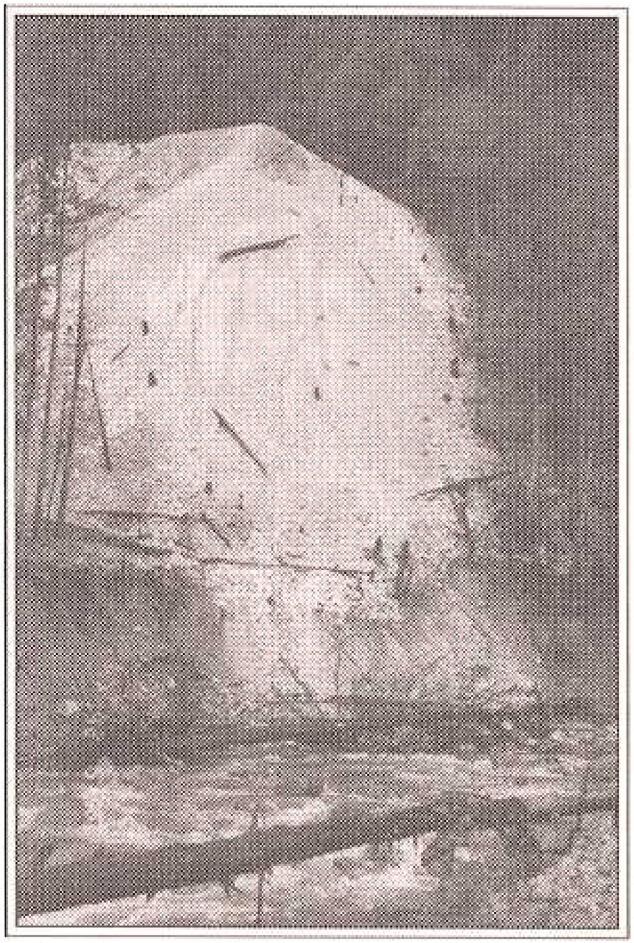
Montana Bureau of Mines and Geology

Abandoned - Inactive Mines Program

Deerlodge National Forest

Volume III

Flint Creek and Rock Creek Drainages



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December, 1995

MONTANA BUREAU OF MINES AND GEOLOGY

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DEERLODGE NATIONAL FOREST

VOLUME III
FLINT CREEK AND ROCK CREEK DRAINAGES

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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 (See 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 which, in turn, increases the solubility of metals. 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:

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.

To this list, most geochemists would add the availability of minerals such as calcite that can neutralize the acidity. These six components occur not only within the mines themselves, 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 color in surface waters and forms a similar colored 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 pHs 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 ($CdCO_3$) 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 ug/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 ug/L at pHs 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 ug/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 percent 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 percent error range. Further, 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 MILS database (U.S. Bureau of Mines),
2) the MRDS database (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 wilderness areas, and
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 both 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 were visited.

In addition, the MBMG and the USFS developed screening criteria Table 1.1) which 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.

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 <u>all</u> "NO" (based on literature, personal knowledge, or site visit), then the site was not investigated any further.

Mine sites which were not visited were retained in the database along with the data source(s) that were consulted (See 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. Due 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.

1.4.3 Field Screening

All 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. The geologist 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. 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.

1.4.4 Field Methods

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.

1.4.4.1 Selection of 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.

Since 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.

1.4.4.2 Marking and Labeling Sample Sites

Sample location stakes were placed as close as possible to the actual sample location and labeled with a sample identification number. 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 identifier based on its location as follows:

D DA T L I C

D: Drainage area - determined from topographic map
DA: Development Area (dominant mine)
T: Sample type: T - Tailings, W - Waste Rock, D - Soil, A - Alluvium, L - Slag S - Surface Water, G - 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.

1.4.4.3 Collection of Water and Soil Samples

Sampling crews collected soil and water samples, and took field measurements (e.g. stream flow) 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.

1.4.4.4 Existing Data

Data collected in previous investigations were not qualified nor validated under this project. The quality-assurance managers and project hydrogeologist determined the useability 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 try put 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. 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. Since no assessments of this kind have been done, concentrations of metals in soils were compared to the limits postulated by the U.S. EPA 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 ARC/INFO Geographical Information System (GIS).

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). Headquartered in Butte, it lies in the heart of historic mining country. 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.

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.

Vicinity Map
Deerlodge National Forest

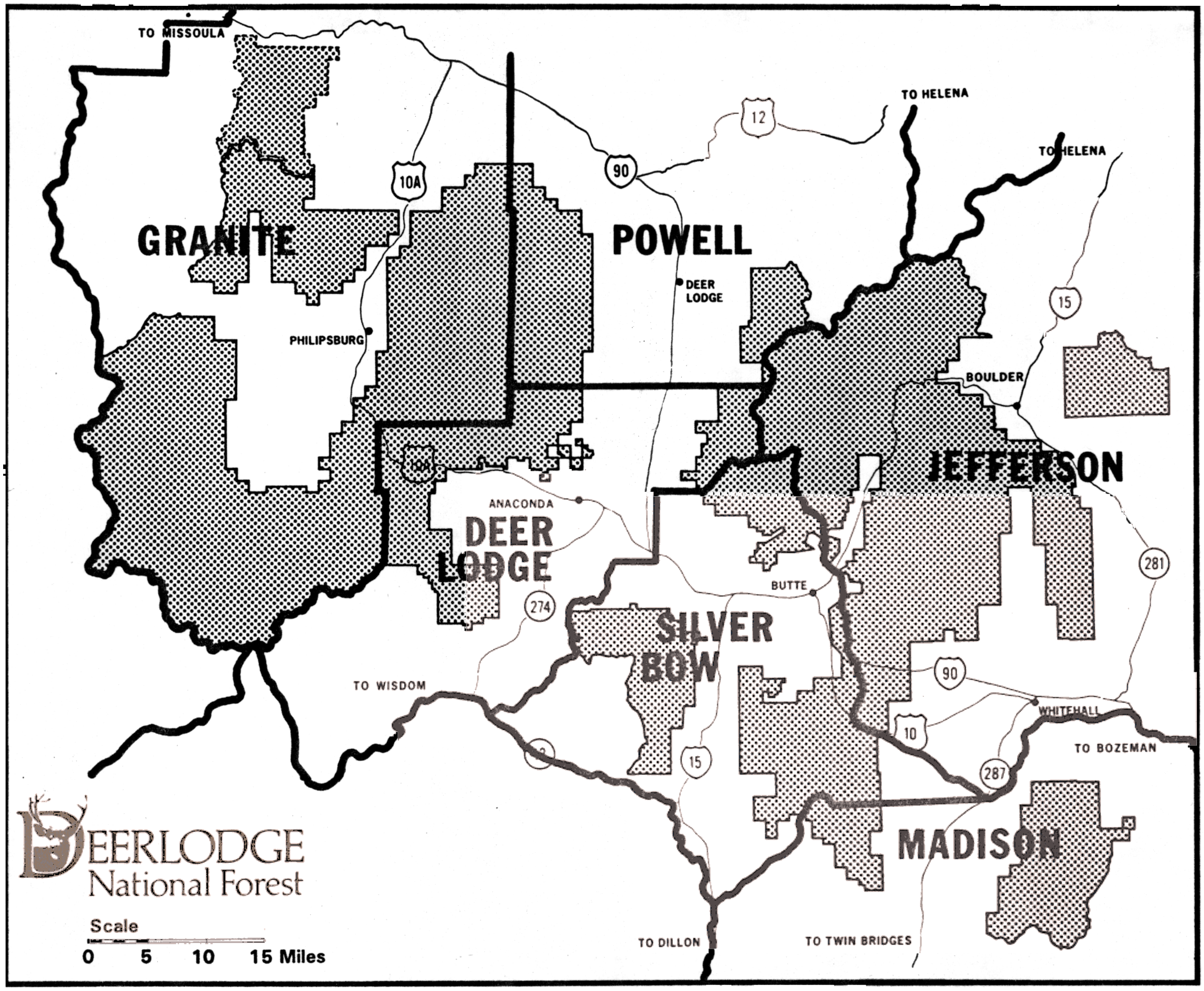


FIGURE 1.1

Legend

- Deerlodge National Forest Lands
- County Boundaries

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 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 U.S. 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 1051 sites in the general area of the Deerlodge National Forest. The pre-field investigation that followed indicated that at least 1044 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:

<u>PART A - Field Form</u>	
Located in general area from Literature Search	1051
Not on or affecting Deerlodge NF	- 7
<u>PART B - Field Form (Screening Criteria)</u>	
Possibly affecting the Deerlodge NF	
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
<u>PART C - Field Form</u>	
Sampled (Water and Soil)	

A separate discussion of each of the 100 sites is included in the five volumes that comprise the DNF report. All 1051 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.

FLINT CREEK DRAINAGE

The Flint Creek drainage is in the western portion of the Deerlodge National Forest (Figure 2.1). The creek originates in the Flint Creek range and flows into Georgetown Lake. From Georgetown Lake, it flows northward through the Philipsburg valley, past the town of Maxville, and eventually into the Clark Fork River near the town of Drummond. Important tributaries to Flint Creek include (in downstream order) Fred Burr Creek, Camp Creek, Boulder Creek, Henderson Creek, Douglas Creek, and Lower Willow Creek. Several important mining districts are located along the creek and its tributaries. Figure 2.2 shows the approximate locations of these districts as well as locations of individual mines and mills.

Terrain within the Flint Creek basin varies from rugged uplands to broad valley bottoms. The Flint Creek, Anaconda, and John Long mountains enclose all but the northernmost portion of the Flint Creek drainage. At 9,067 feet above sea level, Twin Peaks in the Flint Creek range 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: Georgetown Lake attracts thousands of fishermen and boating enthusiasts annually. Also, there are many National Forest and private campgrounds. Philipsburg, with about 1,000 residents, is the largest community within the drainage. Smaller towns include Maxville, Princeton, Hall, and New Chicago.

2.1 GEOLOGY

The Flint Creek drainage includes the Black Pine, Princeton, Maxville, Philipsburg, Red Lion, and Henderson Creek mining districts (See Figure 2.2). Part of the Dunkleburg district also lies withing the drainage. Most of the Philipsburg, Black Pine, and Maxville districts lie outside forest boundaries, so they were not examined in detail.

The geology of much of the area was first mapped and descibed by Emmons and Calkins (1913) and Calkins and Emmons (1915) in their classic study of the Philipsburg quadrangle. McGill (1959, 1965) later re-mapped part of the area in more detail. Mapping was further revised by Bakken (1984) in an effort to settle the controversy over the origin of opposing compressional structures. Hughes (1970) mapped the western portion of the watershed. The entire Flint Creek area is also included on the 1:250,000 scale Butte 1°x2° quadrangle map (Wallace, 1987). A generalized geologic map of the Flint Creek drainage is shown in Figure 2.3.

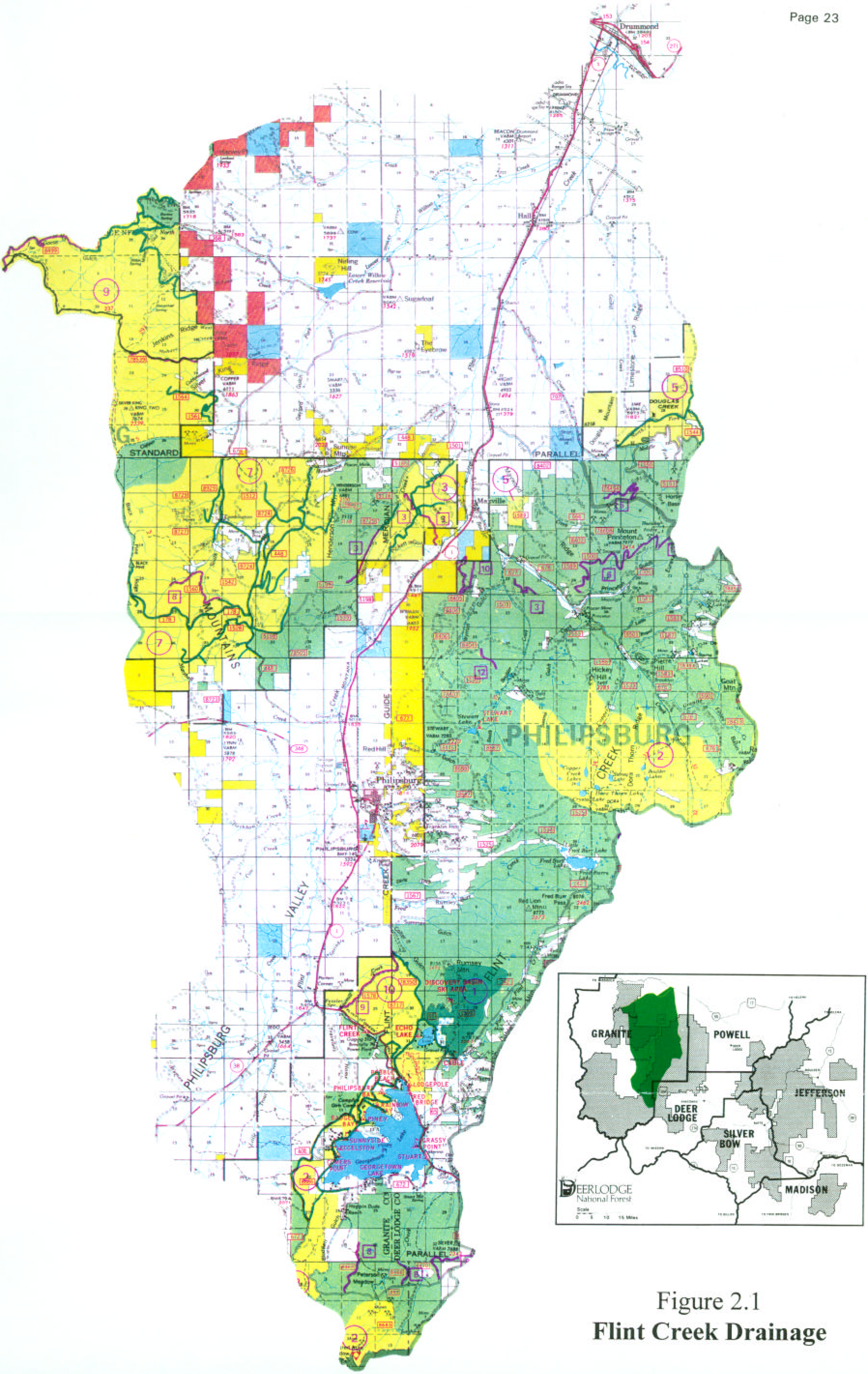
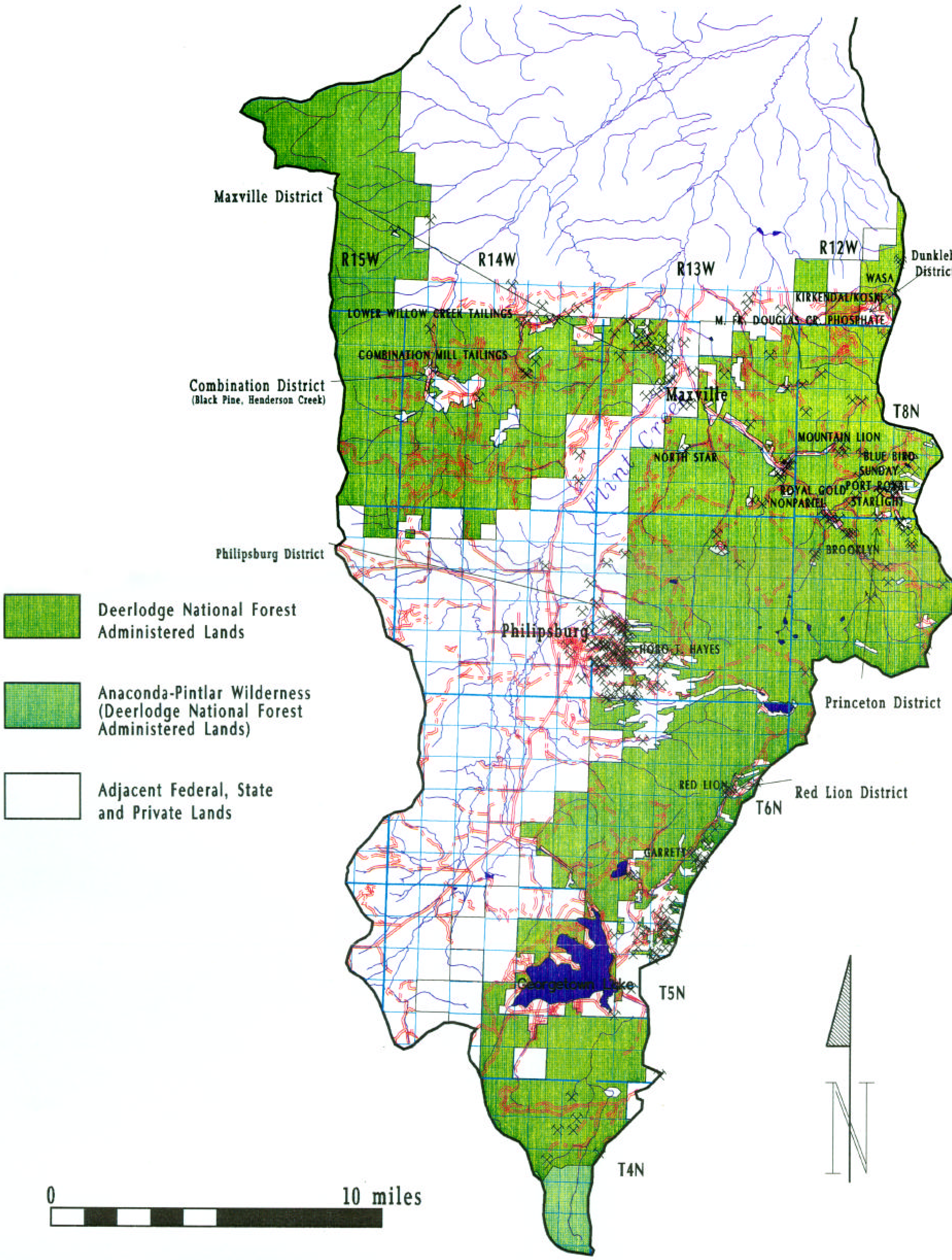


Figure 2.1
Flint Creek Drainage

Figure 2.2 Abandoned-Inactive Mines, Flint Creek Drainage



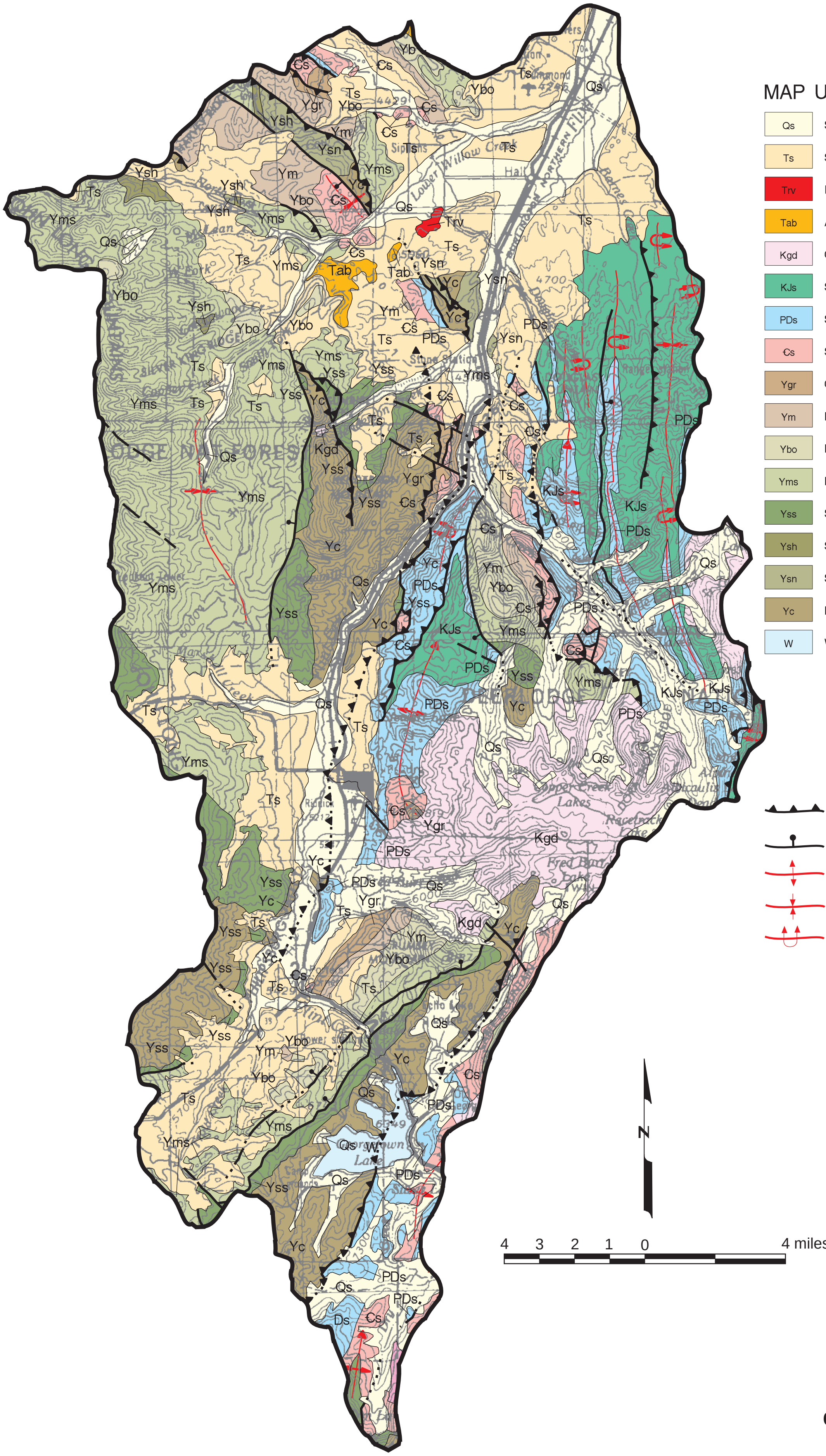


Figure 2.3
Generalized geologic map
of the Flint Creek drainage.
Reference: Lewis 1998

In the region, late Cretaceous to Eocene compression produced thrust faults and asymmetric folds. The Philipsburg and Georgetown thrusts place Proterozoic Belt rocks over Paleozoic sedimentary rocks, but even the footwall Phanerozoic rocks are allocthonous and are part of the Sapphire Tectonic Block (Hyndman, 1979). Most folds verge eastward except in the northeastern part of the region. Here, opposing westward verging folds and east-dipping reverse faults are present and of controversial origin. Bakken (1984) attributed the unusual structures to backthrusting created as the the east-moving allocthon slid over a ramp formed by a buttress in the crystalline basement rocks.

Near the end of compression, the Philipsburg batholith, the Royal stock, the Henderson Creek stock, the Cable stock, and numerous smaller igneous bodies were emplaced. Their locations and geometries were probably influenced by thrusts, which continued to move during emplacement of the igneous bodies (Benoit, 1975; Hawley, 1975).

Cenozoic extension then produced north, northeast, and northwest trending high angle normal faults, some of which may be listric. Finally, much of the bedrock geology was covered by Quaternary glacial drift.

2.2 ECONOMIC GEOLOGY

The economic geology of most of the area has not been studied in detail. Emmons and Calkins (1913) provide the most comprehensive descriptions of mines and prospects. Silverman (1965) presents a brief summary of the economic geology of the Flint Creek Range. Erickson and others (1981), Walker (1960), Waisman (1985), and Earll (1972) also present some information on economic geology, but, except for the Philipsburg district (see Prinz, 1967), no comprehensive descriptions of the mining districts exist.

Most deposits are probably related to the Cretaceous plutons, but some, particularly in the Red Lion, Black Pine, and Maxville districts, have no obvious igneous association. Both high-angle extensional and flat compressional structures probably played major roles in localizing mineralization. The Princeton, Maxville, and Henderson districts form an elongate northwest mineralized zone that is roughly parallel to a major strike-slip(?) fault zone (Wallace, 1987) and lineament. Geology of the Red Lion district is dominated by a klippe of Belt quartzite overlying Paleozoic carbonate rocks; all rocks are mineralized.

Mineralization types in the Flint Creek drainage include gold-quartz veins along shear zones in competent sedimentary and igneous rocks, silver-lead-zinc replacement bodies in limestone, gold-bearing skarns, tungsten-bearing tactites, and stratiform copper in Belt quartzite. Primary commodities sought varied by district: mostly silver was produced from the Philipsburg, Black Pine, and Maxville districts; mostly gold from the Red Lion and Henderson districts; and gold, silver, and base metals from the Princeton district. The region also yielded some tungsten, manganese, and phosphate.

Production totals for the various mining districts of the Flint Creek drainage are listed in Table 2.1. The Black Pine and Philipsburg districts have been the most productive, yielding $113 million in precious and base metals. Obviously, the Flint Creek drainage has been an important mining region in Montana, and exploration continues across the area today.

Table 2.1
Production Totals for Mining Districts in the Flint Creek Drainage

District	Gold (oz) x1000	Silver (oz) x1000	Copper (lbs) x1000	Lead (lbs) x1000	Zinc (lbs) x1000	Dollar Value*
Black Pine	2.82	2,433.6	479.93	262.89	27.92	22,000,000
Henderson	79.29	10.	352.9	0.35	--	2,228,000
Maxville	0.59	47.07	20.73	63.71	0.4	127,000
Philipsburg	259.16	56,386.18	3,700.87	18,059.94	54,366.43	91,000,000
Princeton	61.69	168	568.49	863.35	250.	1,870,000
Red Lion	24.85	12.23	1.49	--	--	841,000
Total	428.4	59057.08	5124.41	19250.24	54644.75	118,066,000

Source: Elliott and others (1992a), and Elliot and others (1992b) Production estimates from diverse sources, for diverse periods of time.
* Dollar value at time of production.

2.3 HYDROLOGY AND HYDROGEOLOGY

Average annual precipitation in the Flint Creek drainage ranges from 12 to 18 inches in the valleys to over 40 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 0°F during the winter months to over 90°F during the summer.

The Flint Creek drainage basin is about 41 miles long and has an areal extent of approximately 500 square miles. The drainage generally descends northward, from 7500 feet above sea level at its head in the Flint Creek range, to 3940 feet above sea level at its confluence with the Clark Fork River. As noted previously, important tributaries include (in downstream order) Fred Burr Creek, Camp Creek, Boulder Creek, Henderson Creek, Douglas Creek, and Lower Willow Creek. The drainage pattern is largely controlled by the structure of the underlying Belt and plutonic rocks and glacial deposits.

The U.S. Geological Survey currently maintains six stream-flow gaging stations within the Flint Creek drainage. The locations, periods of record, drainage areas, and annual mean flows are summarized in Table 2.2.

Table 2.2
Stream-Gaging Locations within the Flint Creek Drainage

Gage Location	Period of Record	Drainage Area (sq. miles)	Annual Mean Flow (cfs)
Flint Creek near Southern Cross	1941-1994	52.6	29.2
Flint Creek above Fred Burr Creek	6/94-9/94	108	NA
Fred Burr Creek near Philipsburg	4/94-9/94	15.7	NA
Flint Creek at Maxville	1942-1994	208	97.3
Boulder Creek at Maxville	1940-1994	71.3	45.4
Flint Creek near Drummond	1991-1994	490	91.1

NA: Not available
Source: Shields et al., 1995

2.4 SUMMARY OF THE FLINT CREEK DRAINAGE

For the abandoned/inactive mine inventory for the Deerlodge National Forest, the MBMG investigated 118 mines and/or mills within the Flint Creek drainage basin (Table 2.3). Of these sites, 90 were found to have no environmental impact on DNF administered land, 19 may pose environmental problems, and nine could not be located. Of the 19 sites with potential environmental impacts, 14 have discharges that flow from workings or waste materials. Nine of the 19 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, then the site is designated unsafe, or hazardous, in Table 2.3. Of the 118 sites inventoried, 19 were found to have safety concerns. The only sites that were screened for safety hazards in detail were those where soil and/or water samples were collected. 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 Flint Creek Drainage
Site name in bold type indicates potential environmental problems
Y under Hazard indicates physical safety concern

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
A & M	PRV	Y	N	NE	Reclaimed and dry.
Albion	PRV	Y	N	NE	Dry caved adits.
Annie	NF	N	N	NE	Dry hillside.
Apex	NF?	N	N	NE	Unable to locate; same as Travonia?
Archegan	PRV	N	N	NE	Dry ridgetop.
Banker	PRV	Y	N	**Y**	Open dry adit and stope.
Barnes	NF	Y	N	NE	Dry cave workings.
Bielenberg Lake	NF	Y	N	NE	Small dry prospect.
Big Bill	PRV	N	N	NE	Ridgetop.
Bloomington	NF	Y	N	NE	Dry caved adit.
Bloomington Mill[5]	NF	Y	N	NE	No tailings.
Blue Bird	NF	Y	Y	**Y**	Adit discharge. Open adit. Water-quality standards exceeded.
Bonanza	NF	Y	N	NE	Two dry, caved adits.
Boulder Creek Graphite	NF	N	N	NE	Small prospect.
Bronze	NF	N	N	NE	Small prospect.
Brooklyn	NF	Y	Y	N	Streamside waste; seasonal discharge. Reclaimed in 1995.
Brooklyn Mill[5]	NF	Y	Y	N	Tailings mass wasting.
Caroline	NF	N	N	NE	Unable to locate; dry hillside.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Coberly Syncline	NF	N	N	NE	Phosphate prospect.
Combination Mill Tailings[5]	PRV	Y	Y	**Y**	Tailings in contact with stream. Water-quality standards exceeded. Unstable structures.
Contact #1	PRV	N	N	NE	Unable to locate.
Copper Creek	PRV	Y	N	NE	Dry caved adit.
Copper Lode	NF	N	N	NE	Unable to locate.
Copper Ridge	NF	N	N	NE	Small prospect.
Copper State	PRV	N	N	**Y**	No effect on DNF. Hazardous mine opening or structure.
Deer Hunter	PRV	N	N	NE	Prospects only.
Deerlodge Basin	PRV	Y	N	NE	Small dry prospects.
Delaware	NF	Y	N	NE	Dry phosphate mine.
Delta	PRV	N	N	NE	Dry hillside; Golden Eagle site.
DG	NF	Y	N	NE	Part of Brooklyn site.
Dougherty Mill[5]	NF	Y	N	NE	No tailings.
Douglas	NF	Y	N	NE	Three dry, caved adits.
Douglas Mill[5]	NF	Y	N	NE	No tailings.
Eagle	NF	N	N	NE	Dry ridgetop.
East Mountain Lion	NF	Y	N	NE	Dry locked adit.
Finley Basin	NF	N	N	NE	Drill holes only.
Flint Creek	PRV	N	N	NE	Dry hillside; Golden Eagle site.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Garrett (Mickey)	NF	Y	Y	**Y**	Adit discharge; caved. Water-quality standards exceeded. Unstable structure
Garrett Mill[5]	PRV	Y	N	NE	Small volume of tailings; dry, closed basin.
Gird Creek	NF	Y	N	NE	Dry phosphate mine.
Goat Mountain	NF	N	N	NE	Small prospect; mountaintop.
Golden Eagle	PRV	N	N	NE	Dry hillside; operating permit?
Golden Jubilee	NF	Y	Y	**Y**	Flooded pit; operating permit. Hazardous mine opening or unstable structure.
Gold Hill	PRV	Y	N	**Y**	Numerous dry workings. Hazardous mine opening or unstable structure.
Gold Reef	MIX	Y	N	NE	Dry caved workings.
Gould-Corry	PRV	N	N	NE	Visualized; small, dry.
Grant Creek	UNK	N	N	NE	Unable to locate.
Greater New York	NF	Y	N	**Y**	Small, dry. Hazardous mine opening or unstable structure.
Grubstake	PRV	N	N	NE	Dry hillside; Golden Eagle site.
Hannah	PRV	N	N	NE	Ridgetop.
Hanna Mill[5]	MIX	Y	N	NE	Dry tailings; small volume.
Harry Miller	NF	N	N	NE	Dry ridgetop.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Hobo-T. Hayes	MIX	Y	Y	**Y**	Locked adit with discharge; eroding waste; seeps. Water-quality standards exceeded. Unstable structures.
Homer	NF	N	N	NE	Dry ridgetop.
Horseshoe Bend	NF	Y	N	**Y**	Dry caved adit. Hazardous mine opening or unstable structure.
Jefferson	NF	Y	N	NE	Dry caved workings.
Johnson	NF	N	N	NE	Dry ridgetop.
Kirkendal/Koski	NF	Y	Y	N	Adit discharge. Water-quality standards exceeded. Associated with Wasa.
Lark	MIX	Y	N	NE	Dry prospect pits.
Last Chance	NF	N	N	NE	Dry ridgetop.
Lead Streak	NF	N	N	NE	Dry ridgetop.
Letus #1	NF	Y	N	NE	Dry; Golden Jubilee site.
Lila Dixon/A. Flag	PRV	N	N	NE	Ridgetop.
Lower Willow CreekTailings	NF	Y	Y	**Y**	Streamside tailings and seeps. Water-quality standards exceeded. Unstable structure.
Marjea	NF	N	N	NE	Unable to locate.
Mayflower	NF	Y	N	NE	Dry caved adits.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Middle Fork of Douglas Creek Phosphate	NF	Y	Y	**Y**	Locked adit with discharge. Water-quality standards exceeded; unstable footing on waste-rock dump.
Montana	NF	Y	N	NE	Dry open stope.
Moonlight	NF	Y	N	NE	Locked dry adit.
Mountain Lion	NF	Y	Y	**Y**	Adit discharge. Unstable structures.
Mountain View	NF	N	N	NE	Small prospect.
Nellie	NF	Y	N	NE	Dry phosphate mine.
Nellie Barnes	PRV	Y	N	NE	Dry caved workings.
Nineteen Hundred	NF	Y	N	NE	Dry; St. Thomas site.
Non Pareil	PRV	Y	N	NE	Dry workings.
Non Pareil Tailings[5]	NF	Y	Y	**Y**	Tailings discharge. Water-quality standards exceeded. Unstable structure.
Northern Cross	PRV	Y	N	NE	Dry caved workings.
N. Fork Granite Cr.	NF	N	N	NE	Small prospect.
North Star	PRV	Y	N	N	Dry caved workings.
North Star Mill[5]	PRV	Y	Y	N	Streamside tailings.
Peacock	NF	Y	N	NE	Two dry, caved adits.
Porter	NF	Y	N	NE	Dry caved workings.
Port Royal	PRV	Y	Y	NE	Adit discharge.
Port Royal Tailings[5]	NF	Y	Y	N	Streamside tailings.
Powell Mines	PRV	N	N	NE	Visualized; interviewed locals.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Princeton	PRV	Y	N	NE	Caved dry shaft.
Queen	UNK	N	N	NE	Unable to locate; same as Non Pareil?
Radar	NF	Y	N	NE	Dry; Golden Jubilee site.
Red Lion	PRV	Y	Y	N	Caved adit with discharge.
Red Lion Mill[5]	NF	Y	Y	NE	No tailings.
Robinson	NF	Y	N	NE	Dry caved adit and shaft.
Rombauer	NF	Y	N	NE	Dry caved adits.
Royal Gold Tailings[5]	NF	Y	Y	N	Streamside tailings. Water-quality standards exceeded.
St. Thomas	NF	Y	N	NE	Dry caved workings.
Sallie Mellen	PRV	Y	N	NE	Dry workings; no effect on DNF.
Saranac	PRV	Y	N	NE	Reclaimed shaft.
Shamrock	PRV	Y	N	**Y**	Open cut and caved adit.
Sixteen to One Claim	NF	Y	N	NE	Small dry prospect.
Snow Cap	NF	Y	N	NE	Dry caved workings.
South Boulder Mill[5]	NF	Y	Y	NE	Minor contaminated soil, dry.
Starlight (Little Queen)	PRV	Y	Y	N	Adit discharge. Unmineralized streamside waste.
State	PRV	Y	N	NE	Dry caved adit.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Sunday	PRV	Y	Y	**Y**	Adit discharge. Water-quality standards exceeded. Unstable structures
Sunday Extension	NF	Y	N	NE	Dry caved workings.
Sunday Mill[5]	NF	Y	N	NE	No tailings.
Sunrise (Queen)	PRV	N	N	NE	No affect on DNF.
Swamp Gulch Mill[5]	NF	Y	N	NE	No tailings.
Swamp Gulch Prospect	NF	N	N	NE	Small prospect.
Thursday-Friday	NF	Y	N	**Y**	Dry open adit.
Travonia	NF	Y	N	NE	Dry locked adit.
Tussle	MIX	Y	N	NE	Dry workings.
Unnamed Shaft	NF	Y	Y	**Y**	Open shaft.
Upper Granite	NF	N	N	NE	Ridgetop prospect.
Upper Mountain Lion	NF	Y	N	NE	Dry caved workings.
Vallejo	NF	Y	N	NE	Dry caved adit.
W.J. Bryan	UNK	N	N	NE	Unable to locate; same as Banker?
Wasa	MIX	Y	Y	**Y**	Adit discharge. Water-quality standards exceeded. Dangerous high wall and open adit.
Yellow Metal	UNK	N	N	NE	Unable to locate.

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)
   PRV: Private
   MIX: Mixed (DNF 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

2.4.1 Summary of Environmental Observations

For sites investigated within the Flint Creek drainage, the Kirkendal/Koski mine on the North Fork of Douglas Creek , the Hobo-T. Hayes mine near Philipsburg, and the Lower Willow Creek tailings 10 miles northwest of Philipsburg have the most severe water-quality problems. Adit discharges at Kirkendal/Koski and Hobo-T. Hayes sites have concentrations of cadmium, manganese, and zinc that exceed water-quality criteria. Seeps flowing from the Lower Willow Creek tailings have high concentrations of arsenic, copper, lead, and mercury.

The Non Pareil site on Boulder Creek, the Hobo-T. Hayes mine, and the Lower Willow Creek tailings have the worst soil-quality problems. Concentrations of arsenic, copper, and lead in soils at these sites are all above phytotoxic levels. Waste materials associated with the Brooklyn mine and mill, the Port Royal tailings, and the Mountain Lion also have high concentrations of various metals. The Brooklyn site was reclaimed by the Forest Service during the summer, 1995.

2.5 RED LION MINE AND MILL

2.5.1 Site Location and Access

The Red Lion mine is located on the North Fork of Flint Creek (T6N R12W Section 14 CDAA) and is on both DNF administered and private land. The site is approximately 3.5 miles upstream of the Cable Campground and approximately five miles upstream of Georgetown Lake; both the lake and the campground are high-use recreation areas. The Red Lion mill site is on the east side of the main road and the main development area of the mine is on the west side of the road.

2.5.2 Site History - Geologic Features

The Red Lion mined a replacement zone in the Hasmark Formation which was sub-parallel to bedding at N50E 73SE (Earll, 1972). This discontinuous zone is up to 4 feet wide, carries $5-20 per ton in gold (1905 prices), and extends 2000 feet northeast to the contact with the Philipsburg batholith. The mineralized zone consists of quartz, calcite, pyrite, limonite, specularite, and magnetite (Emmons and Calkins, 1913). Two caved shafts (100 and 180 feet deep) and one caved adit of unknown extent are present on private ground. The site has been partially reclaimed.

The original Red Lion Mill was constructed near the present day Golden Jubilee and was designed to treat ore using an amalgamation process (Emmons and Calkins, 1913). Only a small volume of tailings is present.

2.5.3 Environmental Condition

Since most of the site is on private land, no site map was made. The mill area consists of foundations and mill equipment that is largely overgrown by vegetation. A small spring breaks out on the hillside above the mill and flows onto DNF administered land and eventually into the North Fork of Flint Creek. A reclaimed adit is discharging into a small stream which also flows into the North Fork of Flint Creek. Also, a small volume of tailings is present on private ground near the North Fork Flint Creek.

A second mine on private land, identified as the Lower Red Lion, is on the west side of the creek. Extensive open pit workings as well as a flooded decline were observed. Waste-rock piles at the site contain little or no sulfides; soils did not appear adversely impacted downhill of the piles.

2.5.3.1 Site Features - Sample Locations

Samples were collected at the Red Lion mine on 8/26/92. The adit-discharge stream was sampled where it flows onto DNF administered land (FRLS10L). The North Fork of Flint Creek was sampled below the confluence with the adit discharge stream (FRLS20L) as well as upstream (FRLS40L) and downstream (FRLS30L) of the site. The North Fork of Flint Creek was flowing at about 663 gpm above the site, 441 gpm below the confluence of the creek and the adit discharge, and 945 gpm below the site. The adit discharge stream was flowing at about 40 gpm.

All of the waste material on the site was on private land; no soil samples were collected.

2.5.3.2 Soil

The small tailings pile on private land is well vegetated, and no evidence of impact to soils was observed. The waste material present in the main development area contains little or no sulfides; erosion of this material during storm or runoff events appears unlikely.

Figure 2.4 Most of the disturbed area of the Red Lion mine is on private land. A small tailings pile is near the North Fork of Flint Creek.

Figure 2.5 A small discharge issues from a collapsed adit at the Red Lion mine. The adit shown is on DNF administered land.

2.5.3.3 Water

No water-quality standards were exceeded at the Red Lion site (Table 2.4) The adit discharge stream (FRLS40L) had the highest concentrations of several metals, but the concentrations were generally well below the MCLs considered.

Table 2.4
Water-Quality Exceedences
Red Lion Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
N Fk Flint Cr. - Upstream (FRLS40L)																			
Adit discharge (FRLS10L)																			
N Fk Flint Cr. - below adit (FRLS20L)																			
N Fk Flint Cr. - downstream (FRLS30L)																			

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

2.5.3.5 Summary of Environmental Condition

Most of the disturbed area of the Red Lion mine is on private land. The portion that is on DNF administered land is small. Overall, the mine appears to have little impact on surface-water quality; erosion in the disturbed area appears to be restricted to the disturbed area. Mass-wasting or other movement of material toward the North Fork of Flint Creek is unlikely.

2.5.4 Structures

All significant structures associated with the Red Lion mine are on private land. The mill site on DNF administered land is within a few feet of the road, but only remnants are visible.

2.5.5 Safety

No safety concerns were identified that relate to the mine. Observations of this type were restricted to DNF administered land.

2.6 GARRETT MINE

2.6.1 Site Location and Access

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

2.6.2 Site History - Geologic Features

The Garrett mine sought high-grade ore from veins and irregular solution cavities in Cambrian carbonate rocks. The main adit follows a N40W 75NE vein 1-3 feet wide for 145 feet in Cambrian Hasmark limestone (Earll, 1972). Skarn minerals are present in the carbonates, and bismuthinite is present in the vein (unpublished information, MBMG files). Apparently the mine produced a little ore in the early 1960's (Earll, 1972). A mill on private land below the mine has an associated tailings dam but no tailings.

2.6.3 Environmental Condition

The mine consists of a single caved adit that is discharging a small amount of water onto a waste-rock dump. The water infiltrated the waste material within a few feet. No seeps or other water were found between the adit and North Fork of Flint Creek.

2.6.3.1 Site Features - Sample Locations

The site was visited and sampled on 8/26/92. A sample was collected of the adit discharge (FGAS10M), which was flowing at less than one gpm. The North Fork of Flint Creek was sampled downstream of the mine and just upstream of the Cable Mountain Campground (FNFS30L). Sample FNFG10L was collected from a well at the campground (hand-pump).

No soil samples were collected.

Figure 2.6 The Garrett mine has a single adit that discharges less than one gpm. Impact to the area appears to be restricted to the adit and waste-rock dump.

2.6.3.2 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. No indication of erosion or contamination exists below the disturbed area.

2.6.3.3 Water

The field-pH (8.58) of the adit discharge exceeded the upper limit of the secondary drinking water MCL (Table 2.5); however, the lab-pH did not. Specific conductance and pH data were collected at several points in the wetland area along the North Fork of Flint Creek, downhill of the mine. No indications of change attributable to the mine were found.

The sample collected from the Cable Mountain Campground well exceeded MCLs for manganese and zinc. This contamination is probably not a mining-related impact. Instead, ground water in this mineralized region may have naturally high concentrations of certain metals.

Table 2.5
Water-Quality Exceedences
Garrett Mine

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 (FGAS10M)																			S
N Fk Flint Cr. - Downstream (FNFS30L)																			
Cable Mountain Campground well (FNFG10L)									S				A,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

2.6.3.4 Vegetation

The vegetation in the vicinity of the Garrett mine varies from sparse to dense. There is no indication of stressed vegetation near the mine site. The waste-rock dump and the area near the adit are partially vegetated.

2.6.3.5 Summary of Environmental Condition

The Garrett mine is a small, isolated adit with a waste-rock dump several hundred feet above the creek. The adit discharge is small and infiltrates the ground within a few feet; there is no evidence of discharge off the site. Although the waste-rock dump is on a steep hillside, it is partially vegetated and appears stable.

2.6.4 Structures

There is a single building near the adit of the mine; ownership of the structure is uncertain because it lies close to the boundary between DNF and private land. The building is in poor repair.

2.6.5 Safety

The poor condition of the building may pose a risk; the mine is on a steep hillside and footing on the waste-rock dump is loose in some places.

2.7 HOBO-T. HAYES MINE

2.7.1 Site Location and Access

The Hobo-T. Hayes mine (T7N R13W 29 BCCA) is about 1.5 miles east of Philipsburg and is accessible by road. The site is within a small drainage that feeds into Camp Creek, a tributary to Flint Creek. According to a DNF property boundary map (1:24k), most of the site is on private land; however, part of a waste-rock dump on the north end of the site may be on DNF administered land.

2.7.2 Site History - Geologic Features

This locked adit with a discharge must be the lower access to the Hobo workings, probably the tunnel described by Emmons and Calkins (1913) as drifting 2000 feet along the vein. There are three tunnels at higher elevations, for a total of 3500 feet of workings. At the Hobo, a 1.5 foot wide vein strikes N80E 75SE in granite of the Philipsburg batholith. Vein minerals include quartz, rhodochrosite, galena, sphalerite, pyrite, arsenopyrite, stibnite, chalcocite, realgar, and ruby silver. Mostly oxidized ore was mined, but some unoxidized ore carried "100 oz/ton silver and $3 in gold" (Emmons and Calkins, 1913). Value of metals produced was about $100,000.

2.7.3 Environmental Condition

Water discharges from a gated adit (A-1, see Figure 2.6) at a rate of 10-20 gpm. After running across the top and down the southern edge of a large waste-rock dump (W-1), the discharge flows into an ephemeral drainage. This drainage crosses onto DNF administered land a short distance below the site. Waste material eroded by the discharge has been washed into the ephemeral stream channel; deposition of these wastes extends onto DNF administered land. Northwest (downhill) of the waste-rock dump, several springs and seepage areas are present. The ground surface near the seepage areas is barren or partially covered with moss.

2.7.3.1 Site Features - Sample Locations

The site was sampled on 9/23/93. Two surface water samples were collected on DNF administered land below the site. One sample (CHHS10H) was collected along the ephemeral stream drainage; no water was present along the drainage above the site, so this water originated primarily from the adit discharge.

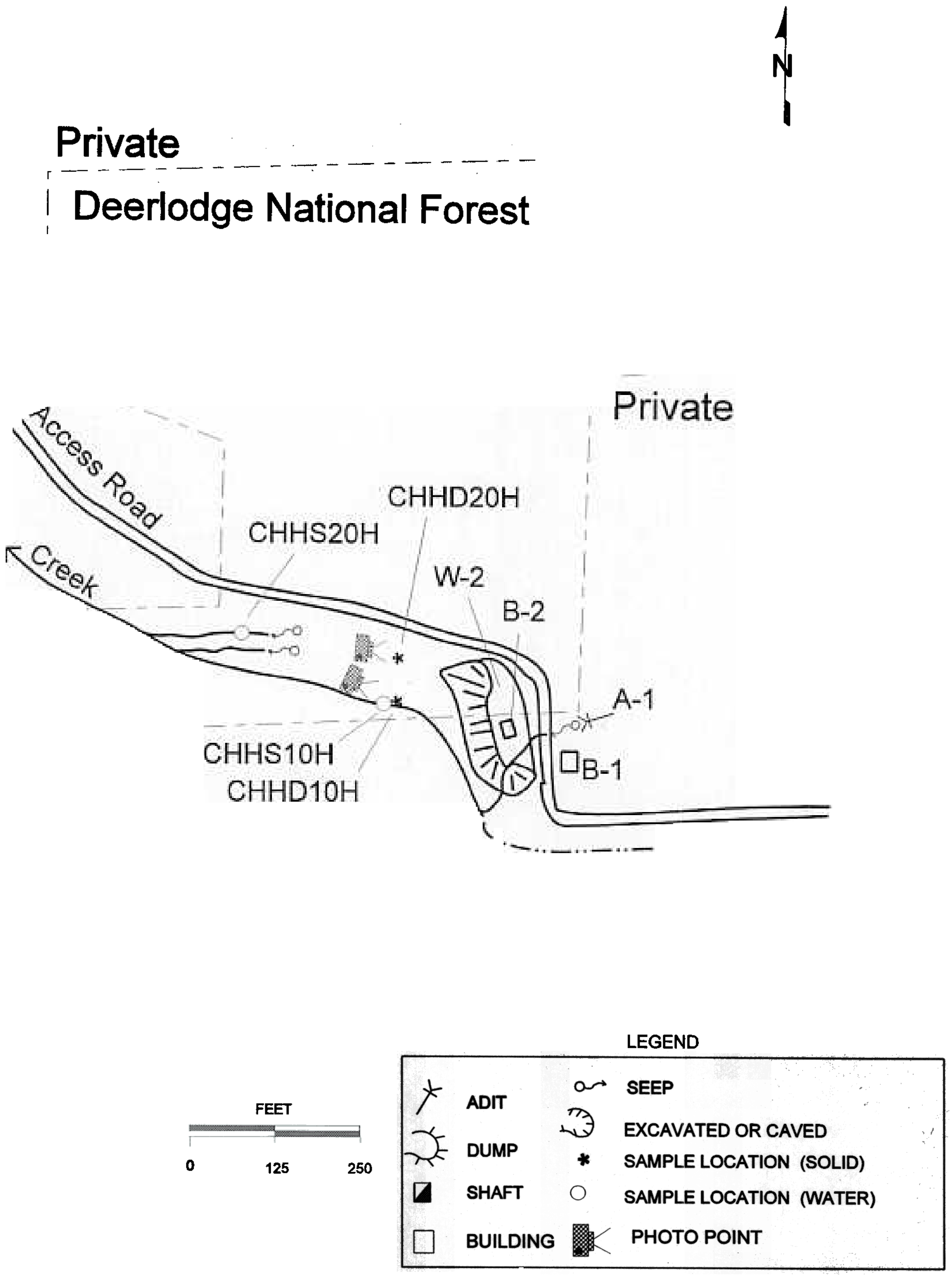


Figure 2.7 Site map of Hobo-T. Hayes mine

Figure 2.8 Adit discharge flowing along ephemeral drainage below the site. Water sample CHHS10H was collected at this location.

Figure 2.9 Mossy to barren patch of ground below waste-rock dump. Soil sample CHHD20H was collected from this area.

The other sample (CHHS20H) was collected from one of the springs. At sample location CHHS10H, the flow rate was 20 gpm; the flow rate of the spring was 1.0 gpm.

A composite soil sample (CHHD10H) was collected along the natural drainage where waste material from the dump has been deposited. A second sample (CHHD20H) was collected from one of the barren seepage areas below the dump.

2.7.3.2 Soil

The soil along the ephemeral drainage below the site has concentrations of arsenic, cadmium, copper, lead, and zinc that exceed one or more Clark Fork Superfund background levels (Table 2.6). In addition, the concentration of zinc also exceeds phytotoxic levels. The soil in the seep area has concentrations of arsenic, copper, and lead that are more than four times higher than phytotoxic levels; the concentration of zinc is more than 40 times greater than the phytotoxic level.

Table 2.6
Soil Sampling Results
Hobo-T. Hayes Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Soil along natural drainage (CHHD10H)	33.94[1]	2.28[1]	13.04[1]	180.94[1]	965.36[1,2]
Soil in barren area below dump (CHHD20H)	488.30[1,2]	62.49[1]	465.77[1,2]	4049.20[1,2]	20637.18[1,2]

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

2.7.3.3 Water

The water in the drainage below the site had concentrations of cadmium, manganese, mercury, and zinc that exceeded water-quality criteria (Table 2.7). The spring also had exceedances for these constituents; also, its pH (6.13) was below the acceptable lower secondary MCL range of 6.5.

Table 2.7
Water-Quality Exceedences
Hobo-T. Hayes Mine

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 - drainage below site (CHHS10H)				P,A C					S	C			A,C						
Spring - below site (CHHS20H)				P,A C					S	C			S,A C						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

2.7.3.4 Vegetation

The undisturbed portions of the site are vegetated with grasses, willows, and conifers. The seepage areas below the site are either barren or covered with mosses. The waste-rock dump is sparsely vegetated.

2.7.3.5 Summary of Environmental Condition

The impact of this site on DNF administered land is visually apparent. Waste material eroded from the dump has been deposited for several hundred feet along the drainage below the site; also, there are barren or mossy patches of ground where seeps appear to have poisoned the native vegetation. Contaminant concentrations in the soils in these areas are high.

Surface-water quality below the site is poor, and ground-water quality is also very likely to be poor. The soil contamination in the seepage areas below the dump is probably due to evaporative concentration of the metals that are present in the ground water.

2.7.4 Structures

Two mine buildings (B-1 and B-2) are located on private land. Building B-1 is in fair condition; B-2 is in bad condition. No structures were observed on DNF administered land.

2.7.5 Safety

No hazardous openings or buildings were observed on DNF administered land. The two mine buildings, which are on private land, may pose a minor threat to safety. Although the adit at the site is intact, it is sealed with a gate, so visitors cannot enter.

2.8 BROOKLYN MINE

Author's note: This site was reclaimed by the Forest Service during the summer, 1995. Many of the features discussed below are no longer present.

2.8.1 Site Location and Access

The Brooklyn mine is on DNF administered land, about 2.5 miles southeast of Princeton, Montana (T7N R12W Section 5 ACDC). Boulder Creek forms the southwestern boundary of the site. The site can be accessed by a road that follows Boulder Creek and passes through the site.

2.8.2 Site History - Geologic Features

The Brooklyn is one of the most extensively developed mines in the Princeton district. Underground maps (unpublished information, MBMG files) indicate the ore was mostly mined from a soft, sheared porphyry dike with a N36W vertical attitude. The dike contains pyrite and nodules of quartz, barite, sphalerite, galena, calcite, lead carbonate, and copper carbonate (Emmons and Calkins, 1913). Some ore was also extracted from the adjacent sheared limestone and black shale of the Madison group. An outcrop of granodiorite related to the Royal stock is mapped one half mile to the southeast (McGill, 1959). The average grade of ore produced was 12 oz/ton Ag, 1% Cu, 3% Pb, and 8% Zn (unpublished information, MBMG files), but some of the ore was of considerably higher grade. In 1907, 80 tons provided 37 oz/ton Ag, 1.7% Cu, 8% Pb, and 13% Zn (Emmons and Calkins, 1913).

The mine was worked intermittently beginning in 1907. Exploration was still proceeding at the mine in the early 1960s. Today the mine encompasses over 3000 feet of workings with four caved adits, one caved shaft, and one open adit. The lower dump along the banks of Boulder Creek contains 5000 tons of clays, black shale, limestone, and porphyry with about 5% pyrite and some quartz alteration. Upper dumps are smaller, but of similar mineralogy.

A flotation mill was constructed on the bench well above Boulder Creek in 1917 and operated for two years, treating the silver-copper-lead-zinc ore of the Brooklyn Mine. Tailings were impounded on the bench, where 5000-10,000 tons remain, and they wash into Boulder Creek during storm events. An attempt was made to put the mill back into production in 1927, but the mill burned to the ground.

2.8.3 Environmental Condition

The site consists of one open and four caved adits, a caved shaft, mill tailings and waste-rock dumps (Figure 2.10). Mill tailings and waste material from upper portions of the site are washed onto lower portions of the site and into Boulder Creek by storm-water runoff. During high flows, Boulder Creek undercuts the waste material along its banks. Iron-oxyhydroxide stains are present along a discharge channel leading away from the lowest adit. The stains suggest that water is discharged from this adit, but at the time of the site visit, there was no discharge.

2.8.3.1 Site Features - Sample Locations

The site was sampled on 8/17/92. A composite soil sample (BLBD10M) was collected downhill of the tailings impoundment. A water sample from Boulder Creek (BLBS10L) was collected about 200-feet downstream from the streamside-waste material.

2.8.3.2 Soil

The concentrations of elements in Table 2.8 exceed all of the Clark Fork Superfund background levels. Arsenic, copper, lead, and zinc exceed the phytotoxic limits.

Table 2.8
Soil Sampling Results
Brooklyn Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Soil downhill from tailings impoundment (BLBD10M)	449[1,2]	34.6[1]	112[1,2]	3470[1,2]	5330[1,2]

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

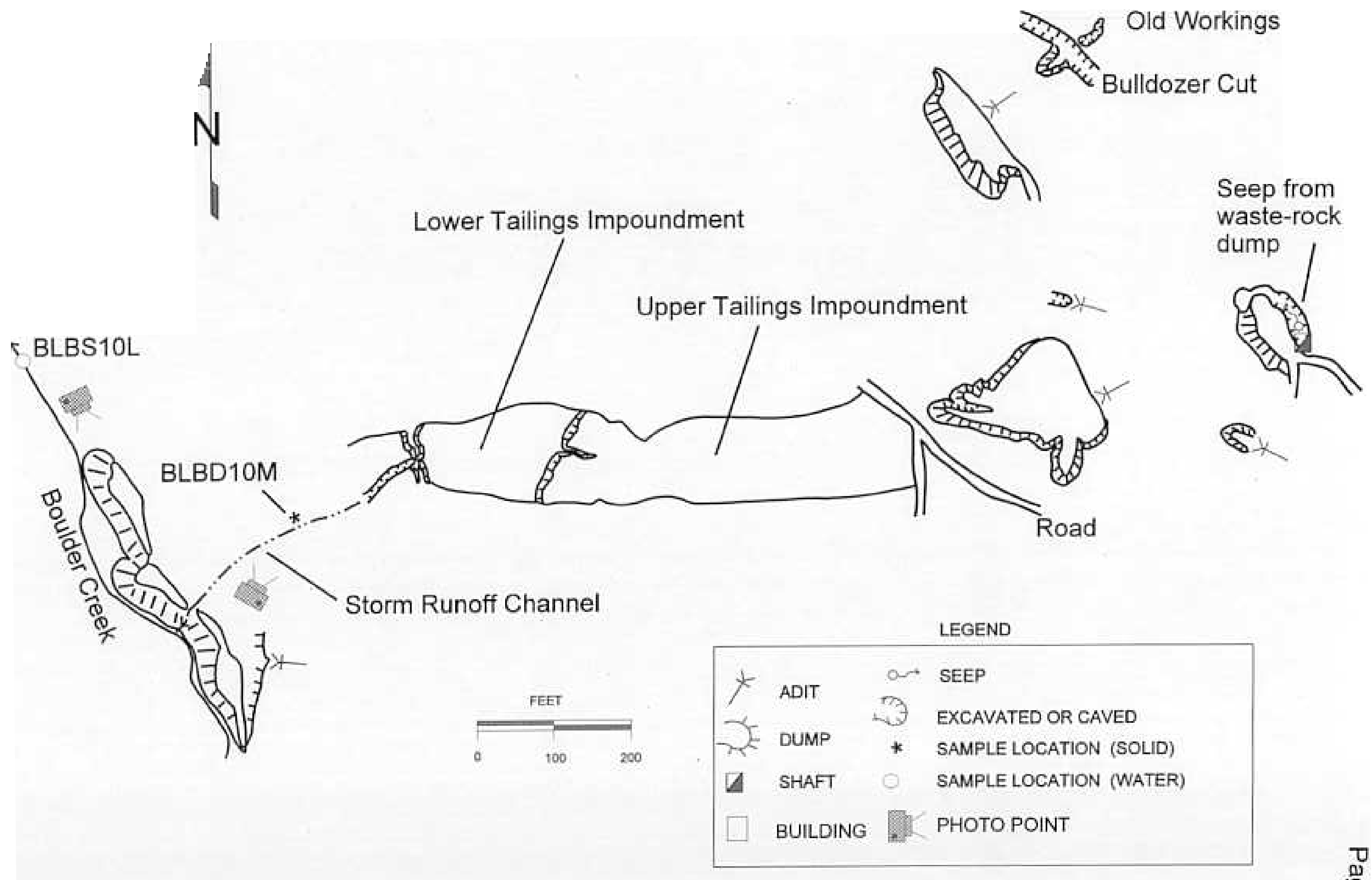


Figure 2.10 Site map of th Brooklyn mine and mill

Figure 2.11 During runoff events, mill tailings and waste rock from Brooklyn mine and mill wash downhill towards the lower portion of the site and Boulder Creek.

Figure 2.12 Waste-rock dump on the banks of Boulder Creek, at the lower end of the Brooklyn site.

2.8.3.3 Water

No water-quality standards were exceeded in Boulder Creek downstream of the site.

Table 2.9
Water-Quality Exceedences
Brooklyn Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Boulder Creek 200-feet downstream from the site (BLBS10L)																			

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

Waste-rock dumps at the site are devoid of vegetation. The mill tailings are very sparsely vegetated with trees and grasses. The vegetation of undisturbed areas appears to be healthy and unaffected.

2.8.3.5 Summary of Environmental Condition

Stormwater runoff transports waste rock and mill tailing downhill onto the lower portions of the site and into Boulder Creek. During wetter periods, the lower adit may discharge water. High stream flows may undercut the waste rock along the banks of Boulder Creek.

2.8.4 Structures

A metal building in good shape and a dilapidated hydroelectric-generation building are present at the lower end of the site.

2.8.5 Safety

The hydroelectric-generation building may be a safety concern.

2.9 PORT ROYAL AND SUNDAY MINES

2.9.1 Site Location and Access

The Port Royal mine (T8N R12W Section 34 BBDB) and Sunday mine (T8N R12W Section 27 CCDC) which has an associated mill are on private land in a small tributary drainage of Royal Gold Creek. A small tailings impoundment and other waste material are on DNF administered land downhill of the Port Royal mine The site is accessible by a jeep trail from the town of Princeton.

2.9.2 Site History - Geologic Features

The Port Royal mine was the largest producer in the Princeton district, with over $2 million in gold recovered from the 1890s until its closure in 1931 (unpublished information, MBMG files). Five drifts with a total length of 8000 feet follow a S65E 60SE vein along a normal fault in granodiorite of the Royal stock (Emmons and Calkins, 1913). The vein is 4 inches to 2 feet wide and is composed of quartz, pyrite, and galena, although vein pieces on the dump contain less than 1% sulfides. Biotite and feldspar in the granodiorite have been altered to calcite, sericite, and chlorite. The ore was richest on either side of a 100-foot wide granite porphyry dike which must be related to the mineralization. The vein contained from $8 to $200 per ton in gold values.

A gravity mill was built at the mine in 1892 and the tailings were allowed to run down Royal Gold Creek. Although a few remnants of the original tailings remain just below the mine (the Port Royal tailings), most ended up a mile downstream (Royal Gold tailings, next section). Here a cyanide mill was built in 1905 to re-treat them (Emmons and Calkins, 1913).

About 250 tons of the original Port Royal gravity tailings remain. These tailings have a quartz-muscovite composition.

The Sunday mine was worked in 1902, producing $73,000 in gold (Emmons and Calkins, 1913). Ore was mined from several parallel veins up to one foot wide in sericitized granodiorite of the Royal stock. The geology is probably similar to that at the adjacent Port Royal mine. About 940 feet of workings are present, but not accessible through the caved adits today.

An amalgamation mill supposedly treated several hundred tons of ore, but no associated tailings were observed.

2.9.3 Environmental Condition

Since the main development areas of both mines and the mill are on private land, a detailed investigation was not conducted. The Port Royal mine has at least two caved adits; the lower one discharges water which flows onto DNF administered land. Some seeps issue from the tailings, and the tailings are being eroded by the Port Royal discharge stream.

There were two adits on the Sunday mine site and both are discharging water. Neither discharge reaches DNF administered land. There is no evidence of waste material from either mine being deposited on DNF administered land.

2.9.3.1 Site Features - Sample Locations

Sampling was conducted on 8/18/92 and was restricted to DNF administered land, particularly the tailings impoundment (Figure 2.13). A sample was collected of the Port Royal mine adit discharge where it flowed into the tailings impoundment (FPRS10L) and where it flowed out of the impoundment (FPRS20L). The stream was discharging approximately 2.8 gpm at both sample locations.

A soil sample (FPRD10H) was collected from an area downhill of the tailings impoundment where soils had been washed toward the small stream.

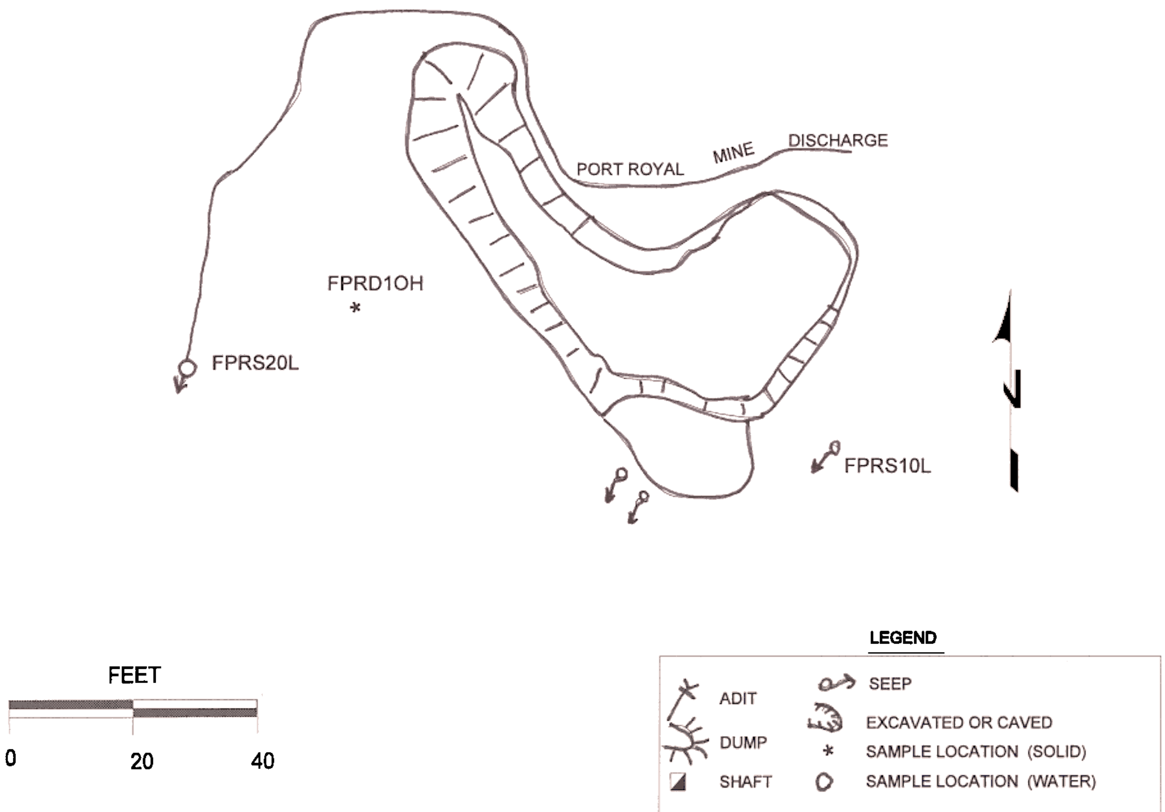


Figure 2.13 Most of the disturbances associated with the Port Royal and Sunday mines are on private land. The investigation, therefore, focused on the tailings impoundment downhill of the Port Royal mine.

Figure 2.14 The Port Royal tailings are on private land, uphill from DNF administered land.

Figure 2.15 The main development area of the Sunday mine has several acres of waste material.

2.9.3.2 Soil

There is no indication of waste material from private land being eroded and deposited on DNF administered land. The tailings impoundment is moderately vegetated and appears stable; however, a small amount of material has been washed toward the stream. The soils in this area exceeded phytotoxic levels for copper and lead (Table 2.10).

Table 2.10
Soil Sampling Results
Port Royal Tailings
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Tailings wash area (FPRD10H)	60.7[1]	3.62[1]	213[1,2]	3360[1,2]	466[1]

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

2.9.3.3 Water

No water-quality exceedences were found at the Port Royal tailings site. The field-pH was slightly lower in the "downstream" sample, but otherwise there was little difference in the chemistry of the two samples that were collected. Although present in high quantities in the nearby soil, copper and zinc concentrations in the water were not very high.

Table 2.11
Water-Quality Exceedences
Port Royal Tailings

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 - upstream of tailings (FPRS10L)																			
Adit discharge - downstream of tailings (FPRS20L)																			

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 tops and sides of the waste-rock dumps are sparsely vegetated to barren. Vegetation is noticeably reduced in the tailings impoundment.

2.9.3.5 Summary of Environmental Condition

The disturbed area of the Port Royal and Sunday mines/mills covers a rather large area on private land. The downhill area on DNF administered land has been impacted by the deposition of tailings and waste material, but water quality has not been strongly impacted. Soil has been impacted, but the impact appeared to be limited to a small area.

2.9.4 Structures

Several structures, including cabins and mill buildings, are on private land. A small cabin is near a dry caved adit downhill from the tailings impoundment.

2.9.5 Safety

No apparent safety risks were identified on DNF administered land, but there are several buildings and structures on private land that may be potential hazards.

2.10 ROYAL GOLD MILL TAILINGS

2.10.1 Site Location and Access

Royal Gold mill tailings (T8N R12W Section 32 ADAA) are in the same tributary drainage as the Port Royal and Sunday development areas. The site is accessible by a primitive road from the main Boulder Creek road. All of the tailings area is on DNF administered land.

2.10.2 Site History - Geologic Features

The Royal Gold tailings were originally from a gravity and amalgamation process, and were later treated in a cyanide mill. It is difficult to estimate the volume present because most of the tailings are covered by heavy vegetation or beaver ponds. A composite sample carried 0.068 oz/ton Au, 0.44 oz/ton Ag, 0.039% Cu, 0.102% Pb, 0.073% Zn. As noted in the previous section, it is possible that tailings from the Port Royal and Sunday mills were carried this far.

2.10.3 Environmental Condition

The Royal Gold Creek mill site is within the floodplain of Royal Gold Creek which is a tributary to Boulder Creek. Tailings are present in the area below the mill site and, in places, have accumulated in sufficient quantity to have impacted vegetation. Tailings are also evident where the stream has eroded into the floodplain.

2.10.3.1 Site Features - Sample Locations

The site was visited and sampled on 8/18/92. The areal extent of the tailings was not discernable; surface water samples were collected upstream (FRGS10L) and downstream (FRGS20M) of the wetlands area that contained the tailings (Figure 2.16). Royal Gold Creek was flowing at approximately 956 gpm upstream of the wetlands and approximately 2217 gpm downstream at the termination of the wetlands.

No soil samples were collected

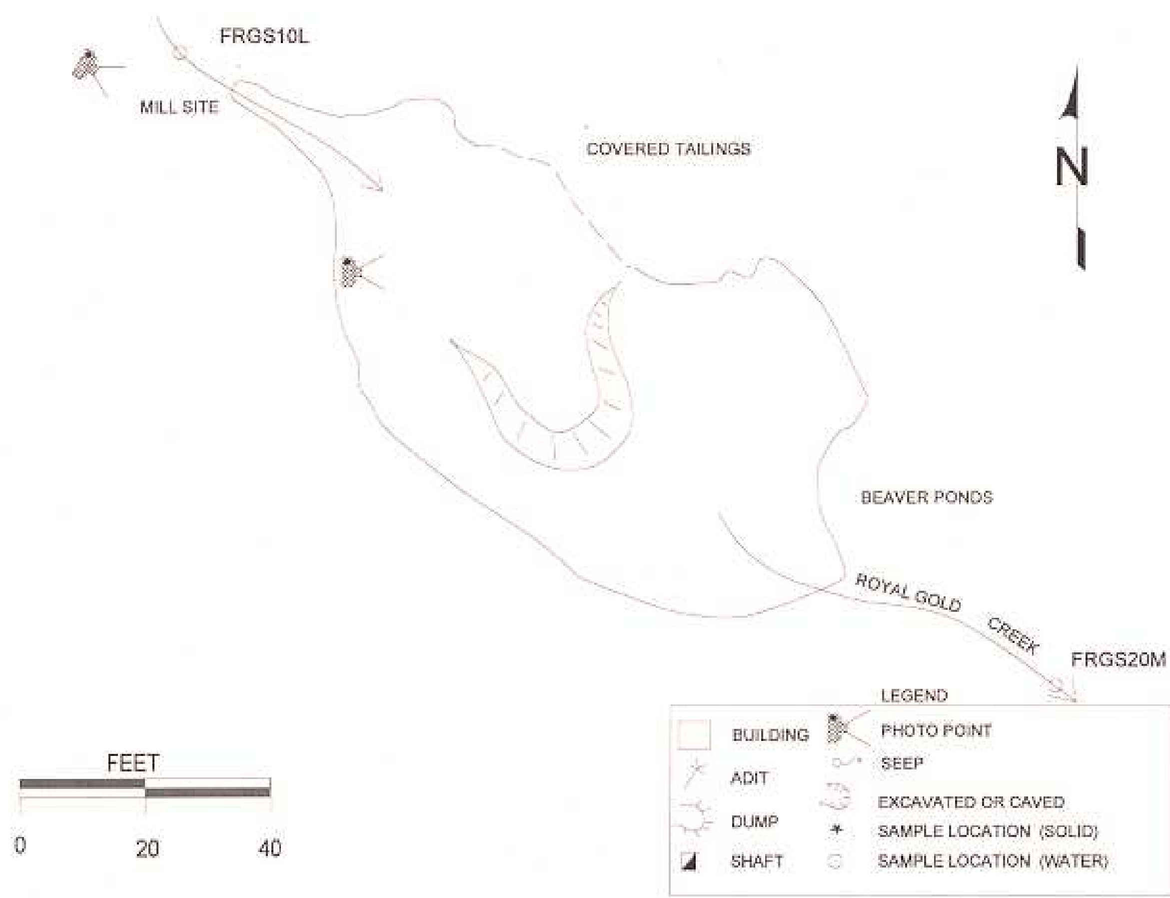


Figure 2.16 The Royal Gold mill tailings area may contain tailings from the Port Royal and Sunday mills. Samples were collected upstream and downstream of the general area of the tailings.

Figure 2.17 Most of the tailings near the Royal Gold mill are covered by vegetation. Small areas devoid of vegetation were observed throughout the area.

Figure 2.18 Some portions of the Royal Gold mill tailings have been eroded and re-deposited by the creek.

2.10.3.2 Soil

The only evidence of impact from the tailings were small areas where vegetation was sparse. The largest of these areas was a few square feet. No tailings were observed in the stream channel.

2.10.3.3 Water

A comparison of the sample collected upstream to the sample collected downstream of the tailings indicates an increase in the concentration of dissolved arsenic, iron, manganese, lead, and zinc. Only the concentrations of lead exceed MCLs for aquatic life (chronic) in the downstream sample.

Table 2.12
Water-Quality Exceedences
Royal Gold Mill Tailings

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Royal Gold Cr. - Upstream (FRGS10L)																			
Royal Gold Cr. - Downstream (FRGS20M))								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

2.10.3.4 Vegetation

Stressed vegetation is found in small patches (several square feet) throughout the wetlands area. The largest area where vegetation is sparse or barren is adjacent to the mill where a small tailings pile is present. The vegetation at the edge of the pile appears healthy. Overall, the area is heavily vegetated with grasses and willows.

2.10.3.5 Summary of Environmental Condition

There appears to be some impact to surface-water quality from the Royal Gold mill tailings. The concentrations of several dissolved constituents increase downstream of the site; however, lead is the only metal that exceeds water-quality standards. As noted, there are other potential sources of tailings, but no positive identification could be made. The wetlands area where the tailings lie appears to be stable and capable of absorbing large runoff surges. Re-working of the buried tailings by the stream may occur in the future, but the amount of tailings exposed at any given time is likely to be minor.

2.10.4 Structures

The location of the Royal Gold mill is defined more by the location of the tailings than by building remnants. No buildings or remnants were observed in the area.

2.10.5 Safety

No apparent safety concerns were identified at this site.

2.11 STARLIGHT MINE

2.11.1 Site Location and Access

The Starlight mine is about three-quarters of a mile east of Pierre Hill and is easily accessible by road (T8N R12W Section 33 DCCA). The entire site is on private land.

2.11.2 Site History - Geologic Features

A series of caved adits follow a N40W 80NE quartz-pyrite-copper carbonate vein in Quadrant quartzite. The deposit may be associated with a thin parallel(?) granodiorite dike. Dumps consist of unaltered quartzite. No production was recorded from this site (Elliott and others, 1992). An unpublished letter (MBMG files) indicates that this property was valued for its silver and lead content.

2.11.3 Environmental Condition

The site consists of several caved adits and associated waste-rock dumps. An unnamed creek, a tributary to Boulder Creek, flows onto the site and sinks into the waste-rock dump. At the base of the waste-rock dump, seeps emerge and flow into a channel which subsequently flows onto DNF administered land. Material from the waste-rock dump does not appear to be eroding onto DNF administered land. Because the site is on private land, a site map was not constructed.

2.11.3.1 Site Features - Sample Locations

A water sample was collected from the discharge channel where it crosses onto National Forest land (BQNS10L). The flow was about 1.2 gpm, pH was about 8.2, and specific conductance was about 58 umhos @ 25°C. Because waste material is not eroding onto DNF administered land, soil samples were not collected.

2.11.3.2 Soil

Soil samples were not collected.

2.11.3.3 Water

No water-quality criteria were exceeded.

Table 2.13
Water-Quality Exceedences
Starlight Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Discharge below mine (BQNS10L)																			

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

2.11.3.4 Vegetation

Vegetation growing on the waste-rock dump and near the discharge channel appears healthy.

2.11.3.5 Summary of Environmental Condition

The waste-rock dump is stable and is not eroding onto DNF administered land. The water seeping from the unaltered waste material is generally of good quality and is not adversely impacting DNF administered land.

2.11.4 Structures

No structures are present at this site.

2.11.5 Safety

This site does not pose any threat to safety.

2.12 NON PAREIL MILL TAILINGS

2.12.1 Site Location and Access

The Non Pareil tailings (T8N R12W Section 32 CCCC) are within the flood-plain of Boulder Creek immediately above its confluence with Royal Gold Creek. The site is approximately two miles upstream of Princeton and is adjacent to the main road. Most of the tailings are on DNF administered land.

2.12.2 Site History - Geologic Features

A flotation mill, although located at the Non Pareil mine, actually treated mostly ore from the Brooklyn. It was built sometime in the 1940's and operated until about 1951 (unpublished information, MBMG files). Approximately 7000 tons of tailings are present and grab samples contained very little gold, from 0.68-3.0 oz/ton Ag, 0.008-0.034% Cu, 0.091-0.633% Pb, and 0.082-0.805% lead. Metal contents of the piles appear to decrease with each successive downstream pile.

2.12.3 Environmental Condition

There are four main tailings impoundments; two contain flowing water that originates from springs on the site. Boulder Creek flows around the site and joins with the impoundment discharge just below the last tailings dam.

2.12.3.1 Site Features - Sample Locations

The site was visited and sampled on 8/18/92. Samples were collected from Boulder Creek both upstream (FNPS50L) and downstream of the site (FNPS40L). At the upstream location, the creek was flowing at about 2220 gpm; at the downstream location, the flow rate was about 2334 gpm. Samples were also collected from a spring originating in an area between two impoundments (FNPS20M, flow rate: 4.9 gpm), from the discharge stream at the outlet of the middle impoundment (FNPS10M, flow rate: 1.5 gpm), and from the discharge stream at the outlet of the lowest impoundment (FNPS30M, flow rate: 120 gpm).

A soil sample was collected near the origin of the spring (FNPD10H). Site features and sample locations are presented in Figure 2.19.

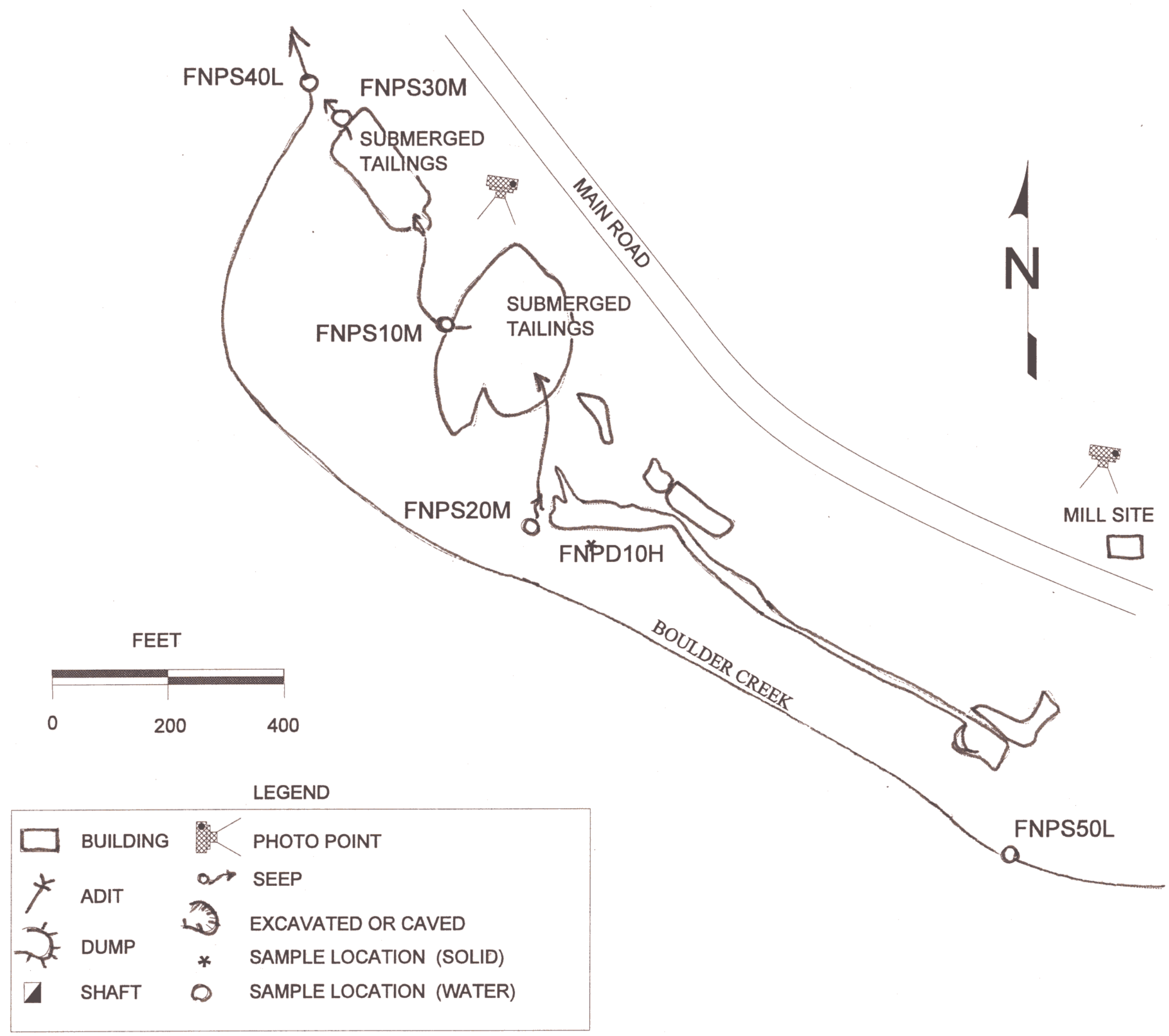


Figure 2.19 The Non Pareil tailings extend about 1500 feet along Boulder Creek above Princeton. Samples were collected upstream, downstream, and within the tailings impoundments.

Figure 2.20 The mill site of the Non Pareil mill is adjacent to the main Boulder Creek Road, approximately 2 miles upstream of the town of Princeton.

Figure 2.21 The two largest tailings impoundments contain water. However, large areas of tailings remain exposed.

2.12.3.2 Soil

Soils in the tailings impoundments have been subject to erosion and mixing. Storm events have obviously redistributed soils and tailings throughout the site. Some small-scale mass-wasting has occurred above the middle impoundment. The concentration of all the metals considered in the soil sample collected near the spring between the two larger ponds exceeded phytotoxic levels. Lead and zinc were especially high (Table 2.14). Although mercury was not one of the targetted metals for this study, the concentration in this sample was 194.7 mg/kg. This value is the highest of any sample collected at a mine site in the Deerlodge National Forest.

Table 2.14
Soil Sampling Results
Non Pareil Mill Tailings
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Spring area (FNPD10H)	529[1,2]	115[1,2]	384[1,2]	5100[1,2]	17100[1,2]

(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

Concentrations of lead in the spring and the lower impoundment discharge exceeded the aquatic life (chronic) standard. Concentrations of lead in Boulder Creek downstream of the site also exceeded the aquatic life (chronic) standard, which suggests that the discharges from the tailings impoundments are degrading the water quality of the creek (Table 2.15).

Table 2.15
Water-Quality Exceedences
Non Pareil Mill Tailings

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Boulder Cr. - Upstream (FNPS50L)																			
Spring in tailings area (FNPS20M)								C											
Middle impoundment discharge (FNPS10M)																			
Lower Impoundment discharge (FNPS30M)								C											
Boulder Cr. - Downstream (FNPS40L)								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

2.12.3.4 Vegetation

The tailings area ranges from well-vegetated to barren. The lower impoundment dam is heavily vegetated with willows and grasses. There are dead trees in several areas but few dying trees.

2.12.3.5 Summary of Environmental Condition

The water quality of Boulder Creek is slightly degraded as it flows past the site. During snowmelt and larger storm events, the water leaving the tailing impoundments is probably much poorer quality and thus has a greater impact on Boulder Creek. The tailings dams appear stable; they are generally overgrown with willows and small conifers. Failure during an extreme event is possible, however.

2.12.4 Structures

There is a building on the mill site adjacent to the main Boulder Creek road. Also, an old water pumping station is next to the creek near the upper end of the tailings.

2.12.5 Safety

The building which is near the main road is in poor repair and is easily accessible; therefore, it is a safety hazard. There is evidence that the site is visited regularly.

2.13 BLUE BIRD MINE

2.13.1 Site Location and Access

The Blue Bird mine (T8N R12W Section 27 ACDC) is in a tributary drainage of Little Gold Creek which flows into Boulder Creek near Princeton. The site is on DNF administered land.

2.13.2 Site History - Geologic Features

Three adits crosscut to a due east 50°S vein which is two feet wide and comprised of quartz, pyrite, galena, sphalerite, copper carbonate, and iron oxide within granodiorite of the Royal stock (Emmons and Calkins, 1913). A select sample carried 0.234 oz/ton Au, 5.4 oz/ton Ag, 0.46% Cu, 1.85% Pb, and 2.69% Zn. Some development work was being done on the property as recently as 1980 (Lawson, 1981). The total length of workings is probably about 1500 feet.

2.13.3 Environmental Condition

There are three adits at the site, one open and two caved. The lowermost adit, which is open, discharges a considerable amount of water across the dump of mostly unaltered granodiorite. The discharge eventually merges with the flow from a small spring that surfaces on the hillside above the adit.

A shaft with a head-frame is several hundred feet downhill of the Blue Bird site. The area shows signs of recent activity and was assumed to be either an active mine or on private land.

2.13.3.1 Site Features - Sample Locations

The site was visited and sampled on 8/18/92. Samples were collected from the adit discharge (FBBS10M), from the spring above the adit (FBBS20L), and from the spring below its confluence with the adit discharge (FBBS30M). Site features and sample locations are shown in Figure 2.22. The adit was discharging at about 6.2 gpm; the spring was discharging approximately 2.8 gpm at its source and approximately 4.6 gpm below its confluence with the adit discharge stream.

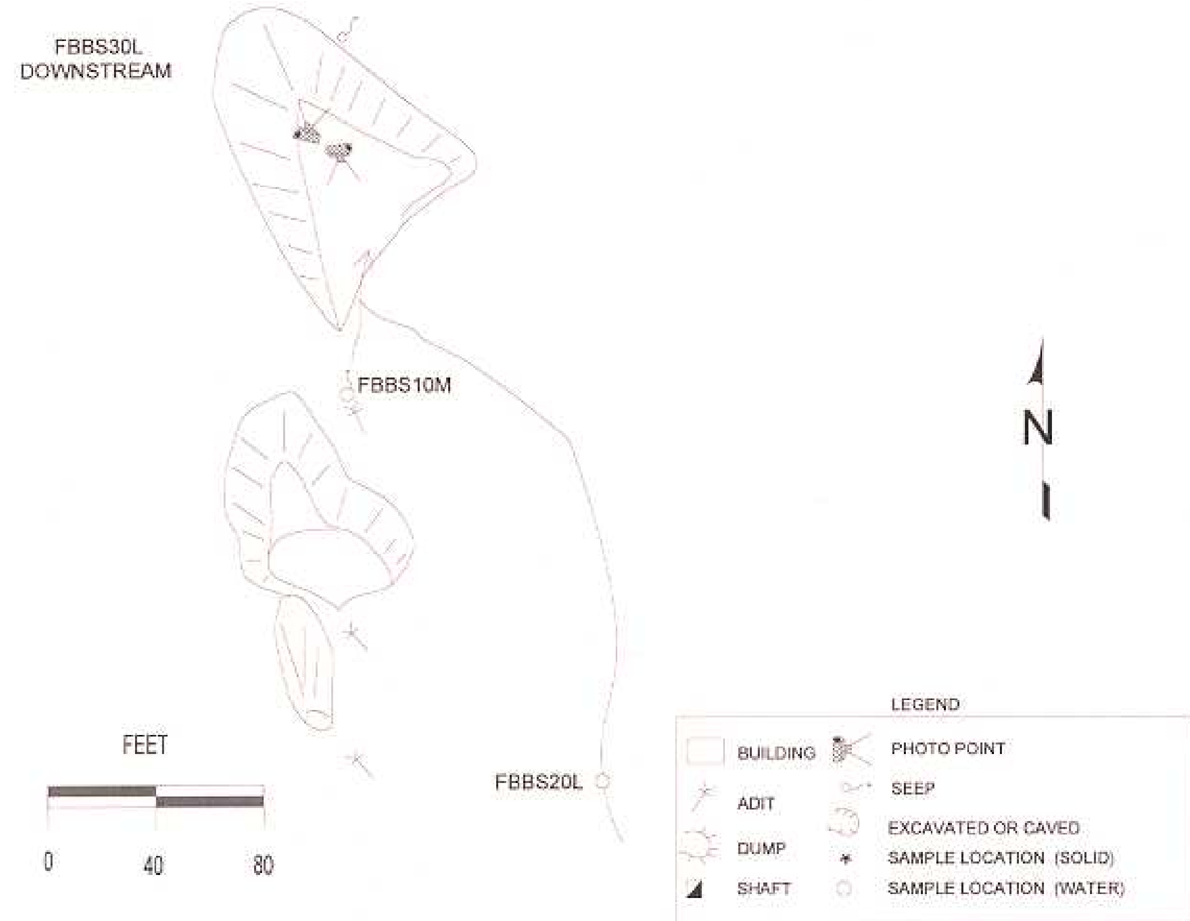


Figure 2.22 There are three adits on the Blue Bird mine site. Only the lower adit discharges water; samples were collected of the adit discharge and of the spring that flow through the site.

Figure 2.23 A spring breaks from the hillside above the adit of the Blue Bird mine. The adit also discharges water.

Figure 2.24 The adit discharge and the natural spring merge below the disturbed area of the Blue Bird mine.

2.13.3.2 Soil

The area around the adits is disturbed but appears to be stable. Much of the material in the waste-rock dumps is boulder and cobble size; no indication of erosion or other movement was observed.

2.13.3.3 Water

The adit discharge exceeded water-quality standards for zinc, and the stream below the adit exhibited low pH (Table 2.16). Mercury concentrations in the stream below the adit also exceeded aquatic life (chronic) standards. Although the concentrations of other metals were higher in the adit discharge than the other sample sources, they were generally well below MCLs. The concentrations of dissolved constituents in the sample collected below the confluence of the adit discharge and the spring were obviously elevated above the background concentrations in the spring itself.

Table 2.16
Water-Quality Exceedences
Blue Bird Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Spring above adit (FBBS10M)																			
Adit discharge (FBBS20L)													C						
Downstream of confluence of adit discharge and spring (FBBS30M)										C									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

2.13.3.4 Vegetation

The vegetation outside the disturbed area appears unstressed. Little or no vegetation is growing on the waste-rock dumps or near the adits.

2.13.3.5 Summary of Environmental Condition

The adit discharge had concentrations of metals significantly higher than the spring above the adit; however, only zinc exceeded water-quality standards. The impact of the adit discharge on water quality is apparent in the stream below the adit, where metal concentrations are somewhat higher than the background concentrations in the spring. Vegetation did not appear stressed outside the disturbed area.

2.13.4 Structures

There are no structures in the vicinity of the adits. A cabin and several small buildings are near the shaft downhill from the site.

2.13.5 Safety

The upper two adits are caved, but the waste material is deposited on a steep slope. Footing appears to be very poor in these areas. The lower adit of the Blue Bird mine poses an obvious risk because it is open and access is unrestricted.

2.14 MOUNTAIN LION MINE

2.14.1 Site Location and Access

The Mountain Lion mine is about a half mile uphill from Princeton Gulch and about 1.6 miles northeast of Princeton, Montana (T8N R12W Section 20 CDCD). The site can be accessed by vehicle from a road that turns off the main road up Princeton Gulch. The site is on DNF administered land.

2.14.2 Site History - Geologic Features

The Mountain Lion, according to Emmons and Calkins (1913), produced silver-lead ore from a steeply southeast-dipping, northeast striking sheeted zone in Quadrant quartzite. The ore appears to be a quartzite breccia cemented by quartz and iron oxides; an assay of a composite sample of this mineralized rock from the dump consisted of 0.010 oz/ton Au, 2.34 oz/ton Ag, 0.049% Cu, 0.303% Pb, and 0.053% Zn. Most of the dump is unaltered quartzite that has been disturbed by bulldozers, so volume estimates cannot be easily obtained. A few hundred tons of oxidized, mineralized breccia (represented by the composite sample described above) are also present.

2.14.3 Environmental Condition

The Mountain Lion consists of a collapsed adit and waste-rock dump. Water seeps from the caved adit at a rate of about 1.1 gpm, flows across the waste rock, and sinks into ground within 60 feet of where it emerged. A cabin in fair condition and an ore bin are also present on the site.

2.14.3.1 Site Features - Sample Locations

The site was sampled on 8/18/92. A water sample of the adit seep was collected about five feet downstream from where the seep emerges (FRLS10L). The specific conductivity and pH of the water were 165 umhos/cm @ 25°C and 7.7, respectively. A composite soil sample was collected along the toe of the waste-rock dump (FRLD10M). Site features and sample locations are shown in Figure 2.25.

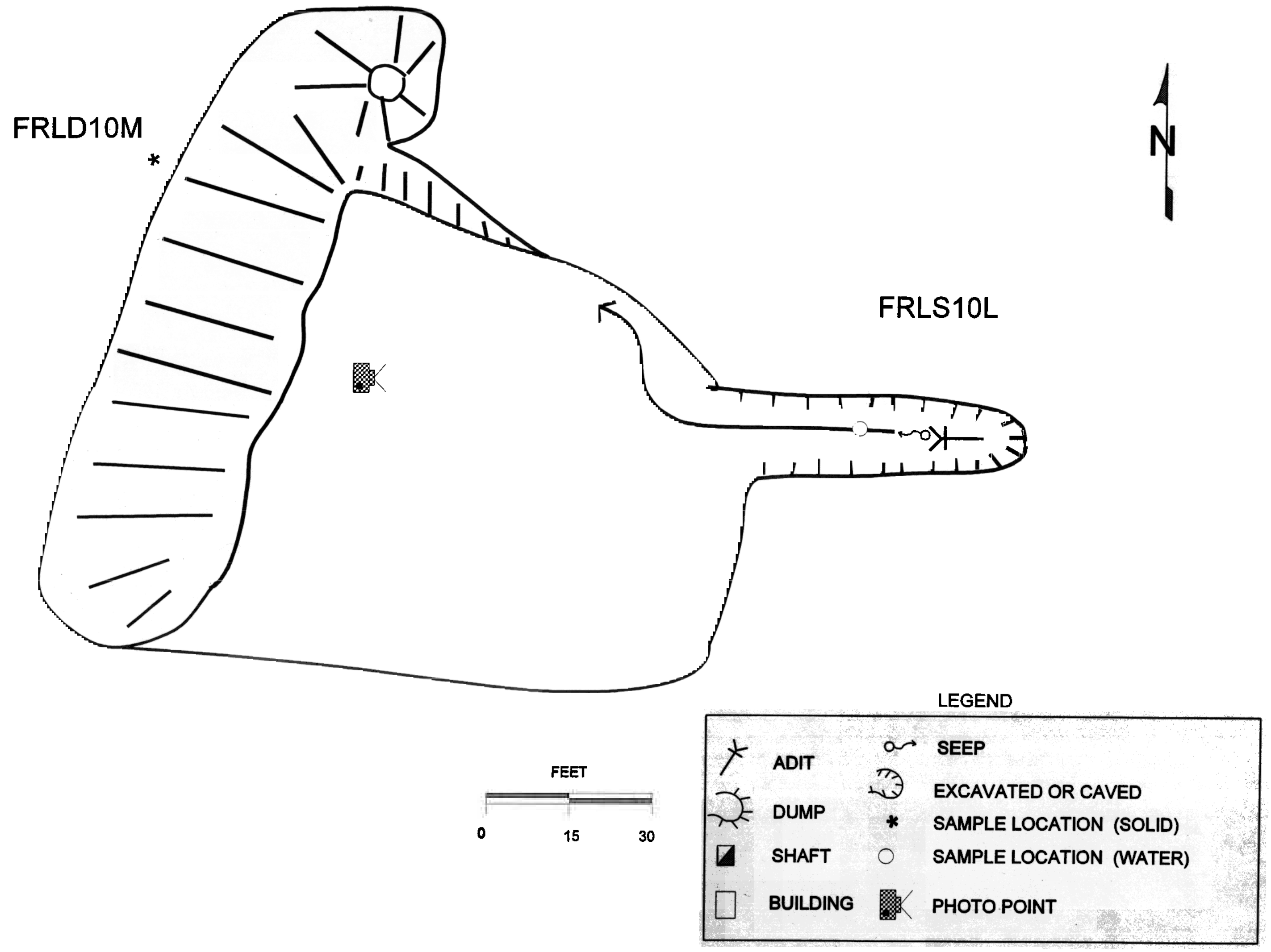


Figure 2.25 Site map of Mountain Lion mine

Figure 2.26 The caved adit of the Mountain Lion has a small discharge that infiltrates the ground about 60 feet from where it emerges. Note the lush vegetation around the adit.

2.14.3.2 Soil

Waste material from the waste-rock dump has washed onto the soils near the toe of the dump. The affected area is within about five feet of the toe. All analytes exceed Clark Fork Superfund background levels (Table 2.17). Arsenic, copper and lead also exceed phytotoxic limits.

Table 2.17
Soil Sampling Results
Mountain Lion Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Along toe of waste-rock dump (FRLD10M)	163[1,2]	11.2[1]	660[1,2]	3990[1,2]	516[1,2]

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

2.14.3.3 Water

No water-quality standards were exceeded.

Table 2.18
Water-Quality Exceedences
Mountain Lion Mine

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 (FRLS10L)																			

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

2.14.3.4 Vegetation

The adit discharge has enhanced plant growth in and near the discharge channel. Trees, grasses, and other brush have started to vegetate the waste-rock dump. Vegetation around the site appears to be healthy.

2.14.3.5 Summary of Environmental Condition

The adit discharge and waste-rock dump do not appear to adversely impact DNF administered land.

2.14.4 Structures

A log cabin and ore bin are located northwest of the adit. The cabin and ore bin are both in fair condition.

2.14.5 Safety

Although the site is not easily seen from the road and is probably visited infrequently, the log cabin and ore bin could be safety concerns because of their condition.

2.15 NORTH STAR MINE AND MILL

2.15.1 Site Location and Access

The North Star mine and mill (T8N R13W Section 21 DCDB) are along Wyman Gulch which flows into Boulder Creek near Princeton. The site is adjacent to the road, about three miles from the Boulder Creek road below Princeton. All of the workings are on private land.

2.15.2 Site History - Geologic Features

At the North Star, fine grained disseminated pyrite and chalcopyrite is present in light gray Mount Shield quartzite. Apparently this mineralization is roughly stratabound and, like bedding and slickensides, has a N9W 45NW attitude (Emmons and Calkins, 1913). The ore contained 3-6% copper. No vein material could be found on the extensive dumps. The mine was still producing as late as 1975 (Lawson, 1976). Mill ruins are present at the site, as are some mill tailings on private land. The tailings are covered by beaver ponds and heavy vegetation.

2.15.3 Environmental Condition

At least two caved adits and the remnant of a mill are near the road. There was no evidence of discharges from the workings. Since the entire disturbed area is on private land, sampling was restricted to DNF administered land, and no site map was prepared.

2.15.3.1 Site Features - Sample Locations

Samples were collected from Wyman Gulch upstream (BNSS10L) and downstream (BNSS20L) of the disturbed area on 6/16/95. The stream was flowing at about 0.24 cfs upstream and about 0.25 cfs downstream.

2.15.3.2 Soil

The road cuts into the base of the disturbed area. A small amount of waste material was in the area between the road and the stream, but it was probably placed there during road construction. There was no evidence of material having been washed into the creek or onto DNF administered land downstream. No samples were collected.

2.15.3.3 Water

A comparison of sampling results indicates little difference between the upstream and downstream samples. Aluminum and copper concentrations exceeded water-quality standards in the upstream sample but not the downstream sample (Table 2.19). The concentration of zinc was slightly higher in the upstream sample, but did not exceed any standards.

Table 2.19
Water-Quality Exceedences
North Star Mine and Mill

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Wyman Gulch above site (BNSS10L)	S,A					A,C													
Wyman Gulch below site (BNSS20LI)																			

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 vegetation outside the disturbed area appears unstressed. Little or no vegetation is growing on the waste-rock dumps or near the adits.

2.15.3.5 Summary of Environmental Condition

The North Star appears to have little, if any, environmental impact on Wyman Gulch. Upstream of the site, aluminum and copper exceeded water-quality standards; however, downstream of the site, no standards were exceeded. Outside the disturbed area, vegetation did not appear stressed.

2.15.4 Structures

No buildings are on DNF administered land. The foundation of the mill and old building materials are present in the disturbed area.

2.15.5 Safety

No safety concerns were identifed on DNF administered land

2.16 MIDDLE FORK OF DOUGLAS CREEK PHOSPHATE MINE

2.16.1 Site Location and Access

The Middle Fork of Douglas Creek Phosphate mine (T8N R12W 4 ACBA) is near the head of the Middle Fork of Douglas Creek drainage. The Middle Fork of Douglas Creek flows into Douglas Creek, a tributary to Flint Creek. The site is easily accessible by vehicle from the road up the Middle Fork drainage. The entire site is on DNF administered land.

2.16.2 Site History - Geologic Features

This site with an adit discharge was initially identified by DNF personnel; however, it turned out to be a phosphate mine. The mine is not listed in any references, but workings appear to be extensive. A steeply dipping bed of phosphate within the Phosporia Formation on the west side of the Dunkleburg anticline was mined.

2.16.3 Environmental Condition

The site consists of an adit (A-1, see Figure 2.27) and a large waste-rock dump (W-1). The adit is intact but has been sealed with a heavy gate. A discharge flows from the adit and down the face of the dump.

2.16.3.1 Site Features - Sample Locations

The adit discharge was sampled at two locations on 9/27/93. The first sample (DMDS10H) was collected where the discharge emerges from the adit; the second sample (DMDS20H) was collected several hundred feet below the site, after the discharge had flowed down the waste-rock dump. At the adit, the flow rate of the discharge was 480 gpm; below the waste-rock dump, the flow rate was 6.7 gpm. The discharge sinks into the ground before reaching the perennial portion of the Middle Fork of Douglas Creek drainage.

Because the adit discharge has the potential to erode the waste-rock dump, a soil sample (DMDD10L) was collected at the top of the dump, near the adit. The soil in this area is thin and rocky, but grasses and small conifers have taken hold.

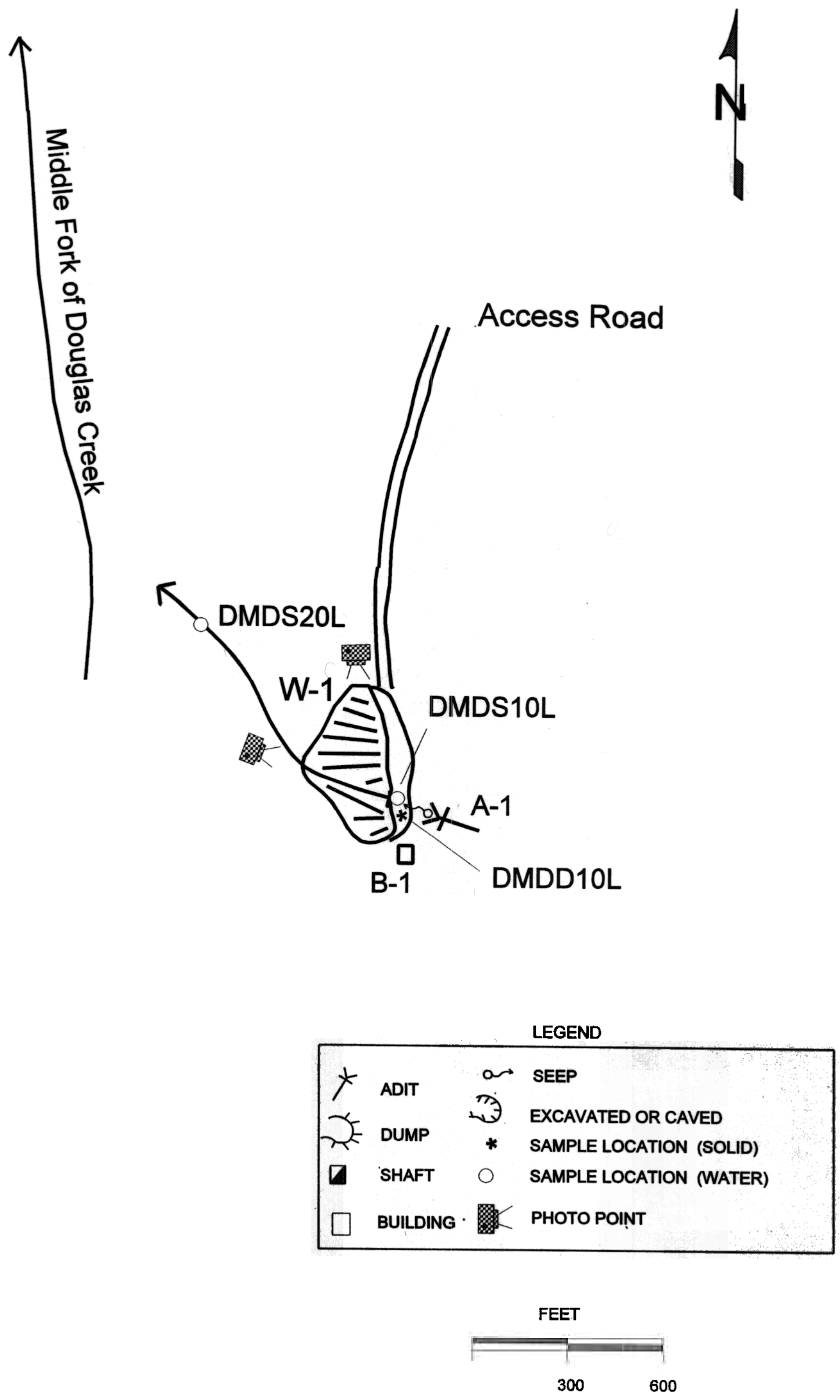


Figure 2.26 Site map of Middle Fork of Douglas Creek Phosphate mine

Figure 2.28 Water flowing from the adit crosses the top of the waste-rock dump.

Figure 2.29 Grasses and conifers have taken root on the steep slopes of the waste-rock dump.

2.16.3.2 Soil

Although the soil sample collected near the adit entrance had detectable amounts of metals, none of the metal concentrations exceeded phytotoxic levels. However, all of the metals exceeded one or more of the Clark Fork Superfund background levels. Analytical results are summarized in Table 2.20.

Table 2.20
Soil Sampling Results
Middle Fork of Douglas Creek Phosphate Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Soil near adit discharge (DMDD10L)	5.97[1]	1.80[1]	27.08[1]	22.41[1]	121.1[1]

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

2.16.3.3 Water

The pH of the adit discharge (8.67) at the adit entrance was greater than the upper secondary MCL limit (8.5). Below the waste-rock dump, the pH of the discharge (7.68) was closer to neutral, but mercury exceeded aquatic life (chronic) levels.

Table 2.21
Water-Quality Exceedences
Middle Fork of Douglas Creek Phosphate Mine

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 - at mouth of adit (DMDS10H)																			S
Adit discharge - below waste-rock dump (DMDS20H)										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

Because much of the dump is composed of cobbles and boulders and the slope is so steep, grasses and small trees are the only vegetation that has taken hold. The vegetation outside of the disturbed area shows no stress.

2.16.3.5 Summary of Environmental Condition

The water at this site is generally of very good quality. Given the steep slopes and coarse size of the dump material, the site is well vegetated. The impact of the site on the surrounding area is minimal.

2.16.4 Structures

The foundation of a mine building is the only structure at the site.

2.16.5 Safety

The slope of the waste-rock dump is steep and footing is very loose. If the integrity of the adit gate is maintained, no other features present safety concerns on this site.

2.17 WASA AND KIRKENDAL/KOSKI MINES

2.17.1 Site Location and Access

The Wasa and Kirkendal/Koski mines, located along the North Fork of Douglas Creek, are about 8.5 miles southeast of the town of Jens (T9N R12W Section 27 CDCD). The sites can be accessed by either the road near Jens that follows Dunkleburg Creek or the road south of the town of Hall that follows Douglas Creek. The Kirkendal/Koski and part of the Wasa are on DNF administered land.

2.17.2 Site History - Geologic Features

Popoff (1953) provided a detailed description and underground maps of the Wasa area. Mineralization at the Wasa was localized by the Wasa-Dunkleburg fault, which is subparallel to the axial plane of the Dunkelburg Anticline, and by favorable limestone beds in the Kootenai Formation. Mineralization occurs both along the fault and in replacement zones in the limestone. The ore contains fine grained sphalerite, pyrite, chalcopyrite, galena, quartz, pyrrhotite, and siderite (Popoff, 1953; Pardee, 1917). The Wasa was primarily a zinc mine; grab samples assayed at 4.3-5.5% Zn, and 0.3% Pb, and had only a trace of precious metals. Drilling indicates vertical zonation, with an increase in galena with depth (Popoff, 1953).

The Wasa mine operated in the early 1900's and again from 1941-1947. It was also operated more recently by a miner who operated without a Notice of Intent or a Plan of Operation (Wintergerst, personal communication). There are three adits over a 120 foot vertical range, with at least 3500 feet of workings and some large stopes. The lower (Wasa No. 1) adit discharges water, which combines with the discharge from the Kirkendal/Koski to form the headwaters of the North Fork of Douglas Creek.

Northern Testing Laboratories (1983) performed a detailed study of cleanup options for the dumps at the Wasa. Using drill hole data from five holes, they estimated that there are 12,000 tons of material with an average grade of a trace of gold, 0.2 oz/ton silver, 0.010-0.044% copper, 0.001% zinc, and 0.58-0.99% zinc. They concluded that metal values were too low to provide any economic benefit to the cleanup.

The Kirkendal/Koski mine has two adits that are probably connected by stopes. The upper adit, the Kirkendal, is open and has 740 feet of workings. The Koski is caved with 400 feet of workings. A substantial discharge issues from the

Koski. It sinks into the alluvium, but probably reappears at the location of the Wasa disharge below.

The same orebody was mined from both adits. It was a 2-foot thick replacement zone in limestone and calcareous argillite of the lower Kootanai fromation, and contained quartz, pyrite, sphalerite, chalcopyrite, and tetrahedrite (Popoff, 1953; Pardee, 1917).

2.17.3 Environmental Condition

The Wasa and Kirkendal/Koski sites have five adits (four of which are caved), waste-rock dumps, and numerous exploration trenches. The waste-rock dumps are along the course of the North Fork of Douglas Creek and are on private property. The Koski adit is on DNF administered land and has a discharge. One of the adits at the Wasa is open and appears to be flooded. This adit is believed to be on DNF administered land. An adit at the north end of the Wasa is caved and has water discharging from it.

2.17.3.1 Site Features - Sample Locations

A sample from a seep 250 feet from the south (uphill) end of the Kirkendal/Koski was collected to establish background water quality (DWSS10L). The seep flowed at about 0.4 GPM; the pH was about 7.1; and the specific conductance was about 140 umhos @ 25 °C. A sample of the discharge from the caved Koski adit (DWSS20L) was also collected. The discharge flowed at 4.4 gpm; the pH was about 6.3; and the specific conductance was about 228 umhos @ 25 °C. An iron-oxyhydroxide precipitate in the discharge channel was also sampled (DWSD10H).

Water from the caved Koski adit flows north towards the North Fork of Douglas Creek and either totally infiltrates into the ground or is ponded before flowing onto private ground. On the day the site was sampled, the adit discharge sank into the ground before reaching the pond. The pond was dry, and the bottom of the pond was coated with iron-oxyhydroxide precipitate. Composite samples of the upper one inch (DWSD20H) and the upper one to six inches (DWSD30H) of the pond bottom were collected.

A sample of the seepage from the caved adit at north end of the Wasa (DWSS30L) was collected where it flows onto DNF administered land. The seep flowed at about 75 gpm; the pH was about 7.9; and the specific conductance was about 360 umhos @ 25°C. All samples were collected on 9/1/92.

2.17.3.2 Soil

The concentration of arsenic, cadmium, copper, lead, and zinc in the soil samples collected at the Wasa and Kirkendal/Koski sites exceed all of the Clark Fork Superfund background levels; arsenic, copper, and zinc also exceed the phytotoxic limits.

Table 2.22
Soil Sampling Results
Wasa and Kirkendal/Koski Mines
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Iron oxyhydroxide precipitate in Koski adit discharge channel (DWSD10H)	829[1,2]	24.9[1]	7350[1,2]	72.9[1]	966[1,2]
Composite sample of the upper one inch of the pond bottom (DWSD20H).	503[1,2]	96.6[1]	3040[1,2]	63.3[1]	7020[1]
Composite sample of the upper one to six inches of the pond bottom (DWSD30H).	308[1,2]	39.5[1]	1380[1,2]	97.1[1]	2760[1,2]

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

2.17.3.3 Water

The seep south of the Kirkendal/Koski exceeded water-quality criteria for copper, mercury, and zinc. The discharge from the Koski adit exceeded water-quality criteria for aluminum, cadmium, copper, iron, mercury, manganese, zinc, and pH. The discharge from the adit at the north end of the Wasa site exceeded water-quality criteria for cadmium, mercury, and zinc.

Table 2.23
Water-Quality Exceedences
Wasa and Kirkendal/Koski Mines

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Seep 250-feet south of Kirkendal/Koski site (DWSS10L)						C				C			A,C						
Koski adit discharge (DWSS20L)	S,C			P,A C		A,C	S		S	C			A,C						S
Adit discharge - north end of Wasa (DWSS30L)				A,C						C			A,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 discharge channel of the Koski adit, the pond where the adit discharge collects, and the waste-rock dumps are almost devoid of vegetation. The vegetation in the undisturbed areas around the Wasa and Kirkendal/Koski mines appears unaffected.

2.17.3.5 Summary of Environmental Condition

Although the discharge from the Koski adit sinks into the ground before reaching any other surface-water body, it may impact ground water in the area. The adit discharge channel as well as the pond area have been impacted by precipitates that are deposited by the discharge; these areas are devoid of vegetation. The discharge from the north adit at the Wasa mine exceeds several water-quality criteria, but visual impacts are not apparent.

2.17.4 Structures

There are no structures at either site.

2.17.5 Safety

Safety hazards at the Wasa mine include steep high walls and an open, flooded adit; these features are believed to be on DNF administered land.

2.18 COMBINATION MILL TAILINGS

2.18.1 Site Location and Access

The Combination mill tailings (T8N R14W Section 7 DAD) are within the floodplain of the South Fork of Lower Willow Creek, at the confluence with Mill Creek. The site is approximately 10 miles northwest of Philipsburg. The site is easily accessible by vehicle from the Black Pine Road (F.S. Road 678). Most of the site is on private land.

2.18.2 Site History - Geologic Features

Volin (1952) states that the 200 ton mill was established at the site in 1932. He also goes on to state that most of the tonnage milled during the operation period was from old mine tailings and mine dump material.

2.18.3 Environmental Condition

There is one main tailings impoundment at the site which affects approximately 10 acres. Lower Willow Creek flows along the western edge of the tailings, which Mill Creek meanders through the impoundment. Although most of the tailings are on private land, large amounts of tailings material have been eroded onto land administered by the Deerlodge National Forest.

2.18.3.1 Site Features - Sample Locations

Although DNF administered land has been impacted as a result of past activity at the site, no sampling was done under this project. This is because the Forest Service had recently had a comprehensive, site-specific investigation performed. This investigation included the collection of numerous soil samples across the entire site (with the landowner's permission). In addition, water samples were taken from Lower Willow Creek above and below the mill site as well as from Mill Creek above the mill site and above the confluence with Lower Willow Creek. It was determined that any further sampling at the site would be an unnecessary duplication of efforts.

2.18.3.2 Soil

As mentioned in the previous section, no samples were collected by the MBMG at the site. However, sampling done under the site-specific investigationfor the Forest Service shows the presence of several metals in relatively high concentrations (Schafer, 1992).

2.18.3.3 Water

Water samples from Lower Willow Creek showed an increase in copper, iron and manganese below the site; however, none of these metals exceeded MCLs. Samples from Mill Creek showed an increase in several metals, with cadmium, manganese, and mercury exceeding MCLs.

2.18.3.4 Vegetation

Most of the main tailings impoundment is void of vegetation. However, a small portion of the impoundment has been reclaimed (prior to 1986) and is heavily vegetated with grasses and trees. Vegetation on DNF administered land below the site has been impacted by the movement of tailings off the site.

2.18.3.5 Summary of Environmental Condition

As of 1994, the water quality in Lower Willow Creek was slightly degraded as it flowed past the site. During snowmelt and large storm events, the water quality was probably much poorer. However, the present landowner began a full-scale reclamation program at the site in the fall of 1994. This activity should substantially improve the water quality of Lower Willow Creek.

2.18.4 Structures

Three small out buildings along with the foundation of the mill are located at the site. All of the structures are on private land.

2.18.5 Safety

The buildings at the site are in fair to poor condition and are easily accessible from the road. However, the site is remote and does not attract many people.

2.19 LOWER WILLOW CREEK TAILINGS

2.19.1 Site Location and Access

The Lower Willow Creek tailings (T8N R14W Section 6 ADBC) are within the floodplain of the South Fork of Lower Willow Creek, approximately 1.3 miles downstream of the Combination mill tailings (section 2.18). The site is accessible by 4-wheel drive vehicle from a road leading north from the Combination site. The entire site is on DNF administered land.

2.19.2 Site History - Geologic Features

Tailings washed down from the Combination site appear to have been re-worked at this location. A wooden structure equipped with two layers of screens is located near the west end of a barren to sparsely vegetated tailings impoundment. The structure may have been used to process tailings to obtain flux material for smelting (Robin McCulloch, personal communication). In addition to the tailings impoundment area, there are extensive streamside tailings deposits in the floodplain of the South Fork of Lower Willow Creek.

2.19.3 Environmental Condition

The tailings impoundment (MI1, see Figure 2.30) and streamside tailings cover an area of more than 10 acres. Seeps flow from the impoundment and the streamside tailings into the South Fork of Lower Willow Creek. Also, streamside tailings are washed into the creek during high-flow events.

2.19.3.1 Site Features - Sample Locations

Water samples were collected from a seep flowing from the tailings impoundment area (WLWS10M) and a second seep discharging from the streamside tailings deposits several hundred feet to the south (WLWS40L). The flow rates of the seeps were 0.9 and 0.6 gpm, respectively. Samples were also collected from the South Fork of Lower Willow Creek, both upstream (WLWS30L) and downstream (WLWS20L) of the site. The flow rate of the creek at the upstream location was 940 gpm; at the downstream location, it was 850 gpm.

Two soil samples were also collected at the site, one from the main tailings impoundment (WLWD10M) and the other from the streamside tailings (WLWD20M). All of the soil and water samples were collected on 9/5/95.

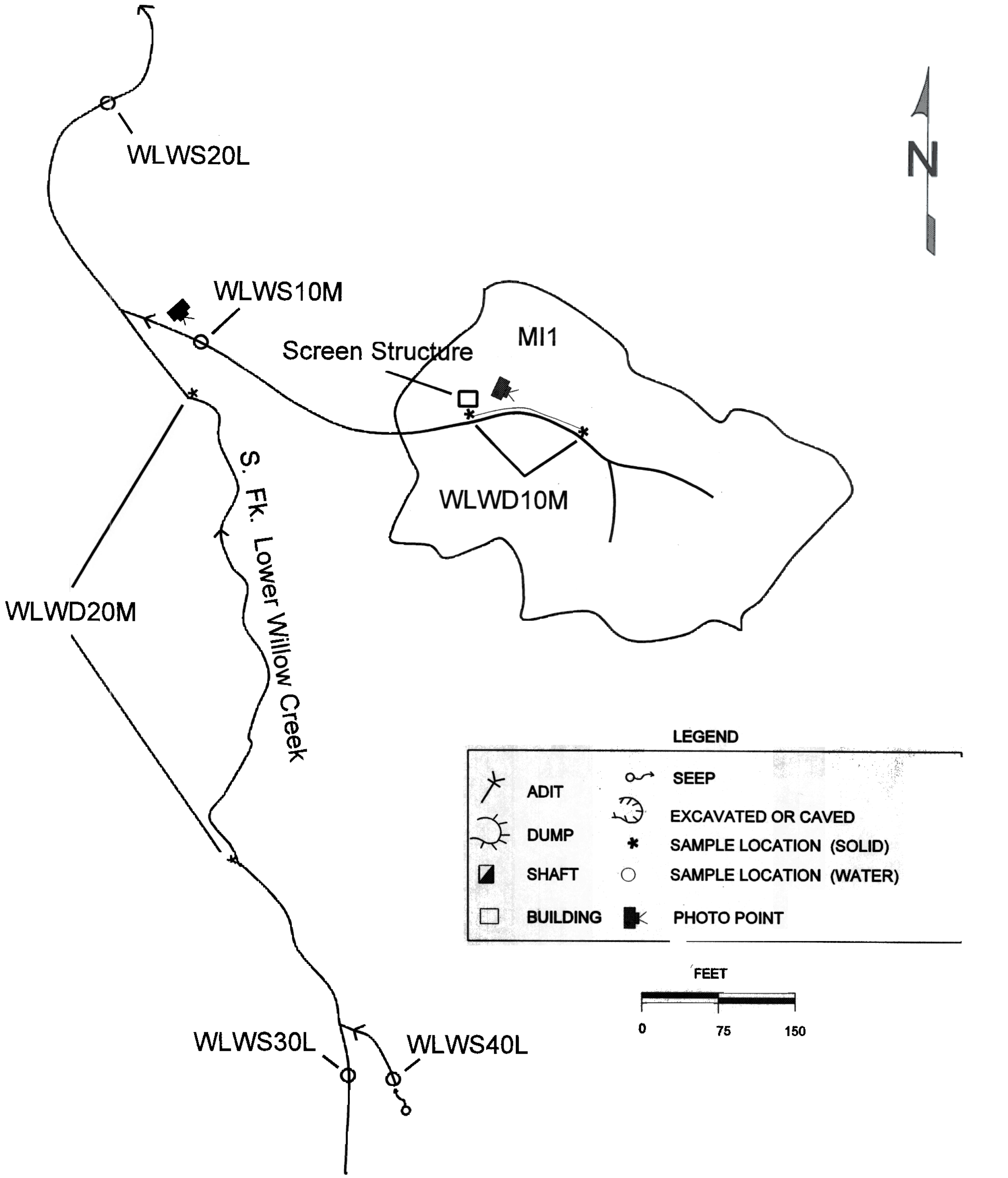


Figure 2.30 Site map of the Lower Willow Creek tailings

Figure 2.31 Sample WLWS10M was collected from the seep that flowed from the main tailings impoundment.

Figure 2.32 The main tailings impoundment is generally barren; however, along the seep drainage, grasses are growing. Sample WLWD10M was collected in this area.

2.19.3.2 Soil

The streamside tailings and the tailings from the main impoundment area had concentrations of arsenic, copper, and lead that exceed phytotoxic levels (see Table 2.24). Although mercury was not a target analyte for soils in this study, it was found in very high concentrations in the soil samples. The concentration in the tailings from the impoundment was 41.2 mg/kg; in the streamside tailings, the concentration was 57.5 mg/kg. These values are among the highest that were found during the Deerlodge National Forest study.

Table 2.24
Soil Sampling Results
Lower Willow Creek Tailings
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Tailings along seep channel in the tailings impoundment (WLWD10M)	695[1,2]	16.6[1]	4120[1,2]	4978[1,2]	152[1]
Streamside tailings along S. Fk. Willow Creek (WLWD20M).	202[1,2]	7.06[1]	1188[1,2]	1758[1,2]	167[1]

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

2.19.3.3 Water

Copper, iron, manganese, mercury, and pH did not meet water-quality standards in the seeps flowing from the tailings. The seep from the impoundment area also had high concentrations of arsenic and lead. The South Fork of Willow Creek had concentrations of aluminum, copper, and mercury that exceeded standards both upstream and downstream of the site.

Table 2.25
Water-Quality Exceedences
Lower Willow Creek Tailings

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
S. Fk. Lower Willow Cr., Upstream of seeps (WLWS30L)	S,C					A,C				C									
Seep from streamside tailings (WLWS40L)						A,C	S		S	C									S
Seep from tailings impoundment (WLWS10M)		P,C				A,C	S,A	C	S	C									S
S. Fk. Lower Willow Cr., Downstream of seeps (WLWS20L)	S,C					A,C				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

2.19.3.4 Vegetation

Most of the tailings impoundment is devoid of vegetation. However, along the main seep channel, grasses have taken root. The streamside tailings south of the impoundment are re-vegetating with grasses, willows, and conifers; however, there are still some barren to sparsely vegetated patches.

2.19.3.5 Summary of Environmental Condition

Arsenic, copper, lead, and mercury are leaching from the tailings, contaminating surface and ground water at the site. The high concentrations of mercury in the soil suggest that an amalgamation process was used to recover gold from the ore. Contaminated seeps at the site flow directly into the South Fork of Willow Creek but do not appear to significantly impact water quality. However, the water quality of the creek is already poor, presumably due to streamside tailings and discharges further upstream (see Section 2.18, Combination Mill Tailings).

2.19.4 Structures

As previously noted, a wooden structure with screens is located at the west end of the tailings impoundment. The structure may have been used to re-process the tailings to produce flux for smelting.

2.19.5 Safety

The wooden structure is in fair condition but could pose a safety hazard if someone climbed on top of it.

2.20 SUMMARY OF MINING IMPACTS ON DNF ADMINISTERED LAND - FLINT CREEK DRAINAGE

Adverse impacts due to acid mine drainage appear to be minimal on DNF administered land within the Flint Creek drainage. Of the 118 mine sites screened for this study area, 14 sites had discharges flowing from mine workings or waste materials. At these 14 sites, only five samples were collected that had field pH values less than 6.5. One of the samples came from a spring at the Hobo-T. Hayes mine (pH = 6.13); another came from an adit discharge at the Kirkendal/Koski mine (pH = 6.31); a third was from below the confluence of an adit discharge and a spring at the Blue Bird mine (pH = 6.49); and two others were from seeps flowing from the Lower Willow Creek tailings (pH = 5.80,6.07). In addition to having low pH values, the discharges at the Hobo-T. Hayes and the Kirkendal/Koski had high concentrations of dissolved cadmium, manganese, and zinc. The seeps from the Lower Willow Creek tailings had high concentrations copper, iron, manganese, and mercury. Most other water samples collected from sites within the Flint Creek drainage had neutral to moderately high pHs (7.5-8.5) and few, if any, water-quality exceedences for metals.

At several sites, erosion of waste materials is a concern. The Non Pareil tailings site has contaminated soils with exceptionally high concentrations of lead, zinc, and mercury. Although the soils are currently contained within tailings impoundments, it is possible that the impoundments could fail during a large storm or runoff event. At the Combination mill and Lower Willow Creek tailings sites, waste materials are eroding directly into the stream, resulting in water-quality degradation. At the Hobo-T. Hayes, an adit discharge has carried waste-rock material into the ephemeral drainage adjacent to the site; also, soils below the waste-rock dump have been contaminated as metal-laden ground water seeps to the surface and evaporates. Waste materials at the Brooklyn mine and mill have periodically washed down the mountainside and into Boulder Creek; however, this site was reclaimed during the summer of 1995, so erosion problems have been reduced. The Port Royal tailings, the Royal Gold tailings, the North Star mill, the Kirkendal/Koski, and the Mountain Lion are five additional sites with soil contamination and/or potential waste-erosion problems.

Nineteen sites were identified that have safety concerns: the Banker, Blue Bird, Thursday-Friday, and Wasa mines have open adits; the Unnamed Shaft site has an open shaft; the Middle Fork of Douglas Creek Phosphate mine has a steep waste-rock dump; the Combination tailings, Lower Willow Creek tailings, Garrett, Hobo-T. Hayes, Mountain Lion, Non Pareil, and the Sunday sites have unstable structures; and the Copper State, Golden Jubilee, Gold Hill, Greater New York, Horseshoe Bend, and Shamrock sites have either hazardous openings or unstable structures. The hazardous features at the Banker, Combination mill, Hobo-T.

Hayes, Sunday, Copper State, Gold Hill, and Shamrock sites are on private lands; the hazards at the other sites are on DNF administered lands.

ROCK CREEK DRAINAGE

The Rock Creek drainage is in the southwest corner of the Deerlodge National Forest (Figure 3.1). Tributaries to Rock Creek include Upper Willow Creek, the West Fork of Rock Creek, the Ross Fork of Rock Creek, the Middle Fork of Rock Creek, and the East Fork of Rock Creek. Mining districts of various sizes are located along all of these tributaries. Figure 3.2 shows the locations of individual mines and mills within the portion of the Deerlodge National Forest drained by Rock Creek and it tributaries. Approximate locations of the mining districts are also shown.

Terrain within the drainage varies from steep mountains to broad river valleys. Elevations range from a high of 10,463 feet at the summit of Warren Peak to 3,520 feet at Rock Creek's confluence with the Clark Fork River. Land use in the drainage is primarily agricultural, with timber being harvested from the upland areas, and livestock and alfalfa (hay) being raised in the valleys. Because the drainage hosts one of Montana's premier trout fisheries, recreational use in the area is high. Also, several hunting lodges and NF campgrounds are located in the area. Year-round residences and others seasonal dwellings are scatttered throughout the drainage; there are no large population centers.

3.1 GEOLOGY

This area includes the Rock Creek, eastern Sapphire Mountains, and southern John Long Mountains areas, and contains the Frogpond Basin, Alps, and Moose Lake mining districts. Detailed geologic mapping is lacking in most of the area. The northern portion was mapped by Hughes (1970), the southern part by Pederson (1976), the southwestern part by Wallace and others (1982), and the Miners Gulch area by Blaskowski and others (1983). The remainder of the area is only mapped at the 1:250,000 scale (Wallace, 1987). Both the economic and general geology of the area have been overlooked by researchers, probably because the task of unraveling the complex structure within this thick, monotonous sequence of Belt strata seems overwhelming. Most of the area is underlain by metasedimentary Proterozoic Belt rocks of the Sapphire thrust plate. These rocks were complexly thrusted by Cretaceous compression, and later, in the Cenozoic, cut by high-angle strike-slip and normal faults. Several Cretaceous to Tertiary plutons intrude these rocks, including the 73 M.A. granodioritic Sapphire batholith on the southwest, intrusions of the Henderson-Willow Creek igneous belt on the northeast, and Tertiary(?) plugs on the west edge of the area in the Sapphire Mountains. Figure 3.3 is a generalized geologic map of the portion of the Rock Creek drainage within the Deerlodge National Forest.

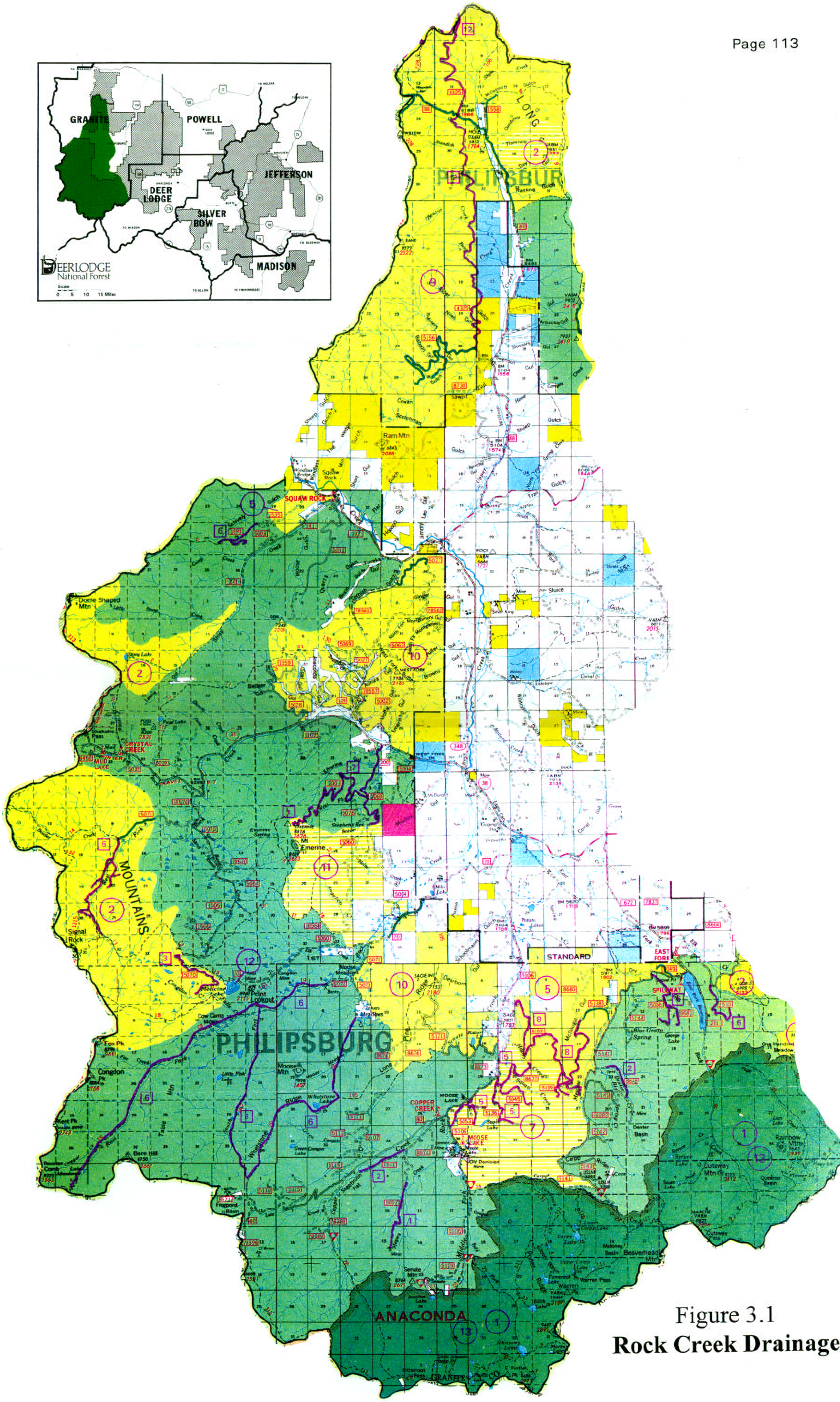
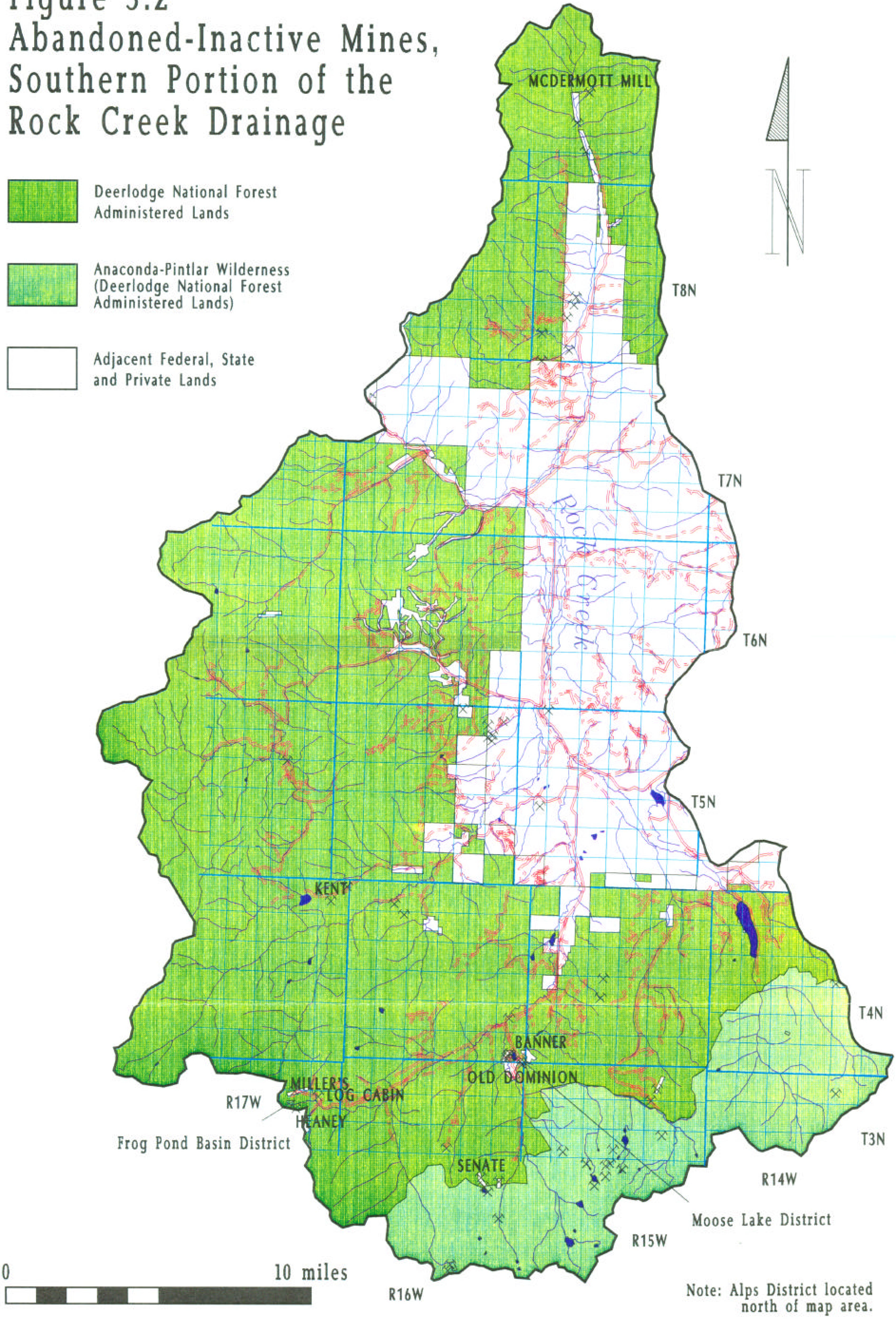


Figure 3.1
Rock Creek Drainage

Figure 3.2 Abandoned-Inactive Mines, Southern Portion of the Rock Creek Drainage



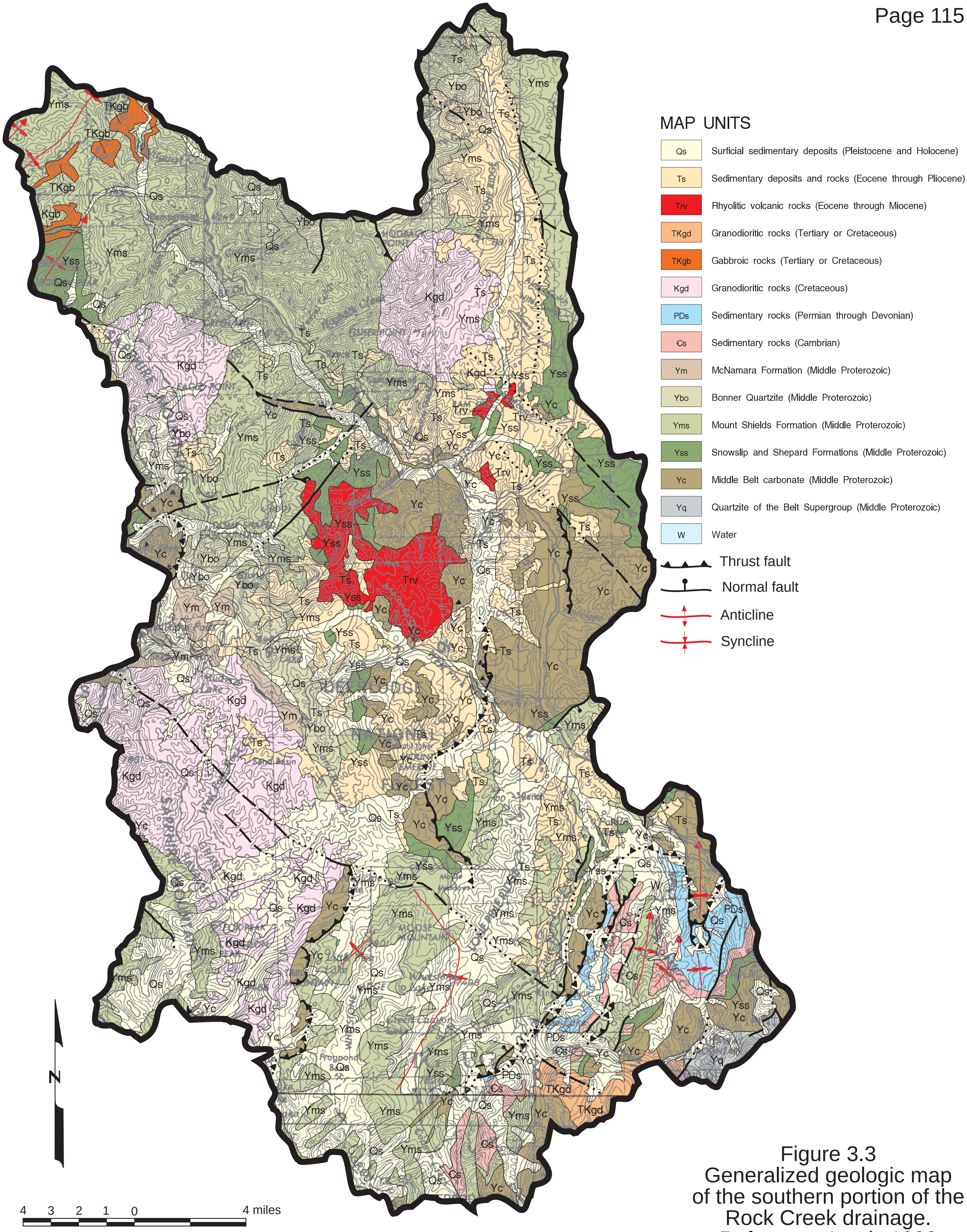


Figure 3.3
Generalized geologic map
of the southern portion of the
Rock Creek drainage.
Reference: Lewis 1998

3.2 ECONOMIC GEOLOGY

Economic geology has only been documented for portions of the Rock Creek basin. The mineralization in the Frogpond Basin district (Banister and others, 1983), the Sapphire Wilderness Study (Wallace and others, 1985), the Pintlar Wilderness (Close and others, 1982), the Miners Gulch area (Loen and others, 1989), and the Rock Creek Gold Belt (Woodward, 1993) have been well described. Walker (1963), Stentz (1975), and Lofholm (1985) describe a few additional deposits. Mineral deposits may have been controlled on a broad scale by the Great Falls tectonic zone (O'Neill and Lopez, 1985). However, geology of the deposits is quite varied. Those of the Rock Creek gold belt (mostly outside forest boundaries) are hosted by Middle Belt carbonate formations; some are associated with exposed igneous rocks while others are not. In fact, Belt-hosted precious metal deposits without any obvious relationship to igneous rocks, such as in Alps and Moose Lake districts, and at the McDermott mine, are common in the area, and their genesis remains a mystery. Many are hosted by Belt quartzites. Mineralization often appears to be locally controlled by low-angle thrust(?) faults.

Other deposits are clearly related to igneous activity, such as those of the Frogpond Basin district, the Miners Gulch area, and the Basin-Quartz Creek area. The most important of these, in the Frogpond Basin district, occupy steeply-dipping, sulfide and base metal-rich veins within the Sapphire batholith.

Only 10,879 ounces of gold, 10,896 ounces of silver, 23,465 pounds of copper, 84,000 pounds of lead, and 22,000 pounds of zinc are known to have been produced in the entire Rock Creek area (Bannister and others, 1983; Elliott and others, 1992).

3.3 HYDROLOGY AND HYDROGEOLOGY

Average annual precipitation ranges from 16 to 20 inches in valleys to 40 inches or more 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 southwest Montana can be extreme and range from well below 0°F during the winter months to more than 90°F during the summer; freezing temperatures can occur at any time during the year.

The Rock Creek basin encompasses an area of approximately 885-square miles. As noted previously, Rock Creek is fed by five important tributaries: the West Fork of Rock Creek, the Ross Fork of Rock Creek, the Middle Fork of Rock Creek, the East Fork of Rock Creek and Upper Willow Creek. With the exception of Upper Willow Creek, all of these tributaries drain the east flank of the Sapphire Mountains and/or the north flank of the Anaconda Range. Upper Willow Creek receives runoff from the John Long Mountains. The drainage paths within the Rock Creek basin are largely controlled by the structure of the underlying Belt and plutonic rocks and glacial deposits.

The U.S. Geological Survey currently maintains two streamflow gaging stations within the Rock Creek drainage. One is on Rock Creek near the confluence with the Clark Fork River; the other is on the Middle Fork of Rock Creek. For water years 1973 through 1994, the average flow rate of Rock Creek was 513 cfs; for the period of record 1938 through 1994, the average flow of the Middle Fork of Rock Creek was 118 cfs (Shields et al., 1995).

3.4 SUMMARY OF THE ROCK CREEK DRAINAGE

For the abandoned/inactive mine inventory for the Deerlodge National Forest, the MBMG investigated 35 mine and/or mill sites within the Rock Creek drainage (Table 3.1). Of these sites, 25 were found to have no impact on DNF administered land, eight may pose environmental problems, and two could not be located. Of the eight sites with potential environmental impacts, five have flooded shafts or adit discharges. Several of the eight sites also have problems related to erosion of and runoff from waste materials. The sites listed in **bold** in Table 3.1 are those that have some indication of adverse impact and were investigated in detail; these sites are discussed in the following sections.

If mine openings or other dangerous features (unstable structures, steep waste-rock dumps, high walls) were observed at a site, then the site was designated unsafe, or hazardous, in Table 3.3. Of the 35 sites inventoried, nine were found to have safety concerns. The only sites that were screened for safety hazards in detail were those where soil and/or water samples were collected. Hazards may exist at many of the other sites, but they were not inventoried as part of this project.

Table 3.1
Summary of Sites within the Rock Creek Drainage
Site name in bold type indicates potential environmental problems
Y under Hazard indicates physical safety concern

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Airdale	NF	N	N	NE	Ridgetop location.
Amseley	PRV	N	N	NE	No effect on DNF.
Amseley Mill[5]	PRV	N	N	NE	No effect on DNF.
Banner[5]	PRV	Y	Y	**Y**	Streamside dump; tailings in closed basin. Unstable waste-rock dump.
Basin/Quartz Gulch Placer and Mill Tailings[5]	PRV	Y	N	**Y**	Streamside tailings and waste. Hazardous tailings dam structure.
Bentz (Gold Leaf)	NF	Y	N	NE	Dry.
Black Pine	PRV	N	N	NE	Current operating permit.
Congdon (Broken Bottle)	NF	Y	N	NE	Dry, caved adit.
Copper Queen	UNK	N	N	NE	Unable to locate.
Green Goose-Moly Hogan	NF	N	N	NE	Small prospect.
Heaney	NF	Y	Y	**Y**	Flooded, open shaft. Water-quality standards exceeded.
Indiana	NF	Y	N	NE	Trenches only.
J.P. Prospect	NF	N	N	NE	Prospect pits only.
Joker	NF	Y	N	NE	Prospects only.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Kent	NF	Y	Y	**Y**	Adit discharge; seep near dump. Open adit; water-quality standards exceeded.
Last Chance	NF	N	N	NE	Small prospect.
Little Wonder	NF	N	N	NE	Small prospect.
Log Cabin	NF	Y	Y	**Y**	Flooded, open shafts. Water-quality standards exceeded.
Mayflower Lode	NF	N	N	NE	Prospect pit; ridgetop location.
M & T	NF	Y	N	NE	Dry, locked adit.
McDermott	NF	Y	N	NE	Dry, cave workings.
McDermott Mill[5]	NF	Y	Y	**Y**	Streamside dump. Unstable building; water-quality standards exceeded.
Miller's	PRV	Y	Y	**Y**	Discharges from flooded shafts; seeps. Open shafts; water-quality standards exceeded.
Moose Lake Tailings	PRV	Y	N	NE	Small, dry tailings pile.
Mountain Ram	P	Y	N	NE	Seasonal discharge.
Nancy Lee	NF	Y	N	NE	Dry pits and trenches.
O'Brien	NF	Y	N	NE	Dry, caved workings.

SITE[1]	OWNER[2]	VISIT	SAMPLE[3]	HAZARD[4]	REMARKS
Ohio	NF	Y	N	NE	No trace of workings.
Old Dominion[5]	PRV	Y	N	**Y**	Tailings in marshy, closed basin. Possible ground-water contamination; unstable structures; open shaft.
Sand Basin Placer	NF	N	N	NE	Rare earth placer.
Senate	PRV	Y	Y	**Y**	Adit discharge; spring below waste-rock dump. Open adits. Unstable structures.
TMT	NF	N	N	NE	Small prospect.
Townsend	NF	Y	N	NE	Dry, caved workings.
Tuscarora	NF	Y	N	NE	Dry, hilltop workings.
Unnamed (near Kent)	NF	N	N	NE	Unable to locate.

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)
   PRV: Private
   MIX: Mixed (DNF 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

3.4.1 Summary of Environmental Observations

Within the Rock Creek drainage, Miller's mine is the site with the most severe acid mine-drainage problems. This site is in the Frogpond basin, a large marshy area that is drained by Lutz Creek, a tributary to Copper Creek which flows into the Middle Fork of Rock Creek. At this site, there is a large seepage area that is devoid of vegetation. Water from the seeps flows into an adjacent creek and significantly degrades the water-quality. Also, flooded workings on the northeast end of the site discharge water; however, samples could not be collected from these discharges because most of the site is on private land.

The Log Cabin prospect and the Heaney mine are two additional sites in the Frogpond basin that have water-quality problems. Both of these sites have shafts flooded with water that exceeds water-quality standards for aluminum, iron, manganese, lead, mercury, silver, and pH. Although little or no surface water flows from these workings, ground-water quality is probably poor.

Other sites with potential ground-water quality problems include the Old Dominion and the Banner mines/mills. At these sites, tailings have been impounded in closed depressions. Storm water collects in the depression and gradually infiltrates the ground. Both of these sites are on private land within the DNF and therefore could not be investigated fully. The Banner site also has a very large streamside waste-rock dump that is being undercut by the Middle Fork of Rock Creek. Catastrophic failure of this dump could cause severe sedimentation problems.

The Senate mine, the Kent mine, and the McDermott mill are three other sites that were sampled in the Rock Creek drainage. These sites have only minor environmental impacts on DNF administered land.

3.5 SENATE MINE

3.5.1 Site Location and Access

The Senate mine is adjacent to the head of an unnamed tributary to the Middle Fork of Rock Creek (T3N R16W Section 23 DBDD), near the northern edge of the Anaconda-Pintlar Wilderness Area. Although the site is on private land, the Forest Service is considering acquisition of this property and therefore requested that the site be investigated. The site can be accessed by vehicle via a steep haul road that turns off the road along the Middle Fork of Rock Creek.

3.5.2 Site History - Geologic Features

At this site, a stratabound zone of disseminated mineralization in Precambrian lower Miller Peak Formation quartzite was mined from two principle adits, which are about 60 to 80 feet apart in elevation. The deposit has been described by Oster (1944), Stentz (1975), and Banister and others (1983).

In the mineralized area, ankerite and barite have replaced quartzite near bedding-plane and high-angle faults. Sparse pyrite and chalcopyrite are disseminated in both replaced and unreplaced quartzite, and in quartz veins. This is one of several similar mineralized zones in a five square mile area which extends to the south of the Senate mine.

A small amount of copper and silver ore was reportedly produced from the mine in the late 1890's, but no records are available on this production. Between 1958 and 1962, Bear Creek Mining conducted an exploration program at the site. Their best drilling intercept (from 3518 feet of drilling) contained 0.44% copper (Stentz, 1975).

3.5.3 Environmental Condition

Features investigated by the MBMG included three adits (A-1 through A-3, see Figure 3.3) with associated waste-rock dumps (W-1 through W-3) and several cabins in poor condition (C-1 through C-5); adits A-1 and A-2 are open. An old boiler, scrap metal, timbers, drums, and machinery are also scattered about the area. As noted previously, the site is on private land, but the NFS obtained permission from the landowner to investigate the property as part of a land acquisition/exchange inquiry.

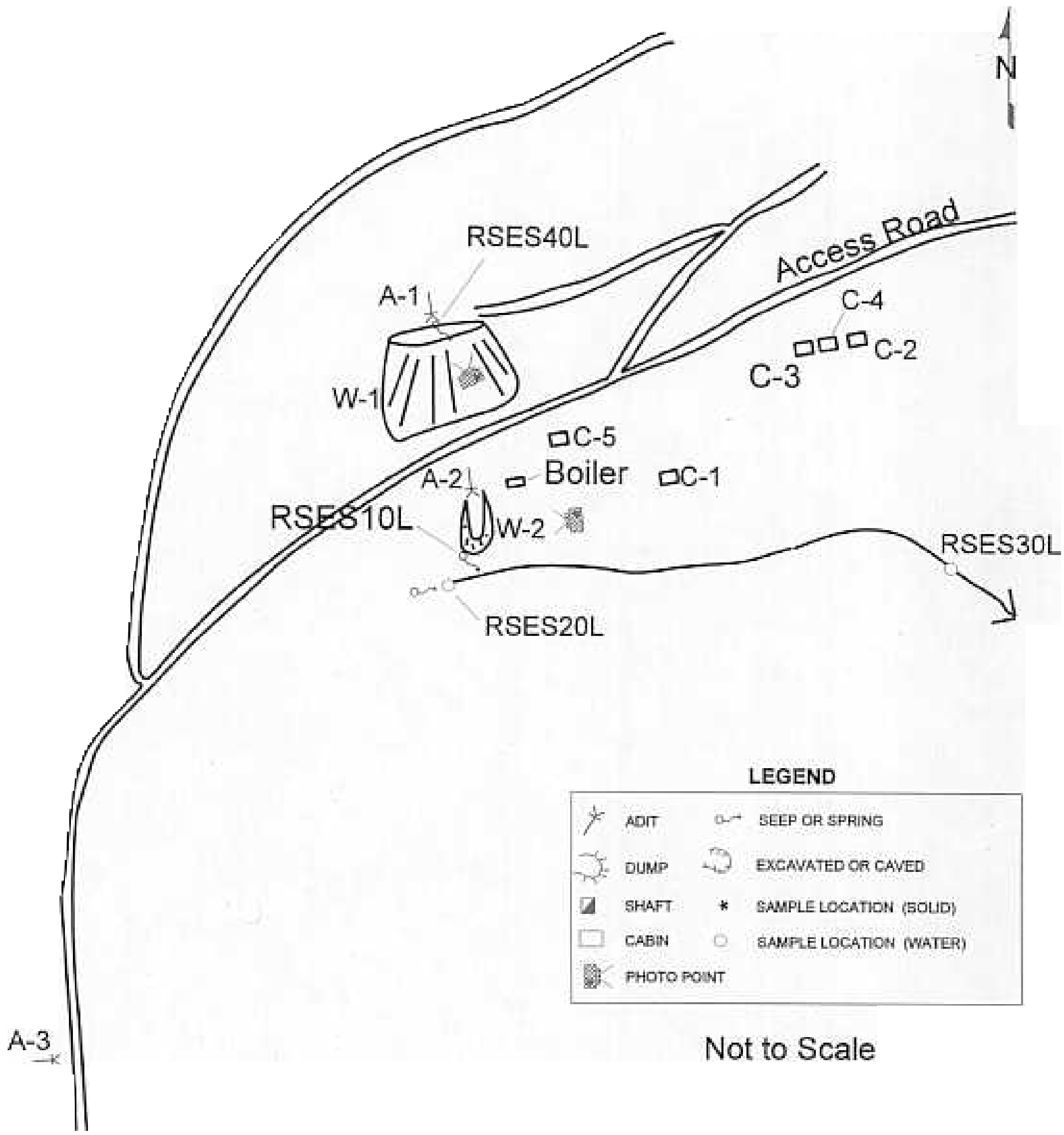


Figure 3.4 Site map of Senate mine

Figure 3.5 A small, clean discharge flows from open adit A-1. The discharge infiltrates the ground before reaching the creek.

Figure 3.6 Waste-rock dump W-2 is vegetated with grasses and small conifers. A small seep at the base of the dump does not appear to have an adverse impact.

3.5.3.1 Site Features - Sample Locations

The site was visited and sampled on 7/15/94. Adit A-1, which is open and partially flooded, has a small discharge (1.1 gpm) that flows across the top of the W-1 waste-rock dump and then infiltrates the ground. Sample RSES40L was collected from this discharge. Sample RSES10L was collected from a seep that breaks out at the base of waste-rock dump W-2 adjacent to the unnamed stream. The seep flows at a rate of approximately 0.5 gpm and has a specific conductivity of 176 umhos/cm @ 25 °C, which is slightly higher than that of the unnamed stream.

The unnamed stream begins in a boggy area 75 feet southwest of the W-2 dump. One of the numerous springs in this area is enclosed within a wooden box. This spring probably provided drinking water when the mine was active. Sample RSES20L was collected from one of the springs near this box. The flow rate was measured at 15.6 gpm, but this was only a fraction of the total flow discharging from the bog. At the downstream location where sample RSES30L was collected, the unnamed stream has a well-defined channel and the flow rate was 128 gpm.

3.5.3.2 Soil

Native soils in the vicinity of the mine did not appear to be impacted; therefore, no soil samples were collected.

3.5.3.3 Water

Concentrations were below the water-quality criteria for all of the constituents considered.

Table 3.2
Water-Quality Exceedences
Senate Mine

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 (RSES40L)																			
Seep at base of waste-rock dump (RSES10L)																			
Unnamed stream - Upstream of site (RSES20L)																			
Unnamed stream - Downstream of site (RSES30L)																			

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

Note: Analytical results are listed in Appendix V

3.5.3.4 Vegetation

The undisturbed portions of the site are vegetated with grasses and conifers. Along the stream, riparian grasses, willows, and moss are growing. No impacts to vegetation apppear to result from the presence of the adit discharge and the seep at the base of dump W-2. The waste-rock dumps are supporting some vegetation, but not to the same degree as native soil.

3.5.3.5 Summary of Environmental Condition

The Senate mine has little, if any, adverse impact on soils or surface water. The water quality of both the A-1 adit discharge and the seep at the base of waste-rock dump W-2 is good.

3.5.4 Structures

Several cabins, storage sheds, and outhouses are located at the site. One of the storage sheds (C-4) was used as a core repository for exploration drilling. All of the core boxes have been destroyed, and core samples are scattered across the ground in this area.

3.5.5 Safety

As noted previously, adits A-1 and A-2 are open; therefore, they are an obvious safety concern. The cabins, sheds, and outhouses may also be safety concerns because of their poor condition.

3.6 OLD DOMINION MINE AND MILL

3.6.1 Site Location and Access

The Old Dominion mine and mill (T4N R16W Section 36 DDC) are a quarter mile southeast of Moose Lake and are easily accessible by road. The entire site is on private land surrounded by DNF administered land. Moose Lake is a high-use recreation area which has numerous summer cabins, a hunting lodge, and a DNF picnic area.

3.6.2 Site History - Geologic Features

The Old Dominion mine was studied in detail by Lofholm (1985) as part of a gold exploration program. He included a 1:6000 scale map of the area. The Bonner quartzite host rock has been brecciated and sheared by two small thrust faults with a N30W strike and SW dip. Stockworks of thin quartz-tourmaline-pyrite-gold-minor flourite veins were localized by these zones, which are 16 to 100 feet thick. The zone is contained within a 2500 by 1500 foot wedge-shaped zone. Alteration is slight because the host is quartzite. The nearest exposed igneous rock is diorite at the M & T mine 1.5 miles away. Apparently, samples of ore from the dumps commonly ran better than 0.3 oz/ton gold, and occassionally contained more than 1 oz/ton Au. An ore(?) sample of slightly silicified, gossanous quartzite breccia was collected by MBMG and contained only <0.006 oz/ton Au, 0.20 oz/ton Ag, 0.013% copper, 0.005% lead, and 0.009% zinc.

The site has at least two caved adits with 800 feet of workings (W.M.H. Woodward, 1935, unpublished information, MBMG files), numerous prospect pits and an open shaft of unknown depth. A cyanide mill operated at the site for a year or two in the 1930's (Lofholm, 1985). Tailings from the mill were disposed of in a marsh in a closed depression (a kettle in the glacial drift) on private land. They may not affect ground water as they appear to be comprised only of quartz sand, with no sulfides evident.

3.6.3 Environmental Condition

Two caved adits, an open shaft, and a mill are located at the site. Tailings from the mill were allowed to run into a marshy, closed depression north of the workings. Because the site is on private land, no map was constructed.

Figure 3.7 An open shaft is enclosed within a log building below the mill.

Figure 3.8 A glacial kettle was used as a tailings impoundment. Vegetation growing on the tailings appears to be healthy.

3.6.3.1 Site Features - Sample Locations

Because the depression containing the tailings is on private property, no soil or water samples could be collected to investigate the possibility that ground-water quality in the area may be degraded. No other impacts to soil or water were observed near the site.

3.6.3.2 Soil

No impact to soil was observed on DNF administered land adjacent to the site.

3.6.3.3 Water

The bottom of the tailings impoundment area is marshy and wet; however, no surface water flows off the site onto DNF administered land. Because the tailings are in a wet closed depression, there is a possibility that metals leaching from the mill tailings are impacting ground water that eventually flows beneath DNF administered land.

3.6.3.4 Vegetation

The tailings in the closed depression are vegetated with grasses and willows which appear to be healthy. Vegetation elsewhere around the site is also healthy.

3.6.3.5 Summary of Environmental Condition

Although surface water discharges impacting DNF administered land, the mill tailings in the closed depression may be impacting ground-water quality in the area. Monitoring wells would be needed to determine if this is a problem affecting DNF administered land.

3.6.4 Structures

Structures on private property include four cabins, a large storage shed, two mine buildings, and a mill. All of the buildings are in fair to poor condition. The mine building at the foot of the mill covers an open shaft.

No mine-related structures are on DNF administered land adjacent to the site.

3.6.5 Safety

Because the Old Dominion is near a recreational area with numerous summer cabins, a hunting lodge, and a DNF picnic area, the open shaft in the mine building below the mill is a serious safety concern. Access to this structure is not restricted.

Wells which supply drinking water to residents and recreational users in this area should probably be tested for metals to determine if ground water has been impacted by the mine and mill.

3.7 BANNER MINE AND MILL

3.7.1 Site Location and Access

The Banner mine and mill are on private land near the Middle Fork of Rock Creek, a quarter mile west of Moose Lake. The site location (T4N R16W Section 36 CDAC) is shown on the Moose Lake USGS 7.5 minute quadrangle. Access to the site is by the road to Moose Lake. As noted in the previous section, Moose Lake is a high use recreational area.

3.7.2 Site History - Geologic Features

Very little information on the Banner exists in the literature. It is located in an area of glacial moraine and has been reclaimed, so geology is concealed. A USFS report dated 1920 (unpublished information, MBMG files) states that the mine then included a 250 foot inclined shaft with 600 feet of drifts on two levels. Bannister and others (1983) uncovered some information. They stated that the mine was worked from 1921 to 1923 and from 1934 to 1936, producing 1979 oz of gold, 5896 oz of silver, and 20,935 lbs of copper. The size of the dump and tailings indicate several thousand feet of workings are present.

Vein material containing quartz, 5-10% pyrite, traces of galena and chalcopyrite is present on the dumps; a select sample assayed 0.158 oz/ton gold, 1.76 oz/ton silver, 0.18% copper, 0.12% lead, and 0.060% zinc. Host rock appears to be Mount Shields (?) quartzite; some of the host rock on the dump contains 1-2% disseminated pyrite. This altered wallrock also had some metal value--a grab sample assayed 0.014 oz/ton gold, 0.28 oz/ton silver, 0.015% copper, 0.002% lead, and 0.014% zinc. The nearest outcrop of igneous rock is Cretaceous(?) diorite at the M & T Mine which is 1.5 miles to the north. The vein is supposedly 4-9 feet thick with a N25W 30SW attitude (Bannister and others, 1983), so it may occupy a shear created by thrust faulting. The nearby Old Dominion Mine contains similar structural controls, but the vein mineralogy is vastly different (Lofholm, 1985).

The mine dumps of 75% unaltered and 25% altered quartzite are perched on the banks of the Middle Fork of Rock Creek on private land. There is also a considerable volume of tailings present in a kettle within the glacial moraine.

3.7.3 Environmental Condition

The site consists of a collapsed shaft (S-1), a large waste-rock dump (W-1), and a tailings impoundment (MI-1). The aerial extent of the site is approximately six acres. Site features, sampling locations, and approximate property boundaries are shown in Figure 3.9.

3.7.3.1 Site Features - Sample Locations

Waste-rock dump W-1 rises 40 to 50 feet above the east bank of the Middle Fork of Rock Creek. It is periodically undercut by the creek, so the potential for mass failure is extremely high. Waste material has obviously been washed into the creek in the past. Because the site is on private land, surface water and soil samples could not be collected near the waste-rock dump. Instead, surface water samples were collected on DNF administered land upstream (RBAS20M) and downstream (RBAS10M) of the site. Upstream of the site, the measured flow of the creek was 14.5 cfs; downstream it was 11.8 cfs. The date of the sampling and flow measurements was 9/8/93.

Ponded water is present in the tailings impoundment but there is no surface outflow. Impact to ground water is likely but could not be evaluated within the scope of this study.

3.7.3.2 Soil

No impact to soil was observed on DNF administered land near the site.

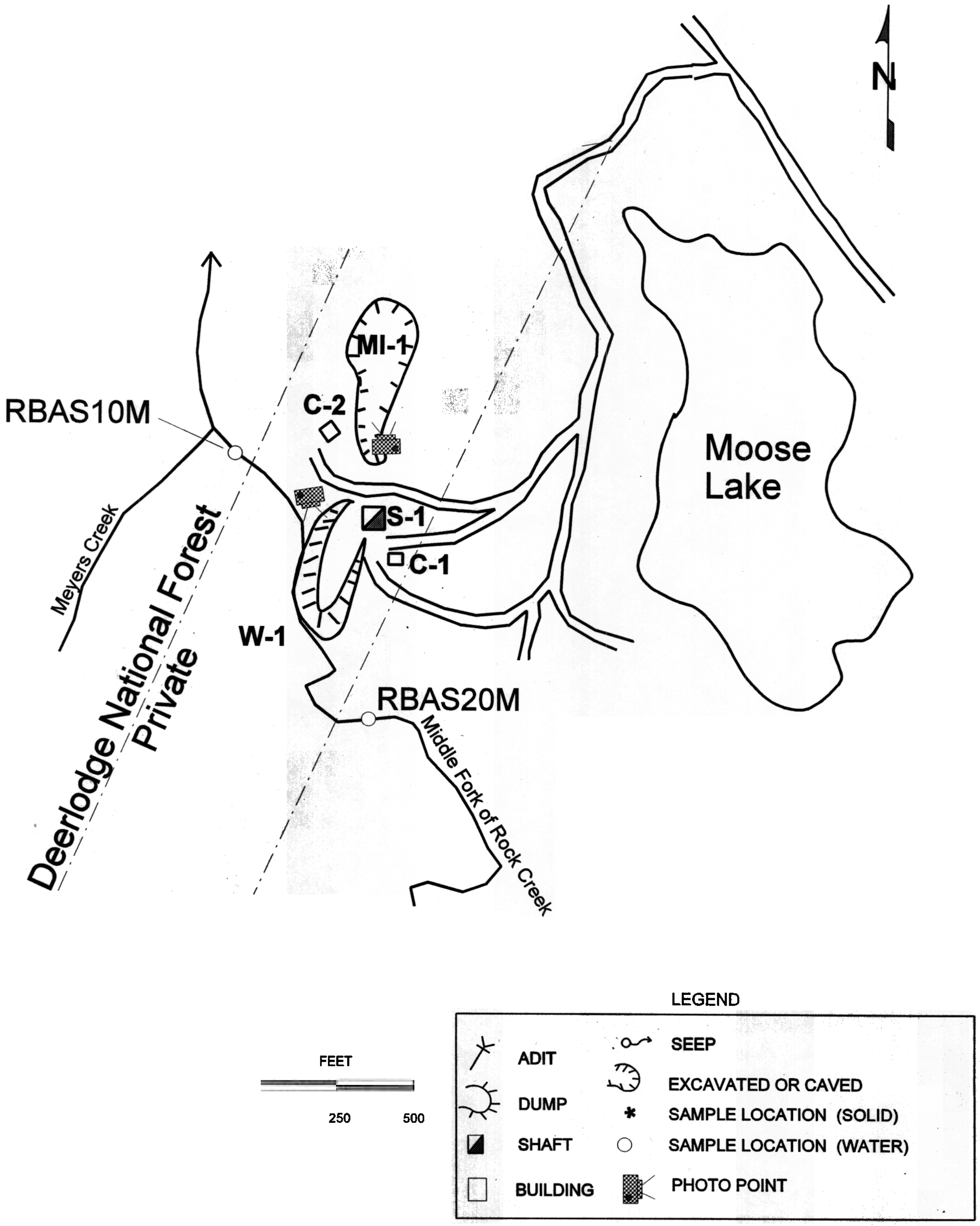


Figure 3.9 Site map of Banner mine and mill

Figure 3.10 Tailings are spread over a large area at the north end of the site.

Figure 3.11 The Middle Fork of Rock Creek (upper right corner) is undercutting and eroding the sparsely vegetated waste-rock dump.

3.7.3.3 Water

Concentrations of all analytes considered were less than their respective water-quality limits.

Table 3.3
Water-Quality Exceedences
Banner Mine and Mill

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Middle Fork of Rock Creek - Upstream of site (RBAS20M)																			
Middle Fork of Rock Creek - Downstream of site (RBAS10M)																			

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

Note: Analytical results are listed in Appendix V

3.7.3.4 Vegetation

The tailings impoundment is the most severely impacted portion of the site. The area is almost devoid of vegetation. The waste-rock dump is sparsely vegetated with grasses. Vegetation is abundant and healthy away from the tailings impoundment and off the dump.

3.7.3.5 Summary of Environmental Condition

No surface water or soil quality problems were identified on DNF administered land adjacent to the site. However, large volumes of waste material evidently slough off the waste-rock dump and into the creek periodically; this may be causing a sedimentation problem that is impacting the trout fishery along the Middle Fork of Rock Creek. Further study would be required to document this supposition.

Another possible problem at the site is ground-water contamination caused by infiltration of water in the tailings-impoundment area. Monitoring wells would be required to evaluate this possible impact.

3.7.4 Structures

Two cabins (C-1 and C-2) in good condition are located on private land; the mill that generated the tailings has apparently been removed. No structures were observed on DNF administered land.

3.7.5 Safety

The greatest physical-safety concern at the site is the waste-rock dump. The face of the dump is unstable, and the potential for mass failure is high. A lesser concern is the depression around the collapsed shaft. Both of these features are on private property. No safety hazards related to the mine were noted on DNF administered land.

3.8 MILLER'S MINE

3.8.1 Site Location and Access

Miller's mine (T3N R17W Section 11 BAAC) is in the Frogpond basin near the head of Lutz Creek, a tributary to Copper Creek. The site is accessible by a poor road. Most of the disturbed area is on private land, but adjacent DNF administered land has been visibly impacted.

3.8.2 Site History - Geologic Features

Miller's Mine was the largest and most productive mine of the Frogpond District. Bannister and others (1983) provide a detailed desciption, summarized here. Workings follow two veins that strike N63-77E and dip steeply north in quartz monzonite. The veins are from one inch to nine feet wide and contain quartz, pyrite, galena, sphalerite, arsenopyrite, and copper sulfides. Ore was mined from shoots with good downdip continuity. Between 1929 and 1937, 1269 tons of ore were mined, from which 817 oz of gold, 4145 oz of silver, 2177 lbs of copper, 76,436 lbs of lead, and 22,397 lbs of zinc were recovered. An estimated 100,000 tons of reserves of an unspecified grade remain. Dump material also constitutes a resource, with the main dump of vein (quartz, sericite, and pyrite) and altered quartz monzonite containing 6,200 tons at 0.054 oz/ton gold, 0.37 oz./ton silver, and 0.56% lead.

Workings are all caved and flooded, and include a 450-foot shaft with two levels and 785 feet of drifts, an adit, and an 18-foot shaft. The adit discharges water which precipitates iron oxyhydroxides. The associated dumps contain at least 10% pyrite and generate runoff which contaminates a large area of soil downhill.

3.8.3 Environmental Condition

The MBMG inventoried four shafts (S-1 through S-4, see Figure 3.12), and adit (A-1), and two large waste-rock dumps (W-1 and W-2) at the site. The two easternmost shafts (S-1 and S-4) are flooded to the surface and discharge water. Shaft S-2 has a headframe and is flooded to within 20 to 30 feet of land surface. The adit has a small iron-oxyhydroxide stained discharge that joins with the S-1 discharge. A large, unvegetated seep area occurs south of dump W-2.

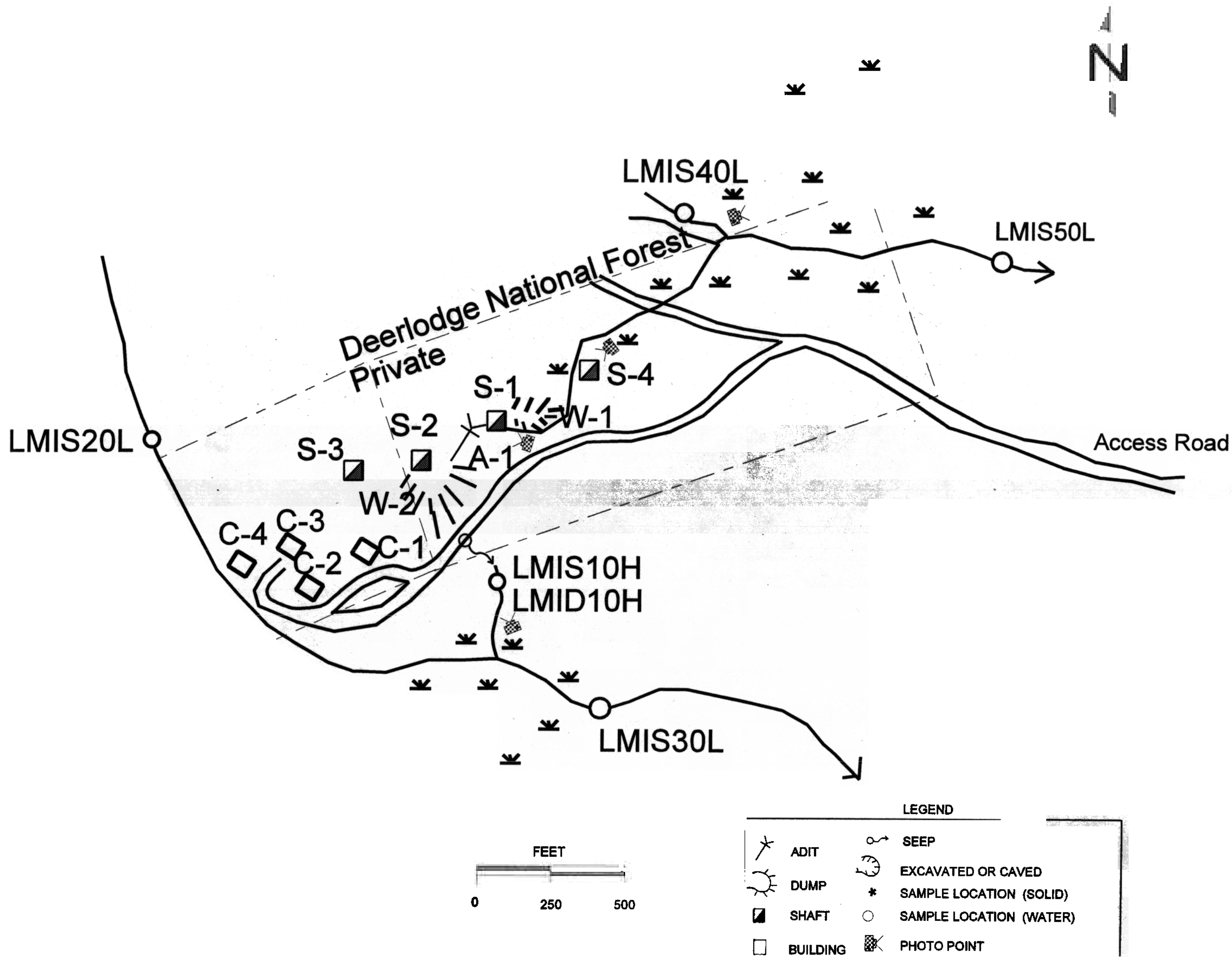


Figure 3.12 Site map of Miller's mine

Figure 3.13 Seeps south of waste-rock W-2 have heavily impacted soil and vegetation on DNF administered land.

Figure 3.14 A ferric-hydroxide stained adit discharge (lower left) mixes with water flowing from flooded shaft S-1. The combined discharge flows into a wetland to the east.

Figure 3.15 Flooded shaft S-4 has a discharge which also flows into the wetland east of the site.

Figure 3.16 Wetland east of Miller's mine.

3.8.3.1 Site Features - Sample Locations

The seep area south of the mine drains to the south, into an unnamed tributary to Lutz Creek. Field parameters indicate that water quality in the seep area is poor (pH=5.76, SC=230 umhos/cm @25°C) compared to that in creeks adjacent to the site (pH=6.41-6.56, SC=28.4-31.2 umhos/cm @25°C). The flow rate of the seep was 0.35 gpm. Water (LMIS10H) and soil (LMID10H) samples were collected on DNF administered land impacted by the seep. Water samples were also collected on the unnamed creek upstream (LMIS20L) and downstream (LMIS30L) of its confluence with the seep. The flow rates of the stream above and below the confluence were 2.6 and 6.0 gpm, respectively.

The discharges from adit A-1 and shafts S-1 and S-4 flow eastward into a large wetland. Water samples were collected from a spring (LMIS40L) on the west end of the marsh and from the creek (LMIS50L) that drains the marsh. The flow rate of the spring was 1.2 gpm and that of the creek was 10 gpm. The site was sampled on 9/8/93.

3.8.3.2 Soil

Soils have obviously been impacted by the seeps south of the mine. Cadmium, copper, lead, and zinc exceed one or more Clark Fork Superfund background levels. Zinc also exceeds phytotoxic limits (Table 3.4).

Table 3.4
Soil Sampling Results
Miller's Mine
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Soil mix area -south of W-2 dump (LMID10H)	1.56	62.32[1]	211.21[1]	153.31[1]	918.50[1,2]

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

3.8.3.3 Water

The seep south of the site exceeded water-quality criteria for aluminum, cadmium, copper, lead, manganese, mercury, zinc, and pH. Even though the seep is relatively small (flow rate=0.35 gpm), its impact is evident on the unnamed creek; concentrations of cadmium, lead, and zinc in the sample collected downstream of the confluence with the seep all exceeded one or more water-quality standards.

Upstream and downstream samples collected from the drainage east of the site both have exceedances for aluminum and lead. The upstream sample also has exceedances for iron, manganese, and pH. The poor quality of the upstream sample suggests that water-quality around the site may be naturally poor due to mineralization of the local bedrock.

Table 3.5
Water-Quality Exceedences
Miller's Mine

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 site (LMIS20L)	S,C																		
Seep south of mine (LMIS10H)	S,C			P,A C		A,C		C	S	C			S,A C						S
Unnamed creek - Downstream of site (LMIS30L)	S			P,A C				C		C			A,C						
Spring on west end of marsh - Upstream of site (LMIS40L)	S,C						S,A	C	S										S
Unnamed creek that drains wetland - Downstream of site (LMIS50L)	S,C							C											

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

Note: Analytical results are listed in Appendix V

3.8.3.4 Vegetation

Many of the trees along the seep drainage south of the site are dead or stressed, and much of the ground in the area is barren. In a few locations, marsh grasses are growing. Around the waste-rock dumps, the ground is barren to sparsely vegetated.

3.8.3.5 Summary of Environmental Condition

Water and soil quality south of the site is degraded by the seeps south of the main workings. Impact to DNF administered land is visually evident. The discharges from adit A-1 and shafts S-1 and S-4 that drain to the east do not appear to impact DNF administered lands.

3.8.4 Structures

Several cabins (C-1 through C-4), a mine building (B-1), an ore bin (FL-1), and a headframe (over shaft S-2) are present on the site. Cabins C-1 and C-3 are well maintained and are probably used by hunters. All of the structures are on private land. No structures were observed on DNF administered land.

3.8.5 Safety

Although it is on private land, the flooded shaft with the headframe (S-2) is an obvious safety concern. This mine opening has been covered with loose planks but is otherwise accessible. No safety hazards were noted on DNF administered land adjacent to the site.

3.9 HEANEY MINE

3.9.1 Site Location and Access

The Heaney mine (T3N R17W 11 ACCD) is on a small "island" of dry ground in the Frogpond basin. Access to the site is limited to a trail west of the main road through the basin. The site is on DNF administered land.

3.9.2 Site History - Geologic Features

Workings at the Heaney mine follow a one-foot thick quartz-pyrite-tetrahedrite vein with a N70W vertical attitude for 500 feet along strike (Bannister and others, 1983). The best of ten samples assayed 0.14 oz/ton gold and 1.5 oz/ton in silver; the mine is considered to have a low potential for metallic resources. In 1937, five tons of ore were shipped, yielding 2 oz of gold, 9 oz of silver, and 367 lbs of lead.

3.9.3 Environmental Condition

The Heaney mine has a flooded shaft (S-1, see Figure 3.17) with a small waste-rock dump (W-1) of unaltered granodiorite. The depth to water in the shaft is appproximately 10 feet. No discharges to surface water were observed at the site.

There is an old fuel oil tank east of the shaft. Although the tank has an oily odor, no fuel oil remains, and no stains or stressed vegetation were observed near the tank.

3.9.3.1 Site Features - Sample Locations

The site was sampled on 9/9/93. A water sample (LHES10M) was collected from the flooded shaft as an indicator of ground-water quality at the site. A second sample was collected from a small unnamed creek several hundred feet south of the site (LHES20L) to provide background water-quality information. This unnamed creek is a tributary to Lutz Creek. A third sample (LHES30L) was collected several hundred yards downstream of LHES20L to assess if ground water discharges to the creek and impacts water quality. The flow rate of the creek was 1.4 gpm at sample location LHES20L; at LHES30L, the rate was 15.1 gpm.

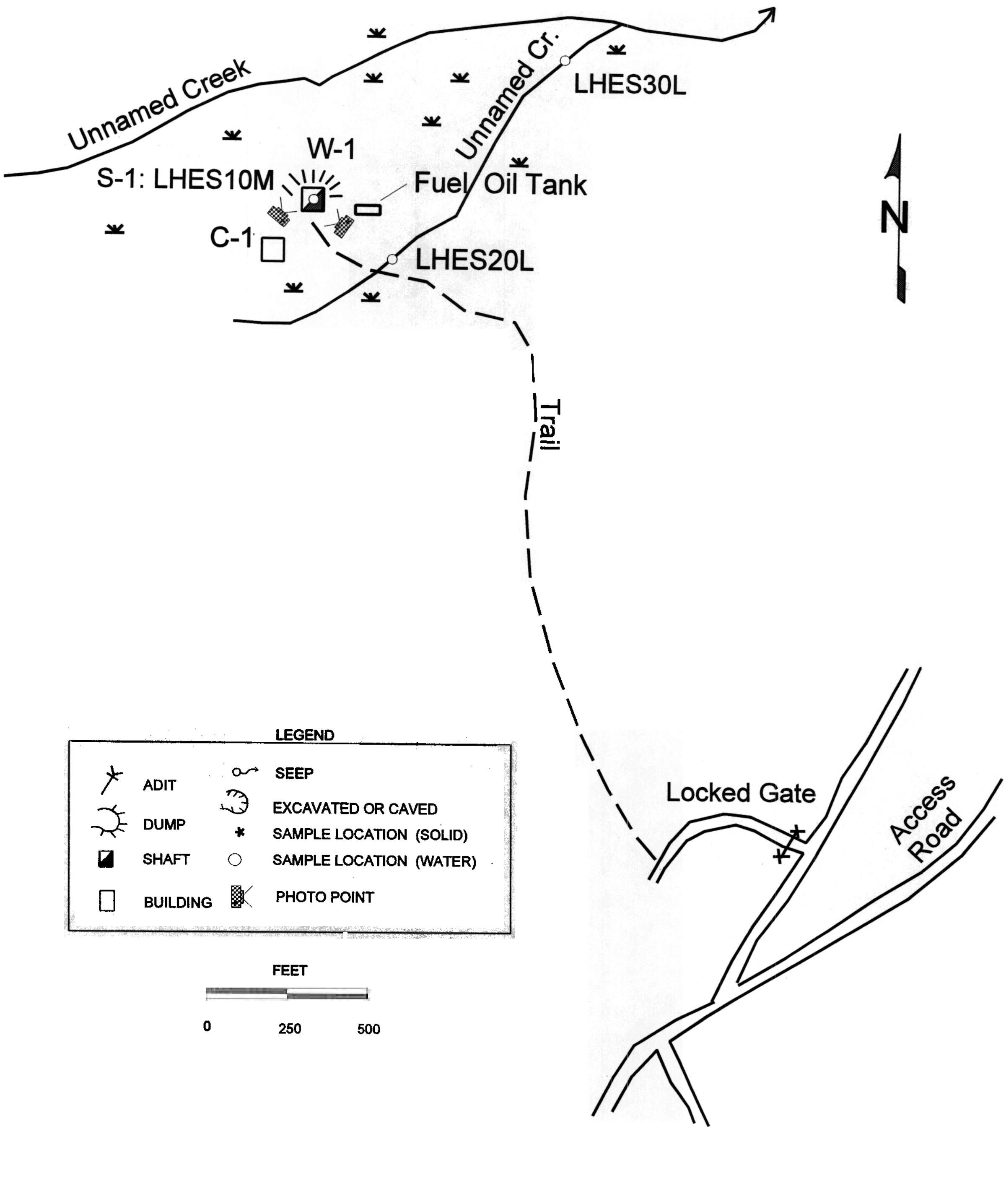


Figure 3.17 Site map of Heaney mine

Figure 3.18 Open, flooded shaft at the Heaney mine. Depth to water is approximately ten feet.

Figure 3.19 The waste-rock dump is comprised of unaltered granodiorite.

3.9.3.2 Soil

Impacts to soils were not evident; therefore, no soil samples were collected.

3.9.3.3 Water

The sample from the flooded shaft exceeded numerous MCLs and aquatic life standards (Table 3.6). The background water-quality sample from the unnamed creek indicates that concentrations of aluminum and iron are naturally high and that pH is naturally low (6.36) in this area. Downstream of the site, water quality improves slightly; aluminum was the only constituent that exceeded water-quality criteria.

Table 3.6
Water-Quality Exceedences
Heaney Mine

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Flooded Shaft (LHES10M)	S,C			P,A C		C	S	P,C	S	C		C							S
Unnamed Creek (LHES20L)	S,C						S												S
Unnamed Creek - Downstream of site (LHES30L)	S																		

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

Note: Analytical results are listed in Appendix V

3.9.3.4 Vegetation

Near the shaft and waste-rock dump, the ground is sparsely vegetated with grasses. Vegetation in the undisturbed areas is healthy.

3.9.3.5 Summary of Environmental Condition

Water from the flooded shaft has concentrations of several metals that exceed water-quality criteria and are high relative to background; this suggests that the mine may be impacting ground-water quality. However, the water-quality of the unnamed creek near the site does not appear to be impaired.

3.9.4 Structures

The remnants of a cabin (C-1) are located southwest of the flooded shaft. A pile of timbers is all that remains.

3.9.5 Safety

The flooded shaft is the primary physical safety concern at the site; it is open to a depth of at least 10 feet (depth to water) and access is unrestricted.

3.10 LOG CABIN PROSPECT

3.10.1 Site Location and Access

The Log Cabin Prospect (T3N R17W 12 BACB) is on the east edge of the Frogpond basin. The site is adjacent to a small creek which flows into Lutz Creek. Access to the site is by the main road to the Frogpond basin and then north along the road east of Lutz Creek. The entire site is on DNF administered land.

3.10.2 Site History - Geologic Features

Five caved shafts with 500 feet of associated workings and numerous pits and trenches trace a N45-60E quartz-pyrite-galena vein for 1,600 feet along strike in granite and metasedimentary rocks of the Wallace Formation (Bannister and others, 1983). Sampling showed that the vein contained high silver values averaging 15 oz/ton in granite, but low silver values in the sedimentary rocks. Four of the shafts are flooded; associated dumps contain oxidized, weakly iron-stained granite.

3.10.3 Environmental Condition

Four flooded shafts (S-1 through S-4, see Figure 3.20) with waste-rock dumps (W-1 through W-4) were investigated at this site. All of these workings are within a few feet of an unnamed creek. There are also numerous prospect trenches and pits at the site. A small seep occurs in a trench at the base of the W-1 dump. The water from this seep flows into the unnamed creek. The S-2 shaft has an intermittent discharge that flows over a breach in its associated waste-rock dump. On the day the site was sampled (9/8/93), no water was flowing across the breach.

3.10.3.1 Site Features - Sample Locations

Water samples were collected from each of the flooded shafts: LLCG10M at S-1, LLCG20L at S-2, LLCG30L at S-3, and LLCG40L at S-4. A sample (LLCS20M) was also collected from the seep in the trench at the base of waste-rock dump W-1. The unnamed creek was sampled upstream (LLCS30L) and downstream (LLCS10L) of the disturbed area; at both locations the flow rates were 0.87 gpm.

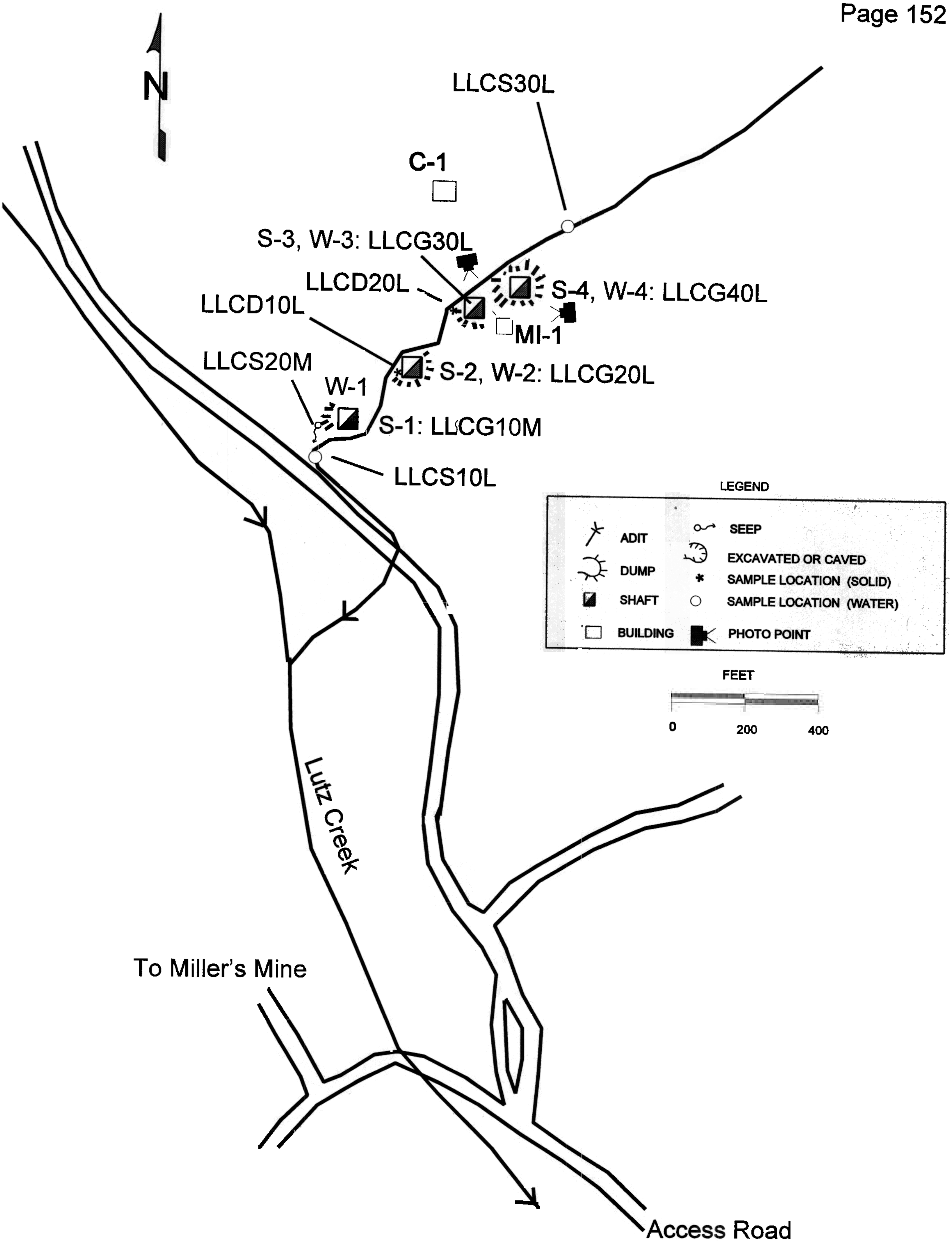


Figure 3.19 Site Map of Log Cabin Prospect

Figure 3.21 Flooded shaft S-3 is surrounded by a small waste-rock dump.

Figure 3.22 A dilapidated mine building (B-1) with some old machinery is south of shaft S-3.

Soil samples LLCD10L and LLCD20L were collected from waste-rock dumps W-2 and W-3, respectively. These dumps are along the south bank of the unnamed creek. Although the dumps are close to the creek, no significant erosion of waste material appears to have occurred.

3.10.3.2 Soil

Concentrations of cadmium and zinc in the soils near waste-rock dumps W-2 and W-3 exceed one or more Clark Fork Superfund background levels. The soil near W-2 also has high levels of copper and lead. However, none of the trace metals occur in concentrations that exceed phytotoxic levels.

Table 3.7
Soil Sampling Results
Log Cabin Prospect
(mg/kg)

Sample Location	As	Cd	Cu	Pb	Zn
Soil at base of W-3 dump - adjacent to unnamed creek (LLCD20L)	3.38	2.59[1]	14.16[1]	607.58[1]	282.19[1]
Soil at base of W-2 dump - adjacent to unnamed creek (LLCD10L)	0.86	0.70[1]	4.06	10.85	47.12[1]

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

3.10.3.3 Water

Water in shafts S-3 and S-4 is of moderately poor quality; several secondary MCLs and aquatic life standards are exceeded. The water in shafts S-1 and S-2 and the seep near dump W-1 are of better quality with fewer exceedances. The water quality of the unnamed creek upstream of the site is similar to that of shafts S-3 and S-4. Downstream of the site, aluminum is the only analyzed constituent that exceeds water-quality standards.

Table 3.8
Water-Quality Exceedences
Log Cabin Prospect

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 - Above site (LLCS30L)	S,C					C	S,A	C	S			C							
Shaft S-1 (LLCG10M)							S		S			C							
Shaft S-2 (LLCG20L)																			S
Shaft S-3 (LLCG30L)	S,C						S,A	C	S	C		C							S
Shaft S-4 (LLCG40L)	S,C						S		S	C									S
Seep - Base of Waste-rock dump W-1 (LLCS20M)									S	C									
Unnamed Creek - Below site (LLCS10L)	S,C																		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

3.10.3.4 Vegetation

The waste-rock dumps are moderately vegetated with grasses and small conifers. No obvious stress to vegetation occurs outside of the disturbed area.

3.10.3.5 Summary of Environmental Condition

Impact of the Log Cabin workings on the adjacent watershed appears to be limited to the disturbed area. Although water quality at the site is moderately poor, the unnamed creek is not degraded as it flows past the site.

Soils at the site are impacted minimally by waste materials; only a small volume of waste is present and erosion appears to be minimal.

3.10.4 Structures

A mine building and cabin are located at the site; both structures are in poor condition. The mine building is located near the S-3 shaft and contains some old machinery. The cabin is several hundred feet north of the workings; a carved inscription on the cabin door reads "R. Knox and Bill Hasley '15".

3.10.5 Safety

The shafts, especially S-4, pose a safety concern. All of the shafts are flooded to the surface, so a person could crawl out if he fell in; however, shaft S-4 is in a closed depression with steep slopes and loose footing. The unstable walls of the mine building are also a concern.

3.11 KENT MINE

3.11.1 Site Location and Access

The Kent mine (T4N R17W 1 CADB) is approximately a half mile west of the Ross Fork of Rock Creek. Access to the site is via a three-mile trail from the main Ross Fork road. The entire site is on DNF administered land.

3.11.2 Site History - Geologic Features

The Kent Mine has been well-described by Wallace and others (1985). A shear zone along or parallel to the contact between Belt quartzite and Cretaceous granite of the Sapphire batholith strikes N80E 70SE for at least 1700 feet. The shear zone is up to 10 feet thick and contains quartz-pyrite-limonite veins up to 0.2 feet thick. Some high grade samples were collected, including a chip channel sample across 2.5 feet containing 1.06 oz/ton Au and 242 oz/ton Ag. Samples also contained up to 1.1% Pb. Although the resources are of high grade, tonnage was predicted to be low.

About 2000 feet of workings are present beyond a caved shaft and caved adit (caved at 100 feet). Production totals are 341 tons of ore yielding 88 oz of gold, 5932 oz of silver, 177 lbs of copper, and 2162 lbs of lead (Wallace and others, 1985). Presently, a discharge issues from the adit and runs through a heavily vegetated dump consisting of 4,000 tons of unaltered to weakly iron-stained granite.

3.11.3 Environmental Condition

A discharge issues from the open adit (see Figure 3.23) and flows around the south side of the waste-rock dump. Several seeps emerge at the base of the dump. Below the site, these discharges mix with numerous springs that breakout on the hillside.

3.11.3. Site Features - Sample Locations

On 9/7/93, surface water samples were collected from the adit discharge (RKES10L), the seeps at the base of the dump (RKES30L), and from one of the springs downhill of the mine (RKES20L). The adit discharge flowed at about 4

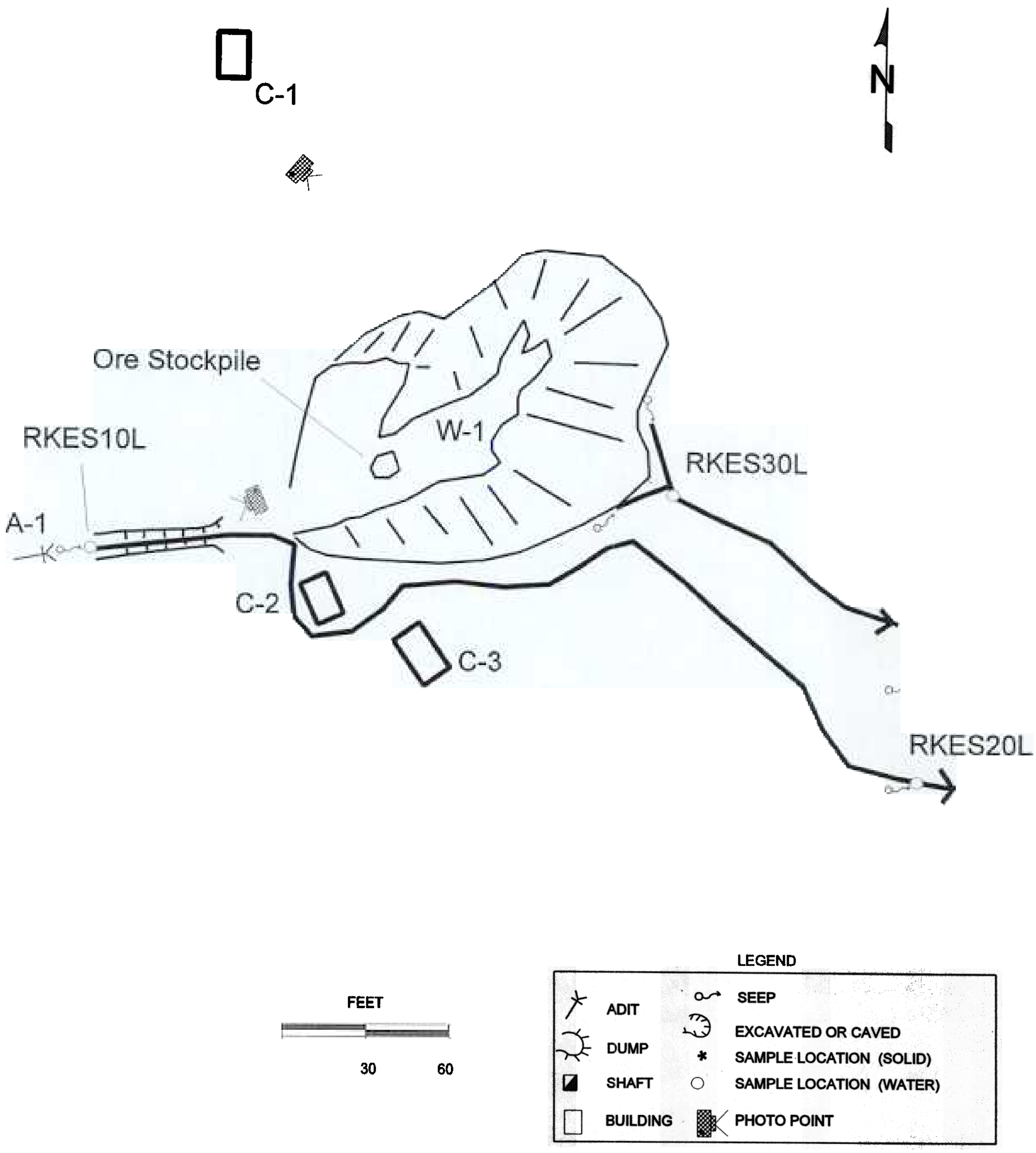


Figure 3.23 Site map of Kent mine

Figure 3.24 Water sample RKES10L was collected from the discharge flowing from the open adit.

Figure 3.25 The waste-rock dump at the Kent mine is vegetated with grasses, brush, large conifers.

gpm, the seeps at the base of the dump flowed at less than 0.1 gpm, and below the disturbed area, the sampled spring flowed at approximately 0.1 gpm.

The soils adjacent to the site did not appear to be impacted; therefore, no soil samples were collected.

3.11.3.2 Soil

No soil samples were collected.

3.11.3.3 Water

The adit discharge and the seeps at the base of the waste-rock dump exceed several water-quality standards, including the aquatic life (chronic) standard for mercury. However, both discharges appear to have little impact on water quality below the mine.

Table 3.9
Water-Quality Exceedences
Kent Mine

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 (RKES10L)									S	C									
Seep at base of dump (RKES30L)	S									C									S
Spring downhill of site (RKES20L)										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

3.11.3.4 Vegetation

Grass, brush and mature conifers are growing on the waste-rock dump. The boggy areas around the site are densely vegetated and do not appear to be impacted by the mine discharges.

3.11.3.5 Summary of Environmental Condition

Although several discharges flow from the site, no adverse impact is evident downhill of the mine. Vegetation around and downhill of the site is healthy.

3.11.4 Structures

Three cabins are located at the site. Cabin C-1, north of the adit, is in good condition. The two cabins south of the workings are in bad condition.

3.11.5 Safety

The open adit is the most serious safety concern at the site. Cabin C-1 may pose a concern if deer mice infected with the hunta virus are present.

3.12 MCDERMOTT MILL

3.12.1 Site Location and Access

The McDermott mill (T9N R15W 16 DABD) is located on McDermott Gulch approximately 1.6 miles east of its confluence with Upper Willow Creek. The site is accessible only by trail, and all site features are on DNF administered land.

3.12.2 Site History - Geologic Features

This small six-stamp mill was built to treat ore from the McDermott mine, one half mile away; however, no tailings are present, so it is likely that the mill never operated. There is a short caved adit in weakly iron-stained quartzite just above the mill. A sample of ore from the millsite contained 0.2610 oz/ton gold, 1.8 ppm silver, 149 ppm copper, 16 ppm lead, 4 ppm zinc, and 462 ppm arsenic

3.12.3 Environmental Condition

Features at the site include a caved adit (A-1, see Figure 3.26), a small cut in the hillside above the adit, and a waste-rock dump (W-1) that blocks the path of McDermott Gulch. A stamp mill and ore bin are a short distance below the dump. No tailings are present.

3 2.3.1 Site Features - Sample Locations

Water flowing down McDermott Gulch sinks into the talus just above the waste-rock dump and then resurfaces at the base of the dump. Water samples RMTS10L and RMTS20L were collected above and below the dump, respectively. Above the site, the flow rate of McDermott Gulch was 2.2 gpm; below the waste-rock dump, the rate was 3.1 gpm. The site was sampled on 10/14/94.

Soils along the drainage below the waste-rock dump were not impacted by waste materials; therefore, no soil samples were collected.

3.12.3.2 Soil

Since erosion of waste materials is negligible, no soil samples were collected.

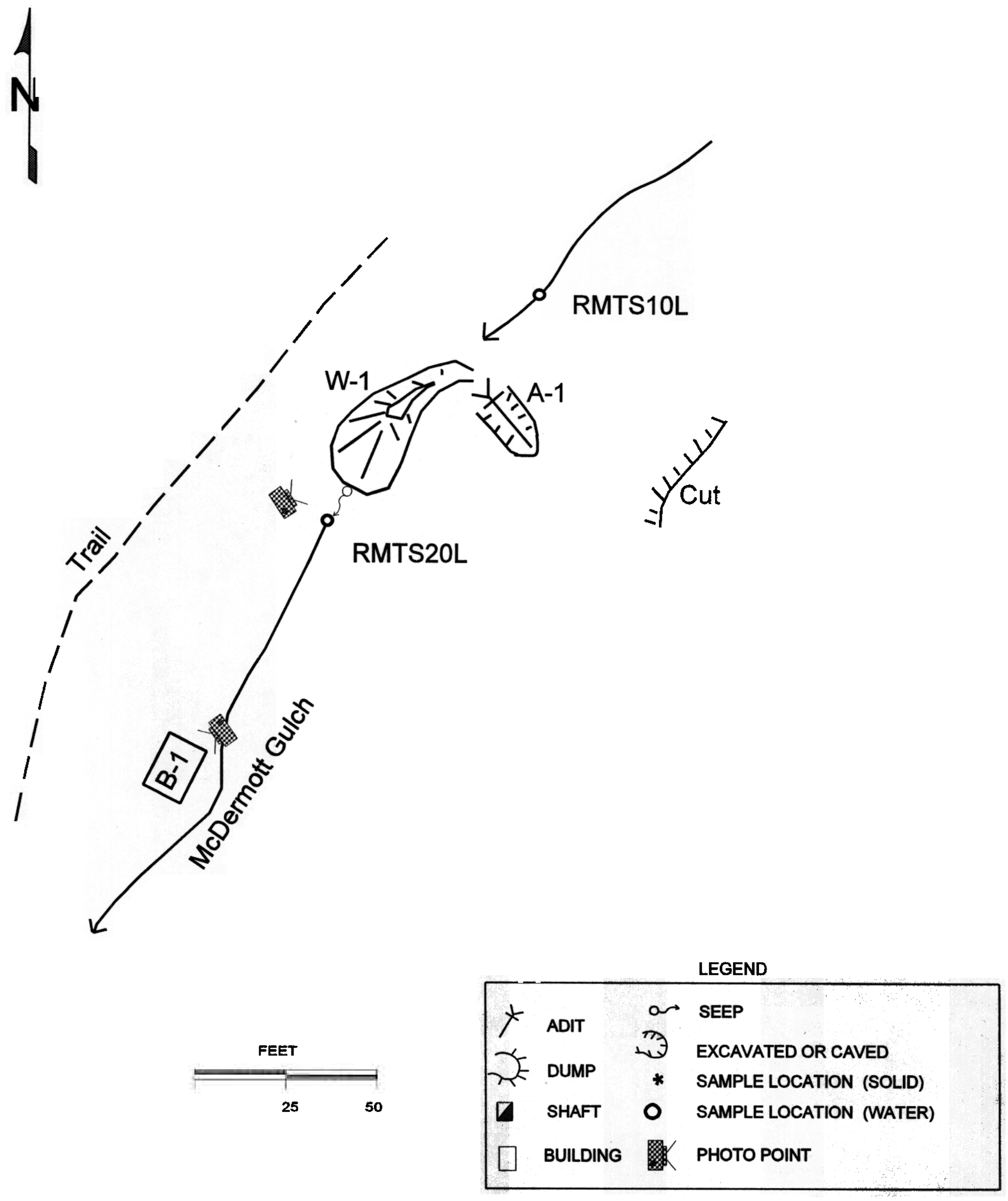


Figure 3.26 Site map of McDermott mill

Figure 3.27 A waste-rock dump near the McDermott mill lies in the path of McDermott Gulch.

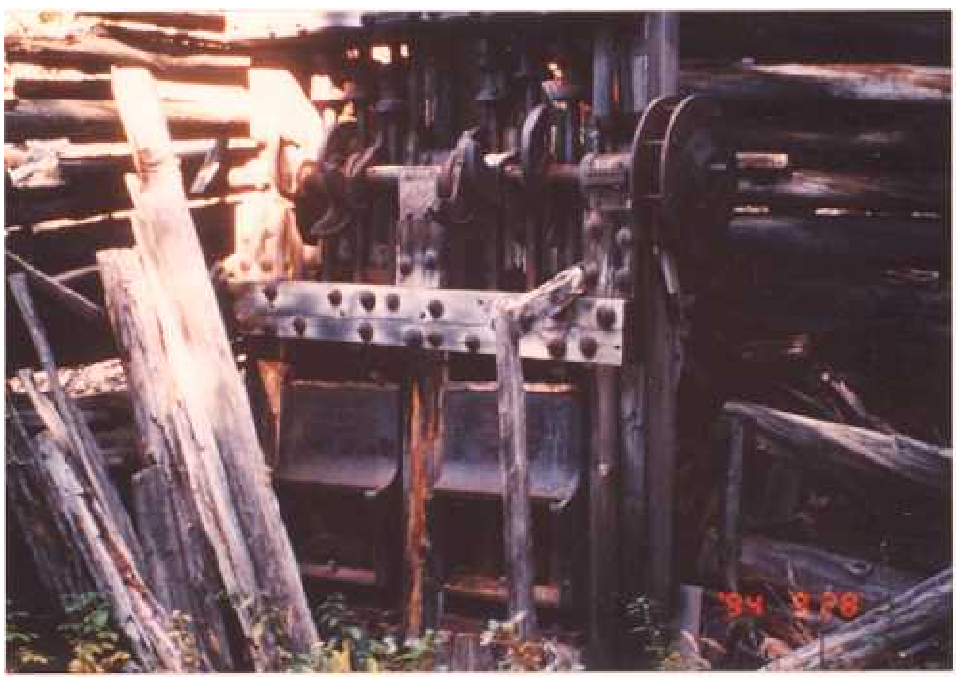


Figure 3.28 Stamp mill forged at the Philipsburg Iron Works.

3.12.3.3 Water

Concentrations of lead exceeded water-quality standards both above and below the waste-rock dump. No other water-quality criteria were exceeded.

Table 3.10
Water-Quality Exceedences
McDermott Mill

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
McDermott Gulch - Above site (RMTS10L)								P,A C											
McDermott Gulch - Below site (RMTS20L)								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

3.12.3.4 Vegetation

Vegetation growing on the waste-rock dump and along McDermott Gulch appears healthy.

3.12.3.5 Summary of Environmental Condition

Although the waste-rock dump is in the path of McDermott Gulch, it appears to have little or no impact on the drainage. The waste material is coarse and unmineralized; it does not appear to impact the native soils.

3.12.4 Structures

The stamp mill and ore bin are in bad condition, but the mill machinery may be of historical interest. The mill consists of six stamps that were forged at the Philipsburg Iron Works.

3.12.5 Safety

Because the site is accessible only by trail, it is visited infrequently. Therefore, the mill building and ore bin probably pose only a minor hazard.

3.13 SUMMARY OF MINING IMPACTS ON DNF ADMINISTERED LAND - ROCK CREEK DRAINAGE

Miller's mine, the Heaney mine and the Log Cabin prospect, all of which are in the Frogpond mining district, have the greatest adverse impacts on DNF administered land within the Rock Creek drainage. At Miller's mine, metal-laden seeps have killed or stressed vegetation on DNF administered land south of the main workings. The contaminated water from the seeps eventually flows into an adjacent creek, significantly degrading the creek's water-quality. At the Heaney mine, water in a flooded shaft has high concentrations of several metals. Although there is no surface water discharge from the shaft, ground-water quality in the vicinity of the site may be degraded. The Log Cabin prospect has several flooded shafts and waste material in contact with a small stream. Both the Heaney mine and the Log Cabin prospect are on DNF administered land; the workings at Miller's mine are on private land.

The Old Dominion and Banner sites are both on private land, and they both have mill tailings impounded in closed depressions with no surface outlets. Metals may be leaching from the tailings and adversely impacting ground-water resources on adjacent DNF administered lands. However, an evaluation of ground-water contamination was beyond the scope of this project. The Banner site also has a large streamside dump which is eroding into the Middle Fork of Rock Creek; erosion of the dump could be causing a sedimentation problem in the creek.

Three other sites, the Kent, the McDermott mill, and the Senate, have only minor environmental problems. The McDermott mill has a small, unmineralized waste-rock dump that blocks the path of McDermott Gulch, a tributary to Upper Willow Creek; water and soil quality are not adversely impacted. The Kent and Senate mines both have adit discharges; however, the discharges are not heavily loaded with metals. Impacts at these sites are restricted to the areas immediately adjacent to the workings and dumps.

Nine sites were identified that have safety concerns: the Senate and Kent mines have open adits; the Old Dominion, Log Cabin, Miller's, and Heaney sites have open shafts.; the Banner mine has an unstable waste-rock dump and debris-filled shaft; the Basin/Quartz Gulch placer and tailings site has very steep embankments associated with tailings dams; and the McDermott mill has an unstable structure. The Senate, Old Dominion, Miller's, Log Cabin, and Kent sites also have building structures and debris that could be hazardous. The Senate, Log Cabin, Heaney, Kent, and McDermott sites are on DNF administered lands.

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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 and 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 all 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

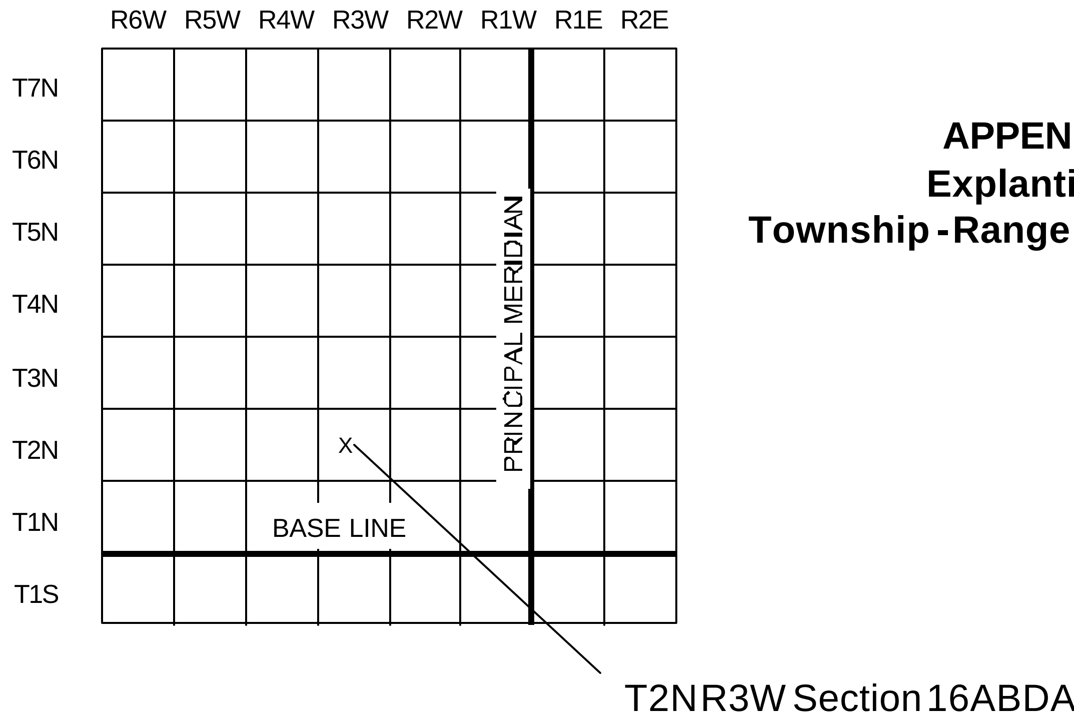
Sensitive Environments
List any sensitive environments (as listed in the HRS) within 2 miles of the site or along receiving stream for 15 miles downstream of site (*wetlands, wilderness, national/state park, wildlife refuge, wild and scenic river, T&E or T&E habitat, etc*):
____
____
____

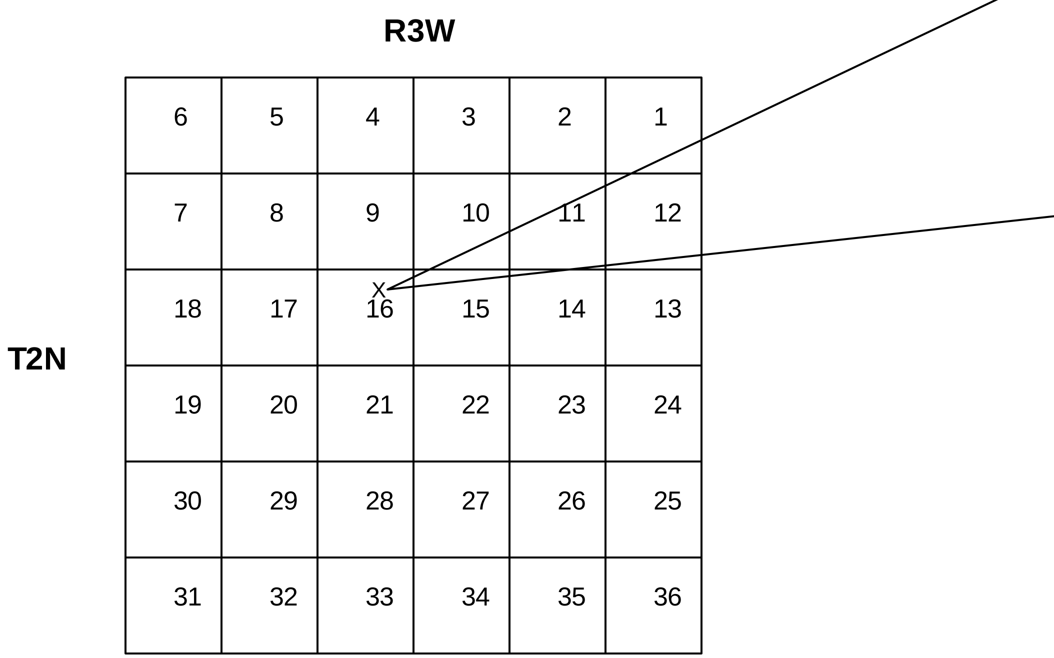
Population (*From census data*)
Population within _____0-¼ miles _____¼-½ miles _____½- mile _____1-2 miles _____2-3 miles _____3-4 miles of site

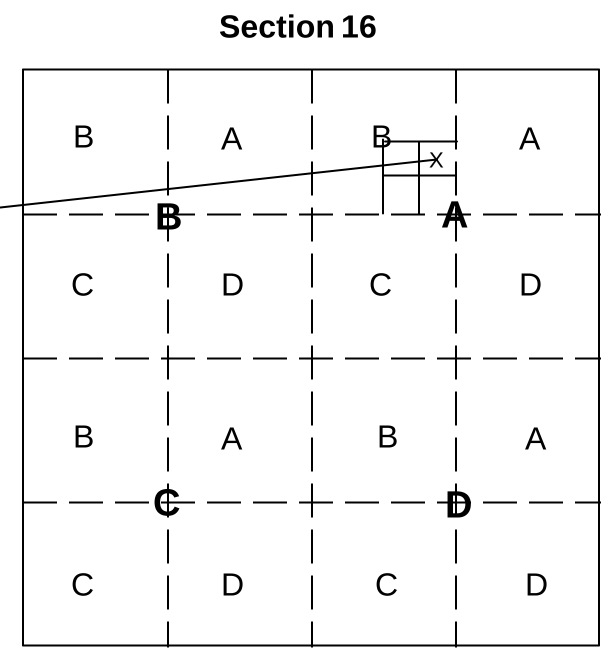
Public Interest
Level of Public Interest: _____Low, _____Medium, _____High
Is the site under regulatory or legal action? _____Yes, _____No

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

Code	ID	Name	Quadrangle
U	JF007477	6354	DELMOE LAKE
X	JF007478	A & B	LOCKHART MEADOWS
X	GR008168	A & M	MAXVILLE
X	DL007479	ABBOT	SILVER LAKE
S	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	DL008251	ANACONDA QUARRIES TWO	WEST VALLEY
O	GR000866	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	GR008049	BASIN GULCH MILL TAILINGS	CORNISH GULCH
O	JF006613	BASIN JIBE MINE	BASIN
O	GR000878	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	SB001084	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
O	JF006645	BIG FOOT	RATIO MOUNTAIN
O	JF006609	BIG FOOT CREEK PLACER	RATIO MOUNTAIN
X	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

Code	ID	Name	Quadrangle
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	GR008190	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

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

Code	ID	Name	Quadrangle
X	JF007600	COLUMBUS	BASIN
O	GR005705	COMANCHE	PHILIPSBURG
P	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	MA000781	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
O	GR007625	DERBY MORNING	PHILIPSBURG
O	PO003786	DEWEY PROSPECT	PIKES PEAK
O	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
O	JF006589	ELKHORN CREEK PLACER	TACOMA PARK
O	JF005518	ELKHORN MINE	ELKHORN
X	JF005462	ELKHORN PEAK IRON	ELKHORN
O	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
S	JF002679	ENTERPRISE	THREE BROTHERS
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

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

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
S	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
X	GR003391	LARK	POZEGA LAKES
O	JF006405	LAST CHANCE	BASIN
O	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	GR007758	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	DL004904	MORGAN EVANS CLAIM	WEST VALLEY
S	JF004936	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
X	JF005201	PEN YAN	MOUNT THOMPSON
O	JF001625	PERRY PARKS PLACER	THREE BROTHERS
X	JF008165	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
O	GR003599	SECOND CHANCE ORE	MAXVILLE
X	DL007887	SECTION 18 PROSPECT	OROFINO MOUNTAIN
X	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
X	JF001577	SPRINGTIME	BOULDER WEST
O	PO002474	SQUARE GULCH PIT	ROCK CREEK LAKE
X	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
X	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
X	SB001048	TEMPLEMAN	PIPESTONE PASS
O	GR003601	THOMPSON LAKE PROSPECT	PIKES PEAK
O	SB004928	THOMPSON PARK	HOMESTAKE
O	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	TWILIGHT 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	TWOHY	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				
O	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 - Unable to locate

APPENDIX III

MINE AND MILL SITES VISITED
IN THE FLINT AND ROCK CREEK DRAINAGES
WHICH HAD NO IMPACTS OR DID NOT AFFECT
DNF ADMINISTERED LAND

FLINT CREEK DRAINAGE

A & M

The A & M has a short, caved shaft that apparently explored a limestone breccia with a quartz-pyrite-copper carbonate matrix in the Devonian Jefferson formation. The property has been reclaimed, so it is difficult to determine any details about the site. Location: T7N R12W Section 5 BACB.

Albion

Two N32W 80SW veins of quartz, flourite, sphalerite, galena, chalcocite, pyromorphite, and pyrite were mined principally for their silver content of 20 oz/ton with minor gold averaging $2 per ton (Emmons and Calkins, 1913). The property was studied for its flourite content by Reyner and Trauerman (1949), Ross (1950), and Sahinen (1962). Apparently the flourite is a late replacement feature of vein quartz. One vein is at the Royal granodiorite-Quadrant quartzite contact; the other is within the quartzite. A total of 2100 feet of workings were present along which the vein was mined for 800 feet of strike length. The veins averaged 1-3 feet wide. Development work was proceeding as late as 1949 (Reyner and Trauerman, 1949). Today the three adits are dry and caved. The dumps are composed of granodiorite and quartzite wallrock that contains a trace of disseminated pyrite. Location: T7N R12W Section 3 BABD.

Banker (Bryan and Banker)

One open adit, an open stope, and numerous trenches investigate an extention of the zone mined by the Saranac. This is a vertical N72W zone in Cambrian Red Lion limestone, and evidently contains two narrow (6-inch) veins of quartz, flourite, galena, cerrusite, and sphalerite that crosscut bedding and produced $1000 worth of silver ore (Emmons and Calkins, 1913; Ross, 1950). Location: T8N R13W Section 25 CAAD.

Barnes

A caved adit less than 100 feet long and a short caved shaft explore a N5W structure containing iron-stained shale. According to Emmons and Calkins (1913), this is a bedding parallel structure within the Ellis Formation. Sandstone at the mine contains organic material with red copper oxides; this ore assayed a few percent copper. Location: T8N R12W Section 7 CCAD.

Bielenberg Lake Prospect

A cat cut in the Royal Stock examines a 5 foot wide, N70E 51SE zone of iron stained granodiorite and quartz veins up to 6 inches wide. Location: T8N R12W Section 27 BDDB.

Bloomington Mine and Mill

An 875 foot crosscut intersects four narrow northeast trending quartz-pyrite-galena veins (Emmons and Calkins, 1913) in granodiorite of the Royal stock. A select sample of the vein contained 0.184 oz/ton Au, 1.28 oz/ton Ag, 0.060% Cu, 0.56% Pb, and 0.083% Zn, so it appears the vein was probably mined for its gold content. A gravity concentration and amalgamation mill was built in 1896, but was used only a few months (Emmons and Calkins, 1913). No tailings can be found today. The dump consists almost entirely of unaltered granodiorite with minor sericite alteration on pieces adjacent to the vein. Location: T8N R12W Section 33 ABDB.

Bonanza

Emmons and Calkins (1913) describe this as a shear zone in Belt Supergroup limestone with pyrite and gold present. The only workings in the area found by this study are two short caved adits in weakly iron-stained quartzite, siltite, and argillite of the Helena (Wallace, 1987) formation. Location: T8N R13W BDCA.

Copper Creek

Several prospects and a short caved adit trending N30E examine a limestone breccia cemented by iron oxide and chalcedony. Host rock is limestone of the Mission Canyon formation. Location: T8N R12W Section 32 CCDD.

Deerlodge Basin Prospect

Several prospect pits investigate the extension of the Albion quartz vein in Quadrant quartzite near the contact with the Royal stock. Elliott and others (1992) state that commodities are silver, lead, tunsten, zinc, and copper, but no metallic minerals are present on the dumps. Location: T7N R12W Section 3 BABB.

Delaware

According to Emmons and Calkins (1913), silver-lead ore was mined at the Delaware from a 200-foot adit and a 100-foot shaft. The ore is apparently localized in a shear zone parallel to bedding of the Quadrant Formation and contains lead carbonates and iron oxides. Fourteen tons, with a grade of 28 oz/ton Ag and 22% lead, were shipped. The few pieces of ore remaining on the dumps consist of quartz, chalcedony, iron oxides, and fine-grained galena. All workings are caved. Location: T8N R12W Section 18 CACD.

DG

Part of the Brooklyn site. Location: T7N R12W Section 9 ADDC.

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.

Douglas

According to Emmons and Calkins (1913), the Douglas mine includes two caved adits with a total length of 700 feet which follow a 1-3 foot vein that strikes N70E 40SE. The ore appears to be quartz-iron oxide breccia enclosed within iron-stained Belt quartzite and siltite. A select sample of this material ran 0.090 oz/ton gold, 0.64 oz/ton silver, 0.026% copper, 0.029% lead, and 0.018% zinc. A third caved adit several hundred yards northwest investigates a N38E 76SE shear zone. It appears that the Douglas and Peacock are both on the same northeast striking, southeast dipping structure. The area is near a thrust mapped by Wallace (1987) which has placed younger Missoula Group rocks over older Helena formation. Only more detailed mapping will elucidate the structures and their relationships to the mineralization in this area. Location: T8N R14W Section !0 DACB.

Douglas Mill

The Douglas Mill lies in the marshy drainage bottom adjacent to the Douglas Mine. The oxidized ore was crushed and treated with cyanide here, but recovery was poor and only 200 tons were treated (Emmons and Calkins, 1913). No tailings are evident today, and the area surrounding the mill is covered with a thick growth of sedges. Location: T8N R14W Section 10 DBDD.

East Mountain Lion

A locked adit trends S18W to a quartzite breccia with a matrix of quartz and iron oxide. The dump is comprised of unaltered quartzite and siltite of the Cretaceous Kootenai formation. Like its neighbors, the Mountain Lion and Moonlight, the East Mountain Lion was probably worked for its silver values. Location: T8N R12W Section 20 DCBB.

Gird Creek

The Gird Creek mine consists of a series of trenches and pits that explore phosphate beds. Popoff (1965) gives a brief description of the property. Location: T8N R12W Section 7 ADCC.

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 N56E 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 0.404 oz/ton gold, 0.20 oz/ton silver, 0.050% copper, 0.005% lead, and 0.016% 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 CBCD.

Gold Hill (Princeton District)

The Gold Hill is located on a horst of Cambrian Hasmark dolomite within the Princeton thrust system (Baken, 1984). A vein 2-6 feet wide and striking due N 70-85W (Emmons and Calkins, 1913), approximately parallel with the reverse faults and bedding, was mined from six shafts up to 165 feet deep with several hundred feet of drifts (Trauerman and Reyner, 1950). The vein contains quartz, calcite, iron oxide, copper carbonate, and magnetite. Production figures from 1936 to 1940 indicate an average grade of 1.32 oz/ton Au (unpublished information, MBMG files). Iron stained dolomite is present over an extensive area; some breccia from the fringes of this zone ran 0.02 oz/ton Au, 0.22 oz/ton Ag, 0.010% Cu, 0.010% Pb, and 0.012% Zn.

The mine produced 87,018 tons of ore between 1934 and 1949 (Trauerman and Reyner, 1950). Location: T8N R13W Section 35 ACDA.

Gold Reef

Five caved adits with more than 2000 feet of total length follow one or more S42E 70SW veins over a strike length of more than 2000 feet. The vein, 2.5 feet wide, is comprised of quartz, siderite, specularite, chalcopyrite, magnetite, and carries high gold values. A select vein sample ran 0.392 oz/ton Au, 0.40 oz/ton Ag, 0.029% Cu, 0.013% Pb, 0.007% Zn. The vein is discordant with the enclosing unaltered quartzite of the Proterozoic Snowslip Formation (Elliott and others, 1992). Seven chip samples along a portion of the vein averaged 0.689 oz/ton (unpublished information, MBMG files). The nearby South Boulder Mill (Gold Reef Mill) was built to process ore, most of which was oxidized, from the mine (Emmons and Calkins, 1913). Location: T7N R13W Section 2 CCAD.

Greater New York

This property was well described by Emmons and Calkins (1913). At the site, a 52-degree 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.

Hanna Mill

This is the amalgamation/cyanidation mill (Emmons and Calkins, 1913) at the Red Lion Mine. Ore was shipped via tramway from the Hannah Mine, 0.75 miles away. Only a few tons of quartz-iron oxide tailings remain on a dry slope below the millsite. Location: T6N R13W Section 14 CACB.

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 0.006 oz/ton gold, 0.14 oz/ton silver, 0.004% copper, 0.008% lead, and 0.010% zinc. Location: T5N R13W Section 3 ABDB.

Jefferson

According to Emmons and Calkins (1913), the Jefferson produced low grade copper-lead ore from a quartz-pyrite-copper carbonate vein from two tunnels. However this is adjacent to and similar to the Mayflower, which contains only abundant copper. The 5-10 foot thick vein appears concordant with the enclosing Mission Canyon formation at N70W 60SW. Location: T7N R12W Section 7 ABAA.

Lark

Several prospect pits in Mount Shields(?) quartzite explore several parallel N5W vertical quartzite-iron oxide breccia zones. They are up to 10 feet wide. A select sample of this material ran 0.028 oz/ton Au, 0.16 oz/ton Ag, 0.007% Cu, 0.013% lead, and 0.008% 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.

Letus #1

Part of the Golden Jubilee. Location: T6N R13W Section 14 CBDD.

Mayflower Vein

Like the nearby Jefferson mine, this was presumably a copper mine. A select sample of a limestone-quartz breccia with a chalcedony-iron oxide matrix ran 0.010 oz/ton Au, 0.260 oz/ton Ag, 9.17% Cu, 0.044% Pb, and 0.023% Zn. The mineralized zone appears to have a N70W orientation, parallel to bedding. Two caved adits probably have less than 100 feet of total length. Location: T7N R12W Section 7 ABDB.

Montana

A 1-2 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 N69W 70NE orientation, and is in Mount Shield formation. Workings are dry and caved, with one open stope. Location: T6N R13 W Section 23 ACDA.

Moonlight

The Moonlight is an unusual mine in that it was first worked for production of metallic minerals, then later (after World War II) produced 5000 tons of phosphate ore (Popoff, 1965). Gold, silver, copper, and lead were sought from iron and copper-stained quartz-cemented quartzite fault breccia. A select sample of this ore contained 0.012 oz/ton Au, 7.76 oz/ton Ag, 0.15% Cu, 0.47% Pb, and 0.44% Zn. A map included by Popoff (1965) indicates that the fault zone is parallel to bedding with a N25W 50NE attitude. A phosphate bed forms the hanging wall. Dump material is almost entirely quartzite. More than 3000 feet of workings are present behind a locked portal. Several cabins in good condition are still standing near the mine. The workings are on DNF administered land. Location: T8N R12W Section 20 CCCD.

<u>Nellie</u>

A caved adit with extensive workings drifts on a steeply deeping phosphate bed. The dump has been reclaimed. Location: T8N R12W Section 7 CDDB.

<u>Nellie Barnes</u>

Four short caved adits and a small open cut investigate structures in quartzite that sub-parallel bedding and cut it at N50E 62SE. Ore consists of quartzite breccia with a matrix of quartz, iron oxides, and minor fine-grained galena. Workings probably total only about 500 feet in length. Location: T8N R13W Section 12 DCDB.

<u>Non Pareil(Queen)</u>

Emmons and Calkins (1913) provide the most information on this site. The mine was worked from 1889 to 1893, with about $50,000 in silver and lead produced. It consisted of a 280 foot shaft with two levels. The ore occurs on a brecciated fault contact of Jefferson and Mission Canyon limestone up to 120 feet wide. The ore consisted of iron stained limestone and clay with nodules of galena, lead carbonate, and copper carbonate. In 1907, an 80 ton shipment averaged 37 oz/ton Ag, 1.7% Cu, 8% Pb, and 13% Zn.

Presently, all workings are covered by overburden from recent bulldozer work. Some limestone breccia with a chalcedony-iron oxide matrix and a N46W 77NE orientation is exposed in outcrop at the site. This attitude is similar to that of the Brooklyn structure on trend one half mile to the southeast. Location: T8N R12W Section 32 CCAC.

<u>Northern Cross</u>

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 <0.006 oz/ton gold, 0.12 oz/ton silver, 3.02% copper, 0.005% lead, and 0.021% zinc. Recent drilling has been performed as part of a Hidden Lake gold exploration project. Location: T6N R12W Section 9 CBBC.

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Peacock

A N50E 36SE fault zone in nearly horizontal limestone of the Helena formation contains fine grained quartz, pyrrhotite, chalcopyrite, galena(?), and sphalerite(?). The mineralization also seems to occur in small replacement lenses along bedding. A select sample of this high sulfide material ran 0.108 oz/ton gold, 2.56 oz/ton silver, 0.26% copper, 0.073% lead, and 0.055% zinc. However, the zone is only 1-8 inches wide (Emmons and Calkins, 1913). This may be on the same structure as the Douglas mine to the southwest.

The mineralization has been explored by two adits, now caved, with a combined length of 700 feet (Emmons and Calkins, 1913). Location: T8N R14W Section 11 BBCD.

Porter

An oxidized quartz-calcite-pyrite vein at least 1 foot wide with a westerly strike and steep southerly dip in Hasmark Formation was explored at the Porter Mine (Emmons and Calkins, 1913). A few tons of oxidized gold ore were supposedly produced. A select sample contained 0.071 oz/ton Au, 0.09 oz/ton

Ag, 0.004% copper, 0.018% lead, and 0.006% zinc. One caved adit and numerous small prospect pits are present. Location: T6N R13W Section 22 DDCD.

Princeton

A caved shaft is in an area of placer workings, so it is difficult to speculate on the size or geology of the mine. Emmons and Calkins (1913) describe it as a silver vein in Red Lion limestone. Location: T8N R13W Section 25 ADBB.

Radar

Part of the Golden Jubilee site. Location: T6N R13W Section 14 CBCD.

Robinson

An 80-foot decline and an adit supposedly followed a N40W 60SW 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.

Rombauer

One short caved S75W adit explores a small skarn deposit at the Mission Canyon limestone-Royal stock granodiorite contact. The mineralized area contains pyrite, arsenopyrite, magnetite, garnet, epidote, actinolite, and tremolite. Emmons and Calkins (1913) also noted chalcopyrite and galena. A select sample of mineralized rock from the dump ran only 0.042 oz/ton Au, 1.06 oz/ton Ag, 0.086% Cu, 0.061% Pb, and 0.033% Zn. Location: T7N R12W Section 4 CCCC.

St. Thomas-Nineteen Hundred

Both the St. Thomas and adjoining Nineteen Hundred mined a narrow N79E 47SE sheeted zone which cuts bedding in the host, Mount Shields quartzite. Both mines 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 CDAD.

Sallie Mellen

One caved adit follows a N68W vertical structure which crosscuts the host Missoula Group(?) quartzite and contains quartz, limonite, malachite, pyrite, cuprite, and pyromorphite (Emmons and Calkins, 1913). The zone carried 60 oz of silver and $4 in gold per ton, but is only 5 inches wide. One quarter mile north are several prospect pits and one caved adit in a quartz-iron oxide breccia that strikes parallel to bedding. This area has recently undergone exploration drilling, but results are unavailable. Location: T9N R13W Section 32 DACA.

Saranac

A 150-foot shaft with 1000 feet of workings (Trauerman and Reyner, 1949) follow a N72W near vertical vein in Red Lion limestone with quartz, pyrite, chalcopyrite, galena, calcite, enargite, and sphalerite. The vein is four feet wide in outcrop, and a select sample had 0.074 oz/ton Au, 4.79 oz/ton Ag, 0.151% Cu, 1.71% Pb, and 3.79% Zn. Skarn minerals are present in the wallrock. Ruins of a flotation mill are present at the site, but no tailings can be found. Location: T8N R13W Section 25 DBCB.

Shamrock

A fault zone N12W 52NE and approximately parallel to bedding is explored by a large open cut and a caved adit at the Shamrock. It is described as 22 feet wide, contains 1.88-4.75% zinc, and can be followed for 2500 feet to the south (Popoff, 1953). Location: T12N R14W Section 3 ACBD

Sixteen-to-One

Emmons and Calkins (1913) describe this prospect as examining a concordant SE striking, 35SW dipping quartz-pyrite-chalcopyrite-copper carbonatevein. Currently a few propect pits expose a bull quartz vein in the Quadrant formation. Location: T7N R12W Section 3 BDAC.

Snow Cap

A caved, 1200-foot long adit apparently explored for phosphate. Location: T8N R12W Section 18 BCDC.

South Boulder Mill (Gold Reef Mill)

The South Boulder Mill treated ore from the Gold Reef Mine through a stamp and amalgamation process (Emmons and Calkins, 1913). In 1906, a cyanide plant was added. Ore treated only totaled 800 tons. Today 300 tons of coarse quartz sand remain with low metal values. A small area of soil appears to have been contaminated by runoff. The site is dry and 200 feet from the nearest stream. Location: T7N R13W Section 3 DBAB.

State

A caved adit at least 500 feet long follows the contact between the Philipsburg batholith and Paleozoic limestone. No outcrops are present, but both rock types on the dump are weakly iron-stained. Location: T6N R13W Section 14 ACBC.

Starlight

A series of caved adits follow a N40W 80NE quartz-pyrite-copper carbonate vein in Quadrant quartzite. The deposit may be associated with a thin parallel(?) granodiorite dike. Dumps are vegetated unaltered quartzite. No production was recorded from this site (Elliott and others, 1992). An unpublished letter (MBMG files) indicates that this property was valued for its silver and lead content. Location: T8N R12W Section 33 DCCA.

Sunday Extension

Two caved adits in unaltered granodiorite explore the western extension of the Sunday mineralization. Location: T8N R12W Section 27 CCCB.

Swamp Gulch Mill

A few hundred tons of oxide ore from the Gold Hill Mine were treated here using an amalgamation process (Emmons and Calkins, 1913), but there is only a dry discontinous veneer of vegetated tailings remaining. Location: T8N R13W Section 36 CBBB.

Thursday-Friday

An open adit less than 100 feet long follows a curving breccia zone in limestone and siltite of the Kootanai formation. The zone contains shale clasts with quartz, pyrite, chalcopyrite, and galena in the matrix, and no pieces larger than 6 inches are present. A select sample ran 0.182 oz/ton Au, 6.22 oz/ton Ag, 1.66% Cu, 4.31% Pb, 0.62% Zn. Location: T8N R12W Section 16 BCBB.

Travonia (Apex?)

Two hundred fifty feet of workings mined an east-striking, 68N dipping vein of quartz, calcite, galena, sphalerite, chalcopyrite, iron oxide, and copper carbonate in Cambrian Hasmark dolomite and limestone. The workings are dry and accessible through a gated portal. Location: T8N R13W Section 25 DDDA.

Tussle

Emmons and Calkins (1913) give a fairly complete description. The mine followed a N87W 63SW quartz-pyrite-galena-chalcocite vein in granodiorite of the Royal stock with sericite and pyrite alteration products. The ore averaged 30 oz/ton Ag, $2/ton Au, 2% Cu, and some Pb. It was worked 1904-1906, producing $12,000 worth of metals. The workings included a 160-foot inclined shaft with three levels, and two adits. All workings are caved today, but there is some evidence for recent work. Location: T8N R12W Section 2 DCCD.

Upper Mountain Lion

Two caved adits and a caved shaft chase an oxidized, silicified breccia zone in Quadrant quartzite. A select sample indicates silver, lead, and zinc were the primary commodities, containing 0.020 oz/ton Au, 7.48 oz/ton Ag, 0.15% Cu, 3.47% Pb, and 2.84% Zn. Location: T8N R12W Section 21 CCCD.

Vallejo

A short caved adit in unaltered dolomite trends S50E. The area is dry. Location: T6N R13W Section 27 ACDB.

ROCK CREEK DRAINAGE

Basin/Quartz Creek Placer

Although this is a placer mine, it was investigated as part of this project because extensive areas of altered bedrock have been exposed and numerous seeps and springs are scattered across the site. Lyden (1946) estimated that 7000 oz of gold have been produced from these drainages since 1904. Near the heads of the gulches, a large Tertiary rhyolite porphyry intrusion has been emplaced in sedimentary rocks of the middle Belt carbonate unit. Although the country rock has been contact metamorphosed, the igneous rock appears to be extensively altered, and it is now composed mainly of quartz, kaolinite, sericite, and 3% disseminated pyrite. Placer workings extend well upstream of the sedimentary rocks, providing further indications that the source of the placer gold is the intrusion. However, a sample of this ran less than 0.006 oz/ton Au, 0.16 oz/ton Ag, 0.003% Cu, 0.005% Pb, and 0.015% Zn. Nonetheless, exploration drilling was proceeding in 1992. The entire site is on private land. Location: T7N R16W Section 34 ACBA.

Bentz

Wallace and others (1985) describe the Bentz in detail. The mine contains seven subparallel, molybdenum-bearing quartz veins that strike north to northwest and dip 20-40 west. This zone is 370 feet wide, and veins within it are up to 1.5 feet wide. Strike lengths of 40 are exposed. The best of thirteen sample contained 0.23% Mo and 1.7 oz/ton Ag.

Workings consist of two short open adits (40 and 80 feet) and the site is dry. Location T4N R16W Section 5 DBCC.

Black Pine

Because the Black Pine was covered by an operating permit at the time of this study, it was not examined as part of this project. Geology of the mine has been well-described by Waisman (1985). Location: T8N R14W Section 16 BCDB.

Congdon (Broken Bottle)

At the Congdon, a caved adit less than 500 feet in length probably crosscuts to a N85E quartz-iron oxide vein exposed in a series of pits to the south for 200 feet along strike. Host rock is granite of the Sapphire batholith. A sample of oxidized, iron-stained quartz vein contained 0.008 oz/ton Au, 0.84 oz/ton Ag, 0.017% Cu, 0.03% Pb, 0.041% Zn, and 0.13% As. Despite reports of uranium mineralization, gamma radiation readings were normal. Structure, mineralogy, and geologic setting appear similar to the nearby, well-studied Kent Mine. Location: T4N R17W Section 1 AADB.

Indiana

See Wallace and others (1982), Wallace and others 1983), and Wallace and others (1985). Location: T3N R17W Section 11 BDDB.

Joker

See Wallace and others (1982), Wallace and others 1983), and Wallace and others (1985). Location: T3N R17W Section 17 CCDB.

M & T

An altered, iron-stained, N89W 24NE shear zone about 4 feet thick in diorite is exposed at the locked portal of the M & T. The dump has been removed. Little else is known, except that the mine was active as late as 1958 (Stout and Ackerman, 1959) and gold, silver, copper, and lead were mined. Location: T4N R16W Section 25 BDDC.

McDermott Mine

Mining in this area has not been described in any literature available to the public. Workings consist of at least five caved adits with a total length of less than 500 feet and numerous trenches. They expose a breccia zone at least 12 inches wide of quartzite clasts, derived from the enclosing Mt. Shields Formation, in a matrix of vuggy quartz, pyrite, and hematite after pyrite. The mineralized zone does not crop out, but distribution of the workings suggests it parallels bedding. A sample ran only 0.0370 oz/ton gold, 1.4 ppm silver, 57 ppm copper, 32 ppm lead, 2 ppm zinc, and 1490 ppm arsenic. However, this was the source for the McDermott Mill ore, which contained considerably more gold. Location: T9N R15W Section 16 DABD.

Moose Lake Tailings

A small volume of tailings on private land near the Banner mine are an enigma. There is no information on a mill here, and no associated mine could be found. They are on dry glacial moraine and pose no environmental threat. T4N R16W Section 36 CADA.

Mountain Ram

Emmons and Calkins (1913) describe this mine in the "Rock Creek Gold Belt" (Woodward, 1993). Gold and silver were mined from a 5-20 foot thick zone parallel to the bedding of the host Helena-Wallace Formation. The zone was explored for at least 190 feet downdip. The zone is a breccia containing fragments of the host rock, abundant barite, pyrite, iron oxides, quartz, and calcite. Adjacent areas of Belt rock have been pervasively silicified. According to Emmons and Calkins (1913), average grade of the ore was 0.25 oz/ton gold; samples taken by Woodward (1993) ran from 0.042 to 2.18 oz/ton gold and up to 17.9 oz/ton silver. Numerous recent reclaimed drill pads are present. Location: T^N R 15W Section 35.

Nancy Lee

Some prospect pits and trenches in quartz monzonite follow a N78E, steeply dipping, 16-inch thick quartz-pyrite-galena vein (Bannister and others, 1983). The best of ten samples contained only 0.05 oz/ton gold and very low silver and base metal values. Location: T3N R17W Section 11 BDAB.

O'Brien

The O'Brien workings explore a large 0.125 square mile area of Mount Shields quartzite and argillite adjacent to the granodiorite contact. Shear zones strike N40E 83NW and contain quartz, pyrite, chalcopyrite, and galena veins (Bannister and others, 1983). Material from a stockpile carried as much as 48.9 oz/ton silver, but Bannister and others (1983) estimated that there are 3000 tons of resources present with an average of 5.2 oz/ton silver. All workings are caved, small, and dry. Location: T3N R17W Section 13 CDAC.

Ohio

See Wallace and others (1982), Wallace and others 1983), and Wallace and others (1985). Location: T3N R17W Section 11 ACCB.

Townsend

Dry caved shafts and pits follow a WNW trending vertical vein in granite. Two select samples averaged only 0.025 oz/ton Au and minor silver (Bannister and others, 1983). Location: T3N R17W Section 11 AAAD.

Tuscarora

Three shafts 10-20 feet deep and some prospect pits explore two sets of limonite-stained shears in granodiorite (Bannister and others, 1983). The shear zones are from an inch to one foot thick, and have N65W 51SW and N70E 35NW orientations. The best select sample had only 0.06 oz/ton gold and 1.8 oz/ton silver. The workings are located on a dry hilltop. Location: T3N R17 W Section 14 DABA.

APPENDIX IV

ASSAY DATA
FLINT AND ROCK CREEK DRAINAGES

APPENDIX V

WATER-QUALITY AND SOIL CHEMISTRY DATA
FLINT CREEK AND ROCK CREEK DRAINAGES

NATIONAL FOREST SERVICE - DEERLODGE NATIONAL FOREST
FLINT CREEK AND ROCK CREEK DRAINAGES
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Al (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Fe (mg/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 (mg/l)	SO4 (mg/l)	SiO2 (mg/l)	Field pH (SU)	Field SC (umhos/cm)	Temp (C)
BANNER MINE AND MILL																							
RBAS10M	94Q0438	Mid. Fk. Rock Creek, downstream of site	<30.	<1.	52.1	<2.	<2.	<2.	0.015	<2.	0.003	<.1	<2.	<1.	5	<.2	0.15	1.31	3.3	8	8.21	152.2	12.5
RBAS20M	94Q0443	Mid. Fk. Rock Creek, upstream of site	<30.	<1.	53.6	<2.	<2.	<2.	0.008	<2.	0.002	<.1	<2.	<1.	4.1	2.3	0.18	0.33	3.3	8	8.42	153.4	10.4
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-	0	-	-		0	0	0		0		0		
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0		0	0/0		0/0								
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0		0/0		+	0/0		0/0								
BLUE BIRD MINE																							
FBBS10M	92Q0894	Adit discharge	<30.	<1.	2.6	<2.	<2.	6	0.025	<2.	0.003	<.1	<2.	<1.	118	0.12	0.06	0.54	3.4		6.8	48.6	7.7
FBBS20L	92Q0899	Spring above adit	<30.	<1.	<2.	<2.	<2.	<2.	0.004	<2.	<.002	<.1	<2.	<1.	8.4	0.17	0.03	0.31	2.2	8	7.07	30.5	8
FBBS30M	92Q0895	Below confluence of adit discharge and spring	<30.	<1.	2.7	<2.	<2.	4.1	0.007	<2.	0.003	0.1	<2.	<1.	76.3	0.17	0.04	<.10	3.6	8	6.49	44.7	13.5
No. Exceeded CWA-Primary			-	0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-		-	-	0	0	-	0	-	-	0	0	0	0		0				
No. Exceeded AQLC-Acute (1)			0	0		0/0	0/0	0/0	0	0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			0	0		0/0	0/0	0/0		0/0		1+	0/0	+	1/0								
BROOKLYN MINE AND MILL																							
BLBS10L	92Q0884	Boulder Creek, 200 ft. downstream of site	<50.	1.4	14.5	<2.	<2.		<.003	<2.	<.002	<.1	<2.	<1.	15.4		0.06	0.9	3.8	8	8.43	148	15.8
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-	0	-	-	0	0		0		0				
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0		0/0		+	0/0	+	0/0								
GARRETT MINE																							
FGAS10M	92Q1040	Adit discharge	<30.	<1.	25.5	<2.	<2.	<2.	0.01	<2.	0.007	<.1	<2.		7.7	0.38	0.04	0.1	2.95	6	8.58	240.3	5
FNFS30L	92Q1050	N.Fk. Flint Creek, downstream of site	<30.	<1.	22.4	<2.	<2.	<2.	0.045	<3.	0.004	<.1	<2.		7.8	0.35	0.25	0.01	4.1	11	8.29	251.5	6.6
FNFG10L	92Q1066	Cable Mountain Campground well	<30.	<1.	29.8	<2.	<2.	2.4	0.012	<2.	0.095	<.1	<2.		432	1.1	0.31	0.75	1.1	2	8.46	269.6	11.8
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-		-	-		0	0	0	-	0				
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0		0	0/0		1/1			-					
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0		0/0		+	0/0		1/1								
HEANEY MINE																							
LHES10M	94Q0464	Flooded shaft	129	<1.	23.5	9.5	<2.	12.2	0.35	58	0.436	0.3	<2.	1	53.7	<.2	0.075	1.73	<1.	5	5.98	39.1	8
LHES20L	94Q0449	Unnamed creek near mine, background	265	<1.	26.5	<2.	<2.	5.1	0.437	<2.	0.031	<.1	<2.	<1.	14.3	1.7	0.034	<.1	2.5	10	6.03	32.23	10
LHES30L	94Q0440	Unnamed creek downstream of mine	60	<1.	14.3	<2.	<2.	<2.	0.099	<2.	0.004	<.1	<2.	<1.	4	<1.	0.019	<.1	3.09	9	6.5	26.51	13.6
No. Exceeded CWA-Primary				0	0	1	0	-		1		0	0			-	0	0	0				
No. Exceeded CWA-Secondary			3	-	-	-	-	0		-		-	-	0	0	0	0		0	0			
No. Exceeded AQLC-Acute (1)			0	0	-	1/1	0/0	0/0		0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			2	0	-	1/1	0/0	1/1		1/1		1+	0/0	1+	0/0								
HOBO T. HAYES																							
CHHS10H	94Q0627	Adit discharge on DNF administered land	30.	1	10.5	5.8	<2.	<2.	0.007	<2.	1.513	0.21	3.2	<1.	3940	2.6	0.104	0.087	144	19	7.32	480.52	8.9
CHHS20H	94Q0626	Spring below site	29	<1.	20.1	7.9	<2.	2.5	0.007	<2.	0.103	0.17	5.5	<1.	9500	3.06	0.185	0.44	209	40	6.13	551.45	8.9
No. Exceeded CWA-Primary						2	0			0			0			-	0	0					
No. Exceeded CWA-Secondary			0			-	-	0		-			-	0	1	0	0	-					
No. Exceeded AQLC-Acute (1)			0			2/0	0/0	0/0		0/0			0/0	0	2/2								
No. Exceeded AQLC-Chronic (1)			0			2/2	0/0	0/0		0/0			0/0	+	2/2								

NATIONAL FOREST SERVICE - DEERLODGE NATIONAL FOREST
FLINT CREEK AND ROCK CREEK DRAINAGES
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Al (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Fe (mg/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 (mg/l)	SO4 (mg/l)	SiO2 (mg/l)	Field pH (SU)	Field SC (umhos/cm)	Temp (C)
KENT MINE																							
RKES10L	94Q0467	Adit discharge	<30.	<1.	30	<2.	<2.	<2.	0.13	<2.	0.068	0.11	<2.	<1.	14.8	0.3	0.135	0.13	3.5	33	7.24	92.27	12.5
RKES20L	94Q0465	Spring on hillside below mine	<30.	1.1	34.8	<2.	<2.	<2.	0.02	<2.	0.006	0.16	<2.	<1.	3.1	<.2	0.15	0.18	2.3	33	7.92	115	15.1
RKES30L	94Q0468	Seep at base of waste-rock dump	69	<1.	40.4	<2.	<2.	<2.	0.15	<2.	0.037	0.19	<2.	<1.	11.2	<.2	0.113	0.094	<1.	33	6.44	114.22	13.3
No. Exceeded CWA-Primary			-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary			1	-	-	-	-	0	0	-	1	-	-	0	0	0	0	-	0	0	1	-	-
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0	-	0/0	-	3	0/0	+	0/0	-	-	-	-	-	-	-	-
LOG CABIN PROSPECT																							
LLCG10M	94Q0458	Shaft S-1	27	<1.	41.3	<2.	<2.	<2.	0.49	<2.	0.11	<0.1	<2.	1	8.2	<1.	0.043	0.012	<5.	28	6.71	174.06	5.2
LLCG20L	94Q0457	Shaft S-2	48	<1.	25.8	<2.	<2.	<2.	0.09	<2.	0.036	<0.1	<2.	<1.	5	<1.	0.1	<.25	<5.	14	5.69	43.7	6.7
LLCG30L	94Q0459	Shaft S-3	100	<1.	32	<2.	<2.	<2.	1.8	28	0.51	0.25	<2.	2	17.4	0.3	0.06	1.8	<1.	14	6.34	39.22	6.2
LLCG40L	94Q0460	Shaft S-4	92	1.2	24.6	<2.	<2.	2.5	0.59	<2.	0.129	0.15	<2.	<1.	4.8	0.2	0.085	0.156	<1.	16	6.32	31.4	7
LLCS10L	94Q0454	Unnamed creek, downstream of site	90	<1.	17.8	<2.	<2.	<2.	0.079	<2.	0.003	<0.1	<2.	<1.	<2.	<.2	0.09	0.26	<1.	18	8.61	53	5.3
LLCS20M	94Q0463	Seep at base of waste-rock dump W-1	<30.	<1.	35	<2.	<2.	<2.	0.25	2.5	0.124	0.14	<2.	<1.	2	<.2	0.121	0.44	<1.	19	7.16	164.46	5.7
LLCS30L	94Q0461	Unnamed creek, upstream of site	169	2.6	31	<2.	<2.	13.6	1.9	21.4	0.434		<2.	1.7	20.1	<1.	0.086	2.6	<5.	16	7.3	25	10
No. Exceeded CWA-Primary			-	0	0	0	0	-	-	0		0	0			-	0	0	0				
No. Exceeded CWA-Secondary			4	-	-	-	-	0	4	-		-	-	0	0	0	0	-	0	0	4		
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	2	0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			4	0	-	0/0	0/0	1/1	-	2/2		3+	0/0	3+	0/0								
LOWER WILLOW CREEK TAILINGS																							
WLWS10M	96Q0308	Seep from tailings impoundment	<30.	255.5	141.3	<2.	<2.	32.7	9.5	10.8	1.5	0.79	2.8	<1.	11.7	1.0	0.6	0.1	<2.5	25.8	6.07	121	19.1
WLWS20L	96Q0312	Lower Willow Creek - downstream of site	92.2	4.2	68.1	<2.	<2.	20.5	0.062	<2.	0.015	0.13	<2.	<1.	25.2	0.5	0.1	0.05	10.0	16.8	6.87	48	15.3
WLWS30L	96Q0309	Lower Willow Creek - upstream of site	96.9	3.8	77.1	<2.	<2.	20.9	0.067	<2.	0.013	0.10	<2.	<1.	27.4	0.5	0.1	0.05	10.0	16.4	6.98	46	16.3
WLWS40L	96Q0311	Seep from streamside tailings south of impoundment	<30.	31.1	81.7	<2.	<2.	25.1	0.918	2.3	0.166	0.31	<2.	<1.	25.2	1.5	0.1	<0.05	7.5	16.7	5.80	49	18.1
No. Exceeded CWA-Primary			-	1	0	0	0	-	-	0		0	0				0	0	0				
No. Exceeded CWA-Secondary			2	-	-	-	-	0	2	-		-	-	0	0	0	0	-	0				
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	4/0	1	0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			2	1	-	0/0	0/0	4/4	-	1/1		4	0/0	+	0/0								
MCDERMOTT MILL																							
RMTS10L	95Q0283	McDermott Gulch, upstream of waste-rock dump	<30.	<1.	70	<2.	<2.	3.5	0.014	233.3	0.004	<0.1	<2.	<1.	10.4	0.5	0.057	0.35	<2.5	12	7.42	70	3
RMTS20L	95Q0282	Seep at base of waste-rock dump	34.5	<1.	77.5	<2.	<2.	4.8	0.017	3.8	0.006	<0.1	<2.	<1.	18.5	0.5	0.08	0.05	<2.5	12	7.54	49	2.9
No. Exceeded CWA-Primary				0	0	0	0		-	1		0	0			-	0	0	0				
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-	0	-	-	0	0	0	0		0	0			
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	1/1		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0	-	2/1		+	0/0	+	0/0								
MID. FK. DOUGLAS CREEK PHOSPHATE MINE																							
DMDS10H	94Q0654	Adit discharge	<30.	1.2	3.1	<2.	<2.	<2.	0.008	<2.	<.002	<0.1	<2.	<1.	4.4	<.2	0.168	0.055	7.8	9	8.67	368	3.9
DMDS20H	94Q0656	Adit discharge below waste-rock dump	<30.	1.3	4	<2.	<2.	<2.	0.006	<2.	<.002	0.11	<2.	<1.	10.2	<.2	0.142	<.05	7.9	9	7.68	142	10.4
No. Exceeded CWA-Primary				0	0	0	0			0		0	0			-	0	0	0				
No. Exceeded CWA-Secondary			0	-		-	-	0		-	0	-	-	0	0	0	0	-	0	0			
No. Exceeded AQLC-Acute (1)			0	0		0/0	0/0	0/0		0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			0	0		0/0	0/0	0/0		0/0		1+	0/0	+	0/0								
MILLER'S MINE																							
LMIS10H	94Q0466	Seep on south side of site	174	<1.	32.1	97.3	<2.	110	0.1	6	0.494	0.17	4.5	<1.	5766	2.2	0.16	0.063	104	17	5.76	229.8	12
LMIS20L	94Q0436	Unnamed creek, upstream of site, south and west of site	93	<1.	15.8	<2.	<2.	<2.	0.201	2.6	0.023	<.1	<2.	<1.	16.9	0.26	0.071	0.48	1.05	9	6.56	31.2	10.1
LMIS30L	94Q0469	Unnamed creek, downstream of site, south site	85	<1.	16.2	5.4	<2.	8	0.16	18.7	0.023	0.12	<2.	<1.	212	<1.	0.104	3.01	<5.	9	7.22	39.6	17
LMIS40L	94Q0441	Spring on NE side of site	136	<1.	18.5	<2.	<2.	<2.	1.6	4.2	0.059	<.1	<2.	<1.	10.7	0.31	0.059	0.113	<1.	11	6.41	28.4	10.1
LMIS50L	94Q0445	Unnamed creek draining marsh, E of site	111	<1.	10.1	<2.	<2.	2.3	0.175	5.3	0.007	<.1	<2.	<1.	17.2	0.2	0.043	0.107	<1.	3	6.57	28.4	13
No. Exceeded CWA-Primary					0	2	0		-	0		0	0						0				
No. Exceeded CWA-Secondary					-	-	-	0	1	-		-	-		1				0				
No. Exceeded AQLC-Acute (1)					-	2/1	0/0	1/1	1	0/0		0	0/0		2/2								
No. Exceeded AQLC-Chronic (1)					-	2/2	0/0	1/1	-	4/1		2+	0/0		2/2								

NATIONAL FOREST SERVICE - DEERLODGE NATIONAL FOREST
FLINT CREEK AND ROCK CREEK DRAINAGES
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Al (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Fe (mg/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 (mg/l)	SO4 (mg/l)	SiO2 (mg/l)	Field pH (SU)	Field SC (umhos/cm)	Temp (C)
MOUNTAIN LION MINE																							
FRLS10L	92Q0905	Adit discharge	<30.	<1.	35.9	<2.	<2.	<2.	0.018	<2.	<.002	<.1	<2.	<1.	22.3	0.21	0.01	<.10	4	10	7.7	164.7	9.4
No. Exceeded CWA-Primary			-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	0	-	-
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0	-	0/0	-	+	0/0	+	0/0	-	-	-	-	-	-	-	-
NON PAREIL TAILINGS																							
FNPS10M	92Q0881	Middle impoundment discharge	<50.	4.9	35.3	<2.	<2.	3.8	0.052	2.8	0.002	<.1	<2.	<1.	20	0.21	0.15	<.10	6.7	9	8.3		16.5
FNPS20M	92Q0882	Spring in tailings area	<50.	1.8	29.3	<2.	<2.	<2.	0.013	3.9	0.002	<.1	<2.	<1.	36.5	0.24	0.09	<.10	6.5	10	7.87	193.73	9.6
FNPS30M	92Q0883	Lower impoundment discharge	<50.	5.3	43.7	<2.	<2.	3.3	0.05	5.8	0.003	<.1	<2.	<1.	42.8	0.25	0.07	<.10	7.3	9	8.18	179.07	16.5
FNPS40L	92Q0887	Boulder Creek, downstream of site	<30.	<1.	23.7	<2.	<2.	2.2	0.007	3.7	<.002	<.1	<2.	<1.	20.7	1.35	0.06	0.43	5.4	9	8.31	172	12.4
FNPS50L	92Q0888	Boulder Creek, upstream of site	<30.	<1.	20.9	<2.	<2.	<2.	0.015	<2.	0.002	<.1	<2.	<1.	55.6	0.25	0.04	0.21	5.4	9	8.3	148.8	20
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-		-	-	0	0	-	0	-	-		0	0	0		0				
No. Exceeded AQLC-Acute (1)			0	0		0/0	0/0	0/0	0	0/0		0	0/0		0/0								
No. Exceeded AQLC-Chronic (1)			0	0		0/0	0/0	0/0		3/0		+	0/0		0/0								
NORTH STAR MINE AND MILL																							
BNSS10L	95Q0610	Wyman Gulch, upstream of site	76.9	1.2	75.6	<2.	<2.	22.5	0.124	<2.	0.047	<0.1	<2.	<1.	76.7	1.0	0.11	<0.05	7.5	13.0	8.1	251	10.5
BNSS20L	95Q0611	Wyman Gulch, downstream of site	43.3	2.0	81.0	<2.	<2.	5.4	0.059	<2.	0.018	<0.1	<2.	<1.	6.7	1.5	0.11	<0.05	5.0	13.2	8.17	290	10.8
No. Exceeded CWA-Primary				0	0	0	0	-		0		0	0				0	0	0				
No. Exceeded CWA-Secondary			1	-	-	-	-	0	0	-	0	-	-	0	0		0		0	0	0		
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	1/0	0	0/0		0	0/0	0	0/0		-						
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	1/1		0/0		+	0/0	+	0/0		-						
PORT ROYAL TAILINGS																							
FPRS10L	92Q0897	Adit discharge, upstream of tailings	<30.	<1.	4.1	<2.	<2.	<2.	<.003	<2.	0.002	<.1	<2.	<1.	20.5	0.26	0.01	<.10	2.4		7.19	41	13
FPRS20L	92Q0896	Adit discharge, downstream of tailings	<30.	<1.	4.1	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	17.2	0.25	0.02	<.10	2.6		6.97	36	13.7
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-		-	-	0	0	-		-	-	0	0	0	0		0		0		
No. Exceeded AQLC-Acute (1)			0	0		0/0	0/0	0/0	0	0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			0	0		0/0	0/0	0/0		0/0		+	0/0	+	0/0								
RED LION MINE AND MILL																							
FRLS10L	92Q1024	Adit discharge	<30.	<1.	34	<2.	<2.	2.6	0.016	<2.	0.005	<.1	<2.	<1.	12.6	0.39	0.22	0.06	3.4	7	8.29	284	7
FRLS20L	92Q1025	N.Fk. Flint Creek, below adit	<30.	<1.	17.1	<2.	<2.	<2.	0.02	<2.	0.003	<.1	<2.	<1.	12.9	0.26	0.24	<.10	2.9	14	8.18	188.2	7
FRLS30L	92Q1026	N.Fk. Flint Creek, downstream of site	<30.	<1.	18.6	<2.	<2.	<2.	0.003	<2.	<.002	<.1	<2.	<1.	5.1	0.25	0.23	0.11	3	13	8.35	196.8	6
FRLS40L	92Q1027	N.Fk. Flint Creek, upstream of site	<30.	<1.	14.4	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	5.1	0.27	0.14	0.07	2.87	14	8.35	173.7	6.5
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-	0	-	-	0	0		0		0	0	0		
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0		0/0		+	0/0	+	0/0								
ROYAL GOLD TAILINGS																							
FRGS10L	92Q0885	Royal Gold Creek, upstream of site	<50.	<1.	4.4	<2.	<2.	2.2	0.006	<2.	<.002	<.1	<2.	<1.	18.3	0.18	0.16	<.10	3.9	11	7.75	58.49	2.1
FRGS20M	92Q0886	Royal Gold Creek, downstream of site	<30.	2.1	8.8	<2.	<2.	8.4	0.208	3.8	0.047	<.1	<2.	<1.	39.7	0.19	0.11	<.10	3.4	11	7.21	61.54	14.8
No. Exceeded CWA-Primary					0	0	0	-		0		0	0										
No. Exceeded CWA-Secondary						-	-	0		-		-	-	0	0								
No. Exceeded AQLC-Acute (1)						0/0	0/0	0/0		0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)						0/0	0/0	0/0		1/0		+	0/0	+	0/0								

NATIONAL FOREST SERVICE - DEERLODGE NATIONAL FOREST
FLINT CREEK AND ROCK CREEK DRAINAGES
Water-Quality Results - Dissolved Concentrations

Mine/ Sample ID	Lab ID	Sample Location	Al (ug/l)	As* (ug/l)	Ba* (ug/l)	Cd* (ug/l)	Cr* (ug/l)	Cu* (ug/l)	Fe (mg/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 (mg/l)	SO4 (mg/l)	SiO2 (mg/l)	Field pH (SU)	Field SC (umhos/cm)	Temp (C)
SENATE MINE																							
RSES10L	95Q0030	Seep at base of waste-rock dump W-2	<30.	<1.	305	<2.	<2.	<2.	0.005	<2.	0.002	<.1	<2.	<1.	<2.	<.05	0.089	<.05	4	6	7.14	171	5.8
RSES20L	95Q0031	Unnamed creek, upstream of site	<30.	<1.	371	<2.	<2.	<2.	0.007	<2.	0.002	<.1	<2.	<1.	2.9	<.5	0.055	0.1	<2.5	6	6.59	117	3
RSES30L	95Q0033	Unnamed creek, downstream of site	<30.	<1.	369	<2.	<2.	<2.	0.015	<2.	<.002	<.1	<2.	<1.	<2.	<.05	0.071	<.05	<2.5	6	7.3	110	.5
RSES40L	95Q0035	Adit A-1 discharge	<30.	<1.	259	<2.	<2.	3.5	0.008	<2.	<.002	<.1	<2.	<1.	<2.	<.05	0.069	<.05	2.5	7	7.8	194	4.6
No. Exceeded CWA-Primary			-	0	0	0	0	-	-	0	-	0	0	-	-	-	0	0	0	-	-	-	-
No. Exceeded CWA-Secondary			0	-	-	-	-	0	0	-	0	-	-	0	0	0	0	-	0	0	0	-	-
No. Exceeded AQLC-Acute (1)			0	0	-	0/0	0/0	0/0	0	0/0	-	0	0/0	0	0/0	-	-	-	-	-	-	-	-
No. Exceeded AQLC-Chronic (1)			0	0	-	0/0	0/0	0/0	-	0/0	-	+	0/0	+	0/0	-	-	-	-	-	-	-	-
STARLIGHT MINE																							
BQNS10L	92Q0898	Seepage from waste-rock dump	<30.	<1.	<2.	<2.	<2.	2	0.01	<2.	0.002		<2.	<1.	14.9	0.73	0.01	<.10	4.28	20	8.22	58	9.4
No. Exceeded CWA-Primary				0	0	0	0			0		0	0				0	0	0				
No. Exceeded CWA-Secondary				-		-	-	0		-		-	-	0	0		0		0	0	0		
No. Exceeded AQLC-Acute (1)				0		0/0	0/0	0/0		0/0		0	0/0	0	0/0								
No. Exceeded AQLC-Chronic (1)				0		0/0	0/0	0/0		0/0		+	0/0	+	0/0								
WASA AND KIRKENDAL/KOSKI MINES																							
DWSS10L	92Q1058	Seep, 250 feet south of site		<1.	23.1	<2.	<2.	12.2	<.003	<2.		<.1	10.6	<1.	176	0.37	0.18	0.05	36.8	18	7.1		6.5
DWSS20L	92Q1059	Adit at south end of site		4.1	<2.	21.4	<2.	205.7	0.4	<2.		<.1	32	<1.	1540	0.32	0.37	0.157	69.2	21	6.31		5.9
DWSS30L	92Q1060	Adit at north end of site		<1.	8	4.2	<2.	<2.	0.005	<2.		<.1	5.6	<1.	630	0.23	0.2	0.09	46.4	11	7.85		7.9
No. Exceeded CWA-Primary				0	0	1	0	-		0		0	0						0				
No. Exceeded CWA-Secondary					-	-	-	0		-		-	-		0				0				
No. Exceeded AQLC-Acute (1)					-	2/2	0/0	1/1		0/0		0	0/0		3/2								
No. Exceeded AQLC-Chronic (1)					-	2/2	0/0	2/2		0/0		+	0/0		3/2								

Notes:
* Critical elements. Lab data have been qualified according to QAPP.
+ MDL is above Aquatic Life (Chronic) Criteria.
(1) Where two values are listed, criteria is hardness dependent. Values are
calculated on hardness of 100 and 200 mg/L, respectively.
Mercury concentrations are blank corrected for all samples with lab IDs beginning "92Q".

DEERLODGE NATIONAL FOREST
FLINT CREEK AND ROCK CREEK DRAINAGES

Soil Analyses (Qualified Data)
(Concentrations in mg/kg)

Mine/ Sample ID	Lab ID	Sample Location	Ag	C	Q	As	C	Q	Ba	C	Q	Cd	C	Q	Cr	C	Q	Cu	C	Q	Hg	C	Q	Ni	C	Q	Pb	C	Q	Zn	C	Q
BROOKLYN MINE AND MILL																																
BLBD10M	92S892	Below tailings impoundment	52			449			1250			34.6			4.48			112			52.47			2.32	B		3470			5330		
HOBO-T. HAYES MINE																																
CHHD10H	94S0061	Along natural drainage below site	3.829			33.94		*	72.54			2.285			3.468	B		13.04			0.070			3.20	B		180.94			965.36		
CHHD20H	94S0062	Barren area below dump	181.91			488.30		*	230.12			62.49	B		5.475			465.8			2.204			11.47			4049.2			20637		
LOG CABIN PROSPECT																																
LLCD10L	94S0058	Base W-2 dump , adjacent to unnamed cr.	0.941	B		0.861	B	*	141.72			0.703	B		5.646			4.064	B		0.063			4.89			10.85			47.125		
LLCD20L	94S0057	Base W-3 dump, adjacent to unnamed cr.	16.75			3.387			150.07			2.592			6.126			14.16			0.089			7.13	B		607.58			282.19		
LOWER WILLOW CREEK MILL TAILINGS																																
WLWD10M	96S0053	Tailings in impoundment area	65.9			695			290			16.6			5.3	B		4120			41.2			5.3	B		4978			152		
WLWD20M	96S0052	Streamside tailings	23.7			202			283			7.06			5.67			1188			57.5			5.0	B		1758			167		
MID.FK. DOUGLAS CREEK PHOSPHATE MINE																																
DMDD10L	94S0065	Along adit discharge channel	0.470	U		5.966		*	56.025			1.804	B		32.637			27.08			0.047	B		30.73			22.41			121.10		
MILLER'S MINE																																
LMID10H	94S0059	Soil/seep mix area south of site	0.848	U		1.556	B	*	127.90			62.32			7.602	B		211.206			0.092	B		5.17	B		153.31			918.50		
MOUNTAIN LION MINE																																
FRLD10M	92S900	Along toe of waste-rock dump	125			163			94.8			11.2			4.84			660			10.12			16.7			3990			516		
NON PAREIL MILL TAILINGS																																
FNPD10H	92S889	Spring area	72.4			529			724			115			3.73			384			194.7			0.54	B		5100			17100		
PORT ROYAL TAILINGS																																
FPRD10H	92S891	Tailings wash area	3.19			60.7			98.0			3.62			1.87	B		213			27.45			0.53	U		3360			466		
WASA MINE																																
DWSD10H	92S1065	Iron ppt in south adit discharge channel	0.764	U		829			30.6	B		24.9			3.34	B		7350			2.427			5.38	B		72.9			966		
DWSD20H	92S1064	Pond bottom (0-1 inch depth)	0.383	U		503			56.9	B		96.6			15.4			3040			1.570			70			63.3			7020		
DWSD30H	92S1063	Pond bottom (1-6 inch depth)	0.361	U		308			78.7			39.5			15.2			1380			1.229			69.8			97.1			2760		

APPENDIX VI

DATABASE FIELDS
MBMG-USFS AIM PROGRAM

Sites Table (Msites.db)

ID number
Name
Alternate 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
Mine type
Current status
mine method
Map
Scale
First year of production
Last year of production
Process method
Mill process capacity
Total waste produced
Total ore produced
Au mined
Ag mined
Cu mined
Pb mined
Zn mined
As mined
Tons mined
Au milled
Ag milled
Cu milled
Pb milled
Zn milled
As milled
Tons milled
Published reserves measured
Published reserves indicated
Published reserves inferred
Depth of workings
Length of workings
Surface area disturbed
Surface map
Surface map agency
Sur map address
Sur map city
Sur map zip
Underground map
Underground map agency
UG map address
UG map city
UG map zip
Date of update
Who update

Mines Table (Mmines.db)

ID
Type of opening
Latitude
Longitude
Utm northing
Utm easting
Size.opening length
Size.opening width
Elevation
Elev units

Mine Openings Table (Fmines.db)

ID
Type of opening
Condition
Ground water
Photo
Photo #s
Ownership
Comments

Forest Table (Forest.db)

ID
Investigator
Date
Photos
Access
Near wetlands
Drainage basin
Waste contact stream
Nearest surface water intake
# of sw intakes within 15 miles
Surface water uses
Nearest well
Well uses
Nearest dwelling
months occupied
houses
Recreational use
Nearest recreation area
Name of area
Hmo adit
Hmo wall
Hmo struct
Hmo chem
Hmo solid
Hmo explosive
Sensitive environments
Pop within 0.25 miles
Pop within 0.5 miles
Pop within 1 mile
Pop within 2 miles
Pop within 3 miles
Pop within 4 miles

Screening Table (Fscreen.db)

ID
Mill or tailings
Adit discharge
Metals leaching
Water erosion
Residences
Hazmat
Open adit or shaft
Visit
Remarks

Water Sample Table (Fsample.db)

ID
Sample ID
Sampler
pH
Sc25C
Date
Temp C
Flow rate
Flow units
Flow method
Sample source
Indicators of contam.
Vegetation
Stain
Salt
Sulfide
Turbid
Location rel. stream
Stream name
Sedimentation
Photo
Photo #s
Remarks

Soils Table (Fsolids.db)

ID
Sample ID
Source
Date
Sampler
Sample type
Length of transect
Soil depth interval
Indicators of contamination
Path
Vegetation
Color
Salt
Photo #s
Photos

Waste Table (Fwaste.db)

ID
Waste type
Wind erosion
Vegetation
Rill
Gully
Seep
Pond
Breach
No indicators of flow
Stability
Floodplain
Distance to stream
Photos
Photo #s

Contamination Table (Fcontam.db)

ID
Type of contamination
Estimated quantity
Container condition
Remarks

Assay Table (Fassay.db)

ID
Sample ID
Material type
Sample method
Comments

Leach Test Table (Leach.db)

ID
Sample ID
Material type
Sample method
Comments