Abandoned - Inactive Mines of the
Blackfoot and Little Blackfoot River Drainages

Helena National Forest
Volume II

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MBMG

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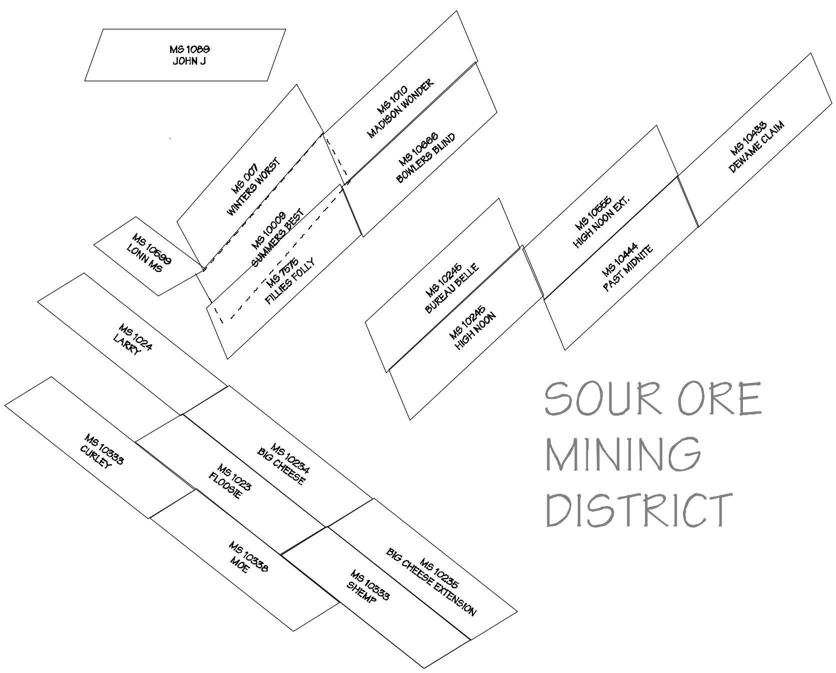

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Introduction

To fulfill its obligations under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Northern Region of the United States Forest Service (USFS) desires to identify and characterize the abandoned and inactive mines with environmental, health, and/or safety problems that are on or affecting National Forest System lands. The Northern Region of the USFS administers National Forest System lands in Montana and parts of Idaho and North Dakota. 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. The results of this inventory are presented in five volumes: Volume I - Basin Creek, Volume II - Cataract Creek, Volume III - Flint Creek and Rock Creek, Volume IV - Upper Clark Fork River, and Volume V - Jefferson River. The second Forest inventoried was the Helena National Forest. The results of this inventory are presented in Volume I - Upper Missouri River, and Volume II - Blackfoot and Little Blackfoot Rivers.

1.1 Project Objectives

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

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

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

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

4. Cooperate with other state and federal agencies, and integrate the Northern Region program with their programs.

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

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

1.2 Abandoned and Inactive Mines Defined

For the purposes of this study, mines, mills, or other processing facilities related to mineral extraction and/or processing are defined as abandoned or inactive as follows:

> A mine is considered abandoned if there are no identifiable owners or operators for the facilities, or if the facilities have reverted to federal ownership.
>
> A mine is considered to be inactive if there is an identifiable owner or operator of the facility, but the facility is not currently operating and there are no approved authorizations or permits to operate.

1.3 Health and Environmental Problems at Mines

Abandoned and inactive mines may host a variety of safety, health, and environmental problems. These may include metals that contaminate ground water, surface water, and soils; airborne dust from abandoned tailings impoundments; sedimentation in surface waters from eroding mine and mill waste; unstable waste piles with the potential for catastrophic failure; and physical hazards associated with mine openings and dilapidated structures. Although all problems were examined at least visually (See appendix I - Field Form), the hydrologic environment appears to be affected to the greatest extent. Therefore, this investigation focused most heavily on impacts to surface 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 *et al.* (1975) identified six components that govern the formation of metal-laden acid mine waters. They are as follows:

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

Most geochemists would add 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 material 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 southwestern Montana. The dissolution of any given metal is controlled by the solubility of that metal.

1.3.2 Solubility of Selected Metals

At a pH above 2.2, ferric hydroxide [$Fe(OH)_3$] precipitates to produce a brown-orange stain in surface waters and forms a 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 such as sulfate and phosphates in soil also may control copper solubility in soils. Copper is present in many ore minerals, including chalcopyrite ($CuFeS_2$), bornite (Cu_5FeS_4), chalcocite (Cu_2S), and tetrahedrite ($Cu_{12}Sb_4S_{13}$).

Mercury readily vaporizes under atmospheric conditions and thus, is most often found in concentrations well below the 25 µg/L equilibrium concentration. The most stable form of mercury in soil is its elemental form. Mercury is found in low temperature hydrothermal ores as cinnabar (HgS), in epithermal (hot springs) deposits as native mercury (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, which has an equilibrium concentration of 50 µg/L at a pH between 7.5 and 8.5. As with other metals, concentrations in solution increase with decreasing pH. In sulfate soils with a pH less than 6, anglesite controls solubility while cerussite, a lead carbonate, controls solubility in buffered soils. Lead occurs in the common ore mineral galena (PbS).

Zinc solubility is controlled by the formation of zinc hydroxide and zinc carbonate in natural waters. At a pH greater than eight, the equilibrium concentration of zinc in waters with a high bicarbonate content is less than 100 µg/L. Franklinite may control solubility at pH less than five 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 similar mine evaluation studies, pH and specific conductance (SC) have been used to distinguish "problem" mine sites from those that have no adverse water-related impacts. The general assumption is that low pH (<6.8) and high SC (variable) indicate a problem, and that neutral or higher pH and low SC indicate no problem.

Limiting data collection only to pH and SC largely ignores the various controls on solubility and can lead to erroneous conclusions. Arsenic, for example, is most mobile in waters with higher pH values (>7), and its concentration strongly depends on the presence of dissolved iron. Cadmium and lead also may exceed standards in waters with 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 to 75% of the total dissolved solids (TDS) depending on the concentration of sulfate. Without knowing the sulfate concentration, an estimate of TDS based on SC has a 25% error range. Further, without having a “statistically significant” amount of SC data for a study area, it is hard to define what constitutes a high or low SC value.

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

1.4 Methodology

1.4.1 Data Sources

The MBMG began this inventory effort by completing a literature search for all known mines in Montana. The MBMG plotted the published location(s) of the mines on U.S. Forest Service maps. From the maps, the MBMG developed an inventory of all known mines located on or 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),
2) the MRDS (mineral resource data systems) data base (U.S. Geological Survey),
3) published compilations of mines and prospects data,

4) state publications on mineral deposits,
5) U.S. Geological Survey publications on the general geology of some quads,
6) recent USGS/USBM mineral resource potential studies of proposed wilderness areas,
7) MBMG mineral property files.

During subsequent field visits, the MBMG located numerous mines and prospects for which no previous information existed. Conversely, other mines for which data existed could not be 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 did not have enough information to make that determination without a field visit. For problems to exist, a site must have a source of hazardous substances and a method of transport from the site. Most metal mines contain a source for hazardous substances, but the common transport mechanism, water, is not always present. Consequently, sites on dry ridgetops were assumed to be lacking this transport mechanism, while mines described in the literature as small prospects were considered to have inconsequential hazardous-materials sources; neither type was visited.

In addition, the MBMG and the USFS developed screening criteria (table 1) that they used to determine if a site had the potential to release hazardous substances or posed other environmental or safety hazards. The first page of the Field Form (appendix I) contains the screening criteria. If any of the answers were “yes” or unknown, the site was visited. Personal knowledge of a site and published information were used to answer the questions. Forest Service mineral administrators used these criteria to "screen out" several sites using their knowledge of an area.

Table 1. Screening criteria.

Yes	No		
__	__	1.	Mill site or tailings present
__	__	2.	Adits with discharge or evidence of a discharge
__	__	3.	Evidence of or strong likelihood for metal leaching or AMD (water stains, stressed or lack of vegetation, waste below water table, etc.)
__	__	4.	Mine waste in 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 all "NO" (based on literature, personal knowledge, or site visit), then the site was not investigated any further.

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

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

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 USFS Global Positioning System (GPS) crews. Each site is located by latitude/longitude and by Township-Range-Section-Tract (see appendix I for explanation).

At sites for which 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 1). In other words, if at least one of the first six screening criteria was met, the site was studied further. Sites that were not studied further are included in appendix III.

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

1.4.3.1 Collection of Geologic Samples

The geologist took the following samples, as appropriate:

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

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

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

The three types of samples were used, respectively, to characterize the economic geology of the deposit, to examine the value and metal content of dumps and tailings, and to 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

A 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 be releasing metals in 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 so as to assess conditions on National Forest System lands; therefore, samples sites were located on National Forest System lands to the extent ownership boundaries were known.

Because monitoring wells were not installed as part of this investigation, the evaluations of impacts to ground water were limited to 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 (stream flow) 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 were defined as follows:

D DA T L I C

D: Drainage area - determined from topographic map
DA: Development area (dominant mine)
T: Sample type: T - Tailings, W - Waste Rock, D - Soil, A - Alluvium, L - Slag
S - Surface Water, G - Ground Water
L: Sample location (1-9)
I: Sample interval (default is 0)
C: Sample concentration (High, Medium, Low) determined by the hydrogeologist, based on field parameters.

1.4.4.4 Existing Data

Data collected in previous investigations were neither qualified nor validated under this project. The quality-assurance managers and project 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 analyses performed in the laboratory conformed to the MBMG Laboratory Analytical Protocol (LAP).

1.4.6 Standards

EPA and various state agencies have developed human health and environmental standards for various metals. To 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 Water-Quality Standards

The Safe Drinking Water Act (SDWA) directs EPA to develop standards for **potable** water. Some of these standards are mandatory (primary), and some are desired (secondary). The standards established under the SDWA are often referred to as primary and secondary maximum contaminant levels (MCLs). Similarly, the Clean Water Act (CWA) directs EPA to develop water-quality standards (acute and chronic) that will protect **aquatic organisms**. These standards may vary with water hardness and are often referred to as the Aquatic Life Standards. The primary and secondary MCLs along with the acute and chronic Aquatic Life Standards for selected metals are listed in table 2. 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.

1.4.6.2 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, concentrations of metals in soils were compared to the limits postulated by the U.S. EPA and the Montana Department of Health and Environmental Sciences for sites within the Clark Fork River basin in Montana. The proposed upper limit for lead in soils is 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 pers. comm. 1993) are listed in table 3.

Table 2. Water-quality standards.

	PRIMARY MCL[1] (mg/L)	SECONDARY MCL[2] (mg/L)	AQUATIC LIFE ACUTE[3,4] (mg/L)	AQUATIC LIFE CHRONIC[3,5] (mg/L)
Aluminum		0.05-0.2	0.75	0.087
Arsenic	0.05		0.36	0.19
Barium	2			
Cadmium	0.005		0.0039/0.0086[6]	0.0011/0.0020[6]
Chromium	0.1		1.7/3.1[6,7]	0.21/0.37[6,7]
Copper		1	0.018/0.034[6]	0.012/0.021[6]
Iron		0.3	1	
Lead	0.05		0.082/0.2[6]	0.0032/0.0077[6]
Manganese		0.05		
Mercury	0.002		0.0024	0.000012
Nickel	0.1		1.4/2.5[6]	0.16/0.28[6]
Silver		0.1	0.0041[8]	0.00012[8]
Zinc		5	0.12/0.21[6]	0.11/0.19[6]
Chloride		250		
Fluoride	4	2		
Nitrate	10(as N)			
Sulfate	500[9]	250		
Silica		250		
pH (Standard Units)		6.5 - 8.5		

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

Table 3. Clark Fork Superfund background levels (mg/kg) for soils.

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

1.4.7 Analytical Results

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

The data for this project were collated with existing data and incorporated into a new MBMG abandoned - inactive mines data base. The data base will eventually include mines and prospects throughout Montana. 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 presented in appendix V and are compatible with the MBMG Arc/Info Geographic Information System (GIS).

1.5 Helena National Forest

Approximately 1,246,688 acres are administered by the U.S. Forest Service, Helena National Forest (HNF). The area straddles the Continental Divide in southwestern Montana (figure 1) and includes 83,000 acres in the Scapegoat Wilderness, 28,600 acres in the Gates of the Mountains Wilderness and 160,000 acres in the Elkhorn Wildlife Management Unit. The regional office is located in Missoula, Montana, with the Supervisor’s office in Helena and district offices located in Helena, Townsend, and Lincoln, Montana. The east half of the Butte 1^{o} x 2^{o} and the west half of the White Sulphur Springs 1^{o} x 2^{o} quadrangles cover the area. Helena National Forest-administered land lies within portions of Broadwater, Jefferson, Meagher, Powell, and Lewis and Clark counties.

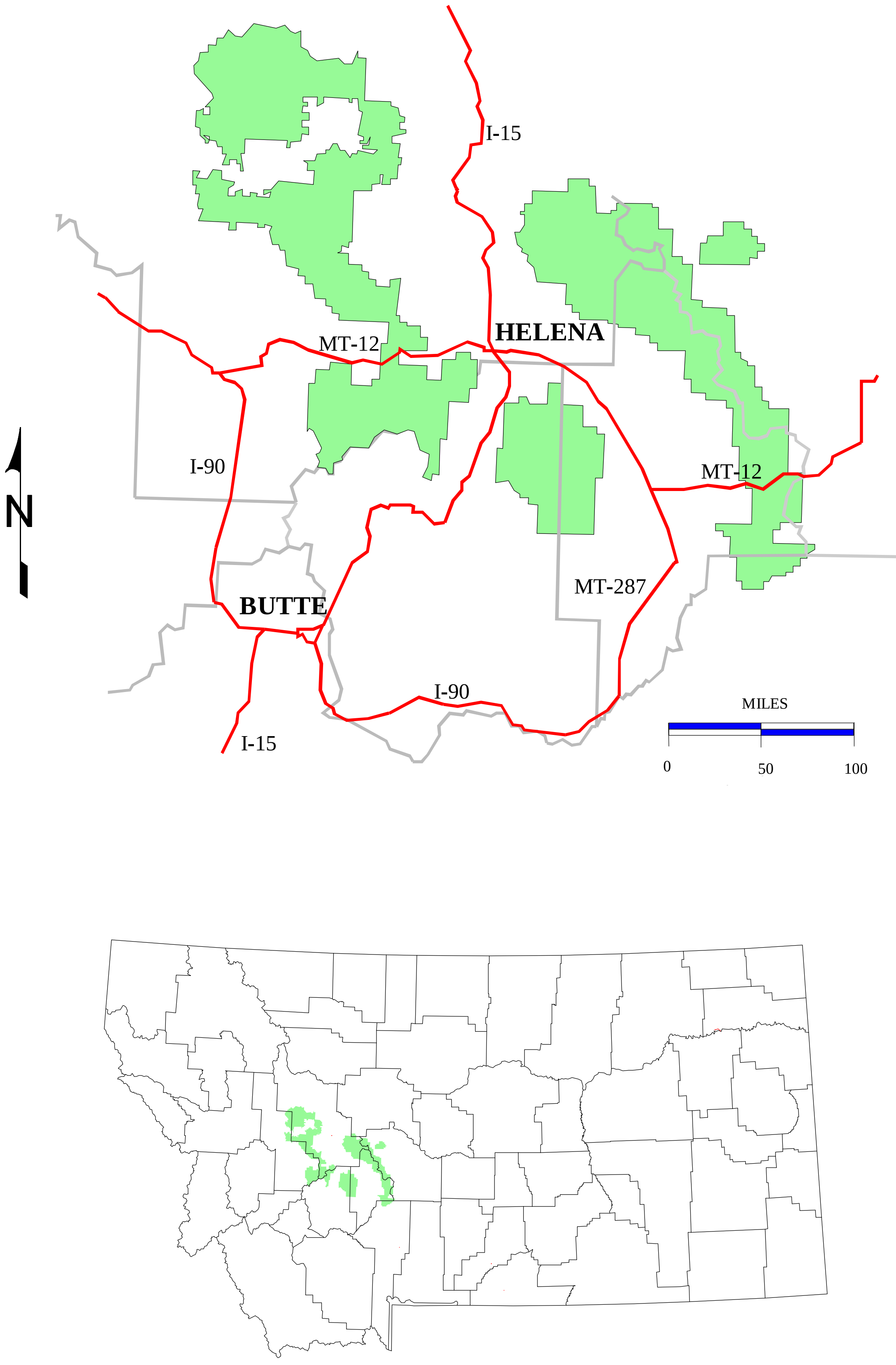

Figure 1. The Helena National Forest and associated wilderness areas cover nearly 1.3 million acres in west-central Montana.

The topography is typical of southwestern Montana's basin and range province, grading from semiarid grass/sagebrush vegetated valleys to coniferous forests and alpine peaks above timberline. Typical elevations in the HNF range from Elkhorn Peak at 9,381 feet in the Elkhorn Mountains, Mount Edith at 9,480 feet in the Big Belts, and Greenhorn Mountain, north of Helena, at 7,400 feet. Valley elevations are about 4,000–4,500 feet.

1.5.1 History of Mining

Some knowledge of the local mining history is helpful in understanding the problems created by the abandoned and inactive mines in the area. Gold was first discovered in the area in Last Chance Gulch in 1864 (Lyden 1948) at the present site of Helena. Associated lode deposits were located soon thereafter; a few of the earliest being the Whitlatch-Union (1864), the Gregory (1864), Legal Tender (1866), East Pacific (1867), and the Drumlummon (1876). According to Sahinen (1959), the majority of the lode mines were in their heyday prior to the turn of the century and have been worked sporadically since then.

The Helena National Forest includes all or part of more than 26 mining districts as defined by Elliot *et al.* (1992), Sahinen (1935), and Pardee and Schrader (1933). These districts include Clancy, Rimini, Elliston, Helena, Scratchgravel Hills/Grass valley, Austin, Ophir, Marysville, Wickes-Corbin, Elkhorn, Buffalo, Nevada Creek, Finn, Heddleston, Stemple-Gould, McClellan Gulch, Lincoln, Big Blackfoot as well as seven loosely defined "areas" on the Butte 1° x 2° sheets. The White Sulphur Springs 1° x 2° sheet contains additional districts of Winston, Park, Radersburg, York, Spokane Hills, and Confederate, Hellgate, and Magpie gulches.

Placers in the area, including those along Tenmile Creek and its tributaries, were worked since the 1860s; they provided only $80,000 in gold from 1864 to 1920. Confederate Gulch was the largest placer-gold producer in Broadwater County, yielding an estimated $12,000,000 by 1933 with gold at $35.00 per ounce (Lyden 1948). Other placers in Broadwater County were found in the Beaver Creek, Indian Creek, and Crow Creek drainages (Lyden 1948). Lesser amounts of gold came from Skelly, Davis, and Greenhorn gulches, Scratchgravel Hills, and the Marysville placers on Silver Creek. Tributaries to the Blackfoot River such as Stonewall, Sauerkraut, and Liverpool creeks have placers. Sapphires, along with gold, are found in the placers of El Dorado, Gruell's, French, and American bars on the Missouri River.

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

1.5.1.1 Production

The total value of minerals produced from all mines within the Helena National Forest boundaries was probably in the range of $190,850,000 with $50 million from placers and approximately $140 million from lode mines (Sahinen 1935). The estimated values reflect the price of commodities at the time of production and not current prices. A more current estimate would total in the range of $294 million (Elliot *et al.* 1992) but again this is a “ballpark” figure.

1.5.1.2 Milling

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

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

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

1.6 Summary of the Helena National Forest Investigation

A total of 468 sites were identified in or near the Helena National Forest (HNF) by using the U.S. Bureau of Mines MILS data base as a basic reference. Other sources of information include Knopf (1913), Pardee and Schrader (1933), Elliot *et al.* (1992), and McClernan (1976, 1983). Table 4 summarizes the process by which the final results were achieved in the Helena National Forest inventory. These numbers are accurate to the extent that the data base is updated and will change reflecting current progress in data base entry.

Table 4. Summary of Helena National Forest investigation.

Total Number of Abandoned/Inactive Mines Sites that were:

PART A - Field Form	
Located in the general area from MILS	468
PART B - Field Form (Screening Criteria)	
Screened out by HNF minerals administrator or by description in literature	140
Location inaccurate	27
Visited by MBMG geologist	301
Screened out by geologist	219
Visited by hydrogeologist	82
Screened out by hydrogeologist	15
PART C - Field Form	
Sampled (Water and Soil)	67

An individual discussion of each of the 67 sites referred to the hydrogeologists and sampled is included in the appropriate volume of the Helena National Forest report. All 468 sites inventoried as possibly affecting HNF-administered land are listed in appendix II of each volume.

1.7 Mining Districts and Drainage Basins

The Helena National Forest includes more than 26 mining districts as defined by several authors. These boundaries are subject to interpretation, change, and often the same district is known by various names. Some mines are not located in traditional districts, so for the purposes of this study, all the mines studied have been organized by drainage basin. This is a convenient way to separate the National Forest into manageable areas for discussion of geology and hydrogeology;

and perhaps more important, it is an aid to the assessment of cumulative environmental impacts on the drainage.

Blackfoot and Little Blackfoot Drainages

The Blackfoot and Little Blackfoot drainages are in the western portion of the Helena National Forest, west of the Continental Divide (figure 2). Major tributaries within this area of the Helena National Forest include Ontario, Telegraph, Snowshoe, Carpenter, and Ophir creeks as tributaries to the Little Blackfoot River which, in turn, joins the Clark Fork River at Garrison. The "Big" Blackfoot River's major tributaries include Beartrap, Pass, Willow, Hogum, and Seven-Up Pete creeks, Poorman, Keep Cool and Lincoln gulches as well as Nevada Creek to the west. The Blackfoot River also drains into the Clark Fork River but at Bonner near Missoula.

2.1 Geology

Little Blackfoot Drainage

The area and its mineral occurrences are influenced by three principal Cretaceous quartz monzonite intrusions: the Boulder batholith south of Elliston, the Marysville stock, and the Blackfoot City stock at Ophir (Schmidt *et al.* 1994). The northern limit of the Elkhorn Mountains Volcanics occurs in the Elliston area where they overlie and are intruded by the Boulder batholith. The Eocene Avon volcanic complex (Trombetta 1987) dominates the western part of the area with its rhyolites and basalts. Tertiary sediments fill the east-west–trending valley and more recent Quaternary gravels, along with local glacial till and outwash deposits fill the Avon-Helmville and the Little Blackfoot valleys. A Paleozoic/ Mesozoic section from Devonian Jefferson to Cretaceous Kootenai is present in the area adjacent to the Little Blackfoot valley and at Ophir. These formations occur associated with the dominant Black Mountain syncline, a large northwest-trending, southeast-plunging fold.

Structure in the area includes the overlapping influences of the leading edge of the Sapphire thrust sheet with its imbricate thrusts, high-angle normal faults (Blackfoot City, Illinois Ridge and Dog Creek faults), and the strike-slip Bald Butte fault, which is a part of the Lewis and Clark line (Schmidt *et al.* 1994). Geologic mapping in the area was done by Wallace *et al.* (1986), Trombetta, (1987), Loen (1990), and Schmidt *et al.* (1994).

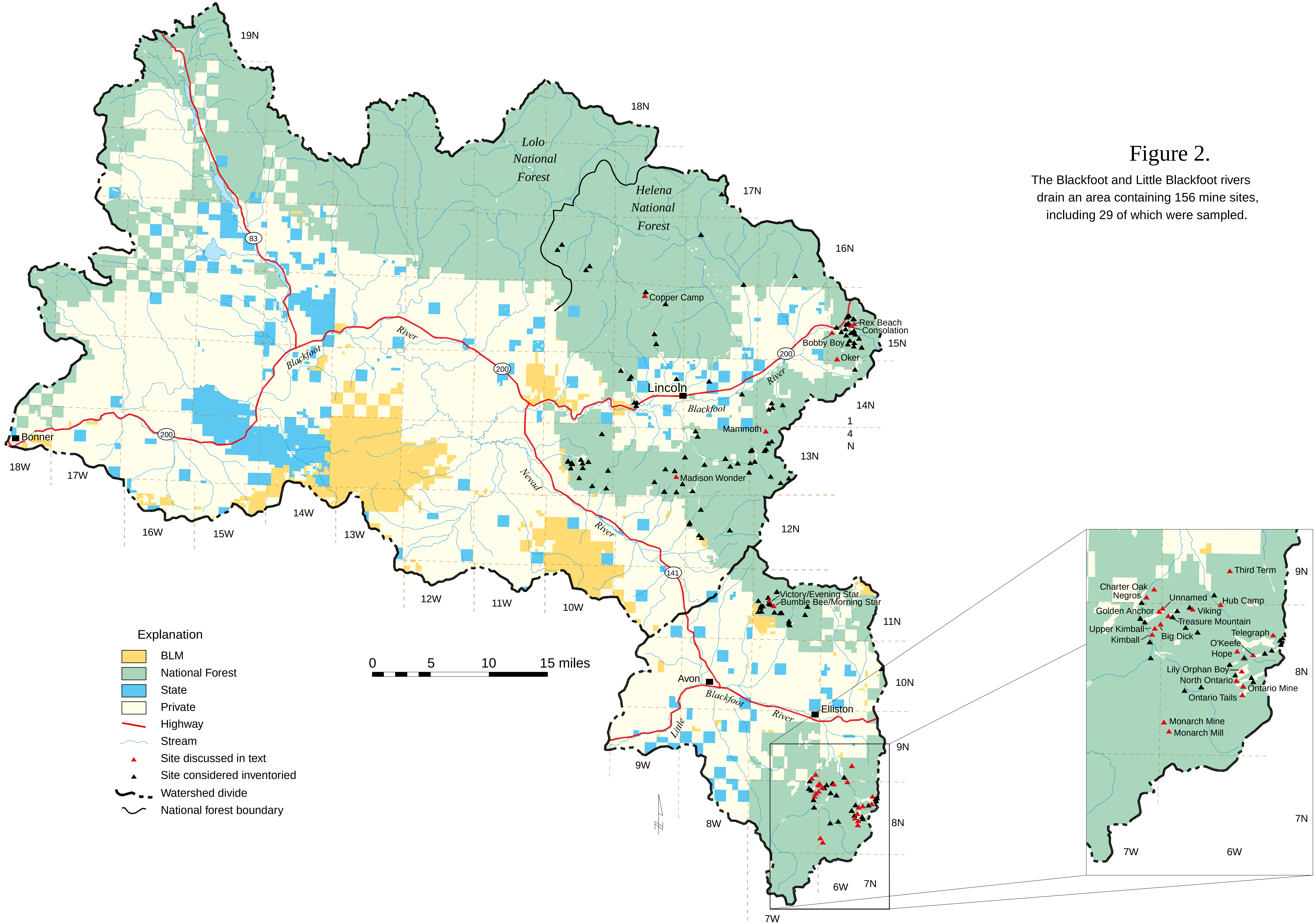

Figure 2.

The Blackfoot and Little Blackfoot rivers drain an area containing 156 mine sites, including 29 of which were sampled.

Blackfoot River

This area is part of the Butte 1° x 2° quadrangle mapped by Wallace *et al.* (1986) at a scale of 1:250,000. The Scapegoat Wilderness, north of the Blackfoot River, was studied as a part of the mineral resource study conducted by the U.S. Geological Survey (Earhart *et al.* 1977); many of their descriptions were based on mapping by Harrison and Grimes (1970).

The Precambrian Helena, Empire, and Spokane formations dominate the geology of the Blackfoot River drainage. Many of these rocks were intruded by intermediate-composition sills of Precambrian age (Earhart *et al.* 1977). The Precambrian formations extend down to immediately north of the Ophir district's Blackfoot City stock and the drainage divide between the Blackfoot River and the Little Blackfoot River. Here, they are truncated by the Blackfoot City fault to the southwest; they end near Helena to the southeast (Schmidt *et al.* 1994).

Small intrusive stocks (Odgen Mountain, Dalton Mountain, Granite Butte and Silver Belle) are associated with scattered small deposits. These stocks have been related to the mineralization, and their erosion has been credited for the occurrence of the placers of the area. The Crater Mountain Volcanics have been deposited east of Lincoln and southeast of Stemple Pass. The Mammoth mine is associated with these volcanics as well as the occurrences at Seven-Up Pete, Keep Cool, and the McDonald project near Lincoln.

2.2 Economic Geology

The portion of Helena National Forest that is west of the Continental Divide contains all or part of many mining districts: Finn, Lincoln, Big Blackfoot, Ogden Mountain, Poorman, McClellan Gulch, Seven-Up Pete, and Heddleston districts, with many small unnamed outliers in the Blackfoot drainage (Sahinen 1935). The Little Blackfoot drainage, in addition, contains the Elliston, Marysville, and Ophir mining districts defined by the USGS (Sahinen 1935, Elliott *et al.* 1992). Figure 2 represents the mines and mills within the Helena National Forest in the Blackfoot and Little Blackfoot River drainages.

Elliston

The Elliston district has been studied by many authors, including Lusty (1973), Robertson (1956), and Regnier (1951). Sahinen (1935) lists the most productive period here as that between 1890 to 1908; although, mining began in the 1860s. Mining on a small scale in the area continued at the time of this study. The northernmost extension of the Boulder batholith occurs in the Elliston district, with volcanics of the Elkhorn Mountains Volcanics hosting the rest of the deposits. The area was noted for its lead and zinc values, but it also produced some gold, silver, and copper.

Ophir

The Ophir mining district is known more for its placer deposits than its lode mines. Lode mines did produce 4991 ounces of gold, 188,672 ounces silver, 591,781 pounds copper, 197,400 pounds lead and 2,766 pounds zinc since records were kept (1902-1968) (McClernan 1976). Total production of placer gold added approximately another 322,000 ounces (Loen 1990). Actual dates of mining range from 1865 to the present. In 1992, American Copper & Nickel had a core drilling project at Ophir (McCulloch 1993) and in 1994, there was an active placer mine in S½ sec. 25, T. 11 N., R. 8 W. The placer was idle but not reclaimed as of 1995. Other recent activity includes Clarke Smith's application for two mining patents along Ophir Creek in the vicinity of the Bumble Bee/Morning Star.

Both the lode and placer mines of the area have been studied by Pardee and Schrader (1933), Lyden (1948), McClernan (1976) and Loen (1990). Ophir mines were also included in Elliot *et al.* (1992).

Lodes are primarily in limestone (Meagher, Hasmark, Jefferson, and Madison formations) that have been intruded by the Blackfoot City stock, a Cretaceous granodiorite, or quartz monzonite. Most are irregular skarn occurrences but the Victory and others are described as pipe-like replacement bodies (Pardee and Schrader 1933). The Katie Allen and mines on the southeast side of the district are disseminated deposits in rhyolite dikes. Vein deposits such as the Nancy Helen and Fairview that are associated with shear zones occur in the southwest portion of the district (Loen 1990).

Heddleston

The Heddleston mining district's ore deposits are hosted by various lithologies and are affected by a complex history of intrusion, faulting, and several episodes of veining and alteration. Precambrian Belt Series, Spokane Formation, and a late Proterozoic diorite sill were intruded by Tertiary monzonite/quartz monzonite porphyry (both as stocks and dikes), and Tertiary breccias associated with the Mike Horse stock (Whipple *et al.* 1987). Mineralization occurs in: 1) the porphyry intrusives, 2) breccias formed along the intrusive contacts, and 3) in the heavily fractured wallrocks (Miller *et al.* 1973). Structural trends in the area include N20^{o}-40^{o}E and later N50^{o}-70^{o}W faults that control the emplacement of mineralized porphyry dikes (Miller *et al.* 1973). Chalcopyrite - molybdenite deposits are primarily hosted by veins in the porphyry intrusives. Supergene enrichment is widespread but not uniformly present; it is controlled by older fracturing and older veins. The Anaconda Company controlled 41 patented claims, 187 unpatented claims, 3,500 additional acres and drilled over 220,000 feet in the Heddleston district. Total production from the area equaled $25,000,000 (Castle 1978).

Primary references used for this area include Pardee and Schrader (1933), Shea (1947), Lyden (1948), and McClernan (1983), as well as various annual mining directories of Montana. Pardee and Schrader's (1933) encompassing report on the area includes summaries of the active mines at the time. They place the area into historical perspective, beginning with its discovery in 1889 by William Heddleston and George Padbury. Miller *et al.* (1973) pick up where mining left off in 1964 and describe Anaconda Company's exploration efforts from 1962 to 1970. Castle (1978) also summarizes Heddleston's history and geology in his thesis on pedogeochemical and biogeochemical trends in the area. Earhart *et al.* (1977) studied the proposed additions to the Scapegoat Wilderness, including the Alice Creek occurrences. Connor and McNeal (1988) studied in detail the geologic setting of the copper/silver occurrence near Alice Creek. Whipple and Bregman (1981) mapped the Rogers Pass quadrangle at 1:24,000 scale; Whipple, Mudge, and Earhart (1987) published a geologic map of the Rogers Pass area at 1:48,000 scale. Stout (1949) described the mines in the Ogden Mountain (or Big Blackfoot) mining district at a scale of 1:24,000.

Area near Lincoln, Montana

Host rock for the majority of the mines in this area is Precambrian (Belt) Helena Formation (Wallace) and to a lesser degree the Empire, and Spokane formations. Earhart *et al.* (1977) summarize copper deposits north of Lincoln as: 1) vein-type deposits (Cotter Basin and Copper Camp), 2) deposits in calcareous sandstone (Byrnes Creek), and 3) other copper deposits (Giant claim). The Blackfoot and Giant mines are hosted by diorite intrusives into the above formations.

Primary references used in the Lincoln area include Pardee and Schrader (1933), Shea (1947), Lyden (1948), and McClernan (1983), as well as various annual mining directories of Montana. Earhart *et al.* (1977) studied the proposed additions to the Scapegoat Wilderness, including mines Cotter Basin, Copper Camp, Byrnes Creek, Stonewall Creek, and Giant occurrences. Byer (1987) studied the Cotter Basin deposit’s geology and geochemistry.

The Big Blackfoot/Ogden Mountain area was studied by Stout (1949). Many scattered deposits including those in the Finn district occur along the area from Ophir to the Blackfoot River. The placers in Jefferson, Washington and Buffalo gulches have been worked since the 1890s.

2.3 Hydrology and Hydrogeology

Average annual precipitation in the Blackfoot drainage ranges from 14 inches in valleys to greater than 60 inches in the mountains. In the Little Blackfoot drainage, precipitation ranges from 14 inches in valleys to greater than 30 inches in the mountains. Most precipitation occurs in the spring months in the form of rain or snow. Temperatures in the area vary from well below 0^{o}F during the winter to over 90^{o}F during the summer.

The Blackfoot and Little Blackfoot drainages have an areal extent of about 2,700 square miles. Both drainages descend southwestward from greater than 8,000 feet above sea level in the headwaters, to 4,340 feet above sea level at Garrison and 3,340 feet above sea level at Bonner.

The USGS currently maintains three stream-flow gaging stations within the Little Blackfoot and Blackfoot drainages. The locations, periods of record, drainage areas, and annual mean flows are summarized in table 5.

Table 5. Stream gage locations within the Little Blackfoot and Blackfoot drainages.

Gage Location	Period of Record (water year)	Drainage Area (sq. miles)	Annual Mean Flow (cfs)
Little Blackfoot River near Garrison, MT	1973-1995	407	155
Nevada Creek above reservoir near Finn, MT	1939-1995	116	35.8
Blackfoot River near Bonner, MT	1900-01, 1904, 1940-present	2,290	1,573

2.4 Summary of the Blackfoot and Little Blackfoot Drainages

There are 191 mine and mill sites on or near the Helena National Forest within the Blackfoot and Little Blackfoot drainages. Of these, 35 were determined to have a potential to have adverse effects on soil or water quality on HNF-administered land. Of the 35 that have a potential of affecting HNF-administered land, 18 sites have one or more discharges from workings or waste material and 17 sites exhibited signs of water or wind erosion. Six sites in the Heddleston district were designated CECRA (Comprehensive Environmental Cleanup and Response Act) sites as a part of the Upper Blackfoot mining complex and were actively being remediated during the time this study was being conducted.

The sites listed in **bold** exhibited one or more environmental problems and are discussed in the following sections. The mines in these drainages are presented generally upstream to downstream with the Little Blackfoot discussed first because it drains into the Clark Fork, the farthest upstream toward the headwaters. Then the mines of the Blackfoot River drainage are discussed again, upstream to downstream.

All of the sites inventoried are presented in tables 6 and 7. If mine openings or other dangerous features (unstable structures, highwalls, steep waste-rock dumps) were observed at a site on HNF-administered land, it is identified (Y) under the hazard heading in each table. In general, only those sites at which samples were collected were evaluated. Of the 191 sites inventoried, 45 sites on or partially on HNF-administered land were identified as having potential safety problems.

The mines in the Blackfoot River drainage marked with an asterisk (*) in table 7 were actively being remediated during the time of this study in connection with the Upper Blackfoot mining complex, CECRA superfund sites. No samples were taken because of safety factors involved and the detail of the previous studies of the area.

Table 6. Summary of sites in the Little Blackfoot drainage (Elliston and Ophir districts).

NAME	ID #	VISIT	OWNER[2]	SAMPLE	HAZARD[4]	REMARK
Adams Brothers mine	PO002774	Y	NF	N	NE	Dry
Ajax mine	PO001327	Y	NF	N	Y	Dry NVI, open adits & shafts
Anna R and Hattie M	PO002882	N	UNK	N	NE	Location inaccurate
Arnold mine	PO004905	Y	PRV	N	Y	Dry NVI, open adits
Big Dick/Black Jack	PO002888	Y	NF	N	Y	No comments
Big Dick mill site [3, 5]	PO008244	Y	NF	Y	Y	Tailings in stream
Blackfeet No. 1	PO004795	N	UNK	N	NE	Location inaccurate
Bluebird	PO002924	N	PRV	N	NE	Field sheet filled out
Bluebird East	PO008250	N	PRV	N	NE	Mine discharge
Bullion	PO002522	N	PRV	N	NE	No comments
Bullion South	PO008358	Y	NF	N	NE	Dry NVI
Bumble Bee/Morning Star [3]	PO005195	Y	NF	Y	NE	Small adit discharge
Charter Oak [3]	PO005095	Y	NF	Y	Y	Adit discharge / streamside tailings
Cyclone/Whirlwind	PO005170	Y	NF	N	Y	Partly open shaft
Divide shafts	PO007463	Y	NF	N	NE	No comments
Eldorado mine	PO005230	Y	NF	N	Y	Boards over open shaft
Esmeralda	PO002906	Y	NF	N	NE	Dry, NVI
Flora mine	PO004685	N	NF	N	NE	No comments
Golden Anchor [3]	PO005110	Y	PRV	Y	NE	Streamside waste.
Hardluck	PO005045	Y	NF	N	Y	Dry NVI
Hope adit [3]	PO008236	Y	NF	Y	NE	Adit discharge
Hub Camp [3]	PO005320	Y	NF	Y	Y	Adit discharge
Julia mine	PO005140	Y	NF	N	NE	No comments
Kimball mines [3]	PO004950	Y	NF	Y	NE	Waste in floodplain
Lady Smith/Shamrock	PO008169	Y	PRV	N	Y	Dry NVI, steep slopes
Lily - Orphan Boy [3]	PO004970	Y	PRV	Y	NE	Waste in stream
Little Daisy mine	PO004975	Y	NF	N	NE	Dry NVI
Lower Telegraph	PO005325	N	UNK	N	NE	No comments
Mary Quartz lode	PO007472	Y	NF	N	NE	Reported adit discharge
McKay mine	PO004995	Y	MIX	N	NE	Dry NVI
Monarch mill [3, 5]	PO008254	Y	NF	Y	Y	Tailings in floodplain
Monarch mine [3]	PO002470	Y	NF	Y	Y	Adit refurbished
Nancy Helen	PO008276	Y	NF	N	NE	Dry, caved adits
Nancy mine	PO005050	Y	NF	N	Y	Open adit
Negros [3]	PO005055	Y	PRV	Y	Y	Waste in floodplain
Newman's Camp	PO007465	Y	NF	N	Y	Active

NAME	ID #	VISIT	OWNER[2]	SAMPLE	HAZARD[4]	REMARK
Nora Darling	LC004489	Y	NF	N	Y	Partly open workings
N. Fork O'Keefe Creek	PO007464	Y	PRV	N	Y	No comments
North Ontario [3]	PO008238	Y	NF	Y	Y	Adit discharge
North Pole mine	PO002464	N	UNK	N	NE	Location inaccurate
O'Keefe Creek/Copper King ? [3]	PO008227	Y	PRV	Y	Y	Active site, streamside waste
O'Keefe Mountain adits	PO007468	Y	PRV	N	NE	Adit discharge
Ohio-Speculator mine	PO002840	N	UNK	N	NE	Bad map location
Ontario [3, 5]	PO005435	Y	MIX	Y	NE	Adit discharge, mill site
Open adits	PO008286	Y	NF	N	Y	Open adits on hillside
Ophir Cave	LC004349	Y	NF	N	Y	Open cave
Pond adit	PO008237	Y	NF	N	NE	No comments
Pond shaft	PO007469	Y	NF	N	NE	Flooded shaft
Price Group mine	PO005065	Y	NF	N	NE	Dry NVI
Steel Frame shaft	PO008235	Y	PRV	N	NE	Flooded shaft
Stumble Upon	PO008170	Y	NF	N	NE	Dry NVI
Sunrise mine	PO002458	Y	NF	N	NE	No comments
Surething mine	PO002624	Y	PRV	N	NE	No comments
Surething South	PO008260	Y	NF	N	NE	Dry NVI
Telegraph/Telegraph Creek [3, 5]	PO002936	Y	NF	Y	Y	Adit discharge, mill site
Third Term [3]	PO005360	Y	NF	Y	Y	Reclaimed adit collapsed, intermittent adit discharge
Track adit (?)	PO007467	Y	NF	N	Y	Active site
Treasure Mountain [3]	PO002630	Y	NF	Y	NE	Adit discharge
Unnamed	LC007462	N	NF	N	Y	No comments
Unnamed	PO007461	N	UNK	N	Y	Dry NVI
Unnamed	PO007473	N	NF	N	Y	MBMG source: Dave Turner
Unnamed 8N6W6ABD [3]	PO008368	Y	PRV	Y	NE	Adit discharge on to HNF-administered land
Unnamed mine- sec 20	PO008015	Y	NF	N	Y	Dry NVI
Unnamed open shaft	LC008016	Y	NF	N	Y	Open shaft
Unnamed quarries	PO005175	N	NF	N	Y	Steep highwalls
Unnamed sec 15	PO008259	N	UNK	N	NE	Dry NVI
Unnamed sec 19	PO008279	Y	NF	N	Y	Open adit by road
Upper Kimball (Kimball North) [3]	PO008243	Y	NF	Y	NE	Adit discharge, streamside waste
Victory/Evening Star [3, 5]	LC007276	Y	MIX	Y	Y	Sreamside tailings, mill site
Viking mine [3]	PO002636	Y	NF	Y	Y	Adit discharge
Wall Street mine	PO002642	Y	NF	N	Y	Dry NVI, open adits
Wolverine	PO005070	Y	NF	N	Y	No comments

1) Mines in **bold** may pose environmental problems and are discussed in the text; others are included only in appendix II (all mines) and appendix III (sites visited).

2) Administration/Ownership Designation

NF: HNF-administered land
PRV: Private
MIX: Mixed (HNF-administered land and private)
UNK: Owner unknown

3) Solid and/or water samples (including leach samples).
4) Y: Physical and/or chemical safety hazards exist at the site.
NE: Physical and chemical safety hazards were not evaluated.
5) Mill site present

Table 7. Summary of sites in the Blackfoot River drainage (Heddleston, Lincoln, Poorman, Big Blackfoot and Finn districts).

NAME	ID #	VISIT	OWNER [2]	SAMPLE	HAZARD [4]	REMARK
Adele mine	LC001183	Y	NF	N	NE	Open cut, other workings not located
All placer	LC001045	N	MIX	N	NE	Screened out
Alice Creek	LC001183	Y	NF	N	NE	Open cut, assay PAAM-1
American Gulch placer	PO002314	N	MIX	N	NE	Screened out
Anaconda * [,5]	LC001345	Y	PRV	N	NE	Part of Upper Blackfoot mining complex state superfund site, active cleanup
Black Watch	LC004474	Y	NF	N	NE	No comments
Blackfoot mine	LC007393	Y	MIX	N	Y	Open adits & shaft
Blackfoot tailings [5]	LC008025	Y	MIX	N	NE	Dry, no discharge, studied by DSL-AMRB, moved in 1996
Blacktail Cave	LC004369	N	PRV	N	NE	Private
Blue Star	LC004619	Y	NF	N	NE	No comments
Bobby Boy mine [3]	LC001201	Y	NF	Y	Y	Flooded adit with small discharge, streamside waste
Bugle Mountain group	PO002260	N	NF	N	NE	No site visit, prospects
Butterfly mine	LC001555	Y	NF	N	NE	No comments
Byrnes Creek Copper	LC007349	Y	NF	N	NE	Outcrop only, some sampling
Calliope / Copper Gate	LC007396	Y	PRV	N	NE	Private, dry, collapsed adits
Carbonate * [,5]	LC001951	Y	PRV	N	NE	Part of Upper Blackfoot mining complex state superfund site, active cleanup
Carbonate Hill	LC007389	Y	NF	N	Y	Open cut and adits, seep discharge
Chicken Creek placer	PO002326	Y	NF	N	NE	No comments
Chimney Creek placer	PO005035	N	UNK	N	NE	No comments
Columbia mine	LC007401	N	PRV	N	NE	No comments
Consolation [3]	LC001801	Y	PRV	Y	NE	Streamside waste dump
Copper Bowl mine	LC001207	N	UNK	N	NE	Could not locate
Copper Camp/Rainy Day [3]	LC001597	Y	NF	Y	Y	2 adit discharges

NAME	ID #	VISIT	OWNER [2]	SAMPLE	HAZARD [4]	REMARK
Corbin mine	PO004640	Y	NF	N	NE	No comments
Cotter Basin mine	LC007347	Y	NF	N	Y	Steep highwalls, large open cuts, 2 caved adits
Crumb mine	LC007329	Y	NF	N	NE	No comments
Cyclone mine	LC007312	Y	MIX	N	NE	No comments
Dan Oker's mine	LC001885	N	UNK	N	NE	No comments
Davis Gulch adits	LC008133	Y	NF	N	NE	No comments
Deer Creek mine	PO002320	N	UNK	N	NE	No comments
Discovery & Margurette	LC001105	N	NF	N	NE	Location inaccurate
Edith *	LC008028	N	PRV	N	NE	Part of Upper Blackfoot mining complex state superfund site, active cleanup
Eureka claim	LC007408	N	PRV	N	NE	Location uncertain, private patented claim
Fisher group	PO002254	N	NF	N	NE	No site visit, wilderness
Giant claim	LC007350	Y	PRV	N	NE	Dry caved adit, patented
Gold Dollar mine	LC004314	N	UNK	N	NE	Private. Not evaluated
Gossan & Junior claims	LC001741	Y	NF	N	NE	Workings caved, one small spring & 2 ponds
Granite Butte prospects	LC008140	Y	NF	N	NE	No comments
Gray	PO002564	N	MIX	N	NE	No comments
Green Mountain occurrence	LC008202	N	NF	N	NE	Unlikely to impact
Heddleston deposits	LC001675	N	MIX	N	NE	General category
Heddleston group	LC001723	N	MIX	N	NE	General category
Hidden Vein Copper	LC001531	N	PRV	N	NE	No visit, private, trench only
Higgins prospect	PO004715	Y	NF	N	NE	No comments
Hilda/Blackfoot Gold/ Blackfoot	PO005235	Y	NF	N	NE	No comments
Hill Top/Hilltop	PO002576	N	UNK	N	NE	No comments
Hobby Horse mine	PO004720	N	PRV	N	NE	No comments
Hog claim	LC007338	N	PRV	N	NE	No visit, private, reclamation below
Hogall	LC007359	N	PRV	N	NE	No visit, private, reclamation below, reported discharge
Hopkins prospect	PO005030	N	UNK	N	NE	No comments
Humdinger group	LC001225	Y	NF	N	NE	No comments
Humdinger mine	PO005240	N	UNK	N	NE	Mislocated
Illini mine	LC001231	Y	PRV	N	NE	Prospects only
Iron Hill claim	LC007368	Y	NF	N	NE	1 small seep at lower adit, unable to sample
Jefferson Creek placer	PO005075	N	UNK	N	NE	Screened out, placer
Jefferson Gulch	LC007379	N	MIX	N	NE	Screened out
John Neufeld	LC001585	N	UNK	N	NE	Location inaccurate

NAME	ID #	VISIT	OWNER [2]	SAMPLE	HAZARD [4]	REMARK
Keep Cool Creek	LC007422	N	PRV	N	NE	Screened out, placer
Kilburn placer	PO004945	N	UNK	N	NE	Placer
King David lode	LC004574	N	UNK	N	NE	Location inaccurate
Kleinschmidt	LC007384	N	PRV	N	NE	No site visit, private
Klondike mine	PO004955	N	NF	N	NE	No site visit
L and M placer	PO004960	N	MIX	N	NE	Screened out
Last Chance mine	LC007386	N	UNK	N	NE	No comments
Lincoln Creek	LC007419	N	MIX	N	NE	Screened out
Lincoln Gulch placer	LC001129	Y	NF	N	NE	1 active placer, rest of creek historically placered
Lincoln Valley Bentonite	PO002492	N	PRV	N	NE	Screened out, private
Lincoln View mine	LC001051	N	MIX	N	NE	Location inaccurate
Liverpool Creek	LC007421	N	PRV	N	NE	Screened out/ private/no impact to USFS
Lucky Bernice No. 3	LC004274	N	PRV	N	NE	Screened out, private
Lucky Strike	LC001909	Y	NF	N	NE	No comments
Madison Gulch placer	PO002302	N	UNK	N	NE	Screened out
Madison Northwest	LC008077	Y	NF	N	NE	No comments
Madison Wonder [3]	LC008076	Y	MIX	Y	NE	Small adit discharge & streamside waste
Mammoth mine [3]	LC004324	Y	NF	Y	NE	Small discharge; streamside waste
Mary P. *	LC008026	Y	PRV	N	NE	Part of Upper Blackfoot mining complex state superfund site, active cleanup
Mascotte mine	PO005185	Y	PRV	N	NE	No comments
McCacran	PO002918	N	NF	N	NE	Adit discharge
McClellan mine	LC007432	N	MIX	N	NE	Screened out
Midnight	LC007358	N	UNK	N	NE	Unable to locate
Mike Horse *	LC004559	Y	PRV	N	NE	Part of Upper Blackfoot mining complex state superfund site, active cleanup
Milliron	LC007433	Y	PRV	N	Y	Same as R.T.C. & Ward Thompson
Mineral Hill prospect	PO005000	N	NF	N	NE	No site visit, wilderness
Nellie Miles lode	LC004294	N	NF	N	NE	No site visit, wilderness
Oker / Sandbar Creek adits [3]	LC007296	Y	NF	Y	NE	Streamside waste, stained water
Old Shoe No 1 placer	PO004985	N	MIX	N	NE	Screened out
Pack Horse	LC008078	Y	NF	N	Y	Dry NVI
Paymaster *	LC007304	Y	PRV	N	NE	Part of Upper Blackfoot mining complex state superfund site, active cleanup
Plutarc mine	PO004890	Y	NF	N	NE	No comments
Poorman Creek	LC007416	N	UNK	N	NE	Placer

NAME	ID #	VISIT	OWNER [2]	SAMPLE	HAZARD [4]	REMARK
Poorman mines	LC008147	Y	NF	N	NE	No comments
Porto Rico mine	PO004895	N	NF	N	NE	No site visit, wilderness
Prize mine	LC007317	Y	MIX	N	NE	No comments
R. T. C. lode	LC001957	Y	PRV	N	NE	One seep, unable to sample
Rainy Day mine	LC001525	Y	NF	N	NE	See Copper Camp
Red Rock claims	LC001021	N	NF	N	NE	Screened out, prospect
Red Star	LC001903	Y	MIX	N	NE	No comments
Red Wing	LC007319	N	PRV	N	NE	Private, active reclamation below
Rex Beach [3]	LC007321	Y	NF	Y	NE	Adit discharge/ streamside waste
Rover mine	LC007323	N	PRV	N	NE	No comments
Seven-up Pete Creek	LC007423	N	UNK	N	NE	No comments
Sheep Creek No. 1 & 2 placer	LC001915	N	NF	N	NE	No site visit
Silver Bell mine	LC001843	N	PRV	N	NE	No comments
Skyscraper	LC007302	Y	NF	N	NE	Dry NVI, prospects
Smith Jones	PO008121	N	NF	N	NE	Screened in office
Stonewall Creek placer	LC007410	Y	NF	N	NE	Placer, dredge piles
Sunshine	PO002350	Y	NF	Y	NE	Mill site
Swansea mine	LC004239	N	PRV	N	NE	No comments
Unknown (Poorman)	LC008150	Y	MIX	N	NE	No comments
Unnamed Lincoln Gulch mines	LC008024	Y	MIX	N	Y	Open inclined shaft & adit
Unnamed Poorman	LC008156	Y	NF	N	NE	No comments
Upper Copper Creek	LC004409	N	NF	N	NE	Screened out, general loc
Ward Thompson	LC001471	Y	PRV	N	NE	Seep only, could not sample
Washington Gulch	PO002654	N	UNK	N	NE	Mislocated
White Hope	LC008027	N	PRV	N	NE	Private, active
Wiggins mine	LC001039	N	PRV	N	Y	Active mine
Wiggins West	LC008075	Y	NF	N	NE	No comments
William Paul placer	PO005135	N	MIX	N	NE	Screened out
Wilson Creek placer	PO008225	N	UNK	N	NE	No comments

1) Mines in **bold** may pose environmental problems and are discussed in the text; others are included only in appendix II (all mines) and appendix III (sites visited).
2) Administration/Ownership Designation
NF: HNF-administered land
PRV: Private
MIX: Mixed (HNF-administered land and private)
UNK: Owner unknown
3) Solid and/or water samples (including leach samples)
4) Y: Physical and/or chemical safety hazards exist at the site.
NE: Physical and chemical safety hazards were not evaluated.
5) Mill site present
*) See page 25, last paragraph

2.5 Telegraph Mine and Mill

2.5.1 Site Location and Access

The Telegraph mine (T08N R05W 11ABAC) is immediately adjacent to the Tenmile-Telegraph Creek road near Bullion Parks. The site is entirely on HNF-administered land. The road is generally well traveled; a hiker's vehicle was parked near the mine at the time of the visit.

2.5.2 Site History - Geologic Features

A brief description of a shallow adit in a streambed and a stamp mill can be found in McClernan (1976). A placer worked cobbles of argillized quartz monzonite and aplite and left placer tailings. Production as reported in McClernan (1976) for the years of 1927, 1928, and 1934 totaled 30 tons of ore yielding 17 ounces gold, 339 ounces silver, 24 pounds of copper, and 994 pounds of lead.

2.5.3 Environmental Condition

The site consisted of a collapsed, discharging adit on the north side of the road and a mill building and tailings on the south side of the road. The adit discharge infiltrated the ground about 100 feet from its origin and before it reached the road. A spring emerged near the mill and flowed through what appeared to be a mix of waste rock, tailings and native material before flowing into Bryan Creek. The average elevation of the site is 6,760 feet.

2.5.3.1 Site Features - Sample Locations

The Telegraph mine and mill site was visited and sampled on 8/3/95. A sample of the adit discharge (MTGS10M) was collected. The discharge flowed 12 gpm and had a pH of 4.78 and an SC of 105 µmhos/cm. A second sample (MTGS20M) was collected from the small stream just below the mill site. The stream was flowing about 5 gpm, with a pH of 4.53 and an SC of 97 µmhos/cm. Bryant Creek was dry for several hundred feet downstream, and so was not sampled. A soil sample (MTGD10M) was collected near the stream where tailings, waste rock, and soil had mixed. Site features and sample locations are shown in figure 3; photographs are shown in figures 3a, and 3b.

2.5.3.2 Soil

Arsenic concentration in the soils below the mill was high but did not exceed the phytotoxic limit of 100 mg/kg (table 8). The concentrations of other metals were generally well below phytotoxic limits. This sample represents a significant amount of material that has been washed down from

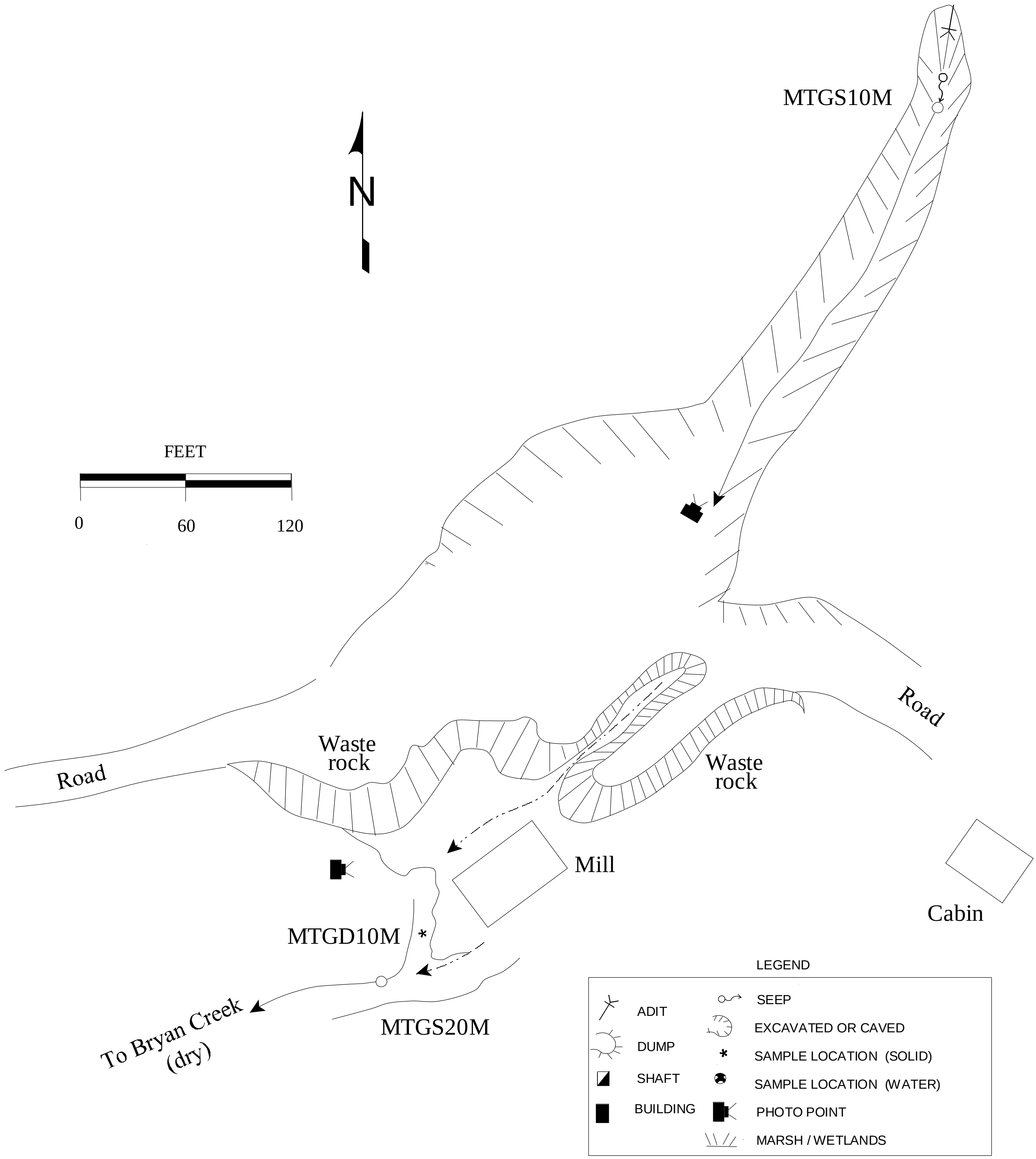

Figure 3. The Telegraph Creek mine (8/3/95) was discharging water from the adit and from springs below the mill. The site is bisected by the main road between Telegraph Creek and Tenmile Creek.

Figure 3a. The adit of Telegraph mine discharged acidic water with ferric hydroxide evident along the discharge channel.

Figure 3b. The Telegraph mill was in poor condition. The area was generally overgrown by small trees and bushes.

the mill area toward Bryan Creek. The steep slope of the area and channelized nature of the small stream suggests a large sediment load is possible during runoff events.

Table 8. Soil sampling results at the Telegraph mine and mill (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Below mill, next to stream (MTGD10M)	95.3[1]	0.92[1]	32.2[1]	152[1]	43

(1) Exceeds one or more Clark Fork Superfund background levels (table 3)

2.5.3.3 Water

Both the adit and the stream below the mill exceeded MCLs for several constituents (table 9). Overall, the chemistry of the two waters was different and indicated little relationship. The adit discharge infiltrated the ground before reaching the road; however there was some evidence that the discharge stream flows alongside the road for some distance at other times. Although Bryan Creek was dry in the area below the mill, it was apparent that the stream from the mill flowed into an active creek at other times of the year.

Table 9. Water-quality exceedences at the Telegraph mine and mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (MTGS10M)				C		A,C			S				A,C						
Unnamed stream below mill (MTGS20M)						C		C	S				A,C						

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

2.5.3.4 Vegetation

Local undisturbed vegetation at the site consisted of weeds, grasses, brush, and conifers. In the waste-rock dump areas, the ground was barren to sparsely vegetated. The area below the site near Bryan Creek showed some stressed vegetation near the small stream.

2.5.3.5 Summary of Environmental Condition

The soils below the mill contain moderate concentrations of metals. The stressed vegetation, steep slope, and channelized stream enable sediment loading to Bryan Creek. The adit discharge exceeded several MCLs, as did the small unnamed stream below the mill.

2.5.4 Structures

In addition to the mill building, there was a small cabin. Both buildings were on the steep hill below the road on HNF-administered land.

2.5.5 Safety

The mill building was in poor condition and in danger of collapse. The highwalls near the caved adit were steep and, in some areas, appeared unstable.

2.6 North Ontario Mine

2.6.1 Site Location and Access

The North Ontario mine (T08N R06W 22BADD) is on a tributary near the head of O'Keefe Creek. The site is approximately 1,500 feet southwest of the main road and is accessible only by trail. The main road is well traveled from Telegraph Creek to Ontario Creek. All of the workings are on HNF-administered land.

2.6.2 Site History - Geologic Features

No references to this mine were found in the literature. It is assumed that the geology is similar to that of the Ontario mine and other mines in the area. Robertson (1956) and Lusty (1973) are the two most specific references for this area.

2.6.3 Environmental Condition

The site consisted of one open adit and associated waste-rock dump on HNF-administered land. The adit was discharging water that flowed across the dump, into a small pond, and then down the side of the waste-rock dump. The stream was not flowing about 500 feet below the site. The average elevation of the site is 7,200 feet.

2.6.3.1 Site Features - Sample Locations

The site was sampled on 8/9/95. A sample was collected of the adit discharge (OONS10L) just inside the portal. The adit was discharging about 13 gpm, the pH was 7.24, and the SC was about 46 µmhos/cm. A second sample (ONOS20L) was collected from the stream at a point just below the waste-rock dump. At this location, the stream was flowing only about 3 gpm. The pH was 7.24, and the SC was about 49 µmhos/cm. A soil sample (ONOD10L) was collected near the base of the waste-rock dump where waste and soils had mixed. Site features and sample locations are shown in figure 4; photographs are shown in figures 4a and 4b.

2.6.3.2 Soil

Soils adjacent to the disturbed area did not appear to be impacted; however, the concentration of arsenic was close to the phytotoxic limit. The concentrations of all of the metals considered were well above the Clark Fork background levels (table 10). Erosion of the dump appeared minimal; there was no evidence of mass wasting.

Table 10. Soil sampling results at the North Ontario mine (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
At base of waste-rock dump (ONOD10L)	86.2[1]	2.1[1]	106[1,2]	141[1]	151[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3)
(2) Exceeds phytotoxic levels (table 3)

2.6.3.3 Water

The concentration of zinc exceeded acute and chronic aquatic life criteria in both samples (table 11). The concentration of the other constituents considered were generally well below MCLs. There was little, if any, significant increase in concentrations of metals in the stream below the dump compared to the adit discharge.

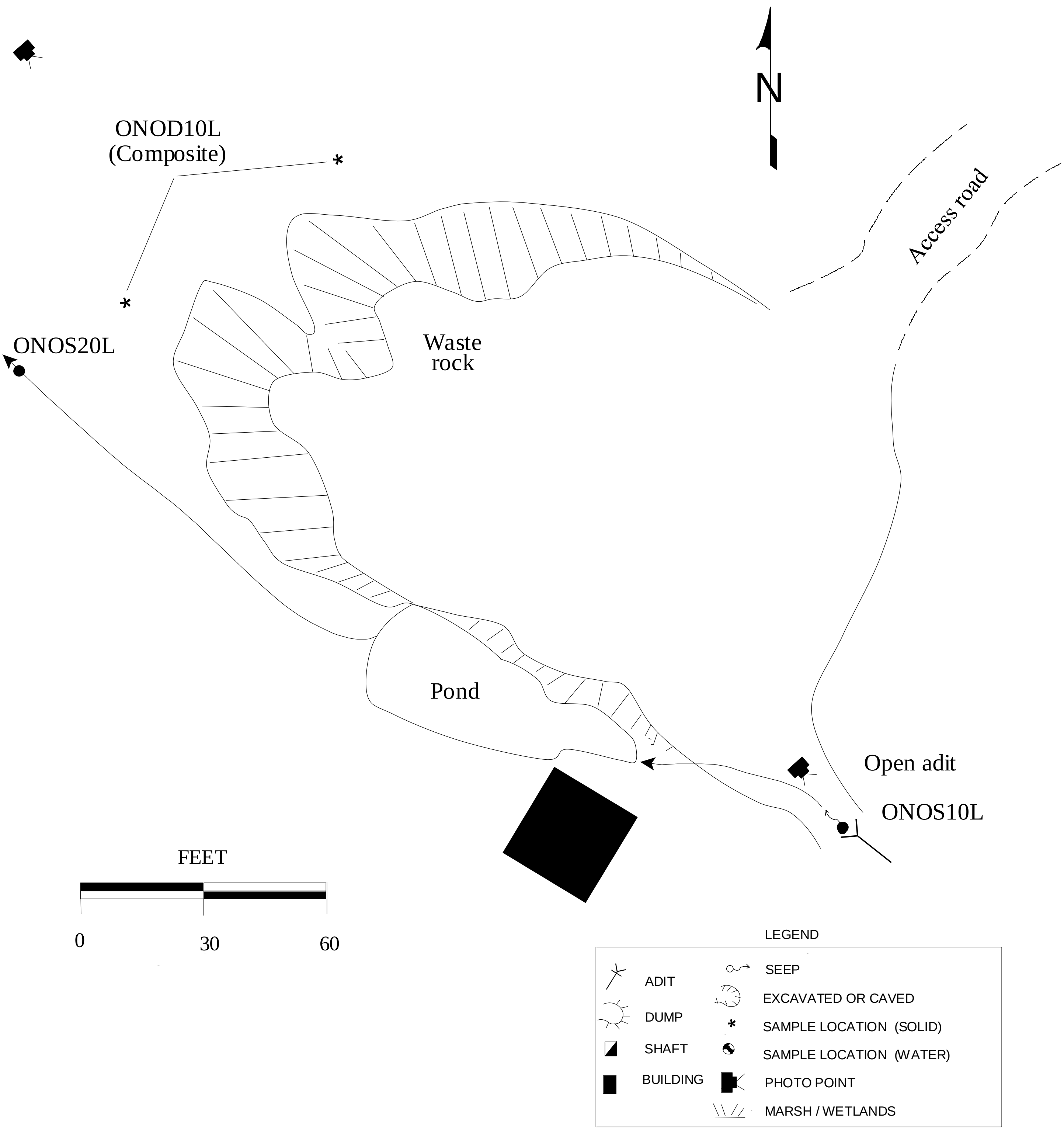

Figure 4. The North Ontario mine adit was open and discharging water to a small pond (8/9/95). The road to the site is not well marked but showed recent traffic.

Figure 4a. The adit of the North Ontario mine remained open at least 40 feet from the surface. The tunnel was partially flooded and discharged water on to the dump.

Figure 4b. The lower waste-rock dump of the North Ontario was partially vegetated near the base. A soil sample was collected were soils and waste had mixed.

Table 11. Water-quality exceedences at the North Ontario mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (ONOS10L)	S,C												A,C						
Unnamed stream below mine (ONOS20L)	S,C												A,C						

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

2.6.3.4 Vegetation

Local undisturbed vegetation at the North Ontario mine consisted of weeds, grasses, and coniferous trees. In the waste-rock dump area, the ground was barren to sparsely vegetated. At the base of the waste-rock dump, the vegetation showed some stress for several yards downhill.

2.6.3.5 Summary of Environmental Condition

The disturbed area was generally sparsely vegetated; the area below the dump was sparsely vegetated for several yards downhill. The concentrations of metals in the soils near the base of the waste-rock dump were moderately high. The adit discharge and the stream below the mine exceeded MCLs for aluminum and zinc; however, the metals concentration in the water did not appear to increase as a result of the discharge flowing across the waste.

2.6.4 Structures

The only structure observed on HNF-administered land was a small cabin near the waste-rock dump. The cabin was in poor condition.

2.6.5 Safety

The open adit is of special concern at this site. Although access to the site is restricted to a poorly defined trail, there was evidence of recent visitors. Rotten timbers were observed about 40 feet into the tunnel. The small cabin was in poor condition but appeared stable.

2.7 Lily (Little) Orphan Boy Mine

2.7.1 Site Location and Access

The Lily - Orphan Boy mine (T08N R06W 15CAAB) is on private land on an unnamed tributary of Telegraph Creek. The site is accessible by road a few hundred feet off the Telegraph Creek - Ontario Creek road. The site is within the same drainage as (and about ¼-mile below) the North Ontario mine.

2.7.2 Site History - Geologic Features

This mine is referred to in Robertson (1956) simply as the "Lilly" and his regional geologic map (1" = ½ mile) shows its location as approximately ½-mile from the southwest portion of the Tertiary quartz monzonite batholith. An alternative spelling of the name is "Lily" (Lusty 1973). Robertson (1956, p. 261) mapped the underground workings at a scale of 1" = 50', showing three northeast-trending levels totaling almost 900'. McClernan (1973) describes it as a 180'-vertical shaft with additional surface cuts and pits. Thickness and mineralogy of the veins in this map average from 4.5' to 6.3' of quartz, tourmaline, pyrite, galena, sphalerite with some sericitic/argillic alteration. Lusty (1973) reported that the veins at the Lilly had a massive appearance except for "faint ghost-like banding." One adit and one shaft are shown. Regnier (1951) conducted a study of the mineralogy and paragenesis of this area and the Lilly in particular. It was operating at the time. Regnier (1951) hypothesized that there were five occurrences of faulting that were conduits for the mineralizing fluids. Lusty (1973) also found evidence of movement after mineralization.

Production (McClernan 1973) totaled 1,228 tons of ore yielding 333 ounces of gold, 12,520 ounces silver, 2,753 pounds copper, 85,377 pounds lead, and 39,899 pounds zinc. Recorded production spanned, intermittently, from 1934 to 1951, but McClernan's (1969) field notes state that work had been done 1 to 2 years previous to his 1969 study.

2.7.3 Environmental Condition

The Lily (Little) Orphan Boy mine consisted of a shaft and associated waste-rock dumps on the hill above an unnamed tributary to O'Keefe Creek. There were several waste piles (tailings?) and dams in the creek bottom. The shaft had been the focus of recent water-treatment studies, which included lowering a plug of cow manure into the shaft. There was also evidence of discharge capture and treatment near the creek. The site is bordered upstream and downstream by HNF-administered land.

2.7.3.1 Site Features - Sample Locations

Because the site was on private land, sample collection was restricted to HNF-administered land. The site was sampled on 9/26/95. A sample was collected from the creek above the site (TOBS10L). At this location, the stream was flowing about 17 gpm, the pH was 7.21, and the field SC was about 63 µmhos/cm. A second sample was collected from the creek downstream of the site (TOBS20L). At this location the stream was flowing about 30 gpm, the pH was 6.98, and the SC was about 97 µmhos/cm. The average elevation of the creek bottom near the site is 6,700 feet above sea level. Site features and sample locations are shown in figure 5; a photograph of the mine is shown in figure 5a.

2.7.3.2 Soil

Because all of the exposed waste-rock and tailings (?) and any visually impacted soils were on private land, no samples were collected. No impacted soils or tailings were observed on HNF-administered land.

2.7.3.3 Water

There were notable increases in the concentrations of most of the metals in the downstream sample (table 12). In particular, the concentrations of cadmium, lead, and zinc exceeded one or more MCLs downstream, but not upstream of the mine. Although iron content exceeded the MCL upstream and not downstream, the difference in concentration was very small.

Table 12. Water-quality exceedences at the Lily (Little) Orphan Boy mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed Cr. - upstream (TOBS10L)	S						S		S										
Unamed Cr. - downstream (TOBS20L)	S,C			A,C				C	S				A,C						

Exceedence codes:

S - Secondary MCL

A - Aquatic Life Acute

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

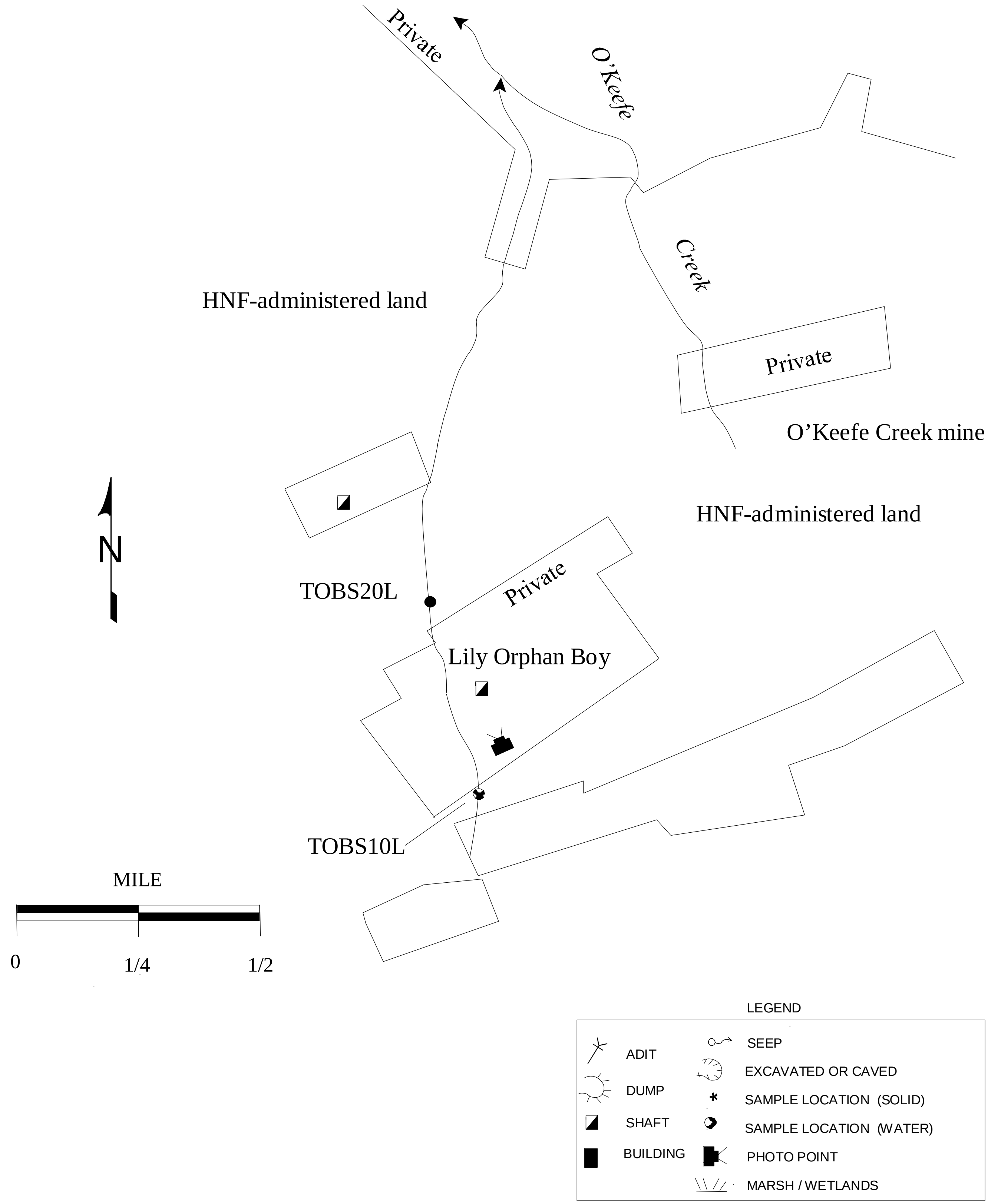

Figure 5. The Lily (Little) Orphan Boy mine is on private land (8/9/95). A sample was collected from the creek upstream and downstream of the mine on HNF-administered land.

Figure 5a. The Lily (Little) Orphan Boy shaft and the development area occurred on private land within HNF-administered land.

2.7.3.4 Vegetation

The vegetation on private land was not evaluated. The vegetation on HNF-administered land above and below the site consisted of grasses, willows, and conifers. There was no visible evidence of stress related to mining activities at either sampling site.

2.7.3.5 Summary of Environmental Condition

The concentrations of metals in the unnamed creek generally increased downstream of the Lily (Little) Orphan Boy mine. Several MCLs were exceeded in the downstream sample. The presence of waste material in the creek on private land provides an obvious source of metals to the stream. There was no visible impact to soils or vegetation below the site, and there was no evidence of waste material in the stream bed on HNF-administered land.

2.7.4 Structures

No structures were observed on HNF-administered land; there were several structures on private land.

2.7.5 Safety

No safety concerns were identified on HNF-administered land.

2.8 O'Keefe Creek (Copper King) Mine

2.8.1 Site Location and Access

The O'Keefe Creek (Copper King) mine (T08N R06W 11CDBA) is on private land adjacent to O'Keefe Creek. The site is bordered by HNF-administered land upstream and downstream of the patented claim. Access to the site is possible by a marginal road from the Telegraph Creek - Ontario Creek main road across O'Keefe Creek.

2.8.2 Site History - Geologic Features

No references were found for this mine, specifically. Robertson (1956) and Lusty (1973) are the most detailed geologic references for the general area.

2.8.3 Environmental Condition

No inspection of the mine was made. The site was posted, and the area heavily timbered. The area upstream of the site was also heavily timbered on the slopes. The flood plain was heavily vegetated, and no flowing water was noted. Downstream of the site, O'Keefe Creek flows into Bryan Creek to form Telegraph Creek.

2.8.3.1 Site Features - Sample Locations

The site was sampled on 8/9/95. A sample was collected from O'Keefe Creek on HNF-administered land downstream of the mine. At this location the stream was flowing about 500 gpm, the pH was 7.69, and the field-SC was about 66 µmhos/cm. Because the mine was on private land, no site map was prepared, and no photos were taken; a generalized map with the sample location is shown in figure 6.

2.8.3.2 Soil

The area downgradient of the mine on HNF-administered land was generally well vegetated and there was no indication of adverse impact to soils.

2.8.3.3 Water

The concentration of iron exceeded an MCL in the sample collected downstream of the mine (table 13). The concentrations of other constituents considered were generally well below MCLs, if not below detection limits. Despite the appearance of the water flowing through the waste material upstream, there was little apparent impact to water quality below the O'Keefe Creek (Copper King) mine.

Table 13. Water-quality exceedences at the O'Keefe Creek mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
O'Keefe Cr. - downstream (OOKS10L)							S												S

Exceedence codes:

S - Secondary MCL

Note: The analytical results are listed in appendix IV

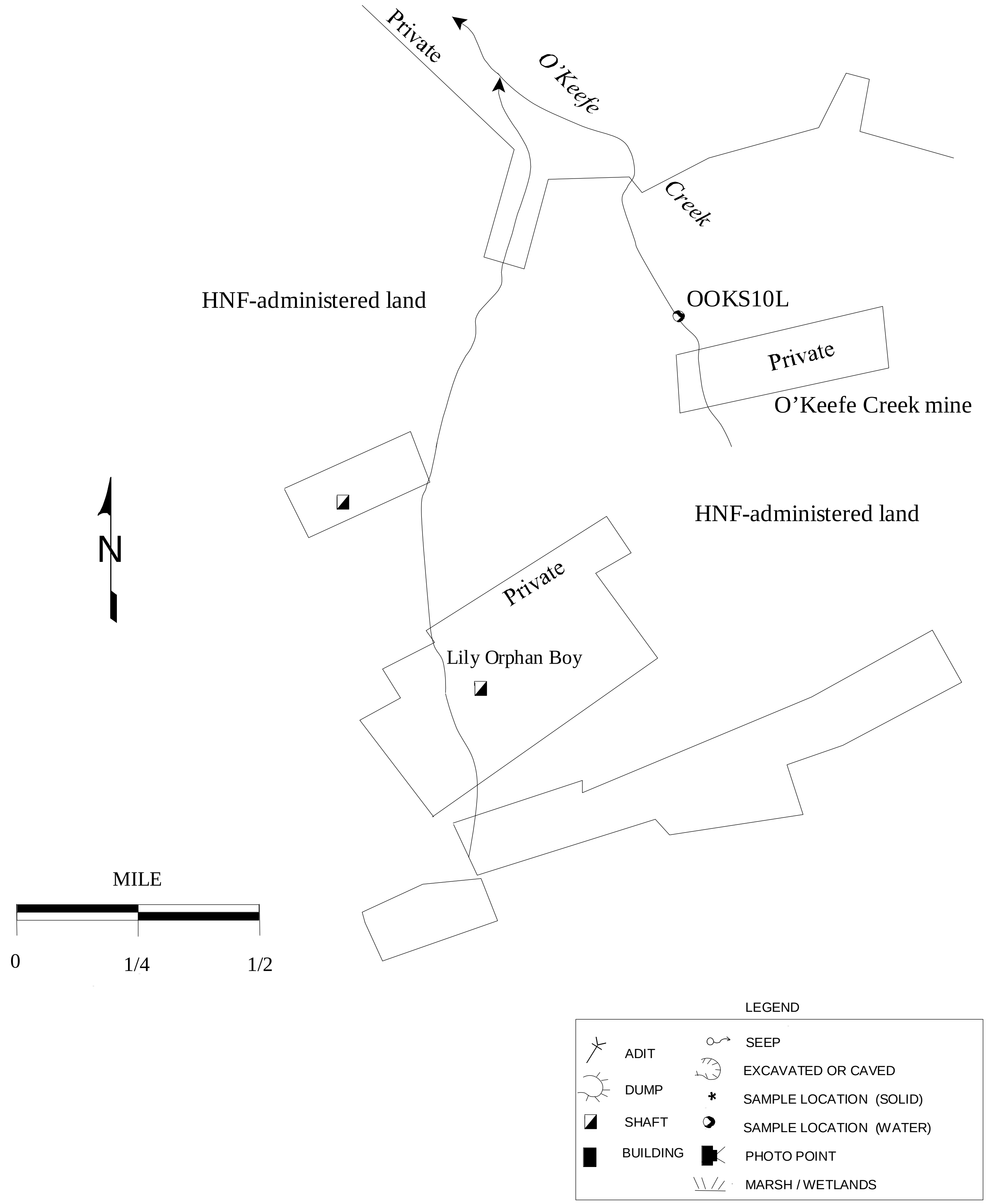

Figure 6. The O'Keefe Creek mine is on private land (8/9/95). A sample was collected from the stream downstream of the mine.

2.8.3.4 Vegetation

Local undisturbed vegetation at the sample site consisted of tall grasses and coniferous trees. There was no visible evidence of stressed vegetation.

2.8.3.5 Summary of Environmental Condition

Although waste was in contact with the stream and several impoundments were observed, the water quality of O'Keefe Creek below the mine was generally acceptable. Iron exceeded the secondary MCL for drinking water, but the concentrations of other constituents were generally low. There was no evidence of sediment from the mine in the fast-flowing stream, nor was there any obvious impact to vegetation.

2.8.4 Structures

There were no structures observed on HNF-administered land. The mine was apparently active at the time of the visit, and there were several structures in various states of repair on private land.

2.8.5 Safety

No safety concerns were identified on HNF-administered land.

2.9 Hope (Adit) Mine

2.9.1 Site Location and Access

The Hope mine (T08N R06W 16AABC) is on HNF-administered land in Clemmer Gulch, a tributary of Telegraph Creek. Access to the site is by means of a very poor road (about two miles) from the Telegraph Creek - Ontario Creek road.

2.9.2 Site History - Geologic Features

No geologic references were found specifically for the Hope adit. According to Robertson's (1956) map, the Hope is hosted in Cretaceous andesitic volcanics. It is represented on the map by a mine symbol on a northeast-trending vein similar to, and parallel with, the vein which the Anna R. (Newman's Camp?), Queen (Copper King ?), and Track Adit mines are located.

2.9.3 Environmental Condition

The Hope mine consisted of a caved adit that was discharging water and an associated waste-rock dump. The adit discharge flowed to the access road and then infiltrated the ground. It was apparent that the discharge had flowed much farther in the recent past. No other active streams were observed in the area; however, there was a dry spring and several dry channels adjacent to the disturbed area and at the base of the waste-rock dump. Clemmer Gulch is about 1,200 feet downhill of the site. There was no evidence of sediment or other impacts from the mine. The aerial extent of the mine is approximately one-half acre. The average elevation of the site is 6,800 feet.

2.9.3.1 Site Features - Sample Locations

The site was sampled on 8/9/95. A sample of the adit discharge was collected (THOS10M). The adit was flowing about 1 gpm, the field-pH was 4.13, and the field-SC was approximately 176 µmhos/cm. As noted, this was the only water on or near the site. A soil sample was collected from the stream channel at the base of the waste-rock dump (THOD10M). This was an area where material had eroded from the dump and mixed with native sediment. Site features and sample locations are shown in figure 7; photographs are shown in figures 7a and 7b.

2.9.3.2 Soil

The concentrations of arsenic and zinc exceeded the phytotoxic limits in the sample collected from the dry stream channel at the base of the waste-rock dump (table 14). The concentration of lead was elevated, but below phytotoxic limits. This sample represents the bedload of the stream when it is flowing at other times during the year. The same type of sediment was observed in the channel for several yards downstream.

Table 14. Soil sampling results at the Hope mine (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
At base of waste-rock dump (THOD10M)	184[1,2]	4.7[1]	39.9[1]	609[1]	622[1,2]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3)
(2) Exceeds phytotoxic levels (table 3)

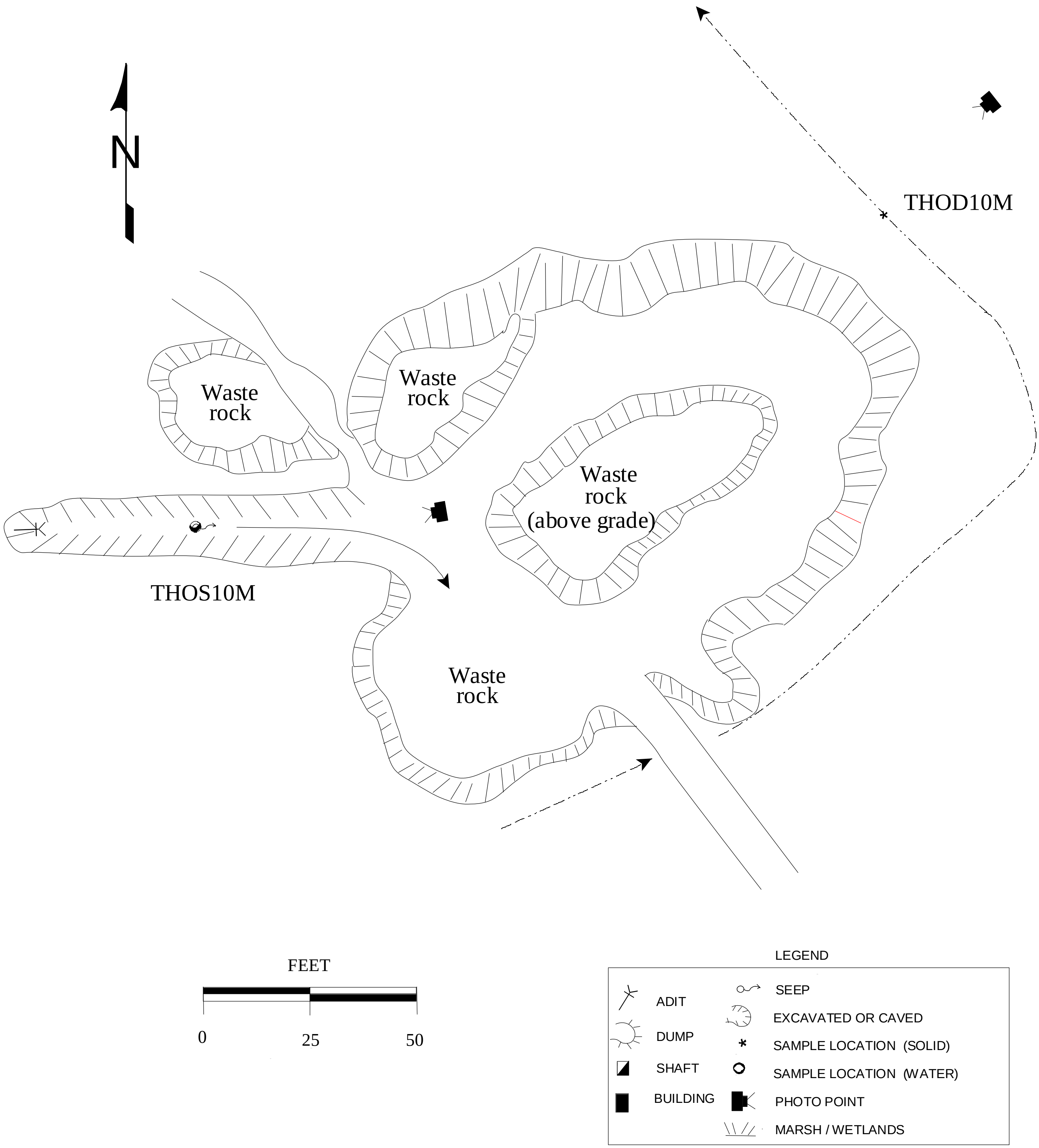

Figure 7. The Hope mine (8/9/95) was discharging water from a caved adit. There were several dry stream beds that probably flow during snowmelt and large storms.

Figure 7a. The collapsed adit at the Hope mine discharged about 1 gpm. The highwall was steep but generally stable.

Figure 7b. The lower waste-rock dump of the Hope mine was barren of vegetation. MBMG staff collected a soil sample from the dry stream bed at the base of the dump.

2.9.3.3 Water

The concentrations of several metals exceeded MCLs in the adit discharge (table 15). The pH was below the minimum secondary drinking water standard. Although the flow at the time of sampling was low (1 gpm), it was evident that the flow is much greater at other times of the year. It was not visually evident, however, if the water quality was better or worse with higher flows.

Table 15. Water-quality exceedences at the Hope mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Hope adit discharge (THOS10M)	C			P,A C		C		C	S				A,C						S

Exceedence codes:

P - Primary MCL

S - Secondary MCL

A - Aquatic Life Acute

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

2.9.3.4 Vegetation

Local undisturbed vegetation at the site consists of grasses and coniferous trees. The waste-rock dump was barren as was most of the area around the adit. The dry stream bed and area immediately adjacent were also sparse to barren. There were dead trees on the dump, but most had been cut down and moved when part of the dump was re-worked. About 100 feet downstream, vegetation near the stream was similar to that of the surrounding undisturbed area.

2.9.3.5 Summary of Environmental Condition

The concentrations of metals in the soils (and probably of the waste-rock dump) are quite high. The phytotoxic concentrations were evidenced by sparse to barren vegetation, not only on the waste-material but also in the dry stream bed near the base of the dump. The adit was discharging poor quality, acidic water. Although the discharge rate at the time of the visit was small, there was evidence of greater discharge in the recent past.

2.9.4 Structures

No structures were observed on HNF-administered land.

2.9.5 Safety

The highwall above the caved adit was steep but stable. The waste-rock dumps were generally low angle.

2.10 Hub Camp Mine

2.10.1 Site Location and Access

The Hub Camp mine (T08N R06W 04BAAD) is located on HNF-administered land, approximately seven miles southeast of Elliston. The site is adjacent to Telegraph Creek and the main road.

2.10.2 Site History - Geologic Features

An underground map (1"=50') by Robertson (1956, p. 256) shows the workings including 2", 4", and 6" veins of pyrite and chalcopyrite, with copper stains and quartz gangue. The veins fall into two trends, a narrower N65^{o} E set and a east-west set up to 40" wide. The map also illustrates approximately 350 feet of total workings in two levels (0' and 140' elevations) trending east-northeast following northeast striking, southeast dipping (60^{o}) veins. Polished sections examined by Lusty (1973) reveal sphalerite, galena and chalcopyrite are present along with other veins of quartz/pyrite/galena. Open-space filling texture was found as a principal emplacement method in the Hub Camp veins. A vein of quartz and pyrite was described near the mouth of the lower adit McClernan (1976).

The Robertson map (scale 1" = ½ mile) shows the regional geologic setting of the Hub Camp mine, in the middle of the Tertiary quartz monzonite (actually Cretaceous Butte quartz monzonite) intrusive and on a vein on which several other mines are located. Unpublished notes by McClernan from 1969 indicated at that time that 105' of workings were open in the lower adit and the upper adit was caved. Lusty (1973) describes a propylitic alteration zone surrounding the vein here as “several tens of feet wide or 6 meters.” According to Lusty, the sericitic zone surrounding the Hub Camp vein is one to two feet wide and several samples had sericitic and quartz alteration. McClernan (1976) reports argillization and pyritization of the wall rock. According to McClernan (1976), the Hub Camp group produced at least from 1937 to 1948 with 52 tons of ore yielding 51 ounces gold, 1,128 ounces silver, 91 pounds copper, 19,608 pounds lead, and 250 pounds zinc.

2.10.3 Environmental Condition

The Hub Camp mine consisted of a two caved adits and associated waste-rock dumps. The lower adit was discharging a small amount of water which flowed across the dump and down the access road. The disturbed area is near the base of a steep hill, several hundred feet north of Telegraph Creek and the main road.

2.10.3.1 Site Features - Sample Locations

The site was visited and sampled on 8/3/95. A sample was collected from the adit discharge as it emerged (THCS10H). The discharge stream infiltrated the waste material before reaching the end of the dump. The adit was discharging about 1.5 gpm, the field-pH was 8.21 and the field-SC was bout 662 µmhos/cm. No other water was observed between the site and Telegraph Creek. The waste-rock dump was generally comprised of coarse material; the base of the dump was well vegetated and a small amount of erosion had occurred. No soil samples were collected. Site features and sample locations are shown in figure 8; a photograph is shown in figure 8a.

2.10.3.2 Soil

There was no visible evidence of impact to soils near the base of the waste-rock dump. The coarse material showed little erosion, and the dump generally appeared stable.

2.10.3.3 Water

The concentration of iron exceeded the secondary drinking water limit (table 16); the pH of the discharge was higher (8.21) than the recommended limit. With the exception of sulfate, the concentrations of other constituents were generally well below MCLs. The adit discharge is probably greater at other times of the year based on the erosion channel on the waste-rock dump. No other evidence of water was found on or near the site.

Table 16. Water-quality exceedences at the Hub Camp mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (THCS10H)							S												S

Exceedence codes:

S - Secondary MCL

Note: The analytical results are listed in appendix IV

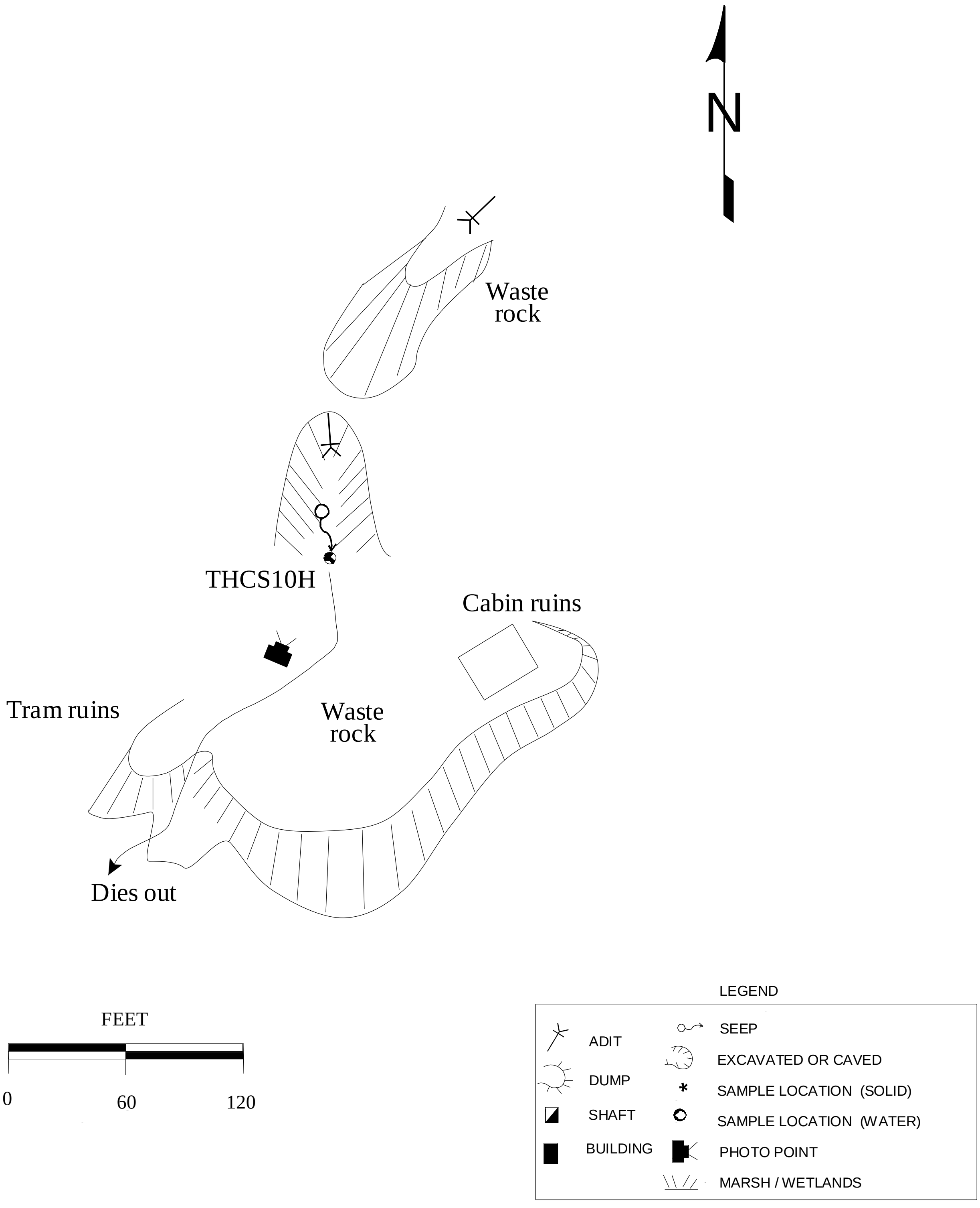

Figure 8. The Hub Camp mine (8/3/95) consisted of two caved adits; the lower adit was discharging a small amount of water. The stream infiltrated the ground within a short distance from the base of the dump.

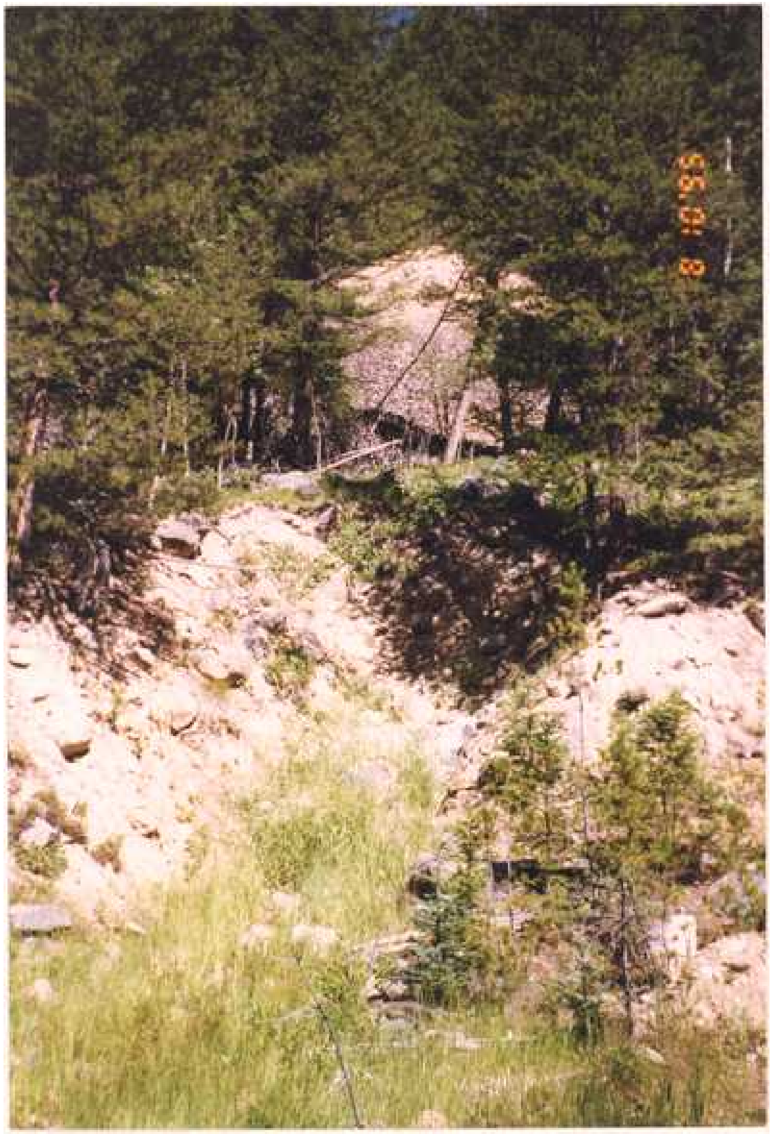

Figure 8a. The collapsed adit of the Hub Camp mine discharged about 1.5 gpm, which infiltrated the ground within 100 feet of its origin.

2.10.3.4 Vegetation

Local undisturbed vegetation at the site consisted of grasses and coniferous trees. The waste-rock dumps were generally barren. Along the drainage between the upper and lower dumps, there was a large area of dead vegetation. Some of the vegetation below the lowermost dump was stressed or dead.

2.10.3.5 Summary of Environmental Condition

The adverse impact to water quality from off-site runoff was evident during the first visit. The samples collected indicate at least some impact to water quality during dry periods. Erosion of the waste-rock dumps was active during the initial visit by the geologist and visually apparent during the second visit.

2.10.4 Structures

There were several dilapidated structures near a caved shaft. Small cabins in poor repair were located next to the drainage between waste-rock dumps and northward, away from the site.

2.10.5 Safety

There were some debris and remnants of buildings on the site that may pose a concern for safety.

2.11 Unnamed Mine 8N6W6ABDB

2.11.1 Site Location and Access

A mine was located in the same drainage as and above the Viking mine; the USFS ownership map indicated the site is on patented land. No name could be found for this particular claim (T08N R06W 06ABDB) surrounded by HNF-administered land. The site is accessible by a poor condition road about 125 feet from the road leading to the Viking mine. Both sites were accessed by the road from the Little Blackfoot River drainage.

2.11.2 Site History - Geologic Features

Neither references nor an exact name could be found for this location. It is approximately 0.6 mile west of the Mary or Mary Quartz mine, and 0.3 mile east of the Big Dick/Black Jack mine. The area was mapped by Robertson (1956) as Cretaceous andesitic volcanics which have been cut by northeast-trending faults along which veins were emplaced. Robertson’s map shows a prospect in this area located on a more east-west-trending vein. The area lies less than ½-mile from the outcrop boundary of the west edge of the Boulder batholith.

2.11.3 Environmental Condition

The mine consisted of a caved adit with an associated waste-rock dump. The adit was discharging a small amount of water that flowed into a pond caused by a depression on the top of the dump. The pond discharge stream flowed down the dump toward Moose Gulch.

2.11.3.1 Site Features - Sample Locations

Samples were collected on 9/26/96. All of the waste-rock dump and the area below were determined to be on private land. At the point where the adit discharge stream flowed onto HNF-administered land, it was flowing about 3.5 gpm, the pH was 7.33, and the SC was about 163 µmhos/cm. A sample was collected from the stream at this point. Site features and sample locations are shown in figure 9; a photograph of the adit is shown in figure 9a.

2.11.3.2 Soil

All of the workings and waste-rock dump were on private land. There was no evident waste material on or impacts to HNF-administered land.

2.11.3.3 Water

The concentration of copper and zinc were slightly elevated, and both were well below MCLs (table 17). There was no visible evidence of acid mine drainage in or near the stream. The flow of the stream (approximately 3.5 gpm) appeared to be about average based on the size of the channel.

Table 17. Water-quality exceedences at the Unnamed mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed tributary of Moose Gulch below mine (TUNS10M)																			

Note: The analytical results are listed in appendix IV

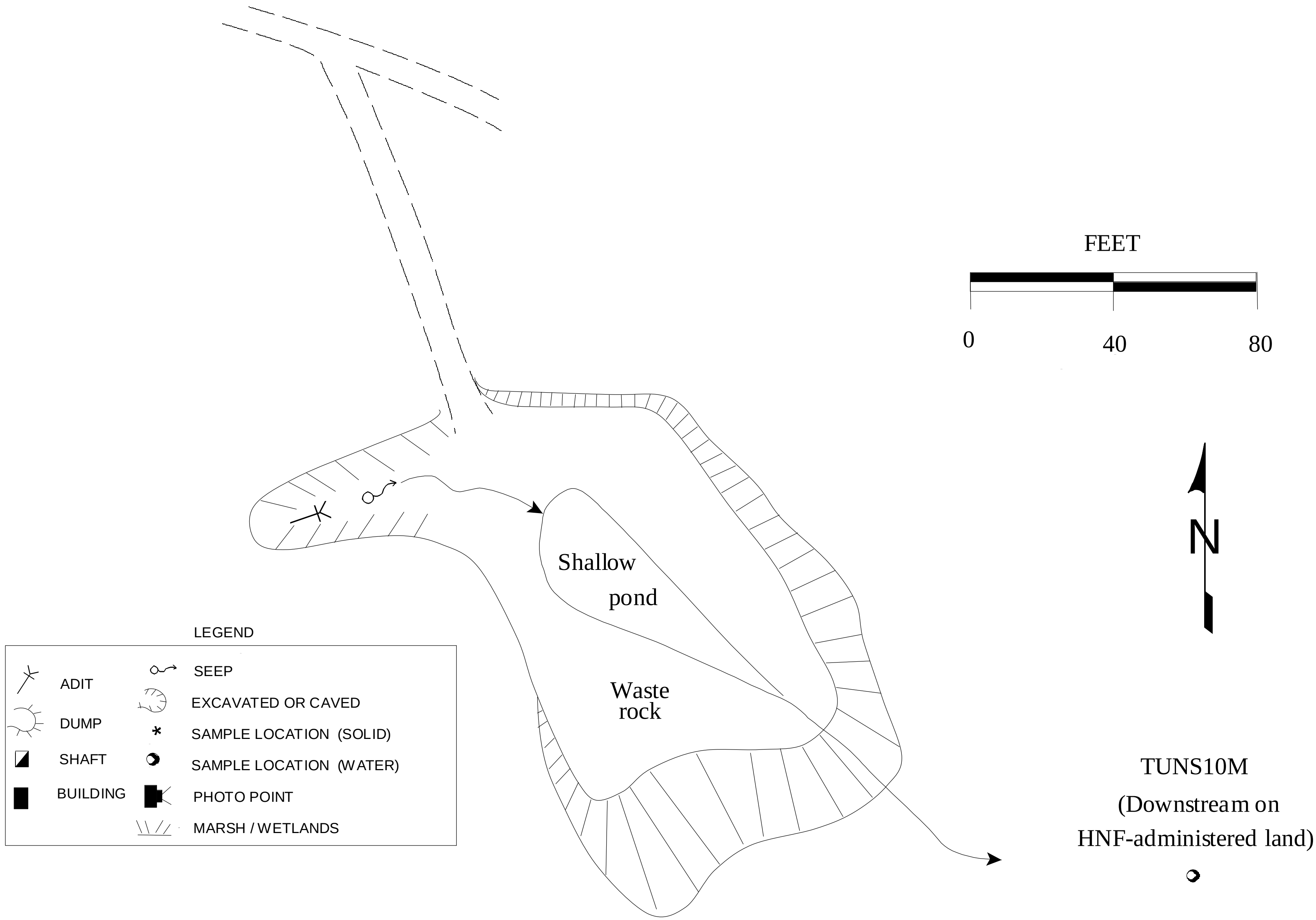

Figure 9. The Unnamed mine in Moose Gulch is on private land (9/26/95). The adit discharge flowed onto HNF-administered land below the site.

Figure 9a. The adit of the Unnamed mine in Moose Gulch is on private land upstream of HNF-administered land.

2.11.3.4 Vegetation

Local undisturbed vegetation at the Unnamed mine consisted of weeds, grasses, and coniferous trees. The waste-rock dump was sparse to barren except along the adit discharge stream and pond, which were well vegetated.

2.11.3.5 Summary of Environmental Condition

No waste material was found on HNF-administered land below the site. There was no visible impact to soils, and the water quality of the stream into which the adit was discharging was good.

2.11.4 Structures

No structures were observed on HNF-administered land.

2.11.5 Safety

No safety concerns were identified on HNF-administered land.

2.12 Viking Mine

2.12.1 Site Location and Access

The Viking mine (T08N R06W 05AACC) is located on HNF-administered land, approximately seven miles southeast of Elliston in Moose Gulch, a tributary of Telegraph Creek. Access to the site is by a primitive road from the main Little Blackfoot River road over Negro Mountain and then, by foot, about one-quarter mile along a closed road.

2.12.2 Site History - Geologic Features

McClernan's (1969) field notes state that this mine was at one time relocated as the 'View' by Henry Laury. He states that the vein is supposed to be east-west, 16" wide, and that the tunnel and shaft connect at about 400' from the portal; the tunnel is driven in quartz monzonite. McClernan (1976) quotes Geach's field notes reporting the adit caved and estimated to be 500' long. The same summary reports the vein the adit explores trends N70^{o}W with the vein material containing tourmaline and galena in quartz. The Viking was also being explored in the early 1970's when Lusty was working in the area. Lusty reported that the strike-lengths of the ore shoots at the Viking were generally only a few feet.

2.12.3 Environmental Condition

The Viking Camp mine consisted of a caved adit and associated waste-rock dumps with an ore bin. The adit was discharging a small amount of water that flowed across the dump and then infiltrated the ground. The adit discharge was the only water for several hundred feet.

2.12.3.1 Site Features - Sample Locations

The site was visited and sampled on 9/28/95. A sample was collected from the adit discharge as it emerged (TVIS10M). The discharge stream that was flowing about 0.5 gpm, infiltrated the waste material before reaching the end of the dump. The pH was 5.45 and the field-SC was about 219 µmhos/cm. No other water was observed between the site and Moose Gulch. The waste-rock dump was generally comprised of coarse material; the base of the dump had been cut for the access road, and recent cat work was evident. Site features and sample locations are shown in figure 10; photographs of the site are shown in figures 10a and 10b.

2.12.3.2 Soil

There was no visible evidence of impact to soils near the base of the waste-rock dump outside of the disturbed area. The coarse material showed little evidence of erosion and the dump generally appeared stable.

2.12.3.3 Water

The concentrations of several metals exceeded MCLs in the adit discharge of the Viking mine (table 18). As noted, the discharge was small and infiltrated the dump material before reaching the edge. There was no evidence of much greater discharge and no evidence of other discharges near the site.

Table 18. Water-quality exceedences at the Viking mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge (TVIS10M)	S,C			P,A C		A,C		C	S				A,C						S*

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

*Laboratory and field pH were below the secondary drinking water standard

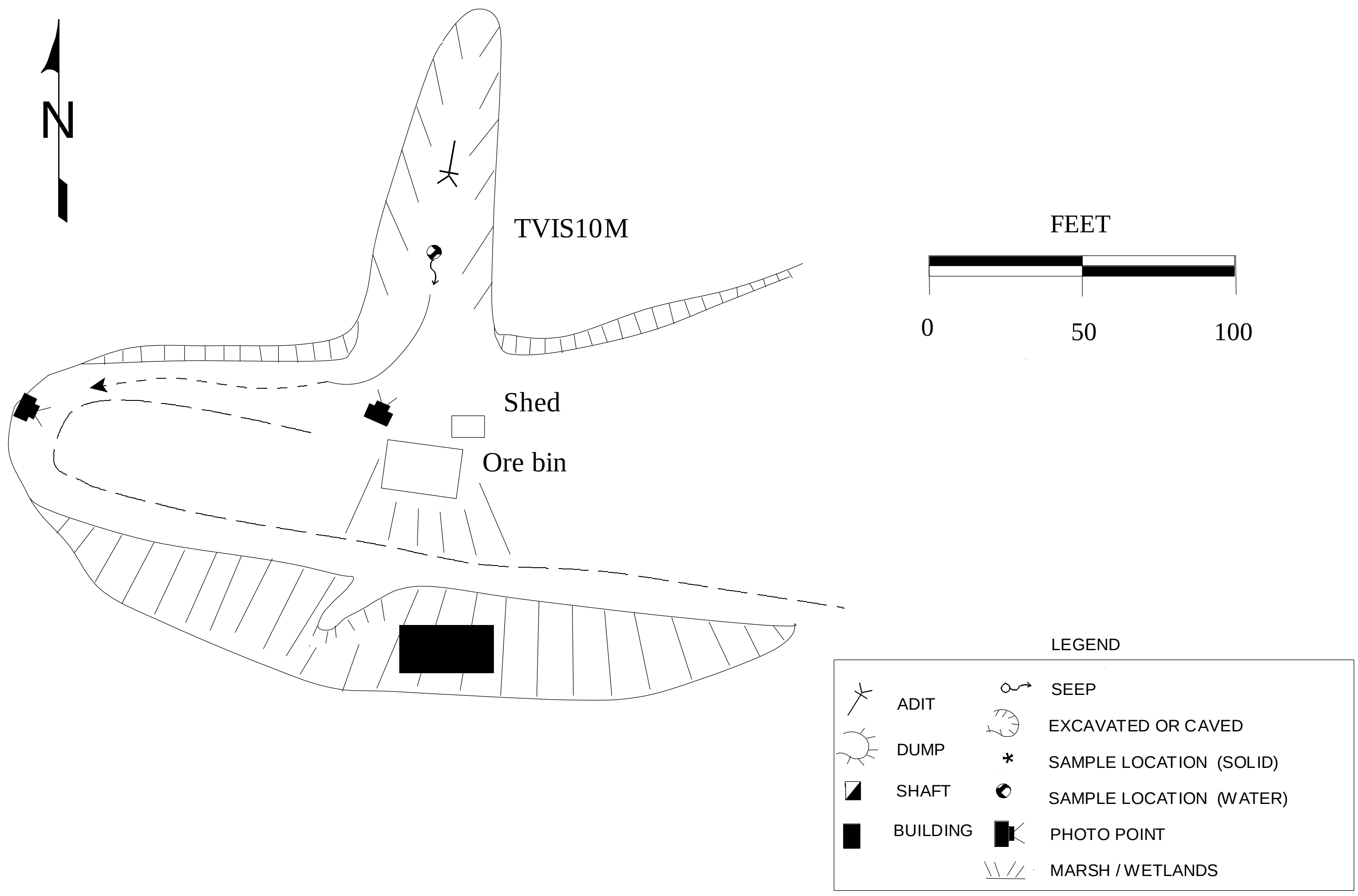

Figure 10. The Viking mine adit was discharging a small amount of water that flowed part way down the road (9/28/95). The road to the site had been blocked off at Moose Gulch.

Figure 10a. The collapsed adit of the Viking mine discharged about 0.5 gpm. No other discharges were observed on or near the site.

Figure 10b. An ore bin lies near the base and a metal shed sits at the top of the waste-rock dump of the Viking mine. Part of the dump has been reworked.

2.12.3.4 Vegetation

Local undisturbed vegetation at the site consisted of grasses and coniferous trees. The waste-rock dump was sparsely vegetated to barren. The adit discharge stream supported several grasses and small shrubs.

2.12.3.5 Summary of Environmental Condition

The water discharging from the caved adit of the Viking mine was of poor quality. The discharge was small and infiltrated the dump within a few tens of feet. Soils below the disturbed area did not show visible impacts from mining activities.

2.12.4 Structures

There was a dilapidated metal building and an ore bin on the waste-rock dump. No other structures were observed on the site; however, at the junction of the access road and Moose Gulch, there was a small, locked cabin in good condition.

2.12.5 Safety

The metal building contained some equipment; the building generally wasn't in good condition. The machinery would be a tempting target for scavengers. The waste-rock dump appeared to be stable.

2.13 Third Term Mine

2.13.1 Site Location and Access

The Third Term mine (T9N R6W 28 DACB) is on HNF-administered land adjacent to Flume Gulch that flows into Hahn Creek, a tributary of Telegraph Creek. The site is about seven miles from Elliston, and 2.5 miles from the Telegraph Creek road. The road was generally narrow but in good condition.

2.13.2 Site History - Geologic Features

Robertson's (1956) map (scale 1" = ½ mile) shows the regional geologic setting of the Third Term mine, located in andesitic volcanics but near the north edge of the Tertiary quartz monzonite. Johns (1952) and McClernan (1976) both describe a drift and crosscut 900' long following a N80°W vein that in turn is localized along a steeply dipping fault. The vein is from ½-

foot to 2½-feet in width, consisting of pyrite, chalcopyrite, galena, sphalerite, tetrahedrite, tennantite, and covellite(?) in quartz. Alteration consists of seritization and minor argillization (McClernan 1976).

Production records are shown in McClernan (1976) for the years of 1947, 1952, 1956, 1957, and 1959; the Third Term's recorded production totaled 50 tons of ore, with nine ounces gold, 378 ounces silver, 1,606 pounds copper, 4,922 pounds lead, and 3,452 pounds zinc.

2.13.3 Environmental Condition

The Third Term mine consisted of a large reclaimed area that included the adit and waste-rock dump(s). The area around the adit had collapsed after reclamation. The geologist visiting the site reported a small discharge; however, on the second visit, the seep was dry but evident.

2.13.3.1 Site Features - Sample Locations

Samples were collected on 9/26/95. A sample was collected from Flume Gulch upstream of the site (MTTS10L) where the stream was flowing about 69 gpm. The pH was 7.91 and the field-SC was about 107 µmhos/cm. A second sample (HTTS20L) was collected from Flume Gulch downstream of the site. At this location the stream was flowing about 68 gpm, the pH was 7.76, and the field-SC was about 117 µmhos/cm. There were no soils in the reclaimed area; most of the material was gravel-size or coarser. There was no mining-related material observed near the stream. Site features and sample locations are shown in figure 11; a photograph is shown in figure 11a.

2.13.3.2 Soil

There were no soils in the reclaimed area. The adit and waste were on a steep hillside but appeared stable and resistant to erosion. No waste was observed near the stream where soils and vegetation did not show any impacts related to mining activities.

2.13.3.3 Water

The concentrations of aluminum and copper exceeded MCLs in the downstream sample, whereas the concentration of lead exceeded one MCL in the upstream sample (table 19). The concentration of zinc was about 10 times higher in the downstream sample and was just below the drinking water MCL. The concentrations of arsenic, iron, and lead decreased downstream while the concentrations of the other constituents considered increased. Despite the absence of surface flow, there is a possibility that the adit was discharging water through the coarse material into the stream. The quantity of water discharging would have to be of sufficient volume to overcome

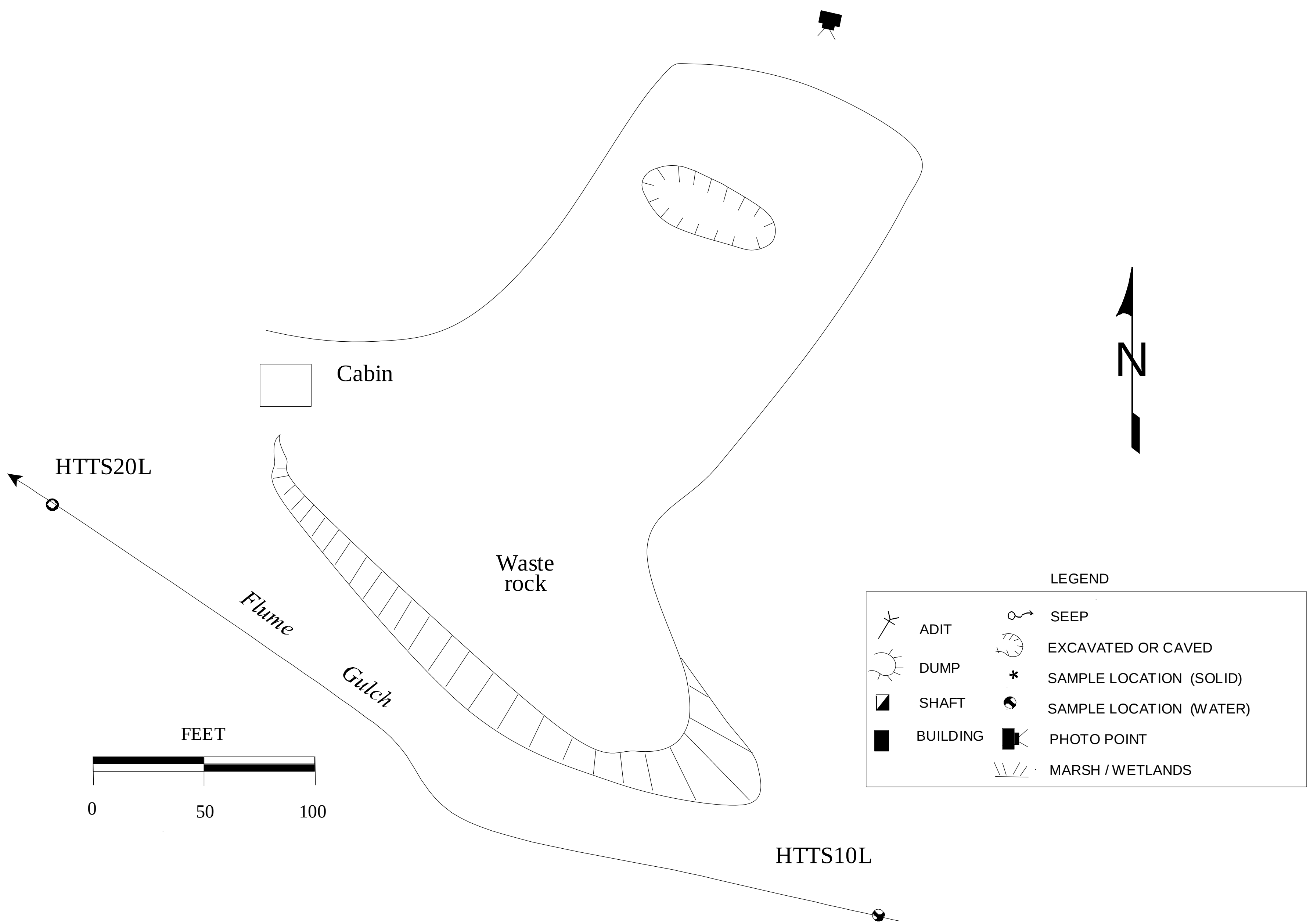

Figure 11. The Third Term mine had been reclaimed at the time of the visit (9/26/95). On an earlier visit by the geologist, water was seeping from the collapsed adit.

Figure 11a. The Third Term mine has been reclaimed; however, a part of the adit subsided after reclamation (shadow in center of picture).

dilution by nearly 70 gpm but would be small enough to be within the margin of error in stream-flow measurements.

Table 19. Water-quality exceedences at the Third Term mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Flume Gulch - upstream (HTTS10L)								C											
Flume Gulch - downstream (HTTS20L)	S,C					A,C													

Exceedence codes:

S - Secondary MCL

A - Aquatic Life Acute

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

2.13.3.4 Vegetation

Local undisturbed vegetation at the Third Term mine consisted of weeds, grasses, and coniferous trees. In the reclaimed area, the ground was generally barren.

2.13.3.5 Summary of Environmental Condition

The Third Term mine had recently been reclaimed. The area reclaimed was generally barren and consisted of coarse material; no waste material was observed near the stream below the site. Based on an upstream and downstream sample, the water quality of Flume Gulch was being impacted as it flowed through the site, possibly by subsurface discharge from the reclaimed adit.

2.13.4 Structures

A small wood building was observed on HNF-administered land near the base of the steep hill.

2.13.5 Safety

The adit had apparently been buried during reclamation; however, the area around the adit had collapsed again. The maximum subsidence was one to two feet at the center. The possibility of continued subsidence raises a safety concern.

2.14 Ontario Mine and Mill

2.14.1 Site Location and Access

The Ontario mine and mill (T08N R06W 22CAAA) are on private land upstream from HNF-administered land. The tailings (T08N R06W 22CAD and 27 BAD) extend from the mill to Ontario Creek, a distance of about 3,400 feet mostly on HNF-administered land. Additionally, they have been deposited down Ontario Creek at least 1,500 feet. The mine and mill are accessible by a short four-wheel drive road from the Telegraph Creek - Ontario Creek road. The waste and the area below the mine and mill are crossed by an improved road.

2.14.2 Site History - Geologic Features

The Ontario workings developed a quartz vein deposit containing pyrite, sphalerite, and galena (Pardee and Schrader 1933). Principal production from this mine was silver and lead with lesser copper and gold (McClernan 1976). Knopf (1913) mapped this area at 1:250,000 and briefly described the principal mines in his publication on the Helena mining region. Pardee and Schrader (1933) elaborated on this same region and also published a map at 1:250,000. Ruppel (1963) mapped the Basin quadrangle, including the Elliston mining district, at 1:48,000 and provided detailed geologic descriptions. Robertson (1956) provided a thorough discussion of the geology and mineral deposits of the Elliston mining district as well as a geologic map (1:31,680). Regnier (1951) and Lusty (1973) did thesis research on the eastern portion of the Elliston mining district, including the Ontario mine area. Lusty's work includes a structure and mineralization map (1:24,000), a geologic map (1:24,000), and geologic cross sections. Earlier work using the Ontario mine as a case study for mining impacts on the Boulder batholith was done by the MBMG (Watson *et al.* 1995).

The country rock in the mine area is medium-gray, medium-grained quartz monzonite (Lusty 1973). A sizeable body of alaskite (alkaline feldspar granite) and associated aplite also is exposed in the immediate area (Robertson 1956). The alaskite and aplite are replacement bodies in, and above, the quartz monzonite (Robertson 1956). Below the mine site, along Ontario Creek, Tertiary volcanic rocks or glacial deposits rest unconformably on batholithic rocks.

Vein mineralogy consists primarily of white, mostly massive quartz with relatively small crystals of tourmaline; significant amounts of pyrite are also present in dump samples. Sphalerite and galena are also present (McClernan 1976). Production for the years of 1924 to 1940 totaled 1,092 tons of ore yielding 615 ounces gold, 3,547 ounces silver, 116 pounds copper, 2,179 pounds lead and no recorded production of zinc (McClernan 1976).

2.14.3 Environmental Condition

The HNF-administered land topographically below the Ontario mine and mill consisted of extensive tailings deposits covering an area about 150 feet wide and 3,400 feet long down the hill toward Ontario Creek. At Ontario Creek, thick (5 to 10+ feet) deposits of tailings extend at least 1,500 feet downstream. Several possible breached dams were observed. Waste rock from the mine on private land may have extended to HNF-administered land, but property boundaries were not evident. There were at least two springs outside and east of the development area on private (?) land that exhibited iron stained discharge streams. The pH of one of these streams was 5.66; this may be related to the underground workings.

2.14.3.1 Site Features - Sample Locations

The upper area of the site was sampled on 8/3/95 and Ontario Creek was sampled on 9/26/95. A sample was collected of the caved, lower adit discharge (OONS10M) on what appeared to be HNF-administered land. The adit was flowing about 13 gpm, the pH was 4.67, and the field SC was about 171 µmhos/cm. A sample was collected from the stream flowing from the upper area of the mine above its confluence with the lower adit discharge stream and waste-rock dump (OONS20M). At this location the stream was flowing about 8 gpm, the pH was 3.76, and the field-SC was about 369 µmhos/cm. A third sample was collected from the culvert beneath the main road where all of the surface flow from the mine and mill converged (OONS40M). At this location the stream was flowing about 36 gpm, the pH was 3.99, and the field-SC was about 301 µmhos/cm. The stream from the upper workings was flowing into the tailings below the road and infiltrated completely about 300 feet from the road. The entire area of the tailings was generally wet, but there was little flowing water. A sample was collected from the lowest flowing water in the tailings (OONS30M). At this point the flow was about 1 gpm, the pH was 3.36, and the field-SC was about 394 µmhos/cm. Samples were collected from Ontario Creek above the tailings and about 1,500 feet downstream of the area where the tailings were washed into the creek. At the upstream sample point (OONS60L), the creek was flowing about 71 gpm, the pH was 7.35, and the field-SC was about 56 µmhos/cm. At the downstream location, Ontario Creek was flowing about 76 gpm, the pH was 7.29, and the field-SC was about 80 µmhos/cm.

Soil samples were collected below the waste-rock dumps above the road (OOND10H) and in an area of soil/tailings mix about 300 feet below the road (OOND20H). Site features and sample locations are shown in figure 12; photographs are shown in figures 12a and 12b.

2.14.3.2 Soil

The arsenic concentrations below the dump and in the soil/tailings mix area are extreme (table 20). The concentration of copper in the tailings area and the lead concentration below the dump exceed phytotoxic limits. The phytotoxic concentrations of metals in the soil/tailings mix area was strongly indicated by the lack of vegetation and poor soil formation.

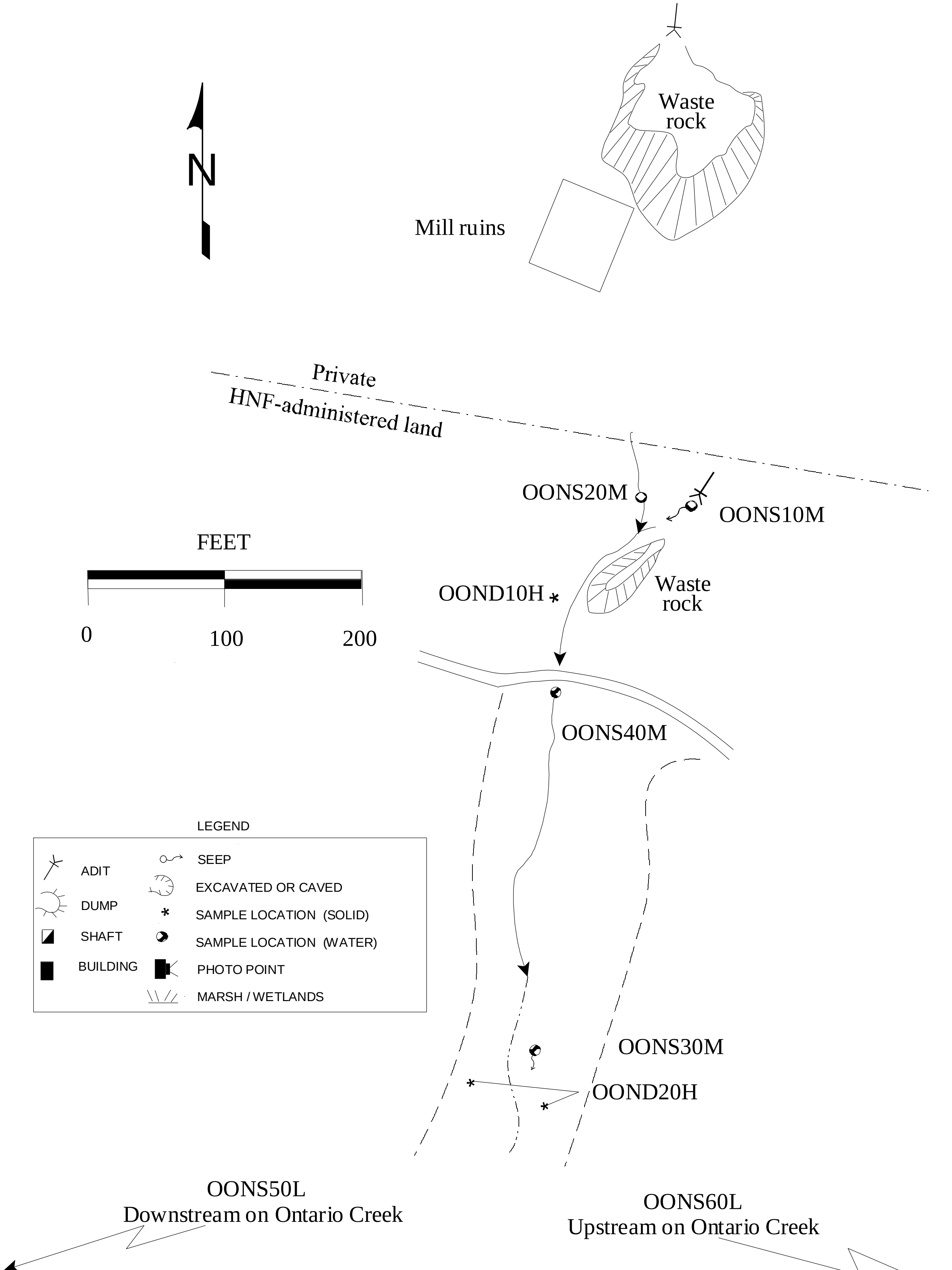

Figure 12. The Ontario mine and mill (8/3/95) have had an extensive impact on the drainage. The tailings extend at least 1,500 feet downstream on Ontario Creek (not shown).

Figure 12a. The lower waste-rock dump of the Ontario mine channels the discharge from the workings toward a wet area above the road.

Figure 12b. The Ontario mill tailings extend from the road about 3,400 feet downhill (tree line) and then at least 1,500 feet down Ontario Creek.

Table 20. Soil sampling results at the Ontario mine and mill (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Soils below dump (OOND10H)	11,225[1,2]	1.1[1]	66.9[1]	1,085[1,2]	116[1]
Soils/tailings mix (OOND20H)	3,073[1,2]	3.0[1]	102[1,2]	700[1]	337[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3)
(2) Exceeds phytotoxic levels (table 3)

2.14.3.3 Water

The concentrations of metals exceeded one or more MCLs in all of the samples (table 21). The concentration of metals in the site discharges were quite high; the highest were generally in the stream flowing from the upper workings. The sample collected from Ontario Creek upstream of the tailings exceeded the MCL for aluminum by 3 µg/L; the downstream concentration was two-fold higher. Overall, the impact to water quality in Ontario Creek from the Ontario mine and mill was severe.

Table 21. Water-quality exceedences at the Ontario mine and mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Lower adit discharge (OONS10M)	S,A C			P,A C		A,C	S,A		S				A,C						S*
Upper adit discharge (OONS20M)	S,A C			P,A C		A,C	S		S				A,C						S*
Stream at culvert (OONS40M)	S,A C			P,A C		A,C	S,A	C	S				A,C						S*
Spring in tails (OONS30M)	S,A C	p		P,A C		A,C	S,A	P,A C	S				A,C						S*
Ontario Creek - upstream (OONS60L)	S,C																		
Ontario Creek - downstream (OONS50L)	S							C	S				A,C						S*

Exceedence codes:
P - Primary MCL
S - Secondary MCL

A - Aquatic Life Acute
C - Aquatic Life Chronic
Note: The analytical results are listed in appendix IV
* Laboratory pH was below lower limit for secondary drinking water standard

2.14.3.4 Vegetation

Local undisturbed vegetation at the Ontario mine and mill consisted of weeds, grasses, brush, and coniferous and deciduous trees. The waste-rock dumps were barren; tailings and tailings/soil mixed areas were sparse to barren.

2.14.3.5 Summary of Environmental Condition

Mining and milling activities at the Ontario have strongly and negatively impacted the soil and water quality downgradient of the site. The concentrations of metals in the soils are as high as 100 times the phytotoxic limits. All of the waters from which samples were collected had concentrations much higher than some MCLs. A comparison of the upstream versus downstream sample of Ontario Creek shows high loading of metals even 1,500 feet downstream.

2.14.4 Structures

The mine and mill buildings at the upper end were on private land. Remnants of a building were located next to Ontario Creek adjacent to the area where the tailings had washed down.

2.14.5 Safety

The high concentrations of metals and arsenic pose some concern. The tailings deposits on Ontario Creek were deeply eroded and unstable near some banks; small-scale mass wasting is possible.

2.15 Monarch Mine and Mill

2.15.1 Site Location and Access

The Monarch mine (T08N R06W 31BABB) is on HNF-administered land approximately 11 miles south of the town of Elliston. The site is accessible by way of an improved road and then a primitive road after a locked gate about one-half mile from the main road. The Monarch mill (T08N R06W 30DBDA) is on the main road near the locked gate on the main road.

2.15.2 Site History - Geologic Features

The Monarch is listed as one of the more (if not the most) productive mines in the Elliston mining district with an estimate of $1,000,000 in total production (Pardee and Schrader 1933). The Monarch mainly operated from approximately 1894 to 1909 (Pardee and Schrader 1933) with the last reported work in 1916 according to the authors. Workings consisted of 3,000 feet of drifts, two tunnels and 350' deep shaft; these totaled one mile. McClernan (1969) notes that there are "1,600 feet of open tunnel with stopes at the end."

Recorded production (McClernan 1976) totaled 1,663 tons of ore yielding 157 ounces of gold, 10,677 ounces of silver, 25,034 pounds of copper, 96,514 pounds of lead, and 48 pounds of zinc. These totals include production from the "Old Monarch" mine the location of which is unknown.

The ore occurs at or near the contact of the andesite and quartz monzonite intrusive in an east-striking, north-dipping vein (locally greater than 20' wide) (Pardee and Schrader 1933). Minerals in the veins include pyrite, chalcopyrite, arsenopyrite, sphalerite and galena with lesser tetrahedrite (tennantite ?) with quartz gangue. Alteration products of these minerals included limonite, covellite and anglesite.

McClernan (1969) notes that there were at least two mills operating at the Monarch at one time. One was to the west of the adit. No other information on this mill could be found in literature.

2.15.3 Environmental Condition

The Monarch mine site consisted of a locked but open adit, coalescing waste-rock dumps, what appeared to be a collapsed adit, and several buildings. On the initial visit by the geologist in September 1993, the main adit was caved and was discharging water. When the site was visited and sampled by the hydrogeologist, the main adit had been refurbished, and there was no discharge from it. The caved adit was discharging a small amount of water toward the lower portion of the waste-rock dump. The ownership maps indicated that the site was on HNF-administered land, so samples were collected.

The Monarch mill consisted of a collapsed mill building and buried tailings about 100 feet downstream of the mill adjacent to Monarch Creek. There were only small (less than a square yard) exposures of tailings; the total extent of the tailings was estimated to be 0.75 acre. The main indicators of tailings were ferric-hydroxide-stained pools throughout the wetlands between the mill and the creek.

2.15.3.1 Site Features - Sample Locations

The mine and mill site were sampled on (9/27/95). A sample (MMNS10M) was collected from the lower, caved adit discharge at its origin. The adit was flowing about 0.3 gpm, the pH was

6.82, and the field-SC measured 139 µmhos/cm. A small spring emanated from the hillside several hundred feet below the development area and buildings. Although the stream appeared unaffected, field parameters indicated poor quality water. A second sample (MMNS20H) was collected from the stream below all of the workings and associated buildings. At this location the stream was flowing about 0.8 gpm, the pH was 8.05, and the field-SC was about 292 µmhos/cm.

A sample (MMNS30L) was collected upstream of the mill on Monarch Creek where the creek was flowing about 530 gpm, the pH was 7.31, and the field-SC was about 33 µmhos/cm. A sample (MMNS40L) also was collected from Monarch Creek about 100 feet below the tailings. At this location, the stream was flowing about 530 gpm, the pH was 7.32, and the field-SC was about 32 µmhos/cm. A sample was collected from a small spring within the suspected tailings area. The spring was flowing about 0.8 gpm, the pH was 6.98, and the field-SC was about 86 µmhos/cm. A map of the mine is shown in figure 13 and a photograph in 13a. A site map of the tailings is shown in figure 14 and a photograph of the tailings is shown in figure 14a.

2.15.3.2 Soil

The buildings and equipment area were at the base of the waste-rock dumps. Outside the development area, there was no visible impacts to soils.

2.15.3.3 Water

The concentrations of copper, lead, and manganese exceeded MCLs (table 22). The spring in the tailings below the mill exceeded MCLs for iron and manganese. The concentration of sulfate in the stream below the mine was several time higher than even the adit discharge, but was well below MCLs. The concentrations of metals in the sample collected from Monarch Creek below tailings showed a slight (significant ?) increase. All constituents in both samples were well below MCLs.

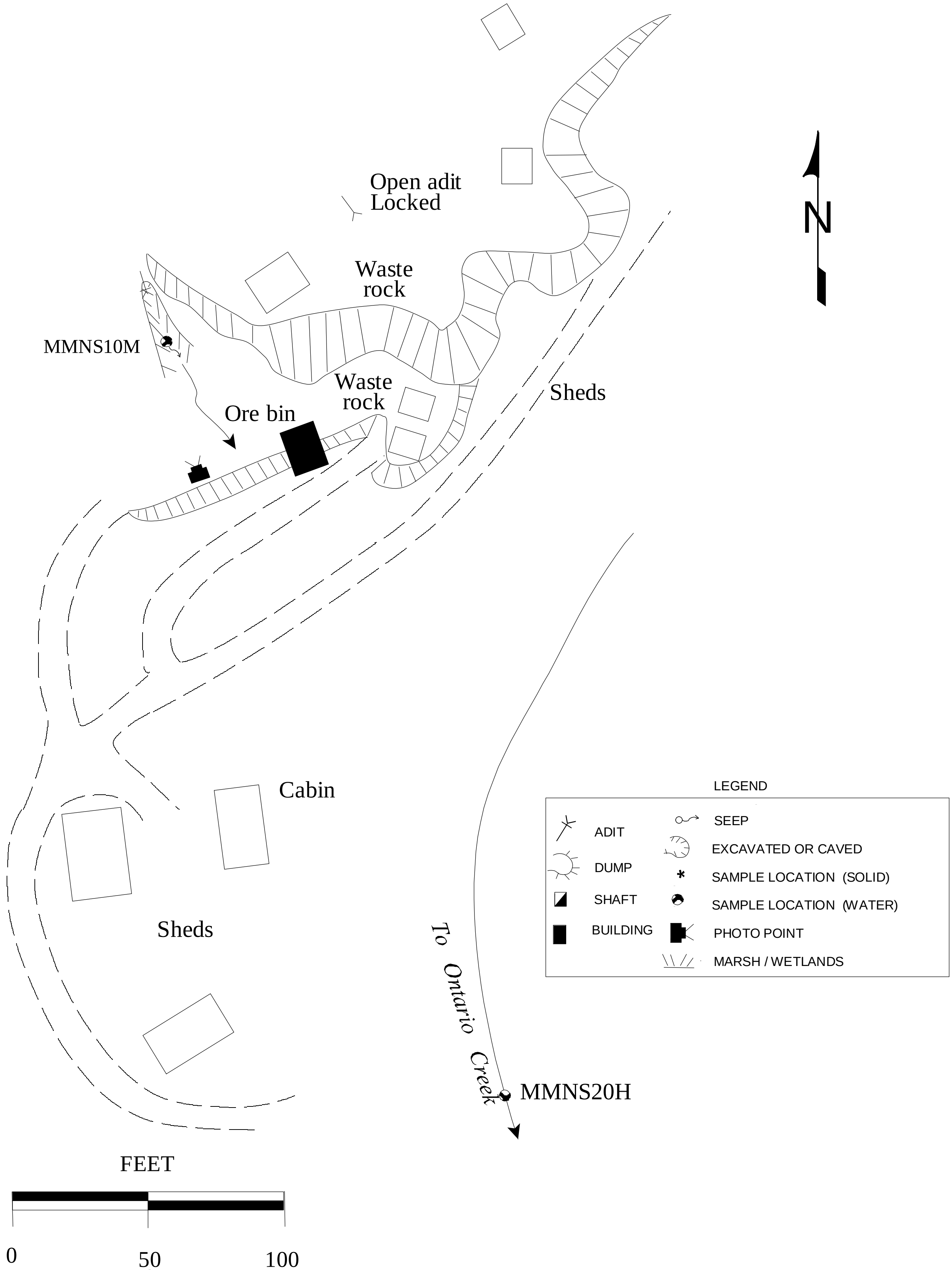

Figure 13. The Monarch mine was apparently active (9/27/95); the upper adit had recently been repaired. The lower adit was discharging about 0.3 gpm.

Figure 13a. The lower, caved adit of the Monarch mine was discharging a small amount of water on to the lower waste-rock dump. The adit lies in the trees just left of center.

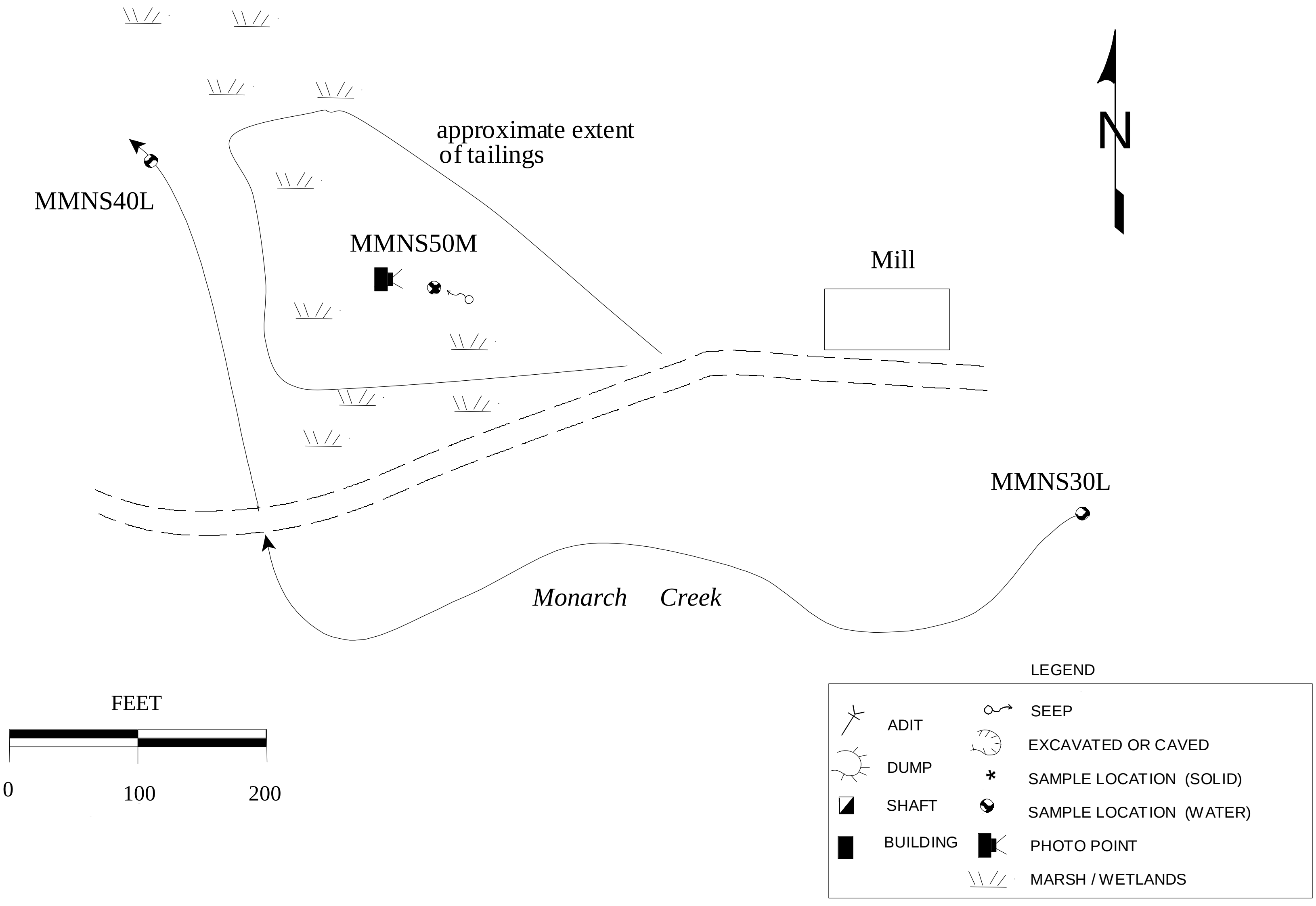

Figure 14. The tailings of the Monarch mill were buried and well vegetated (9/27/95). Small springs with ferric-hydroxide staining gave evidence of their presence.

Figure 14a. The tailings of the Monarch mill were buried; however, there were several telltale ferric-hydroxide–stained springs.

Table 22. Water-quality exceedences at the Monarch mine and mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Lower adit discharge (MMNS10M)						A,C		C	S										
Stream below mine (MMNS20H)																			
Monarch Creek - upstream (MMNS30L)																			
Spring in tailings (MMNS50M)							S,A		S										
Monarch Creek - downstream (MMNS40L)																			

Exceedence codes:

S - Secondary MCL

A - Aquatic Life Acute

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

2.15.3.4 Vegetation

Local undisturbed vegetation at the Monarch mine and mill consisted of weeds, grasses, and coniferous trees. The waste-rock dumps were generally barren; the tailings were generally well vegetated with grasses and willows.

2.15.3.5 Summary of Environmental Condition

The Monarch mine site appeared to have recent mining activities. The small discharge from the caved adit infiltrated the dump within a few feet; there was no indication of seeps below. Most of the impact to soils appeared related to the disturbance caused by the refurbishing of the mine.

The Monarch mill tailings were generally well vegetated; only ferric-hydroxide–stained seeps gave evidence to their presence.

2.15.4 Structures

There were several buldings in various states of repair near the Monarch mine. The mill building next to Monarch Creek was large and partially collapsed.

2.15.5 Safety

The open adit at the mine was locked and secure, as were most of the buildings. The mill building, which is immediately adjacent to the main road, was in danger of collapse. Behind the mill building, there were several pits, a wooden tripod, and other hazards.

2.16 Kimball Mine

2.16.1 Site Location and Access

The Kimball mine (T08N R07W 12ABAC) is on HNF-administered land, approximately seven miles southwest of Elliston along the Little Blackfoot River. The site is accessible from the main road by crossing the river next to a private, locked bridge. The lower part of the site is in the flood plain of the river.

2.16.2 Site History - Geologic Features

The Kimball mine lies in an area of Cretaceous andesitic volcanics to the northwest of the Sunset mine as mapped by Robertson (1956). McClernan (1976) quotes Geach’s field notes, estimating the adit to be 250' long; it cuts a N35^{o}E-trending, 48^{o} to 68^{o}SE-dipping vein. The quartz/ pyrite, 4" vein is silicified and pyritized. There is a mine map of the Kimball in McClernan at a scale of 1"=50' showing all 250' of workings that intersect the fault-controlled vein. McClernan (1969) states that he found the Kimball “heavily lagged for more than half (of the) total distance.”

2.16.3 Environmental Condition

The Kimball mine consisted of at least two caved adits and several large, coalescing waste-rock dumps on a steep hillside. Both of the adits were dry and did not indicate past discharges. The base of the waste-rock dumps were in the flood plain of the Little Blackfoot River. In general, the dumps contained what appeared to be high concentrations of sulfides, chiefly pyrite. The steep hillside enhanced erosion throughout the disturbed area.

2.16.3.1 Site Features - Sample Locations

The site was sampled on 10/6/95. No discharges were observed, nor was there evidence of past discharges on or near the site. Because the waste material was in the flood plain of the river, a composite sample (LKBD10H) along 100 feet on 10-foot centers was collected where waste material had eroded and mixed with the soils in the flood plain. Site features and sample locations are shown in figure 15; photographs are shown in figure 15a and 15b.

2.16.3.2 Soil

The composite soil sample collected near the base of the waste-rock dumps, in the flood plain of the Little Blackfoot River indicated high concentrations of arsenic and lead (table 23). The concentrations of other metals were slightly elevated, but well below phytotoxic limits. The site is several hundred feet from the river.

Table 23. Soil sampling results at the Kimball mine (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Soils at base of dumps (LKBD10H)	5,721[1,2]	1.2[1]	44.2[1]	1,588[1,2]	118[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3)
(2) Exceeds phytotoxic levels (table 3)

2.16.3.3 Water

There was no evidence of discharge from the caved adits or springs on the site. There was evidence of erosion throughout the disturbed area, resulting in erosion of fine-grained waste-rock. Samples were taken on the Little Blackfoot River as a downstream sample for the Kimball mine and they are discussed in the Charter Oak section.

2.16.3.4 Vegetation

Local undisturbed vegetation consisted of weeds, grasses, willows, and deciduous and coniferous trees. In the waste-rock dump areas, the ground was generally barren.

2.16.3.5 Summary of Environmental Condition

The waste rock has eroded from the steep dumps and have been deposited partly in the flood plain of the Little Blackfoot River. No surface water discharges were noted on or near the site.

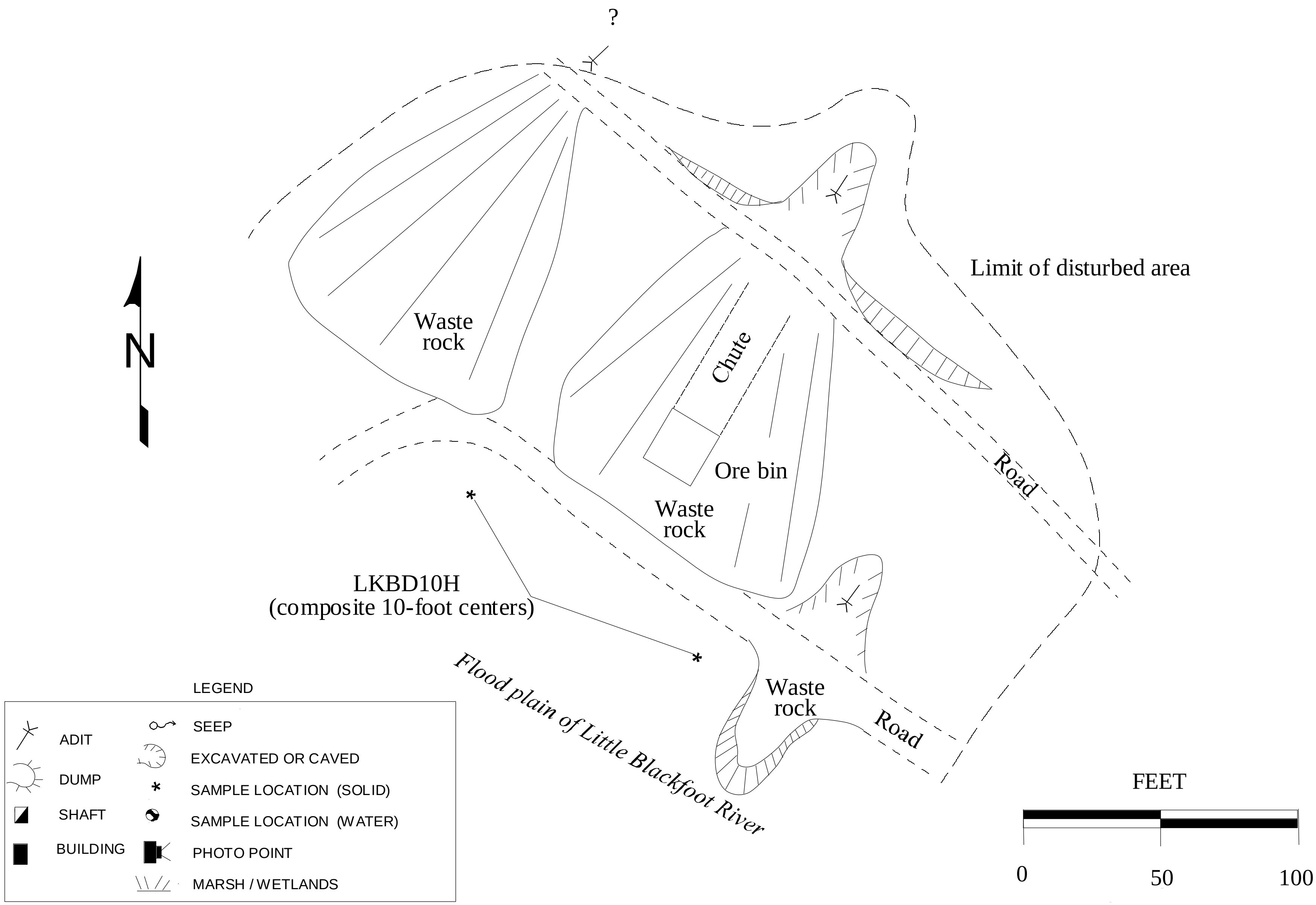

Figure 15. The Kimball mine had no site discharges at the time of the visit (10/6/95); however, waste material had been eroded and deposited in the flood plain of the Little Blackfoot River.

Figure 15a. Erosional rills marked several large waste-rock dumps on a steep hillside at the Kimball mine.

Figure 15b. The ore bin remaining on the Kimball mine sat near the base of the dumps.

2.16.4 Structures

There was an ore bin in poor condition near the base of the dumps. The adits were marked by collapsed timber. Remnants of other buildings were observed near the base of the dumps.

2.16.5 Safety

The ore bin may pose some concern for safety, but the site did not appear to have had many visitors.

2.17 Treasure Mountain Mine

2.17.1 Site Location and Access

The Treasure Mountain mine (T08N R06W 06DBAC) is on HNF-administered land about 1.5 miles up an unnamed tributary of the Little Blackfoot River. The site is accessible by primitive road first along the stream and then along a poor road on the southeast flank of Negro Mountain. The disturbed area was not accessible by vehicle.

2.17.2 Site History - Geologic Features

No specific references to this mine could be found in the literature, but it is located in an area mapped as Cretaceous andesitic volcanics by Robertson (1956) and Lusty (1973). Its geology is assumed to be similar to that of the Big Dick and Black Jack mines (see next section).

2.17.3 Environmental Condition

The Treasure Mountain mine consisted of a caved adit and two waste-rock dumps. The adit was discharging water which flowed across the dump and eventually joined a stream that originated northwest of the site, and also was flowing across the waste dump. A small pond upstream of the caved adit contained some timbers that suggested another adit, but none was found.

2.17.3.1 Site Features - Sample Locations

The site was sampled on 9/28/95; a sample (LTMS10H) was collected from the adit discharge at its origin. The adit was discharging about 16 gpm, the pH was 7.70, and the field SC was about 280 µmhos/cm. A second sample (LTMS20L) was collected from the unnamed stream topographically above the site. At this location, the stream was flowing about 5.5 gpm, the pH was 7.60, and the field-SC was about 130 µmhos/cm. A third sample (LTMS30H) was collected from the unnamed stream downstream from the Treasure Mountain mine and upstream from the Big Dick mill (next section). At this location, the stream was flowing about 63 gpm, the pH was 8.20, and the field-SC was about 320 µmhos/cm. No soil samples were collected. Site features and sample locations are shown in figure 16; photographs are shown in figures 16a and 16b.

2.17.3.2 Soil

The base of the dumps appeared stable and there was scant evidence of erosion. There was no visible impact to soils below the dumps.

2.17.3.3 Water

The concentrations of metals in the adit discharge and in the stream below the mine both exceeded several MCLs, but not the same MCLs (table 24). The arsenic concentration in the adit discharge was about three times the 50 µg/L MCL for drinking water. A similarly high concentration was found at the upper Kimball mine downstream. The relationship in metals concentrations between the downstream and upstream samples is mixed; some are greater while others are less in the downstream sample. However, the concentrations of arsenic, cadmium, zinc, and sulfate are notably higher downstream of the Treasure Mountain mine.

Table 24. Water-quality exceedences at the Treasure Mountain mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Upstream of adit (LTMS20L)								C											
Treasure Mountain adit discharge (LTMS10H)		P					S		S										
Downstream of lower dump (LTMS30H)				C									A,C						

Exceedence codes:

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

Note: The analytical results are listed in appendix IV.

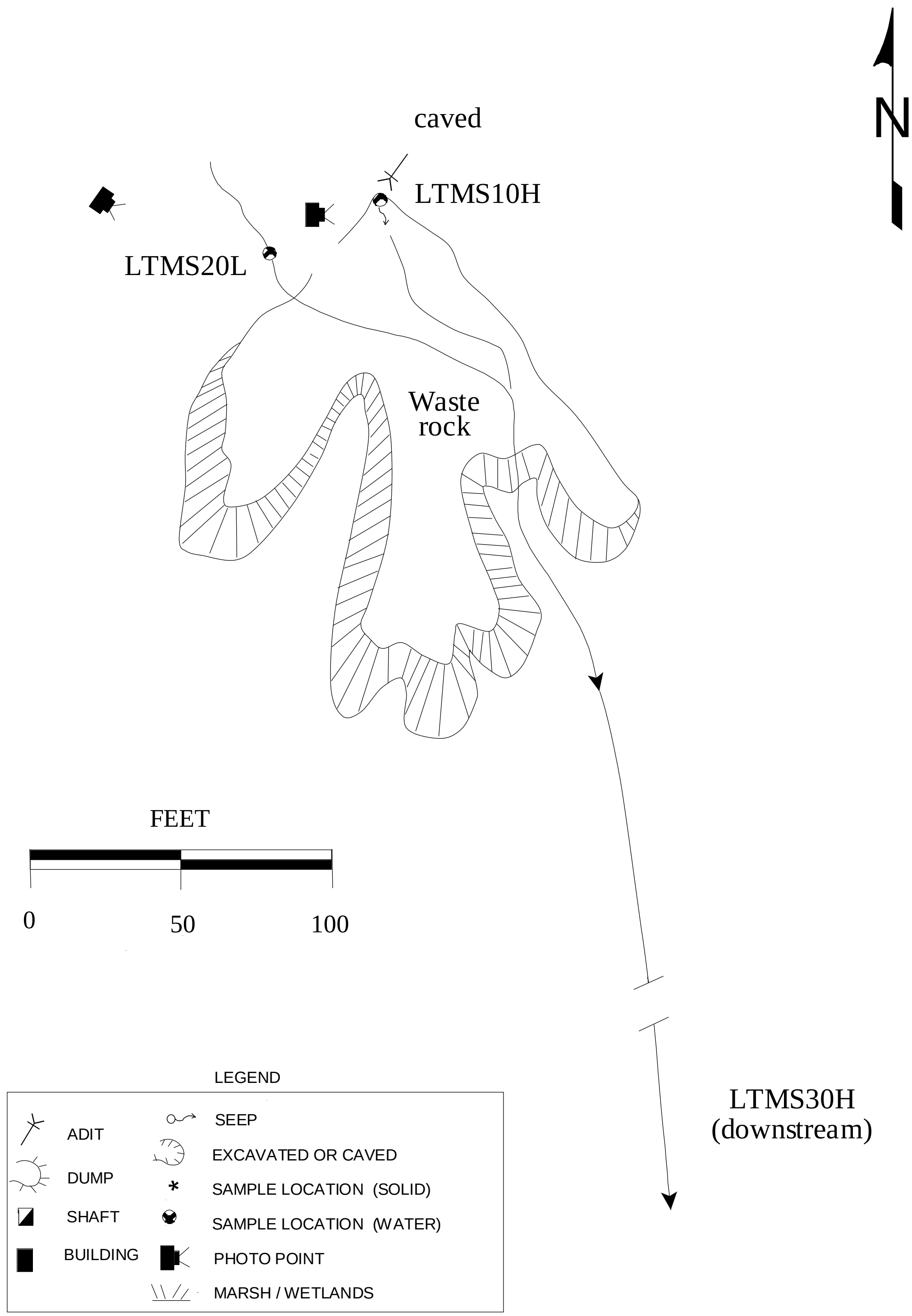

Figure 16. The Treasure Mountain mine adit was discharging about 6 gpm. There was evidence that the adit has greater flows at other times of the year. The lower waste-rock dump is not shown.

Figure 16a. The Treasure Mountain adit discharged water into a small stream that originated above the mine.

Figure 16b. The waste-rock dump of the Treasure Mountain mine was well vegetated in some areas, barren in other areas.

2.17.3.4 Vegetation

Local undisturbed vegetation at the Treasure Mountain mine consisted of weeds and grasses. The waste-rock dumps were barren to sparsely vegetated on the tops and upper slopes, while the base of the dumps, near the stream, were moderate to well vegetated.

2.17.3.5 Summary of Environmental Condition

The base of the waste-rock dumps were generally well vegetated and appeared stable. The concentrations of several metals in the stream below the mine are notably higher, and can probably be attributed to the Treasure Mountain adit discharge and leachate from the waste-rock dumps.

2.17.4 Structures

No structures were observed on or near the Treasure Mountain mine site.

2.17.5 Safety

The upper waste-rock dump had steep slopes but appeared stable. Other mines and structures in the area offer a much greater lure for visitors.

2.18 Big Dick Mill and Tailings

2.18.1 Site Location and Access

The Big Dick mill (T8N R6W 06CCBA) is on HNF-administered land, approximately one-half mile from the main road along the Little Blackfoot River. The road, in fair condition, follows the stream past the upper Kimball mine (next section) to the mill and nearby settlement. In some reports, this site is referred to as the Golden Anchor mill.

2.18.2 Site History - Geologic Features

Pardee and Schrader (1933) state the Black Jack workings include a 300' drift, and a 350' deep inclined shaft which is east of the adit. Workings at the Big Dick consist of a 1,000' long tunnel connected to a 300' deep shaft and a 200' raise. Robertson (1956) shows the regional geologic setting of the Big Dick mine (scale 1" = ½ mile) on a northeast trending vein along with the Little Dick mine one mile to the southwest.

Pardee and Schrader (1933) described the mineralogy at both these mines as consisting of black sphalerite, arsenopyrite, pyrite, sphalerite, and galena in a quartz/calcite gangue. McClernan (1973) also reports cerussite on the dump. Small inclusions of chalcopyrite are in the galena. The primary ore vein at the Big Dick strikes due east and dips 20°N (McClernan 1973) while a second vein strikes north and dips 40°W. The Black Jack explored this north-striking vein primarily but did intersect the lower angle vein. The trend of the vein was N50°E, dipping 20° NW as reported by Knopf (1913). The rock is a “porphyritic andesite breccia,” composed of gray feldspars, hornblende, pyroxene, and disseminated sulfides with some alteration to chlorite and sericite. Pardee and Schrader make no mention of the mills in this vicinity. McClernan (1969) notes that there is a flotation mill “in town” below the Golden Anchor, which he speculated to be older than the gravity mill up at the Golden Anchor.

Production from both mines reported by McClernan (1973) spanned the years of 1902 to 1954, intermittently, and totaled 16,200 ton of ore yielding 7,687 ounces of gold, 51,236 ounces of silver, 1,870 pounds of copper, 716,553 pounds of lead and 3,800 pounds of zinc. The majority of the production came from the years between 1905 and 1923.

2.18.3 Environmental Condition

The Big Dick mill consisted of a large mill building with a small waste-rock pile, several small cabins scattered throughout the surrounding area, and a large bunkhouse that appeared in danger of collapse. The mill tailings were difficult to discern in the vegetation near the stream but extended from the mill at least 450 feet down along the stream. The remnants of tailings impoundments were marked by wood cribs crossing the stream; there were at least two such impoundments. The upper Kimball mine (next section) is about 600 feet downstream; no definitive tailings deposits were found in that area.

2.18.3.1 Site Features - Sample Locations

The site was sampled on 9/28/95. Surface water samples were collected above and below the mill. The sample downstream of the Treasure Mountain mine (previous section) but above the Big Dick mill (LTMS30H), was used as an upstream sample. At this location, the stream was flowing about 63 gpm, the pH was 8.20, and the field-SC was about 320 µmhos/cm. Another sample (LUKS10M) was collected from the unnamed stream below the lowest extent of mappable tailings and above the upper Kimball mine (next section). At the downstream sample location, the stream was flowing about 76 gpm, the pH was 8.09, and the field-SC was about 277 µmhos/cm. Site features and sample locations are shown in figure 17; a photograph is shown in figures 17a.

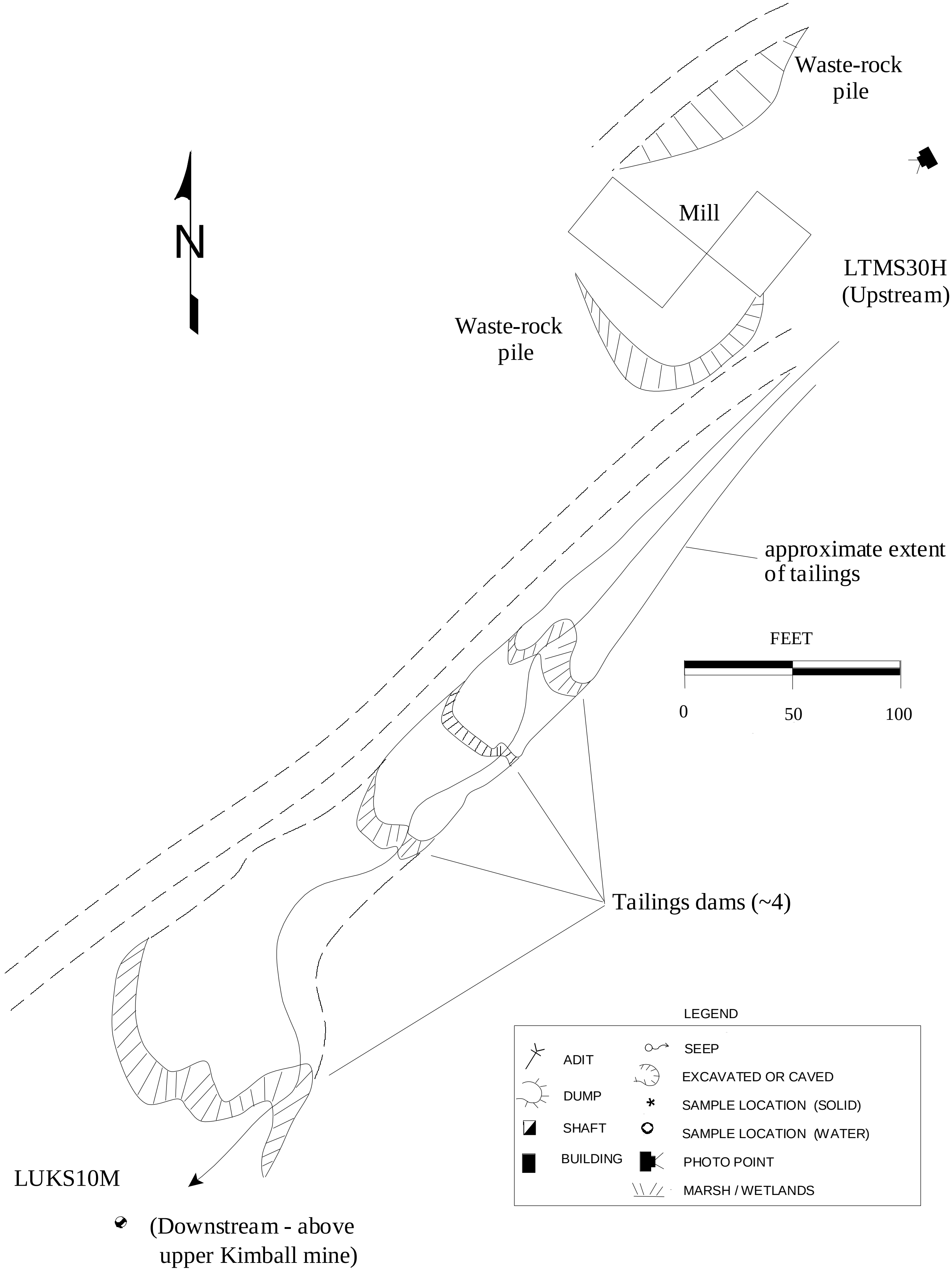

Figure 17. The Big Dick mill tailings extended about 500 feet downstream of the mill (9/28/95). The lateral extent was difficult to distinguish in some areas.

Figure 17a. The mill building of the Big Dick mill lies immediately adjacent to the road. The stream flows on the opposite site of the road.

2.18.3.2 Soil

The entire length of the stream in which tailings were deposited had well-developed soils and gentle slopes. Deposits of tailings were evident in only a few areas and were marked by steeper than normal slopes. There was no visible evidence of recent erosion or deposition of the tailings.

2.18.3.3 Water

The concentration of cadmium exceeded the chronic aquatic life MCL in the upstream sample, but not the downstream sample (table 25). Although the downstream sample had a zinc concentration above MCLs, the concentration was less than half of that in the upstream sample. In fact, the concentrations of most of the constituents were lower in the downstream sample.

Table 25. Water-quality exceedences at the Big Dick mill.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed stream above mill (LTMS30H)				C									A,C						
Unnamed stream below mill (LUKS10M)													A,C						

Exceedence codes:

A - Aquatic Life Acute

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

2.18.3.4 Vegetation

Local undisturbed vegetation at the mill site consisted of weeds, grasses, and coniferous trees. The areas suspected of containing tailings near the stream were well vegetated with grasses and small trees.

2.18.3.5 Summary of Environmental Condition

The tailings from the mill were difficult to find; no waste was exposed. Soils had developed over nearly all of the tailings. Based on the upstream and downstream samples, the tailings have no impact on the quality of water in the stream. No stressed vegetation was observed in the area of the tailings.

2.18.4 Structures

The mill building of the Big Dick mill was in fair condition. Several pieces of equipment were observed in the building. Other buildings in the area across the stream ranged from cabins to a large hotel-like structure. All were in various conditions but generally poor or collapsed. The largest building was in danger of collapse.

2.18.5 Safety

The easy access and poor condition of the mill building and other buildings combines for a concern for the safety of visitors. Although the access road did not appear well traveled, the site is only one-half mile from the main road.

2.19 Upper Kimball Mine

2.19.1 Site Location and Access

The upper Kimball mine (T08N R07W 01DCAA) is on HNF-administered land on an unnamed tributary of the Little Blackfoot River. The mine is just below the tailings of the Big Dick mill (previous section) and is easily accessible by road along the drainage about one-quarter mile from the river.

2.19.2 Site History - Geologic Features

The upper Kimbal(l) lies ¼-mile to the northeast of the Kimball proper. It is assumed that it followed a separate, but parallel, northeast-trending vein. Robertson’s (1956) map shows the general area as Cretaceous andesitic volcanics.

2.19.3 Environmental Condition

The upper Kimball mine consisted of a caved adit and associated waste-rock dump. The adit was discharging water that flowed across the dump and into the stream. The base of the waste-rock dump was in contact with the stream.

2.19.3.1 Site Features - Sample Locations

The site was sampled on 9/28/95. A sample (LUKS10M) was collected from the stream above the site in conjunction with sampling for the Big Dick mill. At this sample location, the stream was flowing about 76 gpm, the pH was 8.09, and the field-SC was about 277 µmhos/cm. A sample

(LUKS20M) also was collected from the adit discharge near its point of origin. The adit was flowing about 12 gpm, the pH of the discharge was 7.61, and the field-SC was about 260 µmhos/cm. A sample (LUKS30M) was collected from the unnamed tributary of the Little Blackfoot River below the waste-rock dump. At this location, the stream was flowing about 86 gpm, the pH was 8.0, and the field-SC was about 261 µmhos/cm. Site features and sample locations are shown in figure 18; a photograph is shown in figure 18a.

2.19.3.2 Soil

Soils outside the disturbed area showed little impact from mine-waste erosion and deposition; most of the erosion occurred along the base of the dump by the stream. The dump appeared stable and generally resistant to erosion.

2.19.3.3 Water

The adit discharge of the upper Kimball mine exceeded MCLs for iron, manganese, and zinc (table 26). The concentration of arsenic in the adit discharge was close to the drinking water limit -- much higher than the concentration in the stream above or below the site. Metal concentrations in the downstream sample generally reflect the concentrations of metals in the stream topographically above the site; most concentrations are the same or lower in the downstream sample. The exceptions are iron and manganese, whose concentrations were higher downstream of the site and were much higher in the adit discharge.

Table 26. Water-quality exceedences at the Upper Kimball mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed stream - upstream (LUKS10M)													A,C						
Upper Kimball adit discharge (LUKS20M)							S,A		S				A,C						
Unnamed stream downstream (LUKS30M)									S				A,C						

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

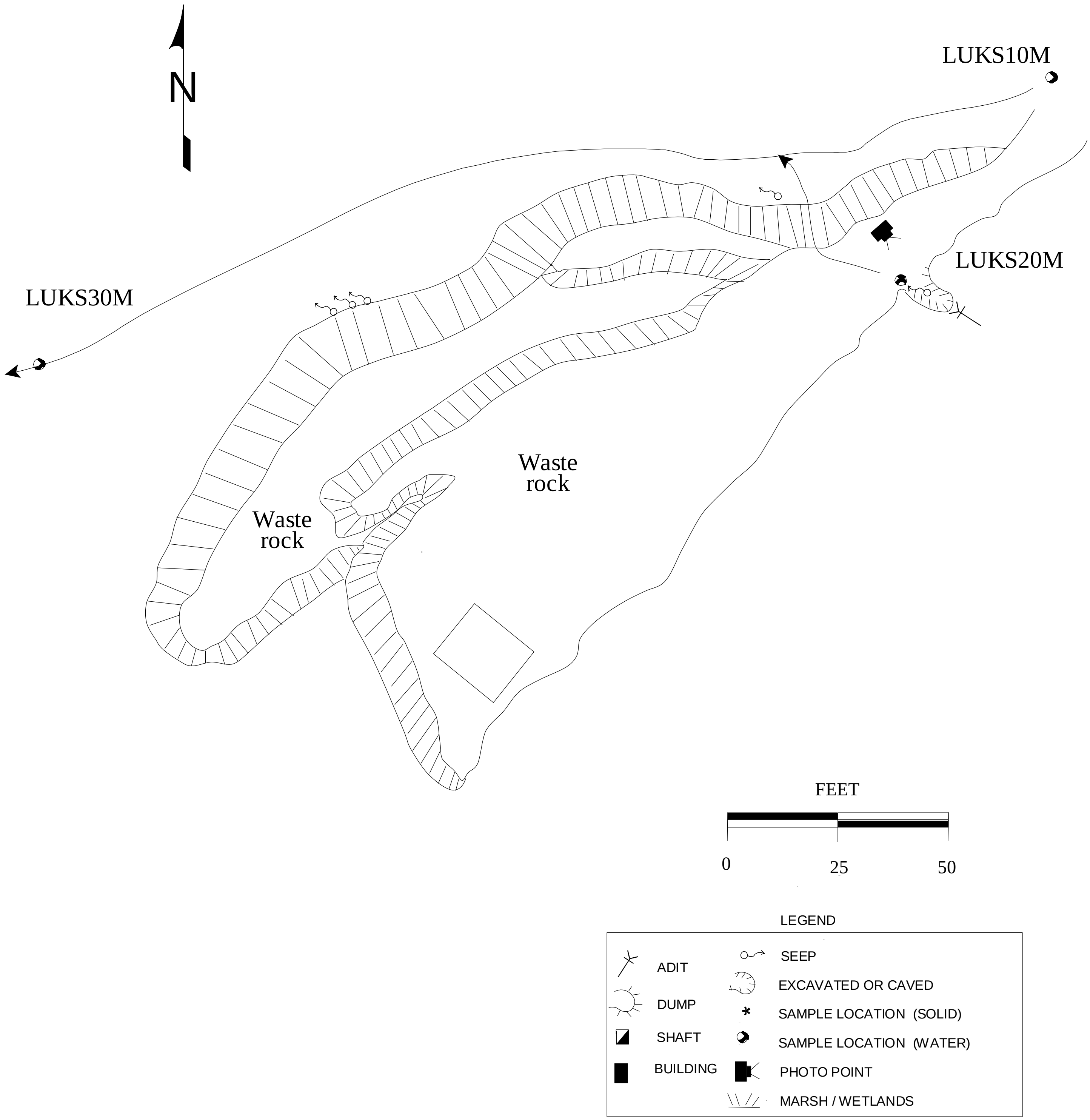

Figure 18. The upper Kimball mine is below the Big Dick mill, the Treasure Mountain mine, and several other mines and mills. The adit was caved and was discharging water to an unnamed tributary of the Little Blackfoot River (9/28/95).

Figure 18a. The upper Kimball mine adit discharged water from an adit heavily covered by vegetation.

2.19.3.4 Vegetation

Local undisturbed vegetation at the upper Kimball mine consisted of weeds, grasses, and coniferous trees. In the waste-rock dump area, the ground was barren to sparsely vegetated. The portal area was heavily grown over by willows and grasses; the area near the discharge stream also was heavily vegetated.

2.19.3.5 Summary of Environmental Condition

The adit discharge from the portal of the Kimball mine contained higher concentrations of arsenic, iron, and manganese than the stream above or below. The increased concentrations of iron and manganese in the stream could be attributed to the adit discharge, but the concentrations of other metals were probably related to mine waste upstream. The waste-rock dump was in contact with the stream; erosion was limited to some extent by the large-size material at the base.

2.19.4 Structures

A small metal shed and some debris were observed in the disturbed area. The shed was in fair condition.

2.19.5 Safety

No safety concerns were identified on HNF-administered land.

2.20 Charter Oak Mine & Mill, Negros Mine, and Golden Anchor Mine

2.20.1 Site Location and Access

The Charter Oak mine and mill (T09N R07W 36CCB) is on HNF-administered land, the Negros mine (T09N R07W 36CDA) and Golden Anchor mine (T08N R07W 01AC and 01CA) are on private land within HNF-administered land. All three sites are adjacent to the Little Blackfoot River on the opposite side as the main road. Only the Charter Oak was accessible by road along the east side of the river. The three sites are included in one section because the investigation of the private sites was limited to what could be observed from the river banks, and sampling was limited to the river itself.

2.20.2 Site History - Geologic Features

The andesite at the Charter Oak hosts two main veins: one, at least, is vertical and the other is of unknown orientation (Pardee and Schrader 1933). Mineralization consists principally of argentiferous galena and boulangerite (a lead-antimony sulfide) (Pardee and Schrader, 1933) along with arsenopyrite, sphalerite and plumbojarosite in quartz. Robertson (1956) describes this mine as the Hopkins mine. McClernan (1976) reiterates what Pardee and Schrader wrote in 1933, but does provide a 1" = 50' scale underground mine map. The map shows 300 feet of a NW-trending drift splitting as it encountered the NE-striking, 88°SE-dipping fault-controlled vein. Elliot *et al.* (1992) state that there were five adits driven along shear zones in Cretaceous andesite.

Pardee and Schrader (1933) do mention that some of the ore here was treated at a small mill on site, while some was shipped directly to the smelter. McClernan (1969) makes reference to a "Hopkins mill" near the Charter Oak mine. Production at the Charter Oak totaled (intermittently from 1916 to 1966) 9,127 tons ore yielding 382 ounces gold, 39,146 ounces silver, 10,041 pounds copper, 672,046 pounds lead, and 168,270 pounds zinc (McClernan 1976).

Robertson (1956) shows the regional geologic setting (scale 1" = ½ mile) of the Negroes mine located in Cretaceous andesitic volcanics. The mine is shown on the same vein as the Flora mine ½- mile to the southwest, and the Hopkins and Sadie mines to the northeast (Robertson 1956). McClernan (1973) describes two adits driven along three veins, ½- foot to three feet wide, east- and northeast-trending veins in pyritized and argillized andesite porphyry. McClernan also includes a 1" = 50' underground mine map of the Negros mine showing two adits driven to the northeast, one with a winze. Both adits follow two separate northwest-trending faults along which quartz-pyrite veins occur and were later brecciated. The mines were driven in andesite.

Total production listed in McClernan (1973) was 985 tons of ore producing 170 ounces gold, 6,118 ounces silver, 808 pounds copper, 132,026 lead, and 10,083 pounds zinc. Years of operation listed in the same report were intermittent from 1946 to 1968.

McClernan (1969) describes the Golden Anchor as consisting of a shaft "open and very dangerous." The dump, at that time, had been dozed and partially hauled away. He noted a mill with four tables and abundant sulfides in the NW¼ sec 6, T. 8 N., R. 6 W. that was operated by the Golden Anchor Mining and Milling Company of Elliston, Montana. No mention of the Golden Anchor is in Robertson (1956) or Regnier (1951) but is listed on Lusty's (1973) topographic map as active in 1973. Lusty shows it located in Cretaceous andesitic volcanics, but shows no structure mapped in the immediate area. It lies more than a mile from the nearest outcrop of batholith as mapped by Lusty (1973) and Robertson (1956).

2.20.3 Environmental Condition

The Charter Oak mine consisted of at least six adits: two of which were discharging water toward the river. Both of these adits were open several feet back from the portal. The mill tailings, which were extensive, were partially submerged and in the flood plain of the Little Blackfoot River. The mine and mill have been the site of several recent remedial investigations by the State of Montana and USFS.

The Negros mine consisted of a collapsed adit and waste-rock dumps in the flood plain of the Little Blackfoot River. The site is entirely on private land; no on-site investigation was made, and no site map was prepared.

The Golden Anchor mine extends from the top of Negro Mountain to the banks of the river. Waste rock was observed on the banks of the river. Because the site was entirely on private land, no on-site investigation was made, and no site map was prepared.

2.20.3.1 Site Features - Sample Locations

The sites were sampled on 10/6/95. Samples were collected from the two discharging adits of the Charter Oak mine. The upper adit (LCOS10M) was discharging about 8.5 gpm, the pH was 7.07, and the field-SC was about 1082 µmhos/cm. The lower adit (LCOS30M) was discharging about 4.5 gpm, the pH was 3.17, and the field-SC was about 1044 µmhos/cm. A small stream was flowing from the area above the adits through the main development area. A sample was collected from this stream (LCOS20M), which was flowing about 12.5 gpm. The pH of the stream was 7.77, and the field-SC was about 155 µmhos/cm.

A soil sample (LCOD10H) was collected where soils and tailings had mixed below the lower tailings impoundment near the river. The extent of the tailings deposits was large; the sample collected did not characterize the extent of impact. Site features and sample locations on the Charter Oak mine and mill are shown in figure 19; a photograph is shown in figure 19a.

Samples were collected at three locations on the Little Blackfoot River. The first sample was collected upstream of the Kimball mine (LLBS10L) and several miles below the Monarch mill. At this location the pH was 6.95, and the field-SC was about 98 µmhos/cm. The second sample (LLBS20L) was collected just below the Golden Anchor mine, which is below the tributary containing the Treasure Mountain mine, the Big Dick mill, and the lower Kimball mine. At this location, the pH was 7.01, and the field-SC was about 100 µmhos/cm. The third sample (LLBS30L) was collected about one-half mile below the Charter Oak mine and mill. At this location, the pH was 8.71, and the field-SC was about 101 µmhos/cm.

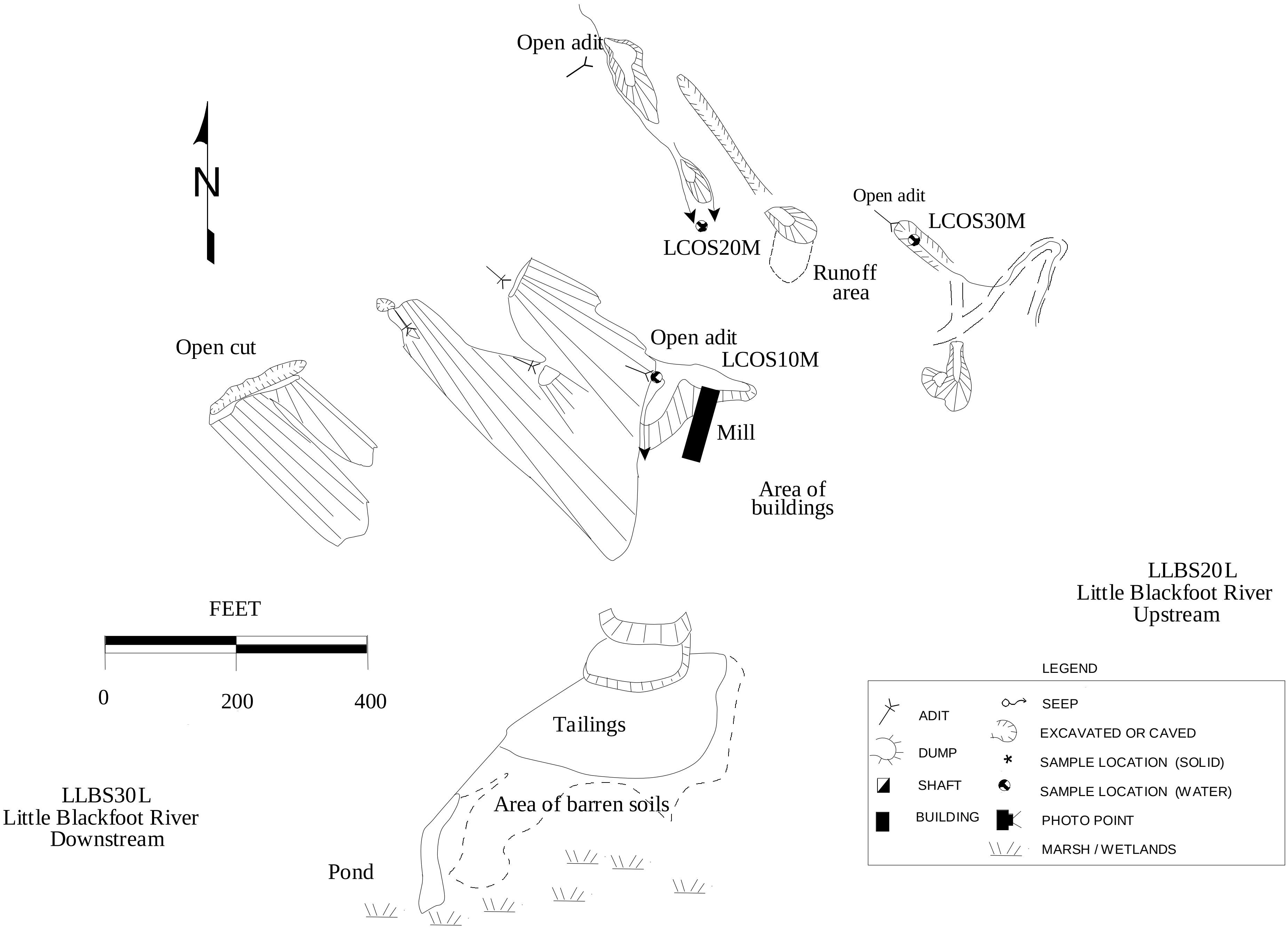

Figure 19. The Charter Oak mine and mill covered a large area next to the Little Blackfoot River (10/6/95). The tailings are in the flood plain of the river.

Figure 19a. The lower adit of the Charter Oak mine was open, and water flowed toward the nearby Little Blackfoot River.

2.20.3.2 Soil

The concentrations of several metals in the soil/tailings exceeded phytotoxic limits (table 27). Stressed and dead vegetation were evident in the areas where the samples were collected as well as in several other areas. The extent and phytotoxicity of the tailings are probably widespread throughout the area covered by tailings. The single soil sample was collected to document the magnitude of the concentrations of metals. There were indications that a previous, more detailed, soil sampling program (possibly by Pioneer Technical Services 1995) had been conducted in the area. This study probably better represents the nature and extent of the contamination.

Table 27. Soil sampling results at the Charter Oak mill (mg/kg).

Sample Location	As	Cd	Cu	Pb	Zn
Tailings / soil in lower impoundment (LCODl0H)	10,122[1,2]	2.9[1]	166[1,2]	7,013[1,2]	233[1]

(1) Exceeds one or more Clark Fork Superfund background levels (table 3)
(2) Exceeds phytotoxic levels (table 3)

2.20.3.3 Water

The poor quality water issuing from the Charter Oak development area is indicated by the exceedences of a range of MCLs (table 28). Metal concentrations in the acidic discharge of the lower adit were especially high. The stream flowing from the upper development area also exceeded MCLs, but concentrations of metals were generally much lower than those of the adit discharges.

Metal concentrations in the Little Blackfoot River were below MCLs at all three locations. The flow in the river was relatively low and should have shown at least some metals loading if it occurs. Arsenic and sulfate concentrations generally increased downstream; the increases could be attributed to the unnamed tributary containing the Treasure Mountain, upper Kimball, and other mines as well as the Golden Anchor, Negros, and Charter Oak mines along the river.

Table 28. Water-quality exceedences at the Charter Oak mine & mill, Negros mine, and Golden Anchor mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Charter Oak - upper adit (LCOS10M)		P					S		S				A,C				S		
Charter Oak - lower adit (LCOS30M)	S,A C	P,A C		P,A C		A,C	S,A	P,C	S				A,C				P,S		S
Charter Oak - stream from upper area (LCOS20M)		P											A,C						
L.Blackfoot River - above Kimball mine (LLBS10L)																			
L.Blackfoot River - below Golden Anchor mine (LLBS20L)																			
L.Blackfoot River - below Charter Oak mine & mill (LLBS30L)																			

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

2.20.3.4 Vegetation

The vegetation near the Little Blackfoot River consisted of grasses, weeds, shrubs (willows), and conifers. The disturbed areas of the Charter Oak mine were barren to sparsely vegetated as were the waste-rock dumps of the Negros and Golden Anchor mines. The tailings from the Charter Oak mine were sparse to barren. Stressed willows and grasses were common throughout the area.

2.20.3.5 Summary of Environmental Condition

The Charter Oak mine discharges and mill tailings contained very high concentrations of several metals and arsenic. The impact on water quality in the Little Blackfoot River has probably been greatest during snowmelt and storm events. A slight increase in metal concentrations below the tributary containing the Treasure Mountain mine, the Big Dick mill, the upper Kimball mine, and others was shown in samples collected along the river. The elevated concentrations persisted downstream of the Charter Oak mine.

2.20.4 Structures

There was a mill and several other buildings on the Charter Oak site. Plans to restore the site by the USFS were in progress. No structures were observed on the lower portions of the Golden Anchor mine or the Negros mine.

2.20.5 Safety

There were numerous items that pose safety concerns at the Charter Oak mine, including open adits and unsafe buildings. Access to the site was restricted by a locked gate. No safety concerns were identified for the Golden Anchor or Negros mines.

2.21 Victory/Evening Star Mine

2.21.1 Site location and Access

The Victory and Evening Star are two adjacent, patented claims located in T11N R07W 17CADA on the Ophir Creek 7.5-min. quadrangle. Additional workings to the north are grouped with these mines because of a lack a separate name. The area is easily reached by an improved dirt road (141) from the Avon-Helmville road or alternatively from Marysville on a less- maintained dirt road.

2.21.2 Site History - Geologic Features

This mine was the largest gold producer in the district according to Loen (1990); it was established in 1900. Elliot *et al.* (1992) summarized workings here as 500 feet in a replacement deposit in brecciated Devonian Jefferson Dolomite near a Cretaceous granodiorite contact.

This was the only mine with an identifiable mill site present in the Ophir district. Pardee and Schrader (1933) reported that the mill processed most of the ore from the mine and later those tails were cyanided. The mill here is located immediately north of the Ophir-Marysville Road on patented private land. The tailings, however, were deposited south of the road along the flood plain of Ophir Creek and has mixed ownership (private/HNF-administered land).

There is an open, vertical shaft (15-20 feet deep) in the NW¼ section 17, immediately north of the mine shaft symbols on the topographic map. It is easily accessible from the logging road in the clearcut and is on HNF-administered land.

Loen (1990) also collected five assay samples from the Victory with the results published in his dissertation. Ore and gangue minerals at the Victory include quartz, pyrite, chalcopyrite, geothite, hematite, limonite, malachite and magnetite (Pardee and Schrader 1933, Loen 1990). The ore was interpreted as either being found in a breccia pipe in Devonian Jefferson limestone or as a replacement deposit (Elliot *et al.* 1992). Underground mine maps with scales of 1"=20', 30', and 50' are available in the MBMG mineral property files.

2.21.3 Environmental Condition

The Victory/Evening Star workings primarily are well away from the flood plain of Ophir Creek, except for the area adjacent to the creek along which tailings have been deposited. There are no adit discharges from the workings.

This area was tested by Pioneer Technical Services (1994, page 5-138) with arsenic, iron, copper, and mercury in the tailings -- all at least three times background. No obvious effects of the elevated metal content were noted in the vegetation. The area is completely revegetated with grasses and willows and is heavily grazed by cattle. The DSL report found elevated levels of mercury, copper, and arsenic in their stream sediment samples, which they attributed to this site.

2.21.3.1 Site Features - Sample Locations

The MBMG-AIM program staff took one sample downstream of the site (OESS10H); the creek upstream of the tailings and mine was not flowing at the surface at the time of this visit on 7/26/95. Site features and sample location at the Victory/Evening Star mine and mill are shown in figure 20; photographs are shown in figures 20a and 20b.

2.21.3.2 Soil

No soil samples were taken at the Victory/Evening Star because the limit of the tailings could not be discerned. They were reported to be spread along the area in front of the mill adjacent to Ophir Creek.

2.21.3.3 Water

Ophir Creek in this vicinity flows intermittently at the surface and beneath its placered channel. The MBMG AIM program staff took one sample downstream of the site (OESS10H); the creek upstream was not flowing at the surface at the time of the study. The area where the sample was taken flowed approximately 224 gpm; the water in the creek re-emerged from the subsurface just above this point in a pond. No exceedences were noted in the downstream sample (table 29). The pH measured approximately 7.69; the field-SC was 420 µmhos/cm.

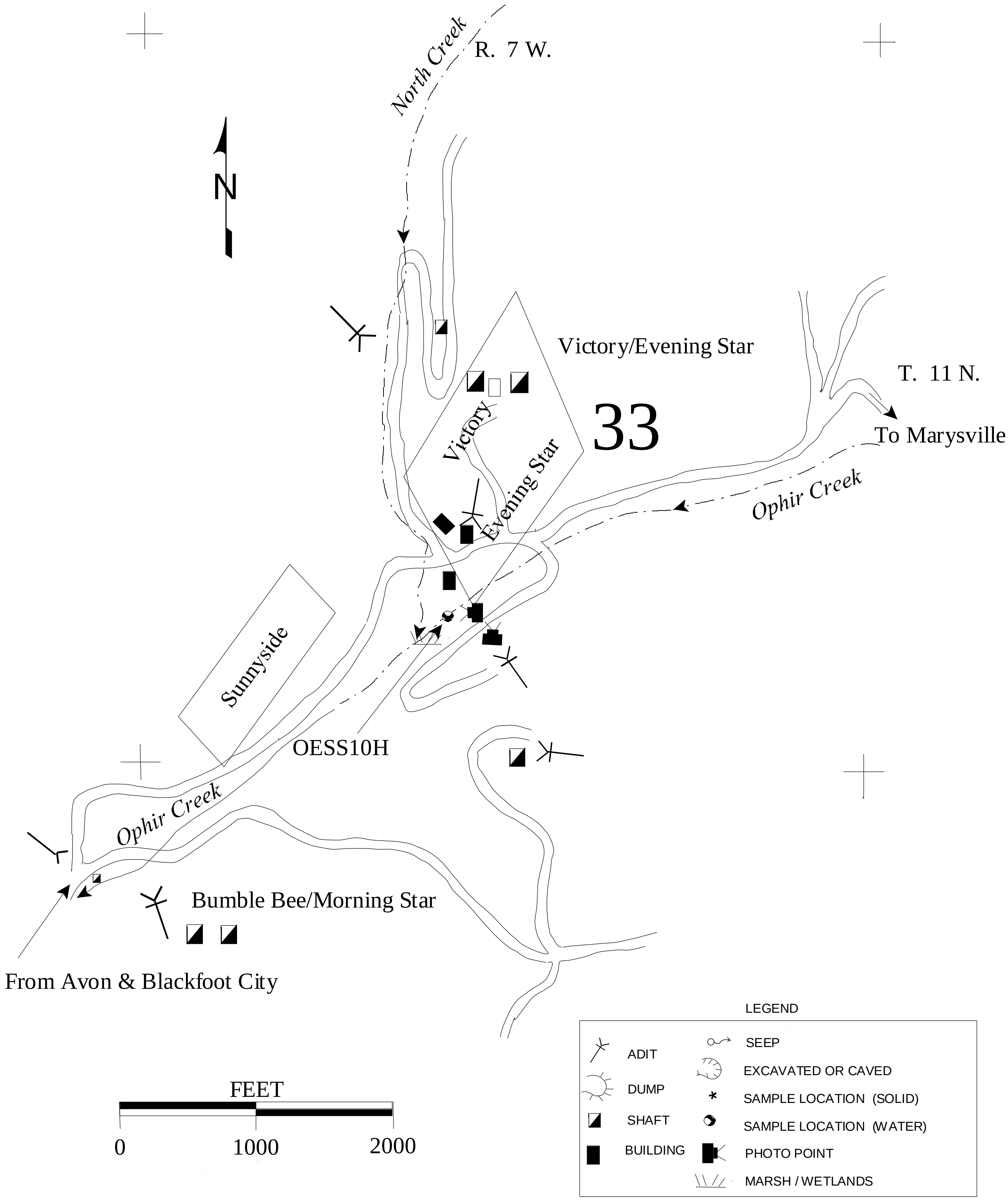

Figure 20. Schematic map of the Victory/Evening Star area showing sample location, taken from USFS ownership map.

Figure 20a. Victory/Evening Star looking north from Ophir Creek toward patented land, the collapsed mill and the underground workings.

Figure 20b. Ophir Creek re-emerged from the subsurface in a small pond immediately upstream from where OESS10H was taken.

Table 29. Water-quality exceedences at the Victory mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Downstream (OESS10H)																			

Note: The analytical results are listed in appendix IV

2.21.3.4 Vegetation

Grasses and thistles grow on the area where the tailings were deposited, and cattle seemed to prefer grazing in this flat, well-vegetated area. The creek banks here were thick with willows, wildflowers, and grasses. No negative effects of the mining on the vegetation could be recognized in this area. The area was lush in the early summer but had dried up because of the lack of rainfall in early autumn.

2.21.3.5 Summary of Environmental Condition

The area of the Victory/Evening Star has not been impacted by the mining to a great extent except for surface disturbances in the actual area mined. The tailings were spread out in the area in front of the mill to an unknown extent. The creek was below the level of the tailing's base and did not appear to be actively eroding them. The limestone/dolomite host rock may act as a buffer to any acid generated by the small amount of sulfides that were reported.

2.21.4 Structures

All structures at the Victory/Evening Star were in poor condition except for one ore bin. The mill had been reduced to a pile of boards. A bunkhouse and other unidentified buildings were also collapsed. A platform that may have served as a conveyor laid in ruins in the meadow. One board cabin located in the meadow had the roof partially intact. A cabin near the upper shafts was built of logs and also was in poor condition.

2.21.5 Safety

The intact ore bin posed a small safety concern, as well as the vertical-sided shaft to the north of the shaft symbols on the topographic map, which is on HNF-administered land. The area seemed to have a fair amount of use from hunters and campers with an unofficial campsite located immediately to the southwest of the mine and mill.

2.22 Bumble Bee/Morning Star Mine

2.22.1 Site location and Access

The Bumble Bee/Morning Star can be reached via the Ophir Creek road, by two-wheel drive vehicle to within 500 feet of the mine. The Bumble Bee is located on the Ophir Creek 7.5-min. quadrangle in T11N R07W 20BBCD. A cabin located to the west of Ophir Creek was seasonally inhabited by Clarke Smith in 1994 and 1995.

2.22.2 Site History - Geologic Features

Dates of significant mining included 1939 to 1940, 1950, 1966 to 1968, 1970 to 1974 and 1976. Activity before 1939 is probable, but references to it could not be found in literature. Literature states that a shaft is the main entrance, but there is also an adit to the northwest of the shafts. It is this adit that has a very small discharge. The adit and shafts are caved. Two placer patents were applied for part of this area in 1990 by Clarke Smith of Avon.

Host rock for the mine is stated as Jefferson Dolomite in contact with quartz monzonite/ granodiorite (Elliot *et al.* 1992, Loen 1990). Workings were in excess of 300 feet and total production estimated at greater than $50,000. Last reported work on the mine was in 1976 (MBMG mineral property file). There also is an accessible open adit to the northwest of the main access road as well as a flooded, poorly fenced shaft to the southeast of the road. These are not technically a part of the Bumble Bee/Morning Star. No sulfides were noted on the waste dump.

2.22.3 Environmental Condition

Evidence indicated that the 1–2 gpm discharge has been captured for a water supply for the nearby cabin; the discharge emerged from a black plastic pipe that is buried under the caved portion of the adit. The discharge had no obviously adverse effects on vegetation, and there was no evidence that it reached Ophir Creek. A flooded shaft lies northwest of Ophir Creek Road.

2.22.3.1 Site Features - Sample Locations

The adit discharge was sampled (OBBS10H) where the black plastic pipe goes into the box leading down to the cabin. An upstream sample (OBBS20M) was taken immediately to the northeast of the small bridge crossing Ophir Creek. A downstream sample (OBBS30M) was taken below the workings. At the time of this study, Ophir Creek intermittently flowed at the surface and under the dredge piles in the creek. The average elevation of the area is 5,800 feet. Site features and sample locations on the Bumble Bee/Morning Star mine are shown in figure 21; photographs are shown in figures 21a and 21b.

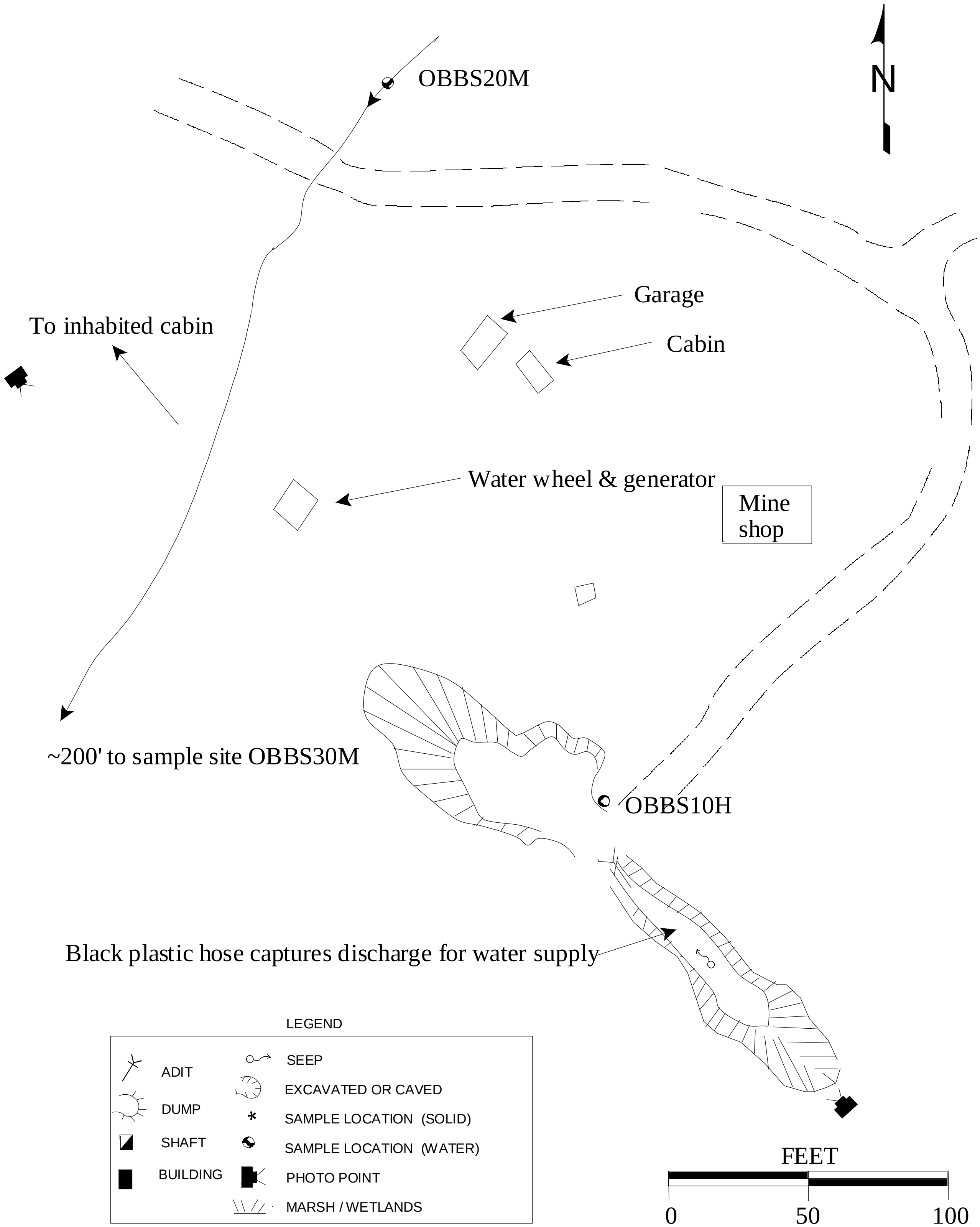

Figure 21. A small discharge issues from white marble of the collapsed adit at the Bumblebee mine, as mapped 09/15/94.

Figure 21a. One of two dry, collapsed shafts found at the Bumble Bee/Morning Star.

Figure 21b. Looking NW along the collapsed adit at the Bumble Bee with the small greenish discharge channel visible in the center of the photo.

2.22.3.2 Soil

The soil below the limestone dump was not visibly impacted by the waste. The waste dump itself was cobble to boulder sized. No soil sample was taken.

2.22.3.3 Water

Most elements analyzed for at the Bumble Bee were near or below detection limits (table 30). The pH was approximately 8.0 (range from 7.99 to 8.27) in all three samples; the field-SC ranged from 284 to 370 µmhos/cm. No evidence of sedimentation was obvious, but some iron staining was noted. At the time of this study, Ophir Creek flowed approximately 1400–1900 gpm.

Table 30. Water-quality exceedences at the Bumblebee/Morning Star mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Upstream-(OBBS20H)																			
Adit discharge (OBBS10M)																			
Downstream-(OBBS30M)																			

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

2.22.3.4 Vegetation

The vegetation at the Bumble Bee appeared healthy and not stressed. Grasses, thistles, and willows grew in the open areas with Douglas fir and lodgepole pine growing on the slopes. Aspen grew on the waste dump and along the slopes of the valley.

2.22.3.5 Summary of Environmental Condition

Visually and chemically, this area does not pose any concern to the environmental condition of Ophir Creek. No metal concentrations were elevated in any of the samples.

2.22.4 Structures

The buildings are all in good condition. The old mine shop, the largest building, may be considered of historical significance and appeared to have many of the original tools remaining. A cabin on the northwest side of the creek is seasonally used by Clarke Smith with another abandoned one on the south side of the creek. There are also a storage shed/garage, an outhouse and a water wheel/generator shed.

2.22.5 Safety

The adit is completely collapsed but with a steep highwall; the shafts are collapsed but further collapse is a possibility. The pits left by the collapse of the shafts are 15–20 feet deep with tapering but steep sides. A flooded adit on the west side of the creek had a pole fence in poor condition and may be a hazard to livestock.

The following mines are in the Blackfoot drainage and are organized from the most upstream contributor to the more downstream contributors.

2.23 Rex Beach Mine

2.23.1 Site location and Access

The Rex Beach lies three quarters of a mile up Shoue Creek after turning left off the Blackfoot River Road (No. 1846) at Rowland's Camp. It lies just north of the Consolation group of patented claims and in the Heddleston district, T15N R06W 12AABA on the Rogers Pass 7.5-min. quadrangle. The site is entirely on HNF-administered land; access is via a fair dirt road up the east side of Shoue Creek. The upper road has been obscured by alders; the lower road to the associated cabin is accessible by two-wheel drive but has also been somewhat overgrown by vegetation. The adit is 500 feet uphill from the cabin.

2.23.2 Site History - Geologic Features

Pardee and Schrader (1933) list a total workings of 500 feet: a 200-foot crosscut and "300 feet of drifts along two veins." This was a silver, gold, and lead mine with lesser zinc, copper, arsenic, and antimony. The two veins strike N15^{o}W (4 to 7 feet) and N15^{o}E (2 to 3 inches). Pardee and Schrader also show this mine in diorite, which concurs with Whipple *et al.* (1987) who show it in Late Proterozoic diorite. Whipple and Bregman (1981) show this area in more detail, locating it near or on a NW-trending fault with diorite to the northwest and diorite/Precambrian Spokane Formation to the southeast. Pardee and Schrader list sulfide minerals of pyrite, galena, and sphalerite as well as carbonate gangue. McClernan (1983) summarized Pardee and Schrader's information but with a few differences.

A composite sample from the waste dump of altered Spokane Formation and gabbro (clays), pyrite, and quartz ran 0.020 opt Au, 5.75 opt Ag, 0.13% Cu, 5.03% Pb, and 0.82% Zn. A sample as reported in Pardee and Schrader (1933) showed the ore contained values in silver, gold, lead, zinc, copper, arsenic, and antimony.

2.23.3 Environmental Condition

This is a relatively small site, not more than two acres. The creek flows across a hummocky area —what may be a landslide—then reappears from a totally collapsed adit and flows adjacent to the waste dump (eroding it slightly), and then joins Shoue Creek 500 feet to the northwest.

2.23.3.1 Site Features - Sample Locations

Workings located on the southeast side of Shoue Creek consisted of one totally collapsed adit with a small discharge as well as streamside waste pile with active erosion of the northeast side. A small, steep gully enters above the adit from the southeast. The caved adit may capture the water from the creek through an unconsolidated landslide and then appears to discharge it. There was a highwall behind the adit that is fairly steep. The discharge that erodes the side of the waste dump did not reach the creek at the time of this visit. The waste dump was composed of <5% sulfide (pyrite, galena?), gabbro, siltstone, iron oxide and abundant clay (from alteration of gabbro (?) Shea (1947), or diorite Pardee and Schrader (1933). Pardee and Schrader (1933) state the workings total 500 feet; 200 feet of adit and 300 feet of drifts.

One upstream sample (SRBS20M) and one downstream (SRBS10M) sample were collected on the small tributary to Shoue Creek. Shoue Creek below this mine was sampled as the upstream sample for the Consolation Group (SCOS10M). The adit had a small seep area, but there was not enough water to sample.

Site features and sample locations on the Rex Beach mine are shown in figure 22; photographs are shown in figures 22a and 22b.

2.23.3.2 Soil

No soil sample was collected here. The surrounding vegetation was not visibly affected by the waste.

2.23.3.3 Water

Water condition was clear and cold; upstream field measurement of pH was 7.8 and SC was 122.4 µmhos/cm; downstream field measurement of pH was 7.2 and SC was 116.8 µmhos/cm. The flow in the tributary reaches Shoue Creek only at certain times of the year; when measured it was flowing at only 8 gpm. There were no exceedences noted in the water samples for the Rex Beach (table 31).

Table 31. Water-quality exceedences at the Rex Beach mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Unnamed creek - downstream (SRBS10M)																			
Unnamed creek - upstream (SRBS20M)																			

Note: The analytical results are listed in appendix IV

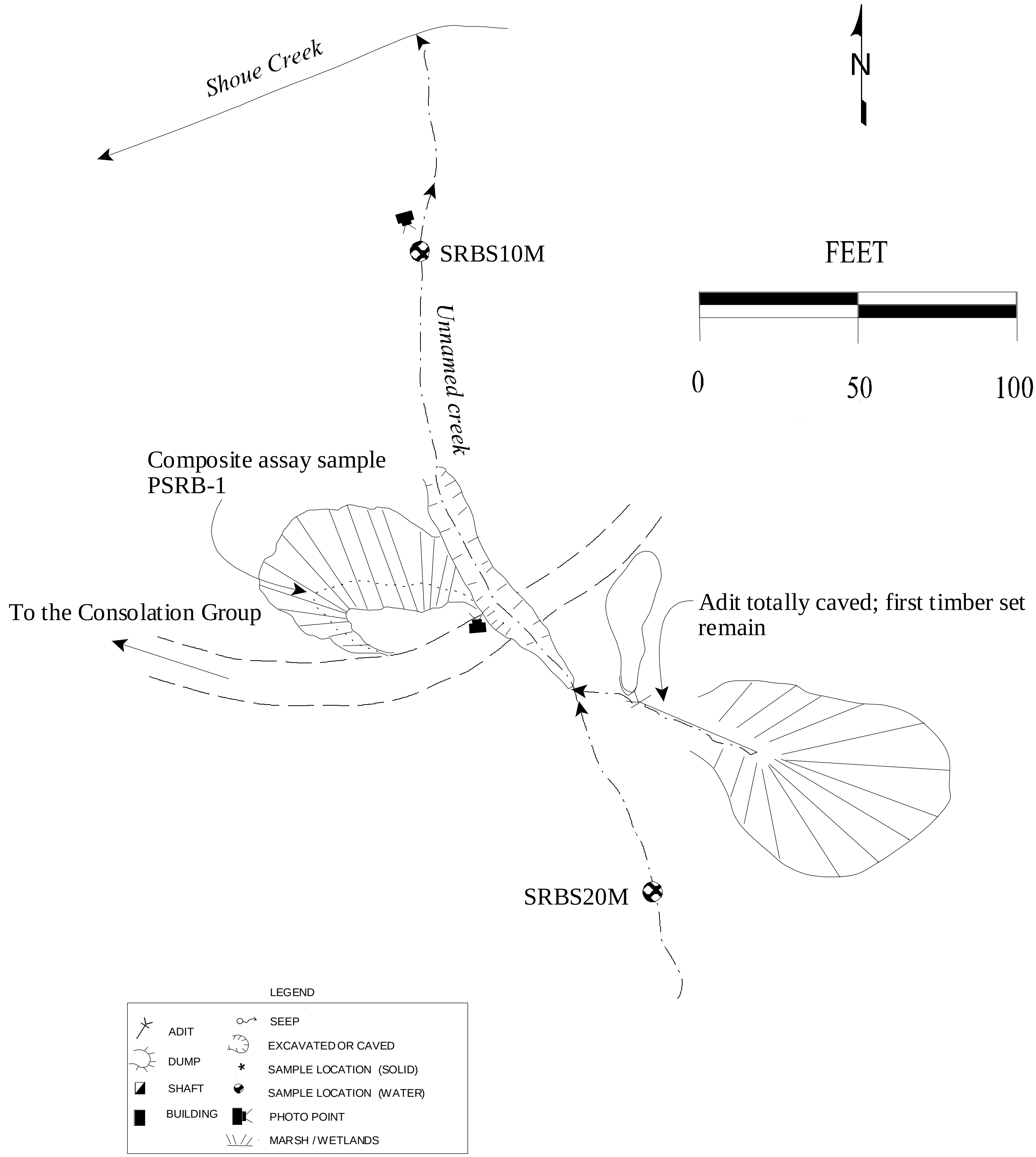

Figure 22. Rex Beach's discharge joins with the flow in an unnamed creek, as mapped 10/12/94.

Figure 22a. Unnamed creek, tributary of Shoue Creek, flowed on the east (right) side of the waste-rock dump.

Figure 22b. Sample site SRBS10M on the unnamed tributary to Shoue Creek flowed clear and cold.

2.23.3.4 Vegetation

Vegetation was lush along the creek bed; willows, alders, huckleberries and Douglas fir have revegetated the mine workings and road. Only the waste dump remained unvegetated.

2.23.3.5 Summary of Environmental Condition

The waste dump contained sulfides and was being eroded by the small unnamed creek flowing along its east side. Because of its small size, there was not much impact from the site. No waste was evident downstream and vegetation is unaffected. Visibility of the site was low, probably with only a few hunters and recreationalists stumbling upon it.

2.23.4 Structures

A cabin in bad condition and outhouse were built downhill (northwest) from the mine. The cabin has almost totally collapsed and was not high-quality construction to begin with. The floor remained and two sides were standing. The outhouse was still standing; a two holer with the second hole a smaller "kiddie" seat. There was a pile of lumber on the waste dump, probably from an old building.

2.23.5 Safety

There was a steep highwall surrounding the collapsed adit, and the dump was steep and clayey; both are remote and not highly visible.

2.24 Consolation Group

2.24.1 Site location and Access

The Consolation lies approximately 0.4 mile up Shoue Creek from the turnoff at Rowands Camp on the Blackfoot River. Access is easily available to the public on an improved dirt road. An occasional visitor probably stumbles upon the site, but the area is not heavily used, and the road dead ends to two-wheel drive traffic immediately above the mine. The group is located on the Rogers Pass 7.5-min. quadrangle in T15N R06W 21ABCD.

2.24.2 Site History - Geologic Features

Pardee and Schrader (1933) described the Consolation in the 1920s and 1930s at which time they were already caved. The 500-foot-long adit was driven in the diorite along a vein striking N50^{o}W, dipping 85°SW (Pardee and Schrader 1933). Ore minerals included pyrite, galena, sphalerite, and locally, bornite, in a quartz gangue (Pardee and Schrader 1933). Veins here are hosted in Cretaceous gabbro (Shea 1947) or diorite sill (Pardee and Schrader 1933) and were last worked in 1969.

2.24.3 Environmental Condition

Shoue Creek ran clear and cold with a bed of primarily red (Belt?) argillite cobbles and gravel. No adit discharges were noted; a 50-foot section of waste dump on private land was actively being eroded by the creek. Mine-related trash was strewn around on private land, including rusting iron junk, flotation tanks, oily waste in a drum and a burned vat that may have been used as a leach tank.

2.24.3.1 Site Features - Sample Locations

Although this mine is located on patented ground, the Consolation may adversely affect Helena National Forest land downstream. A sulfide-rich waste dump is located adjacent to Shoue Creek, and there is a rudimentary vat leach tank partially burned in the flood plain. All adits were completely caved.

One sample (SCOS10M) was collected on HNF-administered land approximately 200 feet upstream from the mine. A downstream sample (SCOS20M) was collected approximately 300 feet down from the mine workings. Site features and sample locations at the Consolation mine are shown in figure 23; photographs are shown in figures 23a and 23b.

2.24.3.2 Soil

No soil samples were collected in connection with the Consolation. All waste dumps were on private land.

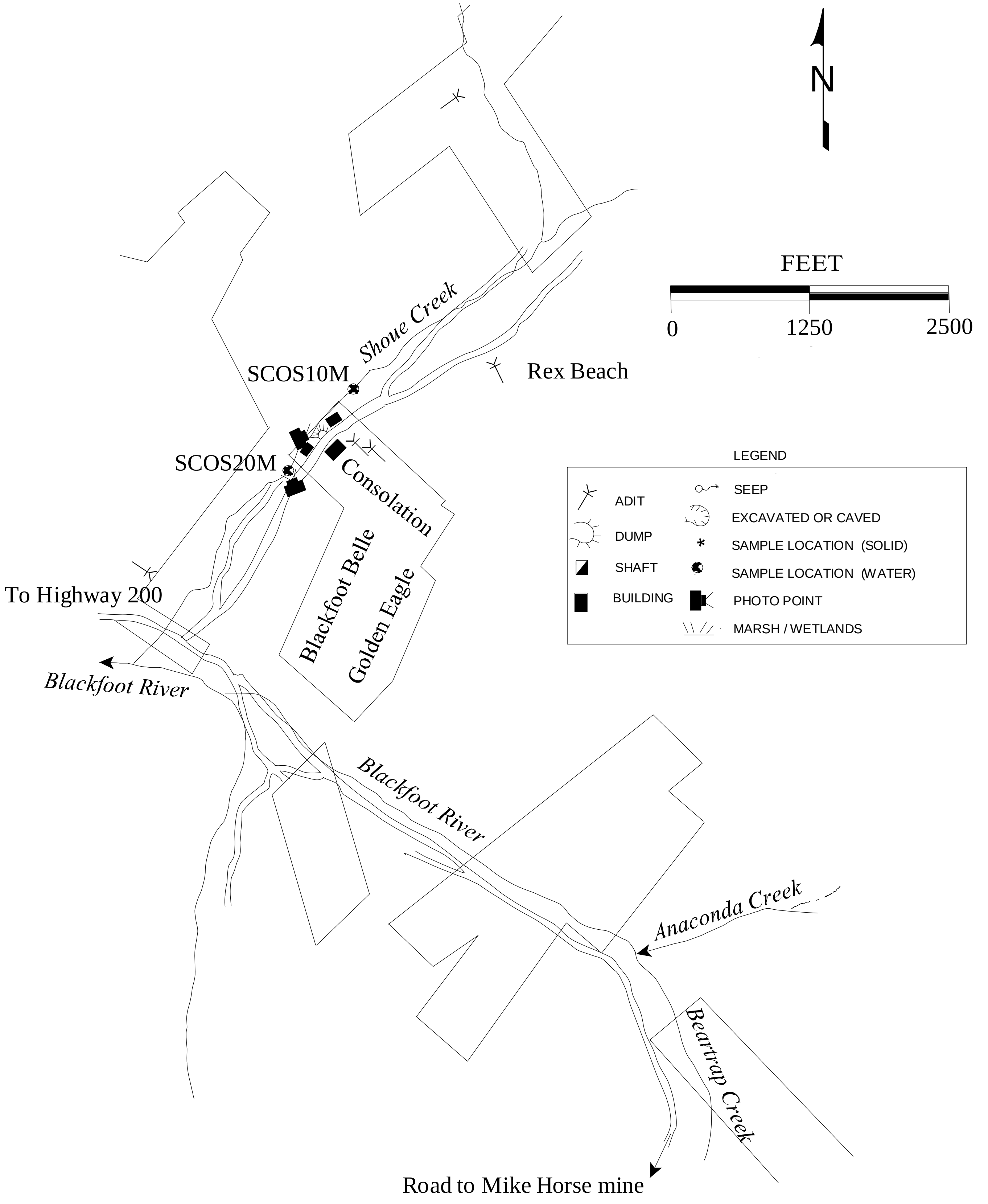

Figure 23. Schematic of the Consolation Group and surrounding area showing upstream/downstream sample sites; taken from a USFS ownership map of the Rogers Pass 7.5-min. quadrangle.

Figure 23a. Shoue Creek flowed by the Consolation mine and its waste, eroding the waste slightly.

Figure 23b. Burned vat and junk clutter the Consolation mine, primarily on patented land.

2.24.3.3 Water

The only exceedence noted at the Consolation was for mercury in the upstream sample (table 32). The level was near the detection limit at 0.1 ppm. The pH, upstream and downstream, was in the 7.2–7.7 range; the SC was the same upstream and downstream at approximately 120 µmhos/cm.

Table 32. Water-quality exceedences at the Consolation group.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Upstream - SCOS10M										C									
Downstream - SCOS20M																			

Exceedence codes:

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

2.24.3.4 Vegetation

No effects to the vegetation were noted along the banks of Shoue Creek. The waste dump on private land was sparsely vegetated, but its influence appeared to be restricted to the immediate area.

2.24.3.5 Summary of Environmental Condition

The Consolation's primary impacts appear locally in the garbage strewn about and the actively eroding waste dump with sulfides. There was debris scattered over the area; two cabins and one mine building are left standing. A wooden, half-burned vat with junk in it may have been used as a pseudo-vat leach arrangement. All the disturbances were on private, patented land.

2.24.4 Structures

All structures at the Consolation were on private land. One, three-room log cabin in poor condition (walls standing, roof partially gone) overlooks Shoue Creek on the west side of the road. A mine shop lies to the east of the road; it also is in poor condition with the roof mostly gone and the sides still standing. The shop was a fairly recent building built partially of logs and partially of sawn lumber and 2 x 4's.

2.24.5 Safety

All possible safety concerns are located on patented claims. The private land does have steep slopes and unstable buildings.

2.25 Bobby Boy Mine

2.25.1 Site location and Access

Access to the Bobby Boy is via Highway 200 turning north at the USFS Meadow Creek sign and proceeding 0.1 mile. After crossing the small bridge at the Blackfoot River, proceed up the small road that goes straight instead of bearing left and go to the end of the small two-track road. The Bobby Boy mine is located 0.3 miles up Porcupine Gulch, T15N R06W 19DDBC on the Cadotte Creek 7.5-min. quadrangle. It is possible to drive to the mine using four-wheel drive but just as easy to park at a small campsite and walk the last ⅛-mile. The site is entirely on land administered by the Helena National Forest/Lincoln Ranger District.

2.25.2 Site History - Geologic Features

Whipple *et al.* (1987) show this mine located in Middle Proterozoic Spokane Formation to the southwest of a NW-trending fault juxtaposing Spokane with Late Proterozoic diorite. A composite sample from the perimeter of the waste dump (PBBB-1) yielded assays of 0.001 opt Au, 0.14 opt Ag, 0.01% Cu, 0.03% Pb, and 0.08% Zn. The dump contained all oxides. MBMG mineral property files show evidence of activity in 1972. According to Lawson (1975, 1976), the mine's status was inactive.

2.25.3 Environmental Condition

The maximum area of disturbance at this site was two acres, with natural revegetation almost complete. The creek ran clear and cold and is well vegetated. The single adit here had approximately one foot of standing water for the 20 feet or so that remained open; the water had exceedences in cadmium, manganese, mercury, and zinc. The pH (6.34) was lower than the secondary MCL. At the time of this visit, it had an adit discharge of less than one gpm. The discharge channel was well vegetated and indicated that flow did not greatly exceed the present rate. The discharge disappeared after approximately 80 feet and there was no evidence that it ever reaches the creek. There were streamside wastes, but they are not obviously stressing the vegetation.

2.25.3.1 Site Features - Sample Locations

Three samples were taken on 08/23/95: one from the standing water in the adit (PBBS10M), the others from an upstream (PBBS20L), and a downstream (PBBS30L) site. The water in the adit was tested instead of the actual discharge because the small amount of water actually leaving the adit was insufficient for sampling. Site features and sample locations at the Bobby Boy mine are shown in figure 24; photographs are shown in figures 24a and 24b.

2.25.3.2 Soil

No soil sample was collected. The waste dump was well stabilized by vegetation, primarily contained oxides, and did not appear to impact the surrounding vegetation.

2.25.3.3 Water

Analyses of the upstream and downstream samples showed no exceedences. The water appeared clear and cold with fairly lush vegetation along the banks of the stream. Field parameters for the samples upstream and downstream, respectively, include a pH of 7.2 and SC equal to 127.1 µmhos/cm @ 25°C; a pH of 6.8, and an SC equal to 123.6 µmhos/cm. The adit water measured 6.5 pH and the SC was 271 µmhos/cm. The exceedences for the water in the adit are listed in table 33 below.

Table 33. Water-quality exceedences at the Bobby Boy mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit water - (PBBS10H)				P,A, C					S	C			A,C						S
Porcupine Gulch - upstream (PBBS20M)																			
Porcupine Gulch - downstream (PBBS30M)																			

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

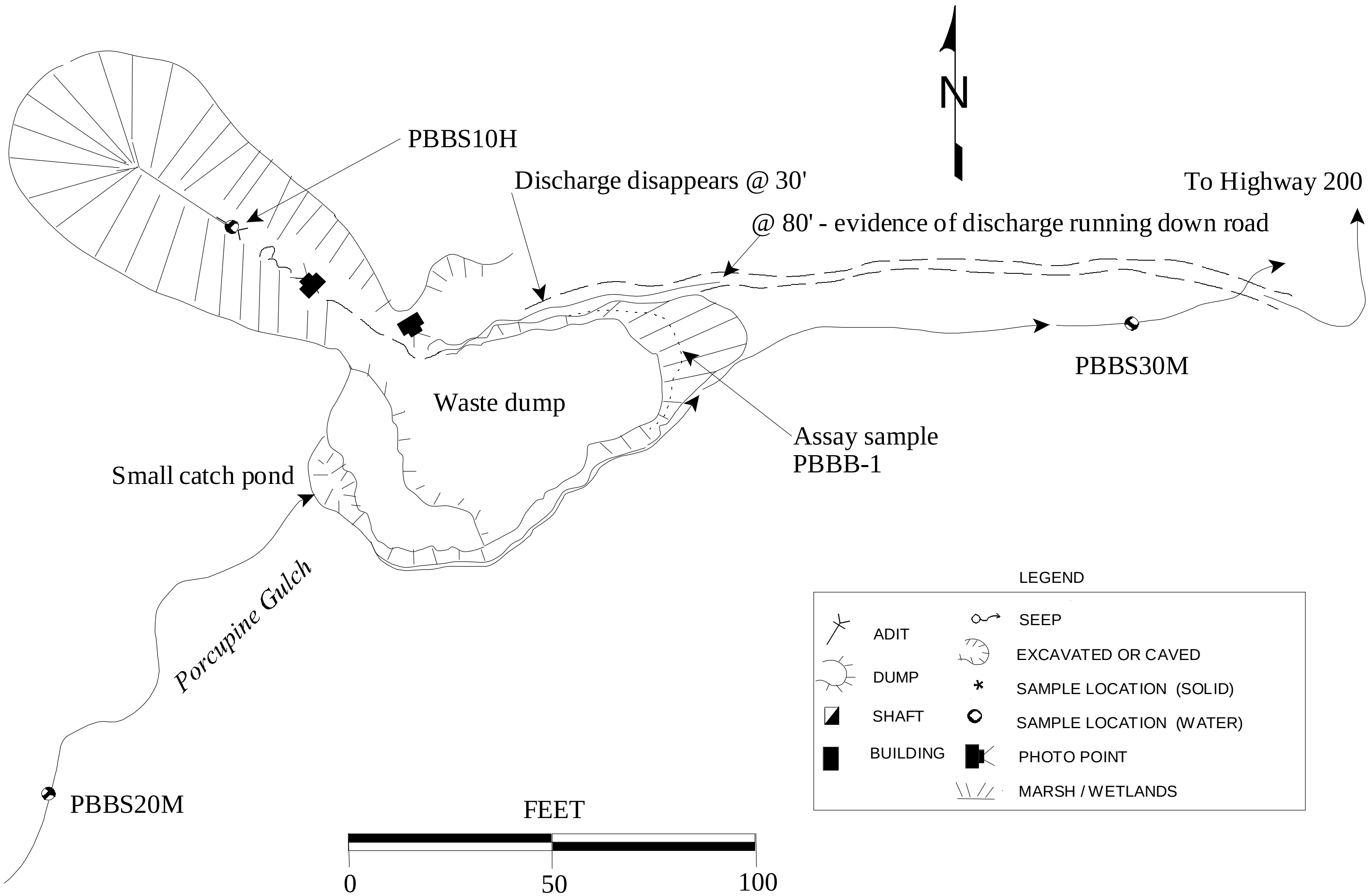

Figure 24. Bobby Boy mine on Porcupine Gulch discharges less than one gpm as mapped 09/08/94.

Figure 24a. Water stands in the open, timbered, and lagged adit at the Bobby Boy with a <0.5-gpm discharge.

Figure 24b. A small discharge (<0.5 gpm) flows from the adit at the Bobby Boy.

2.25.3.4 Vegetation

Vegetation here was not noticeably stressed. The waste dump has been revegetated by grasses and 3- to 5-feet tall Douglas fir. Grasses, ferns, and shrubs lined Porcupine Gulch. The steep slopes, formed when the adit was driven, were still somewhat barren but probably due to steepness of slope and lack of water more than presence of metals.

2.25.3.5 Summary of Environmental Condition

Environmentally, this site was not pristine but did not appear to impact the Blackfoot River below it. The Blackfoot River below was visibly impacted by the Heddleston district so that any impact Porcupine Gulch definitely did not add a significant amount of metals to it. The Blackfoot at the bridge on the road leading to the Bobby Boy was cloudy and stained with orange precipitate. Although waste was in the drainage of Porcupine Gulch, it was not being eroded to a large extent.

2.25.4 Structures

The topographic map shows a cabin near there, but during the site visit, no structure was found. It may have been destroyed by the logging operation immediately north.

2.25.5 Safety

The timbered and lagged portion of the adit, extending back approximately 20 feet, was flooded with as much as 20 inches of standing water. This posed a slight danger, mostly to small animals that might fall in and not be able to climb out over the board at the portal.

2.26 Oker Mine

2.26.1 Site location and Access

This group of adits and associated waste dumps can be reached via Highway 279 turning northeast up Sandbar (or Sanborn) Creek and proceeding 1.3 miles to the first adit, and a total of 2.0 miles to the end of the road (to the fourth or last adit). The area is accessible by two-wheel drive when the road is fairly dry. The sites occur in T14N R06W 05, and T15N R06W 32 and 33, on the Cadotte Creek 7.5-min. quadrangle; they are entirely on HNF-administered land.

2.26.2 Site History - Geologic Features

Pardee and Schrader (1933, plate 12) show the location of this mine in their history of the area but do not include it in their description of the Heddleston district's mines. The adit in section 5 is driven into a Tertiary monzonite porphyry stock according to Whipple *et al.* (1987). This intrusive is inferred to be the same lithology with which the Heddleston district is associated. The same map shows the next two adits to the east are driven in Proterozoic diorite, and the fourth is in Precambrian Spokane Formation. The adits also have widely divergent trends leading to the conclusion that the exploration was perhaps not based on geologic knowledge.

There is a file in the MBMG files on "Sanborn" Creek that fits the description of Sandbar Creek but the occurrence described is a manganese one. Samples from the mines described above are not anomalous in manganese, so the two occurrences may be unrelated.

During the first visit in 1994, no signs of recent activity were present. In August of 1995, red sample flags had been placed on the upper waste dump (adit four), and it appeared as if a study were in progress.

2.26.3 Environmental Condition

The most outstanding feature of this site, environmentally, was the orange, iron-oxyhydroxide precipitate deposited to the southeast of the workings in section 5 and downstream in Sandbar Creek to its confluence with Willow Creek. It began approximately 500 feet above adit number one (the easternmost adit); the creek was cloudy and iron stained all the way down to its confluence with Willow Creek. No direct cause of the staining was evident, but it may have been a result of cumulative effects. The upper (easternmost) and middle dumps had white salts precipitated on the surface.

The creek cut across the waste dump of the middle adit; the upper and lower adits had streamside wastes. One pile of ore sat on timbers, apparently as an attempt at an open-roasting set up or an ore-loading platform. Charcoal remains of earlier burnings remain under and adjacent to the pile. A road had been constructed across the middle waste dump, and adjacent to this area, the streambed has been placered. None of the three—possibly four—totally caved adits had discharges.

2.26.3.1 Site Features - Sample Locations

Samples were taken: 1) upstream from adit A04, 2) downstream from adit A04, 3) downstream from adit A03, but upstream from adit A02, 4) upstream from adit A01 and 5) downstream from A01. A grab assay sample (PBLOM-1) was taken from the ground 125 feet along the length of A01, the westernmost adit; it included fault breccia, altered intrusive and siltites cut by hairline to 2-mm veinlets. It assayed <0.0005 opt Au, 0.65 opt Ag, 0.02% Cu, 0.06% Pb, and 0.001% Zn. Another sample, a composite from the easternmost waste dump (PBLOK-2), ran 0.087 opt Au, 2.15 opt Ag, 0.05% Cu, 1.05% Pb, and 0.20% Zn. This dump is adjacent (within 10 feet) to Sandbar Creek, but no active erosion was noted. A third sample composited from the waste dump of the middle adit (PBOKM-1) assayed 0.006 opt Au, 0.68 opt Ag, 0.05% Cu, 0.28% Pb, and 0.03% Zn. Site features and sample locations at the easternmost adit of the Oker mine are shown in figures 25, 26 and 27; photographs are shown in figures 25a and 25b; 27a and 27b.

2.26.3.2 Soil

No soil samples were taken. No impact to the surrounding area was noted.

2.26.3.3 Water

The water was visibly impacted by something between the first and second adit to the western part of the area. It flowed clear and cold until approximately 500 feet above the lowermost adit where it abruptly became iron stained in a series of beaver ponds. It retained this cloudy appearance and orange staining (to varying degrees) all the way to its confluence with Willow Creek (>1 mile downstream). Small, one-inch fish (minnows) were observed in the water as well as water striders and other macroinvertebrates.

Exceedences in iron and manganese were noted in the farthest downstream sample from Sandbar Creek (table 34). Mercury exceeded the chronic aquatic life limit but was near the detection limit. Arsenic and copper concentrations increased in the downstream sample although they remained below the MCLs. The creek flowed at approximately 66 gpm upstream and varied from 50 to 70 gpm at various sites downstream. The pHs ranged from 7.9 to 7.2 and lab-SC ranged from approximately 172 to 499 umhos/cm downstream. The field-SCs may be inaccurate because of a malfunctioning instrument.

Table 34. Water-quality exceedences at the Oker mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
SOKS10M - Sandbar Creek - upstream from 4th adit																			
SOKS20M - downstream from 4th adit										C									
SOKS30H - downstream from 3rd adit; upstream from 2nd adit																			
SOKS40H - upstream from 1st adit																			
SOKS50H - Sandbar Creek downstream from all mines							S		S										

Exceedence codes:

S - Secondary MCL

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

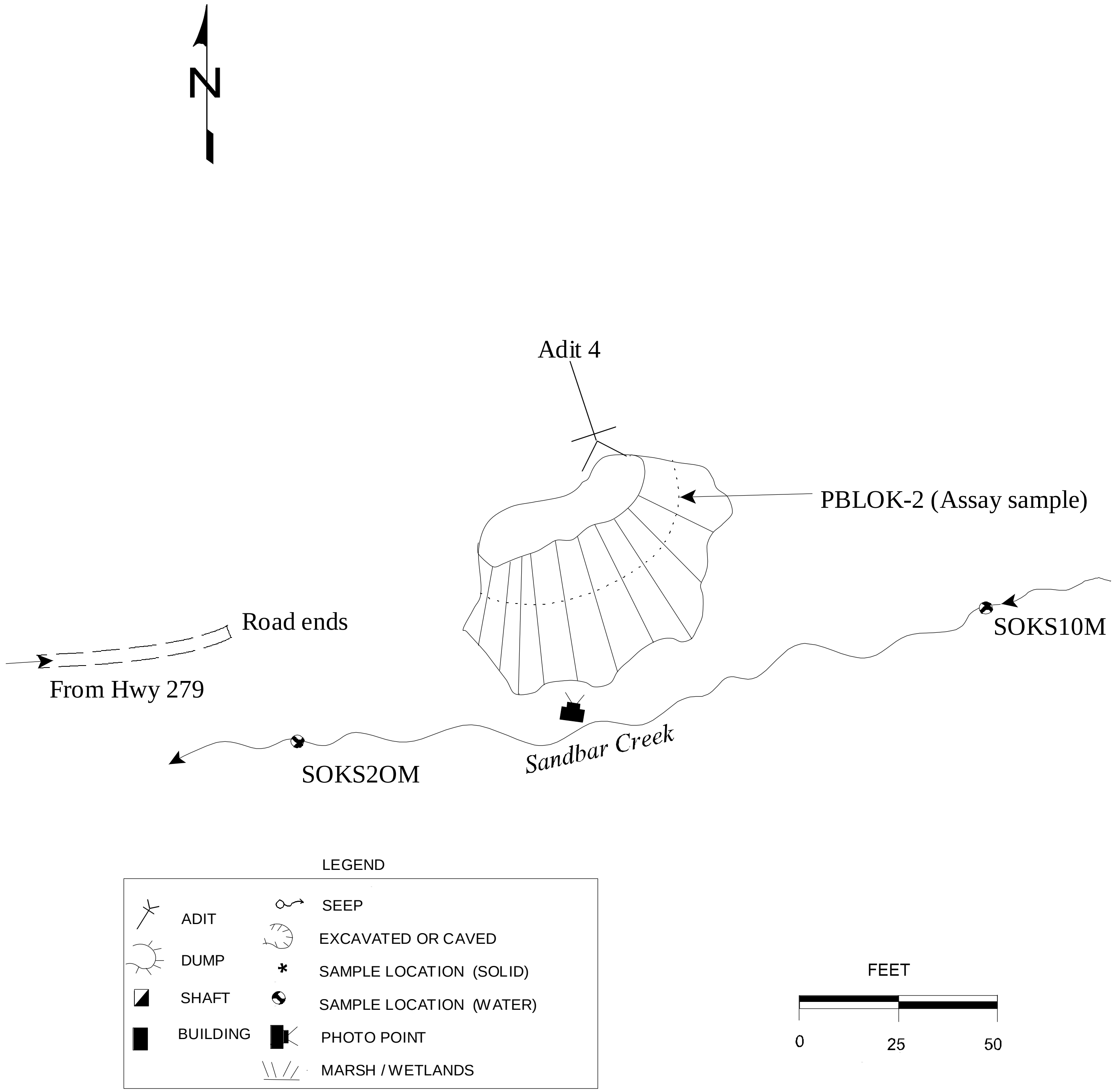

Figure 25. Easternmost adit; Oker mine, sulfide-rich dump, as mapped 09/07/94.

Figure 25a. Shoue Creek flows clear and cold upstream from the easternmost adit.

Figure 25b. Shoue Creek was iron stained as it flowed in front of the fourth and westernmost adit.

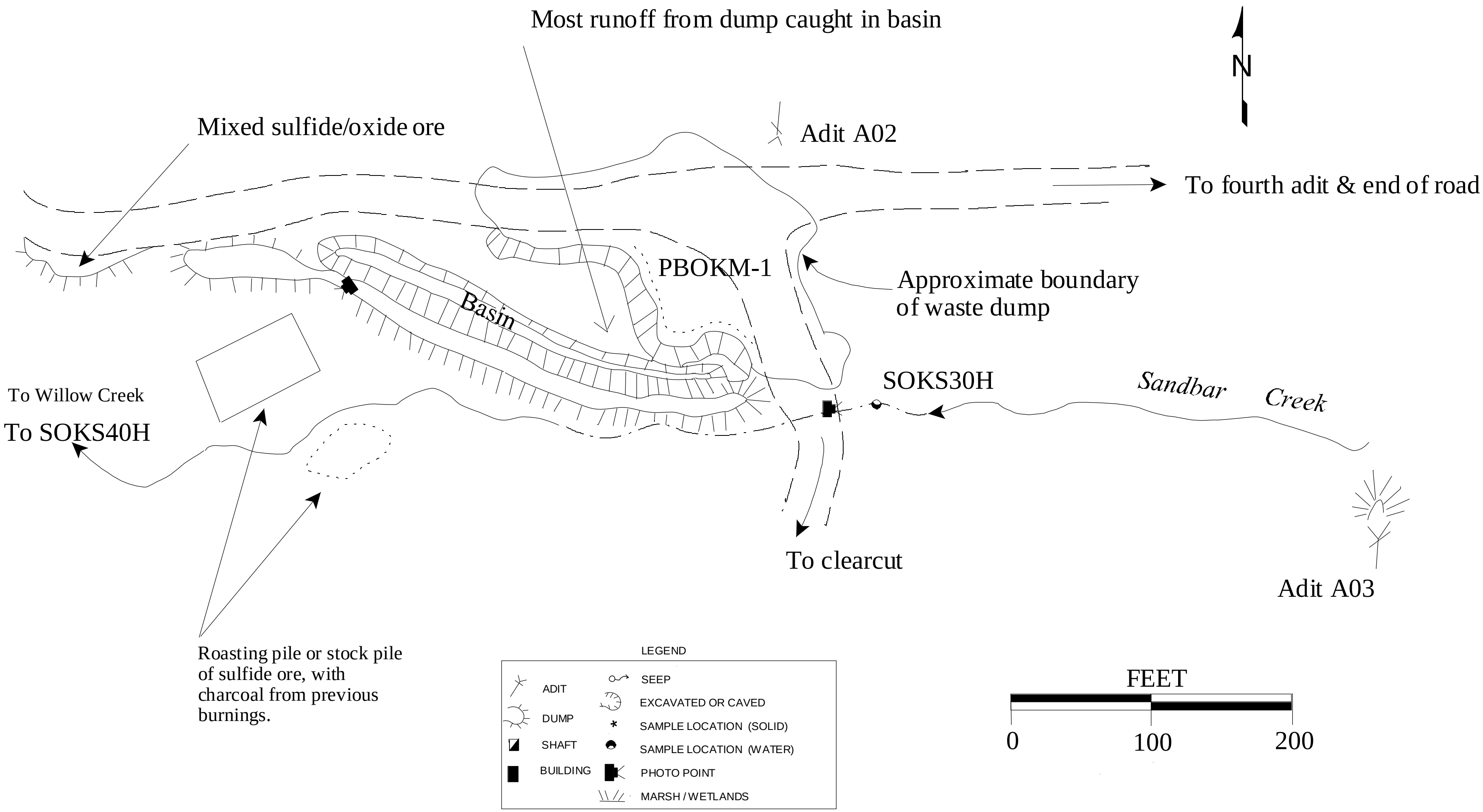

Figure 26. The samples upstream and downstream of the middle adits on Sandbar Creek have no exceedences, as mapped 09/13/94.

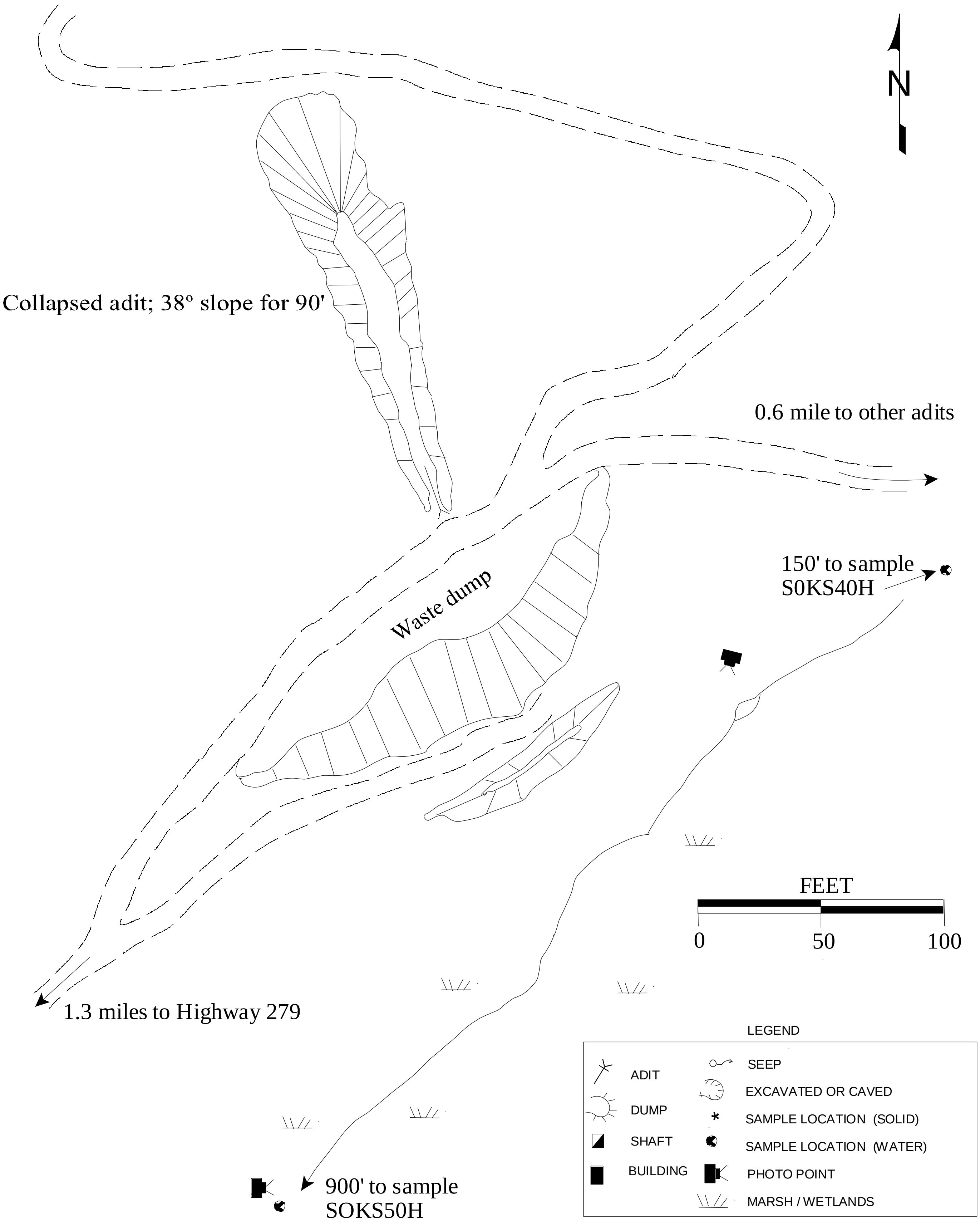

Figure 27. The water of Sandbar Creek was strongly iron stained as it flowed by the westernmost adit, as mapped 09/13/94.

Figure 27a. Waste dump of the easternmost Oker adit with surveyors' flags was a probably a part of an unidentified study.

Figure 27b. A possible roasting pile with charcoal and sulfides lies near the third Oker adit.

2.26.3.4 Vegetation

Whatever problems these sites had, they did not appear to impact the vegetation. Grasses, willows, daisies, raspberries, lodgepole pines, Douglas fir, and several species of woodland plants choked the banks of Sandbar Creek. No vegetation grew on the upper and middle waste dumps, probably because of the lack of soil and water. Lodgepole pines grew on the lower adit's waste dump.

2.26.3.5 Summary of Environmental Condition

Environmentally, this site seems to adversely affect Sandbar Creek in a highly visible way. The creek flowed clear and cold until just above the lowermost adit where it became extremely stained with iron-oxyhydroxide precipitate. The orange precipitate continued all the way to the junction with Willow Creek. The vegetation did not appear to be affected and tended to grow rampantly along the banks. The dumps were small and were presently not being deeply eroded. The upper and middle dumps were adjacent to the creek and may contribute some sediment during runoff.

2.26.4 Structures

There were no structures present along Sandbar Creek near the mines. The topographic map does show a symbol for the ruins of a cabin in section 32, but no such remains were found.

2.26.5 Safety

No open adits remain here, but the lowermost adit (adit A01) had a steep highwall and there was a steep slope on the waste dump in front of the adit. All of the adits were completely caved (obscured to the point of being hard to discern), and the three other waste dumps were small and not steep.

2.27 Copper Camp

2.27.1 Site location and Access

This remote site lies at the westernmost end of the Copper Camp road (FS road 330) adjacent to the Scapegoat Wilderness, in T15N R09W 04DBCC on the Stonewall Mountain 7.5-min. quadrangle. When the roads are dry, access can be achieved by two-wheel drive, but four-wheel drive definitely helps when the roads are muddy. Three other adits reportedly were driven above this lower adit—only one of which has not been obscured by talus.

2.27.2 Site History - Geologic Features

Earhart *et al.* (1977) show these adits in glaciated country and hosted in Precambrian Helena, Spokane, and Empire formations (dolomite, argillite, and quartzite), which dip 30°NNE with an andesite porphyry nearby. The mineralization consists of calcite veins dipping 85°N with copper minerals associated with a shear zone (Earhart *et al.* 1977). They list copper minerals (in decreasing order of abundance) bornite, chalocite, azurite, malachite, and chalcopyrite, also with anomolous antimony in one sample.

Western Mining World (1899) described workings at a property which fits this description. Rainy Day mine is another name by which this area was known in the 1940s (USBM mineral property file 21.56) when it was touted as having a five-foot vein of 10% copper totaling 30,000 to 40,000 tons (also having 10 opt silver). According to McClernan (1983), there is no record of the production from this mine. The two patented claims, the Snowstorm (west) and the MacGindry (east), reverted to the Forest Service (Helena National Forest) in a land exchange.

The occurrence is similar to the Cotter Basin mine two miles to the southeast (Earhart *et al.* 1977). Similarities also extend to the Bugle Mountain prospects to the west.

2.27.3 Environmental Condition

The five-gpm discharge from the two adits infiltrated into the waste dumps before ever reaching an active stream. The seeps from the lower adit also did not intersect an active stream. The dumps appeared stable, were not in contact with flowing water, and did not exhibit erosional features.

2.27.3.1 Site Features - Sample Locations

The site was visited 08/13/92 as requested by the Forest Service prior to the land acquisition, when four water samples were collected. Water-quality samples were collected from the upper adit (CCCS10M), the lower adit (CCCS20M), a seep determined to be upgradient of the lower adit/dump (CCCS30M), and at the confluence of several small streams below the waste rock dumps associated with the lower adit (CCCS40M). A follow-up visit was conducted 08/22/94.

Grab sample assays from the upper adit's waste dump (PBCC-1) ran 0.001 opt Au, 1.88 opt Ag, 7.46% Cu, 0.04% Pb, and 0.02% Zn. A second grab sample assay (PBCC-2) from the lower adit's waste dump ran <0.0005 opt Au, 0.17 opt Ag, 0.53% Cu, 0.004% Pb, and 0.01% Zn. Site features and sample locations at the Copper Camp mine are shown in figures 28 and 29; photographs are shown in figures 29a and 29b.

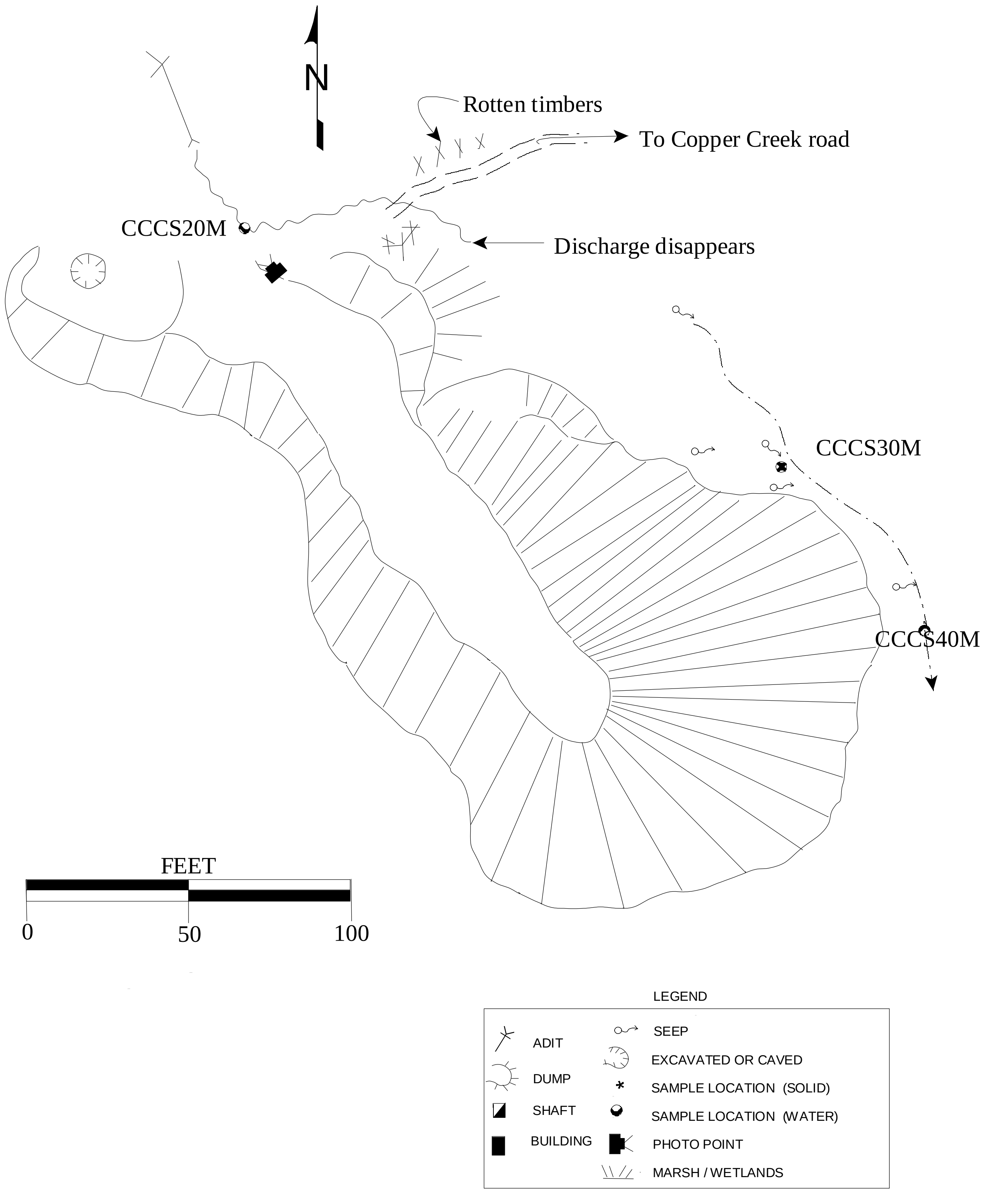

Figure 28. Several springs and an adit discharge emerge from the lower workings of the Copper Camp site, 08/22/94.

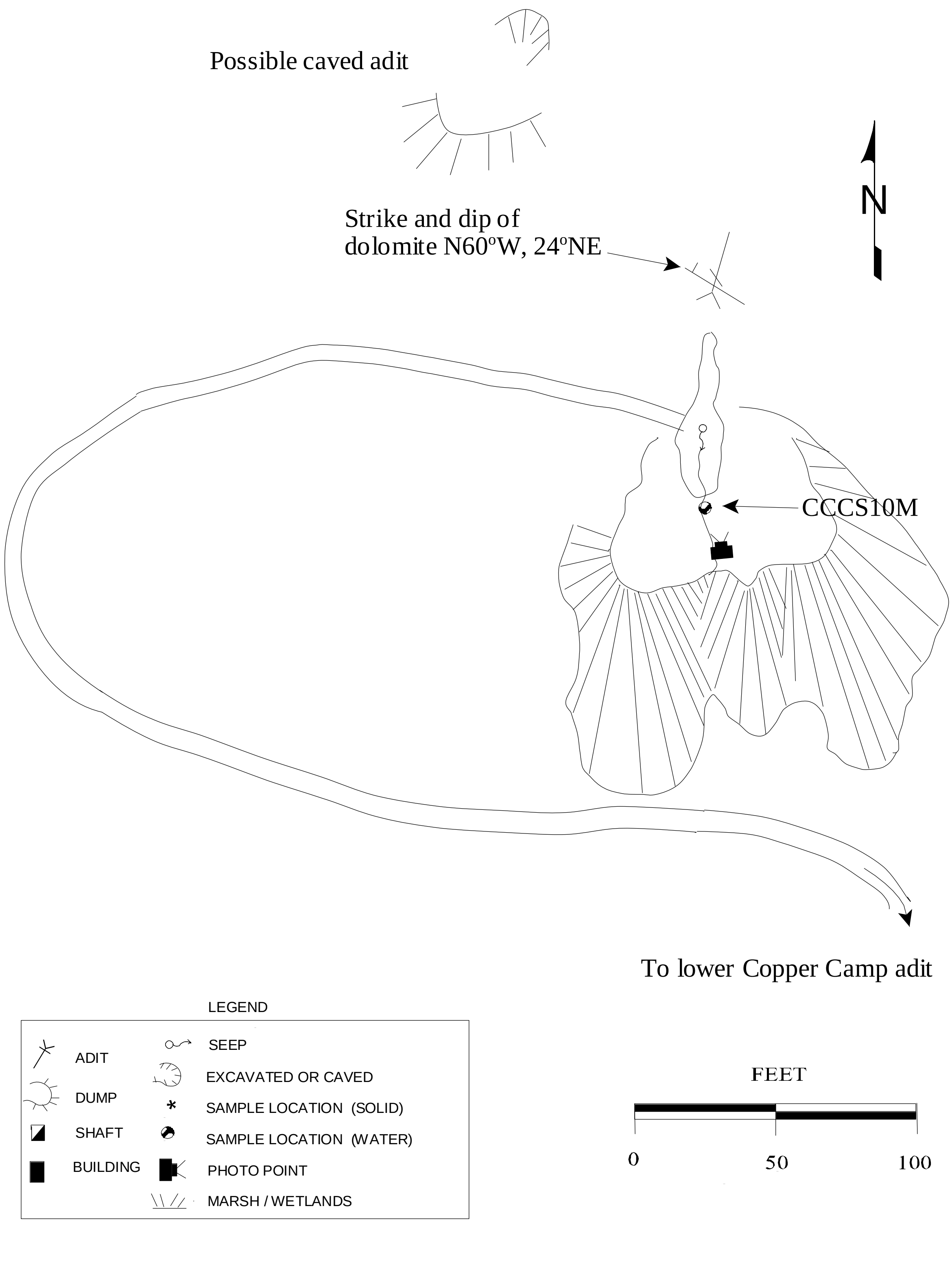

Figure 29. Upper Copper Camp adits, small discharge issues from one, as mapped 08/22/94.

Figure 29a. Upper Copper Camp adit, trended N15°E, with <five-gpm discharge that infiltrated into dump.

Figure 29b. Five-gpm discharge emerged from the lower Copper Camp adit that was caved beyond the lagging.

2.27.3.2 Soil

No soil samples were taken. The waste rock did not visibly impact the surrounding area.

2.27.3.3 Water

Two adits were each discharging approximately five gpm of cold, clear water at the time of the field visit. Field pH measurements ranged from 7.86 to 8.17. Moss was growing in the upper discharge; grasses and wildflowers lined the lower discharge channel. Both discharges infiltrate into the ground before ever reaching an active stream. The only exceedence was in mercury, which was above chronic aquatic life standards for all four samples, but the mercury level was determined to be 0.1 or at the detection limit (table 35).

Table 35. Water-quality exceedences at the Copper Camp mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
CCCS10M - upper adit discharge										C									
CCCS20M - lower adit discharge										C									
CCCS30M - seep up-gradient from lower adit										C									
CCCS40M - below lower adit dumps										C									

Exceedence codes:
C - Aquatic Life Chronic
Note: The analytical results are listed in appendix IV

2.27.3.4 Vegetation

Vegetation consisted of spruce, fir, pine typical of the 7,400'+ elevation with woody shrubs, wildflowers, and grasses as an understory. The site was very close to treeline, especially the upper adits. Vegetation had not been affected by the discharges or by the waste dumps.

2.27.3.5 Summary of Environmental Condition

All analyses indicate that most of the dissolved constituents are below acute and chronic aquatic-life standards. The indication is that there is no adverse impact of sufficient magnitude to surface-water quality to warrant concern (Metesh 1993).

2.27.4 Structures

No cabins or mine buildings remained save two rotting log foundations hidden by the forest. There was a rusting iron boiler by the lower adit, but no other junk was in evidence.

2.27.5 Safety

Dump slopes were steep but no steeper than the surrounding topography. The lower adit was open as far back as the timber and lagging extend; the adit was caved beyond this point. The upper adit was totally collapsed except for one timber set which will likely collapse after several winters. The timbering was in good shape. The road was gated lower down on Copper Creek road to restrict access to this area from September 1 to June 30 because of grizzly bear habitat.

2.28 Mammoth Mine

2.28.1 Site location and Access

The area is accessed by turning off the Stemple Pass/Virginia Creek road north onto the Page Gulch (#1841) road at 8.4 miles from the Virginia Creek turnoff; at 0.6 mile one should bear left onto a marked cross country ski trail, then 0.1 mile farther bear left (the x-country trail goes right). At another 1.1 mile, a road comes in from the right (keep left, then go another 2.3 miles to the mine). The road dead ends at the mine. The Mammoth is located on the Swede Gulch 7.5-min. quadrangle in T13N R07W 05CBAD; the site is totally on HNF-administered land.

2.28.2 Site History - Geologic Features

Elliot *et al.* (1992) make brief mention of the Mammoth mine, which was a small producer of copper, silver, and gold that explored a vein in a shear zone in Tertiary andesite. The Mammoth appeared to have no recent activity. The adit may have been closed and recontoured as an attempt at reclamation, or the collapse may have occurred naturally. No other references could be found for the Mammoth; McClernan (1983), Pardee and Schrader (1933), and Knopf (1913) do not mention the mine.

The dump consisted of 80% Crater Mountain volcanics, 10% quartz vein material (locally vuggy and euhedral), 9% unaltered purple andesites, and <1% secondary copper minerals and sulfides.

2.28.3 Environmental Condition

The Mammoth mine has the potential for further erosion until all the mine waste has been eroded and the drainage is restored to its original topography. Very few sulfides were noted on the waste dump and clays were abundant, so the dump may not be the source for the exceedences downstream. The adit discharge was very small and probably not of any great concern.

2.28.3.1 Site Features - Sample Locations

No water was flowing in the drainage above the mine at the time of the site visit. All water was emanating from the adit discharge or from the ground beneath the waste. Just one water sample (SMMS10H) was taken because of the small amount of water coming from the seep. Site features and sample locations at the Mammoth mine are shown in figure 30; photographs are shown in figures 30a and 30b.

2.28.3.2 Soil

No soil samples were taken. The edge of the waste dump is in contact with the stream.

2.28.3.3 Water

No water flowed in the channel above the site. A small seep emerged from what looked like a collapsed portal of the adit. The discharge flowed along the edge of the dump and became the headwaters of the South Fork of Humbug Creek. Humbug Creek joins the Blackfoot River near Lincoln just above Poorman Creek. Exceedences in copper and cadmium are noted in table 36.

Table 36. Water-quality exceedences at the Mammoth mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Downstream - SMMS10H				P,A,C		A,C													

Exceedence codes:

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

Note: The analytical results are listed in appendix IV

2.28.3.4 Vegetation

The vegetation downstream did not appear affected by the addition of metals. The waste dump itself was only sparsely vegetated along the edges and barren near the middle. The trees and brush along the edges appeared healthy.

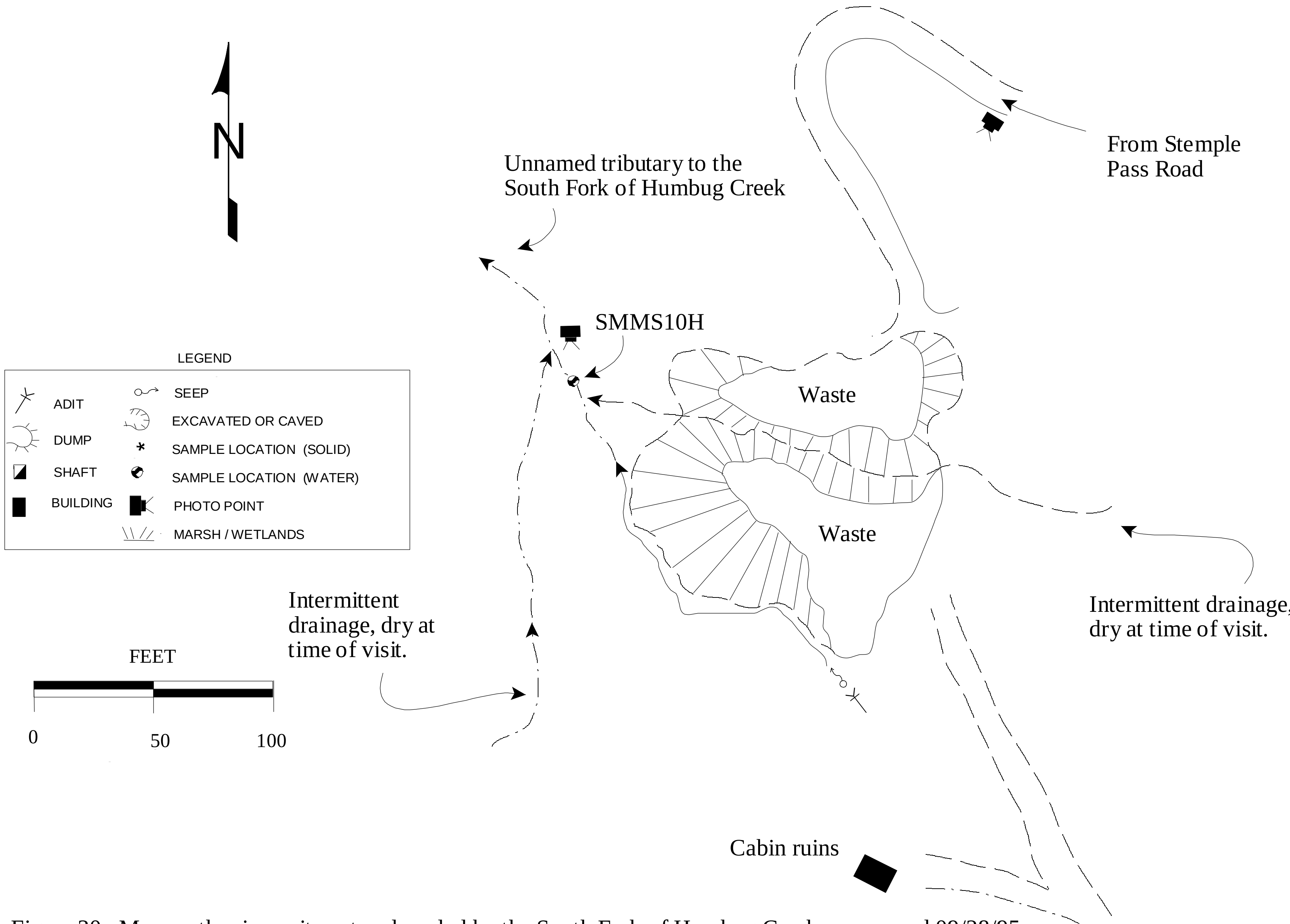

Figure 30. Mammoth mine - site cut and eroded by the South Fork of Humbug Creek, as mapped 09/28/95.

Figure 30a. A channel cut through the waste of the Mammoth mine; an adit discharge/seep appears in the upper left of photo and flows to the right at the edge of the waste dump.

Figure 30b. Sample site SMMS10H below the Mammoth mine where the headwaters of the South Fork of Humbug Creek flow clear and cold.

2.28.3.5 Summary of Environmental Condition

The waste associated with this site is located directly in the drainage, and a channel has been eroded through them. The downstream water sample showed exceedences in cadmium and copper. The flow was very small however (5 gpm). Snowmelt and storms are probably the greatest factors in metals transport.

2.28.4 Structures

Buildings that were associated with this site have been either removed or are in ruins. There are remains of a small cabin that is presently nothing more than a pile of boards.

2.28.5 Safety

No safety concerns were noted here. The site is not readily accessible to the public and can only be reached by a circuitous route off of Stemple Pass Road. The adit is completely caved.

2.29 Madison Wonder Mine

2.29.1 Site location and Access

The Madison Wonder is reached via a trail from the top of Dalton Mountain and by walking the Helmville trail. The alternative route up Washington Gulch was gated and locked at the time of this study. The Madison Wonder was a name coined by this study; it is located in the Madison Gulch drainage. The mine lies on the Finn 7.5-min. quadrangle in T13N R09W 25ABCB.

2.29.2 Site History - Geologic Features

The Finn district is known more for its placers in Washington, Madison and Jefferson gulches. No specific references to the Madison Wonder could be found. The district has been a historical producer of gold, copper, and silver from quartz veins in middle Proterozoic Belt rocks (Mount Shields, Shepard, and Snowslip formations) near the contact with the late Cretaceous Dalton Mountain granodiorite intrusive (Elliot *et al.* 1992). The rocks intruded are mostly quartzites and argillites. The rock on the dumps at the Madison Wonder are green argillites, iron-stained quartzites and granodiorite. There were an estimated 300—500 feet of workings in one or two caved adits.

2.29.3 Environmental Condition

The site was very small with one totally caved adit with a 1- to 3-gpm discharge. The discharge appeared clear and cold; it emerged from the ground in front of the adit and flowed around the small dump then soaked into the ground. The waste dump was located in the drainage, and the small discharge flowed on one side of it. Erosion of the waste dump was minimal.

2.29.3.1 Site Features - Sample Locations

One sample was taken at a location down from the adit discharge. It was one of the only places that there was enough water to sample. The sample was taken on 09/27/95. Madison Gulch did not have flowing water in it at the time of this investigation. The topographic map shows it as a permanent stream approximately ¾-mile down from the Madison Wonder. Site features and sample locations at the Madison Wonder mine are shown in figure 31; photographs are shown in figures 31a and 31b.

2.29.3.2 Soil

No soil samples were taken. The waste dumps were all on private land.

2.29.3.3 Water

No exceedences were noted at the Madison Wonder (table 37). The field pH was 7.3, and the SC was approximately 130 µmhos/cm. The flow was estimated at 3 gpm; it ran clear and cold.

Table 37. Water-quality exceedences at the Madison Wonder mine.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Adit discharge - MMWS10L																			

Note: The analytical results are listed in appendix IV

2.29.3.4 Vegetation

The vegetation was not affected by the small adit discharge. In fact, it provided a small source of water to the area's vegetation and wildlife.

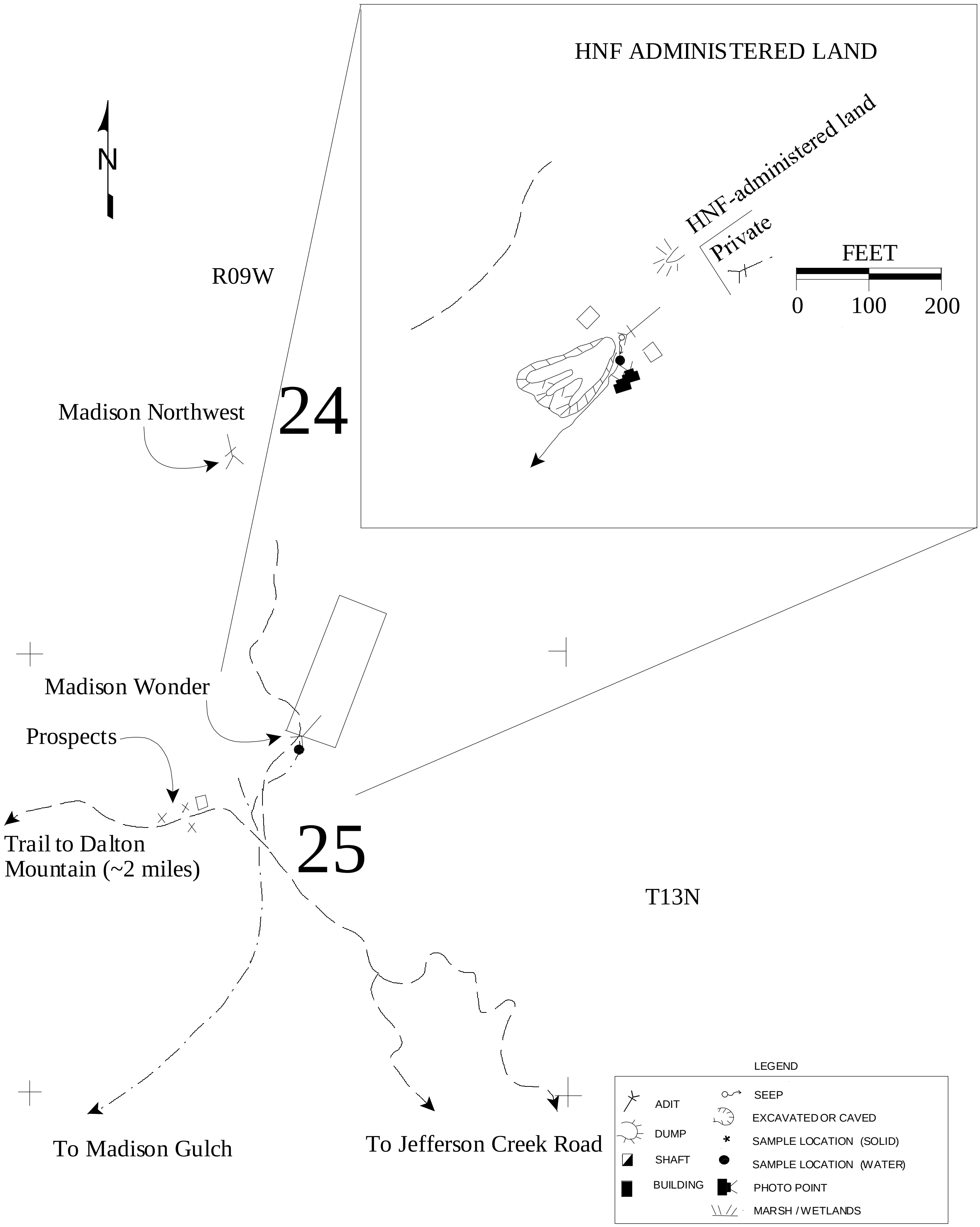

Figure 31. Madison Wonder discharges 2–3 gpm, as mapped 09/08/94. Location is a schematic from USFS ownership map of the Finn 7.5-min. quadrangle.

Figure 31a. A discharge from the adit at the Madison Wonder flowed around the margin of the waste dump.

Figure 31b. A collapsed adit at the Madison Wonder occurred on patented land.

2.29.3.5 Summary of Environmental Condition

The environmental condition at the Madison Wonder is near the original state; it appeared as if the mine had not been worked in many decades. The adits have all collapsed and the adit discharge is small (three gpm).

2.29.4 Structures

The cabins present were totally collapsed piles of logs. They also were located on private (patented) land.

2.29.5 Safety

No hazards were evident. The site is remote and not easily reached. Most workings were on private land.

2.30 Summary of the Blackfoot and Little Blackfoot River Drainages

Most of the mine and mill sites exhibiting a potential to cause environmental problems on HNF-administered land are in the Elliston district on the Little Blackfoot and are associated with the Boulder batholith. Of the 29 sites that have a potential to adversely affect soil or water quality on HNF-administered land, six are on private land and two are on private and public land. Many of the sites in the Elliston district were discharging water to nearby streams (faults were associated with many of the mines); several had waste material in contact with the stream. The relative severity of the impacts to HNF-administered land in this area was generally small; the concentrations of metals in the receiving streams, while elevated, were low except for zinc. Exceptions include such mines and mills as the Ontario, the Charter Oak, the Viking mine, and the Hope adit; these sites contribute a significant amount of dissolved metals to surface water and ground water.

Repeated visits to some sites exemplify the need for multiple sampling events. For example, the Third Term adit was discharging when first visited by the geologist but was not discharging when the hydrogeologist arrived to sample it.

The Telegraph and Ontario Creek drainages are headwaters for the Little Blackfoot River. Many of the mines are on patented claims and were tested by taking samples upstream and downstream; as was the case in the Lily-Orphan Boy, the Golden Anchor, and the Negros mines. The Hope Adit, Hub Camp, the Big Dick, Charter Oak, and Third Term are on HNF-administered land.

An accurate assessment of the cumulative impact of mining on the drainage would require extensive sampling on private land. Only three samples were taken on the Little Blackfoot. It is included in the write-up of the Charter Oak mine. The Blackfoot River has been the subject of a great deal of study and is presently the subject of remediation as a result of its designation as a CECRA site. Sampling on private land also would be necessary to determine the impact of the mining upstream.

Other drainages in the Blackfoot and Little Blackfoot watersheds also have clusters of mines and mills, but overall the impacts are local. Waste material is deposited over a long stretch of the Blackfoot drainage because of the catastrophic flood of 1975. Table 38 lists the mines considered in this report. The exceedence of one or more MCLs is noted for each site as well as the analyses for each sample. All of the samples collected at that site were considered.

Table 38. Summary of water-quality exceedences in the Little Blackfoot and Blackfoot drainages.

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Telegraph mine & mill	S,C			C		A,C		C	S				A,C						S
North Ontario mine				C									A,C						
Lily-Orphan Boy mine	S,C			A,C			S	C	S				A,C						
O'Keefe Creek							S												
Hope (Adit) mine	S,C			P,A,C		C		C	S				A,C						S
Hub Camp																			
Unnamed mine																			
Viking mine	S,C			P,A,C		A,C		C	S				A,C						S
Third Term mine	S,C					A,C		C											
Ontario mine & mill	S,A,C	P		P,A,C		A,C	S,A	P,A,C	S				A,C						S
Monarch mine & mill						A,C	S,A	C	S										
Kimball mine												C							
Treasure Mountain		P		C			S	C	S				A,C						
Big Dick mill & tails													A,C						

Sample Site	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO_3	SO_4	Si	pH
Upper Kimball							S,A		S				A,C						
Charter Oak mine	S,A, C	P,A, C		P,A, C		A,C	S,A	P,C	S				A,C				P,S		S
Negros mine																			
Golden Anchor												C							
Victory/Evening Star																			
Bumble Bee mine																			
Rex Beach mine										C									
Consolation group										C									
Bobby Boy mine				P,A, C						C			A,C						S
Oker mine							S		S	C									
Copper Camp mine										C									
Mammoth mine				P,A, C		A,C													S
Madison Wonder																			

Exceedence codes:

P - Primary MCL

S - Secondary MCL

A - Aquatic Life Acute

C - Aquatic Life Chronic

Note: The analytical results are listed in appendix IV

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Appendix I
USFS - MBMG Field Form
Explanation of Township - Range - Section

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*):

____
____
____

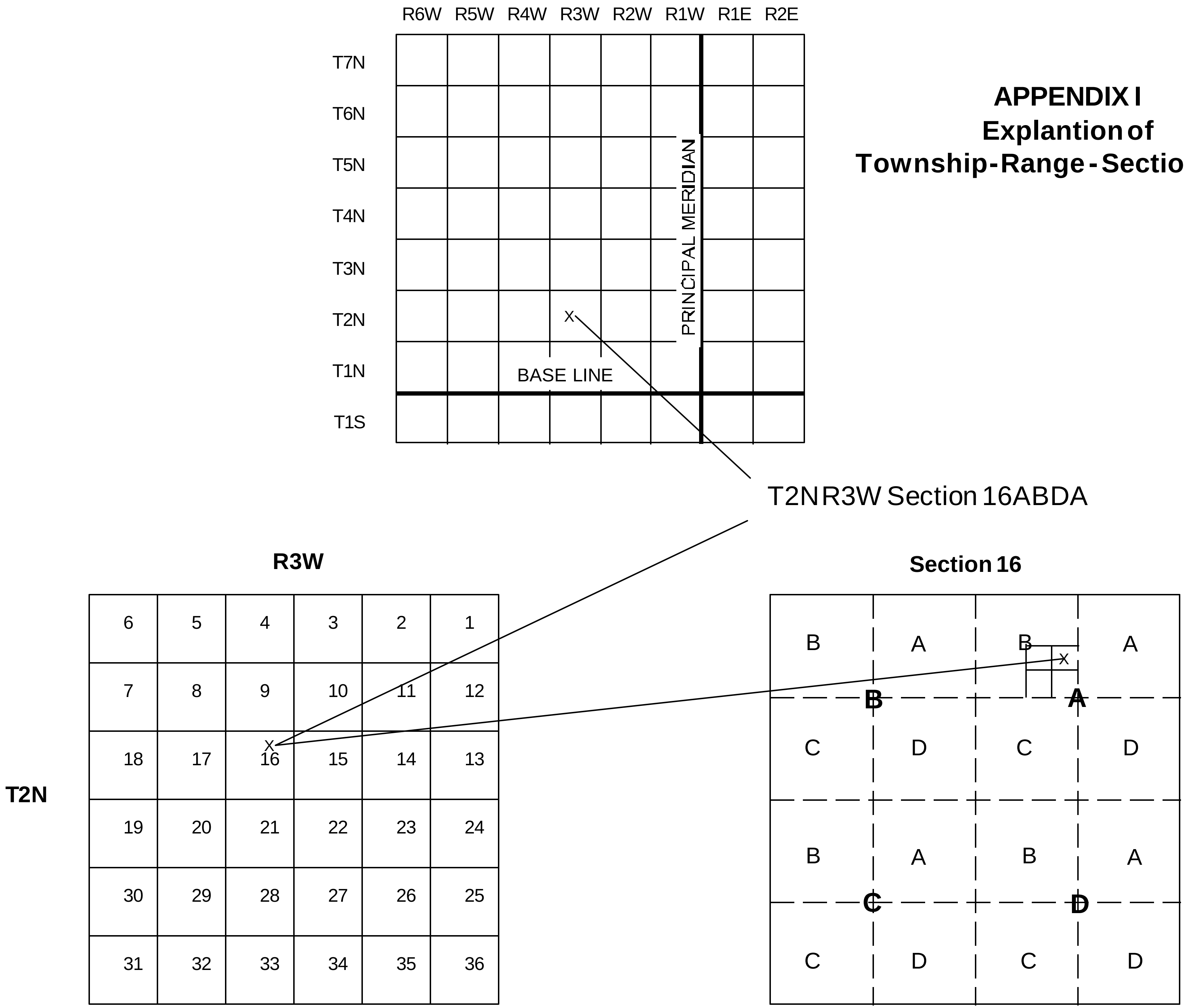
Population (*From census data*)
Population within _____0-¼ miles _____¼-½ miles _____½-1 mile _____1-2 miles _____2-3 miles _____3-4 miles of site

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 I
Explantion of
Township-Range-Section-Tract



Appendix II
List of Sites in the Helena National Forest

MINES IN THE LITTLE BLACKFOOT DRAINAGE						
Name	**ID**	**VISIT**	**OWNER**	**SAMPLED**	**HAZARD**	**REMARK**
ADAMS BROTHERS MINE	PO002774	Y	N	N	N	DRY, NO IMPACTS
AJAX MINE	PO001327	Y	N	N	Y	DRY NVI
ANNA R AND HATTIE M	PO002882	N	U	N	U	LOCATION INACCURATE, NO SITE VISIT.
ARNOLD MINE	PO004905	Y	P	N	Y	DRY NVI
BIG DICK / (BLACK JACK)	PO002888	Y	N	N	Y	NO COMMENTS
BIG DICK MILLSITE	**PO008244**	**Y**	**N**	**Y**	**Y**	**TAILINGS IN STREAM**
BLACKFEET NO. 1	PO004795	N	U	N	U	LOCATION INACCURATE
BLUEBIRD	PO002924	N	P	N	U	FIELD SHEET FILLED OUT, BUT NOT NOTED IF VISITED
BLUEBIRD EAST	PO008250	N	P	N	N	MINE DISCHARGE?
BULLION	PO002522	N	P	N	U	NO COMMENTS
BULLION SOUTH	PO008358	Y	N	N	N	DRY NVI
BUMBLEBEE / MORNINGSTAR	**PO005195**	**Y**	**N**	**Y**	**N**	**SMALL ADIT DISCHARGE**
CHARTER OAK	**PO005095**	**Y**	**N**	**Y**	**Y**	**ADIT DISCHARGE, TAILINGS IN STREAM**
CYCLONE MINE / WHIRLWIND	PO005170	Y	N	N	Y	PARTLY OPEN SHAFT
DIVIDE SHAFTS	PO007463	Y	N	N	N	NO COMMENTS
ELDORADO MINE	PO005230	Y	N	N	Y	BOARDS OVER OPEN SHAFT
ESMERALDA	PO002906	Y	N	N	N	NO COMMENTS
FLORA MINE	PO004685	N	N	N	N	NO COMMENTS
GOLDEN ANCHOR	**PO005110**	**Y**	**P**	**Y**	**N**	**PRIVATE, UPSTREAM/DOWNSTREAM SAMPLES**
HARDLUCK	PO005045	Y	N	N	Y	DRY NVI
HOPE ADIT	**PO008236**	**Y**	**N**	**Y**	**N**	**ADIT DISCHARGE**
HUBCAMP / HUB CAMP	**PO005320**	**Y**	**N**	**Y**	**Y**	**ADIT DISCHARGE**
JULIA MINE	PO005140	Y	N	N	N	NO COMMENTS
KIMBALL MINES	**PO004950**	**Y**	**N**	**Y**	**N**	**WASTE IN FLOODPLAIN**
LADY SMITH / SHAMROCK GROUP	PO008169	Y	P	N	Y	DRY NVI
LILLY (LITTLE) ORPHAN BOY	**PO004970**	**Y**	**P**	**Y**	**N**	**WASTE IN STREAM**
LITTLE DAISY MINE	PO004975	Y	N	N	N	NO COMMENTS
LOWER TELEGRAPH	**PO005325**	**N**	**U**	**Y**	**U**	**NO COMMENTS**
MARY QUARTZ LODE	PO007472	Y	N	N	N	REPORTED ADIT DISCHARGE, NONE FOUND
MCKAY MINE	PO004995	Y	M	N	N	NO COMMENTS
MONARCH MILL	**PO008254**	**Y**	**N**	**Y**	**Y**	**TAILINGS IN FLOODPLAIN**
MONARCH MINE	**PO002470**	**Y**	**N**	**Y**	**Y**	**ADIT REFURBISHED, LOWER ADIT DISCHARGE**
NANCY HELEN	PO008276	Y	N	N	N	DRY, NVI
NANCY MINE	PO005050	Y	N	N	Y	OPEN ADIT, DRY, NOT EASILY ACCESSIBLE
NEGROS	**PO005055**	**Y**	**P**	**Y**	**Y**	**WASTE IN FLOODPLAIN**
NEWMAN'S CAMP	PO007465	Y	N	N	Y	ACTIVE, GUARDED SITE, NO ACCESS 9/95
NORA DARLING	LC004489	Y	N	N	Y	PARTLY OPEN WORKINGS
NORTH FORK O'KEEFE CREEK	PO007464	Y	P	N	Y	NO COMMENTS
NORTH ONTARIO	**PO008238**	**Y**	**N**	**Y**	**Y**	**ADIT DISCHARGE**
NORTH POLE MINE	PO002464	N	U	N	U	LOCATION INACCURATE
O'KEEFE CREEK/COPPER KING	**PO008227**	**Y**	**P**	**Y**	**Y**	**ACTIVE SITE; PRIVATE.**
O'KEEFE MOUNTAIN ADITS	PO007468	Y	N	N	Y	TOM BOWLER, AUGUST 24, 1993; JMETESH 9/26/95
OHIO-SPECULATOR MINE	PO002840	N	U	N	N	BAD MAP LOCATION
ONTARIO	**PO005435**	**Y**	**M**	**Y**	**N**	**ADIT DISCHARGE, TAILS IN STREAM**
OPEN ADITS	PO008286	Y	N	N	Y	OPEN ADITS ON HILLSIDE & NEXT TO ROAD
OPHIR CAVE	LC004349	Y	N	N	Y	NO COMMENTS
POND ADIT	PO008237	Y	N	N	N	NO COMMENTS
POND SHAFT	PO007469	Y	N	N	N	FLOODED SHAFT
PRICE GROUP MINE	PO005065	Y	N	N	N	NO COMMENTS
STEEL FRAME SHAFT	PO008235	Y	P	N	N	FLOODED SHAFT
STUMBLE UPON	PO008170	Y	N	N	N	NO COMMENTS
SUNRISE MINE	PO002458	Y	N	N	N	NO COMMENTS
SURETHING MINE	PO002624	Y	P	N	N	NO COMMENTS
SURETHING SOUTH	PO008260	Y	N	N	N	DRY NVI, MOSTLY NATIONAL FOREST
TELEGRAPH / TELEGRAPH CREEK	**PO002936**	**Y**	**N**	**Y**	**Y**	**ADIT DISCHARGE, TAILS IN STREAM**
THIRD TERM	**PO005360**	**Y**	**N**	**Y**	**Y**	**RECLAIMED ADIT COLLAPSED, NEAR STREAM**
TRACK ADIT (?)	PO007467	Y	N	N	Y	ACTIVE SITE, NO ACCESS FOR SAMPLING
TREASURE MOUNTAIN MINE	**PO002630**	**Y**	**N**	**Y**	**N**	**ADIT DISCHARGE, WASTE IN STREAM**
UNNAMED	LC007462	N	N	N	Y	NO COMMENTS
UNNAMED	PO007461	N	U	N	Y	DRY NVI
UNNAMED	PO007473	N	N	N	Y	MBMG: SOURCE: DAVE TURNER, HELENA RD. 1993
UNNAMED 8N6W6ABDB	**PO008368**	**Y**	**P**	**Y**	**N**	**ADIT DISCHARGE ON TO HNF ADMINISTERED LAND**
UNNAMED MINE- SEC 20	PO008015	Y	N	N	Y	DRY NVI
UNNAMED OPEN SHAFT	LC008016	Y	N	N	Y	PHOTOS 13-10, 11, 12, 13.
UNNAMED QUARRIES	PO005175	N	N	N	Y	STEEP HIGHWALLS
UNNAMED SEC 15	PO008259	N	U	N	N	DRY NVI...NOT LOCATED ON DIG. MAP, NO FIELD FORM
UNNAMED SEC 19	PO008279	Y	N	N	Y	OPEN ADIT BY ROAD
UPPER KIMBAL (KIMBAL NORTH)	**PO008243**	**Y**	**N**	**Y**	**N**	**ADIT DISCHARGE, WASTE IN STREAM**
VICTORY MINE / EVENING STAR	**LC007276**	**Y**	**M**	**Y**	**Y**	**SREAMSIDE TAILINGS**
VIKING MINE	**PO002636**	**Y**	**N**	**Y**	**Y**	**ADIT DISCHARGE, TAILINGS**
WALL STREET MINE	PO002642	Y	N	N	Y	DRY NVI
WOLVERINE	PO005070	Y	N	N	Y	NO COMMENTS

MINES IN THE BLACKFOOT DRAINAGE

Site Name	**MBMG ID #**	**VISIT**	**OWNER**	**SAMPLED**	**HAZARD**	**COMMENTS**
ADELE MINE	LC001183	Y	N	N	N	DRY, NVI
ALL PLACER	LC001045	N	M	N	U	SCREENED OUT, PLACER.
AMERICAN GULCH PLACER	PO002314	N	M	N	U	SCREENED OUT, PLACER, NO SITE VISIT.
ANACONDA	LC001345	Y	P	N	N	PART OF DHES STATE SUPERFUND SITE
BLACK WATCH	LC004474	Y	N	N	N	NO COMMENTS
BLACKFOOT MINE	LC007393	Y	M	N	Y	OPEN ADITS, DRY.
BLACKFOOT TAILINGS	LC008025	Y	M	N	N	DRY, NO WATER
BLACKTAIL CAVE	LC004369	N	P	N	N	PRIVATE, NO IMPACT TO HNF ADMINISTERED LAND
BLUE STAR	LC004619	Y	N	N	N	NO COMMENTS
BOBBY BOY MINE	**LC001201**	**Y**	**N**	**Y**	**Y**	**ADIT DISCHARGE, STREAMSIDE WASTE**
BUGLE MOUNTAIN GROUP	PO002260	N	N	N	N	NO SITE VISIT, IN SCAPEGOAT WILDERNESS
BUTTERFLY MINE	LC001555	Y	N	N	N	NO COMMENTS
BYRNES CREEK COPPER	LC007349	Y	N	N	N	NO COMMENTS
CALLIOPE MINE / COPPER GATE	LC007396	Y	P	N	N	PRIVATE, VISITED GENERAL SITE
CARBONATE	LC001951	Y	P	N	N	PART OF DHES STATE SUPERFUND SITE, RECLAIMED
CARBONATE HILL	LC007389	Y	N	N	Y	PHOTOS 12-19,20,21. MBMG PHYLLIS HARGRAVE 09/13/94
CHICKEN CREEK PLACER	PO002326	Y	N	N	N	NO COMMENTS
CHIMNEY CREEK PLACER	PO005035	N	U	N	U	NO COMMENTS
COLUMBIA MINE	LC007401	N	P	N	U	NO COMMENTS
CONSOLATION	**LC001801**	**Y**	**P**	**Y**	**N**	**STREAMSIDE WASTE, CAVED ADITS**
COPPER BOWL MINE	LC001207	N	U	N	N	COULD NOT LOCATE
COPPER CAMP / RAINY DAY	**LC001597**	**Y**	**N**	**Y**	**Y**	**2 ADIT DISCHARGES**
CORBIN MINE	PO004640	Y	N	N	N	NO FIELD SHEET OR COMMENTS
COTTER BASIN MINE	LC007347	Y	N	N	Y	STEEP HIGHWALLS
CRUMB MINE	LC007329	Y	N	N	N	NO COMMENTS
CYCLONE MINE	LC007312	Y	M	N	N	NO COMMENTS
DAN OKER'S MINE	LC001885	N	U	N	N	NO COMMENTS
DAVIS GULCH ADITS	LC008133	Y	N	N	N	NO COMMENTS
DEER CREEK MINE	PO002320	N	U	N	U	NO COMMENTS
DISCOVERY AND MARGURETE	LC001105	N	N	N	U	LOCATION INACCURATE, ONE OPEN SHAFT IN SW 1/4 SEC.
EDITH	LC008028	N	P	N	N	PART OF DHES SUPER FUND SITE
EUREKA CLAIM	LC007408	N	P	N	N	NO SITE VISIT, PRIVATE
FISHER GROUP	PO002254	N	N	N	N	NO SITE VISIT, IN SCAPEGOAT WILDERNESS
GIANT CLAIM	LC007350	Y	P	N	N	DRY, NVI, PATENTED CLAIM
GOLD DOLLAR MINE	LC004314	N	U	N	N	PRIVATE. NE
GOSSAN & JUNIOR CLAIMS	LC001741	Y	N	N	N	DRY, NVI, NOT EASILY ACCESSIBLE
GRANITE BUTTE PROSPECTS	LC008140	Y	N	N	N	NO COMMENTS
GRAY	PO002564	N	M	N	N	MBMG: SOURCE: ROB McCULLOCH, 9-94
GREEN MOUNTAIN OCCURRENCE	LC008202	N	N	N	N	FROM CONNOR AND MCNEAL, 1988, UNLIKELY TO IMPACT.
HEDDLESTON DEPOSITS	LC001675	N	M	N	N	GENERAL LOCATION, INCLUDES MANY MINES.
HEDDLESTON GROUP	LC001723	N	M	N	N	GENERAL LOCATION, INCLUDES MANY MINES.
HIDDEN VEIN COPPER DEPOSIT	LC001531	N	P	N	N	NO VISIT TRENCH ONLY.
HIGGINS PROSPECT	PO004715	Y	N	N	N	NO COMMENTS
HILDA / BLACKFOOT GOLD	PO005235	Y	N	N	U	NO COMMENTS
HILL TOP / HILLTOP	PO002576	N	U	N	U	NO COMMENTS
HOBBY HORSE MINE	PO004720	N	P	N	U	NO COMMENTS
HOG CLAIM	LC007338	N	P	N	N	NO VISIT, PART OF MIKE HORSE MINE.
HOGALL	LC007359	N	P	N	N	NO VISIT.
HOPKINS PROSPECT	PO005030	N	U	N	U	NO COMMENTS
HUMDINGER GROUP	LC001225	Y	N	N	N	NO COMMENTS
HUMDINGER MINE	PO005240	N	U	N	U	MISLOCATED, NO SITE VISIT
ILLINI MINE	LC001231	Y	P	N	N	MANY PROSPECTS ON PATENTED CLAIM, DRY NVI.
IRON HILL CLAIM	LC007368	Y	N	N	N	1 SMALL SEEP AT LOWER ADIT, UNABLE TO SAMPLE
JEFFERSON CREEK PLACER	PO005075	N	U	N	U	SCREENED OUT, PLACER, NO SITE VISIT.
JEFFERSON GULCH	LC007379	N	M	N	U	SCREENED OUT, PLACER, NO SITE VISIT.
JOHN NEUFELD	LC001585	N	U	N	U	LOCATION INACCURATE
KEEP COOL CREEK	LC007422	N	P	N	N	SCREENED OUT, PLACER CLAIM
KILBURN PLACER MINE	PO004945	N	U	N	U	PLACER
KING DAVID LODE	LC004574	N	U	N	U	LOCATION INACCURATE
KLEINSCHMIDT	LC007384	N	P	N	N	NO VISIT
KLONDIKE MINE	PO004955	N	N	N	N	NO SITE VISIT, SCAPEGOAT WILDERNESS
L AND M PLACER	PO004960	N	M	N	U	SCREENED OUT, PLACER, NO SITE VISIT.
LAST CHANCE MINE	LC007386	N	U	N	U	NO COMMENTS
LINCOLN CREEK	LC007419	N	M	N	U	SCREENED OUT, PLACER/INACCURATE LOCATION
LINCOLN GULCH PLACER	LC001129	Y	N	N	N	SCREENED OUT, PLACER MINE
LINCOLN VALLEY BENTONITE	PO002492	N	P	N	N	SCREENED OUT, POOR LOCATION & BENTONITE DEPOSIT
LINCOLN VIEW MINE	LC001051	N	M	N	U	LOCATION INACCURATE.
LIVERPOOL CREEK	LC007421	N	P	N	N	SCREENED OUT/ PRIVATE/NO IMPACT, PLACER CLAIM
LUCKY BERNICE NO. 3	LC004274	N	P	N	N	MILS LOCATED THIS ON PRIVATE LAND
LUCKY STRIKE	LC001909	Y	N	N	N	NO COMMENTS
MADISON GULCH PLACER	PO002302	N	U	N	U	SCREENED OUT, PLACER, NO SITE VISIT
MADISON NORTHWEST	LC008077	Y	N	N	N	NO COMMENTS
MADISON WONDER	**LC008076**	**Y**	**M**	**Y**	**N**	**SMALL ADIT DISCHARGE & STREAMSIDE WASTE**
MAMMOTH MINE	**LC004324**	**Y**	**N**	**Y**	**N**	**SMALL DISCHARGE, STREAMSIDE WASTE**
MARY P.	LC008026	Y	P	N	N	DROVE BY, PART OF DHES STATE SUPERFUND SITE
MASCOTTE MINE	PO005185	Y	P	N	N	NO COMMENTS
MCCACRAN	PO002918	N	N	N	N	ADIT DISCHARGE?? NO FIELD SHEET
MCCLELLAN MINE	LC007432	N	M	N	U	SCREENED OUT, PLACER, NO SITE VISIT.

MINES IN THE BLACKFOOT DRAINAGE						
Site Name	**MBMG ID #**	**VISIT**	**OWNER**	**SAMPLED**	**HAZARD**	**COMMENTS**
MIDNIGHT	LC007358	N	P	N	N	NO VISIT.
MIKE HORSE	LC004559	Y	P	N	N	PART OF DHES STATE SUPERFUND SITE
MILLIRON	LC007433	Y	P	N	Y	MBMG; PHYLLIS HARGRAVE; 10/13/1994
MINERAL HILL PROSPECT	PO005000	N	N	N	N	NO SITE VISIT, SCAPEGOAT WILDERNESS
NELLIE MILES LODE	LC004294	N	N	N	N	NO SITE VISIT, SCAPEGOAT WILDERNESS
OKER MINE / SANDBAR CRK	**LC007296**	**Y**	**N**	**Y**	**N**	**STREAMSIDE WASTE, FOUR ADITS**
OLD SHOE NO 1 PLACER	PO004985	N	M	N	U	SCREENED OUT, PLACER, NO SITE VISIT.
PACK HORSE	LC008078	Y	N	N	Y	DRY NVI
PAYMASTER	LC007304	Y	P	N	N	PART OF DHES STATE SUPERFUND SITE
PLUTARC MINE	PO004890	Y	N	N	N	NO COMMENTS
POORMAN CREEK	LC007416	N	U	N	U	PLACER, NO SITE VISIT
POORMAN MINES	LC008147	Y	N	N	N	NO COMMENTS
PORTO RICO MINE	PO004895	N	N	N	N	NO SITE VISIT, SCAPEGOAT WILDERNESS
PRIZE MINE	LC007317	Y	M	N	N	NO COMMENTS
R. T. C. LODE	LC001957	Y	P	N	N	ONE SMALL SEEP
RAINY DAY MINE	LC001525	Y	N	N	N	SAME AS COPPER CAMP ?
RED ROCK CLAIMS	LC001021	N	N	N	N	SCREENED OUT, PROSPECTS ONLY
RED STAR	LC001903	Y	M	N	N	NO COMMENTS
RED WING	LC007319	N	P	N	N	MBMG; NO VISIT, PHYLLIS HARGRAVE, 1994.
REX BEACH	**LC007321**	**Y**	**N**	**Y**	**N**	**ADIT DISCHARGE AND STREAMSIDE WASTE**
ROVER MINE	LC007323	N	P	N	U	NO COMMENTS
SEVEN-UP PETE CREEK	LC007423	N	U	N	U	NO COMMENTS
SHEEP CREEK NO. 1 & 2 PLACER	LC001915	N	N	N	N	NO SITE VISIT, SCAPEGOAT WILDERNESS
SILVER BELL MINE	LC001843	N	P	N	N	NO COMMENTS
SKYSCRAPER	LC007302	Y	N	N	N	DRY, NVI, PROSPECTS ONLY
SMITH JONES	PO008121	N	N	N	N	SCREENED IN OFFICE; 40 FOOT INCLINE ONLY
STONEWALL CREEK	LC007410	Y	N	N	N	PLACER, HISTORIC DREDGE PILES
SUNSHINE	PO002350	N	U	N	U	NO COMMENTS
SWANSEA MINE	LC004239	N	P	N	U	NO COMMENTS
UNKNOWN (POORMAN)	LC008150	Y	M	N	N	NO COMMENTS
UNNAMED LINCOLN GULCH MINE	LC008024	Y	M	N	Y	OPEN INCLINED SHAFT AND ADIT
UNNAMED POORMAN	LC008156	Y	N	N	N	NO COMMENTS
UPPER COPPER CREEK AREA	LC004409	N	N	N	N	PRE-SCREENED OUT
WARD THOMPSON	LC001471	Y	P	N	N	SEEP ONLY, NEVER REACHES CREEK
WASHINGTON GULCH	PO002654	N	U	N	U	MISLOCATED, SCREENED OUT.
WHITE HOPE MINE	LC008027	N	P	N	U	PRIVATE, SCREENED OUT.
WIGGINS MINE	LC001039	N	P	N	Y	ACTIVE MINE, 9-94.
WIGGINS WEST	LC008075	Y	N	N	N	NO COMMENTS
WILLIAM PAUL PLACER	PO005135	N	M	N	U	SCREENED OUT, PLACER, NO SITE VISIT.
WILSON CREEK PLACER	PO008225	N	U	N	U	NO COMMENTS
			P = PRIVATE			
			M = MIXED			
			N = NATIONAL FOREST			
			S = STATE			
					U = UNDETERMINED	
					Y = YES	
					N = NO	

Appendix III
Description of Mines and Mill Sites
in the Blackfoot and Little Blackfoot Drainages
Helena National Forest

Mines and Prospects of the Little Blackfoot Drainage

Ajax Mine
LC001327

Four adits and several shafts were used to mine replacement structures in Cambrian Hasmark dolomite. The structures are pipe shaped ranging in diameter from 6 inches to 2 feet, and are oriented nearly vertical. Primary sulphides are scarce in waste rock dumps. Most pyrite has been replaced by iron oxyhydroxides. Free gold is visible in some of the waste material. Produced $48,000 worth of gold from 1988-1912. From 1909 to 1936, 109 tons of ore were mined producing 227 ounces of gold, 110 ounces of silver, and 901 pounds of copper (Pardee and Schrader 1933).

Arnold Mine (Bielenberg, Boulder Ores, Strategic, Snowshoe, Old Lady Smith)
PO004905, PO004920, PO008169

Numerous adits and surface cuts explored skarn in Mission Canyon Limestone in contact with monzonite and quartz monzonite (Walker 1963). Mineralization consists of garnet, epidote, quartz, and calcite with magnetite, chlorite, chalcopyrite, and scheelite. In 1916, about 300 tons of ore averaging about 5% copper were shipped. Tungsten minerals were recognized in the district in 1940; about 222 tons of ore averaging 0.54% WO_3 were shipped in 1943--the only production from the district.

Bumble Bee/Morning Star
PO005195

Two placer patents were applied for, including part of this area in 1990 by Clarke Smith of Avon, Montana. Literature states that a shaft is the main entrance, but there is also an adit to the northwest of the shafts. It is this adit that has a very small discharge, probably 1-2 gpm at the greatest. The adit and shafts are caved. Evidence indicates that in the discharge has been captured for a water supply for nearby cabins. The discharge has no obviously adverse effects on vegetation, and there is no evidence that it reaches Ophir Creek. No sulfides were noted on the waste dump.

Host rock for the mine is stated as Jefferson Dolomite in contact with quartz monzonite / granodiorite (Elliot *et al.* 1992, Loen 1990). Workings were in excess of 300 feet and total production estimated at greater than $50,000. Last reported work on the mine was in 1976 (MBMG mineral property file). There is also an accessible open adit to the northwest of the main access road as well as a flooded, poorly fenced shaft to the southeast of the road. These are not technically a part of the Bumble Bee/Morning Star.

Cyclone/Whirlwind
PO005170

The Cyclone (later called the Whirlwind) is located in the NE¼ sec. 20, T. 11 N., R. 7 W. just above the 6,200-foot contour and is located by a shaft and an adit symbol on the Ophir Creek 7.5-min. quadrangle. According to Loen (1990), the workings consist of an open cut, two inclined shafts and a vertical shaft, of which only one of the inclined shafts (adit?) is presently open. A sample (POCY-1) was taken yielding assays of 0.017 opt Au, 0.64 opt Ag, 1.85% Cu, 0.02% Pb, and 0.05% Zn.

McClernan (1976) contains a plan map of the Cyclone's workings, and Loen (1990) contains the results of an assay of a sample from this location. Minerals include a blue-green mica (vermiculite according to McClernan 1976), porphyritic quartz monzonite, malachite, garnet, and iron oxide.

<u>Eldorado</u>
PO005230

There is some confusion about the location of this mine. The USBM data base shows it +/-5 km. Loen (1990) shows it in the SE¼ sec. 17, T. 11 N., R. 7 W., and the latitude/longitude implies that it is approximately 150 feet due east of the Cyclone mine.

Trauerman and Reyner (1950) reported on an "Eldorado Mining Company" operating on three unpatented claims consisting of a "cross-cut tunnel and drift" in Powell County, 12 miles north of Avon. The mine was never positively identified. There is a cluster of mine workings east to northeast and uphill from the Cyclone, which has several partially open shafts and a large log building. It has copper oxides and iron staining of minerals on the dump. It can be reached following the logging/mining road from the Cyclone.

The Eldorado is a skarn occurrence in Devonian Jefferson dolomite in contact with either Cretaceous quartz monzonite (Loen 1990) or granodiorite (Elliot *et al.* 1992).

<u>Esmeralda Mine</u>
PO002906

Numerous adits, shafts, and surface cuts follow vein and replacement zones in the Madison Limestone. Vein strikes 25ºNW parallel to a fault that dips 56ºSW. Skarn in Madison Limestone in contact with granodiorite consists of garnet, epidote, copper oxidation products, and chalcopyrite. The mine was worked in the late 1800s and in 1923 when it produced 10 tons of ore containing 6 ounces of gold and 2 ounces of silver (McClernan 1976).

<u>Friday No. 1, Strategic, Shamrock, and Tungstate Areas</u>
PO004920 / PO008169

Numerous surface cuts explored small irregular shaped skarn in Mission Canyon Limestone in contact with monzonite and quartz monzonite. Mineralization consists of garnet, epidote, quartz, and calcite with magnetite, chlorite, chalcopyrite, and scheelite. Tungsten minerals were recognized in the Friday No. 1 area in 1940 (Walker 1963).

<u>Little Daisy</u>
PO004975

Underground workings explored veins and skarn in Jefferson Dolomite near contact with quartz monzonite (McClernan 1976). Malachite and other copper oxides appear to have completely replaced primary copper minerals. Most pyrite has been replaced by iron oxyhyroxides. Quartz veins are present but not prevalent.

<u>McKay Mine</u>
PO004995

Underground workings explored a four-feet-wide vein dipping about 40º to the north (Pardee and Schrader 1933). The gold- and silver-bearing vein contains quartz, galena, pyrite, tetrahedrite, goethite, jarosite, malachite, and chrysocolla, and is hosted in argillically altered and silicified quartz monzonite. The mine operated between 1908 and 1909 and between 1916 and 1923.

Nancy
PO005050

One, open adit, trending S40ºE, was driven into an intrusive (Kqm) outcrop in the SE¼ sec. 18, T. 11 N., R. 7 W. The dump consists of massive white quartz, secondary copper minerals. This occurrence is classified by Loen (1990) as a vein or replacement deposit. Loen (1990) shows this as the Nancy Helen, but according to Robin McCulloch (pers. comm.) and Clarke Smith (pers. comm), the Nancy Helen is the adit by the Ophir Creek Road, and the adit at the base of the outcrop on the hill is the Nancy.

Nancy Helen
PO008276

This mine is located immediately to the southeast of Ophir Creek and the Ophir Creek Road. Access is via the Ophir Creek Road, on the 'flat' just before the road crosses the National Forest boundary sign. The adits are completely collapsed and there is no discharge. It appears that there were at least two adit levels. An old wagon frame and other junk are present on the dump.

Nora Darling
LC004489

The Nora Darling (also called the 7-11) is located in the SE¼ sec. 17, T. 11 N., R. 7 W. Workings include three adits (two caved, one partially caved but still open with stulls and daylighted with a hazardous vertical hole remaining. There also is a vertical shaft and an inclined shaft, both partially open. Access by vehicle to this site good to within one-half mile then access is by walking. No mine discharges and very few sulfides are present. The buildings here have all totally collapsed.

Ore appears to have been brecciated limestone (Devonian Jefferson dolomite according to Loen (1990) with an associated Tertiary andesite dike. Loen (1990) describes this occurrence as a replacement deposit. A sample (POND-1) included limestone breccia cemented with orange-stained silica, silicified orange-red microcrystalline quartz, some ocherous-punky limonite, secondary copper minerals, MnOx, FeOx, and drusy, gray quartz/calcite veins. POND-1 assayed 0.131 opt Au, 0.088 opt Ag, 0.98% Cu, 0.002% Pb, and 0.01% Zn.

Ophir Mine
LC004349

Several shafts explored a 15-foot-wide shear zone in Precambrian Bonner Quartzite (Pardee and Schrader 1933). The shear zone dips to the southwest; foot wall is composed of Bonner Quartzite with hanging wall composed of lower Cretaceous quartz monzonite. The copper and gold mine operated from 1906 to 1911 and from 1918 to 1938, producing less than $50,000 in metals.

Price Claims
PO005065

Two adits were used to explore skarn formed in the Madison Limestone near the contact with granitic rocks. Dump material consists mostly of argillically altered granitics. Dump material stained with malachite and iron oxyhydroxides.

Unnamed quarries
PO005175

This occurrence has no references, but it occurs to the north of the main access road. The skarn here covers a significant area. The mineralization includes a blue-to-white crystalline limestone (marble), epidote, garnet, calcite, amphibole (?), MnOx, chalcopyrite, and possibly magnetite. It is associated with a granodiorite intrusive. Loen (1990) shows these quarries in the Cambrian Hasmark and Park formations.

Grab sample POUQ-1 was taken yielding assays of <0.0005 opt Au, 0.04 opt Ag, 0.013% Cu, 0.004% Pb, and 0.003% Zn. There is no AMD, no hazardous highwalls, and an open, NW-trending adit is probably associated with the Bumblebee/Morning Star property. There are two open adits on the northwest side of the road; one less than 30 feet from the road and the other open quite a ways, uphill from what look like old drill roads.

Victory Mine
LC007276

This mine was the largest gold producer in the district according to Loen (1990). Elliot *et al.* (1992) summarized workings here as 500 feet in a replacement deposit in brecciated Devonian Jefferson dolomite near a Cretaceous granodiorite contact.

This was the only mine in the area with an identifiable millsite present. Pardee and Schrader (1933) reported that the mill processed most of the ore from the mine and later those tails were cyanided. The mill here is located immediately north of the Ophir-Marysville Road on patented private land. The tailings, however, were deposited south of the road along the flood plain of Ophir Creek and has mixed ownership (private/HNF-administered). This area was tested by DSL-AMRB (1994, page 5-138) with arsenic, iron, copper, and mercury in the tailings all at least three times background. No obvious effects of the elevated metal content were noted in the vegetation. The area is completely revegetated with grasses and willows and is heavily grazed by cattle. The DSL report found elevated levels of mercury, copper, and arsenic in their stream sediment samples which they attributed to this site. The AIM program took one sample downstream of the site (OESS10H); the area upstream was not flowing at the surface at the time of the study.

There is an open vertical shaft (15-20 feet deep) in the NW¼ sec. 17, immediately north of the mine shaft symbols on the topographic map. It is easily accessible from the logging road in the clearcut and is on HNF-administered land.

Loen (1990) also collected five assay samples from the Victory with the results published in his dissertation. Ore and gangue minerals at the Victory include quartz, pyrite, chalcopyrite, geothite, hematite, limonite, malachite, and magnetite (Pardee and Schrader 1933, Loen 1990). The ore is found was interpreted as either being found in a breccia pipe in Devonian Jefferson limestone or as a replacement deposit (Elliot *et al.* 1992). Underground mine maps with scales of 1"=20', 30' and 50' are available in the MBMG mineral property files.

Wall Street
PO002642

Six adits explored skarn in Mission Canyon Limestone in contact with monzonite and quartz monzonite. Ore mineralogy includes calcium-iron silicates, magnetite, pyrite, and chalcopyrite; ore may have contained up to 18% copper and low Au:Ag ratios(0.02-0.4)(Loen 1990). In most of the waste material, pyrite and chalcopyrite have been replaced by hematite and secondary copper minerals (azurite, malachite, chalcocite), respectively.

Mines and Prospects of the Blackfoot Drainage

Adele Mine
LC001183

This mine was never located as described by Lawson (1975, 1976, 1978). Lawson reported the Adele produced and developed in 1974 and 1975 but the status was unknown in 1977. The area in the NE¼ section 33 as plotted from the MILS data base was walked but only one old, shallow cut was noted. A larger, more recent open cut is located across Alice Creek but is described as the Alice Creek mine by Connor and McNeal (1988).

Alice Creek Mine
LC001183

Access to this mine is via the Alice Creek road then right across Alice Creek in SE¼ section 27 (the trail marked on the topo) to a locked gate then 1,000 feet on foot. A 160-foot open cut was recently worked in Precambrian Spokane quartzites and siltstones (lithic arkose) (Connor and McNeal 1988). Chalcocite is the primary ore mineral with lesser amounts of acanthite and native silver in a Ag-rich pod (Connor and McNeal 1988). Malachite, quartz, bornite, and covellite also are reportedly present. A grab sample (PAAM-1) taken along the entire cut assayed <0.0005 opt Au, 2.43 opt Ag, 0.81% Cu, 0.002% Pb, and 0.01% Zn. Other assays are reported by Connor and McNeal (1988).

Anaconda
LC001345

This mine operated from 1901 to 1948 and was being developed as late as the 1970s. As of 1995, it was being reclaimed as a part of the Upper Blackfoot mining complex CECRA site. It is on private land. Its tailings were being removed as of the fall of 1994 and trucked to the Mike Horse mine site. It was not considered as a part of this study because of its status as a superfund site.

Blackfoot Mine
LC007393

Blackfoot Tailings
LC008025

Roadside, highly visible tailings (mixed ownership) and a poorly fenced shaft (on private land) are the major concerns. The tailings are not in contact with the Blackfoot River, which is on the opposite side of Highway 200. Pioneer Technical Services (1994, 5-127) estimated the tailings volume as 5000 cubic yards, and elevated levels of As, Co, Cu, Hg, Pb, Cd, Cr, Fe, Ni, and Zn. Ground water also had observed releases of all of the above minerals except Co and MCLs were exceeded for Cu, Cr, Hg, and Ni. Workings consist of numerous open cuts, one nearly totally collapsed adit and one trench/shaft that is poorly fenced.

The occurrence is hosted by a north-trending shear zone in a diorite dike intruded into Precambrian Belt argillites and quartzites. Mineralization (also from Pardee and Schrader) includes quartz, siderite (?), iron oxides and pyrite with primarily sericite alteration. McClernan (1983) reiterates Pardee and Schrader. Ownership maps show the tailings as being located primarily on Helena National Forest land but with some private land involved. The mine adjacent to the tails is on a private, patented claim. The tailings were hauled to ASARCO's Paymaster mine waste repository in Sept./Oct. of 1996 (Norm Yogerst, written comm). The work was done by the Mine Waste Cleanup Bureau (MWCB).

<u>Bobby Boy</u>
LC001201

The single adit here has approximately one foot of standing water for the 20 feet or so that remains open. At the time of this visit, it had an adit discharge of less than one gpm. The discharge channel is well vegetated and indicates that flow does not greatly exceed the present rate. The discharge disappears after approximately 80 feet and there is no evidence that it reaches the creek. There are streamside wastes but they are not obviously stressing the vegetation. A composite sample from the perimeter of the waste dump (PBBB-1) yielded assays of 0.001 opt Au, 0.14 opt Ag, 0.01% Cu, 0.03% Pb, and 0.08% Zn. The dump contained all oxides.

MBMG mineral property files show evidence of activity in 1972. According to Lawson (1975, 1976), the mine's status was inactive. The Bobby Boy is located in HNF-administered land. Access is via Meadow Creek turnoff on Highway 200 then bearing right up Porcupine Gulch.

<u>Byrnes Creek Copper</u>
LC007349

This site was visited, but no evidence of anything but sampling was located. This remote location is described in Earhart *et al.* (1977) as hosted in Precambrian Helena Formation (a calcareous sandstone). The occurrence may be associated with a normal fault trending N20^{o}W with a southwest dip. Earhart *et al.* (1977) estimated ore as a few hundred tons.

<u>Calliope</u>
LC007396

Tertiary rhyolite porphyry hosts this mine with both veins and a separate pipe-like body. It is located on a patented claim with a 80-foot shaft and a 300-foot adit as described by Pardee and Schrader (1933). Also according to Pardee and Schrader, this was the first mine discovered in this district. No production figures are available, except that it produced $11,000 worth of gold in the 1890s (Pardee and Schrader 1933). It is totally on private patented land.

<u>Carbonate</u>
LC001951

This is part of the Montana DHES Upper Blackfoot mining complex and CECRA site and was being reclaimed in the fall of 1994. The tailings were put in a repository on the patented claim located near the mine adit (Norm Yogerst, written comm). The area was recontoured and wetlands created. A 70-ton and a 75-ton mill were located here in the 1940s. The mine consisted of an adit and shaft with several levels. Commodities including Ag-Pb-Zn were recovered from a Cretaceous diorite sill according to Pardee and Schrader (1933). The Carbonate is discussed in Byer, 1987, McClernan, 1983, Shea, 1947, and Miller *et al.* (1973). It is on patented claims.

Carbonate Hill

LC007389

The location of this mine is not clearly defined but workings in this area were generally caved. The area was naturally revegetated. There are two partially caved adits located to the east of Highway 200 that are potential hazards; one open for transients and the other located under a 4x4 road and is daylighted under the road. A small seep is located on the workings farther to the east above the collapsed buildings. There is a natural spring and a small pond formed on an open cut or bench to the east of the abandoned cabins. Thirty-two assays from a map by Higgins in the MBMG mineral property files show an average width of the paystreak of ten inches and 0.77 opt Au, 25.5 opt Ag, 0.34% Cu, 7.36% Pb, and 8.4% Zn.

Consolation

LC001801

Although this mine is located on patented ground, the Consolation may adversely affect Helena National Forest land downstream. A sulfide-rich waste dump is located adjacent to Shoue Creek, and there is a rudimentary vat leach tank partially burned in the flood plain. All adits are completely caved. There is debris scattered over the area; two cabins and one mine building are left standing. A wooden, half-burned vat with junk in it may have been used as a pseudo-vat leach arrangement. Veins here are hosted in Cretaceous gabbro (Shea 1947) or diorite sill (Pardee and Schrader 1933) and was last worked in 1969. The vein strikes N50ºW, and dips 85ºSW (Pardee and Schrader 1933).

Copper Bowl

LC001207

The Copper Bowl was not found because of poor location data (+/- 1 km in the MILS data base) and because access was poor due to private ground to the east (Elk Meadows subdivision). The workings consist of an open cut and underground, each 75 feet long according the MBMG mineral property files. The mine was listed in MBMG publications in the early 1970s (Lawson 1970, 1975, 1976).

Copper Hill

LC001489

This location of this prospect is in the same general place as the Grunter and Bluebell claims as plotted from the MILS data base. It may also be known as the Big 4 Mining Company properties and consisted of four unpatented mining claims. The mineralization occurs as veins and as secondary copper in Precambrian Belt quartzite (Spokane Formation). Workings include several old prospect pits downhill from a talus where several bulldozer trenches were cut. Minerals present include secondary copper minerals, iron oxides, manganese oxides and quartz. An eight ton bulk sample taken in 1960 averaged 1.37% Cu (USBM mineral property file 21.96). A grab sample (PBGBB-1) from taken vertically on the talus ran <0.0005 opt Au, 1.84 opt Ag, 2.72% Cu, 0.01% Pb, and 0.002% Zn.

This prospect is located on Helena National Forest land. A 4x4 road/trail leads up from Canyon Creek or access may be gained by foot after driving up the road off the switchback at the base of Flesher Pass. No discharges or hazardous physical aspects (besides being a steep talus) are associated with this site.

Cotter Basin
LC007347

Cotter Basin mine is principally two large open cuts with the older (?) adits completely caved. Although, there is considerable surface disturbance and steep highwalls present. The site is fairly remote and highly visible so the hazard is lessened. The mine is not located where plotted on the 7.5 min. topographic map, but is on the ridge to the northwest at an elevation of 7,680 feet and another disturbance to the northwest at an elevation of 7,240 feet. It is located on HNF-administered land.

Ore minerals include bornite, chalcocite, azurite, malachite, chalcopyrite, galena, sphalerite, molybdenite, and gold (Earhart *et al.* 1977). McClernan (1983) and Byer (1987) also discuss the deposit. A 5-foot-thick shear zone runs along the ridge intermittently for 1,100 feet (Earhart *et al.* 1977). A random grab along the length of a collapsed adit's side (PBCB-1) ran 0.0005 opt Au, 0.41 opt Ag, 2.63% Cu, 0.02% Pb, and 0.01% Zn. This site is on HNF-administered land; it has no AMDs or physical hazards.

Crystal Mining
LC001543

This occurrence was screened out because of information provided by the USBM mineral property file 21.095. One four foot open pit, one caved crosscut adit and several trenches were worked prior to 1920. Host rock for the deposit Precambrian shale in contact with Proterozoic Z diorite (Whipple and Bregman 1981).

Discovery & Margurette Mine
LC001105

This site was never positively identified; the accuracy according to the MILS data base is either +/-1 km or +/-5 km. Trauerman (1940) is the only reference to Margarette [*sic*]; saying it was four patented and six unpatented claims. The memoir further states the workings extended approximately 1,000 feet. No workings this extensive were found but one open shaft (as marked in section 8 on the 7.5-min. topo) was located; it is a vertical, timbered open shaft open for 15 feet. It is covered by a few boards but is accessible and highly visible. It is located on HNF-administered land.

Eclipse
LC001513

The Eclipse was never exactly located, but the general area was visited. It is located adjacent to the Flesher Pass Road (Highway 279) and has probably been naturally reclaimed. Workings are described as test pits (in 1944) along the strike of a vein (or veins) exposed in road building. Minerals present included malachite, cuprite, limonite and quartz. The property was described as three claims, but the land is privately held according to USFS ownership maps. It is a contact deposit between an andesite porphyry and quartzite (or late Proterozoic diorite sills/dikes and Precambrian Spokane Formation (Whipple *et al.* 1987).

Eureka
LC007408

The Eureka is a patented claim associated with the Milliron and Carbonate Hill group. A plat of the patented claims located in MBMG mineral property files shows the Eureka claim occurs in the

SW¼ section 16 and the NW¼ section 21. The shafts, which were reported as caved by Pardee and Schrader (1933), are not evident today.

<u>Giant Claim</u>
LC007350

This occurrence is also known as Cameron mine and is located up Stonewall Creek on a patented claim. There is one collapsed adit with no discharge. McClernan (1983) and Earhart *et al.* (1977) describe this mine as a vein or gold-bearing shear zone occurrence in Precambrian Spokane Formation associated with a diorite sill. Iron oxides, quartz stringers, epidote, calcite were found on a small dump; ore minerals of chalcocite and malachite were reported Earhart *et al.* (1977). A grade from literature (Earhart et al. 1977) of 0.59 opt Au, 0.4 opt Ag, 0.063% Cu, and 0.002% Pb. Fifty-five feet of adit and a 25-foot winze (McClernan 1983) is reflected in the size of the dump. All disturbances are on patented ground. There are active unpatented claims to the north not associated with this mine.

<u>Gossan & Junior</u>
LC001741

This occurrence was not definitely located but the general location was found and is the same as Carbonate Hill. It is located ½-mile southwest of Rogers Pass. Whipple *et al.* (1987) and Whipple and Bregman (1981) show the area as a contact occurrence between porphyry and shale. A 42-inch-wide sample across the vein in a trench assayed 15% Pb, 18 opt Ag, and some Zn (according to a USBM mineral property file report. Evidence of surface trenches remain. Workings up the hill in this area are all collapsed, and there are no discharges except one small seep or wet spot and a pond, but this is assumed to be on the Carbonate Hill claim.

<u>Grunter & Bluebell</u>
LC001591

This occurrence was not located but it is assumed to be the same as the Copper Hill occurrence described elsewhere. The general area was walked and no hazards or disturbances of any note were present except those described in the Copper Hill claims. The sample PBGBB-1 could probably be generalized to include this claim.

<u>Heddleston-Cu-Mo</u>
LC001675

This record in the MILS data base reflects the location of the Heddleston district, and there is no Heddleston mine as such. The district was named for William Heddleston, one of the earliest miners in the area during the 1880s and 1890s. Production was sporadic from the first discovery in 1889 until the 1970s. The Mike Horse, Carbonate, Anaconda, Paymaster, Edith, and the Mary P. mines are presently actively being reclaimed as a part of the Upper Blackfoot mining complex CECRA site. Miller *et al.* (1973), McClernan (1983), Byer (1987) and Castle (1978) updated original work by Pardee and Schrader (1933). Original maps of the area are located in the MBMG mineral property files.

<u>Heddleston Group</u>
LC001723

Another entry in the MILS data base that reflects the Heddleston district in general. It should be deleted as an entry as a mine location.

Hidden Vein

LC001531

This occurrence is located up Lyons Creek on the Rogers Pass quadrangle in section 32, T.15N., R.5W. Workings at this site consist of a single shallow trench approximately 100' long (USBM file 21.061). This site was screened out due to the limited extent of the reported workings and the low-grade nature of the ore (a sample taken by the USBM ran 0.005 opt Au, 0.6 opt Ag, and 2.18% Cu). The mineralization occurs near the contact between Precambrian Spokane formation and diorite. Ore and gangue minerals reportedly are bornite, quartz, epidote, siderite and carbonates.

Hog Claim

LC007338

This is a patented claim and was considered part of the Mike Horse mine workings for this study.

Hogall

LC007359

This also is a patented claim and associated with the Mike Horse mine claim group. Pardee and Schrader 1933 described it as a eastward continuation of the Mike Horse vein and is located approximately 1,220 feet from the Mike Horse adit. McClernan (1983) and Gilbert (1935) are the only other two references to this claim.

Iron Hill

LC007368

Workings are accessed by crossing to the north of the Blackfoot River below the Anaconda mine site and going northeast approximately 1,000 feet. Workings include three adits: a totally collapsed adit with a prominent, sulfide-rich dump (at least 300-400 feet from the river), another collapsed adit to the north with a smaller dump (this may or may not be the same property) and a short collapsed adit near river level with a seep but no real discharge. A line of prospects trends uphill towards the Skyscraper property from the most prominent adit. A small seep issues from a collapsed adit at the base of a talus at the lower adit. No evidence of adverse effects are present. Commodities at the Iron Hill include lead and zinc (MILS data base); assays from a composite sample from the waste dump ran 0.004 opt Au, 0.23 opt Ag, 0.04% Cu, 0.08% Pb, and 0.02% Zn. Diorite, FeOx, pyrite, euhedral quartz, and clays are found on the largest dump. The Iron Hill is found on HNF-administered land and is mentioned in Pardee and Schrader (1933), Shea (1947), McClernan (1983), and Byer (1987).

Kleinschmidt

LC007384

Pardee and Schrader (1933) and Miller *et al.* (1973) discuss the Kleinschmidt, saying that it has, "extensive underground workings" but for the purpose of this study it should be included with the Mike Horse mine study.

Lincoln Gulch Placer Mine

LC001129

Lincoln Gulch placers were discovered in 1865 (Pardee and Schrader 1933) and as of 1994 active placering was continuing. Over $7,000,000 in gold was taken from less than a mile and a half of placer drifting (Pardee and Schrader 1933). Access via Forest Service Road 626 follows the gulch which shows evidence of placer disturbance, but no hazards. There are dredge piles and steep walled cuts in the alluvium. An active placer was operating near the center of section 8, T.14N., R.9W. in 1994. Shea (1947) states this property was also mined for tungsten during World War 2. References for this location are Pardee and Schrader (1933) and later Lyden (1948) and McClernan (1983) who basically reiterate Pardee and Schrader.

Midnight
LC007358

The Midnight is located on private, patented ground. Additionally, there is a Midnight mill site located to the east of the Mike Horse Mine Road at Shoue Creek. Locations were found on an original map of patented claims located in the MBMG mineral property files. References describe this mine as several adits, last worked in 1926, partially caved in 1947 (Shea 1947) hosted in diorite and argillite (Spokane shale). Minerals, again according to Shea (1947), include galena, sphalerite, bornite, and pyrite.

Mike Horse
LC004559

The Mike Horse is part of the DHES Upper Blackfoot mining complex CECRA site and is the subject of active study and reclamation (MSE was grouting in the fall of 1994). The Mike Horse was the major producer in this area (total amount $6,942,565, [Byer 1987]). It also was the site of at least three mills. A catastrophic flood in 1975 breached the tailings dam, and the resulting discharge profoundly affected the Blackfoot River.

An original set of underground maps are located in the map files at the MBMG at scales of 1"=200' and 1"=50'.

Milliron
LC007433

This mine was never definitely located although it plots near the Carbonate Hill mine. Reconnaissance found no adverse effects. Pardee and Schrader (1933) describe workings as "adits and open cuts south of the Carbonate Hill" but the field visit found two partially caved adits adjacent to and east of Highway 200. One partially caved adit passes beneath a four-wheel drive road. The other appears to be used occasionally by transients and is visible from the highway.

Oker Mine
LC007296

This group of mines has affected the entirety of Sandbar Creek with orange, iron staining. Flow above the easternmost adit appears normal. There are three—possibly four—totally caved adits, none with discharges. The creek cuts across the waste dump of the middle adit; the upper, and lower adits both have streamside wastes. One pile of ore sits on timbers and is apparently an attempt at an open-roasting setup or an ore loading platform. A road has been constructed across the middle waste dump and adjacent to this area the streambed has been placered.

A select sample along 125' of colluvium in the westernmost adit (PBLOM-1) assayed <0.0005 opt Au, 0.65 opt Ag, 0.02% Cu, 0.06% Pb, and 0.001% Zn. Another sample, a composite from the easternmost waste dump (PBLOK-2), ran 0.087 opt Au, 2.15 opt Ag, 0.05% Cu, 1.05% Pb, and 0.20% Zn. This dump is adjacent (within 10 feet) to Sandbar Creek, but no active erosion was noted. A third sample composited from the waste dump of the middle adit (PBOKM-1) assayed 0.006 opt Au, 0.68 opt Ag, 0.05% Cu, 0.28% Pb, and 0.03% Zn. These mines are located primarily, if not entirely, on HNF-administered land. There is a file in the MBMG files on "Sanborn" Creek that fits the description of Sandbar Creek, but the occurrence described is a manganese one and samples from the mines described above are not anomalous in manganese. The two occurrences may or may not be related.

Paymaster
LC007304

One of the mines included in the DHES Upper Blackfoot mining complex CECRA site. This mine has streamside waste dumps and also possible tailings (although no references to a mill was found in literature). It was not included in this study; it also is on private land.

Rainy Day Mine
LC001525

As described in the USBM MILS data base, this is the same as Copper Camp. The information listed in this file is from 1943.

Red Wing
LC007319

This is a private claim, consisting of a 75-foot-long adit according to Pardee and Schrader (1933). It was screened out for this reason.

Rex Beach
LC007321

Located of the southeast side of Shoue Creek, workings consist of one totally collapsed adit with a small discharge as well as streamside waste pile with active erosion of the northeast side. A small, steep gully enters above the adit from the southeast. The caved adit may capture the water from the creek through an unconsolidated landslide and then appears to discharge it. There is a highwall behind the adit that is fairly steep. The discharge that erodes the side of the waste dump did not reach the creek at the time of this visit. The waste dump is composed of <5% sulfide (pyrite, galena?), gabbro, siltstone, iron oxide and abundant clay (from alteration of gabbro (?) [Shea 1947] or diorite [Pardee and Schrader 1933]). Pardee and Schrader (1933) state the workings total 500 feet; 200 feet of adit and 300 feet of drifts. There is a pile of lumber on the waste dump, probably from an old building. A cabin in bad condition lies to the northwest, down the drainage.

A composite sample from the waste dump ran 0.020 opt Au, 5.75 opt Ag, 0.13% Cu, 5.03% Pb, and 0.82% Zn. A sample as reported in Pardee and Schrader (1933) showed the ore contained values in silver, gold, lead, zinc, copper, arsenic, and antimony. This site is on HNF-administered land; access is via a fair dirt road up the east side of Shoue Creek.

R.T.C.
LC001957

Two totally collapsed adits and one waste dump are present here. The upper adit has a seep, but there is no erosional channel present leading to the creek. The waste dump is near the creek but is not in contact with it. Total disturbance is less than one acre. An ore bin is in good condition and a cabin is in fair condition. Access is via a fair dirt road up the east side of Shoue Creek then by a 4x4 trail that crosses the creek several times and finally turns up Chambers Gulch. The mine is located at the end of the road. This property is also known as the Ward Thompson. There is a mineral property file on the R.T.C. located in the MBMG files. R.T.C. stands for Robert T. Cummings.

Skyscraper
LC007302

A shaft was supposed to be present here (Pardee and Schrader 1933) but all that was found was a large prospect pit which may be a collapsed shaft. The original shaft was supposedly 40 feet deep (Pardee and Schrader 1933). It is located uphill from the Iron Hill claim after following a line of prospects. A grab sample from the small remaining waste pile ran 0.011 opt Au, 0.30 opt Ag, 0.04% Cu, 0.02% Pb, and 0.02% Zn. No hazards were associated with this site on HNF-administered land.

Stonewall Creek
LC007410

Dredge piles, an occasional foundation and equipment fragments are the only remnants of the placer operations located in this valley. Pardee and Schrader (1933), Lyden (1948) and Earhart *et al.* (1977) all mention this placer. Lyden (1948) speculated that the gold was probably derived from quartz veins on Stonewall Mountain. The cobbles in the dredge piles are primarily Precambrian Belt with lesser amounts of intrusive.

Unnamed Lincoln Gulch Mines
LC008024

A group of adits were worked in the NE¼ section 7, T. 14 N., R. 9 W. on the west slope of Lincoln Gulch. One vertical, 30+ foot shaft/stope is poorly fenced with woven wire and is obscured by alders. All adits (six total) are either caved or one is secured by woven wire. Another shaft at the north end of the road is completely caved. The site is not easily reached, but the one open vertical shaft is a potential hazard to timber cutters, hunters and recreationalists. The Forest Service ownership maps show one patented claim here and the workings on HNF land. The workings are located in a siltstone with molar-tooth structure (probably Precambrian Helena or Wallace Formation (Wallace 1987). Assays from select sample (PLUA-1) ran <0.0005 opt Au, 0.36 opt Ag, 0.001% Cu, 0.03% Pb and 0.005% Zn.

Upper Copper Creek Area
LC004409

This designation was screened out because of the generality of the description, and the inaccuracy of the location (+/-1 km). It probably includes Copper Camp (i.e., Rainy Day mine) and also could include Cotter Basin.

Ward Thompson
LC001471

This also is known as the R.T.C. lode. The relationships between minerals are described in Young (1962, MBMG Bulletin 30, p. 28). It is described as an east-west vein in diorite. Galena, sphalerite, pyrite, chalcopyrite, quartz, ankerite, tetrahedrite, covellite, and cerussite are described by Young *et al.* (1962) and McClernan (1983).

Appendix IV
Soil and Water
Analytical Results
Blackfoot and Little Blackfoot Drainages
Helena National Forest

Analytical results and exceedences of soil samples
Most recent update: 3/21/96

Note: * in column A indicates that data has been updated by RKM with data provided by Tim, 6/2/95
ICP indicates that the value is estimated. The value was outside the calibrated range of the ICP.

Units: (mg/Kg dry weight)

	SOIL SAMPLE	LAB ID	Ag	C	Q	As	C	Q	Ba	C	Q	Cd	C	Q	Cr	C	Q	Cu	C	Q	Hg	C	Q	Ni	C	Q	Pb	C	Q	Zn	C	Q	COMMENT	
Charter Oak																																		
	LCOD10H	96S0091	51			10122			59.5			2.9	B		2.6	B		166			1.04			1.0	B		7013			233			67.30%	96-17
Kimball																																		
	LKBD10H	96S0092	28			5721			17.0	B		1.2	B		0.6	B		44.2			0.12			4.8	U		1588			118			84.10%	96-17
Hope Adit																																		
	THOD10M	96S0038	6.4			184			50.3			4.7			4.6			39.9			0.11			2.0	B		609			622			90.70%	96-18
North Ontario																																		
	ONOD10L	96S0037	0.80	B		86.2			62.7			2.1	B		3.7	B		106			0.13			3.0	B		141			151			77.70%	96-18
Telegraph																																		
	MTGD10M	96S0039	2.1	B		95.3			26.6			0.92	B		2.3	B		32.2			0.51			2.4	B		152			43.0			78.80%	96-18
Ontario																																		
	OOND10H	96S0028	15			11225			61.7			1.1	B		4.2	B		66.9			0.98			2.6	B		1085			116			71.20%	96-17
	OOND20H	96S0029	28			3073			8.2			3.0	B		5.2	U		102			0.13			5.2	U		700			337			77.00%	96-17

Appendix IV. Analytical results and exceedences of water analysis.

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

	Sample	Al	As	Ba	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Ni	Ag	Zn	Cl	F	NO3	SO4	SiO2	Field	Field	Temp	LAB SC	LAB	FLOW	UNITS
	Date	UG/L	UG/L	UG/L	UG/L	UG/L	UG/L	MG/L	UG/L	MG/L	UG/L	UG/L	UG/L	UG/L	MG/L	MG/L	AS N MG/L	MG/L	(mg/l)	pH	SC umhos	Cent	umhos	pH	RATE	
Big Dick Mill Site																										
LUKS10M	28-Sep-95	<80.	22.6	17.7	<2.	<2.	<2.	0.015	<2.	0.005	<.1	<2.	<1.	227 A C	1.5	<.1	<.05	110	32.5	8.09	277.4	7.9	307	7.72	76	GPM
Bobby Boy																										
PBBS10H	23-Aug-95	<80.	<1.	182.7	7.4 P A C	<2.	3.1	0.016	<2.	0.788 S	0.13 C	6.5	<1.	851.3 A C	<.5	0.3	0.05	70	12.5	6.5	271.7	7.2	224	6.34 S		
PBBS20M	23-Aug-95	<80.	1.1	241.9	<2.	<2.	<2.	<.003	<2.	0.005	<.1	<2.	<1.	4.2	<.5	<.1	0.05	10	8.9	7.2	127.1	8.5	131.4	7.55	5.5	GPM
PBBS30M	23-Aug-95	<80.	<1.	222.7	<2.	<2.	2.2	<.003	<2.	<.002	0.13 C	<2.	<1.	45.7	<.5	<.1	0.1	10	9.2	6.83	123.6	8.3	132.7	7.29	6.2	GPM
Bumble Bee/Morning Star																										
OBBS10H	26-Jul-95	<30.	1.3	22.5	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	5.8	<.5	0.08	0.15	7.5	16.3	7.99	370	9.8	410	7.8		
OBBS20M	26-Jul-95	<30.	<1.	75.5	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	<2.	0.5	0.06	<.05	5	8.6	8.1	304	7	290	8.09	1886	GPM
OBBS30M	26-Jul-95	<30.	<1.	75.6	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	4.6	<.5	0.06	<.05	5	8.6	8.27	284	7.6	280	8.21	3.2	1437
Charter Oak																										
LCOSI0M	06-Oct-95	<80.	106.9 P	8.7	<2.	<2.	2.3	0.732 S	<2.	2.6 S	<.1	9.4	<1.	353.1 A C	1	0.5	<.05	450 S	25.1	7.86	1081.8	3.9	1108	7.67	8.5	GPM
LCOS20M	06-Oct-95	<80.	60.4 P	15.5	<2.	<2.	<2.	0.059	<2.	0.007	<.1	<2.	<1.	120.5 A C	1	<.1	<.05	40	25.1	S	155.5	2.9	175	7.45	12.5	GPM
LCOS30M	06-Jun-95	1541 S A C	4568 P A C	16.9	35.1 P A C	<2.	369.2 A C	51.5 S A	68.1 P C	1.4 S	<.1	9.2	<1.	353.1 A C	1.5	<.1	<.05	500 P S	25.1	3.17 S	1044.2	4.6	1323	2.88 S	4.5	GPM
LLBS30L	06-Oct-95	<80.	6.5	29	<2.	<2.	<2.	0.018	<2.	<.002	<.1	<2.	<1.	8	1	0.3	<.05	12.5	16.8	8.71 S	154.7	6.9	126	7.51		
Consolation																										
SCOS10M	24-Aug-95	<80.	<1.	229.6	<2.	<2.	<2.	<.003	<2.	<.002	0.11 C	<2.	<1.	6.8	<.5	<.1	<.05	2.5	8.5	7.4	117	10.2	125.4	7.73	359	GPM
SCOS20M	24-Aug-95	<80.	<1.	225.2	<2.	<2.	4.2	<.003	<2.	0.015	<.1	<2.	<1.	80.4	<.5	<.1	<.05	5	8.9	7.2	122.6	10	122.7	7.7	359	GPM
Copper Camp/ Rainy Day																										
CCCS10M	13 AUG 1992	<50.	11	53.2	<2.	<2.	6.5	0.006	<2.	<.002	0.1 C	<2.	<1.	5	<.5	0.09	0.075	4.91	4	8.17	156.2	3.6	224	8.39		
CCCS20M	13 AUG 1992	<50.	12	169	<2.	<2.	3.2	0.004	<2.	<.002	0.1 C	<2.	<1.	2.9	<1.0	0.07	0.049	7.4	6	8.17	204.6	4.3	222	8.24		
CCCS30M	13 AUG 1992	<50.	7.9	192	<2.	<2.	<2.	<.003	<2.	<.002	0.1 C	<2.	<1.	<2.	0.2	0.06	0.046	6	5	8.05	206.2	5.2	216	8.36		
CCCS40M	13 AUG 1992	<50.	10.3	200	<2.	<2.	<2.	0.007	<2.	0.002	0.1 C	<2.	<1.	3.8	0.26	0.06	<.10	6.2	6	7.86	208.4	8.5	221	8.05		
Golden Anchor																										
LLBS10L	06-Oct-95	<80.	3.8	25.4	<2.	<2.	<2.	0.021	<2.	0.003	<.1	<2.	<1.	12.4	<.5	<.1	<.05	7.5	20	6.95	97.6	4.1	113	7.66		
LLBS20L	06-Oct-95	<80.	7.5	23.4	<2.	<2.	<2.	0.03	<2.	0.007	<.1	<2.	1.8 C	14.5	3	<.1	<.05	10	20.1	7.01	100	5.6	126	7.51		
Hope Adit																										
THOS10M	09-Aug-95	704.9 S C	1	9.3	11.5 P A C	<2.	16.7 C	0.189	19.8 C	2.5 S	<.1	5.6	<1.	1534 A C	<.5	0.4	<.05	70	36	4.13 S	175.7	7	181.2	4.06 S	1	GPM
Hub Camp																										
THCS10H	09-Aug-95	<30.	11.8	4.9	<2.	<2.	2.4	0.012	<2.	0.003	<.1	2.8	<1.	29.3	1.5	0.1	<.05	162.5	16.2	8.21	662	16.5	525	8.21	1.5	GPM
Kimball																										
LLBS10L	06-Oct-95	<80.	3.8	25.4	<2.	<2.	<2.	0.021	<2.	0.003	<.1	<2.	<1.	12.4	<.5	<.1	<.05	7.5	20	6.95	97.6	4.1	113	7.66		
LLBS20L	06-Oct-95	<80.	7.5	23.4	<2.	<2.	<2.	0.03	<2.	0.007	<.1	<2.	1.8 C	14.5	3	<.1	<.05	10	20.1	7.01	100	5.6	126	7.51		
Upper Kimball																										
LUKS10M	28-Sep-95	<80.	22.6	17.7	<2.	<2.	<2.	0.015	<2.	0.005	<.1	<2.	<1.	227 A C	1.5	<.1	<.05	110	32.5	8.09	277.4	7.9	307	7.72	76	GPM
LUKS20M	28-Sep-95	<80.	49.9	15.6	<2.	<2.	<2.	2.9 S A	<2.	0.974 S	<.1	2.1	<1.	143.8 A C	0.5	0.2	<.05	75	51.5	7.61	258.6	9.1	267	7.3	12	GPM
LUKS30M	28-Sep-95	<80.	24.8	17.5	<2.	<2.	<2.	0.041	<2.	0.065 S	<.1	<2.	<1.	193.5 A C	1	<.1	<.05	100	34.3	8	261	8.9	292	7.6	86	GPM
Lily - Orphan Boy																										
TOBS10L	26-Sep-95	68.2 S	2.3	7.2	<2.	<2.	<2.	0.304 S	2.1	0.126 S	<.1	<2.	<1.	15.1	1	<.1	<.05	12.5	26.4	7.21	62.8	5.1	71.3	7.02	16.5	GPM
TOBS20L	26-Sep-95	97 S C	8.4	8.2	4.8 A C	<2.	5.4	0.279	5.1 C	0.693 S	<.1	2.5	<1.	714 A C	1	<.1	<.05	35	27.6	6.98	96.5	5.1	117.7	6.75	27.7	GPM
Madison Wonder																										
MMWS10L	27-Sep-95	<30.	<1.	44.2	<2.	<2.	<2.	<.02	<2.	<.002	<.1	<2.	<1.	13	0.5	<.1	0.15	5	16.3	7.34	129.2	5.1	97.9	7.41	3	GPM
Mammoth																										
SMMS10H	28-Sep-95	<30.	<1.	65.5	6.8 P A C	<2.	126.2 A C	<.02	<2.	0.03	<.1	8.5	<1.	<8.	0.5	0.4	<.05	47.5	16.8	5.81 S	320.5	7.9	253	8.04	5	GPM

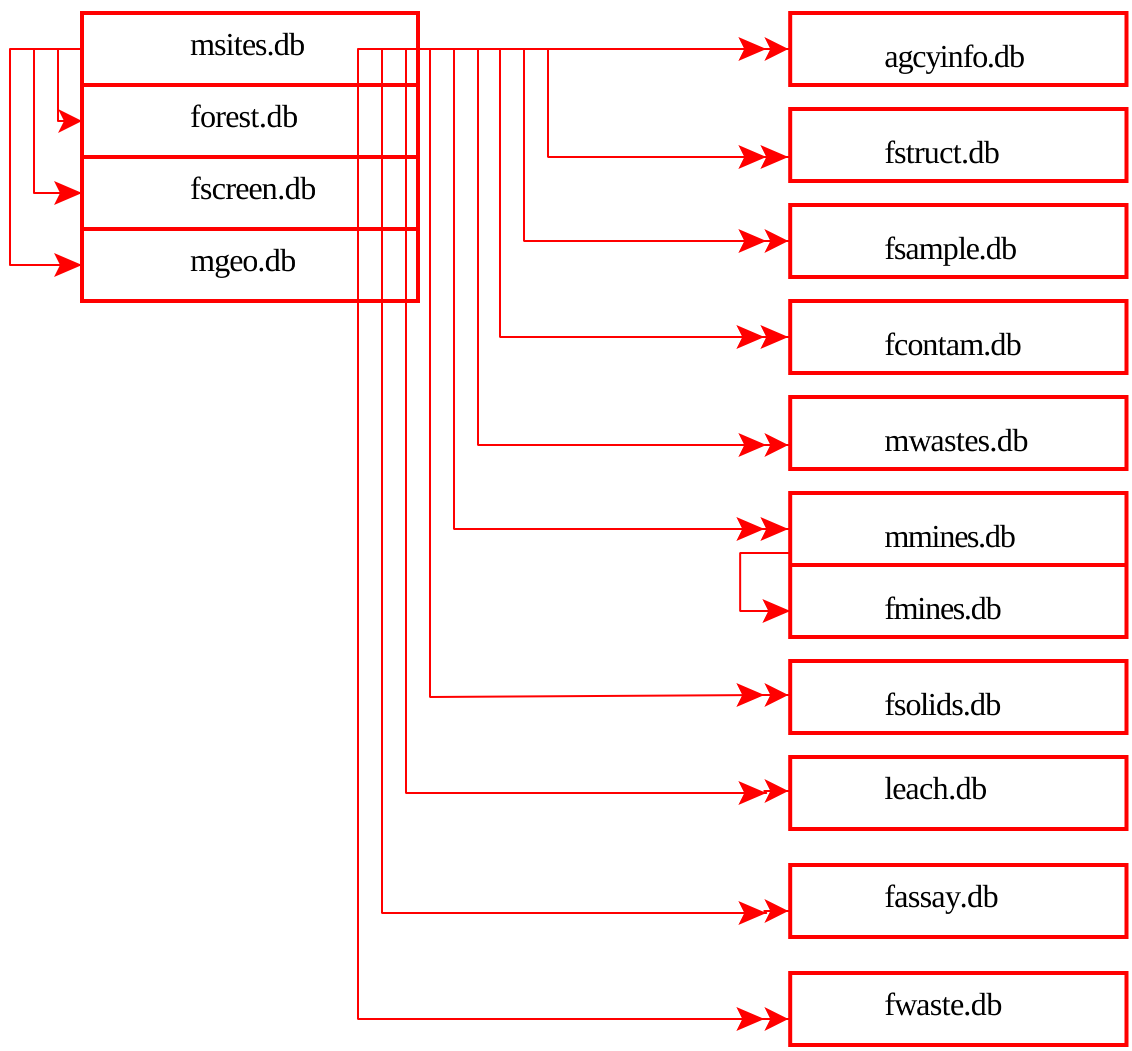
[UG/L = micrograms/liter; MG/L = milligrams/liter; < = below method detection limit; P = primary drinking water standard exceeded;
S = secondary drinking water standard exceeded; A = acute aquatic standard exceeded; C = chronic aquatic standard exceeded
SC = specific conductance in micromhos/centimeter;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

	Sample Date	Al UG/L	As UG/L	Ba UG/L	Cd UG/L	Cr UG/L	Cu UG/L	Fe MG/L	Pb UG/L	Mn MG/L	Hg UG/L	Ni UG/L	Ag UG/L	Zn UG/L	Cl MG/L	F MG/L	NO3 AS N MG/L	SO4 MG/L	SiO2 (mg/l)	Field pH	Field SC umhos	Temp Cent	LAB SC umhos	LAB pH	FLOW RATE	UNITS
Monarch Mill																										
MMNS10M	27-Sep-95	<80.	3.3	9.8	<2.	<2.	34.4 A C	0.151	18.6 C	0.064 S	<.1	<2.	<1.	11.8	0.5	0.3	0.05	20	14.8	6.82	139	7	156	6.98	0.3	GPM
MMNS20H	27-Sep-95	<80.	<1.	18.1	<2.	<2.	2.1	0.022	<2.	0.003	<.1	<2.	<1.	<2.	<.5	<.1	<.05	95	17	8.05	291.7	7	315	7.71	0.8	GPM
MMNS30L	27-Sep-95	<80.	<1.	25.9	<2.	<2.	<2.	0.018	<2.	0.004	<.1	<2.	<1.	11.5	<.5	<.1	<.05	5	18.7	7.31	32.5	10	43	7.02	530	GPM
MMNS40L	27-Sep-95	<80.	<1.	27.4	<2.	<2.	<2.	0.015	<2.	0.004	<.1	<2.	<1.	17.4	0.5	<.1	<.05	5	18.7	7.32	31.8	7.3	45	7.24	530	GPM
MMNS50M	27-Sep-95	<80.	6.7	29	<2.	<2.	2.1	4.9 S A	2.1	1.3 S	<.1	<2.	<1.	9.3	<.5	<.1	<.05	5	15.5	6.98	86.3	9.9	90	6.61	0.8	GPM
North Ontario																										
ONOS10L	09-Aug-95	<30.	12.5	4.1	3.1 C	<2.	10.8	0.016	<2.	0.016	<.1	<2.	<1.	227.4 A C	<.5	<.1	<.05	17.5	31.5	7.24	46.2	4.2	56.7	6.63	13.5	GPM
ONOS20L	09-Aug-95	<30.	12.3	4.9	2.3 C	<2.	3.4	0.01	2.1	0.004	<.1	<2.	<1.	162.5 A C	<.5	<.1	<.05	17.5	30.8	7.24	49.5	4.2	57.8	6.55	3	GPM
O'Keefe Creek/Copper King																										
OOKS10L	09-Aug-95	<30.	3.1	6.8	<2.	<2.	2	0.368 S	<2.	0.011	<.1	<2.	<1.	31.7	<.5	<.1	<.05	7.5	16.7	7.69	66.4	14	74.7	7.52	494	GPM
Oker Mine/Sandbar Creek adits																										
SOKS10M	16-Aug-95	<80.	<1.	182.8	<2.	<2.	<2.	0.011	<2.	0.004	<.1	<2.	<1.	7.3	<.5		<.05	10	9.3	7.95	172.21	8.7	174	7.69	66.3	GPM
SOKS20M	16-Aug-95	<80.	<1.	173.2	<2.	<2.	<2.	0.008	<2.	<.002	0.1 C	<2.	<1.	7.4	<.5		<.05	10	9.5	7.94	177.19	9	176	7.9	65	GPM
SOKS30H	16-Aug-95	<80.	<1.	166.1	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	8.1	<.5		0.1	10	9.9	7.6	404.46	10	172	7.93	50	GPM
S0KS40H	16-Aug-95	<80.	<1.	121	<2.	<2.	3.3	0.008	<2.	<.002	<.1	<2.	<1.	13.2	<.5		<.05	15	12.5	7.75	505	10.4	141.9	7.63	50	GPM
SOKS50H	16-Aug-95	<80.	1.1	110.7	<2.	<2.	7.6	0.693 S	<2.	0.192 S	<.1	<2.	<1.	10.7	<.5		<.05	15	13.7	7.27	499.37	12.9	134.6	7.15	70	GPM
Ontario																										
OONS10M	03-Aug-95	2669 S A C	13	13.4	5.8 P A C	<2.	21.2 A C	4 S A	<2.	1 S	<.1	7	<1.	850.4 A C	0.5	0.29	<0.05	95	51.1	4.67 S	170.7	5.4	254	4.01 S	13.5	GPM
OONS20M	03-Aug-95	11,000 S A C	1.6	21.5	28.4 P A C	<2.	157 A C	0.393 S	<2.	2 S	<0.1	7.1	<1.	4056 A C	1	0.3	<0.05	162.5	69.2	3.76 S	368.8	12	396	3.47 S	8	GPM
OONS30M	03-Aug-95	2490 S A C	77.1 P	14.4	14.4 P A C	<2.	134.7 A C	2.8 S A	304.7 P A C	1.3 S	<0.1	6.8	<1.	2695 A C	1	0.2	<0.05	125	60	3.36 S	381	25	394	3.12 S	1	GPM
OONS40M	03-Aug-95	4376 S A C	17.9	13.5	11.6 P A C	<2.	85 A C	1.7 S A	27 C	1.4 S	<.1	8.1	<1.	1692 A C	0.5	0.22	<.05	105	54.1	3.99 S	301.2	11.9	317	3.72 S	36	GPM
OONS50L	26-Sep-95	115.2 S C	4.9	10.3	<2.	<2.	8	0.129	17.4 C	0.243 S	<.1	<2.	<1.	235.5 A C	1.3	<.1	<.05	30	36	7.29	80.2	5.9	98.4	5.87 S	76	GPM
OONS60L	26-Sep-95	53.7 S	<1.	12.8	<2.	<2.	<2.	0.086	<2.	0.04	<.1	<2.	<1.	30	0.5	<.1	<.05	22.5	30	7.35	57.6	5.3	82.3	6.54	71	GPM
Rex Beach																										
SRBS10M	24-Aug-95	<80.	<1.	120.9	<2.	<2.	<2.	<.003	<2.	<.002	0.13 C	<2.	<1.	30.1	<.5	<.1	<.05	10	9.7	7.21	116.8	8.3	121.6	7.65	8	GPM
SRBS20M	24-Aug-95	<80.	<1.	179.6	<2.	<2.	<2.	<.003	<2.	<.002	0.11 C	<2.	<1.	3.2	<.5	<.1	<.05	5	8.8	7.8	122.4	8	124.8	7.88	8	GPM
Telegraph																										
MTGS10M	03-Aug-95	379.7 S C	<1.	27.4	2.5 C	<2.	66.8 A C	0.199	<2.	0.382 S	<0.1	5.3	<1.	325.5 A C	<0.5	<0.1	0.1	55	27.4	4.98 S	104.8	7.2	151.7	4.78 S	12	GPM
MTGS20M	09-Aug-95	421.6 S C	<1.	19.2	<2.	<2.	16.1 C	0.125	15.7 C	0.156 S	<.1	2.4	<1.	121.9 A C	0.5	<.1	<.05	40	27	4.53 S	96.8	10.8	104.5	4.51 S	5	GPM
Lower Telegraph																										
TTCS10L	26-Sep-95	<30.	2.1	7.5	<2.	<2.	<2.	0.161	4.7 C	0.012	<.1	<2.	<1.	52	1.5	<.1	<.05	15	20.1	7.63	77.7	5.6	92.3	7.46	2245	GPM
Third Term																										
HTTS10L	26-Sep-95	<80.	1.5	9.5	<2.	<2.	2	0.112	3.4 C	0.023	<.1	<2.	<1.	7.9	0.5	<.1	<.05	22.5	26.3	7.91	106.5	6.6	123	7.5	69	GPM
HTTS20L	26-Sep-95	92 S C	1.3	10	<2.	<2.	19.8 A C	0.085	<2.	0.041	<.1	2.2	<1.	87.4	0.5	0.1	<.05	27.5	27.4	7.76	117.4	6.6	132	7.49	68	GPM
Treasure Mountain																										
LTMS10H	28-Sep-95	<80.	147.4 P	7.1	<2.	<2.	<2.	0.547 S	<2.	1 S	<.1	<2.	<1.	62.5	1	0.4	<.05	70	43	7.7	280	8.3	308	7.6	16	GPM
LTMS20L	28-Sep-95	<80.	23.4	21.5	<2.	<2.	<2.	0.023	4.5 C	0.015	<.1	<2.	<1.	15.3	0.5	<.1	<.05	25	27	7.6	130.5	11	147	7.31	5.5	GPM
LTMS30H	28-Sep-95	<80.	45.8	22.9	2.9 C	<2.	<2.	0.008	<2.	0.011	<.1	2.8	<1.	506 A C	1.5	<.1	0.1	212.5	29.1	8.2	454	9.8	482	7.69	63	GPM
Unnamed																										
TUNS10M	28-Sep-95	<80.	37	<2	<2.	<2.	7.9	0.015	<2.	0.005	<.1	2.3	<1.	31.4	0.5	0.3	0.35	42.5	36.6	7.33	163.5	7.9	181	7.2	3.5	GPM
Victory Mine/Evening Star																										
OESS10H	26-Jul-95	<30.	<1.	25.5	<2.	<2.	<2.	<.003	<2.	<.002	<.1	<2.	<1.	2.9	<.5	0.08	<.05	7.5	12.5	7.68	420	7	469	7.69	225	GPM
Viking																										
TVIS20M	28-Sep-95	231 S C	<1.	47.7	20 P A C	<2.	20.4 A C	0.019	15.6 C	0.541 S	<.1	12.1	<1.	1287 A C	<.5	<.1	<.05	105	24.8	5.45 S	219	4.6	245	4.82 S	0.5	GPM

Appendix V
MBMG - USFS
AIM Data Base Tables and Fields

AIM data base tables.

Data Model: FORESTR2.FSL



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

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

Mine Open Table
Id
Type
Condition
Ground Water
Photo
Ownership
Comments

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

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

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

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

Fcontamination
Id
Type of Contamination
Estimated Quantity

Fstructure
Id
Type
Condition

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

Water
Id
Sample Id
Source