Montana Bureau of Mines and Geology

Abandoned - Inactive Mines Program

Deerlodge National Forest

Volume IV
Upper Clark Fork River Drainage

Open-File Report 346

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Introduction

In order to fulfill its obligations under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Northern Region of the United States Forest Service (USFS) desires to identify and characterize the abandoned and inactive mines with environmental, health, and/or safety problems that are on or affecting National Forest System lands. The Northern Region of the USFS administers National Forest System lands in Montana and parts of Idaho and North Dakota. Meanwhile, the Montana Bureau of Mines and Geology (MBMG) collects and distributes information about the geology, mineral resources, and ground water of Montana. Consequently, the USFS and the MBMG determined that an inventory and preliminary characterization of abandoned and inactive mines in Montana would be beneficial to both agencies, and have entered into a series of participating agreements to accomplish this work. The first Forest inventoried was the Deerlodge National Forest. The results of this inventory are presented in five volumes: Volume I - Basin Creek, Volume II - Cataract Creek, Volume III - Flint Creek and Rock Creek, Volume IV - Upper Clark Fork River, and Volume V - Jefferson River.

1.1 Project Objectives

In 1992, the USFS and MBMG entered into the first of these agreements to identify and characterize abandoned and inactive mines on or affecting National Forest System lands in Montana. The objectives of this discovery process, as defined by the USFS, were to:

1. Utilize a formal, systematic program to identify the "Universe" of sites with possible human health, environmental, and/or safety related problems that are either on or affecting National Forest System lands.

2. Identify the human health and environmental risks at each site based on site characterization factors including screening-level soil and water data that has been taken and analyzed in accordance with EPA quality control procedures.

3. Based on site characterization factors, including screening-level sample data where appropriate, identify those sites that are not affecting National Forest System lands, and can therefore be eliminated from further consideration.

4. Cooperate with other State and Federal agencies, and integrate the Northern Region program with their programs.

5. Develop and maintain a data file of site information that will allow the Region to pro-actively respond to governmental and public interest group concerns.

In addition to the USFS objectives outlined above, the MBMG objectives also included gathering new information on the economic geology and hydrogeology associated with these abandoned and inactive mines. Enacted by the Legislative Assembly of the State of Montana (Section 75-607, R.C.M., 1947, Amended) the scope and duties of the MBMG include: “...the collection, compilation, and publication of information on Montana's geology, mining, milling, and smelting operations, and ground-water resources; investigations of Montana geology emphasizing economic mineral resources and ground-water quality and quantity.”

1.2 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 authorizations or permits to operate.

1.3 Health and Environmental Problems at Mines

Abandoned and inactive mines may host a variety of safety, health, and environmental problems. These may include metals that contaminate ground water, surface water, and soils; airborne dust from abandoned tailings impoundments; sedimentation in surface waters from eroding mine and mill waste materials; unstable waste piles with the potential for catastrophic failure; and physical hazards associated with mine openings and dilapidated structures. Although all problems were examined at least visually (appendix I - Field Form), the hydrologic environment appears to be affected to the greatest extent. Therefore, this investigation focused most heavily on impacts from the mines to surface and ground water.

Metals are often transported from a mine by water (ground-water discharges or surface runoff) either by being dissolved, suspended, or carried as part of the bedload. When sulfides are present, acid can form that in turn increases the metal solubility. This condition, known as acid mine drainage (AMD), is a significant source of metal releases at many of the mine sites in Montana.

1.3.1 Acid Mine Drainage

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

1) availability of sulfides, especially pyrite,
2) presence of oxygen,
3) water in the atmosphere,
4) availability of leachable metals,
5) availability of water to transport the dissolved constituents, and
6) mine characteristics, which affect the other five elements.

Most geochemists would add mineral availability, such as calcite, which can neutralize the acidity. These six components occur not only within the mines, but can exist within mine dumps and mill tailings piles, making waste materials sources of contamination as well.

Acid-mine drainage (AMD) is formed by the oxidation and dissolution of sulfides, particularly pyrite (FeS_2) and pyrrhotite ($Fe_{1-x}S$). Other sulfides play a minor role in acid generation. Oxidation of iron sulfides forms sulfuric acid (H_2SO_4), sulfate ($SO_4^{=}$), and reduced iron (Fe^{2+}). Mining of sulfide-bearing rock exposes the sulfide minerals to atmospheric oxygen and oxygen-bearing water. Consequently, the sulfide minerals are oxidized and acid mine waters are produced.

The rate limiting step of acid formation is the oxidation of the reduced iron. This oxidation rate can be greatly increased by iron-oxidizing bacteria (*Thiobacillus ferrooxidans*). The oxidized iron produced by biological activity is able to promote further oxidation and dissolution of pyrite, pyrrhotite, and marcasite (FeS_2 - a dimorph of pyrite).

Once formed, the acid can dissolve other sulfide minerals such as arsenopyrite (FeAsS), chalcopyrite ($CuFeS_2$), galena (PbS), tetrahedrite ($[CuFe]_{12}Sb_4S_{13}$), and sphalerite ([Zn,Fe]S) to produce high concentrations of copper, lead, zinc, and other metals. Aluminum can be leached by the dissolution of aluminosilicates common in soils and waste material found in southwestern Montana. The dissolution of any given metal is controlled by the solubility of that metal.

1.3.2 Solubility of Selected Metals

At a pH above 2.2, ferric hydroxide ($Fe[OH]_3$) precipitates to produce a brown-orange stain in surface waters and forms a similar coating on rocks in affected streams. Other metals, such as copper, lead, cadmium, zinc, and aluminum, if present in the source rock, may co-precipitate 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 pH less than 4, depending on $SO_4^{=}$ and K^+ activities (Lindsay, 1979). Once the acid conditions are present, the solubility of the metal governs its fate and transport:

> **Manganese** solubility is strongly controlled by the redox state of the water and is limited by several minerals such as pyrolusite and manganite; under reduced conditions, pyrolusite (MnO_2) is dissolved and manganite ($MnO[OH]$) is precipitated. Manganese is

found in mineralized environments as rhodochrosite ($MnCO_3$) and its weathering products.

Aluminum solubility is most often controlled by alunite ($KAl_3[SO_4]_2[OH]_6$) or by gibbsite ($Al[OH]_3$) depending on pH. Aluminum is one of the most common elements in rock-forming minerals such as feldspars, micas, and clays.

Silver solubility is strongly affected by the activities of halides such as Cl^-, F^-, Br^-, and I^-. Redox and pH also affect the solubility of silver, but to a lesser degree. Silver substitutes for other cations in common ore minerals such as tetrahedrite and galena, and is found in the less common hydrothermal minerals pyrargyrite (Ag_3SbS_2) and proustite (Ag_3AsS_3).

Arsenic tends to precipitate and adsorb with iron at low pH and de-sorb or dissolve at higher pH. Thus, once oxidized, arsenic will be found in solution in higher pH waters. At a pH between 3 and 7, the dominant arsenic compound is a monovalent arsenate H_2AsO_4. Arsenic is abundant in metallic mineral deposits as arsenopyrite (FeAsS), enargite (Cu_3AsS_4), and tennantite ($Cu_{12}As_4S_{13}$), to name a few.

Cadmium solubility data are limited. In soils, the solubility of cadmium is controlled by the carbonate species octavite ($CdC0_3$) at a soil-pH above 7.5 and by strengite ($Cd_3[PO_4]_2$) at a soil-pH below 6. In soils, octavite is the dominant control on solubility of cadmium. In water, at low partial pressures of H_2S, $CdCO_3$ is easily reduced to CdS.

Copper solubility in natural waters is controlled primarily by the carbonate content; malachite ($Cu_2[OH]_2CO_3$) and azurite ($Cu_3[OH]_2[CO_3)_2$) control solubility when CO_3 is available in sufficient concentrations. In soil, copper complexes readily with soil-iron to form cupric ferrite. Other compounds such as sulfate and phosphates in soil may also control copper solubility in soils. Copper is present in many ore minerals, including chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), chalcocite (Cu_2S), and tetrahedrite ($Cu_{12}Sb_4S_{13}$).

Mercury readily vaporizes under atmospheric conditions and thus, is most often found in concentrations well below the 25 µg/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 (HgS), in epithermal (hot springs) deposits as native mercury, and as native mercury in man-made deposits where mercury was used in the processing of gold ores.

Lead concentrations in natural waters are controlled by lead carbonate, which has an equilibrium concentration of 50 µg/L at a pH between 7.5 and 8.5. As with other metals, concentrations in solution increase with decreasing pH. In sulfate soils with a pH less than 6, anglesite controls solubility while cerussite, a lead carbonate, controls solubility in buffered soils. Lead occurs in the common ore mineral galena (PbS).

Zinc solubility is controlled by the formation of zinc hydroxide and zinc carbonate in natural waters. At pHs greater than 8, the equilibrium concentration of zinc in waters 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 is strongly affected by sulfate concentrations. Thus, production of sulfate from AMD may ultimately control solubility of zinc in water affected by mining. Sphalerite (ZnS) is common in mineralized systems.

(References: Lindsay, 1979; Stumm and Morgan, 1981; Hem, 1985; Maest and Metesh, 1993).

1.3.3 The Use of pH and SC to Identify Problems

In similar mine evaluation studies, pH and specific conductance (SC) have been used to distinguish "problem" mine sites from those that have no adverse water-related impacts. The general assumption is that low pH (<6.8) and high SC (variable) indicate a problem, and that neutral or higher pH and low SC indicate no problem.

Limiting data collection only to pH and SC largely ignores the various controls on solubility and can lead to erroneous conclusions. 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 lead to erroneous conclusions. The SC value of a sample represents 55 to 75 % of the total dissolved solids (TDS) depending on the concentration of sulfate. Without knowing the sulfate concentration, an estimate of TDS based on SC has a 25 % error range. Furthermore, without having a statistically significant amount of SC data for a study area, it is hard to define what constitutes a high or low SC value.

Thus, a water-sample with a near-neutral pH and a moderate SC could be interpreted to mean that no adverse impacts have occurred when in fact one or more dissolved-metal species may exceed standards. With this in mind, the evaluation of a mine site for adverse impacts on water and soil must include the collection of samples for analysis of metals, cations, and anions.

1.4 Methodology

1.4.1 Data Sources

The MBMG began this inventory effort by completing a literature search for all known mines in Montana. The MBMG plotted the published location(s) of the mines on US Forest Service maps. From the maps, the MBMG developed an inventory of all known mines which are located on or could affect National Forest System lands in Montana. The following data sources were used:

1) the Mineral Industry Location System (MILS) - U.S. Bureau of Mines,
2) the Mineral Resource Data System (MRDS) - U.S. Geological Survey,
3) published compilations of mines and prospects data,
4) state publications on mineral deposits,
5) U.S. Geological Survey publications on the general geology of some quads,
6) recent USGS/USBM mineral resource potential studies of proposed wildernes areas
7) MBMG mineral property files.

During subsequent field visits, the MBMG located numerous mines and prospects for which no previous information existed. Conversely, other mines for which data existed could not be found.

1.4.2 Pre-field Screening

Field crews visited only sites with the potential to release hazardous substances, and sites which did not have enough information to make that determination without a field visit. For problems to exist, a site must have a source of hazardous substances and a method of transport from the site. Most metal mines contain a source for hazardous substances, but the common transport mechanism, water, is not always present. Consequently, sites on dry ridgetops were assumed to be lacking this transport mechanism, while mines described in the literature as small prospects were considered to have an inconsequential hazardous materials source; neither type was visited.

In addition, the MBMG and the USFS developed screening criteria (table 1.1) that they used to determine if a site had the potential to release hazardous substances or posed other environmental or safety hazards. The first page of the Field Form (appendix I) contains the screening criteria. If any of the answers were “yes” or unknown, the site was visited. Personal knowledge of a site and published information were used to answer the questions. Forest Service mineral administrators used these criteria to "screen out" several sites using their knowledge of an area.

Mine sites which were not visited were retained in the database along with the data source(s) that were consulted (appendix II). However, often these sites were viewed from a distance while visiting another site. In this way the accuracy of the consulted information was often checked.

Placer mines were not studied as part of this project. Although mercury was used in amalgamation, the complex nature of placer deposits makes detection of mercury difficult and is beyond the scope of this inventory. Because of their oxidized nature, placer deposits are not likely to contain other anomalous concentrations of heavy metals. Limestone and building stone quarries, gravel pits, and phosphate mines were considered to be free of anomalous concentrations of hazardous substances and were not examined.

Table 1.1 Screening Criteria

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

If the answers to questions 1 through 6 were all "NO" (based on literature, personal knowledge, or site visit), then the site was not investigated any further.

1.4.3 Field Screening

Sites which could not be screened out as described above were visited. All visits were conducted in accordance with a Health and Safety Plan which was developed for each Forest. An MBMG geologist usually made the initial field visit and gathered information on environmental degradation, hazardous mine openings, presence of historic structures, and land ownership. All site locations were refined using conventional field methods or by USFS Geographic Position System (GPS) crews. Each site is located by latitude/longitude and by Township-Range-Section-Tract (see appendix I for explanation).

At sites for which little geologic or mining data existed, geologists characterized the geology, collected samples for geochemical analysis, evaluated the deposit, and described workings and processing facilities present.

Sites with potential environmental problems were studied more extensively. The selection of these sites was made during the initial field visit using the previously developed screening criteria (table 1.1). In other words, if at least one of the first six screening criteria was met, the site was studied further. Sites which were not studied further are included in appendix III.

On public lands, sites with ground-water discharge, flowing surface water, or contaminated soils (as indicated by impacts on vegetation) were mapped by the geologist using a Brunton compass and tape (or string box). The maps show locations of the workings, exposed geology, dumps, tailings, surface water, and geologic-sample locations.

1.4.3.1 Collection of Geologic Samples

The geologist took the following samples, as appropriate:

1) select samples - specimens representing a particular rock type taken for assay;

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

3) leach samples - duplicates of selected composite samples for testing leachable metals (EPA Method 1312).

The three types of samples were used, respectively, to characterize the economic geology of the deposit, to examine the value and metal content of dumps and tailings, and to check the availability of metals for leaching when exposed to water. Assay samples (appendix IV) were only taken to provide some information on the types of metals present and a rough indication of their concentrations. Outcrops and waste-materials were not sampled extensively enough to provide reliable estimates of tonnages, grades, or economic feasibility.

A hydrogeologist visited all of the sites that the geologist determined had the potential for environmental problems. A hydrogeologist also visited the sites that only had evidence of seasonal water discharges, possible sedimentation, airborne dust, mine hazards, or stability problems and determined if there was a potential for significant environmental problems. The hydrogeologist then determined whether sampling was warranted and, if so, selected soil and water sampling locations.

1.4.3.2 Selection of Environmental Sample Sites

This project focused on the impact 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 hydrogeologist selected and marked water and soil sampling locations based on field parameters (SC, pH, Eh, etc.) and observations (e.g. erosion and staining of soils/streambeds). The hydrogeologist chose sample locations that would provide the best information on the relative impact of the site to surface water and soils. If possible, surface water sample locations were chosen that were upstream, downstream, and at any discharge points associated with the site. Soil sample locations were selected in areas where waste material was obviously impacting natural material. In most cases where applicable, a composite-sample location across a soil/waste mixing area was selected. In addition, all sample sites were located so as to assess conditions on

National Forest System lands; therefore, samples sites were located on National Forest System lands to the extent ownership boundaries were known.

Because monitoring wells were not installed as part of this investigation, the evaluation of impacts to ground water was limited to strategic sampling of surface water and soils. Background water-quality data is restricted to upstream surface water samples; background soil samples were not collected. Laboratory tests were used to determine the propensity of waste material to release metals and may lend additional insight to possible ground-water contamination at a site.

1.4.3.3 Collection of Water and Soil Samples

Sampling crews collected soil and water samples, and measured field parameters (e.g. stream flow, pH, SC, Eh, etc.) in accordance with the following:

> **Sampling and Analysis Plan (SAP)** - These plans are site specific and they specify the type, location, and number of samples and field measurements to be taken at a site.
>
> **Quality Assurance Project Plan or QAPP** (Metesh, 1992) - This plan guides the overall collection, transportation, storage, and analysis of samples, and the collection of field measurements.
>
> **MBMG Standard Field Operating Procedures (SOP)** - The SOP specifies how field samples and measurements will be taken.

1.4.3.4 Marking and Labeling Sample Sites

Sample location stakes were placed as close as possible to the actual sample location and labeled with sample identification numbers. The visiting hydrogeologist wrote a site sampling and analysis plan (SAP) for each mine site or development area which was then approved by the USFS project manager. Each sample location was plotted on the site map or topographic map and described in the SAP; each sample site was given a unique seven character identifier based on its location, sample type, interval, and relative concentration of dissolved constituents as follows:

<u>D</u> <u>DA</u> <u>T</u> <u>L</u> <u>I</u> <u>C</u>

D: Drainage area - determined from topographic map
DA: Development Area (dominant mine)
T: Sample type: <u>T</u> - Tailings, <u>W</u> - Waste Rock, <u>D</u> - Soil, <u>A</u> - Alluvium, <u>L</u> - Slag <u>S</u> - Surface Water, <u>G</u> - Ground Water
L: Sample Location (1-9)

I: Sample Interval (default is 0)
C: Sample Concentration (High, Medium, Low) determined by the hydrogeologist based on field parameters.

1.4.4. Existing Data

Data collected in previous investigations were not qualified nor validated under this project. The quality-assurance managers and project hydrogeologist determined the usability of such data.

1.4.5 Analytical Methods

The MBMG Analytical Division performed the laboratory analyses and conformed, as applicable, to the following:

> Contract Laboratory Statement of Work, Inorganic Analyses, Multi-media, Multi-concentration. March 1990, SOW 3/90, Document Number ILM02.0, U.S. EPA, Environmental Monitoring and Support Laboratory, Las Vegas, NV.
>
> Method 200.8 Determination of Trace Metals in Water and Waste by Inductively Coupled Plasma and Mass Spectrometry - U.S. EPA
>
> Method 200.7 Determination of Trace Metals in Water and Waste by Inductively Coupled Plasma and Mass Spectrometry - U.S. EPA

If a Contract Laboratory Procedure method did not exist for a given analysis, the following method was used:

> Test Methods for Evaluating Solid Waste - Physical/Chemical Methods, SW-846, 3rd edition, U.S. EPA, Washington D.C.
>
> EPA Method 1312 Acid-rain Simulation Leach Test Procedure - Physical/Chemical Methods, SW-846, 3rd edition, U.S. EPA, Washington D.C., Appendix G.

All analyses performed in the laboratory conformed to the MBMG Laboratory Analytical Protocol (LAP).

1.4.6 Standards

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

1.4.6.1 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 1.2. In some state investigations, the standards are applied to samples collected as total-recoverable metals. Since total-recoverable-metals concentrations are difficult, if not impossible to reproduce, this investigation used dissolved metals concentrations.

1.4.6.2 Soil Standards

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. Because no assessments of this kind have been done, concentrations of metals in soils were compared to the limits postulated by the U.S. EPA and the Montana Department of Health and Environmental Sciences for sites within the Clark Fork River basin in Montana. The proposed upper limit for lead in soils is 1000 mg/kg to 2000 mg/kg, and 80 to 100 mg/kg for arsenic in **residential** areas. The Clark Fork Superfund background levels (Harrington-MDHES, 1993) are listed in table 1.3.

Table 1.2 Water-quality standards.

	PRIMARY MCL[(1)] (mg/L)	SECONDARY MCL[(2)] (mg/L)	AQUATIC LIFE ACUTE[(3,4)] (mg/L)	AQUATIC LIFE CHRONIC[(3,5)] (mg/L)
Aluminum		0.05-0.2	0.75	0.087
Arsenic	0.05		0.36	0.19
Barium	2			
Cadmium	0.005		0.0039/0.0086[(6)]	0.0011/0.0020[(6)]
Chromium	0.1		1.7/3.1[(6,7)]	0.21/0.37[(6,7)]
Copper		1	0.018/0.034[(6)]	0.012/0.012[(6)]
Iron		0.3	1	
Lead	0.05		0.082/0.2[(6)]	0.0032/0.0077[(6)]
Manganese		0.05		
Mercury	0.002		0.0024	0.000012
Nickel	0.1		1.4/2.5[(6)]	0.16/0.28[(6)]
Silver		0.1	0.0041[(8)]	0.000012[(8)]
Zinc		5	0.12/0.21[(6)]	0.11/0.19[(6)]
Chloride		250		
Flouride	4	2		
Nitrate	10 (as N)			
Sulfate	500[(9)]	250		
Silica		250		
pH (Standard Units)		6.5 - 8.5		

(1) 40 CFR 141; revised through 8/3/93
(2) 40 CFR 143; revised through 7/1/91
(3) Priority Pollutants, EPA Region VIII, August 1990
(4) Maximum concentration not to be exceeded more than once every 3 years.
(5) 4-day average not to be exceeded more than once every 3 years.
(6) Hardness dependent. Values are calculated at 100 mg/L and 200 mg/L.
(7) Cr^{+3} species.
(8) Hardness dependent. Values are calculated at 100 mg/L.
(9) Proposed, secondary will be superseded.

Table 1.3 Clark Fork Superfund background levels (mg/kg) for soils.

Reference	As	Cd	Cu	Pb	Zn
U.S. mean soil	6.7	0.73	24.0	20.0	58
Helena Valley mean soil	16.5	0.24	16.3	11.5	46.9
Missoula lake bed sediments	-	0.2	25.0	34.0	105
Blackfoot River	4.0	<0.1	13.0	-	-
Phytotoxic concentration	100	100	100	1,000	500

1.4.7 Analytical Results

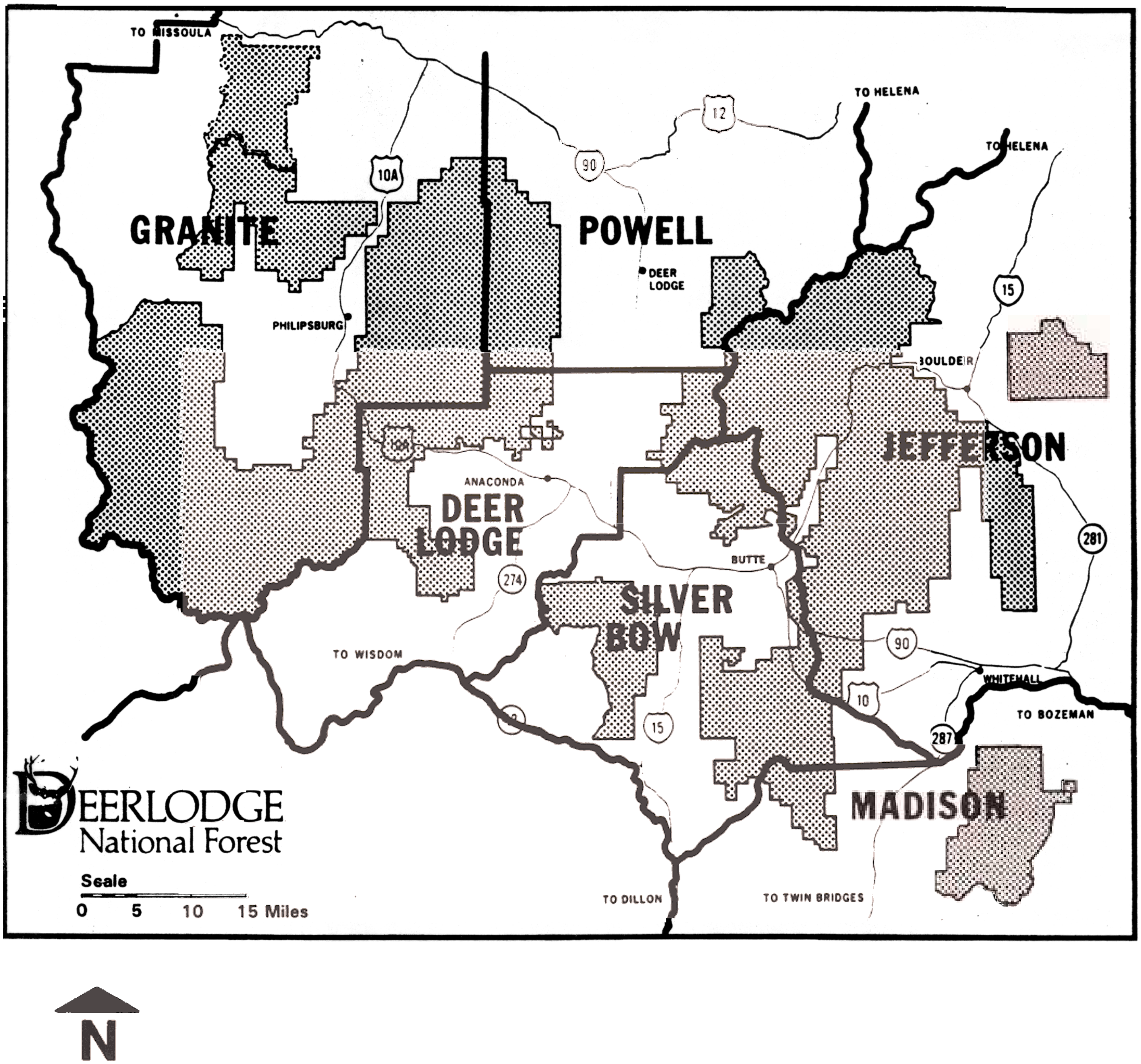
The results of the sample analyses were used to estimate the nature and extent of potential impact to the environment and human health. Selected results for each site are presented in the discussion; a complete listing of water-quality, soil chemistry, and acid rain leach test results are presented in appendix V.

All of the data for this project were collated with existing data and were incorporated into a new MBMG abandoned - inactive mines database. The database will eventually include mines and prospects throughout Montana. It is designed to be the most complete compilation available for information on the location, geology, hydrogeology, production history, mine workings, references, and environmental impact of each of Montana's mining properties. The data fields in the current database are presented in appendix VI and are compatible with the MBMG geographic information system (GIS) package.

1.5 Deerlodge National Forest

The 1.3 million-acre Deerlodge National Forest (DNF-administered land) straddles the Continental Divide in southwestern Montana (figure 1.1). The Forest's eight mountain ranges, with elevations ranging from 4,075 to 10,604 feet, create a diverse landscape grading from semiarid grassland foothills near the valley bottoms, to coniferous forests, to alpine regions of steep rocky peaks.

Vicinity Map
Deerlodge National Forest



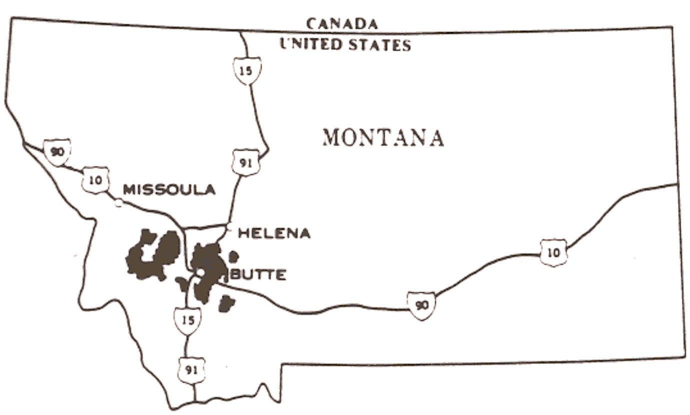


FIGURE 1.1

Legend

Deerlodge National Forest Lands

County Boundaries

1.5.1 History of Mining

Some knowledge of the local mining history is helpful in understanding the problems created by the abandoned and inactive mines in the area. Gold was first discovered in the Deerlodge National Forest area on Gold Creek in the southwest portion of Powell County in 1852. By 1860, some gold placer mines were operating on Gold Creek, but most gold placers were discovered about 1865. Associated lode deposits were located soon thereafter.

Placers reached their maximum production before 1872, when the richest ones began to play out. By 1870, production from gold and silver lode deposits had become important. Most lode mines had been discovered by the late 1880s, with the main period of production from 1880 to 1907. Mines with silver as the major commodity were most active from 1883 until 1893, when the silver panic forced the closure of many of these polymetallic mines. Many operations never resumed. Mines yielding gold ores, especially of the "free milling" variety, which contain free gold, enjoyed a greater longevity. Some of these gold producers were worked until 1942, when the federal government placed restrictions on gold mining as a result of World War II. During World War II, government price supports and essential industry rulings brought many small to medium copper, lead, and zinc properties into production. Following the war, the increased supply and labor costs coupled with the withdrawal of price supports prematurely closed most of these properties. The Korean conflict brought some of these back on line as once again the government influenced the economics of mining. Additional properties were brought on line as the Defense Logistics Agency went through a period of creating stockpiles of critical strategic minerals.

Towns such as Philipsburg were turned into industrial centers for production of manganese until the quotas were met and, once again, the buying programs and price supports were eliminated creating ghost towns, partially mined deposits, and environmental hazards. For most, it may be decades or centuries before economics will coax them into production again.

These boom-to-bust cycles continued with government influence through the 1980's when new environmental standards closed the Anaconda smelter and left many of the mines with no place to sell the ore. The resulting inactive-abandoned properties continue to impact the environment.

1.5.1.1 Production

The total value of minerals produced from lode mines within the Deerlodge National Forest boundaries was probably more than $60 million at the time of production (USGS/USBM, 1978; O'Neill and others, 1983; Loen and Pearson, 1984; Elliott and others, 1992). This excludes the Butte and Philipsburg districts whose production totals are $6 billion and $91 million, respectively. These districts lie adjacent to but outside of the Deerlodge National Forest.

1.5.1.2 Milling

An understanding of the history of milling developments is essential for interpreting mill sites, understanding tailings characteristics, and determining the potential for the presence of hazardous substances. Mills, usually adjacent to the mine, produce two materials: 1) a product which is either the commodity itself or a concentrate which is shipped offsite to other facilities for further refinement, and 2) waste, which is called tailings.

In the 1800s, almost all mills treated ore by crushing and/or grinding to a fairly coarse size followed by concentration using gravity methods. Polymetallic sulfide-ores were concentrated and shipped to be smelted (usually to sites off National Forest administered land). Gold was often removed from free-milling ores at the mill by mercury-amalgamation. Cyanidation arrived in the United States about 1891 and, because it resulted in greater recovery rates, it revolutionized gold extraction in many districts. Like amalgamation, cyanidation also worked only on free milling ores, but it required a finer particle size. About 1910, froth flotation became widely used to concentrate sulfide ores. This process required that the ore be ground and mixed with reagents to liberate the ore-bearing minerals from the barren rock.

Overall then, there were two fundamental processes used for ore concentration: gravity and flotation, and three main processes used for commodity extraction: amalgamation, cyanidation, and smelting. Each combination of methods produced tailings of different size and composition, each used different chemicals in the process, and each was associated with a different geologic environment.

1.6 Summary of the Deerlodge National Forest Investigation

A literature search (Emmons and Calkins, 1913; Roby and others, 1960; Becraft and others, 1963; Ruppel, 1963; Earll, 1972; McClernan, 1976; Krohn and Weist, 1977; MILS database, U.S. Bureau of Mines; MRDS database, U.S. Geological Survey USGS/USBM, 1978; Erickson and others, 1981; O'Neill and others, 1983; Wallace and others, 1983; Loen and Pearson, 1984; Elliott and others, 1985; Elliot and others, 1988; Elliott and others, 1992) identified 1,051 sites in the general area of the Deerlodge National Forest. The pre-field investigation that followed indicated that at least 1,044 abandoned or inactive metal mines and mills are located on or affect land administered by the Deerlodge National Forest. Most became inoperative long before environmental regulations were put into effect, so tailings piles, waste-rock dumps, and mine discharges persist to potentially affect the environment today. Table 1.4 summarizes the results of the Deerlodge National Forest inventory.

Table 1.4 Summary of Deerlodge National Forest investigation.

Total Number of Abandoned/Inactive Mine Sites that were:

PART A - Field Form		
Located in general area from Literature Search		1,051
Not on or affecting Deerlodge NF		- 7
PART B - Field Form (Screening Criteria)		
Possibly affecting the Deerlodge NF		1,044
Screened out by DNF minerals administrator	**OR**	
by description in literature		- 484
Not found (location inaccurate)		- 80
Visited by geologist		**480**
Screened out by geologist		-376
Visited by hydrogeologist		**104**
Screened out by hydrogeologist		- 4
PART C - Field Form		
Sampled (Water and Soil)		100

A separate discussion of each of the 100 sites is included in the five volumes that comprise the DNF report. All 1,051 sites which were inventoried are listed in appendix II of each volume.

1.7 Mining Districts and Drainage Basins

The Deerlodge National Forest includes all or part of 30 mining districts as defined by the USGS (Elliott and others, 1992; Loen and Pearson, 1984). Some mines are not located in traditional mining districts and, for the purposes of this study, have been organized into areas delineated by topography. In either case, boundaries have been determined in part by changes in geology and in part by drainage divides. This provides a convenient way to separate the Forest into manageable areas for discussion of both geology and hydrology; and perhaps more important, it is an aid to the assessment of cumulative environmental impacts on each drainage.

Upper Clark Fork River Drainage

The upper Clark Fork River drainage is in the central portion of the Deerlodge National Forest (figure 1.1). It includes areas of the Deerlodge National Forest tributary to the Clark Fork River above its confluence with Rock Creek. The area also includes a portion of Lolo National Forest nestled between the Rock Creek and Flint Creek drainages that is administered by Deerlodge National Forest. The Clark Fork river has its head at the southern end of the Deer Lodge valley where Silver Bow Creek and Warm Springs Creek flow together to form the Clark Fork River.

Warm Springs and Silver Bow creeks drain the south half of the area. Mining districts and areas in this tributary area include the Highland Mountains area, numerous mines and prospects in the southern part of the Flint Creek Mountain range, Silver Lake district, and Red Lion district.

The northwestern portion of the study area is drained by numerous creeks that flow out of the east and north portions of the Flint Creek Mountain range into the Deer Lodge Valley. Mining districts in this tributary area include the Dunkleberg, Racetrack and the Pioneer-Rose Mountain districts.

The northeast part of the study area is drained by numerous creeks that flow out of the west portions of the Boulder Mountains area. Mining districts and areas in this tributary area include numerous mines and prospects along the western portions of the Boulder Mountains and the Emery District.

Figure 2.1 shows the approximate locations of these districts as well as locations of individual mines and mills.

Terrain within the upper Clark Fork drainage varies from rugged uplands to broad valley bottoms. The Flint Creek, Anaconda, Highland and Boulder mountains enclose all but the northernmost portion of the upper Clark Fork drainage. At 10,665 feet above sea level, Mt Haggin is the highest point within the drainage. Land use in the area is primarily agricultural, with timber being harvested from the uplands and livestock and alfalfa being raised in the valleys. Recreational use in the area is high: Warm Springs Ponds attracts thousands of fishermen annually. Also, there are many National Forest and private campgrounds. Butte, with about 30,000 residents, is the largest community within the drainage. Smaller towns include Anaconda, Rocker, Ramsey, Opportunity, and Deer Lodge.

2.1 Geology and Economic Geology

The Upper Clark Fork drainage contains all or part of 16 mining districts, defined by the U.S. Geological Survey (Loen and Pearson, 1989; Elliott and others, 1992). Local geology varies greatly. Regional geology of the basin was mapped at 1:250,000 scale by Wallace (1987) and Ruppel and others (1993). Geology of the eastern side of the Upper Clark Fork Basin is dominated by granitic igneous rocks of the Boulder Batholith. That of the western side is characterized by Proterozoic to Cretaceous sedimentary rocks that have been folded and thrust faulted and intruded by Cretaceous stocks. Most metallic mineral deposits are related to Cretaceous igneous activity. Mineral deposit types include gold-rich skarns, polymetallic veins, and lead-zinc replacement deposits in limestone.

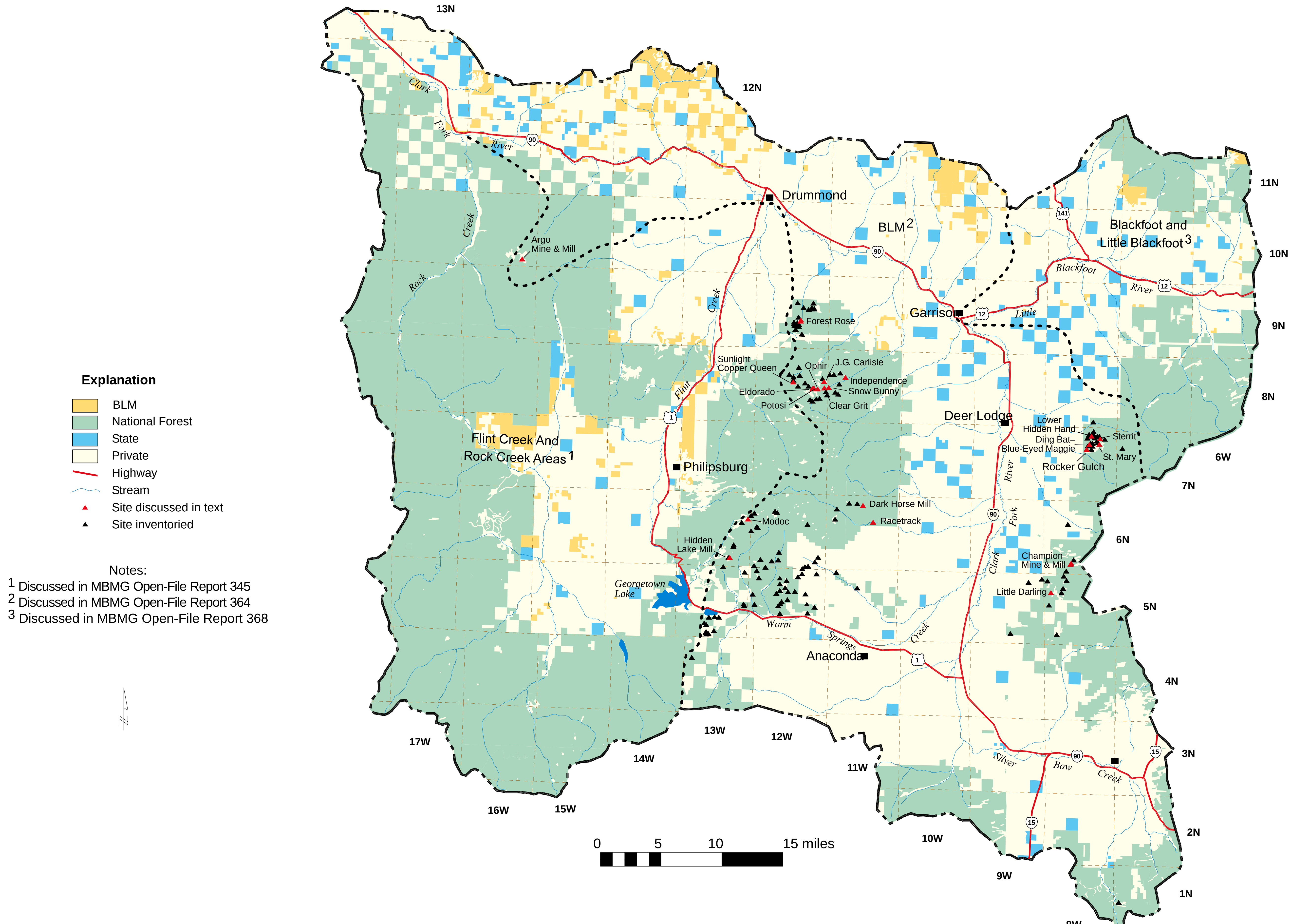


Figure 2.1 Abandoned and inactive mines inventoried in Upper Clark Fork drainage.

2.1.1 Boulder Mountains Area

The Boulder Mountains area of this paper combines several mining districts and areas defined by the USGS (Loen and Pearson, 1989; Elliott and others, 1992), including the Big Foot, Oro Fino, Pipestone, Homestake, and Little Pipestone districts, and the North Boulder and South Boulder Mountains areas. Geology across these areas is remarkably similar. The entire Boulder Mountains area is underlain by igneous rocks, mostly monzogranite, granodiorite, and aplite of the Cretaceous Boulder Batholith, but also including some Cretaceous Elkhorn Mountains Volcanics and Tertiary Lowland Creek Volcanics. Numerous high-angle normal (?) northwest, northeast, and north-trending faults cut the area.

Economic geology has not been comprehensively described, but is similar to that of the Basin district described in detail elsewhere in this paper. Pardee and Schrader (1933), Roby and others (1960), Ruppel (1963), and U.S. Bureau of Mines (1988) gathered information on some of the larger mines. Loen and Pearson (1989) and Elliott and others (1992) compiled existing information on all known mines on the Dillon and Butte 1 x 2 degree quadrangles.

Virtually all mines are hosted by plutonic rocks or adjacent volcanic country rocks. Most examine veins that are short and discontinuous but often rich. The veins usually occupy east-west structures, contain abundant base-metal sulfides, and have high silver-to-gold ratios. A few disseminated molybdenite occurrences are present in plutonic rocks near Butte.

The Boulder Mountains area has been a small producer of metals; the total value has been estimated at only $638,600 (Loen and Pearson, 1989; Elliott and others, 1992). This value was derived from at least 4,332 oz of gold, 76,999 oz of silver, 21,933 lbs of copper, 433,344 lbs of lead, and 152,611 lbs of zinc.

2.1.2 Dunkleberg District

Geology of the Dunkleberg district has been repeatedly studied. Calkins and Emmons (1915) first mapped part of the district, and Pardee (1917) mapped the entire district in a reconnaissance fashion. Mutch (1960) and McGill (1959) both completed detailed maps of the district. Mapping was also compiled and revised by Bakken (1984). The district is underlain by Mesozoic sedimentary rocks and Cretaceous diorite sills. These rocks were deformed by late Cretaceous compression into tight north-trending eastward-verging folds and east-dipping thrusts. Bakken (1984) attributed the unusual sense of movement to backthrusting that occurred as a regional decollement climbed a buttress in the basement rocks. The local structural geology is dominated by the Dunkleberg Anticline and the Wasa-Dunkleberg Reverse Fault, which is sub-parallel to bedding.

The economic geology was studied by Pardee (1917) and Popoff (1953). Deposits are located along the crest of the north-plunging Dunkleberg Anticline where it has been brecciated by high angle faults whose traces run parallel to bedding. Ore occurs a replacement zones in favorable limestone beds, most often within the Kootenai Formation. Some quartz-sulfide fissure veins follow bedding and steep cross-cutting fractures. The ore consists of fine grained sphalerite, pyrite, galena, chalcopyrite, and galena. A 100-300-foot alteration zone, characterized by silicification and bleaching, surrounds the larger orebodies. The nearest exposed Cretaceous igneous rock is exposed three miles south along the crest of the same anticline. Total production for the district was 200 oz of gold, 199,890 oz of silver, 110 tons of copper, 1785 tons of lead, and 2575 tons of zinc (Elliot and others, 1992). This amounted to $1.2 million, with most production occurring in the 1940's. The lack of significant precious metal values and the small size of the orebodies probably discourages exploration in the district.

2.1.3 Emery District

The Emery district has received much attention from geologists due to its high grade gold deposits. The geology of the district was first mapped by Robertson (1952) in a reconnaissance fashion. Ruppel (1962) later included the district on his map of the Deer Lodge 15-minute quadrangle, putting the district geology in a regional perspective. Finally, Derkey (1986) completed a detailed map of the district.

The geology of the area is characterized by stacks of gently-dipping basalt flows which interfinger with and are of the same age as the late Cretaceous Elkhorn Mountain volcanic suite (Derkey, 1986). Elkhorn Mountains Volcanics and basalts of the Emery district were intruded by the Boulder Batholith during the late Cretaceous.

Mineralization in the district is probably related to cooling of the batholith, and was localized mainly along west dipping thrust faults that preceded or were contemporaneous with emplacement of the batholith. Northwest-striking high angle faults of small displacement which offset the mineralized thrusts are also present in the district, and were probably formed during the Cenozoic extensional event.

Mines and prospects in the district are also well described. Robertson (1952), McClernan (1976), Al-Khirbash (1982), and Derkey (1986) all provided information on the economic geology. Placer gold was discovered in the area in 1872 and lode deposits were located in 1887. Emery district mines were most active from 1891 to 1908, and in the 1930's and 1940's. Between 1902 and 1968 the district produced $1.96 million worth of metals (Elliott and others, 1992) from at least 95,151 tons of ore yielding 35,670 oz of gold, 865,980 oz of silver, 42,974 lbs of copper, 2,389,750 lbs of lead, and 693,947 lbs of zinc (McClernan, 1976). Veins of quartz, gold-bearing arsenopyrite, pyrite, galena, sphalerite, and tourmaline, with minor tetrahedrite, boulangerite, chalcopyrite, pyrrhotite, millerite, calcite, and ankerite, occupy gently-dipping reverse faults and high angle tear faults related to thrusting (Derkey, 1986). The mineralogy is similar to that of other Boulder Batholith veins, and so although the nearest outcrop of plutonic rock is miles away, these veins are considered to be related to the cooling batholith.

Elliott and others (1992b) assigned a low rating to the potential for vein and replacement deposits in the Emery district, but the high gold values present have induced explorationists to think otherwise. The district has been the site of several recent intensive exploration programs for low-grade bulk-tonnage gold deposits. However, the little information released indicates that the gold, though often high grade, is spotty and unpredictable (Robin McCulloch, personal communication, 1992). Efforts to revive the Emery Mine are ongoing.

2.1.4 Highland District

Included in this discussion of the Highland district are properties considered by some to be in the Moose Creek district (Loen and Pearson, 1984). The two districts are linked by geography and geology. Geologic mapping in the area was initiated by Veazey (1934) and continued by Sahinen (1950) and Cass (1953). Although Ruppel and others (1983) mapped at only a 1:250,000 scale, they payed more attention to the complex structural geology than did previous authors. Smedes (1980) mapped the western and southwestern portions of the area in detail as part of the Humbug Spires Wilderness study.

Sedimentary rocks of Proterozoic to Jurassic age are exposed in the area. Archean metamorphic rocks are in fault and depositional contact with these sediments just to the south of the district. All of these units were folded and thrust by the late Cretaceous compression, then intruded by quartz monzonite, diorite, aplite, and pegmatite of the Boulder Batholith and its satellite stocks. These late Cretaceous igneous rocks almost surround the area in outcrop, and may underlie the entire area at shallow depths. North to northwest striking high-angle faults cut the sedimentary rocks and some of the plutonic rocks; in other cases igneous rocks cut high-angle faults.

Most mineral deposits are probably related to the Cretaceous igneous activity. An exception is the stratabound massive sulfide mineralization in Belt sediments south of the district. This mineralization is probably syngenetic or diagenetic in origin, and Proterozoic in age (Thorson, 1984). All other metallic deposits are either veins and replacement zones or skarns in Paleozoic carbonates. Most lode production in the district has come from a replacement zone in Cambrian Meagher dolomite at the Butte Highland Mine (Veazey, 1934; Newcomb, 1941; Sahinen, 1950). After the pyrite in this orebody was oxidized by weathering, the residually enriched quartz-gold ore collapsed upon itself to form a unique breccia. Other gold orebodies discovered have been either small or low grade, or both. Production totaled 110,000 ounces of gold worth about $2.2 million at the time of production (Loen and Pearson, 1984).

Pearson and others (1992a) gave the Highlands area a high-to-very-high rating for its potential to yield new vein and replacement deposits. The fact that the most productive gold mine of the district, the Butte Highlands, was essentially a blind orebody is encouraging. Exploration efforts in the past decade have focused on the Highlands Mine, Gold Hill, and massive sulfides of the King and Queen, but results are not been available.

2.1.5 Pioneer-Rose Mountain Districts

These two related districts are considered together. The Pioneer (Gold Creek) district was a placer district which produced over $6 million (Elliott and others, 1985) in gold. This placer gold presumably originated in the Rose Mountain area and from similar lode deposits now concealed beneath the glacial deposits of Gold Creek. In fact, the first discovery of gold in Montana occurred in Gold Creek in 1952.

Geology of the area is shown on maps by Calkins and Emmons (1915), Mutch (1960), Allen (1962), Hawley (1974), Bakken (1984), Elliott and others (1985), Wallace (1987) and Loen (1993). Rocks in the area consist of folded and thrust faulted Paleozoic and Mesozoic sediments on the leading edge of the Sapphire thrust plate. At the end of the Cretaceous compressional event, the Royal Stock, and further south, the Racetrack Creek Pluton and Mount Powell Batholith, were intruded into these sediments. All three are co-magmatic, but emplacement of the Racetrack Creek Pluton preceded the Royal Stock, which in turn preceded the Mount Powell Batholith. Positions of these igneous rocks were strongly influenced by existing Cretaceous thrust planes (Hawley, 1974). All known mineral deposits in the district are probably related to the emplacement of these plutons, and most cluster about the margins of the Royal Stock.

Economic geology of the area has been studied in some detail by Emmons and Calkins (1913), McClernan (1976), Avery (1983), and Loen (1993). Deposit types in the area include vein precious metals, stockwork molybdenum, skarn gold and tungsten, and placer gold. Lode production has been only about 4,650 oz of gold,8,180 oz of silver, 100 pounds of copper, and 3,000 pounds of zinc, in contrast to the over $6 million (282,000 oz) in placer gold produced (Elliott and others, 1992). Naturally, this has led to much debate over the source of the placer gold. Loen (1993) suggested that the if gold concentrations in the now eroded contact aureole of the Royal Stock were similar to those of present day exposures, it was indeed sufficient to form the rich placers. In 1992, exploration drilling was proceeding beneath the glacial till of Gold Creek for buried source rocks.

Most mineralization occurs in veins hosted by northwest striking, southwest dipping shear zones in the Royal Stock. Veins consist primarily of quartz and sericite with very low sulfide content, and most were apparently valued for their gold content. Gold to silver ratios are generally equal to or greater than one. Minor copper mineralization is also common. Alteration products within the wallrock also consist mainly of quartz and sericite.

Avery (1983) and Elliott and others (1985) studied the mineral resource potential of the Dolus Lakes Wilderness Study Area, which includes much of the Rose Mountain-Pioneer district. They concluded that although there are only about 57,000 tons of resources containing gold and silver, the area has significant resource potential for gold, silver, tungsten, and molybdenum. In fact, in the southern part of the district exist six million tons of subeconomic molybdenum-bearing rock (.036% MoS_2). Potential certainly exists for resources beneath glacial deposits as well, especially near the concealed contact between the Royal Stock and the sedimentary rocks.

2.1.6 Racetrack District

The Racetrack district contains a few widely scattered mines on the southeast edge of the Flint Creek Range. Part of the area was mapped by Csejtey (1962). Igneous rocks were mapped and studied in more detail by Allen (1962) and Hawley (1974). The geology of the area is dominated by sediments of Proterozoic to Cretaceous age that were complexly faulted during Cretaceous compression. They were then intruded by first the Cretaceous Racetrack Creek Pluton and then the Mount Powell Batholith.

Economic geology was described by Earll (1972) and McClernan (1976). The few mineral deposits present are hosted by the Mount Powell Batholith or by sedimentary rocks along its contact. Elliott and others (1992) characterized the district as a small producer. Total production for the district was 3,670 oz of gold, 450 oz of silver, and 80 lbs of copper. (Elliot and others, 1992); this amounted to $75,000.

2.1.7 Red Lion District

The Red Lion district lies within a gap in the detailed geologic map coverage. The area was included in Calkins and Emmons' (1915) classic map. Earll (1972) melded their map with more recent, detailed mapping in the area surrounding the district to produce a new map with few changes in the Red Lion area. Wallace (1987) gathered some new data and incorporated it into his 1:250,000 scale map of the Butte 1 x 2 degree quadrangle.

The geology of the area is dominated by a thrust fault which placed Proterozoic Belt Supergroup rocks over Paleozoic carbonate rocks during late Cretaceous compression. In the central part of the district, a klippe of Mount Shields quartzite overlies the Phanerozoic rocks, while to the west, the thrust placed Helena Formation in fault contact with the footwall carbonates. Plutonism followed the compression; the granodioritic Philipsburg Batholith adjoins the district on the north, the Cable Stock is to the south, small intrusions crop out to the east, and some rhyolite porphyry dikes exist within the district. Intrusive rocks may underlie the Paleozoic rocks in the footwall of the thrust at shallow depth. Minor NE to NW, down-to-the-west, normal faults formed during Tertiary extension but exhibit little stratigraphic displacement.

Mineralization in the district appears to be of two types: 1) veins, skarns, and replacement zones in the footwall carbonate rocks which may be closely related to nearby intrusive rocks and 2) veins in brittle quartzite of the Belt klippe above the thrust. Both types of deposits are scattered across the entire district, an area of over ten square miles.

All district mines have low silver-to-gold ratios and few base metals. Mineralogy is characterized by quartz, pyrite, and free gold, with the addition of skarn minerals in deposits hosted by carbonate rocks. Some deposits contained small, unpredictable pockets of incredibly rich ore containing up to 200 oz/ton gold (George Mungas, 1992, oral communication).

Production totals for the district are 24,850 oz of gold, 12,223 oz of silver, and 1,490 lbs of copper (Elliott and others, 1992).

The extensive area of anomalous gold showings has generated enormous interest by exploration companies, and several large drilling programs have resulted. Available mapping is insufficient to answer questions about controls on mineralization in the district. Extensive gold mineralization, complex structural geology, and the unknown relationship between the two make the Red Lion district a prime candidate for detailed geologic mapping. When combined with knowledge gained by explorationists, a detailed picture of metallogenesis in the district may emerge.

2.1.8 Silver Lake District

The Silver Lake district lies in a structurally complex area of the Sapphire thrust plate. Geologic mapping of the district was first done by Calkins and Emmons (1915). Poulter (1956) mapped most of the district in more detail and first recognized the folded thrusts and polyphase compression. Lidke (1985) and Lidke and Wallace (1992) mapped the southwestern part of the district and areas to the southwest in the Anaconda Range. They summarized the geologic history of the area:

1. Proterozoic and Paleozoic sedimentary rocks were tectonically transported to the east and stacked along flat, regionally extensive thrusts during late Cretaceous compression.

2. Continued compression folded these thrusts and produced imbricate and out of syncline reverse thrusts which sometimes placed younger rocks over older rocks.

3. Late Cretaceous to early Tertiary monzongranite and granodiorite stocks intruded the deformed sediments.

4. Tertiary-age, north-striking, high-angle normal faults cut all rocks.

Emmons and Calkins (1913) described many of the mines. Mineral deposits in the district are remarkably similar. All are hosted by Paleozoic carbonate rocks in replacement zones along bedding or shear zones created by reverse and normal faulting. They are probably all related to the late Cretaceous-early Tertiary intrusive event which emplaced large plutons north and south of the district and small stocks and dikes scattered within the district. Orebodies typically contained quartz, calcite, scheelite, and tetrahedrite with minor pyrite, galena, sphalerite, and chalcocite. Most deposits were originally mined for their silver content, but they were re-examined for their tungsten content in the 1950's (Walker, 1960). Minor tungsten production occurred at this time. Base and precious metal production from the district has been 130 ounces of gold, 50,000 ounces of silver, 2,500 pounds of copper, 95,000 pounds of lead, and 55,000 pounds of zinc, worth $477,000 at the time (Elliott and others, 1992).

The district is part of a 15-mile-long belt of tungsten mineralization in deformed Paleozoic rocks that extends northeast to Lost Creek and has been of some interest. However, all known deposits in the district are small. There has been very little gold production from the district, and silver and base-metal occurrences are small and of low grade.

2.1.9 Southeastern Flint Creek Mountains

This area includes for four mining districts defined by the USGS (Elliott and others, 1992)--the Johnson Basin, Olson Gulch, Blue-Eyed Nellie, and Lost Creek districts--with similar geology but in different drainage basins.

Geology of the area was first mapped by Calkins and Emmons (1915), then in more detail by Csejtey (1962). Geology is characterized by Proterozoic-to-Mesozoic sedimentary rocks that were complexly folded and faulted during late Cretaceous compression. They were then intruded by Cretaceous to Tertiary small granitic to dioritic plutons which provided the heat source for the hydrothermal mineralization in the area. High-angle normal faulting followed as did Tertiary volcanism which covered portions of the area. Emmons and Calkins (1913) described some mines in the area, and Earll (1972) summarized the economic geology. Most mineralization consists of veins and replacement zones in carbonate rocks adjacent to intrusions. Commodities were silver, gold, copper, lead, and zinc. Iron has also been mined from magnetite replacement bodies in contact-metamorphosed carbonate rocks (DeMunck, 1956).

Ownership of the area is uncertain. A land exchange between the forest service and private landowners was in progress at the time of the study.

2.2 Hydrology and Hydrogeology

Average annual precipitation in the upper Clark Fork drainage ranges from 10 to 14 inches in the valleys to over 60 inches in the mountains (U.S. Department of Agriculture, 1977). Most precipitation occurs in the spring months in the form of snow or rain. Temperatures in the area vary from well below 0ºF during the winter months to over 90ºF during the summer.

The upper Clark Fork drainage basin has an areal extent of approximately 1,300 square miles. The drainage generally descends northward, from 10,665 feet above sea level in the Anaconda Range and 10,223 in the Highland Range to about 3,790 near Drummond, Montana. The U.S. Geological Survey currently maintains eight stream-flow gaging stations within the upper Clark Fork drainage. The locations, periods of record, drainage areas, and annual mean flows are summarized in table 2.2.

Table 2.1 Production totals for mining districts in the Upper Clark Fork drainage.

District	Gold (oz)	Silver (oz)	Copper (lbs)	Lead (lbs)	Zinc (lbs)	Dollar Value*
Boulder Mountains	4,332	76,999	21,933	433,344	152,611	638,600
Dunkleberg	200	199,890	221,000	3,571,000	5,148,000	1,150,000
Emery	35,670	865,980	42,970	2,389,750	693,950	1,959,300
Highlands	110,000	--	--	--	--	2,200,000
Pioneer-Rose Mountain	286,370	8,180	100	3,000	--	6,165,620
Racetrack	3,670	450	80	--	--	75,750
Red Lion	24,850	12,230	1,490	--	--	841,150
Silver Lake	130	50,000	2,500	95,000	55,000	477,060
Southeastern Flint Creek Mountains	4,170	662,340	4,500	9,002,000	--	1,598,690
Total	**469,392**	**1,876,069**	**294,573**	**15,494,094**	**6,049,561**	**15,106,170**

Source: Elliott and others (1992) and Loen and Pearson (1984).
Production estimates from diverse sources, for diverse periods of time.
* Dollar value at time of production.
--no information available

Table 2.2 Stream-gaging locations within the Upper Clark Fork drainage.

Gage Location	Period of Record	Drainage Area (sq. miles)	Annual Mean Flow (cfs)
Blacktail Creek at Butte, MT	1989-1995	95.4	11.6
Silver Bow Creek below Blacktail Creek, at Butte, MT	1984-1995	103	22.4
Silver Bow Creek at Opportunity, MT	1988-1995	284	54.5
Silver Bow Creek at Warm Springs	1972-1995	483	136
Warm Springs Creek at Warm Springs	1984-1995	163	43.1
Clark Fork at Galen, MT	1988-1995	739	115
Clark Fork at Deer Lodge, MT	1979-1995	1,005	261
Clark Fork at Gold Creek, MT	1978-1995	1,704	523

Source: USGS ADAPS database, May 1996.

2.3 Summary of the Upper Clark Fork Drainage

For the abandoned/inactive mine inventory for the Deerlodge National Forest, the MBMG investigated 179 mines and/or mills within the drainage basin (table 2.3). Of these sites, 137 had no environmental impact on DNF-administered land, 21 may pose environmental problems, and 19 could not be located. Of the 21 sites with potential environmental impacts, 20 have discharges that flow from workings or waste materials, and 4 sites have problems with erosion of and/or runoff from waste materials. The sites listed in **bold** in table 2.3 are those that have some indication of adverse impact and were sampled; these sites are discussed in more detail in the following sections.

If mine openings or other dangerous features (unstable structures, highwalls, steep waste-rock dumps) were observed at a site (and on DNF-administered land), then the site is designated unsafe, or hazardous, in table 2.3. Of the 179 sites inventoried, 10 were found to have safety concerns. Most of the sites were not evaluated for safety hazards. Hazards may exist at many of the other sites, but they were not inventoried as part of this project.

Table 2.3 Summary of Sites Within the Upper Clark Fork Drainage.
Site name in bold indicates potential environmental problems / 'Y' under Hazard indicates physical safety concern.

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Alturus	PRV	N	N	NE	Ridgetop
Amazon	MIX	Y	N	NE	Dry, caved adits
American Beauty	NF	N	N	NE	Small prospect only
Argo	PRV	Y	N	NE	Open adit discharge
Argus	PRV	Y	N	NE	Dry, caved workings
Banker (Chicken Hawk)	PRV	Y	N	NE	Dry, open adit
Barry Dean	NF	N	N	NE	Dry, ridgetop
Bell	PRV	Y	N	NE	Placer workings
Bellaire	NF	N	N	NE	Dry, ridgetop
Ben G	NF	N	N	NE	Surface trenches only
Bertha May	MIX	Y	N	NE	Dry
Big Bear	PRV	Y	N	NE	Dry, caved shaft
Big Bill	PRV	N	N	NE	Dry, ridgetop
Bishop Iron	PRV	Y	N	NE	Small prospect only
Black Chief Iron	PRV	Y	N	NE	Dry, caved adits
Black-eyed May	MIX	Y	N	NE	Dry[5]
Blackshirt	NF	N	N	NE	Ridgetop
Blue Bottle	PRV	Y	N	NE	Dry, fenced workings

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Blue-eyed Maggie (Ding Bat)	PRV	Y	N	NE	Dry, caved adit
Blue-Eyed Nellie	MIX	Y	N	NE	Dry, open workings
Bluebird	NF	N	N	NE	Small prospect only
Bonanza	PRV	Y	N	NE	Dry
Bouvard	NF	Y	N	NE	Dry, hillside[5]
Bresnahan and Fenner	NF	N	N	NE	Dry, ridgetop
Bronze	NF	N	N	NE	Small prospect
Brown's Quarry	PRV	N	N	NE	No effect DNF
Bull Elk	PRV	N	N	NE	Location inaccurate
Bull Moose	NF	Y	N	NE	Dry
Bung Your Eye (Grey Rock)	NF	N	N	NE	Dry, ridgetop
Butte Highlands Mine	Mix	Y	Y	Y	Caved adit discharge
C & W Coleman	Mix	Y	N	NE	Dry, ridgetop[5]
Cameron	NF	N	N	NE	Dry, ridgetop
Carbonater	NF	Y	N	NE	Dry[5]
Champion	PRV	Y	Y	NE	Adit discharge
Champion Mill	MIX	Y	Y	N	Streamside tailings
Chicken Hawk (Banker)	PRV	Y	N	NE	Dry, open adit
Clay Charlie (Hannon)	PRV	Y	N	NE	Dry, fenced workings
Clear Grit	NF	Y	Y	Y	Dry, caved workings
Cliff	NF	N	N	NE	Small prospect only
Clipper	NF	N	N	NE	Ridgetop location
Comet	NF	N	N	NE	Small prospect only
Copper Cliff	NF	N	N	NE	Prospect only; location inaccurate
Copper Queen (Sunlight)	NF	Y	Y	NE	Adit discharge
Copper Prospect	PRV	N	N	NE	Dry
Cottonwood	NF	Y	N	Y	Dry, open adit
Culver	NF	N	N	NE	Surface workings; dry ridgetop
Danielsville Mill	NF	Y	N	NE	No tailings
Dark Horse	PRV	Y	N	NE	Dry, caved adits
Dark Horse Mill	PRV	Y	Y		No tailings
Dead Cow	NF	Y	N	NE	Dry, caved adit

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Ding Bat (Blue Eyed Maggie)	PRV	Y	Y	N	Discharge from dump
Dougherty Mill	NF	Y	N	NE	No tailings
Dunkleberg	UNK	N	N	NE	Location inaccurate
Eldorado (Potosi)	PRV	Y	Y	NE	Dumps in wetland
Elizabeth-L.Emery	NF	Y	N	NE	Dry
Elk	PRV	N	N	NE	No effect to NF
Emery	PRV	Y	N	NE	Dry
Emma Darling	PRV	N	N	NE	Dry, ridgetop
Flume Gulch	MIX	Y	N	Y	Dry, open adits
Forest Rose	PRV	Y	Y	NE	Adit discharge
Forest Rose Tails	MIX	Y	Y	NE	Tailings runoff and discharge
Foster Creek	PRV	N	N	NE	Location inaccurate
Fox	NF	N	N	NE	Small prospect only
George	PRV	Y	N	NE	Dry, caved shaft
Gold Creek Syncline	NF	N	N	NE	Phosphate prospect
Gold Crown (Mayflower)	NF	Y	N	NE	Dry[5]
Golden Jubilee (Letus #1)	NF	Y	N	NE	Dry
Golden Surprise	UNK	N	N	NE	Location inaccurate
Gospel Hill Adit	PRV	Y	N	NE	Caved, dry shaft
Gould-Corry	PRV	Y	N	NE	Dry[5]
Great Eastern	PRV	Y	N	NE	Dry, caved workings
Greater New York	NF	Y	N	NE	Dry; small
Grey Rock (Bung Your Eye)	NF	N	N	NE	Dry, ridgetop
H.O.	NF	N	N	NE	Dry, ridgetop
Hannon (Clay Charlie)	PRV	Y	N	NE	Dry, fenced workings
Hansen-M (Silver Moss)	PRV	Y	N	NE	Dry, caved shafts
Hatta (Magnet)	PRV	N	N	NE	Dry, hillside
Henry	NF	Y	N	NE	Dry, caved adit
Hercules	NF	Y	N	NE	Dry, caved adit
Hidden Hand	NF	Y	N	Y	Dry; some open adits
Hidden Lake	PRV	Y	N	NE	Dry, caved workings
Hidden Lake Tailings	NF	Y	Y	N	Eroding tailings
HLM	NF	Y	N	NE	Covered by talus
Homestake	NF	N	N	NE	Hilltop shaft

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Horseshoe Bend	NF	Y	N	NE	Dry, caved adit
Hughes	NF	Y	N	Y	Dry, open adit
Independence	PRV	Y	Y	NE	Open, adit discharge
Ivanhoe	NF	N	N	NE	Dry ridgetop
J.G. Carlisle	PRV	Y	Y	NE	Adit discharge
Jackson	NF	N	N	NE	Dry ridgetop
Josephine	NF	N	N	NE	Location inaccurate
Kirby	PRV	Y	N	NE	Part of Emery dry
Lark	MIX	Y	N	NE	Dry, prospect pits
Letus #1 (Golden Jubilee)	NF	Y	N	NE	Dry
Lila Dixon/A. Flag	PRV	N	N	NE	Ridgetop
Little Darling	PRV	Y	Y	NE	Adit discharge
Lois	NF	Y	N	NE	Surface trenches
Lower Hidden Hand	NF	Y	Y	N	Adit discharge; caved
Lucky Blue	NF	Y	N	NE	Dry, caved adits
Luke Quarry	PRV	N	N	NE	Silica quarry
M & M	NF	Y	N	NE	Placer mine
Magnet (Hatta)	PRV	N	N	NE	Dry, hillside
Matchless	PRV	N	N	NE	No effect DNF
Matheson	NF	N	N	NE	Dry, ridgetop
Mayflower (Gold Crown)	NF	Y	N	NE	Dry[5]
McKay Adit	PRV	N	N	NE	Dry, ridgetop
Modoc	PRV	Y	Y	NE	Open adit discharge
Monarch	NF	Y	N	NE	Caved, dry adit
Monitor	PRV	N	N	NE	Dry, ridgetop
Montana	NF	Y	N	Y	Dry, open stope
Moondyne	NF	N	N	NE	Location inaccurate
Moonlight	NF	N	N	NE	Dry, ridgetop
Morning Star	NF	Y	Y	NE	Caved, adit discharge
Mountain Chief	NF	N	N	NE	Small, dry ridgetop
Mountain Top	NF	N	N	NE	Small prospect only
Mudhole	NF	N	N	NE	Small prospect only
Nevada	PRV	N	N	NE	Dry, ridgetop
New Year/Abbot (Tip Top)	PRV	Y	N	NE	Dry, fenced workings
New York	NF	N	N	NE	Small, prospect only

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Nineteen Hundred(St. Thomas)	NF	Y	N	NE	Dry, caved workings
Northern Cross	PRV	Y	N	NE	Dry, caved workings
Nugget	NF	N	N	NE	Location inaccurate
Okoreoka	PRV	N	N	NE	Ridgetop
Olson Gulch	NF	N	N	NE	Location inaccurate
Ontario (Richmond)	NF	N	N	NE	Dry, ridgetop
Ophir(Quartzette)	PRV	Y	Y	NE	Streamside dump
Pay Day	PRV	Y	N	NE	Dry, open adit
Paymaster	PRV	N	N	NE	Dry, ridgetop
Pearl	NF	Y	N	NE	Prospect pits only; ridgetop
Pollock	UNK	N	N	NE	Location inaccurate
Pondorf	UNK	N	N	NE	Location inaccurate
Poor Man	PRV	N	N	NE	Location inaccurate
Porcupine	NF	N	N	NE	Location inaccurate
Potosi (Eldorado)	PRV	Y	Y	NE	Streamside dump
Princess	PRV	Y	N	NE	Dry, open adit
Quartzette (Ophir)	PRV	Y	Y	NE	Streamside dump
Queen	NF	Y	N	NE	Dry[5]
Racetrack	NF	Y	Y	Y	Open, adit discharge
Rambler	PRV	Y	N	NE	Dry[5]
Randy	NF	N	N	NE	Location inaccurate
Redeemer	NF	Y	N	NE	Dry[5]
Richmond (Ontario)	NF	N	N	NE	Dry, ridgetop
Robinson	NF	Y	N	NE	Dry, caved adit and shaft
Rocker Gulch	NF	Y	Y	N	Streamside dump;
Ryan	MIX	Y	N	NE	Dry, caved adits
Sabbath	PRV	Y	N	NE	Dry
Sager-Murphy	PRV	N	N	NE	Location inaccurate
Sally Ellen	NF	Y	N	NE	Dry, caved adit
Samuel	NF	N	N	NE	Dry, hillside
Section 18 Prospect	NF	Y	N	NE	Prospect pits only
Section 8 Shaft	PRV	Y	N	NE	Dry
September Snow	NF	N	N	NE	Dry
Sheila	NF	N	N	NE	Prospect pits
Silver Chain-Antelop	PRV	Y	N	NE	Dry[5]

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
Silver Heart	NF	Y	N	Y	Dry, open stope; caved adits
Silver Hill	PRV	N	N	NE	Dry, ridgetop
Silver King	PRV	Y	N	NE	Dry open adits
Silver Moss (Hansen-M)	PRV	Y	N	NE	Dry, caved shafts
Silver Prospect	PRV	Y	N	NE	Small dry prospect
Silver Queen	PRV	Y	N	NE	Dry, open adits
Smith	NF	N	N	NE	Dry, ridgetop
Snow Bunny	NF	Y	Y	NE	Open adit discharge
Snowhome	NF	Y	N	NE	No workings present
Spring Hill	NF	N	N	NE	Dry, ridgetop
St. Mary's	PRV	Y	Y	NE	Adit discharge; caved
St. Thomas(Nineteen Hundred)	NF	Y	N	NE	Dry, caved workings
Sterritt	PRV	Y	Y	NE	Adit discharge, caved
Storm Lake (Tarlach)	NF	N	N	NE	Ridgetop
Stormway-Morgan Evans	MIX	Y	N	NE	Dry, caved workings
Straw Hat	NF	N	N	NE	Small prospect
Summit	NF	N	N	NE	Two short adits; dry ridgetop
Sun	NF	N	N	NE	Dry, hillside, small
Sunlight (Copper Queen)	NF	Y	Y	N	Adit discharge
Sunset	NF	Y	N	NE	Dry, caved adits
Swan	NF	Y	N	NE	Dry[5]
Tanglefoot	NF	Y	N	NE	No workings present
Tarlach (Storm Lake)	NF	N	N	NE	Ridgetop
Tibbetts	MIX	Y	N	Y	Dry, open adits
Tip Top (New Year/Abbot)	PRV	Y	N	NE	Dry, fenced workings
Tolean	NF	N	N	NE	Small prospect only
Tommy	PRV	N	N	NE	Ridgetop
Trigger	MIX	Y	N	NE	Dry, locked workings
Tungsten occurrence	NF	N	N	NE	Surface workings
Twilight #1	NF	N	N	NE	Location inaccurate
Unnamed Gold	NF	N	N	NE	Location inaccurate
Unnamed Lead	NF	N	N	NE	Ridgetop
Valley View	NF	Y	N	NE	Dry, surface workings
Wake-up Jim	PRV	Y	N	NE	Dry; caved
Welcome	NF	Y	N	NE	Dry, open workings

Site[1]	Owner[2]	Visit	Sample[3]	Hazard[4]	Remarks
White Swan	UNK	N	N	NE	Location inaccurate
Yellow Jacket	PRV	N	N	NE	No effect DNF
Yellow Metal	UNK	N	N	NE	Location inaccurate

1) Mines in **bold** may pose environmental problems and are discussed in the text; others are included only in appendix II (all mines) and appendix III (sites visited).
2) Administration/Ownership Designation
NF: USFS (DNF-administered land)
PRV: Private
MIX: Mixed (DNF-administered land and private)
UNK: Owner unknown
3) Solid and/or water samples (including leach samples).
4) Y: Physical and/or chemical safety hazards exist at the site.
NE: Physical and chemical safety hazards were not evaluated.
5) Mill site present

2.3.1 Summary of Environmental Observations

For sites investigated within the Upper Clark Fork drainage, the Clear Grit Mine on the west end of Pikes Peak Creek Basin has the most severe water-quality problems. Water from a flooded shaft contained concentrations of aluminum, copper, iron, lead, and manganese that exceeded water-quality criteria; pH was below the secondary standard of 6.5.

The Sunlight/Copper Queen Mine has the worst soil-quality problems. Concentrations of copper, lead, and zinc in soils at this site are above the phytotoxic levels. Concentrations of arsenic and cadmium exceed the Clark Fork Superfund background levels.

2.4 Argo Mine and Mill

2.4.1 Site Location and Access

The Argo Mine and mill (T10N R16W 35 ACDA) are located on a steep mountainside above Harvey Creek, about 15 miles southeast of Clinton, Montana. The site is on a patented claim that is within the Lolo National Forest. This portion of the Lolo National Forest is administered by the DNF. The site can be accessed by following the Brewster Creek Road from Rock Creek.

2.4.2 Site History - Geologic Features

Host rocks are tan to green argillite and siltite and pink to purple quartzite of the Missoula Group. Underground maps (Walker, 1963) show that gold was mined from a quartz-pyrite-ferberite (wolframite)-dolomite-siderite vein that strikes northeast and dips 35°SE , usually cutting across bedding, but sometimes concordant. The vein averages 2.5 feet thick, and has been explored for 1,250 feet along strike and for 850 feet downdip. About 4,700 feet of workings are present, accessible from two open adits.

A sample of vein material from the dump with 2.76 oz/ton gold, 0.44 oz/ton silver, 0.018% copper, 0.21% lead, and 0.032% zinc generated considerable interest in the property. Obviously, explorationists have had similar experiences; there are numerous reclaimed drill pads in the area. However, 81 channel samples taken across the vein (Walker, 1963) ranged from a trace to 2.78 oz/ton, with an average grade of only 0.29 oz/ton. The property was also studied for its tungsten potential; the same channel samples contained up to 4.1% WO_3.

The history of the property is unknown. Mill remains are present at the lower adit portal.

2.4.3 Environmental Condition

Workings at the site consist of two intact adits, a large waste-rock dump, two tailings piles, and the remnants of a mill (figure 2.2). The lower adit is flooded and has a small discharge that flows across the top of the waste-rock. The discharge flows off the dump and into a gully before sinking into the ground. A second discharge flows from the base of the waste-rock dump and then into Harvey Creek. This discharge has a flow rate of several gallons per minute.

2.4.3.1 Site Features - Sample Locations

Because the workings at the site are on private land, the adit discharge and waste-rock dump seep were not sampled directly. Instead, a sample was collected from Harvey Creek downstream of the site. On the day of sampling (09/23/93), the creek had a flow rate of 60 gpm.

2.4.3.2 Soil

The waste-rock dump and tailings piles are on a steep slope but appear reasonably stable. No signs of catastrophic erosion were observed. Also, no waste material was observed on DNF-administered land below the site.

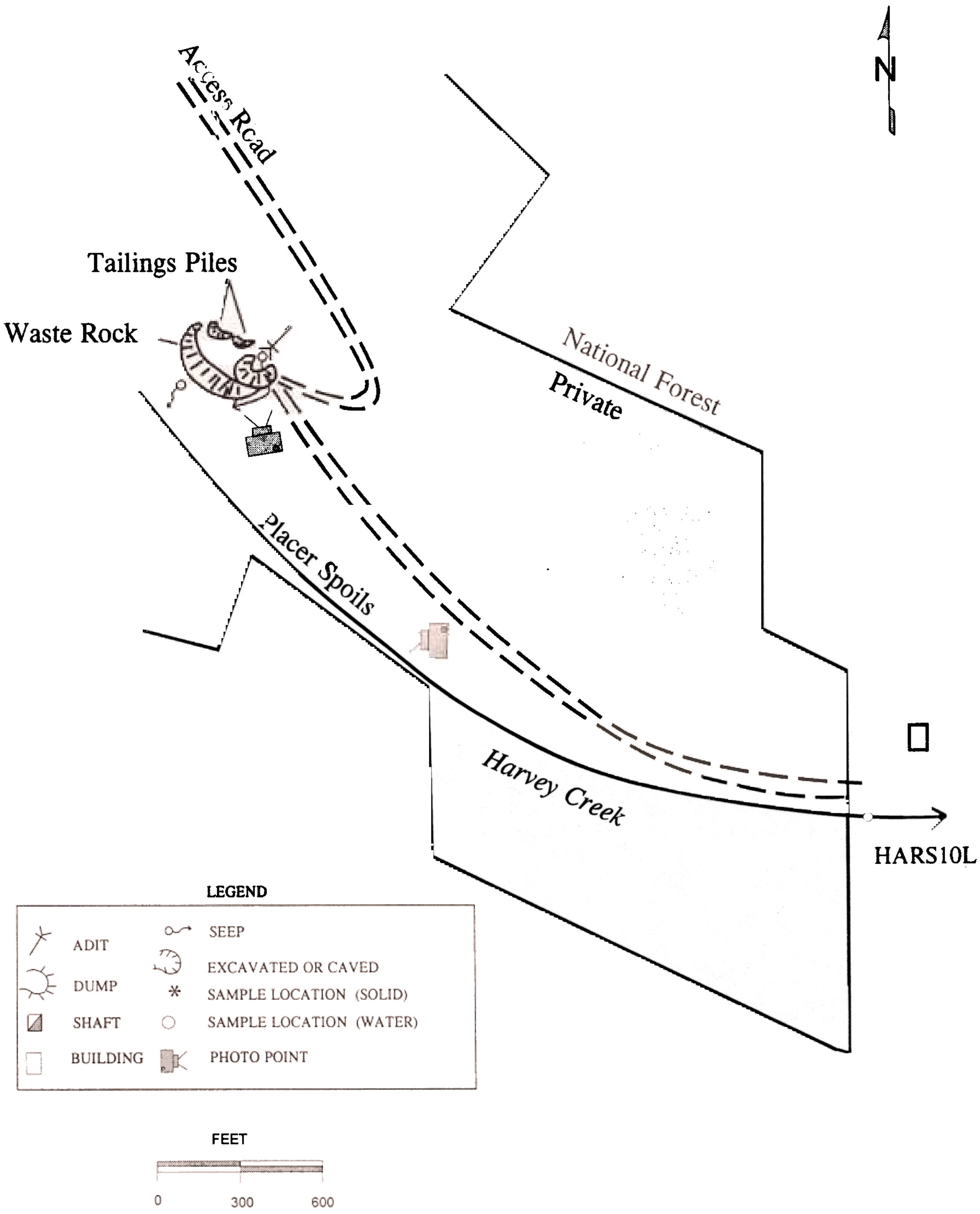


Figure 2.2. Sketch map of Argo mine and mill site. Location of the upper adit is not shown.

Figure 2.2a The discharge from the lower adit runs down the face of the waste-rock dump and into Harvey Creek.

Figure 2.2b Spoil piles line the banks of Harvey Creek which has been extensively placered.

2.4.3.3 Water

Harvey Creek had no water-quality exceedences downstream of the site.

Table 2.4 Argo Mine and Mill water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Harvey Creek - downstream of site (HARS10L)																			

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.4.3.4 Vegetation

Around the waste-rock dump, the ground is sparsely vegetated; the tailings piles are barren. The vegetation along the drainage below the site consists of grasses, conifers, and brush and appears healthy.

2.4.3.5 Summary of Environmental Condition

The adit discharge and the waste-rock dump seep do not appear to seriously impact the water-quality of Harvey Creek. Also, erosion of waste material does not appear to be a problem. Overall, the environmental impact of the site on DNF-administered land appears negligible.

<u>2.4.4 Structures</u>

The remnants of a mill are located above the waste-rock dump. A cabin is located along Harvey Creek, downstream of the site.

<u>2.4.5 Safety</u>

The two open adits at the site are a safety concern.

2.5 Champion Mine and Mill

2.5.1 Site Location and Access

The Champion Mine and mill are located about 8 miles east of Galen, Montana, and about 12 miles southeast of Deer Lodge, Montana (T06N R08W section 33 BACC) . The site is at the end of Forest Route 9411, an improved road. To the south, the site is bordered by an ephemeral stream tributary to Orofino Creek.

2.5.2 Site History - Geologic Features

The Champion Mine was the largest producer in the Boulder Mountains area. The mine was discovered in 1886, but it was only extensively worked beginning in 1918, when a flotation mill was built on the property, until 1926 (Pardee and Schrader, 1933). Ore was valued mainly for its silver content, and was mined from a seven-foot-wide, high-sulfide, polymetallic, east-west striking vein typical of the Boulder Batholith. Between 1918 and 1926, the mine produced 100,000 tons of ore with 1,200,000 ozs of silver (Krohn and Weist, 1977). Underground mine maps (unpublished information, MBMG files) show more than 5,000 feet of workings on nine levels, now all inaccessible. Northern Testing Labs (1982) studied the mine dump in detail, and also mapped the extensive area of eroded tailings, which are probably on DNF-administered land. A composite sample of the tailings contained 0.08 oz/ton gold, 1.24 oz/ton silver, 0.002% copper, 0.008% lead, 0.013% zinc.

2.5.3 Environmental Condition

The site consists of a caved adit, shaft, waste rock dump, and tailings (figure 2.3). The adit, shaft, waste-rock dump, and small part of the tailings are on private property. Most of the tailings are on DNF-administered property. Water discharges from the caved adit, but completely sinks into the waste rock and ground before reaching DNF-administered land. The adit discharge channel contains iron oxyhydroxide precipitants.

2.5.3.1 Site Features - Sample Locations

The site was visited and sampled on 08/06/1992. A sample was collected from a spring flowing from the base of a beaver dam (DCHS10M). The beaver pond was dry.

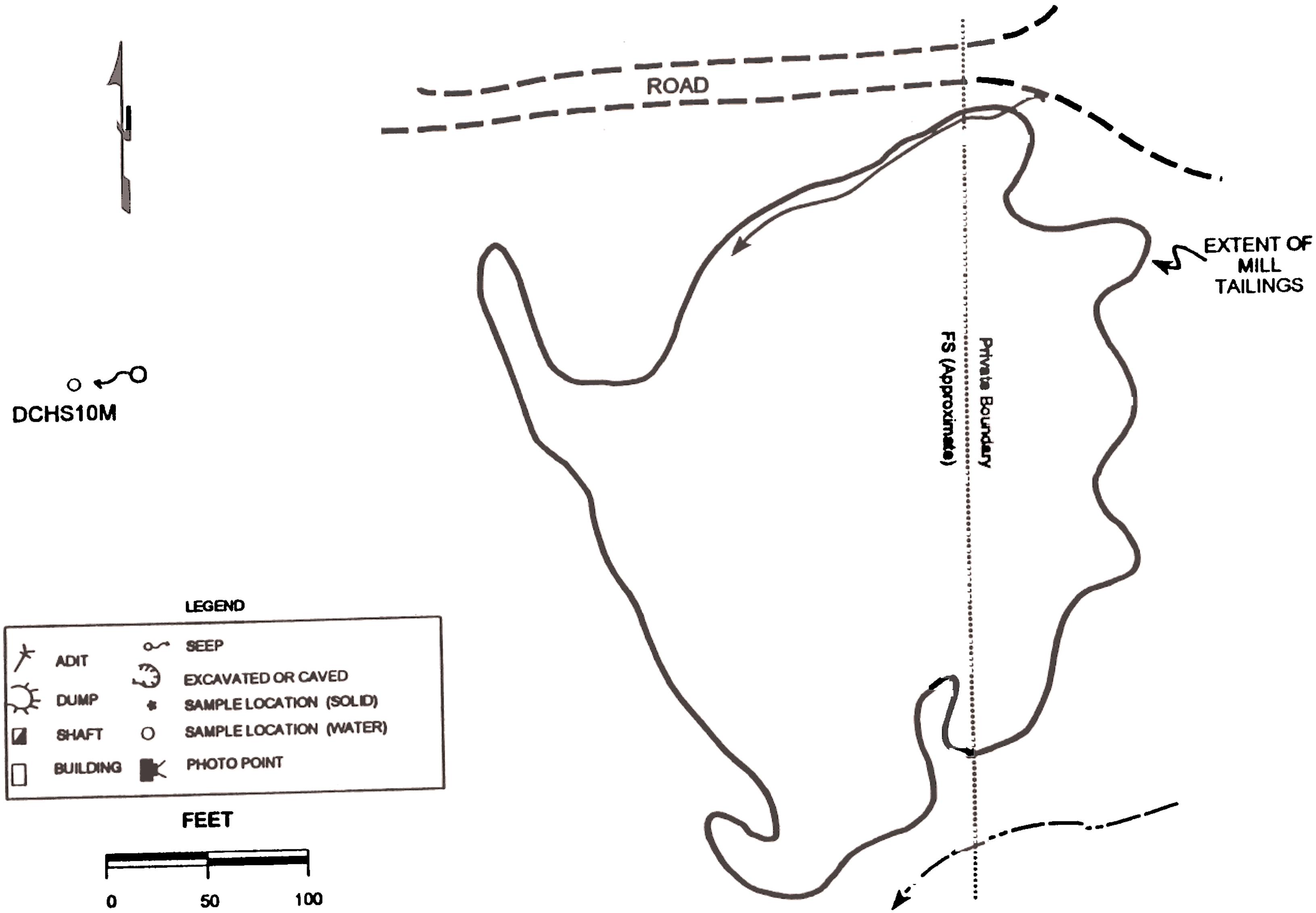


Figure 2.3. Site map of the Champion mine and mill.

2.5.3.2 Soil

Although the tailings are eroded as indicated by their undulating and incised surface, there is no indication that they have impacted soils downgradient. The tailings are partially vegetated with grass and trees. Samples of soil were not collected at this site.

2.5.3.3 Water

Sulphate concentration in the sample collected from the seep below the beaver dam exceeded the primary standard (table 2.5). Mercury concentration exceeded the chronic aquatic life standard, but was at the detection limit of 0.1 µg/L. The field pH of the seep was about 6.24, lower than the lower limit of the secondary drinking water standard; however, the lab pH (6.7) was within the acceptable range.

Table 2.5 Champion Mine and Mill water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Seep at base of beaver dam (DCHS10M)										C							P,S		S

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.5.3.4 Vegetation

The waste dump is mostly barren. The tailings are sparsely vegetated with grass and trees. The vegetation outside of the disturbed area does not appear stressed.

2.5.3.5 Summary of Environmental Condition

Discharge from the caved adit infiltrates into the waste rock and the ground before reaching DNF-administered land. The water that infiltrates into the waste rock and ground may be adversely impacting ground water; the seep at the base of the beaver dam--ground water--was slightly acidic and contained sulphate at a concentration greater than the primary drinking water standard. The tailings are sparsely vegetated with grass and trees, and do not appear to be impacting areas outside of the disturbed area.

2.5.4 Structures

No structures are present on DNF-administered land.

2.5.5 Safety

The site was not evaluated for safety.

2.6 Clear Grit (Lost One) Mine

2.6.1 Site Location and Access

The Clear Grit Mine (T8N R12W 24 ABDC) is located on DNF-administered land at the west end of Pikes Peak Creek basin. Access to the site is via an ATV trail that begins north of the Gold Creek Lakes.

2.6.2 Site History - Geologic Features

One open shaft, one caved shaft, one caved adit, and several surface disturbances follow a N37°W (?) shear zone in the Royal Stock (see figure 2.4). Avery (1983) described quartz-iron oxide veins and stringers with N30°-70°W 85°SW attitudes in this zone. Fifteen samples taken by him ranged from 0.01 to 1.33 oz/ton gold and from 0.01 to 0.99 oz/ton silver. Emmons and Calkins (1913) found veins of quartz, sericite, pyrite, and chalcopyrite, and altered host rock containing pyrite, chalcopyrite, and bornite.

2.6.3 Environmental Condition

Springs located uphill (south) of the site drain into a gully that runs between several shallow trenches and pits, and the southernmost shaft (S1). Before reaching the second shaft (S2), the water seeps into the ground and disappears. Further down the gully, water reappears as a small adit discharge. The discharge flows down the side of a waste-rock dump, across a grassy area, and into an unnamed tributary to Pikes Peak Creek (figure 2.4).

Another environmental concern at the site is the S1 shaft, which is partially flooded. The water level in the shaft is approximately five feet below the ground surface.

2.6.3.1 Site Features - Sample Locations

Water-quality samples were collected from a spring upgradient of the site (PCGS50L), from the gully below the S1 shaft (PCGS40L), and from the adit discharge (PCGS10L). The flow rates at these locations were 3.1, 0.3, and 3.1 gpm, respectively. Sample PCGG10M was collected from shaft S1. Samples PCGS20L and PCGS30L were collected from the unnamed stream above and below the confluence with the adit discharge, respectively. The flow rate of the stream was approximately 200 gpm. All samples were collected on September 17, 1993.

2.6.3.2 Soil

No erosion problems were noted at the site; therefore, no soil samples were collected.

2.6.3.3 Water

The water sampled from the flooded S1 shaft contained concentrations of dissolved aluminum, copper, iron, lead, and manganese that are above water-quality standards; in addition, the water had a low pH. The adit discharge contained lead at a concentration above the chronic aquatic life standard, but had no other problems. These exceedences and several others are listed in table 2.6.

Table 2.6 Clear Grit Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Spring upgradient of site (PCGS50L)										C									
Water in gully below S1 shaft (PCGS40L)																			
Flooded S1 shaft (PCGG10M)	S,C					A,C	S	C	S										S
Adit discharge (PCGS10L)								C											
Unnamed stream - above confluence with adit discharge (PCGS20L)																			S[1]
Unnamed stream - below confluence with adit discharge (PCGS30L)	S																		

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

(1) Laboratory pH did not exceed standard
Note: The analytical results are listed in appendix V.

2.6.3.4 Vegetation

With the exception the waste-rock dumps, the site is densely vegetated with grasses and evergreens. The waste-rock dumps are barren to sparsely vegetated.

2.6.3.5 Summary of Environmental Conditions

Ground-water quality, as indicated by the samples collected from the flooded S1 shaft and the adit discharge, is generally poor in the vicinity of the mine. However, no areas of dead or stressed vegetation were observed, and the unnamed stream flowing through the site does not appear to be impacted.

2.6.4 Structures

The S1 shaft is enclosed within a log mine building which is in poor condition. Several hundred feet to the west of the mine workings, there is a log cabin which is in good condition. This cabin appears to be used as a camp occasionally. Both of the buildings are on DNF-administered land.

2.6.5 Safety

The partially flooded S1 shaft poses a serious safety hazard at the site. Other hazards at the site include the partially collapsed S2 shaft and a subsidence pit between the S2 shaft and the adit.

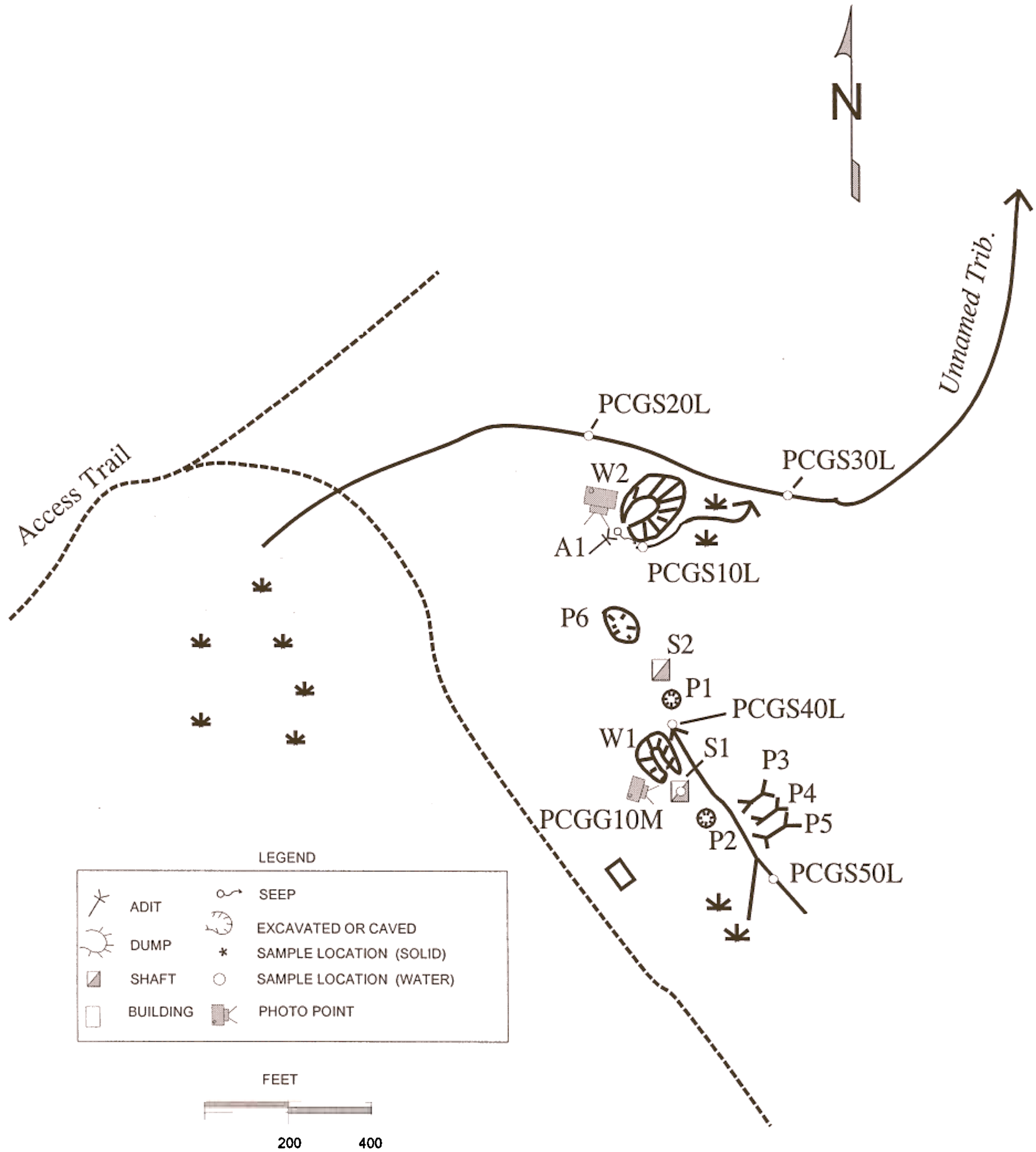


Figure 2.4. Sketch map of the Clear Grit mine.

Figure 2.4a The S1 shaft flooded to within approximately five feet of the ground surface

Figure 2.4b A small discharge flows from the collapsed adit at the Clear Grit Mine.

2.7. Dark Horse Mill

2.7.1 Site Location and Access

The Dark Horse mill (T6N R11W section 3CCAB) is entirely on private land surrounded by federal land in the Deerlodge National Forest in the Mount Powell 7.5-min. quadrangle. The site is west of the town of Racetrack near Deer Lodge.

Access to the site is from the Racetrack exit on Interstate 90, a paved road leads through the town of Racetrack westward to the foothills. At the base of the foothills, a private road provides access to DNF-administered land. The road past this point is primitive and requires a 4-wheel drive vehicle. DNF Road 5147 goes within 300 feet of the site approximately 5.5 miles from the start of DNF-administered land near the head of Granite Creek. A very primitive road from FS Road 5147 leads directly to the mill site.

2.8.2 Site History - Geologic Features

The Dark Horse mill is probably an amalgamation mill built to treat ore from the Dark Horse Mine. The mill is in ruins and although the creek runs through the site, no tailings were found nor were production values available.

2.7.3 Environmental Condition

Since most of the site was on private land, no map was made. The mill area consisted of foundations and parts of the mill building that was largely overgrown by vegetation. Granite Creek flows through the site; a small bog area also drained toward the site.

2.7.3.1 Site Features - Sample Locations

Because the site was on private land and there were no discharges originating on the site, sampling was restricted to Granite Creek upstream and downstream on DNF-administered land. Samples were collected from Granite Creek about 100 feet upstream of the mill (GDHS10L) at which the stream was flowing about 450 gpm and about 200 feet downstream of the mill (GDHS20L) at which the stream was flowing about 540 gpm.

No waste material was found, nor were there any indications of metals release by buried tailings. No soil samples were collected.

2.7.3.2 Soil

There was no evidence of contamination of soils in the area. Although the site is on a hillside, the soils appeared stable and erosion was minimal.

2.7.3.3 Water

Field parameters indicated little difference in water quality; analytical results for the upstream and downstream samples also indicate little difference. None of the concentrations of metals exceeded the standards considered; in fact, most of the metals-concentrations were at or below detection limits.

Table 2.7 Dark Horse Mill water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Granite Cr. - upstream (GDHS10L)																			
Granite Cr. - downstream (GDHS20L)																			

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.7.3.4 Vegetation

The mill area, the small tailings pile, and the area near the adit discharge stream were all well vegetated. None of the vegetation on DNF-administered land appeared to be stressed.

2.7.3.5 Summary of Environmental Condition

All of the disturbed area of the Dark Horse mill is on private land. Overall, the mill appears to have little or no impact on surface-water quality; there appeared to be no erosion in the disturbed area; mass-wasting or other movement of material toward the Granite Creek appeared to be unlikely.

2.7.4 Structures

All significant structures associated with the Dark Horse mill were on private land. These consisted of the remnant of a small cabin and the remnants of the mill. Both structures were in ruin and the mill equipment overgrown by vegetation.

2.7.5 Safety

There were no safety concerns identified that related to the mine; observations of this type were restricted to DNF-administered land.

2.8 Ding Bat - Blue Eyed Maggie Mines

2.8.1 Site Location and Access

The Ding Bat-Blue Eyed Maggie mine sites are located about 7 miles east of Deer Lodge, Montana (T07N R08W section 10 ADCC). The site is accessed from Deer Lodge by taking Forest Route 705. The site is about 0.5 mile east of the powerline and is on private property.

2.8.2 Site History - Geologic Features

Because these two mines explored the same vein and surface features are difficult to separate, they are treated as one site here. The Blue-Eyed Maggie was the most extensive of the two, and contained an inclined shaft with four levels that followed a N40°-50°W, 20°NE vein (McClernan, 1976). The Ding Bat, with 500 feet of drifts, mined a faulted segment of the same vein system (Robertson, 1952). The vein averages six inches wide, and yielded 1-1.5 oz/ton Au and 42-63 oz/ton Ag. It contains quartz, pyrite, arsenopyrite, galena, chalcopyrite, tetrahedrite, boulangerite, and calcite, and is enclosed in amygdaloidal basalt with chalcedony, calcite, and epidote filling some of the cavities. The dumps on these properties are composed almost entirely of this basalt.

2.8.3 Environmental Condition

A seep emerges from the base of an unaltered basalt dump and flows onto DNF-administered land and subsequently into Rocker Gulch. The waste dump is composed of angular pieces of unaltered basalt. Because the site is on private land, no site map was prepared.

2.8.3.1 Site Features - Sample Locations

The site was visited and sampled on 08/10/1992. A sample of the seep was collected where it flows onto DNF-administered land. The seep flows at about 14 gpm. The waste dump appeared stable and not affecting DNF-administered land; soil was not sampled.

2.8.3.2 Soil

Soil was not sampled at the site.

2.8.3.3 Water

Concentration of arsenic exceeded the primary drinking water standard. Concentration of mercury exceeded the chronic aquatic life standard; however, its concentration (0.1 ppb) was at the method-detection limit.

Table 2.8 Ding Bat/Blue Eyed Maggie Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Seep from dump (DDBS10L)		P								C									

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.8.3.4 Vegetation

Vegetation on DNF-administered land adjacent to the site did not appear impacted from mining activities.

2.8.3.5 Summary of Environmental Condition

The concentration of arsenic and mercury exceeded water quality standards. Soil on DNF-administered land adjacent to the site did not appear impacted.

2.8.4 Structures

Structures were not present on DNF-administered land adjacent to the site.

2.8.5 Safety

The site was not evaluated for safety.

2.9 Eldorado and Potosi Mines

2.9.1 Site Location and Access

The Eldorado (T8N R12W 23 ACA) and Potosi (T8N R12W 23 ADBA) mines are located to the southwest of Gold Creek Lakes. Both sites are on a large block of private land that is surrounded by DNF-administered land. Access to the sites is via an ATV trail that begins a mile north of the lakes.

2.9.2 Site History - Geologic Features

Two caved shafts (S1 and S2, figure 2.5), one open shaft (S3), one short caved adit (A1), and one 500-foot caved adit (A2) are dispersed over a few acres at the Eldorado. A large dump (W1) is located in a pond and adjacent wetland. Mineralization is hosted by granodiorite of the Royal Stock, and appears to be localized by narrow shear zones striking N70°E and N15°W. Pieces of vein up to six inches in diameter contain quartz, pyrite, and sericite; wallrock contains quartz, sericite and clay alteration products. A select sample of vein and altered host rock ran 1.151 oz/ton gold, 0.42 oz/ton silver, 0.075% copper, 0.015% lead, and 0.006% zinc. Emmons and Calkins (1913) describe the geology only as a "crushed and sheeted zone of granite".

At the Potosi Mine, two adits (A3 and A4, see figure 2.5), one 20 feet long and the other about 200 feet long and caved, apparently explore a four-inch wide, N10°W quartz vein in unaltered granodiorite of the Royal Stock. South Gold Creek flows around two small mine dumps of this unaltered rock. Emmons and Calkins (1913) noted granite almost completely replaced by sericite, calcite, pyrite, and chalcopyrite, but no evidence of this is present today.

2.9.3 Environmental Condition

Surface runoff from both mines drains into a small creek that flows into the Gold Creek Lakes. The creek originates on DNF-administered land south of the mines. As the creek flows across the private land associated with the sites, it is fed by a small tributary that drains the wetland

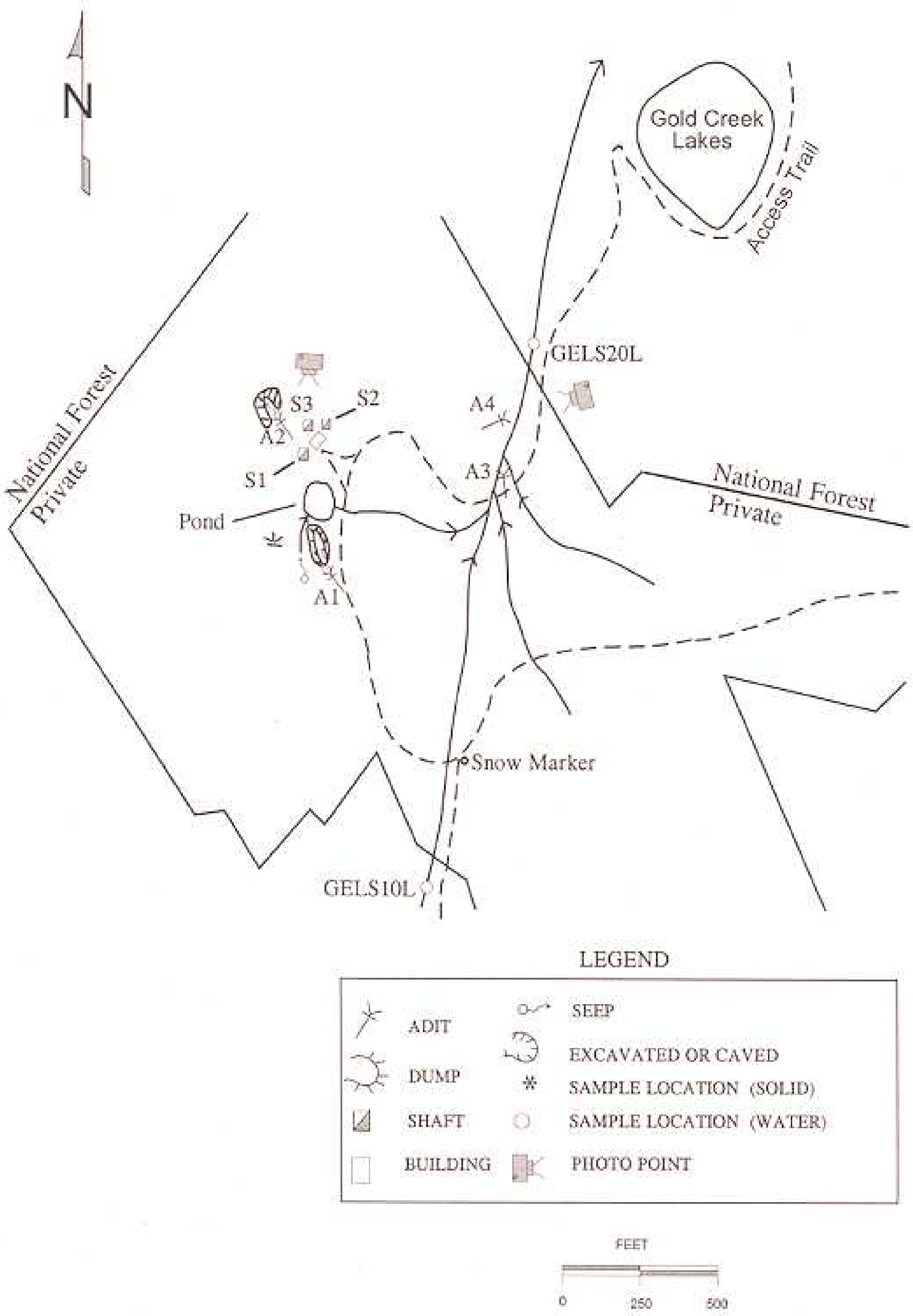


Figure 2.5. Sketch map of Eldorado and Potosi mines.

Figure 2.5a The S3 shaft at the Eldorado Mine appears to be intact.

Figure 2.5b At the Potosi Mine, the A2 adit opening is visible from the ATV trail.

surrounding the W1 waste-rock dump at the Eldorado Mine. The creek then descends past the waste-rock dumps at the Potosi Mine before crossing back onto DNF-administered lands. The dumps at both sites do not appear to be eroding appreciably.

As an additional note, both the A1 and A2 adits at the Eldorado Mine have small, intermittent discharges. The discharges infiltrate the ground a short distance from their origins.

2.9.3.1 Site Features - Sample Locations

The site was sampled on 09/21/1993. Samples were collected from the unnamed creek on DNF land upstream (GELS10L) and downstream (GELS20L) of the two sites. The flow rate of the creek at the upstream location was 79 gpm; at the downstream location, the flow rate was 300 gpm.

2.9.3.2 Soil

No mine waste was observed on DNF-administered land; therefore, no soil samples were collected.

2.9.3.3 Water

The unnamed creek had no water-quality exceedences.

Table 2.9 Eldorado and Potosi Mines water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed Creek - upstream of sites (GELS10L)																			
Unnamed creek - downstream of sites (GELS20L)																			

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.9.3.4 Vegetation

The undisturbed areas around the sites are vegetated with grasses, brush, and evergreens. The wetlands at the Eldorado Mine is vegetated with grasses and brush. The waste-rock dumps at both sites are sparsely vegetated.

2.9.3.5 Summary of Environmental Condition

The Eldorado and Potosi have little, if any, adverse impact on DNF-administered land.

2.9.4 Structures

A cabin and ore bin are located on private land at the north end of the Eldorado site. Both structures are in fair condition.

2.9.5 Safety

The small S3 shaft at the Eldorado and the A2 adit at the Potosi are both open and therefore are hazards. Both openings are on private property. 2.5

2.10 Forest Rose Mine

2.10.1 Site Location and Access

The Forest Rose Mine (T09N R12W 22 DCAB) is located about 5.8 miles southwest of Jens, Montana. The site is on the floodplain of Dunkleberg Creek, and east of Forest Service road 707. The southern three fourths of the site is on private property; the northern quarter is on DNF-administered property.

2.10.2 Site History - Geologic Features

The largest producer in the Dunkleberg district, the Forest Rose consists of at least 3,500 feet of workings over a 400-foot vertical range. The ore occurs on the nose of the north-plunging Dunkleberg Anticline where the Kootenai gastropod limestone intersects an axial plane fault zone (Popoff, 1953). Mineralization replaces the limestone and can be followed for 1,000 feet along plunge. The ore contains galena, sphalerite, pyrite, quartz, and calcite, and ore mined averaged 4.0% Pb, 4.0% Zn, and 3 oz/ton Ag. The grade decreases rapidly away from the crest of the fold.

Wasa ore and Forest Rose ore were processed at the Forest Rose mill. Combined production from both mines totaled 59 oz of gold, 153,624 oz of silver, 106 tons of copper, 1465 tons of lead, and 2540 tons of zinc (Northern Testing Laboratories, 1983). Like the Wasa, the mine was active in the early 1900's and again from 1941-1947.

The main adit is caved and discharges water into the dump and tailings below. Northern Testing (1983) estimated the dump (on private land) contains 18,200 tons of .005 oz/ton Au, 0.4 oz/ton Ag, 0.020% Cu, 0.21% Pb, and 0.63% Zn.

2.10.3 Environmental Condition

Water seeps from two caved adits located on the southern end of the site. Both of the caved adits are on private property (figure 2.6). Water from the caved adits flows onto mine waste and tailings where it completely infiltrates. Tailings from a mill located on the southern end of the site fill about a 700-foot-long section of Dunkleberg Creek. The tailings are about 50 feet thick at the north end of the site. Water from a spring located west of the site flows onto the tailings and feeds a small pond at the north end of the site; the pond does not have a surface water outlet. Several seeps emerge at the toe of the tailings impoundment. The top of the tailings are sparsely vegetated; the toe of the tailings impoundment is lush with vegetation.

2.10.3.1 Site Features-Sample Locations

The site was sampled on 09/01/1992. Three surface water samples were collected; one was collected from Dunkleburg Creek about 1,500 feet upstream of the site (DFRS10L), another from the seeps at the toe of the impoundment (DFRS20l), and another from the seep that feeds the pond (DFRS30L). The seep that feeds the pond was flowing at about 0.25 gpm; combined discharge from the seeps flowing from the toe of the tailings impoundment was about 15 gpm. Dunkleberg Creek upstream of the site was flowing about 1 gpm.

2.10.3.2 Soil

Soil on DNF-administered land did not appear impacted from mining waste and was not sampled.

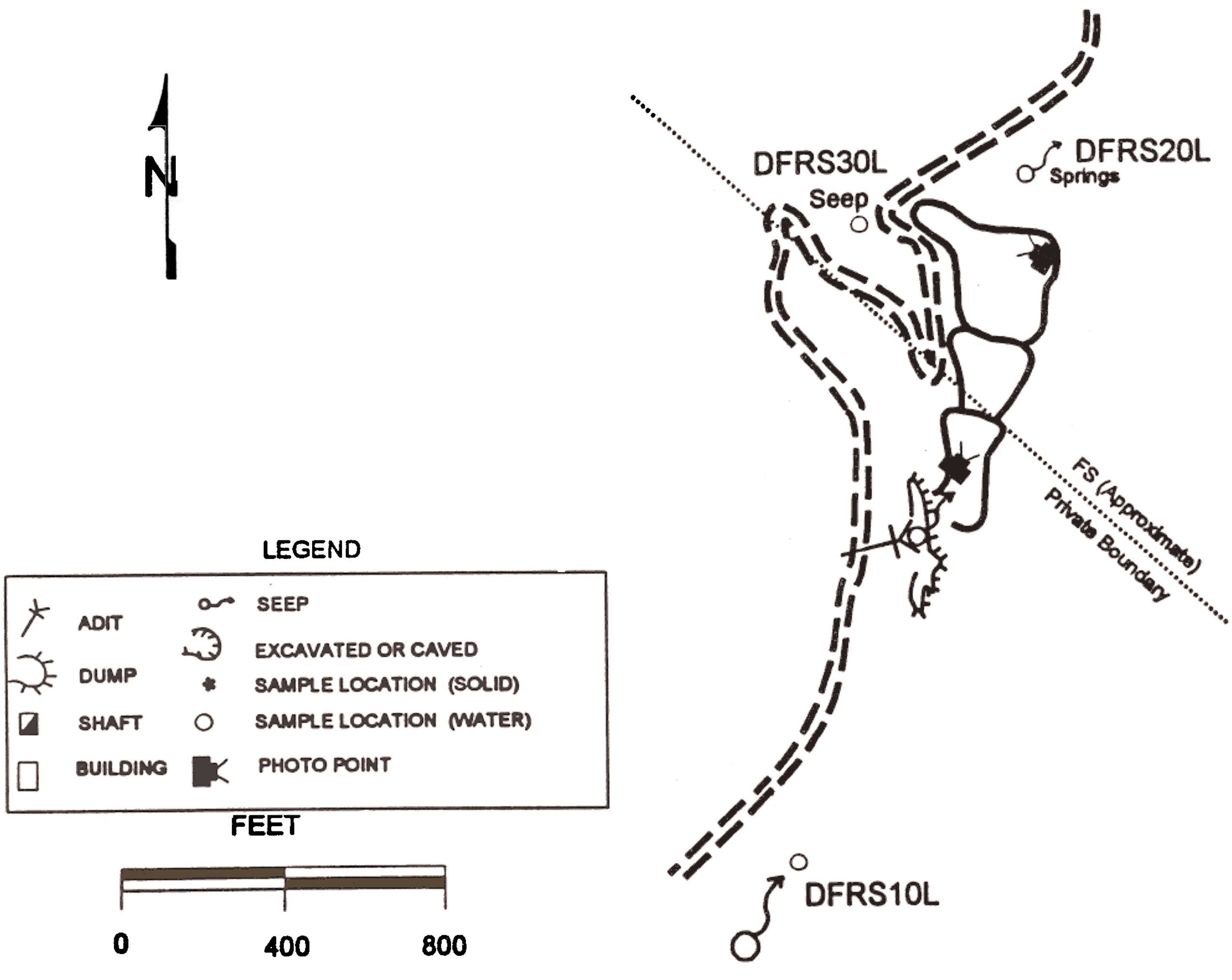


Figure 2.6. Forest Rose site map.

Figure 2.6a Upper tailings and waste rock at Forest Rose Mine. View is to the north.

Figure 2.6b Lower tailings impoundment. A small seep west of the site feeds the pond. View is to the south west.

2.10.3.3 Water

The sample from Dunkleberg Creek upstream of the site and the sample from the toe of the tailings impoundment had concentrations of mercury that exceeded the chronic aquatic life standard, but were at the detection limit of 0.1 µg/L. Water from the seeps at the toe of the impoundment had a higher specific conductance and a lower pH than water upstream of the site (381 µmhos vs. 726 µmhos, and pH 7.91 vs. 7.35). The concentration of zinc slightly increased downstream of the site (26 ppm vs 33 ppm).

Table 2.10 Forest Rose Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Dunkleberg Creek-Upstream (DFRS10L)										C									
Seepage at toe of impoundment (DFRS20L)										C									
Seepage that feeds pond (DFRS30L)																			

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: Analytical results are listed in appendix V.

2.10.3.4 Vegetation

The tailings and waste rock are very sparsely vegetated. The toe of the tailings impoundment, however, is very well vegetated. Vegetation outside of the site does not appear impacted from mining and milling activities.

2.10.3.5 Summary of Environmental Condition

The disturbed area at the Forest Rose Mine and mill includes about a 10-acre area. The south half of the site is privately owned and contains two caved adits with water discharging from them, and several foundations and dilapidated buildings. The north half of the site is on DNF-administered land and contains most of the tailings. Water quality is not strongly impacted as it flows through the waste rock and tailings.

2.10.4 Structures

The south part of the site contains several foundations and dilapidated buildings, all of which are on private property. Structures are not on DNF-administered land.

2.10.5 Safety

The site was not evaluated for safety.

2.11 Hidden Lake Mill

2.11.1 Site Location and Access

The Hidden Lake mill (T6N R13W section 35 BCBD) is on private ground within the West Fork Warm Springs Creek drainage. The tailings from the mill extend several hundred feet onto DNF-administered land. The site is accessible by an unimproved road from Highway 10A near Spring Hill along Cable Creek.

2.11.2 Site History - Geologic Features

The Hidden Lake was a cyanide mill which processed oxidized ore, and the tailings contain mostly quartz and iron oxide. About 100,000 tons are present at an average grade of <0.006 oz/ton gold, 0.40 oz/ton silver, 0.022% copper, 0.020% lead, and 0.088% zinc.

2.11.3 Environmental Condition

A large amount of tailings has been washed downhill onto USFS ground for a distance of several hundred feet. Although no perennial streams are present, tailings are being washed down a small drainage during spring run-off and storm events. Impact to soil is primarily within the tailings; however, where soils and tailings mix, some re-growth has occurred. The site is a considerable distance upstream of the nearest stream, which is Cable Creek.

2.11.3.1 Site Features - Sample Locations

Although there was evidence of springs south of the tailings area, no flowing or standing water was found in the vicinity at the time of the visit on 8/27/92. A composite-soil sample (FHLD10H) was collected near the DNF boundary below the mill site (figure 2.7). The sample was collected from the soil deposited on top of the tailings (top 1-inch).

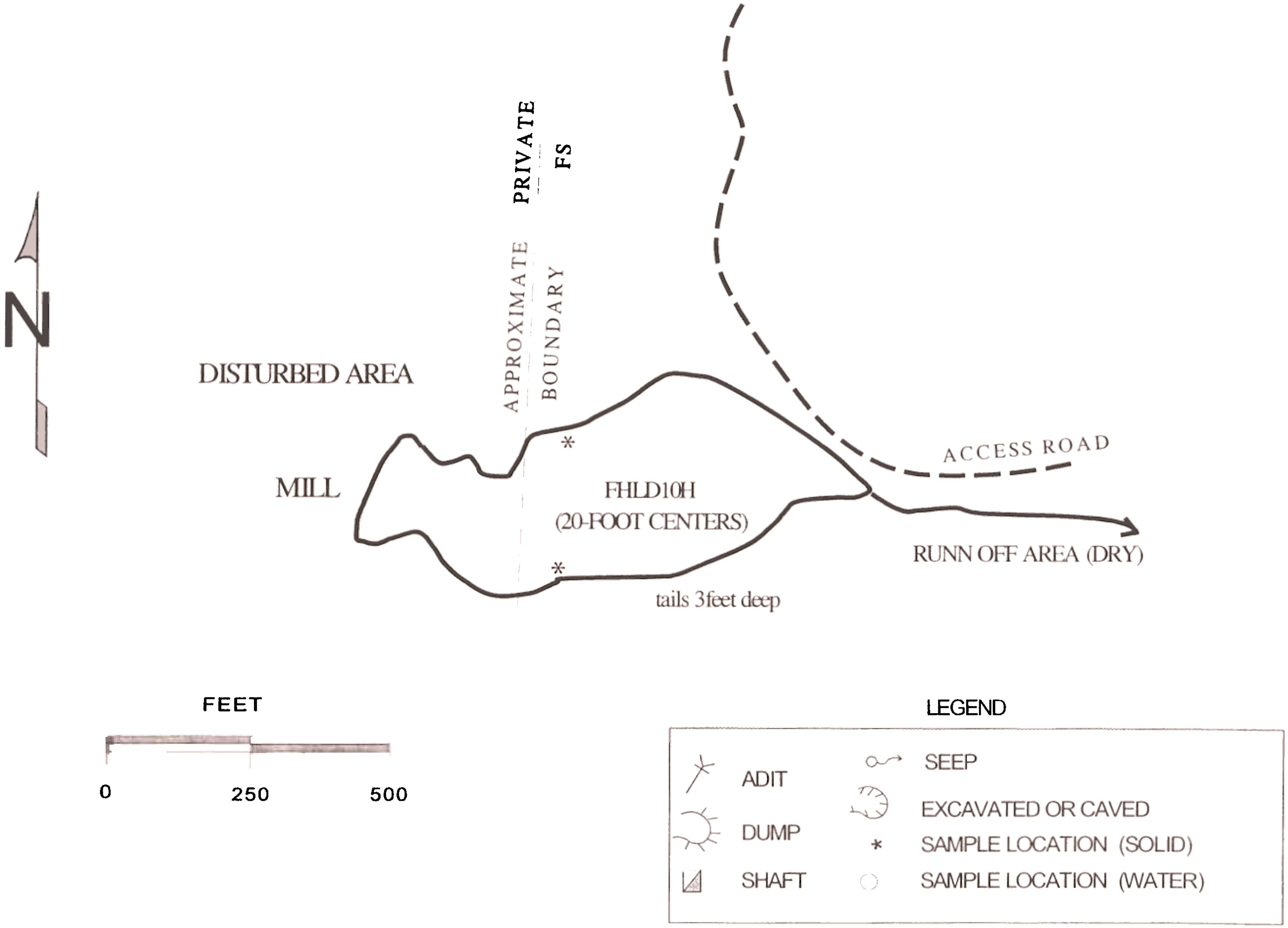


Figure 2.7. The Hidden Lake mine and mill are on private land uphill from DNF-administered land. The tailings are about three feet thick near the forest boundary.

2.11.3.2 Soil

The concentrations of all of the constituents considered exceeded the background levels (table 2.11). None of the concentrations exceeded phytotoxic limits.

Table 2.11 Hidden Lake Tailings soil sampling results (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Tailings wash area (FHLD10H)	49.53[1]	0.647[1]	33.57[1]	55.01[1]	200.6[1]

(1) Exceeds one or more Clark Fork Superfund Background Levels (table 1.3).
(2) Exceeds Phytotoxic levels (table 1.3).

2.11.3.3 Water

As noted, there was evidence of springs south of the tailings area, but all were dry at the time of the visit. There was no evidence of AMD or related impacts.

2.11.3.4 Vegetation

The vegetation cover on the tailings ranged from barren to sparse. Tailings that had been washed onto pre-existing soil was killing vegetation. New soil appeared to have been blown onto areas of the tailings; in these areas, the vegetation appeared to be increasing.

2.11.3.5 Summary of Environmental Condition

The concentration of metals in the soil/tailings is well below phytotoxic limits. The lack of vegetation may be due to poor cohesion of the sandy material or lack of nutrients. The dry spring beds in the area did not indicate impact by contaminated ground water.

2.11.4 Structures

There were remnants of several structures and equipment on private land. There were no structures on DNF-administered land.

2.11.5 Safety

There were no apparent safety risks identified on DNF-administered land.

2.12 Highland Mine

2.12.1 Site Location and Access

The Highland Mine (T01N R07W 31 ACAB) is at the head of the Basin Creek drainage, about 13 miles south of Butte, Montana. Basin Creek flows into the Basin Creek Reservoir, a water supply for the City of Butte. The disturbed area is on both private and DNF-administered land. The site can be accessed by following an improved dirt road (Roosevelt Drive) that turns south off Montana State Highway 10.

2.12.2 Site History - Geologic Features

The Highland Mine has been by far the most productive mine in the Highlands district, providing over 63,000 oz of gold (Sahinen, 1950). As a result, it has been well-studied. The following information has been compiled from Veazey (1934), Newcomb (1941), and Sahinen (1950). The first lode workings in the area, the Only Chance, Murphy, and Tilton, followed narrow veins and pipes in dolomitic limestone of the Meagher Limestone above what was later to become the productive Highland orebody. The veins and pipes merged downward into a large replacement body. In 1930, all properties were merged to form the Butte Highland Mine, and by 1937 all production was coming from the 600-foot level adit, which is the main Highland opening. The mine was worked until it was shut down by law in 1942. The workings consisted of a 2,300 foot crosscut to the orebody, where the replacement zone was mined out over a 550-foot vertical extent.

The orebody was a replacement zone in the Meagher Limestone that was localized by the intersection of a due east 60°N fault and the hinge of a fold. The orebody was an irregular mass that trended generally southeast and dipped 55 -85° NE. It originally contained quartz, pyrite, pyrrhotite, and gold, with minor galena, sphalerite, and chalcopyrite. The sulfides were oxidized and leached by ground water, leaving an open sponge of quartz enriched in residual gold which then slumped to fill the open spaces and formed a unique breccia. The soft oxidized ore contained an average of 0.6 oz/ton in gold, and was easy to mine and recover. The 1942 order to close coincided with a change in the character of the ore as lower levels were reached: no oxidation had taken place here, pyrite and pyrrhotite were abundant, and the gold was found in complex silicates. New milling and recovery methods were necessary, and so the mine was not reopened after World War II.

Although the orebody is hosted by the Meagher Limestone, granite, gabbro, and pegmatite are exposed in the workings. The deposit is probably related to the Boulder Batholith.

2.12.3 Environmental Condition

Features at the site include the caved portal of the 600-foot level (A1, figure 2.8), a small shaft (S1), several pits (P1-P5), a large waste-rock dump (W1), two tailings piles (T1 and T2), and the remnants of several cabins and a mill. In addition, there is a barren pile of white, powdery material (gypsum?, lime?) near the cabins, and several hundred feet downhill of the mill, there are two small garbage dumps containing rusted tin cans, broken glass, and lead battery cores.

A large-volume discharge flows from the A1 adit, around the south end of the W1 waste-rock dump, and under the Forest Service road to the west. Further downstream, the discharge is joined by a small stream that flows from a boggy area downgradient of the two garbage dumps and the tailings piles. Both the adit discharge and the water flowing from the bog had specific conductivities greater than 300 µmhos/cm @25^{o}C.

At the north toe of the W1 dump, iron-oxide stains were observed on the ground surface. The staining suggests that a seep intermittently flows from the dump.

2.12.3.1 Site Features - Sample Locations

Soil and water-quality samples were collected at the site on August 12, 1993. One sample was collected from the adit discharge (BHIS10H), which had a flow rate of 110 gpm. Another sample (BHIS20L) was collected from the stream flowing from the bog below the garbage dumps; the stream had a flow rate of 12 gpm. A third sample (BHIS30M) was collected from Basin Creek, downstream of the confluence of the adit discharge and the bog stream. At this location, the flow rate was 300 gpm. A soil sample (BHID10H) was collected at the north end of the W1 dump where the iron staining was observed.

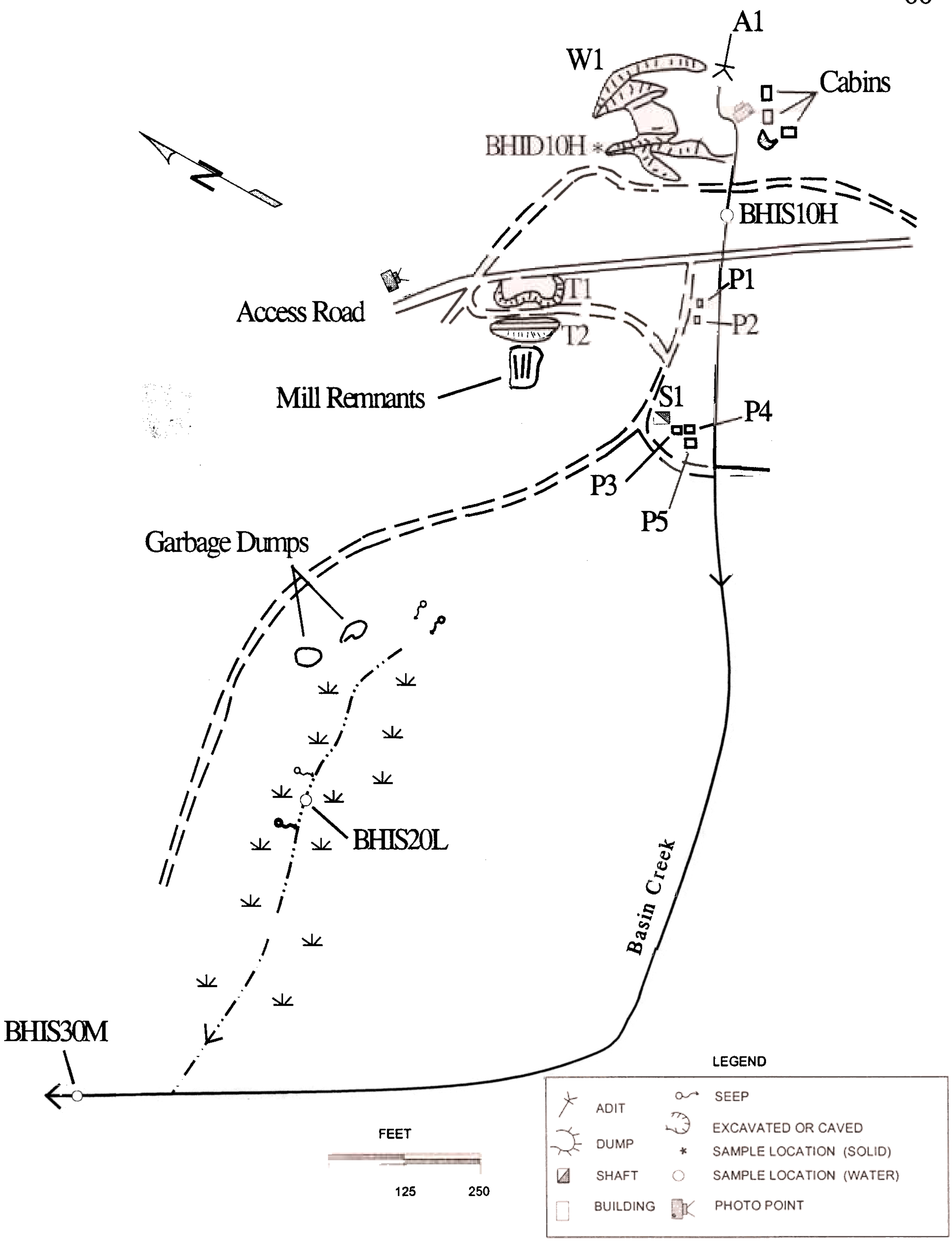


Figure 2.8. Sketch map of the Highland mine and mill.

Figure 2.8a The Highlands Mine is easily seen from a heavily traveled Forest Service road that passes to the west of the main workings.

Figure 2.8b A substantial discharge flows from the collapsed main adit. The discharge is the headwaters of Basin Creek.

2.12.3.2 Soil

The copper concentration in the soil at the north end of the W1 dump was 10 times greater than phytotoxic level (1,000 mg/kg). Arsenic also slightly exceeded its phytotoxic level (100 mg/kg).

Table 2.12 Highland Mine soil sampling results (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Iron-stained soil at north end of W1 waste-rock dump (BHID10H)	127.33[1,2]	1.04[1]	1156.16[1,2]	17.13[1]	59.54[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3).
(2) Exceeds phytotoxic levels (table 1.3).

2.12.3.3 Water

The adit discharge, the bog stream, and Basin Creek had no water-quality exceedences.

Table 2.13 Highland Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit A1 discharge - head of Basin Creek (BHIS10H)																			
Stream flowing from bog (BHIS20L)																			
Basin Creek - downstream of confluence of adit discharge and bog stream (BHIS30M)																			

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.12.3.4 Vegetation

The vegetation along the path of the adit discharge consists of grasses, conifers, and willows. The W1 waste-rock dump is sparsely vegetated with grasses, conifers, and brush. The T1 and T2 tailings piles are moderately vegetated. Outside the disturbed areas, vegetation is generally dense and consists of grasses and conifers.

2.12.3.5 Summary of Environmental Condition

Although some soil at the site has high concentrations of metals, the extent of soil contamination appears to be limited to the area immediately surrounding the W1 dump; no erosion or water-quality problems were identified. Overall, the site has only a minor environmental impact on DNF-administered land

2.12.4 Structures

The remnants of three cabins are located south of the W1 waste-rock dump. All of the cabins are on private land. Below the T1 and T2 tailings piles, a pile of lumber is all that remained of another structure, perhaps a part of the mill. This structure appears to be on DNF-administered land.

2.12.5 Safety

The small shaft and pits pose slip-trip-fall hazards.

2.13 Independence Mine

2.13.1 Site Location and Access

The Independence Mine (T8N R11W Sec 17 BDAB) is a private holding on the north side of the Pikes Peak Creek drainage. Access to the site is via the road that follows Pikes Peak Creek.

2.13.2 Site History - Geologic Features

The Independence produced 481 oz gold, 197 oz of silver, and 189 pounds of copper from 1926 to 1935 (Avery, 1983). Remaining reserves have been estimated at 8100 tons with an average grade of 0.44 oz/ton gold and 0.60 oz/ton silver. Mineralization is contained within a quartz vein

0.77 feet thick localized by a N50°-70°W, 52°-70°SW shear zone in granodiorite of the Royal Stock. Sericite alteration encloses the vein.

Two open adits and one caved adit can be found. Dump material is strewn erratically down the hillside. Vein material found consists only of quartz and sericite, with no visible sulfides.

2.13.3 Environmental Condition

The two lowermost adits (A1 and A2, see figure 2.9) both have small discharges. A third, much larger discharge, flows from the base of a waste-rock dump just south of the A2 adit. All three discharges flow together to form a stream that runs off the private holding and onto DNF-administered land. The stream eventually flows into Pikes Peak Creek, about 700 feet from the site.

2.13.3.1 Site Features - Sample Locations

A surface-water sample (PINS10M) was collected from the mine discharge where it crosses onto DNF-administered land. The flow rate of the discharge was 40 gpm. Samples were also collected from Pikes Peak Creek, upstream (PINS20L) and downstream (PINS30L) of the confluence with the mine discharge. The flow rate of the creek was approximately 3.5 cfs. All samples were collected on September 24, 1993.

2.13.3.2 Soil

No soil samples were collected because the site is on private land.

2.13.3.3 Water

None of the analytes exceeded water-quality criteria for all three samples.

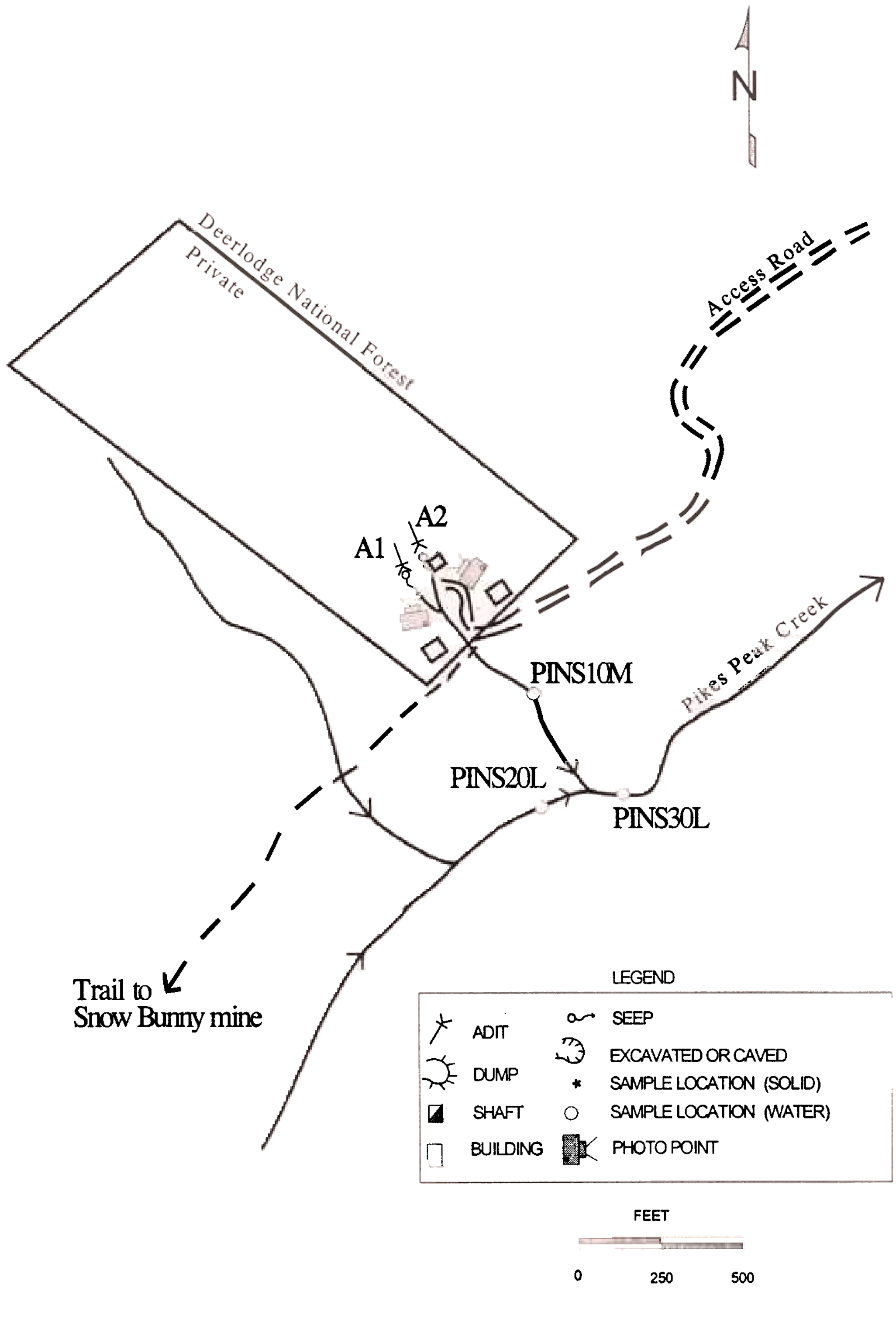


Figure 2.9. Sketch map of Independence mine.

Figure 2.9a A 15-20 gpm discharge flows from a waste-rock dump south of the collapsed A2 adit and an old mine building.

Figure 2.9b The A1 adit at the Independence Mine intact but flooded.

Table 2.14 Independence Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Mine discharge (PINS10M)																			
Pikes Peak Creek - upstream of confluence with discharge (PINS20L)																			
Pikes Peak Creek - downstream confluence with discharge (PINS30L)																			

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

(1) Laboratory pH did not exceed standard
Note: The analytical results are listed in appendix V.

2.13.3.4 Vegetation

The DNF-administered land adjacent to the site is densely vegetated with evergreens and grasses. All of the vegetation appears healthy.

2.13.3.5 Summary of Environmental Condition

Although a large discharge flows off the site, it does not contain high concentrations of metals. Therefore, the site has little, if any, impact on DNF-administered land.

2.13.4 Structures

Two cabins and an old mine building are located on private land at the site. Both cabins are in good condition. No structures were observed on DNF-administered land.

2.13.5 Safety

The site was not evaluated for safety.

2.14 J.G. Carlisle Mine

2.14.1 Site Location and Access

The J.G. Carlisle Mine (T8N R12W 13 DBDC) is a private holding on Rose Mountain east of Gold Creek Lakes. Access to the site is limited to an ATV trail that begins north of the lakes. The last quarter mile to the site must be walked.

2.14.2 Site History - Geologic Features

Avery (1983) studied this mine as part of the Dolus Lakes Wilderness study area. Six hundred feet of workings are present, and the mine produced 129 oz of gold and some silver from 1897-1899 from quartz veins in a shear zone cutting Cretaceous granodiorite of the Royal Stock. The shear zone strikes N50°W 75°SW and may be the same one present in the Snow Bunny (section 2.21) and Queen mines to the southeast. Quartz veins up to 1.25 feet thick are present, and the best of four samples contained 0.13 oz/ton gold, 0.99 oz/ton silver, and 2.56% zinc. Emmons and Calkins also noted the presence of galena, sphalerite, chalcocite, and chalcopyrite in the vein material.

Dump material (about 1,000 tons) consists of 50% unaltered granodiorite and 50% iron-stained granodiorite containing veinlets. Both altered wallrock and veinlets contain quartz, sericite, and minor pyrite, and some galena and sphalerite can be found within the veins.

2.14.3 Environmental Condition

A small (possibly seasonal) seep flows from a collapsed adit at the site. The discharge sinks into the waste-rock dump a short distance from the adit. At the toe of the dump, another seep emerges and flows down the mountainside into an unnamed tributary to Pikes Peak Creek (figure 2.10).

2.14.3.1 Site Features - Sample Locations

The waste-rock dump seep was sampled where it crossed onto DNF-administered land (PJGS10L), several hundred yards downhill of the site. The flow rate at this location was 30 gpm. Samples were also collected from the unnamed stream, above (PJGS20L) and below (PJGS30L) the confluence with the mine discharge. The stream had a flow rate of about 300 gpm. All samples were collected on September 21, 1993.

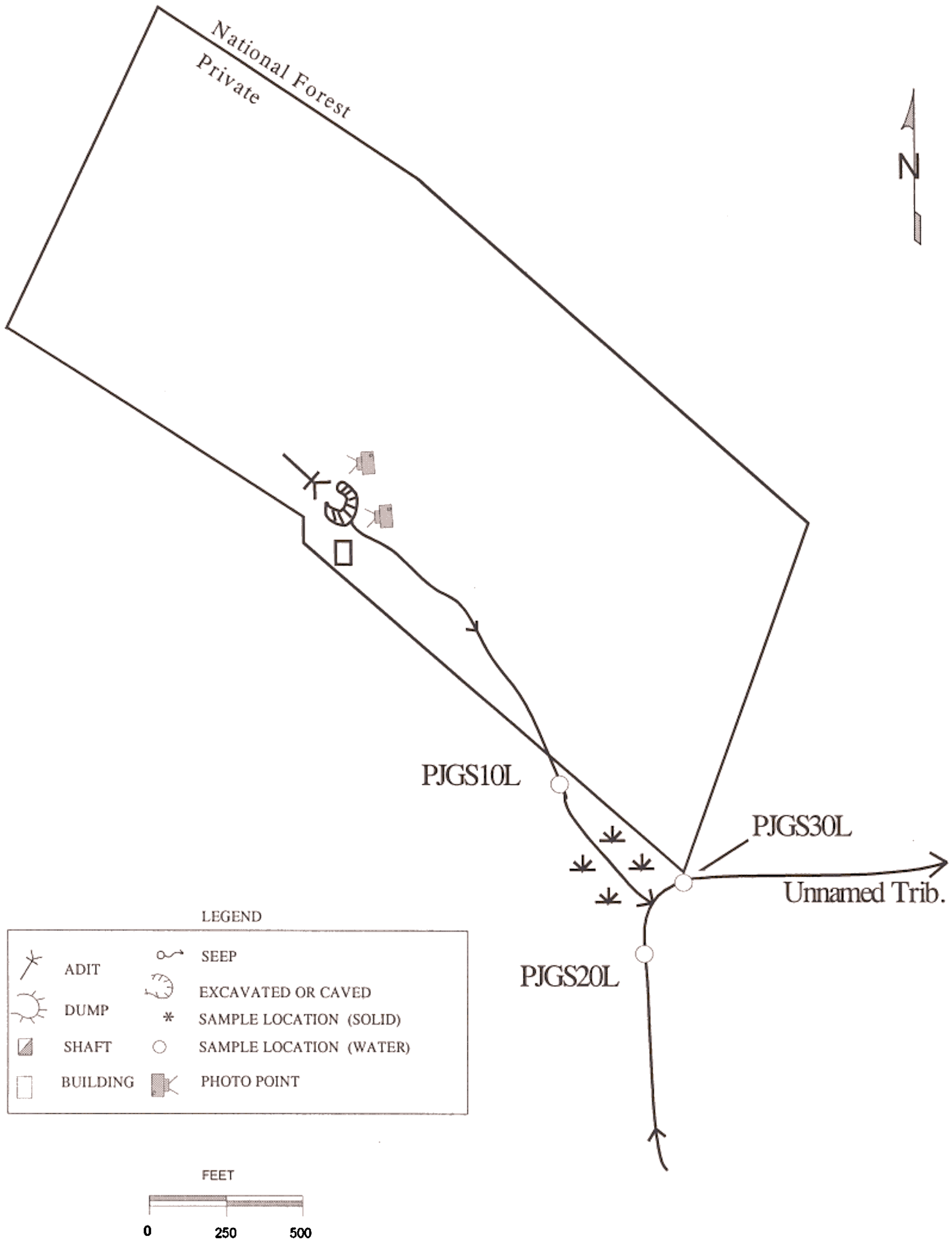


Figure 2.10. Sketch map of J.G. Carlisle mine.

Figure 2.10a A small discharge flows from the collapsed adit at the J.G. Carlisle Mine.

Figure 2.10b A seep emerges at the base of the waste-rock dump and flows down the mountainside into an unnamed tributary to Pikes Peak Creek.

2.14.3.2 Soil

No soil samples were collected.

2.14.3.3 Water

The field pH of the unnamed stream (pH=6.4) was slightly more acidic than the acceptable limit of 6.5. No other water-quality problems were identified at the site.

Table 2.15 J.G. Carlisle Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Waste-rock dump seep - approx. 1000 ft. below mine (PJGS10L)																			
Unnamed stream - upstream of mine discharge (PJGS20L)																			
Unnamed stream - below confluence with mine discharge (PJGS30L)																			S*

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

* Laboratory pH was within the acceptable range of 6.5-8.5

2.14.3.4 Vegetation

The waste-rock dump at the mine is barren to sparsely vegetated. Vegetation elsewhere around the site is generally healthy and prolific.

2.14.3.5 Summary of Environmental Condition

The discharge from the J.G. Carlisle has little, if any, impact on the quality of water on surrounding DNF-administered lands.

2.14.4 Structures

The only structure at the site is a cabin which is in fair condition. The cabin is on private land.

2.14.5 Safety

No safety problems were noted at this site.

2.15 Little Darling Mine

2.15.1 Site Location and Access

The Little Darling Mine is located (T05N R08W section 07 ADAA) on the South Fork of Dry Cottonwood Creek about 6.5 miles northeast of Warm Springs, Montana, and about 6 miles southeast of Galen, Montana . The mine site is about 1,000 feet east of the intersection between Forest Routes 85 and 8634. The road to the site is improved. The site is on private property.

2.15.2 Site History - Geologic Features

The Little Darling Mine was an exploration adit that explored copper and silver veins hosted by monzogranite. About 600 feet of working are present.

2.15.3 Environmental Condition

The site consists of a boarded shut adit, and a waste-rock dump. The adit discharges water at less than a gallon per minute. The water from the adit completely infiltrates the waste dump before reaching the South Fork of Dry Cottonwood Creek. Seeps emerge at the toe of the waste dump, and flow into a beaver pond that is along the southern border of the site. Water does not flow past the beaver pond. The stream emerges downstream on DNF-administered land. Because the site is on private property, a site map was not prepared.

2.15.3.1 Site Features - Sample Locations

The site was visited and sampled on 09/02/1992. A water sample (DLDS10L0 was taken from the South Fork of Dry Cottonwood Creek downstream from the beaver pond. The creek was flowing at about 34 gpm.

2.15.3.2 Soil

The waste material was stable and partially vegetated. The waste material did not appear to impact soils on DNF-administered land.

2.15.3.3 Water

Water-quality standards were not exceeded at the sample location.

Table 2.16 Little Darling Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
South Fork of Dry Cottonwood Creek (DLDS10L)																			

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.15.3.4 Vegetation

The waste-rock dump is partially vegetated. Vegetation on DNF-administered land does not appear affected from mining activities at the Little Darling Mine.

2.15.3.5 Summary of Environmental Condition

The Little Darling Mine consists of an open adit and a waste-rock dump. The waste-rock dump appeared stable, and not affecting soils on DNF-administered land. The adit is boarded shut. Water discharges from the adit and infiltrates the waste-rock dump before reaching the South Fork of Dry Cottonwood Creek. Water-quality standards downstream of the site were not exceeded.

2.15.4 Structures

Structures were not present on the site.

2.15.5 Safety

The site was not evaluated for safety.

2.16 Lower Hidden Hand Mine

2.16.1 Site Location and Access

The Lower Hidden Hand Mine is located about 7.5 miles east of Deer Lodge, Montana (T07N R08W section 03 DACA). The site is accessed from Deer Lodge by taking Forest Route 705 east to Forest Route 5172; the site is about 0.75 miles northeast of the intersection between these two roads. The site is on DNF-administered land.

2.16.2 Site History - Geologic Features

This caved adit is not part of the Hidden Hand Mine but lies between it and the Herculese and Harrison mines to the west. The nearby Herculese, Harrison, and Little Emery-Elizabeth follow gently dipping NW-striking veins as does the Hidden Hand (Robertson, 1952). Presumably, the geology of the Lower Hidden Hand is similar. The associated dump contains 3,000 tons of mostly unaltered plagioclase basalt with a cover of overburden. Less than 5% of the dump contains quartz-pyrite vein and silicified basalt with 1% disseminated pyrite.

2.16.3 Environmental Condition

The site consists of a caved adit and a waste-rock dump (figure 2.11). Water seeps from the adit and flows into an unnamed tributary to Baggs Creek. The waste material appears stable and not affecting undisturbed areas.

2.16.3.1 Site Features - Sample Locations

The site was visited and sampled on 08/10/1992. The flow rate of the adit discharge was about 1 gpm. Because the waste material appeared stable and not affecting undisturbed areas, soil samples were not collected.

2.16.3.2 Soil

Soil samples were not collected at the site.

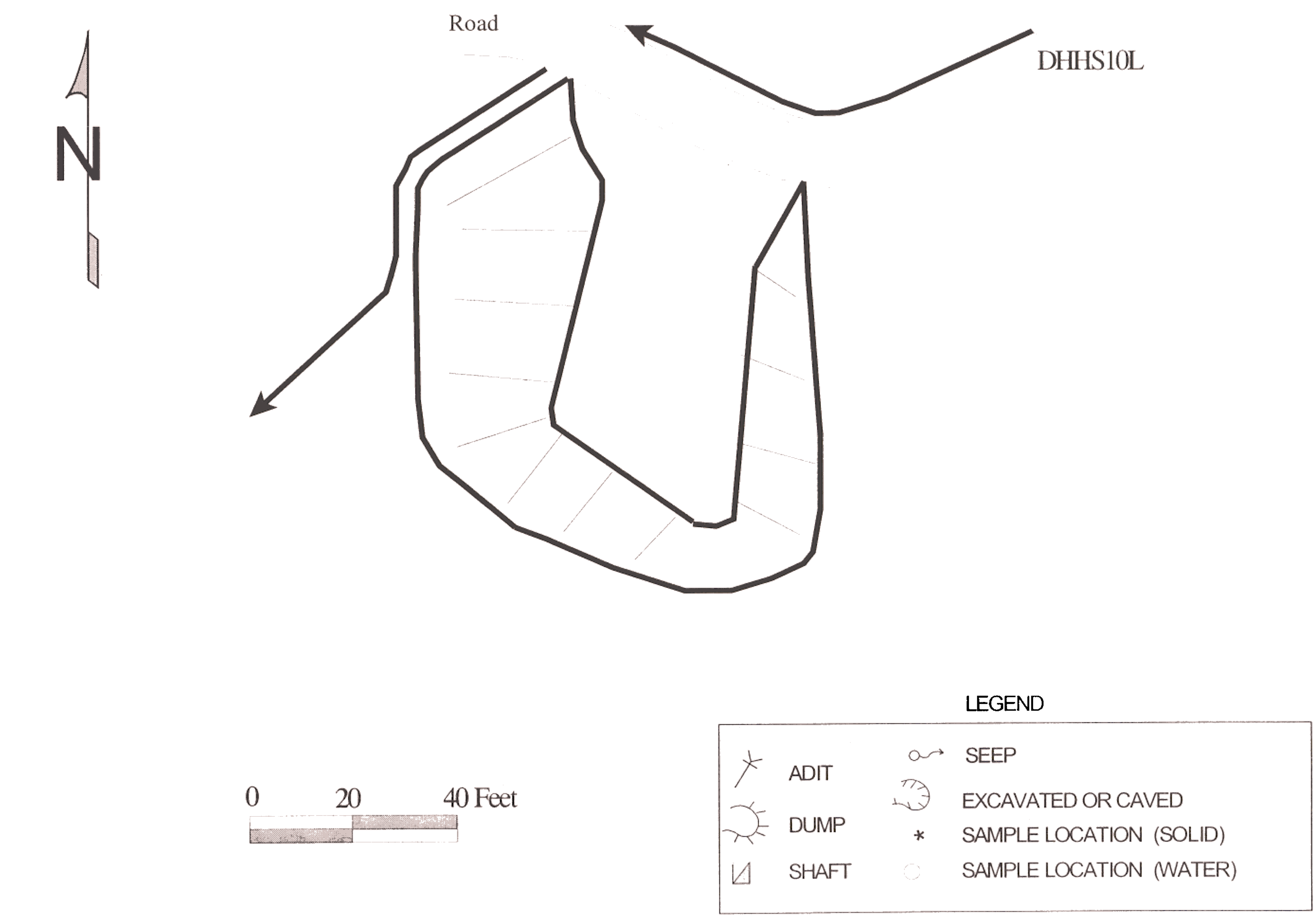


Figure 2.11. Site map of the Lower Hidden Hand mine.

2.16.3.3 Water

The concentration of cadmium and mercury exceeded the chronic aquatic life standard; the concentration of mercury (0.1 ppb) was at the detection limit. The concentration of manganese exceeded the secondary standard (table 2.17).

Table 2.17 Lower Hidden Hand Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (DHHS10L)				C					S	C									

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.16.3.4 Vegetation

The waste dump and the caved adit were partially vegetated with grass. Vegetation in the undisturbed area did not appear affected by the mining activities.

2.16.3.5 Summary of Environmental Condition

Water discharging from the adit exceeds water quality standards for cadmium, manganese, and mercury. The waste rock is stable and partially vegetated; it does not appear to be impacting undisturbed areas.

2.16.4 Structures

An ore bin is present on the site.

2.16.5 Safety

The site was not evaluated for safety.

2.17 Modoc Mine (West Fork Flint Creek)

2.17.1 Site Location and Access

The Modoc Mine is on DNF-administered land several hundred feet in elevation above the North Fork Flint Creek, upstream of the Cable Mountain Campground and Georgetown Lake (T6N R13W section 27ACDB). The mine is on a steep hill and is accessible by an old road through private land.

2.17.2 Site History - Geologic Features

The Modoc explores a small skarn at the contact between limestone and a granite outlier of the Philipsburg Batholith (Emmons and Calkins, 1913). The granite endoskarn was of interest here, and contains calcite, pyrite, chalcopyrite, and bornite in a zone 30-75 feet wide and trending N40°E. An open adit driven a few hundred feet on the contact discharges a small volume of water. The dump is mostly altered granite.

2.17.3 Environmental Condition

The mine site consisted only of a single caved adit that was discharging a small amount of water onto a waste-rock dump, both on private land. The water flowed down a road and infiltrated the waste material within a few tens of feet. A small spring broke out on the hillside above the site and flowed into a bog area downhill of the dump.

2.17.3.1 Site Features - Sample Locations

The site was sampled on 8/31/92. Since the adit and dump were on private land, sampling was restricted to the un-named stream upstream of the site (FNFS20L) and downstream of the site (FNFS10L). The stream was flowing about 7 gpm upstream of the site and about 0.25 gpm downstream just as it entered the bog area. No soil samples were collected.

2.17.3.2 Soil

The waste-rock dump and the area near the adit-discharge stream were moderately vegetated and there was no indication of erosion or mass wasting. There was no indication of erosion or soil contamination below the disturbed area.

2.17.3.3 Water

Specific conductance and pH measurements indicate a slight degradation of water quality below the mine. However, dissolved metals concentrations are generally lower in the downstream sample. Mercury concentrations exceeded chronic aquatic life criteria in both samples, but were at the detection limit of 0.1 µg/L. Table 2.18 presents exceedences for all constituents considered.

Table 2.18 Modoc Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed Cr. - Upstream (FNFS20L)										C									
Unnamed Cr. - Downstream (FNFS10L)										C									

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.17.3.4 Vegetation

The vegetation throughout the area of the Modoc Mine varies from sparse in the disturbed area to dense around the disturbed area. There was little evidence of erosion, and mass wasting seemed unlikely.

2.17.3.5 Summary of Environmental Condition

The Modoc Mine is a small, isolated adit and waste-rock dump about 100 feet away from the creek. The adit discharge is small and infiltrates the ground within a few tens of feet; there was no evidence of discharge off the site. The waste rock dump was partially vegetated and, although on a hillside, appeared stable.

2.17.4 Structures

There were no structures observed on or near the site.

2.17.5 Safety

The adit of the Modoc Mine was caved, but the adit may be partially open. Further caving may occur.

2.18 Ophir Mine

2.18.1 Site Location and Access

The Ophir Mine (T8N R12W section 24 BCBD) is a quarter mile south of the Gold Creek Lakes. The site is accessible by an ATV trail that begins north of the lakes. The entire site is on private land.

2.18.2 Site History - Geologic Features

The Ophir consists of a two caved adits trending S65°E several hundred feet long. Dump material is unaltered granodiorite of the Royal Stock. A small creek flows through this material. There are a few pieces of quartz-pyrite vein on the dump. The site is on private land.

2.18.3 Environmental Condition

Workings at the site include two collapsed adits (A1 and A2, figure 2.12) and their associated waste-rock dumps (W1 and W2). A small creek, which originates in a marshy area above the site, flows beneath the W1 dump. The dump is composed of coarse material and does not appear to be eroding.

2.18.3.1 Site Features - Sample Locations

The site was visited on 09/21/1993. A water sample (GOPS10L) was collected from the small creek on DNF-administered land downstream of the site. The flow rate of the creek at this location was 24.5 gpm.

2.18.3.2 Soil

No soil samples were collected at the site.

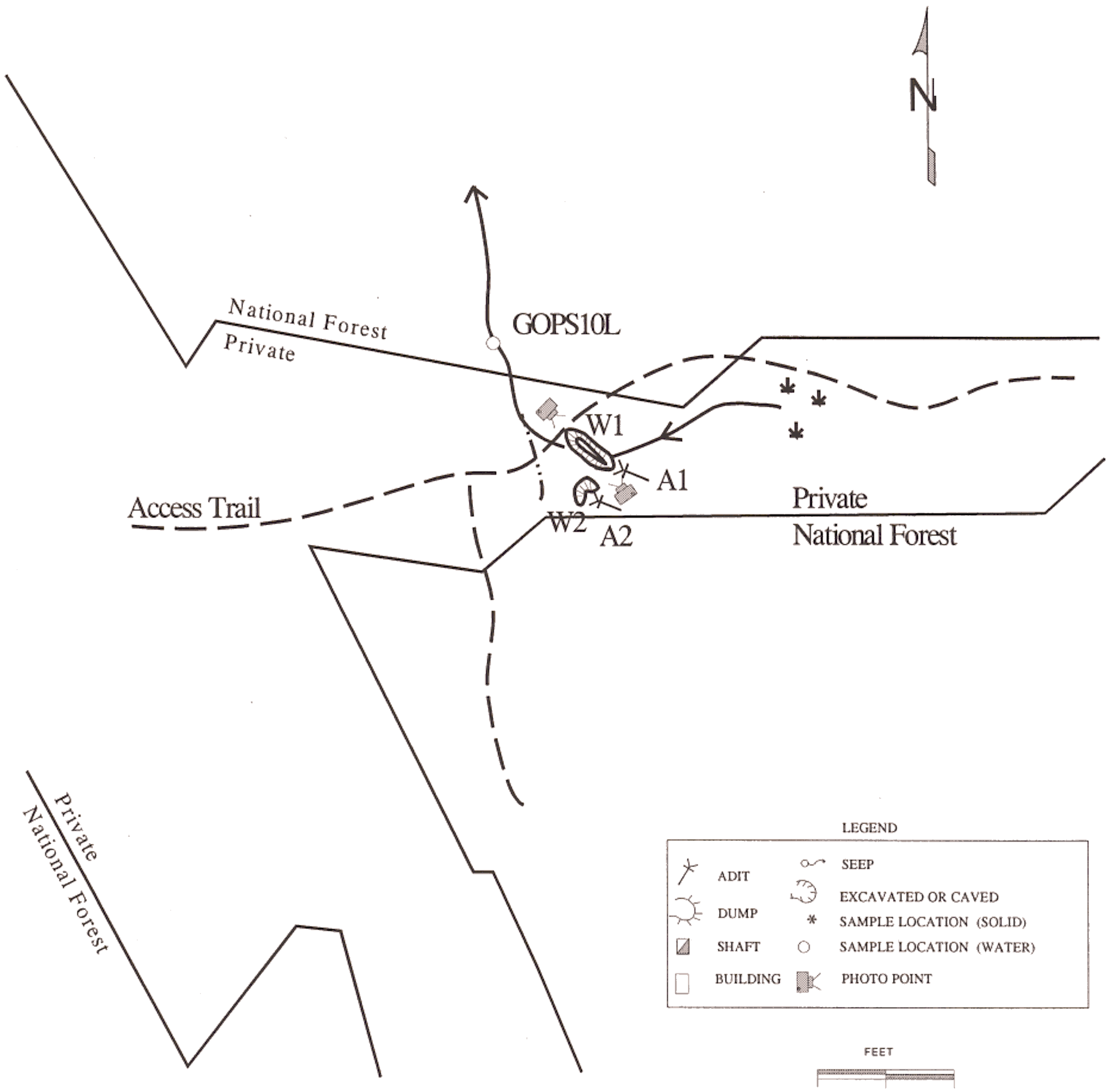


Figure 2.12 Sketch map of Ophir mine.

Figure 2.12a A small creek flows under the unmineralized W1 dump at the Ophir Mine.

Figure 2.12b The A1 adit at the Ophir Mine is collapsed.

2.18.3.3 Water

The concentration of lead in the creek (3.8 µg/L) was slightly above the chronic aquatic life standard (3.2 µg/L for water with a hardness of 100 mg/L). None of the other analytes exceeded standards (table 2.19).

Table 2.19 Ophir Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed creek - downstream of site (GOPS10L)								C											

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.18.3.4 Vegetation

Around the waste-rock dumps, the ground is sparsely vegetated. The undisturbed area around the site is vegetated with healthy grasses, brush, and evergreens.

2.18.3.5 Summary of Environmental Condition

The site may have a small impact on water quality. No other detrimental impacts were observed.

2.18.4 Structures

No structures were observed at the site.

2.18.5 Safety

No safety problems were identified at the site.

2.19 Racetrack Mine

2.19.1 Site Location and Access

The Racetrack Mine (T6N R11W section 15 AADD) is on DNF-administered land along Racetrack Creek. The site is about 1.4 miles west of the Racetrack Creek Campground and is accessible by a dirt road that follows the creek.

2.19.2 Site History - Geologic Features

Earll (1972) describes the Racetrack Mine as an adit 30-40 feet long that trends S65°W with scarce ore of quartz, pyrite, chalcopyrite, and galena. No other history or production information was found.

2.19.3 Environmental Condition

Workings at the site include an open adit (A1, figure 2.13), a collapsed adit (A2), an exploration trench (P1), and a small waste-rock dump (W1). Both adits have discharges that flow together and form a small stream that drains into Racetrack Creek.

2.19.3.1 Site Features - Sample Locations

Water-quality samples were collected at the site on September 13, 1993. Samples RRAS10M and RRAS20M were collected from the A1 and A2 adit discharges, respectively. The flow rate of the A1 adit discharge was 7.5 gpm; the flow rate of the A2 discharge was 9.2 gpm. Another sample (RRAS30M) was collected from the combined adit discharge stream, near its confluence with Racetrack Creek. The flow rate at this location was 20 gpm. Finally, samples were collected from Racetrack Creek upstream (RRAS40L) and downstream (RRAS50L) of the confluence with the discharge. The flow rate of the creek was approximately 40 cfs.

2.19.3.2 Soil

Because the W1 waste-rock dump is densely vegetated and not highly mineralized, soil quality did not appear to be a problem. No soil samples were collected.

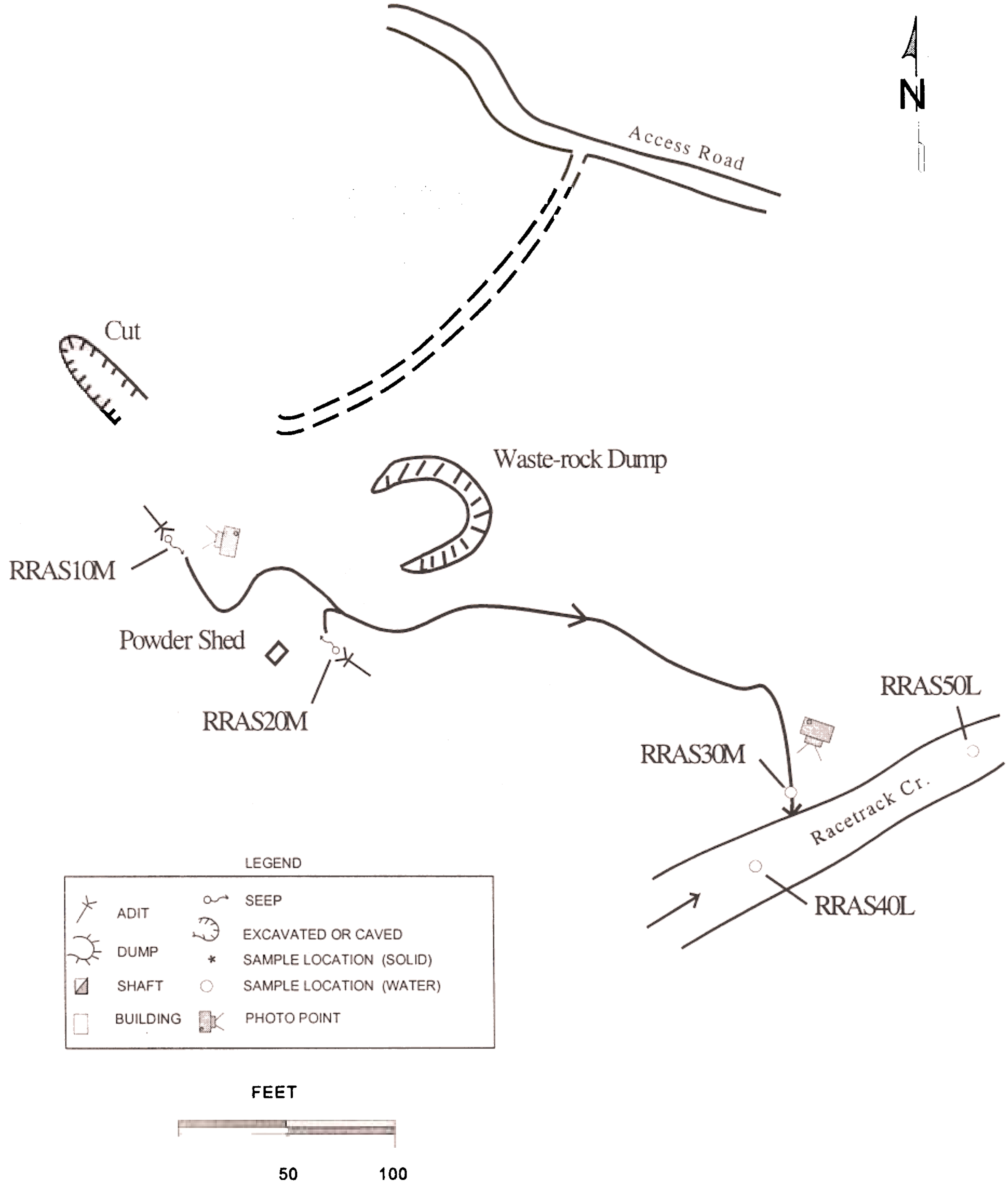


Figure 2.13. Sketch map of Racetrack mine.

Figure 2.13a A discharge flows from the open A1 adit at the Racetrack site. Sample RRAS10M was collected here.

Figure 2.13b The discharges from the A1 and A2 adits form a small stream that flows into Racetrack Creek.

2.19.3.3 Water

Both adit discharges had concentrations of fluoride that were slightly above the secondary MCL of 2.0 mg/L (table 2.20). The combined discharge stream flowing into Race-track Creek also had a fluoride concentration slightly above the secondary MCL. The water quality of Racetrack Creek, however, was not detectably degraded. Several metals were also present in elevated concentrations in the mine discharges, but again, Racetrack Creek was not significantly impacted.

Table 2.20 Racetrack Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit A1 discharge (RRAS10M)										C					S				
Adit A2 discharge (RRAS20M)												C			S				
Adit discharge stream - near confluence with Racetrack Creek (RRAS30M)								C							S				
Racetrack Creek - upstream of discharge (RRAS40L)																			
Racetrack Creek - downstream of discharge (RRAS50L)																			

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.19.3.4 Vegetation

Most of the site is densely vegetated with healthy grasses, brush, and deciduous and coniferous trees. All of the vegetation appears healthy.

2.19.3.5 Summary of Environmental Condition

The discharges from the mine contained concentrations of fluoride and several trace metals that exceeded water-quality standards. However, Racetrack Creek, which has a flow rate several orders of magnitude greater than the mine discharges, was not affected.

2.19.4 Structures

A small powder shed (?) is the only structure at the site.

2.19.5 Safety

The open A1 adit is the only serious safety hazard at the site.

2.20 Rocker Gulch Mine

2.20.1 Site Location and Access

The Rocker Gulch Mine is on private land near the head of Rocker Gulch. The Unnamed #1 Mine is entirely on private land surrounded by DNF-administered land. The site is east of the town Deer Lodge and can be accessed by an improved road that intersects with Rocker Gulch. The disturbed area is a short distance by trail along the Rocker Gulch stream.

2.20.2 Site History - Geologic Features

The Rocker Gulch Mine lies on the south end of the Emery district but is not described in the literature. A dump representing several hundred feet of workings is cut by Rocker Creek. The dump is comprised mainly of amydaloidal basalt with the cavities filled with calcite and chalcedony. Vein material on the dump contains mainly siderite and quartz. Minor fine grained pyrite is associated with the quartz. Since the site is on private land, no map was constructed.

2.20.3 Environmental Condition

The Rocker Gulch Mine and associated dumps are in the bottom of Rocker Gulch. The waste rock is in contact with the stream and appeared to be undergoing erosion. None of the disturbed area or eroded waste material was found on DNF-administered land.

2.20.3.1 Site Features - Sample Locations

The site was visited and sampled on 7/20/94. A water sample was collected downstream of the site on Rocker Gulch (RU1S10L) where the flow was about 30 gpm. There was no evidence of soil washing down from the site and no obvious impact to vegetation, so no soil samples were collected.

2.20.3.2 Soil

There was no evidence of impact to soils caused by erosion of the waste-rock dumps by the stream. Although the stream channel contained sediments probably related to the waste material, no staining or other indicators of metal release was seen.

2.20.3.3 Water

The concentration of arsenic (59.9 µg/L) exceeded the primary drinking water standard of 50 µg/L. All other constituents were below the MCLs considered (table 2.21); several were below detection limits.

Table 2.21 Rocker Gulch Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Rocker Gulch - Downstream (RU1S10L)		P																	

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.20.3.4 Vegetation

There was no indication of stress to vegetation outside the disturbed area. Vegetation was sparse to barren on the waste-rock dumps, but was plentiful at the base of the dump and along the stream.

2.20.3.5 Summary of Environmental Condition

The appearance of the soils, stream, and vegetation indicate little impact by the Rocker Gulch Mine on the drainage. However, arsenic concentration exceed the MCL. It is not clear if the origin of the dissolved arsenic is from the mine or is background.

2.20.4 Structures

No structures were observed in the immediate area of the Rocker Gulch Mine.

2.20.5 Safety

There were no apparent safety concerns identified for this site.

2.21 Snow Bunny (Majestic) Mine

2.21.1 Site Location and Access

The Snow Bunny Mine (T8N R11W Sec 19 BBCA) is on a steep mountainside to the north of Pikes Peak Creek. A well-maintained adit, cabin, and outbuilding at the site suggest that the claim is active; however, the Forest Service map used for delineating property ownership (Pikes Peak, 1:24,000) shows no private holdings in this area. Access to the site is via an ATV trail that begins north of the Gold Creek Lakes, or by a rough hiking trail that follows Pikes Peak Creek.

2.21.2 Site History - Geologic Features

Emmons and Calkins (1913) and Avery (1983) both describe this mine in some detail. One caved adit investigates a mineralized shear zone 2.1 feet thick in granodiorite of the Royal Stock. The zone strikes N55°W 60°SW and may extend for over a mile under glacial deposits to the Queen mine to the southeast and the J.G. Carlisle to the northwest. Above the adit, four shallow shafts trace a splay of the main zone for 1100 feet. The zones contain clay gouge and quartz-sericite-pyrite veinlets. Avery (1983) estimated that there are 49,000 tons of inferred marginal reserves averaging 0.09 oz/ton gold and 0.25 oz/ton silver.

About 1,000 tons of dump material are present, and most is unaltered granodiorite. Ten percent is iron-stained granodiorite and quartz-sericite-pyrite vein.

2.21.3 Environmental Condition

A small discharge flows from the open adit and down the south side of the waste-rock dump (figure 2.14). At the southeast end of the dump, the discharge is joined by water flowing from a developed spring. The combined discharge then runs several hundred feet down a foot trail before sinking into the ground.

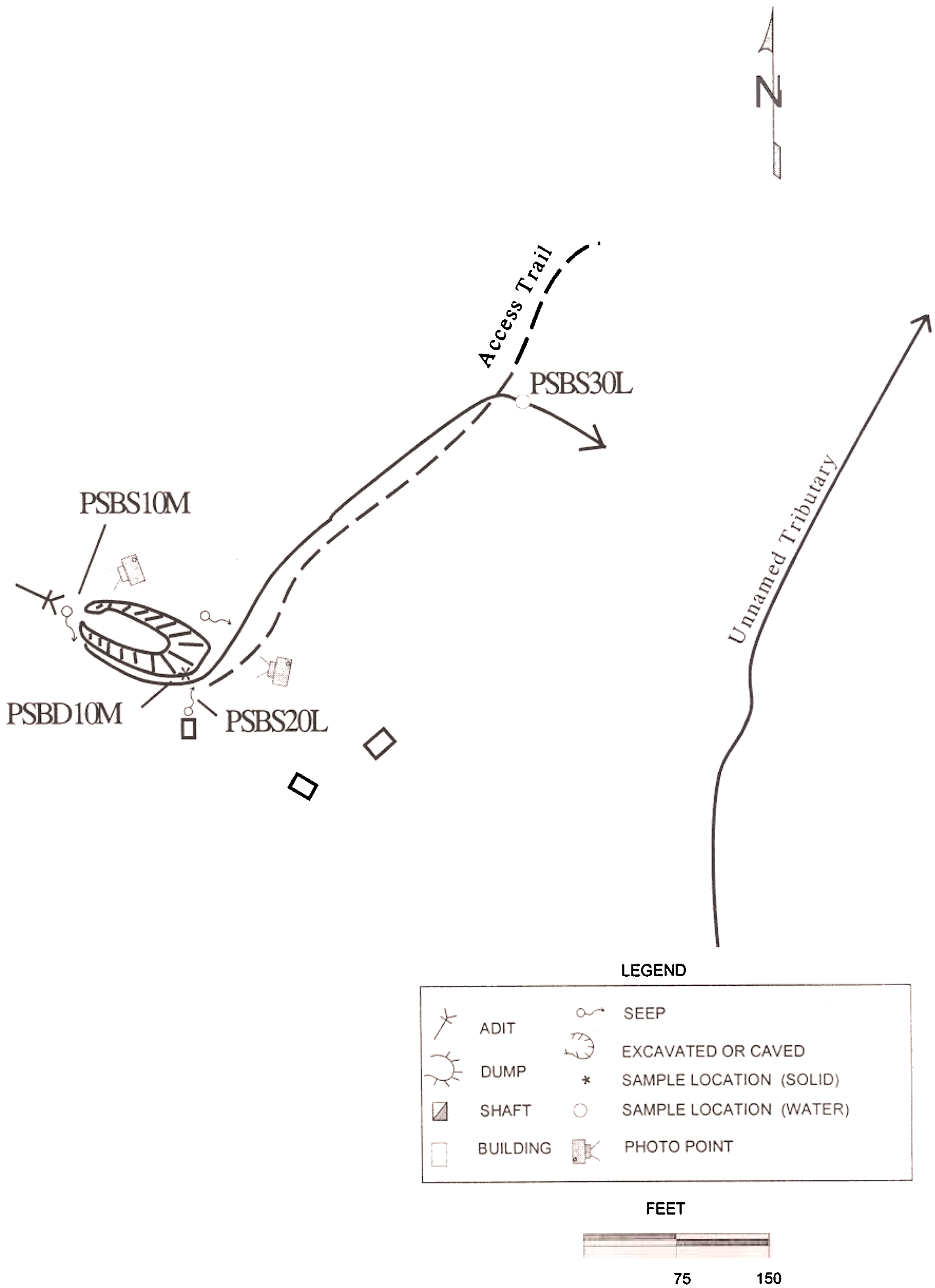


Figure 2.14. Sketch map of the Snow Bunny mine.

Figure 2.14a A small discharge flows from an open adit at the Snow Bunny Mine.

Figure 2.14b The waste-rock dump at the Snow Bunny is barren to sparsely vegetated.

2.21.3.1 Site Features - Sample Locations

Water-quality samples were collected from the adit discharge (PSBS10M), the developed spring (PSBS20L), and the combined discharge downhill from the site (PSBS30L). The flow rates at these sample locations were 2.4, 2.5, and 3.0 gpm, respectively. Also, a soil sample (PSBD10M) was collected at the base of the waste-rock dump to assess if the waste rock is a source of leachable metals. All samples were collected on September 17, 1993.

2.21.3.2 Soil

The concentration of copper in the soil at the base of the dump was slightly above the phytotoxic level of 100 mg/kg (table 2.22). In addition, cadmium, lead, and zinc were above one or more Clark Fork Superfund background levels.

Table 2.22 Snow Bunny Mine soil sampling results (mg/kg).

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Soil at SE edge of waste-rock dump (PSBD10M)	2.76	6.09[1]	109.31[1,2]	342.16[1]	428.82[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3).
(2) Exceeds phytotoxic levels (table 1.3).

2.21.3.3 Water

The manganese concentration in the adit discharge (0.461 mg/L) exceeded the secondary MCL standard, and the aluminum concentration in the developed spring (280 µg/L) exceeded both the secondary MCL and the chronic aquatic life standards (table 2.23). Interestingly, neither of these metals was found to be a problem below the site. Instead, mercury was slightly elevated (0.16 µg/L).

Table 2.23 Snow Bunny Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (PSBS10M)									S										
Developed spring (PSBS20L)	S,C																		
Discharge downhill of site (PSBS30L)										C									

Exceedence codes:
P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.

2.21.3.4 Vegetation

The waste-rock dump is barren to sparsely vegetated. Vegetation elsewhere around the site appears healthy.

2.21.3.5 Summary of Environmental Condition

Water and soil quality show some impact from the mining at the Snow Bunny. However, the impact appears to be limited to the area immediately surrounding the site.

2.21.4 Structures

Structures at the site include a cabin, a storage shed, an outhouse, and a spring house. All of the buildings are in excellent condition.

2.21.5 Safety

The open adit poses a hazard at this site. The entrance is in good condition but should be gated.

2.22 St. Mary Mine

2.22.1 Site Location and Access

The St. Mary Mine is located about 8.5 mile east of Deer Lodge, Montana (T07N R08W section 11 ACBB) and is on private property. The site can be accessed by taking Forest Route 705 (an improved road) from Deer Lodge to Forest Route 5173. The site is about 0.25 miles east of the intersection of these two roads, and about 200 feet west of Spring Creek.

2.22.2 Site History - Geologic Features

No geologic information exists in the literature, and poor exposure prevents any speculations on the geology. The waste-rock dump consists of unaltered basalt.

2.22.3 Environmental Condition

The site consists of a caved adit and a waste-rock dump. Water discharges from the adit and flows into Spring Creek which is about 400 feet south of the site. Because the site is on private property, a site map was not prepared.

2.22.3.1 Site Features - Sample Locations

The site was visited on 08/10/1996. A sample of the adit discharge was collected where it flows onto DNF-administered land.

2.22.3.2 Soil

The waste dump is vegetated and appears stable. Soil on DNF-administered land (away from the site) did not appear impacted.

2.22.3.3 Water

The concentration of mercury exceeded the chronic aquatic life standard. However, its concentration (0.1 µg/L) was at the detection limit (table 2.24).

Table 2.24 St. Mary Mine water-quality exceedences

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge--downstream from site (DSMS10L)										C									

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.22.3.4 Vegetation

Vegetation on DNF-administered land does not appear stressed by mining activities.

2.22.3.5 Summary of Environmental Condition

The St. Mary Mine is not affecting affecting DNF-administered land. The mine dump is small and appears stable. Water exceeded the chronic aquatic life standard for mercury, but the concentration was at the method-detection limit.

2.22.4 Structures

Structures were not present on DNF-administered adjacent to this site.

2.22.5 Safety

This site was not evaluated for safety.

2.23. Sterrit Mine

2.23.1 Site Location and Access

The Sterrit Mine is located about 8 miles east of Deer Lodge, Montana (T07N R08W section 02 DCBD). The site is accessed from Deer Lodge via Forest Route 705, an improved road. The site is at the head of Spring Creek and about 500 feet north of Forest Route 705. The site is on private property, but DNF-administered land is downstream.

2.23.2 Site History - Geologic Features

At the Sterrit, three caved shafts and two caved adits mined two steeply dipping veins, 12-18 inches wide, which strike N80°W and N55°E (Robertson, 1952). McClernan (1976) noted a narrow band of alteration with kaolinite and pyrite adjacent to the veins. In 1921, 1922, and 1937, the mine produced a total of 38 tons of ore containing 12 oz of gold, 1,169 oz of silver, and 5,360 lbs of lead.

2.23.3 Environmental Condition

The site consists of three caved shafts and two caved adits. One of the adits discharges water onto a small dump of unaltered basalt. The adit discharge flows into Spring Creek. The waste material appeared stable and not affecting DNF-administered land. Because the site is on private property, a site map was not prepared

2.23.3.1 Site Features - Sample Locations

The site was sampled on 08/10/1992. A sample was collected from the adit discharge where it flows onto DNF-administered land; the flow rate of the adit discharge was about 4 gpm.

2.23.3.2 Soil

Waste material was unaltered basalt, and did not appear to affect DNF-administered land. Soil samples were not collected.

2.23.3.3 Water

The concentration of mercury exceeded the chronic aquatic life standard; but its concentration (0.1 µg/L) was at the detection limit (table 2.25).

Table 2.25 Sterrit Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit Discharge (SSTS10L)										C									

Exceedence codes:
- P - Primary MCL
- S - Secondary MCL
- A - Aquatic Life Acute
- C - Aquatic Life Chronic

Note: The analytical results are listed in appendix V.

2.23.3.4 Vegetation

Vegetation on DNF-administered land adjacent to the site did not appear affected.

2.23.3.5 Summary of Environmental Condition

The site does not appear to be affecting DNF-administered land. Mercury concentration in the adit discharge exceeded the chronic aquatic life standard but was at the detection limit.

2.23.4 Structures

Structures were not present at the site.

2.23.5 Safety

The site was not evaluated for safety.

2.24 Sunlight-Copper Queen Mine

2.24.1 Site Location and Access

The Sunlight-Copper Queen Mine (T8 R12 section 15 CCBD) is near the head of Gold Creek, 15 miles southwest of the town of Gold Creek. The site is on DNF-administered land and can be accessed by a four-wheel drive road.

2.24.2 Site History - Geologic Features

The deposit is hosted by granodiorite of the Cretaceous Royal Stock, although the contact with the enclosing marble is very close. Most of the 1000 tons of dump material is composed of unaltered granodiorite. Vein material on the dump consists of quartz and coarse grained sericite, with a trace of pyrite, chalcocite, and malachite. Near the vein, the igneous rock is weakly iron-stained and contains clay alteration products. A dump composite of mineralized material (both vein and altered wallrock), which comprises only a minor portion of the dump, contained .189 oz/ton Au, 4.98 oz/ton Ag, .078% Cu, .590% Pb, and .006% Zn. Emmons and Calkins (1913) describe this working as a 600 foot crosscut to a vein mined for its precious metal content.

2.24.3 Environmental Condition

A substantial discharge flows from a collapsed adit (figure 2.15) into a small stream, which is the headwaters of Gold Creek. A seepage area is present at the toe of the adit's waste-rock dump; however, this water does not drain into the creek. Instead, it flows into a drainage ditch and then infiltrates the ground a short distance east of the site.

After passing around the west side of the waste-rock dump, Gold Creek flows several hundred feet downstream of the site before disappearing into a natural limestone cave. A dry, remnant streambed can be seen approximately five feet above the existing channel.

2.24.3.1 Site Features - Sample Locations

Soil and water-quality samples were collected at the site on September 22, 1993. Water sample GSUS10L was collected from the adit discharge; sample GSUS30L was collected from the waste-rock dump seep. The flow rates at these locations were 24 and 0.75 gpm, respectively.

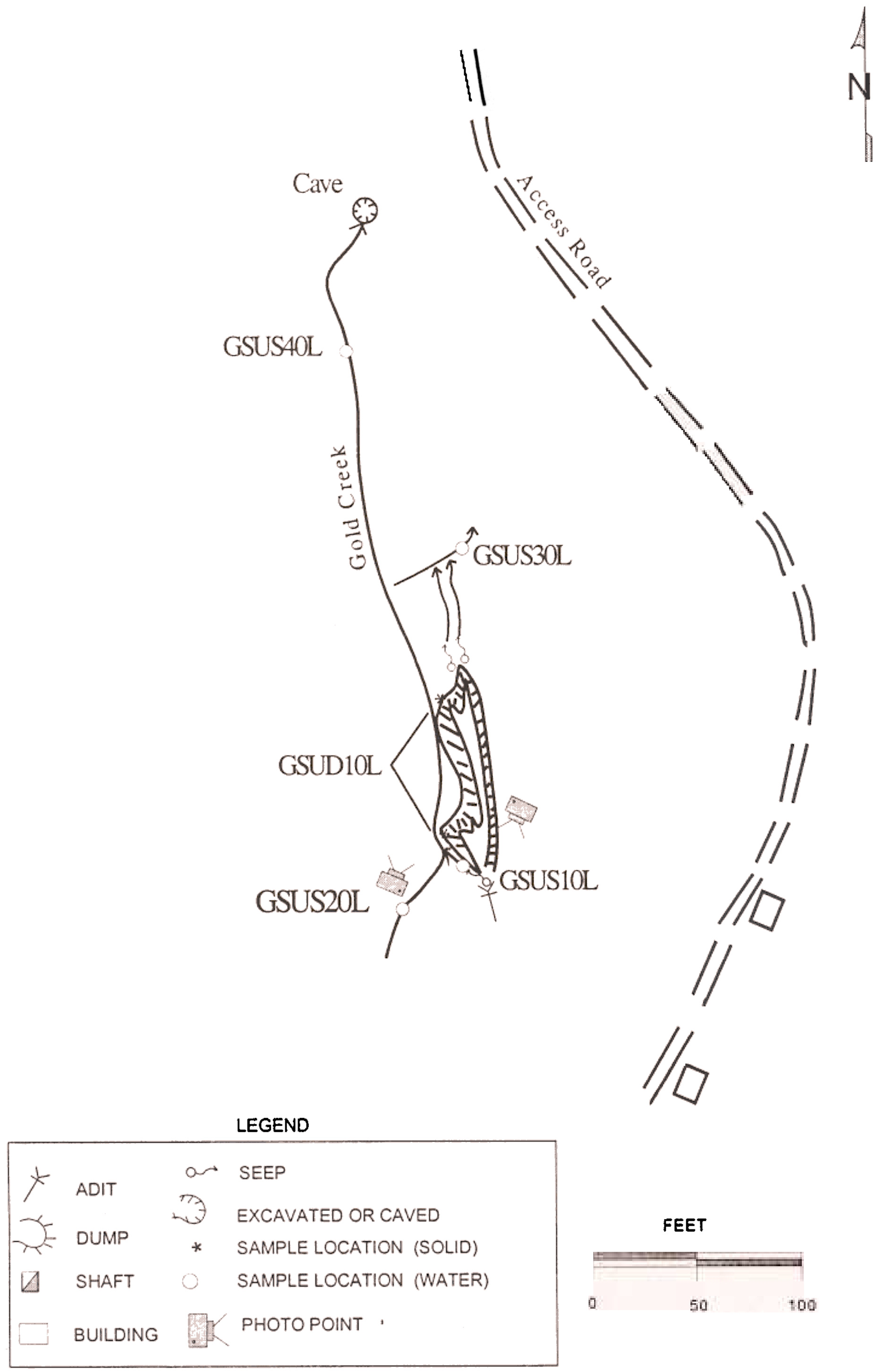


Figure 2.15. Site map of Sunlight/Copper Queen mine.

Figure 2.15a A substantial discharge flows from the collapsed adit at the Sunlight/Copper Queen Mine.

Figure 2.15b Gold Creek flows past the waste-rock dump at the Sunlight/Copper Queen Mine.

Samples were also collected from Gold Creek upstream (GSUS20L) and downstream (GSUS40L) of the site. The flow rate at the upstream location was 3 gpm; at the downstream location, the rate was 40 gpm. Finally, a soil sample (GSUD10L) was collected along the west edge of the streamside waste-rock dump.

2.24.3.2 Soil

Concentrations of copper, lead, and zinc in the soil along the west side of the dump exceeded phytotoxic levels. The results are summarized in table 2.26.

Table 2.26 Sunlight/Copper Queen Mine soil sampling results (mg/kg).

Sample Location	**As**	**Cd**	**Cu**	**Pb**	**Zn**
Soil along west edge of streamside dump (GSUD10L)	23.83[1]	10.43[1]	561.55[1,2]	3856[1,2]	1624[1,2]

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3).
(2) Exceeds phytotoxic levels (table 1.3).

2.24.3.3 Water

The adit discharge and the seep from the dump contained mercury at concentrations above the chronic aquatic life standard (table 2.27). The waste-rock dump seep also contained aluminum in excess of the secondary MCL. Upstream of the site, Gold Creek had no water-quality exceedence; downstream of the site, the creek contained silver (3.3 µg/L); however, mercury and aluminum concentrations were below the laboratory detection limits.

Table 2.27 Sunlight/Copper Queen Mine water-quality exceedences.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Gold Creek - upstream of site (GSUS20L)																			
Adit discharge (GSUS10L)										C									
Waste-rock dump seep (GSUS30L)	S									C									
Gold Creek - downstream of site (GSUS40L)												C							

Exceedence codes:
P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic
Note: The analytical results are listed in appendix V.

2.24.3.4 Vegetation

The waste-rock dump is sparsely vegetated. In the wet areas west and north of the dump, there are grasses and brush. The undisturbed area surrounding the site is vegetated with grasses and evergreens. In general, the vegetation appears healthy; however, snow obscured much of the site on the day it was visited.

2.24.3.5 Summary of Environmental Condition

The two discharges at the site do not appear to significantly impacted Gold Creek. However, the presence of silver downstream of the mine may indicate that the streamside waste-rock dump is leaching metals.

2.24.4 Structures

Two cabins are located on the access road east of the workings. Both structures are in bad condition.

2.24.5 Safety

No safety concerns were noted at the site.

2.25 Summary of Mining Impacts on DNF-Administered Land - Upper Clark Fork Drainage

For the abandoned/inactive mine inventory for the Deerlodge National Forest, the MBMG staff investigated 179 mines and/or mills within the drainage basin (table 2.3). Of these sites, 137 had no environmental impact on DNF-administered land, 21 may pose environmental problems, and 19 could not be located. Of the 21 sites with potential environmental impacts, 20 have discharges that flow from workings or waste materials, and 4 sites have problems with erosion of and/or runoff from waste materials. Six of the sites that were sampled did not have any water quality standard exceedences. Elements and compounds whose concentrations were exceeded include aluminum, arsenic, cadmium, copper, iron, lead, manganese, mercury, silver, fluoride, sulphate.

At three sites, ph was below the acceptable limit of 6.5. Table 2.28 summarizes water quality exceedences at the 20 sites with potential environmental problems.

Soils were impacted at four sites including the Hidden Lake tailings, Highland Mine, Snow Bunny Mine, and Sunlight/Copper Queen Mine. The exceedences are summarized in table 2.29.

Table 2.28 Summary of water-quality exceedences at Upper Clark Fork Drainage sites.

Mine Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Argo																			
Champion										C							P,S		S
Clear Grit	S,C					A,C	S	C	S	C									S
Dark Horse Mill																			
Ding Bat		P								C									
Eldorado and Potosi																			
Forest Rose										C									
Highland																			
Independence																			
J.G. Carlisle																			S
Little Darling																			
Lower Hidden Hand				C					S	C									
Modoc										C									
Ophir								C											
Racetrack								C		C		C			S				
Rocker Gulch		P																	
Snow Bunny	S,C								S	C									
St. Mary										C									
Sterrit										C									
Sunlight	S									C		C							

Exceedence codes:

P - Primary MCL
S - Secondary MCL
A - Aquatic Life Acute
C - Aquatic Life Chronic

Table 2.29 Summary of soil exceedences - Upper Clark Fork Drainage.

Mine Site	As	Cd	Cu	Pb	Zn
Hidden Lake Tailings	1	1	1	1	1
Highland Mine	1,2	1	1,2	1	1
Snow Bunny		1	1,2	1	1
Sunlight/Copper Queen	1	1	1,2	1,2	1,2

(1) Exceeds one or more Clark Fork Superfund background levels (table 1.3).
(2) Exceeds phytotoxic levels (table 1.3).

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Appendix I

Abandoned-Inactive Mines Program
Field Form

and

Explanation of
Township-Range-Section-Tract

PART A

(To be completed for all identified sites)

LOCATION AND IDENTIFICATION

ID# ________________ Site Name(s) ____________________________________
FS Tract # ____________________ FS Watershed Code __________________
Forest ___________________ District ___________________
Location based on: GPS___ Field Map___ Existing Info___ Other____________
Lat___________ Long___________ xutm_________ yutm_________ zutm________
Quad Name ______________________ Principal Meridan ___________________
Township __________ Range _________ Section _____ ¼_____ ¼_____ ¼_____
State _____ County ___________________ Mining District __________________

Ownership of *all* disturbances:

_____ National Forest (NF)
_____ Mixed private and National Forest (or unknown)
_____ Private.

If private only, impacts from the site on National Forest Resources are
____Visually apparent ____Likely to be significant ____Unlikely or minimal

If all disturbances are private <u>and</u> impacts to National Forest Resources are unlikely or minimal - STOP

PART B

(To be completed for all sites on or likely effecting National Forest lands)

SCREENING CRITERIA

Yes	No	
_____	_____	1. Mill site or Tailings present
_____	_____	2. Adits with discharge or evidence of a discharge
_____	_____	3. Evidence of or strong likelihood for metal leaching, or AMD (water stains, stressed or lack of vegetation, waste below water table, etc.)
_____	_____	4. Mine waste in floodplain or shows signs of water erosion
_____	_____	5. Residences, high public use area, or environmentally sensitive area (as listed in HRS) within 200 feet of disturbance
_____	_____	6. Hazardous wastes/materials (chemical containers, explosives, etc)
_____	_____	7. Open adits/shafts, highwalls, or hazardous structures/debris
_____	_____	8. Site visit *(If yes, take picture of site)*, Film number(s) __________

If yes, provide name of person who visited site and date of visit
Name: ______________________________ Date: ____________
If no, list source(s) of information (If based on personal knowledge, provide name of person interviewed and date):

____

If the answers to questions 1 through 6 are <u>all</u> No - STOP

PART C

(To be completed for all sites not screened out in Parts A or B)

Investigator ______________________________ Date ______________
Weather ____

1. GENERAL SITE INFORMATION

Take panoromic picture(s) of site, Film Number(s) __________
Size of disturbed area(s) __________acres Average Elevation __________feet
Access: _____No trail _____Trail _____4wd only _____Improved road
_____Paved road
Name of nearest town (by road): ____________________
Site/Local Terrain: _____Rolling or flat _____Foothills _____Mesa _____Mountains
_____Steep/narrow canyon
Local undisturbed vegetation (*Check all that apply*): _____Barren or sparsely vegetated
_____weeds/grasses _____Brush _____Riparian/marsh _____Deciduous trees
_____Pine/spruce/fir
Nearest wetland/bog: ____On site, ____0-200 feet, ____200 feet - 2 miles, ____> 2 miles
Acid Producers or Indicator Minerals: ____Arsenopyrite, ____Chalcopyrite, ____Galena,
____Iron Oxide, ____Limonite, ____Marcasite, ____Pyrite, ____Pyrrhotite,
____Sphalerite, ____Other Sulfide
Neutralizing Host Rock: ____Dolomite, ____Limestone, ____Marble, ____Other Carbonate

2. OPERATIONAL HISTORY

Dates of significant mining activity____________________________________

MINE PRODUCTION

Commodity(s)							
Production (ounces)							

Years that Mill Operated____________________________________
Mill Process: ____Amalgamation, ____Arrastre, ____CIP (Carbon-in-Pulp), ____Crusher only,
____Cyanidation, ____Flotation, ____Gravity, ____Heap Leach, ____Jig Plant,
____Leach, ____Retort, ____Stamp, ____ No Mill, ____Unknown

MILL PRODUCTION

Commodity(s)							
Production (ounces)							

3. HYDROLOGY

Name of nearest Stream ________________ which flows into ________________
Springs (*in and around mine site*): ____ Numerous ____ Several ____ None
Depth to Groundwater ______ ft, Measured at: ____shaft/pit/hole ____well ____wetland
Any waste(s) in contact with active stream ____Yes ____No

4. TARGETS (*Answer the following based on general observations only)*

Surface Water
Nearest surface water inake _______miles, Probable use ________________
Describe number and uses of surface water intakes observed for 15 miles downstream of site: ________________

____

____

Wells
Nearest well ______miles, Probable use ________________
Describe number and use of wells observed within 4 miles of site:

____

____

____

Population
Nearest dwelling ______miles, Number of months/year occupied ______ months
Estimate number of houses within 2 miles of the site (*Provide estimates for 0-200ft, 200ft-1mile, 1-2miles, if possible*)

____

____

____

Recreational Usage
Recreational use on site: ____High *(Visitors observed or evidence such as tire tracks, trash, graffiti, fire rings, etc.; and good access to site)*, __ Moderate *(Some evidence of visitors and site is accessible from a poor road or trail)*, __ Low *(Little, if any, evidence of visitors and site is not easily accessible)*
Nearest recreational area ______miles, Name or type of area: ________________

5. SAFETY RISKS

______Open adit/shaft, ______Highwall or unstable slopes, ______Unstable structures,
______Chemicals, ______Solid waste including sharp rusted items, ______Explosives

6. MINE OPENINGS

Include in the following chart all mine openings located on or partially on National Forest lands. Also, include mine openings located entirely on private land if a point discharge from the opening crosses onto National Forest land. In this case, enter data for the point at which the discharge flows onto National Forest land; you do not need to enter information about the opening itself.

TABLE 1 - ADITS, SHAFTS, PITS, AND OTHER OPENINGS

Opening Number						
Type of Opening						
Ownership						
Opening Length (ft)						
Opening Width (ft)						
Latitude (GPS)						
Longitude (GPS)						
Condition						
Ground water						
Water Sample #						
Photo Number						

Comments (*When commenting on a specfic mine opening, reference opening number used in Table 1*):

____
____
____
____
____
____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none
Type of opening: ADIT=Adit, SHAFT=Shaft, PIT=Open Pit/Trench, HOLE=Prospect Hole, WELL=Well
Ownership: NF=National Forest, MIX=National Forest and Private (Also, for unknown), PRV=Private
Condition *(Enter all that apply)*: INTACT=Intact, PART=Partially collapsed or filled, COLP=Filled or collapsed, SEAL=Adit plug, GATE=Gated barrier,
Ground water (*Water or evidence of water discharging from opening*): NO=No water or indicators of water, FLOW=Water flowing, INTER=Indicators of intermittant flow, STAND= Standing water only (*In this case, enter an estimate of depth below grade*)

7. MINE/MILL WASTE

Include in the following chart all mine/mill wastes located on or partially on National Forest lands. Also, include mine/mill wastes located entirely on private land if is visually effecting or is very likely to be effecting National Forest resources. In this case enter data for the point at which a discharge from the waste flows onto National Forest land, or where wastes has migrated onto National Forest land; only enter as much information about the waste as relevant and practicable.

TABLE 2 - DUMPS, TAILINGS, AND SPOIL PILES

Waste Number						
Waste Type						
Ownership						
Area (acres)						
Volume (cu yds)						
Size of Material						
Wind Erosion						
Vegetation						
Surface Drainage						
Indicators of Metals						
Stability						
Location with respect to Floodplain						
Distance to Stream						
Water Sample #						
Waste Sample #						
Soil Sample #						
Photo Number						

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Waste Type: WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, HIGH=Highwall, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon, ORE=Ore Stockpile, HEAP=Heap Leach

Ownership: NF=National Forest, MIX=National Forest and Private (*Also, for unknown*), PRV=Private

Size of material (*If composed of different size fractions, enter the sizes that are present in significant amounts*): FINE=Finer than sand, SAND=sand, GRAVEL=>sand and <2", COBBLE=2"-6", BOULD=>6"

Wind Erosion, Potential for: HIGH=Fine, dry material that could easily become airborne, airborne dust, or windblown deposits, MOD=Moderate, Some fine material, or fine material that is usually wet or partially cemented; LOW=Little if any fines, or fines that are wet year-round or well cemented.

Vegetation (*density on waste*): DENSE=Ground cover > 75%, MOD=Ground cover 25% - 75%, SPARSE=Ground cover < 25%, BARREN=Barren

Surface Drainage (*Include all that apply*): RILL=Surface flow channels mostly < 1' deep, GULLY=Flow channels >1' deep, SEEP=Intermittant or continuous discharge from waste deposit, POND=Seasonsal or permanent ponds on feature, BREACH=Breached, NO=No indicators of surface flow observe

Indicators of Metals (*Enter as many as exist*): NO=None, VEG=Absence of or stressed vegetation, STAIN=yellow, orange, or red precipitate, SALT=Salt deposits, SULF=Sulfides present

Stability: EMER=Imminent mass failure, LIKE=Potential for mass failure, LOW=mass failure unlikely

Location w/respect to Stream: IN=In contact with normal stream, NEAR=In riparian zone or floodplain, OUT=Out of floodplain

8. SAMPLES

Take samples only on National Forest lands.

TABLE 3 - WATER SAMPLES FROM MINE SITE DISCHARGES

Sample Number						
Date sample taken						
Sampler (*Initials*)						
Discharging From						
Feature Number						
Indicators of Metal Release						
Indicators of Sedimentation						
Distance to stream (ft)						
Sample Latitude						
Sample Longitude						
Field pH						
Field SC						
Flow (*gpm*)						
Method of measurement						
Photo Number						

Comments: *(When commenting on a specfic water sample, reference sample number used in Table 3)*:

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Discharging From: ADIT=Adit, SHAFT=Shaft, PIT=Pit/Trench, HOLE=Prospect Hole, WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, HIGH=Highwall, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon, WELL=Well

Feature Number: Corresponding number from Table 1 or Table 2 (*Opening Number or Waste Number*)

Indicators of Metal Release (*Enter as many as exist*): NO=None, VEG=Absence of, or stressed vegetation/ organisms in and along drainage path, STAIN=yellow, orange, or red precipitate, SALT= Salt deposits, SULF=Sulfides present, TURB=Discolored or turbid discharge

Indicators of Sedimentation *(Enter as many as exist)*: NO=None, SLIGHT=Some sedimentation in channel, banks and channel largely intact, MOD=Sediment deposits in channel, affecting flow patterns, banks largely intact, SIGN=Sediment deposits in channel and/or along stream banks extending to nearest stream

Method of Measurement: EST=Estimate, BUCK=Bucket and time, METER=Flow meter

TABLE 4 - WATER SAMPLES FROM STREAM(S)

Location relative to mine site/features	Upstream (Background)	Downstream		
Sample Number				
Date sample taken				
Sampler (Initials)				
Stream Name				
Indicators of Metal Release				
Indicators of Sedimentation				
Sample Latitude				
Sample Longitude				
Field pH				
Field SC				
Flow (gpm)				
Method of measurement				
Photo Number				

Comments: (*When commenting on a specfic water sample, reference sample number used in Table 4*):

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Indicators of Metal Release (*Enter as many as exist*): NO=None, VEG=Absence of, or stressed streamside vegetation/organisms in and along drainage path, STAIN=yellow, orange, or red precipitate, SALT=Salt deposits, SULF=Sulfides present, TURB=Discolored or turbid discharge

Indicators of Sedimentation (*Enter as many as exist*): NO=None, SLIGHT=Some sedimentation in channel, natural banks and channel largely intact, MOD=Sediment deposits in channel, affecting stream flow patterns, natural banks largely intact, SIGN=Sediment deposits in channel and/or along stream banks extending ½ a mile or more downstream

Method of Measurement: EST=Estimate, BUCK=Bucket and time, METER=Flow meter

TABLE 5 - WASTE SAMPLES

Sample Number				
Date of sample				
Sampler (*Initials*)				
Sample Type				
Waste Type				
Feature Number				
Sample Latitude				
Sample Longitude				
Photo Number				

Comments: (*When commenting on a specfic waste or soil sample, reference sample number used in Table 5*):

____

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Sample Type: SING=Single sample, COMP=composite sample (enter length)

Waste Type: WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, HIGH=Highwall, PLACER=Placer or hydraulic deposit, POND=Settling pond or lagoon sludge, ORE=Ore Stockpile, HEAP=Heap Leach

Feature Number: Corresponding number from Table 2 (*Waste Number*)

TABLE 6 - SOIL SAMPLES

Sample Number				
Date of sample				
Sampler (*Initials*)				
Sample Type				
Sample Latitude				
Sample Longitude				
Likely Source of Contamination				
Feature Number				
Indicators of Contamination				
Photo Number				

Comments: (*When commenting on a specfic waste or soil sample, reference sample number used in Table 6*):

____

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Sample Type: SING=Single sample, COMP=composite sample (enter length)

Likely Source of Contamination: ADIT=Adit, SHAFT=Shaft, PIT=Open Pit, HOLE=Prospect Hole, WASTE=Waste rock dump, MILL=Mill tailings, SPOIL=Overburden or spoil pile, PLACER= Placer or hydraulic deposit, POND=Settling pond or lagoon, ORE=Ore Stockpile, HEAP=Heap Leach

Feature Number: Corresponding number from Table 1 or 2 (*Opening or Waste Number*)

Indicators of Contamination (*Enter as many as exist*): NO=None, VEG=Absence of vegetation, PATH=Visible sediment path, COLOR=Different color of soil than surrounding soil, SALT=Salt crystals

9. HAZARDOUS WASTES/MATERIALS

TABLE 7 - HAZARDOUS WASTES/MATERIALS

Waste Number				
Type of Containment				
Condition of Containment				
Contents				
Estimated Quantity of Waste				

Comments: (*When commenting on a specfic hazardous waste or site condition, reference waste number used in Table 7*):

____

____

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Type of Containment: NO=None, LID=drum/barrel/vat with lid, AIR=drum/barrel/vat without lid, CAN=cans/jars, LINE=lined impoundment, EARTH=unlined impoundment

Condition of Containment: GOOD=Container in good condition, leaks unlikely, FAIR=Container has some signs of rust, cracks, damage but looks sound, leaks possible, POOR=Container has visible holes, cracks or damage, leaks likely, BAD=Pieces of containers on site, could not contain waste

Contents: from label if available, or guess the type of waste, e.g., petroleum product, solvent, processing chemical.

Estimated Quantity of Waste: Quantity still contained and quantity released

10. STRUCTURES

For structures on or partially on National Forest lands.

TABLE 8 - STRUCTURES

Type						
Number						
Condition						
Photo Number						

Comments:

____

____

____

Codes Applicable for all entries: NA= Not applicable, UNK=Unknown, OTHER=Explain in comments, NO=NO or none

Type: CABIN=Cabin or community service (*store, church, etc.*), MILL=mill building, MINE=building related to mine operation, STOR=storage shed, FLUME=Ore Chute/flume or tracks for ore transport

Number: Number of particular type of structure all in similar condition or length in feet

Condition: GOOD=all components of structure intact and appears stable, FAIR=most components present but signs of deterioration, POOR=major component (*roof, wall, etc*) of structure has collapsed or is on the verge of collapsing, BAD=more than half of the structure has collapsed

11. MISCELLANEOUS

Are any of the following present? (Check all that apply): ______Acrid Odor, ______Drums, ______Pipe, ______Poles, ______Scrap Metal, ______Overhead wires, ______Overhead cables, ______Headframes, ______Wooden Structures, ______Towers, ______Power Substations, ______Antennae, ______Trestles, ______Powerlines, ______Transformers, ______Tramways, ______Flumes, ______Tram Buckets, ______Fences, ______Machinery, ______Garbage

Describe any obvious removal actions that are needed at this site:

____

____

____

____

General Comments/Observations (not otherwise covered)

____

____

____

____

____

____

____

12. SITE MAP

Prepare a sketch of the site. Indicate all pertinent features of the site and nearby environment. Include all significant mine and surface water features, access roads, structures, etc. Number each important fearue at the mine site and use these number throughout this form when referring to a particular feature (Tables 1 and 2). Sketch the drainage routes off the site into the nearest stream.

13. RECORDED INFORMATION

Owner(s) of patented land
Name: ______________________________
Address: ______________________________
Telephone Number: ______________________________

Claimant(s)
Name: ______________________________
Address: ______________________________
Telephone Number: ______________________________

Surface Water (*From water rights*)
Number of Surface Water Intakes within 15 miles downstream of site used for:
_____Domestic, _____Municipal, _____Irrigation, _____Stock,
_____Commerical/Industrial, _____Fish Pond, _____Mining,
_____Recreation, _____Other

Wells (*From well logs*)
Nearest well _____miles
Number of wells within _____0-¼ miles _____¼-½ miles _____½-1 mile _____1-2 miles
_____2-3 miles _____3-4 miles of site

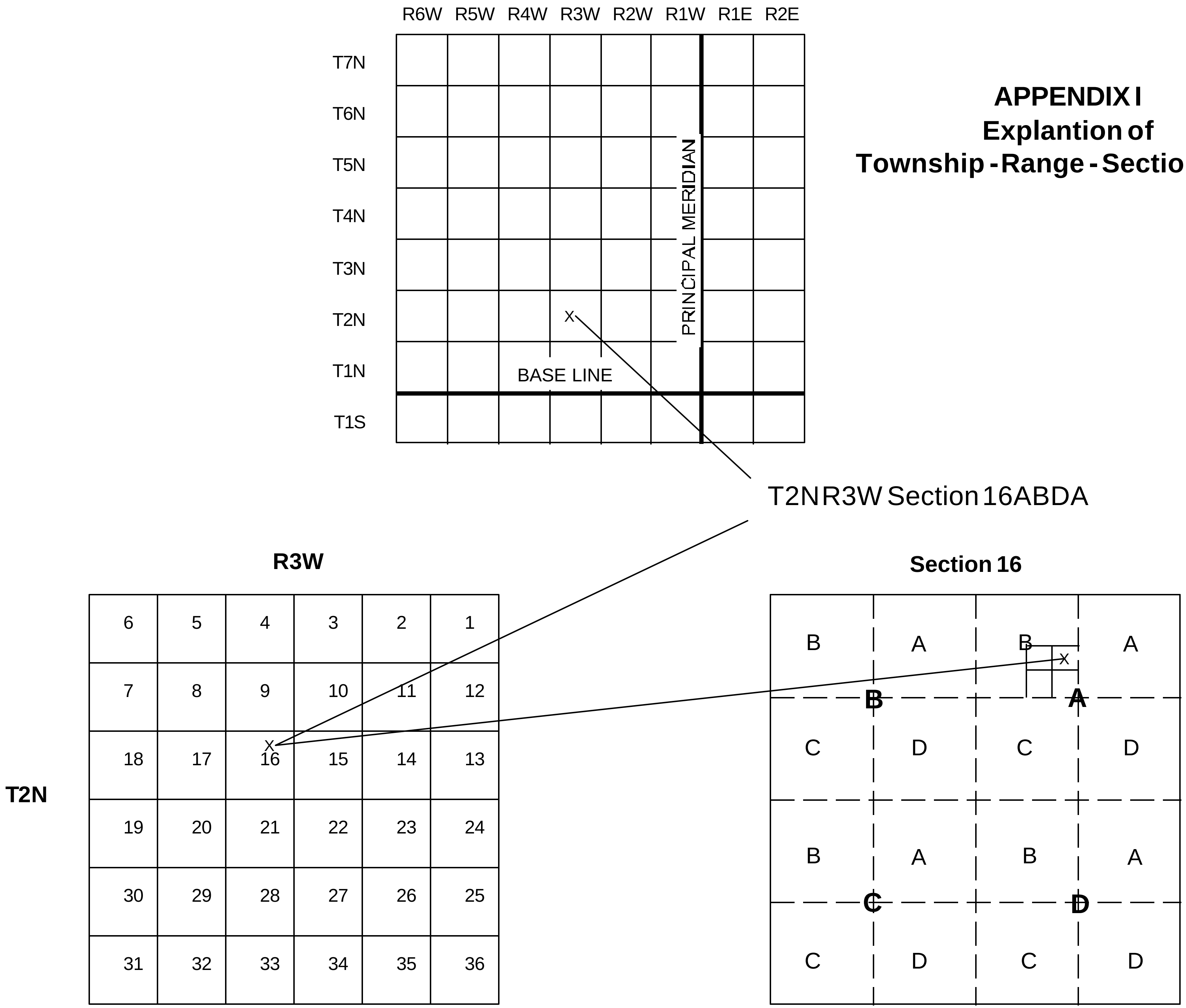
Sensitive Environments
List any sensitive environments (as listed in the HRS) within 2 miles of the site or along receiving stream for 15 miles downstream of site (*wetlands, wilderness, national/state park, wildlife refuge, wild and scenic river, T&E or T&E habitat, etc*):
____
____
____

Population (*From census data*)
Population within _____0-¼ miles _____¼-½ miles _____½-1 mile _____1-2 miles
_____2-3 miles _____3-4 miles of site

Public Interest
Level of Public Interest: _____Low, _____Medium, _____High
Is the site under regulatory or legal action? _____Yes, _____No

Other sources of information (MILs #, MRDS #, other sampling data, etc):
____
____
____
____
____

APPENDIX I
Explantion of
Township - Range - Section - Tract



Appendix II

Abandoned-Inactive Mine Sites
with Potential to Affect
the Deerlodge National Forest Administered Lands

Code	ID	Name	Quadrangle
	JF007477	6354	DELMOE LAKE
	[illegible]07478	A & B	LOCKHART MEADOWS
	[illegible]008168	A & M	MAXVILLE
	DL007479	ABBOT	SILVER LAKE
[illegible]	JF002649	ADA	BASIN
O	JF006477	ADELAIDE	BASIN
X	JF006521	AJAX	RATIO MOUNTAIN
X	GR000644	ALBION MINE	PIKES PEAK
O	GR007484	ALDER GULCH PLACER	ALDER GULCH
O	GR005701	ALGONGUIN	PHILIPSBURG
X	JF005131	ALLPORT / ALPORT	BISON CANYON
O	DL004634	ALTURAS MINE	SILVER LAKE
X	PO005160	AMAZON	POZEGA LAKES
O	GR003046	AMERICAN BEAUTY	PIKES PEAK
O	GR000506	AMERICAN FLAG CLAIM	FRED BURR LAKE
O	PO007490	AMETHYST PROSPECT	PIKES PEAK
O	GR007487	AMSELEY	ALDER GULCH
X	DL007491	ANACONDA QUARRIES ONE	WEST VALLEY
X	DL006251	ANACONDA QUARRIES TWO	WEST VALLEY
O	GR000666	ANDERSON PROSPECT	WHETSTONE RIDGE
O	GR003379	ANNIE CLAIM	HENDERSON MTN
X	DL007495	ANTELOPE	WEST VALLEY
O	MA005988	ANTELOPE CHROMITE DEPOSIT	PONY
O	DL004794	APEX	SILVER LAKE
P	JF006757	APOLLO MINE	MOUNT THOMPSON
X	JF007500	APRIL	SHEEPSHEAD MOUNTAIN
X	JF002505	AQUARIUS	BASIN
O	GR007501	ARCHEGAN	HENDERSON MTN
X	JF001217	ARCTURUS CLAIM	ELKHORN
O	DL001809	AREA NORTH OF WARM SPRINGS CREEK	WEST VALLEY
S	GR003509	ARGO	SPINK POINT
X	PO002242	ARGUS	BAGGS CREEK
O	PO002588	ARROWHEAD & SOUTH AMERICA	MOUNT POWELL
S	MA007504	ATLANTIC AND PACIFIC MINE	PONY
S	MA003982	ATLANTIC AND PACIFIC TAILINGS	PONY
X	JF007505	ATTOWA	RATIO MOUNTAIN
O	JF005538	AURORA	BASIN
X	GR003101	AUTUMN PLACER	SILVER LAKE
O	DL007506	B GROUP	SILVER LAKE
X	MA007507	B&H	OLD BALDY MOUNTAIN
S	MA007508	B&H TAILINGS	OLD BALDY MOUNTAIN
X	JF005316	BA-KA-MAA	MOUNT THOMPSON
O	GR007509	BAIER	PHILIPSBURG
X	SB001042	BALLARAT	PIPESTONE PASS
O	PO004730	BALLARD MINE	ROCK CREEK LAKE
X	GR003259	BANKER CLAIM	MAXVILLE
X	DL007513	BANKER GROUP	LOCKHART MEADOWS
S	GR000134	BANNER MINE	MOOSE LAKE
X	GR003774	BANNER TAILINGS	MOOSE LAKE
X	GR003151	BARBARA ANN	CARPP RIDGE
U	GR000140	BARICH MINE	PIKES PEAK
X	GR003204	BARNES MINE	MAXVILLE
O	PO005390	BARRY DEAN MINE	SUGARLOAF MOUNTAIN
X	GR003139	BASIN AND QUARTZ CREEK PLACERS	CORNISH GULCH
S	JF002655	BASIN BELLE	BASIN
O	JF006569	BASIN CREEK PLACER	BASIN
U	SB007519	BASIN CREEK PLACER	MOUNT HUMBUG
X	JF001649	BASIN GOLD & SILVER	BASIN
O	JF001667	BASIN GOLDFIELDS	BASIN
X	GR006049	BASIN GULCH MILL TAILINGS	CORNISH GULCH
O	JF006613	BASIN JIBE MINE	BASIN
O	GR000678	BASIN MINE	PHILIPSBURG
O	JF001841	BASIN QUARRY	BASIN
O	JF001967	BASIN QUARTZ BLOWOUT	MOUNT THOMPSON
O	JF006649	BASIN TOWNSITE	BASIN
U	PO004785	BATTERTON BAR	ROCK CREEK LAKE
U	MA000739	BAYARD	WATERLOO
O	SB007522	BEAL LODE	DICKIE PEAK
O	GR003494	BEAR AND FLOAT	HENDERSON MTN
U	SB001064	BEAR CAT	PIPESTONE PASS
O	SB007525	BEAR CREEK PLACER	MOUNT HUMBUG
X	MA006779	BEAR GULCH ADIT	OLD BALDY MOUNTAIN
X	JF007527	BEAVER PLACER	RATIO MOUNTAIN
O	GR007528	BEE BEE	MAUKEY GULCH
X	JF007529	BEEF STRAIGHT	DELMOE LAKE
X	JF007530	BEEF STRAIGHT NORTH	DELMOE LAKE
O	PO002480	BELL	BAGGS CREEK
O	GR003104	BELLAIRE MINE	DUNKLEBURG CREEK
O	GR003304	BELLEFLOWER MINE	HENDERSON MOUNTAIN
O	GR000176	BELLUM	PHILIPSBURG
X	DL004949	BEN G PROSPECT	SILVER LAKE
X	GR003564	BENTZ	MAUKEY GULCH
X	DL007533	BERG	SILVER LAKE
X	JF001493	BERKIN FLAT	THUNDERBOLT CREEK
X	JF006633	BERNICE	LOCKHART MEADOWS
O	PO002660	BERTHA MAY	BAGGS CREEK
X	GR003489	BI-METALLIC	FRED BURR LAKE
X	GR007534	BIELENBERG LAKE PROSPECT	PIKES PEAK
O	JF001241	BIG & LITTLE GOLDIE	BOULDER EAST
X	DL004964	BIG BEAR PROSPECT	WEST VALLEY
O	GR003446	BIG BILL	FRED BURR LAKE
O	PO007539	BIG BILL PROSPECT	PIKES PEAK
U	JF002361	BIG CHIEF	DELMOE LAKE
O	GR003779	BIG EXPECTATION MINE	FRED BURR LAKE
[illegible]	JF006645	BIG FOOT	RATIO MOUNTAIN
[illegible]	JF006609	BIG FOOT CREEK PLACER	RATIO MOUNTAIN
[illegible]	JF006641	BIG FOUR	RATIO MOUNTAIN
X	JF002511	BIG MAJOR	BOULDER WEST
X	JF006585	BIGFOOT CREEK PLACER	BOULDER WEST
X	GR003761	BILLIE GOAT	FRED BURR LAKE
P	JF007546	BILLIE T.	MOUNT THOMPSON
O	GR003699	BIMETALLIC TUNNEL	PHILIPSBURG
X	DL001725	BISHOP IRON DEPOSIT	WEST VALLEY
O	GR005717	BISMARK IRON PROPERTY	POZEGA LAKES
S	MA006896	BISMARK MINE	NOBLE PEAK
S	MA007549	BISMARK TAILINGS	NOBLE PEAK
X	JF007550	BISON CANYON MINE	BISON CANYON
S	JF002061	BLACK BEAR	MOUNT THOMPSON
X	DL004889	BLACK CHIEF IRON MINE	WEST VALLEY
U	GR005649	BLACK EAGLE	FRED BURR LAKE
O	DL004849	BLACK MOON CLAIM	SIVER LAKE
O	DL004684	BLACK SHIRT	SILVER LAKE
X	PO004800	BLACK-EYED MAY	BAGGS CREEK
X	JF001223	BLACKBIRD CLAIM	ELKHORN
O	GR000578	BLACKMAIL MINE	PHILIPSBURG
X	JF005136	BLACKWELL	HOMESTAKE
X	GR000638	BLOOMINGTON MINE	PIKES PEAK
S	GR000656	BLUE BIRD	PIKES PEAK
X	DL007561	BLUE BOTTLE	WEST VALLEY
S	JF007562	BLUE DIAMOND	MOUNT THOMPSON
O	PO007563	BLUE DIAMOND PROSPECT	PIKES PEAK
X	JF007564	BLUE ROCK LODE	DELMOE LAKE
O	GR003056	BLUE STREAK NO. 2 CLAIM	PIKES PEAK
X	DL004874	BLUE-EYED NELLIE MINE	WEST VALLEY
X	JF002661	BLUEBELL	DELMOE LAKE
X	JF006517	BLUEBELL HEALTH	BASIN
O	PO007565	BLUEBIRD	PIKES PEAK
O	PO007567	BLUEBIRD CLAIM PROSPECT	PIKES PEAK
O	GR000158	BLUEBIRD QUARTZ LODE	CARPP RIDGE
O	GR007569	BM COR	PIKES PEAK
X	GR001731	BOB EVANS MINE	GEORGETOWN LAKE
U	JF007570	BOB LODE - 1KM	TACOMA PARK
X	GR006190	BONANZA	HENDERSON MTN
X	PO002266	BONANZA	BAGGS CREEK
O	JF006493	BONANZA JACK	BASIN
X	MA008233	BONANZA MINE	MANHEAD MOUNTAIN
X	JF001877	BOULAWAY	ELKHORN
X	JF005141	BOULDER	BASIN
S	JF005021	BOULDER CHIEF	MOUNT THOMPSON
X	MA008187	BOULDER COBALT PROSPECT	NOBLE PEAK
S	MA007573	BOULDER COBALT SHAFT	NOBLE PEAK
X	MA003897	BOULDER COBALT WEST	OLD BALDY MOUNTAIN
U	GR003631	BOULDER CREEK	PIKES PEAK
O	GR003004	BOULDER CREEK	MAXVILLE
O	GR003621	BOULDER CREEK GRAPHITE	POZEGA LAKES
X	MA007259	BOULDER-COBALT MINE	NOBLE PEAK
O	GR007576	BOURARD LODE	DUNKLEBURG CREEK
X	GR003141	BOUVARD	DUNKLEBURG CREEK
O	DL004939	BRESNAHAN & FENNER PROSPECT	WEST VALLEY
O	GR003146	BRONZE LODE	SILVER LAKE
S	GR003109	BROOKLYN MINE AND MILL	MAXVILLE
X	SB001060	BROOKS	PIPESTONE PASS
O	DL004769	BROWNS QUARRY	WEST VALLEY
O	GR005469	BRYANT	PHILIPSBURG
S	JF004851	BUCKEYE	THREE BROTHERS
O	DL001887	BULL ELK	WEST VALLEY
X	PO008174	BULL MOOSE	BAGGS CREEK
S	JF005026	BULLION	BASIN
P	JF008214	BULLION TAILINGS ADIT	BASIN
O	GR003319	BUNKER HILL MINE	HENDERSON MOUNTAIN
O	JF007578	BUSTER	BASIN
U	JF002067	BUTTE & PHILADELPHIA	SHEEPSHEAD MOUNTAIN
U	JF006441	BUTTE - ELK PARK or EUREKA	SHEEPSHEAD MOUNTAIN
U	JF001919	BUTTE TUNGSTEN	ELK PARK PASS
U	JF002427	BUTTE- ELK PARK EXTENSION	SHEEPSHEAD MOUNTAIN
X	JF008173	C & D	ELKHORN
O	DL004989	CABLE MINE	SILVER LAKE
O	DL007580	CABLE PLACER	SILVER LAKE
O	GR005453	CADGIE-TAYLOR MINE	PHILIPSBURG
O	DL004724	CALCABE PROSPECT	SILVER LAKE
O	JF007582	CALVIN MINE	BASIN
O	DL004639	CAMERON QUARTZ LODE MINE	WEST VALLEY
X	PO004735	CAMP VERDE PLACER-	ROCK CREEK LAKE
O	DL001881	CAMPBELL PROSPECT	SILVER LAKE
X	DL004974	CARBONATOR	WEST VALLEY
X	JF002517	CARLA, PAULINE, & FAITH GROUP	SHEEPSHEAD MOUNTAIN
O	JF001115	CARLESON MINE	BASIN
O	JF002433	CARLSON	THUNDERBOLT CREEK
O	MA003817	CARMICHAEL CLAIMS	PONY
O	JF005181	CARMODY GROUP	ELHORN
O	PO002284	CAROLINE & WILLIAM COLEMAN	SUGARLOAF MOUNTAIN
O	GR000494	CAROLINE CLAIM	MAXVILLE
X	GR000710	CARPP MINE	CARPP RIDGE
X	JF006273	CASCADE	BISON CANYON
X	MA007584	CASTLE ROCK	NOBLE PEAK
O	JF007585	CATARACT	MOUNT THOMPSON
O	JF006557	CATARACT CREEK PLACER	MOUNT THOMPSON
S	JF008239	CATARACT TAILINGS	MOUNT THOMPSON
X	DL004714	CETO	STORM LAKE
X	DL008232	CHAMPION MILL TAILINGS	LOCKHART MEADOWS
X	DL007587	CHAMPION MINE	LOCKHART MEADOWS
X	DL007588	CHAMPION PASS PROSPECT	LOCKHART MEADOWS
O	DL008206	CHAMPION SHAFT	LOCKHART MEADOWS
X	DL001677	CHICKEN HAWK CLAIMS	LOCKHART MEADOWS
O	JF007589	CHIEF JOSEPH COPPER	ELKHORN
O	JF005351	CHINESE DIGGINGS	BOULDER WEST
O	DL008197	CLAY CHARLIE	SILVER LAKE
S	GR003229	CLEAR GRIT CLAIM	PIKES PEAK
O	GR003414	CLIFF CLAIM	WEST VALLEY
X	GR007592	CLIFF GULCH	PHILIPSBURG
X	SB006708	CLIMAX	TUCKER CREEK
O	GR005709	CLIMAX	PHILIPSBURG
O	SB001006	CLIMAX (APEX) LODE GROUP	TUCKER CREEK
X	GR007595	CLIPPER	BUTTE
O	GR003481	CLIPPER	KELLY LAKE
U	MA007597	COAL CREEK	OLD BALDY
O	GR003121	COBERLY SYNCLINE	PIKES PEAK
X	JF005106	COLUMBIA MINE	SHEEPSHEAD MOUNTAIN

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Code	ID	Name	Quadrangle
X	JF007600	COLUMBUS	BASIN
	GR006705	COMANCHE	PHILIPSBURG
	GR000212	COMBINATION MILL TAILINGS	BLACK PINE RIDGE
O	GR007603	COMINCO PHOSPHATE	MAXVILLE
X	GR005689	CONGDON MINE	MOUNT EMERINE
X	JF007604	CONNIE JOE	DELMOE LAKE
O	MA000761	CONSTELLATION DEPOSIT	PONY
U	GR003541	CONTACT NUMBER 1 CLAIM	PIKES PEAK
U	PO007606	COPPER CLIFF	BAGGS CREEK
X	GR007607	COPPER CREEK	MAXVILLE
O	GR000224	COPPER JACK MINE	PHILIPSBURG
U	GR007608	COPPER LODE	MAXVILLE
O	PO002594	COPPER LODE PROSPECT	MOUNT POWELL
O	GR003696	COPPER MOUNTAIN LODE	KELLY LAKE
U	GR003436	COPPER QUEEN GROUP	BLACK PINE RIDGE
O	GR005749	COPPER RIDGE	PIKES PEAK
O	GR008256	COPPER STATE MINE	HENDERSON MOUNTAIN
O	GR008218	COPPER STATE MINE	HENDERSON MOUNTAIN
O	PO000230	COSMOPOLITAN	ROCK CREEK LAKE
X	DL007612	COTTONWOOD MINE	LOCKHART MEADOWS
O	PO007613	COUGAR	ROCK CREEK LAKE
O	GR004804	COYLE	PHILIPSBURG
S	JF007614	CRACKER	MOUNT THOMPSON
X	MA008185	CRAIG	NOBLE PEAK
S	JF005486	CRESCENT	CHESSMAN RESERVOIR
S	JF004886	CRYSTAL	BASIN
X	MA004037	CRYSTAL BUTTE	NOBLE PEAK
O	GR003124	CULVER CLAIM	DUNKLEBERG CREEK
X	MA007617	CURLY BILL	NOBLE PEAK
X	SB003271	CURLY GULCH ADITS	MOUNT HUMBUG
X	JF004931	CUSTER	MOUNT THOMPSON
S	JF008128	DAILY WEST	BASIN
X	DL007619	DALY GULCH	SILVER LAKE
X	DL001551	DALY PLACER MINE	SILVER LAKE
X	PO002744	DANIELSVILLE	POZEGA LAKES
S	PO002948	DARK HORSE MILL	MOUNT POWELL
O	PO007620	DARK HORSE MINE	MOUNT POWELL
O	PO007621	DAUGHTERS PROSPECT	PIKES PEAK
O	SB007622	DAY & HARVEY	MOUNT HUMBUG
X	SB001102	DEAD COW ADIT	OROFINO MOUNTAIN
X	JF006509	DEAD END	THUNDERBOLT CREEK
U	PO002558	DECIEVER	ROCK CREEK LAKE
O	GR003399	DEER HUNTER PROSPECT	HENDERSON MTN
X	GR007623	DEER LODGE BASIN PROSPECTS	PIKES PEAK
O	GR003209	DELAWARE	MAXVILLE
O	GR007624	DELTA	SILVER LAKE
X	SB001192	DENNY PROSPECT	PIPESTONE PASS
	GR007625	DERBY MORNING	PHILIPSBURG
	PO003786	DEWEY PROSPECT	PIKES PEAK
	GR007626	DG CLAIMS	POZEGA LAKES
X	JF000266	DIAMOND CITY	RATIO MOUNTAIN
X	DL001497	DIAMOND PLACER	ANACONDA NORTH
X	PO007627	DING BAT & BLUE-EYED MAGGIE	BAGGS CREEK
X	PO002552	DING BAT - BLUE-EYED MAGGIE	BAGGS CREEK
O	GR007628	DISSETT MINES	PHILIPSBURG
O	PO007629	DOLE PROSPECT	ROCK CREEK LAKE
O	JF007630	DORA LEIGH & MCCAULEY LEAD - NE	WILSON PARK
O	JF007631	DORA LEIGH & MCCAULEY LEAD - SW	WILSON PARK
X	JF007632	DORIS	BASIN
O	GR007633	DOUBLE EAGLE PROSPECT	BLACK PINE RIDGE
S	JF008129	DOUBLE SHAFT	THREE BROTHERS
X	GR007634	DOUGHERTY MILL	SILVER LAKE
O	GR007635	DOUGLAS CREEK	PHILIPSBURG
O	GR003116	DOUGLAS CREEK SYNCLINE	MAXVILLE
X	GR008257	DOUGLAS MILL	HENDERSON MOUNTAIN
X	GR003374	DOUGLAS MINE	HENDERSON MTN
X	MA005944	DRY BOULDER IRON	NOBLE PEAK
O	DL001509	DRY COTTONWOOD CREEK	OROFINO MOUNTAIN
O	DL004929	DRY GULCH PLACER	MOUNT POWELL
O	JF002325	DUMAS	GRACE
X	JF007637	DUMORTIERITE PROSPECT	BASIN
U	GR003081	DUNKELBURG	DUNKLEBURG CREEK
O	JF007638	DUNSTONE	ELKHORN
O	GR003334	DURAND MINE	MAXVILLE
O	GR007640	DURANGO	PHILIPSBURG
O	GR003694	DURANGO & MOORLIGHT GROUP	PHILIPSBURG
U	SB001900	E.X.L.	PIPESTONE PASS
X	SB006544	EAGER	WICKIUP CREEK
X	SB001456	EAGER MINING GROUP	WICKIUP CREEK
O	GR003344	EAGLE CLAIM	HENDERSON MTN
O	JF007641	EAGLE HILL & IRON BAR LODES	ELKHORN
O	JF001613	EAST BUTTE MINE	ELKHORN
X	GR007642	EAST MOUNTAIN LION	MAXVILLE
O	JF002529	EAST RIDGE GROUP	ELK PARK PASS
X	SB006148	EAST SOAP GULCH IRON DEPOSIT	WICKIUP CREEK
O	JF001235	ECLIPSE CLAIM	ELKHORN
O	SB007643	EDNA - KIBLER PROSPECT	PIPESTONE PASS
O	PO007644	EDWIN E. GRAUPHER PROSPECT	PIKES PEAK
S	JF006193	ELDORADO AND PLATEAU MINE	CHESSMAN RESERVOIR
S	GR000680	ELDORADO MINE	PIKES PEAK
O	GR000890	ELIZABETH SHAFT	PHILIPSBURG
O	GR007645	ELIZABETH SHAFT	PHILIPSBURG
O	PO002900	ELIZABETH-LITTLE EMERY	BAGGS CREEK
X	SB001384	ELKHORN BUCKHORN	MOUNT HUMBUG
	JF006589	ELKHORN CREEK PLACER	TACOMA PARK
	JF005518	ELKHORN MINE	ELKHORN
	JF005462	ELKHORN PEAK IRON	ELKHORN
	JF005454	ELKHORN QUEEN	TACOMA PARK
X	JF001181	ELKHORN RIDGE PROSPECT	ELKHORN
X	JF001157	ELMER	BASIN
X	PO002272	EMERY	BAGGS CREEK
O	PO002452	EMERY RIDGE PROSPECT	ROCK CREEK LAKE
X	PO007646	EMMA DARLING	BAGGS CREEK
	JF002679	ENTERPRISE	THREE BROTHERS

Code	ID	Name	Quadrangle
X	JF005498	EUREKA MINE	BISON CANYON
X	JF005466	EVA MAY	MOUNT THOMPSON
X	JF008240	EVA MAY TAILINGS	MOUNT THOMPSON
O	JF006253	EVENING STAR	HOMESTAKE
U	JF002685	EVENING STAR & GOLDEN ASSETS M	BASIN
X	JF002073	FAST KATIE	BASIN
O	GR000500	FIELD	PHILILPSBURG
X	GR003131	FIELDS	MAXVILLE
O	GR003766	FINLAY BASIN PROSPECT	POZEGA LAKES
O	JF006601	FIRST SHOT-LAST SHOT	BASIN
X	SB001402	FISH CREEK MINE	MOUNT HUMBUG
O	SB007648	FISH CREEK PLACERS	PIPESTONE PASS
O	JF002937	FLAG PLACER	HOMESTAKE
O	GR000008	FLAGSTAFF HILL	PHILIPSBURG
O	SB006432	FLEECER MTN AREA	DEWEY
O	GR007649	FLINT CREEK	SILVER LAKE
X	MA000565	FLORENCE	WHITEHALL
X	SB007650	FLUME GULCH MINE	OROFINO MOUNTAIN
S	GR008230	FOREST ROSE MILL TAILINGS	DUNKELBERG CREEK
S	GR003594	FOREST ROSE MINE	DUNKLEBURG CREEK
U	DL001785	FOSTER CREEK	SILVER LAKE
O	GR003419	FOX	WEST VALLEY
X	JF005111	FRANKLIN	THUNDERBOLT CREEK
O	GR000014	FRANKLIN HILL IRON	PHILIPSBURG
O	GR007651	FRANZ	HARVEY POINT
X	JF006549	GALENA GULCH MINE	BOULDER WEST
O	GR000020	GARDINER	KELLY LAKE
S	GR003684	GARRETT MINE	SILVER LAKE
O	DL001755	GARRITY HILL AREA	WEST VALLEY
U	MA007654	GENERAL JACKSON MINE	NOBLE PEAK
O	GR003524	GENERAL WASHINGTON ET AL CLAIMS	HENDERSON MOUNTAIN
X	GR000548	GEORGE MINE	WEST VALLEY
O	DL001623	GEORGETOWN PLACERS	SILVER LAKE
O	SB007655	GERMAN GULCH	DICKIE PEAK
O	GR003469	GERTRUDE CLAIM	PHILIPSBURG
X	MA003133	GIANT	OLD BALDY MOUNTAIN
O	PO001126	GILT EDGE PROSPECT	PIKES PEAK
X	GR005449	GIRD CREEK	MAXVILLE
O	GR007657	GIRD CREEK SYNCLINE	MAXVILLE
O	JF006113	GLOWING STAR PLACER	HOMESTAKE
O	GR003111	GMLC FRIDAY	SPINK POINT
O	GR000692	GOAT MOUNTAIN	PIKES PEAK
O	JF004986	GOLD BUG	HOMESTAKE
O	GR003076	GOLD CREEK SYNCLINE	PIKES PEAK
U	SB006152	GOLD DUST	MOUNT HUMBUG
S	SB007658	GOLD HILL MILL	MOUNT HUMBUG
X	GR003249	GOLD HILL MINE	MAXVILLE
X	SB001390	GOLD HILL MINE	MOUNT HUMBUG
X	GR005725	GOLD KING MINE	MAXVILLE
U	GR003736	GOLD PRINCE	MAUKEY GULCH
X	GR003784	GOLD REEF MINE	MAXVILLE
O	JF005246	GOLDEN CURRY MINE	ELKHORN
O	GR000722	GOLDEN EAGLE MINE	SILVER LAKE
X	JF008192	GOLDEN GIRL #4 / GOLDEN GRAIN #4	WHITETAIL PEAK
X	JF007660	GOLDEN GLOW / LULA BELL	THREE BROTHERS
X	GR003426	GOLDEN JUBILEE	FRED BURR LAKE
X	JF005411	GOLDEN MOSS MINE	ELKHORN
U	SB007662	GOLDEN SURPRISE	MOUNT HUMBUG
X	DL006371	GOSPEL HILL ADIT	LOCKHART MEADOWS
O	GR007664	GOULD CARRY LODE	FRED BURR LAKE
X	GR003551	GRANITE	FRED BURR LAKE
O	GR000872	GRANITE BELL	FRED BURR LAKE
O	GR003771	GRANITE CREEK PROSPECT	POZEGA LAKES
X	GR000884	GRANITE RUBY SHAFT	FRED BURR LAKE
O	GR003714	GRANITE TAILINGS	PHILIPSBURG
O	GR003501	GRAVEL PIT	PHILIPSBURG
O	MA003100	GRAY EAGLE	NOBLE PEAK
S	JF002691	GRAY LEAD	MOUNT THOMPSON
X	DL004809	GREAT EASTERN	ANACONDA NORTH
O	JF007666	GREAT SHIELD URANIUM	MOUNT THOMPSON
O	GR007667	GREAT WEST/SHOOFLY	PHILIPSBURG
X	GR000518	GREATER NEW YORK MINE	FRED BURR LAKE
O	DL004834	GREY ROCK CLAIM/GRAY ROCK/BUNG YOUR	WEST VALLEY
X	MA003138	GROUSE MINE	OLD BALDY MOUNTAIN
O	GR000032	GRUBSTAKE	SILVER LAKE
X	JF005215	GRUBSTAKE	DELMOE LAKE
O	DL004934	GYP PROSPECT	SILVER LAKE
O	GR005641	H & H CLAIM	PHILIPSBURG
O	DL004689	H L M PROSPECT	SILVER LAKE
O	GR007668	H.O. GROUP	PIKES PEAK
X	JF007669	HALFWAY PARK PLACER	WHITETAIL PEAK
O	GR003556	HAM GULCH	MAXVILLE
O	MA007199	HAMILTON	OLD BALDY MOUNTAIN
X	JF007671	HANNA	MOUNT THOMPSON
O	GR007672	HANNA TAILINGS	FRED BURR LAKE
O	GR000560	HANNAH MINE / HANNA	FRED BURR LAKE
X	DL006141	HANNON - CLAY CHARLIE	SILVER LAKE
X	DL004624	HANSON-MELOY PROSPECT	SILVER LAKE
X	JF006145	HARRIET MINE	HOMESTAKE
O	GR003474	HARRY MILLER CLAIM	HENDERSON MTN
O	GR003719	HATTA MINE & MAGNET MINES	DUNKLEBURG CREEK
S	JF002697	HATTIE FERGUSON	MOUNT THOMPSON
S	JF006109	HAWKEYE	THREE BROTHERS
O	GR007673	HEADLIGHT	PHILILSBURG
O	JF006277	HEAGAN	ELKHORN
S	GR008066	HEANEY MINE	WHETSTONE RIDGE
S	JF006473	HECTOR	BASIN
O	GR003189	HEILMAN CLAIM	MAXVILLE
X	JF005490	HELPER MINE	BASIN
O	GR003024	HENDERSON CREEK	HENDERSON MTN
O	GR007676	HENDERSON MINE	HENDERSON MTN
X	GR003439	HENRY	DUNKLEBURG CREEK
U	PO004805	HENRY THOMAS	GRIFFEN CREEK
X	PO007677	HERCULESE	BAGGS CREEK

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Code	ID	Name	Quadrangle
O	DL001905	HESPERIA & MINERVA	WEST VALLEY
X	DL001839	HIDDEN HAND	BAGGS CREEK
X	GR003491	HIDDEN LAKE MINE	SILVER LAKE
U	JF006157	HIDDEN TREASURE	BASIN
X	JF001001	HIGH UP CLAIM	ELKHORN
X	JF006489	HIGHLAND	BASIN
O	MA007680	HIGHLAND MARY PROSPECT	MANHEAD MOUNTAIN
S	SB007681	HIGHLAND MILL TAILINGS	MOUNT HUMBUG
S	SB001036	HIGHLAND MINE	MOUNT HUMBUG
O	SB006408	HIGHLAND MOUNTAINS AREA	MOUNT HUMBUG
X	SB001078	HIGHLAND VIEW	PIPESTONE PASS
O	GR003394	HILLTOP CLAIM	STORM LAKE
O	JF007682	HOBO GULCH PROSPECT	ELKHORN
S	GR000584	HOBO-T HAYES MINE	PHILIPSBURG
O	DL001917	HOLDFAST	SILVER LAKE
O	GR003724	HOLLY NO. 1 MINE	DUNKLEBURG CREEK
O	GR007683	HOMER CLAIM	MAXVILLE
X	DL008252	HOMESTAKE	WEST VALLEY
O	GR003079	HOMESTAKE	PIKES PEAK
O	JF006165	HOMESTAKE CREEK PLACR	HOMESTAKE
O	DL001929	HONORAH G.	SILVER LAKE
U	JF005346	HOPE	BISON CANYON
X	GR008178	HORSESHOE BEND	SILVER LAKE
O	GR003464	HORTON	PHILIPSBURG
O	GR007686	HOWARD CLAIM	MAXVILLE
O	GR003716	HUFFMAN	PHILIPSBURG
X	GR003199	HUGHES	PIKES PEAK
O	JF007688	HUMBOLT	WHITETAIL PEAK
O	GR005529	I. B. CLAIM	PHILIPSBURG
S	JF005046	IDA M.	MOUNT THOMPSON
X	JF005426	IDA MAY MINE	CHESSMAN RESERVOIR
O	GR007690	ILLOGAN	PHILIPSBURG
O	PO005355	INCLINE MINE	BAGGS CREEK
S	PO005125	INDEPENDENCE MINE	PIKES PEAK
U	JF007691	INDIAN HEAD ROCK DEPOSITS	BASIN
X	GR007692	INDIANA PROSPECT	WHETSTONE RIDGE
O	JF003266	INDUSTRIAL SILICA BASIN QUARRY	MOUNT THOMPSON
X	JF001121	INFINITE	THUNDERBOLT MTN
X	MA007694	INHA PROSPECT	NOBLE PEAK
U	JF001187	IRENE	HOMESTAKE
O	GR003454	IRON AGE MINE	PHILIPSBURG
X	SB001072	IRON CLIFF	PIPESTONE PASS
O	JF005241	IRON MOUNTAIN	THUNDERBOLT CREEK
O	MA003550	IRON MOUNTAIN PLACER	TABLE MOUNTAIN
O	GR003504	ISABELLA	PHILIPSBURG
O	DL007695	ISABELLE	SILVER LAKE
U	GR003486	IVANHOE LAKE PROSPECT	KELLY LAKE
O	GR007696	IVANHOE MINE	PIKES PEAK
[illegible]	GR003224	J. G. CARLISLE MINE	PIKES PEAK
U	JF003526	JACK CREEK	WILSON PARK
P	JF008215	JACK CREEK MILL TAILINGS	BASIN
O	JF003261	JACK CREEK RIDGE	BASIN
U	JF006369	JACK MINE	RATIO MOUNTAIN
O	JF007697	JACK MOUNTAIN IRON	BASIN
X	SB001156	JACQUELINE MINE	DICKIE PEAK
X	JF005436	JAMES R. KEENE	ELKHORN
O	GR007698	JASPER & MATTHICH	WARREN PEAK
X	GR003279	JEFFERSON MINE	MAXVILLE
X	JF006485	JESSIE	BASIN
X	DL004909	JETTY MINE	WEST VALLEY
O	JF007699	JIB MILL TAILINGS	BASIN
X	JF006373	JIM JR. CLAIM	WHITETAIL PEAK
X	JF008131	JOE BOWER'S MINE	BASIN
O	GR003194	JOE HANKS CLAIM	HENDERSON MOUNTAIN
U	JF007700	JOE METESH LESSEE	BASIN
O	GR008081	JOHN JENNINGS MINE	ALDER GULCH
X	JF007701	JOHN T.	MOUNT THOMPSON
X	JF005187	JOHN T. PROSPECT	SUGARLOAF MTN
O	GR003339	JOHNSON CLAIM	HENDERSON MOUNTAIN
O	GR006377	JOKER PROSPECT	WHETSTONE RIDGE
O	GR003606	JOLEAN PROSPECT	PIKES PEAK
O	JF005001	JOSEPHINE	THREE BROTHERS
O	GR003061	JP PROSPECT	WHETSTONE RIDGE
X	MA006773	JULIA LEE	TABLE MOUNTAIN
O	JF002721	JUMBO	MOUNT THOMPSON
U	JF004981	JUPITOR	DELMOE LAKE
O	JF007703	KELLERS HEMATITE DEPOSIT	BASIN
O	PO002672	KELLEY AND IRVING PITS	ROCK CREEK LAKE
O	GR005481	KENNEDY MINE	MAUKEY GULCH
S	GR000092	KENT MINE	MOUNT EMERINE
U	JF007705	KENTUCKY IRISHMAN	DELMOE LAKE
X	JF008193	KING	DELMOE LAKE
X	SB008012	KING AND QUEEN CLAIMS	WICKIUP CREEK
O	JF007706	KING MINE	DELMOE LAKE
S	GR003084	KIRKENDAL/KOSKI	PIKES PEAK
X	JF005116	KIT CARSON	SHEEPSHEAD MOUNTAIN
X	JF005186	KLONDYKE	ELKHORN
X	JF007707	KLONDYKE	MOUNT THOMPSON
O	PO007709	KOHRS & BIELENBERG PLACER	ROCK CREEK LAKE
O	PO002678	KOHRS AND BIELENBERG MINE 1916 PIT	ROCK CREEK LAKE
O	GR007710	L. FROST CREEK	PHILIPSBURG
O	JF006361	LADY HENNESSEY	THREE BROTHERS
S	JF002487	LADY LEITH	THREE BROTHERS
O	PO002852	LAKE VIEW PROSPECT	ROCK CREEK LAKE
O	PO007712	LANCASTER PROSPECT	PIKES PEAK
[illegible]	GR003391	LARK	POZEGA LAKES
[illegible]	JF006405	LAST CHANCE	BASIN
[illegible]	GR005773	LAST CHANCE	WHETSTONE RIDGE
O	GR003239	LAST CHANCE	HENDERSON MOUNTAIN
O	GR003314	LAST CHANCE MINE	HENDERSON MTN
O	GR003456	LEAD STREAK	MAXVILLE
S	JF002571	LEADVILLE MINE	SUGARLOAF MOUNTAIN
X	JF008194	LEGGET HILL PROSPECTS	DELMOE LAKE
O	JF005256	LEROY MINE	TACOMA PARK
U	JF007713	LEROY QUARTZ LODE	TACOMA PARK
O	GR006617	LETUS	FRED BURR LAKE
O	GR007714	LEVI BURR	PHILIPSBURG
X	SB008177	LIMEKILN HILL	PIPESTONE PASS
O	DL001659	LIMESTONE PROSPECTS	SILVER LAKE
X	SB006456	LIMESTONE QUARRY	PIPESTONE PASS
O	GR005485	LITTLE DANDY	PHILIPSBURG
O	DL007716	LITTLE DARLING	OROFINO MOUNTAIN
O	GR005525	LITTLE EMMA	PHILIPSBURG
O	GR002994	LITTLE GOLD CREEK PLACER	PIKES PEAK
X	GR005629	LITTLE JOE	CARPP RIDGE
O	GR007717	LITTLE WONDER PROSPECT	WHETSTONE RIDGE
X	JF001427	LIZZIE OSBURNE	MOUNT THOMPSON
S	GR007719	LOG CABIN PROSPECT	WHETSTONE RIDGE
X	PO005190	LOIS MINE	PIKES PEAK
O	GR003091	LOOKOUT CLAIM	CARPP RIDGE
O	GR003184	LOOKOUT PROSPECT	HENDERSON MOUNTAIN
O	DL007720	LOST CREEK PLACER	ANACONDA NORTH
X	JF005151	LOTTA MINE	BASIN
X	JF004781	LOUISE	BASIN
O	JF001865	LOUISE MINE	ELKHORN
O	GR007721	LOWER BROOKLYN	MAXVILLE
S	JF008132	LOWER BULLION MILL AND SMELTER	BASIN
X	MA008188	LOWER COAL CREEK	OLD BALDY MOUNTAIN
X	DL007723	LOWER GEORGETOWN	GEORGETOWN LAKE
S	JF007724	LOWER HATTIE FERGUSON	MOUNT THOMPSON
S	JF008143	LOWER HECTOR	BASIN
X	PO007725	LOWER HIDDEN HAND	BAGGS CREEK
X	JF007726	LOWER VERA & MARIE	MOUNT THOMPSON
X	MA008186	LOWER WHITE CHIEF	MANHEAD MOUNTAIN
S	GR008280	LOWER WILLOW CREEK TAILINGS	BLACK PINE RIDGE
X	DL007727	LUCKY ARROWHEAD	WEST VALLEY
X	DL007728	LUCKY BLUE	SILVER LAKE
U	GR007729	LUCKY STRIKE	MOOSE LAKE
O	GR007730	LUCY	PHILIPSBURG
O	GR003161	LUKE CLAIMS	WARREN PEAK
X	DL004674	LUKE SILICA QUARRY	WEST VALLEY
O	JF007732	LULA BELL	THREE BROTHERS
O	JF005321	LUXANBURG	ELKHORN
O	DL004844	LUXEMBURG MINE	SILVER LAKE
O	GR000122	LYON PLACER	MAXVILLE
X	GR007733	M & M PLACER	PIKES PEAK
X	GR000374	M & T MINE	MOOSE LAKE
S	GR003219	M. FK. DOUGLAS CREEK PHOSPHATE	PIKES PEAK
O	GR003214	MACFARLAND PLACER	PIKES PEAK
O	DL001539	MAIN RANGE BERYL	MOUNT EVANS
O	MA005496	MAMMOTH MINE	MANHEAD MOUNTAIN
X	JF002163	MANHATTAN	MOUNT THOMPSON
X	JF005121	MARGUERITE	BASIN
X	GR005497	MARIE CLAIM	PHILIPSBURG
U	GR003396	MARJEA MINE	MAXVILLE
X	GR000614	MARONEY CLAIM	PHILIPSBURG
O	SB001114	MARY ANN	MOUNT HUMBUG
P	JF007735	MARY ANNE	BASIN
O	GR007736	MARY B	PHILIPSBURG
X	JF007738	MASCOT	DELMOE LAKE
X	JF008221	MASCOT EXTENSION	DELMOE LAKE
O	GR003619	MASTER MINE PLACER	PIKES PEAK
O	PO002528	MATHESON	BAGGS CREEK
O	GR000398	MAXVILLE PHOSPHATE	MAXVILLE
X	GR007740	MAXVILLE TAILINGS	MAXVILLE
X	JF006305	MAY DAY MINE	BOULDER WEST
O	JF004966	MAY LITTY	THREE BROTHERS
X	DL004879	MAYFLOWER	WEST VALLEY
O	GR003756	MAYFLOWER LODE	KELLY LAKE
X	GR007741	MAYFLOWER VEIN	MAXVILLE
O	GR007742	MAYWOOD PLACER	MAXVILLE
O	DL001611	MCCABE PROPERTY	SILVER LAKE
S	GR008038	MCDERMOTT MILL	HARVEY POINT
O	GR003254	MCDONALD MINE	MAUKEY GULCH
O	DL001791	MCKAY ADIT	SILVER LAKE
X	SB001180	MCPHAIL PROSPECT / MCPHAIL MINE	PIPESTONE PASS
X	JF002451	MEMPHIS	SHEEPSHEAD MOUNTAIN
O	JF002109	MERRY WIDOW	MOUNT THOMPSON
O	DL004839	MIDDLE OF THE ROAD PYRENEES	SILVER LAKE
X	MA007743	MIDNIGHT	NOBLE PEAK
P	JF007744	MIKE #14	MOUNT THOMPSON
S	GR007745	MILLER'S MINE	WHETSTONE RIDGE
O	GR000404	MINER'S GULCH PLACER	ALDER GULCH
U	MA005964	MINERAL HILL	PONY
O	DL004814	MINNEHAHA & HORSESHOE GROUP	SILVER LAKE
X	GR007747	MINNIE LEE	STORM LAKE
X	GR003544	MITCHELL	PHILIPSBURG
O	DL001803	MODESTY CREEK	MOUNT POWELL
X	GR000512	MODOC CLAIM	FRED BURR LAKE
X	MA003902	MOFFET JOHNSON	OLD BALDY MOUNTAIN
S	MA003370	MOGULLIAN	NOBLE PEAK
X	DL007752	MOHAWK	WEST VALLEY
O	GR003094	MONARCH MINE	DUNKLEBURG CREEK
O	GR007753	MONITOR MINE	DUNNKELBERG CREEK
X	GR003021	MONK	STORM LAKE
X	GR000740	MONTANA MINE	FRED BURR LAKE
X	DL004869	MONTANA MINE	SILVER LAKE
X	JF006325	MONTANA MINE	HOMESTAKE
U	JF004971	MONTE CARLO	BOULDER WEST
S	JF005311	MONTREAL STAR MINE	ELK PARK PASS
U	GR003726	MOONDYNE	PIKES PEAK
O	SB006620	MOONEY CLAIM	BUXTON
X	GR005461	MOONLIGHT MINE	MAXVILLE
O	DL004954	MOONLIGHT PROSPECT	SILVER LAKE
O	SB006376	MOOSE CREEK	MOUNT HUMBUG
O	SB001132	MOOSE CREEK-FISH CREEK TRAVERSE	PIPESTONE PASS
X	GR007756	MOOSE LAKE TAILINGS	MOOSE LAKE
O	GR003461	MOOSE TRAIL	MAUKEY GULCH

S - Sampled; P - Possible impact but private land; X - Visited but no effect; O - Screened in office; U - Unable to locate

Code	ID	Name	Quadrangle
O	JF001607	MOREAU	ELKHORN
X	[illegible]004904	MORGAN EVANS CLAIM	WEST VALLEY
S	[illegible]004936	MORNING GLORY	MOUNT THOMPSON
S	JF007761	MORNING GLORY TAILINGS	MOUNT THOMPSON
S	JF007762	MORNING MARIE	MOUNT THOMPSON
S	JF004826	MORNING MINE	BASIN
X	GR007763	MORNING STAR	PIKES PEAK
X	JF006461	MORNING STAR	BASIN
O	JF002931	MOSCOW MINE	GRACE
O	GR003329	MOTHER VEIN CLAIM	HENDERSON MOUNTAIN
S	JF008222	MOUNT PISGAH ?/WILSON CREEK	BOULDER WEST
X	MA007764	MOUNTAIN BOY	MANHEAD MOUNTAIN
O	JF004976	MOUNTAIN CHIEF	HOMESTAKE
S	JF002619	MOUNTAIN CHIEF	MOUNT THOMPSON
O	GR003114	MOUNTAIN CHIEF MINE	DUNKLEBURG CREEK
S	GR003274	MOUNTAIN LION MINE	MAXVILLE
O	GR003534	MOUNTAIN PARK TUNGSTEN	PIKES PEAK
X	JF002577	MOUNTAIN QUEEN	RATIO MOUNTAIN
O	GR007767	MOUNTAIN TOP CLAIMS	PIKES PEAK
O	DL001941	MOUNTAIN VIEW	GEORGETOWN LAKE
O	GR003416	MOUNTAIN VIEW COPPER	HENDERSON MTN
O	GR007772	MUDHOLE	PIKES PEAK
O	GR005665	MULLEN MINE	PHILIPSBURG
X	GR003559	MULONEY BASIN PROSPECT	CARPP RIDGE
X	GR003581	MULONEY MINE	CARPP RIDGE
O	GR003639	MYERS QUARTZ CLAIM	MOOSE LAKE
X	DL001599	MYSTERY	OROFINO MOUNTAIN
O	GR003549	MYSTERY MINE	PHILIPSBURG
O	GR003626	N. FORK-FLINT CREEK	SILVER LAKE
U	JF007777	N462741	BASIN
X	GR007778	NANCY LEE PROSPECT	WHETSTONE RIDGE
O	JF006337	NANNIE BROWN MINE	HOMESTAKE
O	GR007779	NATIONAL TUNGSTEN & SILVER CO	POZEGA LAKES
O	GR005693	NE SEC 7 GIRD CREEK PROS	MAXVILLE
O	GR005645	NEEDLE GUN CLAIM	FRED BURR LAKE
X	GR008171	NELLIE	MAXVILLE
X	JF006341	NELLIE	HOMESTAKE
O	GR003136	NELLIE BARNES	MAXVILLE
U	PO005025	NELSON PROSPECT	SUGARLOAF MOUNTAIN
O	DL007780	NEVADA	OROFINO MOUNTAIN
X	DL007781	NEW HOPE	SILVER LAKE
O	GR003244	NEW HOPE CLAIM	PHILIPSBURG
U	JF002595	NEW MORNING MINE	BOULDER WEST
O	DL001863	NEW YEAR	SILVER LAKE
O	GR007782	NEW YORK	PIKES PEAK
U	SB006468	NEWCOMB	DICKIE PEAK
X	MA006923	NICHOLSON MINE	NOBLE PEAK
U	JF002085	NICKELODEON	BOULDER WEST
O	JF006349	NIKI MINE	ELK PARK PASS
O	GR007787	NILES GULCH PLACER	ALDER GULCH
X	GR000530	NINETEEN HUNDRED MINE	FRED BURR LAKE
S	GR005657	NON PAREIL TAILINGS	MAXVILLE
X	GR008172	NON-PAREIL	MAXVILLE
O	DL001869	NORTH ATLANTIC	SILVER LAKE
S	JF002631	NORTH BOULDER LEAD MINE	THUNDERBOLT CREEK
O	GR003781	NORTH FORK GRANITE CREEK	PIKES PEAK
X	JF008231	NORTH HARRIET	HOMESTAKE
O	JF001019	NORTH LOUISE PROJECT	ELKHORN
S	GR000440	NORTH STAR MILL AND MINE	MAXVILLE
X	GR000542	NORTHERN CROSS MINE	POZEGA LAKES
O	PO007795	NUGGET	PIKES PEAK
X	GR007796	O'BRIEN	WHETSTONE RIDGE
O	JF001955	OGLE PROPERTY	BLACK BUTTE
X	MA003078	OHIO LODE MINE	WATERLOO
X	GR007797	OHIO PROSPECT	WHETSTONE RIDGE
O	DL004854	OKOREAKA MINE	SILVER LAKE
O	DL004824	OLD BONANZA MINE	SILVER LAKE
X	MA007800	OLD CABIN PROSPECT	NOBLE PEAK
X	GR007801	OLD DOMINION MINE	MOOSE LAKE
P	GR007802	OLD DOMINION TAILINGS	MOOSE LAKE
O	GR005721	OLD KENTUCK	PHILIPSBURG
O	DL001923	OLSON GULCH	WEST VALLEY
O	GR000458	OLYMPIC MINE	POZEGA LAKES
O	GR007803	ONE HUNDRED ACRE MEADOW PROSPECT	STORM LAKE
O	DL004864	ONTARIO MINE	GEORGETOWN LAKE
S	GR000626	OPHIR MINE	PIKES PEAK
U	DL001641	OROFINO CREEK PLACER	LOCKHART MEADOWS
O	PO007808	ORPHAN BOY	ROCK CREEK LAKE
O	DL007809	ORPHAN BOY - OROFINO	SILVER LAKE
S	JF007810	OVERLAND CREEK MINE	CHESSMAN RESERVOIR
X	SB001018	OVERLOOK GROUP MINE	PIPESTONE PASS
X	SB007812	OVERLOOK MILL	PIPESTONE PASS
X	SB000994	OZARK	PIPESTONE PASS
X	MA007815	PARK CREEK TAILINGS	MANHEAD MOUNTAIN
O	GR003704	PARNELL GROUP MINE	HENDERSON MTN
O	GR007816	PARNELL MINE	PHILIPSBURG
X	SB006572	PATSY ANN MINE	DICKIE PEAK
O	JF002600	PAUPER'S DREAM	THREE BROTHERS
X	DL004959	PAY DAY PROSPECT	WEST VALLEY
O	JF006353	PAY ROCK MINE	HOMESTAKE
O	DL004719	PAYOFF PROSPECT	SILVER LAKE
X	GR005745	PEACOCK GROUP	HENDERSON MTN
O	GR007819	PEARL	PHILIPSBURG
X	JF007820	PEARL	THREE BROTHERS
X	GR000944	PEARL	DUNKLEBURG CREEK
	JF005201	PEN YAN	MOUNT THOMPSON
	JF001625	PERRY PARKS PLACER	THREE BROTHERS
X	JF006165	PERSERVERENCE	BASIN
X	MA007094	PETE & JOE	OLD BALDY MOUNTAIN
X	GR007821	PETERSON MEADOW PROSPECT	GEORGETOWN LAKE
S	JF001757	PHANTOM	MOUNT THOMPSON
O	GR003106	PHILIPSBURG AREA	PHILIPSBURG
O	GR003746	PHOSPHATE PROSPECT UPPER	POZEGA LAKE
S	JF002853	PIERMONT NO. 1 EAST (NORTH ADA)	BASIN
O	GR000464	PINEAU MINE	PIKES PEAK
O	PO004835	PIONEER GULCH	ROCK CREEK LAKE
O	DL004779	PLACER FIRE CLAY PIT	ANACONDA NORTH
O	DL007823	PLEIDUS	SILVER LAKE
O	JF005087	PLYMOUTH MINE	ELKHORN
U	SB006640	POHNDERF DEPOSIT - GEMS	MOUNT HUMBUG
O	JF002301	POHNDORF AMETHYST	GRACE
O	PO001864	POLLOCK	SUGARLOAF MOUNTAIN
O	GR007824	POLO	PHILIPSBURG
O	DL001893	POMEROY MINE	SILVER LAKE
U	MA003728	PONY VERMICULITE	PONY
U	PO008175	POOR MAN	BAGGS CREEK
U	GR003669	PORCUPINE	SILVER LAKE
P	GR007828	PORT ROYAL	PIKES PEAK
X	GR007829	PORT ROYAL MILL	PIKES PEAK
S	GR007830	PORT ROYAL TAILINGS	PIKES PEAK
X	GR007831	PORTER	FRED BURR LAKE
S	GR000674	POTOSI MINE	PIKES PEAK
O	SB001450	POWDER GULCH	BUXTON
S	GR000698	POWELL MINES	POZEGA LAKES
O	SB006244	PRICE PLACER - RE	BUXTON
X	SB001438	PRICES GULCH	BUXTON
X	DL007835	PRINCESS	LOCKHART MEADOWS
X	GR000446	PRINCETON	MAXVILLE
O	GR002989	PRINCETON GULCH	MAXVILLE
O	GR007837	PRINCETON PLACER	MAXVILLE
O	SB007840	PROSPECTS	MOUNT HUMBUG
O	GR007841	PURITAN	PHILIPSBURG
O	GR000590	PURITAN	FRED BURR LAKE
O	DL004629	PYRITE MINE	SILVER LAKE
X	MA004182	QUARTZ CITY MINE	NOBLE PEAK
X	JF001433	QUARTZ CREEK	THREE BROTHERS
X	GR008181	QUARTZETTE	PIKES PEAK
X	PO008182	QUEEN	PIKES PEAK
X	JF001025	QUEEN ANN CLAIM	ELKHORN
U	GR003754	QUEEN MINE	PIKES PEAK
X	GR000482	RACETRACK CREEK	POZEGA LAKES
S	PO008035	RACETRACK MINE	MOUNT POWELL
X	GR008277	RADAR	FRED BURR LAKE
O	GR003166	RAINBOW PASS OCCURRENCE	STORM LAKE
O	GR007846	RAINBOW PROSPECT	MOOSE LAKE
X	DL007557	RAMBLER	WEST VALLEY
X	DL004979	RAMBLER	WEST VALLEY
U	DL001875	RANDY	WEST VALLEY
X	SB001090	READYCASH	PIPESTONE PASS
S	GR000686	RED LION	FRED BURR LAKE
S	GR007848	RED LION MILL	FRED BURR LAKE
O	JF006573	RED ROCK CREEK	BASIN
O	JF007849	RED ROCK MINE	BASIN
O	DL007850	RED ROSE	SILVER LAKE
X	SB001066	RED WING	PIPESTONE PASS
X	PO007852	REDEEMER	BAGGS CREEK
O	GR005501	REDEMPTION	PHILIPSBURG
X	SB007853	REDFERN	MOUNT HUMBUG
O	DL004884	RELIANCE MINE	SILVER LAKE
U	JF004766	RELIEF	ELKHORN
O	DL001971	REVENUE	SILVER LAKE
O	DL001605	RICH STRIKE	WEST VALLEY
O	DL007857	RICHMOND	SILVER LAKE
O	MA005632	RIDGEWAY MINE	PONY
O	DL004699	RISING STAR	SILVER LAKE
X	GR000734	ROBINSON MINE	SILVER LAKE
X	JF005177	ROCK CREEK CLAIM	SUGARLOAF MOUNTAIN
O	GR003441	ROCK CREEK MINE JIB MILL	PHILIPSBURG
O	GR005669	ROCK CREEK PROPERTY	MAUKEY GULCH
O	GR003791	ROCK CREEK PROSPECTS	PIKES PEAK
O	GR003386	ROCK RABBIT AND SUNBEAM CLAIMS	WARREN PEAK
S	JF007862	ROCKER	MOUNT THOMPSON
S	JF007863	ROCKER EXTENSION	MOUNT THOMPSON
X	PO008037	ROCKER GULCH MINE	SUGARLOAF MOUNTAIN
X	GR000632	ROMBAUER CLAIMS	PIKES PEAK
O	JF001619	ROSE MINE	MOUNT THOMPSON
S	GR007866	ROYAL GOLD MILL	PIKES PEAK
X	GR000608	ROYAL METALS TUNNEL	FRED BURR LAKE
X	JF004996	RUBY	SHEEPSHEAD MOUNTAIN
X	DL004659	RUBY MINE	LOCKHART MEADOWS
O	GR007867	RUMSEY MILL	PHILIPSBURG
O	GR003309	RUSSEL	HENDERSON MOUNTAIN
O	JF001751	RUTH	MOUNT THOMPSON
X	PO005335	RYAN MINE	PIKES PEAK
X	MA003580	S. BOULDER RIVER PLACERS	MANHEAD MOUNTAIN
O	GR007870	S. CLIPPER	KELLY LAKE
O	GR007871	S. FK ROCK CREEK PLACER	WHETSTONE RIDGE
O	GR007872	S. FRANK HILL	PHILIPSBURG
O	PO002332	SABBATH	BAGGS CREEK
U	DL005014	SAGER-MURPHY	WEST VALLEY
X	GR007873	SALLIE MELLEN	HENDERSON MOUNTAIN
X	GR003644	SALLY ELLEN	PIKES PEAK
O	GR000326	SALMON MINE	PHILIPSBURG
O	GR007875	SAMUEL	DUNKLEBURG CREEK
O	GR007876	SAMUEL LODE	DUNKLEBURG CREEK
O	GR005473	SAN FRANCISCO	PHILIPSBURG
X	GR005621	SARANAC	MAXVILLE
X	JF005341	SARATOGA	THUNDERBOLT CREEK
X	JF004991	SATURDAY NIGHT	BASIN
O	GR005517	SAUNDERS	PHILIPSBURG
O	GR007880	SAWPIT GULCH PLACER	ALDER GULCH
U	SB007881	SCENIC	PIPESTONE PASS
O	PO002696	SCHERMERHORN GULCH PLACER	ROCK CREEK LAKE
O	PO002864	SCHRAMM MINE	ROCK CREEK LAKE
O	GR005729	SCRATCH ALL MINE	PHILIPSBURG
O	GR007884	SE SECTION 5	MAXVILLE
X	JF007885	SEATTLE	MOUNT THOMPSON
X	JF007886	SEC 36 SHAFT	DELMOE LAKE

S - Sampled; P - Possible impact but private land; X - Visited but no effect; O - Screened in office; U - Unable to locate

Code	ID	Name	Quadrangle
[illegible]	GR003599	SECOND CHANCE ORE	MAXVILLE
[illegible]	DL007887	SECTION 18 PROSPECT	OROFINO MOUNTAIN
[illegible]	DL007888	SECTION 8 SHAFT	LOCKHART MEADOWS
S	GR005753	SENATE MINE	KELLY LAKE
O	GR003066	SEPTEMBER SNOW	PIKES PEAK
X	JF006513	SHAMROCK	THUNDERBOLT CREEK
X	GR003134	SHAMROCK	PIKES PEAK
O	GR000554	SHAPLEIGH SHAFT	PHILIPSBURG
O	DL004679	SHEILA PROSPECT	SILVER LAKE
X	GR007892	SHORT STUFF	STORM LAKE
O	GR003566	SHOULETOWN	PHILIPSBURG
O	MA007893	SILICA BUTTE	TABLE MOUNTAIN
U	JF005061	SILVER BELL	RATIO MOUNTAIN
X	DL004649	SILVER CHAIN MINE	WEST VALLEY
O	GR000572	SILVER CHIEF	PHILIPSBURG
S	SB001396	SILVER GLANCE MINE	MOUNT HUMBUG
X	DL001977	SILVER HEART	SILVER LAKE
O	DL001515	SILVER HILL MINE	SILVER LAKE
X	GR000920	SILVER KING	WEST VALLEY
O	SB001216	SILVER KING PLACER	PIPESTONE PASS
X	GR007898	SILVER PROSPECT	WEST VALLEY
O	JF002901	SILVER QUEEN	DELMOE LAKE
X	DL004919	SILVER QUEEN MINE	WEST VALLEY
O	DL004819	SILVER REEF MINE	SILVER LAKE
O	GR005661	SILVER SPIKE	PHILIPSBURG
U	JF001691	SILVERSMITH	BISON CANYON
S	JF005066	SIRIUS	MOUNT THOMPSON
X	JF002421	SIXTEEN TO ONE	DELMOE LAKE
X	GR000650	SIXTEEN TO ONE CLAIM	PIKES PEAK
S	JF005096	SKYLINE	ELKHORN
X	JF008216	SMELTER CREEK ADIT	BASIN
O	DL004969	SMITH PROSPECT	WEST VALLEY
S	PO007902	SNOW BUNNY	PIKES PEAK
X	GR005769	SNOW CAP MINE	MAXVILLE
O	DL004654	SNOW WHITE QUARRY	ANACONDA NORTH
S	MA006902	SNYDER'S MINE	NOBLE PEAK
X	JF005016	SOLAR	THREE BROTHERS
U	DL001563	SOLEDADA & IRON CROWN CLAIMS	WEST VALLEY
X	GR007904	SOUTH BOULDER MILL	MAXVILLE
O	JF007905	SOUTH FORK STATE CREEK MINE	RATIO MOUNTAIN
S	JF008009	SOUTH MANTLE MINE	MOUNT THOMPSON
X	JF007906	SOUTH SILVERSMITH	BISON CANYON
X	JF007907	SOUTH SUICIDE CABIN MINE	DELMOE LAKE
O	DL004994	SOUTHERN CROSS MINE	SILVER LAKE
X	JF006481	SPARKLING WATER	BASIN
X	JF007909	SPORT LODE	ELKHORN
O	DL007910	SPRING HILL	SILVER LAKE
	JF001577	SPRINGTIME	BOULDER WEST
	PO002474	SQUARE GULCH PIT	ROCK CREEK LAKE
	PO007911	ST MARY'S	BAGGS CREEK
X	JF001703	ST. ANTHONY	RATIO MOUNTAIN
X	JF006445	ST. LAWRENCE	BASIN
X	JF006505	ST. NICK	BASIN
X	GR000524	ST. THOMAS MINE	FRED BURR LAKE
O	GR007913	STAR POINT	PHILIPSBURG
S	GR007914	STARLIGHT	PIKES PEAK
X	GR008179	STATE	FRED BURR LAKE
X	JF001697	STATE	RATIO MOUNTAIN
O	GR003359	STEPHENS PLACER	MAUKEY GULCH
X	PO002290	STERRETT	BAGGS CREEK
X	JF001037	STEVE CLAIM	ELKHORN
O	DL001569	STORM LAKE DEPOSITS	STORM LAKE
O	GR003529	STORM LAKE TUNGSTEN	STORM LAKE
X	DL007919	STORMWAY	WEST VALLEY
O	GR003409	STRAW HAT	WEST VALLEY
O	MA007920	STRAWN MILL	WATERLOO
O	MA007010	STRAWN MINE	WATERLOO
O	GR007921	STRIP MINE	PHILIPSBURG
O	DL001773	STUCKEY RIDGE	ANACONDA NORTH
X	DL007923	STUMPTOWN SMELTER / STUMP TOWN	WEST VALLEY
X	JF007924	SUICIDE CABIN MINE	DELMOE LAKE
X	MA003375	SULTANA	NOBLE PEAK
U	JF004856	SUMMIT MINE	THUNDERBOLT CREEK
O	GR003099	SUMMIT MINE	DUNKLEBURG CREEK
X	DL001575	SUMMIT PLACER	ANACONDA
O	GR007926	SUN MINE	DUNKLEBURG CREEK
S	GR007927	SUNDAY	PIKES PEAK
X	GR000902	SUNDAY EXTENSION MINE	PIKES PEAK
O	GR003689	SUNDAY MINE	PIKES PEAK
S	GR007929	SUNLIGHT/COPPER QUEEN MINE	PIKES PEAK
X	GR003429	SUNRISE MINE	HENDERSON MTN
O	SB001108	SUNSET	MOUNT HUMBUG
	GR003299	SUNSET MINE	DUNKLEBURG CREEK
X	GR003654	SUNSET PLACER	MAXVILLE
X	DL004709	SUNSHINE MINE	STORM LAKE
X	GR007931	SWAMP GULCH AMAGALMATION MILL	MAXVILLE
O	GR003646	SWAMP GULCH PROSPECTS	FRED BURR LAKE
O	GR003614	SWEET HOME MINE	PHILIPSBURG
O	JF005231	SWISSMONT	ELKHORN
X	JF006501	SYLVAN	BASIN
X	GR007933	T MCKAY/HOBO	PHILIPSBURG
O	GR003576	T.M.T.	WHETSTONE RIDGE
O	JF004896	TACOMA	TACOMA PARK
X	GR000962	TAMARACK LAKE	CARPP RIDGE
	SB001048	TEMPLEMAN	PIPESTONE PASS
	GR003601	THOMPSON LAKE PROSPECT	PIKES PEAK
	SB004928	THOMPSON PARK	HOMESTAKE
	GR000602	THREE METALS TUNNEL	FRED BURR LAKE
O	JF005207	THUNDERBOLT MOUNTAIN PROSPECT	THUNDERBOLT MTN
X	GR003521	THURSDAY-FRIDAY MINE	PIKES PEAK
O	PO007937	TIBBETTS	PIKES PEAK
X	PO005405	TIBBETTS MINE	PIKES PEAK
X	GR000854	TIM THIRD CHANCE	STORM LAKE
X	DL004944	TIP TOP	SILVER LAKE
O	GR003571	TITANIUM PLACERS	MOUNT EMERINE
O	GR007940	TODD PROSPECT	WHETSTONE RIDGE
O	JF001721	TOLL MOUNTAIN	PIPESTONE PASS
X	JF007941	TOLL MTN LODE-WAR EAGLE-LEROY	PIPESTONE PASS
O	DL004694	TOMMY PROSPECT	SILVER LAKE
O	JF005236	TOURMALINE QUEEN MINE	ELKHORN
O	GR005741	TOWNSEND PLACER	WHETSTONE RIDGE
X	GR007944	TOWNSEND PROSPECT	WHETSTONE RIDGE
X	GR003269	TRAVONIA CLAIM	MAXVILLE
O	JF002319	TREVILLION - JOHNSON	GRACE
O	DL001857	TRIGGER MILL	SILVER LAKE
X	DL004669	TRIGGER MINE	SILVER LAKE
O	DL007946	TRILBY CHAMPAIGN	SILVER LAKE
O	GR003459	TROUT	PHILIPSBURG
O	GR007948	TRUE	PHILIPSBURG
O	SB001168	TUCKER CREEK	MOUNT HUMBUG
O	GR003514	TUNGSTEN MINES	POZEGA LAKES
X	GR007949	TUSCARORA PROSPECT	WHETSTONE RIDGE
X	GR000662	TUSSLE MINE	PIKES PEAK
O	GR003364	TWILGHT CYANIDE PLANT	GEORGETOWN LAKE
O	DL005024	TWILIGHT MINE	SILVER LAKE
U	GR003381	TWILIGHT NO 1	STORM LAKE
O	GR003574	TWIN PEAKS PROSPECT	FRED BURR LAKE
O	GR005477	TWO PERCENT	PHILIPSBURG
X	JF001943	TWO-Y	RATIO MOUNTAIN
S	JF005076	UNCLE SAM	BASIN
X	JF005396	UNION	ELKHORN
X	JF007952	UNKNOWN	DRY MOUNTAIN
X	JF007953	UNKNOWN LOWLAND	SHEEPSHEAD MOUNTAIN
O	MA007954	UNKNOWN MILL CREEK MINE	MANHEAD MOUNTAIN
U	PO005305	UNNAMED	BAGGS CREEK
O	MA007979	UNNAMED	PONY
O	JF007955	UNNAMED	ELK PARK PASS
O	SB007962	UNNAMED	MOUNT HUMBUG
S	JF007957	UNNAMED #1	MOUNT THOMPSON
S	JF007959	UNNAMED #2	MOUNT THOMPSON
S	JF007958	UNNAMED #3	MOUNT THOMPSON
S	JF007956	UNNAMED #4	MOUNT THOMPSON
X	MA008151	UNNAMED 492	WHITEHALL
O	DL007964	UNNAMED AU & AG	SILVER LAKE
X	JF007965	UNNAMED AU & CU	WHITETAIL PEAK
X	MA007951	UNNAMED BEAR GULCH ADIT CLUSTER	OLD BALDY
O	MA006032	UNNAMED DEPOSIT	PONY
O	MA006072	UNNAMED DEPOSIT	PONY
U	JF006725	UNNAMED FIRE CLAY	BASIN
O	GR000974	UNNAMED GEMSTONE DEPOSIT	CARPP RIDGE
O	DL001653	UNNAMED GOLD	GEORGETOWN LAKE
U	DL001683	UNNAMED GOLD	SILVER LAKE
O	JF006745	UNNAMED GOLD & SILVER	RATIO MOUNTAIN
O	GR007968	UNNAMED LEAD	DUNKLEBURG CREEK
U	JF006689	UNNAMED LEAD & COPPER	RATIO MOUNTAIN
O	MA008269	UNNAMED LOCATION	PONY
O	SB001354	UNNAMED LOCATION	BUXTON
O	MA003118	UNNAMED MINE	MANHEAD MOUNTAIN
O	MA003108	UNNAMED MINE	WHITEHALL
O	DL001701	UNNAMED MINERALS	OROFINO MOUNTAIN
X	GR008258	UNNAMED OPEN SHAFT	MAXVILLE
X	MA007969	UNNAMED PHOSPHATE AREA	PONY
O	JF006705	UNNAMED PHOSPHATES	TACOMA PARK
O	GR000812	UNNAMED PHOSPHORUS DEPOSIT	MAXVILLE
O	JF001571	UNNAMED PLACER	THREE BROTHERS
O	JF001565	UNNAMED PLACER	THREE BROTHERS
O	GR007972	UNNAMED PROSPECT	WHETSTONE RIDGE
U	MA007973	UNNAMED PROSPECT	WATERLOO
O	DL005019	UNNAMED PROSPECTS	SILVER LAKE
O	PO005250	UNNAMED PUMICE	SUGARLOAF MOUNTAIN
O	PO007974	UNNAMED PUMICE	ROCK CREEK LAKE
U	GR000794	UNNAMED PUMICE	HARVEY POINT
X	GR007976	UNNAMED PUMICE DEPOSITS	ANTELOPE CREEK
U	JF006721	UNNAMED QUARTZ	RATIO MOUNTAIN
U	SB006564	UNNAMED RE	BUXTON
O	JF007978	UNNAMED SMOKEY QUARTZ PROSPECT	RATIO MOUNTAIN
O	JF006749	UNNAMED URANIUM	BISON CANYON
O	JF006717	UNNAMED URANIUM	THREE BROTHERS
S	JF007980	UPPER BUCKEYE MILL TAILINGS	THREE BROTHERS
S	JF008217	UPPER BULLION MILL TAILINGS	BASIN
U	GR003611	UPPER GRANITE PROSPECT	PIKES PEAK
X	GR007981	UPPER MOUNTAIN LION	PIKES PEAK
X	MA007982	UPPER WHITE CHIEF PROSPECT	NOBLE PEAK
O	GR003149	UPPER WILLOW CREEK PLACER	BLACK PINE RIDGE
X	GR000716	VALLEJO	SILVER LAKE
X	PO007983	VALLEY VIEW	MOUNT POWELL
X	SB001378	VAN DORSTEN	MOUNT HUMBUG
O	JF001679	VENUS MINE	THREE BROTHERS
S	JF002877	VERA & MARIE MINE	MOUNT THOMPSON
X	MA003558	VIKING MINE	PONY
S	JF006597	VINDICATOR	BASIN
X	PO002546	WAKE UP JIM	BAGGS CREEK
X	JF005261	WAR EAGLE & LEROY MINES	PIPESTONE PASS
O	DL004984	WAR EAGLE MINE	GEORGETOWN LAKE
O	GR000434	WARREN PEAK PROPERTY	WARREN PEAK
X	GR003179	WASA MINE	PIKES PEAK
X	JF007991	WATER GULCH PROSPECT	BOULDER WEST
O	JF002331	WELCH QUARRY	DELMOE LAKE
X	GR007992	WELCOME HILL	SILVER LAKE
X	GR000914	WELCOME LODE	SILVER LAKE
O	GR005677	WEST EXP. MN PROS & LAMONT	FRED BURR LAKE
X	JF007994	WEST GALENA GULCH	BOULDER WEST
O	GR000896	WEST GRANITE SHAFT	PHILIPSBURG
X	DL007995	WEST STORMWAY	WEST VALLEY
U	JF001979	WESTERN HOPE	BOULDER WEST
O	GR005513	WHITE HORSE	PHILIPSBURG
U	SB001271	WHITE SWAN MINE	LOCKHART MEADOWS
X	JF007997	WHITETAIL PARK VEIN	WHITETAIL PEAK

S - Sampled; P - Possible impact but private land; X - Visited but no effect; O - Screened in office; U - Unable to locate

Code	ID	Name	Quadrangle	Code	ID	Name	Quadrangle
O	GR005673	WIGHT MN MINE	MAXVILLE				
[illegible]	SB001366	WILDCAT	MOUNT HUMBUG				
U	JF001931	WILLIAM BARTH CLAIMS	WHITETAIL PEAK				
X	JF006545	WILSON CREEK PLACER	BOULDER WEST				
S	JF006457	WINTER'S CAMP	BASIN				
U	GR003264	WJ BRYAN	MAXVILLE				
U	JF001541	WOODVILLE DEPOSIT	ELK PARK PASS				
X	DL001593	YELLOW JACKET MINE	OROFINO MOUNTAIN				
U	GR000536	YELLOW METAL MINE	FRED BURR LAKE				
O	GR003764	YOUNG AMERICAN	PHILIPSBURG				
O	GR008003	ZEUS	PHILIPSBURG				

S - Sampled; P - Possible impact but private land; X - Visited but no effect; O - Screened in office; U - I

Appendix III

Mine and Mill Sites visited
in the Upper Clark Fork Drainage
Which Had No Impacts or Did Not Affect
DNF-Administered Land

Amazon

Five caved adits with 450 feet of total workings (Earll, 1972) explore a northwest-trending zone 1000 feet long containing narrow quartz-pyrite veins. Although both equigranular hornblende quartz diorite of the Racetrack Pluton and porphyritic granodiorite of the Mount Powell Batholith are present on the dumps, the Mount Powell Batholith appears to host the mineralization. The wallrock contains sericite, kaolinite, and pyrite alteration products. A select sample of the vein ran 1.263 oz/ton Au, .85 oz/ton Ag, .056% Cu, .020% Pb, and .053% Zn. Production figures for 1902-1939 are 4795 tons of ore producing 3550 oz of gold, 370 oz of silver, and 95 lbs of copper (McClernan, 1976). Location: T6N R11W section 18 AAAB.

Banker

Two dry open adits with several hundred feet of workings follow at least two north-trending veins containing quartz, pyrite, and chalcopyrite. Silver was the prospective commodity. Williams (1951) reported fluorite and black hematite in the vein. Location: T5N R8W section 5 AACD.

Big Major (New Bald Eagle, Summit)

The Big Major is marked by numerous prospect pits and a caved dry shaft with several hundred feet of workings. A near vertical vein strikes N65°E and is composed of blue-gray, fine-grained quartz and up to 50% pyrite and arsenopyrite. Location: T9N R12W section 22 CCAC.

Black Chief Iron (Morgan Evans)

Three caved adits are present at the contact between Cambrian Hasmark limestone and biotite granite. They apparently sought magnetite replacement zones (DeMunck, 1956). Location: T5N R12W section 16 DCDB.

Blue Bottle

Here, a N69°W 85°NE fissure zone that cuts Jefferson Dolomite near its contact with granodiorite contains disseminated scheelite (Walker, 1969). Workings consist of two short open shafts. Location: T5N R12W section 2 BACB.

Clay Charlie (Mike Hannon)

A N40°W near vertical limestone breccia zone one to three feet wide is present at the Clay Charlie. Workings consist of one open adit, one open shaft, and three short caved adits, and total about 500 feet (Earll, 1972). Location: T5N R12W section 6 BABB.

Cottonwood

The Cottonwood consists of one caved shaft, one caved adit, and one open decline, with less than 100 feet of total workings. They apparently tested a N55°E striking vein of quartz and iron oxide in granite of the Boulder Batholith. Dumps are mostly unaltered and vegetated. Location: T6N R8W section 32 DDAB.

Danielsville Mill

Apparently a Huntington mill was installed at the Danielville townsite in 1905, but treated little if any ore (Earll, 1972). Foundations remain at the site, but no tailings are present. The mill was probably built to treat ore from the Amazon Mine to the south. Location: T6N R11W section 8 BBCB.

Dark Horse

Several short, dry, caved adits explore replacement lenses in metamorphosed Cambrian Hasmark limestone that are parallel to or in contact with quartz diorite of the Mount Powell Batholith (Earll, 1972). One hundred twenty seven tons of oxidized ore containing quartz, limonite, and manganese oxide were produced between 1934 and 1939 and yielded 90 oz of gold, 70 oz of silver, and 75 lbs of copper (McClernan, 1976). Location: T6N R11W section 4 CBCB.

Dead Cow

A short gated adit trends N27°E. Only iron-stained granite of the Boulder Batholith and tuff of the Elkhorn Mountains Volcanics are present on the dump; a composite sample ran .008 oz/ton gold, .14 oz/ton silver, .008% copper, .01% lead, .036% zinc, and .04% arsenic. Location: T5N R8W section 6 CAAA.

Dougherty Mill

A small amalgamation mill (Emmons and Calkins, 1913) was constructed to treat ore from the Robinson Mine. Although a small pile of ore remains at the millsite, no tailings are present. Location: T6N R13W section 26 BDAA.

Golden Jubilee

The Golden Jubilee has operated recently under a permit from the Montana Department of State Lands, so environmental problems were not examined closely by this study. The site contains an open pit with standing water and two open adits.

A N56°E vertical shear zone up to 20 feet wide was apparently mined in Cambrian Hasmark Dolomite. The vein trend is approximately parallel with that of the nearby Red Lion area. The ore consists of fine-grained quartz and pyrite. A select sample from the "stockpile" carried .404 oz/ton gold, .20 oz/ton silver, .050% copper, .005% lead, and .016% zinc, but the ore actually shipped contained 8-10 oz/ton in gold (R. McCulloch, oral communication). It apparently existed only in small pockets. Location: T6N R13W section 14 CCAB.

Greater New York

This property was well described by Emmons and Calkins (1913). At the site, a 52° inclined shaft 100 feet deep followed a NW-striking, SE-dipping fault zone that placed Hasmark Limestone adjacent to Silver Hill Shale. The zone is 20 feet wide and contains quartz, pyrite, limonite, and magnetite in a clay gouge.

The site has been disturbed by bulldozer work, and the only working evident today is an open adit in barren marble. Location: T6N R13W section 12 DDAC.

Hidden Lake Mine

A caved adit and a caved shaft associated with 2100 feet of workings (Elliott and others, 1992) spread over a vertical distance of 400-500 feet mark the site of the Hidden Lake Mine. A sheeted zone striking N47°E, dipping steeply, and containing quartz and pyrite was mined (Earll, 1972). A klippe of Mount Shields Quartzite that was thrust over Paleozoic sedimentary rocks hosts the deposit. The thrust may have had a part in localizing the distribution of ore not only at the Hidden Lake Mine, but across the entire Red Lion district.

Between 1933 and 1942, 100,000 tons of ore with an average gold content of 0.2 oz/ton was produced. The soft, partially oxidized vein material made milling and extraction easy, but with depth, the ore became harder and operations became less efficient, contributing to the closure of the mine. The potential for remaining ore and the distribution of gold showings over a wide area surrounding the mine have interested several exploration companies in the past decade. Numerous drill holes were completed, but no results have been released. Location: T6N R13W section 35 BCBD.

Horseshoe Bend

One caved adit a few hundred feet long and several prospect pits examine a zone of earthy gossan in Mount Shields Quartzite. Presumably, the miners were seeking an extension of the Hidden Lake gold mineralization in a similar geologic setting, but a sample of the "ore" carried only .006 oz/ton gold, .14 oz/ton silver, .004% copper, .008% lead, and .010% zinc. Location: T5N R13W section 3 ABDB.

HLM

This was a tungsten prospect as described by Walker (1960) and contained two adits and a winze. Scheelite and quartz are present in a N60°W 60°-80°NW structure that is discordant with the enclosing Hasmark Formation, which has been recrystallized to a white marble. Samples over a four foot width varied from .01 to 1.56% in their WO_3 content. An underground map shows 200 feet of total workings present, but everything has been covered by talus. Location: T5N R13W section 34 BCCB.

Hughes

A caved adit less than 50 feet long explores weakly iron stained Kootenai sediments with some breccia zones conformable to bedding (N70°W 46°NE). Mineralization is presumably the result of contact metamorphism by the nearby Royal Stock. Exploration drilling was being conducted in this area of extensive glacial cover in 1992. Location: T8N R12W section 15 ABDC.

Lark

Several prospect pits in Mount Shields(?) Quartzite explore several parallel N5°W vertical quartzite-iron oxide breccia zones. They are up to ten feet wide. A select sample of this material ran .028 oz/ton Au, .16 oz/ton Ag, .007% Cu, .013% lead, and .008% zinc, showing that anomalous gold values possibly associated with the Hidden Lake system extend to the northern edge of the Belt klippe. Location: T6N R12W section 8 ADDC.

Lucky Blue

Two short caved adits in Cambrian carbonate rocks explore a thin zone of iron-stained quartz. Attitude is unknown. Location: T5N R12W section 18 BCAD.

Modoc

The Modoc explores a small skarn at the contact between limestone and a granite outlier of the Philipsburg Batholith (Emmons and Calkins, 1913). The granite endoskarn was of interest here, and contains calcite, pyrite, chalcopyrite, and bornite in a zone 30-75 feet wide and trending N40°E. An open adit driven a few hundred feet on the contact discharges a small volume of water. The dump is mostly altered granite. Location: T6N R13W section 13 ABCA.

Monarch

The Monarch is located on the nose of the Dunkleberg Anticline where the axial trace changes direction. An underground map (Popoff, 1953) shows approximately 400 feet of workings. An irregular replacement zone in Kootenai limestone from several inches to five feet thick and containing pyrite, sphalerite, and galena was mined. The adit is now caved and the dump is overgrown with vegetation. Location: T9N R12W section 27 ABCB.

Montana

A one to two foot wide quartzite breccia cemented by quartz, pyrite, and free gold was mined from a 100 foot shaft (Emmons and Calkins, 1913). The zone has a N69°W 70°NE orientation, and is in Mount Shields Formation. Workings are dry and caved, with one open stope. Location: T6N R13W section 23 ACDA.

Morning Star

A prospect pit investigates quartz breccia and gossan at a contact between Paleozoic quartzite and marble. Outcrops of the Royal Stock are present nearby. A select sample of the mineralized material contained low metal values of .002 oz/ton gold, .07 oz/ton silver, .11% copper, .009% lead, and .014% zinc. Location: T8N R12W section 15 CCBA.

New Year

The New Year is well-described in the literature, and the following information has been compiled from Emmons and Calkins (1913), Walker (1960), and Earll (1972). The mine first operated from 1895 until 1905, producing several thousand dollars worth of ore from a replacement zone in Hasmark Dolomite containing quartz, galena, chalcopyrite, scheelite, calcite, and tetrahedrite. This zone is one to ten feet thick, concordant to bedding, and has a N40°-60°E 50-60°NE attitude. There are exposures of biotite granite within ½-mile. Underground mine maps (Walker, 1960) show about 600 feet of workings including a 180 foot inclined shaft. From 1953 until 1955, scheelite was mined and 7650 "units" (Walker, 1960) of WO_3 were produced from surface workings. Workings remain open at present, but are fenced. Location: T5N R12W section 6 CDDD.

Northern Cross

The Northern Cross presumably prospected a fault zone which places Belt quartzite against Paleozoic carbonate rocks. This may be part of the Hidden Lake thrust, although Emmons and Calkins (1913) described it as a steeply east dipping fault carrying quartz, pyrite, and several dollars in gold to the ton. The Northern Cross workings are comprised of a caved shaft and two caved adits on the east side of the fault in iron and copper stained, brecciated, Paleozoic limestone. The site may have been explored for its copper content; a select sample contained <.006 oz/ton gold, .12 oz/ton silver, 3.02% copper, .005% lead, and .021% zinc. Recent drilling has been performed as part of a Hidden Lake gold exploration project. Location: T6N R12W section 9 CBBC.

Pay Day-Big Bear

The Pay Day is a tungsten prospect discovered in 1954. Short workings, consisting of a caved shaft, an open adit, and a series of prospect pits, inspect a tactite developed in faulted Hasmark Dolomite where a one to seven foot wide, concordant N68°E 25°NW zone of quartz, clinozoisite, actinolite, epidote, and scheelite crystals up to one inch, is exposed. A bulk sample of the ore contained 1.5% WO_3 (Walker, 1960). Location: T5N R12W section 2 CABB.

Robinson

An 80 foot decline and an adit supposedly followed a N40°W 60°SW quartz-pyrite-gold vein in Mount Shields Quartzite (Emmons and Calkins, 1913; Earll, 1972). All workings are caved and dry today. Location: T6N R13W section 26 BDDA.

Ryan-Lois

Numerous caved adits (at the Ryan) and surface disturbances (at the Lois) follow the contact of the Royal Stock with sedimentary rocks. Igneous rock does not appear to be mineralized, and Elliott and others (1992) suggested that mineralization is localized by quartzites of the Jurassic Ellis Formation. The metamorphosed sedimentary rocks consist of muscovite phyllite, biotite hornfels, and marble containing skarn minerals. Quartzite and siltite host veinlets of quartz, chalcopyrite, and secondary chalcocite can be found. A sample of vein material ran only .032 oz/ton gold, 2.54 oz/ton silver, .75% copper, .87% lead, and .147% zinc, but values in contact deposits such as this tend to be variable and unpredictable. Location (Ryan): T8N R11W section 18 BAAC; (Lois): T8N R11W section 18 BBBD.

Sally Ellen

A caved adit less than 100 feet long is collared in Cretaceous Kootenai sandstone, and there is black shale on the dump. No metallic minerals are present, but quartzite from a shallow pit below contains a few pyrite blebs. Montana Bureau of Mines and Geology files (unpublished) indicate that gold-silver-lead-zinc ore was sought here. Location: T8N R12W section 16 AACB.

<u>Section 18 Prospect</u>

A few prospect pits are present on a narrow N65°E zone of brecciated black quartz. Location: T5N R8W section 18 DBCA.

<u>Silver Heart</u>

Two caved adits, one caved shaft, and an open stope are present in a zone of quartz-iron oxide cemented dolomite breccia. The zone appears to be controlled by a N25°E 65°NW trending shear zone in Hasmark Formation. A select sample of the breccia contained .004 oz/ton gold, 3.81 oz/ton silver, .036% copper, .046% lead, and .025% zinc. Location: T5N R13W section 27 BDAC.

<u>Silver King</u>

Two open adits, two caved adits, a caved shaft, an open stope test a N42°E 65°SE zone of quartz, galena, chalcedony, and malachite through 500-1000 feet of workings. Emmons and Calkins (1913) also reported tetrahedrite and a "sooty black sulfide". A select sample of vein material contained .008 oz/ton gold, 4.49 oz/ton silver, .015% copper, .95% lead, and .391% zinc; the likely commodity was silver. Host is Cambrian Hasmark Dolomite. Location: T6N R12W section 36 ABCB.

<u>Silver Moss (Hansen-Meloy)</u>

Heavy vegetation and caved workings cause difficulty in understanding the geology of this property, but Emmons and Calkins (1913). They stated that the ore occurred in irregular bunches in a poorly-defined southeast-striking shear zone and along bedding planes in the Hasmark dolomite. Walker (1960) noted some scheelite in float. Location: T5N R13W section 27 BCBA.

<u>Silver Queen</u>

According to Emmons and Calkins (1913), a bedding-parallel sheeted zone 20 inches wide of crushed limestone, quartz, and iron oxides was mined at the Silver Queen. Earll's (1972) mine map shows veins occurring over a 75 foot width. He also described the occurrence of small masses of igneous rock related to the Lost Creek Stock within the mine workings. A tramway transported ore to a mill in the canyon bottom, but no tailings exist. Earll estimated 200 tons of ore were mined.

The deposit is hosted by overturned beds of thin-bedded dolomite, limestone, and siltstone of the Proterozoic Helena Formation with a N34°E 57°SE orientation. The iron-stained rocks crop out on a steep hillside over a 30 by 300 foot area. There are three caved adits and two open adits present. A select sample of vein material contained only .052 oz/ton gold, .74 oz/ton silver, .147% copper, .027% lead, and 1.14% zinc. Location: T5N R11W section 5 BCBD.

<u>Stormway-West Stormway (Morgan-Evans)</u>

Four caved adits (Earll, 1972) with a total length of about 600 feet follow a N73°W 80°NE vein three feet wide that contains quartz, pyrite, chalcopyrite, and bornite (Emmons and Calkins, 1913). Host rock is Tertiary gabbro laced with quartz-calcite veinlets. Location: T5N R12W section 9 DADC.

St. Thomas-Nineteen Hundred

Both the St. Thomas and adjoining Nineteen Hundred mined a narrow N79°E 47°SE sheeted zone which cuts bedding in the host, Mount Shields Quartzite, and both supposedly produced several thousand dollars in gold (Emmons and Calkins, 1913). Earll (1972) observed and sampled a narrow quartz-limonite vein, which contained about 1 oz/ton gold. The lowermost, longest adit apparently contains no mineralization. The short upper workings produced all of the ore. Location: T6N R12W section 18 DCBC.

Sunset

Three short caved adits in a Cretaceous diorite sill and Colorado Group limestone and shale mark the Sunset. Apparently, a N75°E 45°NW veinlet with quartz, galena, chalcopyrite, and abundant oxidation products contained 30-40 oz/ton Ag (Pardee, 1917). At the easternmost adit, seeps emerge from the base of the dump, which consists of mostly unaltered limestone, siltstone, and shale and is vegetated. Location: T9N R12W section 15 DADC.

Tibbetts (Poker Chip)

Two open adits (one with a locked gate), each 100-200 feet long, investigate spotty, discontinuous contact mineralization in quartzite, limestone, and siltstone of the Cretaceous Kootenai Formation near its contact with the Royal Stock. Mineralization which includes calcite, siderite, malachite, iron oxides, chlorite, sericite, clays, minor quartz, and epidote is contained within brecciated and sheared sedimentary rocks in a zone 100-200 feet thick and extending laterally away from the contact for an unknown distance. According to Elliott and others (1992), the Tibbetts was a small producer of gold, silver, and copper. A sample of breccia contained only .003 oz/ton gold, .20 oz/ton silver, .006% copper, .008% lead, and .007% zinc. Location: T8N R11W section 7 DDDD.

Trigger

The Trigger was worked strictly as a tungsten mine, and produced 4000 tons of ore averaging 1% WO_3 in the early 1950's (Walker, 1960). Scheelite occurs along shears, fractures, and along bedding planes in replacement lenses and pipes. It appears that most ore was stoped from a lens with a N25°E 33°NW orientation, sub-parallel to bedding, and that this zone was 400 feet long and 2.5 feet thick. It pinches out up dip. An underground map (Walker, 1960) shows about 300 feet of workings, accessed from two adits. Host rock is Jefferson formation which has been metamorphosed to a white crystalline marble. Three adits and an open stope are either locked or fenced off today. Location: T5N R13W section 28 ACBD.

Valley View

Dry, shallow surface workings mined vein and replacement deposits of silver, gold, and copper in Mississippian Mission Canyon Formation (Elliott and others, 1992). Earll (1972) took a sample here which contained trace amounts of gold, silver, and tungsten (scheelite). Location: T6N R11W section 4 DBDB.

Welcome Hill

This remote site apparently produced several thousand dollars worth of ore from a 500 foot tunnel (Emmons and Calkins, 1913). Pieces of the vein on the dump contained vuggy quartz, calcite after aragonite, galena, sphalerite and tetrahedrite. The vein appears strike N32°W 72°SW, cross-cutting bedding of the surrounding Jefferson dolomite, and is about 10 feet wide. A select sample ran .002 oz/ton gold, 26.20 oz/ton silver, .063% copper, 8.74% lead, and 21.00% zinc. Location: T6N R12W section 31 ADCD.

Yellow Metal

Apparently, a sheeted zone in Mount Shields Quartzite contains quartz, pyrite, and free gold (Emmons and Calkins, 1913). It is oriented N88°E with a south dip. There are 500 feet of drifts and crosscuts, accessible through two adits. This mine could not be located. Location: T6N R12W section 18 CCAA.

Appendix IV

Water-Quality and Soil Chemistry Data
Upper Clark Fork Drainage

Appendix IV. Analytical results and exceedences of water analyses.

[UG/L=micrograms/liter; MG/L=milligrams/liter; <=below method detection limit; P=primary dring water standard exceeded; S= secondary drinking water standard exceeded; A=acute aquatic standard exceeded; C= chronic aquatic standard exceeded; SC= specific conductance in micromhos/centimeter; Temp = temperature in degrees Celcius]

	BOTTLE NO	GWIC QW NO	Sample Date	Al UG/L	As UG/L	Ba UG/L	Cd UG/L	Cr UG/L	Cu UG/L	Fe MG/L
Argo mine and mill	HARS10L	94Q0624	23 SEP 1993	<30.	<1.	73.6	<2.	<2	<2.	0.031
Champion mine and mill	DCHS10M	92Q0819		<50.	<1.	20	<2.	<2.	<2.	
Clear Grit (Lost One) mine	PCGG10M	94Q0580	17 SEP 1993	128 S C	2	27.5	<2.	<2	94.9 A C	0.65
	PCGS10L	94Q0577	17 SEP 1993	<30.	<1.	23.6	<2.	<2	5.3	0.019
	PCGS20L	94Q0574	17 SEP 1993	60 S	<1.	7.7	<2.	<2	<2.	0.079
	PCGS30L	94Q0578	17 SEP 1993	<30.	<1.	6.4	<2.	<2	<2.	0.033
	PCGS40L	94Q0576	17 SEP 1993	<30.	<1.	20	<2.	<2	2.1	0.013
	PCGS50L	94Q0581	17 SEP 1993	29	2.1	19.4	<2.	<2	<2.	0.023
Dark Horse mill	GDHS10L	95Q0036	19 JUL 1994	<30.	<1.	5.1	<2.	<2.	<2.	0.005
	GDHS20L	95Q0038	19 JUL 1994	<30.	<1.	4.6	<2.	<2.	<2.	0.007
Ding Bat and Blue Eyed Maggie mines	DDBS10L	92Q0853	10 AUG 1992	<50.	113 P	11.3	<2.	<2	<2.	
Eldorado and Potosi mines	GELS10L	94Q0608	21 SEP 1993	<30.	<1.	7.6	<2.	<2	<2.	0.009
	GELS20L	94Q0618	21 SEP 1993	<30.	<1.	8	<2.	<2	<2.	0.014
Forest Rose mill	DFRS30L	92Q1057	01 SEP 1992	<20.	<1.	28.6	<2.	<2	<2.	0.006
	DFRS10L	92Q1055	01 SEP 1992	<20.	<1.	7.9	<2.	<2	<2.	<.003
	DFRS20L	92Q1056	01 SEP 1992	<30.	<1.	16.2	<2.	<2	<2.	<.003
Highland mine	BHIS10H	94Q0235	20 AUG 1993	<30.	1.8	16.9	<2.	<2	<2.	0.007
	BHIS20L	94Q0233	20 AUG 1993	<30.	2	15.8	<2.	<2	<2.	0.024
	BHIS30M	94Q0237	20 AUG 1993	<30.	2.4	15.5	<2.	<2	2.5	0.015
Independence mine	PINS10M	94Q0488	14 SEP 1993	<30.	<1.	3	<2.	<2	<2.	<.003
	PINS20L	94Q0474	14 SEP 1993	<30.	<1.	3.3	<2.	<2	<2.	0.031
	PINS30L	94Q0476	14 SEP 1993	<30.	<1.	3.6	<2.	<2	3.3	0.032
J.G. Carlisle mine	PJGS10L	94Q0607	21 SEP 1993	<30.	<1.	4.8	<2.	<2	<2.	0.009
	PJGS20L	94Q0614	21 SEP 1993	24	<1.	6.4	<2.	<2	<2.	0.022
	PJGS30L	94Q0616	21 SEP 1993	33	<1.	6.3	<2.	<2	<2.	0.033
Little Darling mine	DLDS10L	92Q1067	02 SEP 1992	<30.	8.2	84.6	<2.	<2	<2.	
Lower Hidden Hand mine	DHHS10L	92Q0851	10 AUG 1992	<50.	23.9	15.1	3 C	<2	<2.	
Modoc mine (West Fork Flint Cr	FNFS10L	92Q1048	31 AUG 1992	<30.	<1.	27.6	<2.	<2	<2.	0.004
	FNFS20L	92Q1049	31 AUG 1992	<30.	<1.	24	<2.	<2	<2.	0.019

e /L	Pb UG/L	Mn MG/L	Hg UG/L	Ni UG/L	Ag UG/L	Zn UG/L	Cl MG/L	F MG/L	NO3 as N MG/L	SO4 MG/L	SIO2 (mg/L)	Field pH	Field SC mm	TEMP CENT	LAB SC MMHOS	LAB PH
1	<2.	0.006	<0.1	<2	<1	6	<.2	0.098	<.05	10.5	18	6.96	66.33	10.5	1994	6.71
3	<2.	0.019	0.1 C	9	<1	4	3	1	<0.25	532 P S	22	6.24 S	1024		1032	6.7
5 S	18.3 C	0.395 S	<0.1	<2	<1	34.3	<.2	0.02	<.05	18.8	6		105.4		87.5	6.08 S
9	5.3 C	0.003	<0.1	<2	<1	21.1	1.6	0.06	<.05	7.9	8	7.5	97.96	5.9	85.5	7.52
9	<2.	0.017	<0.1	<2	<1	7.8	<.2	0.07	<.05	<1.	10	8.7 S	38.32	6	38.1	6.98
3	<2.	0.003	<0.1	<2	<1	2.8	<.2	0.07	<.05	<1.	10	8	38.74	5.6	36	6.92
3	2.3	<.002	<0.1	<2	<1	14.1	<.2	0.07	<.05	<1.	7	7.7	57.62	5.9	52.6	6.51
3	<2.	0.006	0.18 C	<2	<1	7.3	<.2	0.08	<.05	<1.	8	7.2	52.5	6.8	47.4	7.2
5	<2.	0.005	<.1	<2.	<1.	16.6	<.05	0.362	0.05	5	11.7	7.42	120.8	7.2	141.5	7.71
7	<2.	0.003	<.1	<2.	<1.	4.9	<.5	0.332	<.05	5	11.7	7.77	112.4	7.2	141.2	7.76
3	<2.	0.003	0.1 C	2.7	<1	11.8	0.92	0.25	<.10	116	14	8.18	516.5	10.1	495	8.27
9	<2.	<.002	<0.1	<2	<1	9.4	1.6	0.12	0.32	10.4	11	8.3	49.5	2.6	62.3	7.11
4	<2.	0.002	<0.1	<2	<1	8.5	<.2	0.1	0.29	3.9	12	8.8 S	44.02	2.9	60.3	7.23
6	<2.	0.022	<0.1	1.2	<1	<2.	0.97	0.2	0.069	71.5	10	7.76	519.9	13.2	475	8.16
3	<2.	<.002	0.1 C	<2	<1	25.9	0.52	0.2	0.045	47.5	12	7.91	381.8	8.9	358	8.21
3	<2.	0.005	0.1 C	2.1	<1	33	0.6	0.18	0.14	107	8	7.35	726.2	6.9	613	7.76
7	<2.	0.005	<0.1	<2	<1	4.5	1.6	0.17	0.24	13.8	12	8.37	391	6.3	392	7.35
4	<2.	0.008	<0.1	<2	<1	2.7	1.75	0.11	0.13	60.8	14	8.1	515	9.5	514	7.7
5	2.5	0.002	<0.1	<2	<1	2.2	1.2	0.19	0.14	13.4	16	8.5	338	8.9	345	8.05
3	2.1	<.002	<0.1	<2	<1	<2.	1.3	0.1	0.18	5.9	13	8.16	222.3	5.4	194.4	8.06
1	<2.	0.003		<2	<1	<2.	0.2	0.087	0.083	2.5	9	7.77	38.8	4.9	39.9	6.39 S
2	<2.	0.004	<0.1	<2	<1	<2.	<.2	0.084	<.05	<1.	9	8.14	38.5	5.2	44.9	6.68
9	<2.	<.002	<0.1	<2	<1	25.2	0.3	0.056	0.1	3.3	9	8.2	31.9	2.5	40.5	7.17
2	<2.	0.002	<0.1	<2	<1	3.8	1.3	0.1	<.05	3.6	9	8.5	26.45	2.8	36	7.02
3	<2.	0.006	<0.1	<2	<1	11.3	0.4	0.089	0.12	<1.	10	6.36 S	30.48	3.9	35.9	6.78
3	<2.	0.005	<0.1	<2	<1	7.9	1.4	0.1	<.10	23.8	25	8.35	341.3	12.5	318	8.41
5	<2.	1.4 S	0.1 C	4.2	<1	83.6	1.2	0.51	<.10	201	27	7.2	592.9	8.9	594	7.51
4	<2.	<.002	0.1 C	<2	<1	2.9	0.14	0.05	0.02	2.38	7	7.52	299.4	9.5	291	7.57
9	<2.	<.002	0.1 C	<2	<1	4.1	0.19	0.13	0.013	2.4	8	8.04	213.3	7	205	8.1

Appendix IV. (continued)

	BOTTLE NO	GWIC QW NO	Sample Date	Al UG/L	As UG/L	Ba UG/L	Cd UG/L	Cr UG/L	Cu UG/L	Fe MG/L
Ophir mine	GOPS10L	94Q0621	21 SEP 1993	<80.	<1.	9.5	<2.	<2	<2.	0.017
	GOPS10L	94Q0620	21 SEP 1993	<30.	<1.	9	<2.	<2	<2.	0.009
Racetrack mine	RRAS10M	94Q0478	13 SEP 1993	<30.	<1.	30.9	<2.	<2	<2.	0.009
	RRAS20M	94Q0480	13 SEP 1993	<30.	<1.	25.4	<2.	<2	<2.	<.003
	RRAS30M	94Q0479	13 SEP 1993	33	<1.	27.2	<2.	<2	2.8	0.015
	RRAS40L	94Q0481	13 SEP 1993	<30.	<1.	14	<2.	<2	<2.	0.029
	RRAS50L	94Q0483	13 SEP 1993	<30.	<1.	14.4	<2.	<2	8.1	0.024
Rocker Gulch	RU1S10L	95Q0040	20-Jul-94	<30.	59.8 P	18.9	<2.	2.8	2.7	
Snow Bunny(Majestic) mine	PSBS10M	94Q0572	17 SEP 1993	35	<1.	24.8	<2.	<2	<2.	0.296
	PSBS20L	94Q0571	17 SEP 1993	280 S C	<1.	8.8	<2.	<2	2.2	0.17
	PSBS30L	94Q0570	17 SEP 1993	<30.	<1.	10.6	<2.	<2	<2.	0.024
St. Mary mine	DSMS10L	92Q0850	10 AUG 1992	<50.	9	17.5	<2.	<2	<2.	
Sterrit mine	DSTS10L	92Q0852	10 AUG 1992	<50.	19.7	11.7	<2.	<2	2.9	0.136
Sunlight-Copper Queen mine	GSUS10L	94Q0622	22 SEP 1993	37	<1.	8	<2.	<2	3.1	0.047
	GSUS20L	94Q0610	22 SEP 1993	<30.	<1.	5.2	<2.	<2	<2.	0.009
	GSUS30L	94Q0623	22 SEP 1993	53 S	<1.	9.1	<2.	<2	4.6	0.143
	GSUS40L	94Q0612		<30.	<1.	6.9	<2.	<2	<2.	0.018

Pb UG/L	Mn MG/L	Hg UG/L	Ni UG/L	Ag UG/L	Zn UG/L	Cl MG/L	F MG/L	NO3 as N MG/L	SO4 MG/L	SiO2 (mg/L)	Field pH	Field SC mm	TEMP CENT	LAB SC MMHOS	LAB PH
<2.	0.002	0.18	<2	<1	<2.										
3.8 C	<.002	<0.1	<2	<1	3.1	<.2	0.091	0.058	1.4	10	8.4	35.3	2.7	51.9	6.98
2.5	0.002	0.19 C	<2	<1	<2.	1.9	2.85 S	0.088	16.6	19	7.13	210.07	9.3	189.4	7.01
<2.	<.002	<0.1	<2	1.5 C	<2.	1.2	2.54 S	0.22	15.3	19	7.3	203.1		178.6	7.19
4.6 C	<.002	<0.1	<2	<1	<2.	0.86	2.89 S	0.29	15.7	19	7.88	203.56	9.9	180.3	7.2
2.7	0.002		<2	<1	<2.	<.2	0.39	<.05	<1.	9	7.96	85.48	7	81.6	6.97
<2.	<.002	<0.1	<2	<1	<2.	<.2	0.39	0.28	<1.	9	7.85	86.06	7.5	81.7	7.7
<2.	0.012	<.1	2.9	<1.	31.9	1	0.153	0.1	120	16.1	S	365.9		466	7.84
<2.	0.461 S	<0.1	<2	<1	85.8	<.2	0.25	<.05	33.2	13	7.6	1476.5	5.8	152.3	7.17
2.5	0.009	<0.1	<2	<1	21	<.2	0.06	0.052	<1.	8	7.1	58.59	4.1	56.6	6.4 S
2.1	0.006	0.16 C	<2	<1	74.4	<.2	0.06	<.05	7.1	8	8.3	51.5	4.8	60.4	7.1
<2.	0.007	0.1 C	<2	<1	<2.	0.37	0.17	<.10	18.4	14	8.36	317.7	8	323	8.18
<2.	0.005	0.1 C	<2	<1	22.7	0.98	0.17	1.33	17.5	13	8	277.3	8	275	8.16
<2.	0.004	0.17 C	<2	<1	22.5	<.2	0.01	0.22	<1.	15	8.01	39.18	3.4	35.1	6.7
<2.	<.002	<0.1	<2	<1	5.8	0.2	0.058	0.39	1.2	13	6.88	30	2.8		6.56
<2.	0.033	0.13 C	<2	<1	12.1	0.5	0.014	0.64	<1.	10.9	6.85	17.6	9.1	24.2	6.53
<2.	0.003	<0.1	26	3.3 C	5.9	5.65	0.03	0.26	<1.	14	6.92			32.7	7

Appendix V

Database Fields
MBMG-USFS AIM Program

Sites Table
Id Number
Name
Alt Name
Mine District
County
Mrds #
Amli #
Mils #
Latitude
Longitude
Township
Range
Section
Tract
Utm Northing
Utm Easting
Utm Zone
Average Elevation
Elevation Units
Land Owner
1:250K Map
1:100K Map
1:24K Map
Property Type
Disturbance Type
Current Status
Mine Method
Map
Scale
Year of Production
Process Method
Process Capacity
Published Reserves - Measured
Published Reserves - Indicated
Published Reserves - Geological
Description of Workings
Depth of Workings
Width of Workings
Length of Workings
Disturbed Area of Workings
Surface Map
Surface Agency
Surface Address
Surface City
Surface Zip
Underground Map
Underground Agency
Underground Address
Underground City
Underground Zip
Date of Update
Longview
Plan View
Bibliography

Mines Tables
Id
Type Opening
Latitude
Longitude
Utm Northing
Utm Easting
Utm Zone
Waste Production Rate
Ore Production Rate
Opening Type
Condition
Size Open Length
Size Open Width
Status Rank
Elevation
Elevation Unit

Mine Open Table
Id
Type
Condition
Ground Water
Photo
Ownership
Comments

Wastes Table
Id
Type Waste
Rock Type
Au oz
Ag oz
Cu lb
Pb lb
Zn lb
As lb
Tons
Mineralized

Agency Table
Id
Agency
Division
District/Area
Ftract
Fwatershed Code
Forest
District
Owner
Own Impacts
Report

Forest Table
Id
Investigator
Date
Photos
Access
Nearest Wetlands
Drainage Basin
Waste Contact Stream
Nearest Surface Intake
Num of Surface Intakes
Uses of Surface Intake
Nearest Well
Nearest Dwelling
Number of Months Occupied
Number Houses 2 Miles
Recreational Usage
Nearest Rec Area
Name of Area
Hmo Adit
Hmo Wall
Hmo Struct
Hmo Chem
Hmo Solid
Hmo Explosives
Sensitive Environments
Pop Within .25 Miles
Pop Within .5 Miles
Pop Within 1 Miles
Pop Within 2 Miles
Pop Within 3 Miles
Pop Within 4 Miles
Public Interest

Fwastes Table
Id
Type
Wind Erosion
Vegetation
Surface Drainage
Stability
Location/Flood Plain
Distance to Stream
Photos

Fcontamination
Id
Type of Contamination
Estimated Quantity

Fstructure
Id
Type
Condition

Samples
Id
Sample Id
pH
Sc
Temp
Flow Rate
Flow Units
Flow Method
Soil Interval
Remarks

Water
Id
Sample Id
Source
Date
Sampler
Location Rel Stream
Stream
Sedimentation
Photo
Indicators of Metal

Soil
Id
Sample Id
Type
Sampler
Sample Type
Source
Indicator of Contamination
Photos

AIM data base tables.

Data Model: FORESTR2.FSL