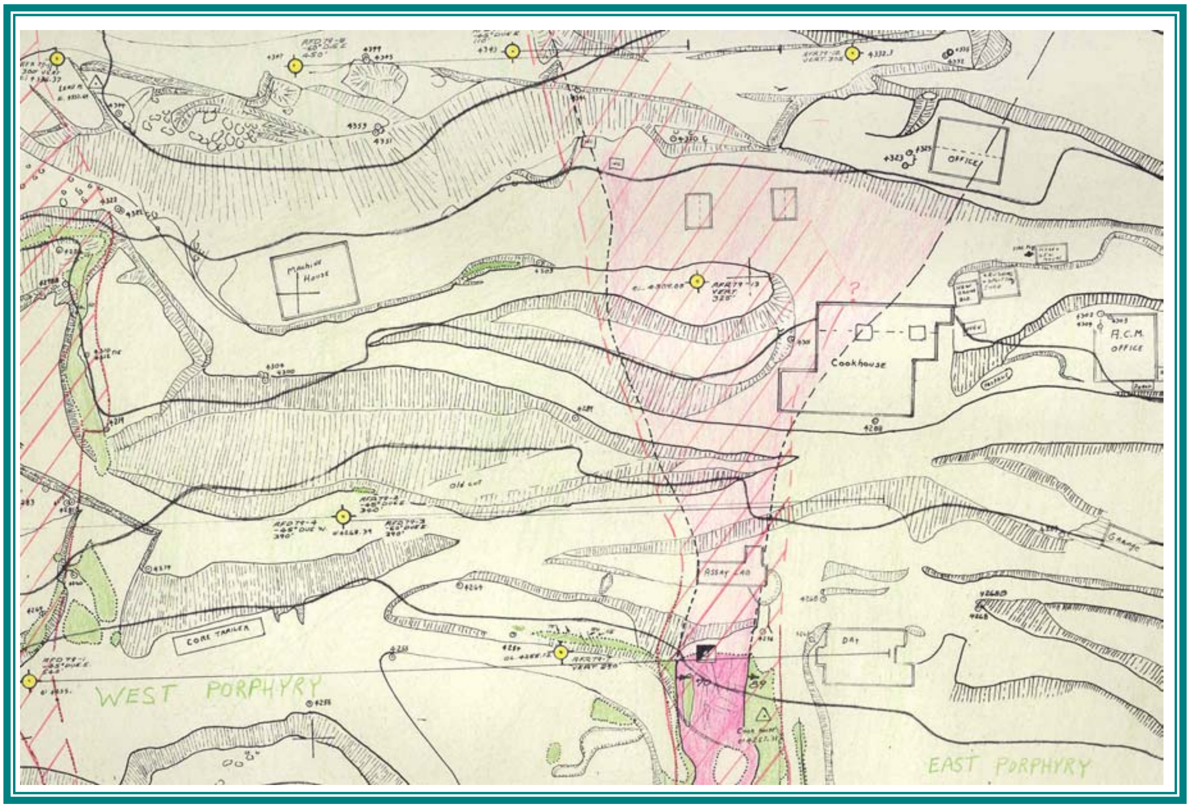
Abandoned-Inactive Mines of the Flathead National Forest-Administered Land



Montana Bureau of Mines and Geology
Open-file Report 462

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Prepared for the U.S. Department of Agriculture
Forest Service-Region 1

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Since 1919
Earth Science Information

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INTRODUCTION

To fulfill its obligations under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Northern Region of the U.S. 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. Concurrently, 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 entered into a series of participating agreements to accomplish this work. The first forest inventoried was the Deerlodge National Forest, followed by the Helena National Forest, then the Beaverhead, Kootenai, and Lewis and Clark Forests (table 1). Inventory on the Custer National Forest was "in progress" at the same time as that for the Gallatin. The Flathead, Lolo, and Bitterroot National Forests were inventoried last.

Table 1. List of previous inventories and open-file report (OFR) numbers

National Forest-Volume	Drainage(s)	MBMG OFR #
Deerlodge-Volume I	Basin Creek	321
Deerlodge-Volume II	Cataract Creek	344
Deerlodge-Volume III	Flint Creek and Rock Creek	345
Deerlodge-Volume IV	Upper Clark Fork River	346
Deerlodge-Volume V	Jefferson River	347
Helena-Volume I	Upper Missouri River	352
Helena-Volume II	Blackfoot-Little Blackfoot Rivers	368
Beaverhead	Entire Forest	379
Kootenai	Entire Forest	395
Lewis and Clark	Entire Forest	413
Gallatin	Entire Forest	418
Custer	Entire Forest	421
Bureau of Land Management	Entire State	365

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 have been obtained 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, 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 various safety, health, and environmental problems that 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; unstable waste piles with the potential for catastrophic failure; and physical hazards associated with mine openings and dilapidated structures. Although all problems were examined at least visually (appendix I-Field Form), the hydrologic environment appears to be affected to the greatest extent. Therefore, this investigation focused most heavily on impacts to surface water and ground water from the mines.

Metals are often transported from a mine by water (ground-water or surface-water 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 metal solubility. This condition, known as acid-mine drainage (AMD), is a significant source of metal releases at many of the mine sites in Montana.

1.3.1 Acid-Mine Drainage

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

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

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

Acid-mine drainage 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 Montana. The dissolution of any given metal is controlled by the solubility of that metal.

1.3.2 Solubilities of Selected Metals

At a pH above 2.2, ferric hydroxide ($Fe[OH]_3$) precipitates to produce a brown-orange stain in surface waters and forms a similarly 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 silver solubility 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 present in solution in higher pH waters. At a pH between 3 and 7, the dominant arsenic compound is a monovalent arsenate H_2AsO_4. Arsenic is abundant in metallic mineral deposits as arsenopyrite (FeAsS), enargite (Cu_3AsS_4), and tennantite ($Cu_{12}As_4S_{13}$), to name a few.

Cadmium solubility data are limited. In soils, cadmium solubility 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 in soil such as sulfate and phosphates also may control copper solubility. Copper is present in many ore minerals, including chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), chalcocite (Cu_2S), and tetrahedrite ($Cu_{12}Sb_4S_{13}$).

Mercury readily vaporizes under atmospheric conditions and thus is most often found in concentrations well below the 25 µg/L equilibrium concentration. The most stable form of mercury in soil is its elemental form. Mercury is found in low-temperature hydrothermal ores as cinnabar (HgS), in epithermal (hot springs) deposits as native mercury (Hg), and as Hg in human-made deposits where mercury was used in the processing of gold ores.

Lead concentrations in natural waters are controlled by lead carbonate (cerrusite), which has an equilibrium concentration of 50 µg/L at a pH between 7.5 and 8.5. As with other metals, concentrations in solution increase with decreasing pH. In sulfate soils with a pH less than 6, anglesite ($PbSO_4$) controls solubility while cerussite ($PbCO_3$) 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 a pH greater than 8, the equilibrium concentration of zinc in waters with a high bicarbonate content is less than 100 µg/L. Franklinite (zinc manganese iron oxide) 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.

1.3.3 The Use of pH and SC to Identify Problems

In other mine evaluation studies similar to this one, pH and specific conductance (SC) have sometimes 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 strongly depends on the presence of dissolved iron. Cadmium and lead also may exceed standards in waters having pH values within acceptable limits.

Reliance on SC as an indicator of site conditions also can lead to erroneous conclusions. The SC value of a sample represents 55–75 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 possible-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 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 trace elements, and major 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. Published location(s) of the mines were plotted on USFS maps. From the maps, an inventory was developed of all known mines located on or that could affect National Forest System lands in Montana. The following data sources were used:

1) the MILS (mineral industry location system) data base [U.S. Bureau of Mines (USBM)],
2) the MRDS (mineral resource data systems) data base [U.S. Geological Survey (USGS)],
3) published compilations of mines and prospects data,
4) state publications on mineral deposits,
5) USGS publications on the general geology of some quadrangle maps,
6) recent USGS/USBM mineral resource potential studies of proposed wilderness areas,
7) MBMG mineral property files, and
8) CRIB (computerized resource information bank) database [USGS].

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 located in the field.

1.4.2 Pre-Field Screening

Field crews visited only sites with the potential to release hazardous substances and sites that lacked information to make that determination without a field visit. For problems to exist, a site must have a source of hazardous substances and a method of transport from the site. Most metal mines contain a source for hazardous substances, but the common transport mechanism, water, is not always present. Sites on dry ridgetops were assumed to have no mechanism for water transport and mines described in the literature as small prospects were considered to have inconsequential hazardous-materials sources; therefore, neither type was visited.

In addition, the MBMG and the USFS developed screening criteria (table 2) 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. USFS mineral administrators used these criteria to "screen out" several sites using their knowledge of an area.

Mine sites that were not visited were retained in the data base along with the data source(s) consulted (appendix II). However, often these sites were viewed from a distance while visiting another site. In this way, the accuracy of the consulted information was often verified. Placer mines were not studied as part of this project. Although mercury was used in amalgamation of placer gold, the complex nature of placer deposits makes detection of mercury difficult and is beyond the scope of this inventory. Due to their oxidized nature, placer deposits are not likely to contain other anomalous concentrations of heavy metals. Limestone and building-stone quarries, gravel pits, and phosphate mines were considered to be free of anomalous concentrations of hazardous substances and were not examined.

Table 2. 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 flood plain 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 further. Question 7 pertained to physical hazards only and was not a criterion for a site visit.

1.4.3 Field Screening

Sites that could not be screened out as described above were visited. All visits were conducted in accordance with a health and safety plan that was developed for each Forest. An MBMG geologist usually made the initial field visit and gathered information on environmental degradation, hazardous mine openings, presence of historical structures, and land ownership. Some site locations were refined using conventional field methods or by Global Positioning System (GPS) data. Each site was located by latitude/longitude and by tract-section-Township-Range as indicated in figure 1.

At sites for which sparse geologic or mining data existed, MBMG 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 2). In other words, if at least one of the first six screening criteria was met, the site was studied further. All sites visited by MBMG are discussed in the text; the screened out sites are included in appendix II.

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.

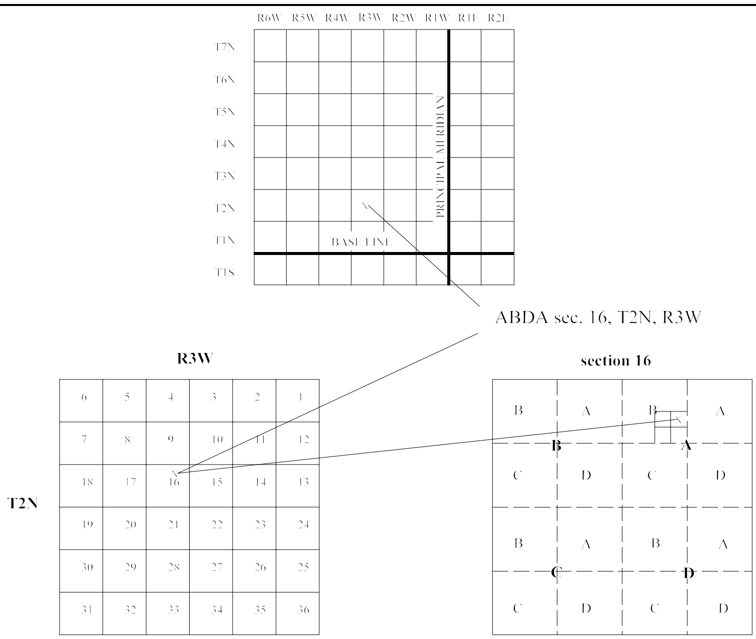

Figure 1. The location of a mine is found using a counterclockwise progression of decreasing quarters of a section of land. The resulting tracts in this case are ABDA.

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 overall composition of material in the source; and
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 verify the availability of metals for leaching when exposed to water. Assay samples were only taken to provide some information on the types of metals present and a rough indication of their concentrations. Outcrops and mine waste were not sampled extensively enough to provide reliable estimates of tonnages, grades, or economic feasibility.

1.4.4 Field Methods

An MBMG 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 at concentrations that adversely impact the environment.

The hydrogeologist selected and marked water and/or soil sampling locations based on field parameters (SC, pH, Eh, etc.) and observations (erosion and staining of soils/streambeds), and 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 to assess conditions on National Forest System lands; therefore, samples sites were located on National Forest System lands to the extent that ownership boundaries were known.

Because monitoring wells were not installed as part of this investigation, the evaluations of impacts to ground water were based solely upon strategic sampling of surface water and soils. Background water-quality data are 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 Collection of Water and Soil Samples

Sampling crews collected soil and water samples, and took field measurements (streamflow) in accordance with the following:

Sampling and Analysis Plan (SAP)–These plans are site specific, and they detail the type, location, and number of samples and field measurements to be taken.

Quality Assurance Project Plan (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.

1.4.4.3 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 sampling and analysis plan (SAP) for each mine site or development area that was then approved by the USFS project manager. Each sample location was plotted on the site map or topographic map and described in the SAP; each sample site was given a unique seven-character identifier based on its location, sample type, interval, and relative concentration of dissolved constituents. The characters of the unique sample identifier were defined as follows:

D DA T L I C where:
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.

1.4.4.4 Existing Data

Data collected in previous investigations were neither qualified nor validated under this project. The quality-assurance managers and hydrogeologists determined the usability of such data.

1.4.5 Analytical Methods

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

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

If a contract laboratory procedure 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 laboratory analyses 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 concentrations of various metals. To 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.

1.4.6.1 Soil Standards

There are no federal standards for metal concentrations and other constituents in soils; acceptable limits for such are often based on human and/or environmental risk assessments for an area. Because no assessments of this kind have been done, metals concentrations in soils were compared to the limits postulated by the EPA and the Montana Department of Health and Environmental Sciences (MDHES) (now Department of Environmental Quality) for sites within the Clark Fork River basin in Montana. The proposed standard for lead in soils is 1,000 mg/kg to 2,000 mg/kg, and 80 to 100 mg/kg for arsenic in residential areas. The Clark Fork Superfund Background Levels (Harrington- MDHES, written commun., 1993) are listed in table 3.

Table 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)*	500

*A more recent level of 500 mg/kg for lead was provided for state superfund programs (Judy Reese, MDEQ, written commun., 1999). The 1,000 level was an upper limit for lead and not used at CFR sites.

For reference, Reese (written commun., 1999) also provided the Clark Fork Superfund phytotoxicity levels (table 4).

Table 4. Various levels of toxicity for lead (ARWWS : Anaconda Regional Water and Waste Standards, a part of the Anaconda National Priorities List)

Source		ppm
ARWWS ecological RA	low pH<6.5	94 (Natural Resource Damage #)
ARWWS ecological RA	low pH>6.5	179 (Natural Resource Damage #)
ARWWS ecological RA	high pH<6.5	250
ARWWS ecological RA	high pH>6.5	250
Kabata-Pendias & Pendias (1992)		100-400
CH2MHill (1987)		1,000

1.4.6.2 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). The maximum contaminant level is defined as " the maximum permissible level of a contaminant in water which is delivered to any user of a public water system" (EPA, 1999). 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 5. In some state investigations, the standards are applied to samples collected as total-recoverable metals. Because total-recoverable-metals concentrations are difficult if not impossible to reproduce, this investigation used dissolved-metals concentrations.

Table 5. 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	0.01[9]		0.34	0.15
Barium	2			
Cadmium	0.005		0.0043[6]	0.0022[6]
Chromium	0.1		1.7[6,7]	0.21[6,7]
Copper	1.3[8]	1.0	0.013[6]	0.009[6]
Iron		0.3		1
Lead	0.015[8]		0.065[6]	0.0025[6]
Manganese		0.05		
Mercury	0.002		0.0014	0.00077
Nickel			0.47[6]	0.52[6]
Silver		0.1	0.0034[6]	
Zinc		5	0.12[6]	0.12[6]
Chloride		250	860	230
Fluoride	4.0	2.0		
Nitrate (as N)	10			
Sulfate		250		
pH (standard units)		6.5-8.5		6.5-9.0

(1) 40 CFR 141; revised through 7/1/99.
(2) 40 CFR 143; revised through 7/1/99.
(3) Priority Pollutants, EPA Region VIII, April 1999.
(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.
(7) Cr^{+3} species.
(8) Action level, EPA Current Drinking Water Standards, National Primary and Secondary Drinking Water Regulations, April, 1999.
(9) The Safe Drinking Water Act, as amended in 1996, requires EPA to revise the existing drinking water standard for arsenic.

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 results is presented in appendix III.

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

THE FLATHEAD NATIONAL FOREST

The Flathead National Forest (FNF) encompasses approximately 2.3 million acres in northwest Montana. The Forest is bordered by Canada to the north, Glacier National Park and the Lewis and Clark National Forest to the east, Lolo National Forest to the south, and the Kootenai National Forest to the west (figure 2). Approximately 47 percent of the 2.3 million acres is in the congressionally designated Bob Marshall, Spotted Bear, Scapegoat, and Mission Mountains Wilderness Areas.

The topography of the Flathead National Forest is characterized by high, rugged northwest-trending mountain ranges separated by narrow valleys. The major mountain ranges include the Whitefish Range, Flathead Range, Swan Range, Mission Range, and parts of the Lewis and Clark and Sawtooth Ranges. The Salish Mountains border the northwestern part of the forest. The valleys are occupied by the Flathead and Swan Rivers and their tributaries. Land-surface altitude ranges from approximately 3,000 feet in the valleys to over 9,000 feet in the Mission Range.

The FNF is administratively divided into four ranger districts: the Tally Lake district with headquarters in Whitefish, the Swan Lake district in Bigfork, and the Glacier View and Spotted Bear districts headquartered in the town of Hungry Horse. The supervisor’s office is located in Kalispell and the regional office is in Missoula, MT. FNF-administered lands are within Flathead, Lake, Lincoln, Missoula, and Powell counties. The FNF covers parts of the Kalispell, Cut Bank, Wallace, and Choteau 1° x 2° series topographic maps.

2.1 History of Mining

Historical mining activity in the Flathead National Forest began in the late 1880's and early 1890's. Placer gold deposits were discovered in the Pleasant Valley area prior to 1890. Copper deposits were discovered in eastern Flathead County in 1890 (Johns, 1970). Early exploration and mining generally focused on the copper lode deposits, although minor gold, silver, coal, and barite were also produced. Most of the exploration began after 1896 when the area west of the Continental Divide was acquired from the Blackfeet Indians and opened by the government for mineral location.

Only a few small gold placer deposits in or near the FNF have been described in the literature. The earliest placers were located along Herrig Creek and its tributaries in the northwest part of the Pleasant Valley (Johns, 1970). The gold was reportedly derived from quartz veins exposed along Herrig Creek and in the area of Haskill Pass. In 1891, Frank Langford located and patented three claims along Coal Creek, near the confluence with the North Fork Flathead River. The claims were known as the Providence, High Bar, and Placer. Other placer deposits were reported north of Ashley Lake, and along Danaher Creek, a tributary of the South Fork Flathead River. There are no production figures available for the placer deposits.

The most significant exploration and mining activity in the Flathead area has been associated with lode copper deposits (Johns, 1970; Marks, 1978). Copper was first discovered in 1890 along Bear Creek, just east of the confluence with the Middle Fork Flathead River. The low-grade deposits, known as the Okedale, Northern, and Lippincott mines, were undeveloped and

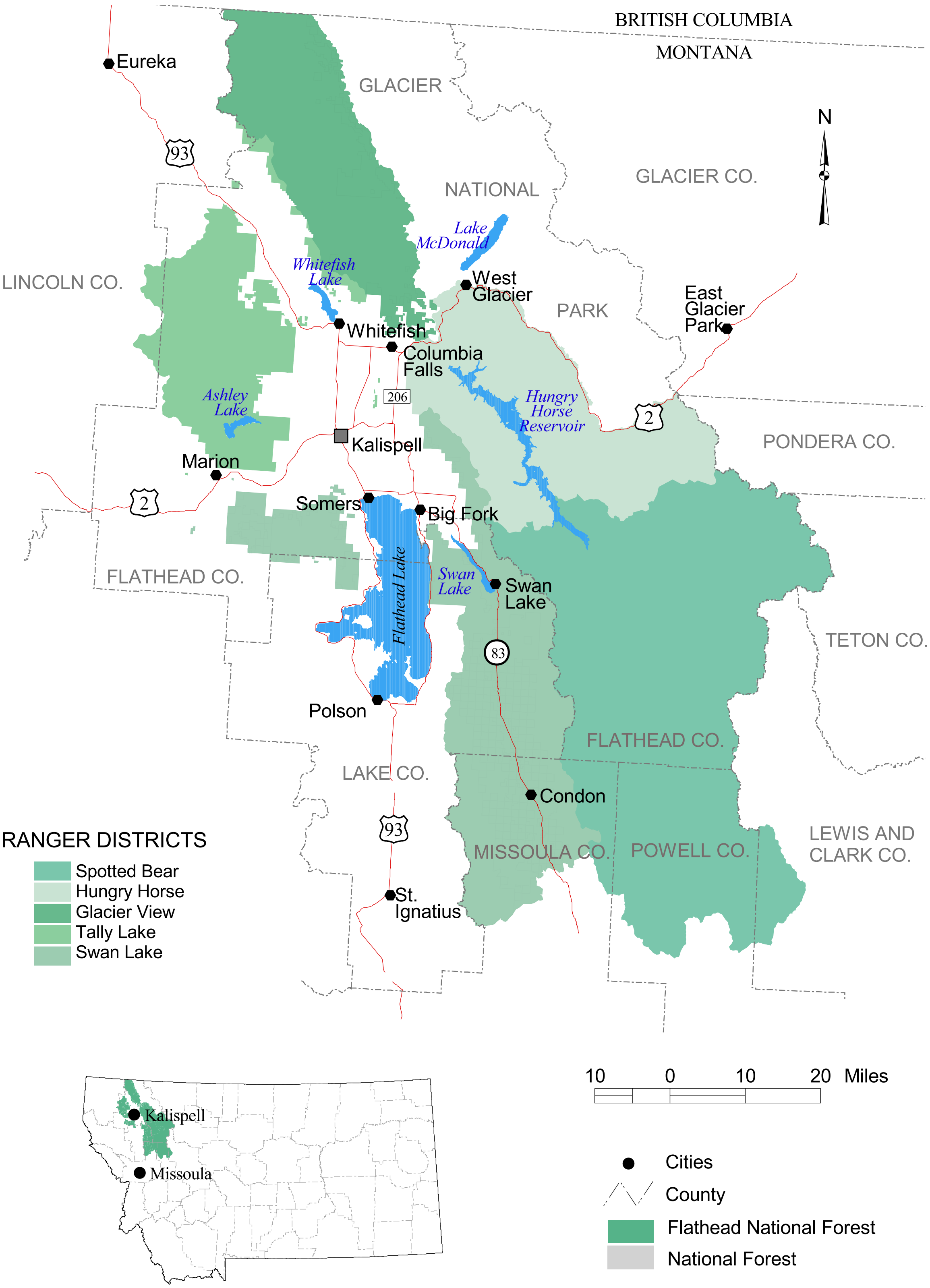

Figure 2. Location of the Flathead National Forest in northwest Montana.

are now part of Glacier National Park. Several copper-bearing quartz lodes were discovered during this same time period along the South Fork Flathead River and its tributaries. Most of the development was along Logan, Felix, and Hoke Creeks. The largest workings on Logan Creek are the One Dead Digger, Half Man, and Jeanette and Little Darling claims (patented in 1896). At least 67 claims have been worked in the Hoke Creek drainage. Sporadic exploration and development continued in this area through the 1970's (Marks, 1978). Further south, near Holland Lake, there was minor exploration on the Copper Angel.

Copper deposits are also present the western half of the Flathead National Forest. In the area southeast of Blacktail Mountain, the Jumbo and Big Four mines were located and developed in the 1910's in the Chief Cliff mining district. No production records were available for these mines. In the Star Meadow area, the first copper discovery was at the West Virginia Mine, located prior to 1900. Total production was approximately 60 tons of ore from two copper-bearing veins (Johns, 1970). From 1900 until the mid-1950's, numerous other mines and properties were located in the area which became known as the Star Meadow mining district (Sahinen, 1935). The primary mines in the district were the Foolsburg (patented in 1958), the Blacktail, Humdinger, and Yukon. Reported production from the district is about 120 tons of ore.

Coal mining in the Coal Banks area along the North Fork Flathead River began around 1892. The largest mine was the North Fork which provided coal for local markets in Kalispell and Columbia Falls (Erdmann, 1947). The North Fork Mine was closed at the beginning of World War II and has been idle since. In 1907 and 1914, several claims were located in the coal beds exposed near Teton Pass in the Bob Marshall Wilderness. A barite deposit, also in the Bob Marshall Wilderness, was staked in 1957 near the headwaters of Black Bear Creek. There was no reported production from the claims.

2.1.1 Production

Mineral production from the Flathead National Forest has been limited compared to other National Forest lands in Montana. Estimated production from the Star Meadow district was approximately 116 tons based on data from the West Virginia, Blacktail, and Yukon mines (Johns, 1970). Copper was the primary commodity along with minor amounts of gold and silver (table 6). Coal was mined in the Coal Creek area until around 1942. The most active period of production was during the 1930's with 600 tons removed in 1933 and approximately 360 tons in 1934 (Johns, 1970) For most of the mines on the FNF, there is no record of mineral output.

Table 6. Estimated production from the primary mines of the Flathead National Forest

Mine	Tons	Gold (oz)	Silver (oz)	Copper (lb)	Coal
West Virginia	60	6	42	9600	–
Blacktail	36	2	126	9828	–
Yukon	20	<1	3	1,350	–
North Fork	960+	–	–	–	960+

Production statistics from Johns (1970) and Erdmann (1947).

2.1.2 Milling

Knowledge 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 mines, produce two materials: 1) a product that is either the commodity itself or a concentrate that is shipped off site to other facilities for further refinement, and 2) mill waste, which is called tailings.

In the 1800's, 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 for smelting (usually to sites off USFS-administered land). Gold was commonly removed from free-milling ores at the mills by mercury amalgamation. Cyanidation arrived in the United States about 1891, and because it resulted in greater recovery rates, it revolutionized gold extraction in many districts. Like amalgamation, cyanidation also worked only on free-milling ores, but it required a finer particle size. About 1910, froth flotation became widely used to concentrate sulfide ores. This process required that the ore be ground and mixed with reagents to liberate the ore-bearing minerals from the barren rock.

Thus, there were 2 fundamental processes used for ore concentration: gravity and flotation, and 3 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.

2.2 Geology

The geology of the Flathead National Forest consists predominately of metasedimentary rocks of the Middle Proterozoic Belt Supergroup and limited exposures of Paleozoic, Mesozoic, and Tertiary strata (figure 3). Local accumulations of Quaternary glacial and alluvial sediments mantle the drainage bottoms. Igneous rocks occur as isolated dikes and sills intruded into the Belt strata. The major structural features are north-northwest trending folds and faults associated with Cretaceous and Tertiary deformation. The northwest-trending Lewis Thrust fault is exposed in the eastern part of the Forest and places Proterozoic Belt strata over Phanerozoic rocks of the Montana Disturbed Belt. The Disturbed Belt lies east of the Lewis Thrust and is an intensely deformed and displaced zone of Cambrian through Cretaceous rocks.

Numerous reports and maps are available summarizing the geology in and around the Flathead National Forest. Johns (1970) provides a thorough summary of the geology and mineral deposits of Lincoln and Flathead counties. Detailed geologic mapping and sampling was completed in several wilderness study areas by the U.S. Geological Survey and the U.S. Bureau of Mines (Harrison and others, 1969; Earhart, 1978; Mudge and Earhart, 1978; Earhart and Marks, 1984). Geologic maps of the area have been compiled by Harrison and others (1986, 1992, 1998), Mudge and others (1982), and Mudge and Earhart (1991). A brief description of the Forest geology summarized from the above reports and maps is presented here.

The oldest rocks exposed in the Flathead National Forest are the metasedimentary rocks of the

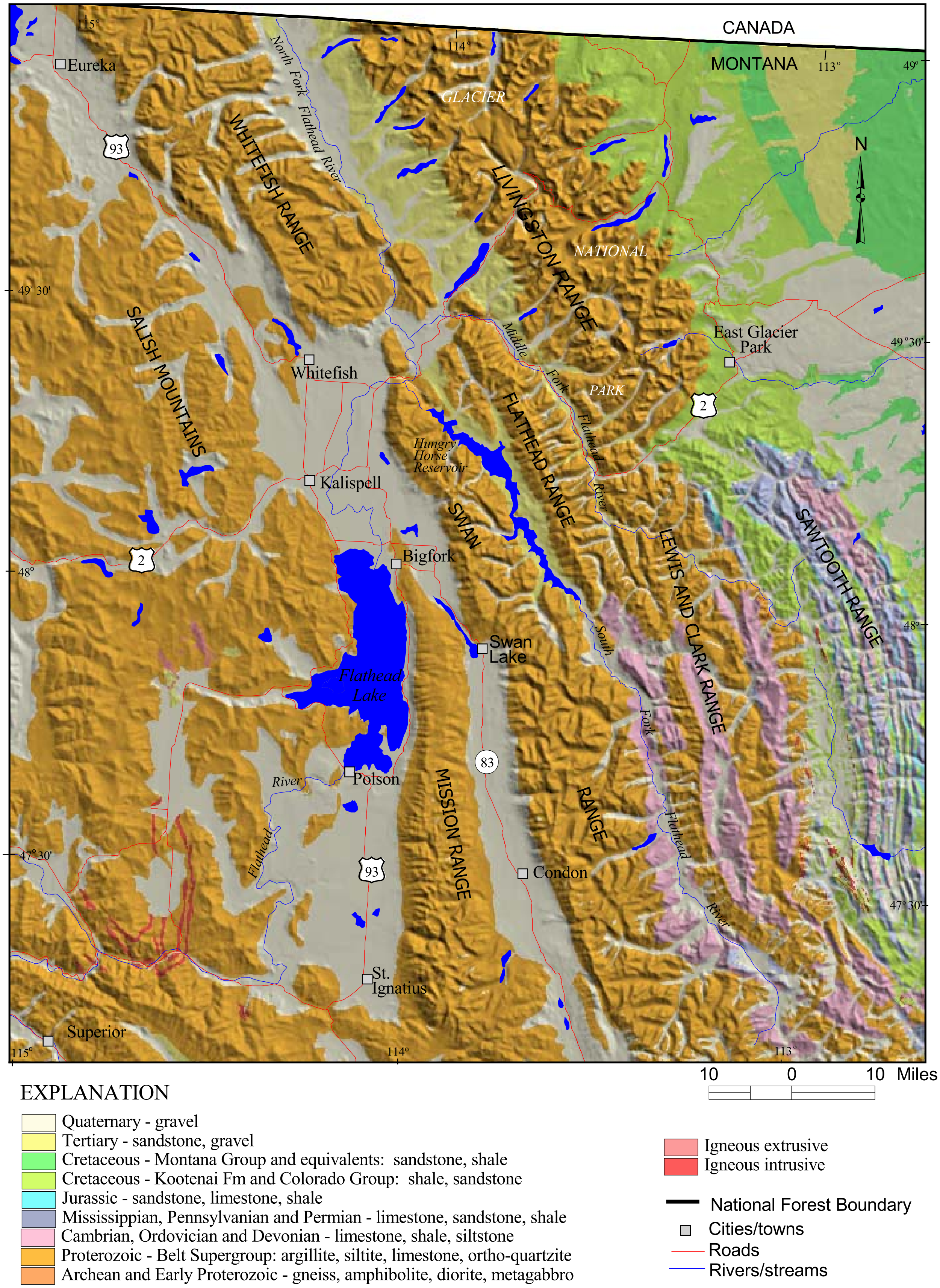

Figure 3. Generalized geologic map of the Flathead National Forest (modified from Ross and others, 1955).

Proterozoic Belt Supergroup. The rocks are mostly fine-grained argillites, siltites, quartzites, and carbonates of the Ravalli and Missoula Groups. The overall thickness of the Belt rocks is about 49,000 feet (Harrison and others, 1992). In the Whitefish Range, the Middle Proterozoic Purcell Lava intrudes the Belt rocks. Exposures of Paleozoic and Mesozoic strata are mostly limited to the Lewis and Clark Range in the far eastern part of the Forest, the northern Whitefish Range, and the southern Swan and Flathead Ranges. The Paleozoic rocks are mainly carbonates but also include relatively minor amounts of sandstone, shale, and siltstone. The Mesozoic rocks are dominantly mudstones and sandstones (Johns, 1970).

Tertiary rocks of the Kishenehn Formation are exposed along the North and Middle Fork Flathead River in the elongate, north- to northwest-trending Kishenehn Basin. The Kishenehn Basin is a narrow, fault-bounded basin that extends north into Canada. The Tertiary basin fill is as much as 11,000 feet thick and consists of conglomerate, sandstone, siltstone, marlstone, oil shale, and coal deposits (Constenius, 1987). Most of the Kishenehn Formation is covered by surficial glacial deposits.

The primary surficial deposits in the Flathead National Forest are Quaternary glacial and alluvial silts, sands, gravels and clays. During latest Pleistocene, the Flathead Lobe of the Cordilleran Ice Sheet covered the valleys and most of the mountains in northwest Montana. Glacial and fluvioglacial drift associated with the continental and alpine glaciers was deposited in the valleys and lower elevations of the mountains. The youngest geologic unit exposed on the Forest is the unconsolidated Quaternary alluvium deposits, consisting of gravel, sand, silt, and clay, present in flood plains and low terraces along active drainages.

2.3 Economic Geology

The primary mineral resources on the Flathead National Forest are copper, silver, gold, lead, zinc, barite, and coal (Johns, 1970; Earhart, 1978). Copper and, to some extent coal, are the only identified resources of economic interest. The coal deposits are located in Cretaceous and Tertiary sedimentary rocks. Host rocks for the metal deposits are mostly quartzites, siltites, and argillites of the Belt rocks. The most numerous and extensive copper deposits are in the Empire, Spokane, and Snowslip Formations which are part of the Ravalli and Missoula Groups. The primary factor in localizing the metallic deposits appears to be geologic structure.

The most widespread types of mineral occurrences in the Flathead National Forest are fissure-filling quartz veins containing scattered copper sulfides and oxides (Johns, 1970). The mines in the Star Meadow and Chief Cliff mining districts are of this type. In these areas, the mines are developed on east-trending veins, many of which are displaced by faults. Ore minerals in the quartz veins include most of the common copper-bearing sulfides. In order of abundance, the ore minerals are pyrite, chalcopyrite, bornite, chalcocite, and very minor galena. Secondary minerals developed within shallow oxidation zones include azurite, malachite, tenorite, chrysocolla, and cerrusite. Gangue minerals are quartz, siderite, calcite, ankerite, and masses of iron oxides.

Copper also occurs as disseminated, strata-bound and related vein deposits. This type of occurrence is typical of the copper and silver resources in the Felix, Hoke, and Logan Creek drainages, east of Hungry Horse Reservoir (Marks and Earhart, 1978). There is no record of production from mines in this area although ore reserves of 100,000 tons of about 0.39% copper and 0.4 ounces silver/ton are estimated for the One Dead Digger and Half Man claims along Logan Creek. Estimated reserves at a deposit associated with the Corkscrew claims along Hoke Creek are 660,000 tons of rock that average 0.15% copper and 0.1 ounce silver/ton (Marks, 1978; Earhart and Marks, 1984). The strata-bound deposits are widely distributed in the Belt rocks in this area but most are too small, low grade, or discontinuous to be of economic importance.

Stratabound occurrences of lead, zinc, and copper-sulfide minerals occur locally in the eastern part of the Bob Marshall Wilderness. All these occurrences are of small size and low grade with no identified resource potential (Marks, 1978). Quartz veins containing traces of gold, silver and the associated sulfide minerals pyrite, galena, sphalerite, and pyrrhotite are present in the Herrig Creek and Haskill Pass areas (Johns, 1970). Fissure-filling vein deposits of barite are widespread in the Bob Marshall Wilderness. The only one of possible economic importance is a 10-foot-thick, relatively pure barite vein exposed near the headwaters of Black Bear Creek (Marks, 1978).

Coal deposits on the Flathead National Forest occur in the Kishenehn Formation in the Coal Creek area and in the Cretaceous Blackleaf Formation near Teton Pass in the Bob Marshall Wilderness (Johns, 1970; Marks, 1978). The Teton Pass prospects consist of sub-bituminous coal in beds 0.5 to 4.0 feet thick. There is no record of production from the claims. Only the North Fork Mine along Coal Creek was worked to any extent. The mine produced from several lignite beds with a combined thickness of approximately 30 feet.

2.4 Hydrology and Hydrogeology

The Flathead National Forest lies within the Flathead Basin of northwest Montana. The basin encompasses six sub-basins (i.e., 8-digit USGS Hydrologic Unit Codes) drained by 7 major tributaries: the North, Middle, and South Forks of the Flathead River, the Stillwater River, the Whitefish River, Ashley Creek, and the Swan River. The North, Middle, and South Forks join near Hungry Horse Reservoir to form the main-stem Flathead River. The Swan River discharges directly into Flathead Lake near Bigfork. Flathead Lake and Hungry Horse Reservoir are the largest open water bodies in the basin. The Flathead River flows south from Flathead Lake to its confluence with the Clark Fork River near Dixon.

The U.S. Geological Survey currently collects streamflow data on the major streams at 9 gaging stations located above Flathead Lake (table 7). The majority of streamflow into Flathead Lake comes from the North, Middle, and South Forks of the Flathead River (approximately 85%). Flow in the South Fork Flathead River is controlled by the dam at Hungry Horse Reservoir.

Climate in the Flathead Basin is modified Pacific maritime dominated by easterly moving Pacific air masses. Precipitation ranges from 15 inches in the valleys to over 40 inches in the mountains

Table 7. USGS stream-gage locations within the Flathead Basin above Flathead Lake

Gage Location	USGS Station Number	Period of Record (WY)	Drainage Area (Sq. Miles)	Annual Mean Flow (cfs)
Flathead River at Flathead, BC	12355000	1929-2000*	427	916
North Fork Flathead River near Columbia Falls, MT	12355500	1940-2000	1,548	3,016
Middle Fork Flathead River near West Glacier, MT	12358500	1940-2000	1,128	2,899
South Fork Flathead River above Twin Creek, near Hungry Horse, MT	12359800	1965-1982**	1,160	2,310
South Fork Flathead River near Columbia Falls, MT	12362500	1929-2000	1,663	3,534
Flathead River at Columbia Falls, MT	12363000	1929-2000	4,464	9,685
Stillwater River near Whitefish, MT	12365000	1931-2000	524	347
Whitefish River near Kalispell, MT	12366000	1930-2000	170	190
Swan River near Bigfork, MT	12370000	1922-2000	671	1,164

(* No winter records prior to 1952. ** Seasonal records only after 1982.)

on the eastern side of the basin (Western Regional Climate Center, 2002) . Most of the precipitation in the mountains occurs as snowfall during the months of November, December, and January. The highest precipitation in the valleys typically occurs in June. January and July are the coldest and warmest months respectively, with average monthly temperatures at the Kalispell Airport of 28.6° F and 80.5° F, respectively.

2.5 Abandoned and Inactive Mines on the Flathead National Forest

The Flathead National Forest (FNF) inventory of abandoned/inactive mines was completed by MBMG during summer and fall of 2000. A total of 63 sites were initially identified in or near the FNF (figure 4) using the USBM MILS data base as a basic reference. Others sources of information included the mineral resource assessment reports for the Bob Marshall and Mission Mountains wilderness areas completed by the U.S. Geological Survey and the U.S. Bureau of Mines (Marks, 1978; Harrison and others, 1969). National Forest Service personnel provided additional information on mine locations. Table 8 summarizes the inventory results for the Flathead National Forest inventory. These numbers are accurate to the extent that the data base is updated and will change, reflecting current progress in database entry.

Only one mine site on the FNF was sampled because of a discharging adit. The mine was located on the Swan River Ranger District. A summary of the environmental conditions for the mine is presented in the following section. A short description of all the sites visited by MBMG is also included. Those sites that were screened out and not visited are described in appendix II of this

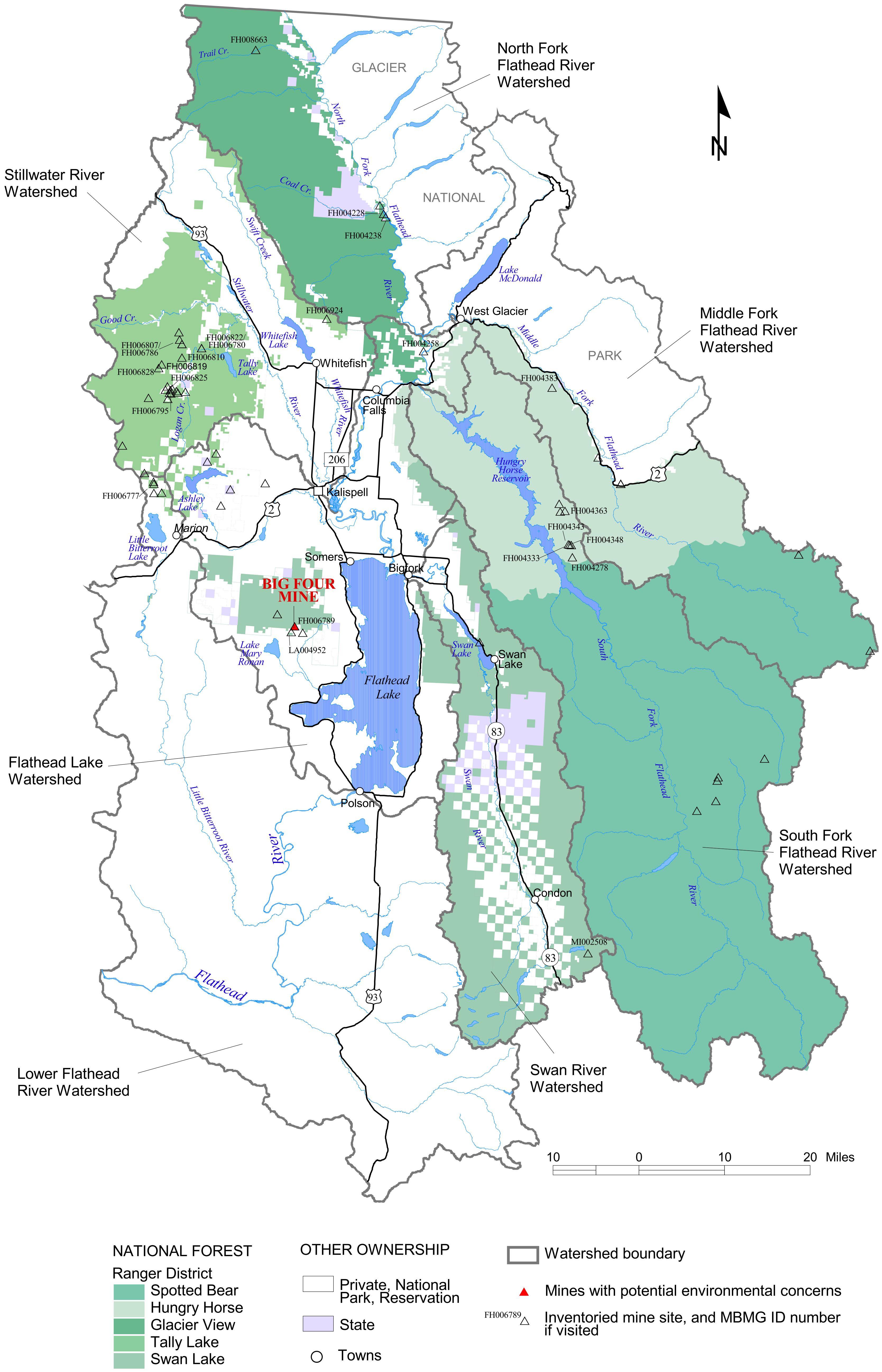

Figure 4. The Flathead National Forest is within six different watersheds. The majority of the mining activity has been in the Stillwater, Flathead Lake, and South Fork Flathead River watersheds. The Big Four Mine in the Swan Lake Ranger District was the only mine sampled with a discharging adit.

Table 8. Summary of Flathead National Forest investigation

Total Number of Abandoned/Inactive Mines Sites that were:	
PART A-Field Form	
Located in the general area from MILS	62
Deleted as a duplicate site	0
Added by MBMG from literature or field visits	1
	63
PART B-Field Form (Screening Criteria)	
Screened out by MBMG based on description in literature	39
Unable to locate	5
Visited by MBMG geologist	18
PART C-Field Form	
Sampled (water and/or soil)	1

volume. During the inventory, MBMG found no evidence of mills or mill tailings at the mine sites visited. There is also no mention of mills in the literature that was reviewed for the inventory.

For the purpose of this report, all mines have been organized by drainage basin. This is a convenient way to separate the Flathead National Forest into manageable areas for assessment of cumulative environmental impacts on the drainages. The drainage basins or watersheds (i.e., 8-digit USGS Hydrologic Unit Codes) are the Flathead Lake, Lower Flathead Lake, Stillwater River, Swan River, and North, South, and Middle Forks of the Flathead River.

FLATHEAD LAKE WATERSHED

There are 10 mine sites in the Flathead Lake watershed, which includes parts of the Tally Lake, Swan River, and Hungry Horse Ranger Districts. Of these, MBMG visited 2 and screened out the remaining 8 (described in appendix II). Table 9 summarizes general information about all the sites; those visited are shown in bold. Only the Big Four prospect in the Swan Lake Ranger District was found to have potential adverse effects on soil or water quality due to a small adit discharge. The Jumbo mine has potential safety concerns. These two sites are discussed below:

3.1 Big Four (FH006789)

3.1.1 Site Location and Access

The Big Four Prospect is located adjacent to the West Fork Dayton Creek, approximately 5.5

Table 9. Mines and prospects in the Flathead Lake watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
TALLY LAKE RD										
Boorman Peak	FH004398	S	N	NE	28N	23W	16		Lone Lake	Screened out: state land, quartzite/silicon occurrence.
Salish Mountains	FH004368	P	N	NE	28N	22W	7		Blue Grass Ridge	Screened out: private; calcium/limestone occurrence.
Unnamed Gold	FH006990	S	N	NE	29N	24W	36		Lone Lake	Screened out: state land, inaccurate location.
Unnamed Quartzite	FH004393	P	N	NE	28N	23W	29		Lone Lake	Screened out: unnamed quartzite deposit.
Unnamed Silver & Lead	FH006987	M	N	NE	29N	23W	30		Lone Lake	Screened out: CRIB is only reference, inaccurate location.
SWAN LAKE RD										
Big Four Prospect	**FH006789**	**NF**	**Y**	**Y**	**26N**	**21W**	**31**	**DCBD**	**Proctor**	**Adit discharge, locked bulkhead inside adit.**
Jumbo	**LA004952**	**NF**	**Y**	**Y**	**25N**	**21W**	**6**	**CBAA**	**Proctor**	**Open shaft surrounded by barbed wire fence, dry adit with small (6"x12") opening**
Old Dominion Claims	FH006930	NF	N	NE	26N	22W	26		Lake Mary Ronan	Screened out: crib was only reference, inaccurate location.
Unnamed Prospect	LA004967	P	N	NE	25N	21W	5		Proctor	Screened out: private, no development (Johns, 1964).
HUNGRY HORSE RD										
Presidents Group	FH004258	P	N	NE	31N	19W	19		Hungry Horse	Private, no evidence of coal mine based on visit to general area.

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y - hazard, NE -not evaluated)

miles northwest of the town of Proctor. The site was accessed by traveling west from Lakeside along Blacktail Road (forest route 917) to route 2990, then 1 mile along route 2993, and 1.8 miles to the end of forest route 5235. From the end of 5235, the site is reached by hiking downslope, approximately 1,000 feet west, to the West Fork Dayton Creek. The adit and workings are in the drainage bottom at an elevation of 3,928 feet. All workings are on FNF-administered land.

3.1.2 Site History-Geologic Features

The site consists of an open adit and a small, unmineralized waste-rock dump (figure 5). A locked bulkhead inside the adit prevents access to the workings (figure 5a). According to Johns (1964) the claim was located prior to 1910. Total adit length is approximately 360 feet with an additional 75 feet of drifting. The adit trends N.43° E. and is driven into gray argillite of the Precambrian Ravalli Group. A thin quartz vein containing scattered malachite and iron oxide is exposed near the portal. A vein sample collected by Johns (1964) assayed 0.11 percent copper, 0.20 ounces per ton silver, and 0.001 ounces per ton gold.

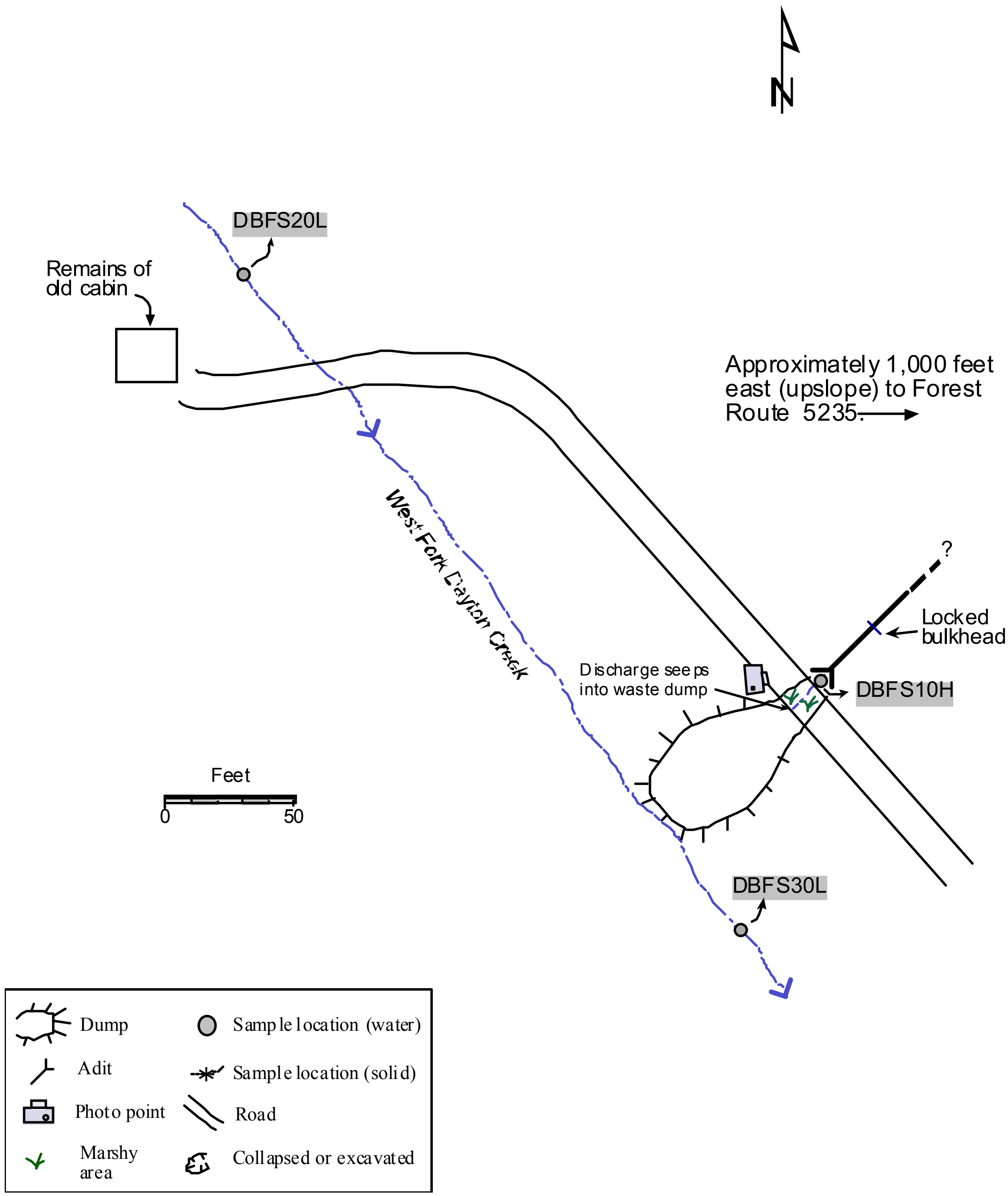

Figure 5. Site map for the Big Four Prospect.

Figure 5a. A locked bulkhead prevented access to the Big Four mine workings.

Figure 5b. The Big Four Prospect had standing water inside the adit that seeps into the road near the mine entrance (area of green grass near center of photo).

3.1.3 Environmental Condition

The adit and waste dump in contact with the West Fork Dayton Creek are the primary environmental concerns at this site. The adit discharge seeps into the waste dump just beyond the portal and does not flow directly into the creek (figure 5b). The waste dump consists mostly of unmineralized argillite.

3.1.3.1 Site Feature-Sample Location

Water-quality samples were collected upstream (DBFS20L) and downstream (DBFS30L) of the adit and waste dump on September 13, 2000. The flow rate of the stream was approximately 0.5 cfs. Sample DBFS10H was collected from the seep coming from the adit.

3.1.3.2 Soil

Soil samples were not collected because the material in the waste dump was mostly cobble-and boulder-size quartzite and argillite rock fragments with no evidence of mineralization.

3.1.3.3 Water

There were no exceedences of water-quality standards for any of the analytes tested. Zinc and nickel were detected in the adit discharge sample; nickel was present upstream and downstream in the stream samples. Most of the metal concentrations were below detection limits and all were well below water-quality standards (table 10). The field pH of the stream and adit discharge were within the range considered normal for surface water.

Table 10. Big Four water-quality results

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe*	Pb	Mn*	Hg	Ni	Ag	Zn	Cl*	F*	NO_3-N*	SO_4*	pH
DBFS10H- adit	<30	<1	18.3	<2	<2	<2	.006	<2	.019	<1	2.11	<1	4.00	.833	<.05	.40	2.83	6.93
DBFS20L-upstream	<30	<1	19.0	<2	<2	<2	<.005	<2	<.001	<1	2.82	<1	<2	<.5	<.05	<.05	<2.5	7.44
DBFS30L-downstream	<30	<1	20.7	<2	<2	<2	<.005	<2	<.001	<1	5.72	<1	<2	.522	<.05	.05	<2.5	7.44

(* - mg/L, all other concentrations are in µg/L, pH is reported in standard units)

3.1.3.4 Vegetation

Vegetation on FNF-administered land does not appear to be impacted by mining activities at this site. The dump was well-vegetated with grasses and pine trees that were green and healthy in appearance.

3.1.3.5 Summary of Environmental Conditions

The water quality of the West Fork Dayton Creek does not appear to be significantly impacted by the streamside dump or adit discharge.

3.1.4 Structures

There were no structures at the site other than the remnants of a cabin approximately 250 feet upstream from the adit.

3.1.5 Safety

The only safety concern noted at the site was the adit which is open for approximately 25 feet from the portal. Beyond that, a locked bulkhead prevented access to the rest of the adit.

3.2 Jumbo Mine (LA004952)

The Jumbo Mine is located on a ridge above the West Fork of Dayton Creek in section 6, T25N, R21W. The deposit was discovered prior to 1916 and development began in 1918 when an adit was driven along a vuggy-quartz vein containing galena, malachite, azurite, and chalcopyrite (Johns, 1964). Additional development included sinking a shaft on the extension of the vein approximately a quarter of a mile west of the adit.

MBMG visited the mine in September 2000. The portal to the adit was collapsed except for a small 6" x 12" opening. The adit was dry with no evidence of discharge and was not accessible. The adit trends approximately N35°W. The dump below the adit is mostly vegetated. Waste rock is gray argillite with some quartz fragments containing sparse malachite and iron oxides. A rusted compressor, ruins of a cabin, and scattered boards are located near the adit. No other structures or environmental hazards were noted. The shaft is located along the ridge approximately a quarter mile west of the adit. The shaft is about 60 feet deep and is surrounded by a barbed-wire fence. The shaft opening is partially covered with timbers. A large waste-rock pile and trench are located adjacent to the shaft.

LOWER FLATHEAD LAKE WATERSHED

There were five mine sites identified in the Lower Flathead Lake watershed (table 11). All the mines were located on the Tally Lake Ranger District. The Blue Grouse Group (shown in bold in table 11) was visited by MBMG and is described below. All other mine sites were screened out.

4.1 Blue Grouse Group (FH006777)

This site was visited by MBMG in September 2000 and no evidence of mining activity was found except for a claim marker on a tree that said “West Boundary of One Hour Lode Claim”.

Table 11. Mines and prospects in the Lower Flathead Lake watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
TALLY LAKE RANGER DISTRICT										
Blue Grouse	**FH006777**	**NF**	**Y**	**NE**	**28N**	**25W**	**14**	**D**	**Pleasant Valley Mtn**	**Visited general area, no evidence of mining other than a claim marker.**
Herrig Placer	FH006813	P	N	NE	28N	25W	23		Pleasant Valley Mtn	Screened out: private: placer downstream from FNF land.
Unnamed Gold	FH006993	NF	N	NE	28N	25W	14		Pleasant Valley Mtn	Screened out: CRIB is only reference, inaccurate location.
Unnamed Gold	FH006897	M	N	NE	28N	25W	24		Pleasant Valley Mtn	Screened out: no references in MILS database, inaccurate location.
Unnamed Gold	FH007005	NF	N	NE	28N	25W	10		Dahl Lake	Screened out: CRIB is only reference, inaccurate location.

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y - hazard, NE -not evaluated)

The location in the MILS data base was accurate only to +/-1 km so it is possible that there are workings that were not found. According to Lawson (1975, 1979) the site was a gold, silver, copper, and bismuth deposit. Johns (1970) described the workings as a 27-foot adit driven in the 1930's, and two small pits. The claims were last active in 1961. The location for this site is listed as section 14, T28N, R25W.

STILLWATER RIVER WATERSHED

Twenty-two mines and prospects were identified in the Stillwater River watershed (table 12). All were on the Tally Lake Ranger District; several are patented mining claims. The majority of the sites were in the Star Meadow mining district. MBMG visited 8 different sites (shown in bold in table 12). Of these sites, none were found to have significant environmental concerns and 5 had safety concerns because of open adits. Brief summaries of the visited sites follow.

5.1 Blacktail Prospect (FH006807) - Sanko Creek Mine (FH006786)

The Blacktail Prospect is located on a tributary to Sanko Creek in section 29, T31N, R24W. The prospect was discovered in 1936 and developed in 1940 by sinking a shaft and driving a 10-foot adit along a chalcopyrite-bearing quartz vein (Johns, 1962). In 1961, the Blacktail and two additional claims were relocated and renamed the Sanko Creek Mine. Additional work that was completed at that time included extending the adit, exposing the vein with an open cut, and digging test pits. Total production from the property was reported as 36 tons.

The site was visited by MBMG in August 2000. The adit was open for approximately 60 feet, although the portal was partly collapsed. The adit trended due east and was dry with no evidence of discharge. Directly above the adit was a narrow, open cut with vertical walls that ran the length of the adit. The remains of an ore chute occupied the bottom of the cut. The cut was

Table 12. Mines and prospects in the Stillwater River watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
TALLY LAKE RANGER DISTRICT										
Blacktail/ Sanko Creek	**FH006807**	**NF**	**Y**	**Y**	**31N**	**24W**	**29**	**BBBB**	**Johnson Peak**	**Appears to be same mine as Sanko Creek Mine (FH006786).**
Copper King Prospect	FH006768	NF	N	NE	30N	24W	20		Ashley Mountain	Screened out: workings described as two shallow pits (Johns,1962).
Crosley-Sucetti	**FH006819**	**NF**	**Y**	**NE**	**30N**	**25W**	**1**		**Johnson Peak**	**Visited area, couldn't find adits described by Johns (1961).**
Foolsburg Mine	**FH006795**	**P**	**Y**	**Y**	**30N**	**24W**	**19**	**DADD**	**Ashley Mountain**	**2 open adits, dump of upper adit visible on hillside.**
Griffin Creek Prospect	FH006804	P	N	NE	30N	24W	19		Ashley Mountain	Screened out: private, one trench (Johns, 1962).
Grubb Mountain	FH004403	NF	N	NE	29N	25W	29		Dahl Lake	Screened out: silicon/quartzite deposit.
Harvey-Nickolas	FH006960	NF	N	NE	31N	24W	17		Johnson Peak	Screened out: inaccurate location, no workings (Johns, 1961).
Humdinger Prospect	**FH006822**	**NF**	**Y**	**Y**	**31N**	**24W**	**26**	**BCAC**	**Johnson Peak**	**One partially-collapsed, dry adit, two small prospect pits.**
Iron Occurrence	FH006903	M	N	NE	30N	24W	19		Ashley Mountain	Screened out: CRIB is only reference, inaccurate location.
Lucky Strike Prospect	**FH006810**	**NF**	**Y**	**NE**	**31N**	**24W**	**32**		**Johnson Peak**	**No evidence of mining activity noted during site visit.**
Micho Mine	**FH006924**	**NF**	**Y**	**Y**	**32N**	**21W**	**32**	**CDDD**	**Whitefish**	**One partially collapsed adit with 2' x 6' opening, dry, overgrown.**
Moonlight Claim	FH006801	P	N	NE	30N	24W	21		Ashley Mountain	Screened out: private copper mine, shallow pits (Johns, 1962).
San Mezcalito Mine	**FH006780**	**NF**	**Y**	**Y**	**31N**	**24W**	**26**	**BCAC**	**Johnson Peak**	**Appears to be same mine as Humdinger (FH006822).**
Sanko Creek Mine	**FH006786**	**NF**	**Y**	**Y**	**31N**	**24W**	**29**	**BBBB**	**Johnson Peak**	**Open adit (dry), trench, and several shallow surficial cuts.**
Stahl Prospect	FH006954	P	N	NE	30N	24W	19		Ashley Mountain	Screened out: private, workings were a 60-foot adit (Johns, 1961)
Unnamed Lead	FH006957	M	N	NE	30N	24W	30		Ashley Mountain	Screened out: CRIB is only reference, inaccurate location.
Unnamed Lead	FH006981	NF	N	N	30N	25W	26		Sylvia Lake	Screened out: CRIB is only reference, inaccurate location.
Unnamed Quartz	FH006900	NF	N	N	30N	24W	19		Ashley Mountain	Screened out: quartz deposit.
Unnamed Quartz	FH006975	NF	N	N	31N	24W	20		Johnson Peak	Screened out: commodity is quartz crystals, inaccurate location.
Unnamed Silver,Gold, Cu	FH006909	NF	N	N	30N	24W	20		Ashley Mountain	Screened out: CRIB is only reference, inaccurate location.
West Virginia Mine	**FH006825**	**M**	**Y**	**Y**	**30N**	**24W**	**19**	**ADAA**	**Ashley Mountain**	**Partially caved adit, Portal may be on private ground, test pit.**
Yukon Mine	**FH006828**	**NF**	**Y**	**Y**	**30N**	**25W**	**1**	**CCDD**	**Johnson Peak**	**Open adit, no evidence of discharge; collapsed shaft.**

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y - hazard, NE -not evaluated)

approximately 20 feet deep and could potentially pose a safety hazard. A small amount of waste rock was in the drainage bottom but since the drainage is dry and heavily overgrown, it does not appear to be an environmental concern. On the hilltop above the adit, a number of small test pits were evident along the trend of the vein. The shaft described by Johns (1962) was not located and may be collapsed. The ruins of two cabins and minor metal debris were scattered around the site.

5.2 **Crosley-Sucetti Prospect** (FH006819)

Johns (1961) described the workings at this site as consisting of two short adits driven along quartz-siderite veins. The prospects were apparently located along an unnamed tributary to Sheppard Creek in section 01, T30N, R25W. MBMG attempted to find the adits in September 2000 but was unsuccessful. The adits may have been destroyed or covered when the area was logged.

5.3 **Foolsburg Mine** (FH006795)

The Foolsburg Mine is a patented mining claim surrounded by National Forest land. The mine is located in section 19, T30N, R24W. MBMG visited the general area of the mine in August 2000. The mine was observed from a distance and there appeared to be two open adits. One adit was located on the hillside above Sullivan Creek and the other was located in the drainage bottom west of Sullivan Creek. The upper adit appeared dry with an unvegetated dump. The lower adit was obscured by vegetation and MBMG was unable to assess its condition. Johns (1961, 1962) described development as a 240-foot lower adit and a 300-foot upper adit. The adits are on a fissure-filled chalcopyrite-bearing vein. The principal minerals present are chalcopyrite, tenorite, azurite, and malachite in a quartz, siderite, and calcite gangue. Host rock is green-gray argillite of the Precambrian Belt Supergroup.

5.4 **Humdinger Prospect** (FH006822) **- San Mezcalito Mine** (FH006780)

The Humdinger Prospect is a vein-type copper deposit located above Logan Creek in section 26, T31N, R24W. The prospect was located in 1934 and the workings consisted of two shallow pits and a 100-foot adit (Johns, 1961). The site was later relocated as the San Mezcalito Mine (Lawson, 1975). MBMG visited the site in August 2000. The portal to the adit was collapsed except for a small 8"x12" opening and was not accessible without excavation. The adit trended N.30° W. and was dry with no evidence of discharge. Waste rock on the dump contained quartz with chalcopyrite and manganese oxides. The small prospect pits above the adit exposed the vein and were less than 10 feet deep. No structures or environmental hazards were observed.

5.5 **Lucky Strike Prospect** (FH006810)

The Lucky Strike is a copper prospect located in section 32, T31N, R24W. Johns (1962) reported that the deposit was an eastward-striking chrysocolla-bearing quartz vein that was in the process of being developed. MBMG visited the area in September 2000 and was unable to find any evidence of mining.

5.6 **Micho Mine** (FH006924)

The Micho Mine is located in section 32, T32N, R21W along a southward-flowing tributary of Haskill Creek. The mine was developed in about 1943 and consisted of one adit and two small pits (Johns and others, 1963). The workings are in grayish-red sericitic argillite interbedded with layers of copper-stained white quartzite and sandstone of the Precambrian Ravalli Group. MBMG visited the site in September 2000. The adit was partially caved with a small 2' x 6' opening. The adit extended back into the hillside approximately 20 feet and trended N. 8° W. The adit was dry with no indication of discharge. The small dump below the adit was heavily vegetated and no mineralization was observed in the waste rock. The mine is located along an unmaintained section of the Micho pack trail.

5.7 West Virginia Mine (FH006825)

The West Virginia Mine is located in section 19, T30N, R24W and was visited by MBMG in August 2000. The workings consisted of an open adit and a small, recently-excavated test pit. The adit was open for approximately 30 feet and trended S. 20° E. There was no evidence of discharge. Mineralization in the waste rock included quartz veins with pyrite and possibly goethite. Johns (1961) described the workings as an inaccessible 30-foot shaft, a 60-foot crosscut to the vein, and about 160 feet of drifting along a displaced vein segment. Bornite was reported as the primary copper mineral and production amounted to about 60 tons of ore. MBMG was unable to locate the shaft described in the literature. Based on the location of National Forest boundary markers and recent survey stakes, it appears that the portal of the adit and the test pit are located on private property and most of the underground workings are on the National Forest. There were no environmental concerns noted at this site; the open adit is a safety concern.

5.8 Yukon Mine (FH006828)

The Yukon Mine is located in the Star Meadow area in section 01, T30N, R25W. The mine was located in 1929 and development consisted of a 257-foot adit, a small prospect pit, and a 20-foot shaft (Johns, 1961). The workings followed quartz-siderite veins within gray-green argillites. Mineralization included chalcopyrite, chrysocolla, malachite, tenorite, and iron oxides. MBMG visited the site in August 2000. The adit was open and accessible for an estimated 250 feet, although the portal was partially caved. The adit trended N 20° W and was dry. The dump was mostly unvegetated. The nearby shaft was completely collapsed and only a few partially buried timbers were visible. No structures or environmental hazards were observed.

SWAN RIVER WATERSHED

Relatively little mining activity has been reported in the Swan River watershed. Two mine sites on the Swan River Ranger District were identified (table 13) and only the Copper Angel Prospect near Holland Lake was visited.

6.1 Copper Angel Prospect (MI002508)

The Copper Angel Prospect is located to the southwest of Holland Lake in the southwest corner of section 36, T20N, R16W. Marks (1978) described the site as an adit driven into massive

Table 13. Mines and prospects in the Swan River watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
SWAN RIVER RANGER DISTRICT										
Copper Angel Prospect	**MI002508**	**NF**	**Y**	**Y**	**20N**	**16W**	**36**	**DDDB**	**Holland Lake**	**Open adit, no evidence of discharge.**
Unnamed Location	LA004962	P	N	NE	25N	18W	4		Yew Creek	Screened out: private,copper & silver prospect, workings consist of road cuts (Johns, 1964).

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y- hazard, NE -not evaluated)

dolomitic limestone, argillite, and quartzite. Mineralization is associated with quartz-filled shear zones. Assays from the site contained minor amounts of silver and copper. MBMG visited the site in September 2000 and observed one open adit trending N. 75° E. The adit was dry with no evidence of discharge. The small dump was partially vegetated. Scattered crusts of malachite and thin quartz veins (less than 1 inch across) were evident in the waste rock and in host rock surrounding the adit. There were no structures or environmental hazards evident in the area. The site is relatively inaccessible since there is no trail or road to the mine.

NORTH FORK FLATHEAD RIVER WATERSHED

Four mine sites were evaluated in the North Fork watershed; three of these were visited by MBMG (shown in bold in table 14). All the mines are in the Glacier View Ranger District. None of the visited sites in this watershed appear to pose any serious environmental or safety concerns.

Table 14. Mines and prospects in the North Fork Flathead River watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
GLACIER VIEW RANGER DISTRICT										
Langford Placer	FH004233	P	N	NE	34N	20W	29		Demers Ridge	Screened out: private, cuts, 2 shafts, 2 adits (Marks, 1978).
North Fork Mine	**FH004238**	**NF**	**Y**	**N**	**34N**	**20W**	**33**	**CAAC**	**Demers Ridge**	**Pit (50' x 50' x 15'), coal waste piles, collapsed cabins.**
Old Emerson	**FH004228**	**NF**	**Y**	**NE**	**34N**	**20W**	**33**		**Demers Ridge**	**Coal mine, tunnel described by Wood (1892) not located.**
Yakinikak Prospect	**FH008663**	**NF**	**Y**	**Y**	**37N**	**23W**	**35**	**AA**	**Mount Hefty**	**Completely collapsed dry adit, bulldozer cut.**

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y - hazard, NE -not evaluated)

7.1 North Fork Mine (FH004238)

The North Fork Mine is located along the North Fork of the Flathead River in section 33, T34N, R20W. The mine was active in the 1930's and was entered through one adit driven 325 feet S. 40° W. from the portal in the river bank (Erdmann, 1947). The coal seams are within the basal portion of the Tertiary Kishenehn Formation. Total production in 1934 was about 600 tons. The coal was used for local markets in Kalispell and Columbia Falls.

MBMG visited the mine in August 2000. The workings consisted of a possible collapsed shaft covered by boards, a 15-foot-deep pit, 50 feet in diameter, remains of an old tram, scattered waste piles of sand with small chunks of coal, a concrete ore bin, and remnants of several cabins. There was no evidence of the adit which may have been destroyed due to slumping along the river bank. No water or other environmental hazards were observed at the site.

7.2 Old Emerson (FH004228)

The Old Emerson mine was described by Wood (1892) as a 102-foot tunnel striking N. 18° E. and intersecting six workable coal seams. The site was visited by MBMG in September 2000 and no evidence of the tunnel or any other workings were found. The location given in the MILS database is section 33, T34N, R20W. The North Fork Mine is located nearby and it may be that the workings from the two mines overlapped.

7.3 Yakinikak Creek Prospect (FH008663)

This prospect is located in the Trail Creek drainage (section 34, T37N, R23W) adjacent to forest route #114. This site was not in the MILS database and MBMG was informed about the site by a Forest Service employee. MBMG visited the site in August 2000. The workings consisted of a collapsed, dry adit and a road cut above the adit. No mineralization was noted in the host rock.

MIDDLE FORK FLATHEAD RIVER WATERSHED

Seven mine sites were identified in the Middle Fork watershed (table 15). Only the Stanton Lake Prospect in the Hungry Horse Ranger district was visited by MBMG. Three of the mines were located outside the FNF boundary in Glacier National Park and were not visited. The two mines on the Spotted Bear Ranger district were screened out and also not visited.

8.1 Stanton Lake Prospects (FH004383)

The Stanton Lake Prospect is located in the Great Bear Wilderness in section 02 of T30N, R17W. Marks (1978) described the workings as one caved adit trending N.35° E. and four pits. The deposit was described as disseminated copper minerals in quartzite beds. The site was visited by MBMG in October 2000. The adit was caved and inaccessible. There was no water or evidence of discharge. The dump was mostly unvegetated and consisted of reddish-purple argillite. No hazards or environmental concerns were observed.

Table 15. Mines and prospects in the Middle Fork Flathead River watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
SPOTTED BEAR RANGER DISTRICT										
Teton Pass Coal Prospects	FH004378	NF	N	NE	25N	11W	28		Porphyry Reef	Screened out: commodity is coal, shallow test pits and trenches (Marks, 1978).
Unnamed Lead	FH006906	NF	N	NE	28N	11W	21		Morningstar Mountain	Screened out: CRIB is only reference, questionable location.
HUNGRY HORSE RANGER DISTRICT										
Essex Quarry	FH004323	P	N	NE	29N	16W	14		Essex	Screened out: private sand & gravel quarry.
Great Northern	FH004248	F	N	NE	29N	15W	31		Nimrod	Screened out: located in Glacier National Park, inaccurate location.
Lippincott	FH004253	F	N	NE	29N	15W	31		Nimrod	Screened out: located in Glacier National Park, inaccurate location.
Okedale	FH004243	NF	N	NE	29N	15W	31		Nimrod	Screened out: located in Glacier National Park, inaccurate location.
Stanton Lake	**FH004383**	**NF**	**Y**	**N**	**30N**	**17W**	**2**	**CBAA**	**Stanton Lake**	**Caved adit, no evidence of discharge, shallow test pits.**

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y - hazard, NE - not evaluated)

SOUTH FORK FLATHEAD RIVER WATERSHED

Thirteen mines or prospects were identified in the South Fork Flathead River watershed (table 16). Seven of the sites were located on the Hungry Horse Ranger District, primarily in the area between the Hoke and Logan Creek drainages. Six of the mine sites, located on the Spotted Bear Ranger District, were screened out and not visited by MBMG. The sites visited by MBMG are discussed below and are shown in bold in Table 16 . There were no environmental concerns observed at the mines in this watershed. Open or partially-open adits at several of the mines may pose safety concerns.

9.1 Corkscrew Copper Prospects (FH004278)

The Corkscrew Copper Prospects are located in the Hoke Creek drainage, just east of Hungry Horse Reservoir. Marks (1978) described the workings as consisting of 8 adits (some caved and inaccessible), 2 inclined shafts, 3 pits, and 1 trench. The deposit is described as disseminated copper minerals found along bedding planes and joint surfaces in argillite, quartzite, and siltites. The site was visited by MBMG in September 2000 and 4 of the adits were located. Two were along the south bank of Hoke Creek in the southwest quarter of section 17, T27N, R16W. The other two were in a small drainage along the hillside north of Hoke Creek (southeast quarter of section 8, T27N, R16W).

Table 16. Mines and prospects in the South Fork Flathead River watershed

MINE NAME	MBMG ID	OWNER	VISIT	HAZARD	T	R	S	TRACT	24K TOPO	COMMENTS
SPOTTED BEAR RANGER DISTRICT										
Black Bear Creek	FH004223	NF	N	NE	23N	13W	16		Pagoda Mountain	Screened out: barite occurrence, inaccurate location.
Bungalow Mtn. Prospect	FH004338	NF	N	NE	24N	13W	33		Bungalow Mountain	Screened out: barite occurrence, Marks (1978) described workings as test pits.
Glacier Prospect	FH004373	NF	N	NE	23N	13W	16		Pagoda Mountain	Screened out: barite occurrence, workings consisted of a pit and trench (Marks, 1978).
Glacier=1,=2 Claims	FH006921	NF	N	NE	23N	13W	16		Pagoda Mountain	Screened out: barite occurrence, CRIB is only reference.
Helen Creek Occurrence	FH004318	NF	N	NE	23N	13W	33		Pagoda Mountain	Screened out: no development according to Marks (1978).
Unnamed Mine	PO005400	NF	N	NE	19N	14W	15		Una Mountain	Screened out: inaccurate location, uranium occurrence.
HUNGRY HORSE RANGER DISTRICT										
Corkscrew Copper	**FH004278**	**NF**	**Y**	**NE**	**27N**	**16W**	**18**	**AAAD**	**Quintonkon**	**Four dry adits, three were open, one was partially open.**
Felix Creek Prospects	FH004358	NF	N	NE	28N	17W	12		Felix Peak	Screened out: workings consisted of 3 shallow test pits and 3 shallow trenches (Marks, 1978).
Half Man Prospect	**FH004343**	**NF**		**Y**	**27N**	**16W**	**6**		**Felix Peak**	**1 open adit, 1 partially open adit, both dry; trench**
Jeanette & Little Darling	**FH004348**	**P**	**Y**	**NE**	**27N**	**16W**	**6**		**Felix Peak**	**Patented claim, location in MILS database wrong, unable to verify correct location.**
One Dead Digger	**FH004333**	**NF**	**Y**	**Y**	**27N**	**16W**	**6**	**CADA**	**Felix Peak**	**Collapsed adit, dry, large (120' x 70') open cut, highwall.**
Unawah Creek	**FH004363**	**NF**	**Y**	**Y**	**28N**	**17W**	**13**	**CDBC**	**Felix Peak**	**Partially collapsed adit, standing water in adit but no discharge.**
Unnamed Copper/Gold	FH006999	NF	N	NE	28N	17W	13		Felix Peak	Screened out: CRIB is only reference, inaccurate location.

(NF - National Forest, F - Federal, P - Private, S - State, M - Mixed; N - not visited, Y - visited; Y - hazard, NE -not evaluated)

The adits along Hoke Creek were within approximately 50 feet of each other and were driven into bedrock adjacent to the stream. The downstream adit was open and trended S.70° E. for approximately 60 feet. The upstream adit extended approximately 10 feet into the hillside and the opening was partially collapsed. Both adits were dry. No obvious mineralization was noted in the host rock and there was no obvious dumps or waste rock piles. The open adits may be a safety concern.

The two adits in the small drainage north of Hoke Creek are at an elevation of approximately 5,840 feet and are within 100 feet of each other, one on the west side of the drainage and the other on the east side. The adit on the east side was open and extended approximately 60 feet back into the hillside, trending N.75° E. The west-side adit was partially caved (1' x 2' opening) and the workings extended back into the slope approximately 10 feet. Both adits were dry and had small unvegetated dumps. Waste rock on the dumps was primarily light gray quartzite with scattered small pieces of quartz with blebs of malachite or chalcocite. No structures or other hazards were noted at either site.

9.2 Half Man Prospect (FH004343)

The Half Man Prospect is located in the South Fork Logan Creek drainage in section 6, T27N, R16W. Marks (1978) described the copper prospect as consisting of a caved adit trending S.65° E. along a fault zone in light gray quartzite and argillite beds. Mineralization occurs in quartz veins that contain abundant malachite and chalcocite.

MBMG visited the site in September 2000 and observed three adits, a large trench, and a small pit. The largest adit was open with a mostly unvegetated dump. The adit trended S.65° E. and may be the collapsed adit Marks (1978) observed. A second adit to the north of the largest adit was partially collapsed at the portal (1-foot. x 1-foot opening) and trended S.65° E. There was no dump associated with this adit. The third adit was very small, driven less than 10 feet into the hillside. An eastward-trending trench, approximately 20 feet deep and 5 feet wide, appears to have followed a quartz vein exposed in the bedrock. The site was dry and there appeared to be no environmental concerns. The name of the prospect may have come from a carving in the rock depicting half a man. A survey crew from the FNF regional office visited this site in 1996 and collected location data (latitude and longitude) on several of the adits. At the time, FNF personnel were attempting to locate the corners of the patented Jeanette and Little Darling claims (FH004348), discussed below. Open adits may be a safety concern.

9.3 Jeanette and Little Darling Claims (FH004348)

The Jeanette and Little Darling Claims are patented claims (Patent No. 34005) that were located in 1896 by William Corran and J.N. Orgard (Johns, 1964). According to the MILS database, the claims are located in the South Fork Logan Creek drainage, approximately 2,200 feet northwest of the Baptiste Lookout (southeast quarter of section 6, T27N, R16W). The workings are reported to consist of several tunnels (one inclined) that followed an eastward-trending vein.

MBMG visited the area in September 2000 and was unable to locate any adits at the location given in the MILS database. A number of small pits were the only indication of mining activity. Further to the west (approximately 1,500 feet further down the ridge at an elevation of approximately 5,100 feet) MBMG did find several adits and a trench that, according to the MILS database, are the workings of the Half Man Prospect (see discussion above). Subsequent to MBMG’s visit to this area, a map of the Jeanette and Little Darling Claims was located that indicates the claims are located in the south halves of sections 4 and 5 and the north halves of sections 8 and 9, T27N, R16W. MBMG was unable to verify this location which suggests the claims are in the headwaters of Silver Basin, east of Mount Baptiste.

9.4 One Dead Digger (FH004333)

The One Dead Digger Prospect is located south of the South Fork Logan Creek in section 6, T27N, R16W. Marks (1978) described the workings as consisting of an open pit (approximately 120 feet long x 70 feet wide) with a caved adit. Mineralization is along a northwest-striking fault zone characterized by quartz veins with malachite, chalcocite, bornite, chalcopyrite, azurite, and chrysocolla. The host rock is argillite.

The site was visited by MBMG in September 2000. The collapsed adit was not evident but may have been concealed beneath material slumped from the highwall surrounding the pit. There was no water or evidence of adit discharge. The dump extended below the access road and was unvegetated. Metal debris, a few barrels, and sections of cable were scattered around the site. The highwall may be a safety concern.

9.5 Unawah Creek Prospects (FH004363)

The Unawah Creek Prospects are located in section 13, T28N, R17W. The site was visited in October 2000. Workings consisted of a partially caved adit with a small 1' x 1' opening and two trenches. The adit trended N. 36° W. and extended into the hillside approximately 30 feet. The floor of the adit was flooded but there was no evidence of discharge. The small dump was partially vegetated. Johns (1964) and Marks (1978) described the deposit as a 2"-5" quartz vein containing scattered blebs and vugs of malachite, chalcocite, and iron oxides. A selected dump sample assayed at 1.33 percent copper and 0.35 ounce silver per ton. Host rock is reddish-purple argillite of the Precambrian Ravalli Group.

SUMMARY OF MINING IMPACTS ON FLATHEAD NATIONAL FOREST

The Big Four Mine on the Swan Lake Ranger District was the only site identified on the Flathead National Forest that has potential impacts on FNF-administered land. Water-quality samples collected upstream and downstream of the site indicated no adverse impacts.

Ten of the inventoried sites were found to have one or more safety concerns. Eight sites had one or more hazardous mine openings; one site, the Jumbo Mine, had an open shaft; and one site, the One Dead Digger, had a potentially hazardous highwall. All of the sites were on or immediately adjacent to FNF-administered land. It should be noted that hazards may exist at more of the sites but they may not have been observed during the brief site visits, especially since vegetation has overgrown many sites.

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Appendix I

USFS-MBMG Field Form

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 _____½-1 mile _____1-2 miles _____2-3 miles _____3-4 miles of site

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

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

____
____
____
____
____

Appendix II

Descriptions of Screened-Out Mine Sites on the Flathead National Forest

Black Bear Creek
FH004223

This site was screened out because the location was too general (+/- 1 mile). There is also conflicting information about the commodity. The MILS database lists the commodity as diatomite and the reference (Elevatorski, 1974) describes the deposit as a barite occurrence. According to the database, this site is located in the Bob Marshall Wilderness in section 16, T23N, R13W (Pagoda Mountain quadrangle).

Boorman Peak
FH004398

This site was screened out because the commodity was quartz (silicon) and it is located on the Stillwater State Forest. The location for this site is listed as section 16, T28N, R23W (Lone Lake quadrangle).

Bungalow Mountain Prospect
FH004338

This site was screened out because the commodity was barite and the only reported development was test pits (Marks,1978). The prospect is located near the top of Bungalow Mountain in section 33, T24N, R13W (Bungalow Mountain quadrangle).

Copper King Prospect
FH006768

This site was screened out because the workings included only two shallow test pits (Johns, 1962) and the location given in the database was too general. The pits followed a 12-inch quartz vein with sparse amounts of chalcopyrite. The prospect is reportedly located on a ridge in section 20, T30N, R24W (Ashley Mountain quadrangle).

Essex Quarry
FH004323

This site was screened out because it is a sand and gravel deposit located on private property. The quarry is located in section 14, T29N, R16W (Essex quadrangle).

Felix Creek Prospects
FH004358

This site was screened out because the workings were minimal and, according to Marks (1978), development consisted of three shallow pits and three shallow trenches. Mineralization included disseminated copper minerals (malachite and possibly chalcocite) in quartzite, argillite, and siltites. The prospect is located in section 12, T28N, R17W (Felix Peak quadrangle).

Glacier = 1, = 2 Claims
FH006921

This site was screened out because there are no references in the MILS database and the commodity is listed as barite. The claims are located in the Bob Marshall Wilderness in section 16, T23N, R13W (Pagoda Mountain quadrangle).

Glacier Prospect
FH004373

This site, located in the Bob Marshall Wilderness area, was screened out because Marks (1978) described the workings as consisting of a 15-foot-long pit and a 75-foot-long trench. The workings were on a steep hillside 900 feet above Black Bear Creek in section 16, T23N R13W (Pagoda Mountain quadrangle). The site is a barite vein-type deposit in the Precambrian McNamara Formation. No production has been recorded.

Great Northern
FH004248

This site was screened out because it is in Glacier National Park. The Great Northern is a copper prospect located in section 31, T29N, R15W (Nimrod quadrangle).

Griffin Creek Prospect
FH006804

This site was screened out because it is located on private ground. Johns (1962) described the workings as a 20-foot trench and a 12-foot x 4-foot x 6-foot-deep pit. The prospect is associated with quartz veins in argillite and dolomitic limestone. Mineralization includes sparse chalcopyrite, tenorite, calcite, and hematite. The development work was apparently done in the 1920's or 1930's. The location of this site is listed as section 19, T30N, R24W (Ashley Mountain quadrangle).

Grubb Mountain Area
FH004403

This site was screened out because the commodity is quartz and the accuracy of the location was too general (+/-1 km). The location of the site is listed as section 29, T29N, R25W (Sylvia Lake quadrangle).

Harvey-Nickolas Prospect
FH006960

This site was screened out because only a general location was given (+/-1 km) and, according to Johns (1961), no development work had been completed. An assay from a vein sample contained copper and trace amounts of lead, silver and gold. The prospect is reportedly located in section 17, T31N, R24W (Johnson Peak quadrangle).

Helen Creek Occurrence
FH004318

This site was screened out because there was no development work completed according to Marks (1978). The deposit is located in the Bob Marshall Wilderness along a tributary to Helen Creek (section 34, T23N, R13W, Pagoda Mountain quadrangle). Mineralization is in discontinuous quartz-barite veins that contain calcite and specular hematite.

Herrig Placer
FH006813

This site was screened out because it is a placer mine located on private property. Johns (1962, 1970) reported that placer mining was done prior to 1900 and that remnants of a sluice box and tailing piles were still present in 1940. Small amounts of gold and mercury were recovered from the tailings piles by prospectors in 1940. The Herrig Placer is located along Herrig Creek in section 23, T28N, R25W (Pleasant Valley Mountain quadrangle).

Iron Occurrence
FH006903

This site was screened out because the location was too general (accuracy +/-1 km), there were no references in the MILS database, and the deposit is only an iron occurrence. The location of this site is listed in the MILS database as section 19, T30N, R24W (Ashley Mountain quadrangle).

Langford Placer
FH04233

This coal prospect was screened out because it is located on private property. According to Johns (1970), the Langford Placer included three patented claims known as the Placer, Providence Placer, and High Bar. The workings consisted of open cuts, two discovery shafts, and two tunnels. There was no information on production. The claims are located in an area designated as the Coal Bank near the junction of the North Fork of the Flathead River and Coal Creek (section 29, T34N, R20W, Demers Ridge quadrangle).

Lippincott
FH004253

This site was screened out because it is located in Glacier National Park. The Lippincott is a copper prospect in section 31, T29N, R15W (Nimrod quadrangle).

Moonlight Claim
FH006801

MBMG attempted to visit the site in September 2000 but the access road was trenched and marked with "Keep Out" signs indicating the claim is on private ground. Johns (1962) reported that the workings were minimal and consisted of several shallow test pits on quartz veins. Mineralization included small amounts of chalcopyrite, malachite, azurite, and chrysocolla. The location of the mine is given as section 21, T30N, R20W (Ashley Mountain quadrangle).

Okedale
FH004243

This site was screened out because it is in Glacier National Park. The Okedale is a copper prospect located in section 31, T29N, R15W (Nimrod quadrangle).

Old Dominion Claims
FH006930

This site was screened out because there were no references in the MILS database and the location was too general (+/-1 km). The commodity was copper and silver. The location of the mine is section 26, T26N, R22W (Lake Mary Ronan quadrangle).

Presidents Group
FH004258

The Presidents Group, according to the MILS database, is located near the town of Coram, in section 19, T31N R19W (Hungry Horse quadrangle). The site was apparently a coal mine although there is no mention of a mine at this location in the reference listed as Erdman (1947). The location given in the MILS database indicates the mine is on private ground, along the west bank of the North Fork Flathead River. The site was viewed from across the river during a visit to the area in September 2000 and there was no indication of any mining activity.

Salish Mountains
FH004368

This site was screened out because it is a limestone deposit located on private ground, there are no references in the MILS database, and the location is too general. The location in the MILS database is given as section 7, T28N, R22W (Blue Grass Ridge quadrangle).

Stahl Prospect
FH006954

This site was screened out because it is located on private ground. Johns (1961) reported that the workings at this copper and silver prospect consisted of a 60-foot adit that followed a 6-inch to 3-foot mineralized zone. The location of the prospect is given as section 19, T30N, R24W (Ashley Mountain quadrangle).

Teton Pass Coal Prospects
FH004378

This site was screened out because Marks (1978) described the workings as consisting only of shallow trenches and pits. The deposit is located in the Bob Marshall Wilderness near Teton Pass in section 28, T25N, R10W (Porphyry Reef quadrangle). The claims were located between 1907 and 1914 within exposures of the Cretaceous Blackleaf Formation.

Unnamed Copper and Gold
FH006999

This site was screened out because there were no references in the MILS database and the location was too general (+/-1 km). The site is reportedly located in section 13, T28N, R17W (Felix Peak quadrangle).

Unnamed Gold
FH006897

This site was screened out because there were no references in the MILS database and the location was too general (+/-1 km). The location of this site is given as section 24, T28N, R25W (Pleasant Valley Mountain quadrangle).

Unnamed Gold
FH006990

This site was screened out because there were no references in the MILS database and the location was too general (+/-1 km). The site is located in the Stillwater State Forest in section 36, T29N, R24W (Lone Lake quadrangle).

Unnamed Gold
FH006993

This site was screened out because there were no references in the MILS database and the location was too general (+/-1 km). The location of this site is given as section 14, T28N, R25W (Pleasant Valley Mountain quadrangle).

Unnamed Gold
FH007005

This site was screened out because there were no references in the MILS database and the location was too general (+/-1 km). This gold prospect is located in section 10, T28N, R25W (Dahl Lake quadrangle) according to the MILS database.

Unnamed Lead
FH006906

This site was screened out because there were no references to it in the MILS database, it is listed as a lead occurrence only, and the location was too general (+/-1 km). The location of this site in the MILS database is listed as section 21, T28N, R11W (Morningstar Mountain quadrangle).

Unnamed Lead
FH006957

This site was screened out because there were no references in the MILS database, it is listed as a lead occurrence only, and the location was too general (+/-1 km). The location of this site in the MILS database is section 30, T30N, R24W (Ashley Mountain quadrangle).

Unnamed Lead
FH006981

This site was screened out because there were no references in the MILS database, it is listed as a lead occurrence, and the location was too general (+/-1 km). The location in the MILS database is section 26, T30N, R25W (Sylvia Lake quadrangle).

Unnamed Location
LA004962

This site was screened out because it is located on private property. According to Johns (1964), development consisted of sampling a highway cut near Swan Lake (section 04, T25N, R18W, Yew Creek quadrangle).

Unnamed Mine
PO005400

This site was screened out because there were no references to it in the MILS database and the location was too general (+/-1 km). The location in the MILS database is listed as section 15, T19N, R14W (Una Mountain quadrangle).

Unnamed Prospect
LA004967

This site was screened out because it is located on private ground. Johns (1964) described this site as a small outcrop where sparse lead, silver, and copper minerals occur in small fissure-filling veins. Samples were collected for assay but no results were listed. The location for this site in the MILS database is given as section 05, T25N, R21W (Proctor quadrangle).

Unnamed Quartz
FH006900

This site was screened out because the commodity was quartz (silicon), there were no references in the MILS database, and the location was too general (+/-1 km). The site is reportedly located in section 19, T30N, R24W (Ashley Mountain quadrangle).

Unnamed Quartz
FH006975

This site was screened out because the commodity was quartz, there were no references in the MILS database, and the location was too general (+/-1 km). The site is reportedly located in section 20, T31N, R24W (Johnson Peak quadrangle).

Unnamed Quartzite
FH004393

This site was screened out because the commodity was quartz and the deposit is located on private ground. The location for this site is listed as section 29, T28N, R23W (Lone Lake quadrangle) in the MILS database.

Unnamed Silver and Lead
FH006987

This site was screened out because there were no references in the MILS database and the location description was too general (+/-1 km). The location for this site is given as section 30, T29N, R23W (Lone Lake quadrangle).

Unnamed Silver, Gold, Copper
FH006909

This site was screened out because there were no references in the MILS database and the reported location was too general (+/-1 km). The location is listed as section 20, T30N, R24W (Ashley Mountain quadrangle).

Appendix III

Water Analytical Results
Flathead National Forest

Ground-Water Information Center
Internet Information Services Water Quality Report
BIG FOUR PROSPECT

Compare to water-quality standards

Sample Id / Site Id:	2001Q0643 / 179626	**Sample Date:**	09/13/2000
Location (TRS):	26N 21W 31 DCBD	**Agency/Sampler:**	MBMG / MDK
Latitude/Longitude:	47° 57' 53" **N** 114° 21' 04" **W**	**Field Number:**	DBFS10H
Datum:	NAD27	**Lab Date:**	02/05/2001
Altitude:	3928.00	**Lab/Analyst:**	MBMG / JMC
County/State:	FLATHEAD / MT	**Sample Method/Handling:**	NOT REPORTED / 3111
Site Type:	MINE DRAINAGE	**Procedure Type:**	DISSOLVED
Geology:	NR	**PWS Id:**	NR
USGS 7.5' Quad:	PROCTOR	**Drainage Basin:**	PH
Project Code(s):	FHFORST		

Cations	**mg/L**	**meq/L**	**Anions**	**mg/L**	**meq/L**
Calcium (Ca)	20.60	1.03	Bicarbonate (HCO_3)	127.60	2.09
Magnesium (Mg)	10.90	0.90	Carbonate (CO_3)	3.60	0.12
Sodium (Na)	6.35	0.28	Chloride (Cl)	0.83	0.02
Potassium (K)	1.54	0.04	Sulfate (SO_4)	2.83	0.06
Iron (Fe)	0.01	0.00	Nitrate (as N)	0.40	0.03
Manganese (Mn)	0.02	0.00	Fluoride (F)	<.05	0.00
Silica (SiO_2)	18.40		Ortho-Phosphate (OPO_4)	0.12	0.00
Total Cations		**2.24**	**Total Anions**		**2.33**

Trace Element Results (µg/L)

Aluminum (Al):	<30	Cadmium (Cd):	<2	Mercury (Hg):	<1	Tin (Sn):	NR
Antimony (Sb):	<2	Chromium (Cr):	<2	Molybdenum (Mo):	<1-	Titanium (Ti):	<1
Arsenic (As):	<1	Cobalt (Co):	<2	Nickel (Ni):	2.11	Thallium (Tl):	<5
Barium (Ba):	18.30	Copper (Cu):	<2	Silver (Ag):	<1	Uranium (U):	NR
Beryllium (Be):	<2	Lead (Pb):	<2	Selenium (Se):	<1	Vanadium (V):	<5
Boron (B):	<30	Lithium (Li):	4.66	Strontium (Sr):	97.30	Zinc (Zn):	4.00
Bromide (Br):	<50					Zirconium (Zr):	<2

Field Chemistry and Other Analytical Results

**Total Dissolved Solids:	128.46	Field Alkalinity as CaCO3:	NR	Langlier Saturation Index:	0.39
**Sum of Diss. Constituents:	193.20	Alkalinity as CaCO3:	110.66	Ammonia (mg/L):	NR
Field Conductivity (µmhos):	224.00	Field Nitrate (mg/L):	NR	T.P. Hydrocarbons (µg/L):	NR
Lab Conductivity (µmhos):	218.00	Nitrite (mg/L as N):	<.05	Field Dissolved O2 (mg/L):	NR
Field pH:	6.93	Water Temp (°C):	15.20	PCP (µg/L):	NR
Lab pH:	8.53	Air Temp (°C):	NR	Phosphate, TD (mg/L as P):	0.17
Field Hardness as CaCO3:	NR	Ryznar Stability Index:	7.75	Field Chloride (mg/L):	NR
Hardness as CaCO3:	96.30	Sodium Adsorption Ratio:	0.29	Field Redox (mV):	NR

Sample Condition: NONE.
Field Remarks: SMALL SEEP AT ADIT PORTAL
Lab Remarks: NONE.

Explanation: **mg/L** = milligrams per Liter; **µg/L** = micrograms per Liter; **meq/L** = milliequivalents per Liter; **ft** = feet; **NR** = No Reading in GWIC
Qualifiers: **A** = Hydride atomic absorption; **E** = Estimated due to interference; **H** = Exceeded holding time; **K** = Na+K combined; **N** = Spiked sample recovery not within control limits; **P** = Preserved sample; **S** = Method of standard additions; ***** = Duplicate analysis not within control limits; ****** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO3, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Ground-Water Information Center
Internet Information Services Water Quality Report
BIG FOUR PROSPECT

Compare to water-quality standards

Sample Id / Site Id:	2001Q0644 / 179627	**Sample Date:**	09/13/2000
Location (TRS):	26N 21W 31 DCBB	**Agency/Sampler:**	MBMG / MDK
Latitude/Longitude:	47° 57' 55" **N** 114° 21' 08" **W**	**Field Number:**	DBFS20L
Datum:	NAD27	**Lab Date:**	02/05/2001
Altitude:	3935.00	**Lab/Analyst:**	MBMG / JMC
County/State:	FLATHEAD / MT	**Sample Method/Handling:**	GRAB / 3111
Site Type:	STREAM	**Procedure Type:**	DISSOLVED
Geology:	NR	**PWS Id:**	NR
USGS 7.5' Quad:	PROCTOR	**Stream Stage:**	
Project Code(s):	FHFORST	**Stream Flow (cfs):**	
Drainage Basin:	PH	**Stream Width (ft):**	
		Sample Depth (ft):	

Cations	**mg/L**	**meq/L**	**Anions**	**mg/L**	**meq/L**
Calcium (Ca)	7.10	0.35	Bicarbonate (HCO_3)	52.10	0.85
Magnesium (Mg)	3.96	0.33	Carbonate (CO_3)	0.00	0.00
Sodium (Na)	3.81	0.17	Chloride (Cl)	<.5	0.00
Potassium (K)	0.78	0.02	Sulfate (SO_4)	<2.5	0.00
Iron (Fe)	<.005	0.00	Nitrate (as N)	<.05	0.00
Manganese (Mn)	<.001	0.00	Fluoride (F)	<.05	0.00
Silica (SiO_2)	18.30		Ortho-Phosphate (OPO_4)	<.05	0.00
Total Cations		**0.87**	**Total Anions**		**0.85**

Trace Element Results (µg/L)

Aluminum (Al):	<30	Cadmium (Cd):	<2	Mercury (Hg):	<1	Tin (Sn):	NR
Antimony (Sb):	<2	Chromium (Cr):	<2	Molybdenum (Mo):	<10	Titanium (Ti):	<1
Arsenic (As):	<1	Cobalt (Co):	<2	Nickel (Ni):	2.82	Thallium (Tl):	<5
Barium (Ba):	19.00	Copper (Cu):	<2	Silver (Ag):	<1	Uranium (U):	NR
Beryllium (Be):	<2	Lead (Pb):	<2	Selenium (Se):	<1	Vanadium (V):	<5
Boron (B):	<30	Lithium (Li):	2.04	Strontium (Sr):	41.60	Zinc (Zn):	<2
Bromide (Br):	<50					Zirconium (Zr):	<2

Field Chemistry and Other Analytical Results

**Total Dissolved Solids:	59.61	Field Alkalinity as CaCO3:	NR	Langlier Saturation Index:	-1.41
**Sum of Diss. Constituents:	86.05	Alkalinity as CaCO3:	42.73	Ammonia (mg/L):	NR
Field Conductivity (µmhos):	78.00	Field Nitrate (mg/L):	NR	T.P. Hydrocarbons (µg/L):	NR
Lab Conductivity (µmhos):	94.40	Nitrite (mg/L as N):	<.05	Field Dissolved O2 (mg/L):	NR
Field pH:	7.44	Water Temp (°C):	15.20	PCP (µg/L):	NR
Lab pH:	7.61	Air Temp (°C):	NR	Phosphate, TD (mg/L as P):	<.05
Field Hardness as CaCO3:	NR	Ryznar Stability Index:	10.43	Field Chloride (mg/L):	NR
Hardness as CaCO3:	34.03	Sodium Adsorption Ratio:	0.29	Field Redox (mV):	NR

Sample Condition: NONE.
Field Remarks: 250 FT UPSTREAM FROM ADIT
Lab Remarks: NONE.

Explanation: **mg/L** = milligrams per Liter; **µg/L** = micrograms per Liter; **meq/L** = milliequivalents per Liter; **ft** = feet; **NR** = No Reading in GWIC
Qualifiers: **A** = Hydride atomic absorption; **E** = Estimated due to interference; **H** = Exceeded holding time; **K** = Na+K combined; **N** = Spiked sample recovery not within control limits; **P** = Preserved sample; **S** = Method of standard additions; ***** = Duplicate analysis not within control limits; ****** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO3, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Ground-Water Information Center
Internet Information Services Water Quality Report
BIG FOUR PROSPECT

Compare to water-quality standards

Sample Id / Site Id:	2001Q0642 / 179625	**Sample Date:**	09/13/2000
Location (TRS):	26N 21W 31 DCBD	**Agency/Sampler:**	MBMG / MDK
Latitude/Longitude:	47° 57' 52" **N** 114° 21' 03" **W**	**Field Number:**	DBFS30L
Datum:	NAD27	**Lab Date:**	02/05/2001
Altitude:	3918.00	**Lab/Analyst:**	MBMG / JMC
County/State:	FLATHEAD / MT	**Sample Method/Handling:**	GRAB / 3111
Site Type:	STREAM	**Procedure Type:**	DISSOLVED
Geology:	NR	**PWS Id:**	NR
USGS 7.5' Quad:	PROCTOR	**Stream Stage:**	
Project Code(s):	FHFORST	**Stream Flow (cfs):**	
Drainage Basin:	PH	**Stream Width (ft):**	
		Sample Depth (ft):	

Cations	**mg/L**	**meq/L**	**Anions**	**mg/L**	**meq/L**
Calcium (Ca)	6.95	0.35	Bicarbonate (HCO_3)	50.60	0.83
Magnesium (Mg)	4.02	0.33	Carbonate (CO_3)	0.00	0.00
Sodium (Na)	3.91	0.17	Chloride (Cl)	0.52	0.01
Potassium (K)	0.80	0.02	Sulfate (SO_4)	<2.5	0.00
Iron (Fe)	<.005	0.00	Nitrate (as N)	0.05	0.00
Manganese (Mn)	<.001	0.00	Fluoride (F)	<.05	0.00
Silica (SiO_2)	18.80		Ortho-Phosphate (OPO_4)	<.05	0.00
Total Cations		**0.87**	**Total Anions**		**0.85**

Trace Element Results (µg/L)

Aluminum (Al):	<30	Cadmium (Cd):	<2	Mercury (Hg):	<1	Tin (Sn):	NR
Antimony (Sb):	<2	Chromium (Cr):	<2	Molybdenum (Mo):	<10	Titanium (Ti):	<1
Arsenic (As):	<1	Cobalt (Co):	<2	Nickel (Ni):	5.72	Thallium (Tl):	<5
Barium (Ba):	20.70	Copper (Cu):	<2	Silver (Ag):	<1	Uranium (U):	NR
Beryllium (Be):	<2	Lead (Pb):	<2	Selenium (Se):	<1	Vanadium (V):	<5
Boron (B):	<30	Lithium (Li):	1.97	Strontium (Sr):	42.30	Zinc (Zn):	<2
Bromide (Br):	<50					Zirconium (Zr):	<2

Field Chemistry and Other Analytical Results

**Total Dissolved Solids:	59.98	Field Alkalinity as CaCO3:	NR	Langlier Saturation Index:	-1.42
**Sum of Diss. Constituents:	85.65	Alkalinity as CaCO3:	41.50	Ammonia (mg/L):	NR
Field Conductivity (µmhos):	87.00	Field Nitrate (mg/L):	NR	T.P. Hydrocarbons (µg/L):	NR
Lab Conductivity (µmhos):	111.30	Nitrite (mg/L as N):	<.05	Field Dissolved O2 (mg/L):	NR
Field pH:	7.44	Water Temp (°C):	15.20	PCP (µg/L):	NR
Lab pH:	7.62	Air Temp (°C):	NR	Phosphate, TD (mg/L as P):	<.05
Field Hardness as CaCO3:	NR	Ryznar Stability Index:	10.46	Field Chloride (mg/L):	NR
Hardness as CaCO3:	33.90	Sodium Adsorption Ratio:	0.29	Field Redox (mV):	NR

Sample Condition: NONE.
Field Remarks: 55 FT DOWSTREAM FROM ADIT.
Lab Remarks: NONE.

Explanation: **mg/L** = milligrams per Liter; **µg/L** = micrograms per Liter; **meq/L** = milliequivalents per Liter; **ft** = feet; **NR** = No Reading in GWIC
Qualifiers: **A** = Hydride atomic absorption; **E** = Estimated due to interference; **H** = Exceeded holding time; **K** = Na+K combined; **N** = Spiked sample recovery not within control limits; **P** = Preserved sample; **S** = Method of standard additions; * = Duplicate analysis not within control limits; ** = Sum of Dissolved Constituents is the sum of major cations (Na, Ca, K, Mg, Mn, Fe) and anions (HCO3, CO3, SO4, Cl, SiO3, NO3, F) in mg/L. Total Dissolved Solids is reported as equivalent weight of evaporation residue.

Appendix IV

Mine Location Data

MBMG ID# - MBMG Abandoned/Inactive database identification number.

Latitude and Longitude - reported in decimal degrees, datum is NAD27. (Latitude and longitude data for sites visited by MBMG were determined with Trimble Geoexplorer III GPS units. For sites MBMG did not visit, the latitude and longitude data is from the MILS database and has not been verified.)

Ownership - N = National Forest, P = Private, F = Federal (National Park), M = Mixed public/private or unknown ownership because of an unknown location.

MBMG ID#	SITE NAME	LATITUDE	LONGITUDE	TOWNSHIP	RANGE	SECTION	TRACT	USGS TOPOGRAPHIC MAP	MBMG SITE VISIT	OWNERSHIP	RANGER DISTRICT
FH006789	Big Four Prospect	47.9647	-114.3508	26N	21W	31	DCBD	Proctor	Y	N	Swan Lake
FH004223	Black Bear Creek	47.7442	-113.2703	23N	13W	16		Pagoda Mountain	N	N	Spotted Bear
FH006807	Blacktail Prospect/Sanko Creek	48.4283	-114.6800	31N	24W	29	BBBB	Johnson Peak	Y	N	Tally Lake
FH006777	Blue Grouse Group/Prospect	48.1897	-114.7278	28N	25W	14	D	Pleasant Valley Mtn	Y	N	Tally Lake
FH004398	Boorman Peak	48.1892	-114.5342	28N	23W	16		Lone Lake	N	S	Tally Lake
FH004338	Bungalow Mtn Prospect	47.7847	-113.1542	24N	13W	33	CC	Bungalow Mountain	N	N	Spotted Bear
MI002508	Copper Angel Prospect	47.4419	-113.5706	20N	16W	36	DDDB	Holland Lake	Y	N	Swan Lake
FH006768	Copper King Prospect	48.3486	-114.6858	30N	24W	20		Ashley Mountain	N	N	Tally Lake
FH004278	Corkscrew Copper Prospect	48.1086	-113.6619	27N	16W	18	AAAD	Quintonkon	Y	N	Hungry Horse
FH006819	Crosley-Sucetti Prospect	48.3922	-114.7283	30N	25W	1		Johnson Peak	Y	N	Tally Lake
FH004323	Essex Quarry	48.2792	-113.6108	29N	16W	14		Essex	N	P	Hungry Horse
FH004358	Felix Creek Prospects	48.1975	-113.7028	28N	17W	12		Felix Peak	N	N	Hungry Horse
FH006795	Foolsburg Mine	48.3461	-114.6972	30N	24W	19	DADD	Ashley Mountain	Y	P	Tally Lake
FH004373	Glacier Prospect	47.7497	-113.2678	23N	13W	16		Pagoda Mountain	N	N	Spotted Bear
FH006921	Glacier=1, =2 Claims	47.6917	-113.3169	23N	13W	16		Pagoda Mountain	N	N	Spotted Bear
FH004248	Great Northern	48.2367	-113.5500	29N	15W	31		Nimrod	N	F	Hungry Horse
FH006804	Griffin Creek Prospect	48.3497	-114.7147	30N	24W	19		Ashley Mountain	N	P	Tally Lake
FH004403	Grubb Mountain Area	48.2508	-114.8136	29N	25W	29		Dahl Lake	N	N	Tally Lake
FH004343	Half Man Prospect	48.1294	-113.6708	27N	16W	6		Felix Peak	Y	N	Hungry Horse
FH006960	Harvey-Nickolas Prospect	48.4478	-114.6897	31N	24W	17		Johnson Peak	N	N	Tally Lake
FH004318	Helen Creek Occurrence	47.7094	-113.2706	23N	13W	33		Pagoda Mountain	N	N	Spotted Bear
FH006813	Herrig Placer	48.1744	-114.7264	28N	25W	23		Pleasant Valley Mtn	N	P	Tally Lake
FH006822	Humdinger Prospect	48.4236	-114.6300	31N	24W	26	BCAC	Johnson Peak	Y	N	Tally Lake
FH006903	Iron Occurrence	48.3494	-114.7017	30N	24W	19		Ashley Mountain	N	M	Tally Lake
FH004348	Jeanette and Little Darling Claims	48.1289	-113.6658	27N	16W	6		Felix Peak	Y	P	Hungry Horse
LA004952	Jumbo	47.9547	-114.3583	25N	21W	6	CBAA	Proctor	Y	N	Swan Lake
FH004233	Langford Placer	48.6833	-114.2000	34N	20W	29		Demers Ridge	N	P	Glacier View
FH004253	Lippincott	48.2367	-113.5500	29N	15W	31		Nimrod	N	F	Hungry Horse
FH006810	Lucky Strike Prospect	48.4056	-114.6778	31N	24W	32		Johnson Peak	Y	N	Tally Lake
FH006924	Micho Mine	48.4867	-114.3175	32N	21W	32	CDDD	Whitefish	Y	N	Tally Lake
FH006801	Moonlight Claim	48.3486	-114.6639	30N	24W	21		Ashley Mountain	N	P	Tally Lake
FH004238	North Fork Mine	48.6639	-114.1833	34N	20W	33	CB	Demers Ridge	Y	N	Glacier View
FH004243	Okedale	48.2367	-113.5500	29N	15W	31		Nimrod	N	N	Hungry Horse
FH006930	Old Dominion Claims	47.9836	-114.3956	26N	22W	26		Lake Mary Ronan	N	N	Swan Lake
FH004228	Old Emerson	48.6694	-114.1889	34N	20W	33		Demers Ridge	Y	N	Glacier View

MBMG ID#	SITE NAME	LATITUDE	LONGITUDE	TOWNSHIP	RANGE	SECTION	TRACT	USGS TOPOGRAPHIC MAP	MBMG SITE VISIT	OWNERSHIP	RANGER DISTRICT
FH004333	One Dead Digger	48.1297	-113.6736	27N	16W	6	CADA	Felix Peak	Y	N	Hungry Horse
FH004258	Presidents Group	48.4417	-114.0672	31N	19W	19		Hungry Horse	Y	P	Hungry Horse
FH004368	Salish Mountains	48.2033	-114.4472	28N	22W	7		Blue Grass Ridge	N	P	Tally Lake
FH006780	San Mezcalito Mine	48.4236	-114.6300	31N	24W	26	BCAC	Johnson Peak	Y	N	Tally Lake
FH006786	Sanko Creek Mine	48.4283	-114.6800	31N	24W	29	BBBB	Johnson Peak	Y	N	Tally Lake
FH006954	Stahl Prospect	48.3558	-114.7100	30N	24W	19		Ashley Mountain	N	P	Tally Lake
FH004383	Stanton Lake Prospects	48.3925	-113.7361	30N	17W	2	CBAA	Stanton Lake	Y	N	Hungry Horse
FH004378	Teton Pass Coal Prospect	47.9753	-112.9019	25N	11W	28		Porphyry Reef	N	N	Spotted Bear
FH004363	Unawah Creek Prospects	48.186	-113.6867	28N	17W	13	CDBC	Felix Peak	N	N	Hungry Horse
FH006999	Unnamed Copper & Gold	48.1844	-113.6989	28N	17W	13		Felix Peak	N	N	Hungry Horse
FH006897	Unnamed Gold	48.1756	-114.7069	28N	25W	24		Pleasant Valley Mtn	Y	M	Tally Lake
FH006990	Unnamed Gold	48.2331	-114.5969	29N	24W	36		Lone Lake	N	S	Tally Lake
FH006993	Unnamed Gold	48.1933	-114.7289	28N	25W	14		Pleasant Valley Mtn	N	N	Tally Lake
FH007005	Unnamed Gold	48.2072	-114.7533	28N	25W	10		Dahl Lake	N	N	Tally Lake
FH006906	Unnamed Lead	48.1317	-113.0919	28N	11W	21		Morningstar Mtn	N	N	Spotted Bear
FH006957	Unnamed Lead	48.3342	-114.7072	30N	24W	30		Ashley Mountain	N	M	Tally Lake
FH006981	Unnamed Lead	48.3342	-114.7556	30N	25W	26		Sylvia Lake	N	N	Tally Lake
LA004962	Unnamed Location	47.9564	-113.8831	25N	18W	4		Yew Creek	N	P	Swan Lake
PO005400	Unnamed Mine	47.2443	-113.2158	19N	14W	15		Una Mountain	N	N	Spotted Bear
LA004967	Unnamed Prospect	47.955	-114.3294	25N	21W	5		Proctor	N	P	Swan Lake
FH006900	Unnamed Quartz	48.345	-114.7033	30N	24W	19		Ashley Mountain	N	N	Tally Lake
FH006975	Unnamed Quartz	48.4356	-114.6872	31N	24W	20		Johnson Peak	N	N	Tally Lake
FH004393	Unnamed Quartzite	48.1606	-114.5556	28N	23W	29		Lone Lake	N	P	Tally Lake
FH006987	Unnamed Silver & Lead	48.2478	-114.5758	29N	23W	30		Lone Lake	N	M	Tally Lake
FH006909	Unnamed Silver, Gold, & Copper	48.3461	-114.6822	30N	24W	20		Ashley Mountain	N	N	Tally Lake
FH006825	West Virginia Mine	48.3519	-114.6975	30N	24W	19	ADAA	Ashley Mountain	Y	M	Tally Lake
FH008663	Yakinakak Prospect	48.9318	-114.5414	37N	23W	35	AA	Mount Hefty	Y	N	Glacier View
FH006828	Yukon Mine	48.3853	-114.7350	30N	25W	1	CCDD	Johnson Peak	Y	N	Tally Lake