Site Inspection Report
Monte Cristo Mining Area
Mt. Baker-Snoqualmie National Forest

December 2007

A valmont COMPANY
Conserving Resources. Improving Life.

Cascade Earth Sciences
12720 E. Nora Avenue, Suite A
Spokane, WA 99216
(509) 921-0290
www.cascade-earth.com

SITE INSPECTION
Monte Cristo Mining Area
Mt. Baker-Snoqualmie National Forest

Principal Authors and Investigators: *MaryAnn Amann, RG, Senior Geologist*
Robert H. Lambeth PE, Senior Engineer II

Reviewed By: *John D. Martin, RG, Principal Geologist*
Dustin G. Wasley, PE, Managing Engineer II

Prepared for: USDA Forest Service
Mt. Baker-Snoqualmie National Forest

Location: Monte Cristo Townsite and Vicinity
Mt. Baker-Snoqualmie National Forest
Snohomish County, Washington

Prepared by: Cascade Earth Sciences
12720 E. Nora Avenue, Suite A
Spokane, Washington 99216
(509) 921-0290

Cover Photographs: *Upper Left = United Companies Concentrator; Upper Right = Ore Collector Crusher Base; Lower Left = Mystery Mine Discharge.*

PN: 2523017
December 2007

TABLE OF CONTENTS

TABLES

TABLE OF CONTENTS (continued)

FIGURES

PLATE

APPENDICES

EXECUTIVE SUMMARY

The United States Department of Agriculture, Forest Service (Forest Service) retained Cascade Earth Sciences (CES) to perform a Site Inspection (SI) at the Monte Cristo Mining Area (MCMA). The MCMA is an area with numerous abandoned base metal and gold mines, located in the Mt. Baker-Snoqualmie National Forest, near Granite Falls, Washington. The Mystery/Pride Mine complex along with the Justice/Golden Chord Mine complex supplied over 90 percent of the ore processed at the Monte Cristo Concentrator, though numerous other adits and claims also contributed. The Site consists of multiple mines, open and collapsed adits and associated wasterock piles, the concrete and wood foundation of a former United Companies Concentrator (Concentrator) with partially processed ore, a tailings spill area, a tramway terminal ore storage facility (Ore Collector), an Assay Shack, and miscellaneous debris. The Site is situated adjacent to Glacier Creek, a headwater tributary of the South Fork of the Sauk River (SFSR) in Washington's North Central Cascades. Mining waste has been introduced into the surface water by historic in-stream disposal practices and by erosion of fine-grained waste material during high rainfall events and spring snowmelt.

Prior to this SI, in 2002, the Forest Service conducted an Abbreviate Preliminary Assessment (APA) at the Concentrator. This was followed in 2003 by an APA at the Mystery Mine. During 2003, the Washington Department of Natural Resources (DNR) published an investigation for potential metal contamination and releases at the Mystery, Justice, Pride of the Woods, Pride of the Mountains, and New Discovery Mines. DNR personnel also obtained discharge samples from the adits, and water and benthic microorganism samples from several locations in the Glacier Creek. In 2004, the Snohomish Health District and the Washington Department of Ecology released a Site Hazard Assessment (SHA) for the MCMA. This effort was based on the above APAs and the DNR reports, supplemented by additional sampling and investigations at several other mines in the Glacier Creek Basin and Seventysix Gulch. A broad x-ray fluorescence (XRF) survey was conducted of additional mine wasterock piles and several sediment sample locations. Based on the preceding reports a SI was performed during 2005 and 2006. In 2006, the Forest Service conducted two additional APAs: one at the Sidney Mine in Seventysix Creek and a combined APA at the Pride of the Mountains, New Discovery, and Pride of the Woods Mines.

All data obtained during the SI is summarized in the "Site Inspection Data Summary Sheet" table following the Executive Summary. Based on the information gathered during the SI and other investigations, the results indicate the following:

Groundwater Pathway: The groundwater pathway is incomplete, because there are no wells or groundwater protection areas within a 4-mile radius of the Site. Further assessment is not recommended.

Surface Water Pathway: The surface water pathway is complete for human and ecological receptors due to elevated concentrations of arsenic and barium in surface water and pore water samples and several elevated metals (dominantly antimony, arsenic, cadmium, copper, lead, and zinc) in stream sediment samples. Water samples from adit drainages, particularly from the acidic Mystery Mine, exceeded both human health and ecological criteria for the following metals: aluminum, antimony, arsenic, cadmium, copper, iron, lead, manganese, and zinc. The Mystery Mine adit discharge infiltrates completely near the base of the wasterock dump, approximately 1,500 feet from Glacier Creek. The surrounding soil most likely removes colloidal metals by filtering, and adsorption can attenuate part if not all of the dissolved metals. Sampling of the groundwater in this area was not feasible and outside of the scope of the SI. Therefore, data is inadequate to determine if the Mystery Mine discharge impacts Glacier Creek. Similarly, discharge from the Justice Mine infiltrates into wasterock and surrounding soils, but at a much closer distance of approximately 300 feet from Glacier Creek; the impact on Glacier Creek is also unknown.

Most sediment samples exceed various ecological criteria for antimony, arsenic, cadmium, copper, lead, and zinc. Metals concentrations increase slightly from upgradient to downgradient samples in both Glacier Creek and Seventysix Gulch, although background concentrations are well above typical crustal concentrations. Antimony, arsenic, cadmium, and lead concentrations are highest in samples from SFSR and increase downgradient, which suggests tailings in alluvium. Surface water aquatic copper compliance is based on procedures and concentrations promulgated in 2002. A new procedure was promulgated in 2007, but this method requires analyses not obtained during this SI.

The aquatic survey indicated potential metals impacts to benthic invertebrate populations in Glacier Creek, Seventysix Gulch, and the South Fork Sauk River (SFRS). However, further surface water and sediment sampling are needed to determine whether observed population anomalies are primarily due to chemical contaminates. Rainbow trout/steelhead, cutthroat trout, and bull trout are known to inhabit Glacier Creek and SFSR in the vicinity of the Site. These fish also likely inhabit the lower portions of Seventysix Gulch.

Soil Pathway: The soil exposure pathway is complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI. This is based on concentrations of antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc metals in wasterock, tailings, and soil samples exceeding both the 90 percent upper confident limit (90UCL) of background soil concentration and one or more comparison criteria.

Metal concentrations in background soils are also elevated; all ten background samples exceeded one or more comparison criteria for arsenic, chromium, mercury, vanadium, and zinc; three background samples exceeded criteria for selenium; two exceeded criteria for antimony and copper; and one each for lead and manganese. However, ten metals were detected in wasterock, tailings, and soil samples at concentrations exceeding both the 90UCL for background soil and one or more comparison criteria. In addition, the Concentrator, Collector, and Assay Shack each had a sample that detected over 80,000 milligrams per kilogram (mg/kg) of arsenic.

Acid-Base Accounting analyses indicated waste material, specifically ore and onsite soil, has the potential to produce acid rock drainage. One of the 15 samples analyzed for toxicity characteristic leaching procedure (TCLP) and synthetic precipitation leaching procedure (SPLP) exceeded the Resource Conservation Recovery Act criteria TCLP Hazardous Waste limit. Numerous federal and state Rare, Threatened, and Endangered mammals, birds, and herpetiles have potential habitat in the vicinity of the Site, thus the potential exists that ecological receptors could be affected.

Air Pathway: The air pathway is complete because metal-contaminated soil and wasterock are concentrated at the surface where human and ecological receptors could be exposed. The most probable air pathway is due to inhalation of particulate matter. However, addressing and/or eliminating the soil exposure pathway will render the air exposure pathway incomplete. Therefore, further assessment of the air pathway is not recommended.

Recommendations

Based on the information gathered as part of the SI as supported by all previous and post SI reports and presented in this report, CES recommends performing a streamlined Engineering Evaluation / Cost Analysis (EECA) at the Site. The EECA should include a significant Data Gap Investigation. The specific items that should be addressed in a Data Gap Investigation include the following:

- The conclusions presented are based on aquatic samples collected during moderately-high flow conditions. Water and sediment concentrations are likely to differ with the change in flow rates within the SFSR and other tributaries. CES recommends that an additional sampling event be performed to determine surface water and sediment concentrations during low flow conditions (typically in the fall).
- As part of the EECA, a risk assessment should be performed to assess the human and ecological impacts, establish removal cleanup standards, and assess if a removal action is warranted.
- The extent and depth of waste, particularly in the vicinity of the Concentrator, require additional delineation. CES recommends that additional sampling be completed with the aid of a small excavator and portable XRF instrument to complete this deficiency. This should include additional work at the Assay Shack as well as the Concentrator and Ore Collector. This data gap could be performed as part of a removal action, if warranted.
- The investigation of the haulage ways was limited by the SI scope to five widely spaced samples. CES recommends that a portable XRF instrument be used to more accurately delineate contaminant extent, including all tramway terminals. This data gap could be performed as part of a removal action, if warranted.
- Detailed sampling and surveying of the Mystery Mine and Justice Mine were beyond the scope of the SI. CES recommends that both sites be sampled in greater detail and to greater depths and surveys be completed to allow an accurate determination of volumes and extent of contamination.
- Land ownership within the Monte Cristo Townsite, the Concentrator, and the Ore Collector is a complex mix of private and Forest Service ownership. Boundaries should be clearly marked so owners can be notified rapidly about potential activity on their properties. This data gap could be performed as part of a removal action, if warranted.
- An unknown volume of tailings was apparently discharged to Glacier Creek. The extent of downstream transport and any attendant contamination should be investigated in more detail than this SI.
- This SI focused on the largest and most obvious contaminant sources, the Mystery and Justice Mines, the Concentrator, the Ore Collector, and the Assay Shack. There are at least 54 mines and prospects within the Glacier Creek and Seventysix Gulch drainage basin, and the overall distribution of contaminant contribution (including natural contribution) is unknown. CES recommends that the Forest Service use a more basin-wide assessment approach in Glacier Creek and Seventysix Gulch to better understand relative contaminant source contribution. Because of the number of mines and prospects, CES recommends that future work begin with mines very near the major surface water bodies. This type of effort should be expanded as information is gained. This will allow better and more focused allocation of resources to decrease the overall metal loading to SFSR.
- The Forest Service should consider a Time Critical Removal Action or more restrictive access control for the small volume (100 cubic yards) of apparent “spilled concentrate” near the Concentrator, because the material is a dangerous waste as defined by Washington Department of Ecology criteria.

SITE INSPECTION DATA SUMMARY SHEET
Project Name: Monte Cristo Mining Area Site Inspection
Project Location: Latitude: 47° 59' 10.9" **Longitude:** 121° 23' 29.4"
Nearest Surface Water Body: Glacier Creek, Seventysix Gulch, and the South Fork of the Sauk River

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION

MEDIA	SAMPLE LOCATION	RATE OF DISCHARGE/VOLUME (cfs, gpm, or cy)	CONTAMINANT	HIGHEST CONCENTRATION	LOWEST CRITERION Eco – Ecological HH – Human Health ORNL – Oak Ridge NL	BACKGROUND CONCENTRATION
Surface Water - Glacier Creek	GC-SW3	14.13 cfs	Arsenic, TR	4.5 µg/L	0.018 µg/L – HH	1.8 µg/L
	GC-SW4	NM	Arsenic, TR	5.7 µg/L	0.018 µg/L – HH	1.8 µg/L
	GC-SW5	37.71 cfs	Arsenic,, TR	7.7 µg/L	0.018 µg/L – HH	1.8 µg/L
Surface Water – Seventysix Gulch	76G-SW2	11.19 cfs	Arsenic, TR Lead, TR	9.5 µg/L 0.68 µg/L	0.018 µg/L – HH 0.14 µg/L – Eco	1.8 µg/L 0.436 µg/L
Surface Water - South Fork Sauk River	SFSR-SW1	54.7 cfs	Arsenic, TR Arsenic V, TR	9.4 µg/L 9.253 µg/L	0.018 µg/L – HH 3.1 µg/L – ORNL	1.8 µg/L 0.936 µg/L
	SFSR-SW2	41.17 cfs	Arsenic, TR	11.3 µg/L	0.018 µg/L – HH	1.8 µg/L
	SFSR-SW3	76.09 cfs	Arsenic, TR Arsenic V, TR	12.4 µg/L 12.157 µg/L	0.018 µg/L – HH 3.1 µg/L – ORNL	1.8 µg/L 0.936 µg/L
Surface Water - Mystery Mine Adit Discharge	MM-AS-01	0.10 cfs	Aluminum, TR Antimony, TR Arsenic, TR Arsenic V, TR Cadmium, TR Copper, TR Iron, TR Lead, TR Manganese, TR Zinc, TR	1,160 µg/L 31.2 µg/L 1,360 µg/L 1,358.3 µg/L 30.3 µg/L 675 µg/L 16,400 µg/L 37.5 µg/L 4,230 µg/L 6,590 µg/L	87 µg/L – Eco, ORNL 5.6 µg/L – HH 0.018 µg/L – HH 3.1 µg/L µg/L – ORNL 0.044 – Eco 1.1 µg/L – Eco 300 µg/L – HH 0.14 µg/L – Eco 50 µg/L – HH 12.96 µg/L – Eco	<30 µg/L 4.58 µg/L 1.8 µg/L 0.936 µg/L <2 µg/L 1.50 µg/L <60 µg/L 0.436 µg/L <4 µg/L 3.89 µg/L
Surface Water - Justice Mine Adit Discharge	JM-AS-02	0.27 cfs	Antimony, TR Arsenic, TR Arsenic V, TR Cadmium, TR	10.3 µg/L 206 µg/L 204.9 µg/L 0.15 µg/L	5.6 µg/L – HH 0.018 µg/L – HH 3.1 µg/L – ORNL 0.044 µg/L – Eco	4.58 µg/L 1.8 µg/L 0.936 µg/L <2 µg/L
Pore Water – Glacier Creek	GC-PW2	NA	Barium, Diss.	42.3 µg/L	4 µg/L – ORNL	17.5 µg/L
	GC-PW5	NA	Arsenic V, Diss.	7.462 µg/L	3.1 µg/L – ORNL	<2.992 µg/L
Pore Water – South Fork Sauk River	SFSR-PW1	NA	Arsenic V, Diss.	10.28 µg/L	3.1 µg/L – ORNL	<2.992 µg/L
	SFSR-PW3	NA	Arsenic, Diss.	15.8 µg/L	10 µg/L – HH	<3 µg/L

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION (cont.)

MEDIA	SAMPLE LOCATION	RATE OF DISCHARGE/VOLUME (cfs, gpm, or cy)	CONTAMINANT	HIGHEST CONCENTRATION	LOWEST CRITERION Eco – Ecological HH – Human Health ORNL – Oak Ridge NL	BACKGROUND CONCENTRATION
Sediment – Glacier Creek	GC-SS3	NA	Antimony Arsenic Lead	11.6 mg/kg 250 mg/kg 84.8 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco 35 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg 37.1 mg/kg
	GC-SS4	NA	Arsenic Cadmium Copper Lead Zinc	367 mg/kg 1.91mg/kg 67.5 mg/kg 69.3 mg/kg 185 mg/kg	5.9 mg/kg – Eco 0.596 mg/kg – Eco 35.7 mg/kg – Eco 35 mg/kg – Eco 123.1 mg/kg – Eco	104.5 mg/kg 1.12 mg/kg 27.0 mg/kg 37.1 mg/kg 109.1 mg/kg
	GC-SS5	NA	Arsenic Copper	291 mg/kg 117 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	COL-SS-01	NA	Arsenic Copper	330 mg/kg 93.5 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	COL-SS-02	NA	Arsenic Copper	294 mg/kg 111 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	COL-SS-03	NA	Arsenic Copper	331 mg/kg 93.4 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	COL-SS-04	NA	Arsenic Copper	112 mg/kg 78.8 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	COL-SS-05	NA	Antimony Arsenic Copper Lead	14.5 mg/kg 469 mg/kg 97.6 mg/kg 72.6 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco 35.7 mg/kg – Eco 35 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg 27.0 mg/kg 37.1 mg/kg
	CON-SS-01	NA	Antimony Arsenic	10.6 mg/kg 160 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg
	CON-SS-02	NA	Arsenic Copper	130 mg/kg 92.1 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	CON-SS-03	NA	Arsenic Copper	282 mg/kg 82.8 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
	CON-SS-04	NA	Antimony Arsenic Copper	14.1 mg/kg 267 mg/kg 82.8 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco 35.7 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg 27.0 mg/kg
	CON-SS-05	NA	Arsenic Copper	197 mg/kg 75.8 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg
Sediment – Seventysix Gulch	76G-SS2	NA	Antimony Arsenic Cadmium Lead Zinc	11.2 mg/kg 276 mg/kg 2.91 mg/kg 89.5 mg/kg 295 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco 0.596 mg/kg – Eco 35 mg/kg – Eco 123.1 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg 27.0 mg/kg 37.1 mg/kg 109.1 mg/kg

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION (cont.)

MEDIA	SAMPLE LOCATION	RATE OF DISCHARGE/VOLUME (cfs, gpm, or cy)	CONTAMINANT	HIGHEST CONCENTRATION	LOWEST CRITERION Eco – Ecological HH – Human Health ORNL – Oak Ridge NL	BACKGROUND CONCENTRATION
Sediment – South Fork Sauk River	SFSR-SS1	NA	Arsenic Copper Lead	269 mg/kg 79.5 mg/kg 65.4 mg/kg	5.9 mg/kg – Eco 35.7 mg/kg – Eco 35 mg/kg – Eco	104.5 mg/kg 27.0 mg/kg 37.1 mg/kg
	SFSR-SS2	NA	Antimony Arsenic Cadmium Copper Lead Zinc	13.5 mg/kg 544 mg/kg 1.99 mg/kg 115 mg/kg 136 mg/kg 206 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco 0.596 mg/kg – Eco 35.7 mg/kg – Eco 35 mg/kg – Eco 123.1 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg 1.12 mg/kg 27.0 mg/kg 37.1 mg/kg 109.1 mg/kg
	SFSR-SS3	NA	Antimony Arsenic Cadmium Copper Lead Zinc	17.3 mg/kg 480 mg/kg 2.02 mg/kg 116 mg/kg 156 mg/kg 192 mg/kg	0.6 mg/kg – Eco 5.9 mg/kg – Eco 0.596 mg/kg – Eco 35.7 mg/kg – Eco 35 mg/kg – Eco 123.1 mg/kg – Eco	4.26 mg/kg 104.5 mg/kg 1.12 mg/kg 27.0 mg/kg 37.1 mg/kg 109.1 mg/kg
Waste Material - Ore Collector	15 samples	2,500 cy coarse plus fine	Antimony Arsenic Cadmium Copper Lead Mercury Selenium Silver Thallium Zinc	9,860 mg/kg 88,700 mg/kg 39.8 mg/kg 1,840 mg/kg 22,500 mg/kg 8.7 mg/kg 4.40 mg/kg 415 mg/kg 5.6 mg/kg 17,400 mg/kg	5 mg/kg - Eco 1.6 mg/kg – HH 2 mg/kg – HH 50 mg/kg – Eco 40.5 mg/kg – ORNL 0.1 mg/kg - Eco 0.21 mg/kg – ORNL 2 mg/kg – Eco, ORNL 1 mg/kg – Eco, ORNL 8.5 mg/kg – ORNL	7.31 mg/kg 236.1 mg/kg 0.77 mg/kg 40.3 mg/kg 30.3 mg/kg 0.379 mg/kg 0.71 mg/kg 0.39 mg/kg 0.75 mg/kg 93.9 mg/kg
Waste Material - Concentrator	24 samples	8,100 cy, plus 100 cy of Dangerous Waste as defined by Ecology.	Antimony Arsenic Barium Cadmium Chromium(One sample) Copper Lead Mercury Nickel (One sample) Selenium Silver Thallium Zinc	10,700 mg/kg 92,100 mg/kg 522 mg/kg 114 mg/kg 94.5 mg/kg 4,240 mg/kg 21,400 mg/kg 8.35 mg/kg 45.6 mg/kg 6.77 mg/kg 376 mg/kg 15.8 mg/kg 18,500 mg/kg	5 mg/kg – Eco, ORNL 1.6 mg/kg – HH 102 mg/kg – Eco 2 mg/kg – HH 5 mg/kg – Eco 50 mg/kg – Eco 40.5 mg/kg – ORNL 0.00051 mg/kg - ORNL 30 mg/kg – Eco, ORNL 0.21 mg/kg – ORNL 2 mg/kg – Eco, ORNL 1 mg/kg – Eco, ORNL 8.5 mg/kg – ORNL	7.31 mg/kg 236.1 mg/kg 62.1 mg/kg 0.77 mg/kg 57.5 mg/kg 40.3 mg/kg 30.3 mg/kg 0.379 mg/kg 27.6 mg/kg 0.71 mg/kg 0.39 mg/kg 0.75 mg/kg 93.9 mg/kg

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION (cont.)

MEDIA	SAMPLE LOCATION	RATE OF DISCHARGE/VOLUME (cfs, gpm, or cy)	CONTAMINANT	HIGHEST CONCENTRATION	LOWEST CRITERION Eco – Ecological HH – Human Health ORNL – Oak Ridge NL	BACKGROUND CONCENTRATION
Waste Material - Assay Shack	Assay Shack AS-02 AS-03 AS-04	200 cy	Antimony Arsenic Cadmium Copper Lead Mercury Selenium Silver Zinc	4,500 mg/kg 85,800 mg/kg 4.33 mg/kg 338 mg/kg 10,200 mg/kg 36.30 mg/kg 2.11 mg/kg 57.9 mg/kg 644 mg/kg	5 mg/kg – Eco, ORNL 1.6 mg/kg – HH 2 mg/kg – HH, ORNL 50 mg/kg – Eco 40.5 mg/kg – ORNL 0.00051 mg/kg - ORNL 0.21 mg/kg – ORNL 2 mg/kg – Eco, ORNL 8.5 mg/kg – ORNL	7.31 mg/kg 236.1 mg/kg 0.77 mg/kg 40.3 mg/kg 30.3 mg/kg 0.379 mg/kg 0.71 mg/kg 0.39 mg/kg 93.9 mg/kg
Mystery Mine	MM-01-0.5' MM-01-1.0' MM-02-0.5' MM-03-0.5' MM-04-0.5'	117,000 cy	Antimony Arsenic Cadmium Copper Iron (One sample) Lead Mercury Nickel (One sample) Selenium Silver Thallium Zinc	4,460 mg/kg 24,300 mg/kg 26.4 mg/kg 1,040 mg/kg 272,000 mg/kg 8,190 mg/kg 2.05 mg/kg 82.7 mg/kg 1.67 mg/kg 251 mg/kg 5.8 mg/kg 3,540 mg/kg	5 mg/kg – Eco, ORNL 1.6 mg/kg – HH 2 mg/kg – HH 50 mg/kg – Eco 100,000 mg/kg – HH 40.5 mg/kg – ORNL 0.00051 mg/kg – ORNL 30 mg/kg – Eco, ORNL 0.21g/kg – ORNL 2 mg/kg – Eco, ORNL 1 mg/kg – Eco, ORNL 8.5 mg/kg – ORNL	7.31 mg/kg 236.1 mg/kg 0.77 mg/kg 40.3 mg/kg 31,692 mg/kg 30.3 mg/kg 0.379 mg/kg 27.6 mg/kg 0.71 mg/kg 0.39 mg/kg 0.75 mg/kg 93.9 mg/kg
Haulage ways	HW-01	200 cy (Est. cumulative)	Arsenic Chromium Lead Zinc	647 mg/kg 93.9 mg/kg 107 mg/kg 150 mg/kg	1.6 mg/kg – HH 0.4 mg/kg – ORNL 40.5 mg/kg – ORNL 8.5 mg/kg – ORNL	236.1 mg/kg 57.5 mg/kg 30.3 mg/kg 93.9 mg/kg
	HW-02		Antimony Arsenic Chromium Copper Lead Mercury Nickel Selenium Silver Zinc	90 mg/kg 11,000 mg/kg 142 mg/kg 220 mg/kg 1,120 mg/kg 0.61 mg/kg 50 mg/kg 1.3 mg/kg 10 mg/kg 150 mg/kg	5 mg/kg – Eco, ORNL 1.6 mg/kg – HH 0.4 mg/kg – ORNL 50 mg/kg – Eco 40.5 mg/kg – ORNL 0.00051 mg/kg – ORNL 30 mg/kg – Eco, ORNL 0.21g/kg – ORNL 2 mg/kg – Eco, ORNL 8.5 mg/kg – ORNL	7.31 mg/kg 236.1 mg/kg 57.5 mg/kg 40.3 mg/kg 30.3 mg/kg 0.379 mg/kg 27.6 mg/kg 0.71 mg/kg 0.39 mg/kg 93.9 mg/kg

SUMMARY OF ANALYTICAL/DOCUMENTED CONTAMINATION (cont.)

MEDIA	SAMPLE LOCATION	RATE OF DISCHARGE/VOLUME (cfs, gpm, or cy)	CONTAMINANT	HIGHEST CONCENTRATION	LOWEST CRITERION Eco – Ecological HH – Human Health ORNL – Oak Ridge NL	BACKGROUND CONCENTRATION
Haulage ways (continued)	HW-03	200 cy (Est. cumulative)	Lead	74 mg/kg	40.5 mg/kg – ORNL	30.3 mg/kg
	HW-04		Antimony	570 mg/kg	5 mg/kg – Eco, ORNL	7.31 mg/kg
			Arsenic	22,600 mg/kg	1.6 mg/kg – HH	236.1 mg/kg
			Cadmium	5.5 mg/kg	2 mg/kg – HH	0.77 mg/kg
			Copper	2,880 mg/kg	50 mg/kg – Eco	40.3 mg/kg
			Lead	2,990 mg/kg	40.5 mg/kg – ORNL	30.3 mg/kg
			Mercury	0.58 mg/kg	0.00051 mg/kg – ORNL	0.379 mg/kg
			Selenium	1.5 mg/kg	0.21g/kg – ORNL	0.71 mg/kg
			Silver	102 mg/kg	2 mg/kg – Eco, ORNL	0.39 mg/kg
			Zinc	970 mg/kg	8.5 mg/kg – ORNL	93.9 mg/kg
	HW-05		Barium	1,170 mg/kg	0.21 mg/kg – ORNL	62.1 mg/kg
			Selenium	1.1 mg/kg	0.21g/kg – ORNL	0.71 mg/kg

Notes: This table only lists sample collected by CES with concentrations that are at least 1.5 times higher than the lowest criterion and 1.5 times background concentration, not including background samples. These exceedances are considered the major contaminants of concern (COCs) and not a complete list of all COCs.
Average background concentrations were used for waters, sediments, and waste material samples.
Abbreviations: TR = Total Recoverable Metals; Diss. = Dissolved Metals; cfs = cubic feet per second; µg/L = micrograms per liter; mg/kg = milligrams per kilogram; NA = Not Applicable; gpm = gallons per minute; cy = cubic yards.

1.0 INTRODUCTION AND OBJECTIVES

The United States Department of Agriculture, Forest Service (Forest Service) initially retained Cascade Earth Sciences (CES) to perform a Site Inspection (SI) at the Monte Cristo Concentrator and Mystery Mine. The SI was performed in accordance to the U.S. Environmental Protection Agency (EPA) publication, *Guidance for Performing Site Inspections Under CERCLA* (USEPA, 1992). The purpose of the SI is to determine the potential threat to human health and the environment from issues identified during the Abbreviated Preliminary Assessment (APA) conducted by the Forest Service at the above locations. The work was performed under CES' existing Forest Service Contract (#10181-1-D007) and in accordance with Purchase Order #AG-046W-P-06-0037. As the SI progressed, the scope of work expanded beyond the traditional, localized site specific approach to include multiple sites in a larger geographic area. Although this geographic area is large, it does not fully include the entire traditional Monte Cristo Mining District. The area evaluated is referred to herein as the Monte Cristo Mining Area (MCMA).

In general, the objectives of the SI were to (1) assess the immediate or potential threat that mining wastes pose to human health and/or the environment, and (2) collect sufficient information to support a decision regarding the need for further action. The information was collected in general accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) protocols and documentation requirements for assessments involving hazardous substances. Specifically, as outlined in the EPA CERCLA guidance document (USEPA, 1992), "the sampling locations are strategically planned to identify the substances present, determine whether hazardous substances are being released to the environment, and determine whether hazardous substances have impacted specific targets."

The SI field activities included sampling and analysis of soil, wasterock, tailings, surface water, pore water, and sediment samples from the MCMA and vicinity. The SI was performed in three phases and followed the Field Operation Plans (FOP) developed by CES and approved by the Forest Service in 2005 and 2006. The FOP was developed based on the APAs completed by the Forest Service in October 2002 for the Monte Cristo Concentrator (Forest Service, 2002) and February 2003 for the Mystery Mine (Forest Service, 2003), the Washington Department of Natural Resources (DNR) report on the Mystery and Justice Mines (Wolff et.al., 2003), a Snohomish Health District (SHD) and Washington Department of Ecology (Ecology) Site Hazard Assessment (Crofoot and O'Brien, 2004), and the Forest Service Task Order dated February 24, 2005.

The primary emphasis of CES' Phase I study assessed impacts of the largest and most obvious potential contaminant sources, the Mystery Mine and Monte Cristo Concentrator (also known as the United Companies Concentrator) on the aquatic environments of Glacier Creek and the South Fork of the Sauk River (SFSR), as well as the general water quality of Seventysix Gulch. The Phase II investigation was comprised of collecting samples of wasterock in the areas of the former Concentrator and Ore Collector, another potential significant contaminant contributor at the MCMA, as well as the Assay Shack and Justice Mine. In addition, background soil samples were collected and additional sediment samples were collected from Glacier Creek to further assess impacts from the Concentrator and Ore Collector. Phase III of the field investigation focused on the delineation of the magnitude and extent of the contamination at the Concentrator, Ore Collector, Assay Shack, and along the abandoned haulage ways.

Following completion of SI field work, the Forest Service completed two additional APAs in the MCMA: one at the Sidney Mine in Seventysix Gulch (Forest Service, 2006a) and one at the Pride of the Woods, New Discovery, and Pride of the Mountains Mines in Glacier Basin (Forest Service, 2006b). The data from these reports as well as information from DNR and Ecology reports are discussed in this SI. CES has also included information from a comprehensive U.S. Bureau of Mines (USBM) economic geology report, Mineral Lands Assessment report MLA 75-83 by Johnson, et.al. (1983). Although this USBM report does not address environmental issues, it provides valuable information relative to deposit sizes and tenor, as well as location. This resulted in an inventory of potential contaminant producing locations

of which three were selected for discussion in this SI, the Rainy, Golden Cord, and Sheridan Mines. An additional 46 mines and prospects beyond those discussed herein are known within the Monte Cristo Mining District.

2.0 SITE DESCRIPTION AND OPERATIONAL HISTORY

The following section gives a specific description of the MCMA location and an operational history. The location is illustrated in Plate 1 and Figure 1. Photographs of the MCMA and sampling locations are included in Appendix A. No regulatory removal activities have been undertaken at the MCMA. However, an investigation was performed in the summer of 2001 by the DNR and four APAs were conducted by the Forest Service in 2002, 2003, and 2006. Further, Ecology published a Site Hazard Assessment Report in 2004 based predominantly on data from the DNR report. Results of the DNR and Ecology investigations are discussed in Section 4.2.3. No environmental enforcement actions have been documented at the MCMA other than the area receiving a Washington Ranking Method (WARM) ranking of 1 from Ecology, which indicates the MCMA is high on Ecology's list of sites requiring further action.

2.1 Description and Location

The MCMA is located in the Mt. Baker-Snoqualmie National Forest in Snohomish County, Washington, near the west-center margin of the Henry M. Jackson Wilderness Area, and approximately 28 air-miles east-southeast of Granite Falls, Washington. Driving time one-way from Granite Falls to the MCMA is approximately 1 hour, depending on road conditions.

To access the MCMA from Granite Falls, take the Mountain Loop Highway (paved) east for approximately 30 miles to Barlow Summit, the three-way intersection of Mountain Loop Highway, Forest Road 20 (the continuation of Mountain Loop Highway to Darrington, Washington), and Monte Cristo Road. Take the un-maintained, gravel Monte Cristo Road approximately 5 miles up to the Historic Monte Cristo Townsite. This access road is currently impassable by vehicular traffic due to a substantial landslide near the Barlow Summit junction. The Townsite is currently accessible by all terrain vehicles or on foot. The Monte Cristo Concentrator within the MCMA is approximately ¼ mile by trail east of the Townsite and up Glacier Creek. To access the Mystery Mine follow the same trail an additional ¾ mile, then turn to the southeast and climb uphill for approximately ⅓ mile (1,000 vertical feet). Total distance traveled from Granite Falls to the Mystery Mine within the MCMA is about 36 miles.

According to the United States Geological Survey (USGS) 1:24,000 Quadrangle Maps – Monte Cristo (USGSb, 1982) and Blanca Lake (USGSa, 1982), the Monte Cristo Concentrator is located in the northeast ¼ of the southeast ¼ of Section 21 (unsurveyed), Township 29 North, Range 11 East, Willamette Meridian and the Mystery Mine portal is located in the southwest ¼ of the southeast ¼ of Section 22 (unsurveyed), Township 29 North, Range 11 East, Willamette Meridian. The MCMA is situated at elevations ranging from approximately 2,880 feet (ft) above mean sea level (amsl) at the Concentrator to 4,280 ft amsl at the Mystery Mine portal. The elevation of the aquatic sampling stations ranges from 4,520 ft amsl at GC-01 to 2,420 ft amsl at SFSR-03. Base metals and gold were historically mined at the MCMA, but the mines and mill have been inactive since the early 1900's. The MCMA drains into Glacier Creek, which discharges into the SFSR, then Sauk River, the Skagit River, and eventually into Skagit Bay.

The MCMA includes three large mine complexes, the Mystery Mine, Justice Mine, and Comet Mine. Aerial tramways from the Mystery and Justice Mines terminated at a common point, the Ore Collector, from which ore was hauled by rail to a common mill, the United Companies Concentrator (Concentrator). The Mystery Mine is not a single mine, but is actually a series of interconnected mines that used the

Mystery Mine's tramway to transport run-of-mine ore to the Ore Collector. These mines are the Mystery, Pride of the Woods, New Discovery, Pride of the Mountains, and numerous smaller mines. The Justice Mine interconnects with the Golden Cord Mine. Ore from the Comet Mine was transported by aerial tramway to a separate terminal for rail haulage to the Concentrator. The Comet Mine ore is effectively addressed by the Concentrator sampling where it was processed. The Comet Mine itself is located high on the mountainside more than one-half mile from Seventysix Gulch and was not investigated as part of this SI. Ruins of the 300-ton per day Concentrator include concrete foundations, old flooring, and partially processed ore. According to a Forest Service report (Forest Service 2002), 14,000 cubic yards (cy) of coarse gravity (jig) tailings were discharged on-land. This volume seems small for the production and mine sizes of the MCMA. The larger portion of tailings were more than likely deposited in Glacier Creek and transported downstream during flood events. Much of this may still be mixed within active stream gravel and can be observed visually and identified by sampling.

The latitude-longitude locations of the key site features are as follows (see Figure 1):

- Monte Cristo Concentrator: Latitude – 47° 59' 10.9"
Longitude – 121° 23' 29.4"
Elevation – 2,880 ft amsl
- Mystery Mine: Latitude – 47°58' 53.6"
Longitude – 121° 22' 5.8"
Elevation – 4,280 ft amsl
- Ore Collector: Latitude – 47°59' 01"
Longitude – 121° 22' 53"
Elevation – 3,020 ft amsl
- Assay Shack: Latitude– 47° 59' 03"
Longitude – 121° 23' 18"
Elevation – 2,920 ft amsl
- Justice/Golden Cord Mine: Latitude – 47°58' 55"
Longitude – 121° 22' 29"
Elevation – 3,600 ft amsl
- Pride Of The Woods Mine: Latitude – 47° 58' 53"
Longitude – 121° 21' 54"
Elevation – 4,400 ft amsl
- Pride Of The Mountains Mine: Latitude – 47° 58' 51"
Longitude – 121° 21' 33"
Elevation – 4,800 ft amsl
- New Discovery Mine: Latitude – 47° 58' 51"
Longitude – 121° 21' 44"
Elevation – 4,580 ft amsl
- Sidney Mine: Latitude – 47° 58' 38"
Longitude – 121° 23' 09"
Elevation – 3,295 ft amsl

2.1.1 Site Ownership

Land ownership in the MCMA is extremely complex. Parcel sizes range from tiny lots in the Monte Cristo Townsite, to patented millsite and placer claims, to multiple blocks of patented lode claims. The Forest Service has been purchasing privately held property in the MCMA, particularly within the Henry M. Jackson Wilderness Area portion of the MCMA. The Forest Service is also in the process of surveying the MCMA to correct uncertainties and inconsistencies related to old Mineral Surveys on which property boundaries are now based. Private property boundaries are illustrated in Figure 1. The ownership status of the key site features are briefly described below.

- **Concentrator Site -** Resurveying of patented claim corners confirmed that most of the mill foundation is on land administered by the Forest Service. The area between the foundation remains and Glacier Creek, including soils/materials (tailings) containing hazardous substances, appears to be privately owned.

- **Mystery Mine Adits And Waste Rock Dumps -** Adit #3 (discharging lower adit) and nearby Adit #1 and #2 are likely located on the west end of the Mystery Lode claim and therefore on land administered by the Forest Service. Adit #3 appears to be very close to the west boundary, however, and ownership can not be verified until additional survey work is completed. Immediately west and down slope from Adit #3, is the patented (private) Baltic Lode Claim, which is adjacent to the Mystery Lode Claim. Based on the map delineation in Figure 1, it appears that much of the Mystery Adit #3 wasterock may be on patented land. Additional surveying is necessary.

- **Collector Site/Surface Tram -** Based on the location of these remains relative to the Concentrator, it appears that they are located on private ground (MS 257B and MS 259B).

- **Assay Shack Site –** Forest Service administered land, based on Forest Service field surveys.

- **Justice/Golden Cord Adits And Waste Rock Dumps -** Forest Service administered land, based on the Bureau of Land Management (BLM) Master Title Plat and USBM mine maps (Johnson, et.al., 1983).

- **Pride Of The Woods Adit And Waste Rock Dump –** Forest Service administered land, based on the Bureau of Land Management (BLM) Master Title Plat and USBM mine maps (Johnson, et.al., 1983).

- **Pride Of The Mountains Adits And Waste Rock Dumps –** Forest Service administered land, based on BLM Master Title Plat and USBM mine maps (Johnson, et.al., 1983).

- **New Discovery Adits And Waste Rock Dumps –** Forest Service administered land, based on BLM Master Title Plat and USBM mine maps (Johnson, et.al., 1983).

- **Sidney Adit And Waste Rock Dump –** Forest Service administered land based on BLM Master Title Plat and USBM mine maps (Johnson, et.al., 1983).

2.1.2 Geologic Setting

Regional geologic information presented in this section was obtained from Orr and Orr (2002). Site-specific geology was compiled from Wolff (2003) and Northwest Underground Explorations (1997), as well as site-specific reconnaissance performed by a CES Washington Registered Geologist.

2.1.2.1 Regional Geology

The MCMA is located in the Eastern Mélange Belt within the North Cascades physiographic province. The North Cascades province is comprised of folded, faulted, and metamorphicly altered rocks ranging in age from Precambrian through Lower Cretaceous. The province is subdivided into numerous terrains which were accreted onto the North American plate during the Cretaceous. The Eastern Mélange Belt is a diverse assemblage of rocks including mafic metavolcanic rocks, chert, argillite, and greywacke along with migmatitic gneiss, metadiabase and ultramafic rocks. The rocks have been considerably deformed and slightly metamorphosed. Many rocks have been recrystallized by thermal metamorphism near Tertiary plutons.

2.1.2.2 Site Specific Mining Geology

The MCMA lies across a contact between Eocene Barlow Pass volcanics and interbedded sediments and a large intruding body of granodiorite and tonalite namely the Miocene-Oligocene aged Grotto batholith. Deposits in the Monte Cristo Mining District are within near vertical shear zones in schist, tonalite, and andesite, with lenses of sulfide ore from 100 to 300 ft in height, 1 to 15 ft thick, and 70 to 400 ft in length. Mineralization also occurs in other minor fractures. The deposits are essentially en echelon shear zones, 1 to 3 ft wide, striking north 50-60^{o} east, and dipping 50-80^{o} northwest. The fracturing is augmented by two or more sets of joint planes striking about north-south and east-west. Veins on the Justice Mine are 1 to 3 ft wide in andesite. The Mystery Mine complex contains mineralized shear zones 1 to 15 ft wide in granodiorite (Derkey et.al., 1990).

The major commodity produced in the MCMA was gold, though silver, lead, copper, and zinc were also present in viable quantities. High concentrations of arsenic and antimony are also associated with the deposits. The veins and mineralized zones in the area contain higher amounts of the minerals pyrite, pyrrhotite, arsenopyrite, sphalerite, galena, chalcopyrite, stibnite, jamesonite, lesser amounts of azurite, malachite, boulangerite, realgar, orpiment, numerous sulfosalts, and the gangue minerals quartz and calcite (Huntting, 1956, and Johnson et.al., 1983).

During a USBM RARE II study (Johnson et.al., 1983) a total of 55 mines and prospects were identified in the mining district. The host rock in both basins is pervasively altered and weakly mineralized. Such alteration and mineralization typically results in elevated background metal concentrations in soil and water.

2.1.3 Climate

Climate data were compiled from the Western Regional Climate Center (WRCC). Climate in Snohomish County varies depending on elevation and distance from the Cascade summit. Precipitation increases and temperatures decrease as elevation rises to the summit of the Cascade Range. The following climate data were compiled from the Scenic (Station 457379; WRCCa, 2006) and Stevens Pass (Station 458089; WRCCb, 2006), Washington monitoring stations. Although not the closest stations to the MCMA, they are appropriate because of the similar elevation. Stevens Pass is located approximately 22 miles southeast of the MCMA at an elevation of 4,056 ft amsl.

- Total average precipitation ranges from approximately 81.5 to 90 inches per year.
- The average minimum temperature of approximately 19° F occurs in January.
- The average maximum daily temperature of approximately 66° F occurs in July.

2.1.4 Operational History and Waste Characteristics

Information regarding the operational history of the MCMA was gleaned from summaries from Huntting (1956), Derkey et.al. (1990), and Wolff et.al. (2003). The following information is a chronological summary of the operational history of the MCMA and the estimated ore production.

- 1889 - Joseph Pearsall located district's first mineral discovery in Seventysix Gulch.
- 1890 - Fred and Mac Wilmans and Frank Peabody located the eastern extension of the "Pride" vein.
- 1891 - John D. Rockefeller bought majority interest in the mines through the Colby-Hoyt syndicate.
- 1892 - Construction of a smelter at Lowell, Washington and the Everett-Monte Cristo Railroad (E&MCR), were both funded by Rockefeller. Numerous aerial tramways were

constructed from mine storage bunkers to the United Concentration Company's gravity mill which was built at the railroad's eastern terminus in Monte Cristo.

- 1894 - A 300-ton-per-day gravity mill was completed which used a series of crushers and rolls, and water-washed jigs to develop a concentrate. First ore sent to Everett smelter.
- 1897 - Production for the district reached a peak. Almost all of the 310,000 tons eventually produced came from the Mystery/Pride complex and Justice Mines.
- 1896 - Serious washouts damaged the E&MCR requiring immense expenditures of time and money to repair.
- 1903 - Rockefeller sells interest in holdings to the Guggenheim smelter trust and the American Smelting and Refining Co, known as ASARCO.
- 1905 - The Mystery Mine complex and Justice Mine, but not smelters, was sold back to the Wilmans brothers.
- 1906 - A total of 33 claims were staked in the area between 1889 and 1906, 16 of which were patented.
- 1906 - The Wilmans sold their interests to Samuel Silverman who formed the Monte Cristo Mining and Metals Co.
- 1907 - Ore was again processed at the Concentrator.
- 1915 - Last serious attempt at mining in the district. Continued washouts on the E&MCR right-of-way, coupled with increasing arsenic content as mining progressed to deeper levels, hastened the district's demise as a producing mining district.
- 1920 - Organized mining at Monte Cristo ended when the Boston-American Mining Company abandoned operations after an avalanche buried most of their equipment.
- 1921 - Rucker Brothers completed the Big Four Inn to capitalize on the growing tourist business. The inn burned down in September 1949.
- 1933 - Train service to Monte Cristo ended.
- 1979 - Over 1,130 claims had been located in Monte Cristo mining district, including 74 patented claims.
- 1994 - Nine patented claims comprising all but three of the original Mystery mine complex were transferred from private ownership to the Forest Service.
- Current - The Monte Cristo Preservation Association (MCPA) maintains a public trust under Snohomish Country sponsorship for the historic Monte Cristo Townsite.

3.0 CONTAMINANT SOURCE LOCATIONS INVESTIGATED

Prior to this SI, in 2002, the Forest Service conducted an APA at the Concentrator (Forest Service, 2002). This was followed in 2003 by an APA at the Mystery Mine (Forest Service, 2003). Results are summarized herein.

During 2003, DNR published an investigation for potential metal contamination and release at the Mystery, Justice, Pride of the Woods, Pride of the Mountains, and New Discovery Mines (Wolff et.al., 2003). DNR personnel also obtained discharge samples from the adits, and water and benthic micro-organism samples from several locations in the Glacier Creek. Results are summarized herein; refer to Wolff et.al. (2003) for sample location details and analyses.

In 2004, SHD and Ecology released a Site Hazard Assessment for the MCMA (Crofoot and O'Brien, 2004). This effort was based on the above APAs and the DNR reports, supplemented by additional sampling and investigations at several other mines in Glacier Creek Basin and Seventysix Gulch. A broad x-ray fluorescence (XRF) survey was conducted of all mine wasterock piles and several sediment sample locations. A limited number of wasterock and sediment samples were also analyzed at Ecology's

Manchester Environmental Laboratory. Results are summarized herein; refer to Crofoot and O'Brien (2004) for details and analyses.

This SI investigation included an inspection of the Mystery and Justice Mines followed by a more detailed inspection of three locations, the Concentrator, Ore Collector, and Assay Shack. The latter three sites were specifically selected because of relative accessibility and potential human health impact. The relative locations of these areas are provided in Plate 1, Figure 1, and Figure 2. More detailed drawings of each site are provided in Figure 3 (Concentrator), Figure 4 (Ore Collector), and Figure 5 (Assay Shack). The base topography is derived from detailed site surveys. Figure 6 illustrates the Justice Mine and Figure 7 illustrates the Mystery Mine. Both figures are derived from Brunton compass & tape surveys and should be considered approximate. Figure 8 illustrates the locations of detailed sediment samples obtained to investigate the near-source impact of the Concentrator and Ore Collector on Glacier Creek.

Following this SI field work and driven by prior investigations, the Forest Service conducted an APA at the Sidney Mine during 2006 (Forest Service, 2006a). This was accompanied by an APA at the Pride of the Woods/New Discovery/Pride of the Mountains Mines complex in 2006 (Forest Service, 2006b). Results are summarized herein; refer to Forest Service (2006a and 2006b) for additional detail.

All following discussions relative to human health and ecological impacts as well as background determinations are based on field work and analyses completed during this SI. This allows documentation that all assessments and recommendations are based on analyses and observations that are consistent and comparable. However, data from other investigations are included and discussed to support and verify work completed during the SI, and to help identify and recommend additional work that should be completed in the MCMA.

4.0 PATHWAYS AND ENVIRONMENTAL HAZARD ASSESSMENT

4.1 Groundwater Exposure Pathway

4.1.1 Hydrogeology

The MCMA is located within the Glacier Creek watershed, a sub-watershed of the SFSR watershed. A review of the Washington Water Resources Department well log database indicates that there are no wells located within a 4-mile radius of the MCMA.

The hydrogeology within the granodiorite is unknown; however, it is probable that groundwater flows preferentially through fractures in bedrock. Adits associated with the MCMA (Mystery and Justice Mines) had flowing drainage during the field investigation.

4.1.2 Targets

Targets are defined as receptors that are located within the target distance for a particular pathway. For the groundwater pathway, the target distance has been defined as 4-miles, and example targets are drinking water wells, wellhead protection areas, etc (See Plate 1). No wellhead protection areas or water supply wells were identified within a 4-mile radius of the MCMA.

4.1.3 Groundwater Exposure Pathway Summary

Groundwater is not used for drinking water within 4-miles of the MCMA, and no wells were available for sampling. No evidence of contaminated groundwater discharge could be identified on the basis of Glacier

Creek surface water sample analyses. Based on this, and absence of groundwater consumption, the groundwater pathway is not complete and no further assessment is warranted at this time.

4.2 Surface Water Exposure Pathway

Within the MCMA, there are two distinct surface water exposure pathways. The largest pathways are the major streams, SFSR, Glacier Creek, and Seventysix Gulch, plus a few limited tributaries. The other pathway is direct discharge from mines. Most of these discharges infiltrate into talus and alluvium before reaching streams. However, two mines (Sydney and Sheridan) with minor discharge are adjacent to major streams, but were not examined as part of this SI. Mines adjacent to streams with possible, but not proven, discharge to surface water, include the Lincoln, Liberty, and Rainy Mines. Minor discharge also occurs at the New Discovery and Pride of the Mountains Mines, but neither is immediately adjacent to flowing surface water and all discharge infiltrates into either wasterock or surrounding soil.

4.2.1 Hydrologic Setting

The MCMA is bordered on the north by Glacier Creek as shown on Plate 1 and Figures 1 and 8. According to the USGS 7½ minute quadrangle maps (USGSa, 1982 and USGSb, 1982) of the area, the Glacier Creek watershed above the MCMA, including Seventysix Gulch, is approximately 2,100 acres or 3.2 square miles (Plate 1). Glacier Creek originates approximately 2.5 miles upstream from the MCMA. Surface waters in the MCMA generally flow to the north and ultimately into Glacier Creek. The confluence of Glacier Creek with Seventysix Gulch is at the former Monte Cristo Townsite, immediately below the Concentrator. The SFSR begins immediately below the Monte Cristo Townsite where a number of unnamed streams join Glacier Creek. The SFSR flows north approximately 7 miles to Monte Cristo Lake and joins the North Fork Sauk River approximately 12 miles downstream from the MCMA. The Sauk River flows north 40 miles to join the Skagit River and eventually Skagit Bay in the Puget Sound.

Approximately two miles below the Monte Cristo Townsite, the SFSR periodically disappears and flows underground for about ¼ mile before resurfacing. This usually occurs only during the summer months of August and September.

The flow rates in Glacier Creek, Seventysix Gulch, and the SFSR were measured on June 1 to June 3, 2005. Flows ranged from 4 cubic feet per second (cfs) at GC-01 to 76 cfs in SFSR-03 (see Figure 1 and Table 1). The closest USGS gauging station (# 12186000) is located on the Sauk River eight miles below the confluence of the North and South Sauk Forks with a drainage area of 152 square miles. Data from this distant location is irrelevant to this SI because of additive flows between MCMA and the station.

4.2.2 Targets

For the surface water pathway, the target distance has been defined as 15-miles, and example targets are surface water intakes, drinking water supplies, sensitive environments (i.e., wetlands), and aquatic organisms.

4.2.2.1 Local Surface Water Use

Plate 1 shows the 1- and 4-mile radii from the MCMA. There are several private cabins on the MCMA. Although there are no permanent residences within a 4-mile radius of the MCMA, recreational use in the watershed is high. There are no surface water rights within 4 miles of the MCMA; however, mine claim and private property owners use Glacier Creek for domestic purposes. Wolff et.al. (2003) states the caretaker and the recreation cabin users at the MCMA also use surface water for domestic purposes. This has been verified; however, in August 2006, the Forest Service posted a warning and advisory against drinking the surface water at the MCMA. Only receptors above Barlow Pass are considered targets because of the large difference in flow rates from the MCMA to the Pass by the additional inflows from other

tributaries. Surface water in or around the MCMA is also used for recreational purposes such as swimming, camping (washing dishes, cooking), and fishing.

4.2.2.2 Wetlands

The National Wetlands Inventory (NWI) utilizes maps as a preliminary tool for determining the location of potential wetlands, although the map alone is not sufficient for ascertaining the presence of jurisdictional wetlands. The following areas are "listed" on the NWI map (USFWS, 1995) that could be affected by the MCMA.

- The SFSR below the MCMA is designated as Riverine, Upper Perennial, Open Water/Unknown Bottom, Intermittently Exposed/Permanent (R3OWZ).
- The SFSR, approximately 1.5 miles downstream of the MCMA, is classified as R3OWZ and R3FLY, Riverine, Upper Perennial, Semi-permanently Flooded.

The NWI map does not clearly outline the boundaries of riverine wetland systems. Therefore, the lateral boundaries adjacent to the stream cannot be determined without a jurisdictional wetland delineation conducted in accordance with the U.S. Army Corps of Engineers (USACE) Technical Report/Y-87-1.

According to CERCLA (40 CFR 230.5) and USACE Technical Report/Y-87-1, "wetlands are those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." A jurisdictional wetland delineation in accordance with USACE standards was not conducted during this investigation. As such, the exact boundaries and areas of potential wetlands were not defined. Based on this definition, other wetlands are probably present near the adit drainages (below Mystery Adit) and other areas of the MCMA (i.e., along the Glacier Creek and Seventysix Gulch).

4.2.2.3 Aquatic Ecological Survey

In the area of the former Monte Cristo Townsite and associated mines, aquatic surveys were conducted at eight locations within Glacier Creek, Seventysix Gulch, and the SFSR to assess the potential impacts of the MCMA on the in-stream habitat, benthic macroinvertebrate community, and presence of fish species. Riparian habitat, in-stream habitat conditions, and presence of fish were observed at two other locations, one on Glacier Creek and one on the SFSR. Refer to Appendix B for supplemental text, figures, and tables. The rare, threatened, or endangered (RTE) species known or expected to inhabit the area surrounding the MCMA are also listed in Appendix B.

The results of the aquatic ecological survey suggest:

- Riparian habitat was absent or limited along much of Glacier Creek, the upper reach of Seventysix Gulch, and portions of the SFSR below the Monte Cristo Townsite. This was due to severe weather and snow cover in the upper creek reaches and to scouring caused by high water or narrow bedrock-confined channels in the lower reaches. Some alpine riparian habitat was present in the vicinity of GC-02 and GC-03. Otherwise, riparian habitat was best developed along the middle portion of Seventysix Gulch Creek and the lower portions of the SFSR.

- Overall in-stream physical habitat conditions (sum of 10 habitat parameters; Barbour et.al., 1999) were suboptimal in Glacier Creek, the upper portions of Seventysix Gulch, and the lower portion of the SFSR, and some individual habitat parameters were rated as marginal or poor. Habitat conditions were optimal in the remaining reaches.

- Substrate within the farthest upstream reach of Glacier Creek (GC-01) and extending to near GC-02 was primarily sand, gravel, cobble, and boulders deposited into headwater basins by snow and rock slides from the surrounding steep mountainsides. Most of the remaining Glacier Creek substrate was scoured boulder due to steep gradient and high flows. However, GC-03 was located in a large shallow pool formed as a result of an earthen dam across the channel. It is unknown whether this dam was natural or manmade. Substrate at the headwaters of Seventysix Gulch (76G-01) was similar to upper Glacier Creek but included a higher proportion of boulders and less sand. The amount of sand increased significantly just below 76G-01 where the stream gradient was lower. The lower portion of Seventysix Gulch (76G-02) was also steep but included a broader array of bedrock, boulder, cobble, gravel, and sand substrate in a narrow relatively straight channel confined by bedrock. The SFSR reaches (SFSR-01 and SFSR-03) were less steep than Glacier Creek or Seventysix Gulch and included a lower proportion of boulder and a higher proportion of gravel and organic matter.
- For invertebrate sampling, both pool and riffle habitats were available at GC-01, GC-03, 76G-02, SFSR-01, and SFSR-02. Only riffle habitats were available at the other stations (GC-04, GC-05, 76G-02). Except for GC-03, pool habitat generally was not well developed and, when present, was along the side of the main channel behind obstacles. Pool habitat consisted primarily of sand and small gravel with some smaller organic matter, except at GC-03 where both finer-grained silt and organic matter were abundant. Riffle samples were often collected in gravel deposits between larger boulders and cobbles.
- Stream invertebrate population differences at GC-01, GC-03, GC-05, 76G-01, SFSR-01, and SFSR-03 showed a potential for naturally low habitat quality and/or MCMA-related chemical or physical stream impacts. The metals tolerance index suggested that metals-related impacts were present in the upstream reaches of Glacier Creek and Seventysix Gulch, and at SFSR-03. Evidence at the remaining potentially impacted reaches did not clearly indicate metals-related impacts.
- No anadromous fish reside and no fish were observed above the falls located between GC-04 and GC-05. Rainbow trout/steelhead, cutthroat trout, and bull trout are known to inhabit Glacier Creek and SFSR downstream from the falls. These fish also likely inhabit the lower portions of Seventysix Gulch.

Overall, results of the aquatic survey indicate there are potential metals impacts to benthic macroinvertebrate populations in one of five pool and three of eight riffle samples in Glacier Creek, the upstream portions of Seventysix Gulch, and SFSR. Further examination of the chemical content of surface water and sediments is necessary to determine whether the differences in invertebrate populations at these stations are related to chemical impacts.

4.2.3 Previous Surface Water Impact Investigations

4.2.3.1 Forest Service Pre-SI APAs

No surface water samples were obtained from near the Concentrator (Forest Service, 2002) or the Mystery Mine (Forest Service, 2003). However, both the Forest Service and the DNR observed iron-rich water discharging from one of the Mystery Mine adits. A SI was recommended to be conducted at both the Concentrator and the Mystery Mine.

4.2.3.2 Department of Natural Resources Abandoned Mine Lands Evaluation

The DNR collected surface water samples from adit drainages and Glacier Creek in July 2001 and September 2002 and reported results in Wolff et.al. (2003). The investigation was part of a cooperative effort between DNR, Forest Service, Bureau of Land Management, EPA, and Ecology to build a single database and geographic information system (GIS) coverage of major inactive and abandoned mines in

Washington. The documentation focused on physical characteristics and hazards (opening, structures, materials, and waste) and water-related issues (acid mine drainage and / or metals transport). The results indicated concentrations of arsenic, copper, lead, and zinc exceed Washington chronic standards for aquatic life in surface water collected from Justice, Mystery (upper and lower), and the Pride of the Mountains adit discharges. Analytical results are presented in Table 1. Arsenic ranged from 200 to 6,350 micrograms per liter (μg/L), copper ranged from 710 to 2,640 μg/L, lead ranged from 11 to 562 μg/L, and zinc ranged from 225 to 6,100 μg/L. Overall, the Pride of the Mountains adit discharge was of the lowest quality. No stream samples exceeded Ecology's chronic surface water quality criteria, which was used for comparison within the DNR report.

4.2.3.3 Joint Snohomish Health District and Ecology Site Hazard Assessment (SHA)

During September 2003, SHD and Ecology personnel obtained surface water samples from Seventysix Gulch, Glacier Creek, and the SFSR; results are presented in Table 1. As outlined in the SHA, Ecology based compliance concentration levels on Ecology's Model Toxics Control Act (MTCA) cleanup criteria. Most samples exceeded MTCA Method A and other Washington criteria for arsenic, ranging from 1.7 μg/L in upper Glacier Basin to 27.4 μg/L downstream near Monte Cristo Lake. This downstream increase of arsenic concentration, rather than a decrease, may indicate an alternative source to the MCMA for arsenic, although arsenic could be derived from contaminated downstream sediment. Arsenic in two water samples collected from the Justice Mine adit discharge were 235 and 264 μg/L. The first sample was obtained near the portal; the second was collected where the discharge infiltrated prior to reaching Glacier Creek.

4.2.3.4 Forest Service Post-SI APAs

During September 2006, the Forest Service completed an APA at the Sidney Mine in Seventysix Gulch (Forest Service, 2006a) and a combined APA for the Pride of the Woods, New Discovery, and Pride of the Mountains Mines (Forest Service, 2006b). At the Sidney Mine, one sample was collected from the adit discharge (2 to 3 gpm) which, at a concentration of 19 μg/L, exceeded the Washington drinking water criteria of 10 μg/L arsenic as well as the Washington/EPA human health criteria of 0.018 μg/L. Drinking water criteria considers only consumption of water whereas human health criteria considers consumption of water plus fish (which can bio-accumulate metals).

Two Seventysix Gulch samples, one above and one below the Sidney Mine, marginally exceeded Washington Aquatic Life (Chronic) lead criteria of 0.14 μg/L and the EPA Aquatic Life (CCC) criteria of 0.156 μg/L. The sample above the mine exhibited a concentration of 0.023 μg/L; that below the mine contained 0.034 μg/L.

Six samples were obtained from Glacier Basin to identify impact from mines; four were collected from Glacier Creek, one was collected from a seep along Glacier Creek near the New Discovery Mine, and one was collected from the Pride of the Mountains adit discharge. Of the four samples collected from Glacier Creek, arsenic exceeded the Washington and EPA human health criteria (0.018 μg/L) in three of the samples, and copper exceeded the Washington and EPA aquatic life criteria (1.4 μg/L and 1.1 μg/L, respectively) in the farthest downstream sample. The sample collected from the seep along Glacier Creek near the New Discovery Mine exceeded the Washington and EPA human health criteria (0.018 μg/L) for arsenic. The sample collected from the Pride of the Mountains adit discharge (5 gpm) significantly exceeded Washington and EPA criteria for arsenic at 1,100 μg/L, cadmium at 11 μg/L, copper at 560 μg/L, lead at 100 μg/L, and zinc at 1,600 μg/L, although pH was generally neutral. Pride of the Mountains adit discharge seeps into the surrounding ground at a point 75 ft from the portal source and 600 ft from Glacier Creek.

Surface water criteria of aquatic organisms in this SI are based on EPA's criteria as published in 2002. A new aquatic life ambient freshwater quality criterion for copper was promulgated by the EPA in 2007

(EPA, 2007). Determination of this criterion, which is based on the Biotic Ligand Model, requires analyses for dissolved organic carbon and an estimate of humic acid percentage. These analyses were not obtained during the SI; therefore, copper compliance herein is based on the 2002 criteria.

All data are presented in Table 1, and the reader is referred to Forest Service (2006a and 2006b) for details.

4.2.4 Site Inspection Analytical Results

This section presents the surface water, pore water, and stream sediment analytical results for the SI conducted at the MCMA. Sample locations are shown on Figures 1 through 8; analytical results are tabulated in Tables 1, 2, and 3; and the original laboratory reports are available in the Forest Service project file. Photographs of selected sampling locations are included in Appendix A. A complete report of the quality assurance / quality control (QA/QC) procedures and results is also available in the Forest Service project file. Field activities were conducted from June 1 through 4, September 9 through 11, 2005, and July 17 through 21, 2006; the reader is referred to the Field Operations Plans by CES for sampling procedure and protocols during each phase of the SI. Analyses from the samples collected by CES are summarized in the following table.

Summary of Surface Water, Pore Water, and Sediment Metals Results

Sample Type/ Location	Table / Sample ID	Metals Exceeding One or More Comparison Criterion	Trends Observed and Comments
Surface Water	**Table 1**	**Total Recoverable Metals (µg/L)**	
Glacier Creek	GC-SW1	Barium (6.2)	These background sample, exceeded lowest barium criterion (4.0 µg/L).
Glacier Creek	GC-SW2	Barium (10.1)	
Glacier Creek	GC-SW3	Arsenic V (4.375), Arsenic (4.5), Barium (8.5)	Arsenic V 4 times mean background and slightly above lowest criterion (3.1 µg/L); arsenic significantly higher than mean background and the lowest criterion; and barium slightly above mean background and 2 times the lower criterion.
Glacier Creek	GC-SW4	Arsenic (5.7), Barium (8.3)	
Glacier Creek	GC-SW5	Arsenic (7.7)	
Seventysix Creek	76G-SW1	Arsenic (0.45)	This background sample, exceeded lowest arsenic criterion (0.018 µg/L).
Seventysix Creek	76G-SW2	Arsenic (9.5), lead (0.68)	Arsenic over 500 times higher than the lowest criterion and 5 times higher than the mean background; lead slightly above mean background and 5 times lowest criterion.
South Fork Sauk River	SFSR-SW1	Arsenic (9.4), arsenic V (9.253)	Arsenic increases in downstream samples with concentrations significantly higher than the mean background and lower criterion.
South Fork Sauk River	SFSR-SW2	Arsenic (11.3)	
South Fork Sauk River	SFSR-SW3	Arsenic (12.4), arsenic V (12.157)	
Mystery Mine Adit	MM-AS-01	Aluminum (1,160), antimony (31.2), arsenic (1,360), arsenic V (1,358.3), cadmium (30.30), copper (675), iron (16,400), lead (37.5), manganese (4,230), zinc (6,590)	All metals listed are significantly higher than the mean background and lowest criterion concentrations.
Justice Mine Adit	JC-AS-01	Antimony (10.3), arsenic (206), arsenic V (204.9), cadmium (0.15)	Antimony slightly greater than the lowest criterion and 2 times the mean background; cadmium is below mean background and slightly above the lowest criterion; arsenic significantly higher than the mean background and lowest criterion.

Summary of Surface Water, Pore Water, and Sediment Metals Results (continued)

Sample Type/ Location	Table / Sample ID	Metals Exceeding One or More Comparison Criterion	Trends Observed and Comments
Pore Water	**Table 2**	**Dissolved Metals (µg/L)**	
Glacier Creek	GC-PW1	Barium (8.4)	Background sample
Glacier Creek	GC-PW2	Barium (42.3), zinc (18)	Background sample
Glacier Creek	GC-PW3	Arsenic V (3.78), barium (9.6)	Arsenic V slightly above lowest criterion (3.1 µg/L) and mean background; barium exceeds lowest criterion but below background.
Glacier Creek	GC-PW5	Arsenic V (7.46), barium (5.7)	Arsenic V greater than lowest criterion and mean background; barium exceeds lowest criterion and mean background.
Seventysix Creek	76G-PW2	Arsenic (10.6)	Arsenic slightly above lowest criterion (10 µg/L).
South Fork Sauk River	SFSR-PW1	Arsenic (10.3), arsenic V (10.284), barium (4.9)	Arsenic slightly above lowest criterion; arsenic V 3 times the lowest criterion; barium slightly above lowest criterion but below mean background.
South Fork Sauk River	SFSR-PW2	Arsenic (14.3)	Arsenic slightly above lowest criterion.
South Fork Sauk River	SFSR-PW3	Arsenic (15.8)	
Sediment	**Table 3**	**Total Metals (mg/kg)**	
Glacier Creek	GC-SS1	Antimony (5.7), arsenic (52), barium (96.3), cadmium (0.96), chromium (67.1), manganese (1,350)	Background sample.
Glacier Creek	GC-SS2	Antimony (9.9), arsenic (227), barium (109), cadmium (1.55), chromium (49.6), copper (50), lead (104), manganese (1,660), thallium (0.263), zinc (163)	Background sample.
Glacier Creek	GC-SS3	Antimony (11.6), arsenic (250), barium (98.4), cadmium (1.71), chromium (48.9), copper (41), lead (84.8), manganese (1,510), selenium (0.41), thallium (0.280), zinc (163)	Arsenic between 42 and 62 times greater than the lowest criterion and between 2.5 and 3.5 times the mean background; other metals similar to background but higher than lowest criterion.
Glacier Creek	GC-SS4	Antimony (7.9), arsenic (367), barium (94), cadmium (1.91), chromium (48.5), copper (67.5), lead (69.3), manganese (1,350), selenium (0.46), thallium (0.248), zinc (185)	
Glacier Creek	GC-SS5	Antimony (3.8), arsenic (291), barium (88.4), cadmium (1.79), chromium (53.5), copper (117), lead (48.2), zinc (156)	
Glacier Creek, closely spaced samples adjacent to and downstream from Ore Collector (highest concentrations shown)	COL-SS-01 through 05	Antimony (14.5), arsenic (469), barium (91.9), cadmium (1.23), chromium (49.0), copper (111), lead (72.6), zinc (166)	Arsenic between 48 and 80 times greater than the lowest criterion and between 2.7 and 4.5 times the mean background; other metals similar to background but higher than lowest criterion.
Glacier Creek, closely spaced samples adjacent to and downstream from Concentrator (highest concentrations shown)	CON-SS-01 through 05	Antimony (14.1), arsenic (282), barium (106), cadmium (1.23), chromium (52.6), copper (92.1), lead (55.3), manganese (1,230), zinc (150)	
Seventysix Creek	76G-SS1	Arsenic (16.8), barium (39.1), cadmium (1.30), chromium (42.6), cobalt (10.6), selenium (0.39),	Background sample.
Seventysix Creek	76G-SS2	Antimony (11.2), arsenic (276), barium (52.8), cadmium (2.91), chromium (41.5), lead (89.5), zinc (295)	Arsenic between 46 and 92 times greater than the lowest criterion and between 2.5 and 4.5 times the mean background; other metals similar to background but higher than lowest criterion.
South Fork Sauk River	SFSR-SS1	Antimony (7.1), arsenic (269), barium (62.8), cadmium (1.90), chromium (46.1), copper (79.5), lead (65.4), zinc (177)	
South Fork Sauk River	SFSR-SS2	Antimony (13.5), arsenic (544), barium (66.8), cadmium (1.99, chromium (56.9), copper (115), lead (136), zinc (206)	
South Fork Sauk River	SFSR-SS3	Antimony (17.3), arsenic (480), barium (57.6), cadmium (2.02), chromium (61.5), copper (116), lead (156), zinc (192)	

Note: mg/kg = milligrams per kilograms; µg/L = micrograms per liter.

4.2.5 Surface Water Exposure Pathway Summary

Based on the information presented in this section, including studies by other investigators, metals from the MCMA have been released into Glacier Creek and appear to have affected stream sediments and surface water. Arsenic is the only persistent metal that exceeds human health criteria. The highest arsenic concentrations detected in surface water are listed in the following bullets:

- Glacier Creek – 12.2 μg/L – below the Concentrator
- Seventysix Gulch – 9.96 μg/L – near the Sidney Mine
- South Fork Sauk River – 12.4 μg/L – at the farthest downstream aquatic station
- Monte Cristo Lake – 27.4 μg/L

Ecological criteria for arsenic in water were not exceeded in surface water bodies. Concentrations of arsenic increase from upgradient to downgradient in both Glacier Creek and Seventysix Gulch. Both natural and anthropogenic sources most likely contribute to this increase. In general, downstream values exceed the background mean concentrations, but not by wide margins or a factor of more than 10. The downgradient increase of arsenic concentrations in the SFSR is unusual and suggests an instream or other source. One probable source is the historical tailings discharged from the Concentrator to Glacier Creek. The tailings would have most likely been transported downstream in episodic, complex geomorphic response fashion. However, there is not adequate data to clearly determine anthropogenic impacts in Glacier Creek and Seventysix Gulch at this time. The decreasing downstream gradient may have caused metals to settle more rapidly in this area, resulting in increasing metals concentrations in both sediment and surface water.

Water samples from adit discharges, particularly from the Mystery Mine, exceeded both human health and ecological criteria for the following metals: aluminum, antimony, arsenic, cadmium, copper, iron, lead, manganese, and zinc. Discharge from the Justice Mine is a much larger flow, but the metal concentrations are much lower; only criteria for antimony, arsenic, and cadmium were exceeded. There is no discharge directly to Glacier Creek from the adits, because the discharges infiltrate into surrounding wasterock and soil before reaching surface water. Much of the metal load is most likely adsorbed by soil, but the overall impacts to surface water are unknown. In order for the Forest Service to determine if a release to flowing surface water has actually occurred, a detailed sampling of streams may be required to determine if a mass load increase can be attributed to adit discharges. The distance of subsurface flow from the Mystery Mine discharge to Glacier Creek is approximately 1,500 ft, but the discharge infiltrates into the wasterock dump. This discharge may emerge as part of a small stream that reaches the Glacier Basin trail before infiltrating at an approximate distance of 300 ft from Glacier Creek.

Pore water chemistry closely mirrors that of surface water. Arsenic is the primary contaminant with sporadic barium and zinc exceedances of ecological and human health (drinking water) criteria. Most exceedances were only slightly higher than the criteria. The downgradient arsenic concentration increase in the SFSR is again suggestive of tailings in alluvium. However, there is not adequate data to clearly determine anthropogenic impacts in Glacier Creek and Seventysix Gulch.

Most sediment samples exceed various ecological criteria for antimony, arsenic, cadmium, copper, lead, and zinc. In general, downstream concentrations were higher than background mean concentrations, but not by wide margins or a factor of 10. The proportional downstream concentration of metals in sediment increases relative to background samples at a greater rate than in surface water and pore water. Closely spaced (detailed) sediment samples collected in Glacier Creek adjacent to the Ore Collector (labeled COL on Table 3) and the Concentrator (labeled CON on Table 3) are chemically similar to upstream and downstream sediment samples in Glacier Creek. Detailed locations are provided in Figure 8. Typically, samples adjacent to and immediately downstream of a source are higher than other values in the stream. The fact that the detailed samples are similar to upstream samples suggests that these locations may not

contribute significantly to sediment contamination. Antimony, arsenic, cadmium, and lead concentrations are highest in samples from SFSR and increase downgradient. This also suggests tailings in alluvium.

The aquatic survey indicates potential metals impacts to benthic macroinvertebrate populations in Glacier Creek, Seventysix Gulch and the SFRS. However, further surface water and sediment sampling are needed to determine whether observed population anomalies are primarily due to chemical contaminates.

The surface water pathway is complete for both human and ecological receptors and further assessment is warranted. The main metals of concern are arsenic (total and V) in water and antimony, arsenic, cadmium, and lead in sediment. The conclusions presented are based on aquatic samples collected during moderately-high flow conditions. Surface water, pore water, and sediment concentrations are likely to differ with the change in flow rates within Glacier Creek and other tributaries. CES recommends that an additional sampling event be performed to determine concentrations during low flow conditions (typically in the fall).

4.3 Soil Exposure Pathway

4.3.1 Targets

4.3.1.1 Local Use

There are no onsite workers or persons living year round within several miles of the MCMA. Private cabins are located in the MCMA and are used as summer or vacation homes. Public use of the MCMA and vicinity is moderate to high, though public access records are not maintained**.** The MCMA is described in *Discovering Washington's Historic Mines* (Northwest Underground Explorations, 1997) which encourages public exploration of the MCMA. Numerous hiking books also publicize hiking to the MCMA. Institutional controls, in the form of temporary fencing and signage, were installed in July 2006 to restrict public access to the Concentrator, Ore Collector, and the Assay Shack. In general, land uses in this area are limited to timber harvesting, firewood cutting, recreation (hiking, fishing, camping, hunting, etc.), and some minerals prospecting.

4.3.1.2 Terrestrial Ecological Survey

Terrestrial habitats and animals that were confirmed present or likely present in and surrounding the MCMA were documented during the ecological survey and via examination of information provided by the regional biologist regarding the MCMA vicinity. Five 30-minute bird surveys were also conducted, four at lower elevations near the Monte Cristo Townsite and one in the upper elevation alpine habitat. In addition, the dominant plants were identified within each major vegetative community. Qualitative surveys were conducted at and surrounding the MCMA for mammal and terrestrial invertebrate presence and use. Lists of RTE plants and animals likely or known to be present in the vicinity of the MCMA were obtained from the Forest Service and the Washington Department of Fish and Wildlife Priority Habitats and Species Program, and the Washington Department of Natural Resources Natural Heritage Information System (WNHP, 2003; See Appendix B1). Full results of the terrestrial ecological survey are provided in Appendix B. Results of the terrestrial ecological surveys showed:

- The MCMA encompasses coniferous forest, alpine, and disturbed plant communities.
- The disturbed community includes areas surrounding the MCMA where primarily wasterock or excavated and compacted gravelly soil was present with colonizing and weedy herbaceous and shrub species, with no significant canopy layer. The disturbed community also included riparian and naturally disturbed areas (e.g., slide areas), because the vegetation within close proximity to these disturbed habitats was similar.

- Other than within the disturbed mine areas, there were also areas of mining-related disturbance such as roadways and clearings where habitat was similar to naturally disturbed areas.
- Invertebrates noted on and near the MCMA include bees, butterflies, moths, mosquitoes, and black flies. None of these or any other invertebrates in the vicinity of the MCMA are known RTE species.
- The birds observed or expected in the MCMA represent an assemblage common among western Washington coniferous forests and alpine areas, and are listed in Appendix B. Of these, many will migrate seasonably from the area to avoid the cold and snowy winters. The marbled murrelet (federally threatened) is the only RTE bird species expected in the MCMA. Spotted owls (federally threatened) are known to inhabit coniferous forest near the MCMA, but are not expected at the MCMA because of the very limited amount of old growth forest present. A few bird species may inhabit the MCMA year-round, but are unlikely to forage primarily in the mining-related disturbed areas.
- Game trails were not clearly present, but evidence of black-tailed deer (state priority species and Forest Service Management Indicator Species), squirrels, and Cascade golden-mantled ground squirrels were noted in the vicinity of the MCMA. Other mammals such as black bear, red fox, weasels, hares, voles, mice, and shrews are also expected. None of these observed or expected mammals are threatened or endangered. The only RTE mammal species that could inhabit the MCMA are Townsend's big-eared bats, Keen's myotis, and the long-eared myotis.
- No amphibians or reptiles were observed at the MCMA. Long-toed salamanders and Pacific tree frogs are expected. No RTE amphibian or reptile species were observed or expected at the MCMA.

Of the terrestrial invertebrates and wildlife documented or likely to inhabit the MCMA, immobile species such as plants and ground-dwelling invertebrates are the species most likely to be exposed to mine-related contamination.

4.3.2 Previous Investigations

4.3.2.1 U.S. Bureau of Mines Mineral Lands Assessment

A comprehensive USBM economic geology report, Mineral Lands Assessment report MLA 75-83 was completed by Johnson, et.al. (1983). Although this report does not address environmental issues, it provides valuable information relative to deposit sizes and tenor, as well as locations. During this assessment, 54 mines and prospects were inventoried, of which 14 were actual mines. This resulted in an inventory of potential contaminant-producing locations of which three were selected for discussion in this SI, the Rainy, Golden Cord, and Sheridan Mines (See Figure 1). These sites were selected because they contain significant mine workings and substantial metal values and are in close proximity to Glacier Creek or Seventysix Gulch. Other mines, such as the Comet (not shown) and Boston-American Mines (on private ground, not shown) involve substantial workings. But, the Comet Mine is located high on the mountain (5,400 ft amsl) about one-half mile from Seventysix Gulch; the Boston and American Mine is developed by a long crosscut through barren host rock and cuts little ore mineralization. The selected sites are described as follows.

- **Rainy Mine** – The mine was developed by an 855 ft adit and a 210 ft deep shaft which is flooded. The shaft accesses 1,095 ft of drifts on four levels. Minimum production was 30,850 tons. Tenor is not known, because of inaccessibility, and no analyses were provided. However, because of the close proximity of Glacier Creek, the site should be investigated. These workings are located on the patented (private) Rainy Lode Claim based upon the current U.S. Department of the Interior (USDI) Master Title Plat and the Rainy Lode Claim Mineral Survey (MS-151).

- **Golden Cord Mine** – The mine is actually part of the Justice Mine complex. It is developed through 2,286 ft of drifts on five levels. Sample analyses ranged form 0.11 to 1.60 percent copper, 0.11 to 5.10 percent lead, 0.11 to 7.10 percent zinc, and 0.13 to 27.0 percent arsenic. Although the mine is not in close proximity to Glacier Creek, it could be contributing to contaminants in Justice Mine discharge and should be investigated. Both the Justice and Golden Cord workings and wasterock appear to be located on Forest Service administered land based upon the current USDI Master Title Plat.
- **Sheridan Mine** – This mine is near the Sidney Mine adjacent to Seventysix Gulch. It is developed by one 410 ft long adit. Arsenic tenor ranged from 0.18 to 2.0 percent. Because of the size, close proximity to Seventysix Creek, and elevated arsenic concentration, the site should be investigated. Both the Sidney and Sheridan Mines appear to be located on Forest Service administered land based upon the current USDI Master Title Plat.

4.3.2.2 Forest Service Pre-SI APAs

During the APA field investigations, Forest Service personal performed a reconnaissance to assess the potential impacts; no soil, wasterock, or tailings samples were collected from either the Concentrator (Forest Service, 2002) or the Mystery Mine (Forest Service, 2003) for laboratory analyses. The Forest Service used a portable XRF to assess the metal concentrations. As outlined in the following table, the Concentrator and Mystery Mine samples exceeded EPA Region IX Industrial Preliminary Remedial Goal (PRG) levels for several metals.

Summary of 2002 and 2003 Forest Service APA Results

Sample Location	Antimony	Arsenic	Iron	Lead	Mercury
	mg/kg				
Concentrator Foundation Area Soil	4,140	290,000	746,000	7,480	1,040
Mystery Mine Wasterock	4,860 – 5,060	32,000 – 35,900	143,000 – 160,000	15,200 – 15,800	ND
EPA Region IX Industrial PRGs	**410**	**1.6**	**100,000**	**800**	**310**

Note: mg/kg = milligrams per kilogram; ND = not detected; PRG = Preliminary Remedial Goals

The APAs recommended that a SI be completed at both sites to assess the human and ecological impact.

4.3.2.3 Department of Natural Resource Abandoned Mine Lands Evaluation

The DNR performed an investigation of the MCMA which consisted of collecting historical information as well as physical attributes and limited sampling from the MCMA in the summer of 2001 and reported results in Wolff et.al. (2003). Results show arsenic concentrations detected in the wasterock at the various adits exceeded the EPA Region IX Industrial PRGs and Washington Industrial soil clean up concentrations for human receptors. The samples were analyzed for arsenic, cadmium (1 sample), copper, iron, lead, and zinc by EPA Method 6010. The results also show concentrations of arsenic, copper, lead, and zinc exceed the Washington Cleanup standards.

Summary of 2001 WA-DNR Soil Analysis Results

Sample Location	Arsenic	Cadmium	Copper	Iron	Lead	Zinc
	mg/kg					
Mystery Adit 3 wasterock dump	14,000	NA	500	230,000	1,700	1,100
Pride of the Woods wasterock dump	15,300	NA	195	55,900	1,450	113
Pride of the Mountain wasterock dump	17,300	7.20	1,010	66,700	7,040	941
EPA Region IX Industrial PRGs	**1.6**	**450**	**41,000**	**100,000**	**800**	**100,000**
WAC 173-340-900	**20**	**2**	**100**	**NS**	**1,000**	**NS**

Note: mg/kg = milligrams per kilogram; NS – No Standard

4.3.2.4 Joint Snohomish Health District and Ecology Site Hazard Assessment

During September 2003, SHD and Ecology personnel obtained wasterock samples from the following mines and conducted XRF traverses (not all shown on Figure 1).

- Concentrator
- 76 Mine; (XRF only)
- Sidney Mine (XRF only)
- Peabody Mine (XRF only)
- Justice Mine
- Ore Collector
- Comet Tram Bunker
- 89 Mine (XRF only)
- Pride of the Mountains Mine
- Pride of the Woods Mine
- The Monte Cristo Townsite

XRF results from the above sites are not incorporated into the overall laboratory tables attached to this report. XRF arsenic concentrations exceeded MTCA Methods A and B at all above sites. Lead XRF results from the above sites exceeded these same criteria at the Pride of the Woods Mine, Comet Tram Bunker, Collector, and the Concentrator. XRF data indicates that the 76 Mine, Sidney Mine, and 89 Mine wasterock, as well as most of the Monte Cristo Townsite locations, exceed MTCA Methods A and B criteria for arsenic, lead, and mercury. The WARM Rank for the MCMA is 1, which is Ecology's most hazardous ranking, indicating the MCMA should be placed high in priority for cleanup.

4.3.2.5 Forest Service Post-SI APAs

During September 2006, the Forest Service completed an APA at the Sidney Mine in Seventysix Gulch (Forest Service, 2006a) and a combined APA for the Pride of the Woods, New Discovery, and Pride of the Mountains Mines (Forest Service, 2006b). At the Sidney Mine, two composite wasterock samples were collected in the field and analyzed in the lab using a Niton XRF. XRF results from the above sites are not incorporated into the overall laboratory tables attached to this report, but are summarized as follows. Arsenic ranged from 7,654 to 40,781 milligram per kilogram (mg/kg) and chromium ranged from 1,010 to 2,480 mg/kg concentrations in both samples. Iron ranged from 65,300 to 149,900 mg/kg. All three elements in one sample exceeded Washington's MTCA Method A cleanup levels and/or EPA Region IX Industrial PRGs. Arsenic, chromium, and lead in both samples exceeded soil concentrations established under MTCA to be protective of terrestrial ecological receptors at most industrial/commercial sites. Seventysix Gulch continues to erode the toe of the wasterock pile.

As in Seventysix Gulch, composite wasterock samples in the upper Glacier Basin were collected in the field and analyzed in the laboratory using a Niton XRF. Eleven composite soil samples were collected from the Pride of the Woods, New Discovery, and Pride of the Mountains Mines and analyzed. Arsenic ranged from 4,650 to 42,982 mg/kg), chromium from <555 to 2,080 mg/kg, and lead from 1,080 to 7,494 mg/kg. Antimony ranged from <37 to 1,170 mg/kg and iron from 53,800 to 125,000 mg/kg. Most of these concentrations exceeded Washington's MTCA Method A cleanup levels and/or EPA Region IX Industrial PRGs. Arsenic, chromium, lead, and zinc (which ranged from 352 to 1,380 mg/kg) commonly exceeded MTCA concentrations for protection of terrestrial ecological receptors at most industrial/commercial sites.

Based on the APAs, SIs were recommended for the Sidney Mine, Pride of the Woods Mine, Pride of the Mountains Mine, and the New Discovery Mine.

4.3.3 Site Inspection Analytical Results

The following section presents the background soil, MCMA soils, wasterock, and tailings analytical results for the MCMA. Sample locations are shown on Figures 1 through 8. Soils and waste source material metal/pH results are in Table 4; analytical results for background soils are provided in Table 5; toxicity characteristic leaching procedure (TCLP) and synthetic precipitation leaching procedure (SPLP) results are in Table 6; and QA/QC samples are in Table 7. The complete laboratory analytical results are located in the Forest Service project file.

4.3.3.1 Background Soil

To provide representative chemistry of undisturbed areas around the MCMA, background soil samples were collected from ten locations upgradient of the MCMA or in undisturbed areas in both Glacier Creek and Seventysix Gulch watersheds. Samples BKG-01 and BKS-02 were collected on the hillsides above the headwaters of Seventysix Gulch; BKG-03, BKG-04, and BKG-05 were collected on the slopes above the headwaters of Glacier Creek. Sample BKG-06 was collected upgradient from the Mystery Mine and BKG-07 from above the Justice Mine. Samples BKG-08, BKG-09, and BKG-010 were collected on the slopes above the Concentrator and Ore Collector. Locations of the background samples are shown on Figure 1.

Table 5 shows that mean background and 90 percent Upper Confidence Limits (90UCL) concentrations for antimony, arsenic, selenium, mercury, vanadium, and zinc are well above most of the respective criteria. For example, the arsenic 90UCL is 148 times the EPA Industrial PRGs of 1.6 mg/kg. Background soil pH ranged from 3.72 to 5.43 standard units (su), a value only marginally higher than most wasterock and tailings samples.

4.3.3.2 Concentrator

Partially processed ore residue, spilled stockpiled ore, and spilled tailings remaining at the Concentrator ruins exceed most human health and ecological criteria as well as the background 90UCLs for antimony, arsenic, cadmium, chromium, copper, lead, mercury, selenium, silver, thallium, and zinc. Antimony and arsenic in particular, and sporadically zinc, exceed the more conservative human health criteria by several orders of magnitude. Arsenic was detected up to 92,100 mg/kg in this area. Various criteria and background 90UCLs were occasionally exceeded for barium, iron, and nickel; and all other metals were elevated. In addition, most soil pH tests were acidic, ranging from 3.00 to 5.02 su. The material is also net acid-producing by Modified Sobek Acid-Base Accounting (ABA) procedures, ranging from -32.8 to -229 t $CaCO_3$/Kt (tons of calcium carbonate needed to neutralize a kiloton of waste). One of the seven samples analyzed for TCLP and SPLP exceeded the Resource Conservation Recovery Act (RCRA) criteria for arsenic and lead by both procedures. By virtue of exceeding TCLP criteria, this material is classified as dangerous waste in accordance with MTCA regulations. This sample appears to represent a volume of up to approximately 100 cy of apparent spilled concentrate. Overall, analyses and accessibility indicate that this material is a potential health and ecological hazard. A temporary fence was erected around this area during Phase III to limit access.

4.3.3.3 Ore Collector

Stockpiled ore remaining at the collapsed Ore Collector exceeds most human health and ecological criteria as well as the background 90UCLs for antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc. Antimony and arsenic in particular and sporadically zinc, exceed the more conservative human health criteria by several orders of magnitude. Arsenic was detected up to 88,700 mg/kg in this area. Various criteria and 90UCLs were sporadically exceeded for barium, and all other metals were elevated. In addition, most soil pH tests were acidic, ranging from 3.25 to 5.65 su. The

material is also net acid-producing, ranging from -18.8 to -40 t $CaCO_3$/Kt. The two samples analyzed for the TCLP and SPLP did not exceed any RCRA criteria. Overall, analyses and accessibility indicate that this material is a potential health and ecological hazard. A temporary fence was erected around this area during Phase III to limit access.

4.3.3.4 Haulage Routes

Spilled ore along the haulage routes exceeds most human health and ecological criteria as well as the background 90UCLs for antimony, arsenic, chromium, copper, lead, mercury, selenium, silver, thallium, and zinc. Antimony and arsenic in particular, and sporadically zinc, exceed the more conservative human health criteria by several orders of magnitude. Arsenic was detected up to 22,600 mg/kg in this area. Soil pH values ranged from 3.98 to 5.90 su. Two of the five samples were analyzed for ABA. One was determined to be potentially acid-producing at -31.6 t $CaCO_3$/Kt. The two samples analyzed for TCLP and SPLP did not exceed any RCRA criteria. Overall, analyses and accessibility indicate that this material is a potential health and ecological hazard.

4.3.3.5 Assay Shack

Soil remaining at the Assay Shack exceeds most human health and ecological criteria as well as the background 90UCLs for antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc at ratios similar to the Ore Collector and Concentrator. Arsenic was detected up to 85,800 mg/kg in this area. All other metals were elevated. The soil pH test was acidic (2.98 to 4.69 su), and the one sample analyzed for ABA was net acid-producing at -21.3 t $CaCO_3$/Kt. One sample was also analyzed for TCLP and SPLP but did not exceed any RCRA criteria. Overall, analyses and accessibility indicate that this area is a potential health and ecological hazard. A temporary fence was erected around this area during Phase III to limit access.

4.3.3.6 Mystery Mine

Stockpiled ore remaining at the collapsed surge bin and wasterock downslope from the Mystery Mine adits exceed most human health and ecological criteria as well as the background 90UCLs for antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc. Again, antimony and arsenic in particular and, occasionally, zinc exceed the more conservative human health criteria by several orders of magnitude. Various criteria and background 90UCLs were exceeded for cobalt, iron, manganese, and nickel. In addition, most soil pH tests were acidic, ranging from 3.34 to 6.18 su. No samples were analyzed for TCLP or SPLP. Overall, analyses and accessibility indicate that this material is a potential health and ecological hazard. However, accessibility is far more difficult than at the Ore Collector and Concentrator, and human health risk may be correspondingly lower.

4.3.3.7 Volume Summary

Sampling and surveying to the extent necessary to accurately detail the depth and extent of most contaminant sources for all sites within the MCMA was beyond the scope of this SI. Therefore, the following volumes are estimates only; deficiencies should be addressed as part of a future Engineering Evaluation / Cost Analysis (EECA) or removal action. The estimated volume of wasterock, tailings, and ore was determined by field measurements, visual observations, and the prismoidal formula and are summarized below:

- Collector = 1,800 cy (coarse ore)
- Collector = 700 cy (finely crushed ore)
- Mystery Mine wasterock = 55,000 cy
- Concentrator = 8,100 cy (mixture of tailings, soil, and wasterock, assume thickness of 5-7 ft)

- Concentrator = 100 cy (dangerous waste)
- Haulage routes ore = 200 cy
- Assay Shack soil = 200 cy

4.3.4 Detailed Discussion

The following table summarizes the metals results for background soil and waste source samples at the MCMA. The table only presents metals that exceeded at least one comparison criteria and the 90UCL of the background samples.

Summary of Background Soil, MCMA Soil, and Waste Source Metals Results

Sample Type/ Location	Table / Sample ID	Metals Exceeding at Least One Criterion	Metals Exceeding One Criterion and Background 90UCL	Trends Observed and Comments
Background Soil	**Table 5**	**Total metals (mg/kg)**		
Background Soil	BKG-01 to -010	Antimony, arsenic (total), chromium, mercury, selenium, vanadium, and zinc.	Not Applicable (NA)	NA
Waste Material	**Table 4**	**Total metals (mg/kg) / Criterion: Eco = Ecological, HH = Human Health**		
Ore Collector	14 samples	Aluminum, antimony, arsenic V, arsenic, barium, cadmium, chromium, cobalt, copper, lead, mercury, selenium, silver, vanadium, and zinc.	Antimony (9,860), arsenic V (18,985), arsenic (88,700), barium (113), cadmium (39.8), chromium (81.5), cobalt (12.9), copper (1,840), lead (22,500), mercury (8.7), selenium (4.40), silver (415), vanadium (41.7), and zinc (17,400).	Antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc are the metals of concern when compared to the lowest criterion (arsenic = 1.6-HH, cobalt = 20-Eco, copper = 50-Eco, lead = 40.5-Eco, mercury = 0.00051-Eco, selenium=0.21-Eco, silver=2-Eco, and zinc=8.5-Eco) and 90UCL background concentrations (arsenic = 236, , cadmium = 0.77, copper = 40.3, lead = 30.3, mercury = 0.38, selenium = 0.71, silver =0.39, thallium =0.75, and zinc =94). In general, all other metals were above the lowest criterion and less than or equal to the 90UCL for background soils.
Concentrator	23 samples	Aluminum, antimony, arsenic V, arsenic, barium, cadmium, chromium, cobalt, copper, iron , lead, mercury, selenium, silver, thallium, vanadium, and zinc.	Antimony (10,700), arsenic V (35,896), arsenic (92,100), barium (522), cadmium (114), chromium (94.5), cobalt (28.1), copper (4,240), iron (142,000), lead (21,400), mercury (8.35), selenium (6.77), silver (376), thallium (15.8), vanadium (90.5), and zinc (18,500).	
Assay Shack	Assay Shack AS-02 AS-03 AS-04	Aluminum, antimony, arsenic V, arsenic, barium, cadmium, copper, iron, lead, mercury, selenium, silver, thallium, vanadium, and zinc.	Antimony (4,500) arsenic V (85,363), arsenic (85,800), barium (203), cadmium (4.33), copper (388),iron (121,000), lead (10,200), mercury (36.30), selenium (2.11), silver (57.9), thallium (1.13), vanadium (21.4), and zinc (644)	Antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc are the metals of concern when compared to the lowest comparison criterion (arsenic = 1.6-HH, cobalt = 20-Eco, copper = 50-Eco, lead = 40.5 Eco, mercury = 0.00051-Eco, selenium=0.21-Eco, silver=2-Eco, and zinc=8.5-Eco) and 90UCL background concentrations (arsenic =236, , cadmium =0.77, copper = 40.3, lead =30.3, mercury = 0.38, selenium=0.71, silver =0.39, thallium =0.75, and zinc =94). In general, all other metals were above the lowest comparison criterion and less than or equal to the 90UCL for background soils.
Mystery Mine	MM-01-0.5' MM-01-1.0' MM-02-0.5' MM-03-0.5' MM-04-0.5'	Aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, mercury, selenium, silver, thallium, vanadium, and zinc.	Antimony (4,460), arsenic (24,300), barium (81), cadmium (26.4), chromium (28.5), cobalt (21.20), copper (1,040), iron (272,000), lead (8,190), mercury (2.05), selenium (1.67), silver (251), thallium (5.8), vanadium (73.9), and zinc (3,540).	

Notes: For multiple samples, the concentration listed is the highest detected concentration in the sample set. Concentrations listed are "total" concentrations, unless indicated (i.e., arsenic V)

4.3.5 Soil Exposure Pathway Summary

The soil exposure pathway is complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI and supported by results of other investigations. This is based on concentrations of antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc metals in wasterock, tailings, and soil samples that exceeded both the 90UCL of background soil concentration and one or more comparison criteria.

Metal concentrations in background soils are elevated; all ten background samples exceeded one or more comparison criteria for arsenic, chromium, mercury, vanadium, and zinc; three background samples exceeded criteria for selenium; two exceeded criteria for antimony and copper; and one each for lead and manganese. However, ten metals were detected in wasterock, tailings, and soil samples at concentrations exceeding both the 90UCL for background soil and one or more comparison criteria. In comparing wasterock concentrations to 90UCL background soil concentrations, antimony, arsenic (total, III, and V), cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc are the metals of concern. Antimony, arsenic, cadmium, and lead concentrations were detected significantly above several comparison criteria at the MCMA. In addition, the Concentrator, Ore Collector, and Assay Shack each had one sample that was detected over 80,000 mg/kg total arsenic. The highest concentration of total mercury (36.3 mg/kg) was detected in a soil sample from the Assay Shack.

Analyses of ABAs indicated most wasterock at the Concentrator and Ore Collector, tailings at the Concentrator, soil at the Assay Shack, and parts of the haulage way soil have potential to produce acid rock drainage. One of the 15 samples analyzed for TCLP and SPLP exceeded the RCRA and Ecology TCLP Hazardous/Dangerous Waste limit. This material is located in the Concentrator tailings and appears to be a concentrate spill of limited extent. Numerous federal and state RTE mammals, birds, and herpetiles have potential habitat in the vicinity of the MCMA, thus the potential exists that ecological receptors could be affected.

4.4 Air Exposure Pathway

4.4.1 Targets

The target distance for the air pathway has been defined as one and four miles from the MCMA. There are no year-round homes within four miles of the MCMA. However, private claimants use the adjacent (or nearby) property frequently, and public usage of the MCMA is moderate to high during the summer. The nearest year-round residences are in Silverton, approximately 12 miles west of the MCMA. The annual prevailing wind direction is to the east-southeast; however, the wind direction shifts to the north-northwest in the summer. There is little sign of dust migration, and neither Concentrator soil, tailings, nor wasterock are easily wind-eroded. Sensitive environments, including wetlands, that are located within four miles from the MCMA, are outlined in Section 3.2.2.

4.4.2 Air Exposure Pathway Summary

Air samples were not collected as part of the SI field activities. Arsenic and other metals were likely released to the air during processing (i.e., crushing, sorting). However, processing is currently not occurring at the MCMA and has not occurred since the early 1900's. The most probable air pathway is due to inhalation of particulate matter. As with soil exposure, this pathway is considered complete because metal contaminated soil and waste material is concentrated at the surface where human and ecological receptors could be exposed to particulate matter. Because the air pathway is linked to the soil exposure pathway, addressing and/or eliminating the soil exposure pathway will address the air exposure pathway for metals. Further assessment of the air pathway is not recommended.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Relevant conclusions and recommendations are presented below.

Groundwater Pathway

The groundwater pathway is not complete because there are no wells or groundwater protection areas within a 4-miles radius of the MCMA. Except as related to adit discharges or seeps, further assessment is not recommended.

Surface Water Pathway

The surface water pathway is complete for human and ecological receptors due to elevated concentrations of arsenic in surface water and pore water samples and several elevated metals (dominantly antimony, arsenic, cadmium, copper, lead, and zinc) in stream sediment samples. The highest arsenic concentrations detected in surface water are listed in the following bullets:

- Glacier Creek – 12.2 μg/L – below the Concentrator
- Seventysix Gulch – 9.96 μg/L – near the Sidney Mine
- South Fork Sauk River – 12.4 μg/L – at the farthest downstream aquatic station
- South Fork Sauk River – 27.4 μg/L – at Monte Cristo Lake

Water samples from adit discharges, particularly from the Mystery Mine, exceeded both human health and ecological criteria for the following metals: aluminum, antimony, arsenic, cadmium, copper, iron, lead, manganese, and zinc. Discharge from the Justice Mine is a much larger flow, but the metal concentrations are much lower; only criteria for antimony, arsenic, and cadmium were exceeded. There is no discharge directly to Glacier Creek from the adits because the discharges infiltrate into surrounding wasterock and soil before reaching surface water. Therefore, the impact on Glacier Creek is not known.
Most sediment samples exceed various ecological criteria for antimony, arsenic, cadmium, copper, lead, and zinc. Metals concentrations increase from upgradient to downgradient in both Glacier Creek and Seventysix Gulch. Antimony, arsenic, cadmium, and lead concentrations are highest in samples from SFSR and increase downgradient. This suggests the possibility that tailings are present in the alluvium.

The aquatic survey indicated potential metals impacts to benthic macroinvertebrate populations in Glacier Creek, Seventysix Gulch and the SFRS, but noted that further surface water and sediment sampling are needed to determine whether observed population anomalies are primarily due to chemical contaminates. In addition, rainbow trout/steelhead, cutthroat trout, and bull trout are known to inhabit Glacier Creek and SFSR in the vicinity of the MCMA. These fish also likely inhabit the lower portions of Seventysix Gulch.

Soil Pathway

The soil exposure pathway is complete for both human and ecological receptors, and a release of hazardous substances has been documented in this SI. This is based on concentrations of antimony, arsenic, cadmium, copper, lead, mercury, selenium, silver, thallium, and zinc in wasterock, tailings, and soil samples exceeding both the 90UCL of background soil concentration and one or more comparison criteria, including soil pH. It should be noted that most background soil pH values are acidic.

Metal concentrations in background soils are elevated; all ten background samples exceeded one or more comparison criteria for arsenic, chromium, mercury, vanadium, and zinc; three background samples exceeded criteria for selenium; two exceeded criteria for antimony and copper; and one each for lead and manganese. However, ten metals were detected in wasterock, tailings, and soil samples at concentrations exceeding both the 90UCL for background soil and one or more comparison criteria. In addition, the

Concentrator, Ore Collector, and Assay Shack each had one sample that detected over 80,000 mg/kg total arsenic.

Analyses of ABAs indicated waste material, specifically ore and onsite soil, has the potential to produce acid rock drainage. One of the 15 samples analyzed for TCLP and SPLP exceeded the RCRA and Ecology TCLP Hazardous/Dangerous Waste limit. Numerous federal and state RTE mammals, birds, and herpetiles have potential habitat in the vicinity of the MCMA, thus the potential exists that ecological receptors could be affected.

Air Pathway

The air pathway is complete because metal contaminated soil, wasterock, tailings, and ore are concentrated at the surface where human and ecological receptors could be exposed. The most probable air pathway is due to inhalation of particulate matter. However, addressing and/or eliminating the soil exposure pathway will render the air exposure pathway incomplete. Therefore, further assessment of the air pathway is not recommended.

Recommendations

Based on the information gathered as part of the SI and presented in this report, CES recommends performing an EECA at the MCMA. The EECA should include a Data Gap Investigation. The specific items that should be addressed in a Data Gap Investigation include the following:

- The conclusions presented are based on aquatic samples collected during moderately-high flow conditions. Water and sediment concentrations are likely to differ with the change in flow rates within the SFSR and other tributaries. CES recommends that an additional sampling event be performed to determine surface water and sediment concentrations during low flow conditions (typically in the fall).
- As part of the EECA, a risk assessment should be performed to assess the human and ecological impacts, establish removal cleanup standards, and assess if a removal action is warranted.
- The extent and depth of waste, particularly in the Concentrator vicinity, require additional delineation. CES recommends that additional sampling be completed with the aid of a small excavator and portable XRF instrument to complete this deficiency. This should include additional work at the Assay Shack as well as the Concentrator and Ore Collector. This data gap could be performed as part of a removal action, if warranted.
- The investigation of the haulage ways was limited by the SI scope to five widely spaced samples. CES recommends that a portable XRF instrument be used to more accurately delineate contaminant extent, including all tramway terminals. This data gap could be performed as part of a removal action, if warranted.
- Detailed sampling and surveying of the Mystery Mine and Justice Mine were beyond the scope of the SI. CES recommends that both sites be sampled in greater detail and to greater depths and surveys be completed to allow an accurate determination of volumes and extent of contamination.
- Land ownership within the Monte Cristo Townsite, the Concentrator, and the Ore Collector is a complex mix of private and Forest Service ownership. Boundaries should be clearly marked so owners can be notified rapidly about potential activity on their properties. This data gap could be performed as part of a removal action, if warranted.
- An unknown volume of tailings was apparently discharged to Glacier Creek. The extent of downstream transport and any attendant contamination should be investigated in more detail than this SI.

- This SI was focused on only the largest and most obvious contaminant sources, the Mystery and Justice Mines, the Concentrator, the Ore Collector, and the Assay Shack. There are at least 54 mines and prospects within the Glacier Creek and Seventysix Gulch drainage basin, and the overall distribution of contaminant contribution (including natural contribution) is unknown. CES recommends that the Forest Service use a more basin-wide assessment approach in Glacier Creek and Seventysix Gulch to better understand relative contaminant source contribution. Because of the number of mines and prospects, CES recommends that future work begin with mines very near the major surface water bodies. This type of effort should be expanded as information is gained. This will allow better and more focused allocation of resources to decrease the overall metal loading to SFSR.
- The Forest Service should considered a Time Critical Removal Action or better access control for the small volume (100 cy) of apparent "spilled concentrate" near the Concentrator, because the material is a dangerous waste.

Forest Service Disclaimer: This abandoned mine/mill site was created under the General Mining Law of 1872 and is located solely on National Forest System (NFS) lands administered by the USDA Forest Service. The United States has taken the position and courts have held that the United States is not liable as an "owner" under CERCLA Section 107 for mine contamination left behind on NFS lands by miners operating under the 1872 Mining Law. Therefore, USDA Forest Service believes that this site 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 this site on the Federal Agency Hazardous Waste Compliance Docket.

Prepared by:

CASCADE EARTH SCIENCES

MaryAnn Amann, RG
Senior Geologist

CASCADE EARTH SCIENCES

Robert Lambeth PE, RPH,
Senior Engineer

Reviewed by:

CASCADE EARTH SCIENCES

Dustin Wasley, PE
Program Manager

REFERENCES

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling, 1999. *Rapid Bioassessment Protocols for Use in-streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish.* Second Edition. U.S. Environmental Protection Agency. Office of Water. EPA 841-B-99-002.

CES, 2005. Field Operations Plan – Site Inspection of the Monte Cristo Mill Site and Mystery Mine, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington. Cascade Earth Sciences.

Crofoot, G.W., and M.L. O'Brien, 2004. Monte *Cristo Mine Area Site Hazard Assessment*. Snohomish Health District and Washington Department of Ecology. January 2004.

Derkey, R.E., N.L. Joseph, and R. Lasmanis, 1990. Metal Mines of Washington-Preliminary Report: Washington Department of Natural Resources, Division of Geology and Earth Resources Open File Report 90-18. p. 577.

Forest Service, 2002. *Abbreviated Preliminary Assessment - Monte Cristo Concentrator, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington.* October 2002.

Forest Service, 2003. *Abbreviated Preliminary Assessment - Mystery Mine, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington.* February 2003.

Forest Service, 2006a. *Abbreviated Preliminary Assessment – Sidney Mine in the Monte Cristo Mining District, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington.* September 2006.

Forest Service, 2006b. *Abbreviated Preliminary Assessment - Pride of Woods, New Discovery, and Pride of Mountains Mines in the Monte Cristo Mining District, Mt. Baker-Snoqualmie National Forest, Snohomish County, Washington.* September 2006.

Huntting, T. Marshall, 1956. *Inventory of Washington Minerals: Part II- Metallic Minerals.* Washington Division of Mines and Geology. Bulletin 37, Part II, 2v.

Johnson, F.L., David K. Denton, Stephen R. Iverson, Robin B. McCulloch, Scott A. Stebbins, and Ronald B. Stotelmeyer, 1983. *Summary Report – Mineral Resources of the Glacier Peak RARE II Area (No. L 6031), Snohomish County, Washington*, U.S. Bureau of Mines, MLA 75-83

Northwest Underground Explorations, 1997. Discovering Washington's Historic Mines, Volume 1: The West Central Cascade Mountains. Oso Publishing. Arlington, WA. p. 230.

Orr, E.L., and Orr, W.N., 2002. Geology of the Pacific Northwest. McGraw-Hill Higher Education. New York, New York. p. 337.

USEPA, 1992. *Guidance for Performing Site Inspections Under CERCLA.*

USFWS, 1995. *National Wetlands Inventory, Monte Cristo, Washington.* U.S. Department of the Interior. Fish and Wildlife Service.

USGSa, 1982. 7.5 Minute Topographic Map, Blanca Lake, Washington. U.S. Geological Survey.

USGSb, 1982. 7.5 Minute Topographic Map, Monte Cristo, Washington. U.S. Geological Survey.

USGS, 1991. *Geologic Map of Washington*, U.S. Geological Survey, Reston, VA.

WRCCa, 2006. Period of Record Monthly Climate Summary for Scenic (Station 457379) Washington, Period of Record 6/1/1948 to 7/25/1970. Western Regional Climate Center. http://wrcc.dri.edu.

WRCCb, 2006. Period of Record Monthly Climate Summary for Stevens Pass (Station 458089) Washington, Period of Record 10/26/1950 to 4/30/1994. Western Regional Climate Center. http://wrcc.dri.edu.

WNHP, 2003. *List of Known Occurrences of Rare Plants and Animals in Washington*, Washington. Natural Heritage Information System.

Wolff, F.E., D.T. McKay, Jr., and D.K. Norman, 2003. *Inactive And Abandoned Mine Lands – Mystery and Justice Mines, Monte Cristo Mining District, Snohomish County, Washington.* Washington Department of Natural Resources, Division of Geology and Earth Resources, Open file Report 2003-7, p. 22. April 2003.

TABLES

Table 1. Surface Water Analytical Results
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample I.D.	Sample Date	Sampling Group (CES, WADNR, USFS, DOE)	Aluminum, TR M200.7	Antimony, TR M200.7	Arsenic (III), TR M1632 Mod.	Arsenic (V), TR Calculated	Arsenic Total, TR M200.8	Barium, TR M200.7	Beryllium, TR M200.7	Cadmium, TR M200.7	Calcium, TR M200.7	Chromium VI, Total Field	Chromium, TR M200.7	Cobalt, TR M200.7	Copper, TR M200.7	Iron, TR* M200.7	Lead, TR M200.8	Magnesium, TR M200.7	Manganese, TR* M200.7	Mercury, Total M245.1	Mercury, Total, UltraTrace M1631, Rev. E	Mercury, Methyl, UltraTrace M1630	Nickel, TR M200.7	Potassium, TR M200.7	Selenium, TR M200.8	Silver, TR M200.7	Sodium, TR M200.7	Thallium, TR M200.8	Vanadium, TR M200.7	Zinc, TR M200.7
			Results in µg/L																											
Glacier Creek																														
GC-SW1 (Background)	6/2/2005	CES	< 30	< *20*	0.041	< 2.959	< *3.0*	6.2	< *2*	< *2*	2,910	10	< 6	< 6	< *10*	< 60	< *3*	476	< 4	< *0.2*	0.00289	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
MC-GC-9 (Background)	8/2/2006	USFS	NA	3.5	NA	NA	< *0.37*	NA	NA	< 0.037	NA	NA	NA	NA	1.0 J	NA	0.21 J	NA	NA	NA	NA	NA	0.35 J	NA	NA	NA	NA	NA	NA	5.2
GC-SW2 (Background)	6/2/2005	CES	< 30	< *20*	NA	NA	< *3.0*	10.1	< *2*	< *2*	3,050	ND	< 6	< 6	< *10*	< 60	< *3*	434	< 4	< *0.2*	0.00218	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
WADNR - No ID (Background - High Flow)	6/2001	WADNR	NA	NA	NA	NA	0.28	NA	NA	NA	NA	NA	NA	NA	< 0.02	NA	< 0.02	NA	NA	NA	0.0042	NA	NA	NA	NA	NA	NA	NA	NA	< 0.2
WADNR - 348072/73 (Background - Low Flow)	8/2001	WADNR	NA	NA	NA	NA	4.52	NA	NA	NA	NA	NA	NA	NA	0.264	NA	0.032	NA	NA	NA	< 0.002	NA	NA	NA	NA	NA	NA	NA	NA	1.8 B
SHA-3394090 (Background)	9/25/2003	DOE	NA	1.8 B	NA	NA	1.7	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	< 0.5	NA	< 0.10	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
SHA-3394091 (near POTM)	9/25/2003	DOE	NA	1.9 B	NA	NA	**3.8**	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	< 0.5	NA	0.14	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
SHA-3394094 (near POTM)	9/25/2003	DOE	NA	1.9 B	NA	NA	**3.6**	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	< 0.5	NA	0.10	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
MC-GC-5 (above New Discovery, below POTM)	8/2/2006	USFS	NS	4.0	NA	NA	**1.6 J**	NA	NA	< 0.037	NA	NA	NA	NA	0.44 J	NA	0.08 J	NA	NA	NA	NA	NA	0.39 J	NA	NA	NA	NA	NA	NA	3.1 J
MC-GC-3 (above POTW, below New Discovery)	8/2/2006	USFS	NS	**5.5**	NA	NA	**6.0**	NA	NA	< 0.037	NA	NA	NA	NA	0.53 J	NA	0.14 J	NA	NA	NA	NA	NA	0.55 J	NA	NA	NA	NA	NA	NA	**3.7 J**
MC-GC-1 (below POTW)	8/2/2006	USFS	NS	4.2	NA	NA	**2.0**	NA	NA	< 0.037	NA	NA	NA	NA	**1.6 J**	NA	0.14 J	NA	NA	NA	NA	NA	1.4 J	NA	NA	NA	NA	NA	NA	**4.6 J**
GC-SW3	6/2/2005	CES	< 30	< *20*	**0.125**	**4.375**	**4.5**	**8.5**	< *2*	< *2*	**3,100**	ND	< 6	< 6	< *10*	< 60	< *3*	**415**	< 4	< *0.2*	0.00088	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
GC-SW4	6/2/2005	CES	< 30	< *20*	NA	NC	**5.7**	**8.3**	< *2*	< *2*	**2,990**	ND	< 6	< 6	< *10*	< 60	< *3*	**407**	< 4	< *0.2*	0.00179	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
SHA-3374084 (below Concentrator)	9/12/2003	DOE	NA	1.3	NA	NA	**7.89**	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	0.67	NA	0.13	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
SHA-3394093 (below Concentrator)	9/25/2003	DOE	NA	1.9 B	NA	NA	**12.2**	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	0.55	NA	0.29	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	6.2
GC-SW5	6/1/2005	CES	< 30	< *20*	NA	NA	**7.7**	5.9	< *2*	< *2*	2,660	ND	< 6	< 6	< *10*	< 60	< *3*	**357**	< 4	< *0.2*	0.00090	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
WADNR - No ID (Background - High Flow)	6/2001	WADNR	NA	NA	NA	NA	**7.37**	NA	NA	NA	NA	NA	NA	NA	0.31	NA	0.02	NA	NA	NA	0.0058	NA	NA	NA	NA	NA	NA	NA	NA	**5.04**
WADNR - 348076/77 (Background - Low Flow)	8/2001	WADNR	NA	NA	NA	NA	**9.24**	NA	NA	NA	NA	NA	NA	NA	0.27	NA	< 0.02	NA	NA	NA	< 0.002	NA	NA	NA	NA	NA	NA	NA	NA	**5.58**
Seventysix Creek																														
76G-SW1 (Background)	6/3/2005	CES	< 30	< *20*	**0.058**	< 2.942	< *3*	3.6	< *2*	< *2*	2,270	NM	< 6	< 6	< *10*	< 60	< *3*	150	< 4	< *0.2*	0.00078	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
76G-SW1 (200.8) (Background)	6/3/2005	CES	NA	< 5	NA	NA	0.45	NA	NA	< *0.12*	NA	NM	NA	NA	< 1	NA	< *0.55*	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
MC-76-1 (Background)	8/3/2006	USFS	NS	3.8	NA	NA	5.8	NA	NA	< 0.037	NA	NA	NA	NA	1.3 J	NA	0.23 J	NA	NA	NA	NA	NA	4.7	NA	NA	NA	NA	NA	NA	7.9
SHA-3374080 (Background)	9/11/2003	DOE	NA	0.48	NA	NA	< *0.5*	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	0.18	NA	0.12	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
SHA-3374081 (near Sidney Mine)	9/11/2003	DOE	NA	2.22	NA	NA	**9.64**	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	0.26	NA	0.19	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
MC-76-3 (below Sidney Mine)	8/3/2006	USFS	NS	3.1	NA	NA	< *0.37*	NA	NA	< 0.037	NA	NA	NA	NA	0.6 J	NA	0.34 J	NA	NA	NA	NA	NA	0.28 J	NA	NA	NA	NA	NA	NA	**5.2**
76G-SW2	6/3/2005	CES	< 30	< *20*	NA	NA	**9.5**	< 2	< *2*	< *2*	**3,140**	NM	< 6	< 6	< *10*	< 60	< *3*	279	< 4	< *0.2*	0.00051	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
76G-SW2 (200.8)	6/3/2005	CES	NA	< 5	NA	NA	NA	NA	NA	< *0.12*	NA	NM	NA	NA	< 1	NA	**0.68**	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
South Fork Sauk River																														
SFSR-SW1	6/1/2005	CES	< 30	< *20*	**0.147**	**9.253**	**9.4**	4	< *2*	< *2*	**2,750**	NM	< 6	< 6	< *10*	< 60	< *3*	309	< 4	< *0.2*	0.00077	NA	< *10*	< 500	< *3*	< *5*	< 500	< *2*	< 5	< 10
SFSR-SW1 (200.8)	6/1/2005	CES	NA	< 5	NA	NA	NA	NA	NA	< *0.12*	NA	NM	NA	NA	< 1	NA	< *0.55*	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
SFSR-SW2	6/1/2005	CES	< 30	< *20*	NA	NA	**11.3**	3.7	< *2*	< *2*	**2,780**	NM	< 6	< 6	< *10*	< 60	< *3*	313	< 4	< *0.2*	0.00045	NA	< *10*	< 500	< *3*	< *5*	510	< *2*	< 5	< 10
SFSR-SW2 (200.8)	6/1/2005	CES	NA	< 5	NA	NA	NA	NA	NA	< *0.12*	NA	NM	NA	NA	< 1	NA	< *0.55*	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
SFSR-SW3	6/1/2005	CES	< 30	< *20*	**0.243**	**12.157**	**12.4**	3.4	< *2*	< *2*	**3,280**	NM	< 6	< 6	< *10*	< 60	< *3*	309	< 4	< *0.2*	0.00042	< 0.000020	< *10*	< 500	< *3*	< *5*	550	< *2*	< 5	< 10
SFSR-SW3 (200.8)	6/1/2005	CES	NA	< 5	NA	NA	NA	NA	NA	< *0.12*	NA	NM	NA	NA	< 1	NA	< *0.55*	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
SHA-3374085 (at Lake MC)	9/12/2003	DOE	NA	**5.44**	NA	NA	**27.4**	NA	< 0.10	< *0.10*	NA	NA	< 0.5	NA	1.41	NA	**0.63**	NA	NA	< *0.05*	NA	NA	< 0.5	NA	NA	< 0.10	NA	< 0.10	NA	< 5.0
Mystery Mine																														
MM-AS-01	9/9/2005	CES	**1,160**	**31.2**	1.70 H	**1,358.3**	**1,360**	2.5	< 0.66	**30.3**	**69,200**	NM	< 6	**15**	**675**	**16,400**	**37.5**	**25,200**	**4,230**	< *0.2*	NA	NA	< 10	**1,210**	< 0.62	0.22	**4,420**	0.36	< 5	**6,590**
WADNR - WMYS2 (Adit 3 discharge)	4/2003	WADNR	NA	NA	NA	NA	**3,300**	NA	NA	NA	NA	NA	NA	NA	**710**	**48,000**	**110**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6,100**
WADNR - WMYS1 (base of WR dump))	4/2003	WADNR	NA	NA	NA	NA	**1,100**	NA	NA	NA	NA	NA	NA	NA	**700**	**12,000**	< 100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6,000**
Justice Mine																														
SHA-3374082 (at Justice Mine)	9/12/2003	DOE	NA	**11.3**	NA	NA	**235**	NA	< 0.10	0.14	NA	NA	< 0.5	NA	**4.22**	NA	**1.26**	NA	NA	< *0.05*	NA	NA	0.92	NA	NA	< 0.10	NA	< 0.10	NA	**21**
SHA-3374083 (below Justice Mine)	9/12/2003	DOE	NA	**11.6**	NA	NA	**264**	NA	< 0.10	0.48	NA	NA	< 0.5	NA	**2.83**	NA	**0.74**	NA	NA	< *0.05*	NA	NA	1.19	NA	NA	< 0.10	NA	< 0.10	NA	**56.8**
WADNR - WJUS1 (Adit 3 dump)	4/2003	WADNR	NA	NA	NA	NA	**200**	NA	NA	NA	NA	NA	NA	NA	**< 100**	< 1,000	< 100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	< 100
JM-AS-01	9/10/2005	CES	< 30	**10.3**	1.08 H	**204.9**	**206**	2.8	< 0.66	0.15	**33,900**	NM	< 6	< 6	< 3	< 60	< 0.6	**4,010**	**12.4**	< *0.2*	NA	NA	< 10	**630**	< 0.62	< 0.12	**4,240**	< 0.24	< 5	**19**
New Discovery																														
MC-GC-4 (seep along GC, below New Discovery)	8/2/2006	USFS	NS	4.9	NA	NA	**2.8**	NA	NA	< 0.037	NA	NA	NA	NA	0.77 J	NA	0.05 J	NA	NA	NA	NA	NA	0.51 J	NA	NA	NA	NA	NA	NA	**7.9**
WADNR - NEWDISCH20 (Adit 2 discharge)	4/2003	WADNR	NA	NA	NA	NA	**30**	NA	NA	< 5	NA	NA	NA	NA	< 10	**729**	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**225**
Pride of the Mountain																														
MC-GC-6 (Adit 1 discharge)	8/2/2006	USFS	NS	**30**	NA	NA	**1,100**	NA	NA	**11**	NA	NA	NA	NA	**560**	NA	**100**	NA	NA	NA	NA	NA	1.3 J	NA	NA	NA	NA	NA	NA	**1,600**
WADNR - PR-MTS (Adit 1 discharge)	4/2003	WADNR	NA	NA	NA	NA	**6,350**	NA	NA	**40**	NA	NA	NA	NA	**2,640**	**17,700**	**562**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5,170**
Sidney Mine																														
MC-76-2 (Adit discharge)	8/3/2006	USFS	NS	1.5 J	NA	NA	**19**	NA	NA	< 0.037	NA	NA	NA	NA	0.74 J	NA	0.1 J	NA	NA	NA	NA	NA	0.32 J	NA	NA	NA	NA	NA	NA	**4.9 J**
Background Mean			< 30	4.58	0.050	0.936	1.80	6.6	< *2*	< *2*	2,743	NC	< 6	< 6	1.50	< 60	0.436	353	< 4	< *0.2*	0.0022	NC	2.6	< 500	< *3*	1.5	< 500	0.52	< 5	3.89
Standards, corrected for hardness where applicable (used 8.37 mg/L average for surface water samples, excluding portal and other seeps)																														
Washington - Aquatic Life (Chronic) [1]			NS	NS	NS	NS	*190*	NS	NS	0.16	NS	*10*	NS	NS	1.4	NS	0.14	NS	NS	0.012	0.012	NS	31.3	NS	5	NS	NS	NS	NS	12.96
Washington - Human Health [2]			NS	14	NS	NS	0.018	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.14	0.14	NS	610	NS	170	NS	NS	1.7	NS	NS
Washington Drinking Water Criteria [3]			NS	6	NS	NS	10	2,000	4	5	NS	NS	100	NS	NS	300	NS	NS	50	2	2	NS	100	NS	50	100	NS	2	NS	50,000
EPA - Aquatic Life (CCC) [4]			87	NS	NS	NS	*150*	NS	NS	0.044	NS	11	NS	NS	*1.1*	1,000	*0.156*	NS	NS	*0.77*	*0.77*	NS	*6.4*	NS	5	NS	NS	NS	NS	14.45
EPA - Human Health (Water+Organism) [5]			NS	5.6	NS	NS	*0.018*	1,000	NS	NS	NS	NS	NS	NS	1,300	300	NS	NS	50	NS	NS	NS	610	NS	170	NS	NS	1.7	NS	7,400
ORNL - Surface Water PRGs [6]			87	30	190	3.1	NS	4	0.66	1.10	NS	11	NS	23	12	1,000	3.20	NS	120	1.3	1.3	0.0026	160	NS	0.39	0.36	NS	9	20	110

GENERAL NOTES:

All CES samples (except Arsenic (III,) Mercury, UltraTrace, & Mercury, Methyl) were conducted by SVL Analytical, Inc., Kellogg, ID following digestion by M200.2.
Arsenic (III), Mercury, UltraTrace, & Mercury, Methyl anlyses were conducted by Brooks Rand, Seattle, WA
Arsenic (V) was calculated from the difference between Arsenic, TR and Arsenic (III), TR
mg/L = Milligrams per liter
µg/L = Micrograms per liter
su = Standard Units
mS = MicroSiemans
< value = Analyte not detected above Method Detection Limit (MDL)
J = Analyte detected between MDL and Practical Quantification Limit (PQL) therefore concentration is estimated
Shaded cells indicate that the value exceeds one or more standard; corresponding criteria also shaded.
Italic values indicate that the MDL exceeds the lowest standard
H = Holding time exceeded.
NM = Not Measured
NA = Not Analyzed
NC = Not Calculated
ND = Not Detected (no MDL provided)
NC = Not Calculated
Bolding indicates an exceedence of background mean (Note - background samples that exceed the mean background concentration are not bolded)
SHA = Site Hazard Assessment Results (Crofoot and O'Brian, 2004)
WADNR = Washington Department of Natural Resources Results (Wolff, McKay, and Norman, 2003)
USFS = USFS Region 6 APAs (Graham, 2006)
(200.8) = Second analyses of selected elements by low level detection ICP-MS

STANDARD NOTES

1 - State of Washington Aquatic Life criteria (WAC 173-201A), underline - corrected for hardness
2 - State of Washington criteria for protection of human health (CLARC-Part IIIf)
3 - State of Washington drinking water criteria (WAC 246-290)
4 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life used (EPA, 2002), underline - corrected for hardness, *italics* - expressed as Dissolved
5 - EPA recommended ambient water quality criteria for protection of human consumption of water and fish (EPA, 2002 NTR), *italics* - expressed as Dissolved
6 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997), underline - corrected for an assumed hardness of 100 mg/L
NS = No Standard

Table 1. Surface Water Analytical Results (continued)
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample I.D.	Sample Date	Sampling Group (CES, WADNR, USFS, DOE)	Flow Rate	Temperature (Field)	pH (Field)	pH (Lab) M150.1	Turbidity (Field)	Conductivity (Field)	Conductivity @25C (Lab) M120.1	Dissolved Oxygen (Field)	Oxygen Reduction Potential (Field)	Hardness as $CaCO_3$, TR M2340B	TDS (Field)	TDS, Residue, Filterable @180C M160.1	TSS, Residue, Non-Filterable @105C M160.2	Cyanide-Toal M335.2	Cyanide-WAD M45001	Sulfate M300.0
			cfs	°C	su	su	NTU	µS/cm	µS/cm	mg/L	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Glacier Creek																		
GC-SW1 (Background)	6/2/2005	CES	3.68	2.52	6.7	7.02	20	23	24.0	11.53	243	9.15	10	< 10	< 5.0	< 0.01	< 0.01	1.57
MC-GC-9 (Background)	8/2/2006	USFS	NM	7.9	6.91	NA	5	51	NA	11.49	178	8.0	30	NA	NA	NA	NA	1.3
GC-SW2 (Background)	6/2/2005	CES	15.05	3.4	6.9	6.99	3	24	24.0	11.45	248	9.66	20	13	< 5.0	NA	NA	1.72
WADNR - No ID (Background - High Flow)	6/2001	WADNR	32	2.2	7.33	NA	NM	18	NA	NA	NM	8.13	NA	NA	NA	NA	NA	NA
WADNR - 348072/73 (Background - Low Flow)	8/2001	WADNR	7.5	3.3	6.78	NA	NM	19	NA	NA	NM	6.92	NA	NA	NA	NA	NA	NA
SHA-3394090 (Background)	9/25/2003	DOE	NM	7.14	7.21	NA	NM	NM	18	10.16	NM	8.15	NM	12	NA	NA	NA	1.16
SHA-3394091 (near POTM Mine)	9/25/2003	DOE	NM	7.43	7.06	NA	NM	NM	18	9.71	NM	8.48	NM	NA	NA	NA	NA	NA
SHA-3394094 (near POTM Mine)	9/25/2003	DOE	NM	4.74	6.91	NA	NM	NM	21	8.98	NM	8.44	NM	NA	NA	NA	NA	NA
MC-GC-5 (above New Discovery, below POTM)	8/2/2006	USFS	NM	9.1	6.65	NA	3	36	NA	10.96	191	7.0	20	NA	NA	NA	NA	1.6
MC-GC-3 (above POTW, below New Discovery)	8/2/2006	USFS	NM	9.6	6.44	NA	2	45	NA	11.49	213	8.0	30	NA	NA	NA	NA	1.7
MC-GC-1 (below POTW)	8/2/2006	USFS	NM	6.8	7.11	NA	3	39	NA	12.44	164	9.0	30	NA	NA	NA	NA	1.8
GC-SW3	6/2/2005	CES	14.13	3.1	6.7	7.04	14	25	22.0	11.56	183	9.75	20	< 10	< 5.0	NA	NA	1.82
GC-SW4	6/2/2005	CES	NM	3.32	6.6	7.03	25	24	21.0	11.88	224	9.71	20	< 10	< 5.0	NA	NA	1.92
SHA-3374084 (below Concentrator)	9/12/2003	DOE	NM	NM	NM	NA	NM	NM	NA	NM	NM	7.92	NM	NA	NA	NA	NA	NA
SHA-3394093 (below Concentrator)	9/25/2003	DOE	NM	NM	NM	NA	NM	NM	NA	NM	NM	9.46	NM	NA	NA	NA	NA	NA
GC-SW5	6/1/2005	CES	37.71	6.26	6.8	6.98	20	22	20.0	11.15	240	8.38	10	< 10	< 5.0	NA	NA	2.48
WADNR - No ID (Background - High Flow)	6/2001	WADNR	83	7.2	7.15	NA	NA	19	NA	NA	NM	7.38	NA	NA	NA	NA	NA	NA
WADNR - 348076/77 (Background - Low Flow)	8/2001	WADNR	20	7.2	7.02	NA	NA	19	NA	NA	NM	6.80	NA	NA	NA	NA	NA	NA
Seventysix Creek																		
76G-SW1 (Background)	6/3/2005	CES	0.71	4.58	6.9	7.00	19	16	14.0	11.08	214	6.13	10	< 10	< 5.0	< 0.01	< 0.01	0.48
MC-76-1 (Background)	8/3/2006	USFS	NM	6.4	5.98	NA	1	40	NA	11.94	288	9	30	NA	NA	NA	NA	1.6
SHA-3374080 (Background)	9/11/2003	CES	NM	NM	NM	NA	NM	NM	NA	NM	NM	4.83	NM	NA	NA	NA	NA	NA
SHA-3374081 (near Sidney Mine)	9/11/2003	DOE	NM	NM	NM	NA	NM	NM	NA	NM	NM	9.48	NM	NA	NA	NA	NA	NA
MC-76-3 (below Sidney Mine)	8/3/2006	USFS	NM	7.0	6.37	NA	1	40	NA	12.05	266	8	30	NA	NA	NA	NA	1.8
76G-SW2	6/3/2005	CES	11.19	4.88	6.6	6.69	21	24	20.0	12.05	217	9.19	20	< 10	< 5.0	NA	NA	1.70
South Fork Sauk River																		
SFSR-SW1	6/1/2005	CES	54.7	6.04	6.8	6.58	57	22	19.0	11.29	201	7.83	10	< 10	< 5.0	< 0.01	< 0.01	2.22
SFSR-SW2	6/1/2005	CES	41.17	6.42	6.7	6.72	18	22	19.0	11.12	234	8.14	10	< 10	< 5.0	NA	NA	2.50
SFSR-SW3	6/1/2005	CES	76.09	6.84	6.0	6.91	72	26	22.0	11.69	217	9.43	20	< 10	< 5.0	< 0.01	< 0.01	2.66
SHA-3374085 (at Lake MC)	9/12/2003	DOE	NM	11.19	7.04	NA	NM	NM	29	9.44	NM	12.1	NM	NA	NA	NA	NA	NA
Mystery Mine																		
MM-AS-01	9/9/2005	CES	0.01	3.2	3.81	3.5	NM	NM	744	9.1	465	278	NM	470	32	NA	NA	302
WADNR - WMYS1 (base of WR dump))	4/2003	WADNR	0.01	10.5	4.4	NA	NM	578	NA	NM	NM	250	NM	NA	NA	NA	NA	NA
WADNR - WMYS2 (Adit 3 discharge)	4/2003	WADNR	0.09	4.4	4.4	NA	NM	570	NA	NM	NM	240	NM	NA	NA	NA	NA	NA
Justice Mine																		
SHA-3374082 (at Justice Mine)	9/12/2003	DOE	NM	4.87	8.12	NA	NM	NM	241	10.85	NM	104	NM	NA	NA	NA	NA	NA
SHA-3374083 (below Justice Mine)	9/12/2003	DOE	NM	NM	NM	NA	NM	NM	NA	NM	NM	99.5	NM	NA	NA	NA	NA	NA
WADNR - WJUS1 (Adit 3 dump)	4/2003	WADNR	< 0.01	11.7	5.0	NA	NM	NA	150	NM	NM	60	NM	NA	NA	NA	NA	NA
JM-AS-01	9/10/2005	CES	0.27	4.2	6.03	7.17	NM	NM	229	9.1	191	98.9	NM	155	< 5	NA	NA	57.6
New Discovery Mine																		57.6
MC-GC-4 (seep along GC, below New Discovery)	4/2003	USFS	NM	6.1	6.81	NA	3	49	NA	12.94	173	9.0	30	NA	NA	NA	NA	NA
WADNR - NEWDISCH20 (Adit 2 discharge)	4/2003	WADNR	< 0.01	7.8	6.7	NA	NM	NM	290	NM	NM	130	NM	NA	NA	NA	NA	NA
Pride of the Mountain																		
MC-GC-6 (Adit 1 discharge)	4/2003	USFS	NM	5.2	6.6	NA	3	316	NA	13.25	208	99	200	NA	NA	NA	NA	NA
WADNR - PR-MTS (Adit 1 discharge)	4/2003	WADNR	< 0.01	7.8	7.7	NA	NM	NM	260	NM	NM	160	NM	NA	NA	NA	NA	NA
Sidney Mine																		
MC-76-2 (Adit discharge)	8/3/2006	USFS	NM	5.6	6.42	NA	7	54	NA	12.24	263	9	40	NA	NA	NA	NA	NA
Standards																		
Washington - Aquatic Life (Chronic) [1]			NS	12	6.5-8.5	6.5-8.5	5x>Bkg	NS	NS	9.5	NS	NS	NS	NS	NS	NS	0.0052	NS
Washington - Human Health [2]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.7	NS	NS
Washington Drinking Water Criteria [3]			NS	NS	6.5-8.5	6.5-8.5	NS	700	700	NS	NS	NS	500	500	NS	0.2	NS	250
EPA - Aquatic Life (CCC) [4]			NS	9-19	6.5-9	6.5-9	NS	NS	NS	9.5	NS	NS	NS	NS	NS	NS	0.0052	NS
EPA - Human Health (Water+Organism) [5]			NS	NS	5-9	5-9	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.7	NS	NS
ORNL - Surface Water PRGs [6]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0052	NS	NS

GENERAL NOTES:
All analyses except Arsenic (III,) Mercury, UltraTrace, & Mercury, Methyl were conducted by SVL Analytical, Inc., Kellogg, ID following digestion by M200.2
Arsenic (III), Mercury, UltraTrace, & Mercury, Methyl anlyses were conducted by Brooks Rand, Seattle, WA
Arsenic (V) was calculated from the difference between Arsenic, TR and Arsenic (III), TR
mg/L = Milligrams per liter
µg/L = Micrograms per liter
su = Standard Units
mS = MicroSiemans
< value = Analyte not detected above Method Detection Limit (MDL)
Shaded cells indicate that the value exceeds one or more standard; corresponding criteria also shaded.
Bolding indicates an exceedence of background mean (Note - background samples that exceed the mean background concentration are not bolded)
Italic values indicate that the MDL exceeds the lowest standard
H = Holding time exceeded.
NM = Not Measured
NA = Not Analyzed
NC = Not Calculated
ND = Not Detected
SHA = Site Hazard Assessment Results (Crofoot and O'Brian, 2004)
WADNR = Washington Department of Natural Resources Results (Wolff, McKay, and Norman, 2003)
USFS = USFS Region 6 APAs (Graham, 2006)

STANDARD NOTES
1 - State of Washington Aquatic Life criteria (WAC 173-201A), underline - corrected for hardness
2 - State of Washington criteria for protection of human health (CLARC-Part IIIf)
3 - State of Washington drinking water criteria (WAC 246-290)
4 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life used (EPA, 2002). underline - corrected for hardness, *italics* - expressed as Dissolved
5 - EPA recommended ambient water quality criteria for protection of human consumption of water and fish (EPA, 2002 NTR), *italics* - expressed as Dissolved
6 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997),underline - corrected for an assumed hardness of 100 mg/L
NS = No Standard

Table 2. Pore Water Analytical Results
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample I.D.	Sample Date	Sampling Group	Aluminum, Diss. M200.7	Antimony, Diss. M200.7	Arsenic (III), TR M1632 Mod.	Arsenic (V), TR Calculated	Arsenic Total, Diss. M200.8	Barium, Diss. M200.7	Beryllium, Diss. M200.7	Cadmium, Diss. M200.7	Calcium, Diss. M200.7	Chromium VI, Diss. Field	Chromium, Diss. M200.7	Cobalt, Diss. M200.7	Copper, Diss. M200.7	Iron, Diss.* M200.7	Lead, Diss. M200.8	Magnesium, Diss. M200.7	Manganese, Diss.* M200.7	Mercury, Diss. M245.1	Mercury, Diss., UltraTrace M1631, Rev. E	Mercury, Methyl, UltraTrace M1630	Nickel, Diss. M200.7	Potassium, Diss. M200.7	Selenium, Diss. M200.8	Silver, Diss M200.7	Sodium, Diss. M200.7	Thallium, Diss. M200.8	Vanadium, Diss. M200.7	Zinc, Diss. M200.7
			Results in µg/L																											
Glacier Creek																														
GC-PW1 (Background)	6/2/2005	CES	< 30	< *20*	< 0.008	< 2.992	< 3.0	8.4	< *2*	< *2*	3,410	10	< 6	< 6	< *10*	< 60	< *3*	510	< 4.0	< *0.2*	0.00216	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
GC-PW2 (Background)	6/2/2005	CES	< 30	< *20*	NA	NC	< 3.0	42.3	< *2*	< *2*	4,550	10	< 6	< 6	< *10*	< 60	< *3*	522	5.8	< *0.2*	0.00070	NA	< *10*	< 500	< 3	< *5*	670	< 2	< 5	18
GC-PW3	6/2/2005	CES	< 30	< *20*	**0.021** B	**3.779**	**3.8**	9.6	< *2*	< *2*	3,030	**20**	< 6	< 6	< *10*	< 60	< *3*	384	< 4.0	< *0.2*	0.00087	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
GC-PW5	6/1/2005	CES	< 30	< *20*	**0.138**	**7.462**	**7.6**	5.7	< *2*	< *2*	2,620	NM	< 6	< 6	< *10*	< 60	< *3*	363	< 4.0	< *0.2*	0.00043	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
Seventysix Creek																														
76G-PW1 (Background)	6/3/2005	CES	< 30	< *20*	< 0.008	< 2.992	< 3.0	3.8	< *2*	< *2*	2,240	NM	< 6	< 6	< *10*	< 60	< *3*	149	< 4.0	< *0.2*	0.00078	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
76G-PW1 (200.8) (Background)	6/3/2005	CES		< 5	NA	NC	NA	NA	NA	< *0.05*	NA	NM	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
76G-PW2	6/3/2005	CES	< 30	< *20*	< 0.008	< *10.59*	**10.6**	< 2	< *2*	< *2*	3,060	NM	< 6	< 6	< *10*	< 60	< *3*	266	< 4.0	< *0.2*	0.00037	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
76G-PW2 (200.8)	6/3/2005	CES		< 5	NA	NC	NA	NA	NA	< *0.05*		NM	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
South Fork Sauk River																														
SFSR-PW1	6/1/2005	CES	< 30	< *20*	**0.016** B	**10.284**	**10.3**	4.9	< *2*	< *2*	2,510	NM	< 6	< 6	< *10*	< 60	< *3*	287	< 4.0	< *0.2*	0.00098	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
SFSR-PW1 (200.8)	6/1/2005	CES		< 5	NA	NC	NA	NA	NA	< *0.05*	NA	NM	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
SFSR-PW2	6/1/2005	CES	45	< *20*	NA	NC	**14.3**	3.7	< *2*	< *2*	2,530	NM	< 6	< 6	< *10*	< 60	< *3*	297	< 4.0	< *0.2*	0.00101	NA	< *10*	< 500	< 3	< *5*	**510**	< 2	< 5	< 10
SFSR-PW2 (200.8)	6/1/2005	CES		< 5	NA	NC	NA	NA	NA	< *0.05*	NA	NM	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
SFSR-PW3	6/1/2005	CES	< 30	< *20*	< 0.008	< *15.79*	**15.8**	3.3	< *2*	< *2*	3,030	NM	< 6	< 6	< *10*	< 60	< *3*	287	< 4.0	< *0.2*	0.00032	< *0.00002*	< *10*	< 500	< 3	< *5*	**530**	< 2	< 5	< 10
SFSR-PW3 (200.8)	6/1/2005	CES		< 5	NA	NC	NA	NA	NA	< *0.05*	NA	NM	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
Background																														
GC-PW1	6/2/2005	CES	< 30	< *20*	< 0.008	< 2.992	< 3.0	8.4	< *2*	< *2*	3,410	10	< 6	< 6	< *10*	< 60	< *3*	510	< 4.0	< *0.2*	0.00216	NA	< *10*	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
GC-PW2	6/2/2005	CES	< 30	< *20*	NA	NC	< 3.0	42.3	< *2*	< *2*	4,550	10	< 6	< 6	< *10*	< 60	< *3*	522	5.8	< *0.2*	0.00070	NA	< *10*	< 500	< 3	< *5*	**670**	< 2	< 5	18
76G-PW1	6/3/2005	CES	< 30	< 5	< 0.008	< 2.992	< 3.0	3.8	< *2*	< *0.05*	2,240	NM	< 6	< 6	< *0.05*	< 60	< *3*	149	< 4.0	< *0.2*	0.00078	NA	< 0.05	< 500	< 3	< *5*	< 500	< 2	< 5	< 10
Background Mean			< 30	< 5	< 0.008	< 2.992	< 3.0	17.5	< *2*	< *0.05*	3,400	10	< 6	< 6	< 0.05	< 60	< *3*	394	3.3	< *0.2*	0.00121	NC	< 0.05	< 500	< 3	< 5	390	< 2	< 5	9.3
Standards, corrected for hardness where applicable (used			**8.88**	**mg/L average for surface water samples, excluding portal seeps)**																										
Washington - Aquatic Life (Chronic) [1]			NS	NS	NS	NS	190	NS	NS	0.17	NS	NS	NS	NS	1.4	NS	0.17	NS	NS	0.012	0.012	NS	32.8	NS	5	NS	NS	NS	NS	13.44
Washington Drinking Water Criteria [2]			NS	6	NS	NS	10	2,000	4	5	NS	NS	100	NS	NS	300	NS	NS	50	2	2	NS	100	NS	50	100	NS	2	NS	50,000
EPA - Aquatic Life (CCC) [3]			NS	NS	NS	NS	150	NS	NS	0.045	NS	NS	NS	NS	1.1	NS	0.17	NS	NS	0.77	0.77	NS	6.7	NS	4.61	NS	NS	NS	NS	15.19
ORNL - Surface Water PRGs [4]			87	30	190	3.1	NS	4	0.66	1.10	NS	NS	NS	23	12	1,000	*3.20*	NS	120	1.30	1.30	0.0000028	160	NS	5.00	0.36	NS	12	20	110

Sample I.D.	Sample Date	Sampling Group	Temperature (Field)	pH (Field)	pH (Lab)	Turbidity	Conductivity (Field)	Conductivity @25C (Lab) M120.1	Dissolved Oxygen (Field)	Oxygen Reduction Potential (Field)	Hardness as $CaCO_3$, TR M2340B	TDS (Field)	TDS, Residue, Filterable @180 M160.1	Cyanide-Total M335.2	Cyanide, WAD M4500I	Sulfate M300.0
			°C	su	su	NTU	µS/cm	µS/cm	mg/L	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Glacier Creek																
GC-PW1 (Background)	6/2/2005	CES	3.57	7.0	6.52	47	26	28.0	11.01	254	10.6	20	11.0	< *0.01*	< *0.01*	1.62
GC-PW2 (Background)	6/2/2005	CES	4.00	6.0	6.21	9	34	33.0	4.00	250	13.5	20	< 10.0	< *0.01*	< *0.01*	1.84
GC-PW3	6/2/2005	CES	4.54	6.9	6.63	17	25	22.0	9.90	233	9.16	20	< 10.0	NA	NA	1.89
GC-PW5	6/1/2005	CES	7.9	7.1	6.79	17	22	20.0	10.76	128	8.02	10	< 10.0	NA	NA	
Seventysix Creek																
76G-PW1 (Background)	6/3/2005	CES	6.06	7.2	7.00	46	17	15.0	9.39	229	6.21	10	< 10.0	NA	NA	0.51
76G-PW2	6/3/2005	CES	5.35	7.0	6.85	10	24	20.0	11.61	230	8.72	20	< 10.0	NA	NA	1.70
South Fork Sauk River																
SFSR-PW1	6/1/2005	CES	7.74	6.8	6.72	40	23	20.0	7.81	205	7.46	20	< 10.0	< *0.01*	< *0.01*	2.26
SFSR-PW2	6/1/2005	CES	7.38	7.0	6.89	20	22	20.0	10.73	131	7.54	10	< 10.0	NA	NA	2.45
SFSR-PW3	6/1/2005	CES	7.55	6.8	6.92	24	26	24.0	11.00	215	8.75	20	< 10.0	< *0.01*	< *0.01*	2.70
Background Mean			4.5433	6.7	6.58	34	26	25.3	8.13	244	10.10	17	7.0	< 0.01	< 0.01	1.32
Standards																
Washington - Aquatic Life (Chronic) [1]			12	6.5-8.5	6.5-8.5	5>Bkg	NS	NS	9.5	NS	NS	NS	NS	NS	0.0052	NS
Washington Drinking Water Criteria [2]			NS	6.5-8.5	6.5-8.5	NS	700	700	NS	NS	NS	500	500	0.2	NS	250
EPA - Aquatic Life (CCC) [3]			9-19	6.5-9	6.5-9	NS	NS	NS	9.5	NS	NS	NS	NS	NS	0.0052	NS
ORNL - Surface Water PRGs [4]			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.0052	NS	NS

GENERAL NOTES:

All CES samples (except Arsenic (III,) Mercury, UltraTrace, & Mercury, Methyl) were analyzed by SVL Analytical, Inc., Kellogg, ID following digestion by M200.2
Arsenic (III), Mercury, UltraTrace, & Mercury, Methyl anlyses were conducted by Brooks Rand, Seattle, WA
Arsenic (V), Diss. was calculated from difference between Arsenic, Total, Diss. and Arsenic (III), Diss.
mg/L = Milligrams per liter
∞g/L = Micrograms per liter
su = Standard Units
mS = MicroSiemans
< value = Analyte not detected above Method Detection Limit (MDL)
B = Analyte detected between MDL and Practical Quantification Limit (PQL)
Shaded cells indicate that the value exceeds one or more standard; corresponding criteria also shaded.
Italic values indicate that the MDL exceeds the lowest standard
NM - Not Measured
NA = Not Analyzed
Bolding indicates an exceedence of background mean (Note - background samples that exceed the mean background concentration are not bolded)

STANDARD NOTES:

1 - State of Washington Aquatic Life criteria (WAC 173-201A)underline - corrected for hardness
2 - State of Washington drinking water criteria (WAC 246-290)
3 - EPA recommended chronic ambient water quality criteria for freshwater aquatic life (CCC) used (EPA, 2002),underline - corrected for hardness
4 - ORNL Preliminary Remediation Goals for Ecological Endpoints (ORNL, 1997)underline - corrected for an assumed hardness of 100 mg/L
NS = No Standard

Table 3. Sediment Analytical Results
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample ID	Sample Date	Sampling Group (CES, WADNR, USFS, DOE)	Aluminum, Total M6010B	Antimony, Total M6010B	Arsenic (III), TR M1632 Mod.	Arsenic (V), TR Calculated	Arsenic, Total M6010B	Barium, Total M6010B	Beryllium, Total M6010B	Cadmium, Total M6010B	Calcium, Total M6010B	Chromium, Total M6010B	Cobalt, Total M6010B	Copper, Total M6010B	Cyanide, Total M9012A	Cyanide-WAD M4500I	Iron, Total M6010B	Lead, Total M6010B	Magnesium, Total M6010B	Manganese, Total M6010B	Mercury, Total M7471A	Mercury, Methyl, Trace M1630	Nickel, Total M6010B	Potassium, Total M6010B	Selenium, Total M7740	Silver, Total M6010B	Sodium, Total M6010B	Thallium, Total M7841	Vanadium, Total M6010B	Zinc, Total M6010B
			mg/kg																											
Glacier Creek																														
GC-SS1 (Background)	6/2/2005	CES	11,500	5.7	0.000207	52.000	52.0	96.3	< 0.20	0.96	4,110	67.1	8.62	20.6	< 0.50	< 0.50	24,200	8.44	6,180	1,350	NA	< 0.000012	12.2	1,540	0.34	< 0.50	649	< 0.20	51.4	72.8
GC-SS2 (Background)	6/2/2005	CES	10,800	9.9	0.001082	226.999	227.0	109.0	< 0.20	1.55	3,030	49.6	9.39	50.0	< 0.50	< 0.50	24,900	104	5,760	1,600	NA	NA	11.2	1,910	0.36	< 0.50	529	0.263	47.0	163
SHA-3394095 (Background)	9/25/2003	WADNR	NA	0.43	NA	NA	122	NA	0.18	0.65	NA	16.4	NA	21.7	NA	NA	NA	26.3	NA	NA	0.874	NA	12.1	NA	< 5.00	0.18	NA	0.14	NA	123
GC-SS3	6/2/2005	CES	9,960	**11.6**	**0.00144**	**249.999**	**250.0**	**98.4**	**0.23**	**1.71**	3,020	**48.9**	**9.56**	**41.0**	NA	NA	25,200	**84.8**	5,220	**1,510**	NA	NA	11.5	**1,680**	**0.41**	< 0.50	468	**0.280**	47.7	**163**
GC-SS4	6/2/2005	CES	11,900	**7.9**	**0.003142**	**366.997**	**367.0**	**94.0**	**0.21**	**1.91**	**3,910**	**48.5**	**10.00**	**67.5**	NA	NA	25,500	**69.3**	5,530	**1,350**	NA	NA	11.7	**1,780**	**0.46**	< 0.50	**711**	**0.248**	**49.4**	**185**
GC-SS5	6/2/2005	CES	**13,400**	3.8	**0.001536**	**290.998**	**291.0**	**88.4**	< 0.20	**1.79**	**4,230**	**53.5**	**12.50**	**117.0**	< 0.50	< 0.50	**28,800**	**48.2**	7,030	959	NA	NA	**15.8**	**2,360**	< 0.30	< 0.50	**628**	< 0.20	**66.2**	**156**
Glacier Creek near Ore Collector																														
COL-SS-01	9/10/2005	CES	NA	5.19	NA	NC	**330.0**	**90.1**	NA	1.09	NA	**49.0**	NA	**93.5**	NA	NA	**30,600**	**37.9**	NA	706	NA	NA	NA	NA	NA	NA	NA	NA	NA	**143**
COL-SS-02	9/10/2005	CES	NA	**5.84**	NA	NC	**294.0**	**82.6**	NA	**1.23**	NA	43.6	NA	**111.0**	NA	NA	**29,400**	**43.6**	NA	868	NA	NA	NA	NA	NA	NA	NA	NA	NA	**166**
COL-SS-03	9/10/2005	CES	NA	**5.56**	NA	NC	**331.0**	**85.5**	NA	1.10	NA	43.5	NA	**93.4**	NA	NA	**30,200**	**37.5**	NA	705	NA	NA	NA	NA	NA	NA	NA	NA	NA	**143**
COL-SS-04	9/10/2005	CES	NA	3.92	NA	NC	**112.0**	**91.9**	NA	**1.14**	NA	**45.1**	NA	**78.8**	NA	NA	**27,900**	32.1	NA	790	NA	NA	NA	NA	NA	NA	NA	NA	NA	**120**
COL-SS-05	9/10/2005	CES	NA	**14.5**	NA	NC	**469.0**	79.5	NA	**1.22**	NA	36.7	NA	**97.6**	NA	NA	**29,100**	**72.6**	NA	821	NA	NA	NA	NA	NA	NA	NA	NA	NA	**165**
Glacier Creek near Concentrator																														
CON-SS-01	9/10/2005	CES	NA	**10.6**	NA	NC	**160.0**	**90.6**	NA	0.89	NA	41.2	NA	**30.5**	NA	NA	24,500	**55.3**	NA	**1,230**	NA	NA	NA	NA	NA	NA	NA	NA	NA	**123**
CON-SS-02	9/10/2005	CES	NA	4.01	NA	NC	**130.0**	**91.8**	NA	**1.12**	NA	**52.6**	NA	**74.7**	NA	NA	**30,000**	35.1	NA	864	NA	NA	NA	NA	NA	NA	NA	NA	NA	**138**
CON-SS-03	9/10/2005	CES	NA	**5.08**	NA	NC	**282.0**	**92.4**	NA	**1.23**	NA	**48.6**	NA	**92.1**	NA	NA	**31,200**	**46.1**	NA	799	NA	NA	NA	NA	NA	NA	NA	NA	NA	**150**
CON-SS-04	9/10/2005	CES	NA	**14.1**	NA	NC	**267.0**	**106.0**	NA	**1.19**	NA	**48.2**	NA	**82.8**	NA	NA	**31,400**	30	NA	715	NA	NA	NA	NA	NA	NA	NA	NA	NA	**143**
CON-SS-05	9/10/2005	CES	NA	3.44	NA	NC	**197.0**	**84.6**	NA	0.92	NA	**44.9**	NA	**75.8**	NA	NA	**28,800**	29.5	NA	616	NA	NA	NA	NA	NA	NA	NA	NA	NA	**122**
Seventysix Creek																														
76G-SS1 (Background)	6/2/2005	CES	15,200	< 2.0	< 0.000075	< 16.800	16.8	39.1	0.20	1.30	3,670	42.6	10.60	15.6	NA	NA	28,700	9.8	10,600	657	NA	NA	14.6	1,020	0.39	< 0.50	287	< 0.20	48.9	77.4
76G-SS2	6/2/2005	CES	**17,100**	**11.2**	**0.00082**	**275.999**	**276.0**	52.8	< 0.20	**2.91**	**4,730**	41.5	**10.50**	**34.2**	NA	NA	**30,600**	**89.5**	**9,200**	950	NA	< 0.000012	10.2	**1,880**	< 0.30	< 0.50	**761**	< 0.20	**61.9**	**295**
South Fork Sauk River																														
SFSR-SS1	6/1/2005	CES	**15,300**	**7.1**	**0.002675**	**268.997**	**269.0**	62.8	**0.20**	**1.90**	3,510	**46.1**	**10.60**	**79.5**	< 0.50	< 0.50	**29,500**	**65.4**	**8,720**	688	NA	0.000017 B	**16.1**	**1,840**	**0.46**	< 0.50	**518**	< 0.20	**58.5**	**177**
SFSR-SS2	6/1/2005	CES	**15,300**	**13.5**	**0.002411**	**543.998**	**544.0**	66.8	**0.22**	**1.99**	**3,630**	**56.9**	**11.40**	**115.0**	NA	NA	**28,400**	**136**	**7,740**	747	NA	NA	**15.4**	**2,020**	0.33	< 0.50	**624**	< 0.20	**56.2**	**206**
SFSR-SS3	6/1/2005	CES	**15,700**	**17.3**	0.004274	**479.996**	**480.0**	57.6	**0.23**	**2.02**	**3,610**	**61.5**	**10.90**	**116.0**	< 0.50	< 0.50	**28,400**	**156**	**8,450**	715	NA	< 0.000012	**17.7**	**1,910**	0.34	< 0.50	**618**	< 0.20	**50.7**	**192**
SHA-3374088 (near Lake MC)	9/12/2003	WADNR	NA	**15.7**	NA	NA	**1090**	NA	**0.17**	**3.90**	NA	36.6	NA	**207**	NA	NA	NA	**278**	NA	NA	0.091	NA	**96.5**	NA	< 0.50	6.94	NA	**0.17**	NA	**806**
Background Mean			12,500	4.26	0.000442	95.800	104.5	81.5	0.15	1.12	3,603	43.9	9.54	27.0	< 0.50	< 0.50	25,933	37.1	7,513	1,202	NC	NC	12.5	1,490	0.36	< 0.50	488	0.15	49.1	109.1
Standards																														
WA - Freshwater (under development)[1]			NS	0.6	NS	NS	51	NS	NS	1	NS	100	NS	830	NS	NS	NS	430	NS	NS	0.75	NS	70	NS	NS	2.5	NS	NS	NS	160
WA - Marine [2]			NS	NS	NS	NS	57	NS	NS	5.1	NS	260	NS	390	NS	NS	NS	450	NS	NS	0.41	NS	NS	NS	NS	6.1	NS	NS	NS	410
EPA - Freshwater TEL [3]			NS	NS	NS	NS	5.9	NS	NS	0.596	NS	37.3	NS	35.7	NS	NS	NS	35	NS	NS	0.174	NS	18	NS	NS	NS	NS	NS	NS	123.1
EPA - Freshwater PEL [4]			NS	NS	NS	NS	17	NS	NS	3.53	NS	90	NS	197	NS	NS	NS	91.3	NS	NS	0.486	NS	35.9	NS	NS	NS	NS	NS	NS	315
ORNL - Freshwater [5]			NS	NS	NS	NS	42	NS	NS	4.2	NS	159	NS	77.7	NS	NS	NS	110	NS	NS	0.7	NS	38.5	NS	NS	1.8	NS	NS	NS	270

Sample ID	Sample Date	Sampling Group (CES, WADNR, USFS, DOE)	Total Organic Carbon Leco Furnace	Size Fraction by Hydrometer ASA #9			Solids (Brooks Rand LLC) CLPSOW390, PART F, D-98	Percent Solids (SVL)	Texture Classification ASTM D-422
				Clay	Sand	Silt			
			%	%			%	%	
Glacier Creek									
GC-SS1 (Background)	6/2/2005	CES	0.130	0.0	100.0	0.0	82.22	83.0	Sand
GC-SS1 (Background)	6/2/2005	CES	0.130	0.0	98.0	2.0	74.86	78.0	Sand
SHA-3394095 (Background)	9/25/2003	WADNR	NA	NA	NA	NA	NA	NA	NA
GC-SS3	6/2/2005	CES	0.300	2.0	88.0	10.0	70.81	79.0	Sand
GC-SS4	6/2/2005	CES	0.280	2.0	90.0	8.0	77.33	85.0	Sand
GC-SS5	6/2/2005	CES	0.330	2.0	94.0	4.0	86.61	89.0	Sand
Glacier Creek near Ore Collector									
COL-SS-01	9/10/2005	CES	NA	NA	NA	NA	NA	84.5	NA
COL-SS-02	9/10/2005	CES	NA	NA	NA	NA	NA	76.1	NA
COL-SS-03	9/10/2005	CES	NA	NA	NA	NA	NA	84.5	NA
COL-SS-04	9/10/2005	CES	NA	NA	NA	NA	NA	77.5	NA
COL-SS-05	9/10/2005	CES	NA	NA	NA	NA	NA	89.7	NA
Glacier Creek near Concentrator									
CON-SS-01	9/10/2005	CES	NA	NA	NA	NA	NA	81.3	NA
CON-SS-02	9/10/2005	CES	NA	NA	NA	NA	NA	79.3	NA
CON-SS-03	9/10/2005	CES	NA	NA	NA	NA	NA	83.2	NA
CON-SS-04	9/10/2005	CES	NA	NA	NA	NA	NA	81.9	NA
CON-SS-05	9/10/2005	CES	NA	NA	NA	NA	NA	82.1	NA
Seventysix Creek									
76G-SS1 (Background)	6/2/2005	CES	0.140	0.0	98.0	2.0	79.73	82.0	Sand
76G-SS2	6/2/2005	CES	0.220	0.0	96.0	4.0	85.35	88.0	Sand
South Fork Sauk River									
SFSR-SS1	6/1/2005	CES	0.340	2.0	94.0	4.0	76.63	81.0	Sand
SFSR-SS2	6/1/2005	CES	0.270	0.0	96.0	4.0	76.73	76.0	Sand
SFSR-SS3	6/1/2005	CES	0.190	0.0	98.0	2.0	81.65	80.0	Sand
SHA-3374088 (near Lake MC)	9/12/2003	WADNR	NA	NA	NA	NA	NA	NA	NA

GENERAL NOTES:

All CES samples (except Arsenic (III,) Mercury, UltraTrace, & Mercury, Methyl) were analyzed by SVL Analytical, Inc., Kellogg, ID following digestion by M3050
Arsenic (III), Mercury, UltraTrace, & Mercury, Methyl anlyses were conducted by Brooks Rand, Seattle, WA
Arsenic (V) was calculated from the difference between Arsenic and Arsenic (III)
mg/kg = Milligrams per kilogram
< value = Analyte not detected above Method Detection Limit (MDL, shown)
Shaded cells indicate that the value exceeds one or more standard; corresponding criteria also shaded.
NA = Not Analyzed
NC = Not Calculated
Bolding indicates an exceedence of background mean (Note - background samples that exceed the mean background concentration are not bolded)
SHA = Site Hazard Assessment Results (Crofoot and O'Brian, 2004)

STANDARD NOTES:

1 - State of Washington, Development of Freshwater Sediment Quality Values (DOE csl recommendations, Sept 2003)
2 - State of Washington, Marine Sediment Management Standards (WAC 172-204-320)
3 - EPA Threshold Effects Level (NOAA, 1999)
4 - EPA Probable Effects Level (NOAA, 1999)
5 - ORNL ecological screening level values for freshwater, lowest chronic value used (ORNL, 1997)
NS = No Standard

Table 4. Wasterock and Soil Analytical Results
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample ID	Sample Date	Sampling Group (CES, WADNR, USFS, DOE)	Sample Depth (feet)	Percent Solids (SVL)	Percent Solids (BR)	Soil pH M9045C	Aluminum, Total M6010B	Antimony, Total M6010B	Arsenic III M 1632 (mod)	Arsenic V (calculated)	Arsenic, Total M6010B	Barium, Total M6010B	Beryllium, Total M6010B	Cadmium, Total M6010B	Calcium, Total M6010B	Chromium, Total M6010B	Cobalt, Total M6010B	Copper, Total M6010B
				%	%	su	mg/kg											
Assay Shack																		
ASSY SHACK	6/1/2005	USFS	0.5-1.0	73.2	NA	4.69	3,290	2,220	NA	NC	20,600	69.2	< 0.20	4.33	2,340	3.96	2.24	338
AS-02	7/19/2006	CES	0.5-1.0	NA	NA	4.01	1,370	400	NA	NC	6,980	23.9	< 0.20	3.47	773	54.3	3.6	305
AS-03	7/19/2006	CES	1.5-2	NA	NA	2.98	980	4,500	437	85,363	85,800	26.2	< 0.20	1.62	260	37.7	2.4	202
AS-04	7/19/2006	CES	0.5-1.0	NA	NA	3.03	1,510	1,290	NA	NC	32,100	203	< 0.20	1.60	315	27.6	4.4	243
Ore Collector																		
ORE COLLECTOR	6/1/2005	USFS	0.5-1.0	82.8	NA	3.58	2,350	1,680	NA	NC	28,100	35.2	< 0.20	7.58	250	4.33	1.13	417
COL-01-0.5'	9/10/2005	CES	0.5	75.2	NA	4.11	10,700	204	NA	NC	41,600	66.8	< 0.20	5.79	1,690	39.60	11.00	1,840
COL-01-2'	9/10/2005	CES	2	81.0	NA	4.60	7,500	183	NA	NC	37,100	46.7	< 0.20	9.26	3,240	35.90	12.60	896
COL-01-3'	9/10/2005	CES	3	79.9	NA	4.92	7,350	328	NA	NC	71,600	36.0	< 0.20	15.9	5,130	41.80	12.90	1,760
COL-02-0.5'	9/10/2005	CES	0.5	85.4	NA	3.49	599	9,860	NA	NC	14,000	26.2	< 0.20	13.7	22.8	29.70	< 0.60	509
COL-02-2'	9/10/2005	CES	2	88.4	NA	3.53	763	3,240	NA	NC	11,500	30.2	< 0.20	5.95	22.5	29.30	< 0.60	318
COL-03-0.5'	9/10/2005	CES	3	84.0	NA	3.25	807	3,270	NA	NC	13,200	113	< 0.20	6.06	43.5	25.00	< 0.60	329
COL-03-2'	9/10/2005	CES	2	89.2	NA	3.75	1,100	6,640	NA	NC	23,200	30.7	< 0.20	19.5	49.9	35.20	1.39	348
COL-04	7/19/2006	CES	1-5.5	NA	NA	3.63	860	3,190	38	10,862	10,900	35.3	< 2.00	10.10	80	38.40	< 6.00	302
COL-05	7/19/2006	CES	0.5-1.0	NA	NA	3.03	2,180	2,490	NA	NC	88,700	19.2	< 2.00	< 2.00	150	13.90	< 6.00	51
COL-06	7/19/2006	CES	6-6.5	NA	NA	5.65	4,340	20	NA	NC	2,160	61.1	< 2.00	7.20	2,020	53.80	9.80	635
COL-07	7/19/2006	CES	1-2	NA	NA	NA	3,870	170	215	18,985	19,200	88.9	< 2.00	9.8	880	60.30	< 6.00	1,140
COL-08	7/19/2006	CES	1-7	NA	NA	3.56	3,130	40	NA	NC	21,400	36.0	< 2.00	114	2,790	33.00	7.00	1,200
COL-10	7/19/2006	CES	0-0.5	NA	NA	4.02	4,990	340	NA	NC	18,600	58.8	< 2.00	2.20	800	59.70	< 6.00	309
COL-11	7/19/2006	CES	0.5-1.5	NA	NA	3.33	660	8,770	NA	NC	42,000	22.5	< 2.00	39.8	50	81.50	< 6.00	647
Concentrator																		
SHA - 10529 (Level 1 West Soil)	9/12/2003	DOE	0.5	NA	NA	NA	NA	1,365	NA	NA	3,460	NA	< 0.07	4.13	NA	2.44	NA	378
SHA - 10530 (Level 1 East Soil)	9/12/2003	DOE	0.5	NA	NA	NA	NA	4,582	NA	NA	34,900	NA	< 0.088	11.4	NA	5.74	NA	516
SHA - 3374086 (Level 2 West Soil)	9/12/2003	DOE	0.5	NA	NA	NA	NA	3,990	NA	NA	14,600	NA	< 0.10	1.54	NA	1.5	NA	1,340
UPPER MILL	6/1/2005	USFS	0.5-1.0	75.4	NA	3.32	2,000	2,240	NA	NC	31,300	53.8	< 0.20	8.54	448	6.84	2.71	591
LOWER MILL	6/1/2005	USFS	0.5-1.0	70.6	NA	3.86	990	4,170	NA	NC	15,000	31.1	< 0.20	7.03	237	2.19	< 0.60	329
CON-01-0.5'	9/10/2005	CES	0.5	91.3	NA	3.48	529	6,460	NA	NC	5,610	28.8	< 0.20	4.43	25.1	37.0	< 0.60	1,080
CON-01-1.5'	9/10/2005	CES	1.5	80.0	75.14	3.40	1,590	10,700	NA	NC	21,700	47.0	< 0.20	12.9	194	33.7	1.20	899
CON-02-0.5'	9/10/2005	CES	0.5	68.0	NA	3.69	5,430	1,130	NA	NC	18,000	445	0.22	2.87	1,420	40.1	3.78	586
CON-02-1.5'	9/10/2005	CES	1.5	79.2	73.53	3.45	4,750	4,780	NA	NC	53,300	239	0.60	76.3	2,060	20.2	10.90	4,240
CON-03-0.5'	9/10/2005	CES	0.5	89.6	NA	3.39	2,120	3,960	NA	NC	14,500	25.5	< 0.20	7.94	335	32.3	1.93	497
CON-03-1.5'	9/10/2005	CES	1.5	79.3	75.01	3.32	2,690	3,420	NA	NC	11,800	26.5	< 0.20	6.33	509	33.4	1.61	635
CON-04-0.5'	9/10/2005	CES	0.5	86.6	NA	3.45	1,610	430	NA	NC	41,300	25.7	< 0.20	7.51	142	21.8	0.65	114
CON-05-0.5'	9/10/2005	CES	0.5	82.3	NA	3.26	840	6,040	NA	NC	22,600	266	< 0.20	14.4	42.9	17.7	0.65	1,770
CON-06-0.5'	9/10/2005	CES	0.5	69.0	NA	5.02	23,600	7.6	NA	NC	446	84.4	0.24	1.87	1,920	62.8	12.10	57.7
CON-07-0.5'	9/10/2005	CES	0.5	70.1	NA	3.36	3,020	4,300	NA	NC	46,400	125	< 0.20	5.81	476	27.0	6.13	734
CON-08-0.5'	9/10/2005	CES	0.5	89.5	NA	3.02	1,230	5,490	NA	NC	34,600	93.2	< 0.20	6.64	254	23.1	< 0.60	501
CON-09-0.5'	9/10/2005	CES	0.5	79.2	NA	3.00	1,080	6,630	NA	NC	92,100	30.2	< 0.20	16.3	12.4	18.5	1.53	1,390
CON-10	7/19/2006	CES	1'	NA	NA	3.70	3,130	3,900	116	14,784	14,900	27.8	< 0.20	8.0	1,090.0	56.1	4.22	569
CON-11	7/19/2006	CES	1	NA	NA	4.45	24,000	140	NA	NC	9,160	47.1	0.28	0.2	1,140	94.5	7.22	292
CON-12	7/19/2006	CES	1	NA	NA	4.34	7,440	620	NA	NC	6,640	19.9	< 0.20	< 0.2	750	83.8	1.99	258
CON-13	7/19/2006	CES	1	NA	NA	4.2	10,400	1,210	NA	NC	9,460	22.4	< 0.20	0.3	568	76.2	1.49	231
CON-14	7/19/2006	CES	1	NA	NA	4.49	21,600	110	NA	NC	1,760	235	1.32	1.8	3,810	69.2	28.10	452
CON-15	7/19/2006	CES	1	NA	NA	NA	4,350	1,300	110	12,490	12,600	37.1	< 0.20	6.2	692	64.6	4.39	396
CON-16	7/19/2006	CES	0-1	NA	NA	4.08	3,320	1,650	NA	NC	14,400	30.9	< 0.20	6.4	468	49.8	5.86	273
CON-16	7/19/2006	CES	1-1.5	NA	NA	4.09	2,770	4,790	NA	NC	41,600	30.1	< 0.20	114.0	6,580	20.7	21.00	2,620
CON-17	7/19/2006	CES	1	NA	NA	4.56	14,100	500	NA	NC	8,850	19.6	< 0.20	0.6	652	69.4	< 0.60	1,250
CON-18	7/19/2006	CES	0-1	NA	NA	4.57	20,700	50	NA	NC	2,150	522	1.85	1.3	7,390	62.3	6.44	203
CON-18	7/19/2006	CES	2-3.0	NA	NA	4.69	25,800	< 2	NA	NC	137	53.3	0.32	< 0.2	1,480	64.6	3.61	30
CON-19	7/19/2006	CES	1	NA	NA	NA	6,470	2,800	204	35,896	36,100	319	0.26	1.4	1,270	50.0	4.80	504
Mystery Mine																		
MM-01-0.5'	9/9/2005	CES	0.5	88.9	NA	3.36	1,590	4,460	NA	NC	24,300	21	< 0.20	7.41	136	18.6	2.54	691
MM-01-1.0'	9/9/2005	CES	1.0	89.9	NA	3.70	1,270	3,750	NA	NC	24,000	19.4	< 0.20	26.4	91.6	22.1	1.51	1,040
MM-02-0.5'	9/9/2005	CES	0.5	58.6	NA	3.57	1,630	320	NA	NC	17,000	81	< 0.20	11.1	333	28.5	1.70	345
MM-03-0.5'	9/9/2005	CES	0.5	86.4	NA	3.34	4,230	650	NA	NC	21,400	32.4	< 0.20	11.2	782	24.0	7.85	823
MM-04-0.5'	9/9/2005	CES	0.5	87.8	NA	6.18	7,370	20.4	NA	NC	2,480	23.6	0.25	7.11	5,580	11.1	21.20	139
WADNR - Mystery Adit 3 Dump	4/1/2003	WADNR	0.5	NA	NA	NA	NA	NA	NA	NC	14,000	NA	NA	NA	NA	NA	NA	500
Justice Mine																		
SHA - 10531	9/12/2003	DOE	0.5	NA	NA	NA	NA	12	NA	NA	4,900	NA	< 0.07	6.75	NA	< 0.232	NA	93.3
Pride of the Mountain Mine																		
SHA - 3394096	9/25/2003	DOE	0.5	NA	NA	NA	NA	0.57 J	NA	NA	332	NA	0.17	1.89	NA	9.71	NA	48
WADNR - POM Adit 1 Dump	4/1/2003	WADNR	0.5	NA	NA	NA	NA	NA	NA	NC	17,300	NA	NA	7.29	NA	NA	NA	1,010
Pride of the Woods Mine																		
SHA - 3394097	9/25/2003	DOE	0.5	NA	NA	NA	NA	416	NA	NA	41,400	NA	0.18	2.42	NA	12.1	NA	517
WADNR - POW Dump	4/1/2003	WADNR	0.5	NA	NA	NA	NA	NA	NA	NC	15,300	NA	NA	< 1.11	NA	NA	NA	195
Comet Mine																		
SHA - 3394098 (Bunker Soil)	9/25/2003	DOE	0.5	NA	NA	NA	NA	168	NA	NA	31,200	NA	0.15	9.12	NA	11.0	NA	212
SHA - 3374087 (Bunker South Soil)	9/25/2003	DOE	0.5	NA	NA	NA	NA	719	NA	NA	14,700	NA	0.11	2.29	NA	11.1	NA	78
Haulage Ways																		
SHA - 10532	9/25/2003	DOE	0.5	NA	NA	NA	NA	133	NA	NA	8,450	NA	< 0.072	8.33	NA	< 0.24	NA	1,160
HW-01	7/20/2006	CES	0.5	NA	NA	5.47	18,100	0.9	NA	NC	647	61.5	< 2.00	< 2.0	4,410	93.9	12.50	35
HW-02	7/20/2006	CES	0.5	NA	NA	3.98	22,100	90	209	10,791	11,000	51.3	< 2.00	2.2	5,520	142.0	11.90	220
HW-03	7/20/2006	CES	0.5	NA	NA	4.18	15,000	4	NA	NC	143	41.2	0.22	0.5	1,270	32.3	5.45	44
HW-04	7/20/2006	CES	0.5	NA	NA	4.47	13,100	570	NA	NC	22,600	52	< 2.00	5.5	1,970	48.2	9.90	2,880
HW-05	7/20/2006	CES	0.5	NA	NA	5.90	20,500	< 2	3	60	63	1,170	2.93	< 2.0	14,300	74.2	9.34	68
Mean Background				97.7	NA	4.66	18,783	5.04	NC	NC	137.5	48.3	0.21	0.64	2412	49.5	7.83	29.5
90% UCL - Background				97.7	NA	4.66	23,762	7.3	NC	NC	236	62.1	0.28	0.77	3,170	57.5	10.3	40.3
Standards																		
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]				NS	NS	2 - 12.5	NS	NS	NS	NS	20	NS	NS	2	NS	NS	NS	NS
WA - Ecological Receptors (p=plant, b=soil biota, w=wildlife)[2]				NS	NS	NS	50 *p	5 p	7 w	10 p	NS	102 w	10 p	4 p	NS	42 bp	20 p	50 b
EPA Indust. PRGs - Human Receptors[3]				NS	NS	NS	100,000	410	NS	NS	1.6	67,000	1,900	450	NS	450	1,900	41,000
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate, p=plant)[4]				NS	NS	NS	NS	21 m	NS	NS	37 p	NS	NS	29 p	NS	5 p	32 b	61 i
ORNL - Ecological Receptors[5]				NS	NS	NS	NS	5	NS	NS	9.9	283	10	4	NS	0.4	20	60

Sample ID	Cyanide, Total M9012A	Cyanide-WAD M4500I	Iron, Total M6010B	Lead, Total M6010B	Magnesium, Total M6010B	Manganese, Total M6010B	Mercury, Total M7471	Mercury, Methyl, Total M1630 Mod.	Nickel, Total M6010B	Potassium, Total M6010B	Selenium, Total M7740	Silver, Total M6010B	Sodium, Total M6010B	Thallium, Total M6010B or M7841	Vanadium, Total M6010B	Zinc, Total M6010B	Sulfur Forms M600/LECO: Sulfur, Total	Sulfur, Pyritic	Sulfur, Non-Extractable	Sulfur, Sulfate	ABAs M600: Acid Generation Potential	Acid Neutralization Potential	Acid-Base Potential
	mg/kg																%				t $CaCO_3$/Kt		
Assay Shack																							
ASSY SHACK	< 0.50	NA	55,100	10,200	509	199	36.30	NA	< 1.0	1,060	2.11	48.0	123	1.13	21.4	353	NA	NA	NA	NA	NA	NA	NC
AS-02	NA	NA	33,200	4,940	276	76	15.30	NA	3.1	261	< 0.6	26.9	488	< 8.00	32.2	644	NA	NA	NA	NA	NA	NA	NC
AS-03	NA	NA	121,000	3,310	184	72	0.33	NA	2.7	562	< 3	32.5	392	< 8.00	21.1	450	1.63	0.68	0.02	0.93	21.3	< 0.3	-21.3
AS-04	NA	NA	58,400	6,300	198	163	0.25	NA	5.2	1,730	1.9	57.9	127	< 8.00	28.4	320	NA	NA	NA	NA	NA	NA	NC
Ore Collector																							
ORE COLLECTOR	NA	NA	58,200	8,460	960	169	2.40	NA	< 1.0	1,750	4.14	72.4	85	< 0.20	14.0	213	NA	NA	NA	NA	NA	NA	NC
COL-01-0.5'	NA	NA	68,200	2,720	4,460	506	8.70	NA	22.3	1,710	2.34	40.2	< 50	< 1.50	41.7	969	2.15	0.6	0.16	1.39	18.8	< 0.3	-18.8
COL-01-2'	NA	NA	71,500	3,720	3,690	1,220	3.83	NA	18.3	2,220	2.03	36.2	< 50	< 1.50	26.8	1,350	NA	NA	NA	NA	NA	NA	NC
COL-01-3'	NA	NA	87,100	2,480	3,830	1,330	5.38	NA	19.4	1,620	3.18	34.1	< 50	< 1.50	34.1	2,130	NA	NA	NA	NA	NA	NA	NC
COL-02-0.5'	NA	NA	33,400	22,500	29.8	29.6	5.45	NA	8.6	1,820	3.23	415	< 50	5.60	1.94	814	NA	NA	NA	NA	NA	NA	NC
COL-02-2'	NA	NA	32,000	16,000	38.2	18.0	7.75	NA	7.7	1,850	3.91	214	< 50	4.90	2.4	298	NA	NA	NA	NA	NA	NA	NC
COL-03-0.5'	NA	NA	40,500	14,700	52	21.2	5.85	NA	10.0	2,450	3.34	182	< 50	4.60	2.66	256	NA	NA	NA	NA	NA	NA	NC
COL-03-2'	NA	NA	59,000	20,800	59	40.4	6.22	NA	12.5	2,280	3.05	180	< 50	4.10	3.42	2,150	5.01	1.28	0.22	3.51	40.0	< 0.3	-40.0
COL-04	NA	NA	47,000	12,400	< 60	23.3	0.27	NA	< 20.0	2,630	3.20	133	< 500	3.40	< 5	317	2.19	0.6	<0.01	1.59	18.8	< 0.3	-18.8
COL-05	NA	NA	149,000	720	910	57.9	0.42	NA	< 100.0	750	4.40	9.8	< 500	< 10.00	24.3	38	NA	NA	NA	NA	NA	NA	NC
COL-06	NA	NA	51,700	2,220	2,160	340.0	0.41	NA	11.0	3,690	< 0.60	16.2	< 500	< 2.00	27.6	995	NA	NA	NA	NA	NA	NA	NC
COL-07	NA	NA	65,000	5,210	1,010	532.0	0.40	NA	< 50.0	3,860	1.20	60.2	< 500	< 4.00	27.3	1,730	NA	NA	NA	NA	NA	NA	NC
COL-08	NA	NA	85,400	11,100	2,000	514.0	0.93	NA	< 50.0	3,500	< 0.60	53.0	< 500	< 10.00	16.2	17,400	NA	NA	NA	NA	NA	NA	NC
COL-10	NA	NA	85,800	3,580	1,490	409.0	1.01	NA	< 50.0	4,280	1.20	29.7	< 500	< 4.00	25.9	397	NA	NA	NA	NA	NA	NA	NC
COL-11	NA	NA	62,500	18,900	< 60	43.9	0.66	NA	< 100.0	1,240	4.30	257	< 500	4.90	< 5	5,160	NA	NA	NA	NA	NA	NA	NC
Concentrator																							
SHA - 10529 (Level 1 West Soil)	NA	NA	NA	9,580	NA	NA	8.5	NA	< 0.469	NA	< 3.05	126	NA	7.5	NA	149	NA	NA	NA	NA	NA	NA	NA
SHA - 10530 (Level 1 East Soil)	NA	NA	NA	7,000	NA	NA	7.07	NA	0.604	NA	< 3.80	115	NA	5.3	NA	852	NA	NA	NA	NA	NA	NA	NA
SHA - 3374086 (Level 2 West Soil)	NA	NA	NA	16,300	NA	NA	4.33	NA	3.26	NA	1.4 J	118	NA	9	NA	471	NA	NA	NA	NA	NA	NA	NA
UPPER MILL	< 0.50	< 0.50	73,000	7,890	1,570	530	2.13	NA	< 1.0	952	2.87	62.4	84	< 2.00	13.5	943	NA	NA	NA	NA	NA	NA	NC
LOWER MILL	< 0.50	< 0.50	49,700	8,800	227	205	1.68	NA	< 1.0	1,050	1.85	91.4	107	< 1.00	11.5	401	NA	NA	NA	NA	NA	NA	NC
CON-01-0.5'	NA	NA	47,600	21,400	17.1	24.2	6.20	NA	18.1	940	< *6.00*	376	< 50	15.8	0.92	452	1.87	1.05	0.02	0.80	32.8	< 0.3	-32.8
CON-01-1.5'	NA	NA	45,600	20,800	490	37.2	3.95	0.040	20.3	1,000	6.77	294	< 50	4.3	9.4	1,290	NA	NA	NA	NA	NA	NA	NC
CON-02-0.5'	NA	NA	60,000	7,370	2,260	235	0.82	NA	33.4	< 1,000	1.36	63.3	< 50	< *1.5*	32.8	205	NA	NA	NA	NA	NA	NA	NC
CON-02-1.5'	NA	NA	142,000	11,200	444.0	219	1.38	0.018 B	45.6	< 2,500	< *6.00*	186	< 50	4.9	21.2	11,600	8.98	7.33	0.6	1.05	229	< 0.3	-229
CON-03-0.5'	NA	NA	48,200	6,140	459.0	249	1.27	NA	19.5	1,690	0.80	74.0	< 50	1.5	12.3	912	NA	NA	NA	NA	NA	NA	NC
CON-03-1.5'	NA	NA	47,000	5,170	556	193	1.52	0.020 B	20.9	1,700	0.61	74.6	< 50	< *1.5*	14.8	850	NA	NA	NA	NA	NA	NA	NC
CON-04-0.5'	NA	NA	68,800	3,580	68.3	170	1.34	NA	26.3	1,500	1.22	23.9	< 50	< *1.5*	11.5	441	NA	NA	NA	NA	NA	NA	NC
CON-05-0.5'	NA	NA	38,700	20,800	42.4	44.0	3.28	NA	15.3	1,330	< *6.00*	360	< 50	3.4	2.5	1,740	NA	NA	NA	NA	NA	NA	NC
CON-06-0.5'	NA	NA	30,000	84.7	8,440	830	0.108	NA	40.1	2,170	< *0.60*	1.01	278	< *1.5*	64.4	176	NA	NA	NA	NA	NA	NA	NC
CON-07-0.5'	NA	NA	86,700	17,200	1,020	133	1.56	NA	35.9	< 2,500	< *6.00*	113	< 50	2.2	20.3	549	NA	NA	NA	NA	NA	NA	NC
CON-08-0.5'	NA	NA	72,200	8,860	184	50.9	2.43	NA	26.2	1,500	1.59	118	< 50	2.5	7.72	719	NA	NA	NA	NA	NA	NA	NC
CON-09-0.5'	NA	NA	82,900	17,900	33.7	16.6	8.35	NA	30.7	< 2,500	< *6.00*	229	< 50	5.6	3.37	1,850	3.39	1.68	0.3	1.41	52.5	< 0.3	-52.5
CON-10	NA	NA	57,500	6,200	1,140	298	0.21	NA	3.4	1,900	< 0.60	52.0	86	< 8.0	15.2	1,210	1.11	0.33	<0.01	0.78	10.3	7.2	-3.1
CON-11	NA	NA	46,200	955	6,290	383	0.29	NA	18.1	1,240	1.00	12.8	183	< 8.0	71.3	135	NA	NA	NA	NA	NA	NA	NC
CON-12	NA	NA	37,000	2,760	1,240	131	0.08	NA	5.6	1,120	< 0.60	24.9	328	< 8.0	40.7	64	NA	NA	NA	NA	NA	NA	NC
CON-13	NA	NA	41,900	3,270	1,270	95.1	0.27	NA	3.3	1,690	< 0.60	55.1	126	< 8.0	32.5	209	NA	NA	NA	NA	NA	NA	NC
CON-14	NA	NA	22,200	857	2,140	1,810	0.18	NA	10.8	769	1.30	17.7	363	< 8.0	88	180	NA	NA	NA	NA	NA	NA	NC
CON-15	NA	NA	58,700	3,530	970	515.0	0.38	NA	5.0	1,930	< 0.60	35.9	130	< 8.0	23.5	900	0.86	0.29	<0.01	0.57	9.1	23.1	14.1
CON-16	NA	NA	55,900	3,980	1,150	908	0.64	NA	3.9	1,780	< 1.50	36.2	55	< 8.0	18.1	570	NA	NA	NA	NA	NA	NA	NC
CON-16	NA	NA	117,000	11,800	4,150	7,210	0.22	NA	7.4	1,880	< 1.50	150	93	< 8.0	16.3	18,500	NA	NA	NA	NA	NA	NA	NC
CON-17	NA	NA	85,100	2,570	304	43	0.11	NA	2.1	495	2.40	22.2	605	< 8.0	28.9	160	NA	NA	NA	NA	NA	NA	NC
CON-18	NA	NA	19,800	699	2,640	294	0.16	NA	11.4	707	1.10	10.1	883	< 8.0	90.5	139	NA	NA	NA	NA	NA	NA	NC
CON-18	NA	NA	21,000	37	4,130	161	0.05	NA	9.5	578	0.90	0.56	314	< 8.0	70.8	59	NA	NA	NA	NA	NA	NA	NC
CON-19	NA	NA	86,800	9,490	2,310	217	0.64	NA	6.6	1,500	< 1.50	131	234	< 8.0	43.9	310	0.89	0.21	0.02	0.66	6.6	5.1	-1.4
Mystery Mine																							
MM-01-0.5'	NA	NA	48,600	8,190	241.0	103	1.78	NA	19.3	1,500	1.54	251	< 50	1.9	9.88	884	1.34	0.17	0.3	0.87	5.31	< 0.3	-5.31
MM-01-1.0'	NA	NA	45,500	7,030	116.0	55.9	2.05	NA	17.5	1,600	1.39	94.6	< 50	1.8	5.94	3,540	2.13	0.43	0.51	1.19	13.4	< 0.3	-13.4
MM-02-0.5'	NA	NA	272,000	815	307.0	301	0.590	NA	82.7	< 1,000	< *0.60*	7.2	< 50	< *1.5*	15.60	278	NA	NA	NA	NA	NA	NA	NC
MM-03-0.5'	NA	NA	121,000	2,350	1,420	203	0.832	NA	38.8	2,300	1.67	46.6	< 50	3.5	30.7	1,360	5.2	2.8	0.41	1.99	87.5	< 0.3	-87.5
MM-04-0.5'	NA	NA	52,500	198	3,000	4,820	0.370	NA	30.3	3,370	< *0.60*	4.6	294	5.8	73.9	1,180	NA	NA	NA	NA	NA	NA	NC
WADNR - Mystery Adit 3 Dump	NA	NA	230,000	1,700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,100	NA	NA	NA	NA	NA	NA	NC
Justice Mine																							
SHA - 10531	NA	NA	NA	228	NA	NA	0.61	NA	15.7	NA	< 3.01	< 0.232	NA	0.92	NA	312	NA	NA	NA	NA	NA	NA	NA
Pride of the Mountain Mine																							
SHA - 3394096	NA	NA	NA	130	NA	NA	0.528	NA	7.9	NA	< 5.00	0.45	NA	0.22	NA	328	NA	NA	NA	NA	NA	NA	NA
WADNR - POM Adit 1 Dump	NA	NA	66,700	7,040	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	941	NA	NA	NA	NA	NA	NA	NC
Pride of the Woods Mine																							
SHA - 3394097	NA	NA	NA	2,760	NA	NA	8.61	NA	< 5.0	NA	< 5.00	49.1	NA	5.42	NA	271	NA	NA	NA	NA	NA	NA	NA
WADNR - POW Dump	NA	NA	55,900	1,450	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	113	NA	NA	NA	NA	NA	NA	NC
Comet Mine																							
SHA - 3394098 (Bunker Soil)	NA	NA	NA	7,340	NA	NA	2.28	NA	11.3	NA	< 5.00	17	NA	0.17	NA	180	NA	NA	NA	NA	NA	NA	NA
SHA - 3374087 (Bunker South Soil)	NA	NA	NA	1,950	NA	NA	0.368	NA	12.1	NA	< 0.50	5.39	NA	0.12	NA	435	NA	NA	NA	NA	NA	NA	NA
Haulage Ways																							
SHA - 10532	NA	NA	NA	20,400	NA	NA	4.47	NA	< 0.481	NA	< 3.13	320	NA	0.4 J	NA	882	NA	NA	NA	NA	NA	NA	NA
HW-01	NA	NA	28,300	107	8,020.0	503	0.06	NA	21.2	1,900	0.90	1.02	831	< 0.8	71.6	150	NA	NA	NA	NA	NA	NA	NC
HW-02	NA	NA	59,800	1,120	7,710.0	483	0.61	NA	50.0	1,350	1.30	9.5	1,130	< 2.0	64.7	233	2.21	1.67	<0.01	0.54	52.2	20.6	-31.6
HW-03	NA	NA	14,400	74	1,850.0	549	0.17	NA	9.3	491	< 0.6	0.88	118	< 0.8	32.4	62	NA	NA	NA	NA	NA	NA	NC
HW-04	NA	NA	68,500	2,990	5,150.0	510	0.58	NA	29.0	1,040	1.50	102	< 500	< 4.0	41.4	970	NA	NA	NA	NA	NA	NA	NC
HW-05	NA	NA	15,800	23	2,480.0	284	0.03	NA	12.6	561	1.10	0.6	878	< 0.8	104	33	<0.01	<0.01	<0.01	<0.01	<0.3	41.1	41.1
Mean Background	NC	NC	28740	23.8	6,017	656	0.233	NC	22.2	1401	0.51	0.32	412	0.75	61.8	74.2	NC	NC	NC	NC	NC	NC	NC
90% UCL - Background	NC	NC	31,692	30.3	8,089	865	0.379	NC	27.6	1,904	0.71	0.39	508	0.75	69.7	93.9	NC	NC	NC	NC	NC	NC	NC
Standards																							
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]	NS	NS	NS	1,000	NS	NS	2	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
WA - Ecological Receptors (p=plant, b=soil biota, w=wildlife)[2]	NS	NS	NS	50 p	NS	1,100 p	0.1 b	NS	30	NS	0.3 w	2 p	NS	1 p	2 p	86 p	NS	NS	NS	NS	NS	NS	NS
EPA Indust. PRGs - Human Receptors[3]	NS	12,000	100,000	800	NS	19,000	310	NS	20,000 *	NS	5,100	5,100	NS	67	1,000	100,000	NS	NS	NS	NS	NS	NS	NS
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate, p=plant)[4]	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	120 i	NS	NS	NS	NS	NS	NS	NS
ORNL - Ecological Receptors[5]	NS	NS	NS	40.5	NS	NS	0.00051	NS	30	NS	0.21	2	NS	1	2	8.5	NS	NS	NS	NS	NS	NS	NS

GENERAL NOTES:
All CES samples were analyzed by SVL Analytical, Inc., Kellogg, ID following digestion by M3050B. Arsenic III analysis was conducted by Brooks Rand in Seattle WA by M1632. Arsenic (V) was calculated from the difference between Total Arsenic and Arsenic (III)
mg/kg = Milligrams per kilogram
su = Standard Units
< value = Analyte not detected above indicated Method Detection Limit (MDL).
Shaded cells indicate that the value exceeds one or more standard; corresponding criteria also shaded.
Mean values calculated using one half the MDL if results were below the MDL.
NA = Not Analyzed
NC = Not Calculated
Bolding indicates an exceedence of Background 90% UCL
SHA = Site Hazard Assessment Results (Crofoot and O'Brian, 2004)
WADNR = Washington Department of Natural Resources Results (Wolff, McKay, and Norman, 2003)
USFS = USFS Region (2005)

STANDARD NOTES:
1 = Wasington Department of Ecology MTCA (WAC 173-340) Industial criteria, Table 745-1 (Ecology, 2001).
2 = Wasington Department of Ecology MTCA (WAC 173-340) Industial criteria, Table 749-3 (Ecology, 2001).
3 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2002).
4 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000)
5 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997
* = As soluble salt only
NS = No standard

Table 5. Background Soil Analytical Results
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample ID	Sample Date	Sampling Group	Sample Depth (feet)	Percent Solids-Solids (SVL)	Paste pH ASA M9	Aluminum, Total M6010B	Antimony, Total M7041	Arsenic, Total M6010B	Barium, Total M6010B	Beryllium, Total M6010B	Cadmium, Total M6010B	Calcium, Total M6010B	Chromium, Total M6010B	Cobalt, Total M6010B	Copper, Total M6010B	Iron, Total M6010B	Lead, Total M6010B	Magnesium, Total M6010B	Manganese, Total M6010B	Mercury, Total M7471	Nickel, Total M6010B	Potassium, Total M6010B	Selenium, Total M7740	Silver, Total M6010B	Sodium, Total M6010B	Thallium, Total M6010B	Vanadium, Total M6010B	Zinc, Total M6010B
				%	su	mg/kg																						
BKG-01-0.5'	9/8/2005	CES	0.5	89.7	4.19	16,900	4.03	110	24.4	< 0.20	0.77	2,680	42.7	13.3	18.5	33,900	28.2	10,800	699	0.177	21.2	1,090	< *0.6*	< 0.5	258	< *1.5*	62.3	99.1
BKG-02-0.5'	9/8/2005	CES	0.5	87.0	4.20	15,500	4.28	127	70.7	0.30	0.95	2,350	40.9	16.1	78.7	35,800	34.6	9,020	986	0.0683	36.7	3,290	< *0.6*	< 0.5	240	< *1.5*	56.5	132
BKG-03-0.5'	9/8/2005	CES	0.5	90.5	4.39	9,440	2.39	44.7	84.1	0.33	0.45	1,040	42.8	9.35	16.0	27,300	11.6	4,920	783	0.720	33.0	1,540	< *0.6*	< 0.5	137	< *1.5*	35.3	63.6
BKG-04-0.5'	9/8/2005	CES	0.5	95.6	5.43	14,000	6.25	69.9	65.8	0.21	0.61	4,710	47.4	10.7	24.2	30,400	11.0	8,220	1,500	0.773	22.9	1,290	< *0.6*	< 0.5	605	< *1.5*	66.3	72.7
BKG-05-0.5'	9/8/2005	CES	0.5	94.3	5.00	14,000	16.70	74.8	40.2	< 0.20	0.59	3,640	48.9	9.24	22.4	27,700	13.9	8,310	1,010	0.338	22.4	1,280	< *0.6*	< 0.5	568	< *1.5*	70.4	75.5
BKG-06-0.5'	9/8/2005	CES	0.5	63.3	4.21	14,800	2.51	23.3	9.7	< 0.20	0.25	797	49.9	1.2	8.2	16,200	14.6	395	101	< *0.0330*	7.2	250	0.78	< 0.5	512	< *1.5*	42.5	14.4
BKG-07-0.5'	9/8/2005	CES	0.5	73.1	3.97	24,900	8.23	700	58.8	0.28	1.13	3,620	39.2	5.29	53.6	29,700	52.3	5,030	403	0.0583	15.9	1,850	0.70	0.54	472	< *1.5*	50.7	110
BKG-08-0.5'	9/8/2005	CES	0.5	70.7	3.72	7,290	1.65	81.5	34.2	< 0.20	0.39	423	53.2	2.3	19.7	22,800	18.3	1,150	323	0.0333	14.1	319	< *0.6*	< 0.5	269	< *1.5*	67.4	29.6
BKG-09-0.5'	9/8/2005	CES	0.5	86.8	4.81	39,000	1.90	78.9	83.1	0.49	0.73	3,930	93.5	9.1	40.1	35,500	21.5	11,600	466	0.0583	38.6	2,750	< *0.6*	< 0.5	738	< *1.5*	89.0	114.0
BKG-10-0.5'	9/8/2005	CES	0.5	67.1	4.08	32,000	2.43	64.5	12.1	< 0.20	0.54	925	36.0	1.61	13.3	28,100	32.4	723	291	0.147	10.2	354	1.5	0.66	320	< *1.5*	77.4	30.6
Mean				81.8	4.40	18,783	5.04	137.5	48.3	0.21	0.64	2,412	49.5	7.83	29.5	28,740	23.8	6,017	656	0.239	22.2	1,401	0.51	0.32	412	0.75	61.8	74.2
Mean/90% UCL				87.7	4.66	23,762	7.31	236.1	62.1	0.28	0.77	3,170	57.5	10.3	40.3	31,692	30.3	8,089	865	0.379	27.6	1,904	0.71	0.39	508	0.75	69.7	93.9
Standards																												
WA - Method A Indust. Soil Cleanup Levels - Human Receptors[1]					2 - 12.5	NS	NS	20	NS	NS	2	NS	NS	NS	NS	NS	1,000	NS	NS	2	NS	NS	NS	NS	NS	NS	NS	NS
WA - Ecological Receptors (p=plant, b=soil biota, w=wildlife)[2]					NS	50 *p	5 p	NS	102 w	10 p	4 p	NS	42 bp	20 p	50 b	NS	50 p	NS	1,100 p	0.1 b	30	NS	0.3 w	2 p	NS	1 p	2 p	86 p
EPA Indust. PRGs - Human Receptors[3]					NS	100,000	410	1.6	67,000	1,900	450	NS	450	1,900	41,000	100,000	800	NS	19,000	310	20,000 *	NS	5,100	5,100	NS	67	1,000	100,000
EPA - Ecological Receptors (m=mammal, b=bird, i = invertebrate, p=plant)[4]					NS	NS	21 m	37 p	NS	NS	29 p	NS	5 p	32 b	61 i	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	120 i
ORNL - Ecological Receptors[5]					NS	NS	5	9.9	283	10	4	NS	0.4	20	60	NS	40.5	NS	NS	0.00051	30	NS	0.21	2	NS	1	2	8.5

GENERAL NOTES:

All analysis was conducted by SVL Analytical, Inc., Kellogg, ID following digestion by M3050B
mg/kg = Milligrams per kilogram
su = Standard Units
< value = Analyte not detected above indicated Method Detection Limit (MDL).
Shaded cells indicate that the value exceeds one or more standard; corresponding criteria also shaded.
Mean an 90% UCL values calculated using one half the MDL if results were below the MDL.

STANDARD NOTES:

1 = Wasington Department of Ecology MTCA (WAC 173-340) Industial criteria, Table 745-1 (Ecology, 2001).
2 = Wasington Department of Ecology MTCA (WAC 173-340) Industial criteria, Table 749-3 (Ecology, 2001).
3 - EPA Region 9 Industrial Preliminary Remediation Goals - (EPA, 2002).
4 - EPA Ecological Soil Screening Levels - Lowest Criteria Listed (EPA, 2000)
5 - ORNL = Oak Ridge National Laboratory Preliminary Remediation Goals for Ecological Endpoints August 1997
* = As soluble salt only
NS = No standard
Paste pH criteria is a Dangerous Waste/RCRA Hazardous Waste designation

Table 6. Toxicity Characterization Leaching Procedure & Synthetic Precipitation Leaching Procedure Results For Tailings and Wasterock Sam
Monte Cristo Millsite / Mystery Mine Site Inspectio

Sample ID	Sample Date	Sampling Group	Sample Depth (feet)	Arsenic, TCLP M6010B	Arsenic, SPLP M6010B	Barium, TCLP M6010B	Barium, SPLP M6010B	Cadmium, TCLP M6010B	Cadmium, SPLP M6010B	Chromium, TCLP M6010B	Chromium, SPLP M6010B	Lead, TCLP M6010B	Lead, SPLP M6010B	Mercury, TCLP M7470	Mercury, SPLP M7470A	Selenium, TCLP M6010B	Selenium, SPLP M6010B	Silver, TCLP M6010B	Silver, SPLP M6010B
				mg/L															
Concentrator																			
CON-01-0.5'	9/10/2005	CES	0.5	< 0.025	< 0.025	0.0657	0.642	< 0.002	< 0.002	< 0.006	< 0.006	2.15	2.61	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
CON-02-1.5'	9/10/2005	CES	0.5	0.401	0.145	0.108	0.129	0.0076	0.0109	< 0.006	< 0.006	1.81	3.08	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
CON-09-0.5'	9/10/2005	CES	0.5	6.58	12.2	0.147	0.0383	0.0368	0.0411	< 0.006	< 0.006	49.7	6.60	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
CON-010 -1.0	7/19/2006	CES	1.0	0.22	0.30	< 1.00	< 0.0020	0.0108	0.0093	< 0.05	< 0.006	0.228	0.139	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
CON-15	7/19/2006	CES	1.0	0.34	0.06	< 1.00	0.0098	< 0.0100	0.0030	< 0.05	< 0.006	0.431	0.119	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
CON-19	7/19/2006	CES	1.0	0.20	< 0.03	< 1.00	0.1840	< 0.0100	0.0033	< 0.05	< 0.006	0.089	0.197	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
CON-20	7/19/2006	CES	1.0	0.247	0.136	< 1.00	< 0.0020	< 0.0100	0.0098	< 0.05	< 0.006	0.2	0.039	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
Ore Collector																			
COL-04	7/19/2006	CES	3-5.5	0.307	0.232	< 1.00	0.0177	0.0123	0.0169	< 0.05	< 0.006	1.1	0.677	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
COL-19	7/19/2006	CES	6-6.5	0.361	2.31	< 1.00	0.0478	0.0174	0.0163	< 0.05	< 0.006	0.38	0.441	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
Wasterock																			
MM-01-0.5'	9/10/2005	CES	0.5	0.538	0.236	0.0146	0.0147	< 0.002	0.0026	< 0.006	< 0.006	0.07	0.105	0.00024	0.00075	< 0.04	< 0.04	< 0.005	< 0.005
MM-01-1.0'	9/10/2005	CES	1.0	0.503	0.276	0.0170	0.0127	0.0023	0.0028	< 0.006	< 0.006	0.1	0.151	0.00028	0.00053	< 0.04	< 0.04	< 0.005	< 0.005
MM-03-0.5'	9/10/2005	CES	0.5	0.358	0.328	0.0207	0.0183	< 0.002	0.0020	< 0.002	< 0.006	0.0	0.041	< 0.0002	< 0.0002	< 0.04	< 0.04	< 0.005	< 0.005
Haulage Routes																			
HW-02	7/20/2006	CES	0.5	0.629	0.10	< 1.00	0.0185	< 0.0100	0.0059	< 0.05	< 0.006	0.19	0.012	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
HW-05	7/20/2006	CES	0.5	< 0.05	< 0.025	1.53	< 0.0020	< 0.0100	< 0.0020	< 0.05	< 0.006	< 0.008	< 0.008	< 0.002	< 0.0001	< 0.05	< 0.04	< 0.05	< 0.005
Assay Office																			
AS-03 (1.5-2)	7/19/2006	CES	1.5-2	0.771	0.674	< 1.00	0.0432	< 0.0100	< 0.0020	< 0.05	< 0.006	< 0.1	0.219	< 0.002	0.00019	< 0.05	< 0.04	< 0.05	< 0.005
Applicable Standards																			
RCRA TCLP Disposal Limits				5		100		1		5		5		0.2		1		5	

GENERAL NOTES:

All analysis was conducted by SVL Analytical, Inc., Kellogg, ID

mg/L = Milligrams per liter

< value = Analyte not detected above Method Detection Limit (MDL)

Shaded cells indicate that the value exceeds criteria; corresponding criteria also shaded.

Table 7. QA/QC Analytical Results
Monte Cristo Millsite / Mystery Mine Site Inspection

Sample I.D.	Sample Date	Aluminum, TR or Diss. M200.7	Antimony, TR or Diss. M200.7	Arsenic (III), TR or Diss. M1632 Mod.	Arsenic (V), TR or Diss. Calculated	Arsenic Total, TR or Diss. M200.8	Barium, TR or Diss. M200.7	Beryllium, TR or Diss. M200.7	Cadmium, TR or Diss. M200.7	Calcium, TR or Diss. M200.7	Chromium, TR or Diss. M200.7	Cobalt, TR or Diss. M200.7	Copper, TR or Diss. M200.7	Iron, TR or Diss. M200.7	Lead, TR or Diss. M200.8	Magnesium, TR or Diss. M200.7	Manganese, TR or Diss. M200.7	Mercury, Total, TR or Diss. M245.1	Mercury, Total, UltraTrace, TR or Diss. M1631, Rev. E	Nickel, TR or Diss. M200.7	Potassium, TR or Diss. M200.7	Selenium, TR or Diss. M200.8	Silver, TR or Diss., M200.7	Sodium, TR or Diss. M200.7	Thallium, TR or Diss. M200.8	Vanadium, TR or Diss. M200.7	Zinc, TR or Diss. M200.7
		Results in µg/L																									
PHASE I																											
Duplicates																											
SFSR-SW1 (TR)	6/1/2005	< 30	< 20	0.147	9.25	9.4	4	< 2	< 2	2,750	< 6	< 6	< 10	< 60	< 3	309	< 4	< 0.2	0.000770	< 10	< 500	< 3	< 5	< 500	< 2	< 5	< 10
SFSR-SW4 (TR)	6/1/2005	< 30	< 20	NA	NC	< 3	11.1	< 2	< 2	3,100	< 6	< 6	< 10	< 60	< 3	431	< 4	< 0.2	0.000620	< 10	< 500	< 3	< 5	< 500	< 2	< 5	< 10
% Difference		0%	0%	NC	NC	145%	94%	0%	0%	12%	0%	0%	0%	0%	0%	33%	0%	0%	22%	0%	0%	0%	0%	0%	0%	0%	0%
SFSR-SW1 (200.8) (TR)	6/1/2005	NA	< 5	NA	NA	NA	NA	NA	< 0.12	NA	NA	NA	< 1	NA	< 0.55	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
SFSR-SW4 (200.8) (TR)	6/1/2005	NA	< 5	NA	NA	< 2.11	NA	NA	< 0.12	NA	NA	NA	< 1	NA	< 0.55	NA	NA	NA	NA	< 5	NA	NA	NA	NA	< 1	NA	NA
% Difference		NC	0%	NC	NC	NC	NC	NC	0%	NC	NC	NC	0%	NC	0%	NC	NC	NC	NC	0%	NC	NC	NC	NC	0%	NC	NC
SFSR-PW1 (Diss.)	6/1/2005	< 30	< 20	0.016 B	NA	10.3	4.9	< 2	< 2	2,510	< 6	< 6	< 10	< 60	< 3	287	< 4.0	< 0.2	0.000980	< 10	< 500	< 3	< 5	< 500	< 2	< 5	< 10
SFSR-PW4 (Diss.)	6/1/2005	54	< 20	NA	NA	9.5	4.3	< 2	< 2	2,630	< 6	< 6	< 10	< 60	< 3	298	< 4.0	< 0.2	0.000870	< 10	< 500	< 3	< 5	< 500	< 2	< 5	< 10
% Difference		113%	0%	NC	NC	8%	13%	0%	0%	5%	0%	0%	0%	0%	0%	4%	0%	0%	12%	0%	0%	0%	0%	0%	0%	0%	0%
SFSR-PW1 (200.8) (Diss.)	6/1/2005	NA	< 5	NA	NA	NA	NA	NA	< 0.05	NA	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
SFSR-PW4 (200.8) (Diss.)	6/1/2005	NA	< 5	NA	NA	NA	NA	NA	< 0.05	NA	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
% Difference		NC	0%	NC	NC	NC	NC	NC	0%	NC	NC	NC	0%	NC	NC	NC	NC	NC	NC	0%	NC	NC	NC	NC	NC	NC	NC
Rinsate Blanks																											
SFSR-PW-05 (Diss.)	6/3/2005	< 30	< 20	NA	NC	< 3.0	< 2	< 2	< 2	< 40	< 6	< 6	< 10	< 60	< 3	< 60	< 4.0	< 0.2	0.003680	< 10	< 500	< 3	< 5	< 500	< 2	< 5	< 10
SFSR-PW-05 (200.8) (Diss.)	6/3/2005	NA	< 5	NA	NC	NA	NA	NA	< 0.05	NA	NA	NA	< 0.1	NA	NA	NA	NA	NA	NA	< 5	NA	NA	NA	NA	NA	NA	NA
SFSR-SW-06 (TR)	6/1/2005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	< 0.000100	NA	NA	NA	NA	NA	NA	NA	NA
PHASE II																											
Duplicate																											
MM-AS-01	9/9/2005	1,160	31.2	1.700 H	1,358.3	1,360	2.5	< 0.66	30.3	69,200	< 6	15	675	16,400	37.5	25,200	4,230	< 0.2	NA	< 10	1,210	< 0.62	0.22	4,420	0.36	< 5	6,590
MM-AS-02	9/9/2005	1,120	29.4	1.500 H	1,248.5	1,250	2.5	< 0.66	29.40	66,300	< 6	14	640	15,700	35.1	24,100	4,060	< 0.2	NA	< 10	1,160	< 0.62	0.23	4,220	0.39	< 5	6,520
% Difference		4%	6%	13%	8%	8%	0%	0%	3%	4%	0%	4%	5%	4%	7%	4%	4%	0%	NC	0%	4%	0%	4%	5%	8%	0%	1%
Rinsate Blank																											
JM-AS-02	9/10/2005	< 30	< 5.6	NA	NC	< 0.43	< 2	< 0.66	< 0.12	72	< 6	< 6	< 3	< 60	< 0.6	< 60	< 4	< 0.2	NA	< 10	< 500	< 0.62	< 0.12	800	< 0.24	< 5	< 10
PHASE III																											
Results in mg/kg Following EPA Method 3050 Digestion																											
CON-10	7/19/2006	3,130	3,900	116	14,784	14,900	27.8	< 0.20	8.0	1,090.0	56.1	4.22	569	57,500	6,200	1,140	298	0.21	NA	3.4	1,900	< 0.60	52	86	< 8.0	15.2	1,210
CON-20	7/19/2006	3,350	3,900	135	15,765	15,900	26.6	< 0.20	9.5	533	49.2	4.71	598	57,300	5,820	822	360	0.24	NA	5.2	1,830	< 0.60	54	95	< 8.0	13.2	1,350
% Difference		7%	0%	15%	6%	6%	4%	0%	17%	69%	13%	11%	5%	0%	6%	32%	19%	15%	NC	42%	4%	0%	3%	10%	0%	14%	11%

GENERAL NOTES:

All analyses except Arsenic (III) & Mercury, UltraTrace were conducted by SVL Analytical, Inc., Kellogg, ID following digestion by M200.2

Arsenic (III) and Mercury, UltraTrace anlyses were conducted by Brooks Rand, Seattle, WA

Arsenic (V) was calculated from difference between Arsenic, TR and Arsenic (III)

µg/L = micrograms per liter

< value = analyte not detected above method detection limit (MDL)

B = Analyte detected between MDL and Practical Quantification Limit (PQL)

H = Holding time exceeded for sample

NA = Not analyzed

NC = Not Calculated

SFSR-PW-05 is an equipment blank on pore water sampling gear.

SFSR-SW-06 is an atmospheric blank.

JM-AS-02 is a sample trowel rinsate blank.

FIGURES

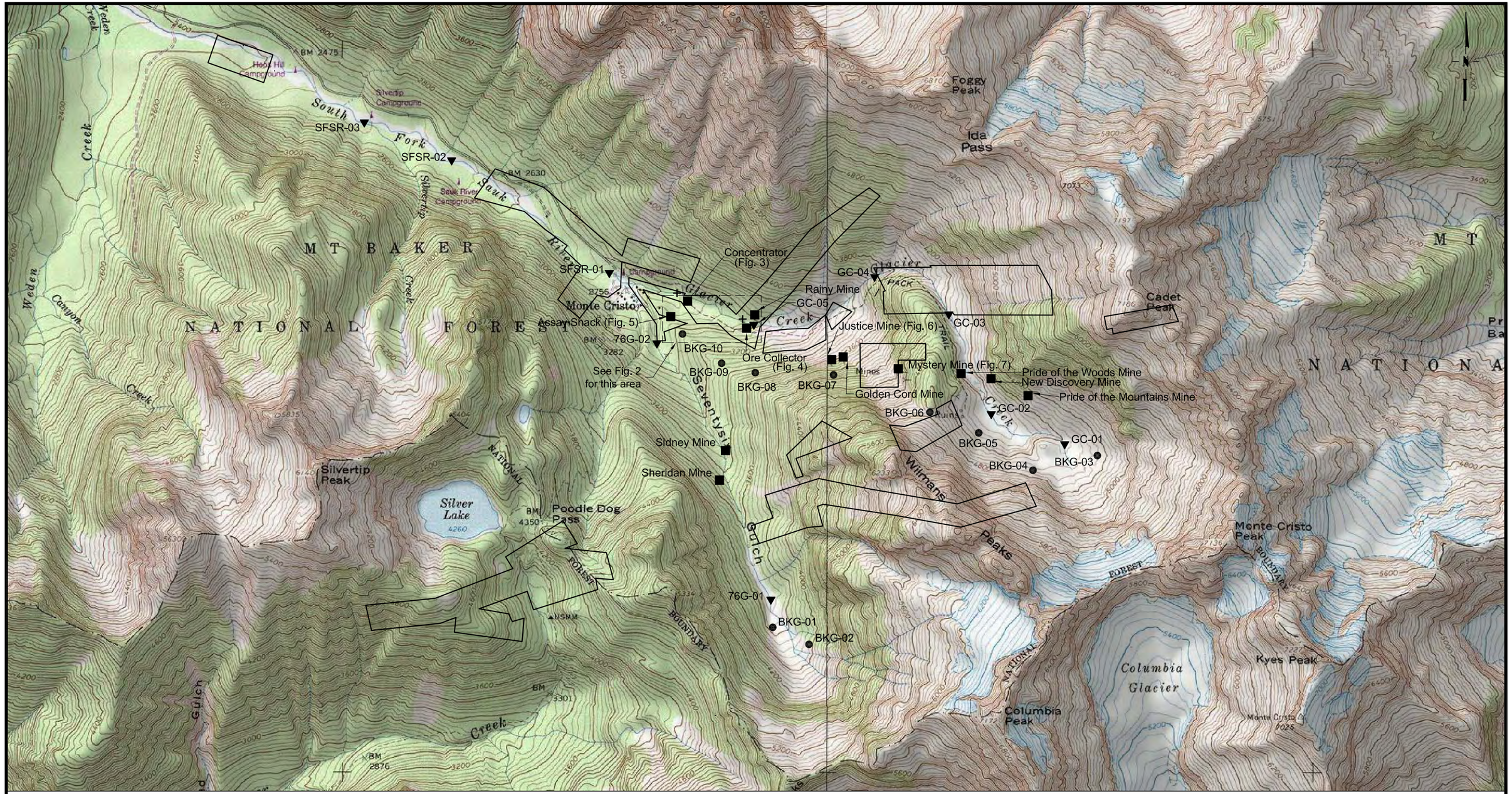


Figure 1. Aquatic and Background Sample Locations, Figure Insets, Significant Sites, and Private Property Boundaries

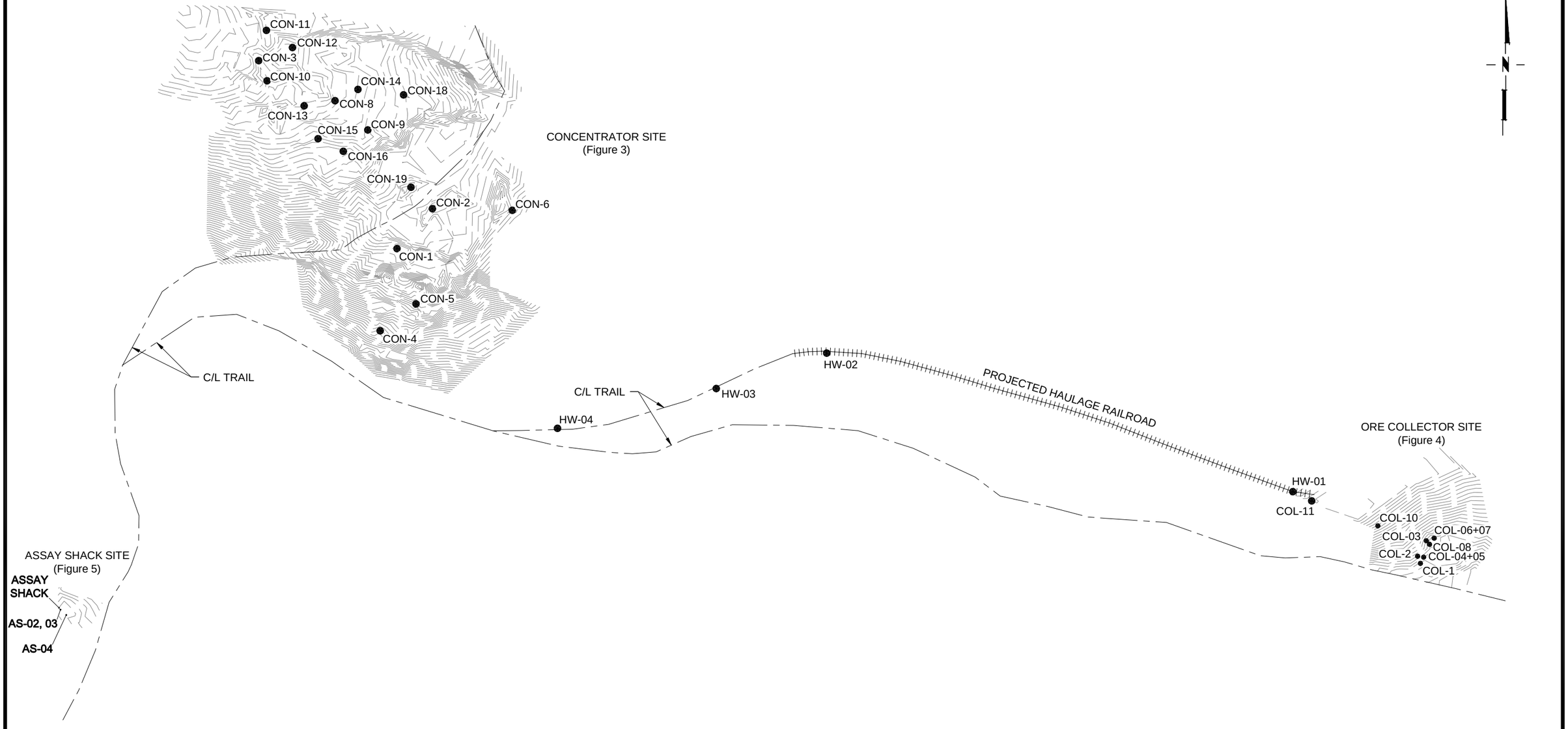
EXPLANATION

- \+ Non-Aquatic Sediment Sample Location (See Fig. 8)
- GC-04 ▼ Aquatic Sample Location
- BKG-08 ● Background Soil Sample Location
- ■ Key Features / Mines
- ▭ Private Porperty (Approximate Boundary Lines, BLM-MTP, 04/25/03 & Current Snohomish Assessor Records)

0 2000 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)
CONTOUR INTERVAL = 40 FT.

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 1/9/08	
DWG BY: dgw / DWG NO: 2523017F1g-final2.dwg	USDA Forest Service Mt. Baker-Snoqualmie National Forest Monte Cristo, Washington
PROJECT MANAGER: 6RHL	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company



EXPLANATION

- Trail ℄
- Haulage RR Tracks
- COL-06+07 Tailing/Ore/Soil Sample Location

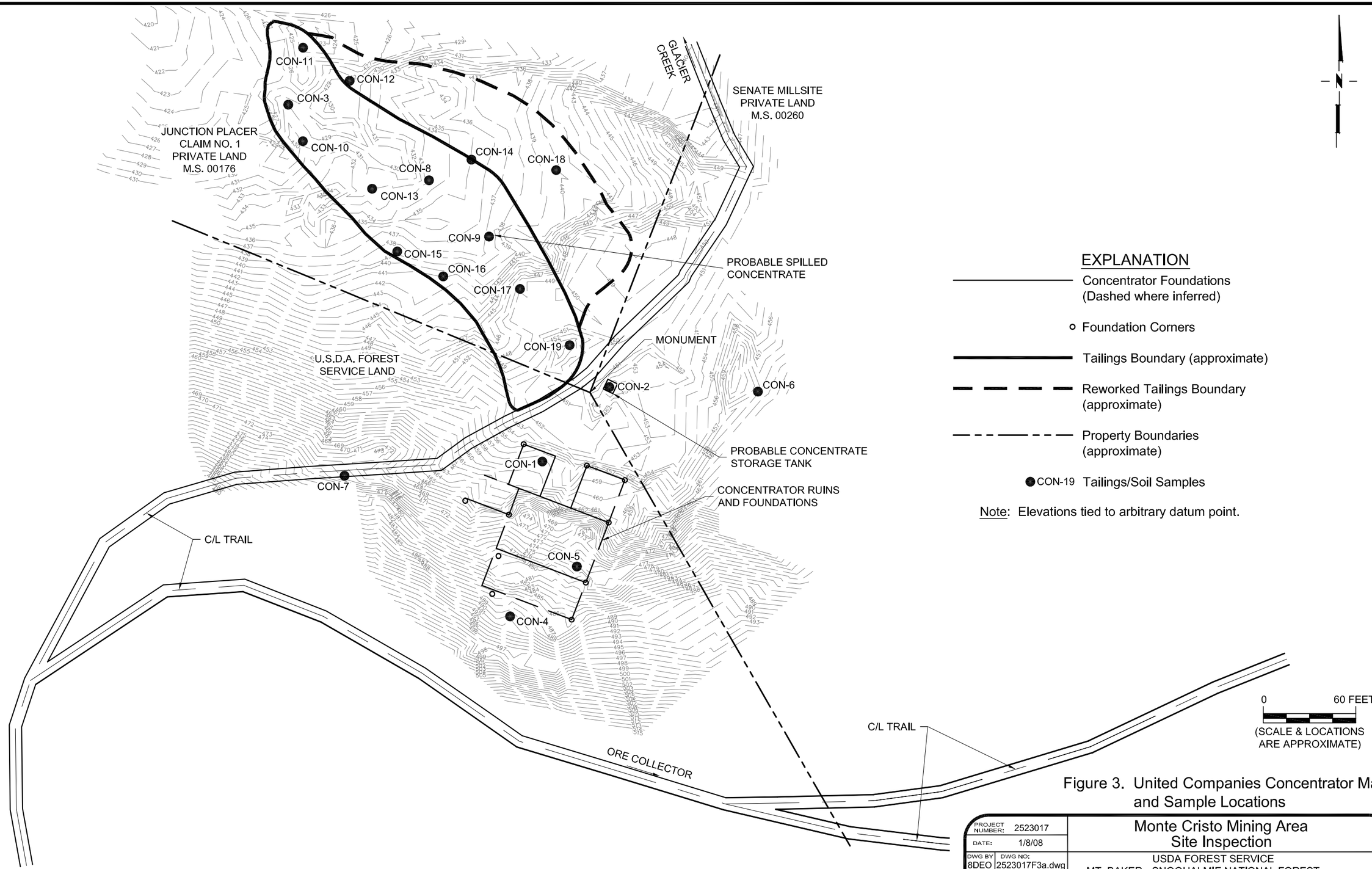
(SOURCE: CASCADE SURVEYING & ENGINEERING, INC., JOB #17275, MONTE CRISTO 1, 10/16/2006)

0 120 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)

Figure 2. Ore Tramming and Processing Area Site Map

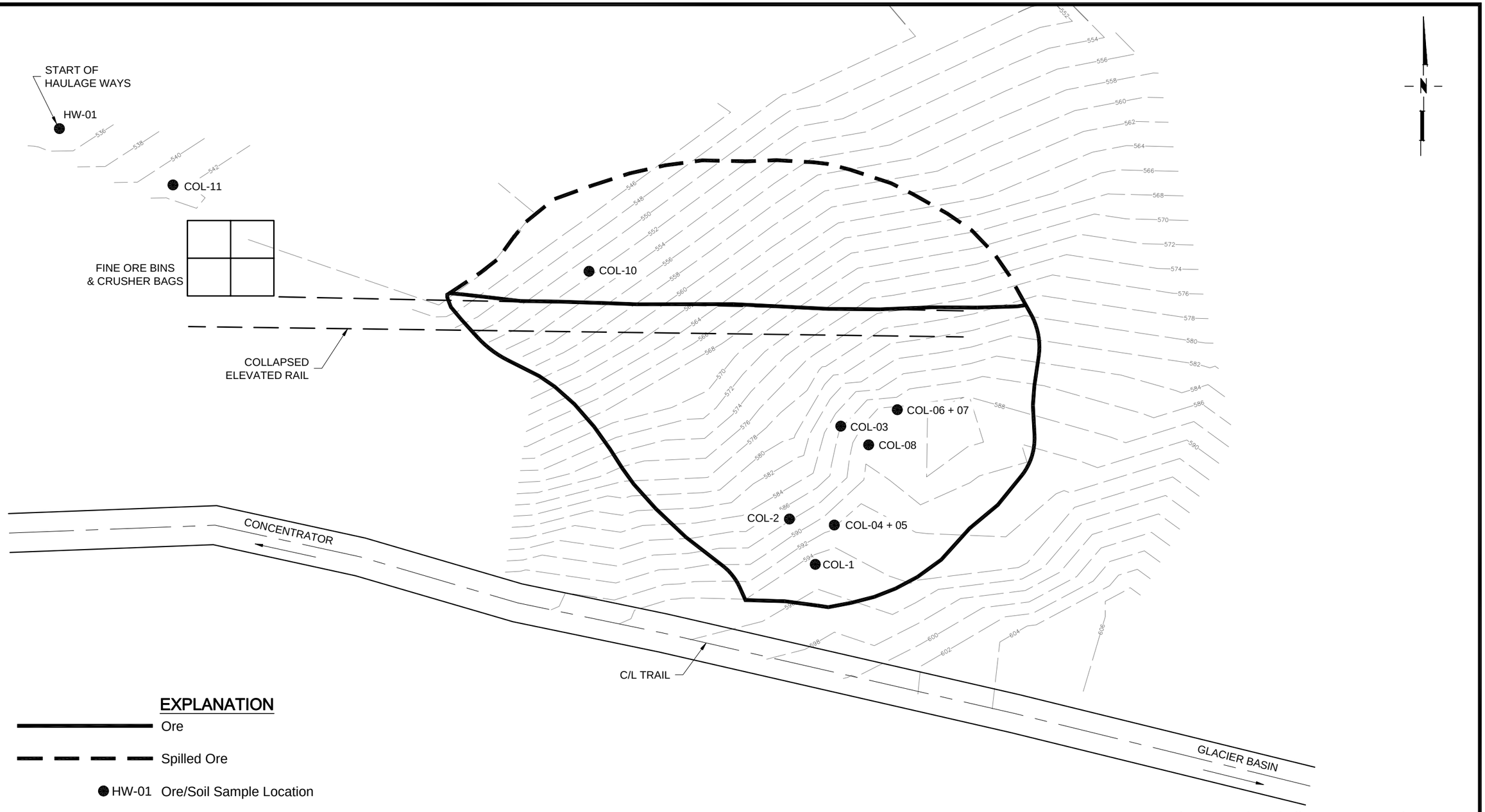
PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 9/7/07	
DWG BY: 8DEO / DWG NO: 2523017F2.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company



(SOURCE: CASCADE SURVEYING & ENGINEERING, INC., JOB #17275, MONTE CRISTO 1, 10/16/2006)

Figure 3. United Companies Concentrator Map and Sample Locations

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 1/8/08	
DWG BY: 8DEO / DWG NO: 2523017F3a.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company



EXPLANATION

- Ore
- Spilled Ore
- ● HW-01 Ore/Soil Sample Location

Note: Elevations tied to arbitrary datum point.

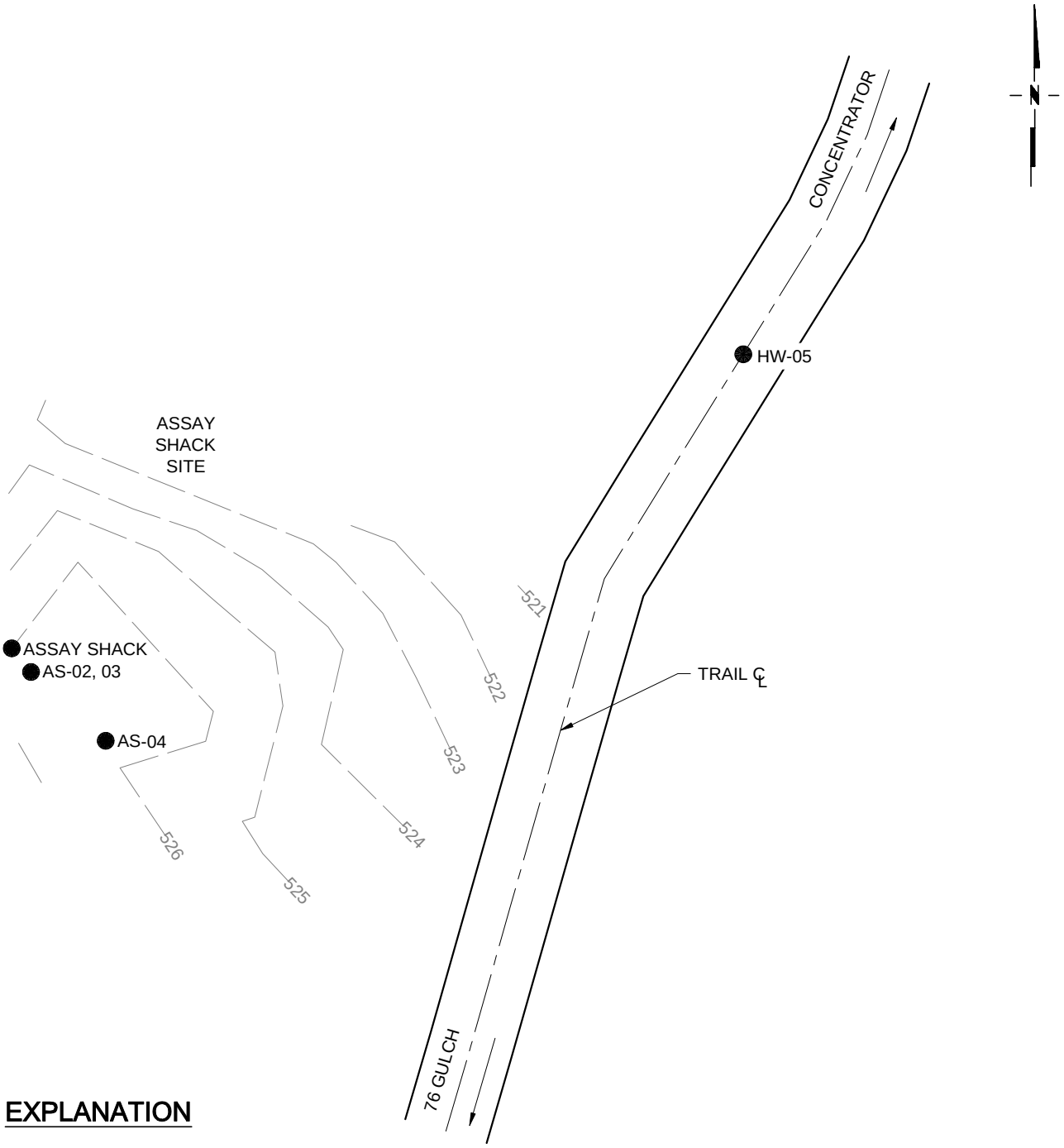
0 20 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)

Figure 4. Ore Collector Map and Sample Locations

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspections
DATE: 9/7/07	
DWG BY: 8DEO / DWG NO: 2523017F4.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

(SOURCE: CASCADE SURVEYING & ENGINEERING, INC., JOB #17275, MONTE CRISTO 1, 10/16/2006)



EXPLANATION

AS-04 Soil Sample Location

526 Contour Line and Elevation

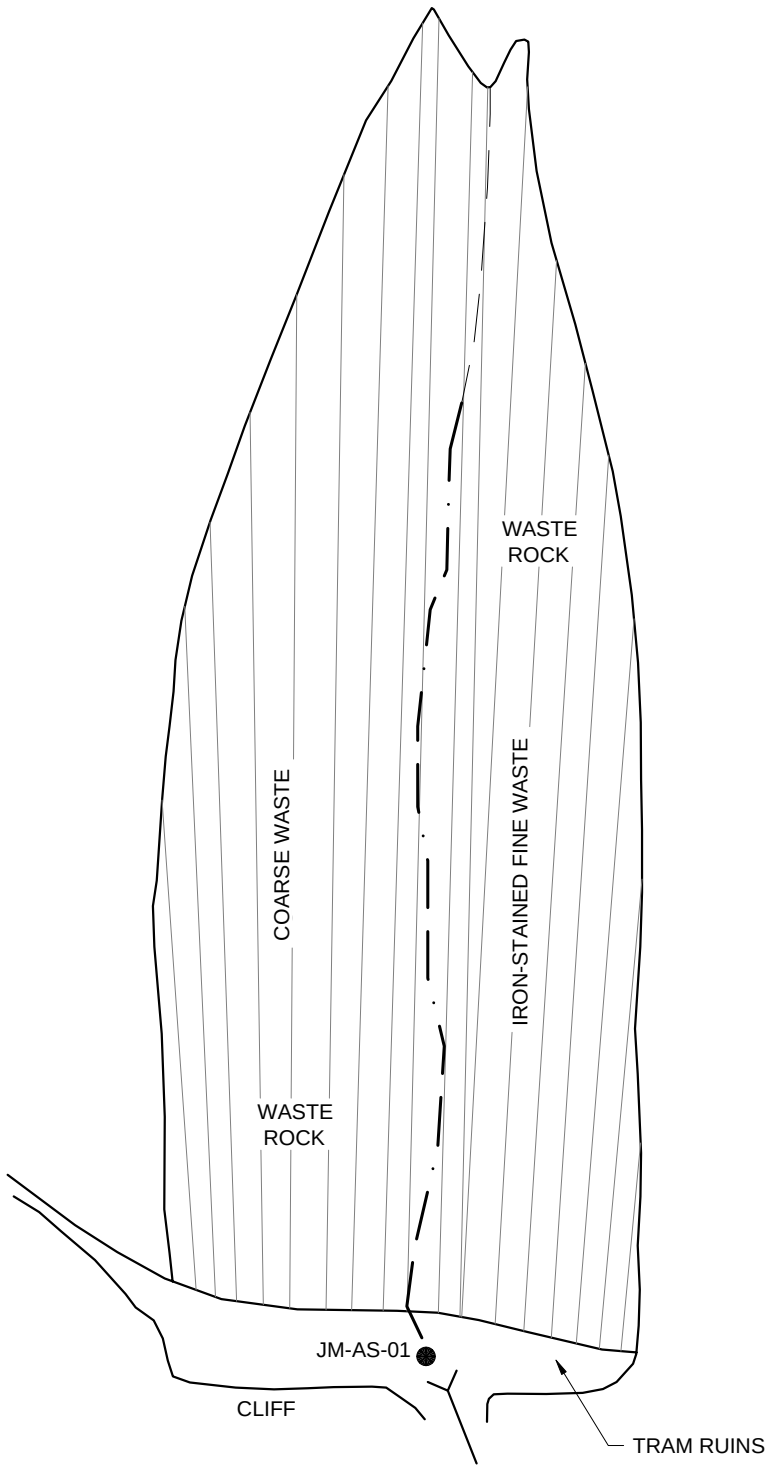
Note: Elevations tied to arbitrary datum point.

Figure 5. Assay Shack Map and Sample Locations

0 15 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 9/7/07	
DWG BY: 8DEO / DWG NO: 2523017F5.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company



EXPLANATION

JM-AS-01 Sample

Adit Discharge

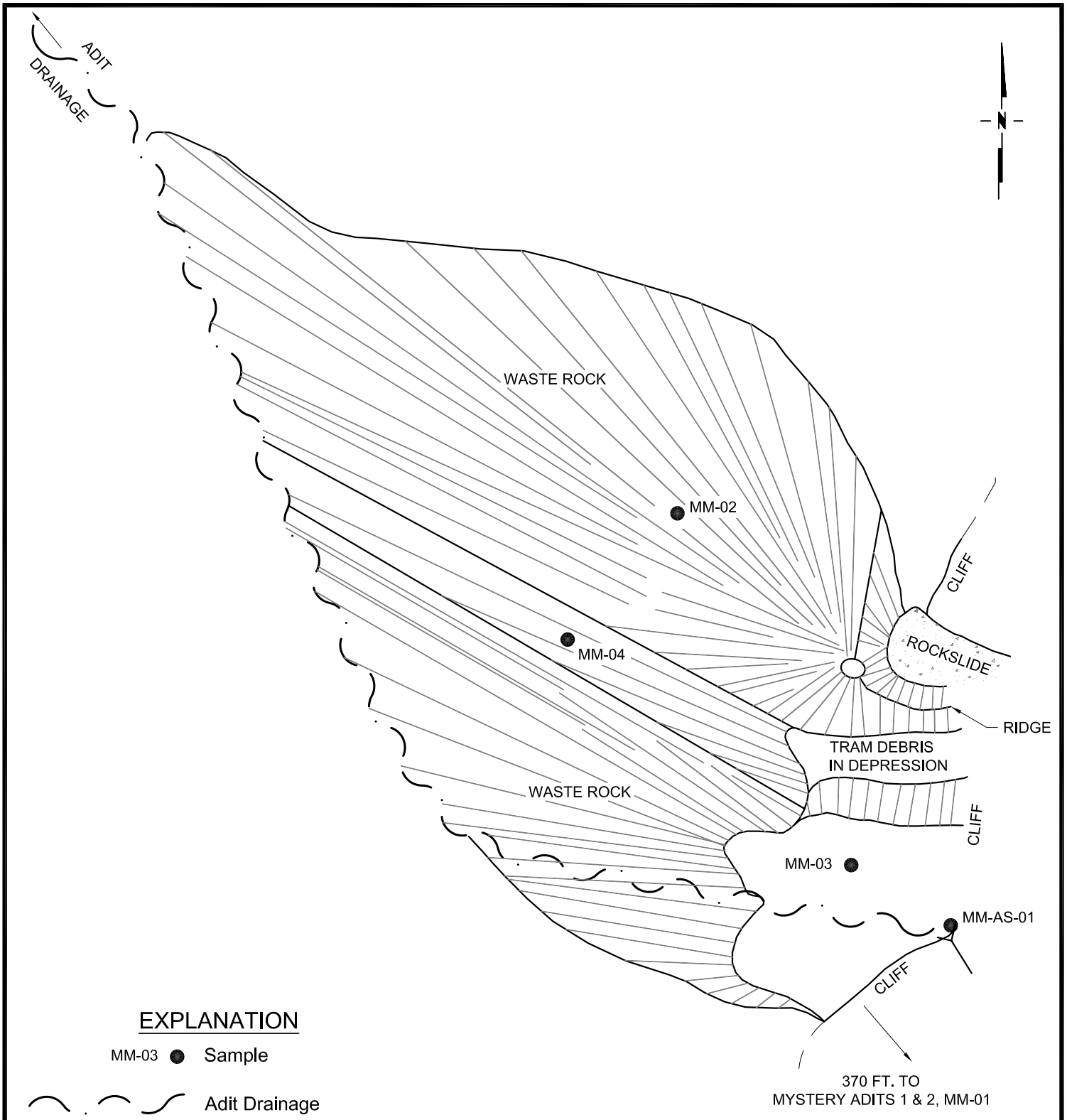
Note: Mine not surveyed; topographic contours not available.

0 50 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)

Figure 6. Justice Mine Map And Sample Locations

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 9/7/07	
DWG BY: 8DEO / DWG NO: 2523017F6a.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company



EXPLANATION

MM-03 ● Sample

Adit Drainage

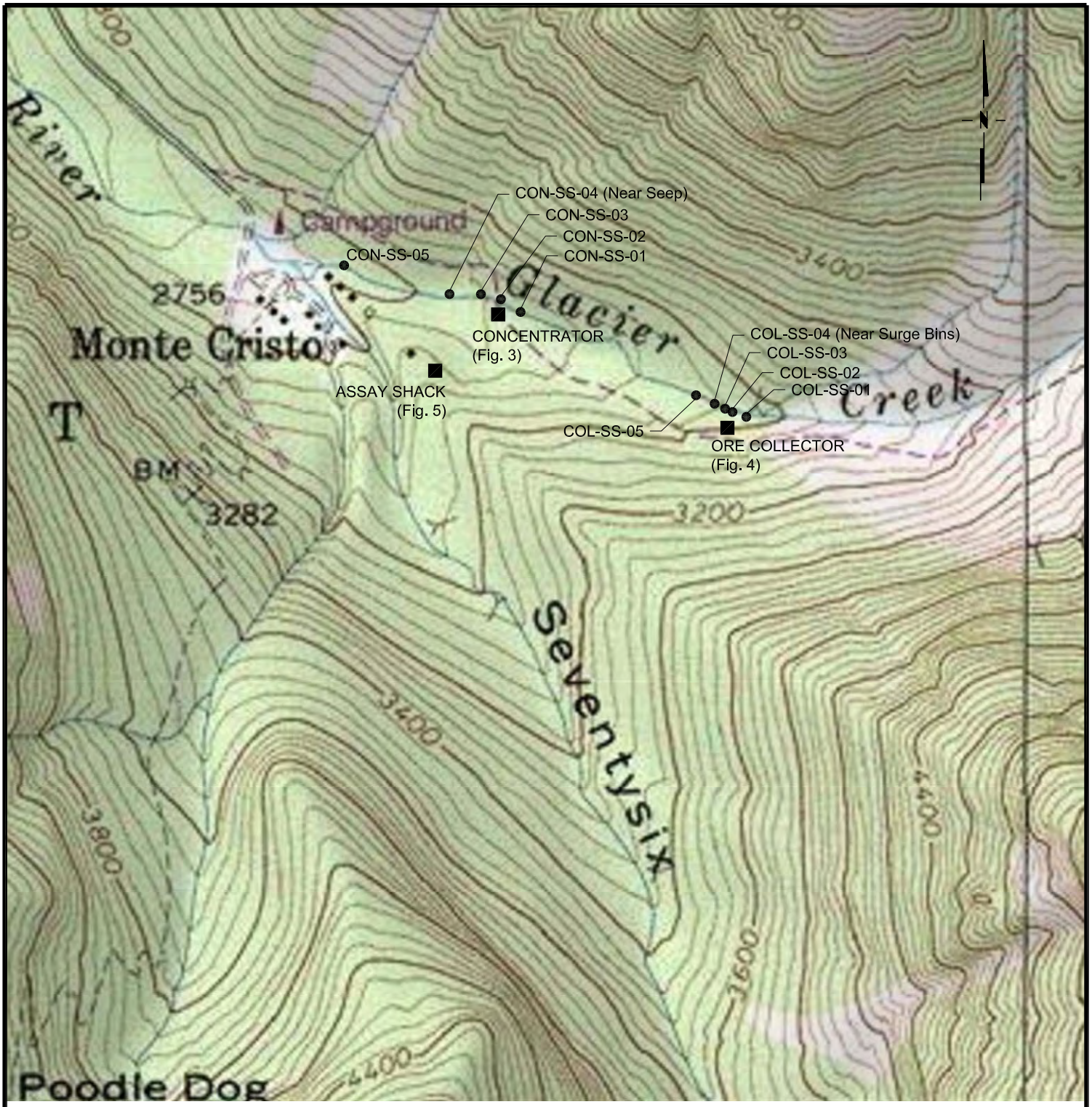
Note: Mine not surveyed; topographic contours not available.

0 40 FEET

(SCALE & LOCATIONS ARE APPROXIMATE)

Figure 7. Mystery Mine Adit 3 Map And Sample Locations

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 9/7/07	
DWG BY: 8DEO / DWG NO: 2523017F7a.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company



EXPLANATION

Ruins

CON-SS-05 Sediment Sample Location

NOT TO SCALE
(LOCATIONS ARE APPROXIMATE)

Figure 8. Detailed Sediment Sample Locations

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 9/7/07	
DWG BY: 8DEO / DWG NO: 2523017F8a.dwg	USDA FOREST SERVICE MT. BAKER - SNOQUALMIE NATIONAL FOREST MONTE CRISTO, WASHINGTON
PROJECT MANAGER: 6RHL	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

PLATE

Plate 1. Monte Cristo Mining Area Watershed Boundary with 1 and 4 Mile Site Radii

EXPLANATION

Watershed Boundary

Radius From Millsite

1 1/2 0 1 MILE

CONTOUR INTERVAL = 40 FT.

Plate 1. Monte Cristo Mining Area Watershed Boundary With 1 and 4 Mile Site Radii

PROJECT NUMBER: 2523017	Monte Cristo Mining Area Site Inspection
DATE: 11/22/2006	
DWG BY: BDEO / DWG NO: 2523017P1A.DWG	USDA Forest Service Mt. Baker-Snoqualmie National Forest Monte Cristo, Washington
PROJECT MANAGER: 6RHL	
REVISED:	CASCADE EARTH SCIENCES A Valmont Industries Company

APPENDICES

Appendix A. Photographs
Appendix B. Ecological Survey

Appendix A.

Photographs

APPENDIX A.

SITE INSPECTION PHOTOGRAPHS

United Companies Concentrator Vicinity:

Photo 1. Lower Concentrator, June 2005

Photo 2. Concentrator From Base, July 2006

Photo 3. Pelton Wheel Race, June 2005

Photo 4. CON-19 Location, July 2006

Photo 5. CON-19 Pit, July 2006

Photo 6. Abandoned access Road, July 2006

APPENDIX A.

Ore Collector:

Photo 7. Upper Ore Collector, June 2005

Photo 8. Lower Ore Collector, Sept. 2005

Photo 9. "Finer" Ore, July 2006

Photo 10. "Coarse" Ore, July 2006

Photo 11. Ore Bin Railway, July 2006

Photo 12. Crusher Base, July 2006

APPENDIX A.

Assay Shack:

Photo 13. View From Trail, June 2005

Photo 14. After Sampling, July 2006

Photo 15. SamplePit, July 2006

Photo 16. Trail Near Assay Shack, July 2006

APPENDIX A.

Mystery & Justice Mines:

Photo 17. Mystery From Trail, June 2005

Photo 18. Mystery Portal, Sept. 2005

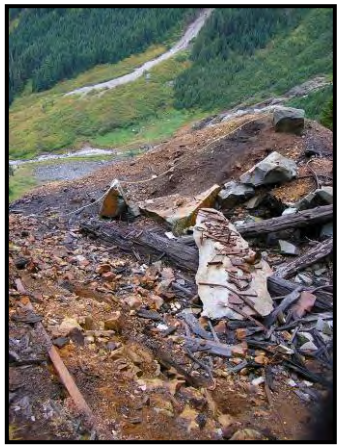


Photo 19. Mystery Dump - Downhil Sept. 2005

Photo 20. Justice Portal - Out, Sept. 2005

Photo 21. Justice Dump - Down, Sept. 2005

Photo 22. Justice - Downstream, Sept. 2005

APPENDIX A.

Aquatic Sampling Stations:

Photo 23. GC-01, June 2005

Photo 24. GC-02, Sept. 2005

Photo 25. GC-03 at POW Mine, June 2005

Photo 26. GC-04, June, 2005

Photo 27. GC-05 June 2005

Photo 28. SFSR-01, June 2005

APPENDIX A.

Aquatic Sampling Stations (Cont.):

Photo 29. SFSR-02, June 2005

Photo 30. SFSR-03, Sept. 2005

Photo 31. 76G-01, June 2005

Photo 32. 76G-02, June, 2005

APPENDIX A.

Miscellaneous:

Photo 33. Monte Cristo Townsite, June 2005

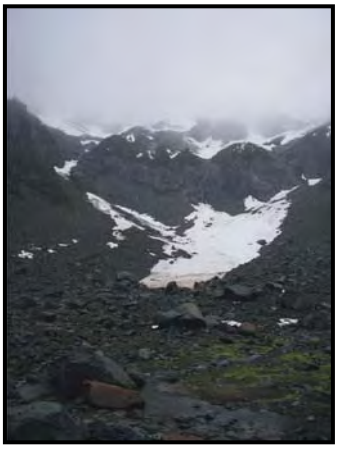


Photo 34. Upper Glacier Basin, June 2005

Photo 35. Lower Glacier Basin, June 2005

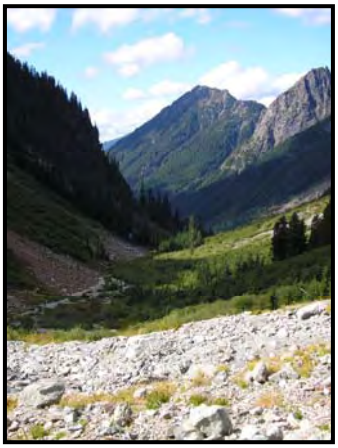


Photo 36. Seventysix Gulch, July 2006

Photo 37. Background Sample BKG-10, Sept. 2005

Photo 38. Excavator Access Ramp, July 2006

APPENDIX A.

Mines Investigated By The USFS, 2006 (Photos By CES, 2005):

Photo 39. Pride Of The Mountains, June 2005

Photo 40. Pride O The Woods, June 2005

Photo 41. Golden Chord - Justice, June 2005

Photo 42. New Discovery, June 2005

Appendix B.

Ecological Survey Tables and Figures

1.0 INTRODUCTION AND OBJECTIVES

This ecological survey report provides the methods and results of an ecological survey at and surrounding the former Monte Cristo Millsite (Site). This area includes numerous mines surrounding the historic mining town of Monte Cristo. The Site is located approximately 15 miles east of Granite Falls, WA on the Verlot Ranger District of the Mount Baker-Snoqualmie National Forest. The Site is adjacent to the headwaters of the South Fork Sauk River (SFSR), including Glacier Creek (GC), and Seventysix Gulch Creek (76G). The ecological survey was conducted as part of the Site Inspection process which is intended to determine the need for further assessment of, and/or remedial actions for, mining-related chemicals.

The overall objective of the ecological survey was to document the ecology of the Site and provide a preliminary assessment of the potential for mine-related ecological effects. The specific objectives were:

- Characterize terrestrial and stream habitats and document terrestrial macroinvertebrates, herpetiles (reptiles and amphibians), birds, mammals, fish, and benthic invertebrates that were present, or likely to be present at the Site, including the presence of threatened and endangered species and their habitat.

- Provide an initial characterization of the potential for exposure of ecological receptors to Site-related chemicals and of ecological effects that may occur as a result of this exposure, or as a result of Site-related physical disturbance of the environment.

- Compare stream invertebrate populations in upstream, adjacent, and downstream of the former Monte Cristo millsite.

- Make recommendations regarding the need for further ecological effects assessment at the Site, and, as necessary, suggest possible actions to better understand the potential ecological effects.

Section 2.0 of this report provides the methods and results of the field surveys. Section 3.0 summarizes the ecological survey results and the potential for Site-related ecological effects. Recommendations are made in Section 4.0 regarding the need for, and approach to, further ecological assessment, and references are provided in Section 5.0.

2.0 METHODS AND RESULTS

2.1 AQUATIC ECOLOGICAL SURVEY

In the area of the former Monte Cristo town site and associated mines, aquatic surveys were conducted within the SFSR, GC, and 76G to assess the potential impacts of the Site on the instream habitat, benthic macroinvertebrate community, and presence of fish species due to the site-related physical habitat alteration or chemical contamination.

2.1.1 HABITAT

Glacier Creek originates at the base of Monte Cristo Peak in upper Glacier Basin where it is a relatively wide, very shallow, and low gradient stream with no or minimal vegetation due to the duration of snow cover and rock/snow slides from the adjacent steep mountainsides. After flowing from the upper basin (Station GC-01), GC drops into a second lower basin that has relatively sparse alpine vegetation including some riparian habitat (GC-02). From this second basin the creek becomes narrower and steeper with a

minimal riparian corridor. After cascading from the lower basin, there is a shallow ponded area (GC-03) caused by a rock/earthen dam and subsequent sedimentation of the streambed. It is not known whether the dam is natural or man-made. Downstream from the pond the creek cascades to a greater than 200-foot waterfall. After these falls the creek flows steeply (GC-04) to the Monte Cristo town site (GC-05). Seventysix Gulch Creek originates at the base of Columbia Peak (76G-01) and flows steeply to the Monte Cristo town site (76G-02) where it meets Glacier Creek and the two streams form the SFSR. Just below SFSR is confined to a relatively narrow boulder-filled channel. The SFSR gains volume as it flows from the town site and becomes a meandering channel within a relatively wide streambed. Station SFSR-02 and SFSR-03 are approximately one-half mile and one mile downstream from SFSR-01. All the stream channels are scoured by spring snowmelt and runoff. The SFSR flows into the main stem Sauk River, which meets the Skagit River approximately 20 miles north of the town site. The Skagit River flows to Puget Sound.

Five GC reaches, two 76G reaches and three SFSR sample reaches were selected for habitat documentation, but invertebrate analysis was not conducted at GC-02 or SFSR-02 as these two stations were considered to be represented by similar upstream and/or downstream stations. Each reach was approximately 200 ft in length. Figure 2 *in* Cascade Earth Sciences (2006) shows the sampling reach locations. An attempt was made to conduct sampling in both riffle and pool habitats in six of the selected stream reaches. However, no pools were present in or near the established sampling reaches at stations GC-05, GC-04, and 76G-01. At the time of the investigation, stream flow was moderately high and likely higher than base flow conditions. Stream volume increased with distance downstream.

Numeric habitat ratings were developed for each reach using USEPA Rapid Bioassessment Protocol - Habitat Assessment Field Data Sheets for High Gradient Streams (Barbour 1999). Using this method, ten instream and riparian habitat parameters are each scored separately and then these individual habitat scores are summed to provide a habitat total score. The individual habitat parameter scores were used to differentiate habitat quality between stream reaches. Additional instream characterization was conducting with the Physical Characterization Field Data Sheet (Barbour 1999). The following habitat conditions were noted:

- Habitat total scores in were 130, 167, 154, 136, and 130 at stations GC-01, GC-02, GC-03, GC-04, and GC-05, respectively. At 76G-01 and 76G-02 the habitat scores were 121 and 174, respectively. At SFSR-01, SFSR-02 and SFSR-03 the habitat scores were 162, 175, and 173, respectively. This indicates the overall instream physical habitat conditions were suboptimal at all GC stations except GC-02, at 76G-01, and at SFSR-01. Conditions were optimal at GC-02, 76G-02, SFSR-02, and SFSR-03.

- At most stations, suboptimal ratings were due primarily to lower ratings for velocity depth regimes, bank stability, and vegetative cover in most of the reaches. Low ratings for available cover and sediment deposition were also indicated for the most upstream stations in GC and 76G.

Generally, these habitat scores are indicative of riffle habitat quality, and are not necessarily correlated with pool habitat quality. The most upstream stations, GC-01 and 76G-01, were similar to each other because they were present in areas subject to similar snow slide and rock fall events that are normal for their locations in the upper watershed and result in significant deposition of rocks, gravel, and sand into the stream channel. Station GC-02 was also unique in that it had relatively well developed, low gradient riffles. The riffle area at GC-03 was similar substrate to that at GC-01 but somewhat unique in that it was a large pool behind a dam created by rockslide that blocked the stream channel, and the pool has subsequently filled with smaller gravel, sand, and silt, which is uncharacteristic of other stations in GC. However, both GC-02 and GC-03 had an alpine riparian corridor. Stations GC-04 and GC-05 were similar, with a steep cascading nature that results in scouring of gravel and finer grained materials and of

the riparian vegetation. Stations 76G-02, SFSR-01, SFSR-02, and SFSR-03 had similar conditions characterized by lower gradient and more stable channel conditions, and development of some riparian vegetation. However, the narrow channel and steep banks along much of the lower portions of 76G limit the width of the riparian vegetation to a very narrow corridor. A narrow riparian corridor was present at SFSR-01 but high flows frequently scour and remove riparian vegetation closest to the channel. The streambed was less confined at SFSR-02 and SFSR-03, and the channel route changes regularly during high water events. Overall, instream and riparian conditions in GC remained relatively poor except the riffle habitat at GC-02 and pool habitat at GC-03. Instream and riparian conditions in 76G and SFSR improved in the downstream portions.

Large woody debris (LWD) was uncommon at all upstream stations, becoming more abundant at 76G-02 and in the SFSR stations. Channel pattern was poor at all stations except SFSR-02 and SFSR-03 due to high stream gradient and confining banks. Mine-related erosional features were noted in several locations on the very steep hillsides above GC, adjacent to the creek in the vicinity of GC-03, and at least one location between 76G-01 and 76G-02. Natural slides were also abundant on the hillsides along the length of GC and 76G.

No pools were present at GC-04, GC-05, or 76G-01. The pools at GC-01 and GC-03 were instream, the result of rocky debris dams. Pools at the remaining stations were similar to each other, alongside the main channel (i.e., side channel pools) behind rocks, logs, or debris that blocked upstream flow. The large size of the pool at GC-03 resulted in the highest content of fine sediment including a relatively high amount of fine-grained organic material. Sediment in other pools was primarily sand with some gravel and if organic material was present, it was relatively large pieces of forest litter or wood.

2.1.2 INVERTEBRATES

2.1.2.1 Pools

Sampling of benthic macroinvertebrates was conducted from stream reaches (excluding GC-02 and SFSR-03 as noted above) using a D-ring kick net with 500 micrometer mesh. Samples were collected from pool and riffle habitats when both were present, or just riffle habitats if no pools were present. Three kick-net samples (i.e, jabs) from each pool and riffle sampling location were composited into one larger sample for a total area of approximately 0.6 square meters (m^2) sampled per habitat type per station. Samples were preserved with 90% ethanol and shipped to the laboratory. Laboratory enumeration was completed to the species level, when possible, for at least 300 individuals in each sample. The identified invertebrates are listed in Table B-1. Abundance, diversity, and several biological indices were examined for the invertebrates present in each pool and riffle sample, and qualitatively compared between stations. Pool data were only compared to other pool data and riffle data were only compared to other riffle data. No rare, threatened, or endangered (RTE) invertebrate species were identified.

The abundance and diversity data provide understanding of the number of individual invertebrates and the number of species, respectively, at each station. The metals tolerance index was developed in Montana (Montana Department of Environmental Quality [MTDEQ], 1995) and is based upon a correlation of invertebrate species present in known metals contaminated streams versus those present in unpolluted streams. A higher metals tolerance index value indicates that a higher percentage of the invertebrate species present are known to be tolerant of the presence of metals contamination. The Shannon-Weaver index is a measure of the number of species (i.e., diversity) and the number of individuals within each species (i.e., evenness). A higher Shannon-Weaver index indicates more diversity and a lower likelihood of impacted invertebrate populations. The fine sediment biotic index is a measure of the number of species present that are tolerant of increased sediment in the stream substrate. A higher fine sediment

biotic index indicates there are more sediment tolerant species present in the sample. The intolerant species index is a measure of how many pollution sensitive species are present in each sample. A lower number in intolerant species suggests the invertebrate population may be impacted.

The results of the benthic invertebrate investigation in pool habitats show that:

- The estimated numbers of all invertebrates in pool samples were 6, 566, 660, 641, and 1196 at GC-01P, GC-03P, 76G-02P, SFSR-01P, and SFSR-03P, respectively.

- Diptera (primarily Chironomidae) were the most abundant species at all stations, and generally showed an increasing trend from upstream to downstream. No chironomids were found at GC-01P. Ephemeropteran, Plecopteran, and Trichopteran (i.e., EPT) species were lowest at GC-03P and SFSR-03P. Oligochaeta were highest at GC-03P. The first dominant taxon decreased with increasing downstream distance until SFSR-03P where it peaked at a level similar to GC-01P. These results are shown on Figure B-1.

- The overall pattern of species diversity was similar at all pool stations except SFSR-01P where diversity was notably lower (Figure B-2).

- The composition of functional feeding groups was similar among GC-01P, 76G-02P, and SFSR-03P. Shredders were more numerous than other stations at GC-03P and predators were more numerous at SFSR-01P (Figure B-3).

- The metals tolerance index increased between at GC-01P and GC-03P, decreased consecutively at 76G-02P and SFSR-01P, then increased notably at SFSR-03P. The Shannon-Weaver species diversity index (log e) decreased between GC-01P and GC-03P, then followed a pattern similar to the metals tolerance index. The numbers of intolerant (i.e. sensitive) species were lowest at GC-03P and SFSR-01P. The fine sediment biotic index was lowest at SFSR-01P. These results are shown in Figure B-4.

The low number of invertebrates at GC-01P may be indicative of lower quality habitat and harsh weather-related conditions found in the upper GC basin. The habitat at GC-03P presented some of the best pool habitat but did not show increased invertebrate abundance compared to downstream stations. This may be related to the relatively higher elevation compared to downstream stations, or may provide evidence of potential non-habitat conditions limiting invertebrate populations at GC-03P. SFSR-01P had similar habitat but higher flows than 76G-02P. With the exception of slightly lower numbers of invertebrates at SFSR-01P compared to 76G-02P, a general increase in invertebrate numbers was found with increasing distance downstream from the headwaters of the streams. However, abundance differences at GC-03P and SFSR-01P may also be the result of non-habitat conditions.

Similarity in the distribution of species at all stations except GC-01P (Figure B-1) confirms a general similarity in habitat conditions at these pool Stations and the increasing numbers of dipteran species suggests higher pool habitat quality or possibly less impacted conditions. However, higher EPT numbers at 76G-02P may reflect less pool-like and more riffle-like characteristics of this small side-channel pool, and lower EPT numbers at GC-03P and SFSR-03P suggests better quality pool habitat. The absence of chironomids and elevated first dominant taxon at GC-01P is most likely related to the very few numbers of invertebrates (only 6) found at this station and not necessarily related to non-habitat conditions. The higher numbers of Oligochaeta at GC-03P likely reflect the higher fine sediment content at this station. Generally, the lower percentages of first dominant taxon at GC-03P, 76G-02P, and SFSR-01P support the concept of increasing habitat quality. The higher first dominant taxon at SFSR-03P is unexpected.

The species diversity shown in Figure B-2 suggests similar distribution of species at all stations except SFSR-01P. However, given its higher pool habitat quality, GC-03P could be expected to have higher diversity than the other stations. The decreased diversity at SFSR-01P was not expected based on pool habitat quality compared to other stations.

As shown in Figure B-3, a similar pattern of functional groups are present at GC-01P, 76G-02P, and SFSR-03P. In contrast, station GC-03P had decreased gatherers and increased shredders and SFSR-01P had decreased gatherers and increased predators. While GC-03P has habitat conditions distinct from the other stations that could account for these differences, there is also mine-related wasterock immediately adjacent to GC-03P. The differences at SFSR-01P were not expected based on pool habitat quality compared to other stations.

The Shannon-Weaver index (Figure B-4) suggests slightly lower species diversity at SFSR-01P compared to the other stations. Station GC-03P also has a relatively high metals tolerance index and a low intolerant (i.e., sensitive) taxa index, suggesting a potential for Site-related impacts at this station. The intolerant taxa index is also low at SFSR-01P, but the metals tolerance index is also lower suggesting lower habitat quality may be causing the differences in invertebrate populations, rather than elevated metals concentrations. The elevated metals tolerance index at SFSR-03P is conflicted by the relatively high intolerant taxa index and increased Shannon-weaver index (compared to SFSR-01P). Based on these indices, Stations GC-03P appears to have the most weight-of-evidence for apparent differences in invertebrate populations related to potential mining impacts, and differences at SFSR-01P and SFSR-03P appear more likely related to habitat differences. Examination of metals concentrations in pool sediment would provide further evidence for differentiating between potential Site-related and habitat quality-related differences in invertebrate populations in these pools.

Generally, pool habitats are representative of instream sediment quality. The benthic invertebrate survey results for pool habitats provide some evidence of potential mine-related impacts at GC-03P, the only station with significant silt and fine organic matter accumulation. Compared to nearby stations, distinct invertebrate population differences were also noted at SFSR-01P. These differences appeared more likely related to habitat conditions, but Site-related affects could not be eliminated as a potential cause.

2.1.2.2 Riffles

Results of the benthic invertebrate investigation in riffle habitats suggest that:

- The numbers of invertebrates were 39, 27, 241, 1224, 94, 541, 251, and 682 at stations GC-01R, GC-03R, GC-04R, GC-05R, 76G-01R, 76G-02R, SFSR-01R, and SFSR-03R, respectively.

- EPT species were among the most abundant species at all Stations except GC-01R, where Diptera were the most abundant. Ephemerellidae were the second most abundant species at GC-04R. Diptera and/or Baetidae were relatively abundant at GC-03R, GC-04R, 76G-01R, SFSR-01R, and SFSR-03R. Oligochaeta were relatively abundant at GC-05R and 76G-02R. The first dominant taxon was highest at GC-01R, GC-05R, 76G-01R, and SFSR-03R. These findings are shown graphically in Figure B-5.

- The diversity of all species increases with increasing distance downstream in GC and 76G, then decrease at the two SFSR stations. However, EPT species diversity was consistent at all downstream stations except at 76G-02R, where there were notably more EPT and non-Chironomidae/non-Oligochaetae species than in other stations. This information is displayed in Figure B-6.

- The composition of functional feeding groups showed gatherers or clingers were dominant at most stations. Scrapers were dominant at 76G-02R and SFSR-03R. Except for at GC-05R, gatherers decreased and scrapers increased with increasing distance downstream. Figure B-7 shows the distributions of functional feeding groups at each riffle station.

- The metals tolerance index was highest at GC-01R, GC-03R, and 76G-01R, and relatively low and consistent at the other stations. The Shannon-Weaver species diversity index (log e) was consistent across all stations. The number of intolerant taxa was lowest at GC-01R and elevated at GC-04R and 76G-02R. These data are shown in Figure B-8.

Differences in the number of invertebrates at each Station suggest increasing quality riffle habitat with increasing distance downstream. The optimal to suboptimal habitat ratings and relative abundance of EPT species across all Stations except GC-01R, suggest that relatively good quality riffle conditions exist at these Stations. Observed riffle habitat conditions were most notably different from other stations at GC-01R, 76G-01R, and GC-03R, which were the stations with the lowest invertebrate abundance. Of these three stations, GC-03R had the highest quality riffle conditions. Overall the community composition data in Figure B-5 suggest that conditions are distinct at GC-01R and that better defined riffle conditions are generally present in the downstream stations. The decreased percentage of EPT species and increased first dominant taxon at GC-05R and the increase in first dominant taxon between SFSR-01R and SFSR-03R are not consistent with the general trends observed at other stations.

Figure B-6 shows increasing diversity proceeding downstream in GC, except at GC-05R. The low Chironomidae richness at GC-03R is also notably lower than at other stations. Similar to GC, increasing diversity was observed with increasing distance downstream in 76G. However, these trends were reversed in the SFSR.

As shown in Figure B-7, except at GC-05R, decreasing numbers of gatherers and increasing numbers of scrapers suggests increasing riffle quality with increasing distance downstream. The lack of scrapers at 76G-01R is inconsistent with the other stations. The relatively high number of clingers at all downstream stations except GC-05R suggests potential differences at this station compared to others. The low number of clingers in GC-01R may be habitat related. While there appears to be more variability in the shredder data, the lack of shredders at GC-03R and SFSR-03R, and the lack of scrapers at 76G-01R seem inconsistent with other stations.

The intolerant taxa and metals tolerance index (Figure B-8) are inversely correlated at the first three GC stations and at 76G-01R. This suggests metals may be elevated at GC-01R, GC-03R, and 76G-01R, but that conditions are improving with increasing distance downstream. Both GC-01R and 76G-01R are located at the headwaters of the two streams. The low intolerant species indices at GC-05R and SFSR-03R are unexpected, and although habitat conditions may not be optimal at SFSR-01R, the low intolerant species index at this station is also unexpected. Because the metals tolerance index is low at these stations, it is possible that habitat differences are responsible for the unexpected conditions. The Shannon-Weaver diversity index is relatively stable across all stations, but the lowest values were observed at GC-05R and SFSR-03R.

Generally, riffle habitats are representative of instream water quality and thus, of potential ongoing chemical inputs into the streams. The invertebrate enumeration data for riffle habitats suggest inconsistencies at stations GC-01R, GC-03R, GC-05R, and SFSR-03R. Potential metals-related impacts were indicated at GC-01R, GC-03R, and 76G-01R. An examination of metals concentrations in these locations would aid in the interpretation of the potential for metals-related impacts. However, weather-related conditions at the headwaters of GC and 76G are very harsh and may also be a cause of the inconsistencies at these stations. The inconsistencies at station GC-05R may also be habitat related given

the severe scouring that occurs in this reach. However, inconsistencies at SFSR-03R are not clearly habitat related. Station 76G-02R appeared to have the most robust invertebrate populations and this is likely due to the combination of stable instream and streamside habitats, and significant canopy cover over the channel.

2.1.3 FISH

The potential presence of fish was documented by visual observation during the ecological survey. No fish were noted, however, several fish species are known to inhabit the SFSR and likely the lower portions of 76G and GC up to the falls above GC-05. These include federally threatened bull trout (*Salvelinus confluentus*), state priority rainbow/steelhead trout (*Oncorhynchus mykiss*), and cutthroat trout (*Oncorhynchus clarki*).

2.2 TERRESTRIAL ECOLOGICAL SURVEY

Terrestrial habitats and animals that are present or likely at, and surrounding, the mine were documented during the ecological survey and via communication with regional biologists. Four 30-minute bird surveys were also conducted. During the field effort, first the Site was inspected to determine the dominant vegetation communities at and surrounding the mines, then the dominant plant species were identified (Cooke, 1997; Hitchcock and Cronquist, 1978; Niehaus and Ripper 1976, Pojar and Mackinnon, 1994; Little, 1980) within each of the communities. The observed plant species were documented on field forms. Qualitative surveys also were conducted at and surrounding the mine for mammal and invertebrate presence. Lists of rare, threatened, or endangered (RTE) plants and animals likely or known to be present in the vicinity of the site were obtained from the U.S. Forest Service (USFS), Washington Department of Fish and Wildlife (WDFW) priority species list (shown in Appendix B1), and Washington Department of Natural Resources' Natural Heritage Program (NHP).

2.2.1 PLANT COMMUNITIES/HABITAT

The mine site is within the Cascades Mixed Forest-Coniferous Forest ecoregion (Bailey 1995). This ecoregion is characterized by warm summers and wet mild winters with average temperatures ranging from 2 to 10 degrees Celsius. Rainfall varies considerably with elevation across the ecoregion with 100 to 200 cm (40-75 inches) of precipitation per year estimated for the Monte Cristo area. Precipitation is common throughout the year, but a majority occurs in the fall, winter, and spring. Relative humidity is often high due to the proximity of this province to the Pacific Ocean. The dominant plant communities in this ecoregion may be Douglas fir (*Pseudotsuga menziesii*), western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), mountain hemlock (*Tsuga mertensiana*), grand fir (*Abies grandis*), silver fir (*Abies amabilis*), or Sitka spruce (*Picea sitchensis*) forests at middle to low elevations. Hemlock and silver fir are often the climax species.

Three distinct plant communities were observed in the vicinity of the Monte Cristo town site including disturbed, conifer forest, and alpine. The disturbed community includes anthropogenically disturbed, naturally disturbed, and riparian because they had many similar species. The primary difference between the disturbed habitats was the presence of a much higher proportion of grass at the town site. The terrestrial RTE plant species potentially present at the Site are listed in Table B-2. No listed RTE plants were observed during the field effort. The U.S. Forest Service has documented the USFS-listed sensitive plant, boreal bedstraw (*Galium kamschaticum*), and the NHP listed the Choris' bog orchid (*Platanthera chorisiana*) in the vicinity of the Site. There are numerous mine and mine-related structures in the vicinity of the town site so not all potentially impacted areas could be surveyed. Therefore, if remediation work is necessary in a particular location, field surveys for protected species may be needed prior to any ground disturbance activity.

The conifer forest community canopy layer was dominated by western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) with Pacific silver fir (*Abies amabilis*) also present. The primary shrub layer species included salmon berry (*Rubus spectabilis*), red elderberry (*Sambucus racemosa*), and red huckleberry (*Vaccinium parvifolium*). The ground (herbaceous) layer primarily included queen's cup (*Clintonia uniflora*), western trillium (*Trillium ovatum*), and mosses (various sp.), with few other species present. These and other species observed in the forest community are listed in Table B-3.

The alpine community had a sparse canopy layer consisting primarily of mountain hemlock and Sitka alder (*Alnus sinuata*). The shrub/herbaceous layer was dominated by mountain heather (*Phyllodoce empetriformis*). These and other species observed in the alpine community are listed in Table B-3.

The disturbed community had a dense to sparse canopy layer, primarily consisting of red alder or Sitka alder with intermixed young western red cedar and hemlock. The shrub layer was dominated by salmonberry (*Rubus spectabilis*) and Scouler's willow (*Salix scouleriana*). The herbaceous layer was dominated by grasses (primarily at or near the town site), horsetail, sedges, and Indian hellebore (*Veratrum viride*). These and other species observed in the disturbed community are listed in Table B-3. The disturbed mining-related plant community encompassed areas surrounding mine adits and processing areas, as well as the extensive network of roadways, excavated areas, and old mining-related buildings. The areas immediately surrounding the mines and processing areas were primarily waste rock, gravelly soil, or compacted gravel roadways, generally with sparse early successional canopy and shrub layers, and a variable herbaceous layer including more colonizing and weedy species.

2.2.2 INVERTEBRATES

Invertebrates noted on and near the Site included bees, butterflies, moths, mosquitos, and many small black flies. None of these or any other invertebrates in the vicinity of the mine are known RTE species. The invertebrate species observed, expected, or possible in the vicinity of the mine are listed in Table B-4.

2.2.3 BIRDS

One bird survey station (BS-01) was established at the same elevation as the town site in a disturbed area of alder and willow trees near the border of the central open grassy area. A second survey station (BS-02) was located uphill from the town site in conifer forest. One bird survey was also conducted in the alpine habitat near GC-03. Two 30 minute surveys were conducted from each of the low elevation stations and one survey was conducted at the higher elevation alpine station. Birds observed during the surveys or during the vegetation, mammal, or stream surveys, and birds expected or possible at the Site are listed in Table B-5. The marbled murrelet (federally threatened) was the only threatened or endangered bird species observed or expected near the Site. Olive-sided flycatchers (*Contopus borealis*; federal species of concern) were observed and three-toed woodpeckers (*Picoides tridactylus*; state monitor species) are expected at the Site. The spotted owl (*Strix occidentalis*; federally threatened) is present within 2 miles of the Site, but is not expected given the open canopy present over much of the Site and the very limited amount of old growth forest in the vicinity.

2.2.4 MAMMALS

Game trails were not clearly present, but deer tracks were noted in the vicinity of the Site, suggesting that black-tailed deer (*Odocoileus hemionus columbianus*; state priority; USFS Management Indicator Species)) are present. Black bear (*Ursus americanus*) are also expected. Mammals or mammal sign observed included, Douglas' squirrel (*Tamiasciurus douglasii*), Cascade golden-mantled ground squirrel (*Citellus sateratus*), and hoary marmot (*Marmota caligata*). Townsend's big-eared bats (*Plecotus townsendi;* state candidate species; federal species of concern; USFS Sensitive) may inhabit caves or

mine shafts in the vicinity of the Site. The long-eared myotis (*Myotis evotis*: state monitor species; federal species of concern; USFS sensitive), and Keen's myotis (*Myotis keenii*; state candidate species) are also expected in the vicinity. Mammals that were observed, expected or possible at the Site are listed in Table B-6. Other RTE mammal species listed in Table B-2 may inhabit the region, but are unlikely or uncommon.

2.2.5 REPTILES AND AMPHIBIANS (HERPETILES)

No herpetiles nor herpetile signs were observed during the field effort. No RTE herpetile are expected at the Site. The RTE herpetile species expected or possibly present in the vicinity of the Site are listed in the Appendix. Other herpetiles observed, expected, or possible at the Site are listed in Table B-7.

3.0 CONCLUSIONS

Chemical impacts to terrestrial species would be expected only if they reside or are consistently feeding from within contaminated areas such as mine wasterock piles or near mine-related buildings such as the concentrators. Thus, immobile or relatively immobile species such as plants and invertebrates are the species most at risk. However, while individual plants and invertebrates may be at risk, impacts to populations of these species are unlikely. Impacts to most mobile terrestrial species are not expected because the mining-related disturbed areas at the Site are small in relation to the available surrounding undisturbed habitat,. Thus, individuals of listed RTE plant and invertebrate species are the primary concern and mobile RTE species are a secondary concern.

Overall, numerous mines, tramways, logging, road building and other human activities have included chemical and physical disturbances to the natural environment at the Site. The areas at and immediately surrounding the mines and mine related buildings are still disturbed and contain disturbed successional plant communities. The habitat adjacent to the disturbed mine areas is relatively undisturbed (except by recreational use) and good quality terrestrial and natural instream habitats are generally present. The mine-related physical disturbances appear to have extended into GC and possibly 76G and have the potential for past and on-going influence on these streams. However, the only apparent and potential areas of chemical effect for terrestrial species are on or near wasterock at each mine and near mining-related building where chemicals were used to separate minerals from the rock. Given the relatively small area of the waste piles compared to available unimpacted habitat, the potential for terrestrial ecological effects is likely limited to species such as plants and invertebrates that may reside in the disturbed areas and are rooted in or regularly exposed to the waste piles. Based on stream invertebrate enumeration results, potential metals-related instream effects were noted at GC-01, GC-03, and 76G-01. and GC-05. Invertebrate population anomalies were also noted at GC-05 and SFSR-03, and possibly at SFSR-01, but these could not be clearly linked to metals concentrations in the stream.

4.0 RECOMMENDATIONS

Ecological risk-based screening should be conducted to identify potential risks, if any, to terrestrial and aquatic ecological receptors and determine contaminants of potential ecological concern (COPECs), if any, in soil/waste piles, surface water, and sediment. Any identified COPECs in soil, surface water, or sediment should be examined with regard to their potential for bioaccumulation in terrestrial and aquatic food chains.

5.0 REFERENCES

Bailey, R.G. 1995. Description of the Ecoregions of the United States. Second Edition. United States Department of Agriculture. Miscellaneous Publication 1391. Washington D.C.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish.* Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency, Office of Water. Washington, D.C.

Brown, H.A. R.B. Bury, D.M. Darda, L.V. Diller, C.R. Peterson, and R.M. Storm. 1995. Reptiles of Washington and Oregon. Seattle Audubon Society. The Trailside Series. Seattle, WA.

Burt, W.H. 1980. A Field Guide to the Mammals, North America North of Mexico. Third Edition. The Peterson Field Guide Series. Houghton Miffline Company. New York, NY.

Cascade Earth Sciences 2006. Site Inspection Report, Monte Cristo Millsite / Mystery Mine, Mt. Baker-Snoqualmie National Forest *for* USDA Forest Service.

Cooke, S.S. 1997. A Field Guide to the Common Wetland Plants of Western Washington and Northwestern Oregon. Seattle Audubon Society. The Trailside Series. Seattle, WA.

EPA. 1990. *Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters*. EPA/600/4-90/030. U.S. Environmental Protection Agency, Office of Research and Development. Washington, D.C. November.

Hafele, R. and S. Hinton. 1996. *Guide to Pacific Northwest Aquatic Invertebrates*. Oregon Department of Environmental Quality. Published by Oregon Trout. Portland, Oregon.

Hitchcock, C.L. and A. Cronquist. 1990. *Flora of the Pacific Northwest*. University of Washington Press. Seattle, Washington.

Leonard, W.P., H.A. Brown, L.L.C. Jones, K.R. McAllister, and R.M. Storm. 1996. Amphibians of Washington and Oregon. Seattle Audubon Society. The Trailside Series. Seattle, WA.

Little, E.L. 1980. The Audubon Society Field Guide to North American Trees: Western Region. Alfred A. Knopf. New York, NY.

Milne, L. and M. Milne. 1980. National Audobon Society Field Guide to North American Insects & Spiders. Alfred A. Knopf. New York, NY.

National Geographic Society. 1992. Field Guide to the Birds of North America. Second Edition. Washington D.C.

Niehaus, T.F. and C.L. Ripper. 1976. Pacific States Wildflowers; Washington, Oregon, California, and Adjacent Areas. The Peterson Field Guide Series. Houghton Mifflin Company. New York, NY.

Parish, R. R. Coupe, and D. Lloyd. 1996. Plants of the Southern Interior: British Columbia and the Inland Northwest. Lone Pine Publishing. Auburn, WA.

Paustian, S.J. (editor), et al. 1992. *A Channel Type User's Guide for the Tongass National Forest, Southeast Alaska*. USDA Forest Service. Alaska Region. R10 Technical Paper 26. 179 p.

Pojar, J. and A. Mackinnon. 1994. Plants of the Pacific Northwest Coast: Washington, Oregon, British Columbia, and Alaska. Lone Pine Publishing. Renton, WA.

Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2001. Weeds of the West. 9th Edition. Western Society of Weed Science, Newark, CA. University of Wyoming.

FIGURES

Figure B-1
Community Composition In Pool Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

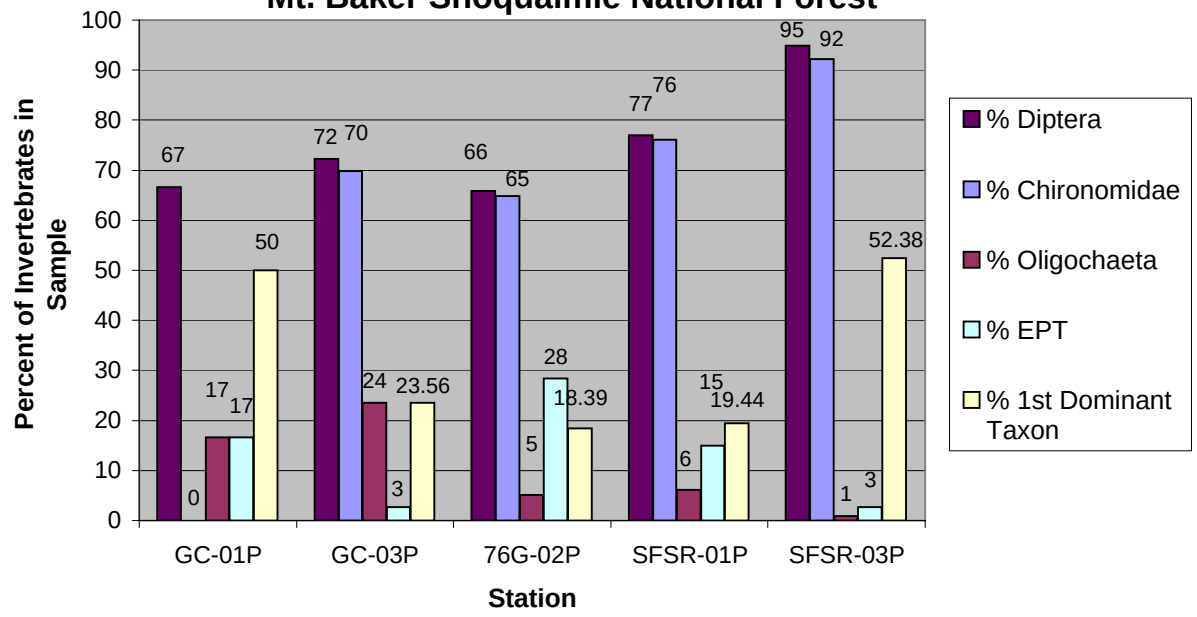


Figure B-2
Species Diversity In Pool Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

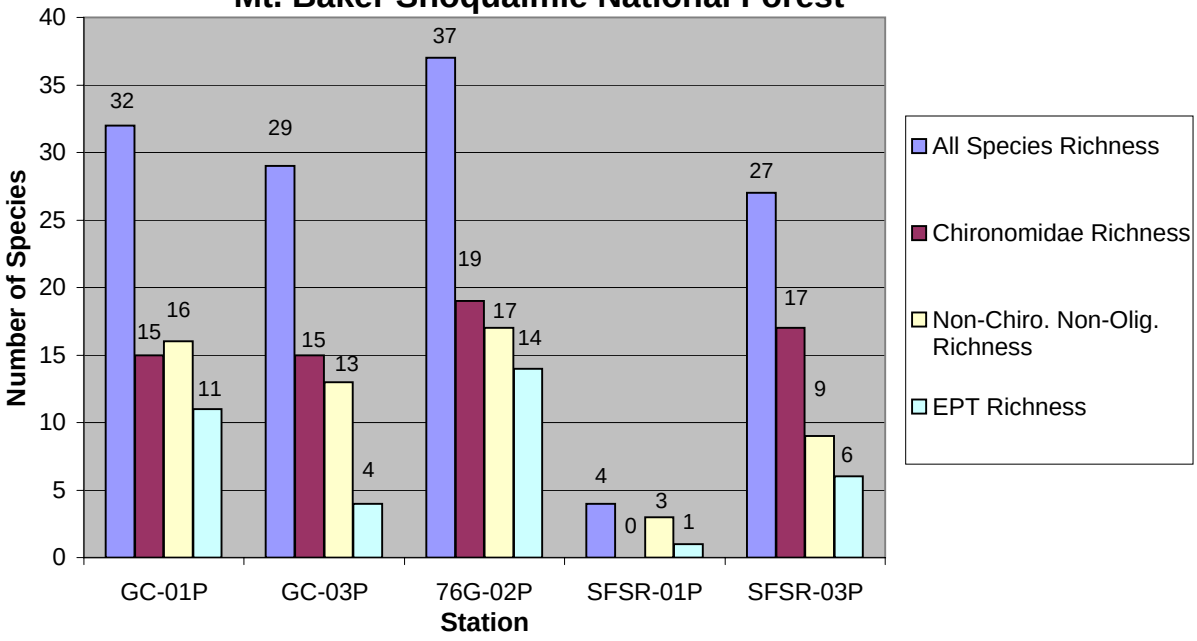


Figure B-3
Functional Group Composition In Pool Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

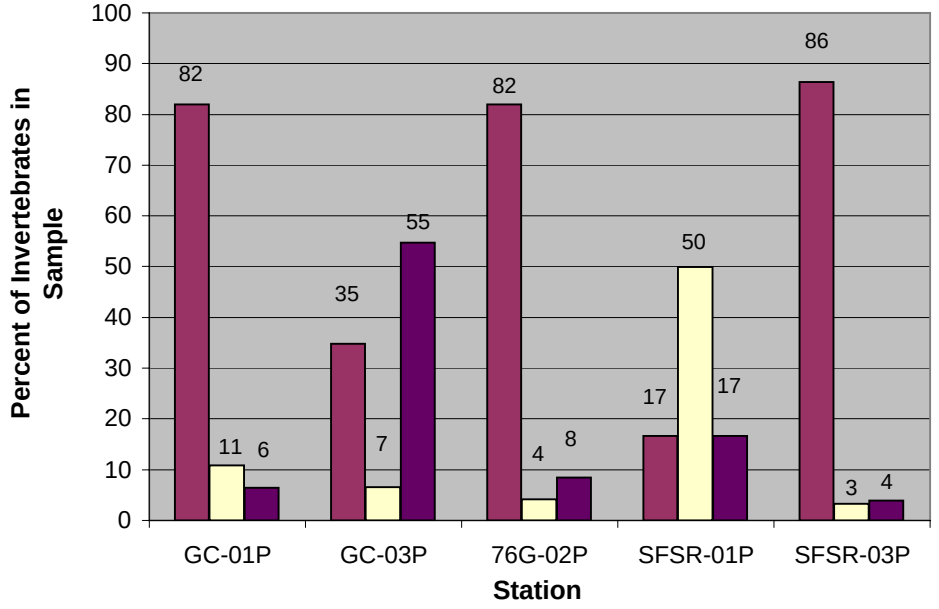


Figure B-4
Biological Indices for Pool Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

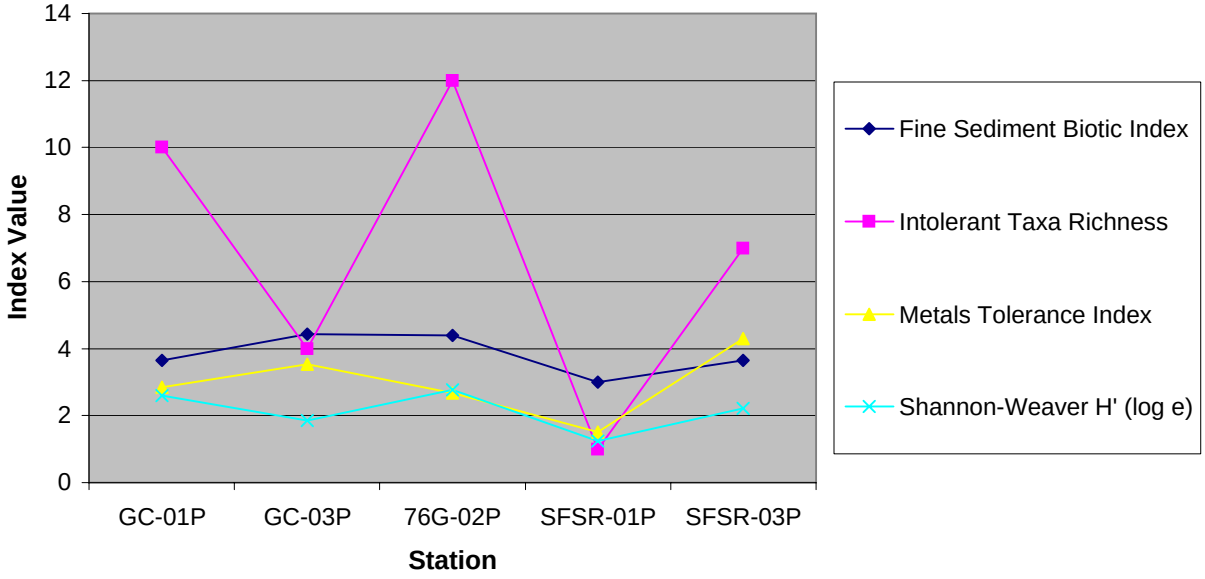


Figure B-5
Community Compostion In Riffle Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

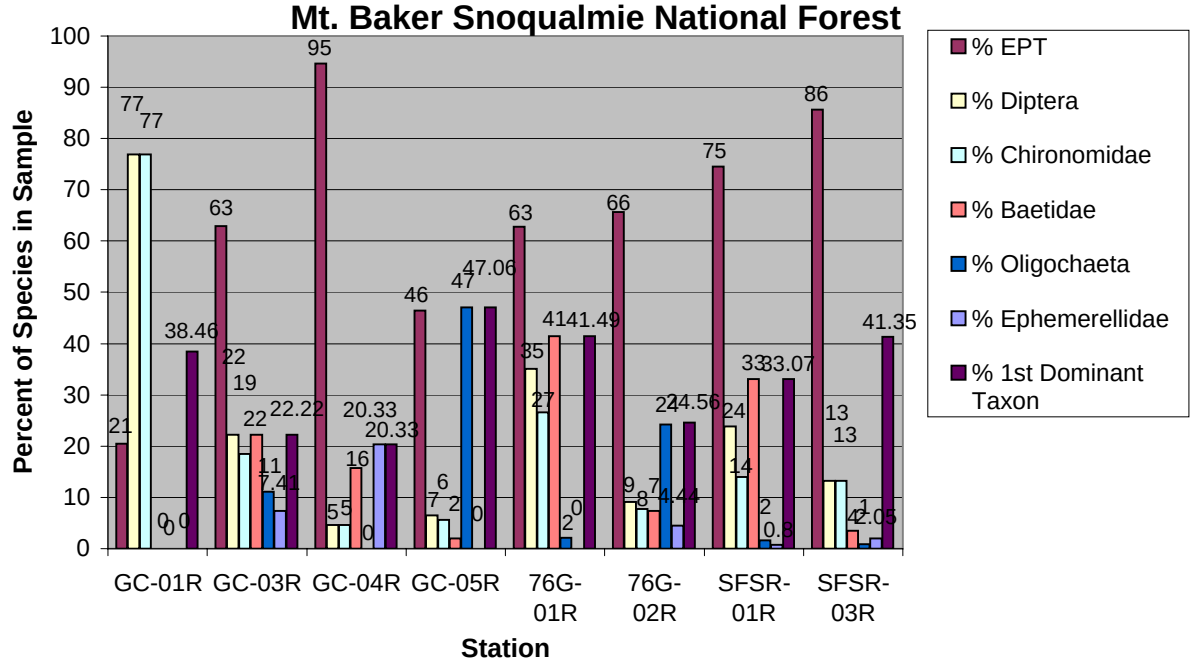


Figure B-6
Species Diversity In Riffle Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

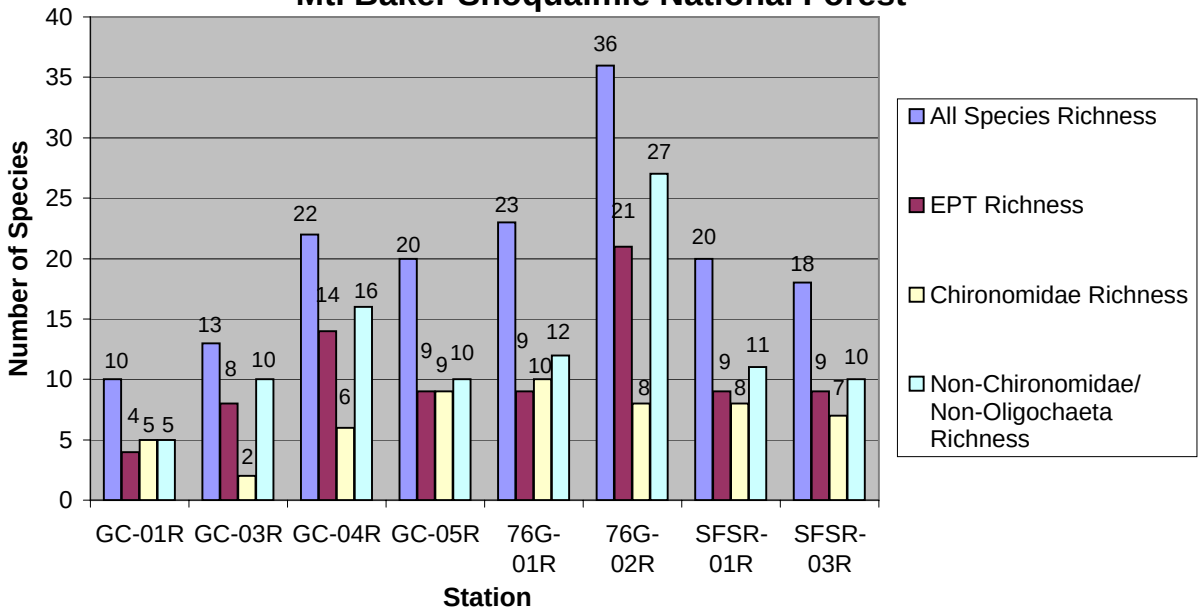


Figure B-7
Functional Group Composition In Riffle Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest

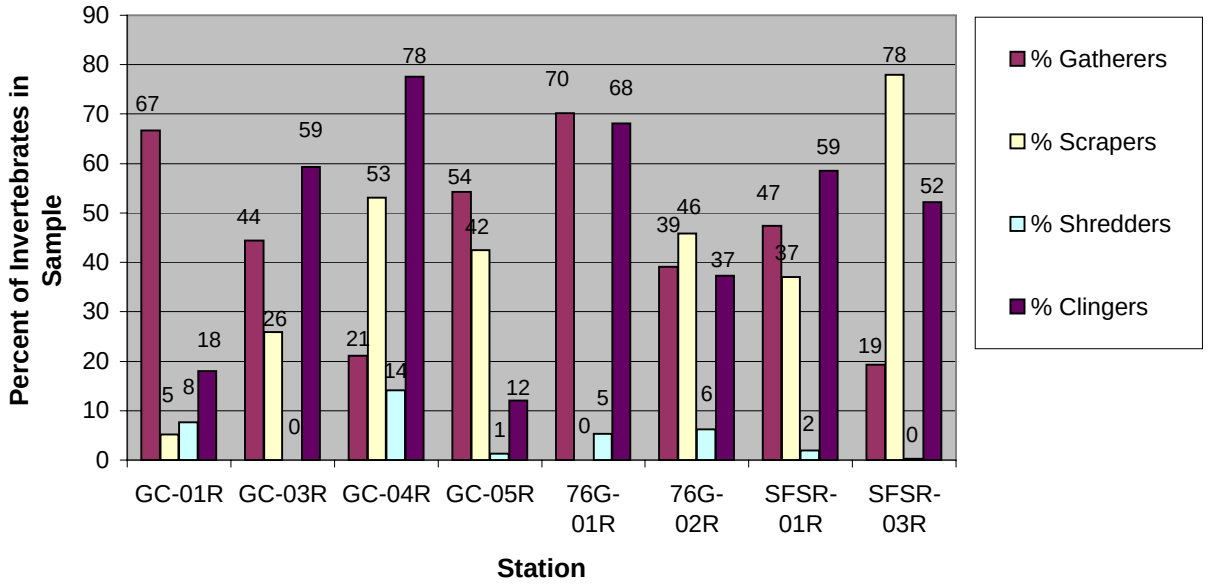
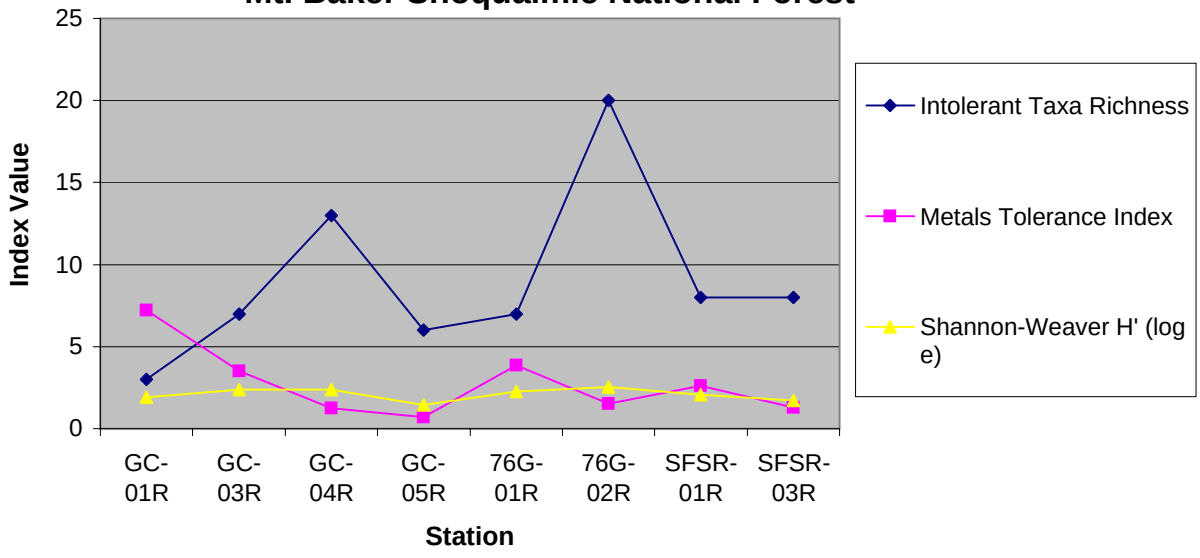


Figure B-8
Biological Indices for Riffle Habitats
Monte Cristo Millsite Site Inspection
Mt. Baker Snoqualmie National Forest



TABLES

TABLE B-1
DOCUMENTED AQUATIC INVERTEBRATE SPECIES
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Taxonomic Group	Scientific Name
Ephemeroptera	Ameletus sp.
	Baetis bicaudatus
	Cinygmula sp.
	Drunella coloradensis/flavilinea
	Drunella doddsi
	Epeorus deceptivus
	Epeorus sp.
	Rhithrogena sp.
	Serratella sp.
Plecoptera	Capniidae
	Chloroperlidae
	Despaxia augusta
	Isoperla sp.
	Leuctridae
	Nemouridae
	Perlodidae
	Podmosta sp.
	Setvena sp.
	Sweltsa sp.
	Taenionema sp.
	Taeniopterygidae
	Visoka cataractae
	Yoraperla sp.
	Zapada columbiana
	Zapada frigida
	Zapada oregonensis gr.
	Zapada sp.
Diptera-Chironomidae	Boreochlus sp.
	Brillia sp.
	Chaetocladius sp.
	Corynoneura sp.
	Diamesa sp.
	Eukiefferiella brevicalcar gr.
	Eukiefferiella devonica gr.
	Eukiefferiella gracei gr.
	Eukiefferiella sp.
	Euryhapsis sp.
	Heleniella sp.
	Heterotrissocladius marcidus gr.
	Hydrobaenus sp.
	Krenosmittia sp.
	Limnophyes sp.
	Macropelopia sp.
	Micropsectra sp.
	Orthocladiinae
	Orthocladius (Euorthocladius) sp.
	Orthocladius Complex
	Orthocladius sp.
	Pagastia sp.
	Parametriocnemus sp.
	Paraphaenocladius "n. sp."
	Paraphaenocladius sp.
	Parorthocladius sp.
Diptera-Chironomidae (continued)	Polypedilum sp
	Pseudodiamesa sp.
	Psilometriocnemus sp.
	Rheocricotopus sp.
	Rheosmittia sp.
	Smittia sp.
	Stempellinella sp.
	Stilocladius sp.
	Thienemanniella sp.
	Thienemannimyia gr. sp.
	Tokunagaia sp.
	Tvetenia bavarica gr.
	Zavrelimyia sp.
Diptera	Agathon sp.
	Bezzia/Palpomyia sp.
	Clinocera sp.
	Dicranota sp.
	Dolichopodidae
	Empididae
	Gonomyodes sp.
	Hesperoconopa sp.
	Limnophila sp.
	Oreogeton sp.
	Prosimulium sp.
	Stilobezzia sp.
	Tipulidae
Trichoptera	Arctopsychinae
	Lepidostoma sp.
	Limnephilidae
	Neophylax sp.
	Neophylax splendens
	Neothremma sp.
	Parapsyche elsis
	Parapsyche sp.
	Psychoglypha sp.
	Rhyacophila alberta gr.
	Rhyacophila betteni gr.
	Rhyacophila hyalinata gr.
	Rhyacophila narvae
	Rhyacophila rickeri
	Rhyacophila sp.
	Rhyacophila vagrita gr.
	Rhyacophila verrula gr.
Annelida	Oligochaeta
Acari	Hygrobates sp.
	Lebertia sp.
	Oribatei
	Sperchon sp.
	Wandesia sp.
Crustacea	Ostracoda
Other Organisms	Nematoda
	Polycelis sp.

TABLE B-2
SUMMARY OF RARE, THREATENED, OR ENDANGERED SPECIES IN THE VICINITY
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Species Name	Washington State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
AQUATIC INVERTEBRATES					
None Identified					
FISH					
Bull trout (Coastal/Puget Sound)	***Salvelinus confluentus***	**Candidate**	**Threatened**		**Expected**
Rainbow trout	***Oncorhynchus mykiss***	**Priority**			**Expected**
Steelhead (Coastal/Puget Sound)	***Oncorhynchus mykiss***	**Priority**			**Expected**
PLANTS					
Tall agoseris	*Agoseris elata*	Sensitive		Sensitive	Possible
Arctic aster	*Aster sibiricus var. meritus*	Sensitive		Sensitive	Possible
False apple-moss	*Bartramiopsis lescurii*			Sensitive	Possible
Triangular-lobed moonwort	*Botrychium ascendens*	Sensitive		Sensitive	Possible
Lance-leaved grape-fern	*Botrychium lanceolatum*	Sensitive			Possible
Stalked moonwort	*Botrychium pedunculosum*	Sensitive	Concern	Sensitive	Possible
Alaska Harebell	*Campanula lasiocarpa*	Sensitive		Sensitive	Possible
Sedge, Blackened	*Carex atrata var. erecta*			Sensitive	Possible
Sedge, bristly	*Carex comosa*	Sensitive		Sensitive	Possible
Sedge, few-flowered	*Carex pauciflora*	Sensitive		Sensitive	Possible
Several-flowered sedge	*Carex pluriflora*	Sensitive		Sensitive	Possible
Smoky mountain sedge	*Carex proposita*	Threatened			Possible
Sedge, russet	*Carex saxatilis var. major*	Sensitive		Sensitive	Possible
Sedge, long-styled	*Carex stylosa*	Sensitive		Sensitive	Possible
Spleenwort-leaved goldthread	*Coptis aspleniifolia*	Sensitive		Sensitive	Possible
Shining flatsedge	*Cyperus bipartitus*	Sensitive			Possible
Yellow mountain-avens	*Dryas drummondii*	Sensitive		Sensitive	Possible
Black Lily	*Fritillaria camschatcensis*	Sensitive		Sensitive	Possible
Boreal bedstraw	***Galium kamtschaticum***	**Sensitive**		**Sensitive**	**Expected**
Creeping snowberry	*Gaultheria hispidula*	Sensitive			Possible
Water lobelia	*Lobelia dortmanna*	Threatened		Sensitive	Possible
Curved woodrush	*Luzula arcuata*	Sensitive		Sensitive	Possible
Treelike clubmoss	*Lycopodium dendroideum*	Sensitive		Sensitive	Possible
Branching Montia	*Montia diffusa*	Sensitive		Sensitive	Possible
Choris' Bog-orchid	*Platanthera chorisiana*	Threatened		Sensitive	Possible
Small northern bog-orchid	*Platanthera obtusata*	Sensitive		Sensitive	Possible
Oldgrowth specklebelly	*Pseudocyphellaria rainierensis*	Sensitive		Sensitive	Possible
Cooley's Buttercup	*Ranunculus cooleyae*	Sensitive		Sensitive	Possible
Goblin's Gold	*Schistostega pennata*			Sensitive	Possible
TERRESTRIAL INVERTEBRATES					
None Identified					
REPTILES AND AMPHIBIANS (HERPETILES)					
Tailed frog	***Ascaphus truei***	**Monitor**	**Concern**	**Sensitive**	**Expected**
Western toad	***Bufo boreas***	**Candidate**	**Concern**		**Expected**
Spotted frog	*Rana pretiosa*	Endangered	Candidate	Sensitive	Possible
BIRDS					
Harlequin duck	***Histrionicus histrionicus***	**Priority**	**Concern**		**Expected**
Northern Flicker	***Colaptes auratus (Colaptes cafer)***			**MIS**	**Expected**
Northern goshawk	***Accipiter gentilis***	**Candidate**	**Concern**	**Sensitive**	**Expected**
olive-sided flycatcher	***Contopus borealis***		**Concern**		**Expected**
Pileated woodpecker	***Dryocopus pileatus***	**Candidate**		**MIS**	**Expected**
Spotted owl	***Strix occidentalis***	**Endangered**	**Threatened**	**Sensitive**	**Expected**
Willow flycatcher	***Empidonax traillii***		**Concern**		**Expected**
American peregrine falcon	*Falco peregrinus anatum*	Sensitive	Concern	Sensitive	Possible
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened	Sensitive	Possible
band-tailed pigeon	*Columba fasciata*		Concern	Sensitive	Possible
black-backed woodpecker	*Picoides arcticus*	Critical		Sensitive	Possible
golden eagle	*Aquila chrysaetos*	Candidate		Sensitive	Possible
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Threatened		Possible
Olive-sided flycatcher	*Contopus borealis*		Concern		Possible
MAMMALS					
black-tailed deer	***Odocoileus hemionus***			**MIS**	**Expected**
Canada lynx	*Lynx canadensis*	Threatened	Threatened	Sensitive	Possible
fisher	*Martes pennanti*	Endangered	Concern	Sensitive	Possible
Gray wolf	*Canis Lupus*	Endangered	Threatened	Sensitive	Possible
long-eared myotis	*Myotis evotis*		Concern	Sensitive	Possible
long-legged myotis	*Myotis volans*		Concern	Sensitive	Possible
Mountain goat	*Oreamnos americanus*	Priority		MIS	Possible
pine marten	*Martes americana*			Sensitive	Possible
Townsend big-eared bat	*Plecotus townsendii townsendii*	Candidate	Concern	Sensitive	Possible
Townsend's big-eared bat	*Coryhorhinus townsendii*	Candidate	Concern	Sensitive	Possible
wolverine	*Gulo gulo luteus*		Concern	Sensitive	Possible

Notes:
Bold indicates a rare, threatened, or endangered species observed or expected at or near the Site
Blank status indicates the species is not rare, threatened, or endangered under that jurisdiction.
Underlined species names are linked to internet fact sheets
MIS = U.S. Forest Service Management Indicator Species

TABLE B-3
OBSERVED PLANT SPECIES
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Habitat Type	Percent Cover	Federal Status	State Status	U.S. Forest Service Status
TREES						
mountain hemlock	*Tsuga mertensiana*	Alpine	15			
Sitka alder	*Alnus sinuata*	Alpine	10			
Pacific silver fir	*Abies amabilis*	Alpine	5			
Pacific silver fir	*Abies amabilis*	Conifer Forest	80			
western red cedar	*Thuja plicata*	Conifer Forest	10			
western hemlock	*Tsuga heterophylla*	Conifer Forest	5			
red alder	*Alnus rubra*	Disturbed	20			
Sitka alder	*Alnus sinuata*	Disturbed	10			
western hemlock	*Tsuga heterophylla*	Disturbed	10			
western red cedar	*Thuja plicata*	Disturbed	10			
SHRUBS						
pink mountain-heather	*Phyllodoce empetriformis*	Alpine	25			
Sitka willow	*Salix sitchensis*	Alpine	<5			
red elderberry	*Sambucus racemosa*	Conifer Forest	5			
red huckleberry	*Vaccinium parvifolium*	Conifer Forest	5			
salmonberry	*Rubus spectabilis*	Conifer Forest	5			
Devil's club	*Oplopanax horridus*	Conifer Forest	<5			
false azalea (fool's huckleberry)	*Menziesia ferruginea*	Conifer Forest	<5			
salmonberry	*Rubus spectabilis*	Disturbed	10			
Scouler's willow	*Salix scouleriana*	Disturbed	10			
red huckleberry	*Vaccinium parvifolium*	Disturbed	5			
thimbleberry	*Rubus parviflorus*	Disturbed	5			
Goats beard	*Aruncus dioicus*	Disturbed	<5			
GROUNDCOVER						
Huckleberry	*Vaccinium sp.*	Alpine	10			
violet	*Viola spp.*	Alpine	5			
yellow wood/stream violet	*Viola glabella*	Alpine	5			
Canada thistle	*Cirsium arvense*	Alpine	<5			
queen's cup	*Clintonia uniflora*	Conifer Forest	5			
western trillium	*Trillium ovatum*	Conifer Forest	5			
bunchberry	*Cornus canadensis*	Conifer Forest	<5			
Deer fern	*Blechnam spicant*	Conifer Forest	<5			
false lily-of-the-valley	*Maianthemum dilatatum*	Conifer Forest	<5			
foamflower	*Tiarella trifoliata*	Conifer Forest	<5			
oak fern	*Gymnocarpium dryopteris*	Conifer Forest	<5			
rosy twistedstalk	*Streptopus roseus*	Conifer Forest	<5			
spiny wood fern	*Dryopteris expansa*	Conifer Forest	<5			
wild ginger	*Asarum caudatum*	Conifer Forest	<5			
grasses	Various species	Disturbed	40			
colonial bentgrass	*Agrostis capillaris*	Disturbed	30			
common horsetail	*Equisetum arvense*	Disturbed	10			
Sedge	Carex sp.	Disturbed	10			
Indian hellebore	*Veratrum viride*	Disturbed	10			
bunchberry	*Cornus canadensis*	Disturbed	5			
Cow parsnip	*Heracleum lanatum*	Disturbed	5			
Cusick's speedwell	*Veronica cusickii*	Disturbed	5			

TABLE B-3
OBSERVED PLANT SPECIES
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Habitat Type	Percent Cover	Federal Status	State Status	U.S. Forest Service Status
GROUNDCOVER (continued)						
false lily-of-the-valley	*Maianthemum dilatatum*	Disturbed	5			
fireweed	*Epilbium angustifolium*	Disturbed	5			
foamflower	*Tiarella trifoliata*	Disturbed	5			
hairy cats ear	*Hypochaeris radicata*	Disturbed	5			
large leaved avens	*Geum macrophyllum*	Disturbed	5			
Pacific sanicle	*Sanicula crassicaulis*	Disturbed	5			
piggyback plant	*Tolmeia menziesii*	Disturbed	5			
yellow wood/stream violet	*Viola glabella*	Disturbed	5			
Alaska/rusty saxifrage	*Saxifraga ferruginea*	Disturbed	<5			
daffodil	*Narcissus spp.*	Disturbed	<5			
Dandelion	*Taraxicum officianale*	Disturbed	<5			
red columbine	*Aquilegia formosa*	Disturbed	<5			
MOSSES						
moss	Various sp.	Alpine	10			
moss	Various sp.	Conifer Forest	40			
moss	Various sp.	Disturbed	40			
LICHENS						
lichens	*Various sp.*	Alpine	25			
lichens	*Various sp.*	Conifer Forest	5			

Notes:
Blank status indicates the species is not rare, threatened, or endangered.

TABLE B-4
OBSERVED, EXPECTED, AND POSSIBLE TERRESTRIAL INVERTEBRATES
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Federal Status	State Status	U.S. Forest Service Status	Observed/ Expected/ Possible
bees	Order *Hymenoptera*				Observed
black flies	*Simulium* sp.				Observed
butterflies and moths	Order *Lepidoptera*				Observed
common black ground beetle	*Pterostichus* sp.				Observed
spiders	Order *Araneae*				Observed
black carpenter ants	*Camponotus pennsylvanicus*				Expected
wasps	Order *Hymenoptera*				Expected
yellow jackets	*Vespula* sp.				Expected
alderflies	*Sialis* sp.				Expected
centipedes	Order *Chilopoda*				Expected
grasshoppers and crickets	Order *Orthoptera*				Expected
mayflies	Order *Ephemeroptera*				Expected
mites and ticks	Order *Acarina*				Expected
daddy-long-legs	Order Opiliones				Possible
banana slug	*Ariolimax columbianus*				Possible
black-foot tightcoil snail	*Pristiloma chirstenella*				Possible

Notes:
Bold indicates regulated or managed species observed or expected at the site.
Blank status indicates no listing was available for the species.

TABLE B-5
OBSERVED, EXPECTED, AND POSSIBLE BIRDS
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Washington State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
American robin	*Turdus migratorius*				Observed
Audubon's warbler	*Dendroica auduboni*				Observed
dark-eyed junco (slate-colored)	*Junco hyemalis*				Observed
golden-crowned kinglet	*Regulus satrapa*				Observed
hermit thrush	*Catharus guttatus (Hylochichla guttata)*				Observed
olive-sided flycatcher	***Contopus borealis***		**Concern**		**Observed**
Pacific-slope flycatcher	*Empidonax difficilis*				Observed
ruby-crowned kinglet	*Regulus calendula*				Observed
rufous hummingbird	*Selasphorus rufus*				Observed
Steller's jay	*Cyanocitta stelleri*				Observed
Townsend's warbler	*Dendroica townsendi*				Observed
varied thrush	*Ixoreus naevius*				Observed
Vaux's Swift	*Chaetura vauxi*				Observed
warbling vireo	*Vireo gilvus*				Observed
white-tailed ptarmigan	*Lagopus leucurus*				Observed
winter wren	*Troglodytes troglodytes*				Observed
yellow warbler	*Dendroica petechia*				Observed
American crow	*Corvus brachyrhynchos*				Expected
American dipper	*Cinclus mexicanus*				Expected
barred owl	*Strix varia*				Expected
black-capped chickadee	*Parus atricapillus*				Expected
brown creeper	*Certhia familiaris*				Expected
cedar waxwing	*Bombycilla cedrorum*				Expected
common raven	*Corvus corax*				Expected
downy woodpecker	*Picoides pubescens (Dendrocopos pubescens)*			MIS	Expected
fox sparrow	*Passerella iliaca*				Expected
great gray owl	*Strix nebulosa*				Expected
great horned owl	*Bubo virginianus*				Expected
hairy woodpecker	*Picoides villosus (Dendrocopos villosus)*			MIS	Expected
Hammond's flycatcher	*Empidonax hammondii*				Expected
marbled murrelet	***Brachyramphus marmoratus***	**Endangered**	**Threatened**		**Expected**
northern flicker	*Colaptes auratus (Colaptes cafer)*				Expected
northwestern crow	*Corvus caurinus*				Expected
pine siskin	*Carduelis pinus (Spinus pinus)*				Expected
pygmy nuthatch	*Sitta pygmaea*				Expected
pygmy owl	*Glaucidium gnoma*				Expected
red crossbill	*Loxia curvirostra*				Expected
red-breasted nuthatch	*Sitta canadensis*				Expected
red-tailed hawk	*Buteo jamaicensis*				Expected
rufous-sided towhee	*Pipilo erythrophthalmus*				Expected
saw-whet owl	*Aegolius acadicus*				Expected
sharp-shinned hawk	*Accipiter striatus*				Expected
song sparrow	*Melospiza melodia*				Expected
Sora	*Porzana carolina*				Expected
Swainson's thrush	*Catharus ustulata (Hylocichla ustulata)*				Expected
three-toed woodpecker	*Picoides tridactylus*	Monitor		MIS	Expected
Townsend's solitaire	*Myadestes townsendi*				Expected
turkey vulture	*Cathartes aura*				Expected
western tanager	*Piranga ludoviciana*				Expected
yellow-bellied sapsucker	*Sphyrapicus varius*				Expected
American redstart	*Wetophaga ruticilla*				Possible
bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened		Possible
band-tailed pigeon	*Columba fasciata*				Possible
black-backed woodpecker	*Picoides arcticus*	Critical		MIS	Possible
black-chinned hummingbird	*Archilochus alexandri*				Possible

TABLE B-5
OBSERVED, EXPECTED, AND POSSIBLE BIRDS
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Washington State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
blue grouse	*Dendragapus obscurus*				Possible
Calliope hummingbird	*Stellula calliope*				Possible
chestnut-backed chickadee	*Parus rufescens*				Possible
common nighthawk	*Chordeiles minor*				Possible
Cooper's hawk	*Accipiter cooperii*				Possible
dusky flycatcher (Wright's flycatcher)	*Empidonax oberholseri*				Possible
flammulated owl	*Otus Flammeolus*	Candidate			Possible
fringed myotis	*Myotis thysanodes*	Monitor	Concern		Possible
golden eagle	*Aquila chrysaetos*				Possible
gray jay	*Perisoreus canadensis*				Possible
Harlequin Duck	*Histrionicus histrionicus*		Concern	Sensitive	Possible
long-eared owl	*Asio otus*				Possible
MacGillivray's warbler	*Oporornis tolmiei*				Possible
mountain bluebird	*Sialia currucoides*				Possible
mountain chickadee	*Parus gambeli*				Possible
northern goshawk	*Accipiter gentilis*	Candidate	Concern		Possible
orange-crowned warbler	*Vermivora celata*				Possible
osprey	*Pandion haliaetus*				Possible
pileated woodpecker	*Dryocopus pileatus*	Critical		MIS	Possible
purple finch	*Carpodacus purpureus*				Possible
red-breasted sapsucker	*Sphyrapicus ruber*				Possible
ruffed grouse	*Bonasa umbellus*				Possible
spotted owl	*Strix occidentalis*	Endangered	Threatened	MIS	Possible
turkey	*Meleagris gallopavo*				Possible
veery	*Catharus fuscescens (Hylocichla fuscescens)*				Possible
western bluebird	*Sialia mexicana*				Possible
western flycatcher	*Empidonax difficilis*				Possible
western wood pewee	*Contopus sordidulus*				Possible
white-winged crossbill	*Loxia leucoptera*				Possible
Williamson's sapsucker	*Sphyrapicus thyroideus*				Possible
Willow Flycatcher (Traill's Flycatcher)	*Empidonax traillii*		Concern		Possible
yellow-rumped warbler	*Dendroica coronata*				Possible

Notes:
Bold indicates regulated or managed species observed, expected, or possible at the site
Blank status indicates no listing was available for the species.
MIS = U.S. Forest Service Management Indicator Species.

TABLE B-6
OBSERVED, EXPECTED, AND POSSIBLE MAMMALS
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Washington Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
Cascade golden-mantled ground squirrel	*Citellus sateratus*				Observed
douglas squirrel (chickaree)	*Tamiasciurus douglasi*				Observed
hoary marmot	*Marmota caligata*				Observed
aplodontia (mountain beaver)	*Aplodontia rufa*				Expected
black bear	*Ursus americanus*				Expected
bobcat	*Lynx rufus*				Expected
Columbia blacktailed deer	***Odocoileus hemionus columbianus***	**Priority**		**MIS**	**Expected**
cougar (mountain lion)	*Felis concolor*				Expected
coyote	*Canis latrans*				Expected
deer mouse	*Peromyscus maniculatus*				Expected
dusky shrew	*Sorex obscurus*				Expected
Keen's myotis	***Myotis keenii***	**Candidate**			**Expected**
long-eared myotis	***Myotis evotis***	**Monitor**	**Concern**	**Sensitive**	**Expected**
longtail weasel	*Mustela frenata*				Expected
masked shrew	*Sorex cinereus*				Expected
mink	*Mustela vision*				Expected
montane shrew	*Soex monticolus*				Expected
mountain vole	*Microtus montanus*				Expected
northern flying squirrel	*Glaucomys sabrinus*				Expected
northern water shrew	*Sorex palustris*				Expected
pika	*Ochotona princeps*				Expected
porcupine	*Erethizon dorsatum*				Expected
raccoon	*Procyon lotor*				Expected
red fox	*Vulpes fulva*				Expected
snowshoe hare	*Lepus americanus*				Expected
Townsend big-eared bat	***Plecotus townsendii townsendii***	**Candidate**	**Concern**	**Sensitive**	**Expected**
Townsend's chipmunk	*Eutamias townsendi*				Expected
water vole (Richardson vole)	*Microtus richardsoni*				Expected
yellow pine chipmunk	*Eutamias amoenus*				Expected
yellow-bellied marmot	*Marmota flaviventris*				Expected
badger	*Taxidea taxus*				Possible
beaver	*Castor canadensis*				Possible
big brown bat	*Eptisicus fuscus*			Sensitive	Possible
boreal redback vole	*Clethrionomys gapperi*				Possible
California myotis	*Myotis californicus*				Possible
Canada lynx	*Lynx canadensis*	Threatened	Threatened	Sensitive	Possible
fisher	*Martes pennanti*	Endangered	Concern	Sensitive	Possible
fringed myotis	*Myotis thysanodes*	Vulnerable	Concern	Sensitive	Possible
gray wolf	*Canis lupus*	Endangered	Threatened	MIS	Possible
grizzly bear	*Ursus arctos*	Endangered	Threatened	MIS	Possible
hoary bat	*Felis concolor*				Possible
little brown myotis	*Myotis lucifugus*			Sensitive	Possible
longtail vole	*Microtus longicaudus*				Possible
long-legged myotis	*Myotis volans*	Monitor	Concern	Sensitive	Possible
marten	*Martes americana*			MIS	Possible
mountain goat	*Oreamnos americanus*			MIS	Possible
mountain phenacomys (heather vole)	*Phenacomys intermedius*				Possible
opossum	*Didelphis marsupialis*				Possible
Pacific Jumping Mouse	*Zapus trinotatus*				Possible
pallid bat	*Antozous pallidus*	Vulnerable	Concern	Sensitive	Possible
Preble's shrew	*Sorex preblei*	Concern		Sensitive	Possible
red bat	*Lasiurus borealis*				Possible
shorttail weasel (ermine)	*Mustela erminea*				Possible
silver-haired bat	*Lasionycteris noctivagans*			Sensitive	Possible
small-footed myotis	*Myotis leibii*	Monitor	Concern		Possible
spotted skunk	*Spilogale putorius*				Possible
striped skunk	*Mephitis mephitis*				Possible
Townsend vole	*Microtus townsendi*				Possible
Trowbridge's shrew	*Sorex trowbridgei*				Possible
vagrant shrew	*Sorex vagrans*				Possible
wolverine	*Gulo gulo luteus*	Candidate	Concern	Sensitive	Possible
yuma myotis	*Myotis yumanensis*	Monitor	Concern		Possible

Notes:

Bold indicates regulated or managed species observed, or expected at the site.

Blank status indicates the species is not rare, threatened, or endangered.

MIS = U.S. Forest Service Management Indicator Species

TABLE B-7
OBSERVED, EXPECTED, AND POSSIBLE AMPHIBIANS AND REPTILES
MONTE CRISTO MILLSITE SITE INSPECTION
MT. BAKER SNOQUALMIE NATIONAL FOREST

Common Name	Scientific Name	Washington State Status	Federal Status	U.S. Forest Service Status	Observed/ Expected/ Possible
AMPHIBIANS					
long-toed salamander	*Ambystoma macrodactylum*				Expected
Pacific treefrog	*Hyla regilla*				Expected
Cascades frog	*Rana cascadae*		Concern	Sensitive	Possible
red-legged frog	*Rana aurora*		Concern	Sensitive	Possible
western toad	*Bufo boreas*	Candidate	Concern		Possible
tailed frog	*Ascaphus montanus*	Monitor	Concern		Possible
REPTILES					
common garter snake	*Thamnophis sirtalis*				Possible
northern alligator lizard	*Gerrhonotus coeruleus*				Possible
rubber boa	*Charina bottae*				Possible
Western skink	*Eumeces skiltonianus*				Possible

Notes:
Bold indicates regulated or managed species observed or expected at the site.
Blank status indicates no listing was available for the species.

APPENDIX

DOCUMENTED RARE, THREATENED, OR ENDANGERED SPECIES

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE - HABITATS AND SPECIES REPORT
IN THE VICINITY OF T29R11E SECTION 21
Report Date: May 09, 2005

Information About Priority Habitats and Species Polygons

Priority Habitats and Species (PHS) polygons are labeled with a unique number and "+" symbol, roughly in the center of the polygon on the map. This PHS Poly number refers to a list of form numbers and species and habitat codes contained in the PHS Polygon Cross Reference Report (listed below). The form numbers refer to the attached PHS Polygon Report. This report details each species or habitat depicted as a polygon on the map. For a complete description of the codes used in this report please refer to the Fish and Wildlife Map Products document. This document may be viewed on our web site at http://www.wdfw.wa.gov/hab/release.htm.

Priority Habitats and Species Polygon - Summary Habitat and Species List:

This report and the accompanying maps may contain some species or habitats that are not considered priority by the agency. YES under the "PHS" column in the table below indicates that the species is considered a priority and is on the Priority Habitats and Species List and/or the Species of Concern List. NO under the "PHS" column indicates the species/habitat is not considered an agency priority.

PHS	State Status	PHS Code	Common Name	Species Use	Species Use Description
YES		HIHI	HARLEQUIN DUCK	B	BREEDING OCCURRENCE

Priority Habitats and Species Polygon Cross Reference Report:

Form number 900000 indicates presence of PHS is unknown or the area was not mapped. Form numbers 909998, 909997, or 909996 indicate compilation errors.

PHS Poly#	Form#	PHS Code*Species Use
2	900000	*-
3	901486	HIHI*B-

Information About Wildlife Heritage Point Report

Wildlife Heritage points on the map can be referenced to this report by noting the quadpt number where the point occurs on the map, and then looking up the information listed below. This report is sorted by the quadpt number and provides details on each species depicted on the map. For a complete description of the codes used in this report, please refer to the Fish and Wildlife Map Products document. This document may be viewed on our web site at http://www.wdfw.wa.gov/hab/release.htm.

Wildlife Heritage Point - Summary Species List:

This report and the accompanying maps may contain some species or habitats that are not considered priority by the agency. YES under the "PHS" column in the table below indicates that the species is considered a priority and is on the Priority Habitats and Species List and/or the Species of Concern List. NO under the "PHS" column indicates the species/habitat is not considered an agency priority.

PHS	State Status	Species Code	Common Name	Species Use	Species Use Description
NO	SM	ASTR	TAILED FROG	IO	INDIVIDUAL OCCURRENCE

Wildlife Heritage Point Report:

Quadpt#: 4712184010 Species Code: ASTR Species Use: IO Common Name: TAILED FROG
Year: 1992 Class: SA Accuracy: C Scientific Name: ASCAPHUS TRUEI
State Status: SM Federal Status: FCo Priority: NO WDFW Region: 4 Verified: V
Township - Range - Section: T29N R11E S21 Occurrence#: 85 Sequence#: 1
General Description: TAILED FROG. S FORK SAUK R, 1/2 MI DOWNSTREAM OF GLACIER CRK., 2 TADPOLES.

Quadpt#: 4712184012 Species Code: ASTR Species Use: IO Common Name: TAILED FROG
Year: 1994 Class: SA Accuracy: C Scientific Name: ASCAPHUS TRUEI
State Status: SM Federal Status: FCo Priority: NO WDFW Region: 4 Verified: V
Township - Range - Section: T29N R11E S21 Occurrence#: 335 Sequence#: 1
General Description: BASE OF SUNDAY FALLS, JUST SOUTH OF MONTE CRISTO. 2 TAILED FROGS SEEN.

HERP RECORD #: 310506

Codes Used In Wildlife Heritage Point Report

Quadpt# : A sequential number for a point based on a US Geological Survey 7.5-minute quadrangle.

Species Code : Alphanumeric code which identifies the species. List of codes are available in the documentation.

Species Use : Criteria that identifies how the area is used by the indicated species. List of codes are available in the documentation.

Common Name : Common name of the species.

Year : Year of the observation.

Class : Code that separates animals into general groups.
AA = Artifical animal (e.g., nest platforms not used yet).
EA = Exotic animal.
GA = Game animal.
NA = No animal found after target specific survey completed.
SA = Special animal (e.g., state listed and monitor species).
SI = Split territory.
ZA = Zapped animal. Site no longer supports original occurrence.

Accuracy : Mapping accuracy of the site as determined by the individual doing the mapping.
C = Accurate to within 1/4 mile radius and confirmed by a reliable source.
G = Location known only to a general locality.
N = Accurate to within one mile radius.
U = Accurate to within 1/4 mile radius and unconfirmed by a reliable source.

Scientific Name : Scientific name of the species.

State Status : State listing status of species.
SE = State endangered. SC = State candidate.
ST = State threatened. SM = State monitor.
SS = State sensitive.

Federal Status : Federal listing status of species.
FE = Federal endangered. FC = Federal candidate.
FT = Federal threatened. FCo = Federal concern.

Priority : Species and habitats that are considered to be priorities for conservation and management by Washington Department of Fish and Wildlife (WDFW). For a copy of the most current Priority Habitats and Species list contact WDFW PHS Section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm.
YES = Indicates that the species is considered a WDFW priority and is on the Priority Habitat and Species List and/or Species of Concern List.
NO = Indicates that the species is not a WDFW priority.

WDFW Region : This contains the WDFW administrative region number 1 through 6.

Verified : Verification code for an observation.
V = Verified by a reliable source, generally WDFW or other agency biologist.
U = Not verified by a reliable source, or identification of species is uncertain.
1 = Confirmed grizzly bear or wolf observation.
2 = Probable grizzly bear or wolf observation.

Township - Range - Section : The legal description of the species occurrence.

Occurrence# : An ascension catalog number that combined with sequence number identifies a unique record within a species.

Sequence# : Occurrences with multiple locations of a species.

General Description : Description of location of a species.

Priority Habitats and Species Polygon Report

Form#: 901486 PHS Code: HIHI Species Use: B Common Name: HARLEQUIN DUCK
Season: S Definition: 4 Accuracy: 1 Scientific Name: HISTRIONICUS HISTRIONICUS
State Status: Federal Status: FCo Priority: YES Site Name: SAUK RIVER HARLEQUIN AREA
General Description: HARLEQUIN BREEDING AREAS.

Source: ABRAMS, T; WDW
Source Date: 041581 Source Code: PROF
Synopsis: 2 PAIRS SEEN 1-3 MILES N OF DARRINGTON

Source: DREKER, BARRY; WDW
Source Date: 041581 Source Code: PROF
Synopsis: 2 PAIRS SEEN WITHIN 1/2 MILE OF SUMMIT TIMBER CO. MILL AT DARRINGTON

Source: KRAEMER, C.
Source Date: 032881 Source Code: PROF
Synopsis: 2 ADULTS SEEN AT THE MOUTH OF THE SUIATTLE, FLYING UPSTREAM.

Codes Used In Priority Habitat and Species Polygon Report

Form# : Unique number that links the information in the reports to features on the map.

PHS Code : This contains a code that identifies the fish and wildlife species found in the area or the habitat that occurs there. List of codes are available in the documentation.

Species Use : Criteria that identifies how the area is used by the indicated species. List of codes are available in the documentation. This field is not used if a habitat is described.

Common Name : Common name of the species or habitat.

Season : Season of species use. Use is indicated by the presence of a non-blank character in one or more positions or sub-strings of the field position.
Position 1: W = Winter use. Position 2: S = Spring use.
Position 3: U = Summer use. Position 4: F = Fall use.
Position 5: S = Severe winter use.

Definition : Identifies the definitions or criteria used to classify the area as a priority. List of codes are available in the documentation.

Accuracy : Mapping accuracy of the line delineation as determined by the mapper.
1 = Accurate within a 1/4 mile. 3 = Location known to within one mile.
2 = Accurate within a 1/2 mile. 4 = Location known to general locality only.

Scientific Name : Scientific name of the species.

State Status : State listing status of species.
SE = State endangered. SC = State candidate.
ST = State threatened. SM = State monitor.
SS = State sensitive.

Federal Status : Federal listing status of species.
FE = Federal endangered. FC = Federal candidate.
FT = Federal threatened. FCo = Federal concern.

Priority : Species and habitats that are considered to be priorities for conservation and management by Washington Department of Fish and Wildlife (WDFW). For a copy of the most current Priority Habitats and Species List contact WDFW PHS Section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm.
YES = Indicates that the species is considered a WDFW priority and is on the Priority Habitat and Species List and/or Species of Concern List.
NO = Indicates that the species is not a WDFW priority.

Site Name : Name assigned to the area based generally on a local place name.

General Description : Description about the area, including how it is used and why it is important.

Source : Identifies and describes the source responsible for the information described on the form or drawn on the map. Single or multiple sources may be cited.

Source Date : Date of source of information.

Source Code : Code identifying the source of information.

Synopsis : Brief narrative describing content of source of information.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
PRIORITY FISH REPORT FROM THE WASHINGTON LAKES AND RIVERS INFORMATION SYSTEM (WLRIS) DATABASE
FOR TOWNSHIP T29R11E, SECTION 21
Report Date: May 09, 2005

Information About The Fish Presence Report

The fish information in this report only includes information that Washington Department of Fish and Wildlife (WDFW) maintains in a central computer database. This information only documents the location of important fish resources to the best of our knowledge. It is not a complete inventory of the fish species in the state. Fish are identified as priority by WDFW if they meet one of three criterion as listed in the Priority Habitats and Species List. The list is available by contacting WDFW Priority Habitats and Species section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm. To insure appropriate use of this information users are encouraged to consult with WDFW biologists.

Streams with presence of priority anadromous and resident fish species from the WLRIS database are highlighted on the accompanying map. Due to the complexity of displaying linear features individual species that utilize each river reach are not distinguishable. If more species specific information is needed, users should request individual species maps, digital data, or contact the WLRIS database manager.

State status information is not available in the WLRIS database for these species. Please see WDFW Species of Concern List for current status. For a copy of this list, contact WDFW Endangered Species Section at (360)902-2515, or it is available on our web site at http://www.wdfw.wa.gov/wlm/diversty/soc/soc.htm.

Priority Anadromous Fish Presence:

Code	Common Name	Stream Name	Stream LLID	Record Date
DBT	Dolly Varden/Bull Trout	Glacier Creek	12139214798?5	05-01-10
DBT	Dolly Varden/Bull Trout	Seventysix Gulch	12139214798?5	05-01-10
DBT	Dolly Varden/Bull Trout	South Fork Sauk River	1213879480978	05-01-10
STWI	Winter Steelhead	South Fork Sauk River	1213879480978	04-02-09
STWI	Winter Steelhead	South Fork Sauk River	1213879480978	04-06-21

Priority Resident Fish Presence:

Code	Common Name	Stream Name	Stream LLID	Record Date
RBT	Rainbow Trout	Silver Creek	1214351478970	04-12-16

Codes Used In The Fish Presence Report

Code : WDFW alphanumeric code that identifies the fish species.

Common Name : Common name of the fish species.

Stream Name : Stream name based on the US Geological Survey, Geographic Names Information System database.

Stream LLID : Unique stream identifier (ID) generated from the node latitude and longitude located at a stream's mouth. This ID is to be construed only as an ID, and not necessarily as a reference to a stream's location.

Record Date : Date the information was entered into the database.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE - HABITATS AND SPECIES REPORT
IN THE VICINITY OF T29R11E SECTION 22
Report Date: May 09, 2005

Information About Priority Habitats and Species Polygons

Priority Habitats and Species (PHS) polygons are labeled with a unique number and "+" symbol, roughly in the center of the polygon on the map. This PHS Poly number refers to a list of form numbers and species and habitat codes contained in the PHS Polygon Cross Reference Report (listed below). The form numbers refer to the attached PHS Polygon Report. This report details each species or habitat depicted as a polygon on the map. For a complete description of the codes used in this report please refer to the Fish and Wildlife Map Products document. This document may be viewed on our web site at http://www.wdfw.wa.gov/hab/release.htm.

Priority Habitats and Species Polygon - Summary Habitat and Species List:

This report and the accompanying maps may contain some species or habitats that are not considered priority by the agency. YES under the "PHS" column in the table below indicates that the species is considered a priority and is on the Priority Habitats and Species List and/or the Species of Concern List. NO under the "PHS" column indicates the species/habitat is not considered an agency priority.

PHS	State Status	PHS Code	Common Name	Species Use	Species Use Description

Priority Habitats and Species Polygon Cross Reference Report:

Form number 900000 indicates presence of PHS is unknown or the area was not mapped. Form numbers 909998, 909997, or 909996 indicate compilation errors.

PHS Poly#	Form#	PHS Code*Species Use
2	900000	*-

Information About Wildlife Heritage Point Report

Wildlife Heritage points on the map can be referenced to this report by noting the quadpt number where the point occurs on the map, and then looking up the information listed below. This report is sorted by the quadpt number and provides details on each species depicted on the map. For a complete description of the codes used in this report, please refer to the Fish and Wildlife Map Products document. This document may be viewed on our web site at http://www.wdfw.wa.gov/hab/release.htm.

Wildlife Heritage Point - Summary Species List:

This report and the accompanying maps may contain some species or habitats that are not considered priority by the agency. YES under the "PHS" column in the table below indicates that the species is considered a priority and is on the Priority Habitats and Species List and/or the Species of Concern List. NO under the "PHS" column indicates the species/habitat is not considered an agency priority.

PHS	State Status	Species Code	Common Name	Species Use	Species Use Description
NO	SM	ASTR	TAILED FROG	IO	INDIVIDUAL OCCURRENCE

Wildlife Heritage Point Report:

Quadpt#: 4712184010 Species Code: ASTR Species Use: IO Common Name: TAILED FROG
Year: 1992 Class: SA Accuracy: C Scientific Name: ASCAPHUS TRUEI
State Status: SM Federal Status: FCo Priority: NO WDFW Region: 4 Verified: V
Township - Range - Section: T29N R11E S21 Occurrence#: 85 Sequence#: 1
General Description: TAILED FROG. S FORK SAUK R, 1/2 MI DOWNSTREAM OF GLACIER CRK., 2 TADPOLES.

Quadpt#: 4712184012 Species Code: ASTR Species Use: IO Common Name: TAILED FROG
Year: 1994 Class: SA Accuracy: C Scientific Name: ASCAPHUS TRUEI
State Status: SM Federal Status: FCo Priority: NO WDFW Region: 4 Verified: V
Township - Range - Section: T29N R11E S21 Occurrence#: 335 Sequence#: 1
General Description: BASE OF SUNDAY FALLS, JUST SOUTH OF MONTE CRISTO. 2 TAILED FROGS SEEN.

HERP RECORD #: 310506

Codes Used In Wildlife Heritage Point Report

Quadpt# : A sequential number for a point based on a US Geological Survey 7.5-minute quadrangle.

Species Code : Alphanumeric code which identifies the species. List of codes are available in the documentation.

Species Use : Criteria that identifies how the area is used by the indicated species. List of codes are available in the documentation.

Common Name : Common name of the species.

Year : Year of the observation.

Class : Code that separates animals into general groups.

AA = Artifical animal (e.g., nest platforms not used yet).
EA = Exotic animal.
GA = Game animal.
NA = No animal found after target specific survey completed.
SA = Special animal (e.g., state listed and monitor species).
ST = Split territory.
ZA = Zapped animal. Site no longer supports original occurrence.

Accuracy : Mapping accuracy of the site as determined by the individual doing the mapping.
C = Accurate to within 1/4 mile radius and confirmed by a reliable source.
G = Location known only to a general locality.
N = Accurate to within one mile radius.
U = Accurate to within 1/4 mile radius and unconfirmed by a reliable source.

Scientific Name : Scientific name of the species.

State Status : State listing status of species.
SE = State endangered. SC = State candidate.
ST = State threatened. SM = State monitor.
SS = State sensitive.

Federal Status : Federal listing status of species.
FE = Federal endangered. FC = Federal candidate.
FT = Federal threatened. FCo = Federal concern.

Priority : Species and habitats that are considered to be priorities for conservation and management by Washington Department of Fish and Wildlife (WDFW). For a copy of the most current Priority Habitats and Species List contact WDFW PHS Section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm.
YES = Indicates that the species is considered a WDFW priority and is on the Priority Habitat and Species List and/or Species of Concern List.
NO = Indicates that the species is not a WDFW priority.

WDFW Region : This contains the WDFW administrative region number 1 through 6.

Verified : Verification code for an observation.
V = Verified by a reliable source, generally WDFW or other agency biologist.
U = Not verified by a reliable source, or identification of species is uncertain.
1 = Confirmed grizzly bear or wolf observation.
2 = Probable grizzly bear or wolf observation.

Township - Range - Section : The legal description of the species occurrence.

Occurrence# : An ascension catalog number that combined with sequence number identifies a unique record within a species.

Sequence# : Occurrences with multiple locations of a species.

General Description : Description of location of a species.

Codes Used In Priority Habitat and Species Polygon Report

prm# : Unique number that links the information in the reports to features on the map.

PHS Code : This contains a code that identifies the fish and wildlife species found in the area or the habitat that occurs there. List of codes are available in the documentation.

Species Use : Criteria that identifies how the area is used by the indicated species. List of codes are available in the documentation. This field is not used if a habitat is described.

Common Name : Common name of the species or habitat.

Season : Season of species use. Use is indicated by the presence of a non-blank character in one or more positions or sub-strings of the field position.
Position 1: W = Winter use. Position 2: S = Spring use.
Position 3: U = Summer use. Position 4: F = Fall use.
Position 5: S = Severe winter use.

Definition : Identifies the definitions or criteria used to classify the area as a priority. List of codes are available in the documentation.

Accuracy : Mapping accuracy of the line delineation as determined by the mapper.
1 = Accurate within a 1/4 mile. 3 = Location known to within one mile.
2 = Accurate within a 1/2 mile. 4 = Location known to general locality only.

Scientific Name : Scientific name of the species.

State Status : State listing status of species.
SE = State endangered. SC = State candidate.
ST = State threatened. SM = State monitor.
SS = State sensitive.

Federal Status : Federal listing status of species.
FE = Federal endangered. FC = Federal candidate.
FT = Federal threatened. FCo = Federal concern.

Priority : Species and habitats that are considered to be priorities for conservation and management by Washington Department of Fish and Wildlife (WDFW). For a copy of the most current Priority Habitats and Species List contact WDFW PHS Section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm.
YES = Indicates that the species is considered a WDFW priority and is on the Priority Habitat and Species List and/or Species of Concern List.
NO = Indicates that the species is not a WDFW priority.

Site Name : Name assigned to the area based generally on a local place name.

General Description : Description about the area, including how it is used and why it is important.

Source : Identifies and describes the source responsible for the information described on the form or drawn on the map. Single or multiple sources may be cited.

Source Date : Date of source of information.

Source Code : Code identifying the source of information.

Synopsis : Brief narrative describing content of source of information.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
PRIORITY FISH REPORT FROM THE WASHINGTON LAKES AND RIVERS INFORMATION SYSTEM (WLRIS) DATABASE
FOR TOWNSHIP T29R11E, SECTION 22
Report Date: May 09, 2005

Information About The Fish Presence Report

The fish information in this report only includes information that Washington Department of Fish and Wildlife (WDFW) maintains in a central computer database. This information only documents the location of important fish resources to the best of our knowledge. It is not a complete inventory of the fish species in the state. Fish are identified as priority by WDFW if they meet one of three criterion as listed in the Priority Habitats and Species List. The list is available by contacting WDFW Priority Habitats and Species section at (360)902-2543, or it is available on our web site at http://www.wdfw.wa.gov/hab/phspage.htm. To insure appropriate use of this information users are encouraged to consult with WDFW biologists.

Streams with presence of priority anadromous and resident fish species from the WLRIS database are highlighted on the accompanying map. Due to the complexity of displaying linear features individual species that utilize each river reach are not distinguishable. If more species specific information is needed, users should request individual species maps, digital data, or contact the WLRIS database manager.

State status information is not available in the WLRIS database for these species. Please see WDFW Species of Concern List for current status. For a copy of this list, contact WDFW Endangered Species Section at (360)902-2515, or it is available on our web site at http://www.wdfw.wa.gov/wlm/diversty/soc/soc.htm.

Priority Anadromous Fish Presence:

Code	Common Name	Stream Name	Stream LLID	Record Date
DBT	Dolly Varden/Bull Trout	Glacier Creek	1213921479875	05-01-10
DBT	Dolly Varden/Bull Trout	Seventysix Gulch	1213921479865	05-01-10
DBT	Dolly Varden/Bull Trout	South Fork Sauk River	1213879480978	05-01-10
STWI	Winter Steelhead	South Fork Sauk River	1213879480978	04-02-09
STWI	Winter Steelhead	South Fork Sauk River	1213879480978	04-06-21

Priority Resident Fish Presence:

Code	Common Name	Stream Name	Stream LLID	Record Date
RBT	Rainbow Trout	Silver Creek	1214351478970	04-12-16

Codes Used In The Fish Presence Report

Code : WDFW alphanumeric code that identifies the fish species.

Common Name : Common name of the fish species.

Stream Name : Stream name based on the US Geological Survey, Geographic Names Information System database.

Stream LLID : Unique stream identifier (ID) generated from the node latitude and longitude located at a stream's mouth. This ID is to be construed only as an ID, and not necessarily as a reference to a stream's location.

Record Date : Date the information was entered into the database.

WASHINGTON STATE DEPARTMENT OF
Natural Resources

MAY 31 2005

DOUG SUTHERLAND
Commissioner of Public Lands

May 24, 2005

Ryan Tobias
Cascade Earth Sciences
7150 Supra Drive SW
Albany OR 97321

SUBJECT: Monte Cristo Mine – Abandoned Mine Lands Site Inspection (T29N R11E S21,22)

We've searched the Natural Heritage Information System for information on rare plants and high quality native wetland and terrestrial ecosystems in the vicinity of your project. A summary of this information is enclosed. In your planning, please consider protection of these significant natural features. Please contact us for consultation on projects that may have an effect on these rare species or high quality ecosystems.

The information provided by the Washington Natural Heritage Program is based solely on existing information in the database. There may be significant natural features in your study area of which we are not aware. These data are being provided to you for informational and planning purposes only - the Natural Heritage Program has no regulatory authority. This information is for your use only for environmental assessment and is not to be redistributed. Others interested in this information should be directed to contact the Natural Heritage Program.

The Washington Natural Heritage Program is responsible for information on the state's rare plants as well as high quality ecosystems. For information on animal species of concern, please contact Priority Habitats and Species, Washington Department of Fish and Wildlife, 600 Capitol Way N, Olympia WA 98501-1091, or by phone (360) 902-2543.

Please visit our internet website at http://www.dnr.wa.gov/nhp for more information. Lists of rare plants and their status, rare plant fact sheets, as well as rare plant survey guidelines are available for download from the site. Please call me at (360) 902-1667 if you have any questions.

Sincerely,

Sandy Swope Moody

Sandy Swope Moody, Environmental Review Coordinator
Washington Natural Heritage Program

Enclosures

Asset Management & Protection Division, PO Box 47014, Olympia WA 98504-7014
FAX 360-902-1789

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
ENDANGERED, THREATENED AND SENSITIVE PLANT SPECIES &
HIGH QUALITY WETLAND ECOSYSTEMS AND HIGH QUALITY TERRESTRIAL ECOSYSTEMS
IN THE VICINITY OF MONTE CRISTO MINE, SNOHOMISH COUNTY WA
REQUESTED BY CASCADE EARTH SCIENCES

Data Current as of May 2005

TOWNSHIP, RANGE AND SECTION	ELEMENT NAME	STATE STATUS	FEDERAL STATUS
T29N R11E S28 N2 S33 NE	*Platanthera chorisiana* (Choris' bog-orchid)	T	

WASHINGTON NATURAL HERITAGE INFORMATION SYSTEM
Rare Plant Species

FEDERAL STATUS DEFINITIONS- (Note: Federally listed plant species are subject to the US Endangered Species Act.)

LE = Listed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

LT = Listed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been formally listed as such in the Federal Register under the Federal Endangered Species Act.

PE = Proposed Endangered: Any taxon that is in danger of extinction throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

PT = Proposed Threatened: Any taxon that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and that has been proposed for listing as such in the Federal Register under the Federal Endangered Species Act.

C = Candidate species: Taxa for which current information indicates the probable appropriateness of listing as Endangered or Threatened and that has been published in the Federal Register as a candidate for listing under the Federal Endangered Species Act.

SC = Species of Concern: Species whose conservation standing is of concern but for which status information is still needed. Species of concern lists are not published in the Federal Register.

STATE STATUS DEFINITIONS- (Note: The state ESA does not include provisions to list or protect rare plant species – the state rare plant list is advisory only.)

E = Endangered: Any taxon in danger of becoming extinct or extirpated from Washington within the foreseeable future if factors contributing to its decline continue. Populations of these taxa are at critically low levels or their habitats have been degraded or depleted to a significant degree.

T = Threatened: Any taxon likely to become Endangered in Washington within the foreseeable future if factors contributing to its population decline or habitat degradation or loss continue.

S = Sensitive: Any taxon that is vulnerable or declining and could become Endangered or Threatened in the state without active management or removal of threats.

X = Possibly Extinct or Extirpated from Washington: Based on recent field searches, a number of plant taxa are considered to be possibly extinct or extirpated from Washington. Taxa in this group are all high priorities for field investigations. If found, they will be assigned one of the above status categories.

R = Review: Taxa of potential concern, but for which no status has yet been assigned.
Group 1 = Taxa in need of additional field work before a status can be assigned.
Group 2 = Taxa with unresolved taxonomic questions.

W = Watch: Taxa more abundant and/or less threatened in Washington than previously assumed.

Non-Vascular Plant:

P = Priority: At this time, there is insufficient information to assign a statewide status to most of the non-vascular taxa. For now, the lichen and macrofungi lists have been divided into two priority groups based on criteria of occurrence pattern, vulnerability, threats, degree of protection, and taxonomy.