SONNEMANN MINE & MILL
SITE INVESTIGATION REPORT
OWYHEE COUNTY, IDAHO



STATE OF IDAHO
DEPARTMENT OF ENVIRONMENTAL QUALITY

March 2005

Submitted to:
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

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LIST OF ACRONYMS

Acronym	Definition
amsl	above mean sea level
BLM	United States Department of the Interior, Bureau of Land Management
DEQ	Department of Environmental Quality
EPA	United States Environmental Protection Agency
gpm	gallons per minute
MCL	Maximum Concentration Limit
PPE	Probable Point of Entry
PRG	Preliminary Remediation Goal
TCLP	Toxicity Characteristic Leaching Procedure
TDL	Target Distance Limit
TMDL	Total Maximum Daily Load

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1. INTRODUCTION

The Department of Environmental Quality (DEQ) was contracted by Region 10 of the United States Environmental Protection Agency (EPA) to provide technical support for completion of a site investigation (SI) at the Sonnemann Mine and Mill site located near South Mountain, Idaho, in Owyhee County. The DEQ also entered into a cooperative agreement with the owners of the Sonnemann South Mountain Mining Company, for cost recovery to complete this SI. The DEQ completed SI activities in accordance with the goals listed below.

1.1. Scope

Conducting the SI included reviewing existing site information, collecting receptor information within the site's range of influence, and conducting a site visit. The SI included the collection of surface water, sediment, soil and ore samples to delineate sources of potential release(s) to the environment.

This document includes a discussion of site background information (Section 2), a discussion of the operational history and waste characteristics (Section 3), a discussion of the migration/exposure pathways and targets (Section 4), a summary and conclusion discussion (Section 5), applicable maps, tables and figures, and a list of pertinent references (Section 6).

1.2. Objectives

The specific objectives for the Sonnemann Mine and Mill sampling activities included the following:

- Determine the presence of hazardous constituents and contaminants in Williams Creek
- Determine the impact of historic mining on surrounding soils and sediments
- Qualify and quantify sources of contaminants
- Evaluate human health and environmental targets potentially affected by the historic mining operations

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2. SITE BACKGROUND

This section specifies the site location, describes the site, provides a survey of previous investigative work, and summarizes the regulatory history of the Sonnemann Mine and Mill.

2.1. Site Location

Site Name:	Sonnemann Mine and Mill
CERCLIS ID No.:	
EPA ID No.:	IDN001002433
Location:	Owyhee County, Idaho
Latitude:	42° 44' 43"N
Longitude:	116° 55' 13"W
Legal Description:	Section 10, Township 8S, Range 5W, Boise Meridian
Congressional District:	Idaho
Site Owners:	South Mountain Mining Company Roger Milliken 70 East Blanchard Road Cumberland, Maine 04021
	Bureau of Land Management c/o Steve Moore 1387 South Vinnell Way Boise, Idaho 83709
Site Contact:	Kenneth Henderson 210 N 2450 E Richfield, UT 84701 (435) 201-9798

2.2. Site Description

The Sonnemann Mine and Mill is an inactive silver and lead mine located in Owyhee County, Idaho, approximately 18 miles southeast of Jordan Valley, Oregon and 20 miles south of Silver City, Idaho (Figure 2-1). The mill site lies immediately adjacent to the mine's portal. The site is located near the headwaters of Williams Creek on the northwest flank of South Mountain. The site is situated on private property owned by the South Mountain Mining Company, though ownership of the tailings pile appears to be public land, managed by the Bureau of Land Management. The site lies along the eastern side of Williams Creek, a northward flowing drainage from South Mountain and an influent tributary to Jordan Creek.

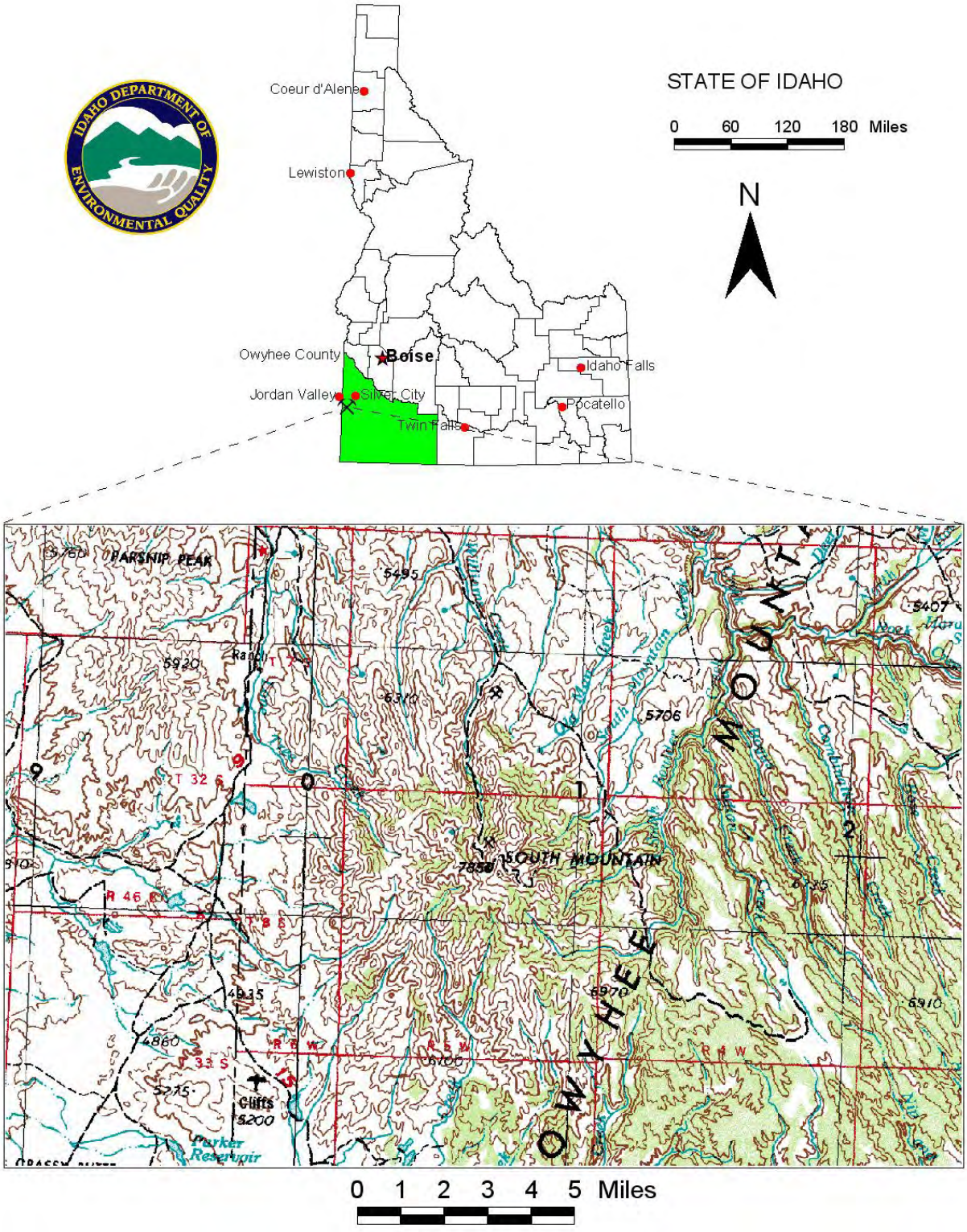


Figure 2-1. Map Showing Location of Sonnemann Mine.

The Sonnemann Mine and Mill (Sonnemann) can best be accessed from Jordan Valley, Oregon. Traveling east on Yturri Boulevard from the 90° curve on Highway 95, continue for 1.8 miles. At this point, Yturri Boulevard becomes Pleasant Valley Road. Continue traveling on Pleasant Valley Road for 1 mile, and then take a right-hand turn to stay on Pleasant Valley Road. Continue traveling on Pleasant Valley Road for 2.8 miles, and then take a right-hand turn (portions of road are unpaved). Continue for 1.6 miles, and then take a left-hand turn onto South Mountain Road. Continue traveling on South Mountain Road for 13.3 miles. The upper portions of the road are narrow and rocky: high-clearance and/or four-wheel drive vehicles may be required. The Sonnemann Mine and Mill site lies on the east side of Williams Creek.

The Sonnemann lies at an elevation of 6,840 feet above mean sea level (amsl) and is located in the NW ¼ of the NW ¼, Section 10, T 8S, R5 W, on the Cliffs 7.5-minute quadrangle (Figure 2-2). The site is also known by several other names, including the Sonnemann Mine, new Golconda Tunnel, and South Mountain Mine. The site is located near the headwaters of Williams Creek on the northwest flank of South Mountain (Figure 2-3). Much of the site is covered with sagebrush (*Artemisia L.)* and mountain mahogany (*Cercocarpus Kunth*).

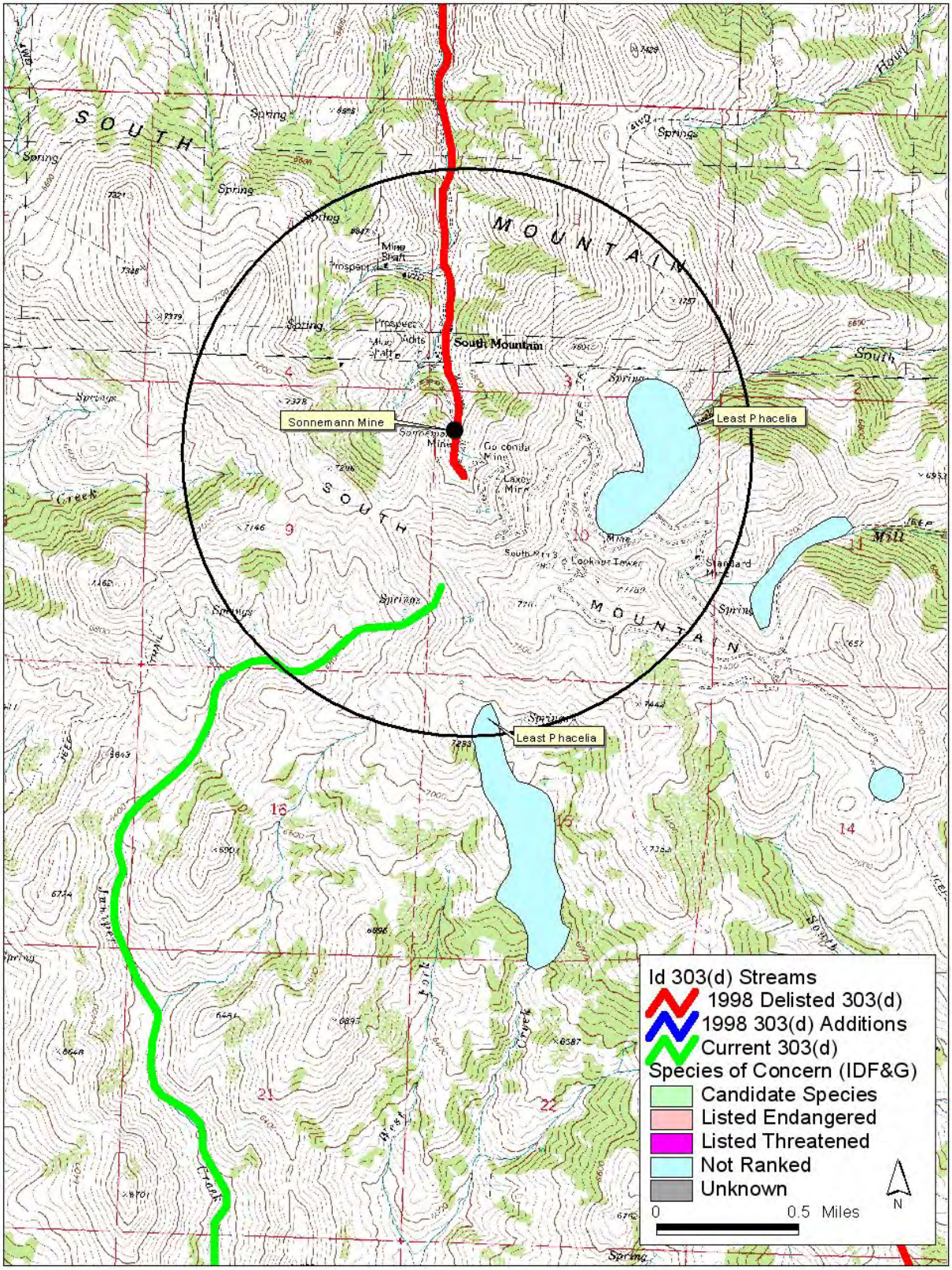


Figure 2-2. Sonnemann Mine & Mill 1-Mile Radius Map.

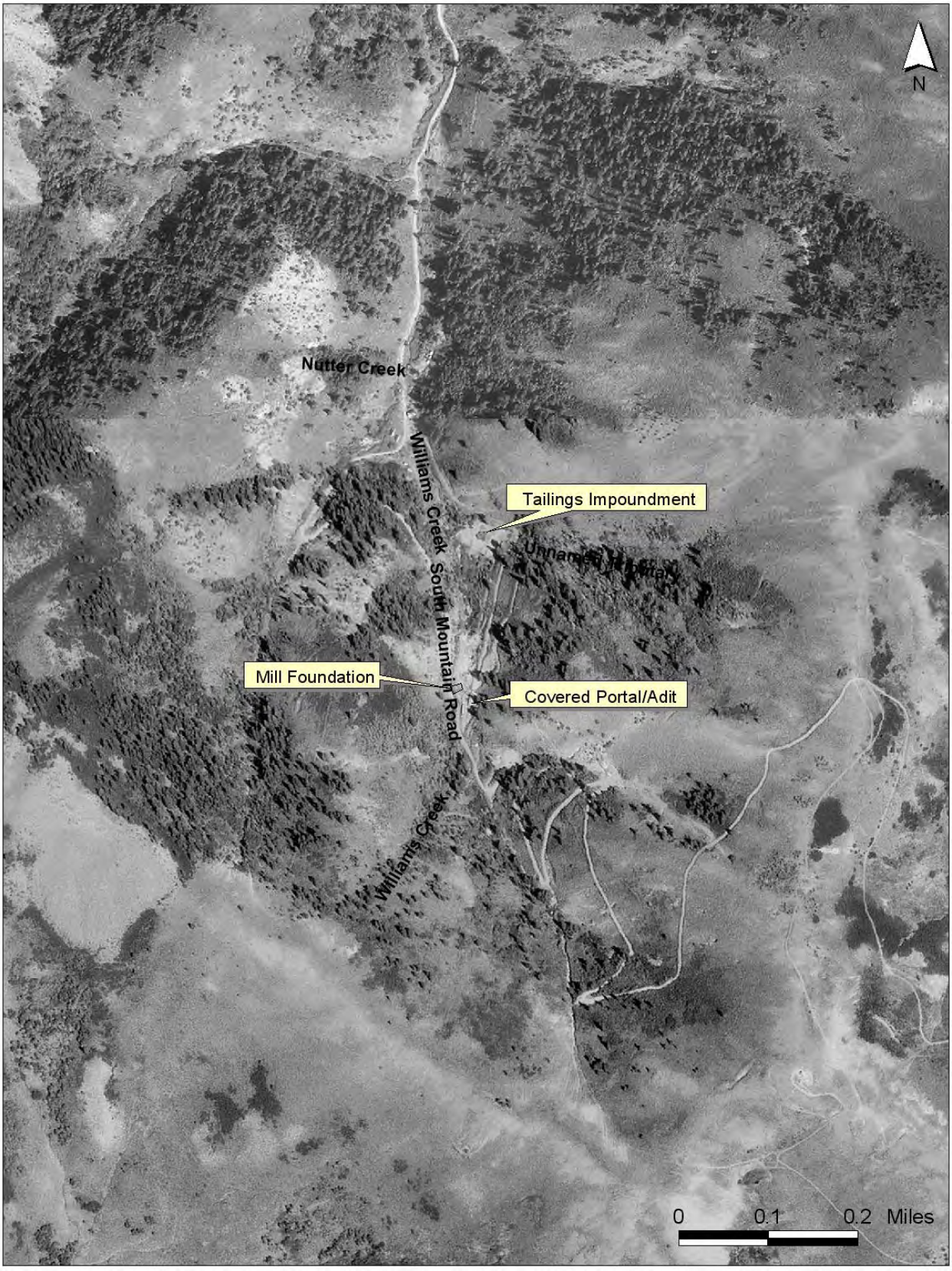


Figure 2-3. Sonnemann Mine & Mill 1-Mile Aerial Photograph.

2.3. Previous Investigative Work

Previous investigative work has been conducted at the Sonnemann. Geologists from the Idaho Geological Survey (IGS) conducted preliminary assessment activities in 1999, as part of an investigation of abandoned and inactive mines in Idaho made in cooperation with state and federal agencies (Bennett, et al, 2000). The IGS report includes a historic literature search of the site as well as fieldwork during which specific mine workings were located and mapped. This report summarized information relative to the historic mineral production and geology of the mine and determined safety hazards and potential surface water impacts. Sample analysis of adit (mine entrance) water indicated exceedance of water quality standards for arsenic and cadmium and aquatic life standards for zinc. (Appendix D of this report contains a copy of the IGS report).

The DEQ conducted a preliminary assessment (PA) at the Sonnemann on July 2, 2002. The PA report includes a historic literature search, historic mineral production information and a description of the geology of the mine, and migration/exposure pathways and potential targets. The PA report states:

> "Water sampled from the adit shows concentrations of arsenic (50 µg/kg) equal to the Maximum Concentration Limit (MCL), but the risk is calculated at 1.1 x E-3 (EPA[1], 2002). The risk from arsenic downstream from the PPE [Probable Point of Entry] is calculated at 5.8 x E-4 and is approximately equal to one-half of the MCL. The lead concentrations of both adit and downstream samples are approximately one-third of the MCL (0.015) as presented in EPA's current Drinking Water Standard (EPA[2], 2002)." (DEQ, 2002, p. 15)

2.4. Regulatory History

In January 2003, the DEQ submitted a PA report to the U. S. EPA Region 10 office. Upon review, the EPA recommended further action at the site. Consequently, DEQ, in cooperation with the site owners, South Mountain Mining Company, embarked on this focused site investigation.

3. OPERATIONAL HISTORY AND WASTE CHARACTERISTICS

This section presents an operational history of the site, defines the characteristics of the waste, and describes previous source sampling efforts.

3.1. Operational History

Mining in the South Mountain area began in the late 1860s and continued into the early 1870s (Sorenson, 1927). In 1874, a small smelter was established in the town site of Bullion City, later renamed South Mountain, which lies 0.75 miles north of the Sonnemann Mine. The Richards report (1989, p.1) states:

> "During the 1860's and 1870's, the mining activity at South Mountain consisted of mining high grade narrow veins of argentiferous lead carbonate found in Bay State section of the South Mountain property…Later, probably in the 1870's, a matte smelter was built at South Mountain. From the size of the existing slag pile, it appears that it only operated for a short time…Most of the mining claims of the South Mountain Group were patented in 1900 by George A Sonnemann and Joseph E. Branscome."

The Alabama claim encompasses the old Golconda Tunnel and Golconda slope, while the Kentuck and Queen of the Mountains claims contain the Sonnemann Mine and Mill site. According to Sorenson (1927, p. 3):

> "The South Mountain district remained practically idle during the period from 1875 to 1906. In 1906 some work was done on the Standard group of claims, and the South Mountain Company's mines were operated under option by the Bagdad-Chase Gold Mining Company in 1907. Operations were soon stopped, however, and the bond was forfeited because of the financial depression. Very little work, other than annual assessment work on unpatented claims, has been done in the period from 1907 to 1926. A bond and option on the property of the South Mountain Mining Company is held now by Utah and eastern capital. Repair work on the camp buildings was started in August, 1926. The name of the new corporation is the Uida Consolidated Mines Company".

Richards' (1989, pp. 1-3) report continues the operational chronology:

> "In the 1920's, a group headed by Charles Butters did extensive underground work at South Mountain…The groups plan for going into production was terminated by circumstances connected with the economic depression of the 1930's.
>
> In 1940, several directors of International Smelting and Refining Company leased the South Mountain property. They mined and shipped 51 thousand tons of ore averaging 10 ounces per ton in silver and 15 percent zinc to Tooele, Utah, for smelting. Most of the mining was done on the Laxey orebody which outcrops just above the portal of the Laxey level. From there the oreshoot was mined to a depth of 200 feet below the lower or Sonneman level. The zinc market eased near the end of World War II and the mining operation and lease were terminated.
>
> In 1950, P. P. Brandenthaler and H. F. Anderson took a lease and option on

the South Mountain property. They rehabilitated the Laxey (upper) level, but they did not open the Sonneman (lower) level. The portal had caved during the period of 1946 to 1950. Anderson and Brandenthaler operated as a partnership known as the South Mountain Mining Company. Anderson was the one actively in charge of the mine. Later they formed a corporation called South Mountain Mining and Concentrating Company. Anderson shipped approximately 2000 tons from the shallow shaft on the Texas orebody. He was so encouraged with the results that he then planned on driving the Laxey level to intersect the Texas orebody. To further the plan, the partnership entered into a contract with the Defense Minerals Exploration Administration in October, 1951, to drive the Laxey level to the Texas orebody a distance of approximately 1000 feet…

Anderson intersected the Texas orebody with the Laxey level extension work. He then stoped the Texas ore and shipped it to the Garfield Smelter in the Salt Lake area.

During 1953-1954, Anderson and Brandenthaler constructed a mill just below the portal of the Sonneman level. The ore was trucked from the Laxey level to the mill. The mill was equipped with a diesel driven 15 x 36 inch jaw crusher and a 2 foot Simons shorthead gyratory crusher. The estimated capacity of the crushing plant was 30 tons per hour. The grinding unit was a 6 x 4.5 foot Marcy ball mill which could grind South Mountain ore at the rate of 6 tons per hour. The flotation unit was confined to a single circuit. Mill power was supplied by two diesel powered generators with a total output of 200 kw.

In 1955, Anderson and Brandenthaler decided to put the mining operation up for sale. They were faced with the expense of enlarging the mill to cover a zinc flotation circuit, and more expense for development work to put the mine in full production.

In June, 1955, they were approached by Rare Metals Corporation…This offer was turned down. Shortly afterward, Anderson and Brandenthaler dealt with Potash Corporation of America. Potash took over the property and added a zinc flotation circuit to the mill…Potash was interested in zinc concentrates which they intended to roast for the purpose of making potassium sulfate….Potash concentrated on stoping the high zinc oreshoots above the Laxey level. There is no evidence that they did any development work. After a short period of time Potash closed down and sold off all equipment.

In 1963, Sunshine Mining Company took a lease and option on the South Mountain property calling for a price of $600,000.00. For the next two years, Sunshine concentrated their efforts on rehabilitating the Laxey level and sampling. Sunshine terminated the option in 1965….

Within a short period of time after the property was dropped by Sunshine, the property was picked up by a lease and option by the Bunker Hill Company. They concentrated their efforts in horizontal core drilling from the Laxey level apparently looking for additional ore zones….the Bunker Hill program was disappointing and the property was released in 1967.

James Keighly optioned the South Mountain property from Mr. Pete

Brandenthaler in 1968. Mr. Brandenthaler had passed away and Mrs. Brandenthaler had bought out Mr. Anderson's interest. Keighley then transferred the option to Mrs. Ora K. Smith and Mr. Roger Milliken. They later exercised the option and bought the property.

Over a period of years prior to 1983, the new owners carried on extensive geologic investigations, sampling, and mineral exporation (sic) at South Mountain. They rehabilitated the Laxey and Sonneman levels, and drove the latter approximately 1000 feet to the Texas oreshoot. After the Sonneman extension, their staff in a 1982 report estimated that the South Mountain mine contained 210,000 tons of probable ore averaging:

Gold	0.65 oz./ton
Silver	8.33 oz./ton
Copper	1.39 percent
Lead	1.13 percent
Zinc	12.95 percent

Mostly through projections of the ore shoots below the Sonneman level, they estimated 124,000 tons of possible ore."

3.2. Waste Characteristics

The Sonnemann Mine was developed within the same sulfide-rich metamorphosed sediments as the old Golconda Tunnel located 0.20 miles to the southeast. The mine was identified as the new Golconda Tunnel (Sorenson, 1927) and constructed as follows: "The new Golconda tunnel was started about 500 feet northwest of the old tunnel portal at an elevation 105 feet lower than the elevation of the latter. Reports indicate that the face of the tunnel is about 275 feet southeast from the portal, but the writer could not examine it because of the caved condition" (ibid. p. 43). Apparently, the new Golconda Tunnel was driven to intersect a "large body of sulfide ore, which was expected to be found underlying the oxidized surface expression of the hedenbergite-ilvaite rock" (ibid. p. 43). According to Mr. Ken Henderson, who represents the owner of the Sonnemann, the tunnel was driven more than 3,000 feet and connects with the old Golconda Tunnel as well as the Laxey and Texas mines (Henderson, 2002).

Classification of ore deposits in the South Mountain mining district reveals typical contact metamorphic replacement and characteristic vein replacement deposits. "The vein-replacements contain pyrite, arsenopyrite, chalcopyrite, sphalerite, galena, and tetrahedrite in a gangue of quartz and calcite. The contact-metamorphic replacements have the same sequence plus typical contact-metamorphic minerals" (Sorenson, 1927, p. 47). The eastern portion of Williams Creek, including the Sonnemann, the old Golconda Tunnel, the Laxey, and the Texas mines within the Golconda Group, contains sulfide deposits from contact metamorphism of limestone units and the underlying granodiorite. The metamorphosed sediments appear to be a roof pendant in the granodiorite intrusive.

Based upon Richards' report, waste rock piles at the former mill site can be attributed to the Sonnemann, Laxey and Texas mines. According to Mr. Henderson, approximately 60 tons of "high grade" ore from the Sonnemann and 40 tons from the Texas were piled into the eastern portion of the mill foundation (2004, verbal communication). The three-tiered tailings impoundment, waste rock, and ore are described in Table 3-1.

Table 3-1. Waste Source Areas.

Workings	Waste Rock Location	Description	Dimensions (ft) **(L x *W x *H)	Volume cubic yards (yd^3)
Adit	Below Sonnemann Tunnel	Waste rock dump, excludes mill foundations	450 x 75 x 50	62,500
Mill	Mill foundation, west portion	Waste rock from Sonnemann Tunnel	100 x 50 x 25	4,630
	Mill foundation, east portion	"High-grade" ore stock-pile, from Sonnemann and Laxey mines	100 x 50 x 25	4,630
Tailings	Upper tier	Fine-grained soil, color - orange to gray (depth)	140 x 50 x 20	5,185
	Middle tier	Same as above, partially covered with brush	140 x 38 x 15	2,956
	Lower tier	Re-deposited tailings from upper & middle tiers (2 feet thickness)	70 x 45 x 2	233

*Average width and height ** Measured by DEQ in 2002

3.3. Previous Source Sampling Activities

The Sonnemann Mine was visited by Earl Bennett of IGS on July 22, 1999. The IGS conducted a preliminary site investigation, which included limited sampling activities. Sampling locations are noted on the sketch diagram of Figure 3-1. Samples were collected from the tailings pile (red) and surface water (blue). Surface water samples are listed in Table 3-2, while Table 3-3 includes the solid sample results.

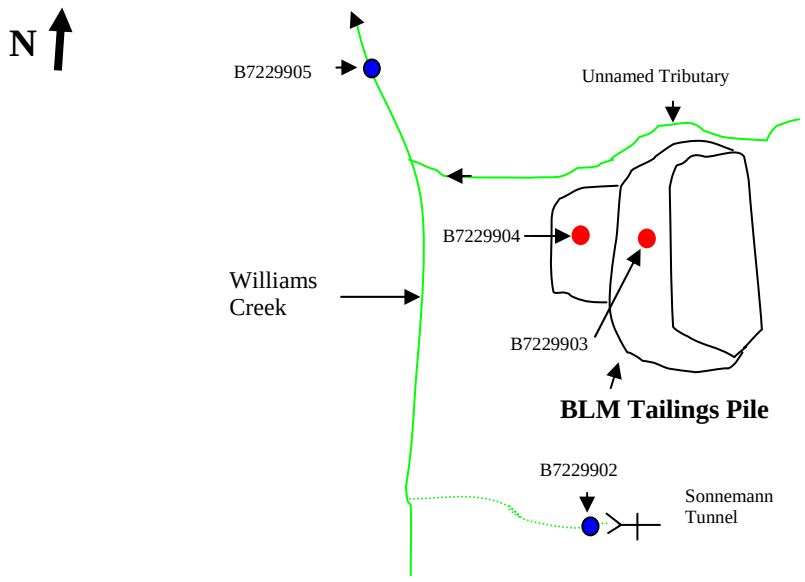


Figure 3-1. IGS (1999) Sample Locations.
(Not to Scale)

Table 3-2. Adit & Surface Water Sample Analysis.

IGS Sample Results	Al*	Ba*	Be*	Cd*	Ca*	Cr*	Co*	Cu*	Fe*	Mg*	Mn*	Mo*	Ni*	K*
Sonnemann Tunnel, adit water	BDL					BDL	BDL	BDL				BDL	BDL	0.85
Sonnemann Tunnel, downstream on Williams Creek						BDL	BDL	BDL				BDL	BDL	1.2

IGS Sample Results	Na*	V*	Zn*
Sonnemann Tunnel, downstream on Williams Creek		BDL	

IGS Sample Results	Ba*	Be*	Cd*	Ca*	Cr*	Co*	Cu*	Fe*	Mg*	Mn*	Mo*	Ni*	K*	Ag*
Sonnemann Tunnel, adit water		BDL			BDL			0.110	1.9000	0.0440	BDL	BDL	1.20	NA
Sonnemann Tunnel, downstream on Williams Creek		BDL	BDL		BDL		BDL		2.3000		BDL	BDL	1.60	NA

IGS Sample Results	Na*	Ti*	V*	Zn*	S*	Ti*	P*
Sonnemann Tunnel, adit water	4.500	NA	BDL	0.9100	NA	NA	NA
Sonnemann Tunnel, downstream on Williams Creek	4.800	NA	BDL	0.4000	NA	NA	NA

IGS Sample Results	As**	Pb**	Hg**
Sonnemann Tunnel, adit water	61.00	3.2	10.00
Sonnemann Tunnel, downstream on Williams Creek	33.00	BDL	5.50

BDL – Below Detection Limit

* Units are mg/L – parts per million

** Units are µg/L – parts per billion

Table 3-3. Tailings & Smelter Slag Sample Analysis.

IGS Sample Results	Ca*	Mg*	K*	Na*	Zn*	Mn*	Cu*	Fe*	P*	S*	Pb*	Cr*	Cd*	Ba*
Sonnemann Mill, mill tailings	44000	4200.0	2500	160	11000.0	1900.0	430.0	82000	500	27000	340.0	40.0	120.0	57.0
Sonnemann Mill, mill tailings	47000	4100.0	1200	320	89000.0	14000.0	4600.0	40000	980	83000	160.0	130.0	870.0	18.0
South Mountain Smelter	4500	6800.0	1100	210	11000.0	1900.0	2100.0	260000	530	9900	16000.0	43.0	18.0	32.0

IGS Sample Results	Ni*	Co*	Be*	Mo*	As*	Hg*	Sb*	Se*	Ag*	Ti*	V*	Sn*	Al*
Sonnemann Mill, mill tailings	23.0	40.0	0.490	16.0	690	NA	NA	NA	NA	NA	NA	NA	NA
Sonnemann Mill, mill tailings	23.0	360.0	0.500	25.0	280	NA	NA	NA	NA	NA	NA	NA	NA
South Mountain Smelter	41.0	30.0	0.250	30.0	4900	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not Available
* Units mg/kg

IGS Sample Results	Pb*	Cr*	As*	Se*	Ag*	Cd*	Hg*	Ba*
Sonnemann Mill, mill tailings	BDL	BDL	BDL	BDL	BDL	BDL	0.015	1.000
Sonnemann Mill, mill tailings	BDL	0.230	BDL	BDL	BDL	2.300	0.014	0.110
South Mountain Smelter	BDL	6.400	2.900	1.400	BDL	30.000	0.018	0.055

BDL - Below Detection Limit
* Units in parts per million

On July 2, 2002, Brian Gaber and Mark Jeffers of the DEQ conducted a preliminary assessment (PA) of the Sonnemann property. At that time, sampling activities were limited to surface water and waste rock/ore media. Sampling locations are noted on the sketch diagram of Figure 3-2.

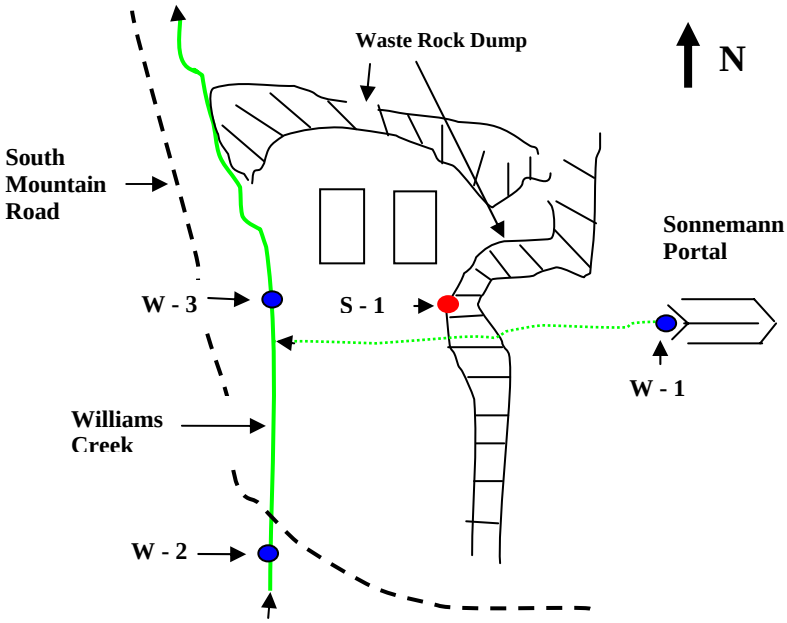


Figure 3-2. DEQ (2002) Sample Locations.
(Not to Scale)

Table 3-4 includes the solid sample results, while surface water samples results are listed in Table 3-5.

Table 3-4. Soil Sample Analysis.

Soil Sample ID	As*	Cd*	Cr*	Pb*	Hg*	Se*	pH
S1	523	80.2	<15	42442	<0.25	<10	8.27

***** All units are mg/kg

Table 3-5. Water Sample Analysis.

Water Sample ID	As*	Cd*	Cr*	Pb*	Hg*	Se*	pH
W1	0.050	0.018	<0.005	0.005	<0.0005	<0.01	8.11
W2	<0.005	<0.001	<0.005	<0.005	<0.0005	<0.01	8.20
W3	0.026	0.007	<0.005	0.005	<0.0005	8.09	<0.01

All units are mg/L*****

3.4. Previous Source Sample Analysis

3.4.1. IGS

On July 22, 1999, Earl Bennett of the IGS conducted an assessment of the Sonnemann that included sampling activities. Water samples collected from the adit of the Sonnemann mine were approximately six (6) times the MCL, and samples collected from Williams Creek were approximately three (3) times the MCL. These results were consistent with arsenic concentrations found near the adit and in Williams Creek during DEQ's investigation. DEQ's evaluation of the data has concluded that risk from surface water exposure in Williams Creek is minimal. Also, arsenic concentrations approaching ambient stream concentrations (approximately 14 ppb) were detected approximately one-half mile down stream from the Sonnemann site.

Soil samples from the tailings and smelter area indicate elevated metals (arsenic, chromium, cadmium and lead). Because these samples were composited, specific risk for any given portion of the area is difficult to determine; however, the concentrations are consistent with metals concentrations found during the DEQ investigation.

3.4.2. DEQ

The Sonnemann was visited by Brian Gaber and Mark Jeffers of the DEQ on July 2, 2002. While conducting preliminary assessment activities, they collected a limit number of surface water and solid samples.

> "During the site visit, the DEQ collected three (3) water samples: directly from the adit at the portal; in Williams Creek immediately downstream from the aforementioned first PPE; and upstream of the Sonnemann Mine to establish background. Analyte concentrations in the upstream sample are all non-detect, therefore, increased metal concentrations downstream of the PPE from the adit is attributable to the mine. Concentrations of arsenic, cadmium and lead observed in the adit water sample appear diluted, but retain a distinctive signature in Williams Creek. The pH of the downstream sample from the PPE is lower (0.10) than from the upstream background sample.
>
> Water sampled from the adit shows concentrations of arsenic (50 µg/L) equal to the Maximum Concentration Limit (MCL), but the risk is calculated at 1.1 x E-3 (EPA[1], 2002). The risk from arsenic downstream from the PPE is calculated at 5.8 x E-4 and is approximately equal to one-half of the MCL. The lead concentrations of both adit and downstream samples are approximately one-third of the MCL (0.015) as presented in EPA's current Drinking Water Standard (EPA[2], 2002).
>
> Ore and/or waste rock (sulfide-rich) are piled in close proximity to the portal, within the foundations of the old mill and scattered along the haul road to the three-tiered tailings impoundment. The DEQ collected a representative sample from the waste dump. Total metals analysis of the dump sample indicates risk levels of barium, cadmium, chromium, mercury, selenium and silver are below 1 x E -6 (or 1 in 1,000,000), conservatively

assuming an industrial exposure scenario. Using the same exposure scenario, risk from arsenic is approximately 3.27 x E-4, and lead is approximately 5.6 x E-5 (EPA[1], 2002)" (DEQ, 2002, p. 13).

3.5. SI Source Sampling Activities

The Sonnemann was visited by Brian Gaber and Curtis Stoehr of the DEQ on August 23-24, 2004, during which time they collected solid and liquid phase samples according to the procedures detailed in the Sample Plan incorporated into the Project Plan (Appendix E). Water temperature and conductivity testing were not completed, as per the Sample Plan, due to equipment malfunction.

Samples were (Figure 3-3) collected from waste rocks dumps (red), surface water (blue) and sediment (yellow), at the locations noted. Surface water samples results are summarized in Section 4.2 and listed in Table 4-1, page 27. Rock and sediment sample results are summarized in Section 4.3 and listed in Table 4-2, page 30, which includes Toxicity Characteristic Leaching Procedure (TCLP) sample results.

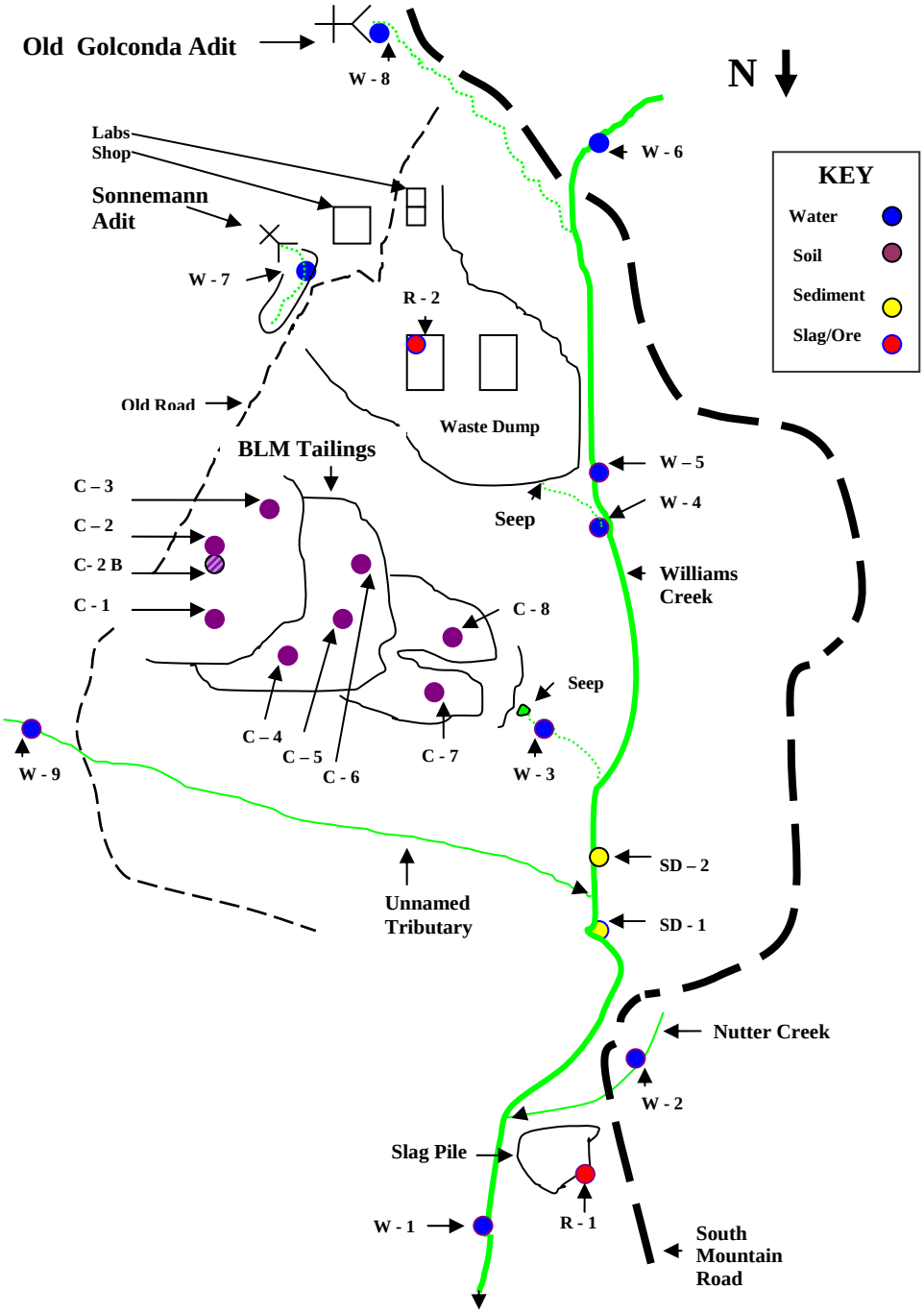


Figure 3-3. DEQ (2004) SI Samples
(Not to Scale)

3.6. SI Source Sample Analysis

In August 2004, a Site Investigation was performed on the Sonnemann Mine and surrounding properties to assess the risk posed by historical mining activities in the area. Metals analysis indicated that arsenic was present, at elevated concentrations, in the tailings and waste rock throughout the area. Arsenic was also present in Williams Creek at elevated levels greater than the average background concentrations of 14 µg/L). Because there are no surface drinking water sources located on Williams Creek, DEQ concluded that there is no impact to the beneficial use of Williams Creek. Williams Creek's beneficial uses are listed, by default, as protected for primary and secondary contact recreation, cold water biota, and salmonid spawning and rearing.

In order to better quantify other potential risks to human and ecological receptors, the DEQ collected and performed totals metals analyses on eleven soil samples. These included samples from the BLM tailing piles and sediment samples from Williams Creek. The following conclusions are based on DEQ's evaluation of this data using the Region IX Preliminary Remediation Goal (PRG) tables.

- Totals analysis of three (3) samples demonstrates an approximate risk of 1E-03 related to the BLM tailings pile. These risks are associated with arsenic based on an industrial risk scenario. This risk is extremely conservative if applied to the infrequent tourist or hunter, which is the most likely risk scenario for the site. The remainders of the samples indicate a risk of approximately 1E-04.
- Sediments from Williams Creek had arsenic levels of 41.8 and 43.0 mg/kg. Literally applied, this would pose a risk of approximately 2E-05 using an industrial risk exposure scenario, which is considered an acceptable risk by US EPA. However, arsenic concentrations in the sediment do not appear to be leaching into Williams Creek water, as evidenced by arsenic concentration levels ranging from 10µg/L to 23µg/L obtained from downgradient water samples. DEQ recommends the collection of at least two (2) additional sediment samples in Williams Creek (one up gradient of the site and one immediately below the waste dump area), and at least two additional surface water samples (one in Williams Creek below Nutter creek and one in Williams Creek below the BLM tailings pile) to further evaluate any potential impacts to the creek from mining operations.
- The Water Quality Standards for arsenic affecting aquatic life is 190 µg/L. Concentrations of arsenic, found in Williams Creek down gradient of the Sonnemann Mine, were considerably lower than the standard.
- Although totals analysis was not performed on samples from the waste rock pile at the Sonnemann site, TCLP analysis of the waste rock indicates risk levels equal to or greater than the BLM tailings. Prior TCLP analysis did not indicate that metals are leaching from the waste rock or tailings into the environment.

Due to the remoteness of the location of the Sonnemann Mine and tailings pile, risk to potential human receptors is probably low. However, since the area is regularly visited by recreationists, the DEQ recommends the ore pile and waste rock along Williams Creek be consolidated and capped in a location that minimizes contact with surface and groundwater as well as exposure for recreationists. This will eliminate the exposure pathway to human receptors and provide a buffer for potential environmental impacts to Williams Creek. Likewise, tailings from the BLM tailings

pile should be removed from the streambed, isolated, and capped to eliminate the exposure route to humans and/or ecological receptors.

4. MIGRATION/EXPOSURE PATHWAYS AND TARGETS

The following sections describe migration/exposure pathways and targets within the site's range of influence.

4.1. Ground Water Migration Pathway

This section describes the ground water migration pathway, addressing geology, hydrology, drinking water systems, and climate.

4.1.1. Geology

South Mountain has been described as a continuation of the Owyhee Range (Lindgren, 1900) and an isolated uplift (Bell, 1906). Sorenson (1927) stated the South Mountain uplift bears no direct connection to the Owyhee range. The highest summits of the South Mountain Range seem to follow the strike of the metamorphosed sediments, while the long axis of the range strikes in a northwest-southeast direction and parallels the Owyhee Range. South Mountain measures 15 miles northwest-southeast with a width of approximately 10 miles.

The stratified rocks of South Mountain are largely metamorphosed sediments (meta-sediments). Lindgren (1900) mapped the South Mountain sediments as Carboniferous age and correlated them with the Seven Devils series from an outcrop exposed near Huntington, Oregon, 115 miles to the north. The meta-sediments are composed of "more than 4,000 feet of garnetiferous-quartz-mica schist, fine-grained quartzite, and marble, which were tightly folded and later intruded and surrounded by a grano-diorite-quartz-monzonite magma" (ibid. p.10). Intrusion of granitic magma created extensive contact metamorphism throughout the South Mountain Mining District and appears to correlate to the sediments of the Flint Mining District to the north (Piper and Laney, 1926).

The sediments were highly folded and contorted before intrusion of the granodiorite. “The only major folded structure still preserved in the sediments is an overturned anticlinal fold whose axis strikes north-south to N. 10° W. in a northerly direction from Bullion City, but east of Bullion City the axis strikes about northwest-southeast. The fold is overturned from west to east with its axial plane dipping 50° to 70° to the west and southwest….On the limbs of the major fold are developed a multitude of minor folds” (Sorenson, 1927, p. 29). [Author’s note: *Sorenson* refers to *Bullion City* which was later changed to the town site of *South Mountain*.]

The mines in the South Mountain district were developed “in a schist, quartzite, and marble roof pendant in Cretaceous or Eocene biotite-hornblende quartz diorite and granodiorite” (Bennett, et al, 2000). Subsequent erosion of the meta-sediments and granodiorite enabled outpouring of Miocene flood basalts (Christiansen and Lipman, 1970). Following deposition of basalts, the area was again subjected to uplift. The present topography resulted from glaciation and stream erosion. Cirques were developed only on the north side of South Mountain. The streams, including Williams Creek, are reworking the glacial debris (Sorenson, 1927).

4.1.2. Hydrologic Setting

The elevation of South Mountain (Figure 4-1) is 7,801 feet while Jordan Valley, Oregon, which lies in the valley to the north, has an elevation of 4,200 feet. The regional relief is about 3,400 feet. The topography of South Mountain is dominated by V-shaped stream valleys. Steep gradient streams and hills with steep slopes are common, but summits tend to be rounded. Glaciation resulting in cirque formation is only evident on the north slope of South Mountain. Williams, Mill, South Mountain and Willow creeks drain the north slopes of South Mountain. Williams Creek, which heads about 200 feet vertically and 500 feet horizontally from South Mountain, is a permanent stream from its source to its end during all seasons (ibid.).

Ground water exists locally within fractures in the meta-sediments and within the unconsolidated, overburden and glacial deposits. Several springs are located within 0.75 miles upgradient from the mine. As evident of flowage at the Sonnemann, ground water also surfaces through the interconnected workings of the Golconda Group mines. Fracturing of the meta-sediments via thrust faulting occurred during the overturning of the folds. The two largest thrust faults are "the Williams Creek overthrust, which strikes north and south and follows Williams Creek canyon for more than a mile north of Bullion City; and the Golconda overthrust, which strikes approximately northwest and southeast and follows along near the foot wall of the "AL" limestone a great part of the distance. Another, but small, overthrust nearly parallels the Golconda overthrust to the north….All of these fractures show considerable displacement vertically" (ibid, p.30).

The Bullion Creek drainage and surrounding area is devoid of wells, so ground water data is unavailable. Consequently, ground water is expected to follow preferential pathways along bedding planes and mine workings and is likely to be controlled by faults and fractures, locally.

4.1.3. Drinking Water Systems

No public drinking water or irrigation wells are located within a 4-mile radius of the Sonnemann Mine. The property is not located within a wellhead protection area (DEQ, 2004).

4.1.4. Climate Summary

No precipitation data is available for the Sonnemann property. The Natural Resources Conservation Service operates a SNOTEL (SNOpack TELemetry) station on South Mountain, at an elevation of 6,500 feet. The average annual precipitation recorded from 1971 to 2000 was 33.41 inches (NRCS, 2005). However, daily maximum precipitation data was not available. Consequently, precipitation data from Silver City, located 20 miles north of and at comparable elevation to the Sonnemann, is supplemented. The mean annual precipitation, recorded from 1978 to 2004, was 20.99 inches, and the 100-year, 24-hour event is 2.75 inches, which occurred on January 12, 1998 (WRCC, 2005). Most likely, the 2.75 inches is a water-equivalent measurement, as the snowfall total would have been much greater.

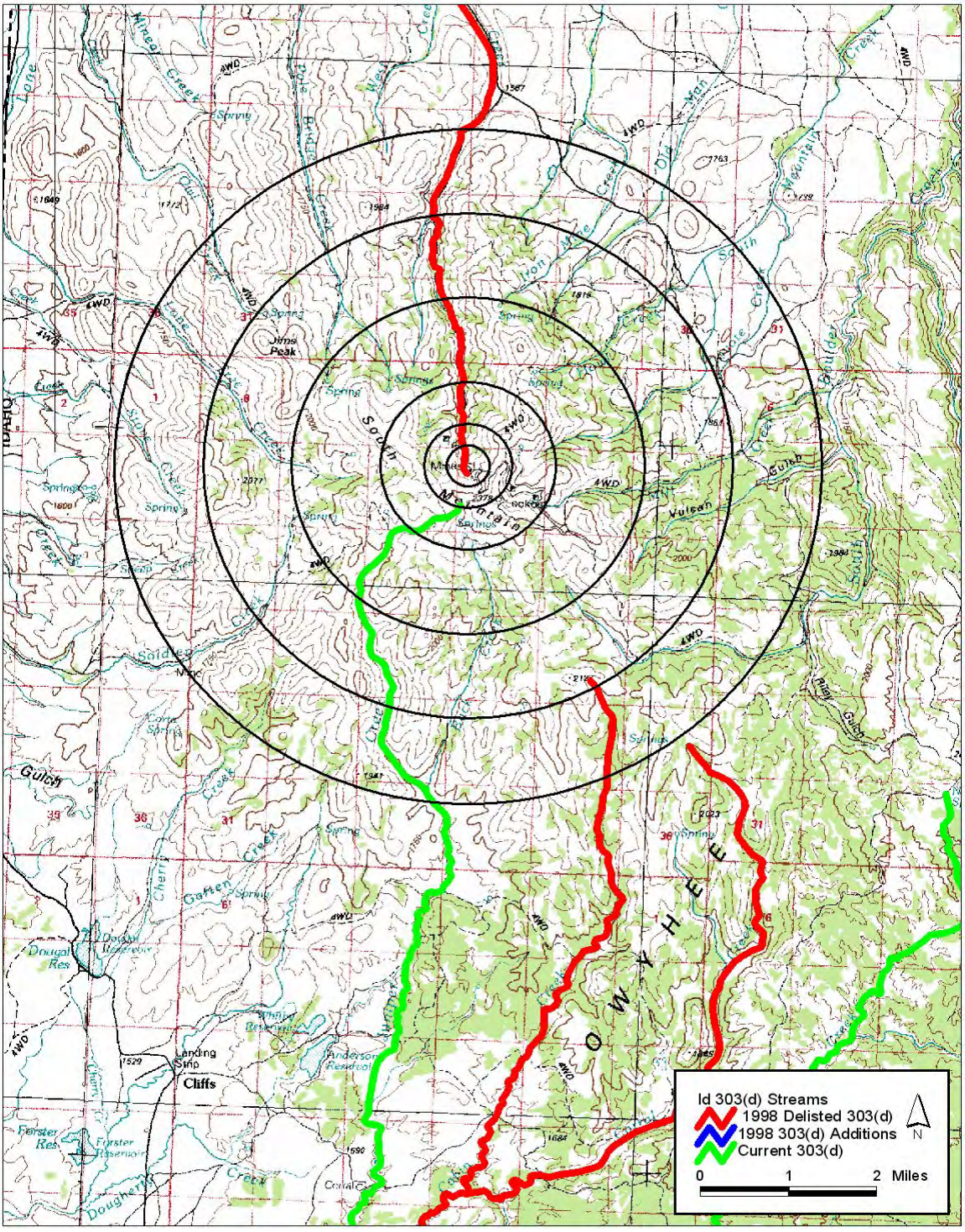


Figure 4-1. Sonnemann Mine 4-Mile Radius Map.

4.2. Surface Water Migration Pathway

This section describes the surface water migration pathway, including the hydrologic setting, in-water segment, target species, and source sample analysis.

4.2.1. Hydrologic Setting

Several springs occupy the drainage, the largest of which births Williams Creek, approximately 0.5 miles upgradient from the mine. Ground water flows from the Sonnemann adit under the large waste rock dump before entering Williams Creek. The adit discharge is estimated to be less than five (5) gallons per minute. Additionally, ground water flows at a rate of 5 to 10 gallons per minute from the old Golconda adit (Photo 17), down slope onto the South Mountain Road, where it enters Williams Creek on the north side of the culvert.

The site slopes north and northwest toward Williams Creek. An unnamed westerly flowing tributary delineates the northern boundary of the site. The unnamed creek, which flows directly into Williams Creek, is incising the north side of the tailings impoundment (Photo 19). Evidence of channeling through the top and middle tiers suggests historic flooding events and erosion of the impoundment by the unnamed creek (Photo 28). Considering that the thickness of the lowest tier appears to be shallow (< 2 feet), this material was most likely re-deposited from erosion of the upper tiers (Photo 31).

At the time of the site visit, water was observed flowing from beneath the soil/rock cover atop the portal, at a rate of less than 5 gallons per minute. Mr. Henderson had previously covered the adit, due to safety concerns, and trenched a flow path along the old road (Photo 15) to channel the water away from the waste dump. Based upon site observations, however, it appears as though a large portion of the flow continues to infiltrate the waste rock and emanates at the toe of the dump near Williams Creek (Photo 8).

Soil survey data for the site is unavailable, but Sorenson (1927) suggests glacial till is an integral component. Direct observation revealed a coarse-grained sandy loam underlain by characteristic glacial debris. Based upon observation during the site visit, moderate infiltration rates would be expected.

4.2.2. In-water Segment

There are no drinking water intakes within the 15-mile Total Distance Limit (TDL) shown in Figure 4-2. Traversing north, the surface water pathway is enjoined by Nutter Creek at 0.75 miles and several unnamed creeks before West Creek merges at 6.25 miles. Pole Bridge Creek merges at 7.75 miles, and it flows into Jordan Creek at 10 miles from the site. Jordan Creek continues within the 15-mile TDL for another 5 miles to the northwest. Jordan Creek is listed by DEQ as a §303(d) stream meeting a total maximum daily load for pesticides, oil and grease, bacteria, sediment and metals; however, metals are not listed as a pollutant after the confluence of Jordan Creek and Williams Creek.

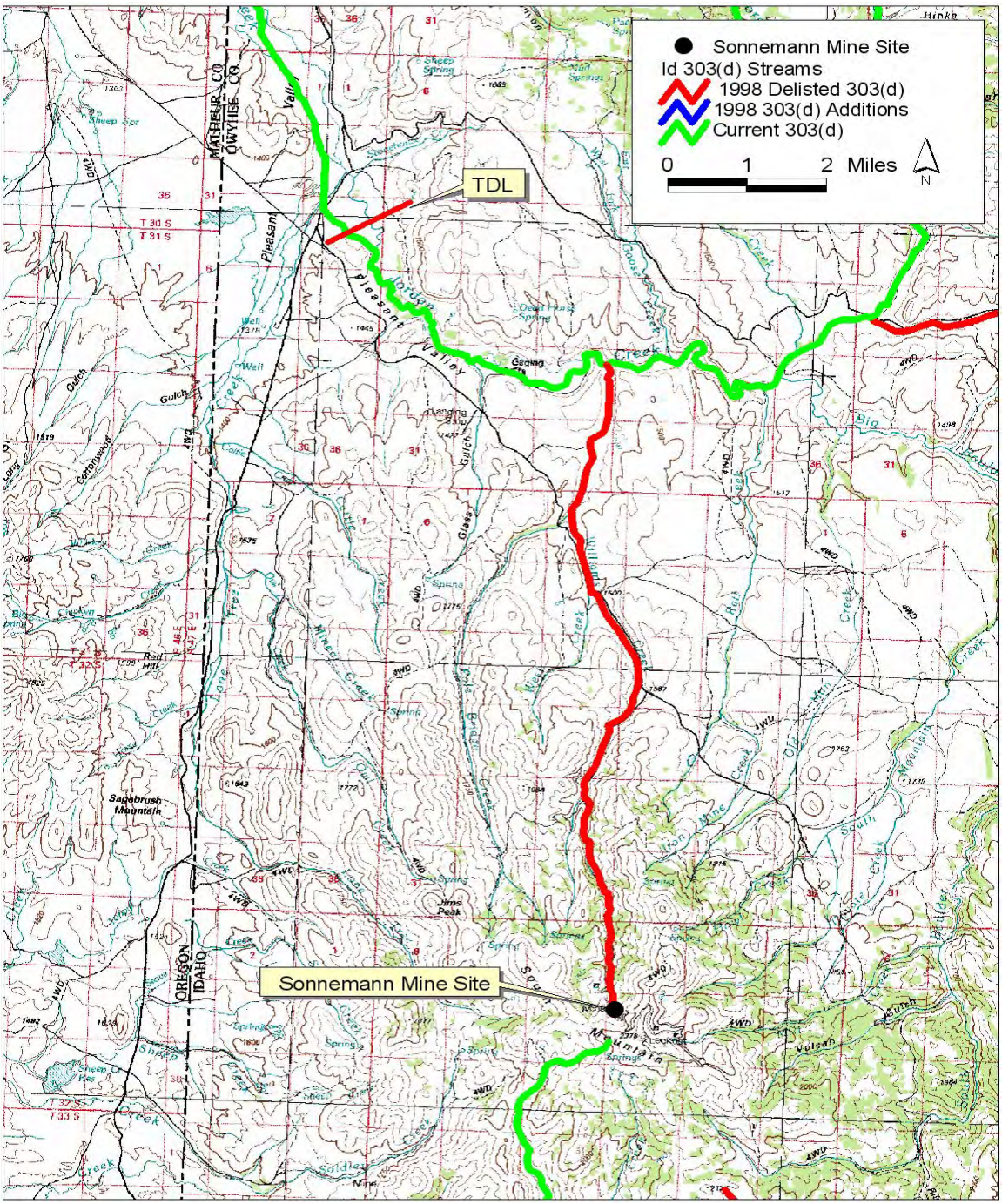


Figure 4-2. Sonnemann Mine 15-Mile Total Distance Limit (TDL).

4.2.3. Target Species

Commercial and subsistence fishing are not conducted within the surface water TDL. Sport fishing was observed in Williams Creek between the old town site of South Mountain (0.5 miles north of site) and West Creek. Fish catch data, however, could not be determined.

"One plant species, listed as sensitive (F&G, 2002), was identified at four locations within a 4-mile radius of the Sonnemann Mine. The Least Phacelia (common name), *Phacelia Minutissima*, was identified at sites 0.60 miles and 1.30 miles southeast, 1.45 miles south, and 2 miles southeast from the Site. One threatened species was identified within a 4-mile radius of the Mine. The Western Toad (common name), *Bufo Boreas*, was identified 3.5 miles north along Williams Creek (USDA Forest Service, 1994). According to the U.S. Fish and Wildlife Service (2002), there are no wetlands inventoried within the TDL" (DEQ, 2002, p.23).

The use of surface water for watering of livestock is evident, particularly amid the tailings piles. Large indigenous mammals (deer, elk, bear, etc.) are presumed to be present in the area and would utilize the water from Williams Creek and its many smaller tributaries.

4.2.4. Source Sample Analysis

Sediments from Williams Creek had arsenic levels of 41.8 and 43.0 mg/kg. However, arsenic concentrations in the sediment do not appear to be leaching into Williams Creek water, as evidenced by arsenic concentration levels ranging from 10µg/L to 23µg/L obtained from downgradient water samples. DEQ recommends the collection of a minimum of two (2) additional sediment samples in Williams Creek (one up gradient of the site and one immediately below the waste dump area), and at least two additional surface water samples (one in Williams Creek below Nutter creek and one in Williams Creek below the BLM tailings pile) to further evaluate any potential impacts to the creek from mining operations.

Surface water samples results are listed in Table 4-1. Rock and sediment sample results are listed in Table 4-2.

Table 4-1. Water Sample Analysis (DEQ-2004).

Water Sample ID	Ag	As	Ba	Cd	Cr	Cu	Pb	Se	Zn
SONN-W-1	<0.0050	0.017	0.0138	<0.0020	<0.0060	0.0037	<0.0050	<0.010	0.0804
SONN-W-2	<0.0050	0.011	0.0125	<0.0020	<0.0060	<0.0030	<0.0050	<0.010	0.0142
SONN-W-3	<0.0050	0.010	0.0120	0.0122	<0.0060	0.0167	<0.0050	<0.010	1.48
SONN-W-4	<0.0050	0.023	0.0108	0.0060	<0.0060	0.0034	<0.0050	<0.010	0.415
SONN-W-5	<0.0050	0.036	0.0126	0.0092	<0.0060	<0.0030	<0.0050	<0.010	0.530
SONN-W-6	<0.0050	0.013	0.0084	<0.0020	<0.0060	<0.0030	<0.0050	<0.010	0.0053
SONN-W-7	<0.0050	0.037	0.0047	0.0100	<0.0060	0.0054	<0.0050	<0.010	0.882
SONN-W-8	<0.0050	0.013	0.0027	<0.0020	<0.0060	<0.0030	<0.0050	<0.010	0.0160
SONN-W-9	<0.0050	0.015	0.0199	<0.0020	<0.0060	0.0035	<0.0050	<0.010	0.0136

Water Sample ID	Hg
SONN-W-1	<0.0002
SONN-W-2	<0.0002
SONN-W-3	<0.0002
SONN-W-4	<0.0002
SONN-W-5	<0.0002
SONN-W-6	<0.0002
SONN-W-7	<0.0002
SONN-W-8	<0.0002
SONN-W-9	<0.0002

*** All units are mg/L**

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4.3. Soil Exposure Pathway

There are not any persons living within one mile of the Sonnemann Mine, nor are there any schools or daycare facilities within 200 feet. Receptors in the area have been identified as seasonal recreationists, including occasional tourists, hikers, campers, hunters and snowmobilers. The BLM staffs and operates a lookout tower atop South Mountain's summit during the fire season (May – September).

4.3.1. Source Sample Analysis

Totals analysis of three (3) samples demonstrates an approximate risk of 1E-03 related to the BLM tailings pile. These risks are associated with arsenic based on an industrial risk scenario. This risk is extremely conservative if applied to the infrequent tourist or hunter, which is the most likely risk scenario for the site. The remainder of the samples indicate a risk of approximately 1E-04.

Although totals analysis was not performed on samples from the waste rock pile at the Sonnemann site, TCLP analysis of the waste rock indicates risk equal to or greater than the BLM tailings. Prior TCLP analysis did not indicate that metals are leaching from the waste rock or tailings into the environment.

There are three types of materials present, which were co-mingled in the dump: mine waste and tailings, which have a propensity to leach heavy metals, and inert wastes, which don't. The three are virtually impossible to visually distinguish from one another.

Table 4-2. Sediment, Tailings and Rock Sample Analysis (Totals).

Soil Sample ID	Ag*	As*	Ba*	Cd*	Cr*	Pb*	Se*	Hg*
SONN-SD-1			90.3	10.1	19.9	153	<1.0	<0.0330
SONN-SD-2		43.0	61.6	7.06	18.1	58.4	<1.0	<0.0330
SONN-C-1			85.7	356	25.0	393	16.1	0.0767
SONN-C-2			13.2	735	3.50	67.8	21.7	0.0600
SONN-C-2B			15.8	474	4.56	640	19.0	0.0367
SONN-C-3			50.5	123	16.2	211	13.4	0.0450
SONN-C-4			43.5	31.8	8.97	52.7	3.0	<0.0330
SONN-C-5			48.9	442	15.3	201	27.7	0.0800
SONN-C-6			17.3	32.2	10.8	336	16.4	0.0633
SONN-C-7			13.0	759	3.75	177	25.4	0.0667
SONN-C-8			5.94	7.90	1.92	194	11.7	<0.0330

*** All units - mg/kg**

TCLP Samples

Soil Sample ID	Ag	As	Ba	Cd	Cr	Cu	Pb	Se	Zn
SONN-R-1	<0.0050	3.99	0.0221	0.0059	0.0101	0.0280	7.32	<0.010	2.07
SONN-R-2	<0.0050	1.41	0.0294	0.325	<0.0060	0.0031	35.0	<0.010	58.0
SONN-SD-1	<0.0050	0.022	0.447	0.206	<0.0060	0.0287	0.0506	<0.010	17.9
SONN-SD-2	<0.0050	0.028	0.674	0.219	<0.0060	0.0964	0.0725	0.018	24.2
SONN-C-1	0.0059	<0.010	0.0598	6.46	<0.0060	0.498	0.0127	<0.010	210
SONN-C-2	0.0094	0.019	0.0397	3.91	<0.0060	0.0038	0.0200	<0.010	527
SONN-C-2B	0.0068	0.012	0.177	0.545	<0.0060	<0.0030	0.425	0.019	48.5
SONN-C-3	<0.0050	<0.010	0.0427	4.12	<0.0060	1.67	0.0156	<0.010	358
SONN-C-4	0.0141	<0.010	0.208	0.782	<0.0060	2.09	<0.0050	<0.010	52.1
SONN-C-5	<0.0050	<0.010	0.0508	3.55	<0.0060	0.338	0.0266	<0.010	174
SONN-C-6	0.0182	0.014	0.0198	0.772	<0.0060	4.97	<0.0050	<0.010	69.7
SONN-C-7	<0.0050	<0.010	0.0380	4.85	<0.0060	1.78	0.0107	<0.010	361
SONN-C-8	<0.0050	<0.010	0.0057	0.286	<0.0060	0.271	0.0348	0.016	23.8

Soil Sample ID	Hg
SONN-R-1	<0.0002
SONN-R-2	<0.0002
SONN-SD-1	<0.0002
SONN-SD-2	<0.0002
SONN-C-1	<0.0002
SONN-C-2	<0.0002
SONN-C-2B	<0.0002
SONN-C-3	<0.0002
SONN-C-4	<0.0002
SONN-C-5	<0.0002
SONN-C-6	<0.0002
SONN-C-7	<0.0002
SONN-C-8	<0.0002

*** All units - mg/kg**

4.4. Air Migration Pathway

There are not any permanent residents living within 4 miles of the Sonnemann Mine. No previous air sampling activities were conducted at the Sonnemann Mine, nor did the DEQ conduct any.

The tailings impoundment soils grade from very fine to fine to coarse-grained, and the berms consist of waste rock. Abundant evidence of livestock grazing suggests the potential for aerial dispersal of the finer-grained particles during strong wind events.

The waste rock dump, located adjacent to the adit amid the mill's western foundation, is mostly consolidated. The majority of this rock is highly indurated, owing to its metamorphic constituency, and typically not susceptible to strong wind flow.

The ore, stockpiled in the mill's eastern foundation, however, comprises mainly sulfide-bearing rock. These rocks appear to be rapidly weathering and, when disturbed, release minor volumes of trapped hydrogen sulfide gas.

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5. SUMMARY AND CONCLUSION

The Sonnemann is an inactive silver and lead mine located in Owyhee County, Idaho, approximately 18 miles southeast of Jordan Valley, Oregon, and 20 miles south of Silver City, Idaho (Figure 2-1). The mill site lies immediately adjacent to the mine's portal. The site is located near the headwaters of Williams Creek on the northwest flank of South Mountain. The site is situated on private property owned by the South Mountain Mining Company, though ownership of the tailings pile appears to be public land, managed by the Bureau of Land Management. The wastes generated from the mine consist of waste rock, ore, and mill tailings.

The principal exposure pathways are surface water and soil. Ground water drains from interconnected workings of the Golconda group mines and flows through waste rock material into the surface water, Williams Creek.

6. RECOMMENDATIONS

There are obviously two major areas of concern for risks to human health and the environment at the site: The ore and waste stockpiles near the Sonnemann adit and the BLM tailings facility lower in the Williams Creek drainage. The risks associated with either can be reduced to acceptable levels by either complete removal or installation of source controls and stable water management systems.

The Sonnemann adit ore and waste stockpiles are angle of repose dumps placed between William Creek and the hillside containing the Sonnemann adit. Meteoric water, adit drainage, and creek water provide for erosion, leaching, and transportation of fine sediment and dissolved metals from the dumps. This situation could be mitigated by either total removal or stabilization in place. DEQ believes that to eliminate this, South Mountain Mining Company should consider pulling back waste and ore from Williams Creek, isolating the waste and ore materials from the influence of the adit discharge and creek water, re-grading the final pile to 3H:1V or gentler slopes, and constructing an evapotranspiration cap over the repository. In addition, some stream channel stabilization of Williams Creek is necessary. Williams Creek tends to overflow its banks where the road to the Sonnemann Labs and Shops crosses the creek. This section of stream should either be armored or placed in a suitable culvert so that water does not run down the shop road towards the repository. The banks of Williams Creek around this stream channel modification, and that area where the mine dumps were pulled back from Williams Creek, should be planted with riparian vegetation for natural self sustaining stabilization. Given the remoteness of the site, this second alternative appears to be the most cost effective and constructible of the two alternatives.

The BLM Tailings Pile has similar source control and water management issues that should be addressed. Snow melt and spring runoff have deeply incised gullies across the tailings. Because of their likely phytotoxic characteristics, the tailings provide for little opportunity to stabilize with vegetation. This situation could be mitigated by either total removal or stabilization in place. DEQ believes that to eliminate erosion, South Mountain Mining Company and the BLM should first consider installing cutoff trenches above the tailings impoundment to intercept overland flow and redirect it towards the unnamed perennial drainage to the north of the tailings. They should also consider re-grading the tailings piles to provide a stable surface area, upon which an

evapotranspiration cap can be installed and revegetated. Given the remoteness of the site, this second alternative appears to be the most cost effective and constructible of the two alternatives.

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City	**State** / **Zip Code**
Boise	ID / 83706

Contact Phone No.	Fax No.
208-373-0546	208-373-0143
Project/Site:	**Sampler Signature**
SONNEMANN SI	

STATE OF IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

CHAIN OF CUSTODY RECORD

SAMPLE ID. NO.	DATE	TIME	SAMPLE LOCATION	SAMPLE MATRIX: WATER	SOIL	OTHER	ANALYSIS REQUESTED: TCLP metals	TCLP ZINC	TCLP Copper	SPECIAL INSTRUCTIONS / COMMENTS
SONN-SD-1	8/23	12:55	williams cr. below tributary upper		X		X	X	X	
SONN-SD-2	8/23	15:55	williams creek above trib.		X		X	X	X	
SONN-C-1	8/24	10:35	upper tier North tailings		X		X	X	X	
SONN-C-2	8/24	11:00	upper tier mid		X		X	X	X	
SONN-C-2B	8/24	11:25	upper tier ~~mid~~ ~~South~~ base		X		X	X	X	
SONN-C-3	8/24	11:45	mid tier ~~North~~ South		X		X	X	X	
SONN-C-4	8/24	12:15	mid tier ~~mid~~ North		X		X	X	X	
SONN-C-5	8/24	12:30	mid tier ~~South~~ mid		X		X	X	X	
SONN-C-6	8/24	12:45	mid tier south		X		X	X	X	
SONN-C-7	8/24	12:50	lower tier North		X		X	X	X	
SONN-C-8	8/24	13:05	Lower tier south		X		X	X	X	

PRESERVATIVE (Ice ≤ 4° C, etc.)

TOTAL # OF CONTAINERS:

RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
Brian Gaber	8/30/04	10:16	[signature]	8/30/04	10:16
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME

SAMPLE RECEIPT:

RECEIVED WITH SEALS INTACT? ☐ YES ☐ NO

LABEL TAG, COC AGREE? ☐ YES ☐ NO

WHITE - ORIGINAL YELLOW - OFFICE PINK - CLIENT

112955 COC 1 OF 2

STATE OF IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

CHAIN OF CUSTODY RECORD

Contact Name	E-mail Address
Brian Gaber	bgaber@DEQ.State.id.us
Address	
1410 N. Hilton St	
City	**State** / **Zip Code**
Boise	ID / 83706

Contact Phone No.	Fax No.
208-373-0566	208-373-0143
Project/Site:	**Sampler Signature**
Sonnemann SI	Brian Gaber

SAMPLE ID. NO.	DATE	TIME	SAMPLE LOCATION	SAMPLE MATRIX: WATER	SOIL	OTHER	ANALYSIS REQUESTED: Total Metals	TCLP metals	pH	Zinc TCPL	Copper TCLP	SPECIAL INSTRUCTIONS / COMMENTS
												RCRA metals plus Zinc + copper Nitric acid already added to samples
SONN-W-1	8/23	11:35	1 mi below Williams Creek Maine Patent	X			X	~~X~~		X	X	
SONN-W-2	8/23	~~12:55~~ 12:35	Nutter creek	X			X		X	X	X	
SONN-W-3	8/23	12:45	Williams creek below trib.	X			X			X	X	
SONN-W-4	8/23	~~13:55~~ 15:45	Williams creek at dump	X			X		X	X	X	
SONN-W-5	8/23	15:55	Seepage below rock dump	X			X			X	X	
SONN-W-6	8/23	16:35	UP gradient sample Williams Cr.	X			X		X	X	X	
SONN-W-7	8/23	17:05	Seepage from Sonnemann adit	X			X		X	X	X	
SONN-W-8	8/23	17:25	Seepage from Golconda adit	X			X		X	X	X	
SONN-W-9	8/23	17:45	UP gradient of tailings on trib	X			X		X	X	X	
SONN-R-1	8/23	12:15	Smelter slag		X			X		X	X	~~ASSAY~~
SONN-R-2	8/24	13:30	High Grade ore		X			X		X	X	~~ASSAY~~

PRESERVATIVE (Ice ≤ 4° C, etc.)

TOTAL # OF CONTAINERS:

RELINQUISHED BY: (Signature) Brian Gaber	DATE 8/30/04	TIME 10:16	RECEIVED BY: (Signature)	DATE 8/30/04	TIME 10:16
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME
RELINQUISHED BY: (Signature)	DATE	TIME	RECEIVED BY: (Signature)	DATE	TIME

SAMPLE RECEIPT: RECEIVED WITH SEALS INTACT? ☐ YES ☐ NO LABEL TAG, COC AGREE? ☐ YES ☐ NO

WHITE - ORIGINAL YELLOW - OFFICE PINK - CLIENT

SVL ANALYTICAL, INC.
One Government Gulch - Kellogg, ID 83837-0929

SAMPLE RECEIPT CONFIRMATION

,IENT: BRIAN GABER
IDEQ
1410 N.HILTON ST.

BOISE ID 83706
FAX: (208)373-0143

SVL JOB No: 112955
Received: 8/30/04
Expected Due date: 9/14/04

/L#	M	ClientID	Sampled	Time	By	Received	Sample Comments
)8683	W	SONN-W-1	8/23/04	11:35	BG	8/30/04	
)8684	W	SONN-W-2	8/23/04	12:35	BG	8/30/04	
)8685	W	SONN-W-3	8/23/04	12:45	BG	8/30/04	
)8686	W	SONN-W-4	8/23/04	15:45	BG	8/30/04	
)8687	W	SONN-W-5	8/23/04	15:55	BG	8/30/04	
)8688	W	SONN-W-6	8/23/04	16:35	BG	8/30/04	
)8689	W	SONN-W-7	8/23/04	17:05	BG	8/30/04	
)8690	W	SONN-W-8	8/23/04	17:25	BG	8/30/04	
)8691	W	SONN-W-9	8/23/04	17:45	BG	8/30/04	

ADDITIONAL COMMENTS FOR JOB: Sample Cooler/Container temp not measured upon receipt.
WATERS

X] These samples will be DISPOSED 30 days after job completion.
] These samples will be ARCHIVED 30 days, then you will receive a letter requesting disposal options.

lease contact Ben Martin (208-784-1258) if you have questions regarding the receipt of these samples. 8/30/04 12:02

08/30/2004 15:13 2087830891 SVL ANALYTICAL PAGE 01/01

SVL ANALYTICAL, INC.
One Government Gulch - Kellogg, ID 83837-0929

ENT: BRIAN GABER
IDEQ
1410 N.HILTON ST.

BOISE ID 83706
FAX: (208)373-0143

SAMPLE RECEIPT CONFIRMATION

SVL JOB No: 113577
Received: 9/28/04
Expected Due date: 10/12/04

#	M	ClientID	Sampled	Time	By	Received	Sample Comments
280	S	SONN-SD-1	8/23/04	12:55	BG	9/28/04	
281	S	SONN-SD-2	8/23/04	15:55	BG	9/28/04	
282	S	SONN-C-1	8/24/04	10:35	BG	9/28/04	
283	S	SONN-C-2	8/24/04	11:00	BG	9/28/04	
284	S	SONN-C-2B	8/24/04	11:25	BG	9/28/04	
285	S	SONN-C-3	8/24/04	11:45	BG	9/28/04	
286	S	SONN-C-4	8/24/04	12:15	BG	9/28/04	
287	S	SONN-C-5	8/24/04	12:30	BG	9/28/04	
288	S	SONN-C-6	8/24/04	12:45	BG	9/28/04	
289	S	SONN-C-7	8/24/04	12:50	BG	9/28/04	
290	S	SONN-C-8	8/24/04	13:05	BG	9/28/04	

DDITIONAL COMMENTS FOR JOB: Sample Cooler/Container temp not measured upon receipt.
SAMPLES RECEIVED 8/30/2004, ORIGINAL SVL JOB 112956

] These samples will be DISPOSED 45 days after job completion.
X] These samples will be ARCHIVED 45 days, then you will receive a letter requesting disposal options.

lease contact Ben Martin (208-784-1258) if you have questions regarding the receipt of these samples. 9/28/04 9:01

09/28/2004 13:53 2087830891 SVL ANALYTICAL PAGE 01/01

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

CLIENT : IDEQ
PROJECT: SONNEMANN SI

Sample Receipt: 8/30/04
Report Date: 9/15/04

SVL JOB: 112955

SVL ID	CLIENT SAMPLE ID		Ag 6010B	As 6010B	Ba 6010B	Cd 6010B	Cr 6010B
W408683	SONN-W-1	8/23/04	<0.0050mg/L	0.017mg/L	0.0138mg/L	<0.0020mg/L	<0.0060mg/L
W408684	SONN-W-2	8/23/04	<0.0050mg/L	0.011mg/L	0.0125mg/L	<0.0020mg/L	<0.0060mg/L
W408685	SONN-W-3	8/23/04	<0.0050mg/L	0.010mg/L	0.0120mg/L	0.0122mg/L	<0.0060mg/L
W408686	SONN-W-4	8/23/04	<0.0050mg/L	0.023mg/L	0.0108mg/L	0.0060mg/L	<0.0060mg/L
W408687	SONN-W-5	8/23/04	<0.0050mg/L	0.036mg/L	0.0126mg/L	0.0092mg/L	<0.0060mg/L
W408688	SONN-W-6	8/23/04	<0.0050mg/L	0.013mg/L	0.0084mg/L	<0.0020mg/L	<0.0060mg/L
W408689	SONN-W-7	8/23/04	<0.0050mg/L	0.037mg/L	0.0047mg/L	0.0100mg/L	<0.0060mg/L
W408690	SONN-W-8	8/23/04	<0.0050mg/L	0.013mg/L	0.0027mg/L	<0.0020mg/L	<0.0060mg/L
W408691	SONN-W-9	8/23/04	<0.0050mg/L	0.015mg/L	0.0199mg/L	<0.0020mg/L	<0.0060mg/L

ID ID00019

Reviewed By: _____ Date: 9/15/04

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

CLIENT : IDEQ
PROJECT: SONNEMANN SI

Sample Receipt: 8/30/04
Report Date: 9/15/04

SVL JOB: 112955

SVL ID	CLIENT SAMPLE ID		Cu 6010B	Pb 6010B	Se 6010B	Zn 6010B	Hg 7470A
W408683	SONN-W-1	8/23/04	0.0037mg/L	<0.0050mg/L	<0.010mg/L	0.0804mg/L	<0.0002mg/L
W408684	SONN-W-2	8/23/04	<0.0030mg/L	<0.0050mg/L	<0.010mg/L	0.0142mg/L	<0.0002mg/L
W408685	SONN-W-3	8/23/04	0.0167mg/L	<0.0050mg/L	<0.010mg/L	1.48mg/L	<0.0002mg/L
W408686	SONN-W-4	8/23/04	0.0034mg/L	<0.0050mg/L	<0.010mg/L	0.415mg/L	<0.0002mg/L
W408687	SONN-W-5	8/23/04	<0.0030mg/L	<0.0050mg/L	<0.010mg/L	0.530mg/L	<0.0002mg/L
W408688	SONN-W-6	8/23/04	<0.0030mg/L	<0.0050mg/L	<0.010mg/L	0.0053mg/L	<0.0002mg/L
W408689	SONN-W-7	8/23/04	0.0045mg/L	<0.0050mg/L	<0.010mg/L	0.882mg/L	<0.0002mg/L
W408690	SONN-W-8	8/23/04	<0.0030mg/L	<0.0050mg/L	<0.010mg/L	0.0160mg/L	<0.0002mg/L
W408691	SONN-W-9	8/23/04	0.0035mg/L	<0.0050mg/L	<0.010mg/L	0.0136mg/L	<0.0002mg/L

Certificate: ID ID00019

Reviewed By: _____ Date: 9/15/04

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :IDEQ

SVL JOB No: 112955

Analyte	Method	Matrix	Units	Prep Blank	True	LCS Found	LCS %R	Analysis Date
Silver	6010B	WATER	mg/L	<0.0050	1.00	1.02	102.0	9/14/04
Arsenic	6010B	WATER	mg/L	<0.010	1.00	1.04	104.0	9/14/04
Barium	6010B	WATER	mg/L	<0.0020	1.00	1.01	101.0	9/14/04
Cadmium	6010B	WATER	mg/L	<0.0020	1.00	0.992	99.2	9/14/04
Chromium	6010B	WATER	mg/L	<0.0060	1.00	1.01	101.0	9/14/04
Copper	6010B	WATER	mg/L	<0.0030	1.00	0.988	98.8	9/14/04
Lead	6010B	WATER	mg/L	<0.0050	1.00	1.01	101.0	9/14/04
Selenium	6010B	WATER	mg/L	<0.010	1.00	0.991	99.1	9/14/04
Zinc	6010B	WATER	mg/L	<0.0050	1.00	0.992	99.2	9/14/04
Mercury	7470A	WATER	mg/L	<0.00020	0.00500	0.00495	99.0	9/09/04

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :IDEQ — SVL JOB No: 112955

Test	Method	Mtx	QC SAMPLE ID	Units	Result	Duplicate or MSD Found		RPD%	Matrix Spike Result	Matrix Spike SPK ADD	%R	Analysis Date
Ag	6010B	W	1	mg/L	<0.0050	1.04	M	1.0	1.03	1.00	103.0	9/14/04
As	6010B	W	1	mg/L	0.017	1.07	M	0.0	1.07	1.00	105.3	9/14/04
Ba	6010B	W	1	mg/L	0.0138	1.01	M	0.0	1.01	1.00	99.6	9/14/04
Cd	6010B	W	1	mg/L	<0.0020	0.985	M	0.7	0.978	1.00	97.8	9/14/04
Cr	6010B	W	1	mg/L	<0.0060	1.01	M	0.0	1.01	1.00	101.0	9/14/04
Cu	6010B	W	1	mg/L	0.0037	0.991	M	1.1	0.980	1.00	97.6	9/14/04
Pb	6010B	W	1	mg/L	<0.0050	1.00	M	0.0	1.00	1.00	100.0	9/14/04
Se	6010B	W	1	mg/L	<0.010	1.04	M	0.0	1.04	1.00	104.0	9/14/04
Zn	6010B	W	1	mg/L	0.0804	1.07	M	0.0	1.07	1.00	99.0	9/14/04
Hg	7470A	W	1	mg/L	<0.00020	0.00095	M	0.0	0.00095	0.0010	95.0	9/09/04

LEGEND:

RPD% = (|SAM - DUP| /((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD| /((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 408683 Client Sample ID: SONN-W-1

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

CLIENT : IDEQ
PROJECT: SONNEMANN SI

Sample Receipt: 8/30/04
Report Date: 9/15/04

SVL JOB: 112956

SVL ID	CLIENT SAMPLE ID		Ag 6010B	As 6010B	Ba 6010B	Cd 6010B	Cr 6010B
E408694	SONN-R-1	8/23/04	<0.0050mg/L E	3.99mg/L E	0.0221mg/L E	0.0059mg/L E	0.0101mg/L E
E408695	SONN-R-2	8/23/04	<0.0050mg/L E	1.41mg/L E	0.0294mg/L E	0.325mg/L E	<0.0060mg/L E
E408696	SONN-SD-1	8/23/04	<0.0050mg/L E	0.022mg/L E	0.447mg/L E	0.206mg/L E	<0.0060mg/L E
E408697	SONN-SD-2	8/23/04	<0.0050mg/L E	0.028mg/L E	0.674mg/L E	0.219mg/L E	<0.0060mg/L E
E408698	SONN-C-1	8/24/04	0.0059mg/L E	<0.010mg/L E	0.0598mg/L E	6.46mg/L E	<0.0060mg/L E
E408699	SONN-C-2	8/24/04	0.0094mg/L E	0.019mg/L E	0.0397mg/L E	3.91mg/L E	<0.0060mg/L E
E408700	SONN-C-2B	8/24/04	0.0068mg/L E	0.012mg/L E	0.177mg/L E	0.545mg/L E	<0.0060mg/L E
E408701	SONN-C-3	8/24/04	<0.0050mg/L E	<0.010mg/L E	0.0427mg/L E	4.12mg/L E	<0.0060mg/L E
E408702	SONN-C-4	8/24/04	0.0141mg/L E	<0.010mg/L E	0.208mg/L E	0.782mg/L E	<0.0060mg/L E
E408703	SONN-C-5	8/24/04	<0.0050mg/L E	<0.010mg/L E	0.0508mg/L E	3.55mg/L E	<0.0060mg/L E
E408704	SONN-C-6	8/24/04	0.0182mg/L E	0.014mg/L E	0.0198mg/L E	0.772mg/L E	<0.0060mg/L E
E408705	SONN-C-7	8/24/04	<0.0050mg/L E	<0.010mg/L E	0.0380mg/L E	4.85mg/L E	<0.0060mg/L E
E408706	SONN-C-8	8/24/04	<0.0050mg/L E	<0.010mg/L E	0.0057mg/L E	0.286mg/L E	<0.0060mg/L E

Samples with SVL ID prefix 'E' were extracted according to: TCLP
ID ID00019

Reviewed By: _____ Date: 9/15/04

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

CLIENT : IDEQ
PROJECT: SONNEMANN SI

Sample Receipt: 8/30/04
Report Date: 9/15/04

SVL JOB: 112956

SVL ID	CLIENT SAMPLE ID		Cu 6010B	Pb 6010B	Se 6010B	Zn 6010B	Hg 7470A
E408694	SONN-R-1	8/23/04	0.0280mg/L E	7.32mg/L E	<0.010mg/L E	2.07mg/L E	<0.0002mg/L E
E408695	SONN-R-2	8/23/04	0.0031mg/L E	35.0mg/L E	<0.010mg/L E	58.0mg/L E	<0.0002mg/L E
E408696	SONN-SD-1	8/23/04	0.0287mg/L E	0.0506mg/L E	<0.010mg/L E	17.9mg/L E	<0.0002mg/L E
E408697	SONN-SD-2	8/23/04	0.0964mg/L E	0.0725mg/L E	0.018mg/L E	24.2mg/L E	<0.0002mg/L E
E408698	SONN-C-1	8/24/04	0.498mg/L E	0.0127mg/L E	<0.010mg/L E	210mg/L E	<0.0002mg/L E
E408699	SONN-C-2	8/24/04	0.0038mg/L E	0.0200mg/L E	<0.010mg/L E	527mg/L E	<0.0002mg/L E
E408700	SONN-C-2B	8/24/04	<0.0030mg/L E	0.425mg/L E	0.019mg/L E	48.5mg/L E	<0.0002mg/L E
E408701	SONN-C-3	8/24/04	1.67mg/L E	0.0156mg/L E	<0.010mg/L E	358mg/L E	<0.0002mg/L E
E408702	SONN-C-4	8/24/04	2.09mg/L E	<0.0050mg/L E	<0.010mg/L E	52.1mg/L E	<0.0002mg/L E
E408703	SONN-C-5	8/24/04	0.338mg/L E	0.0266mg/L E	<0.010mg/L E	174mg/L E	<0.0002mg/L E
E408704	SONN-C-6	8/24/04	4.97mg/L E	<0.0050mg/L E	<0.010mg/L E	69.7mg/L E	<0.0002mg/L E
E408705	SONN-C-7	8/24/04	1.78mg/L E	0.0107mg/L E	<0.010mg/L E	361mg/L E	<0.0002mg/L E
E408706	SONN-C-8	8/24/04	0.271mg/L E	0.0348mg/L E	0.016mg/L E	23.8mg/L E	<0.0002mg/L E

Samples with SVL ID prefix 'E' were extracted according to: TCLP
Certificate: ID ID00019

Reviewed By: _____ Date: 9/15/04

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :IDEQ

SVL JOB No: 112956

Analyte	Method	Matrix	Units	Prep Blank	True	LCS	Found	LCS %R	Analysis Date
Silver	6010B	ESOIL	mg/L Ext	<0.0050	1.00		1.10	110.0	9/14/04
Arsenic	6010B	ESOIL	mg/L Ext	<0.010	1.00		1.07	107.0	9/14/04
Barium	6010B	ESOIL	mg/L Ext	<0.0020	1.00		1.02	102.0	9/14/04
Cadmium	6010B	ESOIL	mg/L Ext	<0.0020	1.00		1.02	102.0	9/14/04
Chromium	6010B	ESOIL	mg/L Ext	<0.0060	1.00		0.988	98.8	9/14/04
Copper	6010B	ESOIL	mg/L Ext	<0.0030	1.00		1.06	106.0	9/14/04
Lead	6010B	ESOIL	mg/L Ext	<0.0050	1.00		1.04	104.0	9/14/04
Selenium	6010B	ESOIL	mg/L Ext	<0.010	1.00		1.09	109.0	9/14/04
Zinc	6010B	ESOIL	mg/L Ext	<0.0050	1.00		0.993	99.3	9/14/04
Mercury	7470A	ESOIL	mg/L Ext	<0.00020	0.00500		0.00524	104.8	9/13/04

LEGEND:
LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :IDEQ — SVL JOB No: 112956

Test	Method	Mtx	QC SAMPLE ID	Units	Result	Duplicate or MSD Found		MSD RPD%	Matrix Spike Result	SPK ADD		%R	Analysis Date
Ag	6010B	E	1	mg/L Ex	<0.0050	1.12	M	0.9	1.11	1.00		111.0	9/14/04
Ag	6010B	E	2	mg/L Ex	0.0182	N/A		N/A	1.17	1.00		115.2	9/14/04
As	6010B	E	1	mg/L Ex	3.99	5.23	M	1.0	5.28	1.00		129.0	9/14/04
As	6010B	E	1	mg/L Ex	3.99	N/A		N/A	5.17	1.00	A	118.0	9/14/04
As	6010B	E	2	mg/L Ex	0.014	N/A		N/A	1.28	1.00		126.6	9/14/04
As	6010B	E	2	mg/L Ex	0.014	N/A		N/A	1.33	1.00	A	131.6	9/14/04
Ba	6010B	E	1	mg/L Ex	0.0221	0.991	M	0.3	0.988	1.00		96.6	9/14/04
Ba	6010B	E	2	mg/L Ex	0.0198	N/A		N/A	0.977	1.00		95.7	9/14/04
Cd	6010B	E	1	mg/L Ex	0.0059	1.01	M	0.0	1.01	1.00		100.4	9/14/04
Cd	6010B	E	2	mg/L Ex	0.772	N/A		N/A	1.72	1.00		94.8	9/14/04
Cr	6010B	E	1	mg/L Ex	0.0101	0.960	M	0.0	0.960	1.00		95.0	9/14/04
Cr	6010B	E	2	mg/L Ex	<0.0060	N/A		N/A	0.977	1.00		97.7	9/14/04
Cu	6010B	E	1	mg/L Ex	0.0280	1.08	M	0.9	1.07	1.00		104.2	9/14/04
Cu	6010B	E	2	mg/L Ex	4.97	N/A		N/A	6.16	1.00		119.0	9/14/04
Pb	6010B	E	1	mg/L Ex	7.32	8.34	M	0.2	8.36	1.00		104.0	9/14/04
Pb	6010B	E	2	mg/L Ex	<0.0050	N/A		N/A	0.948	1.00		94.8	9/14/04
Se	6010B	E	1	mg/L Ex	<0.010	1.19	M	2.5	1.22	1.00		122.0	9/14/04
Se	6010B	E	2	mg/L Ex	<0.010	N/A		N/A	1.21	1.00		121.0	9/14/04
Zn	6010B	E	1	mg/L Ex	2.07	3.09	M	0.0	3.09	1.00		102.0	9/14/04
Zn	6010B	E	2	mg/L Ex	69.7	N/A		N/A	69.8	1.00		R >4S	9/14/04
Hg	7470A	E	1	mg/L Ex	<0.00020	0.00113	M	0.9	0.00112	0.0010		112.0	9/13/04
Hg	7470A	E	2	mg/L Ex	<0.00020	N/A		N/A	0.00116	0.0010		116.0	9/13/04

LEGEND:

RPD% = (|SAM - DUP| /((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD| /((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 408694 Client Sample ID: SONN-R-1

QC Sample 2: SVL SAM No.: 408704 Client Sample ID: SONN-C-6

TCLP Extraction Log

PART I

JOB#: 112956

SVL ANALYTICAL, INC.

Metals only

CASE #: SAS #: SDG #:

SVL#	M	ClientID	Init. Wt.	mls H2O	Init. pH	mls 1N HCl	pH	mls ext. fluid/type	Sample Wt.	Final pH
pH 4 Buffer					4.00		4.00			4.00
pH 7 Buffer					7.00		7.00			7.01
408694	ES	SONN-R-1	5g	96.5mls	6.03	3.5mls	1.85	2000mls#1	100g	5.02
408695	ES	SONN-R-2	5g	96.5mls	4.19	HEAT	4.13	2000mls#1	100g	5.21
408696	ES	SONN-SD-1	5g	96.5mls	6.84	3.5mls	1.86	2000mls#1	100g	5.06
408697	ES	SONN-SD-2	5g	96.5mls	6.77	3.5mls	1.83	1530mls#1	76.5g	5.14
408698	ES	SONN-C-1	5g	96.5mls	6.73	3.5mls	2.32	2000mls#1	100g	5.71
408699	ES	SONN-C-2	5g	96.5mls	6.38	3.5mls	2.13	2000mls#1	100g	5.43
408700	ES	SONN-C-2B	5g	96.5mls	7.04	3.5mls	2.26	2000mls#1	100g	5.79
408701	ES	SONN-C-3	5g	96.5mls	6.45	3.5mls	1.99	2000mls#1	100g	5.16
408702	ES	SONN-C-4	5g	96.5mls	7.82	3.5mls	5.61	2000mls#2	100g	5.60
408703	ES	SONN-C-5	5g	96.5mls	7.07	3.5mls	4.39	2000mls#1	100g	5.81
408704	ES	SONN-C-6	5g	96.5mls	3.01			2000mls#1	100g	4.79
408705	ES	SONN-C-7	5g	96.5mls	6.12	3.5mls	1.96	2000mls#1	100g	5.28
408706	ES	SONN-C-8	5g	96.5mls	3.52			2000mls#1	100g	4.94
408707	ES	EXTRACTION FLUID 1								4.93
408708	ES	EXTRACTION FLUID 2								2.88

Extraction Started By: [signature] Date/Time: 09/08/04 1330

Extraction Completed By: [signature] Date/Time: 09/09/04 0730

Client: IDEQ

Received: 8/30/04

v3.0

TCLP Extraction Log
PART II

JOB#: 112956
SVL ANALYTICAL, INC.

CASE #: SAS #: SDG #:

SVL#	M	ClientID	Ext. Fluid pH	Multi-phasic Y/N	% Solids			Part Size Reduction Y/N	Sample Filtration	Air Temp.	RPM
					Wet	Dry	%				
408694	ES	SONN-R-1	4.93	N			100%	Y	Y	23°C	30
408695	ES	SONN-R-2	4.93	N			100%	Y	Y	23°C	30
408696	ES	SONN-SD-1	4.93	N			100%	N	Y	23°C	30
408697	ES	SONN-SD-2	2.88	Y	23.5	76.5	76.5%	N	Y	23°C	30
408698	ES	SONN-C-1	4.93	N			100%	N	Y	23°C	30
408699	ES	SONN-C-2	4.93	N			100%	N	Y	23°C	30
408700	ES	SONN-C-2B	4.93	N			100%	N	Y	23°C	30
408701	ES	SONN-C-3	4.93	N			100%	N	Y	23°C	30
408702	ES	SONN-C-4	4.93	N			100%	N	Y	23°C	30
408703	ES	SONN-C-5	4.93	N			100%	N	Y	23°C	30
408704	ES	SONN-C-6	4.93	N			100%	N	Y	23°C	30
408705	ES	SONN-C-7	4.93	N			100%	N	Y	23°C	30
408706	ES	SONN-C-8	4.93	N			100%	N	Y	23°C	30
408707	ES	EXTRACTION FLUID 1	4.93								
408708	ES	EXTRACTION FLUID 2	2.88								

Extraction Started By: [signature] Date/Time: 09/08/04 1330

Extraction Completed By: [signature] Date/Time: 09/09/04 0730

Client: IDEQ
Received: 8/30/04

v3.0

SVL ANALYTICAL, INC.
One Government Gulch ▪ P.O. Box 929 ▪ Kellogg, Idaho 83827-0929 ▪ Phone: (208)784-1258 ▪ Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

CLIENT : IDEQ
PROJECT: SONNEMAN SI

Sample Receipt: 9/28/04
Report Date: 10/14/04

SVL JOB: 113577

SVL ID	CLIENT SAMPLE ID		Ag 6010B	As 6010B	Ba 6010B	Cd 6010B	Cr 6010B
S416280	SONN-SD-1	8/23/04	1.63mg/kg	41.8mg/kg	90.3mg/kg	10.1mg/kg	19.9mg/kg
S416281	SONN-SD-2	8/23/04	0.85mg/kg	43.0mg/kg	61.6mg/kg	7.06mg/kg	18.1mg/kg
S416282	SONN-C-1	8/24/04	22.4mg/kg	1900mg/kg	85.7mg/kg	356mg/kg	25.0mg/kg
S416283	SONN-C-2	8/24/04	9.53mg/kg	46.8mg/kg	13.2mg/kg	735mg/kg	3.50mg/kg
S416284	SONN-C-2B	8/24/04	11.7mg/kg	91.5mg/kg	15.8mg/kg	474mg/kg	4.56mg/kg
S416285	SONN-C-3	8/24/04	24.4mg/kg	756mg/kg	50.5mg/kg	123mg/kg	16.2mg/kg
S416286	SONN-C-4	8/24/04	12.9mg/kg	1200mg/kg	43.5mg/kg	31.8mg/kg	8.97mg/kg
S416287	SONN-C-5	8/24/04	32.4mg/kg	1900mg/kg	48.9mg/kg	442mg/kg	15.3mg/kg
S416288	SONN-C-6	8/24/04	47.8mg/kg	404mg/kg	17.3mg/kg	32.2mg/kg	10.8mg/kg
S416289	SONN-C-7	8/24/04	24.3mg/kg	443mg/kg	13.0mg/kg	759mg/kg	3.75mg/kg
S416290	SONN-C-8	8/24/04	26.7mg/kg	247mg/kg	5.94mg/kg	7.90mg/kg	1.92mg/kg

Soil Samples: As Received Basis

ID ID00019

Reviewed By: _____ Date: 10/14/04

SVL ANALYTICAL, INC.
One Government Gulch • P.O. Box 929 • Kellogg, Idaho 83827-0929 • Phone: (208)784-1258 • Fax: (208)783-0891

REPORT OF ANALYTICAL RESULTS

CLIENT : IDEQ
PROJECT: SONNEMAN SI

Sample Receipt: 9/28/04
Report Date: 10/14/04

SVL JOB: 113577

SVL ID	CLIENT SAMPLE ID		Pb 6010B	Se 6010B	Hg 7471A	% Sol. 999
S416280	SONN-SD-1	8/23/04	153mg/kg	<1.0mg/kg	<0.0330mg/kg	76.5%
S416281	SONN-SD-2	8/23/04	58.4mg/kg	<1.0mg/kg	<0.0330mg/kg	71.8%
S416282	SONN-C-1	8/24/04	393mg/kg	16.1mg/kg	0.0767mg/kg	84.7%
S416283	SONN-C-2	8/24/04	67.8mg/kg	21.7mg/kg	0.0600mg/kg	73.2%
S416284	SONN-C-2B	8/24/04	640mg/kg	19.0mg/kg	0.0367mg/kg	73.1%
S416285	SONN-C-3	8/24/04	211mg/kg	13.4mg/kg	0.0450mg/kg	87.9%
S416286	SONN-C-4	8/24/04	52.7mg/kg	3.0mg/kg	<0.0330mg/kg	74.4%
S416287	SONN-C-5	8/24/04	201mg/kg	27.7mg/kg	0.0800mg/kg	85.4%
S416288	SONN-C-6	8/24/04	336mg/kg	16.4mg/kg	0.0633mg/kg	79.4%
S416289	SONN-C-7	8/24/04	177mg/kg	25.4mg/kg	0.0667mg/kg	82.6%
S416290	SONN-C-8	8/24/04	194mg/kg	11.7mg/kg	<0.0330mg/kg	84.8%

Soil Samples: As Received Basis

Certificate: ID ID00019

Reviewed By: _____ Date: 10/14/04

SVL ANALYTICAL, INC.

Quality Control Report
Part I Prep Blank and Laboratory Control Sample

Client :IDEQ

SVL JOB No: 113577

Analyte	Method	Matrix	Units	Prep Blank	LCS True	LCS Found	LCS %R	Analysis Date
Silver	6010B	SOIL	mg/kg	<0.50	5.00	4.17	83.4	10/14/04
Arsenic	6010B	SOIL	mg/kg	<1.0	100	95.9	95.9	10/14/04
Barium	6010B	SOIL	mg/kg	<0.20	100	97.1	97.1	10/14/04
Cadmium	6010B	SOIL	mg/kg	<0.20	100	97.9	97.9	10/14/04
Chromium	6010B	SOIL	mg/kg	<0.60	100	102	102.0	10/14/04
Lead	6010B	SOIL	mg/kg	<0.50	100	100	100.0	10/14/04
Selenium	6010B	SOIL	mg/kg	<1.0	100	90.6	90.6	10/14/04
Mercury	7471A	SOIL	mg/kg	<0.0330	0.834	0.957	114.7	9/30/04

LEGEND:

LCS = Laboratory Control Sample LCS %R = LCS Percent Recovery N/A = Not Applicable

SVL ANALYTICAL, INC.

Quality Control Report
Part II Duplicate and Spike Analysis

Client :IDEQ — SVL JOB No: 113577

Test	Method	Mtx	QC SAMPLE ID	Units	Result	Duplicate Found	or	MSD RPD%	Matrix Spike Result	Matrix Spike SPK ADD		%R	Analysis Date
Ag	6010B	S	1	mg/kg	1.63	5.08	M	6.3	5.41	5.00		75.6	10/14/04
Ag	6010B	S	2	mg/kg	26.7	N/A		N/A	30.7	5.00		80.0	10/14/04
As	6010B	S	1	mg/kg	41.8	148	M	5.6	140	100		98.2	10/14/04
As	6010B	S	2	mg/kg	247	N/A		N/A	360	100		113.0	10/14/04
Ba	6010B	S	1	mg/kg	90.3	206	M	7.0	192	100		101.7	10/14/04
Ba	6010B	S	2	mg/kg	5.94	N/A		N/A	110	100		104.1	10/14/04
Cd	6010B	S	1	mg/kg	10.1	110	M	1.8	108	100		97.9	10/14/04
Cd	6010B	S	2	mg/kg	7.90	N/A		N/A	110	100		102.1	10/14/04
Cr	6010B	S	1	mg/kg	19.9	124	M	0.0	124	100		104.1	10/14/04
Cr	6010B	S	2	mg/kg	1.92	N/A		N/A	111	100		109.1	10/14/04
Pb	6010B	S	1	mg/kg	153	148	M	12.1	167	100		14.0	10/14/04
Pb	6010B	S	1	mg/kg	153	N/A		N/A	243	100	A	90.0	10/14/04
Pb	6010B	S	2	mg/kg	194	N/A		N/A	297	100		103.0	10/14/04
Se	6010B	S	1	mg/kg	<1.0	94.7	M	1.9	92.9	100		92.9	10/14/04
Se	6010B	S	2	mg/kg	11.7	N/A		N/A	119	100		107.3	10/14/04
Hg	7471A	S	1	mg/kg	<0.0330	0.187	M	34.5	0.132	0.167		79.0	9/30/04
Hg	7471A	S	2	mg/kg	<0.0330	N/A		N/A	0.195	0.167		116.8	9/30/04

LEGEND:

RPD% = (|SAM - DUP|/((SAM + DUP)/2) * 100) UDL = Both SAM & DUP not detected. *Result or *Found: Interference required dilution.

RPD% = (|SPK - MSD|/((SPK + MSD)/2) * 100) M in Duplicate/MSD column indicates MSD.

SPIKE ADD column, A = Post Digest Spike; %R = Percent Recovery N/A = Not Analyzed; R > 4S = Result more than 4X the Spike Added

QC limits for MS recoveries apply only if the spike is at least 1/4 the concentration of the analyte in the sample.

Control limits for the RPD apply only if the concentration of the analyte in the sample is at least five times the reporting limit.

QC Sample 1: SVL SAM No.: 416280 Client Sample ID: SONN-SD-1

QC Sample 2: SVL SAM No.: 416290 Client Sample ID: SONN-C-8

APPENDIX B: PHOTOGRAPHIC LOG



Photo 1. Water sample no. 1 (downstream), collected from Williams Creek (center)



Photo 2. South Mountain Road (left), cabins in town site (circa 1980).



Photo 3. Historic smelter's slag pile, rock sample no. 1 collected from pile at right.



Photo 4. Williams Creek drainage towards South Mountain, viewed from town site.



Photo 5. Bay State Group Mine (center above roof), viewed from town site.



Photo 6. Water sample no. 2, collected from Nutter Creek (right), South Mountain Road bisects the town site of South Mountain (top).



Photo 7. Water sample no. 3, collected from toe of tailings pile (lower tier) berm.



Photo 8. Close-up of seep from toe (berm) of lower tier of tailings pile.



Photo 9. Sediment sample no. 1, collected from Williams Creek, below tailings pile and unnamed tributary.



Photo 10. Sediment sample no. 2, collected from Williams Creek, upstream of tailings pile.



Photo 11. Water sample no. 4, collected from Williams Creek, at lower edge of dump.



Photo 12. Water sample no. 5, collected from seep beneath waste rock dump.



Photo 13. Confluence of Williams Creek (right) and seep (left) from beneath waste dump.



Photo 14. Water sample no. 6, collected from Williams Creek (upstream/background), South Mountain Road (center), Mill buildings (top).



Photo 15. Water sample no. 7, collected from drainage ditch at Sonnemann adit (upper left), Mill building in background.



Photo 16. Sonnemann adit (center), portal covered with rock and soil, Mill building (right).



Photo 17. Water sample no. 8, seepage from old Golconda Mine.



Photo 18. Water sample no. 9, collected from unnamed tributary, upstream of tailings pile.



Photo 19. North side of upper tier, unnamed tributary (foreground), core sample no. 1 (red stake by white book at center).



Photo 20. Close-up of central portion of upper tier, core sample no. 2.



Photo 21. South side of upper tier, core sample no. 3 (red stake), gully at right.



Photo 22. North side of middle tier, core sample no. 4 (center).



Photo 23. Central portion of middle tier, core sample no. 5 (red stake).



Photo 24. South side of middle tier, core sample no. 6 (red stake).



Photo 25. North side of lower tier, core sample no. 8 (red stake), flume ruins (right).



Photo 26. South side lower tier, core sample no. 7 (red stake).



Photo 27. South side of middle tier (foreground), waste rock dump (center).



Photo 28. Tailings pile tiers, erosion (gullies) evident through each tier.



Photo 29. Water flume ruins (left), north side of tailings pile.



Photo 30. South side of tailings pile, lower (foreground), middle (boards) & upper tiers.



Photo 31. North side of tailings pile, erosion of middle tier (below brush) and lower tier (center), unnamed tributary drainage (background).



Photo 32. Mill foundations, waste rock (foreground & left) and ore stockpile (right).



Photo 33. Close-up of "high-grade" ore stockpile.

APPENDIX C: OVERSIZED MAPS

(Supplied separately)

AREA CODE 206
524-2364

LESLIE C. RICHARDS
CONSULTING MINING ENGINEER

6300 SAND POINT WAY N.E., SEATTLE, WASHINGTON 98115

September 1, 1989

HISTORICAL SUMMARY SOUTH MOUNTAIN MINE

Owyhee County, Idaho

The first reference to South Mountain found in the literature consists of descriptions in the Raymond Reports (Annual reports for the years 1869 through 1877, statistics of mines and mining in the States and Territories west of the Rocky Mountains, U.S. Treasury Department by R. C. Raymond). After the Civil War, Congress imposed a tax on mineral production for several years to help pay the war debt. Treasury agents covered the mining camps in the West to assess taxes. Their annual reports gave a description of the mining activities in the various mining districts.

During the 1860's and 1870's, the mining activity at South Mountain consisted of mining high grade narrow veins of argentiferous lead carbonate found in Bay State section of the South Mountain property. Raymond stated that some of the ore ran over 50 percent lead and several hundred ounces per ton in silver. He went on to say that the ore was hauled by wagon to Winnemucca, Nevada, a distance of almost 200 miles; then taken by the Central Pacific railroad to Sacramento, California; then by river boat to San Francisco; and then by sailing ship around the Horn to Wales for smelting.

Later, probably in the 1870's, a matte smelter was built at South Mountain. From the size of the existing slag pile, it appears that it only operated for a short time. This was common with the early unsuccessful efforts to concentrate metal values by smelting in the isolated areas of the West.

Most of the mining claims of the South Mountain Group were patented in 1900 by George A. Sonneman and Joseph E. Branscome.

In the 1920's, a group headed by Charles Butters did extensive underground work at South Mountain. Mr. Butters was a well known metallurgist of national reputation. The groups plan for going into production was terminated by circumstances connected with the economic depression of the 1930's.

Two consulting mining engineers, namely; W. R. Wade of Helena, Montana, and J. J. Beason of Salt Lake City, Utah, examined the development work of the Butters group. Their report concluded that there were 252,242 tons of ore developed that assayed:

Gold	0.026	ounces per ton
Silver	10.19	ounces per ton
Lead	0.88	percent
Copper	0.62	percent
Zinc	14.56	percent

Bliss Moore, a mining engineer of Spokane, Washington, in commenting on the Wade and Beason report in 1947, was of the opinion that the tonnage figures were high, and that he estimated that in the light of the subsequent mining of 51,000 tons that approximately 100,000 tons remained developed.

In 1940, several directors of International Smelting and Refining Company leased the South Mountain property. They mined and shipped 51 thousand tons of ore averaging 10 ounces per ton in silver and 15 percent zinc to Tooele, Utah, for smelting. Most of the mining was done on the Laxey orebody which outcrops just above the portal of the laxey level. From there the oreshoot was mined to a depth of 200 feet below the lower or Sonneman level. The zinc market eased near the end of World War II and the mining operation and lease were terminated.

In 1950, P. P. Brandenthaler and H. F. Anderson took a lease and option on the South Mountain property. They rehabilitated the Laxey (upper) level, but they did not open the Sonneman (lower) level. The portal had caved during the period of 1946 to 1950. Anderson and Brandenthaler operated as a partnership known as the South Mountain Mining Company. Anderson was the one actively in charge at the mine. Later they formed a corporation called South Mountain Mining and Concentrating Company. Anderson shipped approximately 2000 tons from the shallow surface shaft on the Texas orebody. He was so encouraged with the results that he then planned on driving the Laxey level to intersect the Texas orebody. To further the plan, the partnership entered into a contract with the Defense Minerals Exploration Administration in October, 1951, to drive the Laxey level to the Texas orebody a distance of approximately 1000 feet. The accepted charges under the contract amounted to $48,860.00. The Government's share amounted to $24,430.00. The contract called for a 5 percent royalty on production until $24,430.00 was paid or a lien on the land for a period of 10 years, whichever occurred first.

Anderson intersected the Texas orebody with the Laxey level extension work. He then stoped the Texas ore and shipped it to the Garfield Smelter in the Salt Lake area.

During 1953 - 1954, Anderson and Brandenthaler constructed a mill just below the portal of the Sonneman level. The ore was trucked from the Laxey level to the mill. The mill was equipped with a diesel driven 15 x 36 inch jaw crusher and a 2 foot Simons shorthead gyratory crusher. The estimated capacity of the crushing plant was 30 tons per hour. The grinding unit was a 6 x 4.5 foot Marcy ball mill which could grind South Mountain ore at the rate of 6 tons per hour. The flotation unit was confined to a single circuit. Mill power was supplied by two diesel powered generators with a total output of 200 KW.

In 1955, Anderson and Brandenthaler decided to put the mining operation up for sale. They were faced with the expense of enlarging the mill to cover a zinc flotation circuit, and more expense for development work to put the mine in full production.

In June, 1955, they were approached by Rare Metals Corporation and offered a deal with a substantial down payment on a total purchase price of $600,000.00 for the property and equipment. The balance was to be paid in equal installments over a five year period. This offer was turned down.

Shortly afterward, Anderson and Brandenthaler dealt with Potash Corporation of America. Potash took over the property and added a zinc flotation circuit to the mill. The terms of the agreement are not known. It is understood that Polash bought all of the equipment and probably had the property under a lease and option agreement. Potash was interested in zinc concentrates which they intended to roast for the purpose of making potassium sulphate. In 1955, the sulphur price was high and the supply limited. During the next couple of years, the supply situation eased and sulphur prices fell by 25 percent. Potash concentrated on stoping the high zinc oreshoots above the Laxey level. There is no evidence that they did any development work. After a short period of time Potash closed down and sold off all equipment.

In 1963, Sunshine Mining Company took a lease and option on the South Mountain property calling for a price of $600,000.00. For the next two years, Sunshine concentrated their efforts on rehabilitating the Laxey level and sampling. Sunshine terminated the option in 1965. This action took place at the time that a new group took control of Sunshine and terminated all of the top management including S. K. Garrett, Vice President for Exploration. Garrett had recommended South Mountain as a worthwhile project.

Within a short period of time after the property was dropped by Sunshine, the property was picked up by a lease and option by The Bunker Hill Company. They concentrated their efforts in horizontal core drilling from the Laxey level apparently looking for additional ore zones. The fact that they took control of the surface downslope from the surface outcrop of the ore bearing limestone suggests that they were looking for a large deposit that could be worked from the surface. In that regard, the Bunker Hill program was disappointing and the property was released in 1967.

James Keighley optioned the South Mountain property from Mrs. Pete Brandenthaler in 1968. Mr. Brandenthaler had passed away and Mrs. Brandenthaler had bought out Mr. Anderson's interest. Keighley then transferred the option to Mrs. Ora K. Smith and Mr. Roger Milliken. They later exercised the option and bought the property.

Over a period of years prior to 1983, the new owners carried on extensive geologic investigations, sampling, and mineral exporation at South Mountain. They rehabilitated the Laxey and Sonneman levels, and drove the latter approximately 1000 feet to the Texas oreshoot. After the Sonneman level extension, their staff in a 1982 report estimated that the South Mountain mine contained 210,000 tons of probable ore averaging:

Gold	0.065 oz./ton
Silver	8.33 oz./ton
Copper	1.39 percent
Lead	1.13 percent
Zinc	12.95 percent

Mostly through projections of the ore shoots below the Sonneman level, they estimated 124,000 tons of possible ore.

Sonnemann Mine & Mill Site Investigation Project Plan

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ACRONYMS AND ABBREVIATIONS

BLM	U.S. Department of the Interior, Bureau of Land Management
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Procedure
CoC	Chain-of-Custody
COPCs	constituents of potential concerns
DEQ	Idaho Department of Environmental Quality
DQOs	Data Quality Objectives
EPA	U.S. Environmental Protection Agency, Region 10
HNO_3	nitric acid
HSP	Health and Safety Plan
IDW	Investigation-Derived Wastes Management Plan
IGS	Idaho Geological Survey
MCL	maximum concentration limit
MDL	method detection limit
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PQL	practical quantitation limit
QA/QC	Quality Assurance/Quality Control
QAOs	Quality Assurance Objectives
RCRA	Resource Conservation and Recovery Act
SP	Sample Plan
SI	Site Investigation
SOW	Statement of Work
TCLP	Toxicity Characteristic Leaching Procedure
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency

1. INTRODUCTION

This Work Plan details the approach and procedures for completion of a Site Investigation (SI) for the Sonnemann Mine and Mill site, located in Owyhee County, Idaho (Figure 2-1). The purpose of this SI is to identify conditions that may pose a risk to human health and the environment as defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The SI will be based upon existing information about the site, including historical and geological information obtained from the University of Idaho, Idaho Geological Survey (IGS), the BLM and the Idaho Department of Environmental Quality (DEQ). This information will be combined with current data obtained during a Site Investigation to produce a SI Report. References cited within this Work Plan will be complied in a reference section of the SI Report.

This Project Plan outlines the scope of work for conducting the SI, and provides details of field work required to complete the project, in accordance with 40 CFR Part 300 and all applicable U.S. Environmental Protection Agency (EPA) guidance documents for preparation of a combined Preliminary Assessment/Site Investigation (EPA Directive No. 9375.2-10FS, October 1993). This Project Plan is broken into three (3) components: A Work Plan (WP), a Sample Plan (SP) that incorporates a Quality Assurance/Quality Control (QA/QC) section, and an Investigation-Derived Wastes (IDW) Management Plan. The Health and Safety Plan (HSP) is provided as a "stand-alone" document. A brief description of each of these components is as follows:

The Work Plan (Section 2.0) includes a description of the site location and history, a summary of previous investigations, a description of the goals and scope of this project; and a schedule for completing the project.

The Sample Plan (Section 3.0) includes a description of the sampling and data collection activities to be performed, and field sampling and data collection procedures to be followed. The Quality Assurance/Quality Control section describes data quality objectives (DQOs), laboratory testing methodology and detection limits, sample handling and custody procedures, data reduction and validation, the appropriate laboratory certifications, and qualifications of participating personnel. The QA/QC also identifies laboratories to be used for sample testing.

The Investigation-Derived Waste (IDW) Management Plan (Section 4.0) includes a description of the characterization, minimization, and disposal activities to be performed.

The Health and Safety Plan (HSP) is provided as a "stand-alone" document and prepared in accordance with 40 CFR Part 300.150(d) and all applicable Occupational Safety and Health Administration (OSHA) requirements, as described in 29 CFR 1910. The HSP will be modified, as necessary during the site visit, for on-site conditions and contingencies.

2. WORK PLAN

2.1. SITE LOCATION AND HISTORY

2.1.1. Site Location

The Sonnemann is an inactive silver and lead mine located in Owyhee County, Idaho, approximately 18 miles southeast of Jordan Valley, Oregon, and 20 miles south of Silver City, Idaho (Figure 2-1). The mill site lies immediately adjacent to the mine's portal. The site is located near the headwaters of Williams Creek on the northwest flank of South Mountain. The Site is situated on private property owned by the South Mountain Mining Company, though ownership of the tailings pile appears to be public land, managed by the Bureau of Land Management. The Site lies along the eastern side of Williams Creek, a northward flowing drainage from South Mountain and an influent tributary to Jordan Creek.

The Sonnemann Mine and Mill (Sonnemann) can best be accessed from Jordan Valley, Oregon. Traveling east on Yturri Boulevard from the 90° curve on Highway 95, continue for 1.8 miles. At this point Yturri Boulevard becomes Pleasant Valley Road. Continue traveling on Pleasant Valley Road for 1 mile then take a right-hand turn to stay on Pleasant Valley Road. Continue traveling on Pleasant Valley Road for 2.8 miles then take a right-hand turn (portions of road are unpaved). Continue for 1.6 miles then take a left-hand turn onto South Mountain Road. Continue traveling on South Mountain Road for 13.3 miles. The upper portions of the road are narrow and rocky, high-clearance and/or four-wheel drive vehicles may be required. The Sonnemann Mine and Mill site lies on the east side of Williams Creek. The Sonnemann lies at an elevation of 6840 feet above mean sea level (amsl) and is located in the NW ¼ of the NW ¼, Section 10, T 8S, R5 W, on the Cliffs 7.5-minute quadrangle (Figure 2-2). The site is also known by several other names including the Sonneman Mine, new Golconda Tunnel, and South Mountain Mine.

2.2. SITE HISTORY

Mining in the South Mountain area began in the late 1860's and worked in the early 1870's (Sorenson, 1927). In 1874, a small smelter was established in the townsite of Bullion City, later renamed South Mountain, which lies 0.75 miles north of the Sonnemann Mine. The Richards report (1989, p.1) states:

> "During the 1860's and 1870's, the mining activity at South Mountain consisted of mining high grade narrow veins of argentiferous lead carbonate found in Bay State section of the South Mountain property…Later, probably in the 1870's, a matte smelter was built at South Mountain. From the size of the existing slag pile, it appears that it only operated for a short time…Most of the mining claims of the South Mountain Group were patented in 1900 by George A Sonneman and Joseph E. Branscome."

The Alabama claim encompasses the old Golconda Tunnel and Golconda stope while the Kentuck and Queen of the Mountains claims contain the Sonnemann Mine and Mill site.

According to Sorenson (1927, p. 3):

> "The South Mountain district remained practically idle during the period from 1875 to 1906. In 1906 some work was done on the Standard group of claims, and the South Mountain Company's mines were operated under option by the Bagdad-Chase Gold Mining Company in 1907. Operations were soon stopped, however, and the bond was forfeited because of the financial depression. Very little work, other than annual assessment work on unpatented claims, has been done in the period from 1907 to 1926. A bond and option on the property of the South Mountain Mining Company is held now by Utah and eastern capital. Repair work on the camp buildings was started in August, 1926. The name of the new corporation is the Uida Consolidated Mines Company".

Richards' (1989, pp. 1-3) report continues the operational chronology:

> "In the 1920's, a group headed by Charles Butters did extensive underground work at South Mountain…The groups plan for going into production was terminated by circumstances connected with the economic depression of the 1930's.
>
> In 1940, several directors of International Smelting and Refining Company leased the South Mountain property. They mined and shipped 51 thousand tons of ore averaging 10 ounces per ton in silver and 15 percent zinc to Tooele, Utah, for smelting. Most of the mining was done on the Laxey orebody which outcrops just above the portal of the Laxey level. From there the oreshoot was mined to a depth of 200 feet below the lower or Sonneman level. The zinc market eased near the end of World Ware II and the mining operation and lease were terminated.
>
> In 1950, P. P. Brandenthaler and H. F. Anderson took a lease and option on the South Mountain property. They rehabilitated the Laxey (upper) level, but they did not open the Sonneman (lower) level. The portal had caved during the period of 1946 to 1950. Anderson and Brandenthaler operated as a partnership known as the South Mountain Mining Company. Anderson was the one actively in charge of the mine. Later they formed a corporation called South Mountain Mining and Concentrating Company. Anderson shipped approximately 2000 tons from the shallow shaft on the Texas orebody. He was so encouraged with the results that he then planned on driving the Laxey level to intersect the Texas orebody. To further the plan, the partnership entered into a contract with the Defense Minerals Exploration Administration in October, 1951, to drive the Laxey level to the Texas orebody a distance of approximately 1000 feet…
>
> Anderson intersected the Texas orebody with the Laxey level extension work. He then stoped the Texas ore and shipped it to the

Garfield Smelter in the Salt Lake area.

During 1953-1954, Anderson and Brandenthaler constructed a mill just below the portal of the Sonneman level. The ore was trucked from the Laxey level to the mill. The mill was equipped with a diesel driven 15 x 36 inch jaw crusher and a 2 foot Simons shorthead gyratory crusher. The estimated capacity of the crushing plant was 30 tons per hour. The grinding unit was a 6 x 4.5 foot Marcy ball mill which could grind South Mountain ore at the rate of 6 tons per hour. The flotation unit was confined to a single circuit. Mill power was supplied by two diesel powered generators with a total output of 200 kw.

In 1955, Anderson and Brandenthaler decided to put the mining operation up for sale. They were faced with the expense of enlarging the mill to cover a zinc flotation circuit, and more expense for development work to put the mine in full production.

In June, 1955, they were approached by Rare Metals Corporation… This offer was turned down. Shortly afterward, Anderson and Brandenthaler dealt with Potash Corporation of America. Potash took over the property and added a zinc flotation circuit to the mill…Potash was interested in zinc concentrates which they intended to roast for the purpose of making potassium sulfate….Potash concentrated on stoping the high zinc oreshoots above the Laxey level. There is no evidence that they did any development work. After a short period of time Potash closed down and sold off all equipment.

In 1963, Sunshine Mining Company took a lease and option on the South Mountain property calling for a price of $600,000.00. For the next two years, Sunshine concentrated their efforts on rehabilitating the Laxey level and sampling. Sunshine terminated the option in 1965….

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James Keighley optioned the South Mountain property from Mr. Pete Brandenthaler in 1968. Mr. Brandenthaler had passed away and Mrs. Brandenthaler had bought out Mr. Anderson’s interest. Keighley then transferred the option to Mrs. Ora K. Smith and Mr. Roger Milliken. They later exercised the option and bought the property.

Over a period of years prior to 1983, the new owners carried on

extensive geologic investigations, sampling, and mineral exporation (sic) at South Mountain. They rehabilitated the Laxey and Sonneman levels, and drove the latter approximately 1000 feet to the Texas oreshoot. After the Sonneman extension, their staff in a 1982 report estimated that the South Mountain mine contained 210,000 tons of probable ore averaging:

Gold	0.65 oz./ton
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Mostly through projections of the ore shoots below the Sonneman level, they estimated 124,000 tons of possible ore."

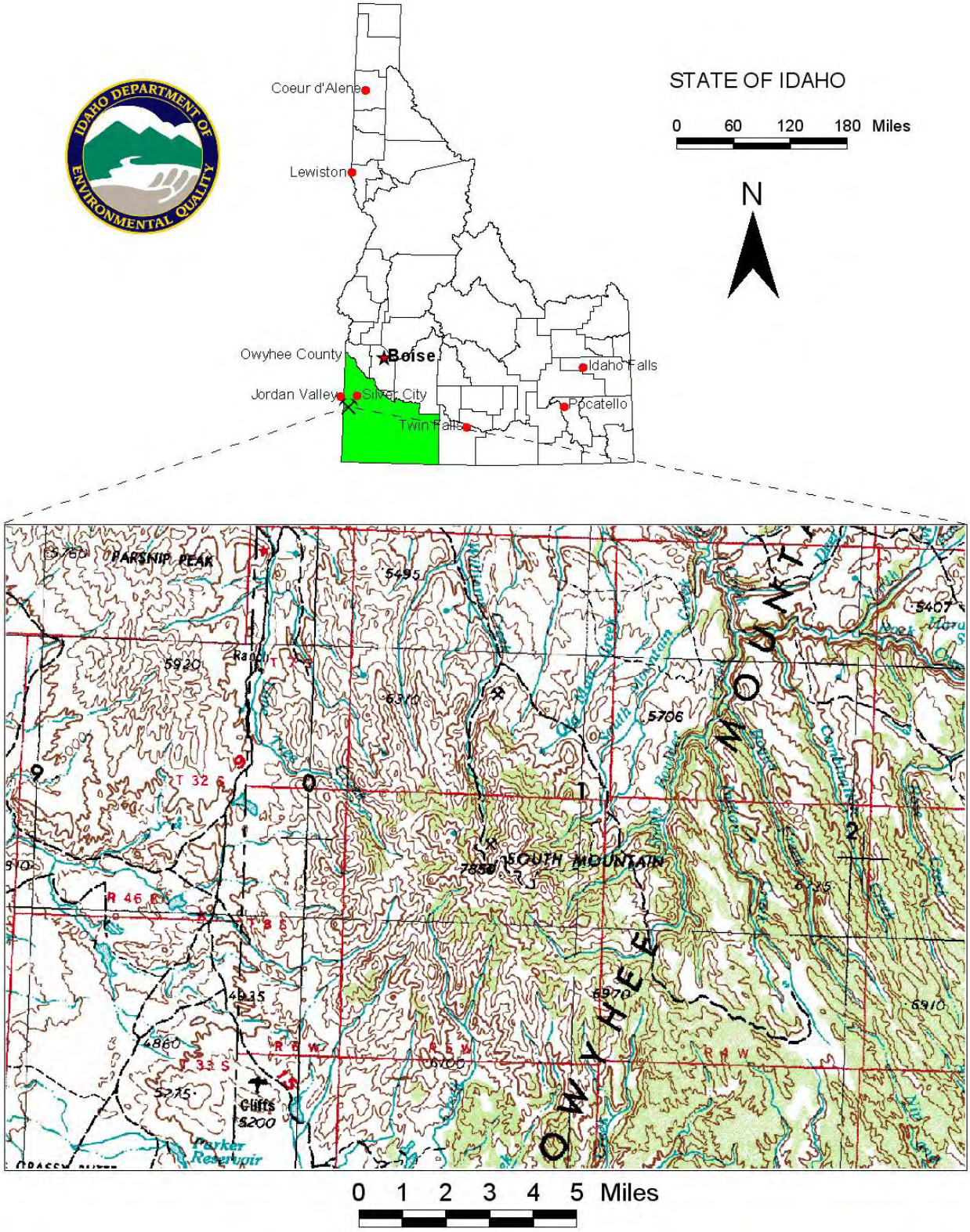


Figure 2-1. Sonnemann Mine Vicinity Location Map

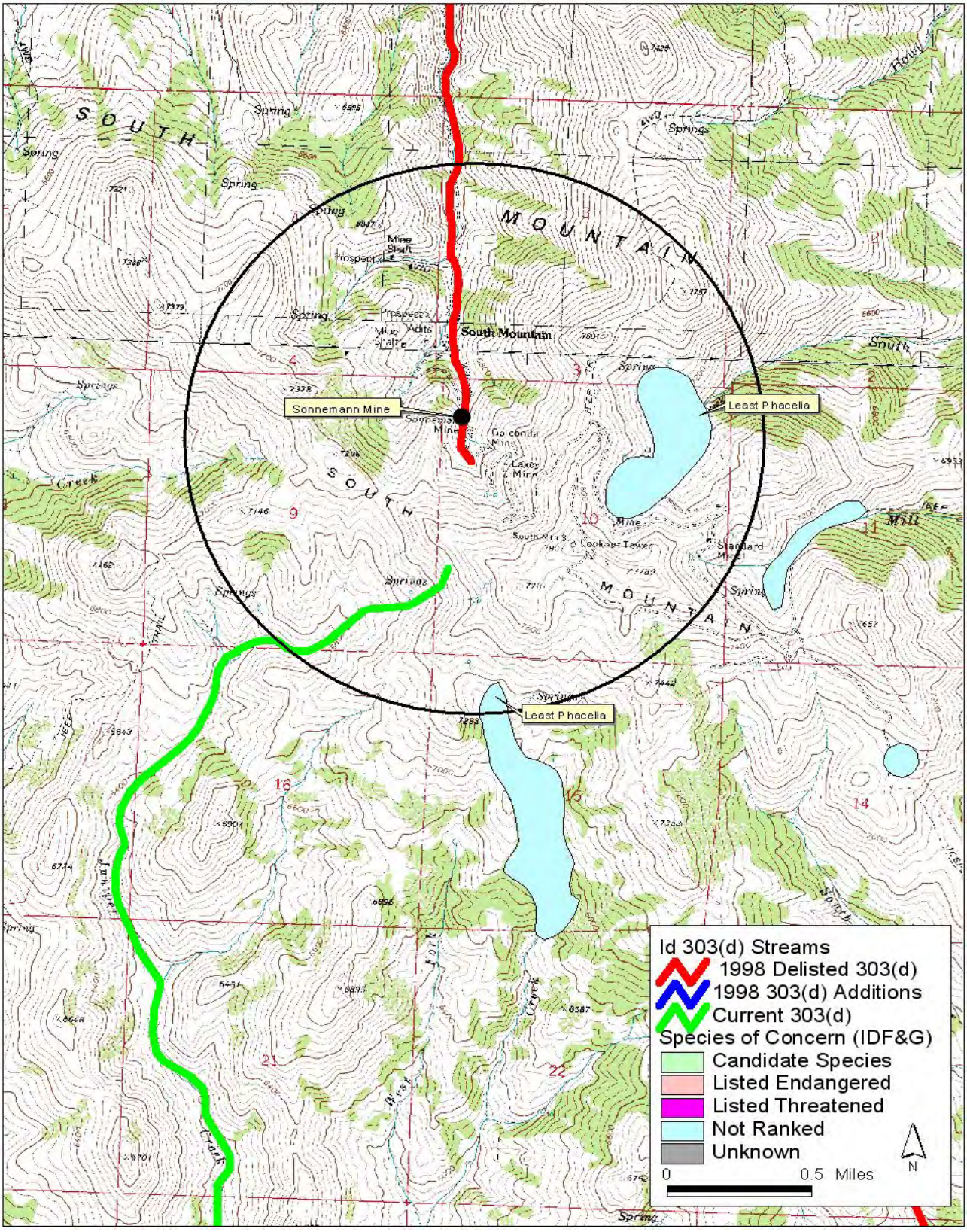


Figure 2-2. Sonnemann Mine 1-Mile Radius Map.

2.3. PREVIOUS INVESTIGATIONS

The following section summarizes the previous investigations conducted at the site. The USEPA and BLM contracted the IGS to conduct Reconnaissance Site Assessments of mine and mill locations within federally-managed lands of Idaho. The IGS conducted an assessment of the Sonnemann and surrounding mines on July 22, 1999. This report will be discussed in detail in the SI Report. A short summary for this report is provided below.

Previous investigative work has been conducted at the Sonnemann. Geologist from the Idaho Geological Survey (IGS) conducted preliminary assessment activities in 1999, as part of an investigation of abandoned and inactive mines in Idaho, in cooperation with state and federal agencies (Bennett, et al, 2000). The IGS report includes a historic literature search of the site as well as fieldwork where specific mine workings were located and mapped. This report summarized information relative to the historic mineral production and geology of the mine and determined safety hazards and potential surface water impacts. Sample analysis of adit (mine entrance) water indicated exceedance of water quality standards for arsenic and cadmium and both Aquatic Life standards for zinc. (Appendix D of this report contains a copy of the IGS report).

The DEQ conducted a preliminary assessment (PA) at the Sonnemann on July 2, 2002. The PA report includes a historic literature search, historic mineral production information and geology of the mine, and migration/exposure pathways and potential targets. The PA report states:

> "Water sampled from the adit shows concentrations of arsenic (50 µg/kg) equal to the Maximum Concentration Limit (MCL), but the risk is calculated at 1.1 x E-3 (EPA[1], 2002). The risk from arsenic downstream from the PPE is calculated at 5.8 x E-4 and is approximately equal to one-half of the MCL. The lead concentrations of both adit and downstream samples are approximately one-third of the MCL (0.015) as presented in EPA's current Drinking Water Standard (EPA[2], 2002)" (DEQ, 2002, p. 15).

2.4. SI TASKS

In addition to the preparation of this Work Plan, the Sample Plan, the Health and Safety Plan, and the Investigation-Derived Wastes Management Plan, this SI will include the following tasks:

Site Investigation – An investigation of the site will be completed, and data will be collected to address the following:

- The nature and extent of hazardous material/waste releases or the threat of future releases,
- Potential threats to human health or the environment,
- The need for any emergency response actions and/or removal,
- Collection and review of existing data,
- The location and nature of sensitive environments and other environmental factors, and

- The condition and integrity of existing surface mine and mill structures and features.

Information contained in the IGS Report and the DEQ PA report will be used as guides for the field team to determine the number and location of features that will be investigated during the site visit. Field personnel will not enter any underground workings as part of this investigation.

Emergency Response Action Assessment – The field team will collect information during the site visit to determine whether or not an emergency response action and/or removal must be taken, in accordance with 40 CFR 300.180. This assessment will be based on the following criteria:

- Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous materials or pollutants or contaminants,
- Actual or potential contamination of drinking water supplies or sensitive ecosystems,
- Hazardous materials or pollutants or contaminants in drums, barrels, tanks, or bulk storage containers that may pose a threat of release,
- High levels of hazardous materials or pollutants or contaminants in soils, largely at or near the surface, that may migrate,
- Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released,
- Threat of fire or explosion, and
- Other circumstances or factors that may threaten human health or the environment.

Site Investigation Report – a SI Report will be prepared to summarize the results of the SI. The report will contain recommendations for whether or not removal actions are warranted for mine tailings, waste rock, contaminated soil, waste containers, and waste tanks and will include the following elements:

- A description of the site, including location, legal description, area and access on and around the site,
- Site features and physical characteristics, including structures and disposal areas, local geology and soils, surface hydrology, and ecological setting,
- Ownership and operational history,
- A detailed review and summary of previous investigations, including sampling activities conducted at the site,
- Identification of sources of contamination, source containment, migration pathways, and potentially affected targets,
- A description of the SI sampling program, analytical results, and their influence on potential receptors,
- Conclusions and recommendations for additional investigation or evaluation,
- Site photographs and photographic log,
- Original field notes,
- Laboratory analytical data,
- References/bibliography, and
- Figures.

2.5. SCHEDULE

The schedule is largely determined by obtaining legal access to the site, the availability of DEQ personnel and resources, and by conditions at the site. The fieldwork is currently scheduled for August 22 through 25, 2004. Due to potential conflicts with other DEQ projects and personnel availability, the dates for the fieldwork may change. The SI final Report will be completed on or before March 31, 2005.

3. SAMPLE PLAN

This section describes specific activities that will be conducted during the SI field data collection efforts. The general scope of work addressed in this SP includes the following tasks:

- Task 1 – Physical Site Characteristics and Hazards Evaluation
- Task 2 – Surface Soil/Tailings Evaluation
- Task 3 – Waste Rock/Ore Evaluation
- Task 4 – Surface Water Evaluation
- Task 5 – Data Evaluation

A description of each of these tasks is provided in the following sections.

3.1. PHYSICAL SITE CHARACTERISTICS AND HAZARD ANALYSIS

Physical site characteristics and hazards will be evaluated during the SI field investigation. Activities included under this task will focus on the following:

- Identify and document physical hazards to the field team and the general public (e.g., unsecured site);
- Estimate the volume of tailings piles, and waste rock dump(s);
- Volume estimates of waste dumps and tailings piles will be obtained by measuring (tape) the base and thickness of the unit;
- Area estimates of all surface impoundments will be obtained by measuring (tape);
- Volumes of surface impoundments can be calculated, if depth is known. Otherwise, visual observations will be conducted to obtain volume estimates;
- Document the location, condition, construction materials (presence of asbestos containing materials and lead-based paint), and estimated size of abandoned structures and equipment;
- The Site Manager will not allow entry into abandoned structures without prior owner/operator permission and a safety assessment;
- Proper PPE (hard hats, safety glasses, and boots) must be worn when entering abandoned structures;
- Document the number, location, and condition of underground mine portals, airshafts and surface workings;
- The presence or absence of water within or emanating from portals or other underground openings will be documented;
- Site conditions including accessibility, structural condition, and associated physical

hazards that may affect the evaluation of chemical hazards will be documented;

3.2. SURFACE SOIL EVALUATION

3.2.1. Soil Sampling and Analysis Activities

Up to ten soil samples will be collected during the site investigation for the purpose of evaluating the presence, nature and extent of hazardous substances. One of the samples collected will be background soil/sediment samples. The remaining eleven samples will be collected from the mine and mill site. The specific locations of the samples will be determined based on visual or subjective evidence of impacts. Soil sample depth will be determined based upon site conditions, though 0-6 inch depth is preferred. Shallow subsurface soil samples may be collected to evaluate the vertical distribution of observed contamination.

All soil samples will be discrete and no compositing will be performed. Non-dedicated sampling equipment will be utilized, when possible, and appropriately decontaminated prior to reuse.

The number and location of soil and sediment samples to be collected are as follows:

- 3 soil samples per tailings pile (3), 9 total
- 1 sediment sample from Williams Creek below merger of unnamed tributary with Williams Creek
- 1 sediment sample from Williams Creek downstream of all South Mountain Mining Company operations (north of all patented ground)
- 1 background soil sample from slope above the Site

Up to twelve of the soil and sediment samples, including the two background samples, and nine mill tailings soil and Williams Creek sediment samples, will be analyzed for eight Resource Conservation and Recovery Act (RCRA) listed metals by EPA Method 6000/7000 series. The samples will also be analyzed with the Toxic Characteristic Leaching Process (TCLP) method for all eight RCRA listed metals. In addition to the eleven primary soil/sediment samples, field duplicate quality control samples will be analyzed at a rate of one per ten primary samples. Matrix spike quality control samples will be analyzed by the laboratory at a rate of at least one per twenty primary samples. Based on these criteria, it is anticipated that one duplicate soil or sediment sample will be collected and analyzed, one for metals, and one matrix spike sample will be analyzed.

3.2.2. Soil/Sediment Sampling Procedures

Sampling will be conducted utilizing stainless steel spoons or scoops for soil and sediment samples. A pre-cleaned shovel may be required to loosen the soil/sediment prior to collection with scoops. A pre-cleaned hand auger will be used to collect soil samples at intervals through the thickness of each pile. The auger will be decontaminated between each sampling event. An estimate of ten soil samples will be collected from the tailings ponds. However, surface soil sampling (upper 6 inches) will be performed in the event that the hand-auger cannot penetrate the subsurface.

The following procedures will be observed:

- Record the date and time of arrival, general site conditions, and other applicable field observations related to the site.
- Record a physical soil/grain size description of the sample.
- Fill one 8-ounce jar per sample.
- After collection, label the sample and record sample collection information and location on the sampling form (see section 3.4.5). Sample information should include date/time sampled, soil color, grain size, and odors (if any).
- Stakes or flag markers will be placed adjacent to each collection point and noted on the site sketch map and GPS coordinates will be recorded at each sample location.
- Discard contaminated personal protective clothing (e.g., latex gloves), as required.
- Decontaminate any non-dedicated sampling equipment used.

3.2.3. WASTE ROCK ASSESSMENT

3.2.3.1. Waste Rock Sampling and Analysis Activities

Up to three (3) waste rock samples will be collected from the waste rock dump and ore storage pile. The specific locations of the samples will be determined based on visual or subjective evidence of impacts. Waste rock sample depth will be determined based upon site conditions, though 0-6 inch depth is preferred.

All waste rock samples will be discrete and no compositing will be performed. Non-dedicated sampling equipment will be utilized, when possible, and appropriately decontaminated prior to reuse.

The number and location of waste rock samples to be collected are as follows:

- 1 sample from upper surface of waste rock dump (west mill foundation)
- 1 sample from dump face adjacent Williams Creek
- 1 sample from “high-grade” ore pile (east mill foundation)
- Discard contaminated personal protective clothing (e.g., latex gloves), as required.
- Decontaminate any non-dedicated sampling equipment used.

The collection of offsite samples will be used to characterize the extent of waste rock material utilized for roadbed construction. The specific locations of the samples will be determined based on observed site conditions, and will be selected to provide as full a characterization of the waste rock stockpiles as possible. The waste rock samples will be analyzed for eight Resource Conservation and Recovery Act (RCRA) listed metals by EPA Method 6000/7000 series.

3.2.3.2. Waste Rock Sampling Procedures

To the extent possible, waste rock samples will be collected in such a way as to provide the maximum representation of the dump/roadway being sampled. The degree sample representation will depend to some extent upon the homogeneity of the dump and the mineralization within the individual rocks.

The following procedures will be observed during waste rock sampling:

- Record the date and time of arrival, general site conditions, and other applicable field observations related to the site. (traffic pattern, maintenance of roadway)

- Visually evaluate the extent of roadbed material, relative to the road's margins
- Visually evaluate the homogeneity of the overall dump, and of the individual rocks within the dump.
- Based on the distribution of rocks within the dump being sampled, select locations that appear representative of the overall waste rock dump. The more homogeneous the dump, the fewer locations will be warranted.
- In each identified location, remove the outer-most rocks that have been most exposed to weathering.
- From the exposed rock at each identified location, collect several fist-sized rocks of varying lithologies to provide the most representative sample possible. Each waste rock sample should total between 2 and 5 lbs.
- Place the waste rock sample in a clean re-sealable plastic bag, and place that bag in an additional cloth or canvas outer bag.
- Label each waste rock sample as described in Section 3.4.5.
- Stakes or flag markers will be placed adjacent to each collection point and noted on the site sketch map.

3.3.WATER QUALITY ASSESSMENT

3.3.1. Surface Water Sampling and Analysis Activities

Up to six primary surface water samples and one background surface water sample will be collected during the site visit. The general locations of the samples will be as follows:

- 1 background sample from the unnamed west flowing tributary upstream of the tailings piles
- 1 background sample from Williams Creek south (upstream) of the South Mountain Road crossing
- 1 sample from Williams Creek, upstream of effluent from Sonnemann Mine adit
- 1 sample from Sonnemann Mine effluent, as close to adit discharge point as possible
- 1 sample from adit effluent where it discharges to Williams Creek
- 1 sample from Williams Creek, downstream of waste rock dump
- 1 sample from Williams Creek downstream (north) and beyond the patented claims owned by South Mountain Mining Company
- 2 samples from springs or seeps at the mine/mill site, or adjacent property, if necessary
- 1 sample from Nutter Creek (drains Bay State Group mines)

The specific locations of surface water samples and stream flow data collection points will be determined in the field, based on observed conditions. Physical water parameters including pH, temperature and conductivity will be measured with a direct reading instrument at the time of sample collection. The water samples will be analyzed for eight RCRA listed metals, both total and dissolved, in accordance with EPA Method 6000/7000 series. Filtration of water samples for dissolved metals will be performed in the field.

In addition to the six primary water samples, field duplicate quality control samples will be collected at a rate of one per ten primary samples. Matrix spike quality control samples will be performed by the laboratory at a rate of at least one per twenty primary samples.

3.3.2. Surface Water Sampling Procedures

Prior to arriving at the sample location, all monitoring equipment (including pH and conductivity meters) will be calibrated (by CRO staff?). Field team(s) will record instrument calibration information, field observations, notes, and measurements, daily, with waterproof ink in all-weather field books. Each field book page will be signed and dated. Upon arrival at the sample site, the following procedures will be followed:

- Record the date and time of arrival, general site conditions, and other applicable field observations related to the site.
- Stream sampling will be conducted from the lowest elevation to the highest, whenever possible. Williams Creek should be sampled before sampling on or adjacent to the site.
- Streams will be accessed for sampling by wading.
- Measure physical water quality parameters (pH, temperature and conductivity) in situ for all water samples at the time of sampling.
- Stream flow measurement will be conducted in creeks by spanning the creek's flow width perpendicular to the flow with a fiberglass tape measure. Depth will be measured in feet at 2-foot intervals across the width of the stream. Flow velocity will then be measured in feet per second by recording the travel time of an object (stick, tennis ball, etc.) from upstream to downstream over a known distance. An estimate of the flow will be calculated using the following formula:

  Flow = (width of stream) x (average depth) x (velocity).

- Position the mouth of the sampling container facing upstream of the person conducting the sampling. Discrete samples will be collected at several locations across the stream and composited in a clean 1-liter plastic bottle.

  Note - During high flow, it may not be possible to span the entire channel. In this case, samples will be collected as far into the main channel as possible from each bank. These samples will be composited in the same manner as above. 2-3 locations from each bank will be obtained.

- For smaller streams and/or seeps, samples will be collected as practical from pools or falls. If necessary, a depression around the shallow stream or seep location will be manually dug to allow for sample collection by submerging a precleaned 1-liter polyethylene bottle into the pool. Once measurements of pH, conductivity, and temperature have stabilized and sediment has settled out, the water sample will be collected from the depression.
- Once field measurements and field tests are completed, sample containers will be filled in the following order:

Analysis Sample Container Type

- Total Recoverable Metals 1-liter polyethylene bottle with nitric acid (HNO3)
- Dissolved Metals, 1-liter polyethylene bottle with nitric acid (HNO3)
- Record sample collection information and sample locations on the sampling form. Note in the field book the sample location collected.
- Stakes or flag markers will be placed adjacent to each collection point and noted on the site sketch map.
- Discard contaminated personal protective clothing (e.g., latex gloves), as required.
- Discard any dedicated and/or disposable sampling equipment, as required
- Decontaminate any non-dedicated sampling equipment used.

3.4.GENERAL FIELD PROCEDURES

3.4.1. Documentation

A bound field book will be maintained by each team sampler to provide a daily record of events. At the beginning of each logbook entry, the following will be recorded:

- Date
- Time
- Meteorological conditions
- Field team members present
- Level of personnel protection
- List of on-site visitors and the level of personal protection
- Signature of the person making the logbook entry

Field book entries will be as detailed as necessary so that essential information is properly documented. All documentation in field books will be in ink. If an error is made, it will be corrected by drawing a line through the error and entering the correct information. Corrections will be dated and initialed. No entries will be obliterated or rendered unreadable. If sample locations cannot be indicated on field maps, a simple drawing of the location (not to scale) will be included in the field book to provide an illustration of all sampling points. The cover of each field book used will contain:

- Person and organization to whom the book is assigned
- Book number
- Start date
- End date

Daily activities and documentation of sampling procedures will be made in the field books. Data to be included in the field books will include travel time, time at the site, a summary of activities, and observations. Entries in the field book will include, at a minimum, the following for each date of sampling:

- Site identification
- Location and description of sampling points
- A brief sketch of sampling points
- Sample identification numbers
- Number of samples taken

- Time of sample collection
- Number and type of QA/QC samples taken
- Sampler's name
- Field observations
- Documentation of photographs taken
- All field measurements made (e.g., pH, temperature and conductivity)

3.4.2. Procedures to Prevent Cross-Contamination

Personnel collecting samples for chemical analyses will take the following precautions to minimize sample contamination or cross-contamination between samples:

- Disposable nitrile or latex gloves will be used while collecting all samples. New gloves will be worn for each separate sampling event.
- Sampling personnel will not touch the inside of the sampling container.
- Sampling personnel will not walk over any areas where samples are to be collected.
- Only equipment that has been properly decontaminated will be used for environmental sample collection.
- Decontamination procedures will be completed while wearing disposable gloves.
- Immediately following the collection of the sample, the container will be sealed and the sample will be labeled and entered in the field logbook and/or appropriate sampling record forms.

3.4.3. Calibration of Water Quality Meters

Equipment to be used during the field investigation will include a Yellow Springs Instrument Corporation (YSI) water meter that measures temperature, pH, and conductivity. This meter will be used to measure these parameters in all water samples collected during the field effort. The YSI instrument will be provided by DEQ for use on the project, and contain manufacturer-supplied calibration solution that will calibrate the meter over the full instrument range of pH and conductivity. Field calibrations will be documented in the field notebook. Entries will be made at the beginning of each sampling or measuring effort and when each instrument is calibrated.

3.4.4. Sample Designation

Samples collected during this SI will be designated a unique sample number according to the following criteria:

Surface Soil Samples: Surface soil samples will be labeled with the prefix SM (for Sonnemann Mine) followed by SS (for surface soil) and consecutive numbers. For example, the first soil sample collected will be designated SMSS#1.

Tailings Pond Soil Samples: Surface soil samples will be labeled with the prefix TM (for Sonnemann Mine), followed by TPSS (for surface soil) and consecutive numbers. For example, the first soil sample collected will be designated TMTPSS#1.

Waste Rock Samples: Waste rock samples will be labeled with the prefix SM (for Sonnemann Mine) followed by WR (for waste rock), and consecutive numbers. For example, the first waste rock sample collected will be designated SMWR#1.

Surface Water Samples: Surface water samples will be labeled with the prefix SM (for Sonnemann Mine) followed by W (for surface water) and consecutive numbers. All surface water samples, including stream samples, seep samples, adit effluent water samples, and spring samples will be numbered in this fashion, and the specific location of each sample will be documented in the field notebook. Background surface water samples will be labeled in the same fashion. The designator BG (for background) will be added to the end of the sample number. For example, if the seventh surface water sample collected is a background sample, the designation will be SMW#7BG

Field Quality Assurance/Quality Control (QA/QC) Samples: Field duplicates and Matrix Spikes will be the QA/QC samples collected. Field duplicate samples will be labeled in the same way as primary samples, but as the next applicable sequential number. Collection documentation of duplicate samples will be made in the field notebooks and noted on the site sketch map.

3.4.5. Sample Identification and Labeling

Each sample shall be identified in the field book and on the sample container label. Sample labels will be formatted as follows:

Site: Sonnemann Mine & Mill
Sampler:
Client: DEQ
Date Collected: Time:
Source:
Analysis:
Unpreserved, Preserved:

The label shall be filled out as follows:

1. Site – Sonnemann Mine
2. Sampler's initials
3. Client – DEQ
4. Date Collected – date of sample collection
5. Time – time of sample collection (for composite samples, use the time of final aliquot collected)
6. Source - sample number and matrix (e.g. soil, water)
7. Analysis –
8. Unpreserved, Preserved –

3.4.6. Sample Containers, Preservation and Storage

All clean sample containers will be provided by DEQ and handled in such a way as to prevent accidental contamination prior to use. All necessary preservative(s) will be placed in appropriate sample containers by the laboratory prior to collection of samples. The types of sample containers that will be used are based on the Analytical Plan for each media to be collected. Table 1 lists the type of analysis, sample preservation (including storage conditions), and holding time requirements.

3.4.7. Sample Packaging

Samples collected must be handled and transported in a manner that will protect against any harmful effects to the samples or the environment due to breakage, leakage, or spoilage. Sample handling procedures will be closely supervised and recorded to minimize the potential for loss modification, or tampering during transit to the analytical laboratory. The samples will remain under DEQ's control at all times.

3.4.8. Sample Shipping

Shipping dates, method of shipment (hand delivered), and shipment identification numbers will be recorded in the field logbook and on the Chain-of-Custody (CoC) forms. Samples will be stored in the field in coolers containing blue ice or gel packs to maintain appropriate temperature and sample integrity, in accordance with "Users Guide to the Contract Laboratory Program" (USEPA, 1988a). DEQ personnel will deliver sample coolers to Western Aviation in Boise, which will fly the sample coolers to their operations at the Coeur d'Alene airport. Western Aviation personnel will then transport the sample coolers directly to the SVL Analytical facility.. Samples must be received by SVL Analytical facility no later than 5:00 p.m. Copies of the CoC will be retained in the DEQ project files.

3.4.9. Sample Custody Procedures

Sample custody and documentation procedures will include completion of CoC forms, transportation tracking, and laboratory acceptance procedures. Sample integrity will be maintained through strict adherence to these procedures. CoC forms will be completed on a daily basis and will be maintained separately from all other documentation. The CoC form will be completed by the sampler prior to releasing each cooler containing samples for transportation to the laboratory. Analytical requests will be identified on the CoC. The information for each sample on the CoC will duplicate information provided on each sample container label. The form will be taped to the inside lid of the cooler containing samples prior to transportation to the laboratory. The laboratory will receive the original CoC plus a carbon copy. A copy of the CoC will be retained in the project files.

3.4.10. Laboratory Receipt

When samples arrive at SVL Analytical, the laboratory personnel receiving the sample cooler will evaluate the integrity of the samples and sign the CoC form. The laboratory will assign work order numbers to the samples to be used in its internal tracking system. The status of a sample can be checked at any time by referring to the laboratory numbers on the CoC form and the laboratory work order numbers in their logbooks. Both the laboratory and sample numbers will be cited when analytical results are reported. The laboratories will send a copy of each signed CoC along with the analytical data package to the Site Manager (Brian Gaber). Damaged sample containers, cooler temperatures, and sample labeling discrepancies between samples and CoC, and analytical request discrepancies will be noted on the form. The laboratory will contact the Project Manager/Site Manager, Brian Gaber, for problem notification and resolution.

3.5.QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

This Section describes QA/QC procedures that will be implemented during data collection activities associated with the Preliminary Assessment/Site Investigation at the Sonnemann Mine. QA/QC procedures govern all aspects of data collection and analytical efforts to ensure that the data collected are representative of conditions in the field and that analytical results are valid and accurately reported.

3.5.1. Quality Assurance Objectives (QAO)

The overall Quality Assurance Objectives (QAOs) for this SI are to develop and implement procedures to obtain and evaluate various levels of data that can be used to satisfy the goal of identifying potential risks to human health or the environment, as defined by CERCLA.

3.5.2. Quality Assurance Objectives for Measurements

Quantitative QAOs for the measurement of various analytes are based on method detection limits, precision, accuracy, and completeness. The definition of each term is provided below (USEPA, 1986, 1987b, 1988b).

Method Detection Limit (MDL): The lowest concentration for which there is at least a 95 percent (95%) chance that an analyte will be positively detected.

Practical Quantitation Limit (PQL): The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Precision: The agreement of a set of results among themselves, and a measure of the ability to reproduce a result.

Accuracy: An estimate of the difference between the true value and the determined mean value. The accuracy of a result is affected by both systematic and random errors.

Representativeness: The degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at the sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program.

Comparability: A qualitative parameter expressing the confidence with which one data set can be compared to another. This goal is achieved through using standard techniques to collect and analyze representative samples, and by reporting analytical results in appropriate units.

Quantitative QAOs for the project analytical methods include:

- MDLs, PQLs, precision, accuracy, completeness, and QC limits for initiating corrective action for each method (if available).
- Qualitative QAOs include determining the representativeness and comparability of the data to be collected.
- Representativeness is established by selecting procedures that will produce results that accurately, precisely, and reliably depict the measured matrix and conditions.

The representativeness of a result is associated with developing and following proper protocols for: sample handling (storage, preservation, packaging, custody, and transportation); sample documentation; and laboratory sample handling and storage procedures.

- Comparability of the data will be maintained using established EPA procedures for sampling activities and analytical methods. Actual MDLs and PQLs reported by the laboratory may vary due to the nature of individual samples.

3.5.3. Detection Limit Goals

An objective of the analytical program is to collect high quality analytical data from each media sampled. Where technically feasible, the analytical objective is to achieve sample detection limits at or below available regulatory guidance.

3.5.4. Sample Containers, Preservation and Holding Time

The types of sample containers that will be used are based on the analytical plan for each media to be collected. Table 1 lists the type of analysis, sample preservation (including storage conditions), and holding time requirements that will govern sample-handling procedures.

3.5.5. Field Sampling Quality Control Samples

Field QA/QC samples will be collected during sampling efforts. This will include field duplicates and matrix spike. The number of field QA/QC samples to be collected during the sampling activities includes the following:

- Field duplicates will be collected at a rate of one duplicate per ten samples per media.
- Matrix spike will be collected at a frequency of one per twenty primary samples.

3.6.ANALYTICAL PROCEDURES

3.6.1. Laboratory Analyses

The analytical procedures that will be used for samples collected during the SI investigation are provided in Table 1. The Project Manager will be responsible for scheduling analyses and will serve as the primary contact for all laboratory issues and problem resolution. SVL Analytical of Kellogg, Idaho will perform the chemical analyses of soil and water samples. The USEPA and DEQ have certified SVL Analytical. Quality Assurance Programs and standard operating procedures for this laboratory are available for review upon request.

3.6.2. Data Validation

Internal laboratory data validation checks will be performed by the laboratory and reviewed by the Site Manager/Project Manager for all laboratory analyses. The following guidelines will be used for data validation reviews of all analyses performed:

- "Test Methods for Evaluating Solid Waste," SW-846 (USEPA, 1986) or latest version.
- "USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review," EPA 540/R-94-013 (USEPA, 1994a), where appropriate.
- "USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review," EPA 540/R-94-012 (USEPA, 1994b), where appropriate.
- "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020 (USEPA, 1983).
- "Water Quality Standards and Wastewater Treatment Requirements" (IDAPA 58.01.02).

Components of the data validation checks will include an evaluation of: holding times, initial and continuing calibrations, system performance, method blanks, matrix spike/matrix spike duplicates, field duplicates, compound identification, compound quantification, and reported detection limits. Data qualifiers will follow those used in the EPA's Contract Laboratory Procedure (CLP) program. Data validation will be performed based on QA/QC criteria specified to each method. A "summary" CLP-equivalent data review will be performed by DEQ's Technical Services Division, and reviewed by the Site Manager/Project Manager, for all data received from the laboratory. The summary review will involve evaluating the data summary and QA/QC summary sheets provided by the laboratory with each data package. The summary review does not include spot-checking the raw data packages or calculations. If the summary review indicates potential problematic areas within a data set, a "standard" review to include checking raw data and calculations will be performed.

3.6.3. Field QA/QC Sample Evaluation

During the Site Investigation and following the data validation reviews of each analytical data set, field procedures and QA/QC sample results will be evaluated. This will provide information regarding the potential introduction of artificial contaminants during the sample collection process, cross-contamination, and site variability. If the introduction of contaminants is indicted by the QA/QC data, specific data will be flagged and qualified as necessary. Discussion of the QA/QC data will be included in the SI Report.

3.6.4. Data Reduction and Reporting

Data obtained in the field will be recorded daily in bound field logbooks and will be maintained by the Site Manager. The field data package will be reviewed by the Site Manager to determine if the field records are complete, and measurements specified in the SP have been performed. Data validation and review of laboratory and field measurement analytical data collected during the sampling efforts will be conducted as described previously. Field and laboratory measurements will be tabulated and reviewed as part of the data validation and reduction efforts.

3.6.5. Internal Quality Control (QC) Checks

Internal QC checks will be performed for field sampling activities and laboratory activities. Internal QC checks of sampling procedures will be performed by submittal and

evaluation of field QA/QC samples. Laboratory analytical internal QC checks will consist of QA/QC criteria and QC limits specified for each methodology and QC checks outlined in each analytical methodology. The frequency of laboratory QC sample analyses, such as laboratory method blanks, duplicate analyses, and matrix spike/matrix spike duplicate analysis will be based on specifications outlined in each specific methodology.

3.7.QUALITY ASSURANCE (QA) REPORTING

QA information that will be reported to the Project Manager and submitted to the project file includes the following:

- Results of data validation reviews
- Field measurements
- Equipment calibration and preventative maintenance activities
- Results of data precision and accuracy calculations
- Evaluation of data completeness and contract compliance
- Field and/or laboratory QA problems and recommended and/or implemented corrective actions

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Table 1. SAMPLE CONTAINERS, PRESERVATIVES AND HOLDING TIMES.

MEDIA	ANALYSES	METHOD REFERENCE	METHOD	CONTAINER	PRESERVATIVE	HOLDING TIME
Soil	RCRA Metals	EPA SW-846	6000/7000 Series	8-oz or 4-oz glass jar	Cool to 4° C	6 months (Hg - 28 days)
	TCLP Metals	EPA SW-846	TCLP	4-oz glass jar	Cool to 4° C	6 months (Hg - 28 days)
Surface Water	Total Recoverable RCRA Metals	EPA SW-846	6000/7000 Series	1 liter poly	HNO_3 (pH<2), Cool to 4° C	6 months (Hg - 28 days)
	Dissolved Metals, plus Zn & Cu	EPA SW-846	6000/7000 Series	1 liter poly	HNO_3 (pH<2), Cool to 4° C	6 months (Hg - 28 days)
	Hardness	EPA SW-846	EPA 2340B	1 liter poly	HNO_3, Cool to 4° C	6 months
Ore	Total Recoverable RCRA Metals	EPA SW-846	6000/7000 Series	2 to 5 lbs. Cloth bag	None	6 months (Hg - 28 days)

Notes:

oz	=	Ounce			
°C	=	Degrees Celsius	Cu	=	Copper
EPA	=	U.S. Environmental Protection Agency	Zn	=	Zinc
HNO_3	=	Nitric Acid	Hg	=	Mercury
Poly	=	Polyethylene bottle/container			
RCRA	=	Resource Conservation and Recovery Act	TCLP	=	Toxic Characteristic Leaching Procedure

Table 2. DATA QUALITY OBJECTIVES SUMMARY.

ACTIVITY	MEDIA		
	Soil	Surface Water	Ore
Objectives	To assess potential metals	To assess potential contaminant transport	To assess potential metals
Constituents of Concern	Metals	Metals	Metals

4. INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT PLAN

Surface water is expected to be non-hazardous under the Resources Conservation and Recovery Act (RCRA). Any quantities of soils and sediments that are not collected as samples will be spread around the sample location and covered with surficial soil. These soils are expected to be RCRA non-hazardous. Any sediment, not collected as samples, will be returned to the surface water.

In the process of collecting environmental samples at the Sonnemann Mine, the DEQ sampling team will generate different types of potentially contaminated investigation-derived waste (IDW) that may include the following items:

- Personnel protective equipment (PPE) **–** Including disposable coveralls, gloves, booties and other PPE.
- Disposable equipment **–** Which may include plastic sheeting and equipment covers, aluminum foil, broken or unused sample containers, sample container boxes, tape, and other related items.
- Decontamination fluids **–** Any spent detergent and wastewater
- Packing and shipping materials.

The U.S. EPA's National Contingency Plan requires management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements to the extent practicable. The IDW will contain minor residual amount of the soil/sediment. These wastes are not considered hazardous and will be disposed of at a municipal landfill. Used PPE and disposable equipment will be double bagged and placed in municipal refuse dumpster. Non-disposable sampling equipment will be decontaminated by scrubbing with a non-phosphate detergent solution and water, with a final de-ionized water rinse. Decontamination fluids that will be generated during sampling will consist of de-ionized water, residual contaminants, and water with non-phosphate detergent. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area, or transported to the DEQ Office in a 5-gallon plastic pail for disposal to the sanitary sewer system.

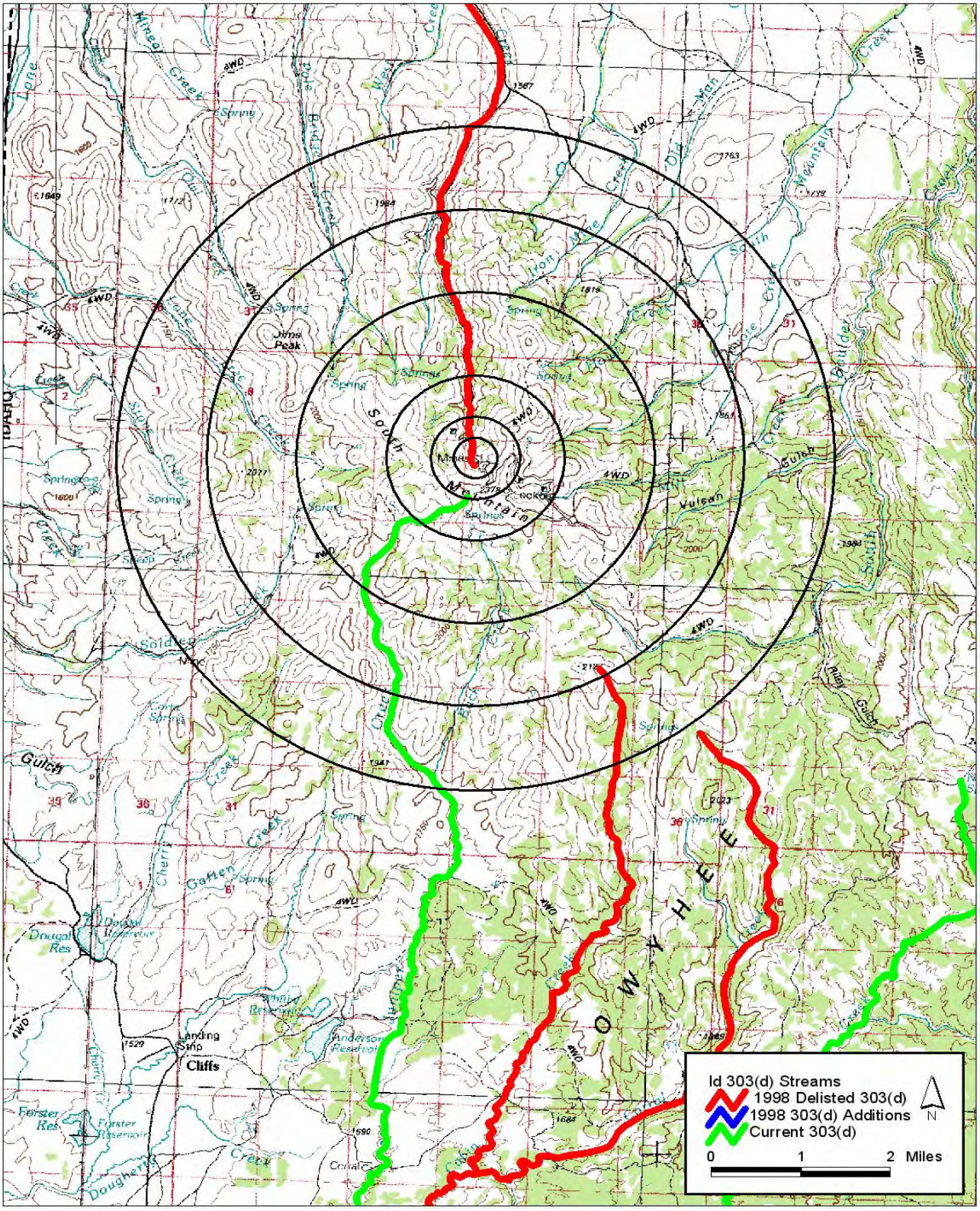


Figure 4-1. Sonnemann Mine 4-Mile Radius Map.

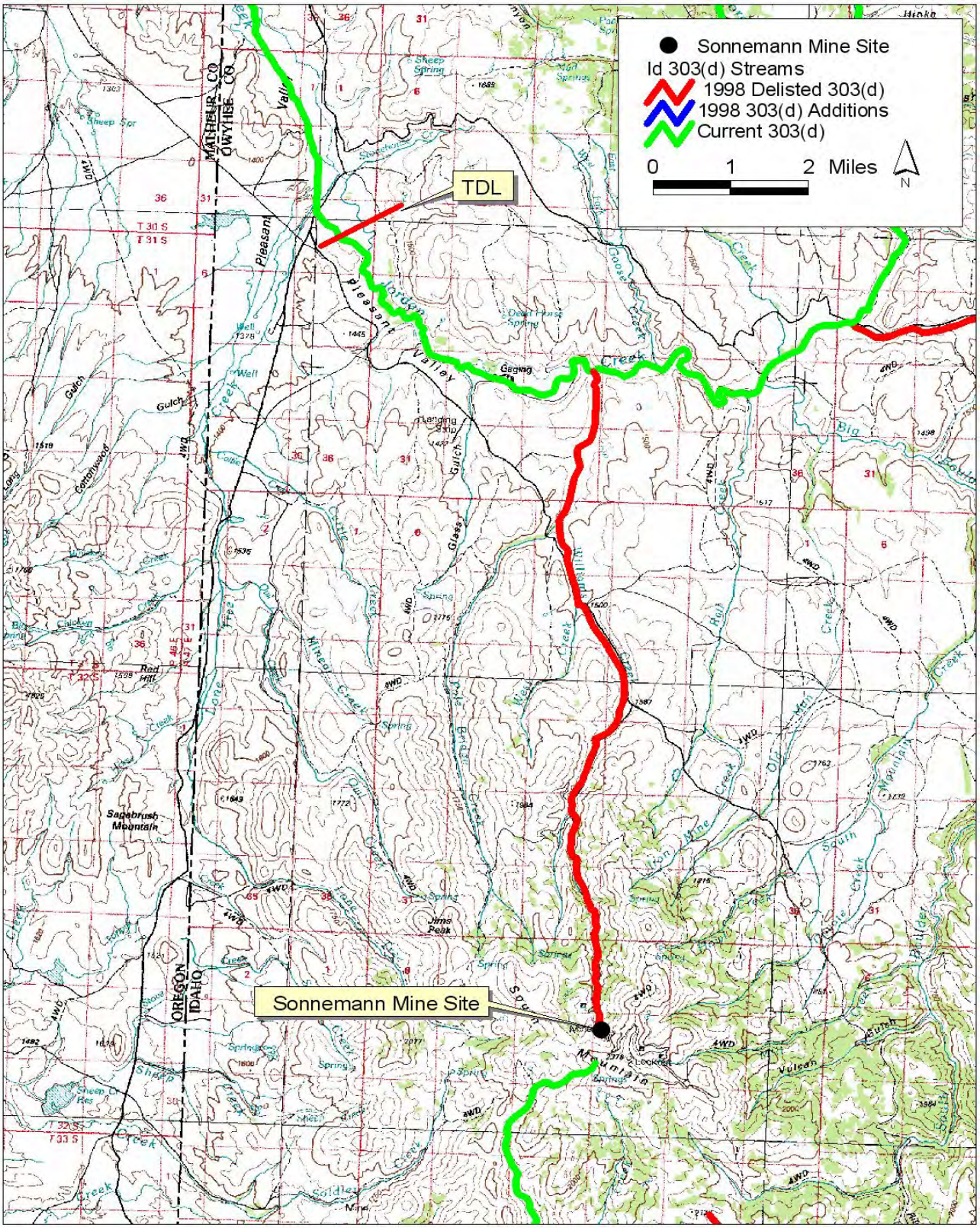


Figure 4-2. Sonnemann Mine 15-Mile Total Distance Limit (TDL) Map.

Sonnemann Mine & Mill Site Investigation Health and Safety Plan

August 2004

		TELEPHONE
DEQ Project Number:	**RMIN.SMCR**	
Project/Site Manager:	**Brian Gaber**	**208-373-0566**
Site Safety Officer:	**Curtis Stoehr**	**208-373-0542**
Project Field Duration:	**August 2004 – September 2004**	
Project Completion Date:	**March 2005**	

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ATTACHMENTS

Attachment A Hospital Route Map

1. SUMMARY

This section provides a summary of pertinent information contained in this Health and Safety Plan. The Site Manager will be issued a satellite telephone to be used for all emergencies encountered during the SI project.

Ambulance	-	Idaho Life Flight St Alphonsus Regional Medical Center – Boise, Idaho
Fire	-	BLM Boise Fire District 208-384-3400
Police	-	Owyhee County Sheriff 911 or 208-495-1154 or 208-337-4222
Hospital	-	West Valley Medical Center 1717 Arlington Caldwell, ID 83605 (208) 459-4641

Project/Site Manager: Brian Gaber 208-373-0566

Site Safety Officer: Curtis Stoehr 208-373-0542

2. SITE DESCRIPTION AND SCOPE OF WORK

2.1.Site Description

This section provides a description of the Sonnemann Mine and Mill to be visited as part of this SI.

2.1.1. Site Location

The Sonnemann is inactive silver and lead mine located in Owyhee County, Idaho, approximately 18 miles southeast of Jordan Valley, Oregon, and 20 miles south of Silver City, Idaho (Figure 2-1). The mill site lies immediately adjacent to the mine's portal. The site is located near the headwaters of Williams Creek on the northwest flank of South Mountain. The Site is situated on private property owned by the South Mountain Mining Company, though ownership of the tailings pile appears to be public land, managed by the Bureau of Land Management. The Site lies along the eastern side of Williams Creek, a northward flowing drainage from South Mountain and an influent tributary to Jordan Creek.

The Sonnemann Mine and Mill (Sonnemann) can best be accessed from Jordan Valley, Oregon. Traveling east on Yturri Boulevard from the 90° curve on Highway 95, continue for 1.8 miles. At this point Yturri Boulevard becomes Pleasant Valley Road. Continue traveling on Pleasant Valley Road for 1 mile then take a right-hand turn to stay on Pleasant Valley Road. Continue traveling on Pleasant Valley Road for 2.8 miles then take a right-hand turn (portions of road are unpaved). Continue for 1.6 miles then take a left-hand turn onto South Mountain Road. Continue traveling on South Mountain Road for 13.3 miles. The upper portions of the road are narrow and rocky, high-clearance and/or four-wheel drive vehicles may be required. The Sonnemann Mine and Mill site lies on the east side of Williams Creek.

The Sonnemann lies at an elevation of 6840 feet above mean sea level (amsl) and is located in the NW ¼ of the NW ¼, Section 10, T 8S, R5 W, on the Cliffs 7.5-minute quadrangle (Figure 2-2). The site is also known by several other names including the Sonneman Mine, new Golconda Tunnel, and South Mountain Mine.

2.1.2. Site History

Mining in the South Mountain area began in the late 1860's and worked in the early 1870's (Sorenson, 1927). In 1874, a small smelter was established in the townsite of Bullion City, later renamed South Mountain, which lies 0.75 miles north of the Sonnemann Mine. The new Golconda or Sonnemann Mine was developed to access the Golconda vein below the Golconda tunnel. The Sonnemann was eventually driven 3,000 feet to connect the workings of the Texas mine. Between the periods of 1868 to 1875, 1906 to 1920, 1940 to 1946, and 1954 to 1955, the Golconda Group conducted mining activities. From 1963 until 1983, only exploration and development activities were conducted. The mill was last operated in 1955, when it was dismantled.

2.2.PURPOSE AND SCOPE OF WORK

The scope of work to be performed at the Sonnemann Mine & Mill site is intended to characterize the environmental conditions currently encountered at the Site. The scope of work for the field activities includes the following tasks:

- Surface and subsurface soil sampling
- Mine waste rock sampling
- Surface water sampling
- Documentation of physical site characteristics and hazards
- Survey of natural resources.

2.3.CONSTITUENTS OF CONCERN

Based on previous sampling and analysis of site media conducted at other similar mines sites in Idaho, the following constituents may be encountered during field activities:

1. Soil and Waste rock - metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) - low to moderate concentrations.
2. Sediments - metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) - low to moderate concentrations.
3. Surface water - metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver) – low concentrations.

The exposure route for metals while sampling soil and waste rock is by ingesting or inhaling contaminated dust. The exposure route for metals while sampling surface water and sediments adjacent to the surface water is by ingesting or dermal contact from contaminated water.

3. SAFE WORK PRACTICES

3.1.General

1. Safety briefings will be held at the mine site prior to starting the day's activities. The briefings will include a review of the potential hazards associated with the work to be done that day, and a review of associated safe work practices.
2. Avoid dermal contact with potentially contaminated soil and water. Wear gloves.
3. In the unlikely event that dusty conditions are encountered, dust filter masks will be worn to reduce potential for breathing in contaminated dusts.
4. Eating, drinking, chewing gum or tobacco, and smoking are prohibited in potentially contaminated areas or where the possibility for the transfer of contamination exists.
5. Personnel will wash their hands and face thoroughly with soap and water prior to eating, drinking or smoking.
6. Potable water will be made available at the Site.

7. Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling, leaning or sitting on contaminated surfaces.
8. Field team members should maintain frequent visual contact with one another. Any activities in or around water, pits, or other hazardous areas require a minimum of two personnel.

3.2.Field Equipment

3.2.1. Health and Safety Equipment Inventory

PPE	**Required**	**Optional/ as Necessary**
Satellite telephone	Y	
Safety glasses	Y	
Steel-toed boots		Y
Sturdy boots	Y	
Chemical resistant rubber boots	Y	
Waders		Y
Tyvek coveralls	Y *	
Dust filter mask		Y
Air filtering respirator (acid-gas cartridges)		Y
Work gloves	Y	
Nitrile and/or Latex gloves	Y	
First Aid Kit	Y	
Drinking water	Y	
ABC type fire extinguisher	Y	
Sunscreen	Y	
Insect repellent		Y
Hat		Y
Hard hat	Y**	

* Required when conducting sampling activities
** Required when entering structures

3.3.Safe Sample Handling Practices

3.3.1. Project Hazard Analysis

Activity, Phase or Task	Chem. Hazard	Heat / Cold Stress	Slip/ Trip/ Fall	Lifting Hazard	Mech. Hazard	Water Hazard
1. Site walk-through evaluation	Low	Low	High	Low	Low	Low
2. Soil/waste rock sampling	Low	Low	Med	Low	Low	N/A
3. Sediment sampling	Low	Low	High	Low	Low	High
4. Water sampling	Low	Low	Med	Low	Low	Med
5. Structure evaluation *	Low	Low	High	Low	Low	N/A

* Prior owner/operator approval and Site Manager pre-survey required

High - Exposure likely more than 50% of the time Med - Exposure likely 10-50% of the time

Low - Exposure likely less than 10% of the time N/A - Exposure not anticipated

3.3.2. Personal Protective Equipment (PPE) Requirements

TASK	MINIMUM PPE REQUIREMENTS
1	Sturdy boots and clothing, work gloves as necessary
2	Sturdy boots (chemical resistant as necessary), safety glasses, nitrile/latex gloves
3 & 4	Rubber boots/waders, safety glasses, nitrile gloves
4 & 5	Sturdy boots and clothing, work gloves as necessary, safety glasses, hard hat

3.3.3. Sample Collection

For all sampling activities, the following standard safety procedures shall be employed:

1. All sampling equipment should be cleaned before proceeding to the site.
2. At the sampling site, sampling equipment should be cleaned after each use.
3. Work in "cleaner" areas should be conducted first where practical.

3.3.4. Personal Exposure Sampling

No personal exposure sampling will be performed.

3.3.5. HAZ-COM Materials Inventory

Nitric acid (sample preservative)

3.3.6. Sample Shipment/Hazardous Material Shipment

The Site Manager will be responsible for ensuring that hazardous materials are managed and shipped in accordance with DOT regulations [49 CFR Parts 171-177].

3.4.Monitoring

Due to the low potential for encountering volatile or radioactive contaminants, real time monitoring will not be used.

Since the main contaminants of concern are metals, metal-bearing dusts should not be inhaled. Should dusty conditions be encountered, the Safety Officer (SSO) will determine if dust control measures (filter masks or respirators) are required.

4. EMERGENCY RESPONSE PLAN

4.1.General

The DEQ will evacuate personnel from areas involved in hazardous material emergencies and summon assistance from agencies with personnel trained to respond to the specific emergency. These procedures will be reviewed during the daily onsite safety briefings conducted by the SSO. In the event of a fire or medical emergency, the emergency numbers identified in Section 1.0 can be called for assistance.

4.2.Assembly Locations

In the event of a site emergency requiring evacuation, all personnel will evacuate to a pre-designated area located a safe distance from any health or safety hazard and away from the area of influence. The SSO will designate a primary assembly area. The location of this area will be determined during the on-site safety briefing prior to the initiation of site activities. If

adverse conditions arise (wind direction/speed), the SSO will evaluate the assembly area and redirect personnel to an alternate location.

4.3.Fire

To protect against fires, ABC type fire extinguishers will be available to contain and extinguish small fires. The appropriate fire department will be summoned in the event of any fire on the site.

4.4.Communication

Emergency telephone numbers (see Section 1.0) will be maintained with the satellite telephone. The SSO is responsible for testing the communication equipment prior to the start of work, and for explaining its operation to all site personnel.

4.5.Emergency Response Procedures

Emergency Response Team

The emergency response team will consist of team members who assume the following roles:

- Emergency Care Provider
  Provides first aid/CPR as needed. Current first aid/CPR training certification is required.
- Communicator
  The role of the communicator is to maintain radio contact with appropriate emergency services, to provide as much information as possible, including the number of persons injured, the type and extent of injuries, and the exact location of the accident scene.
- Site Supervisor
  The site supervisor should survey and assess existing and potential hazards, and evacuate personnel as needed. Follow-up duties include documenting the incident, and notifying appropriate personnel/agencies described under incident reporting. It also includes reviewing and revising site safety and contingency plans, as necessary.

4.6.Incident Report

All site injuries and illnesses must be reported to the SSO, immediately following first-aid treatment. The Site Manager will determine the cause of the incident and take the appropriate action to prevent a reoccurrence. Any injury or illness, regardless of severity, is to be reported to the Project Manager. The completion of an accident report form is required.

4.7.Hospital Directions

Caldwell/Boise

Life-threatening emergency medical transport to Boise, Idaho will be arranged through Life Flight Services. St. Alphonsus Regional Medical Center in Boise is the closest trauma center to the Site.

To reach the hospital from the Site for other than a life-threatening emergency, travel by

vehicle north on South Mountain Road to Pleasant Valley Road, then turn left onto Cow Creek Road and veer left at the next two intersections. This road becomes Yturri Blvd at the Oregon border. Follow Yturri until Jordan Valley; turn right onto US 95 (north). Travel on US 95 for 44.5 miles, then turn right onto ID Highway 55 and continue for 11.5 miles, then turn left onto S. 10th Ave. and continue for 3.3 miles. Turn left onto East Elm Street for 0.1 miles, then turn right on Arlington Ave to the hospital. (Hospital route map is located in Attachment A).

5. TRAINING AND MEDICAL SURVEILLANCE

All DEQ site personnel will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours HAZWOPER training
- Eight hours of annual refresher training for all personnel (as required)

All DEQ site personnel are participating in medical monitoring programs that meet the requirements of 29 CFR 1910.120(f). Current copies of training certificates and statements of medical program participation for all DEQ personnel are maintained at the state office in Boise.

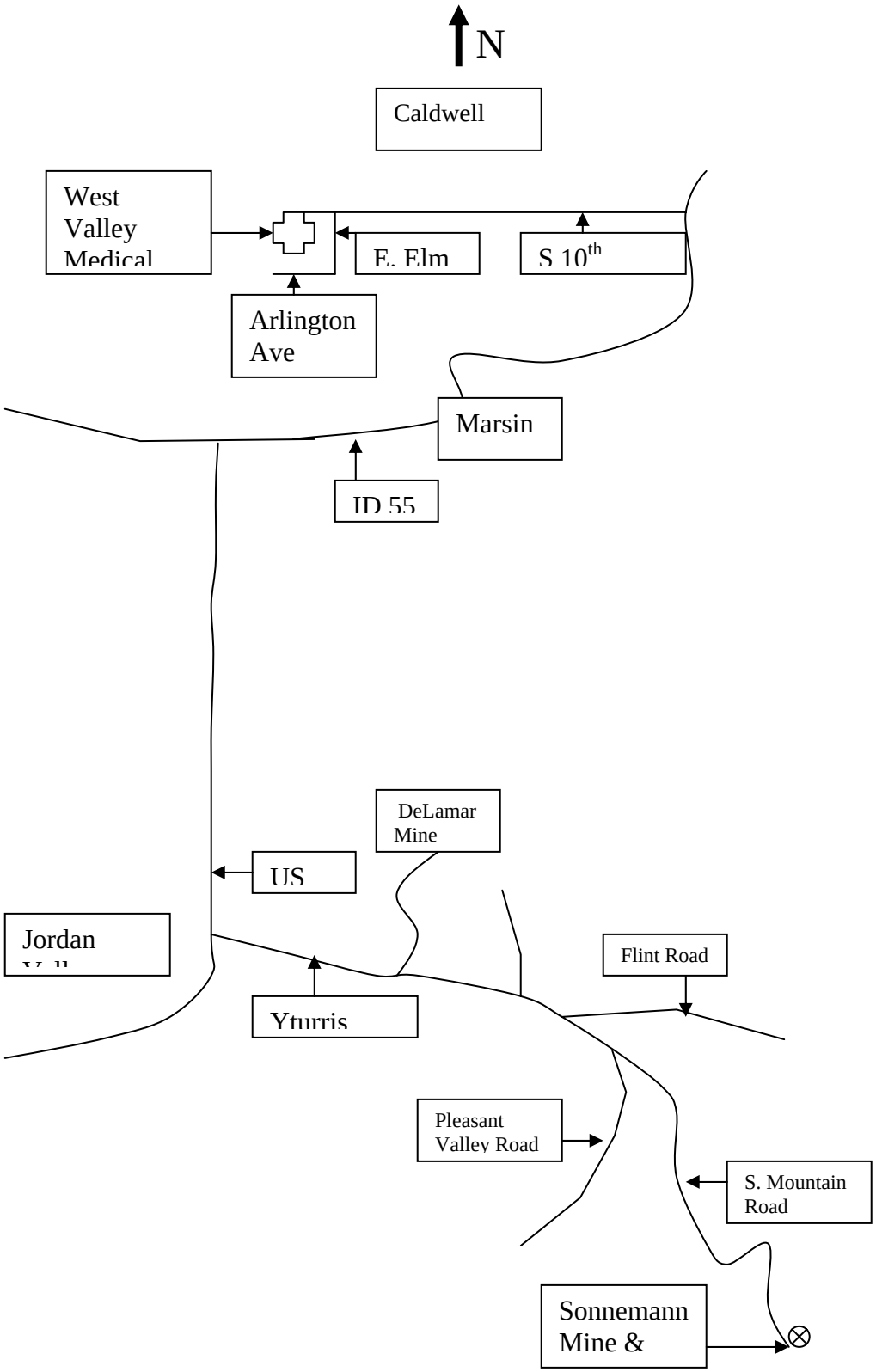
Prior to initiation of SI activities, the SSO will conduct a site safety briefing, which will include all team members involved in site activities. At this meeting, the SSO will discuss:

- Contents of this Safety Plan
- Types of hazards at the site and means for minimizing exposure to them
- Personal protective equipment that will be required
- Safe work practices and communication
- Location and use of emergency equipment
- Emergency procedures, including location of assembly area, evacuation signals and procedures.

6. RECORDKEEPING

The Site Manager and the Site Safety Officer are responsible for site recordkeeping. The Site Safety Officer will conduct a Safety Briefing in accordance with Section 5.0 prior to each day's field activities. Any accident or exposure incident will be investigated and findings forwarded to the Project Manager.

ATTACHMENT A
HOSPITAL ROUTE MAP



APPENDIX G: FIELD NOTES

"Rite in the Rain®"
ALL-WEATHER WRITING PAPER

FIELD

All-Weather Notebook
No. 351

SONNEMANN SI
August 23-24, 2004
South mountain Mining Co.
South mountain, Idaho

4 5/8" x 7" - 48 Numbered Pages
for DEQ

8/23/04 cool, partly cloudy
9:30 onsite
Site recon
Ken Henderson, Curtis Stoehr + Brian Gabel

sample downgradient of williams creek ~~at~~ below 1 mile road to mexican Hat mine (end of patents)
~~to~~ SONN-W-1, water sample unfiltered from creek flow - 11:35 hrs collected by BG cubitainer added 3ml HNO_3 to container after sample collection
collected a filtered (.25 micron) water sample SONN-W-~~2~~ BG 1 Duplicate for Ken Henderson in cubitainer - collected by KH

sample SONN-R-1 assay rock sample of slag pile (old smelter) - 12:15 hours
slag pile measures 30' width 78' length ~ 8 ft thickness, estimate ≤ 500 yds^3
collected by BG; measured with FG tape
~~samples at confluence of Williams Creek and~~ BG

Sample SONN-W-2
Nutter creek flow from SW to williams creek rd and old townsite of South mountain
- sample collected 10 ft upstream from confluence of Nutter + williams creeks checking for any influence of metals in water from Bay state Group mines adjacent to Nutter creek
- duplicate also collected SONN-W-2 dupl HNO_3 3mL added to each unfiltered water sample-cubitainer - 12:55 hours collected by BG
- Sediment sample SONN SD-1 williams Creek below trib. ~~SONN-W-3 water sample same place~~ SONN-W-3 base of lowest tailing tier from seep BG
Lunch
Onsite at Sonnemann Mill
15:45 hours
- Sediment sample SONN-SD-2 william creek at tailings
Sample taken SONN-W-4 water collected from williams creek adjacent to waste rock pump (NW of mill foundations)
no duplicate collected 15:55 hours
collected by C.S. HNO_3 added 3mL

Sample SONN-W-5 cubitainer
seepage from beneath N toe of waste
rock dump, flow ~~estimated~~ at ~~25~~ 10-15 gpm
16:10 collected by CS acid HNO_3 3mL added

Sample SONN-W-6 cubitainer
williams creek above road + millsite
16:35 - water added HNO_3 3mL
collected by BG HNO_3 added 3mL BG

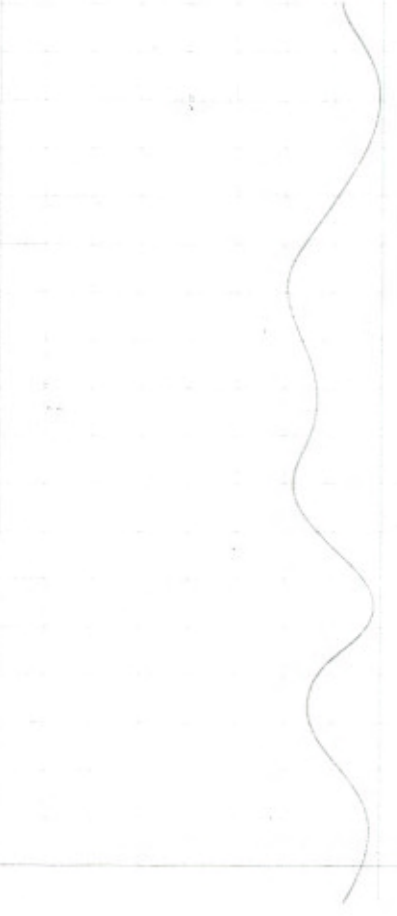
Sample SONN-W-7 cubitainer
~~17:25~~ BG water sample 17:05
closed sonnemann adit seepage
collected by BG

Sample SONN-W-8 cubitainer
17:25 hours golconda seepage from
collapsed adit collected by BG
@ HNO_3 added 3mL BG

Sample collected SONN-W-8 duplicate
250 mL Bottle - collected by BG HNO_3 added 3mL
17:25 hours

Sample SONN-W-9
Upstream tributary above tailings piles collected by BG 17:45 hours

offsite 18:00 hours



8/24/04 Sonnemann SZ

Partly cloudy cool wind 10-15 SW
Onsite 9:45 hours
Drove to base of unnamed tributary. Ken drove his 4WD "mule" Curtis + Brian and sampling gear to mill tailings piles
tailings piles
staked sample locations for Shelby tube samples - to be labeled as SONN-C-1 thru 8
C = core.
Soil Samples - near surface will be labeled as SONN-S-1.. collected in 250 mL Jars ~~10-30 depth 0 inches~~ 6"
Sample SONN-C-1 - brown dirt collected in 250 ml jar 10:35 unable to use shelby tube due to rock in subsurface collected from auger BG

Sample SONN-C-2
mid point upper tier
used hand auger to depth of 2 feet through 6 inches of orange dirt, 6 inches brown dirt, then 12 inches of brown-gray dirt.
Shelby tube sample collected 11:00 hours

8 page 2

sample SONN-C-2 gray dirt/clay

Sample collected at base of Augered hole at depth of 3.5 feet. 250 ml jar SONN-C-2B (base) collected at depth between 3ft 4 in. + 3ft 6 in. gray clay ~~11:25~~ BG 11:25 hours BG

Sample collected SONN-C-3 2ft. 2 at depth of ~~2ft~~ 2.5 feet - orange/brown dirt 11:45 hours BG

Sample collected SONN-C-4 1 Ft dep in brown/yellow clay 12:15 hours BG

Sample collected SONN-C-5 depth of 1.5 ft Brown dirt 12:30 hours

Sample collected SONN-C-6 sample yellow/red dirt. depth of 1.6 ft reached base of red dirt - brown dirt contact at depth of 1.7 ft 12:45

Sample collected brown dirt { SONN-C-7 0.9 ft 12:50

Page 3

Sample collected with Shelby tube at depth of 0-4 inches from surface 13:05 hours
Bright yellow dirt with minor gray dirt

Sample collected "high grade" ore from East side of mill foundations, per Ken the ore was mostly mined from the DMEA zinc ore shoots in the Sonnemann ~~Caldonda~~ & and minor tonnage (< 40 Texas tons) 60 tons in sonnemann
Also, the west side of the foundation was filled with waste rock not ore
sample SONN-R-2 13:30

off-site 14:00 hours

"Rite in the Rain®"
ALL-WEATHER WRITING PAPER

FIELD

All-Weather Notebook
No. 351

Sonneman Mine Site Investigation
Curtis Stoehr
Environmental Compliance Officer
Idaho Department of Environmental Quality

4 5/8" x 7" - 48 Numbered Pages

Site Investigation

CONTENTS

PAGE	REFERENCE	DATE
	8/23/04 9:30 on site	
	Ken Henderson - site Contact	

Sample Site #1 - Downgradient of Williams Creek ≈ 1mile below mexican Hat
(Sonn-W-001) - water sample #1 unfiltered from creek.
- GPS Location #1
- Photo #1

Sample Site #2 - Slag pile
(Sonn-R-001) - Rock Sample #1
80'x 40' ~ 500 yds total
w L
- GPS Location #2
- ~~Photo~~ Local #2

Sample Site #3 -
(Sonn-W-002) - Nutter Creek Prior to the confluence of Williams at South mountain townsite water sample #2
- Gps Location #3
- Photo # 3, 4, 5, 6

Sample Site #4 - ~~tailings Cr.~~
(Sonn-(1)-007) - ~~Sediment sample #1~~
GPS Location #4 water sample #3
- Photo # 7+8 Below lowest Tailings Pile

Sample Site #5
(Sonn SD-001) - Soil sample Below lowest Tailings
GPS Location #5 unnamed creek

Sample site #6
(Sonn SD-002) - soil sample
Williams Creek
-GPS Location #6
- Photo # 10

Sample Site #7
(Sonn-W-004) - water sample ABOVE the ~~Change~~ Rock Dump Adit water confluence Williams Cr.
-GPS Location #7
- Photo #11

Sample Site #8
(Sonn-W-005) - water sample Below the Rock Dump
GPS Location #8
Photo # 12+13

Sample Site #9 - Water Sample - Background upgradient on Wiliams Cr.
(Sonn-W-006)
GPS Location #9
Photo # 14

Sample Site #10 - Water Sample
(Sonn-W-007) Sonn - Closed portal Seal
GPS Location #10
Photo #15 + 16

Sample Site #11 - Water Sample
(Sonn-W-008) Golconda Cr.
Gps Location #11
Photo #17

Sample Site #12
(Sonn-W-009) No Name Cr. Nof Pile
GPS Location #12
Photo #18

Sample Site #13
(Sonn-C-001) Cove Sample of Tailings Pile
GpS Location #13 North side of Top Tier
Photo #19

Sample Site #14 & (Sonn-C-002B)
(Sonn-C-002) Cove Sample of Tailings Pile
GPS Location #14 Middle of top tier
Photo #20

Sample Site #15
(Sonn-C-003) Core Sample of Tailings Pile
GPS Location #15 South side of top tier
Photo #21

Sample Site #16
(Sonn-C-004) Core Sample of Tailings Pile
GPS Location #16 North on middle tier
Photo #22

Sample Site #17
(Sonn-C-005) Core Sample of Tailings Pile
GPS Location #17 middle of middle tier
Photo #23

Sample Site #18
(Sonn-C-006) Core Sample of Tailings
GPS Location #18 South of middle tier Pile
Photo #24

Sample Site #19
(Sonn-C-007) Core sample of Tailin
GPS Location #19 North of lower Tier Pile
Photo #25

Sample Site # 20

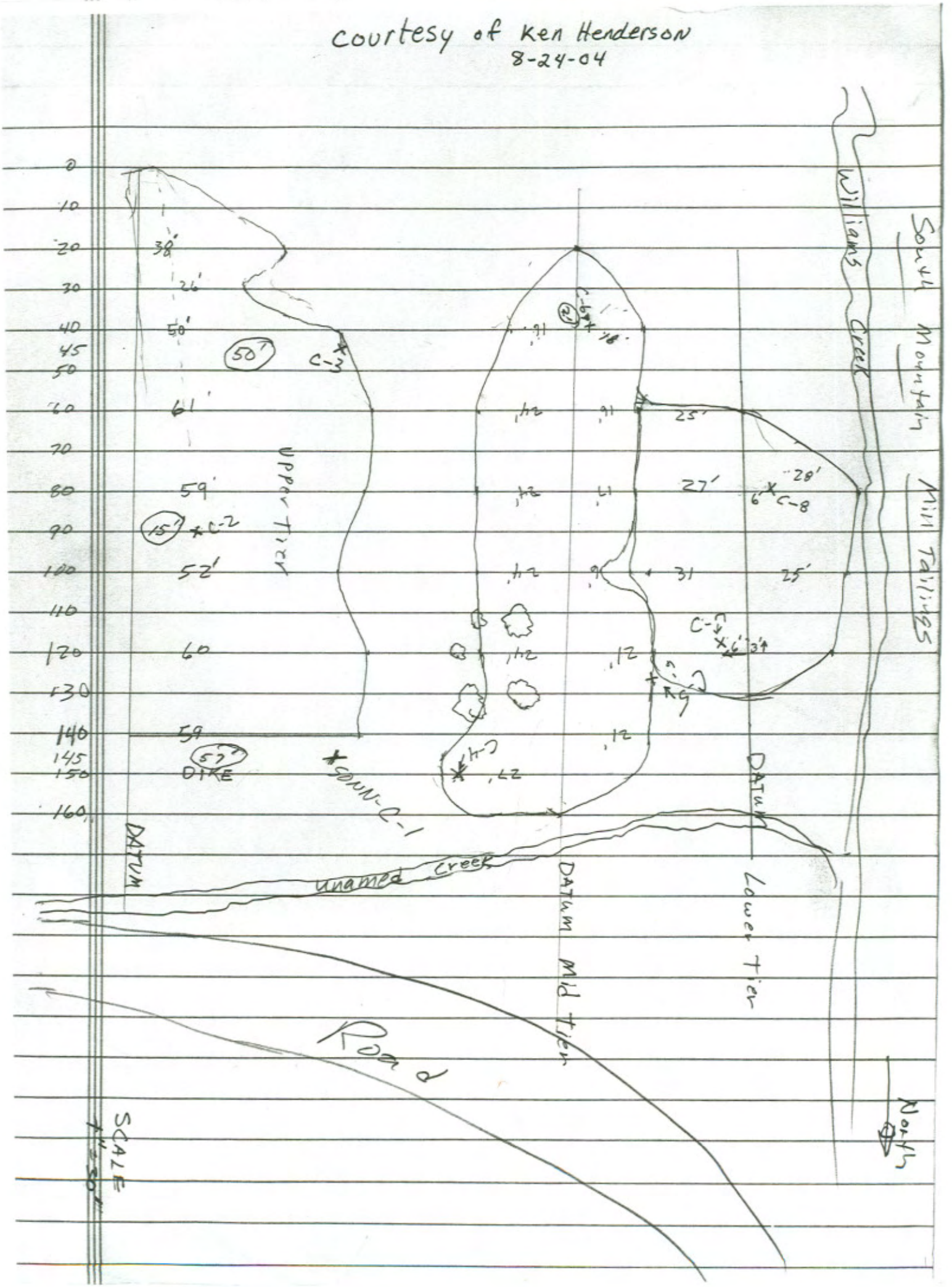
(Sonn-C-008)
GPS Location #20
Photo # 26 + 27
#28, 29 + 30

Core Sample of South Lower Tier

Sample Site #21

Sonn-K-002
GPS Location #21
Photo # 31 + 32

Rock Sample from ore pile


courtesy of Ken Henderson
8-24-04
South Mountain
Williams Creek
Mill Tailings
Upper Tier
Lower Tier
Mid Tier
DATUM
DIKE
C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
Unamed Creek
Road
SCALE
North