, Particle Size
EC-07-RS-080625-URS	EC-07	6/25/08	K0805944-017	Total Metals, Particle Size
EC-07-SD-080625-URS	EC-07	6/25/08	K0805944-018	Total Metals, Particle Size
EC-02-FT-080626-URS	EC-02	6/26/08	K0806006-004	Total Metals
EC-02-SW-080625-URS	EC-02	6/25/08	K0805893-001	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-03-SW-080625-URS	EC-03	6/25/08	K0805893-002	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-04-FT-080626-URS	EC-04	6/26/08	K0806006-005	Total Metals
EC-04-SW-080625-URS	EC-04	6/25/08	K0805893-003	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-04-SW-DUP-080625-URS	EC-04	6/25/08	K0805893-004	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-05-SW-080625-URS	EC-05	6/25/08	K0805893-005	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
EC-06-SW-080625-URS	EC-06	6/25/08	K0805893-006	Dissolved Metals, Sulfate,

Client Sample ID	Sample Location	Sample Date	Laboratory Sample ID	Requested Analyses
				Alkalinity, Hardness, TDS, TSS
EC-07-FT-080626-URS	EC-07	6/26/08	K0806006-006	Total Metals
EC-07-SW-080625-URS	EC-07	6/25/08	K0805893-007	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
AR-01-SW-080624-URS	AR-01	6/24/08	K0805778-001	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
AR-01-RS-080624-URS	AR-01	6/24/08	K0805944-001	Total Metals, Particle Size
AR-01-SD-080624-URS	AR-01	6/24/08	K0805944-002	Total Metals, Particle Size
AR-02-FT-080627-URS	AR-02	6/27/08	K0806006-003	Total Metals
AR-02-FT-DUP-080627-URS	AR-02	6/27/08	K0806006-002	Total Metals
AR-02-SW-080624-URS	AR-02	6/24/08	K0805778-004	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS
AR-02-SD-080624-URS	AR-02	6/24/08	K0805944-003	Total Metals, Particle Size
ARV-01-SD-080624-URS	ARV-01	6/24/08	K0805944-004	Total Metals, Particle Size
ARV-02-FT-080627-URS	ARV-02	6/27/08	K0806006-001	Total Metals
ARV-02-SD-080624-URS	ARV-01	6/24/08	K0805944-005	Total Metals, Particle Size
ARV-03-SD-080624-URS	ARV-03	6/24/08	K0805944-006	Total Metals, Particle Size
ARV-04-SD-080624-URS	ARV-04	6/24/08	K0805944-036	Total Metals, Particle Size
ARV-04-SW-080624-URS	ARV-04	6/24/08	K0805778-003	Dissolved Metals, Sulfate, Alkalinity, Hardness, TDS, TSS

Notes:
Sample matrix identified within Sample ID as:
SD = Sediment
RS = Riparian Soil
SW = Surface Water
WR = Waste Rock
FT = Fish Tissue
Samples collected at sample locations DAM-01, AD-01, AD-02, SP-01, SP-02 are water matrices.

Table 2

Client Sample ID	Laboratory Sample ID	Analyte	Qualifier	Rationale
AR-01-SW-080624-URS	K0805778-001	Zinc (dissolved)	0.50 U	Method Blank
EC-02-SW-080625-URS	K0805893-001	Lead (dissolved)	0.020 U	Method Blank
EC-03-SW-080625-URS	K0805893-002	Lead (dissolved)	0.020 U	Method Blank
EC-04-SW-080625-URS	K0805893-003	Lead (dissolved)	0.020 U	Method Blank
EC-04-SW-DUP-080625-URS	K0805893-004	Lead (dissolved)	0.020 U	Method Blank
EC-05-SW-080625-URS	K0805893-005	Lead (dissolved)	0.020 U	Method Blank
EC-06-SW-080625-URS	K0805893-006	Lead (dissolved)	0.020 U	Method Blank
EC-07-SW-080625-URS	K0805893-007	Lead (dissolved)	0.020 U	Method Blank
JC-01-SW-080625-URS	K0805893-008	Lead (dissolved)	0.020 U	Method Blank
JC-02-SW-080625-URS	K0805893-009	Lead (dissolved)	0.020 U	Method Blank
JC-03-SW-080625-URS	K0805893-010	Lead (dissolved)	0.020 U	Method Blank
JC-04-SW-080625-URS	K0805893-011	Lead (dissolved)	0.020 U	Method Blank
JC-09-SW-080627-URS	K0805893-015	Lead (dissolved)	0.020 U	Method Blank
JC-10-SW-080627-URS	K0805893-016	Lead (dissolved)	0.020 U	Method Blank
JC-11-SW-080627-URS	K0805893-017	Lead (dissolved)	0.020 U	Method Blank
JC-12-SW-080627-URS	K0805893-018	Lead (dissolved)	0.020 U	Method Blank
JC-13-SW-080627-URS	K0805893-019	Lead (dissolved)	0.020 U	Method Blank
JC-14-SW-080627-URS	K0805893-020	Lead (dissolved)	0.020 U	Method Blank
JC-15-SW-080627-URS	K0805893-021	Lead (dissolved)	0.020 U	Method Blank
MG-01-SW-080626-URS	K0805893-023	Lead (dissolved)	0.020 U	Method Blank
T4JC-02-SW-080627-URS	K0805893-025	Lead (dissolved)	0.020 U	Method Blank
AR-01-SW-080624-URS	K0805778-001	Cadmium (dissolved) Iron (dissolved) Lead (dissolved)	J	Detection between MDL and MRL
EC-01-SW-080624-URS	K0805778-002	Arsenic (dissolved) Iron (dissolved)	J	Detection between MDL and MRL
ARV-04-SW-080624-URS	K0805778-003	Arsenic (dissolved) Cadmium (dissolved) Iron (dissolved) Lead (dissolved)	J	Detection between MDL and MRL
AR-02-SW-080624-URS	K0805778-004	Arsenic (dissolved) Iron (dissolved) Lead (dissolved)	J	Detection between MDL and MRL
SP-01-080624-URS	K0805778-007	Arsenic (dissolved)	J	Detection between MDL and MRL
EC-02-SW-080625-URS	K0805893-001	Arsenic (dissolved)	J	Detection between MDL and MRL
EC-03-SW-080625-URS	K0805893-002	Arsenic (dissolved) Iron (dissolved)	J	Detection between MDL and MRL
EC-04-SW-080625-URS	K0805893-003	Arsenic (dissolved)	J	Detection between MDL and MRL

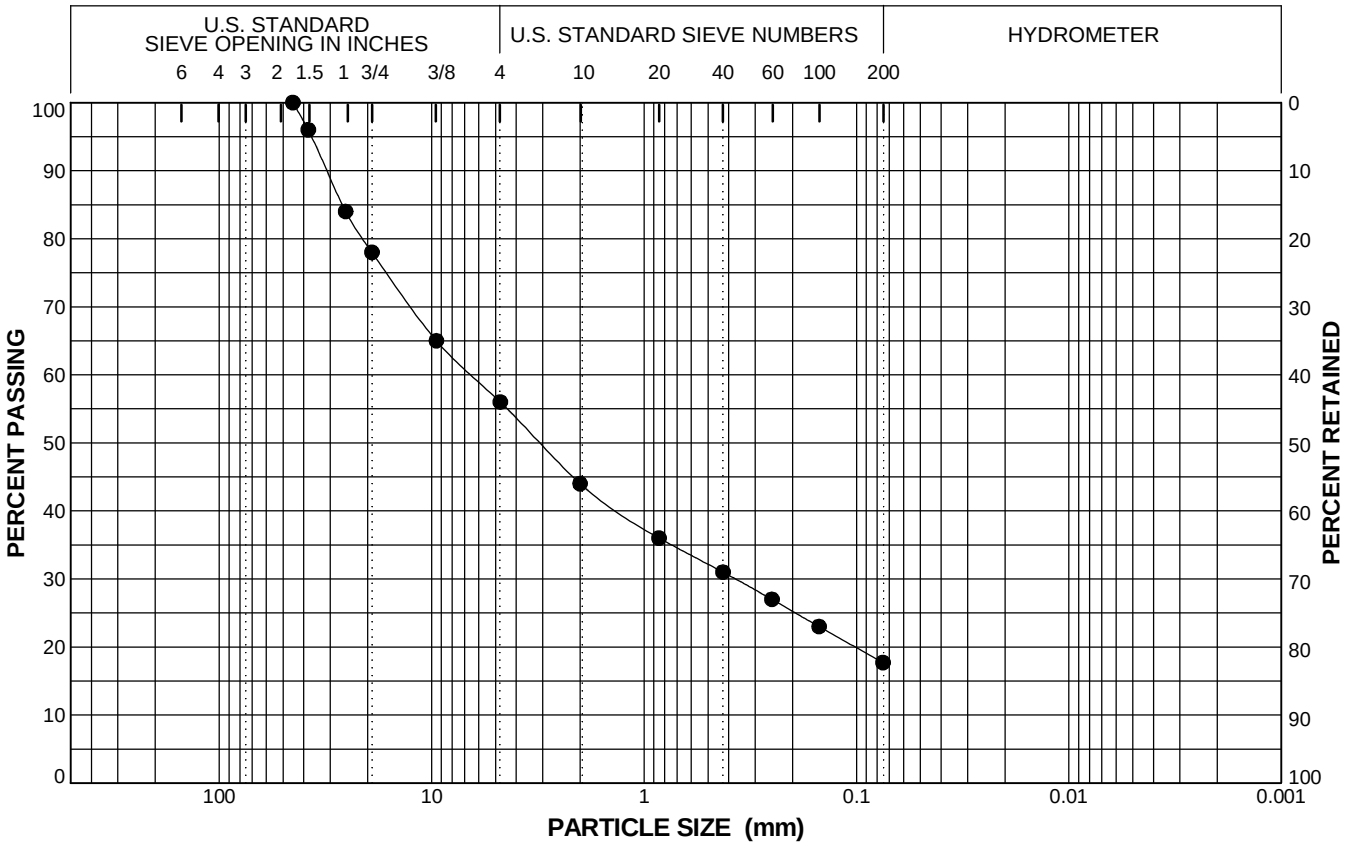
Client Sample ID	Laboratory Sample ID	Analyte	Qualifier	Rationale
EC-04-SW-DUP-080625-URS	K0805893-004	Arsenic (dissolved)	J	Detection between MDL and MRL
EC-05-SW-080625-URS	K0805893-005	Arsenic (dissolved)	J	Detection between MDL and MRL
EC-06-SW-080625-URS	K0805893-006	Arsenic (dissolved)	J	Detection between MDL and MRL
EC-07-SW-080625-URS	K0805893-007	Arsenic (dissolved)	J	Detection between MDL and MRL
JC-01-SW-080625-URS	K0805893-008	Lead (dissolved)	J	Detection between MDL and MRL
JC-02-SW-080625-URS	K0805893-009	Lead (dissolved)	J	Detection between MDL and MRL
JC-03-SW-080625-URS	K0805893-010	Lead (dissolved)	J	Detection between MDL and MRL
JC-04-SW-080627-URS	K0805893-011	Iron (dissolved) Lead (dissolved)	J	Detection between MDL and MRL
JC-09-SW-080627-URS	K0805893-015	Lead (dissolved)	J	Detection between MDL and MRL
JC-10-SW-080627-URS	K0805893-016	Lead (dissolved)	J	Detection between MDL and MRL
JC-11-SW-080627-URS	K0805893-017	Arsenic (dissolved) Lead (dissolved) Zinc (dissolved)	J	Detection between MDL and MRL
JC-12-SW-080627-URS	K0805893-018	Lead (dissolved)	J	Detection between MDL and MRL
JC-13-SW-080627-URS	K0805893-019	Lead (dissolved)	J	Detection between MDL and MRL
JC-14-SW-080627-URS	K0805893-020	Lead (dissolved)	J	Detection between MDL and MRL
JC-15-SW-080627-URS	K0805893-021	Lead (dissolved)	J	Detection between MDL and MRL
MG-01-SW-080626-URS	K0805893-023	Lead (dissolved)	J	Detection between MDL and MRL
T4JC-02-SW-080627-URS	K0805893-025	Iron (dissolved) Lead (dissolved)	J	Detection between MDL and MRL
WRS-1	K0806006-007	TCLP Barium TCLP Cadmium	J	Detection between MDL and MRL
WRS-1-DUP	K0806006-008	TCLP Barium TCLP Chromium	J	Detection between MDL and MRL
WRS-2	K0806006-009	TCLP Barium TCLP Lead	J	Detection between MDL and MRL
WRS-3	K0806006-010	TCLP Barium TCLP Lead	J	Detection between MDL and MRL
WRS-4	K0806006-011	TCLP Barium	J	Detection between MDL and MRL
T3JC-01-SW-080626	K0806006-012	Cadmium (dissolved) Lead (dissolved)	J	Detection between MDL and MRL
JC-08-SD-080626-URS	K0805944-026	Arsenic (total)	J	Laboratory duplicate RPD exceedence
JC-12-SD-080627-URS	K0805944-030	Lead (total)	J	Laboratory duplicate RPD exceedence

Client Sample ID	Laboratory Sample ID	Analyte	Qualifier	Rationale
AR-02-FT-080627-URS	K0806006-003	Iron (total)	J	Field duplicate RPD exceedence
AR-02-FT-DUP-080627-URS	K0806006-002	Iron (total)	J	Field duplicate RPD exceedence

APPENDIX E

GEOTECHNICAL ANALYSIS REPORT

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	



Boring ID	Sample #	Depth (feet)	Sample Moisture (%)	Dry Density (lbs/ft^3)	Symbol	LL	PI	% G	% S	% F	Classification
Waste Rock		1.0	7.1		●			44.0	38.3	17.7	Silty Gravel with Sand [GM]

Report: SIEVE_4_PORT; File: BLUE LEDGE MINE.GPJ; 10/2/2008 Waste Rock

Blue Ledge Mine
Siskiyou County, CA
25696770

PARTICLE SIZE DISTRIBUTION CURVES

URS

APPENDIX F

MACROINVERTEBRATE ANALYSIS REPORT

Biological assessment of sites on Joe Creek and Elliott Creek
Siskiyou County, California
Report to URS Corporation: Brad Rawls, Project Manager

by
W. Bollman
Rhithron Associates, Inc.
Missoula, Montana

INTRODUCTION

Spatial comparisons of aquatic invertebrate communities are frequently used to assess the presence and intensity of heavy metals contamination in streams. Invertebrates are well-suited to this type of analysis for several reasons. Field studies and controlled experiments demonstrate that composition and functional characteristics of aquatic invertebrate assemblages are influenced by metals contamination. The effects of copper, lead, and zinc have been well-studied, but community changes associated with exposure to other metals, including aluminum, cadmium, cobalt, nickel and silver are also documented. Because invertebrates are relatively long-lived and are less motile than fish, evidence of water quality impairment is likely to be persistent, unlike the "snapshot" results of chemical tests. Invertebrate assemblages may exhibit both direct and indirect responses to metals contamination; responses include poisoning and death or avoidance and drift. Direct effects are related to metal uptake from the water column by means of diffusion or absorption through gills or integument. Toxicity may also be related to uptake via food in the form of metals bound to sediment particles; recent studies have suggested that food may be the primary route of uptake for some metals (Munger and Hare 2000 and Roy and Hare, 1999). Indirect effects may include disruption of food webs; for example, alteration of predation rates has been demonstrated when concentrations of metals increase in streams (Clements et al. 1989).

Various studies have shown that aquatic invertebrate community responses to metals contamination are predictable and distinctive. Kiffney and Clements (1994, 1996) demonstrated that mayfly abundance, especially abundance in the family Heptageniidae, was a highly sensitive and reliable metric for assessment of metals impact. This result has been confirmed in many studies, and Heptageniid mayfly abundance and richness are among the most frequently used and cited metrics for the assessment of metals impacts. Heptageniid mayflies have several risk factors for susceptibility to metals accumulation; these include external platelike gills (Kiffney and Clements 2003) and reliance on periphyton as their major food source. Periphyton and other biofilms have been shown to have high metals concentrations when contamination is present (Farag et al. 1998).

In addition to the Heptageniids, other mayflies scrape algal biofilms from stony substrates; the scraper feeding group includes taxa among the caddisflies and beetles. An alteration in the functional composition of invertebrate assemblages may result from lower abundance of scrapers when metal contamination is present (Kiffney and Clements 1993).

Other studies suggest that overall taxa richness also diminishes with metals contamination, however, it must be noted that this metric is responsive

to many other stressors as well. Tolerant midges, especially among the sub-family Orthocladiinae, and worms (Oligochaeta) are known to increase in abundance in metals contaminated systems (Mebane 2003), although the mechanisms for this increase are not well-documented.

The metals tolerance index developed by McGuire (MDEQ 1998) provides an indication of overall assemblage tolerance to metals. The index was demonstrated to be useful at metals contaminated sites in western Montana, but it has also been applied successfully elsewhere. Tolerance values were determined for individual taxa, based on their presence or absence from sites with known levels of water and sediment contamination. Those values, weighted by taxon abundances, are averaged to arrive at an assemblage tolerance score. Higher scores indicate higher tolerance to heavy metals.

METHODS

For this study, sites on 2 streams were sampled for aquatic invertebrates. Samples were collected by URS Corporation personnel. Samples were processed and identified by Rhithron Associates. Laboratory technical procedures and quality assurance protocols applied to this project are described in the Appendix.

The 2 sampled sites on Joe Creek included a "reference" site above the influence of waste rock from a metal mine, and a test site below the mine. On Elliott Creek, a "reference" site above the confluence with Joe Creek was sampled for comparison with a test site below the confluence.

RESULTS

Joe Creek

The sample collected above the waste rock site contained a total of approximately 481 organisms. Below the waste rock site, sampling yielded only about 176 organisms. Assuming that sampling efforts were equivalent between sites, it is apparent that invertebrate density was much lower at the downstream site. Because of the patchy distribution of invertebrates in riffles, some variation in densities is expected, but it is noteworthy that the lower site supported less than half the number of organisms as the "reference" site.

Table 1 summarizes the metals-related compositional, functional, and tolerance measures for the Joe Creek sites. Heptageniid mayflies (*Cinygma* sp., *Cinygmula* sp., *Epeorus grandis*, *Ironodes* sp., and *Rhithrogena* sp.) were common in the sample collected at the "reference" site, but were nearly extirpated below the mine influence. Only 2 taxa persisted at the lower site. Overall mayfly abundance diminished from 162 individuals to 26 individuals.

The precipitous increase in the metals tolerance index value at the downstream site strongly suggests that the assemblage below the mine influence was highly metals-tolerant. The 3 dominant taxa above the mine were all pollution-sensitive taxa: the caddisfly *Anagapetus* sp., the mayfly *Drunella doddsii*, and the stonefly *Yoraperla brevis*. Together, these taxa accounted for 35% of sampled animals at the site. Below the mine however, orthocladine midges (*Orthocladius (Orthocladius)* and *Orthocladius (Euorthocladius)* spp., and *Eukiefferiella gracei*) were dominant, making up 43% of the sampled animals. Midges in all taxa accounted for 63% of animals collected below the mine

influence, while midges accounted for only 13% of animals collected at the "reference" site.

Both sampled sites on Joe Creek supported all expected functional components. However, the sharp decline in scrapers at the downstream site is notable.

Taxa richness decreased by nearly half at the downstream site compared to the "reference" site. There were particularly acute taxa losses among mayflies, stoneflies, and riffle beetles. Oligochaetes were present at the "reference" site, but were not collected below the mine influence; this is not the expected response to metals contamination. However, the worms present above the mine (*Enchytraeus* sp. and *Mesenchytraeus* sp.) are not tolerant taxa. Instead, they are characteristic of cold, unpolluted montane streams; their tolerance of heavy metals is not documented.

Table 1. Metals associated metrics, expected responses when contamination is present, and responses at the downstream (below waste rock) site on Joe Creek.

Metric	Expected response	Response in Joe Creek	Metric values	
			above waste rock	below waste rock
B-IBI	decrease	decrease	44	36
Heptageniid abundance	decrease	decrease	15%	3%
Mayfly abundance	decrease	decrease	34%	15%
Chironomid abundance	increase	increase	13%	63%
Orthocladiinae abundance	increase	increase	25	99
Oligochaete abundance	increase	decrease	19	absent
Taxa richness	decrease	decrease	63	33
Scraper abundance	decrease	decrease	43%	11%
Metals tolerance index	increase	increase	1.49	4.15

Elliott Creek

Invertebrate density at both of the Elliott Creek sites was typical of montane streams; there were between 700 and 900 specimens in each of the samples. Density apparently did not diminish below the confluence with Joe Creek.

Table 2 summarizes the metals-related compositional, functional, and tolerance measures for the Elliott Creek sites. The abundance of heptageniid mayflies (*Cinygmula* sp. and *Rhithrogena* sp.) at the "reference" site was very low; only 6 individuals were collected there. No heptageniid mayflies were collected at the downstream site. The significance of this small shift in taxonomic composition is difficult to assess; sampling variability may account

for the absence of these taxa. However, the influence of metals cannot be ruled out.

There was a shift in dominant taxa between the upstream and downstream site on Elliott Creek. Above the Joe Creek confluence, the 3 most abundant taxa were the caddisfly *Glossosoma* sp. and the tanytarsine midges *Rheotanytarsus* sp. and *Micropsectra* sp. These animals accounted for 30% of organisms in the sample. At the site below the confluence, the orthocladine midges in *Orthocladius (Orthocladius)* spp., the caddisfly *Neophylax occidentalis*, and the elmid beetle *Zaitzevia parvula* were the dominant taxa, accounting for 34% of sampled animals. There was only a slight increase in the overall abundance of midges, but the number of orthocladine midges in the downstream sample was much higher than the sample collected at the upstream site. Taxa richness was slightly higher below the Joe Creek confluence.

The very slight increase in the metals tolerance index at the lower site is within the typical variability of the index. This result provides no evidence that the invertebrate assemblage below the confluence is more metals tolerant than the assemblage collected at the "reference" site.

All expected functional components were present at both Elliott Creek sites. There was a slight shift in shredder abundance, but the contribution of scrapers to the functional mix was only slightly different between the sites.

Oligochaetes in the family Enchytraeidae were collected at both sites on Elliott Creek; however, 3 taxa were collected at the site above the confluence, and only 1 taxon was collected below the confluence. Oligochaetes were not abundant at either site.

Table 2. Metals associated metrics, expected responses when contamination is present, and responses at the downstream (below the confluence with Joe Creek) site on Elliott Creek.

Metric	Expected response	Response in Elliott Creek	Metric values	
			above confluence	below confluence
B-IBI	decrease	slight decrease	44	42
Heptageniid abundance	decrease	decrease	1.2%	absent
Mayfly abundance	decrease	decrease	12%	7%
Chironomid abundance	increase	increase	30%	37%
Orthocladiinae abundance	increase	increase	47	125
Oligochaete abundance	increase	decrease	8	4
Taxa richness	decrease	slight increase	60	63
Scraper abundance	decrease	slight decrease	30%	27%
Metals tolerance index	increase	slight increase	2.52	2.83

DISCUSSION

Other abiotic factors besides metals may have influenced the invertebrate assemblages at the Joe Creek sites; for example, the natural variation in communities along the longitudinal upstream-to-downstream gradient may account for some of the differences in assemblage composition between sites. Stressors and natural gradients interact in complex ways making the detection and diagnosis of probable causes of impairment an inexact exercise. For these reasons, it is very difficult to specifically attribute changes in a benthic community to any particular stressor.

Invertebrate assemblages at Joe Creek site suggest cold water temperatures. More than half of the cold stenotherm taxa collected at the upstream site were not present in the sample collected at the downstream site. Metals contamination could account for the loss of these taxa, since cold stenotherms are often generally pollution-sensitive. But the possibility that water temperatures were warmer at this site cannot be ruled out. "Clinger" taxa were very diverse at the site above the waste rock influence; at least 24 "clinger" taxa were supported here. Below the mine, only 14 "clinger" taxa were collected. Fine sediment deposition could account for the loss of these taxa. Diminished numbers of stonefly taxa at the lower site compared to the "reference" site may be related to reach-scale habitat degradation, such as streambank instability, loss of riparian zone integrity, or channel alteration.

Comparison of metric and community composition responses between upstream and downstream sites on Joe Creek strongly suggests impairment at the site below the mine influence. Responses were generally consistent with the expected invertebrate community responses to metals contamination. Similar comparisons between sites on Elliott Creek yielded less consistent results, with some metric responses either weak or nonexistent. Although metals contamination cannot be ruled out at the downstream site on Elliott Creek, the evidence is not as strong as it is at the downstream site on Joe Creek.

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Appendix

Technical summary of methods and quality assurance procedures
Taxa lists and metric summaries

Joe Creek
Elliott Creek

September 2008

Analysis of biological samples:
Technical summary of methods and quality assurance procedures

METHODS

Sample processing

Four macroinvertebrate samples were delivered to Rhithron's laboratory facility in Missoula, Montana on October 2, 2008. All samples arrived in good condition. Upon arrival, samples were unpacked and examined, and an inventory containing sample identification information was created. An electronic inventory spreadsheet was then created and sent to the Project Manager. This spreadsheet included project code and internal laboratory identification numbers and was verified by the Project Manager prior to upload into the Rhithron database.

Standard sorting protocols were applied to achieve representative subsamples of a minimum of 500 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm were used. Each individual sample was thoroughly mixed in its jar(s), poured out and evenly spread into the Caton tray, and individual grids were randomly selected. The contents of each grid were examined under stereoscopic microscopes using 10x-30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 95% ethanol for subsequent identification. Grid selection, examination, and sorting continued until at least 500 organisms were sorted. The final grid was completely sorted of all organisms. All unsorted sample fractions were retained and stored at the Rhithron laboratory.

Organisms were individually examined by certified taxonomists, using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to the lowest possible level, using appropriate published taxonomic references and keys. Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. To obtain accuracy in richness measures, organisms that could not be identified to the target level specified were designated as "not unique" if other specimens from the same group could be taken to target levels. Organisms designated as "unique" were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory.

Midges were carefully morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were archived at the Rhithron laboratory.

Quality control procedures

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency. These checks were conducted on 100% of the samples by independent observers who microscopically re-examined 20% of sorted substrate from each sample. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = \frac{n_1}{n_{1+2}} \times 100$$

where: SE is the sorting efficiency, expressed as a percentage, n_1 is the total number of specimens in the first sort, and n_{1+2} is the total number of specimens in the first and second sorts combined.

Quality control procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. One sample was randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating a Bray-Curtis similarity

statistic (Bray and Curtis 1957) for the selected sample. Routinely, discrepancies between the original identifications and the QC identifications are discussed among the taxonomists, and necessary rectifications to the data are made. Discrepancies that cannot be rectified by discussions are routinely sent out to taxonomic specialists for identification. However, taxonomic certainty for identifications in this project was high and no external verifications were necessary.

Data analysis

Taxa lists and counts for each sample were constructed. Standard metric calculations for aquatic invertebrate assemblages were made using Rhithron's customized database software.

RESULTS

Quality Control Procedures

Results of quality control procedures for subsampling and taxonomy are given in Table 1. Sorting efficiency averaged 98.56% for macroinvertebrate samples, taxonomic precision for identification and enumeration was 95.81% for the randomly selected QA sample, and data entry efficiency averaged 100% for the project. These similarity statistics fall within acceptable industry criteria (Stribling et al. 2003).

Data analysis

Taxa lists and counts, and values and scores for standard bioassessment metrics are given in this Appendix.

Table 1. Results of internal quality control procedures for subsampling and taxonomy.

RAI Sample ID	Station name	Sorting efficiency	Bray-Curtis similarity for taxonomy and enumeration
URS08BLM001	Elliott Creek Below Confluence	100.00%	
URS08BLM002	Elliott Creek Above Confluence	99.04%	
URS08BLM003	Joe Creek Below Waste Rock Confluence	97.17%	
URS08BLM004	Joe Creek Above Waste Rock Confluence	98.03%	95.81%

REFERENCES

Bray, J. R. and J. T. Curtis. 1957. An ordination of upland forest communities of southern Wisconsin. Ecological Monographs 27: 325-349.

Caton, L. W. 1991. Improving subsampling methods for the EPA's "Rapid Bioassessment" benthic protocols. Bulletin of the North American Benthological Society. 8(3): 317-319.

Stribling, J.B., S.R Moulton II and G.T. Lester. 2003. Determining the quality of taxonomic data. J.N. Am. Benthol. Soc. 22(4): 621-631.

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM001

RAI No.: URS08BLM001 **Sta. Name:** Elliott Creek Below Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Enchytraeidae							
Enchytraeus sp.	4	0.80%	Yes	Immature		4	CG
Planariidae							
Polycelis coronata	1	0.20%	Yes	Unknown		1	OM
Ephemeroptera							
Ameletidae							
Ameletus sp.	1	0.20%	Yes	Larva	Damaged	0	CG
Baetidae							
Acentrella turbida	4	0.80%	Yes	Larva		4	CG
Baetis sp.	1	0.20%	Yes	Larva	Damaged	5	CG
Baetis tricaudatus	23	4.60%	Yes	Larva		4	CG
Ephemerellidae							
Drunella doddsii	1	0.20%	Yes	Larva		1	SC
Drunella grandis	1	0.20%	Yes	Larva		2	PR
Serratella tibialis	3	0.60%	Yes	Larva		2	CG
Plecoptera							
Chloroperlidae							
Suwallia sp.	1	0.20%	Yes	Larva		1	PR
Sweltsa sp.	2	0.40%	Yes	Larva		0	PR
Nemouridae							
Malenka sp.	7	1.40%	Yes	Larva		1	SH
Perlidae							
Calineuria californica	2	0.40%	Yes	Larva		2	PR
Hesperoperla pacifica	1	0.20%	Yes	Larva		1	PR
Perlidae	3	0.60%	No	Larva	Early Instar	2	PR
Perlodidae							
Perlinodes aurea	1	0.20%	Yes	Larva		1	PR
Skwala sp.	2	0.40%	Yes	Larva		3	PR

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM001

RAI No.: URS08BLM001 **Sta. Name:** Elliott Creek Below Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Trichoptera							
Apataniidae							
Apatania sp.	1	0.20%	Yes	Larva		3	SC
Brachycentridae							
Micrasema sp.	5	1.00%	Yes	Larva		1	SH
Calamoceratidae							
Heteroplectron californicum	1	0.20%	Yes	Larva		1	SH
Glossosomatidae							
Agapetus sp.	11	2.20%	Yes	Larva		0	SC
Glossosoma sp.	27	5.40%	Yes	Larva		0	SC
Glossosomatidae	19	3.80%	No	Pupa		0	SC
Hydropsychidae							
Hydropsyche Morosa Gr.	6	1.20%	Yes	Larva	Early Instar	4	CF
Lepidostomatidae							
Lepidostoma sp.	9	1.80%	Yes	Larva		1	SH
Limnephilidae							
Ecclisomyia sp.	2	0.40%	Yes	Larva		4	CG
Rhyacophilidae							
Rhyacophila sp.	2	0.40%	No	Pupa		1	PR
Rhyacophila Angelita Gr.	4	0.80%	Yes	Larva		0	PR
Rhyacophila Betteni Gr.	5	1.00%	Yes	Larva		0	PR
Rhyacophila Brunnea Gr.	4	0.80%	Yes	Larva		2	PR
Rhyacophila Hyalinata Gr.	1	0.20%	Yes	Larva		0	PR
Sericostomatidae							
Gumaga sp.	1	0.20%	Yes	Larva		3	SH
Uenoidae							
Neophylax occidentis	68	13.60%	Yes	Larva		3	SC
Uenoidae	1	0.20%	No	Pupa		0	SC
Coleoptera							
Dytiscidae							
Oreodytes obesus sp.	1	0.20%	Yes	Adult		5	PR
Elmidae							
Ampumixis dispar	1	0.20%	Yes	Adult		4	CG
Ampumixis dispar	10	2.00%	No	Larva		4	CG
Heterlimnius sp.	5	1.00%	No	Larva		3	CG
Heterlimnius koebelei sp.	1	0.20%	Yes	Adult		4	CG
Lara sp.	1	0.20%	Yes	Larva		1	SH
Optioservus sp.	2	0.40%	Yes	Larva		5	SC
Ordobrevia nubifera	5	1.00%	No	Larva		4	CG
Ordobrevia nubifera	1	0.20%	Yes	Adult		4	CG
Zaitzevia parvulus	12	2.40%	Yes	Adult		4	CG
Zaitzevia parvulus	15	3.00%	No	Larva		4	CG
Psephenidae							
Eubrianax edwardsi	4	0.80%	Yes	Larva		4	SC

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM001

RAI No.: URS08BLM001 **Sta. Name:** Elliott Creek Below Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Diptera							
Ceratopogonidae							
Mallochohelea sp.	8	1.60%	Yes	Larva		11	PR
Simuliidae							
Simulium sp.	2	0.40%	No	Pupa		6	CF
Simulium sp.	14	2.80%	Yes	Larva		6	CF
Tipulidae							
Antocha sp.	2	0.40%	Yes	Larva		3	CG
Hesperoconopa sp.	4	0.80%	Yes	Larva		1	CG
Chironomidae							
Chironomidae							
Brillia parva sp.	5	1.00%	Yes	Larva		5	SH
Cardiocladius obscurus	1	0.20%	Yes	Larva		5	PR
Cricotopus triannulatus	10	2.00%	Yes	Larva		7	SH
Eukiefferiella sp.	3	0.60%	No	Larva	Early Instar	8	CG
Eukiefferiella Brehmi Gr.	2	0.40%	Yes	Larva		8	CG
Eukiefferiella Claripennis Gr.	3	0.60%	Yes	Larva		8	CG
Eukiefferiella Pseudomontana Gr.	1	0.20%	Yes	Larva		8	CG
Micropsectra sp.	21	4.20%	Yes	Larva		4	CG
Micropsectra sp.	2	0.40%	No	Pupa		4	CG
Orthocladius (Euorthocladius) sp.	8	1.60%	Yes	Larva	Early Instar	6	CG
Orthocladius (Orthocladius) sp.	62	12.40%	Yes	Larva	Early Instar	6	CG
Orthocladius (Orthocladius) sp.	14	2.80%	No	Pupa	Damaged	6	CG
Pagastia orthogonia	1	0.20%	Yes	Larva		1	CG
Parametriocnemus sp.	6	1.20%	Yes	Larva		5	CG
Pentaneura inconspicua sp.	1	0.20%	Yes	Larva		6	PR
Polypedilum aviceps	3	0.60%	Yes	Larva		6	SH
Polypedilum Fallax Gr.	2	0.40%	Yes	Larva		6	CG
Polypedilum Scalaenum Gr.	1	0.20%	Yes	Larva		6	SH
Polypedilum tritum	1	0.20%	No	Pupa		6	CG
Polypedilum tritum	1	0.20%	Yes	Larva		6	CG
Potthastia Gaedii Gr.	5	1.00%	Yes	Larva		2	CG
Rheotanytarsus sp.	15	3.00%	Yes	Larva		6	CF
Tanytarsus sp.	1	0.20%	No	Pupa		6	CF
Tanytarsus sp.	4	0.80%	Yes	Larva		6	CF
Thienemannimyia Gr.	4	0.80%	Yes	Larva	Early Instar	5	PR
Tvetenia Bavarica Gr.	10	2.00%	Yes	Larva		5	CG
Sample Count	**500**						

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM002

RAI No.: URS08BLM002 **Sta. Name:** Elliott Creek Above Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Enchytraeidae							
Enchytraeus sp.	1	0.19%	Yes	Immature		4	CG
Fridericia sp.	1	0.19%	Yes	Immature		11	CG
Mesenchytraeus sp.	6	1.17%	Yes	Immature		4	CG
Ephemeroptera							
Baetidae							
Acentrella turbida	2	0.39%	Yes	Larva		4	CG
Baetis tricaudatus	46	8.93%	Yes	Larva		4	CG
Ephemerellidae							
Attenella delantala	2	0.39%	Yes	Larva		3	CG
Drunella doddsii	1	0.19%	Yes	Larva		1	SC
Drunella grandis	2	0.39%	Yes	Larva		2	PR
Serratella tibialis	3	0.58%	Yes	Larva		2	CG
Heptageniidae							
Cinygmula sp.	3	0.58%	Yes	Larva		0	SC
Rhithrogena sp.	3	0.58%	Yes	Larva		0	CG
Plecoptera							
Chloroperlidae							
Sweltsa sp.	4	0.78%	Yes	Larva		0	PR
Nemouridae							
Malenka sp.	1	0.19%	Yes	Larva		1	SH
Perlidae							
Calineuria californica	7	1.36%	Yes	Larva		2	PR
Hesperoperla pacifica	5	0.97%	Yes	Larva		1	PR
Perlodidae							
Perlinodes aurea	3	0.58%	Yes	Larva		1	PR
Perlodidae	2	0.39%	Yes	Larva	Early Instar	2	PR
Skwala sp.	17	3.30%	Yes	Larva		3	PR

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM002

RAI No.: URS08BLM002 **Sta. Name:** Elliott Creek Above Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Trichoptera							
Apataniidae							
Apatania sp.	2	0.39%	Yes	Larva		3	SC
Glossosomatidae							
Agapetus sp.	15	2.91%	Yes	Larva		0	SC
Glossosoma sp.	54	10.49%	Yes	Larva		0	SC
Glossosomatidae	46	8.93%	No	Pupa		0	SC
Hydropsychidae							
Arctopsyche grandis	4	0.78%	Yes	Larva		2	PR
Hydropsyche Morosa Gr.	16	3.11%	Yes	Larva	Early Instar	4	CF
Lepidostomatidae							
Lepidostoma sp.	2	0.39%	Yes	Larva		1	SH
Rhyacophilidae							
Rhyacophila sp.	12	2.33%	No	Pupa		1	PR
Rhyacophila Angelita Gr.	1	0.19%	Yes	Larva		0	PR
Rhyacophila Betteni Gr.	6	1.17%	Yes	Larva		0	PR
Rhyacophila Brunnea Gr.	1	0.19%	Yes	Larva		2	PR
Uenoidae							
Neophylax occidentis	24	4.66%	Yes	Larva		3	SC
Coleoptera							
Dytiscidae							
Oreodytes obesus sp.	2	0.39%	Yes	Adult		5	PR
Elmidae							
Ampumixis dispar	9	1.75%	No	Larva		4	CG
Ampumixis dispar	1	0.19%	Yes	Adult		4	CG
Heterlimnius sp.	2	0.39%	Yes	Larva		3	CG
Narpus concolor	1	0.19%	Yes	Adult		2	CG
Optioservus sp.	3	0.58%	No	Larva		5	SC
Optioservus seriatus	3	0.58%	Yes	Adult		4	SC
Zaitzevia parvulus	2	0.39%	Yes	Larva		4	CG
Psephenidae							
Eubrianax edwardsi	2	0.39%	Yes	Larva		4	SC

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM002

RAI No.: URS08BLM002 **Sta. Name:** Elliott Creek Above Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Diptera							
Ceratopogonidae							
Mallochohelea sp.	1	0.19%	Yes	Larva		11	PR
Empididae							
Clinocera sp.	1	0.19%	Yes	Larva		5	PR
Pelecorhynchidae							
Glutops sp.	1	0.19%	Yes	Larva		1	PR
Simuliidae							
Simulium sp.	1	0.19%	No	Pupa		6	CF
Simulium sp.	10	1.94%	Yes	Larva		6	CF
Tipulidae							
Antocha sp.	5	0.97%	Yes	Larva		3	CG
Antocha sp.	8	1.55%	No	Pupa		3	CG
Cryptolabis sp.	2	0.39%	Yes	Larva		11	SH
Hesperoconopa sp.	10	1.94%	Yes	Larva		1	CG
Hexatoma sp.	2	0.39%	Yes	Larva		2	PR
Chironomidae							
Chironomidae							
Brillia parva sp.	4	0.78%	Yes	Larva		5	SH
Eukiefferiella Brehmi Gr.	2	0.39%	Yes	Larva		8	CG
Eukiefferiella Claripennis Gr.	1	0.19%	Yes	Larva		8	CG
Eukiefferiella Devonica Gr.	1	0.19%	Yes	Larva		8	CG
Eukiefferiella Gracei Gr.	3	0.58%	Yes	Larva		8	CG
Eukiefferiella Pseudomontana Gr.	2	0.39%	Yes	Larva		8	CG
Lopescladius sp.	1	0.19%	Yes	Larva		2	CG
Micropsectra sp.	2	0.39%	No	Pupa		4	CG
Micropsectra sp.	48	9.32%	Yes	Larva		4	CG
Microtendipes Rydalensis Gr.	1	0.19%	Yes	Larva		6	CF
Orthocladius (Orthocladius) sp.	3	0.58%	No	Pupa	Damaged	6	CG
Orthocladius (Orthocladius) sp.	7	1.36%	Yes	Larva	Early Instar	6	CG
Parametriocnemus sp.	1	0.19%	Yes	Larva		5	CG
Polypedilum aviceps	6	1.17%	Yes	Larva		6	SH
Rheotanytarsus sp.	4	0.78%	No	Pupa		6	CF
Rheotanytarsus sp.	46	8.93%	Yes	Larva		6	CF
Tanytarsus sp.	1	0.19%	Yes	Larva		6	CF
Tanytarsus sp.	1	0.19%	No	Pupa		6	CF
Thienemanniella sp.	2	0.39%	Yes	Larva		6	CG
Thienemannimyia Gr.	1	0.19%	Yes	Larva	Early Instar	5	PR
Tvetenia sp.	1	0.19%	No	Pupa		5	CG
Tvetenia Bavarica Gr.	19	3.69%	Yes	Larva		5	CG
Sample Count	**515**						

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM003

RAI No.: URS08BLM003 **Sta. Name:** Joe Creek Below Waste Rock Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Ephemeroptera							
Baetidae							
Baetis tricaudatus	13	7.39%	Yes	Larva		4	CG
Ephemerellidae							
Drunella coloradensis	6	3.41%	Yes	Larva		0	SC
Drunella doddsii	2	1.14%	Yes	Larva		1	SC
Heptageniidae							
Epeorus grandis	3	1.70%	Yes	Larva		0	SC
Ironodes sp.	2	1.14%	Yes	Larva		0	SC
Plecoptera							
Capniidae							
Capniidae	1	0.57%	Yes	Larva	Damaged	1	SH
Nemouridae							
Malenka sp.	1	0.57%	Yes	Larva		1	SH
Perlidae							
Doroneuria baumanni	1	0.57%	Yes	Larva		1	PR
Perlodidae							
Perlinodes aurea	1	0.57%	Yes	Larva		1	PR
Perlodidae	1	0.57%	Yes	Larva	Early Instar	2	PR
Trichoptera							
Glossosomatidae							
Anagapetus sp.	7	3.98%	Yes	Larva		0	SC
Hydropsychidae							
Hydropsychidae	1	0.57%	Yes	Larva	Early Instar	4	CF
Limnephilidae							
Cryptochia sp.	2	1.14%	Yes	Larva		0	SH
Rhyacophilidae							
Rhyacophila sp.	10	5.68%	No	Pupa		1	PR
Rhyacophila Betteni Gr.	5	2.84%	Yes	Larva		0	PR
Rhyacophila grandis	1	0.57%	Yes	Larva		1	PR
Rhyacophila Hyalinata Gr.	1	0.57%	Yes	Larva		0	PR
Rhyacophila Vagrita Gr.	2	1.14%	Yes	Larva		0	PR
Coleoptera							
Dytiscidae							
Dytiscidae	1	0.57%	Yes	Larva	Early Instar	5	PR
Elmidae							
Lara sp.	1	0.57%	Yes	Larva		1	SH
Diptera							
Empididae							
Neoplasta sp.	1	0.57%	Yes	Larva		5	PR
Simuliidae							
Simulium sp.	1	0.57%	Yes	Pupa		6	CF
Tipulidae							
Dicranota sp.	1	0.57%	Yes	Larva		3	PR

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM003

RAI No.: URS08BLM003 **Sta. Name:** Joe Creek Below Waste Rock Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Chironomidae							
Chironomidae							
Brillia parva sp.	6	3.41%	Yes	Larva		5	SH
Chironomini	1	0.57%	No	Pupa	Damaged	6	CG
Cricotopus (Cricotopus) sp.	3	1.70%	Yes	Larva	Early Instar	7	SH
Diamesa sp.	1	0.57%	Yes	Larva		5	CG
Eukiefferiella Gracei Gr.	25	14.20%	Yes	Larva		8	CG
Eukiefferiella Pseudomontana Gr.	2	1.14%	Yes	Larva		8	CG
Micropsectra sp.	1	0.57%	Yes	Larva		4	CG
Orthocladius (Euorthocladius) sp.	29	16.48%	Yes	Larva	Early Instar	6	CG
Orthocladius (Euorthocladius) sp.	2	1.14%	No	Pupa	Damaged	6	CG
Orthocladius (Orthocladius) sp.	2	1.14%	No	Pupa	Damaged	6	CG
Orthocladius (Orthocladius) sp.	18	10.23%	Yes	Larva	Early Instar	6	CG
Pagastia orthogonia	9	5.11%	Yes	Larva		1	CG
Parorthocladius sp.	6	3.41%	Yes	Larva		6	CG
Parorthocladius sp.	1	0.57%	No	Pupa		6	CG
Tvetenia Bavarica Gr.	5	2.84%	Yes	Larva		5	CG
Sample Count	**176**						

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM004

RAI No.: URS08BLM004 **Sta. Name:** Joe Creek Above Waste Rock Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Non-Insect							
Enchytraeidae							
Enchytraeus sp.	2	0.42%	Yes	Immature		4	CG
Mesenchytraeus sp.	16	3.33%	Yes	Immature		4	CG
Haplotaxidae							
Haplotaxis sp.	1	0.21%	Yes	Immature		11	PR
Planariidae							
Polycelis coronata	3	0.62%	Yes	Unknown		1	OM
Ephemeroptera							
Ameletidae							
Ameletus sp.	1	0.21%	Yes	Larva	Damaged	0	CG
Baetidae							
Baetis tricaudatus	31	6.44%	Yes	Larva		4	CG
Ephemerellidae							
Caudatella hystrix	3	0.62%	Yes	Larva		0	SC
Drunella coloradensis	3	0.62%	Yes	Larva		0	SC
Drunella doddsii	38	7.90%	Yes	Larva		1	SC
Drunella spinifera	8	1.66%	Yes	Larva		0	PR
Ephemerella sp.	7	1.46%	Yes	Larva	Early Instar	1.5	SC
Heptageniidae							
Cinygma sp.	1	0.21%	Yes	Larva		0	SC
Cinygmula sp.	18	3.74%	Yes	Larva		0	SC
Epeorus grandis	30	6.24%	Yes	Larva		0	SC
Ironodes sp.	6	1.25%	Yes	Larva		0	SC
Rhithrogena sp.	15	3.12%	Yes	Larva		0	CG
Leptophlebiidae							
Leptophlebiidae	1	0.21%	Yes	Larva	Damaged	2	CG
Plecoptera							
Chloroperlidae							
Sweltsa sp.	1	0.21%	Yes	Larva		0	PR
Leuctridae							
Despaxia augusta	1	0.21%	Yes	Larva		0	SH
Moselia infuscata	1	0.21%	Yes	Larva		0	SH
Nemouridae							
Visoka cataractae	17	3.53%	Yes	Larva		0	SH
Zapada columbiana	6	1.25%	Yes	Larva		2	SH
Peltoperlidae							
Sierraperla cora	9	1.87%	Yes	Larva		1	SH
Yoraperla brevis	34	7.07%	Yes	Larva		0	SH
Perlidae							
Doroneuria baumanni	7	1.46%	Yes	Larva		1	PR
Perlodidae							
Megarcys sp.	1	0.21%	Yes	Larva		1	PR
Salmoperla sylvanica sp.	1	0.21%	Yes	Larva		11	PR
Skwala sp.	1	0.21%	Yes	Larva		3	PR
Taeniopterygidae							
Taeniopterygidae	4	0.83%	Yes	Larva	Early Instar	2	SH

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM004

RAI No.: URS08BLM004 **Sta. Name:** Joe Creek Above Waste Rock Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Trichoptera							
Glossosomatidae							
Anagapetus sp.	98	20.37%	Yes	Larva		0	SC
Glossosoma sp.	1	0.21%	Yes	Larva		0	SC
Hydropsychidae							
Hydropsychidae	2	0.42%	No	Larva	Early Instar	4	CF
Parapsyche elsis	3	0.62%	Yes	Larva		1	PR
Limnephilidae							
Ecclisomyia sp.	9	1.87%	Yes	Larva		4	CG
Philopotamidae							
Dolophilodes sp.	2	0.42%	Yes	Larva		0	CF
Rhyacophilidae							
Rhyacophila Betteni Gr.	9	1.87%	Yes	Larva		0	PR
Rhyacophila Hyalinata Gr.	1	0.21%	Yes	Larva		0	PR
Rhyacophila Vagrita Gr.	1	0.21%	Yes	Larva		0	PR
Coleoptera							
Elmidae							
Ampumixis dispar	1	0.21%	Yes	Larva		4	CG
Heterlimnius sp.	2	0.42%	No	Larva		3	CG
Heterlimnius koebelei sp.	3	0.62%	Yes	Adult		4	CG
Lara sp.	3	0.62%	Yes	Larva		1	SH
Zaitzevia parvulus	1	0.21%	Yes	Larva		4	CG
Diptera							
Ceratopogonidae							
Mallochohelea sp.	5	1.04%	Yes	Larva		11	PR
Dixidae							
Dixa sp.	1	0.21%	Yes	Larva		1	CG
Empididae							
Chelifera sp.	1	0.21%	Yes	Larva		5	PR
Empididae	1	0.21%	No	Pupa		6	PR
Neoplasta sp.	1	0.21%	Yes	Larva		5	PR
Pelecorhynchidae							
Glutops sp.	3	0.62%	Yes	Larva		1	PR
Psychodidae							
Pericoma / Telmatoscopus	3	0.62%	Yes	Larva		4	CG
Simuliidae							
Simulium sp.	1	0.21%	Yes	Larva		6	CF
Simulium sp.	1	0.21%	No	Pupa		6	CF

Taxa Listing

Project ID: URS08BLM
RAI No.: URS08BLM004

RAI No.: URS08BLM004 **Sta. Name:** Joe Creek Above Waste Rock Confluence
Client ID:
Date Coll.: 9/9/2008 **No. Jars:** 1 **STORET ID:**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Chironomidae							
Chironomidae							
Boreochlus sp.	1	0.21%	Yes	Larva		1	CG
Brillia parva sp.	1	0.21%	Yes	Larva		5	SH
Cricotopus triannulatus	1	0.21%	Yes	Larva		7	SH
Diamesa sp.	2	0.42%	Yes	Larva		5	CG
Eukiefferiella Brehmi Gr.	1	0.21%	Yes	Larva		8	CG
Eukiefferiella Gracei Gr.	1	0.21%	Yes	Larva		8	CG
Limnophyes sp.	1	0.21%	Yes	Larva		8	CG
Micropsectra sp.	1	0.21%	No	Pupa		4	CG
Micropsectra sp.	31	6.44%	Yes	Larva		4	CG
Orthocladius (Euorthocladius) sp.	2	0.42%	Yes	Larva	Early Instar	6	CG
Orthocladius (Orthocladius) sp.	1	0.21%	Yes	Larva	Early Instar	6	CG
Pagastia orthogonia	1	0.21%	Yes	Larva		1	CG
Parametriocnemus sp.	1	0.21%	No	Pupa		5	CG
Parametriocnemus sp.	7	1.46%	Yes	Larva		5	CG
Parorthocladius sp.	1	0.21%	Yes	Larva		6	CG
Parorthocladius sp.	1	0.21%	No	Pupa		6	CG
Thienemanniella sp.	1	0.21%	Yes	Larva		6	CG
Tvetenia Bavarica Gr.	6	1.25%	Yes	Larva		5	CG
Sample Count	**481**						

Metrics Report

Project ID: URS08BLM
RAI No.: URS08BLM001
Sta. Name: Elliott Creek Below Confluence
Client ID:
STORET ID:
Coll. Date: 9/9/2008

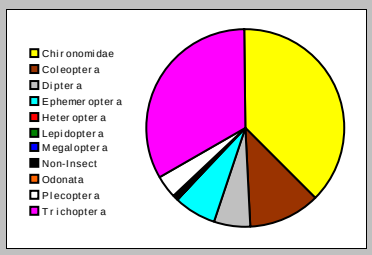
Abundance Measures

Sample Count: 500
Sample Abundance: 833.33 60.00% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	2	5	1.00%
Odonata			
Ephemeroptera	7	34	6.80%
Plecoptera	7	19	3.80%
Heteroptera			
Megaloptera			
Trichoptera	14	167	33.40%
Lepidoptera			
Coleoptera	8	58	11.60%
Diptera	4	30	6.00%
Chironomidae	21	187	37.40%

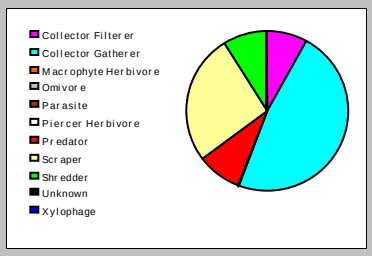


Dominant Taxa

Category	A	PRA
Orthocladius (Orthocladius)	76	15.20%
Neophylax occidentis	68	13.60%
Zaitzevia parvulus	27	5.40%
Glossosoma	27	5.40%
Micropsectra	23	4.60%
Baetis tricaudatus	23	4.60%
Glossosomatidae	19	3.80%
Simulium	16	3.20%
Rheotanytarsus	15	3.00%
Ampumixis dispar	11	2.20%
Agapetus	11	2.20%
Tvetenia Bavarica Gr.	10	2.00%
Cricotopus triannulatus	10	2.00%
Lepidostoma	9	1.80%
Orthocladius (Euorthocladius)	8	1.60%

Functional Composition

Category	R	A	PRA
Predator	16	44	8.80%
Parasite			
Collector Gatherer	25	236	47.20%
Collector Filterer	4	42	8.40%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	7	134	26.80%
Shredder	10	43	8.60%
Omivore	1	1	0.20%
Unknown			

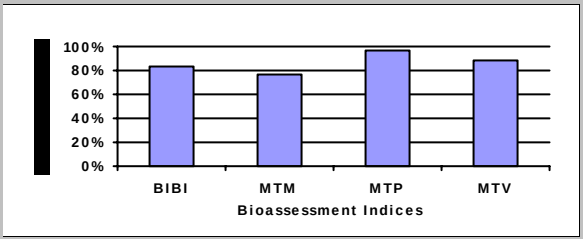


Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	63	5	3		3
Non-Insect Percent	1.00%				
E Richness	7	3		3	
P Richness	7	3		3	
T Richness	14	5		3	
EPT Richness	28		3		3
EPT Percent	44.00%		2		1
Oligochaeta+Hirudinea Percent	0.80%				
Baetidae/Ephemeroptera	0.824				
Hydropsychidae/Trichoptera	0.036				
Dominance					
Dominant Taxon Percent	15.20%		3		3
Dominant Taxa (2) Percent	28.80%				
Dominant Taxa (3) Percent	34.20%	5			
Dominant Taxa (10) Percent	61.00%				
Diversity					
Shannon H (loge)	3.315				
Shannon H (log2)	4.783		3		
Margalef D	10.277				
Simpson D	0.065				
Evenness	0.037				
Function					
Predator Richness	16		3		
Predator Percent	8.80%	1			
Filterer Richness	4				
Filterer Percent	8.40%			2	
Collector Percent	55.60%		3		3
Scraper+Shredder Percent	35.40%		3		1
Scraper/Filterer	3.190				
Scraper/Scraper+Filterer	0.761				
Habit					
Burrower Richness	2				
Burrower Percent	2.40%				
Swimmer Richness	4				
Swimmer Percent	5.80%				
Clinger Richness	25	5			
Clinger Percent	50.00%				
Characteristics					
Cold Stenotherm Richness	5				
Cold Stenotherm Percent	15.20%				
Hemoglobin Bearer Richness	2				
Hemoglobin Bearer Percent	0.80%				
Air Breather Richness	2				
Air Breather Percent	1.20%				
Voltinism					
Univoltine Richness	25				
Semivoltine Richness	9	5			
Multivoltine Percent	38.00%		3		
Tolerance					
Sediment Tolerant Richness	1				
Sediment Tolerant Percent	0.40%				
Sediment Sensitive Richness	1				
Sediment Sensitive Percent	5.40%				
Metals Tolerance Index	2.825				
Pollution Sensitive Richness	6	5		3	
Pollution Tolerant Percent	6.60%	5		2	
Hilsenhoff Biotic Index	3.695		3		2
Intolerant Percent	24.80%				
Supertolerant Percent	1.80%				
CTQa	56.889				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	42	84.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	29	96.67%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	16	88.89%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	16	76.19%	Slight



Metrics Report

Project ID: URS08BLM
RAI No.: URS08BLM002
Sta. Name: Elliott Creek Above Confluence
Client ID:
STORET ID:
Coll. Date: 9/9/2008

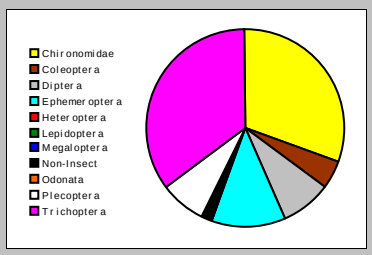
Abundance Measures

Sample Count: 515
Sample Abundance: 735.71 70.00% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	3	8	1.55%
Odonata			
Ephemeroptera	8	62	12.04%
Plecoptera	7	39	7.57%
Heteroptera			
Megaloptera			
Trichoptera	10	183	35.53%
Lepidoptera			
Coleoptera	7	25	4.85%
Diptera	8	41	7.96%
Chironomidae	17	157	30.49%

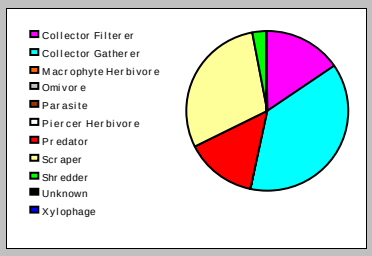


Dominant Taxa

Category	A	PRA
Glossosoma	54	10.49%
Rheotanytarsus	50	9.71%
Micropsectra	50	9.71%
Glossosomatidae	46	8.93%
Baetis tricaudatus	46	8.93%
Neophylax occidentis	24	4.66%
Tvetenia Bavarica Gr.	19	3.69%
Skwala	17	3.30%
Hydropsyche Morosa Gr.	16	3.11%
Agapetus	15	2.91%
Antocha	13	2.52%
Rhyacophila	12	2.33%
Simulium	11	2.14%
Orthocladius (Orthocladius)	10	1.94%
Hesperoconopa	10	1.94%

Functional Composition

Category	R	A	PRA
Predator	17	72	13.98%
Parasite			
Collector Gatherer	25	195	37.86%
Collector Filterer	5	80	15.53%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	8	153	29.71%
Shredder	5	15	2.91%
Omivore			
Unknown			

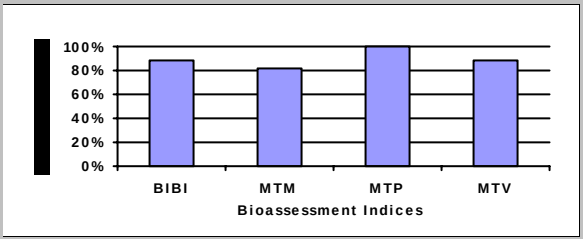


Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	60	5	3		3
Non-Insect Percent	1.55%				
E Richness	8	3		3	
P Richness	7	3		3	
T Richness	10	5		3	
EPT Richness	25		3		3
EPT Percent	55.15%		3		2
Oligochaeta+Hirudinea Percent	1.55%				
Baetidae/Ephemeroptera	0.774				
Hydropsychidae/Trichoptera	0.109				
Dominance					
Dominant Taxon Percent	10.49%		3		3
Dominant Taxa (2) Percent	20.19%				
Dominant Taxa (3) Percent	29.90%	5			
Dominant Taxa (10) Percent	65.44%				
Diversity					
Shannon H (loge)	3.234				
Shannon H (log2)	4.666		3		
Margalef D	9.749				
Simpson D	0.063				
Evenness	0.039				
Function					
Predator Richness	17		3		
Predator Percent	13.98%	3			
Filterer Richness	5				
Filterer Percent	15.53%			1	
Collector Percent	53.40%		3		3
Scraper+Shredder Percent	32.62%		3		1
Scraper/Filterer	1.913				
Scraper/Scraper+Filterer	0.657				
Habit					
Burrower Richness	5				
Burrower Percent	3.11%				
Swimmer Richness	2				
Swimmer Percent	9.32%				
Clinger Richness	27	5			
Clinger Percent	56.70%				
Characteristics					
Cold Stenotherm Richness	5				
Cold Stenotherm Percent	7.38%				
Hemoglobin Bearer Richness	1				
Hemoglobin Bearer Percent	1.17%				
Air Breather Richness	4				
Air Breather Percent	5.24%				
Voltinism					
Univoltine Richness	28				
Semivoltine Richness	9	5			
Multivoltine Percent	37.86%		3		
Tolerance					
Sediment Tolerant Richness	2				
Sediment Tolerant Percent	2.91%				
Sediment Sensitive Richness	2				
Sediment Sensitive Percent	11.26%				
Metals Tolerance Index	2.515				
Pollution Sensitive Richness	5	5		3	
Pollution Tolerant Percent	1.94%	5		3	
Hilsenhoff Biotic Index	3.008		3		2
Intolerant Percent	36.89%				
Supertolerant Percent	1.75%				
CTQa	57.775				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	44	88.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	30	100.00%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	16	88.89%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	17	80.95%	Slight



Metrics Report

Project ID: URS08BLM
RAI No.: URS08BLM003
Sta. Name: Joe Creek Below Waste Rock Confluence
Client ID:
STORET ID:
Coll. Date: 9/9/2008

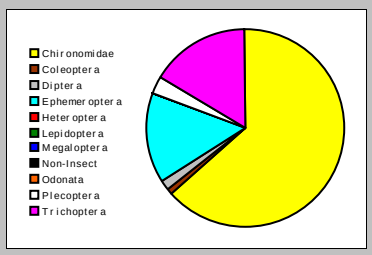
Abundance Measures

Sample Count: 176
Sample Abundance: 176.00 100.00% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect			
Odonata			
Ephemeroptera	5	26	14.77%
Plecoptera	5	5	2.84%
Heteroptera			
Megaloptera			
Trichoptera	7	29	16.48%
Lepidoptera			
Coleoptera	2	2	1.14%
Diptera	3	3	1.70%
Chironomidae	11	111	63.07%

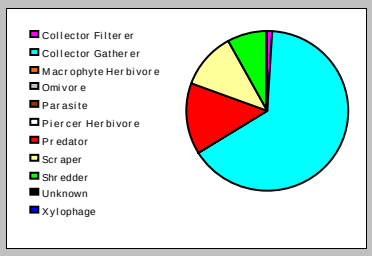


Dominant Taxa

Category	A	PRA
Orthocladius (Euorthocladius)	31	17.61%
Eukiefferiella Gracei Gr.	25	14.20%
Orthocladius (Orthocladius)	20	11.36%
Baetis tricaudatus	13	7.39%
Rhyacophila	10	5.68%
Pagastia orthogonia	9	5.11%
Parorthocladius	7	3.98%
Anagapetus	7	3.98%
Drunella coloradensis	6	3.41%
Brillia parva	6	3.41%
Tvetenia Bavarica Gr.	5	2.84%
Rhyacophila Betteni Gr.	5	2.84%
Epeorus grandis	3	1.70%
Cricotopus (Cricotopus)	3	1.70%
Ironodes	2	1.14%

Functional Composition

Category	R	A	PRA
Predator	10	25	14.20%
Parasite			
Collector Gatherer	10	115	65.34%
Collector Filterer	2	2	1.14%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	5	20	11.36%
Shredder	6	14	7.95%
Omivore			
Unknown			

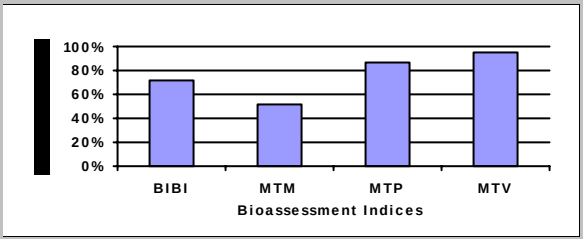


Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	33	3	3		3
Non-Insect Percent	0.00%				
E Richness	5	3		2	
P Richness	5	3		3	
T Richness	7	3		3	
EPT Richness	17		3		2
EPT Percent	34.09%		2		0
Oligochaeta+Hirudinea Percent					
Baetidae/Ephemeroptera	0.500				
Hydropsychidae/Trichoptera	0.034				
Dominance					
Dominant Taxon Percent	17.61%		3		3
Dominant Taxa (2) Percent	31.82%				
Dominant Taxa (3) Percent	43.18%	5			
Dominant Taxa (10) Percent	76.14%				
Diversity					
Shannon H (loge)	2.833				
Shannon H (log2)	4.087		3		
Margalef D	6.305				
Simpson D	0.084				
Evenness	0.054				
Function					
Predator Richness	10		3		
Predator Percent	14.20%	3			
Filterer Richness	2				
Filterer Percent	1.14%			3	
Collector Percent	66.48%		2		2
Scraper+Shredder Percent	19.32%		2		0
Scraper/Filterer	10.000				
Scraper/Scraper+Filterer	0.909				
Habit					
Burrower Richness	2				
Burrower Percent	1.70%				
Swimmer Richness	1				
Swimmer Percent	7.39%				
Clinger Richness	14	3			
Clinger Percent	26.14%				
Characteristics					
Cold Stenotherm Richness	6				
Cold Stenotherm Percent	9.66%				
Hemoglobin Bearer Richness					
Hemoglobin Bearer Percent					
Air Breather Richness	2				
Air Breather Percent	1.14%				
Voltinism					
Univoltine Richness	17				
Semivoltine Richness	4	3			
Multivoltine Percent	44.32%		2		
Tolerance					
Sediment Tolerant Richness	1				
Sediment Tolerant Percent	0.57%				
Sediment Sensitive Richness	1				
Sediment Sensitive Percent	3.98%				
Metals Tolerance Index	4.149				
Pollution Sensitive Richness	7	5		3	
Pollution Tolerant Percent	0.57%	5		3	
Hilsenhoff Biotic Index	4.313		3		1
Intolerant Percent	31.82%				
Supertolerant Percent	15.34%				
CTQa	58.900				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	36	72.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	26	86.67%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	17	94.44%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	11	52.38%	Moderate



Metrics Report

Project ID: URS08BLM
RAI No.: URS08BLM004
Sta. Name: Joe Creek Above Waste Rock Confluence
Client ID:
STORET ID:
Coll. Date: 9/9/2008

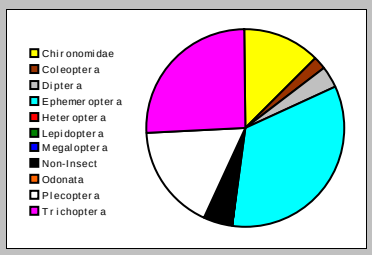
Abundance Measures

Sample Count: 481
Sample Abundance: 481.00 100.00% of sample used

Coll. Procedure:
Sample Notes:

Taxonomic Composition

Category	R	A	PRA
Non-Insect	4	22	4.57%
Odonata			
Ephemeroptera	13	162	33.68%
Plecoptera	12	83	17.26%
Heteroptera			
Megaloptera			
Trichoptera	8	126	26.20%
Lepidoptera			
Coleoptera	4	10	2.08%
Diptera	7	17	3.53%
Chironomidae	15	61	12.68%

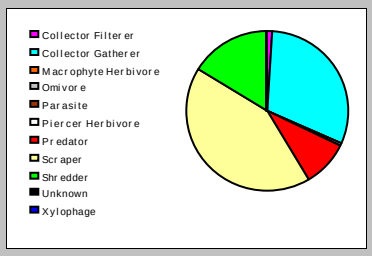


Dominant Taxa

Category	A	PRA
Anagapetus	98	20.37%
Drunella doddsii	38	7.90%
Yoraperla brevis	34	7.07%
Micropsectra	32	6.65%
Baetis tricaudatus	31	6.44%
Epeorus grandis	30	6.24%
Cinygmula	18	3.74%
Visoka cataractae	17	3.53%
Mesenchytraeus	16	3.33%
Rhithrogena	15	3.12%
Sierraperla cora	9	1.87%
Rhyacophila Betteni Gr.	9	1.87%
Ecclisomyia	9	1.87%
Parametriocnemus	8	1.66%
Drunella spinifera	8	1.66%

Functional Composition

Category	R	A	PRA
Predator	15	45	9.36%
Parasite			
Collector Gatherer	25	145	30.15%
Collector Filterer	2	6	1.25%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	10	205	42.62%
Shredder	10	77	16.01%
Omivore	1	3	0.62%
Unknown			

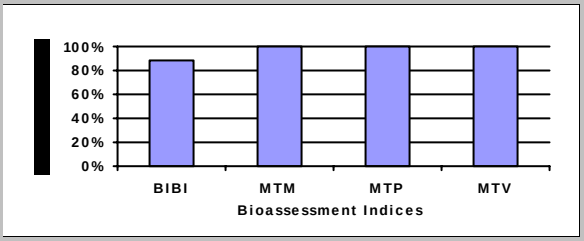


Metric Values and Scores

Metric	Value	BIBI	MTP	MTV	MTM
Composition					
Taxa Richness	63	5	3		3
Non-Insect Percent	4.57%				
E Richness	13	5		3	
P Richness	12	5		3	
T Richness	8	3		3	
EPT Richness	33		3		3
EPT Percent	77.13%		3		3
Oligochaeta+Hirudinea Percent	3.95%				
Baetidae/Ephemeroptera	0.191				
Hydropsychidae/Trichoptera	0.040				
Dominance					
Dominant Taxon Percent	20.37%		3		3
Dominant Taxa (2) Percent	28.27%				
Dominant Taxa (3) Percent	35.34%	5			
Dominant Taxa (10) Percent	68.40%				
Diversity					
Shannon H (loge)	3.186				
Shannon H (log2)	4.597		3		
Margalef D	10.070				
Simpson D	0.074				
Evenness	0.039				
Function					
Predator Richness	15		3		
Predator Percent	9.36%	1			
Filterer Richness	2				
Filterer Percent	1.25%			3	
Collector Percent	31.39%		3		3
Scraper+Shredder Percent	58.63%		3		3
Scraper/Filterer	34.167				
Scraper/Scraper+Filterer	0.972				
Habit					
Burrower Richness	4				
Burrower Percent	2.08%				
Swimmer Richness	3				
Swimmer Percent	6.86%				
Clinger Richness	24	5			
Clinger Percent	62.16%				
Characteristics					
Cold Stenotherm Richness	19				
Cold Stenotherm Percent	56.55%				
Hemoglobin Bearer Richness					
Hemoglobin Bearer Percent					
Air Breather Richness	0				
Air Breather Percent	0.00%				
Voltinism					
Univoltine Richness	36				
Semivoltine Richness	6	5			
Multivoltine Percent	19.75%		3		
Tolerance					
Sediment Tolerant Richness	0				
Sediment Tolerant Percent	0.00%				
Sediment Sensitive Richness	4				
Sediment Sensitive Percent	21.62%				
Metals Tolerance Index	1.485				
Pollution Sensitive Richness	20	5		3	
Pollution Tolerant Percent	0.42%	5		3	
Hilsenhoff Biotic Index	1.459		3		3
Intolerant Percent	70.48%				
Supertolerant Percent	0.62%				
CTQa	60.179				

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	44	88.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	30	100.00%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	18	100.00%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	21	100.00%	None



APPENDIX G
FIELD NOTES

Blue Goose Mine JRM + Z. Greenland

6/24/08 Conditions: Sunny, 70's

0700 Group meets at Motel to prep equipment for field work. Todays tasks include:

1. Mine waste rock volume estimation (B. Duvel)
2. River sediment and fish sampling (B. Rawls + M. Mudge)
3. Adit + Seep Sampling (J. Ray + Z. Greenland)

0800 M. Mudge and B. Rawls to store to pick up perishable supplies for today.

B. Duvel, J. Ray + Z. Greenland to Forest Service office to copy maps. JRM 6/24/08

1100 J. Ray, Z. Greenland, B. Duvel leave Mudfold for site.

1130 Checked in with B. Rawls + M. Mudge to pick up supplies, continued to mine site.

1200 Arrive at site, break for lunch and prep supplies.

1230 Begin climbing to mine

ONE ADIT OBSERVED DURING CLIMB, WILL SAMPLE ON RETURN TO VEHICLE.

AT END OF ROAD, TEAM ASSESSES BEST ROUTE TO TOP. B. DUVEL REACHES TOP AND BEGINS HIS INVESTIGATION

1430 COLLECT AD-01-080624-UNS.
pH = 2.40
MAX TDS + COND OF METER (>3999 µs/cm + > 2000 ppm TDS)
T = 26.0°C
1 L UNPRESERVED CONAINER ONLY ½ FULL + NOTED ON COC TO CONTACT PM IF NOT ENOUGH SAMPLE VOLUME FOR REQUESTED ANALYSES.

1600 COLLECT SP-01-080624-UNS
pH = 6.84
COND = 92 µs/cm
T = 19.5°C
TDS = 46 ppm

1645 COLLECT AD-02-080624-UNS
pH = 7.73
COND = 435 µs/cm

T = 9.2°C
TDS = 463 ppm
B. DUEVEL COLLECTS WASTE ROCK
- VOLUME FOR LABORATORY
ANALYSIS WHILE JJR + ZO
COLLECT AD-02-080624-URS
- WEIR SET UP OUTSIDE OF ADIT,
~1/2" ~~vol~~ in HEIGHT OF FLOWOVER
WEIR.
1815 COLLECT DAM-01-080624-URS
pH = 3.42
COND = 310 µS/cm
T = 16.1°C
TDS = 155 ppm
1900 PACK UP AT VEHICLES
AND RETURN TO MEDFORD

"Rite in the Rain

/27/08

AR-2-~~0~~ FISH COLLECTION
SETTINGS:
BURST OF PULSES
300V
35 Hz
DUTY CYCLE 3

BLUE LEDGE MINE (RAY B. CANTS)
6/27/08 SUNNY 90s
1620 ARRIVE AT JC-04 VIA OLD LOGGING ROAD. SAMPLE POINT APPROXIMATELY 150' UPSTREAM OF A ~~DRY CREEKBED~~ and SIDE CHANNEL on
WATER QUALITY PARAMETERS
pH = 7.19
COND = 79 µS
T = 16.9°
WATER DEPTH ~ 2"
1630 COLLECTED JC-04-SW-080627-URS
1 250ml UNP. FF
1 500ml HNO_3 FF.
1 L UNP.
1635 COLLECTED JC-04-SD-080627-URS
1 4 OZ JAR
3/4 QT ZIPLOC
1640 COLLECTED JC-04-RS-080627-URS
1 4 OZ JAR
3/4 QT ZIPLOC
*THIS SAMPLE WAS

ON ORIGINAL PLAN, HOWEVER,
COLLECTED DUE TO LACK
OF ACCESS TO JC-06.
1705 RETURN TO VEHICLES
ON ROAD, MOB TO
APPLEGATE RIVER ELECTRO-
FISHING LOCATION

BLUE LEDGE

MINE

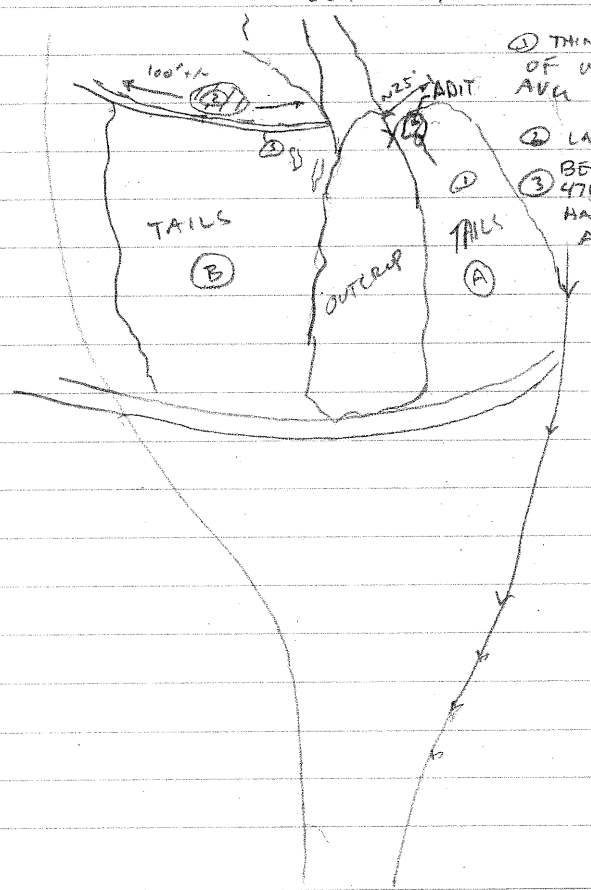
6/24/08 -

6/24/08

0800 - ARRIVE AT FS OFFICE - MEET W/ PETE JONES, GO THROUGH FILES, DUPLICATE MAPS.

1200 ARRIVE AT MINE SITE. BEGIN RECON.

- ESTIMATE TAILINGS SLOPES ~1.2H:1V +/-, SOME STEEPER, SOME FLATTER.
- ROAD ACCESS TO CENTER OF PILE BELOW ROCK OUTCROP



① THIN VENIR OF WASTE - AVG 3-6"

② LARGE ADIT

③ BENCH @ ~4750+/- OLD HAUL ROAD/ ACCESS

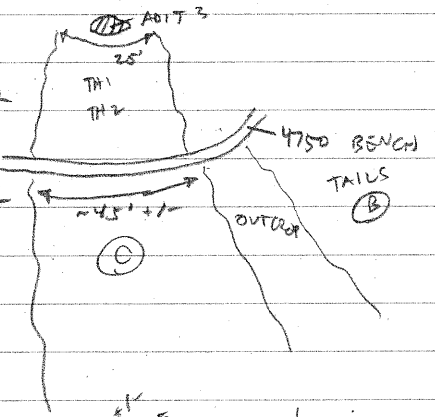
6/24/08

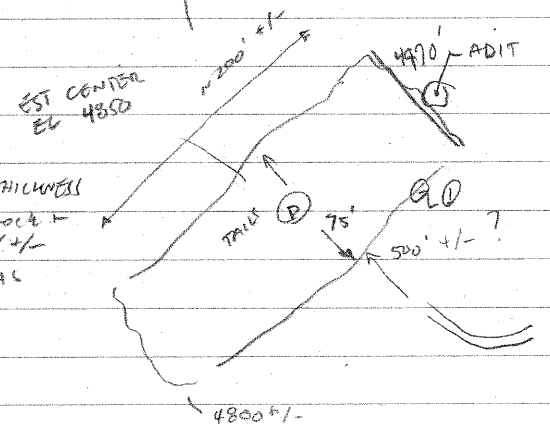
@ ~4750', BENCH EXTENDS TO ADIT 2 - POTENTIAL ACCESS POINT.

TH 1 - ~6" TAILS OVER BLACK HORIZON

TH 2 ~6" TAILS OVER ROOT HORIZON

ADIT 4 - ~75' SOUTH OF S. EDGE OF PILE (C)



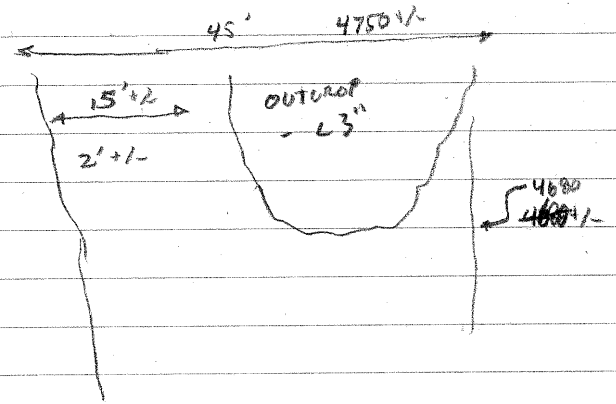


① IN GULLY, THICKNESS BETWEEN ROCK + WASTE IS 2'+/-

- OTHER AREAS 6"+

6/24/08

TAILINGS DUMP "C"

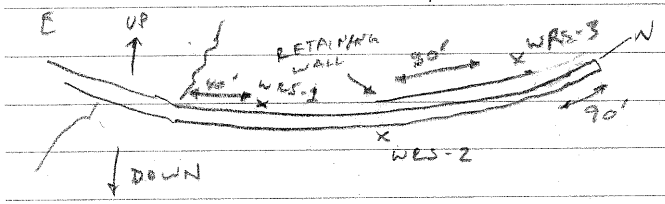


1700 - 1730 SAMPLING BULK WASTE ROCK FROM SWIP-
SAMPLES OBTAINED ALONG ACCESS ROAD
LEADING TO OUTCROP ON UPPER SLOPE.

WRS-3 : AT FAR END OF WASTE ROCK
RETAINING WALL, EL ~4507. 90'
E OF END OF ROAD, DIRECTLY BELOW
ROCK NOSE. - UPSLOPE

WRS-2: 80' E OF WRS-3, @ ~ E END
OF WALL, ~EL. 4500, DOWN SLOPE

WRS-1: ~EL 4481', UPSLOPE 40' FROM
EAST EDGE OF TAILS (UPSLOPE SIDE)



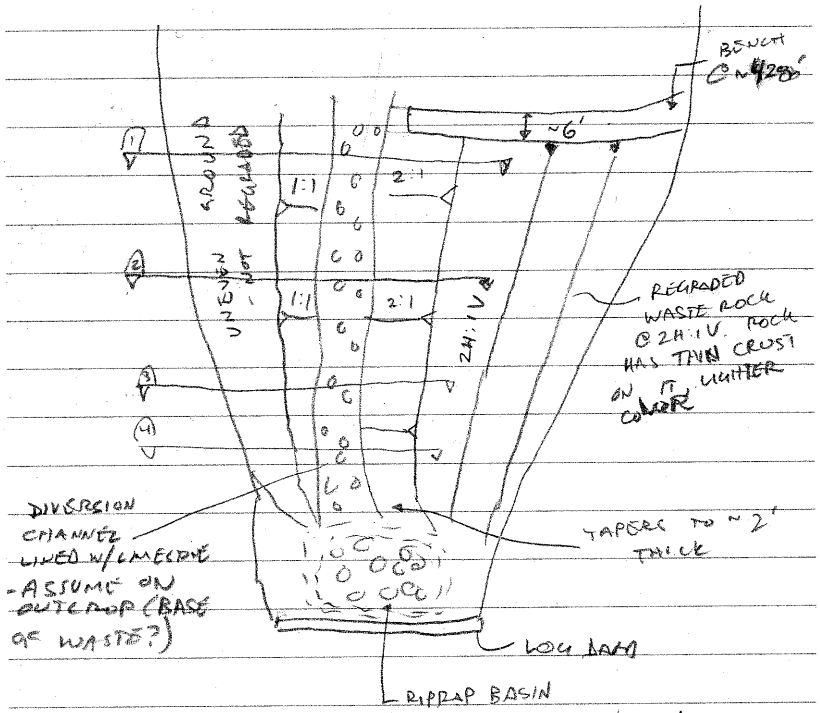
6/25/08

1000 ARRIVE @ SITE - HIKE UP TO ROAD @ MIDPOINT
TO ASSESS SITE W/ OREMLAND.

1100 - DOWN TO MEET SURVEYORS - THEY DO NOT SHOW
UP.

- NOTE - ACCESS POINT ON ~~ROAD~~ CAT ROAD JUST ABOVE LIMESTONE
TREATMENT DAM

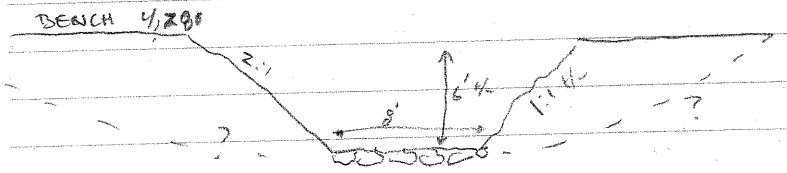
REGRADE AREA



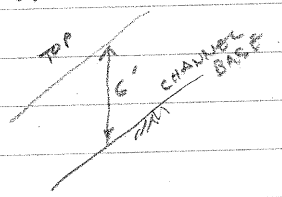
NOTE - OBTAIN EPA CM/DESIGN INFO! * *

6/25/08

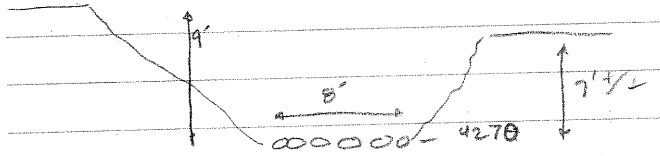
SECTION 1 (LOOKING DOWN)



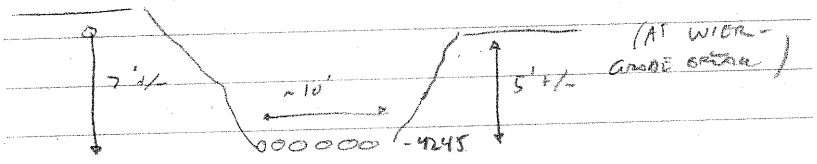
NOTE: 6' MEASURE VERT TO SLOPE



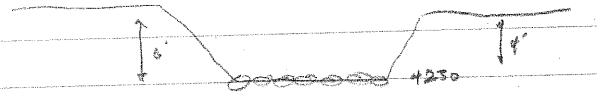
SECTION 2



SECTION 3



SECTION 4



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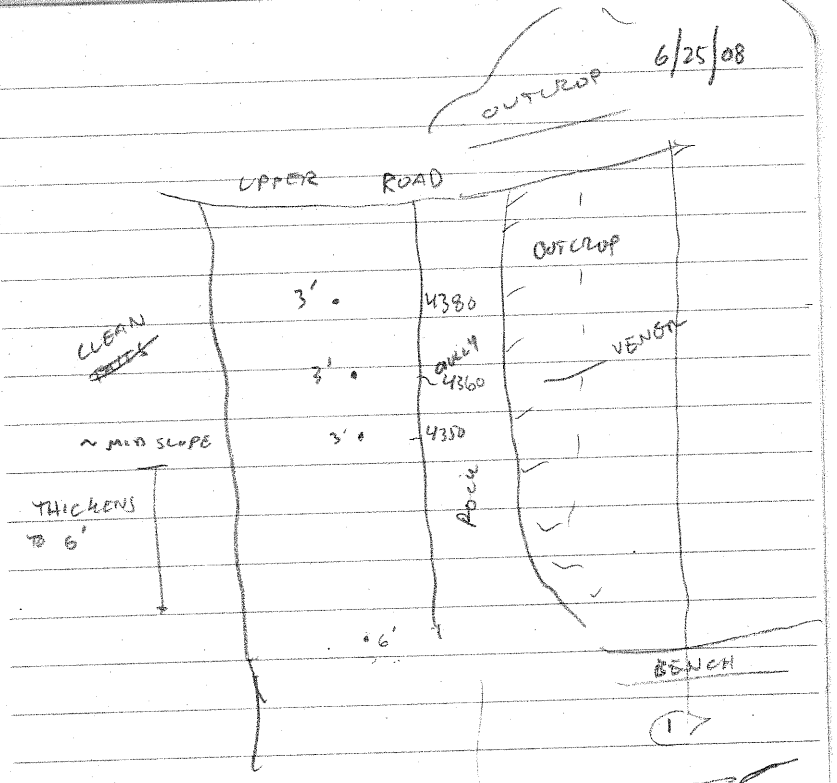
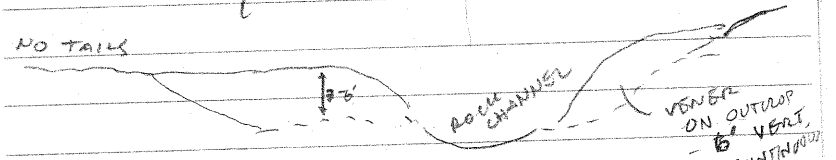
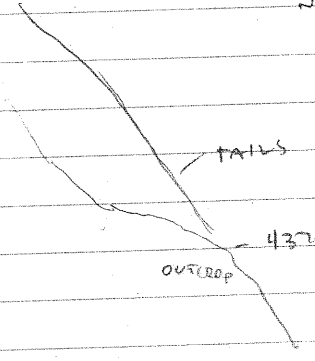


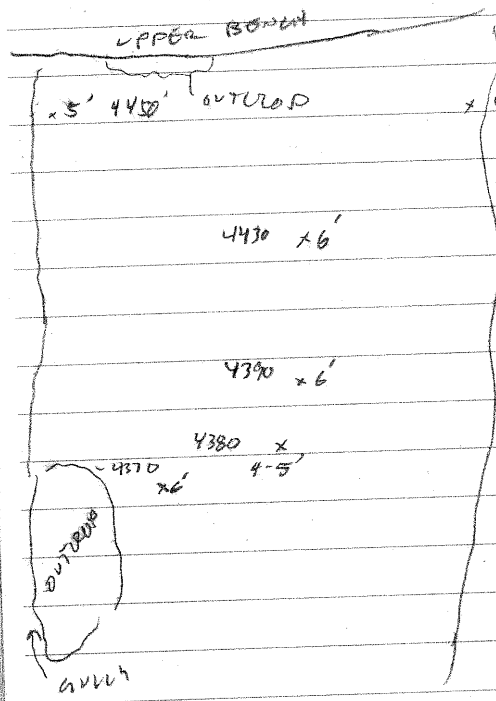


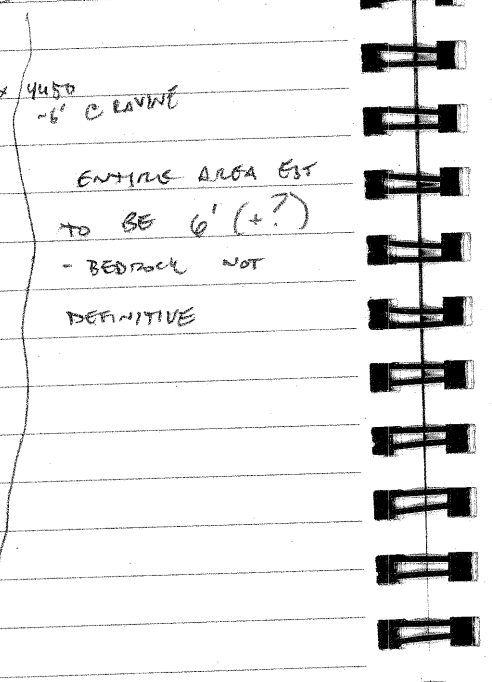
SECTION 1

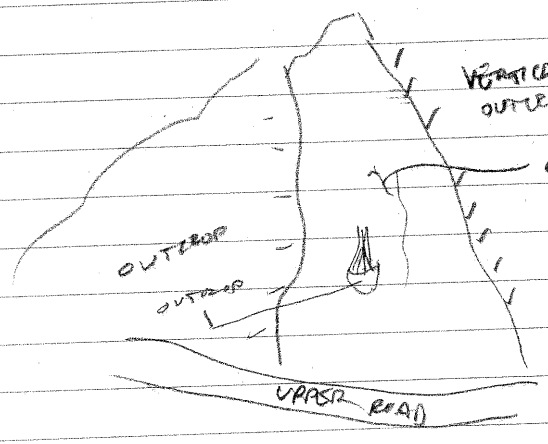
- BELOW OUTCROP
ON UPPER ROAD

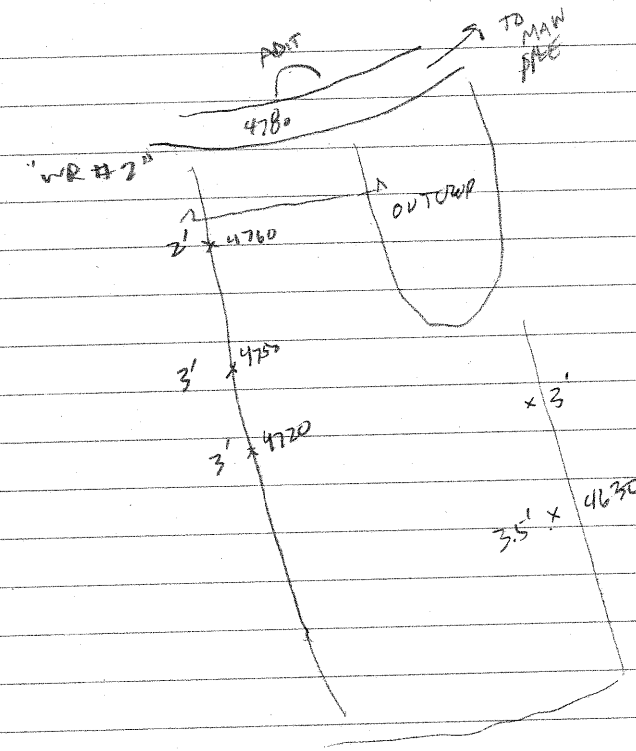


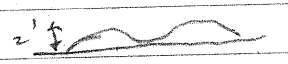
6/25/08

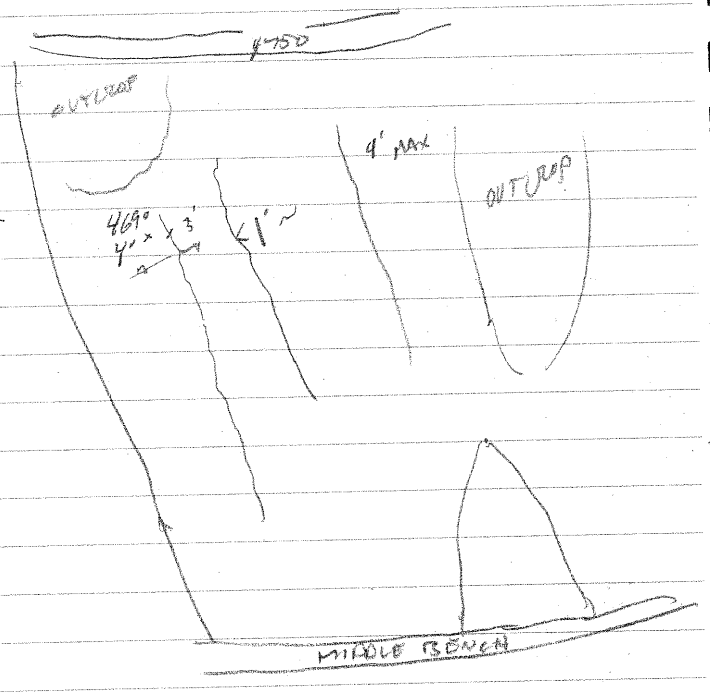

UPPER BENCH
x 5' 4450' OUTCROP
4430 x 6'
4390 x 6'
4380 x 4-5'
4370 x6'
OUTCROP
GULLY


x 4450
~6' CRAVINE
ENTIRE AREA EST
TO BE 6' (+?)
- BEDROCK NOT
DEFINITIVE


VERTICAL
OUTCROP W/ CABLE
6' IN RIVULET
OUTCROP
OUTCROP
UPPER ROAD


ADIT
TO MAIN PIPE
4780
"WR #2"
OUTCROP
2' x 4760
3' x 4750
3' x 4720
x 3'
3.5' x 4630


2'

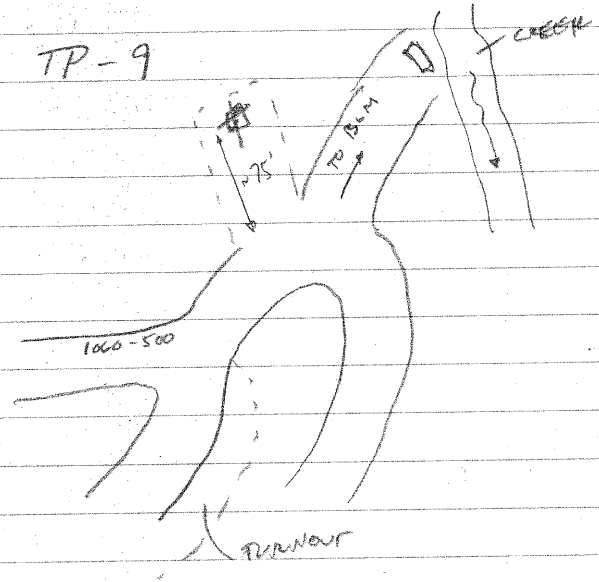


6/26/08

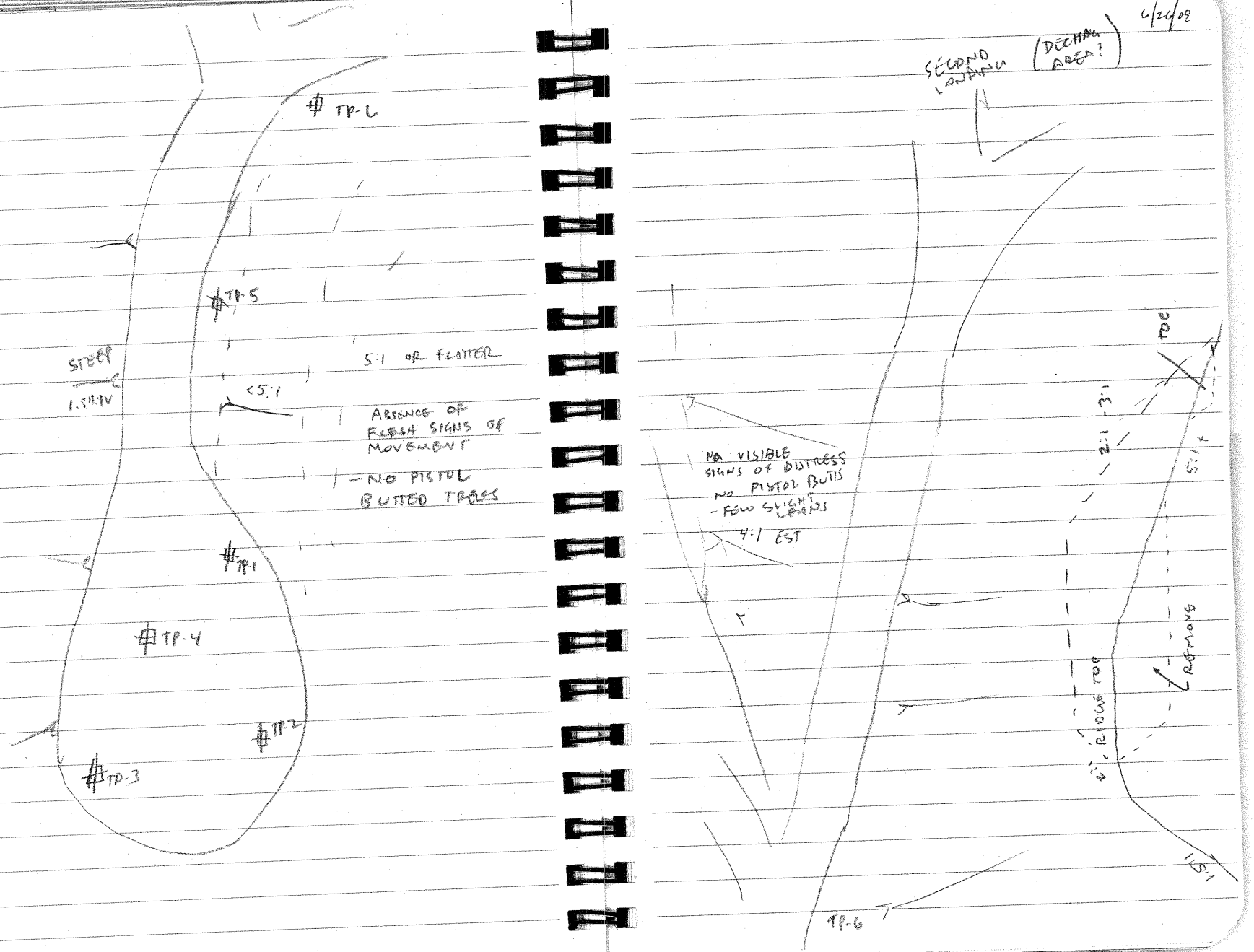
900 MEET BACKHOE OPERATOR @ RESERVOIR

1000 ARRIVE @ DISPOSAL SITE.

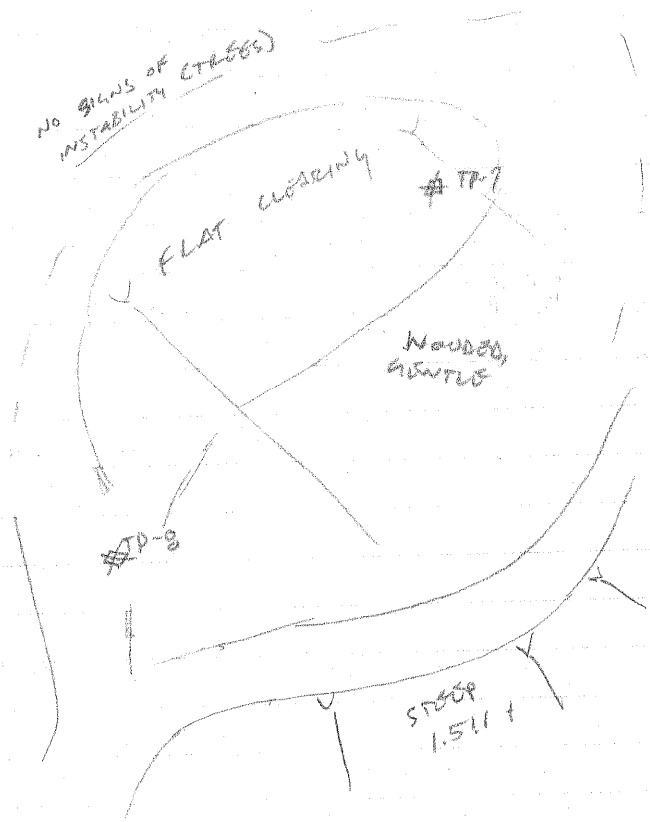
TP - 9



4/26/09


TP-6
TP-5
STEEP
1.5:1 IV
5:1 OR FLATTER
<5:1
ABSENCE OF FRESH SIGNS OF MOVEMENT
- NO PISTOL BUTTED TREES
TP1
TP-4
TP2
TP-3
SECOND LANDING (DECKING AREA?)
NO VISIBLE SIGNS OF DISTRESS
NO PISTOL BUTTS
- FEW SLIGHT LEANS
4:1 EST
TP-6
TOP
3:1
5:1
2:1 RELOAD TOP
REMOVE
1.5:1

6/20/08


NO SIGNS OF INSTABILITY (TREES)
FLAT CLOSEDIN
TP-7
WOODED, SWAMPY
TP-8
STEEP 1.5:1 +

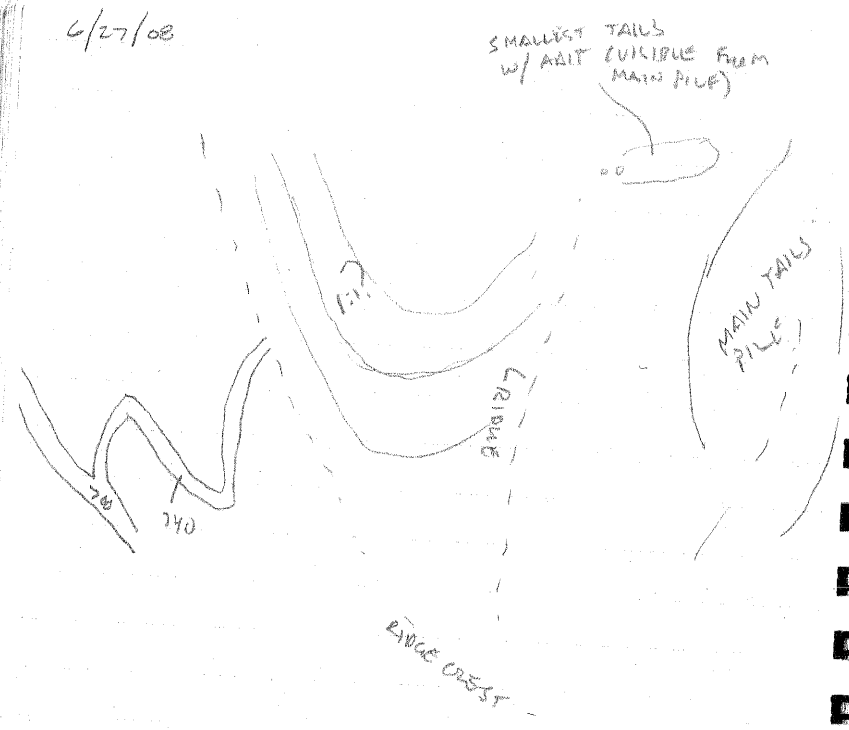
6/27/08

BLUE LEDGE MINE

1430 MEET RAWLS + RAY ON LOWER REACH - SWITCH VEHICLES TO VISIT UPPER ACCESS POINT

- DRIVE UP 1055 ROAD - ROAD IS NARROW + WINDING BUT PASSABLE - LOW BOY MAY BE DIFFICULT, DUMP ON. "ACCESS" TO UPPER END OF MINE IS CLOSEST TO 700 ROAD. FROM 700 TO 740 ROAD, ROAD IS STEEP + NARROW - 4WD ONLY ON 740. CONSTRUCTION EQUIPMENT CAN ACCESS W/O PROBLEM. ROAD ENDS AT CREST OF RIDGELINE. TOP EAST OF RIDGE (TOWARDS MINE) IS V. STEEP - NATURAL SLOPES 1:1 +/- AT END OF ROAD, BACKSIDE OF RIDGE CONTAINING MINE SITE + (IMMEDIATELY WEST OF MAIN PILE).
- SIGNIFICANT EFFORT REQUIRED TO GET CONSTRUCTION MACHINERY DOWN TO MINE SITE FROM ABOVE - POTENTIALLY EASIER FROM BELOW.
- I DID NOT FOLLOW S. SPUR OF 700 ROAD TO TERMINUS - ENDS AT HIGHER EL (5500+) AND HAD DOWNED TREES BLOCKING VEHICLE ACCESS.

6/27/08



1700 RETURN TO RAWLS + RAY.
LEAVE SITE.

Smith - Root LR-24

Blue Ledge 6/26/08

E. Fish w/ Jim Wheaton
of CDFG

Elliot Crk 02
Met team from UC Davis
Confirmed ~~#~~ Cottid sp
as Reticulate Sculpin
- Sampling Elliot for
sculpin but also
capture fin-clipped
bows new station

Sampled ~ 100 ft
of stream area
including bowles &
mid channel riffle
riffle habs.
27 Sculpin captured
11 - 1+ & 16 - 0+

Sunset 300 J 6
~ 20 min

Elliot Ck 04
Upstream for Joe Bar
Bridge
~30 min & 50'
- Bank & mid channel
hab
- 13 Sculpin
7 - 1+ / 6 - 0+
1 native Bow
~5"
Hemorrhaged but
survived

EC 07 Site is ~200'
Above confluence w/ Joe
~35 min & 125' Ck
- Bank & mid-channel
- Sculpins
6 - 1+
14 - 0+

Joe Ck 02 site is ~50'
upstream from confluence
w/ Elliot Ck.
~200' for 40 min
No Fish / No macroinverts

6/24 Blue Ledge Mine -M Mudge
-B. Rauls

7:00 - Field prep w/ crew @ hotel
↳ unloaded / reorganized / repacked for field activities.
* mine waste rock pile (Zach, Jenny)
* river sediment / fish. (Brad, Matt)
↳ supply run w/ Fred, Megan.
9:00 - Hit the site.
10:30 - Arrived @ 1st location
↳ prepd for reservoir sampling.
* ARV-01 thru ARV-04
Conditions:
- Sunny, 70's
- for reservoir samples, depth too deep for trident, so deployed rubber raft & float tube.
11:50 - Collected ARV-02 sample (sediment)
↳ used Ekman box core dredge sampler
* 1x 4oz jar
* 1 qrt. ziplock.
- ~~Filter~~ MSM
* depth to sediment ~ 8 ft., deployed sampler several times in order to get adequate sample volume.

M.S. Mudge

* grey, fine sand, w/ minor silt, grains of flect minerals (mica?)
- cont. to ARV-03, slight headwind making it hard to navigate.

12:25 - Collected ARV-03 sample. (sediment)
↳ used Ekman box core dredge sampler
* 1 x 4oz jar
* 1 qrt. ziplock.
* depth to sediment ~15 ft., deployed sampler several times in order to obtain adequate sample volume.
* grey, fine → very fine sand w/ silt.
- cont. to next location.

12:57 - Collected ARV-04 sample. (sediment)
↳ used Ekman box core dredge sampler
* 1 x 4oz jar
* 1 qrt. ziplock.
* depth to sediment ~20 ft, deployed sampler several times in order to obtain adequate sample volume.
* grey, fine → coarse sand w/ minor silt.
* surface water sample collected before sediment using bailer / grab technique.
* 1 x 500 mL Poly w/ HNO_3 (TF)
* 1 x 250 mL Poly (TF)

M.S. Mudge

* 1 x 1L Poly
(TF) w/ disposable 0.45 µm water filter and bailer (disposable)
Water Quality Measurements:
pH = 7.91
conductivity = 95 µS
temp = 21.2°C
* probe ~1 ft. below surface.
- Rubber raft punctured one of the pontoons, so had to go ashore and attempt patch (w/ duct tape).
↳ not successful, so decided to pull boat/float tube and cont. additional sample from shoreline (w/ wading as necessary)
- Hiked back to vehicle, packed out boat / float tube and equipment.
- Setup for cont. river sediment sampling.

15:35 - Collected ARV-01 sample. (sediment)
↳ used Ekman box core dredge sampler w/ trident.
* sampled on (W) side river in depositional area.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock

M.S. Mudge

*depth to sediment = 5 ft.
* grey, med sand w/ trace silt.
- Setup on AR-02 (just (N) of bridge)
Water Quality Measurements:
pH = 7.65
conductivity = ~~[illegible]~~ 95 µS
temp = 14.3 °C
*probe ~ 15 ft below surface.
15:38 - collected water sample, using bailer/grab methods.
15:38 - collected AR-02 sample (sediment)
↳ used shovel
*sampled on (W) side of river in a depositional area.
↳ 1 x 4oz
↳ 1 qrt. ziplock.
*depth to sediment = 3 ft.
* grey, gravely sand, med → coarse sand, fine gravel (rounded).
- back to vehicle to drop-off samples & prep for next locations.

16:15 AR 2
Adult Salmonid observed
~ 12 - 15 in.
M. S. Mudge

- Setup / moved vehicle to (E) side of Applegate River, upstream 1(S) of bridge.
- AR-01
Water Quality Measurements:
pH = 7.62
conductivity = 100 µS
temp = 14.1 °C
- *probe ~ 8" below water surface.
16:40 - collected water sample using bailer/grab methods. ↳ 1 x 500 ml Poly w/ HNO3 (E), 1 x 250 ml Poly (E)
16:45 - collected AR-01-SD (sediment) ↳ 1 x 1L Poly
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
*used shovel *depth to sediment = 1 ft.
*sampled on (E) side of river in a depositional area just downstream of Applegate / Elliot confluence.
* grey, sand w/ gravel, fine → coarse sand coarse gravel (rounded)
16:58 - collected AR-01-RS (riparian)
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
*used shovel.
*sampled ~ 12 ft from water on (E) riverbank, @ ordinary high water/bank full
M. S. Mudge

EC-01 (upstream of confluence w/ Applegate River ~ 200 ft. (S))
~ 30' (S) of orange flagging tied on tree branch.

Water Quality Measurements:
pH = 7.57
conductivity = 103 µS
temp = 14.2 °C
* probe ~ 1 ft. below water surface.

17:25 - collected EC-01-SW (surface water)
↳ ~~used shovel~~ used
↳ ~~2 x 4 oz jars~~ used
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1L Poly.
* used bailer / grab methods.

17:35 - Collected EC-01-SD (sediment)
* used shovel
↳ 1 x 4 oz jar
↳ 1 qrt. ziplock.
* depth to sample = 1.5 ft.
* sampled on (E) side of river in a deep stained area.

* USFW stowaway temp probe in river @ location.
" * Chris Meyer 541-750-7017 "

M.S. Mudge

17:45 - collected EC-01-RS (riparian) on (E) riverbank
* used shovel
* sampled ~ 5 ft. from surface water @ ordinary high water / bank full.
↳ 1 x 4 oz jar
↳ 1 qrt. ziplock.

17:53 - observed caddis fly & stonefly @ EC-01 location.
- Packed out supplies / equipment back to vehicle.

18:30 - Mob'd up to mine site to meet up w/ other crew.
- Update on their progress:
↳ located handfull of adits.
↳ identified 4 waste rock piles
↳ collected WR samples for SPLP analysis.
↳ collected adit / seep water samples.

19:00 - Loaded vehicles, mob'd to hotel.

20:15 - Back @ hotel

M.S. Mudge

6/25/08 Blue Ledge Mine -A. Hodge
-B. Rawls.

7:00 - Field prep / loaded vehicles @ hotel.
- Met w/ J. Ray (Sample COCs, shipping)
↳ reviewed field notes, updated sampling nomenclature, FedEx details
- Met w/ B. Rawls
↳ reviewed sampling locations, logistics w/ fish sampling (CA USFW biologist)
- Mine waste Rock activities today are:
↳ begin survey of piles.
↳ test pitting to determine pile thickness.

9:30 - Mob to site.

10:45 - Arrived @ next sampling location (EC-02)
- Field prep.
- @ EC-02 location (~80 ft (W) of forest Service Road bridge) (ie. downstream)
- Water Quality Measurements
pH = 7.5 *probe ~6" under surface.
conductivity = 103 µS.
temp = 11.1 °C
- Collected EC-02-SW-080625-WRS (surface water)
*used bailer / grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1L Poly

11:20 - Collected EC-02-SD-080625-WRS (Sediment)
*used shovel, sample 4-6" below water
*sample on (N) side of river in depositional area.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.

11:36 - Collected EC-02-RS-080625-WRS (riparian)
*used shovel, sample ~8 from water surface on (N) bank, within 1 vertical foot of ordinary bank / vegetation line.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
* observed caddis fly & stone-fly in the area.
- Packed up, moved to next location upstream
* No hatched caddis, mayfly, stone fly. (ie. still in larva stage)
- Met B. Drewell on forest service road,
↳ surveyors haven't shown up yet, he's going to 1st campground @ reservoir to check for them.

- Setup @ EC-03
- Water Quality Measurements
  pH = $7^{.39}$
  conductivity = 103 µS
  temp = $11^{.6}$ °C
  * probe ~ 1 ft below water surface

12:10 - Collected EC-03-SW-080625-URS (surface water)
  * used bailer / grab methods
    ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
    ↳ 1 x 250 mL Poly (FF)
    ↳ 1 x 1 L Poly

12:15 - Collected EC-03-SD-080625-URS (sediment)
  * used shovel, sample collect on (S) side of river in depositional area / behind rock outcrop / boulder.
  * sample ~10" below water surface
    ↳ 1 x 4 oz jar
    ↳ 1 qrt. ziplock.
  * grey, ~~med-coarse~~ fine → coarse sand, with fine → med. gravel (rounded).
- preponderance of caddis fly, fewer stoneflys (but still present). high velocity area of stream

12:35 - Back @ vehicle, prep'd for sampling in Joe Bar area (private residences)
  ↳ EC-04 → EC-07 & JC-01 → JC-02
    * 6 samples.
  ↳ prep'd sample cont. for each location in designated ziplocks, then packed back pack.

13:20 - Moved vehicle to Joe Bar area.
  - Met J. Ray on roadway.
    ↳ was in Medford shipping water samples to lab and buying additional equipment (waders & wading boots).
    ↳ she's going to drive up to mine site and check on the other team.

~13:00 - OBEC surveyors drove past on forest service road. (running late) (supposed to be on site @ ~11am)

13:40 - Setup @ EC-04
  - Water Quality Measurements:
    pH = $7^{.51}$
    conductivity = 101 µS
    temp = $13^{.5}$ °C
  * probe ~ 1 ft. under water

13:50 - collected EC-04-SW-080625-URS (surface water)

*used bailer / grab methods
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly

13:55 - Collected EC-04-SD-080625-URS (sediment)
*used shovel, sample collected on (N) side of river in depositional area (behind rocks / boulders)
*sample ~18" under water
↳ 1 x 4 oz jar
↳ 1 qt. ziplock.
*grey, med → coarse sand w/ gravel (fine-med & rounded.

14:20 - collected EC-04-SD-DUP-080625-URS
↳ 1 x 4 oz jar
↳ 1 qt. ziplock.

14:35 - collected EC-04-SW-DUP-080625-URS
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly.

~14:00 - Landowner approached us, wanted to know what was going on and why we were on "private property".
↳ indicated we were working for Forest Service.

- Met J. Ray @ vehicle, field prep.

14:50 - Back on Elliott Creek.
↳ began hiking upstream

15:15 - @ EC-05 location
- Water Quality Measurements:
pH = 7.45
Conductivity = 90 µS
temp = 11.3 °C
*probe ~10 inches below water surface.

15:30 - Collected EC-05-SW-080625-URS (surface water).
*used bailer / grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly.
*collected MS / MSD @ this location. (double volume).

15:40 - Collected EC-05-SD-080625-URS (sediment)
*used shovel, sample collected from (N) edge of river in depositional area.
*appears to be ephemeral tributary on (N) bank @ sample location.
*sample ~10 inches below water
↳ 1 x 4 oz jar

↳ 1 qrt. ziplock

* collected MS/MSD @ this location (double volume).

* grey, fine → coarse sand w/ minor fine gravel.

15:50 - Collected EC-05-RS-080625-URS (riparian)

* used shovel, sample collected from (N) river bank w/in 1 vertical foot of ordinary high water/vegetation.

* sample collected ~ 3' from water surface.

↳ 1 x 4oz jar

↳ 1 qrt. ziplock.

* grey, fine → med sand w/ minor fine gravel (rounded).

15:53 - Collected EC-05-RS-DUP-080625-URS

↳ 1 x 4oz jar

↳ 1 qrt. ziplock.

FISH HAB INFO

EC 04

CADDISFLY NUMBERS APPEAR SIMILAR TO D/S SAMPLE POINTS

FEWER STONE FLYS OBSERVED

LOCAL LANDOWNER INFO

STEELHEAD SPAWN IN AREA W/IN LAST 2 YEARS

RESIDENT CUTS & BOWS PRESENT

STLHD & CHNK USED TO BE PREVALENT B/F DAM

EC 05

CADIS PRESENT BUT LESS NUMEROUS

STONEFLY NOT NEARLY AS NUMEROUS

ABU EXAMPLES ARE STILL SMALL & LARVAL IN DEVELOPMENT

- Cont. hiking upstream to next sampling location.
  ↳ several scoured chutes / ledges in river bed.

16:43 - Arrived @ EC-06 (just downstream of Joe Creek confluence)
- Water Quality Measurements.
  pH = 6.92
  conductivity = 52 µS
  temp = 10.2 °C
  * probe ~10" under water surface.

16:52 - Collected EC-06-SW-080625-URS (surface water)
  * used bailer / grab methods
  ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
  ↳ 1 x 250 mL Poly (FF)
  ↳ 1 x 1 L Poly.

16:55 - Collected EC-06-SD-080625-URS (sediment)
  * used shovel, sample collected from (W) side of river and ~100 ft. downstream of Joe Creek confluence
  * sample ~4" under water surface.
  ↳ 1 x 4 oz jar.
  ↳ 1 ziplock (qwt).

* B. Rounds observed limestone cobbles in sample area (possible wash down from EPH action @ mine site?)
* cobbles ranged from 4" - 18" diameter.
- observed caddisfly & stonefly (lots of both), no hatches, yet.
- Packed up gear & moved upstream on Elliott Creek.

17:15 - @ EC-07 location.
- Water Quality Measurements:
  pH = 7.56
  conductivity = 91 µS
  temp = 10.8 °C
  * probe ~10" under water surface.

17:25 - Collected EC-07-SW-080625-URS (surface water)
  * used bailer / grab methods.
  ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
  ↳ 1 x 250 mL Poly (FF)
  ↳ 1 x 1L Poly.

17:30 - Collected EC-07-SD-080625-URS (sediment)
  * used shovel, sample collected from (N) side of river in depositional area. (hand-dug).
  * sample ~10" below water surface.

17:36 - Collected EC-07-RS-080625-URS
(riparian)
* used shovel, sample collected on (N) riverbank and within 1 vertical foot of ordinary high water / vegetation.
* sample collected ~4 ft. from water surface.
↳ 1.4 oz jar
↳ 1 qt. ziplock.
* collected MS/MSD @ this location (double volume).
* grey, fine → med sand.
- Packed up and headed back to Joe Creek confluence (bridge/road)
- observed caddis & stonefly are abundant.
- Hiked up to road, M. Mudge stayed w/ gear & B. Rawls / J. Ray
18:15 - PROCEED UP VEHICLES.
- MET WITH ZACH C. & BRIAN D. COMING DOWN FROM MINE SITE
18:40 LEFT SITE FOR MESSROLD
19:50 ARRIVED BACK AT HOTEL.

6/26/08 Blue Ledge Mine - M. Mudge
- J. Ray
7:00 FIELD PREP / EQUIPMENT & LOADING VEHICLES AT HOTEL.
↳ disposal site evaluation crew - B. Overall
↳ electro-fishing - B. Rawls - Z. Cromland
↳ river sampling - M. Mudge - J. Ray
8:15 - Mob to site.
9:55 - Arrived @ Joe creek & Elliot creek confluence.
↳ Packed up equipment for sampling up Joe Creek.
* JC-01 thru JC-03 & TCJC-01.
(4 sample locations)
10:48 - Arrived @ JC-01 (~50' upstream of bridge)
↳ ~ 200 ft. upstream from confluence w/ Elliot Creek (3/50 of confluence)
- Water Quality Measurements:
pH = 7.41
conductivity = 75 µS
temp = 10.5°C
* probe ~ 4" under water.
11:08 - Collected JC-01-SW-080626-URS
(surface water)
* used bailer / grab method.

↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly

11:15 - Collected JC-01-SD-080626-URS (sediment)
* used shovel, sample collected on (S) side of creek in depositional area.
* sample in ~10" of water.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock
* gray, med → coarse sand w/ fine → med gravel (rounded).

11:20 - Collected JC-01-RS-080626-URS (riparian)
* used shovel, sample collected w/in 1 vertical foot of ordinary high / vegetation line.
* sample ~5' from water surface.
* (S) creek bank is exposed rock outcrop, so no deposition.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
- Packed up and cont. upstream to next sample location.
↳ very steep gradient for creek, lots of bedrock chutes w/ pools.
↳ steep banks on either side, up to 30ft tall w/ little to no access.
- observed 2 frogs in creek on travel to next location
- Arrived @ JC-02 (~1,000 ft. upstream of JC-01)
- Water Quality Measurements:
pH = 6.77
conductivity = 74 µS
temp = 11.6 °C
* probe ~10" under water surface.

12:20 - Collected JC-02-SW-080626-URS (surface water)
* used bailer / grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly.

12:25 - Collected JC-07-SD-080626-URS
* used shovel, collected sample from middle of creek bed. in ~3' of water.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
* gray, coarse sand w/ fine → med gravel (rounded)
- Packed up and cont. upstream
↳ still very steep gradient for creek.

not as many bedrock ledges / chutes, but still very steep w/ cliffed riverbank on either side.

- located JC-03 location and ~~[illegible]~~ T1JC-01 (tributary entering from (W), No flow, but observed creek bed up ~150 ft. to confirm.)
- Setup for JC-03 sampling.
  - ↳ location ~50 ft. downstream of T1JC confluence.
- Water Quality Measurements:
  - pH = 6.97
  - conductivity = 75 µS
  - temp = 12.2 °C
  - * probe ~10 inches under water.

13:40 - Collected JC-03-SW-080626-URS (Surface water)

- * used bailer / grab methods
  - ↳ 1 × 500 mL Poly w/ HNO_3 (FF)
  - ↳ 1 × 250 mL Poly (FF)
  - ↳ 1 × 1L Poly

13:45 - Collected JC-03-SD-080626-URS (Sediment)

- * used shovel, collected sample from (E) side of creek in ~12 inches of water, in depositional area (behind cobble)
  - ↳ 1 × 4 oz jar
  - ↳ 1 qrt ziplock.
- * grey, med → coarse sand w/ fine → med gravel (rounded).

13:50 - Collected JC-03-RS-080626-URS (riparian)

- * used shovel, sample collected from (E) creek bank... difficult to determine ordinary high / vegetation line b/c the creek has cut it's channel thru the bedrock resulting in very steep banks (i.e. very little possibility of overflow deposits).
  - ↳ sample may represent topsoil that has sloughed down riverbank instead of overbank deposits.
  - ↳ 1 × 4 oz jar
  - ↳ 1 qrt ziplock.
- * brown, fine → med sand w/ some gravel (fine, subrounded).
- Packed up equipment and cont upstream looking for access up (E) riverbank to get back to vehicle.
- Bushwacked up hillside and reached road.

- Hiked back to vehicle, break for lunch.

15:45 - Packed coolers, prep'd for additional sampling.
- Drove up road looking for tributaries.

16:10 - Arrived @ Manzanita Gulch.
↳ has flow.

16:25 - Collected M6-01-SW-080626-GBS (surface water)
*used bailer/grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly

- Water Quality Measurements:
pH = 7.28
conductivity = 164 µS
temp = 13.1 °C
* probe ~2" below water.
*sample collected ~6 ft. upstream of culvert.

- Back driving up road towards mine.
↳ located potential access to JC-06 (old logging / forest service road?)
*overgrown, but later grade, don't know if it goes to river/creek.
↳ began map review.

17:20 - B. Rawls & Z. Overland arrived
↳ completed all California fish sampling
↳ completed stream flow measurements.

- Discussed the remaining scope.
↳ OR fish sampling
↳ remaining river sampling
↳ geotech GPS locations.
↳ waste rock samples (5-gal buckets).

- Decided to have B. Rawls / Z. Overland head to (W) side drainage and assess T3 JC tributary and collect water sample if flowing.

- B. Dwevell approached w/ excavation contractor
↳ completed assessment, contractor moving home.
↳ B. Dwevell heading back up to disposal site to complete notes/photos etc.

18:00 - Cont. up to Mine site to cont. river/creek sampling.
- @ JC-08 location (~30' downstream of mine's waste rock discharge

- Water Quality Measurements:
  - pH = 6.44
  - conductivity = 47 µS
  - temp = 10.5°C
  - * probe ~10 inches under water's surface
18:15 - Collected JC-08-SW-080626-URS (surface water)
  - * used bailer / grab methods.
    - ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
    - ↳ 1 x 250 mL Poly (FF)
    - ↳ 1 x 1L Poly.
18:25 - Collected JC-08-SD-080626-URS (sediment)
  - * used shovel, sample collected from (E) side of creek in depositional area behind cobbles.
  - * sample collected in ~12 inches of water
    - ↳ 1 x 4oz jar
    - ↳ 1 qt. ziplock.
  - * collected MS/MSD @ this location
    - ↳ for water (SW) & sediment (SD)
- Assessed next location for safe access.
  - ↳ JC-07.
    - * very steep terrain leading down to creek.
- creek is a series of chutes thru bedrock w/ very steep banks (really it's almost all bedrock / boulders / cobbles)
- Hiked down to JC-07 location.
19:10 - @ JC-07 (~300 ft. downstream / (N) of JC-08)
- Water Quality Measurements:
  - pH = 7.45
  - conductivity = 6.4 µS
  - temp = 12.3°C
  - * probe ~10 inches under water.
19:20 - Collected JC-07-SW-080626-URS (surface water)
  - * used bailer / grab methods
    - ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
    - ↳ 1 x 250 mL Poly (FF)
    - ↳ 1 x 1L Poly.
19:22 * collected dup
  - ↳ JC-07-SW-DUP-080626-URS
- Packed up
21:30 RETURN TO HOTEL

6/27/08 BLUE LEDGE MINE M. MUDGE J. RAY

0700 MEET TO MOB TO SITE, REPLENISH ICE ON SAMPLES

0730 E. OLEMLAND LEAVES TO SITE TO COMPLETE WASTE ROCK COLLECTION FOR GEOTECH AND POTENTIAL BENCH STUDIES.

0740 J. RAY + M. MUDGE MOB TO SITE

0930 ARRIVE AT SITE. E. OLEMLAND HAS BROUGHT DOWN 3 WASTE ROCK BUCKETS TO VEHICLE. M. MUDGE + E. OLEMLAND CLIMB ROAD TO COLLECT TWO ADDITIONAL BUCKETS AND EXPLORE ALTERNATIVE ROUTE TO . ONE FORMER LOGGING ROAD BRANCHES OFF AT TURN ON MINE ACCESS ROAD WHERE GEAR TRAIL TO THE TOP ADITS SPLITS FROM ROAD, LIKELY THE BEST CHANCE TO GET TO AFTER EXAMINATION OF CONTOUR MAP.

J. RAY STAYS AT VEHICLE, PREPS BOTTLES + SUPPLIES FOR JC BRGD SAMPLES.

1100 LOCATE JC-09. SAMPLE POINT APPROXIMATELY 30' DOWNSTREAM/ NORTH OF CONFLUENCE OF JC AND . ALSO ADJACENT TO CONCRETE FOOTING (USED FOR FORMER OPERATIONS?)

WATER QUALITY PARAMETERS*
*DEPTH ~ 6"

pH = 7.29
COND = 48 µS
TEMP = 9.1°C

1105 COLLECTED JC-09-SW-080627-UES (SURFACE WATER ONLY

* USED BAILER / GRAB METHODS

COLLECTED: 1-250ml UNP. (F) Poly
1-500ml HNO_3 (F) Poly
1-1L UNP. Poly

- Back @ vehicle, packed up for collecting background samples + JC-10 thru JC-15 (6 samples)

11:30 - @ JC-10 location
* ~30' ft. upstream

- Water Quality Measurements.
  pH = 8.13
  conductivity = 55 µS
  temp = 9.7 °C
  * probe ~ 6" under water surface.

11:33 - Collected JC-10-SW-080627-URS
(surface water)
  * used bailer/grab techniques
    ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
    ↳ 1 x 250 mL Poly (FF)
    ↳ 1 x 1 L Poly.

11:38 - collected JC-10-SD-080627-URS
(sediment)
  * used shovel, sample collected from depositional area (behind watson (W) side of creek)
  * sample collected in ~18 inches of water
    ↳ 1 x 4 oz jar
    ↳ 1 qrt. ziplock
  * grey, fine → coarse sand.
    ↳ worm-like grub observed in sample (see photos).
- Packed up, headed upstream,
- @ JC-11 location.
  (~140 ft upstream / (W)-(Sw) from JC-10)

- Water Quality Measurements:
  pH = 7.93
  conductivity = 54 µS
  temp = 10.2 °C
  * probe ~ 6" under water

11:52 - collected JC-11-SW-080627-URS
(surface water)
  * used bailer/grab methods.
    ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
    ↳ 1 x 250 mL Poly ~~w/ HNO_3~~ (FF)
    ↳ 1 x 1 L Poly.

12:0 - collected JC-11-SD-080627-URS
(sediment)
  * used shovel, sample collected from center of creek in ~12 inches of water.
    ↳ 1 x 4 oz jar.
    ↳ 1 qrt. ziplock.
  * grey, med → coarse sand w/ some fine gravel (rounded).
- Packed up, moved to next location.
- @ JC-12
  (~120 ft. upstream of JC-11)
  * GPS has poor coverage and not very accurate at this location.

- Water Quality Measurements.
  pH = 7.93
  conductivity = 56 uS
  temp = 10.13 °C
  * probe ~16 inches below water surface.

12:12 - Collected JC-12-SW-080627-URS
(Surface water)
  * used bailer / grab methods.
  ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
  ↳ 1 x 250 mL Poly (FF)
  ↳ 1 x 1 L Poly

12:15 - Collected JC-12-SD-080627-URS
(Sediment)
  * used shovel, sample collected from center of creek in depositional area (behind cobble / boulder).
  ↳ 1 x 4 oz jar
  ↳ 1 qrt. ziplock.
  * grey, fine → coarse sand w/ some gravel (fine, rounded).

12:25 - collected JC-12-RS-080627-URS
(riparian)
  * used shovel, sample collected from (W) river bank ~5 ft from standing water.
  ↳ difficult to determine ordinary high / vegetation line b/c forest is thick and not a lot of understory plants.
  ↳ 1 x 4 oz jar
  ↳ 1 qrt. ziplock.
- Packed up and moved to next location.
- @ JC-13 location.
  (u
- Water Quality Measurements.
  - pH = 7.89
  - conductivity = 56 uS
  temp = 10.1 °C
  * probe ~6 inches under water.

12:40 - Collected JC-13-SW-080627-URS
(Surface water)
  * used bailer / grab ~~sampling~~ usu methods.
  ↳ 1 x 500 mL Poly w/ HNO_3 (FF)
  ↳ 1 x 250 mL Poly (FF)
  ↳ 1 x 1 L Poly
- Collected JC-13-SD-080627-URS
(sediment)
  * used shovel, sample collected from center of creek in ~18 inches of water.

↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
- Packed up and moved upstream.
↳ beginning to get very steep and can see a waterfall / chute ahead (maybe 300 ft)
- @ JC-14 location (~60 ft. upstream)
- Water Quality Measurements:
pH = 7.6
conductivity = 55 µS
temp = 10.2 °C
* probe ~10 inches under water.

13:00 - Collected JC-14-SW-080627-URS (surface water)
* used bailer / grab methods
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly.

13:05 - Collected JC-14-SD-080627-URS (sediment)
* used shovel, sample collected from center of creek in depositional area.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
* med-coarse sand w/ some fine gravel (rounded)
* grey

13:10 - Collected JC-14-RS-080627-URS (riparian)
* used shovel, sample collected from (W) bank within 1 vert. foot of ordinary high/vegetation line.
↳ 1 x 4oz jar
↳ 1 qrt. ziplock.
* grey, fine-coarse sand w/ minor fine gravel
- Packed up, moved upstream to final location.
- @ JC-15 (~60 ft. upstream of JC-14)
* very steep streambed w/ waterfall/chute ~60 ft. upstream / (S)
- Water Quality Measurements.
pH = 7.6
conductivity = 55 µS
temp = 11.2 °C
* probe ~10 inches under water.
- Collected JC-15-SW-080627-URS (surface water)
* used bailer / grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1 L Poly.

- Collected JC-15-SD-080627-URS (sediment)
  * used shovel, sample collected from (E) side of creek in depositional area
  * sample in ~10 inches of water.
  - ↳ 1 24oz jar
  - ↳ 1 qt. ziplock.
* grey, fine → coarse sand w/ some fine gravel (vermiculite)
- Packed up and headed back to vehicles.
- loaded coolers w/ samples, prep'd for remaining river sampling locations
  * 1st group → JC-06 & JC-04
    * JC-05 not easily/safely accessible.
  * 2nd group → TH JC-01 & T4JC-02
    * if possible, contours are very steep.

14:30 - B. Rawls arrived.
- 1st group (J. Ray & B. Rawls) hiked down forest service road to JC-06.

14:30 - 2nd group (M. Mudge & Z. Overmyer) began hike up mine access road.

- at curve in road (where goat trail begins to top of mine) bushwacked (5) @ ~4400 ft. elev. to locate tributary and collect 2 background samples.
* Very steep / precipitous terrain, used extreme caution.
  - ↳ crossed 3 dry creek bed.
  - ↳ located 2nd creek (had some flow
    * looked up slope, but could not see waste rock pile.
- followed creek down to confluence w/ T4JC
  - ↳ steep gradient w/ lots of bedrock / cobble / boulders & chutes. (B)

15:40 - @ T4JC-01 (upstream of 2nd creek confluence ~50 ft.)
- Water Quality Measurements:
  - pH = 6.76
  - conductivity = 20 µS
  - temp = 13 °C
* probe ~6 inches underwater

15:45 - Collected T4JC-01-SW-080627-KRS
(surface water)
* used bailer/grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1L Poly
* location in creek too steep a gradient for any sediment accumulation (all bedrock scoured creekbed w/ woody debris).
- Packed up and headed upstream to next location.

16:03 - @ T4JC-02 (upstream of T4JC-01 ~ 50 ft.
- Water Quality Measurements.
pH = 6.62
conductivity = 19 uS
temp = 13.3°C
* probe ~10 inches under water.

16:10 - Collected T4JC-02-SW-080627-KRS
(surface water)
* used bailer/grab methods.
↳ 1 x 500 mL Poly w/ HNO_3 (FF)
↳ 1 x 250 mL Poly (FF)
↳ 1 x 1L Poly.

* location in creek has no sediment.
↳ bedrock scoured creekbed.
- Packed up and headed back down to vehicle. (took ridge between JC & T4JC)
↳ much safer way down.

16:50 - back @ vehicle.
- Packed samples on ice, prep'd