Site Inspection Report for Abandoned and Inactive Mines in Southern Idaho:
Volume II:
Flint Creek-South Mountain Area,
Owyhee County, Idaho

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1.0 PROJECT OVERVIEW

1.1 INTRODUCTION

In order to identify and characterize the abandoned and inactive mines with environmental, health, and/or safety problems that are on or that could impact federal and state lands, the U.S. Environmental Protection Agency (EPA), the U.S. Bureau of Land Management (BLM), the Idaho Department of Lands (IDL), and the Idaho Geological Survey (IGS) have undertaken to evaluate the mines in Owyhee County, Idaho. This report describes work that was done in the Flint Creek and South Mountain areas. As the lead state agency for the collection, interpretation, and distribution of information about the geology and mineral resources of Idaho, the state geological survey is keenly interested in cooperative projects that will expand our knowledge of current and historic mining areas. Major funding for this project came from the EPA, Idaho Operations Office. Additional support came from the BLM, Idaho State Office, for the analysis of geochemical samples and from the IDL in conjunction with an ongoing revision of the state’s mines and prospects database.

1.2 PROJECT OBJECTIVES

The overall objectives of this inventory and preliminary characterization process are to:

1. Systematically identify all mine sites with possible human health, environmental, and/or safety related problems.

2. Identify the human health and environmental risks at each location based on site characterization factors (see Section 1.5), including screening-level soil and water samples collected and analyzed in accordance with Environmental Protection Agency (EPA) protocols and quality control procedures.

3. Cooperate with other state and federal agencies, and integrate these data with their programs.

4. Develop and maintain a data file of site information that will enable federal and state agencies to pro-actively respond to governmental and public interest groups.

In addition to the above objectives, the IGS is interested in gathering new information associated with these abandoned and inactive mines. This is an outgrowth of the Survey’s enabling legislation (Sections 47-201–47-204 of the Idaho Code), which designates the IGS as the lead state agency for the collection, interpretation, and distribution of all geologic and minerals data for Idaho.

1.3 ABANDONED AND INACTIVE MINES DEFINED

For the purposes of this study, mines, mills, or other processing facilities related to mineral extraction and/or processing are defined as abandoned or inactive as follows:
A mine is considered *abandoned* if there are no identifiable owners or operators for the facilities, or if the facilities have reverted to federal ownership.

A mine is considered to be *inactive* if there is an identifiable owner or operator of the facility, but the facility is not currently operating and there are no approved plans or permits to operate.

### 1.4 HEALTH AND ENVIRONMENTAL PROBLEMS AT MINES

A variety of safety, health, and environmental problems may occur at abandoned and inactive mines. These include metals that contaminate ground water, surface water, and soils; airborne dust from abandoned tailings impoundments; eroding mine and mill wastes that contribute excessive amounts of sediment to surface waters; unstable waste piles with the potential for catastrophic failure; and physical hazards associated with mine openings and dilapidated structures.

Metals are often transported from a mine by water (ground water discharge or surface runoff) and may be dissolved, suspended, or carried as part of the bedload. When sulfides are present, acid water can form; this, in turn, increases the solubility of metals. This condition, known as acid mine drainage (AMD), is a significant source of metal releases at some mine sites in Idaho. The most important environmental hazard is the contamination of both surface and subsurface water by metals, acid mine drainage, or sediment loading.

#### 1.4.1 Acid Mine Drainage

Trexler and others (1975) identified six factors that govern the formation of metal-laden acid mine waters. They are:

1. availability of acid-producing minerals, particularly pyrite,
2. presence of oxygen,
3. moisture in the atmosphere,
4. availability of leachable heavy metals,
5. availability of water to transport the dissolved constituents, and
6. mine characteristics, which affect movement of air and water through the mine workings.

These factors occur not only within the mines themselves, but also within mine dumps and mill tailings piles, making these wastes potential sources of contamination as well. Formation of acid mine drainage can be reduced if minerals such as calcite, which can neutralize acidity, are present (Trexler and others, 1975; Marvin and others, 1995).

Acid mine drainage is formed by the oxidation and dissolution of sulfides, particularly pyrite ($\text{FeS}_2$) and pyrrhotite ($\text{Fe}_{1-x} \text{S}$). Other sulfides play a minor role in acid generation. Oxidation of
iron sulfides forms sulfuric acid (H$_2$SO$_4$), sulfate ions (SO$_4^{2-}$), and reduced iron (Fe$^{2+}$). When sulfide-bearing rock is mined, the sulfide minerals are exposed to atmospheric oxygen and oxygen-bearing water. Consequently, the sulfide minerals are oxidized, and acid mine waters are produced (Trexler and others, 1975; Marvin and others, 1995).

The oxidation of the reduced iron is the step that limits how much acid will form. The rate of this reaction can be greatly increased by iron-oxidizing bacteria (*Thiobacillus ferrooxidans*). The oxidized iron produced by biological activity promotes further oxidation and dissolution of pyrite, pyrrhotite, and marcasite (FeS$_2$, a dimorph of pyrite) (Trexler and others, 1975; Marvin and others, 1995).

Once formed, the acid can dissolve other sulfide minerals to produce high concentrations of copper, lead, zinc, and other metals. Minerals that can contribute heavy metals to acid mine drainage include arsenopyrite, FeAsS; chalcopyrite, CuFeS$_2$; galena, PbS; tetrahedrite, (CuFe)$_{12}$S$_8$S$_4$; and sphalerite, (Zn, Fe)S. Aluminum can be leached by the dissolution of aluminosilicates common in soils and waste material found in Idaho. The dissolution of any given metal is controlled by the solubility of that metal (Trexler and others, 1975; Marvin and others, 1995).

### 1.4.2 Solubility of Selected Metals

The following information is paraphrased from Marvin and others (1995, p. 5-6). This report cites the following references as sources for this material: Lindsay (1979), Stumm and Morgan (1981), Hem (1985), and Maest and Metesh (1993).

At a pH above 2.2, ferric hydroxide [Fe(OH)$_3$] produces a brownish orange color in surface waters and forms a precipitate with a similar color on rocks in affected streams. If other metals, such as copper, lead, cadmium, zinc, and aluminum, are present in the source rock, they may also precipitate with or adsorb onto the ferric hydroxide (Stumm and Morgan, 1981). Alunite [KAl$_3$(SO$_4$)$_2$(OH)$_6$] and jarosite [KFe$_3$(SO$_4$)$_2$(OH)$_6$] will precipitate at a pH of less than 4, depending on SO$_4^{2-}$ and K$^+$ activities (Lindsay, 1979).

Under acidic conditions, the solubility of the metal controls how much will be released into the environment:

**Manganese** solubility is strongly controlled by the redox state and is limited by the presence of minerals such as pyrolusite and manganite; under reducing conditions, pyrolusite [MnO$_2$] dissolves and manganite [MnO(OH)] precipitates. Manganese is found in mineralized environments as rhodochrosite [MnCO$_3$] and its weathering products.
Aluminum solubility is most often controlled by alunite \([\text{KAl}_3(\text{SO}_4)_2(\text{OH})_6]\) or by gibbsite \([\text{Al(OH)}_3]\), depending on pH. Aluminum is one of the most common elements in rock-forming minerals such as feldspars, micas, and clays.

Arsenic tends to precipitate and adsorb with iron at low pH and de-sorb or dissolve at higher pH. Once oxidized, arsenic will be found in solution in higher pH waters. When the pH is between 3 and 7, the dominant arsenic compound is a monovalent arsenate, \(\text{H}_2\text{AsO}_4\). Arsenic is abundant in metallic mineral deposits as arsenopyrite \([\text{FeAsS}]\), enargite \([\text{Cu}_3\text{AsS}_4]\), tennantite \([\text{Cu}_2\text{As}_4\text{S}_{13}]\), and other minerals.

Cadmium solubility data are limited. When the pH of soils is above 7.5, the solubility of cadmium is controlled by the carbonate species octavite \([\text{CdCO}_3]\); when the pH of the soil is below 6, cadmium solubility is controlled by strengite \([\text{Cd}_3(\text{PO}_4)_2]\). Octavite is the dominant control on the solubility of cadmium in soils. In water, at low partial pressures of \(\text{H}_2\text{S}\), \(\text{CdCO}_3\) is easily reduced to \(\text{CdS}\).

Copper solubility in natural waters is controlled primarily by the amount of carbonate present; malachite \([\text{Cu}_2(\text{OH})_2\text{CO}_3]\) and azurite \([\text{Cu}_3(\text{OH})_2(\text{CO}_3)_2]\) form when \(\text{CO}_3^{2-}\) ions are available in sufficient concentrations. In soil, copper combines readily with iron to form cupric ferrite. Other compounds, such as sulfate and phosphates, may also control copper solubility in soils. Copper is present in many ore minerals, including chalcopyrite \([\text{CuFeS}_2]\), bornite \([\text{Cu}_9\text{FeS}_4]\), chalcocite \([\text{Cu}_2\text{S}]\), and tetrahedrite \([\text{Cu}_{12}\text{Sb}_4\text{S}_{13}]\).

Mercury readily vaporizes under atmospheric conditions and thus is most often found in concentrations well below the 25 \(\mu\text{g/L}\) equilibrium concentration. The most stable form of mercury in soil is its elemental form. Mercury is found in low temperature hydrothermal ores as cinnabar \([\text{HgS}]\), in epithermal (hot springs) deposits as native mercury, and as native mercury in man-made deposits where mercury was used to process gold ores.

Lead concentrations in natural waters are controlled by the formation of lead carbonate, which has an equilibrium concentration of 50 \(\mu\text{g/L}\) when the pH is between 7.5 and 8.5. As with other metals, concentrations in solution increase with decreasing pH. In sulfate soils with a pH of less than 6, the formation of anglesite determines how much lead will remain in solution. The formation of cerussite, a lead carbonate, controls solubility in buffered soils. Lead occurs in the common ore mineral galena \([\text{PbS}]\).
Zinc solubility is controlled by the formation of zinc hydroxide and zinc carbonate in natural waters. When the pH is above 8, the equilibrium concentration of zinc in water with a high bicarbonate content is less than 100 µg/L. Franklinite may control solubility at pH less than 5 in water and soils, and its formation is strongly affected by sulfate concentrations. Thus, production of sulfate from acid mine drainage may ultimately control the solubility of zinc in water affected by mining. Sphalerite [ZnS] is common in mineralized systems.

1.4.3 The Use of pH and Specific Conductivity to Identify Water Quality Problems

Specific conductance (SC) and pH provide a rapid way to distinguish many “problem” mine sites from those that have no adverse water-related impacts. As a rough screening tool, low pH (<6.0) and high SC (variable) usually occur at sites with problems; neutral or higher pH and low SC indicate sites that are less likely to have serious problems.

Limiting data collection only to pH and SC largely ignores the various controls on solubility and can lead to overlooking some types of problems. Arsenic, for example, is most mobile in waters with higher pH values (>7), and its concentration is strongly dependent on the presence of dissolved iron. Cadmium and lead may also exceed standards in waters with pH values within acceptable limits.

Reliance on SC as an indicator of site conditions can also be misleading in certain situations. The SC value of a sample represents 55 to 75 percent of the total dissolved solids (TDS), depending on the concentration of sulfate. Also, it is necessary to have a statistically significant amount of SC data for a study area in order to define what constitutes a high or low SC value.

In some cases, a water sample with a near-neutral pH and a moderate SC could have one or more dissolved metal species that may exceed standards. The complete evaluation of a mine site for adverse impacts on water and soil should include the collection of samples for analysis of metals, cations, and anions.

1.5 METHODOLOGY

1.5.1 Data Sources

The IGS began compiling a database of mining properties in Idaho in 1979. This work has continued to date, and the database (now digital) contains information on some 8,700 mines and prospects. All or parts of the following databases and information sources have been integrated into this digital information system:

1. the Mineral Industry Location Subsystem (MILS) database (U.S. Bureau of Mines)
2. the Mineral Resources Data System (MRDS) database (U.S. Geological Survey)
3. published compilations of mines and prospects data
4. state publications on Idaho mineral deposits  
6. IGS mineral property files  
7. mines and prospects noted on the appropriate USGS 7.5-minute quadrangle maps  
8. data held in private collections or company information  
9. mines and prospects examined in the field as part of abandoned mine lands (AML) studies (1994 to date).

Most of the data for this project were collated with existing data in the IGS Mines and Prospects digital database. As noted, this is the most complete compilation available for information on Idaho’s mining properties. The IGS continues to update the database, which now contains an estimated 85-90 percent of the mining properties in the state. During the field visits, the IGS located some (but not many) mines and prospects for which no previous information existed. Also, a very few mines listed in the database were not found.

1.5.2 Pre-field Screening

Field crews visited most of the mine sites in the study area that were on federal land, emphasizing the properties with the potential to release hazardous substances and those without enough information to make that determination without a field visit. The criteria used to evaluate these sites was similar to that developed by the IGS and the U.S. Forest Service for similar work in north Idaho. The screening criteria (Table 1.5-1) were used to determine if a site had the potential to release hazardous substances or posed other environmental or safety hazards. Published information was also used to help evaluate the sites. Mine sites which were not visited were retained in the database along with the data source(s) that were consulted.

Placer mines were not studied as part of this project. Although mercury was used in amalgamating free gold in placer mines, the complex nature of placer deposits makes detection of mercury difficult and is beyond the scope of this inventory.

Table 1.5-1. Screening Criteria (answer Yes or No to each item).

<table>
<thead>
<tr>
<th>Yes/No</th>
<th>Screening Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mill site or tailings present.</td>
</tr>
<tr>
<td>2.</td>
<td>Adits with discharge or evidence of discharge.</td>
</tr>
<tr>
<td>3.</td>
<td>Evidence of or strong likelihood for metal leaching or AMD (water stains, stressed or lack of vegetation, waste below water table, etc.)</td>
</tr>
<tr>
<td>4.</td>
<td>Mine waste in floodplain or shows signs of water erosion.</td>
</tr>
<tr>
<td>5.</td>
<td>Residences, high public use area, or environmentally sensitive area (as listed in HRS) within 200 feet of the disturbance.</td>
</tr>
<tr>
<td>6.</td>
<td>Hazardous wastes/materials (chemical containers, explosives, etc.)</td>
</tr>
<tr>
<td>7.</td>
<td>Open adits/shafts, highwalls, or hazardous structures/debris.</td>
</tr>
</tbody>
</table>
1.5.3 Field Inspection Procedures

All sites discussed in this report were visited by an IGS geologist. At each site, geologists briefly characterized the geology, described surface workings, and noted if any ore processing facilities were present. Samples for geochemical analysis were collected from selected sites. All site locations were refined using conventional field methods, and each site was located by latitude and longitude and by Township, Range, and Section. If previously determined, these values were checked and corrected, as needed. In addition, Global Positioning System (GPS) readings were taken at a number of the sites visited (Appendix A).

On public lands, sites with ground-water discharge, flowing surface water, or contaminated soils (as indicated by impacts on vegetation) were mapped. Sketch maps show locations of the workings, exposed geology, dumps, tailings, and surface water and geologic sample locations. The site was photographically recorded using both still images and videotape. The videotape record proved especially useful for site description and review, and is recommended for future studies.

1.5.3.1 Soil, Rock, Stream Sediment, and Mine Waste Sampling Procedures

At selected sites identified as having a potential problem, the geologist collected tailings or mine waste samples, as appropriate. Sample locations were selected in areas where waste material was obviously impacting natural areas. In most cases a composite sample was gathered to get as representative a sample as possible. Three types of samples were collected:

1) select tailings or mine waste samples—specimens representing a particular material taken for analysis;

2) composite samples—rock and soil taken systematically from a waste dump or tailings pile for analysis, representing the overall composition of material in the source;

3) leach samples—duplicates of selected composite samples for testing leachable metals.

The three types of samples were used to examine the metal content of dumps and tailings, and to check the availability of metals from leaching when sample sites were exposed to water. Waste materials were not sampled extensively enough to provide reliable estimates of tonnages, grades, or economic feasibility.

1.5.3.2 Water Sampling Procedure

As noted, this project focused on the impacts of mining on surface water, ground water, and soils. The reasoning behind this approach was that a mine disturbance may have high total metal concentrations yet may be releasing few metals into the surface water, ground water, or soil. Conversely, another disturbance could have lower total metal content but be releasing metals in concentrations that adversely impact the environment.
The geologist selected water sample sites based on field parameters (SC, pH, temperature) and observations (such as erosion and staining of soils or stream beds). Sample locations were chosen that would provide the best information on the relative impact of the mine site to surface water and soils. All sample locations were accurately located on topographic base maps. Surface water samples were collected at discharge points.

At each water sampling site, the temperature, specific conductivity, and pH were measured. A unique sample number was affixed to the sample bottle. Two 125-ml samples were collected as required by various EPA analytical protocols. One sample was left raw and the other was acidified with $0.1N$ nitric acid. Both samples were stored in a secured ice box. The samples remained under constant refrigeration and security until submitted for analysis. Laboratory leach tests were used to determine if metals might be released from mine waste material, which could provide additional insight to possible ground-water contamination.

### 1.5.4 Analytical Methods

The Analytical Sciences Laboratory at the University of Idaho performed all of the laboratory analyses using the following EPA-approved protocols and quality assurance standards:

- Water Samples (acidified and unfiltered)—Total Recoverable Metal Screen (EPA Test 200.7).
- Water Samples (acidified and unfiltered)—Arsenic (EPA Test 200.9), Lead (EPA Test 200.9), and Mercury (EPA Test 245.1).
- Water Samples (raw and filtered 0.45 micron filter)—Dissolved Metal Screen (EPA Test 200.7).
- Soil and Waste Material—Element Screen (EPA Test 3050/6010), Leachable Metals (TCLP for Metals) Screen (EPA Test 1311/6010).

### 1.5.5 Standards

EPA and various state agencies have developed human health and environmental standards for various metals. In an attempt to put the metal concentrations that were measured into some perspective, they were compared to these developed standards. However, it is understood that the background metal concentrations in mineralized areas may exceed these standards.

#### 1.5.5.1 Water-Quality Standards

The Safe Drinking Water Act (SDWA) directs EPA to develop standards for potable water. Some of these standards are mandatory (primary) and some are desired (secondary). The standards established under the SDWA are often referred to as primary and secondary maximum contaminant levels (MCLs). Similarly, the Clean Water Act (CWA) directs EPA to develop water-quality standards (acute and chronic) that will protect aquatic organisms. These standards may vary with water hardness and are often referred to as the Aquatic Life Standards. The primary and secondary MCLs along with the acute and chronic Aquatic Life Standards for selected metals are listed in Table 1.5-2. As these standards can vary with water hardness, a range of values is given for some elements. Hardness was not measured for this study.
Table 1.5-2. Standards for contaminants in water.

<table>
<thead>
<tr>
<th>Element</th>
<th>Primary MCL (mg/L)</th>
<th>Secondary MCL (mg/L)</th>
<th>Aquatic Life, Acute (mg/L)</th>
<th>Aquatic Life, Chronic (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>---</td>
<td>0.05-0.2</td>
<td>0.75</td>
<td>0.087</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.05</td>
<td>---</td>
<td>0.36</td>
<td>0.19</td>
</tr>
<tr>
<td>Barium</td>
<td>2</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.005</td>
<td>---</td>
<td>0.004/0.009</td>
<td>0.001/0.002</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.1</td>
<td>---</td>
<td>1.7/3.1</td>
<td>0.21/0.37</td>
</tr>
<tr>
<td>Copper</td>
<td>1.3</td>
<td>1</td>
<td>0.018/0.034</td>
<td>0.012/0.021</td>
</tr>
<tr>
<td>Iron</td>
<td>---</td>
<td>0.3</td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td>Lead</td>
<td>0.015</td>
<td>---</td>
<td>0.082/0.2</td>
<td>0.003/0.008</td>
</tr>
<tr>
<td>Manganese</td>
<td>---</td>
<td>0.05</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.002</td>
<td>---</td>
<td>0.0024</td>
<td>0.000012</td>
</tr>
<tr>
<td>Nickel</td>
<td>0.1</td>
<td>---</td>
<td>1.4/2.5</td>
<td>0.16/0.28</td>
</tr>
<tr>
<td>Zinc</td>
<td>---</td>
<td>5</td>
<td>0.12/0.21</td>
<td>0.11/0.19</td>
</tr>
</tbody>
</table>

1.5.5.2 Soil and Rock Background Standards

It is useful to have some idea about the natural background values of rocks and soils when interpreting geochemical data. Although no whole rock or soil samples were run for this study, an estimate can be made from the analyses presented by Bennett and Galbraith (1975). This study analyzed stream sediment samples collected from active stream channels in the 500-square-mile area surrounding Silver City and South Mountain. The results from these analyses are presented in Table 1.5-3, which shows the data for catchment areas of four different sizes. These samples were analyzed by atomic absorption spectrophotometry, whereas the current samples were analyzed by Inductively Coupled Plasma (ICP) mass spectrometry. However, these values give an indication of the level of contaminants present in various samples.

There are no federal standards for concentrations of metals and other constituents in soils; acceptable limits for such are often based on human and/or environmental risk assessments for an area. Since no assessments of this kind have been done, concentrations of metals in soils were compared to the limits postulated by the U.S. EPA for the Clark Fork Superfund site (Table 1.5-4). The proposed upper limit for lead in soils is 1,000 mg/Kg to 2,000 mg/Kg, and 80 to 100 mg/Kg for arsenic in residential areas.
Table 1.5-3. Mean and threshold values for elements in stream sediment samples for catchment basins of different sizes in the Silver City-South Mountain area, Owyhee County (data from Bennett and Galbraith, 1975; ppm = mg/Kg). Values higher than the threshold may be considered anomalous.

<table>
<thead>
<tr>
<th>Elements (in ppm)</th>
<th>Group 1: All samples (n=450)</th>
<th>Group 2: Catchment area ≤ 3 square miles (n=369)</th>
<th>Group 3: Catchment area &gt; 3 square miles (n=81)</th>
<th>Group 4: Catchment area ≤ 3 square miles; contaminated samples removed (n=308)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Threshold</td>
<td>Mean</td>
<td>Threshold</td>
</tr>
<tr>
<td>Copper</td>
<td>19.5</td>
<td>72.6</td>
<td>19.8</td>
<td>69.2</td>
</tr>
<tr>
<td>Manganese</td>
<td>555.9</td>
<td>1,531.0</td>
<td>569.0</td>
<td>1,589.0</td>
</tr>
<tr>
<td>Zinc</td>
<td>70.8</td>
<td>169.8</td>
<td>70.3</td>
<td>182.4</td>
</tr>
<tr>
<td>Chromium</td>
<td>18.4</td>
<td>62.5</td>
<td>18.4</td>
<td>61.4</td>
</tr>
<tr>
<td>Nickel</td>
<td>18.9</td>
<td>78.2</td>
<td>18.9</td>
<td>77.5</td>
</tr>
<tr>
<td>Lead</td>
<td>15.1</td>
<td>35.2</td>
<td>15.3</td>
<td>35.6</td>
</tr>
<tr>
<td>Silver</td>
<td>0.69</td>
<td>3.24</td>
<td>0.64</td>
<td>2.50</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>1.85</td>
<td>5.27</td>
<td>1.90</td>
<td>5.56</td>
</tr>
<tr>
<td>Gold</td>
<td>12.4</td>
<td>39.8</td>
<td>12.0</td>
<td>33.5</td>
</tr>
<tr>
<td>Copper (cold extractable)</td>
<td>2.5</td>
<td>6.1</td>
<td>2.5</td>
<td>5.9</td>
</tr>
<tr>
<td>Heavy metals (cold extractable)</td>
<td>11.8</td>
<td>20.1</td>
<td>11.7</td>
<td>19.7</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Threshold</td>
<td>Mean</td>
<td>Threshold</td>
</tr>
<tr>
<td>Copper</td>
<td>18.5</td>
<td>87.2</td>
<td>18.4</td>
<td>59.4</td>
</tr>
<tr>
<td>Manganese</td>
<td>491.2</td>
<td>1,254.0</td>
<td>525.0</td>
<td>1,230.0</td>
</tr>
<tr>
<td>Zinc</td>
<td>74.5</td>
<td>270.8</td>
<td>64.6</td>
<td>147.1</td>
</tr>
<tr>
<td>Chromium</td>
<td>18.4</td>
<td>69.4</td>
<td>18.3</td>
<td>58.2</td>
</tr>
<tr>
<td>Nickel</td>
<td>18.8</td>
<td>81.1</td>
<td>17.9</td>
<td>68.4</td>
</tr>
<tr>
<td>Lead</td>
<td>14.3</td>
<td>33.6</td>
<td>14.3</td>
<td>29.0</td>
</tr>
<tr>
<td>Silver</td>
<td>0.88</td>
<td>7.65</td>
<td>0.54</td>
<td>1.15</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>1.66</td>
<td>3.99</td>
<td>1.81</td>
<td>5.06</td>
</tr>
<tr>
<td>Gold</td>
<td>14.4</td>
<td>73.1</td>
<td>10.6</td>
<td>15.8</td>
</tr>
<tr>
<td>Copper (cold extractable)</td>
<td>2.8</td>
<td>6.6</td>
<td>2.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Heavy metals (cold extractable)</td>
<td>12.0</td>
<td>21.3</td>
<td>11.1</td>
<td>16.1</td>
</tr>
</tbody>
</table>
Table 1.5-4. Clark Fork Superfund background levels for selected elements.

<table>
<thead>
<tr>
<th>Material</th>
<th>As (mg/Kg)</th>
<th>Cd (mg/Kg)</th>
<th>Pb (mg/Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Mean Soil</td>
<td>6.7</td>
<td>0.7</td>
<td>20.0</td>
</tr>
<tr>
<td>Helena Valley Mean Soil</td>
<td>16.5</td>
<td>0.2</td>
<td>11.5</td>
</tr>
<tr>
<td>Missoula Lake Bed Sediments</td>
<td>n.a.</td>
<td>0.2</td>
<td>34.0</td>
</tr>
<tr>
<td>Blackfoot River</td>
<td>4.0</td>
<td>&lt;0.1</td>
<td>n.a.</td>
</tr>
<tr>
<td>Phytotoxic Concentration</td>
<td>100.0</td>
<td>100.0</td>
<td>1,000.0</td>
</tr>
</tbody>
</table>

1.5.6 Analytical Results

The results of the sample analyses were used to estimate the nature and extent of potential impacts to the environment and human health. Selected results for each site are presented in the discussion; a complete listing of water quality, soil chemistry, and leach test results are presented in Appendix C. It should be noted that the sampling for this study was of a reconnaissance nature only, sufficient for outlining possible problem areas for future study. Sampling density was not sufficient to provide a statistically valid description of any specific site.

The data fields in the current database are presented in Appendix B, and the format (dBase IV) is compatible with the widely used ARC/INFO Geographical Information System (GIS).

1.5.7 Sample and Site Identification Numbers

All water, tailings, and dump samples were assigned unique numbers. These were determined according to the following system: 1) an initial letter code identifying the person who took the sample (usually the first letter of the last name); 2) one digit for the month; 3) two digits for the day on which the sample was taken; 4) the last two digits in the year in which the sample was taken (i.e., “99,” if the sample was taken in 1999); and 5) two digits, including a leading zero, identifying the individual sample. Site numbers for properties that did not have a database identification number assigned to them were generated in the same manner.
2.0 FLINT CREEK AND SOUTH MOUNTAIN AREAS, OWYHEE COUNTY, IDAHO

2.1 INTRODUCTION

This report describes twenty-one sites in the Flint Creek and South Mountain areas of Owyhee County, Idaho. Five of these properties have produced some ore since 1900, and one had over 1,000 tons of total output during that period. Pre-1900 production, which was substantial for some of these mines, is not well documented. The study area covers the Flint mining district (Figure 2.1-1) along Flint Creek, which drains the southwestern flank of the Silver City Range, and the South Mountain mining district (Figure 2.1-2), north and northwest of South Mountain in west-central Owyhee County.

Many of the older mines are on patented mining claims. The U.S. Bureau of Land Management administers the federal lands in this area, and a few of the mines are on land owned by the State of Idaho.

The twenty-one sites in this report, some of which include parts of several mines and prospects, are on three 7.5-minute topographic maps (U.S. Geological Survey). Locations are shown in Figures 2.1-1 and 2.1-2. Elevations in the Flint district range from about 5,200 feet on Flint Creek near the southern edge of the study area to about 6,600 feet near the northern edge of the area. Elevations in the South Mountain district range from about 6,440 feet at the South Mountain smelter site on Williams Creek, which was the northernmost site examined, to 7,801 feet at the South Mountain Lookout on the southern boundary of the area. Much of the area is covered with thickets of sagebrush and mountain mahogany, and the topography is generally steep.

2.1.1 Summary of the Flint and South Mountain Study Areas

There were twenty-one mining sites (Table 2.1.1-1) examined in the Flint Creek and South Mountain areas. Of these, four have the potential for an environmental impact on adjacent waterways. Two of these have water discharges that exceed one or more water quality standards, one has mill tailings near active waterways, and one site has smelter slag impinging on an active waterway. Of the twenty-one sites, sixteen have open adits or shafts. Three of these sites had gated openings, and three of the properties have multiple open workings.

2.2 GEOLOGY

The most recent references describing the geology of the Flint Creek and South Mountain areas are Ekren and others (1981, 1984). The geology and ore deposits of the area are discussed in Lindgren (1900), Piper and Laney (1926), Bennett and Galbraith (1975), Sorenson, (1927), and unpublished reports on individual deposits. Bennett and Galbraith (1975) discuss the geochemistry of the area between Silver City and South Mountain. A brief description of the geologic framework of the area follows.
Figure 2.1-1. Location of properties in the Flint Creek area (Flint U.S. Geological Survey 1:24,000-scale map).
Figure 2.1-2. Location of properties in the South Mountain area (Williams Creek and Cliffs U.S. Geological Survey 1:24,000-scale maps).
Table 2.1-1. List of mines and prospects visited in the Flint Creek and South Mountain areas, Owyhee County, Idaho. Properties are listed in the order they are discussed in the text.

Explanation:

**Site Number**: Idaho Geological Survey file number, or field designation number.  
**Surface Owner**: S = State; P = Private or Patented claims; BLM = Bureau of Land Management; M = mixed ownership; ? = ownership uncertain.

**Environmental Concerns**: W = water; D = waste dump; T = mill tailings; S = smelter slag. Environmental concerns are noted as follows: W - samples of adit water that exceed one or more water quality standards in the Dissolved Metals Screen, the Total Recoverable Metals Screen, or the arsenic, lead, or mercury tests; T or S - tailings or smelter slag samples that exceed background or environmental standards for one or more elements in the Element Screen, and/or dump or tailings samples that show significant leaching of one or more metals in the TCLP for Metals Screen. Sites with environmental concerns are highlighted.

**Samples**: numbers indicate the number of samples collected: W = water; T = mill tailings; S = smelter slag.

**Physical Conditions**: AO = open adit; AG = gated adit; AC = caved or otherwise closed adit; SO = open shaft; SC = caved shaft; P = pit; T = trench. Numbers indicate how many of each are at the site; queried when type or condition of workings is uncertain or unknown; physical hazards are shown in **bold**.

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Mine Name</th>
<th>Surface Owner</th>
<th>Samples</th>
<th>Environmental Concerns</th>
<th>Physical Conditions/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>JV-28</td>
<td>North Extension of the Silver Queen</td>
<td>BLM</td>
<td>none</td>
<td>none</td>
<td>1AO, T, P</td>
</tr>
<tr>
<td>JV-27</td>
<td>Treasure Vault Mine</td>
<td>BLM</td>
<td>none</td>
<td>none</td>
<td>1AO, 1AC?</td>
</tr>
<tr>
<td>JV-18</td>
<td>Nellie Anne Mine</td>
<td>S</td>
<td>none</td>
<td>none</td>
<td>1AO</td>
</tr>
<tr>
<td>JV-21</td>
<td>Martin Prospect</td>
<td>S</td>
<td>none</td>
<td>none</td>
<td>1AC</td>
</tr>
<tr>
<td>JV-16</td>
<td>Unnamed Prospect</td>
<td>M</td>
<td>none</td>
<td>none</td>
<td>1AO, P</td>
</tr>
<tr>
<td>JV-22</td>
<td>Jefferson Mine</td>
<td>BLM</td>
<td>none</td>
<td>none</td>
<td>1AC</td>
</tr>
<tr>
<td>JV-24</td>
<td>Hornet Mine</td>
<td>BLM</td>
<td>none</td>
<td>none</td>
<td>1SO</td>
</tr>
<tr>
<td>JV-30</td>
<td>Crescent Mine</td>
<td>BLM</td>
<td>none</td>
<td>none</td>
<td>1SC, 1AO</td>
</tr>
<tr>
<td>JV-31</td>
<td>Silver Queen Mine</td>
<td>BLM</td>
<td>none</td>
<td>none</td>
<td>2AO, 1AC</td>
</tr>
<tr>
<td>JV-33</td>
<td>Perseverance Mine</td>
<td>P ?</td>
<td>2W</td>
<td>W</td>
<td>1AG</td>
</tr>
<tr>
<td>---</td>
<td>Perseverance Mill</td>
<td>P ?</td>
<td>1T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>JV-36</td>
<td>Rising Star Mine</td>
<td>P ?</td>
<td>none</td>
<td>none</td>
<td>1SC, 1AO, 1AC</td>
</tr>
</tbody>
</table>
Table 2.1-1 (continued). List of mines and prospects visited in the Flint Creek and South Mountain areas, Owyhee County, Idaho.

<table>
<thead>
<tr>
<th>Site Number</th>
<th>Mine Name</th>
<th>Surface Owner</th>
<th>Samples</th>
<th>Environmental Concerns</th>
<th>Physical Conditions/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>JV-154 and JV-153</td>
<td>Standard Mine</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AC, 1SO</td>
</tr>
<tr>
<td>JV-151</td>
<td>Texas Mine</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1SO</td>
</tr>
<tr>
<td>JV-144</td>
<td>Laxey Tunnel</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AC</td>
</tr>
<tr>
<td>JV-140</td>
<td>Golconda Mine</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AC</td>
</tr>
<tr>
<td>B7229901</td>
<td>Unnamed Prospect</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AC</td>
</tr>
<tr>
<td>JV-138</td>
<td>Sonnemann Tunnel</td>
<td>P</td>
<td>2W</td>
<td>W</td>
<td>1AG</td>
</tr>
<tr>
<td>---</td>
<td>Sonnemann Mill</td>
<td>P</td>
<td>2T</td>
<td>T</td>
<td></td>
</tr>
<tr>
<td>JV-132 through JV-135</td>
<td>Bay State Mine</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AC, 3SO</td>
</tr>
<tr>
<td>JV-127</td>
<td>Washington Tunnel</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AO, 1SO</td>
</tr>
<tr>
<td>JV-128</td>
<td>Mexican Shaft</td>
<td>P</td>
<td>none</td>
<td>none</td>
<td>1AO, 1SO</td>
</tr>
<tr>
<td>---</td>
<td>South Mountain Smelter</td>
<td>P</td>
<td>1S</td>
<td>S</td>
<td>smelter for various mines in the area</td>
</tr>
</tbody>
</table>
The Flint district is underlain by granitic rocks of Cretaceous age (Figures 2.2-1 and 2.2-2). These rocks are principally biotite-muscovite granodiorite, with lesser amounts of albite granite and quartz monzonite. Other major rock units include basalt and welded, flow-layered rhyolite, both of Miocene age (Ekren and others, 1981, 1984; Piper and Laney, 1926). The mines in the South Mountain area are in a schist, quartzite, and marble roof pendant in Cretaceous or Eocene biotite-hornblende quartz diorite and granodiorite (Figures 2.2-1 and 2.2-3). The roof pendant and associated granitic rocks are overlain by basalt (Ekren and others, 1981, 1984; Sorenson, 1927).

A number of north-northwest-trending faults cross the study area (Ekren and others, 1981, 1984). Additional faults are described by Piper and Laney (1926) and Sorenson (1927).

2.3 ECONOMIC GEOLOGY

2.3.1 General Characteristics of the Ore

The mineralization in the Flint district is hosted by granitic rocks of Cretaceous age (Ekren and others, 1981, 1984; Piper and Laney, 1926). The mines exploited silver-gold veins, which contained minor amounts of base metals or antimony. Ore minerals include miargyrite, pyrargyrite, polybasite, stephanite, tetrahedrite, proustite, and minor amounts of gold in a gangue composed mainly of quartz. The veins follow a prominent joint set in the granodiorite (Piper and Laney, 1926).

Most of the mines in the South Mountain district are hosted in the marble units of the South Mountain roof pendant (Ekren and others, 1981, 1984; Sorenson, 1927). The mines are either contact metamorphic replacement deposits (skarns) that generally occur in the marble bodies southeast of Williams Creek or vein replacement deposits that followed fractures in the marble. The ore minerals in the contact metamorphic deposits are chiefly chalcopyrite and sphalerite in a gangue of quartz, hedenbergite, ilvaite, calcite, and garnet. The ore minerals in the vein replacement deposits are galena, tetrahedrite, sphalerite, and chalcopyrite in a gangue of calcite and quartz (Sorenson, 1927).

The major work at most of these mines was done before 1900, and much of the available geological information was written long after the major workings had become inaccessible. Even so, five of the properties in the study area (Rising Star, Perseverance, Standard, Nellie Ann, and Golconda) have produced ore since 1900, with one of these (Rising Star) producing over 1,000 tons of ore.

2.3.2 Summary of Mill Development

The location and history of ore processing mills in the study area are important because a major source of environmental problems in many mining camps is old mill tailing disposal sites. These problems include high metal loadings, which could be available to waterways, and fine sediment, which could increase stream loadings or provide a source of fine wind-blown material. At one
Figure 2.2-1. Geology of the Flint Creek and South Mountain areas, Owyhee County, Idaho (Ekren and others, 1981). m = pre-
Cretaceous metamorphic rocks; Khg = Cretaceous hornblende gabbro; Kg = Cretaceous granitic rocks; TKg = Cretaceous and
Eocene granitic rocks, Tab = Oligocene andesite and basalt of Upper Salmon Creek; Tbh = Miocene basalt, TI = Miocene latite
flows and associated clastic rocks, Tr = Miocene rhyolite dikes and plugs; Tsu = Miocene Sucker Creek Formation; Tsr =
Miocene rhyolitic welded tuffs; Tb = Miocene Banbury Basalt and interbedded sediments; QTg = Tertiary and Quaternary
fan and terrace gravel deposits; Qls = Quaternary landslide deposits; Qa = Quaternary alluvium.
Figure 2.2-2. Geology of the Flint mining district, Owyhee County, Idaho (Piper and Laney, 1926, Plate III). Kgd = Cretaceous granodiorite; Tb = Tertiary basalt; Tr = Tertiary rhyolite; Trd = Tertiary rhyolite dikes.
Figure 2.2-3. Geology of the South Mountain mining district, Owyhee County, Idaho (Sorenson, 1927, Plate IIB).
time or another, mills were present at the following properties (ranked by decreasing quantity of mill tails noted at the site):

- Sonnemann Mine — flotation tailings
- Perseverance Mine — flotation tailings
- Treasure Vault Mine
- Texas Mine

These mills were flotation mills, although gravity methods were initially tried at some of the properties. The Sonnemann and Perseverance millsites both have significant amounts of tailings.

2.4 HYDROLOGY AND HYDROGEOLOGY

The study areas cover parts of the drainages of Flint Creek and Williams Creek, both tributaries to Jordan Creek (Figure 2.1-1). Because only limited sampling was conducted during the course of this study, no reference water samples were collected.

2.5 SUMMARY OF THE FLINT CREEK AND SOUTH MOUNTAIN AREAS

2.5.1 Summary of Environmental Observations

2.5.1.1 Water Samples

All the water samples collected for this study exceeded EPA water standards for one or more elements (Tables 2.5-1 and 2.5-2). Water quality variances include significant amounts of mercury and zinc in all water samples, of cadmium from the Sonnemann Tunnel, and of iron, manganese, and aluminum from the Perseverance Mine. Arsenic exceeded the Primary MCL in the Sonnemann Tunnel.

2.5.2.2 Tailings and Smelter Slag Samples

Samples were collected from properties where the mill tailings or smelter slag impinged on an active waterway (Tables 2.5-3 and 2.5-4). As expected, these samples contain high metal loadings, particularly of arsenic, cadmium, lead, and zinc.
Table 2.5-1. Dissolved metals in water samples from the properties in the Flint Creek and South Mountain areas, Owyhee County, Idaho. Numbers in bold-face type exceed one or more water quality standards.

<table>
<thead>
<tr>
<th>FIELD NO.</th>
<th>REMARKS</th>
<th>Al (ppm)</th>
<th>As (ppm)</th>
<th>Ba (ppm)</th>
<th>Cd (ppm)</th>
<th>Cr (ppm)</th>
<th>Cu (ppm)</th>
<th>Fe (ppm)</th>
<th>Pb (ppm)</th>
<th>Mn (ppm)</th>
<th>Hg (ppm)</th>
<th>Ni (ppm)</th>
<th>Zn (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7219901</td>
<td>Perseverance Mine (JV-33), adit water</td>
<td>0.460</td>
<td>1.1000</td>
<td>---</td>
<td>0.0088</td>
<td>11.000</td>
<td>0.8000</td>
<td>0.015</td>
<td>0.5700</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7219903</td>
<td>Perseverance Mine (JV-33), downstream on Flint Creek</td>
<td>0.110</td>
<td>0.6800</td>
<td>---</td>
<td>0.0140</td>
<td>0.0022</td>
<td>---</td>
<td>0.2900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7229902</td>
<td>Sonnemann Tunnel (JV-138), adit water</td>
<td>---</td>
<td>0.0015</td>
<td>0.0120</td>
<td>---</td>
<td>0.0500</td>
<td>0.0370</td>
<td>---</td>
<td>0.9700</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7229905</td>
<td>Sonnemann Tunnel (JV-33), downstream on Williams Creek</td>
<td>0.076</td>
<td>0.0100</td>
<td>0.0069</td>
<td>---</td>
<td>0.0053</td>
<td>0.0057</td>
<td>---</td>
<td>0.4000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXPLANATION**

Blank space equals no analysis
Below Detection Limit is ---

**WATER QUALITY STANDARDS**

<table>
<thead>
<tr>
<th></th>
<th>Al (mg/L)</th>
<th>As (mg/L)</th>
<th>Ba (mg/L)</th>
<th>Cd (mg/L)</th>
<th>Cr (mg/L)</th>
<th>Cu (mg/L)</th>
<th>Fe (mg/L)</th>
<th>Pb (mg/L)</th>
<th>Mn (mg/L)</th>
<th>Hg (mg/L)</th>
<th>Ni (mg/L)</th>
<th>Zn (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary MCL</td>
<td>0.050</td>
<td>2.000</td>
<td>0.005</td>
<td>0.100</td>
<td>0.050</td>
<td>0.002</td>
<td>0.100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary MCL</td>
<td>0.05-0.2</td>
<td></td>
<td>0.300</td>
<td>0.05</td>
<td>5.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquatic Life, Acute</td>
<td>0.750</td>
<td>0.360</td>
<td>0.004-0.009</td>
<td>1.7-3.1</td>
<td>0.018-0.034</td>
<td>1.000</td>
<td>0.082-0.2</td>
<td>0.0024</td>
<td>1.4-2.5</td>
<td>0.12-0.21</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquatic Life, Chronic</td>
<td>0.087</td>
<td>0.190</td>
<td>0.001-0.002</td>
<td>0.21-0.37</td>
<td>0.012-0.021</td>
<td>0.003-0.008</td>
<td>0.00012</td>
<td>0.16-0.28</td>
<td>0.11-0.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated Detection Level (33% confidence)</td>
<td>0.074</td>
<td>0.0007</td>
<td>0.0014</td>
<td>0.0019</td>
<td>0.0080</td>
<td>0.0067</td>
<td>0.0053</td>
<td>0.0025</td>
<td>0.0016</td>
<td>0.0005</td>
<td>0.011</td>
<td>0.0019</td>
</tr>
</tbody>
</table>
Table 2.5-2. Total recoverable metals in water samples from the properties in the Flint Creek and South Mountain areas, Owyhee County, Idaho. Numbers in bold-face type exceed one or more water quality standards.

<table>
<thead>
<tr>
<th>FIELD NO.</th>
<th>REMARKS</th>
<th>Al (ppm)</th>
<th>As (ppm)</th>
<th>Ba (ppm)</th>
<th>Cd (ppm)</th>
<th>Cr (ppm)</th>
<th>Cu (ppm)</th>
<th>Fe (ppm)</th>
<th>Pb (ppm)</th>
<th>Mn (ppm)</th>
<th>Hg (ppm)</th>
<th>Ni (ppm)</th>
<th>Zn (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7219901</td>
<td>Perseverance Mine (JV-33), adit water</td>
<td>0.0360</td>
<td>0.100</td>
<td>---</td>
<td>---</td>
<td>0.020</td>
<td>16.000</td>
<td>0.9400</td>
<td>---</td>
<td>0.0600</td>
<td>0.031</td>
<td>0.0650</td>
<td></td>
</tr>
<tr>
<td>B7219903</td>
<td>Perseverance Mine (JV-33), downstream on</td>
<td>0.0014</td>
<td>0.022</td>
<td>---</td>
<td>---</td>
<td>0.074</td>
<td>0.0061</td>
<td>0.00650</td>
<td>0.1000</td>
<td>---</td>
<td>0.0120</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Flint Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7229902</td>
<td>Sonnemann Tunnel (JV-138), adit water</td>
<td>0.0610</td>
<td>0.007</td>
<td>0.009</td>
<td>---</td>
<td>0.010</td>
<td>0.110</td>
<td>0.0032</td>
<td>0.0440</td>
<td>0.0100</td>
<td>---</td>
<td>0.9100</td>
<td></td>
</tr>
<tr>
<td>B7229905</td>
<td>Sonnemann Tunnel (JV-33), downstream on</td>
<td>0.0330</td>
<td>0.017</td>
<td>---</td>
<td>---</td>
<td>0.091</td>
<td>0.0095</td>
<td>0.00550</td>
<td>0.00650</td>
<td></td>
<td>0.4000</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Williams Creek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EXPLANATION

- Blank space equals no analysis
- mg/L = ppm
- Below Detection Limit is ---

WATER QUALITY STANDARDS

<table>
<thead>
<tr>
<th></th>
<th>Al (mg/L)</th>
<th>As (mg/L)</th>
<th>Ba (mg/L)</th>
<th>Cd (mg/L)</th>
<th>Cr (mg/L)</th>
<th>Cu (mg/L)</th>
<th>Fe (mg/L)</th>
<th>Pb (mg/L)</th>
<th>Mn (mg/L)</th>
<th>Hg (mg/L)</th>
<th>Ni (mg/L)</th>
<th>Zn (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary MCL</td>
<td>0.0500</td>
<td>2.0000</td>
<td>0.005</td>
<td>0.100</td>
<td>1.000</td>
<td>0.050</td>
<td>0.002</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary MCL</td>
<td>0.05-0.2</td>
<td></td>
<td></td>
<td></td>
<td>1.000</td>
<td>0.300</td>
<td>0.050</td>
<td>5.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquatic Life, Acute</td>
<td>0.750</td>
<td>0.3600</td>
<td>0.004-0.009</td>
<td>1.7-3.1</td>
<td>0.018-0.034</td>
<td>1.000</td>
<td>0.082-0.2</td>
<td>1.4-2.5</td>
<td>0.12-0.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquatic Life, Chronic</td>
<td>0.087</td>
<td>0.1900</td>
<td>0.001-0.002</td>
<td>0.21-0.37</td>
<td>0.012-0.021</td>
<td>0.003-0.008</td>
<td>0.00012</td>
<td>0.16-0.28</td>
<td>0.11-0.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated Detection</td>
<td>0.0005</td>
<td>0.001</td>
<td>0.002</td>
<td>0.0047</td>
<td>0.150</td>
<td>0.019</td>
<td>0.0049</td>
<td>0.0006</td>
<td>0.0005</td>
<td>0.012</td>
<td>0.0028</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.5-3. Element screen for tailings and smelter slag samples for properties in the Flint Creek and South Mountain areas, Owyhee County, Idaho.

<table>
<thead>
<tr>
<th>FIELD NO.</th>
<th>REMARKS</th>
<th>Al (ppm)</th>
<th>As (ppm)</th>
<th>Ba (ppm)</th>
<th>Cd (ppm)</th>
<th>Cr (ppm)</th>
<th>Cu (ppm)</th>
<th>Fe (ppm)</th>
<th>Pb (ppm)</th>
<th>Mn (ppm)</th>
<th>Hg (ppm)</th>
<th>Ni (ppm)</th>
<th>Zn (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7219902</td>
<td>Perseverance Mill, mill tailings</td>
<td>120.0</td>
<td>21.0</td>
<td>0.76</td>
<td>3.1</td>
<td>11</td>
<td>5,100</td>
<td>99</td>
<td>18</td>
<td>---</td>
<td>64.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7229903</td>
<td>Sonneman Mill, mill tailings</td>
<td>690.0</td>
<td>57.0</td>
<td>120.00</td>
<td>40.0</td>
<td>430</td>
<td>82,000</td>
<td>340</td>
<td>1,900</td>
<td>23.0</td>
<td>11,000.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7229904</td>
<td>Sonneman Mill, mill tailings</td>
<td>280.0</td>
<td>18.0</td>
<td>870.00</td>
<td>130.0</td>
<td>4,600</td>
<td>40,000</td>
<td>160</td>
<td>14,000</td>
<td>23.0</td>
<td>89,000.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smelter slag</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7229906</td>
</tr>
</tbody>
</table>

**Clark Fork Superfund Background Levels (mg/Kg) = ppm**

<table>
<thead>
<tr>
<th></th>
<th>As</th>
<th>Cd</th>
<th>Pb</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Mean Soil</td>
<td>6.7</td>
<td>0.7</td>
<td>20.0</td>
</tr>
<tr>
<td>Helena Valley Mean Soil</td>
<td>16.5</td>
<td>0.2</td>
<td>11.5</td>
</tr>
<tr>
<td>Missoula Lake Bed Sediments</td>
<td>NA</td>
<td>0.2</td>
<td>34.0</td>
</tr>
<tr>
<td>Blackfoot River</td>
<td>4.0</td>
<td>&lt;0.1</td>
<td>NA</td>
</tr>
<tr>
<td>Phytotoxic Concentration</td>
<td>100.0</td>
<td>100.0</td>
<td>1000.0</td>
</tr>
</tbody>
</table>

**Explanation**

Below Detection Limit is ---
Not analyzed equals NA
Table 2.5-4. Toxicity Characteristic Leaching Procedure (TCLP) for tailings and smelter slag samples from properties in the Flint Creek and South Mountain areas, Owyhee County, Idaho.

<table>
<thead>
<tr>
<th>FIELD NO.</th>
<th>REMARKS</th>
<th>As (ppm)</th>
<th>Cd (ppm)</th>
<th>Cr (ppm)</th>
<th>Pb (ppm)</th>
<th>Hg (ppm)</th>
<th>Se (ppm)</th>
<th>Ag (ppm)</th>
<th>Ba (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>tailings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7219902</td>
<td>Perseverance Mill, mill tailings</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.015</td>
<td>---</td>
<td>---</td>
<td>1.000</td>
</tr>
<tr>
<td>B7229903</td>
<td>Sonnemann Mill, mill tailings</td>
<td>---</td>
<td>2.300</td>
<td>0.230</td>
<td>---</td>
<td>0.014</td>
<td>---</td>
<td>---</td>
<td>0.110</td>
</tr>
<tr>
<td>B7229904</td>
<td>Sonnemann Mill, mill tailings</td>
<td>2.900</td>
<td>30.000</td>
<td>6.400</td>
<td>---</td>
<td>0.018</td>
<td>1.400</td>
<td>---</td>
<td>0.055</td>
</tr>
<tr>
<td>smelter slag</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B7229906</td>
<td>South Mountain Smelter, smelter slag</td>
<td>4.000</td>
<td>0.130</td>
<td>0.061</td>
<td>10.00</td>
<td>0.016</td>
<td>---</td>
<td>---</td>
<td>0.640</td>
</tr>
</tbody>
</table>

**EXPLANATION**
- Blank space equals no analysis
- Below Detection Limit is ---

<table>
<thead>
<tr>
<th>WATER QUALITY STANDARDS</th>
<th>As (mg/L)</th>
<th>Cd (mg/L)</th>
<th>Cr (mg/L)</th>
<th>Pb (mg/L)</th>
<th>Hg (mg/L)</th>
<th>Se (mg/L)</th>
<th>Ag (mg/L)</th>
<th>Ba (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary MCL</td>
<td>0.050</td>
<td>0.005</td>
<td>0.100</td>
<td>0.050</td>
<td>0.002</td>
<td>0.050</td>
<td></td>
<td>2.000</td>
</tr>
<tr>
<td>Secondary MCL</td>
<td>0.100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aquatic Life, Acute</td>
<td>0.360</td>
<td>0.004 - 0.009</td>
<td>1.7 - 3.1</td>
<td>0.082 - 0.2</td>
<td>0.002</td>
<td>0.000012</td>
<td>0.0041 - 0.0134</td>
<td></td>
</tr>
<tr>
<td>Aquatic Life, Chronic</td>
<td>0.190</td>
<td>0.001 - 0.002</td>
<td>0.21 - 0.37</td>
<td>0.003 - 0.008</td>
<td>0.0017</td>
<td>0.650</td>
<td>0.270</td>
<td>0.050</td>
</tr>
<tr>
<td>Estimated Detection Level (33% confidence)</td>
<td>0.49</td>
<td>0.02</td>
<td>0.03</td>
<td>0.500</td>
<td>0.0017</td>
<td>0.650</td>
<td>0.270</td>
<td>0.050</td>
</tr>
</tbody>
</table>
3.0 MINE DESCRIPTIONS

FLINT CREEK AREA

3.44 NORTH EXTENSION OF THE SILVER QUEEN (Site No. JV-28)
Alternate name—Birmingham.

This site is incorrectly identified as the Treasure Vault Mine on the video segment. The adit was given a field site designation of B7199901.

3.44.1 Site Location and Access (Figure 2.1-1)

This property is in Twilight Gulch near the center of the SW¼ of the NE¼ of section 2, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.44-1). Access is via the main Flint Creek Road, then on the left fork up Flint Creek to the Perseverance Mine at Astor Gulch. About ¼ mile past the Perseverance Mine, the road forks again. The left fork goes west and north to Twilight Gulch. This adit is about 300 feet northeast of Adit #2 of the Treasure Vault Mine and is the last adit on the east side of the creek going up Twilight Gulch. The adit is on BLM land.

3.44.2 Geologic Features (Figures 2.2-1 and 2.2-2)

This adit is on the north extension of the Silver Queen vein. According to Piper and Laney (1926), a small pit on this extension yielded several hundred pounds of stibnite ore from a 6-inch quartz stringer in the granite. A basaltic dike, 2-4 feet wide, follows the general course of the vein.

3.44.3 Site History

See section 3.53.3, Silver Queen Mine, for a history of this property.

3.44.4 Environmental Conditions

3.44.4.1 Site Features

This site was visited by Earl Bennett on July 19, 1999. A video segment describing the property is on the Owyhee County Videotape (Tape 3, 0:53:17-0:57:41). Documenting photographs are Roll B1, frames 1-2.

The adit is just above the road that follows the stream and is not shown on the topographic map. It is open and has timbers inside the portal (Figure 3.44-2). The opening is in granite and has a small seep. A trench leads from the adit about 40 feet to the dump, which measures 50 feet long, 40 feet wide, and 6 feet thick, and has some fragments of bull quartz on it (Figure 3.44-3). A pit (possible caved adit) and a small dump are across the creek, also in granite. The disturbed area covers less than 0.25 acre.
3.44.4.2 Sample Locations

3.44.4.2.1 Solid Samples
No solid samples were collected.

3.44.4.2.2 Water Samples
No water samples were collected.

3.44.5 Structures
No structures were found.

3.44.6 Safety
The open adit is the only safety hazard at the site.
Figure 3.44-1. Location of the North Extension of the Silver Queen Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.44-2. Looking south at the open adit of the North Extension of the Silver Queen (Roll B1, frame #1).

Figure 3.44-3. Looking north at the trench and the waste dump at the North Extension of the Silver Queen (Roll B1, frame #2).
3.45 TREASURE VAULT MINE (Site No. JV-27)
Alternate names—Twilight Mine; Birmingham Group.

3.45.1 Site Location and Access (Figure 2.1-1)

The Treasure Vault Mine is on the southeast side of Twilight Gulch near the center of section 2, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.45-1). This property includes the second and third adits on the east side of the creek going up Twilight Gulch. Access is via the main Flint Creek Road, then north on the fork up Flint Creek to the Perseverance Mine. About ¼ mile past the Perseverance, the road forks again. The left fork goes west and north to Twilight Gulch, then northeastward about ¼ mile to the mine. This property is on BLM land.

3.45.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The veins in the Flint District are entirely within granodiorite and do not penetrate overlying basalt units. The vein in the Treasure Vault strikes N. 5º E. and dips 65º E. The dominant gangue mineral is quartz, carrying varying amounts of several silver minerals, as well as minor amounts of other sulfides (Piper and Laney, 1926).

3.45.3 Site History

Piper and Laney (1926, p. 159) reported:

The property was actively worked as the Twilight mine in the early eighties [1880s] and a considerable tonnage of ore was extracted from an inclined shaft and a drift along the vein, although the quantity of precious metals produced is unknown.

In 1921, Arthur and Howard Birmingham located fourteen unpatented claims in Astor and Twilight gulches. These claims, known as the Birmingham Group, included the Treasure Vault, Crescent, Silver Queen, North Extension of the Silver Queen, and Gray Eagle properties (Piper and Laney, 1926).

Twilight Silver Mines Company was incorporated in 1924. The company held a contract to purchase the Birmingham Group from Arthur Birmingham. The property had a 330-foot crosscut to the vein and a 150-foot crosscut with 200 feet of drifting on the vein, as well as numerous small tunnels and shafts. After doing little or no work on the Birmingham Group, Twilight Silver forfeited its corporate charter in 1926.

Glacier Silver Lead Mining Company was incorporated in 1942, and again this company arranged to purchase the Birmingham Group. (Glacier Silver’s purchase contract was with Mr. and Mrs. W. Earl Sommers, who in turn were buying the property from Art Birmingham.) The property had 2,805 feet of development, including thirteen tunnels, eight shafts, four raises, and four crosscuts. Labor shortages caused by World War II limited the Glacier Silver’s activities, and the company abandoned the property in 1945. Glacier Silver forfeited its corporate charter in 1949.
Productive Mines, Ltd. (which described itself as “an Estate in Joint Tenancy”) worked the Birmingham property from 1950 to 1952 and held an option to purchase the property from Arthur Birmingham. The company began installing a 50 tons-per-day (tpd) mill and started underground development. About 1,200 feet of the old workings were accessible in 1950. In 1952, the property was examined by the U.S. Bureau of Mines to determine if it qualified for a Defense Minerals Exploration Administration (DMEA) loan as an antimony prospect. Popoff (1952) concluded that the minerals were irregularly distributed in the veins and that the stibnite could only be mined economically in connection with silver production.

3.45.4 Environmental Conditions

3.45.4.1 Site Features

This property was visited by Earl Bennett on July 19, 1999 and again on July 20, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 0:57:45-1:05:09). Documenting photographs are Roll B1, frames 3-6, and Roll B2, frames 21-22.

There are two adits and a decline at this mine. All three workings are shown on the topographic map. Adit 1, the main adit at the Treasure Vault, is open with a little water flowing from it. The adit has a post with an obliterated sign in the center of the rock portal (Figure 3.45-2). The water disappears into a small wetland in front of the portal. Southwest of the adit is a big pile of white bull quartz. This white dump is very obvious coming up the road in Astor Gulch (Figure 3.45-3). The dump, which measures 50 feet long, 80 feet wide, and 50 feet thick, extends onto the road but does not impinge on the creek.

Adit 2 (Figure 3.45-4) is about 200 feet northeast of Adit 1. This adit is also in granite and appears to be caved inside. There is a small stockpile of bull quartz on this dump (Figure 3.45-5), which measures 100 feet long, 12 feet wide, and 80 feet thick on the nose. The dump does not impinge on the drainage.

About 50 feet above and just south of Adit 2 is a decline (Figure 3.45-6) on the quartz vein. The hillside between the decline and the adit is covered with bull quartz (Figure 3.45-7), and iron-stained quartz and granite are on the decline dump. There are two other small pits between the adit and the decline.

The total disturbed area covers about 1 acre.

3.45.4.2 Sample Locations

3.45.4.2.1 Solid Samples

No solid samples were collected.

3.45.4.2.2 Water Samples

No water samples were collected.
3.45.5 Structures
There are no structures at the site.

3.45.6 Safety
Adit 1 is open and easily accessible. The decline is also open and, although narrow, is relatively steep. Adit 2 appears to be caved a short distance inside.
Figure 3.45-1. Location of the Treasure Vault Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.45-2. Adit 1 at the Treasure Vault Mine. A minor seep forms a small grassy bog in front of the adit (Roll B2, frame #21).

Figure 3.45-3. White bull quartz on the waste dump of Adit 1 at the Treasure Vault Mine. The dump reaches the access road but does not impinge on the creek (Roll B2, frame #22).
Figure 3.45-4. Adit 2 at the Treasure Vault Mine. The adit was driven along a quartz vein. Although the adit appears open in this photo, it is caved inside (Roll B1, frame #5).

Figure 3.45-5. Waste dump and quartz stockpile at Adit 2 of the Treasure Vault Mine (Roll B1, frame #6).
Figure 3.45-6. Open decline at the Treasure Vault Mine (Roll B1, frame #3).

Figure 3.45-7. Quartz-covered waste dump at the decline of the Treasure Vault Mine (Roll B1, frame #4).
3.46 NELLIE ANN MINE (Site No. JV-18)

3.46.1 Site Location and Access (Figure 2.1-1)

The Nellie Ann Mine is in the headwaters of Washington Gulch in the NW¼ of the SW¼ of the NE¼ of section 34, T. 5 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.46-1). Access is via the Flint Creek Road on the fork to the Perseverance Mine, then on a very rough road west along Flint Creek from the main mine road to Barrel Spring and beyond. A road to the west from this rough road leads to the Nellie Ann as shown on the topographic map. The mine is on state land.

3.46.2 Geologic Features (Figures 2.2-1 and 2.2-2)

According to Piper and Laney (1926), the prospect is on a 20-foot-wide crushed zone in granite. The crushed zone has been healed by intense silicification. It strikes N. 15º E and dips 70º W. Auriferous pyrite is carried in numerous quartz stringers 2-4 inches wide that branch from or traverse the silicified zone. The granite is overlain by basalt, and the adit was driven in just below the contact.

3.46.3 Site History

The group includes three unpatented claims located in 1923 (Piper and Laney, 1926). W. W. Jones of Jordan Valley, Oregon, leased the property from the state in 1941. The mine had two tunnels, 600 feet and 750 feet in length. No work was done on the property that year.

3.46.4 Environmental Conditions

3.46.4.1 Site Features

The Nellie Ann Mine was visited by Earl Bennett on July 20, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:05:15-1:08:22). Documenting photographs are Roll B1, frames 7-9.

There is an open, dry adit in the granite just below the basalt (Figure 3.46-2). The creek flows over the south side of the dump, which is built out into the drainage (Figure 3.46-3), and then into Washington Gulch. Sulfides were noted on the dump, which appears to have been bulldozed and flattened. The dump measures 90 feet long, 45 feet wide, and 7 feet thick. The disturbed area covers about 1 acre.

3.46.4.2 Sample Locations

3.46.4.2.1 Solid Samples

No solid samples were collected.
3.46.4.2.2 Water Samples
No water samples were collected.

3.46.5 Structures
No structures were found.

3.46.6 Safety
Although the adit is open, the area is very remote and the access road is in very, very poor condition. It is doubtful that there are many visitors.
Figure 3.46-1. Location of the Nellie Ann Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.46-2. Nellie Ann adit, looking south (Roll B1, frame #7).

Figure 3.46-3. Looking north from the Nellie Ann portal. The waste dump is built out across the drainage (Roll B1, frame #9).
3.47 MARTIN PROSPECT (Site No. JV-21)

3.47.1 Site Location and Access (Figure 2.1-1)

The Martin Prospect is in the headwaters of Washington Gulch in the NE¼ of the SE¼ of the NW¼ of section 34, T. 5 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.47-1). Access to the Martin Prospect is via the Flint Creek Road to the Perseverance Mine. North-northwest of the Perseverance, the Flint Creek Road becomes very rough, both where it follows Flint Creek and where it heads north-northeast to Barrel Spring and beyond. A road to the west from Flint Creek Road leads to the Nellie Anne Mine, as shown on the topographic map. From the Nellie Anne adit, walk west and south around the hill to the Martin Prospect. The adit is accurately located on the topographic map. A road goes from the Martin back to the top of the hill, then on to the rough road to Barrel Spring and Flint Creek. The prospect is on state land.

3.47.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The adit was driven in granite just below the contact with an overlying basalt. Piper and Laney (1926, Plate III) mapped the adit at the southwest end of a northeast-trending vein. Their adit appears to be south of the adit described in this report and may be at the location of the prospect symbol on the topographic map.

3.47.3 Site History

The Martin is shown on Piper and Laney’s (1926, Plate III) map of the Flint district, but it is not discussed in the text. It is near the Nellie Anne and may have been worked at about the same time.

3.47.4 Environmental Conditions

3.47.4.1 Site Features

The site was visited by Earl Bennett on July 20, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:08:28-1:11:25). Documenting photographs are Roll B1, frames 10-11.

Figure 3.47-2 is a sketch of the site. The caved adit (Figure 3.47-3) was driven into the granite just below the basalt. Some water flows from the adit, but it quickly dries up in the surrounding rock-soil cover. The dump (Figure 3.47-4) is 65 feet long, 11 feet wide, and 50 feet thick. There are some rails on the dump. The disturbed area covers about 0.5 acre.

3.47.4.2 Sample Locations

3.47.4.2.1 Solid Samples

No solid samples were collected.
3.47.4.2.2 Water Samples
No water samples were collected.

3.47.5 Structures
No structures were found at the site.

3.47.6 Safety
There are no safety hazards at this prospect.
Figure 3.47-1. Location of the Martin Prospect, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.47-2. Sketch of the Martin Prospect.
Figure 3.47-3. Caved adit at the Martin Prospect (Roll B1, frame #10).

Figure 3.47-4. View to the west of the waste dump at the Martin Prospect (Roll B1, frame #11).
3.48 UNNAMED PROSPECT (Site No. JV-16)

3.48.1 Site Location and Access (Figure 2.1-1)

This site is near the head of Cottonwood Creek along the boundary between sections 23 and 26, T. 5 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.48-1). Access is on the Flint Creek Road to the Perseverance Mine, then on the rough road along Flint Creek past Barrel Spring about 1.5 miles. A road or trail leads from the road to Barrel Spring up the Cottonwood Creek drainage to the prospect. The adit is on BLM land, and the shaft is either on BLM or private land.

3.48.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The adit and shaft (or pit) are in granite.

3.48.3 Site History

Nothing is known about the history of this prospect.

3.48.4 Environmental Conditions

3.48.4.1 Site Features

The prospect was visited by Earl Bennett on July 20, 1999. A video sequence describing the site is on the Owyhee County Videotape (Tape 3, 1:11:31-1:15:41). Documenting photographs are Roll B1, frames 12-13.

The site contains a shaft or deep prospect pit (Figure 3.48-2) and an adit (Figure 3.48-3). There is a claim post with a tobacco tin on it at the dry 20-foot-deep prospect pit. The dump is small, measuring 10 feet by 15 feet by 30 feet, and contains a minor amount of white quartz. An old bucket is also on the dump. The adit is east of the prospect pit, as shown on the topographic map, and is open, dry, and in granite. The dump is very small, measuring 10 feet by 15 feet by 30 feet thick on the nose. The disturbed area covers less than 0.25 acre.

3.48.4.2 Sample Locations

3.48.4.2.1 Solid Samples

No solid samples were collected.

3.48.4.2.2 Water Samples

No water samples were collected.

3.48.5 Structures

There are no structures at the prospect.
3.48.6 Safety

The prospect shaft is hidden in the bushes but is off the main Barrel Spring road, which itself is barely passable by four-wheel-drive or all-terrain vehicle. The adit is open, but it is doubtful that there are any visitors to this site.
Figure 3.48-1. Location of Unnamed Prospect JV-16, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.48-2. Open shaft or prospect pit at Unnamed Prospect JV-16. The pit is about 20 feet deep (Roll B1, frame #12).

Figure 3.48-3. Open adit at Unnamed Prospect JV-16 (Roll B1, frame #13).
3.49 JEFFERSON MINE (Site No. JV-22)

3.49.1 Site Location and Access (Figure 2.1-1)

The Jefferson Mine is near the center of the SE¼ of the SE¼ of section 34, T. 5 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.49-1). The adit is on Flint Creek, just above the confluence with Hard Up Gulch and is shown on the topographic map. Access is from the Flint Creek Road to the Perseverance Mine, and then on the rough road that continues to Barrel Spring. The Jefferson is slightly over 1 mile north of the Perseverance Mine and is reached by walking down the hill from the Barrel Spring Road. The mine is on BLM land.

3.49.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The adit was driven in granite just below the contact with the overlying basalt. According to Piper and Laney (1926, Plate III), there is a northeast-striking vein bounded by a faults on the property.

3.49.3 Site History

Although shown on the Flint district map, Piper and Laney (1926) did not discuss the history of this prospect.

3.49.4 Environmental Conditions

3.49.4.1 Site Features

The Jefferson Mine was visited by Earl Bennett on July 20, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:15:45-1:17:48). Documenting photographs are Roll B1, frames 14-15.

The site contains a single, open, dry adit in granite, just below the basalt. The adit is partially hidden by bushes (Figure 3.49-2). A pile of timbers (possibly from an old cabin) and a piece of rail sticking in the ground were noted (Figure 3.49-3). An old bucket and other scrap metal are also on the dump, which measures 20 feet long, 20 feet wide, and 30 feet thick on the nose. The dump is on a steep hillside. The disturbed area covers about 0.25 acre.

3.49.4.2 Sample Locations

3.49.4.2.1 Solid Samples

No solid samples were collected.

3.49.4.2.2 Water Samples

No water samples were collected.
3.49.5 Structures

The pile of logs and timbers may be the remains of an old cabin.

3.49.6 Safety

The adit is open but very remote. Visitors to the site are unlikely.
Figure 3.49-1. Location of the Jefferson Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.49-2. Looking west at the Jefferson Mine adit (Roll B1, frame #14).

Figure 3.49-3. Pile of logs and several rails sticking out of the ground on the waste dump of the Jefferson adit (Roll B1, frame #15).
3.50 HORNET MINE (Site No. JV-24)

This property is identified as the “Homet” mine on the video segment. Although this mine is correctly labeled as “Hornet” on the topographic map, the “r” and “n” are crowded so close together that the two letters appear to be the letter “m”.

3.50.1 Site Location and Access (Figure 2.1-1)

This property is on the western boundary of the SW¼ of the NW¼ of section 2, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.50-1). It is at the junction of Hard Up Gulch and the northwest branch of Flint Creek. Access is via the Flint Creek Road to the Perseverance Mine and then on the rough road that continues along Flint Creek to Barrel Spring. The property was reached by walking down to Flint Creek from the Barrel Spring Road, and then down the gulch and back up the west slope over 100 feet to the Hornet shaft. The mine is on BLM land.

3.50.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The shaft is in a quartz vein in granite just below the contact with the overlying basalt. According to Piper and Laney (1926, Plate III), the shaft is on a nearly north-south-trending continuation of the vein in the Doughboy Mine.

3.50.3 Site History

The Hornet Mine is shown on Piper and Laney’s (1926) map of the Flint district. It is near the Doughboy property, which was held by Precious Metals Mines Company in the 1920s, but does not seem to have been part of their holdings.

3.50.4 Environmental Conditions

3.50.4.1 Site Features

The Hornet Mine was visited by Earl Bennett on July 20, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:17:56-1:20:21). Documenting photographs are Roll B1, frames 16-17.

The site contains a single shaft (Figures 3.50-2 and 3.50-3) sunk in granite. The opening is at least 20 feet deep and 15 feet across and could be hazardous to someone coming down the steep brushy hillside. The waste dump, over 100 feet above the creek, contains some quartz fragments and is overgrown. The disturbed area covers less than 0.25 acre.
3.50.4.2 Sample Locations

3.50.4.2.1 Solid Samples
No solid samples were collected.

3.50.4.2.2 Water Samples
No water samples were collected.

3.50.5 Structures
No structures were found.

3.50.6 Safety
The open shaft is about 20 feet deep and hazardous, although the site is not easily accessible. Visitors to the site are unlikely.
Figure 3.50-1. Location of the Hornet Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).

Figure 3.50-2. Opening of the Hornet shaft (Roll B1, frame #16).

Figure 3.50-3. View into the Hornet shaft. The depth is about 20 feet (Roll B1, frame #17).
3.51 DOUGHBOY MINE (Site No. JV-25)

3.51.1 Site Location and Access (Figure 2.1-1)

This property is in the NE¼ of the SE¼ of the NE¼ of section 3, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.51-1). It is less than ¼ mile south of the Hornet Mine on Flint Creek. Access is via the Flint Creek Road to the Perseverance Mine, and then on the rough road paralleling Flint Creek to Barrel Spring. The property was reached by walking down to Flint Creek from the Barrel Spring Road. The mine is on BLM land.

3.51.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The adit is in granite not far below the contact with the overlying basalt. The vein is a quartz seam 15 inches wide that is enclosed by granite. It was displaced 40 feet by a northwest-trending fault, with the northern block moving eastward (Piper and Laney, 1926).

3.51.3 Site History

The Doughboy is on an unpatented claim that was held by Precious Metals Mines Company (Piper and Laney, 1926). Precious Metals’ claim group included the Perseverance and Rising Star properties (sections 3.54 and 3.55, respectively).

3.51.4 Environmental Conditions

3.51.4.1 Site Features

The Doughboy Mine was visited by Earl Bennett on July 20, 1999. A video sequence describing the site is on the Owyhee County Videotape (Tape 3, 1:20:27-1:23:39). Documenting photographs are Roll B1, frames 18-19.

The site contains a single, caved, dry adit in granite (Figure 3.51-2) and a prospect pit above the adit. Some seepage comes from the adit opening, judging from the brush growing near the portal. An old wheelbarrow (Figure 3.51-3) and other pieces of scrap metal are on the dump. A piece of black plastic pipe extends from the adit into the brush. The dump is densely overgrown and measures an estimated 80 feet long, 15 feet wide, and 10 feet thick. The prospect pit, located 50 feet above the adit, is about 6 feet deep and has some bull quartz and granite on the small dump. The disturbed area covers about 0.25 acre.

3.51.4.2 Sample Locations

3.51.4.2.1 Solid Samples

No solid samples were collected.
3.51.4.2.2 Water Samples
   No water samples were collected.

3.51.5 Structures
   No structures were found.

3.51.6 Safety
   No safety hazards were found at this site.
Figure 3.51-1. Location of the Doughboy Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.51-2. Caved adit at the Doughboy Mine (Roll B1, frame #18).

Figure 3.51-3. Old wheelbarrow on the waste dump for the Doughboy adit (Roll B1, frame #19).
3.52 CRESCENT MINE (Site No. JV-30)

3.52.1 Site Location and Access (Figure 2.1-1)

The Crescent Mine is at the head of Astor Gulch in the NE¼ of the NE¼ of the SE¼ of section 2, T.6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.52-1). The mine is reached by taking the Flint Creek Road to the Perseverance Mine. The road forks about ¼ mile north of the Perseverance, with the east fork following Astor Gulch and the west fork continuing up Flint Creek to Barrel Spring. The main Astor Gulch Road goes to the Crescent, as does the four-wheel-drive road connecting Astor Gulch to the Crescent Mine that is shown on the topographic map. The property is on BLM land.

3.52.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The shaft and adit are in granite. The shaft is at the contact between the granite and the overlying basalt. According to Piper and Laney (1926), a 5 foot vein of iron-stained, shattered quartz strikes N. 15º W. and dips 75º E.

3.52.3 Site History

The Crescent was one of several old properties restaked as the Birmingham Group in 1921 by Arthur and Howard Birmingham (Piper and Laney, 1926). Piper and Laney (1926, p. 160) noted:

> The property has been idle since the seventies or early eighties [1870s or early 1880s], so that little is accurately known about it, although the size of the dump indicates about 500 feet of underground work. A considerable amount of ore which is scattered over the dump, presumably represents material rejected in the old days when high-grade ore was cobbled over before shipment. . . . An adit tunnel is being driven to intersect the old workings about 150 feet below the collar of the shaft, but lacks about 300 feet of reaching its objective.

The history of the Birmingham group is discussed in section 3.45.3.

3.52.4 Environmental Conditions

3.52.4.1 Site Features

This mine was visited by Earl Bennett on July 20, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:23:43-1:27:21). Documenting photographs are Roll B1, frames 23-24, and Roll B2, frames 1-2.

The upper shaft or pit, measuring about 10 feet long by 5 feet wide and 5 feet deep, is accurately located on the topographic map. It was sunk on a quartz vein in the granite, right below the overlying basalt (Figure 3.52-2). The dump at this shaft measures 25 feet long, 10 feet wide, and
30 feet deep (Figure 3.52-3). The substantial adit is open (about a 2-foot by 2-foot hole at the top of debris sloughed from above) and dry (Figure 3.52-4). It is about ¼ mile southeast and downhill from the pit. The dump for the adit is 85 feet long, 23 feet wide, and 30 feet thick on the face (Figure 3.52-5). There are some rails and pipe at the site, but no structures. The disturbed area covers about 1 acre.

3.52.4.2 Sample Locations

3.52.4.2.1 Solid Samples
No solid samples were collected.

3.52.4.2.2 Water Samples
No water samples were collected.

3.52.5 Structures
There are no structures at the site.

3.52.6 Safety
The open adit is the only safety hazard at the site. The shaft or pit is only 5 feet deep.
Figure 3.52-1. Location of the Crescent Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.52-2. Pit at the Crescent Mine. The pit was excavated at the contact of basalt and granite (Roll B1, frame #23).

Figure 3.52-3. Waste dump of the pit at the Crescent Mine (Roll B1, frame #24).
Figure 3.52-4. Open adit at the Crescent Mine (Roll B2, frame #1).

Figure 3.52-5. Waste dump of the adit at the Crescent Mine (Roll B2, frame #2).
3.53 SILVER QUEEN MINE (Site No. JV-31)

3.53.1 Site Location and Access (Figure 2.1-1)

This property is about ½ mile up Astor Gulch from the fork in the Flint Creek Road at the Perseverance Mine, in the NW¼ of the SE¼ of section 2, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.53-1). Access is via the Flint Creek Road to the Perseverance Mine and then up Astor Gulch. The main Astor Gulch Road continues to the Crescent Mine, but there is also a trail that goes north from the Silver Queen up a tributary. The mine workings are centered on the junction of the road and the trail. The mine is on BLM land.

3.53.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The Silver Queen is on a steeply eastward dipping, roughly north-south-trending quartz vein in the granitic host rock. A narrow basaltic dike, 2-4 feet wide, follows the general trend of the vein (Piper and Laney, 1926).

3.53.3 Site History

Piper and Laney (1926, p. 161) reported:

It was opened in the early seventies [1870s], by shaft and adit tunnel, in the south wall of the canyon, and by adit drifts, into the north wall. It is reputed to have yielded a large tonnage of high grade ore. The dumps represent an aggregate of about 750 feet of underground development, although the ground was not open in 1925. A small pit on the northward extension of the vein yielded in 1925 several hundred pounds of stibnite from a 6-inch stringer in the granite.

The Silver Queen was another of the properties held by Arthur and Howard Birmingham (Piper and Laney, 1926). The history of these claims, known as the Birmingham Group, is previously discussed under the Treasure Vault Mine (section 3.45).

3.53.4 Environmental Conditions

3.53.4.1 Site Features

The Silver Queen Mine was visited by Earl Bennett on July 20, 1999. A video sequence describing the site is on the Owyhee County Videotape (Tape 3, 1:27:26-1:34:08). Documenting photographs are Roll B2, frames 3-5.

There are three adits, a large dump, and an old cabin at the site (Figure 3.53-2). Open Adit 1, north and west of the road, has a seep coming from it (Figure 3.53-3). The totally collapsed cabin is above Adit 1, and the remains of a shed are just south of the adit. Adit 2 is east of Adit 1 and probably was the main entry. This adit is open and has water standing inside. Logs from the
old portal are present (Figure 3.53-4). The large dump, common for both adits, is about 100 feet long, 44 feet wide, and 20 feet thick (Figure 3.53-5). The access road crosses this dump. There are two adits shown on the topographic map that were driven to the southeast from Astor Gulch just south of the dump. Only one of these (Adit 3) was found. It is totally collapsed and has a very small seep and a very small dump. A cut was found that could be the other adit. The disturbed area covers about 5 acres.

3.53.4.2 Sample Locations

3.53.4.2.1 Solid Samples
No solid samples were collected.

3.53.4.2.2 Water Samples
No water samples were collected.

3.53.5 Structures
The cabin at the site is totally collapsed, and only parts of a small shed or outhouse are left.

3.53.6 Safety
The open adits are a hazard, but visitors to the site are unlikely.
Figure 3.53-1. Location of the Silver Queen Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.53-2. Sketch of the Silver Queen Mine.
Figure 3.53-3. Open Adit 1 at the Silver Queen Mine (Roll B2, frame #3).

Figure 3.53-4. Open Adit 2 at the Silver Queen Mine. Several of the old portal timbers are still present (Roll B2, frame #4).
Figure 3.53-5. Waste dump common to Adits 1 and 2 of the Silver Queen Mine (Roll B2, frame #5).
3.54 PERSEVERANCE MINE (Site No. JV-33)
Alternate names—Iva Grace; Precious Metals Mines Co. No. 4 adit; Mill tunnel; Flint Creek Mine.

3.54.1 Site Location and Access (Figure 2.1-1)

The Perseverance Mine, the major producing mine in the Flint District, is in the NE¼ of the SW¼ of the NW¼ of section 11, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.54-1). Access is from the Flint Creek Road. A section of this road about ½ mile south of the mine (just south of the word “Flint” in Flint Creek, as shown on the topographic map) is very rough and is difficult even in four-wheel drive. The mine appears to be on patented claims surrounded by BLM land. The site exceeds 20 acres in size.

3.54.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The Perseverance vein is one of a series of nearly parallel north-south-trending, moderately to steeply easterly dipping veins in the granitic host rock. The veins are dominated by quartz, with limited quantities of calcite, sericite, muscovite and graphite. A variety of silver-bearing minerals accompany the veins, with minor amounts of lead, zinc and copper sulfides. A few blocks of schist are incorporated in the granitic rock (Piper and Laney, 1926).

3.54.3 Site History

The Perseverance and Rising Star (section 3.55) mines are closely associated and have a common history. The mines were discovered in 1865 and worked by individuals for many years (Piper and Laney, 1926). Shaffer (1944, p. 2-4) reported the following historical overview of the mines: Early activities in the district were confined to small mining operations along the Rising Star and Perseverance veins. (See attached map [omitted].) These operations were conducted by individuals until work was stopped during the panic of 1873. The district was dormant until 1886. In that year a group of Nebraska men, including G. W. Holdredge, General Manager of the Chicago, Burlington and Quincy Railroad, and H. Bonnel, Sr. (father of the present owner) took over the mines. A concentrating plant equipped with Cornish rolls, revolving screens, and Golden Gate concentrators was built but proved unadapted to the ore. Development of the mines went ahead under the direction of these men at intervals from 1886 to 1911. A second mill, equipped with stamps and vanners and powered with steam, was built during those years. The recovery of the silver and gold in the ores was approximately 50 percent.

The operation was inefficient. Wood for the steam hoists at the shafts was hauled up the hill from the Flint Creek Valley by teams; these teams in turn hauled ore down to the mill in the valley. The high costs incident to this sort of operation, together with poor recoveries in the mill, led to the sale of the properties in 1911 to Elias Meyer of London, England. The reported price was $85,000.
During the next few years the Mill Tunnel [the adit at this site] (see sketch [omitted]) was driven to both the Perseverance and the Rising Star veins (1369 and 1707 feet respectively from the portal). In addition to this work a vertical shaft was sunk 200 feet below the tunnel and crosscuts driven to the Rising Star vein at the 100 and 200 foot levels. Some development of the Perseverance vein was undertaken by drifting from the Mill tunnel. In 1914 the outbreak of the World War caused the withdrawal of financial support and the mine ceased operations. No ore had been milled.

The property was idle until 1923. In that year the Precious Metals Mines Company operated the mine and mill. This operation was short lived. Several shipments of concentrates are recorded for this period.

In 1929 H. F. Bonnel secured the property at a sheriff’s sale. Since acquiring the mine Bonnel has cleaned out the Mill Tunnel to a distance of 950 feet from the portal. The property is idle at present.

Mr. Bonnel still owned four patented and ten unpatented claims in 1957 (Lickes, 1957).

3.54.4 Environmental Conditions

3.54.4.1 Site Features

The Perseverance Mine was visited by Earl Bennett on July 21, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:34:12-1:46:41). Documenting photographs are Roll B2, frames 6-21.

The site covers about 20 acres and consists of an adit, a mill, a tailings impoundment, and several outbuildings, all in good repair (Figure 3.54-2). The main adit (Figure 3.54-3) is just east of the mill and the large dump. It has a covered portal but is caved just behind the portal timbers. About 5 gallons per minute of cloudy water flows from the adit. Just west of the adit is a locked motor barn in good repair (Figure 3.54-4). The dump is directly west of the motor barn and is approximately 120 feet long, 210 feet wide, and about 30-40 feet thick. Another waste dump measuring 300 feet long, 25 feet wide, and 50 feet thick follows the hillside just behind and north of the power shack (north of the main dump). Rails from the motor barn lead to the main dump face to the south (Figure 3.54-5) and to the mill to the north (Figure 3.54-6). There are timbers and scrap steel at the site.

The mill (Figures 3.54-7 and 3.54-8) was a gravity fed system with a jaw crusher and other fine-grinding equipment feeding a Wilfley table (Figure 3.54-9) and other devices. Parts of some of the machinery are still in the mill. Rock retaining walls are prominent on the south side of the mill.
The tailings impoundment is in two parts. The largest section is in front (west) of the mill (Figure 3.54-10) and measures about 105 feet to the west, 65 feet to the south, 120 feet back to the road, and then 127 feet back to the mill. The tailings are an estimated 5 feet thick. A dam, which contained the tails on the southeast corner, has washed out. The tailings were washed into another area (Figure 3.54-11) that is about 50 feet wide, 110 feet long, and about 1-2 feet thick. These tailings impinge on, and have been removed in part by, Flint Creek (Figure 3.54-12). There are numerous cattle grazing in the area. The tailings are flotation tails consisting of a fine yellow-colored material that is easily carried by the wind. The main Flint Creek road crosses the tailings in front of the mill. Just north of the mill is a small power shack and cabin, and a larger building is located across the main road from the mill (Figure 3.54-13). These buildings are in good repair.

3.54.4.2 Sample Locations

3.54.4.2.1 Solid Samples

A composite grab sample (B7219902) was taken of the mill tailings across the main tailings impoundment.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Analyzed (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7219902</td>
<td>Perseverance mill tailings</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3.54.4.2.2 Water Samples

Sample B7219901 was taken from the adit water. Sample B7219903 was collected from Flint Creek, ¼ mile south of the mill where a small road crosses the creek to an old outhouse.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Specific Conductivity (µS)</th>
<th>Temperature (°F)</th>
<th>pH</th>
<th>Flow (gpm)</th>
<th>Analyzed (Yes/No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7219901</td>
<td>Perseverance adit</td>
<td>500</td>
<td>50</td>
<td>6.90</td>
<td>5</td>
<td>Yes</td>
</tr>
<tr>
<td>B7219903</td>
<td>downstream on Flint Creek</td>
<td>138</td>
<td>58</td>
<td>7.73</td>
<td>---</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3.54.4.2.3 Analytical Results

Solid Sample

The Perseverance mill tailings (sample B7219902) have elevated levels of arsenic and lead in the element screen. In the TCLP for metals test, mercury showed signs of leaching.
Water Samples

Adit water sample B7219901 exceeds all standards for iron, the Secondary MCLs for manganese and aluminum, the Aquatic Life Acute standard for aluminum, and both Aquatic Life standards for zinc in the dissolved metals screen. In the total recoverable metals screen, copper is within the range of both Aquatic Life standards, iron exceeds all standards, and manganese exceeds the Secondary MCL. Mercury exceeds all standards (ICP cold vapor test).

Sample B7219903 from Flint Creek exceeds both Aquatic Life standards for zinc and the Secondary MCL and Aquatic Life Acute standards for aluminum in the dissolved metals screen. The sample also exceeds all standards for mercury (ICP cold vapor test).

3.54.5 Structures

Structures at the site include the motor barn, mill building, power shack, outhouse, and two large wood buildings, all in fair to good condition.

3.54.6 Safety

No significant hazards were found at the site. Minor hazards of cuts or abrasions are associated with unauthorized entry into or on the structures.
Figure 3.54-1. Location of the Perseverance Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.54-2. Sketch of the Perseverance Mine and millsite.
Figure 3.54-3. Looking east at the Perseverance Mine adit. Although the portal is covered and open, the adit is completely caved just behind the entrance (Roll B2, frame #6).

Figure 3.54-4. Motor barn at the Perseverance adit. The caved adit is behind the barn at the right side of the picture (Roll B2, frame #7).
Figure 3.54-5. Rails on the Perseverance waste dump extending to the south part of the dump (Roll B2, frame #9).

Figure 3.54-6. Rails (lower left) extending to the mill on the north part of the dump. The small “shed” is actually the uppermost part of the mill structure (Roll B2, frame #8).
Figure 3.54-7. Perseverance mill, looking northeast. Several small outbuildings are north of the mill (Roll B2, frame #14).

Figure 3.54-8. Mill building, looking southeast. The rock retaining wall is prominent on the north side of the structure (Roll B2, frame #20).
Figure 3.54-9. Wilfley table inside the mill (Roll B2, frame #12).

Figure 3.54-10. Perseverance mill with tailings in the foreground (Roll B2, frame #17).
Figure 3.54-11. Tailings washed out of the main impoundment (Roll B2, frame #18).

Figure 3.54-12. Tailings being eroded by Flint Creek (Roll B2, frame #19).
Figure 3.54-13. Buildings below and north of the mill. The edge of the mill is at the far left of the photograph (Roll B2, frame #10).
3.55 RISING STAR MINE (Site Nos. JV-35 and JV-36)
Alternate name—Flint Creek Mine.

3.55.1 Site Location and Access (Figure 2.1-1)

The Rising Star Mine is in the western part of the NE¼ of section 11, T. 6 S., R. 4 W., on the Flint 7.5-minute quadrangle (Figure 3.55-1). The mine is reached by a continuation of the road that goes onto the dump at the Perseverance Mine. The main access is the same as to the Perseverance, following the Flint Creek Road. The road to the Rising Star dump is between the mill and the power shack (and the other building just north of the mill) at the Perseverance. There are a number of prospect pits and trenches along the access road to the Rising Star that are not described in this report. The Rising Star Mine is on either patented claims or BLM land.

3.55.2 Geologic Features (Figures 2.2-1 and 2.2-2)

The material on the waste dumps of the Rising Star Mine consists of bull quartz, granite, and schist. The Rising Star vein parallels the Perseverance vein and is similar in character to that described in section 3.54.2 for the Perseverance Mine.

3.55.3 Site History

Section 3.54.3 (Perseverance Mine) contains a historical review that includes the Rising Star.

3.55.4 Environmental Conditions

3.55.4.1 Site Features

The Rising Star mine was visited by Earl Bennett on July 21, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 3, 1:46:47-1:54:54). Documenting photographs are Roll B2, frames 22-24, and Roll B3, frames 1-5.

The property consists of an upper shaft, a conical-shaped dump and another large dump (both from the shaft), a partially open adit (#1), and a lower caved adit (#2) with a large dump. The shaft (Figure 3.55-2) is 75 feet uphill and a little south of the open adit. The foundation for the hoist is on one side of the shaft. The shaft is caved, full of brush, and about 50 feet across and 50 feet deep. Waste rock from the shaft makes up both the conical dump (Figure 3.55-3) and the other large dump that is just above Adit 1 (Figure 3.55-4). The dump for Adit 1 (Figure 3.55-5) is 70 feet long, 15 feet wide, and 50 feet thick. About 100 feet below Adit 1 is Adit 2, which is caved but has a seep (Figure 3.55-6). The dump for Adit 2 is 330 feet long, 30 feet wide, and 50 feet thick (Figure 3.55-7). The disturbed area at the site covers about 1 acre.
3.55.4.2 Sample Locations

3.55.4.2.1 Solid Samples
No solid samples were collected.

3.55.4.2.2 Water Samples
No water samples were collected.

3.55.5 Structures
Aside from the hoist foundation, there are no structures at the site.

3.55.6 Safety
Although the pit of the caved shaft is about 50 feet deep, the sides are not steep and do not present a hazard. The open adit is the only other hazard at the site.
Figure 3.55-1. Location of the Rising Star Mine, Owyhee County, Idaho (U.S. Geological Survey Flint 7.5-minute topographic map).
Figure 3.55-2. Pit of the caved shaft at the Rising Star Mine (Roll B2, frame #22).

Figure 3.55-3. Conical waste dump of the Rising Star shaft (Roll B3, frame #1).
Figure 3.55-4. Partially open Adit 1 at the Rising Star Mine. The adit is just below the conical waste dump of the shaft (Roll B3, frame #4).

Figure 3.55-5. Waste dump of Adit 1 at the Rising Star Mine (Roll B3, frame #5).
Figure 3.55-6. Caved Adit 2 at the Rising Star Mine (Roll B3, frame #6).

Figure 3.55-7. Waste dump for Adit 2 at the Rising Star Mine (Roll B3, frame #7).
SOUTH MOUNTAIN AREA

3.56 STANDARD MINE (Site Nos. JV-153 and JV-154)

3.56.1 Site Location and Access (Figure 2.1-2)

The Standard Mine is at the head of Mill Creek in the NE¼ of the SE¼ of section 10, T. 8 S., R. 5 W., on the Cliffs 7.5-minute quadrangle (Figure 3.56-1). Access is from the Williams Creek Road that leads to the South Mountain Lookout. About ¾ mile north of the lookout, the road forks. The east fork goes to the Texas and Standard mines. The Standard is about 1 mile from the junction and is east of and ½ mile below the lookout. The site is either on patented land or BLM land; Sorenson (1927) reported the shaft was on an unpatented claim.

3.56.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The South Mountain ore bodies are contact metamorphic deposits in marble and schist around a granodiorite intrusive. The contact zone commonly consists of hedenbergite-ilvaite, with pods and lenses of sulfide mineralization. Tetrahedrite is the predominant ore mineral, with lesser amounts of other metallic sulfides. Typically an oxidized zone at the surface grades into a zone of secondary enrichment and then into unoxidized sulfide ore (Sorenson, 1927). Concerning the Standard Mine, Bell (1907, p. 136) noted:

The best development on this group is immediately adjoining the Texas claim of the Sonnemann property, on what is known as the Standard claim, where a body of soft iron and manganese gossen, twenty feet thick, carries some fine streaks of rich lead carbonate ore. One of these swells to as much as four feet. It has been opened with an incline shaft forty feet deep, from which a drift has been run on the best ore streak, sixty feet long. The ore carries average values of fifty-five per cent lead, fifty to ninety ounces silver, and several dollars in gold per ton, and a carload of mineral has been sorted out ready for shipment. . . . There are several handsome gossen showings along the strike of the main lode on this property to the southeast, in which direction the metal values seem to show a marked increase in copper, and selected samples are found in some of the company’s shallow openings that run as much as twenty per cent copper, one hundred forty ounces silver and one ounce gold per ton. A cross vein has been opened on this group at a point one thousand feet southwest of the main lime zone that shows four feet of carbonate ore containing average values of eighteen per cent lead, ninety ounces silver and eight dollars gold. The extensive development of this group is likely to reveal several important bodies of high grade mineral.

3.56.3 Site History

In the fall of 1902, the Standard Mine was sold to T. F. Walsh. At that time, the property was considered one of the best at South Mountain (1903 Idaho Mine Inspector’s report (IMIR)). By
1906, Walsh’s American Standard Mining and Milling Company held a large group of claims southeast of the Texas claim. The mine shipped 14 tons of ore in 1907 (1907 IMIR). Work continued on the property for the next few years. In 1914, the property had one adit, two crosscuts, and three shafts, for a total development of 1,267 feet. In 1926, the Standard tunnel was caved (Sorenson, 1927).

3.56.4 Environmental Conditions

3.56.4.1 Site Features

The Standard Mine was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:00:42-0:07:03). Documenting photographs are Roll B3, frames 8-10.

The adit at the Standard Mine is caved with a seep of about ½ gallon-per-minute (Figure 3.56-1). Rails from the caved adit extend out onto the waste dump, which measures about 45 feet long, 30 feet wide, and 20 feet thick (Figure 3.55-2). An abundance of pyrite and other sulfides on the yellow-colored dump produce an acrid odor. There is a collapsed structure on the dump that had a tin roof. Just north of the adit and east of the road is a building in good condition. The access road to the mine goes between the building and the dump.

North of the Standard adit is a shaft right on the access road. There is a wire fence on steel posts around the shaft, but one side of the fence has collapsed (Figure 3.55-3). The shaft was sunk in limestone and is about 15 feet deep and full of trash. It is a danger to traffic. The small, overgrown dump for the shaft lies along the road.

The disturbed area at the site covers about 1 acre.

3.56.4.2 Sample Locations

3.56.4.2.1 Solid Samples
   No solid samples were collected.

3.56.4.2.2 Water Samples
   No water samples were collected.

3.56.5 Structures

One building in good condition is along the road, and a collapsed shed is on the adit waste dump.

3.56.6 Safety

The shaft on the access road is a hazard to vehicle traffic.
Figure 3.56-1. Location of the Standard Mine, Owyhee County, Idaho (U.S. Geological Survey Cliffs 7.5-minute topographic map).
Figure 3.56-2. Looking west at the caved adit at the Standard Mine. A rail extends out onto the waste dump. Part of a collapsed building is in the brush to the left of the adit (Roll B3, frame #8).

Figure 3.56-3. Looking southwest at the waste dump for the caved adit at the Standard Mine (Roll B3, frame #10).
Figure 3.56-4. Caved shaft on the access road. Several strands of a barbed wire fence, partly collapsed, surround the shaft (Roll B3, frame #9).
3.57 TEXAS MINE (Site No. JV-151)
Alternate names—Golconda Group; Texas Claim; South Mountain Mine; Sonnemann.

3.57.1 Site Location and Access (Figure 2.1-2)

The Texas Mine is identified by name in the SW¼ of the NE¼ of section 10, T. 8 S., R. 5 W., on the Cliffs 7.5-minute quadrangle (Figure 3.57-1). Access is from the Williams Creek Road that leads to the South Mountain Lookout. The road forks about ¾ mile north of the lookout, with the east fork going to the Texas Mine (Figure 3.57-1). The Texas is about ½ mile from the junction and is north of and ¼ mile below the lookout. A short spur road goes from the main road downhill to the headframe/decline. The mine is at the head of South Mountain Creek on patented claims.

3.57.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The Texas decline is in a manganese-quartz skarn typical of many of the veins on South Mountain. The country rocks are limestone/marble and granite. According to Zoldok and Puffett (1954, p. 7):

The Texas shaft is horizontally 2,100 feet on an approximate bearing of S. 57º E. from the portal of the Laxey adit. This shaft explores an oreshoot in the southeastern extension of the marble-hedenbergite zone to a depth of 90 feet. This oreshoot consists predominantly of chalcopyrite with a zone of sphalerite to the northwest and a relatively rich galena zone to the southeast. The ore is confined to marble bands, interfingering bands of hedenbergite being barren. Considerable oxidation occurs in the upper 50 feet in the shaft, but the tenor of 132 tons of ore taken from near the bottom of the shaft averaged 4.97 percent copper, 8.19 percent zinc, 1.25 percent lead, and 25.25 ounces per ton of silver. Indications are that the oreshoot in the Texas shaft dips and rakes parallel to oreshoots exposed in the lower mine workings.

3.57.3 Site History

Most of the South Mountain properties were discovered and worked in the late 1860s and early 1870s (Sorenson, 1927). A smelter was built in 1874, but the collapse of the Bank of California caused virtually all of the operations to cease the following year (Lindgren, 1900).

In the early 1900s, George Sonnemann consolidated a group of fifteen patented claims, including the Texas claim, under the Golconda Group Mining Company (incorporated in 1908). The claims were apparently idle until leased in 1927 to the Uida Consolidated Mines Company. This company existed for less than a year, and its equipment was sold in the fall of 1927 to cover the company’s debts. In 1929, the Exploration Company of California (ECC), which was incorporated in 1929, optioned the Golconda Group and the adjacent Queen of the Mountains property. Development work started in December 1929 and continued until August 1931. ECC’s option expired in late 1933 or early 1934.
George Sonnemann died in 1939, and subsequently, the property was leased to the South Mountain Mining Company (incorporated in 1940). In 1941, the property had three tunnels (670 feet, 1,360 feet, and 1,935 feet), one 232-foot inclined shaft, five raises, thirty-seven crosscuts, and three drifts, for a total of 4,197 feet of workings. South Mountain continued developing the property for the next four years, and by the middle of 1945, the Golconda Group had a total of 7,704 feet of workings. The company reported ore sales every year from 1941 through 1946 (the 1946 sales were minimal), plus the receipt of government premiums for war-time production. The primary focus of this operation was to obtain zinc ore (Zoldok and Puffett, 1954). After doing 1,055 feet of diamond drilling in the latter half of 1945, South Mountain abandoned the property in late December.

From 1950 to 1954, the property was optioned to P. P. Brandenthaler, doing business in partnership with H. F. Anderson as South Mountain Mining Company (IGS mineral property files). According to Zoldok and Puffett (1955), development work began on the Texas ore shoot in 1950. South Mountain was awarded a DMEA contract for $36,260 (with 50 percent government participation) in 1951. This contract was later increased to $48,860. By the end of November 1953, direct shipping of hand-sorted ore from the Texas ore shoot had repaid $966 of the government loan under this DMEA contract.

South Mountain Mining and Concentrating Company was incorporated in 1954. The company was paying $65,000 for the patented claims (the Golconda Group) and $12,000 for 5 unpatented claims (adjacent to the Golconda Group). A 100-tpd mill was installed on the property in 1955. According to McRae (1965), this mill was built by Potash Corporation of America and processed the dumps and some ore from the Golconda and Laxey ore shoots until 1957. However, South Mountain Mining terminated all its mining and milling operations in June 1956, and the company was dissolved shortly thereafter.

W. A. Bowes, Inc., conducted exploration and development work at South Mountain Mine in the late 1970s. This work continued into the 1980s. In 1984, six men worked at the property, drilling and reconditioning tunnels.

3.57.4 Environmental Conditions

3.57.4.1 Site Features

The Texas Mine was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:07:08-0:11:48). Documenting photographs are Roll B3, frames 11-13.
The most striking feature at the Texas is the headframe at the decline (Figure 3.57-2). The decline measures about 6 feet by 4 feet and has a barbed wire fence around it, but the fence has collapsed (Figure 3.57-3). The pit of the decline contains collapsed timbers and rock debris, but has a small narrow opening among the timbers that someone might be able to squeeze into. A dump just north of the headframe is 145 feet along the steep hillside, measures 30 feet wide, and goes down the hill for about 80 feet (Figure 3.57-4). Copper staining is evident on pieces of the black manganese/iron skarn that, with limestone, comprises the waste rock. The 15-foot-high headframe has an attached ore bin and loading chute. Rails from the headframe went down the decline. The disturbed area covers about 3 acres.

### 3.57.4.2 Sample Locations

#### 3.57.4.2.1 Solid Samples

No solid samples were collected.

#### 3.57.4.2.2 Water Samples

No water samples were collected.

### 3.57.5 Structures

The headframe for the decline is the only structure at the site.

### 3.57.6 Safety

The decline is nearly caved, but a small opening among the collapsed timbers in the pit may lead into the shaft.
Figure 3.57-1. Location of the Texas Mine, Owyhee County, Idaho (U.S. Geological Survey Cliffs 7.5-minute topographic map).
Figure 3.57-2. Headframe at the Texas shaft (Roll B3, frame #11).

Figure 3.57-3. Collapsed debris in the Texas shaft. A narrow opening in the timbers may lead into the decline (Roll B3, frame #12).
Figure 3.57-4. Looking south toward the Texas Mine. The waste dump extends along the slope below the headframe (Roll B3, frame #13).
3.58 LAXEY TUNNEL (Site No. JV-144)
Alternate names—Golconda Group; Mississippi Claim; South Mountain Mine; Sonnemann.

3.58.1 Site Location and Access (Figure 2.1-2)

The Laxey Tunnel is in the upper Williams Creek drainage and is identified by name near the center of the NW¼ of section 10, T. 8 S., R. 5 W., on the Cliffs 7.5-minute topographic map (Figure 3.58-1). The tunnel is the uppermost of the three-tunnel series (the Laxey, Golconda, and Sonnemann adits) that were all driven eastward into the main ore deposit at South Mountain. The Williams Creek Road to the South Mountain Lookout provides access to the tunnel. The adit is about ¾ mile above the cabins at the base of South Mountain and is just north of a switchback on the main road. The adit is on patented claims.

3.58.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The general geology of the South Mountain area has been described section 3.56.2 (Standard Mine). Sorenson (1927, p. 43) described this site:

The Laxey tunnel is driven for 60 feet into an oxidized deposit near the footwall of the contact rock. It exposes oxidized ore throughout its length. A short crosscut, 15 feet long, is driven toward the foot wall in oxidized material, a sample of which assayed $11 gold, 26.4 ounces silver, 1.7% lead, 4.25% copper, and 6.7% zinc according to Hayden [manuscript report referenced by Sorenson]. The minerals present are of the oxidized type. Malachite, azurite, cerusite, smithsonite, calamine, caledonite, linarite, limonite, and hematite were identified from this deposit.

3.58.3 Site History

The Laxey is on one of the patented claims of the Golconda Group. See section 3.57.3 (Texas Mine) for the history of the property.

3.58.4 Environmental Conditions

3.58.4.1 Site Features

This site was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:11:54-0:17:39). Documenting photographs are Roll B3, frames 15-18.

The mine consists of a single open, but gated, adit with a large dump. A double-locked wire gate, about 40 feet inside from the timber-covered portal, secures the adit (Figures 3.58-2 and 3.58-3). There are mine timbers and other lumber in front of the portal. A seep trickling out of
the adit disappears into the dump. Old rails from the adit extend out over a large dump measuring 125 feet long, 80 feet wide, and 90 feet thick. The rails are suspended on a partially collapsed wooden trestle that is about 100 feet long (Figure 3.58-4). A considerable amount of scrap iron is on the dump. Calc-silicate minerals are prominent in pieces of the manganese/iron skarn and limestone on the dump. The site covers about 3 acres.

3.58.4.2 Sample Locations

3.58.4.2.1 Solid Samples
No solid samples were collected.

3.58.4.2.2 Water Samples
No water samples were collected.

3.58.5 Structures
There are no structures at the site.

3.58.6 Safety
The adit is open but well-secured by a double-locked wire gate. No other hazards were found.
Figure 3.58-1. Location of the Laxey Tunnel, Owyhee County, Idaho (U.S. Geological Survey Cliffs 7.5-minute topographic map).
Figure 3.58-2. Covered portal of the Laxey Tunnel (Roll B3, frame #17).

Figure 3.58-3. View inside the covered entrance to the Laxey Tunnel. The adit is blocked by a locked wire gate about 40 feet from the entrance (Roll B3, frame #16).
Figure 3.58-4. Looking northwest at the trestle at the north end of the waste dump for the Laxey Tunnel (Roll B3, frame #18).
3.59 GOLCONDA TUNNEL (Site No. JV-140)
Alternate name—old Golconda Tunnel; Golconda Group; Alabama Claim; South Mountain Mine; Sonnemann.

3.59.1 Site Location and Access (Figure 2.1-2)

The Golconda Tunnel, the next major adit downhill (¼ mile) from the Laxey Tunnel, is along the south edge of the NW¼ of the NW¼ of section 10, T. 8 S., R. 5 W., on the Cliffs 7.5-minute quadrangle (Figure 3.59-1). The Williams Creek Road to the South Mountain Lookout passes the adit. It is about ½ mile above the cabins at the base of South Mountain and just north of the main road. The Golconda is shown by name on the topographic map and is on patented claims.

3.59.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The general geology of the South Mountain area is discussed in section 3.56.2 (Standard Mine). The old Golconda tunnel was driven to intersect the Golconda vein, and from this level, carbonate ore was stoped to the surface (Sorenson, 1927, citing a manuscript by R. N. Bell, 1907). Sorenson (1927, p. 42), quoting from Bell’s report, reported:

“From the face of this old tunnel at a point on the cross fissure, a shaft was sunk 100 feet deep which is said to carry its full width in the solid sulphide ore, rich in lead from top to bottom, and from a station 100 feet distant on the same ore body, a winze was sunk 60 feet on the same class of solid sulphide ore.”

3.59.3 Site History

This adit is on one of the patented claims of the Golconda Group. See section 3.57.3 for the history of the property.

3.59.4 Environmental Conditions

3.59.4.1 Site Features

The Golconda Tunnel was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:17:45-0:20:00). Documenting photographs are Roll B3, frames 19-21.

The caved adit (Figure 3.59-2) has a flow of about 2 gallons per minute that goes around the south side of the dump. A sample was not collected here because of the large quantity of water flowing from the Sonnemann tunnel (which was sampled) about ¼ mile down the hill from the Golconda. The road to the lookout crosses a corner of the bulldozed and flattened dump, which measures 95 feet long, 85 feet across, and 50 feet thick on the nose (Figure 3.59-3). The dump and adit cover about 1.5 acres.
3.59.4.2 Sample Locations

3.59.4.2.1 Solid Samples
No solid samples were collected.

3.59.4.2.2 Water Samples
No water samples were collected.

3.59.5 Structures
There are no structures at the site.

3.59.6 Safety
There are no safety hazards at the site.
Figure 3.59-1. Location of the Golconda Tunnel, Owyhee County, Idaho (U.S. Geological Survey Cliffs 7.5-minute topographic map).
Figure 3.59-2. Caved Golconda Tunnel. Water discharges from the caved adit at about 2 gallons per minute (Roll B3, frame #19).

Figure 3.59-3. Looking east at the Golconda Tunnel waste dump (lower part of picture). The Laxey Tunnel waste dump and trestle is just above the Golconda at the center of the picture (Roll B3, frame #21).
3.60 UNNAMED PROSPECT (Site No. B7229901; JV-181)

3.60.1 Site Location and Access (Figure 2.1-2)

Just south of the Golconda dump and the access road to the South Mountain Lookout is an old road leading northwestward to a red-colored dump. This prospect is near the center of the west edge of the NW¼ of section 10, T. 8 S., R. 5 W., on the Cliffs 7.5-minute quadrangle (Figure 3.60-1). It is close to the prospect shown near the west border of the section. The dump is just above Williams Creek on patented claims.

3.60.2 Geologic Features (Figures 2.2-1 and 2.2-3)

This prospect is in iron-stained carbonate/skarn typical of the South Mountain deposits.

3.60.3 Site History

This prospect is probably related to the Golconda Group or the Bay State Group. See section 3.57.3 for the history of the Golconda Group. History on the Bay State Group is given in section 3.62.3

3.60.4 Environmental Conditions

3.60.4.1 Site Features

The site was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:20:06-0:22:07). Documenting photograph is Roll B3, frame 20 (taken from the Golconda Tunnel waste dump).

The prospect consists of a caved, dry adit with a red-colored, iron-stained dump (Figure 3.60-2). There are also a few pits along the short, overgrown access road to the adit. The site covers no more than 0.5 acre.

3.60.4.2 Sample Locations

3.60.4.2.1 Solid Samples

No solid samples were collected.

3.60.4.2.2 Water Samples

No water samples were collected.

3.60.5 Structures

There are no structures at the site.
3.60.6 Safety
There are no safety hazards at the site.
Figure 3.60-1. Location of Unnamed Prospect, Site No. B7229901, Owyhee County, Idaho (U.S. Geological Survey Cliffs 7.5-minute topographic map).
Figure 3.60-2. Small waste dump of Unnamed Prospect, Site No. B7229901 (on the far slope, just above the center of the picture). The large flat area in the foreground is the waste dump of the Golconda Tunnel (Roll B3, frame #20).
3.61 SONNEMANN MINE (Site No. JV-138)
Alternate names—new Golconda Tunnel; Sonneman Mine; South Mountain Mine; Golconda Group Mining Co.

3.61.1 Site Location and Access (Figure 2.1-2)

The Sonnemann Mine, on Williams Creek, is identified on the topographic map in the SW¼ of the NW¼ of section 10, T. 8 S., R. 5 W., on the Cliffs 7.5-minute quadrangle (Figure 3.61-1). Access is via the Williams Creek Road that continues past the mine to the South Mountain Lookout. The road passes the Sonneman adit and mill. The mine and mill are on patented claims.

3.61.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The geology for this adit is similar to that described for the rest of the Golconda Group (section 3.56.2, Standard Mine). The adit was caved when Sorenson visited the property in 1926.

3.61.3 Site History

This site is part of the Golconda Group, organized by George Sonnemann around 1900. See section 3.57.3 for a historical overview of the property. Although this adit, originally called the new Golconda tunnel, is part of the Golconda Group, a map showing the claims in the area by Sorenson (1927, Plate IIA) locates the adit on the Queen of the Mountains claim, one of two claims between the Golconda Group and the Bay State Group. The Queen of the Mountains was often leased to the same operators as the Golconda Group.

3.61.4 Environmental Conditions

3.61.4.1 Site Features

The Sonnemann Mine was visited by Earl Bennett on July 22, 1999. A video segment describing the property is on the Owyhee County Videotape (Tape 4, 0:22:13-0:39:07). Documenting photographs are Roll B3, frames 22-25, and Roll B4, frames 1-8; and frames 22-25 (mine and mill sites), and Roll B5, frames 0A-3A (old townsite).

The Sonnemann Mine site is the largest at South Mountain. This site consists of the Sonnemann adit, a large waste dump, and a millsite with a significant amount of tailings (Figures 3.61-2 and 3.61-3). The mine has an open adit that has water discharging at 15-20 gallons per minute. The adit is gated and locked with a sign painted on the gate that reads “Danger Keep Out.” A timbered portal with plywood siding covers the opening (Figure 3.61-4). The water flows out over a very large dump and into the area below the portal containing the remains of the mill (Figure 3.61-5). The mill buildings are gone, but the foundations are still evident (Figures 3.61-6 and 3.61-7). The dump measures at least 500 feet long, 60 feet wide, and 60 feet thick, not
including additional waste rock near the mill foundation. There are several buildings above the old mill and just outside of the adit that are in good condition, including one large steel-covered building, a row of sheds, and a small power shack (Figure 3.61-8). The tunnel, dump, and millsite cover at least 20 acres.

About ¼ mile downhill and north from the Sonneman tunnel and mill is the mill tailings disposal site (Figures 3.61-9 and 3.61-10). The impoundment is just southeast of the mine camp (townsite). The tailings area is large, and Williams Creek flows through part of the impoundment. The waste material is stacked in three tiers or benches. A dam, about 5 feet thick and made of boards set on end, constrained the tails at the north end of the impoundment. A white crust has formed on top of some of the tailings. Signs of cattle activity on the tailings were plentiful. Most of the tailings are very fine and are probably flotation tails. The impoundment covers about 1 acre.

The old townsite (mine camp) has six standing buildings. Included are two older buildings on the south end of the settlement (Figure 3.61-11), a nice cabin on the Bay State adit dump (west side of Williams Creek; Figure 3.61-12), older buildings and an outhouse on the north end of the settlement on the east side of Williams Creek (Figure 3.61-13), and two good buildings on the west side of the road, which are posted “No Trespassing” (Figure 3.61-14). The townsite covers several acres.

3.61.4.2 Sample Locations

3.61.4.2.1 Solid Samples

Two samples were collected from the tailings. B7229903 was a composite grab sample. Sample B7229904 is the white crust material on the lower part of the impoundment.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Analyzed (Yes/No)</th>
</tr>
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<tbody>
<tr>
<td>B7229903</td>
<td>Sonnemann mill tails</td>
<td>Yes</td>
</tr>
<tr>
<td>B7229904</td>
<td>Sonnemann mill tails with white crust</td>
<td>Yes</td>
</tr>
</tbody>
</table>

3.61.4.2.2 Water Samples

Sample B7229902 was collected from the adit water. A water sample (B7229905) was also taken from the east tributary of Williams Creek just behind and south of the older buildings on the south end of the townsite.
3.61.4.2.3 Analytical Results

Solid Samples

In the element screen, Sample B7229903 has elevated levels of arsenic, cadmium, copper, iron, lead, and zinc. Cadmium, chromium, and mercury were leaching from the sample in the TCLP for metals test. Sample B7229904, from the white crust, has elevated levels of arsenic, cadmium, chromium, copper, iron, manganese, lead, and zinc in the element screen. In the TCLP for metals test, a significant tendency for leaching was noted for arsenic, cadmium, chromium, mercury, and selenium.

Water Samples

Sample B7229902 from the Sonnemann adit exceeds all standards for cadmium and both Aquatic Life standards for zinc in the dissolved metals screen. In the total recoverable metals screen, zinc exceeds both Aquatic Life standards and cadmium exceeds all standards. In addition, the sample exceeds the Primary MCL for arsenic, the Aquatic Life Chronic standard for lead, and all standards for mercury.

The downstream sample from Williams Creek, B7229905, exceeds all standards for cadmium, is within the range of the Primary MCL for aluminum, and exceeds both Aquatic Life standards for zinc in the dissolved metals screen. It exceeds both Aquatic Life standards for zinc in the total recoverable metals screen. The sample also exceeds all standards for mercury (ICP cold vapor test).

3.61.5 Structures

Most of the buildings at the Sonnemann tunnel are in reasonable repair. The mill footings and foundations are present. Part of the wooden tailings dam is preserved at the tailings impoundment. There are several good buildings at the townsite (mine camp) located on Williams Creek below the mine and tailings impoundment.
3.61.6 Safety

The adit is gated and securely locked. No other significant physical hazards were found at the site.
Figure 3.61-1. Location of the Sonnemann Mine, Owyhee County, Idaho (U.S. Geological Survey Cliffs 7.5-minute topographic map).
Figure 3.61-2. Sketch of the Sonnemann Mine site.
Figure 3.61-3. Sketch of the Sonnemann mill tailings impoundment.
Figure 3.61-4. Covered entrance and large metal building at the Sonnemann adit. A steady stream of water flows from the adit. The bent rails extend out across the dump (Roll B4, frame #4).

Figure 3.61-5. Adit water flowing below the adit across the area formerly occupied by the mill (Roll B4, frame #6).
Figure 3.61-6. Left frame of a two-frame panorama of the millsite, looking southwest. The collapsed wood structure at the left was probably an ore bin or chute. The concrete mill footings are at the lower right (Roll B4, frame #2).

Figure 3.61-7. Right frame of a two-frame panorama of the millsite. The Williams Creek Road crosses the center of the frame. View is to the west (Roll B4, frame #1).
Figure 3.61-8. Row of sheds and metal building at the Sonnemann adit. The covered portal is at the far left. View is to the south (Roll B4, frame #5).
Figure 3.61-9. Left frame of a two-frame panorama of the three-tiered tailings impoundment. A crust of white precipitate has formed on the lowest tier. The brown spots in the white crust are cattle tracks (Roll B4, frame #22).

Figure 3.61-10. Right frame of a two-frame panorama of the tailings impoundment. The three tiers of the impoundment are evident in this picture (Roll B4, frame #24).
Figure 3.61-11. Two old buildings at the south end of the settlement on Williams Creek (Roll B5, frame #0A).

Figure 3.61-12. Nice cabin (center of the photograph) on the Bay State Mine adit dump on the west side of Williams Creek (Roll B5, frame #3A).
Figure 3.61-13. Older buildings and outhouse at the north end of the settlement (Roll B5, frame #1A).

Figure 3.61-14. Two buildings in good condition on the east side of Williams Creek (Roll B5, frame #2A).
3.62 BAY STATE MINE (Site Nos. JV-132 through JV-135)

Alternate names—JV-132: Bay State Tunnel; Bay State Group; Massachusetts Claim; JV-133: Independence Shaft; Independent Claim; JV-134: Bay State Shaft; Bay State Group; Massachusetts Claim; JV-135: Illinois Shaft; Bay State Group; Illinois Claim.

3.62.1 Site Location and Access (Figure 2.1-2)

The workings of the Bay State Mine are in the SE¼ of section 4, T. 8 S., R. 5 W., on the Williams Creek and Cliffs 7.5-minute quadrangles (Figure 3.62-1). Included in this site description are the Bay State tunnel (JV-132), which is now a cabin site near the old townsite on Williams Creek, the Bay State shaft (JV-134), the Independence shaft (JV-133), and the Illinois shaft (JV-135). All three shafts are near the boundary of the two quadrangles. About ½ mile south of the old townsite, an old overgrown road splits from the Williams Creek Road at the first major switchback. This old road leads to the Illinois shaft and continues on to the larger Independence and Bay State shafts and other workings. The Bay State workings are on patented claims.

3.62.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The general geology of the South Mountain area has been discussed in section 5.56.2. Sorenson (1927, p. 40-41) described several veins on the Bay State Group claims.

3.62.3 Site History

The Bay State was one of the original mines in the area and was discovered about 1870. Raymond (1873a, p. 254) noted: “During the fall [of 1871] accounts reached me of the discovery of valuable mines at South Mountain, about twenty-five miles south of Silver City.” In 1872, Raymond (1873b) noted that the Bay State shaft was 30 feet deep and the Independent (Independence) shaft was 60 feet deep. He also reported that the townsite for Bullion City had been laid out. In 1874, the Bay State shaft was 135 feet deep and levels extended over 200 feet along the vein in each direction (Raymond, 1875). By 1875, in part because of the collapse of the Bank of California, South Mountain was a “dead camp.” In addition to the bank collapse, the incompetence of the management of the South Mountain Consolidated Mining and Smelting Company was blamed for the closure of the mines (Raymond, 1877, p. 227).

The property was apparently inactive in 1926 (Sorenson, 1927), and no references to later activity were found. Present ownership of the patented claims was not determined.

3.62.4 Environmental Conditions

3.62.4.1 Site Features

The Bay State Mine was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:39:13-0:50:13). Documenting photographs are Roll B3, frame 14, and Roll B4, frames 11-21.
What is believed to be the caved and dry Bay State tunnel site is now a cabin site on a dump on the extreme west side of the townsite (Figure 3.61-12).

The Bay State shaft (JV-134) is a dry, open decline with no supporting timbers (Figures 3.62-2 and 3.62-3) in red-colored gossan and limestone. It was fenced with barbed wire at one time, but the fence has been knocked down. The dump is extensive on the very steep hillside.

The Independence shaft (Figure 3.62-4) is southwest of the Bay State shaft. It is a much larger, and probably very deep, vertical shaft. A pipe fence around the Independence (about 30 feet across) is posted with “Danger-Keep Out” signs. One side of the opening looks as if it will soon cave into the shaft, taking part of the pipe fence with it. Behind the shaft is an open area (Figure 3.62-5) with some old gearboxes that are probably part of the hoist. The open, flat space where the hoist was located is in limestone. A large dump (Figure 3.62-6) is downhill from the shaft.

The Illinois shaft, a dry and open decline (Figure 3.62-7), is southeast of the Independence shaft and above the first switchback on the road to the lookout. The dump measures 25 feet wide and 20 feet long, but a considerable amount of waste rock is on the hillside. A black plastic pipe from an undetermined source goes into the decline. Some of the water from the pipe flows down the road and some drains into the shaft.

The Grant Incline (JV-129) was not documented. Sorenson (1927) shows it just south of the Mexican Shaft (section 3.63) on the south side of the same drainage (Sorenson calls this drainage Wessels Creek).

The total disturbed area at the Bay State workings covers several acres. Disturbance at individual sites is less than 0.5 acre.

3.62.4.2 Sample Locations

3.62.4.2.1 Solid Samples
No solid samples were collected.

3.62.4.2.2 Water Samples
No water samples were collected.

3.62.5 Structures

Buildings at the old townsite on Williams Creek are described in the Sonnemann Mine section (section 3.61). One of the cabins is on what is most likely the Bay State tunnel waste dump.

3.62.6 Safety

The open shafts are a hazard. A barbed wire fence at the Bay State shaft has been knocked down. The pipe fence around the Independence shaft is mostly intact, but part of the fence appears ready to collapse into the shaft. There is no fence at the Illinois shaft and no warning signs are posted.
Figure 3.62-1. Location of the Bay State Mine workings, Owyhee County, Idaho (U.S. Geological Survey Williams Creek and Cliffs 7.5-minute topographic maps).
Figure 3.62-2. Looking west toward the Bay State shaft sunk in gossan and limestone. The opening is at the center of the photograph (Roll B4, frame #11).

Figure 3.62-3. Close-up of the small opening into the Bay State shaft, a decline (Roll B4, frame #12).
Figure 3.62-4. Opening into the Independence shaft at the Bay State Mine (Roll B4, frame #17).

Figure 3.62-5. Pipe fence around the Independence shaft (Roll B4, frame #14).
Figure 3.62-6. Open area behind the pipe fence at the Independence shaft. This area probably supported the hoist for the shaft (Roll B4, frame #13).

Figure 3.62-7. Waste dump below the Independence shaft, looking north (Roll B4, frame #19).
Figure 3.62-8. Large rocks at the opening of the Illinois shaft, another decline (Roll B4, frame #20).
3.63 WASHINGTON TUNNEL AND MEXICAN SHAFT (Site Nos. JV-127 and JV-128)
Alternate names—Washington Claim; Tunnel Group.

3.63.1 Site Location and Access (Figure 2.1-2)

The Washington Tunnel and the Mexican Shaft, which is about 100 yards east of the Washington Tunnel, are on a short tributary to Williams Creek in the NW¼ of the NE¼ of the SE¼ of section 4, T. 8 S., R. 5 W., on the Williams Creek 7.5-minute quadrangle (Figure 3.63-1). Access is by a road to the west from the Williams Creek Road about ¼ mile north of the townsite (mine camp) at the base of South Mountain and a short distance south of the smelter slag pile. The property is probably on patented claims.

3.63.2 Geologic Features (Figures 2.2-1 and 2.2-3)

Sorenson (1927, p. 40) identified these workings as the Tunnel Group and described them as follows:

The Tunnel Group includes the patented claims north of Wessels Creek. They are the northern parts of the Washington, Idaho, and Oregon claims, and the New York, Vermont, and Maine claims in entirety. Shallow surface openings on the New York and Washington claims expose some oxidized material which outlines a fairly well defined deposit in the “AL” limestone dipping and striking with the latter. The surface exposure of the deposit is about 3 to 5 feet in thickness. The Washington tunnel, which is caved near the portal, was evidently run to tap the deposit exposed on the hill north of the tunnel opening. Sulphide ore on the Washington tunnel dump contains the usual sequence of pyrite, arsenopyrite, pyrrhotite, chalcopyrite and sphalerite, and galena. No tetrahedrite was positively identified in the material. The gangue is quartz and calcite, and the vein matter replaces residual calcite.

3.63.3 Site History

In 1872, Raymond (1873b), indicated the Grant (probably the Grant incline of the Bay State Group) was the lowest location being worked in the canyon. The Grant is just south of the Washington Tunnel and Mexican Shaft, so these workings may not have been started until 1873 or 1874. They probably closed when the rest of the mines shut down in 1874 or 1875.

3.63.4 Environmental Conditions

3.63.4.1 Site Features

This site was visited by Earl Bennett on July 22, 1999. A video segment describing the workings is on the Owyhee County Videotape (Tape 4, 0:50:18-0:55:04). Documenting photographs are Roll B5, frames 4A-7A.
The workings consist of an open, dry adit (covered with stinging nettles) at the Washington Mine (Figure 3.63-2) and a shaft at the Mexican Shaft. The dump at the Washington adit is 100 feet long, 20 feet wide, and 20 feet thick. It lies parallel to and impinges on the tributary drainage. There are rails coming out of the adit, and a small, collapsed building on the dump.

A wood platform marks the location of the hoist base at the Mexican shaft (Figure 3.63-3). The shaft is open, has a concrete collar, and is full of water (Figure 3.63-4). Pipe and other scrap metal, including a steel barrel with holes in it, are on the dump, which measures 100 feet long, 25 feet wide, and 30 feet thick. This dump is close to the stream (Figure 3.63-5). The dumps from the adit and the shaft are almost connected. Each site covers about 1 acre.

3.63.4.2 Sample Locations

3.63.4.2.1 Solid Samples
No solid samples were collected.

3.63.4.2.2 Water Samples
No water samples were collected.

3.63.5 Structures
The wooden platform at the shaft is the only remnant of a structure at the site.

3.63.6 Safety
The adit is open, although overgrown with stinging nettles. The shaft is open and filled with water. Both sites are easily accessible from Williams Creek Road.
Figure 3.63-1. Location of the Washington Tunnel and the Mexican Shaft, Owyhee County, Idaho (U.S. Geological Survey Williams Creek 7.5-minute topographic map).
Figure 3.63-2. Nettle-covered entrance of the Washington tunnel (Roll B5, frame #4A).

Figure 3.63-3. Old wooden platform over the Mexican shaft (Roll B5, frame #5A).

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Figure 3.63-4. Close up of the opening into the Mexican shaft under the platform. The shaft is filled with water (Roll B5, frame #6A).

Figure 3.63-5. Waste dump for the Mexican shaft (Roll B5, frame #7A).
3.64 SOUTH MOUNTAIN SMELTER SITE (no site number)

3.64.1 Site Location and Access (Figure 2.1-2)

The old smelter site for the South Mountain mines is in the NW¼ of the SW¼ of the NW¼ of section 3, T. 8 S., R. 5 W., on the Williams Creek 7.5-minute quadrangle (Figure 3.64-1). A black slag pile and the remains of a building are evident on the east side of the road that goes up Williams Creek to the South Mountain Lookout. The road crosses the creek at the smelter site. Just past the smelter is the tributary to the west where the Mexican shaft and Washington tunnel are located. The smelter site is either on patented claims or BLM land.

3.64.2 Geologic Features (Figures 2.2-1 and 2.2-3)

The smelter was built on a schist and quartzite unit in the South Mountain roof pendant (Sorenson, 1927).

3.64.3 Site History

The South Mountain smelter was built in 1874 but shut down the following year because of the financial collapse of the Bank of California (Lindgren, 1900).

3.64.4 Environmental Conditions

3.64.4.1 Site Features

The smelter site was visited by Earl Bennett on July 22, 1999. A video segment describing the site is on the Owyhee County Videotape (Tape 4, 0:55:12-0:59:05). Documenting photographs are Roll B5, frames 8A-9A.

The site is characterized mainly by black smelter slag (glass), which covers about 1.5 acres and is about 6 feet thick. The slag pile is in two parts, probably separated by the site of the smelter (Figure 3.64-2). A pile of timbers is on the north side of the lower slag pile (Figure 3.64-3). The south edge of the pile is only three feet from Williams Creek.

3.64.4.2 Sample Locations

3.64.4.2.1 Solid Samples

Sample B7229906 is a composite grab sample of the slag.

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<td>B7229906</td>
<td>South Mountain smelter slag</td>
<td>Yes</td>
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3.64.4.2.2 Water Samples
   No water samples were collected.

3.64.4.2.3 Analytical Results
   Solid Sample
   Slag sample B7229906 has elevated levels of arsenic, cadmium, chromium (slight), copper, iron, lead, and zinc in the element screen. Elements that showed significant amounts of leaching in the TCLP for metals test include arsenic, cadmium, chromium, mercury, and lead.

3.64.5 Structures
   No structures remain at the site.

3.64.6 Safety
   There are no safety hazards at the site.
Figure 3.64-1. Location of the South Mountain smelter, Owyhee County, Idaho (U.S. Geological Survey Williams Creek 7.5-minute topographic map).
Figure 3.64-2. Looking northeast at the slag piles for the South Mountain smelter. Williams Creek flows along the base of the pile (lower right). Williams Creek Road is at the lower left (Roll B5, frame #8A).

Figure 3.64-3. Lower of the two slag piles along the road. A pile of old timbers is adjacent to the slag (lower left) (Roll B5, frame #9A).
References


Appendix A
GPS Locations
Table A-1. GPS readings for abandoned mine sites in the Flint Creek-South Mountain area.

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<th>Latitude</th>
<th>Longitude</th>
<th>Comments</th>
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<tbody>
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<td>Nellie Anne Mine</td>
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<td>116º 47.872'</td>
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<tr>
<td>JV-21</td>
<td>Martin Prospect</td>
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<td>116º 48.034'</td>
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<td>Rising Star Mine</td>
<td>42º 55.197'</td>
<td>116º 46.675'</td>
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<td>JV-153</td>
<td>Standard Mine</td>
<td>42º 44.379'</td>
<td>116º 54.389'</td>
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<td>JV-154</td>
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<td>JV-140</td>
<td>Golconda Tunnel</td>
<td>42º 44.715'</td>
<td>116º 55.249'</td>
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<td>JV-138</td>
<td>Sonnemann Mine</td>
<td>42º 44.803'</td>
<td>116º 55.292'</td>
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Appendix B
Database Fields
NEWLOCWL 1
ORNENUM 451
MAPLOC 1
DEPOSIT Eagle Creek Mine

MRDSREC MIRSREF 0160790528
PERIODPROD

ORE COMMOD Au

LATITUDE 474325
LONGITUDE 1154916
HARDFILE N
MLA
NAME EAGLE CREEK MINE
SEC 33
SUBSEC NESE
TWN 051 N
RNG 005 E
DDMMSS 474325
DDDMMSS 1154904
OPTYP SURFAC
STATUS PAST PRO
COMMO2 GOLD
COMMO3
COMMO4
COMMO5
MAPNAME BURKE
QUAD WALLACE
POP 1KM
TOE M
YFC
MPF
SEITENAME
DISTRICT
COUNTY
SECQUAD
SECUADSCSCL
UTMNORTH
UTMEAST
UTMZONE
COMMODITY
LAT
LON
TOWN
SECTION
RANGE
Appendix C
Geochemical Data
ACCURACY OF GEOCHEMICAL DATA

The following information was received on the subject of the accuracy and the detection limits for the geochemical data presented in this report:

That is something I put together some years ago for another client. Also Greg Moller [Technical Director, Analytical Sciences Laboratory] had input. Other than that, the refs are included in the discussions I sent [discussion titled “Practical Quantitation Limits”; see next page].

Good Luck
Kim,

Kim A. Anderson, Ph.D.
Asst. Prof. / Food Science and Toxicology Dept.
Chief Chemist / Analytical Sciences Laboratory
University of Idaho
Moscow, Idaho 83844-2201
208-885-7900/FAX 209-885-8937
Sensitivity of an analytical method is often based on its ability to reproducibly detect target analytes above the method noise level. Several similar definitions of this Minimum Detection Level or Limit (MDL) or Limit of Detection (LOD) are currently used. According to the American Chemical Society (ACS) (Principles of Environmental Analysis, p 9):

**Limit of detection (LOD)** "is defined as the lowest concentration level that can be determined as statistically different from the blank".

**Instrument detection limit (IDL)** "is the smallest signal above background noise that an instrument can detect reliably and is often equivalent to the LOD".

**Method detection limit (MDL)** "is the lowest concentration of analyte that can that a method can detect reliably in either a sample or a blank".

ACS recommends the value of LOD to be $3\sigma$ for a 99% confidence level, where $\sigma$ is the standard deviation of the measurement.

**Limit of Quantitation (LOQ)** "is defined as the level above which quantitative results may be obtained with a specified degree of confidence".

ACS recommends an LOQ of $10\sigma$ and this imparts a quantitative measurement uncertainty of +/-30% in the measured value at this 99% confidence level. ACS contends "**quantitative interpretation, decision-making and regulatory actions should be limited to data at or above the limit of quantitation**". In particular, ACS states: "Analytical chemists must always emphasize to the public that the single most important characteristic of any result obtained from one or more analytical measurements is an adequate statement of its uncertainty level. Lawyers usually attempt to dispense with uncertainty and try to obtain unequivocal statements; therefore, an uncertainty interval must be clearly defined in cases involving litigation and/or enforcement proceedings. Otherwise, a value of 1.001 without a specified uncertainty, for example, may be viewed as legally exceeding a permissible level of 1."

EPA Methods used for regulatory enforcement use the same definition of MDL. "The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the value is above zero". Since performance of analytical methodology and therefore detection limits vary significantly with non-controllable laboratory to laboratory variables such as the exact type of analytical instrumentation, EPA promulgates the concept of Practical Quantitation Limits (PQL). A PQL is equal to the MDL multiplied by a factor of ten or greater and are published as a general guide to laboratory method performance. The factors can range from ten to ten thousand depending on sample matrix and are intended to allow the laboratory the flexibility to determine the relative performance of an analytical method in a more complex sample matrix. In confirmation of laboratory variability, EPA methods as well as other published analytical methods often estimate detection limits and quantitation limits using a bench-level expert, performance estimate.
Recognition of the "average performance" nature of the PQL guidelines, EPA states that PQL's "are the lowest concentrations of analytes in (samples) that can be reliably determined within specified limits of precision and accuracy by the indicated methods under routine laboratory operating conditions. The PQL's listed are generally stated to one significant figure. CAUTION: The PQL values in many cases are based only on a general estimate for the method and not on a determination for the individual compounds; PQL’s are not a part of the regulation (40 CFR Part 264 Appendix IX, Footnote 6)."
### Water Samples

#### Dissolved Metals Screen (EPA 200.7)

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Location</th>
<th>Al (ppm)</th>
<th>Ba (ppm)</th>
<th>Be (ppm)</th>
<th>Cd (ppm)</th>
<th>Ca (ppm)</th>
<th>Cr (ppm)</th>
<th>Co (ppm)</th>
<th>Cu (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B7219901</td>
<td>Perseverance Mine (JV-33), adit water</td>
<td>0.460</td>
<td>1.1000</td>
<td>0.0006</td>
<td>BDL</td>
<td>80.000</td>
<td>BDL</td>
<td>0.0140</td>
<td>0.0088</td>
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<tr>
<td>B7219903</td>
<td>Perseverance Mine (JV-33), downstream on 0.110</td>
<td>0.6800</td>
<td>0.0003</td>
<td>BDL</td>
<td>17.000</td>
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<td>BDL</td>
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<tr>
<td>B7229902</td>
<td>Sonnemann Tunnel (JV-138), adit water</td>
<td>BDL</td>
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<td>0.0003</td>
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<td>BDL</td>
<td>BDL</td>
</tr>
<tr>
<td>B7229905</td>
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<td>0.0003</td>
<td>0.0069</td>
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#### Total Recoverable Metals Screen (EPA 200.7)

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<th>Be (ppm)</th>
<th>Cd (ppm)</th>
<th>Ca (ppm)</th>
<th>Cr (ppm)</th>
<th>Co (ppm)</th>
<th>Cu (ppm)</th>
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</thead>
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<tr>
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<td>Perseverance Mine (JV-33), adit water</td>
<td>0.100</td>
<td>0.0006</td>
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<td>B7219903</td>
<td>Perseverance Mine (JV-33), downstream on Flint Creek</td>
<td>0.022</td>
<td>BDL</td>
<td>BDL</td>
<td>18.000</td>
<td>BDL</td>
<td>0.005</td>
<td>BDL</td>
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<tr>
<td>B7229902</td>
<td>Sonnemann Tunnel (JV-138), adit water</td>
<td>0.007</td>
<td>BDL</td>
<td>0.009</td>
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<td>Sonnemann Tunnel (JV-138), downstream on Williams Creek</td>
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#### EPA 200.8 EPA 200.8 ICP Cold Vapor

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<th>As (ppb)</th>
<th>Pb (ppb)</th>
<th>Hg (ppb)</th>
</tr>
</thead>
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<tr>
<td>B7219901</td>
<td>Perseverance Mine (JV-33), adit water</td>
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<td>B7229902</td>
<td>Sonnemann Tunnel (JV-138), adit water</td>
<td>61.00</td>
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<td>Mg (ppm)</td>
<td>Mn (ppm)</td>
<td>Mo (ppm)</td>
<td>Ni (ppm)</td>
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## Solid Samples

**Element Screen (EPA 3050)**

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<th>Zn (ppm)</th>
<th>Mn (ppm)</th>
<th>Cu (ppm)</th>
<th>Fe (ppm)</th>
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<td>B7219902</td>
<td>Perseverance Mill, mill tailings</td>
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<td>380.0</td>
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<td>71</td>
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## TCLP for Metals (EPA 1311)

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<td>Cr (ppm)</td>
<td>Cd (ppm)</td>
<td>Ba (ppm)</td>
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<td>Co (ppm)</td>
<td>Be (ppm)</td>
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<td>North Extension of the Silver Queen (Birmingham)</td>
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