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Red Elephant Mill Site
Preliminary Assessment Report

Blaine County
State of Idaho

Department of Environmental Quality

March 2007

Submitted to:
U. S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

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Acronym	Definition
ATV	all terrain vehicle
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
gpm	gallons per minute
PA	Preliminary Assessment
TDL	Target Distance Limit
USGS	US Geological Survey

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Section 1. Introduction

This document presents the results of the preliminary assessment (PA) of the Red Elephant Mill Site. The Department of Environmental Quality (DEQ) was contracted by Region 10 of the United States Environmental Protection Agency (EPA) to provide technical support for completion of preliminary assessments at various mines within the Mineral Hill Mining District in Blaine County, Idaho.

DEQ often receives complaints or information about sites that may be contaminated with hazardous waste. These sites can include abandoned mines, rural airfields that have served as bases for aerial spraying, old landfills, illegal dumps, and abandoned industrial facilities that have known or suspected releases.

In February 2002, DEQ initiated a Preliminary Assessment Program to evaluate and prioritize assessment of such potentially contaminated sites. Due to accessibility and funding considerations, priority is given to sites where potential contamination poses the most substantial threat to human health or the environment.

For additional information about the Preliminary Assessment Program, see the following:

http://www.deq.idaho.gov/waste/prog_issues/mining/pa_program.cfm

1.1 Overview

The Red Elephant Mill site (Mill) and tailings are located in the lower reaches of Red Elephant Gulch, along Elk Creek, and downgradient from the workings of the Red Elephant Mine. The closest workings, the Lipman Tunnel, lie approximately 0.5 miles to the north. Three patented mill site claims, the Suzie V, Augusta V, and Central, encompass the Mill's remains and associated tailings.

The general location of the Red Elephant Mill is identified in Figure 1. The Mill exists on private land at latitude 43.4717 N and longitude 114.427965 W, within Sections 28 and 33 of Township 2N & Range 17E. The closest town to the Mill is the city of Hailey, approximately six miles by air and road.

Figure 2 shows the topography around the site, and Figure 3 provides an aerial view. The site of the historic mine facilities can be reached from Hailey by driving east along the Croy Creek Road, then north along the Red Elephant Gulch Road.

There are no locked gates on the small road leading to the site, which would prevent public access. However, the site is posted with *no trespassing* signs. As a whole, Red Elephant Gulch has numerous indications of frequent public use; including fire rings, all-terrain vehicle (ATV) tracks, and foot and bike trails.

The current owner, Mr. Jack Ballschmider, provided access to the site and has requested technical assistance with his remedial designs for the site. With the final development plans focused on residential development, Mr. Ballschmider has begun to stabilize soils

and reestablish riparian vegetation by applying soil amendments on sparsely vegetated areas. In discussions with DEQ, Mr. Ballschmider has also expressed an interest in stabilizing the stream channel and stream banks by revegetation and construction of appropriate stream channel crossings. Mr. Ballschmider is designing a comprehensive site development plan that incorporates risk management for the tailings contaminated portions of the patented mining claims.

The Mineral Hill Mining District is located in the south-central part of Blaine County, west of the Big Wood River valley near the towns of Hailey and Bellevue. There are multiple historic mining sites within the district, although this preliminary assessment addresses only one site within the Elk Creek sub-watershed.

1.2 Historical Perspective

Available sources provide the history of the Mill and adjacent mine:

> Ore was first discovered in 1864, and the boom days of the region were in 1880 to 1887. The total production has amounted to more than $25,000,000, most of which came from lead-silver ore, with minor amounts from gold, copper and zinc ore.
>
> Umpleby, et al, 1930, p. X

> The deposit (Red Elephant Mine) was worked during the early period of mining activity in the region but made its principal production between 1890 and 1898; more recently it has been worked by lessees but with only moderate success, and in 1923 it had been shut down for several years. The mine reopened in 1926.
>
> Umpleby, et al, 1930, p. 146

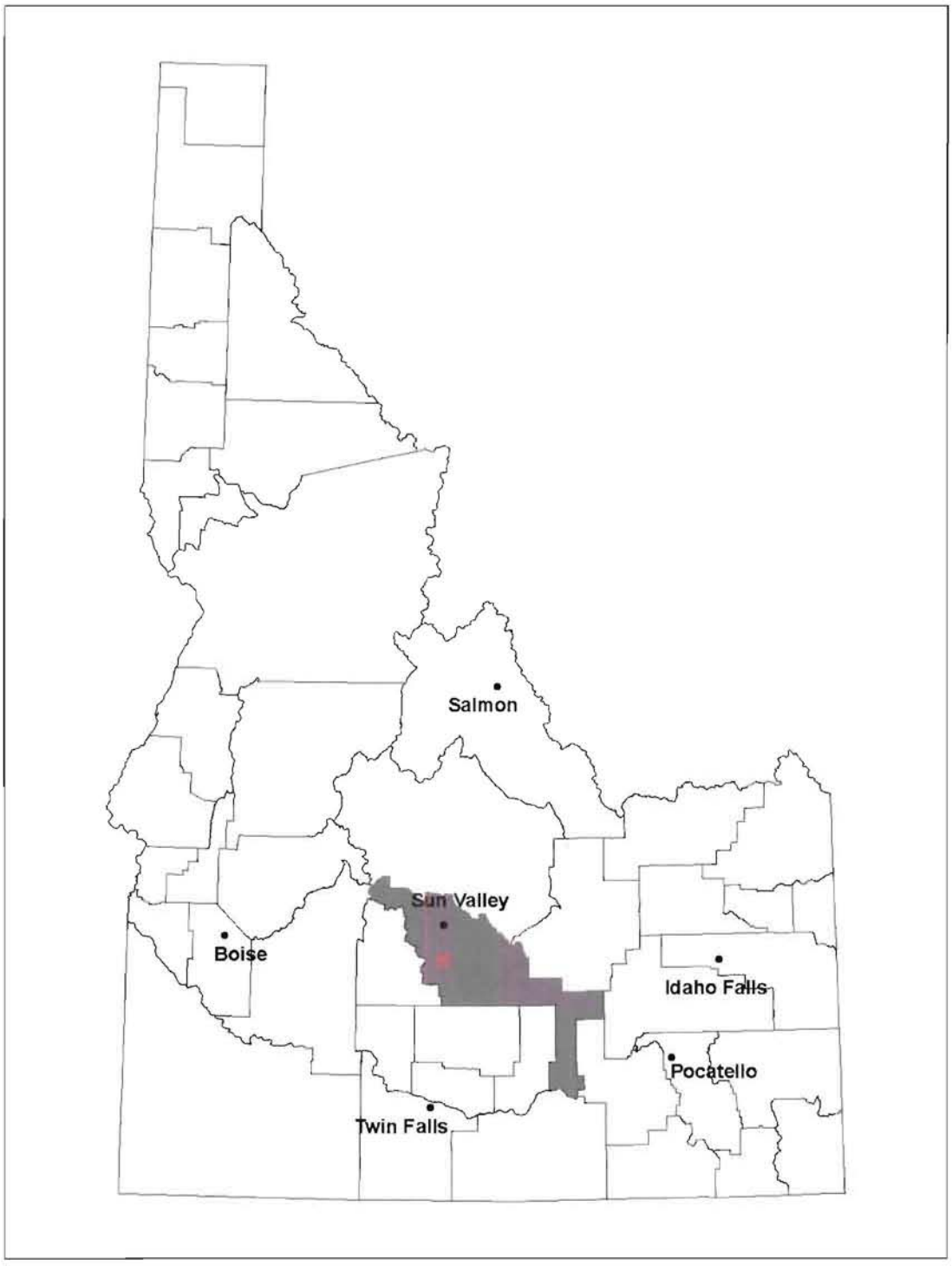

Figure 1. Location of the Red Elephant Mill Site within the State of Idaho.

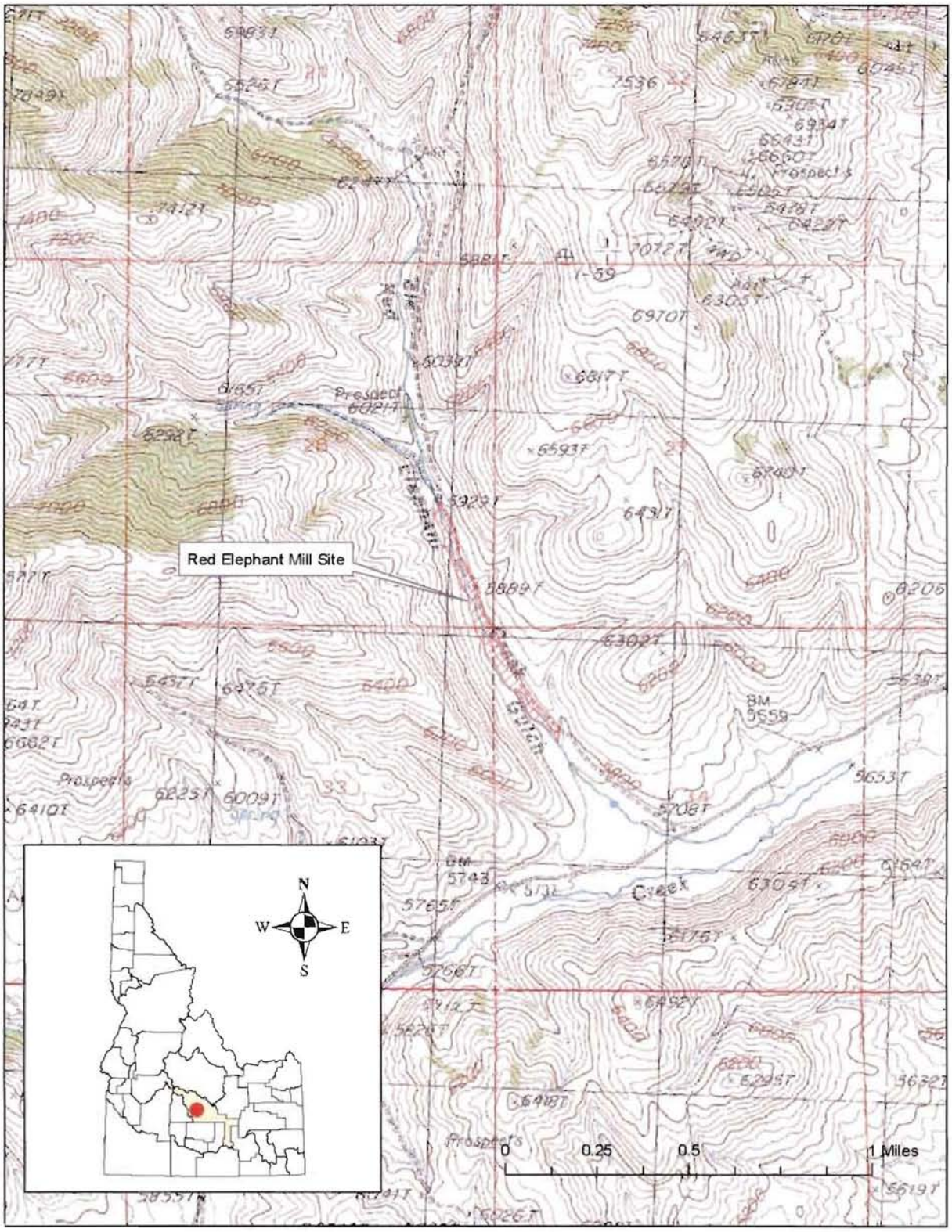

Figure 2. Topographic overview of the Red Elephant Mill Site Area.

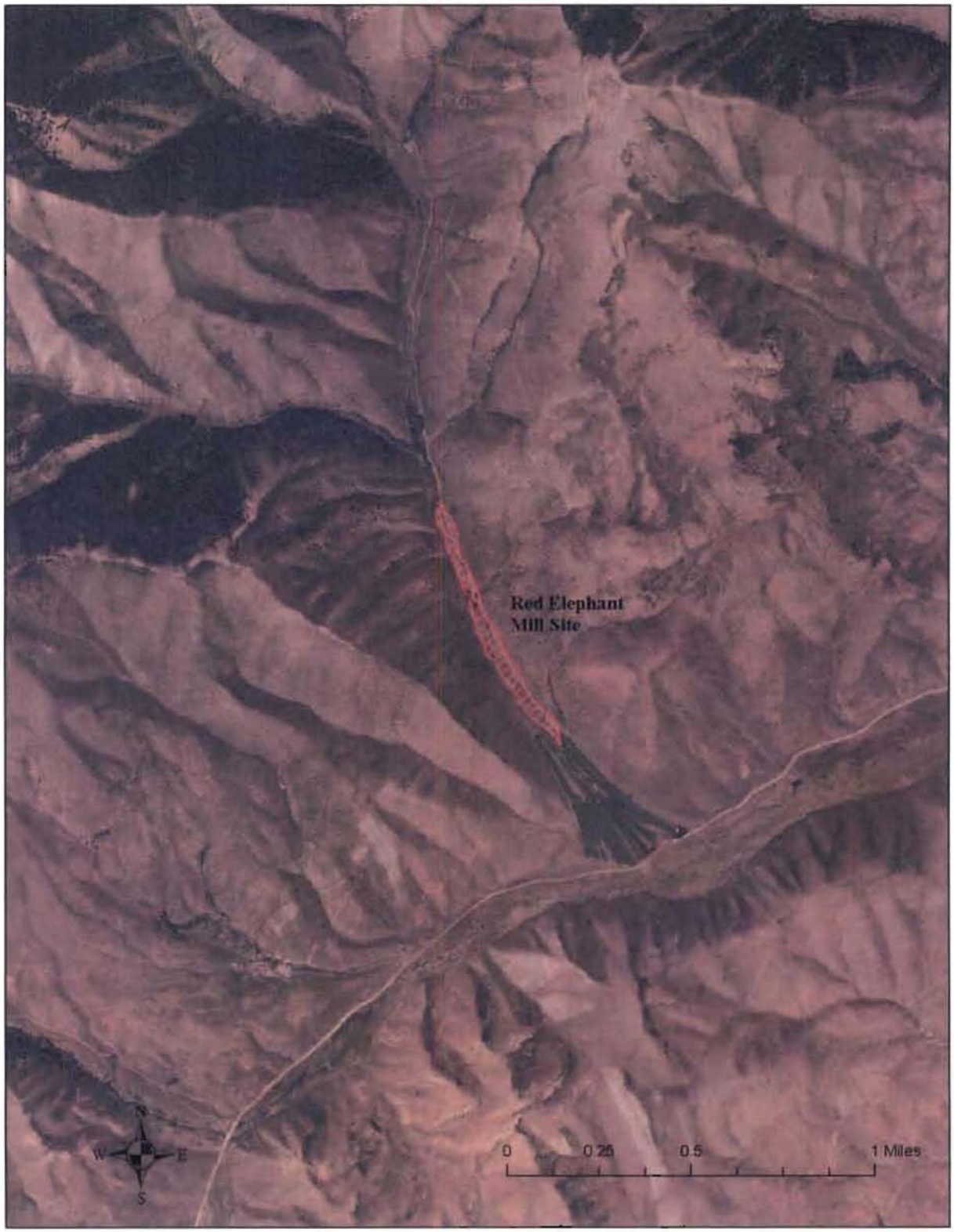

Figure 3. Aerial photograph of the Red Elephant Mill site area.

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Section 2. Site Description, Operational History, and Waste Characteristics

Physical characteristics of the Red Elephant Mill site are presented in the following, along with the operational histories and characteristics of the wastes that remain.

2.1 Site Description

The Red Elephant Mill is located in the lower reaches of Elk Creek in Red Elephant Gulch (Figure 4), about a half-mile above the confluence of Elk Creek and Croy Creek. Dispersed tailings deposits, broken tailings dams structures and mill ruins are the primary historic mine facility features of the lower Gulch. The floodplain of Elk Creek consists of tailings and associated earthen impoundment dams (all breached), while small ore piles and concrete foundations, measuring approximately 100 feet long by 60 feet wide, are the only indications of the previous mill's existence. Mitchell and Gillerman described the tailings as "approximately one-half mile long, 150 feet wide, and with an average of 3 feet deep" (2005, p.8).

2.2 Operational History

Information relating to the mill's construction, equipment or dates of operation could not be determined. Sparse operational data is presented below.

> Some years ago the Quincy Junior Mining Co. operated an electrostatic zinc mill on the tailings and mine dumps at the Red Elephant.
>
> Umpleby and Ross, 1930, p. 86

> Production records, obtained from E. Daft and the Ketchum smelter, during the period 1882–1900: 8,231 tons of ore yielded 9.44 ounces of gold; 834,601 ounces of silver; 8,655,493 pounds of lead; and 781,433 pounds of copper. Subsequent records, obtained from the U.S. Geological Survey (USGS), during the period 1904-1918: 6,410 tons of milled ore and 537 tons of crude ore yielded 42.56 ounces of gold; 125,099 ounces of silver; 853,409 pounds of lead; 170,615 pounds of zinc; and 7,425 pounds of copper.
>
> Umpleby and Ross, 1930, p. 147

Based upon the production history and owing to the lack of information concerning the mill's operational history, this writer presumes that the Red Elephant mill intermittently operated between 1904 and 1917, as indicated by the USGS records. Similarly, records of early production (1882-1900) suggest that crude ore from the Red Elephant mine was

transported directly to the Ketchum smelter for processing. Milling operations appeared to commence in 1904, with continuous runs until 1909; and reopening of the mill in 1913 and again in 1917. Records of zinc production in 1905 and 1913, suggest that perhaps the Quincy Junior Mining Co. operated the mill, at least partly during its history.

Figure 4. Aerial photograph of the Red Elephant Mill site.

2.3 General Geology

> The Hailey-Bellevue mineral belt is underlain by a varied assemblage of sedimentary and igneous rocks, which, except for volcanics of mid-Tertiary age and some still younger unconsolidated sedimentary rocks, are all older than the ore deposits. The earlier rocks include fairly wide exposures of the Milligen and Wood River formations that host many of the ore deposits in the Wood River region. They also host rather large intrusive bodies of diorite and quartz monzonitic rock which are regarded as outliers of the Idaho batholith. There is a younger group of intrusive rocks which are of more pertinent interest because of their close association with the mineralization....In addition to the Milligen formation (Mississippian age) and the Wood River formation (Pennsylvanian age), the area contains some strata in and beneath a series of Tertiary volcanics (Oligocene) and much poorly consolidated and unconsolidated slope wash, terrace gravels, and stream alluvium of Quaternary age.
>
> Anderson, 1950, p. 2

Anderson (p 7) went on to note that, "The folding within the area is comparatively simple and consequently faulting constitutes the outstanding feature."

2.3.1 Previous Studies

Numerous studies of the geology and mineral resources of the Wood River and adjacent areas have been made. Geologic studies have been conducted to investigate mineral deposits (Lindgren, 1900 & 1933; Umpleby et al, 1930; Anderson and Wagner, 1946; Anderson et al, 1950; Hall et al, 1978; Wavra and Hall, 1989; Link and Worl, 2001; Worl and Lewis, 2001); individual formations and units (Hall et al, 1974; Sandberg et al, 1975; Wavra and Hall, 1986; Worl and Johnson, 1995); quadrangles (Batchelder and Hall, 1978; Mitchell et al, 1991; Kiislgaard et al, 2001) and to compile regional information (Rember and Bennett, 1979). Preliminary and environmental assessment investigations have been conducted to assess current and potential impacts from historic mining in the region (Mitchell and Gillerman, 2005; IDEQ, 2002 & 2006; IDEQ & USEPA, 2006 & 2007).

2.3.2 Stratigraphy and Lithology

Link and Worl (2001) reviewed previous geologic and historic information relating to stratigraphy and mineralization relationships in the Mineral Hill district, including Red Elephant Gulch.

> The Bullion mineralized area...is underlain by the lower and middle members of the Pennsylvanian and Permian Dollarhide Formation, which are folded into upright and west-overturned map scale folds....The lower member of the Dollarhide Formation hosts most of the mineralized rock (Skipp and others, 1994). Fryklund (1950), following Umpleby and others (1930), labeled these rocks as Wood River Formation, though he notes, "it is possible that Milligen formation is also present" (p. 64). An unpublished map (circa 1970) of W.E. Hall labels the dark-colored rocks in the Bullion area as Milligen Formation. Hall

(1985) showed the rocks as Dollarhide Formation, and Wavra and Hall (1989) showed them as upper member, Dollarhide Formation.

The lower member of the Dollarhide Formation in the Bullion area contains fine- to medium-grained sandstone, black siltite and black limestone or marble. A distinctive lithology in the lower member is channelized disorganized conglomerate that contains mainly intrabasinal soft-sediment clasts of siltstone and sandstone. The lower member occupies both sides of Bullion Gulch and the central part of Red Elephant Gulch. The rocks east of Bullion Gulch are mapped as being stratigraphically high in lower member Dollarhide Formation, because the middle member quartzite is not present. They are intruded on the east by the Deer Creek stock.

In the Bullion area the middle member of the Dollarhide Formation (regionally about 300 m [984 ft] thick) contains silicified sandstone that crops out as light-gray to brown quartzite that forms the high ridge between Red Elephant and Bullion Gulches. These rocks were shown as Wood River Formation on the map of Hall (1985). The mineralized veins of the Bullion area do not extend southward into the middle member Dollarhide Formation. The middle member, much less silicified, is also present in west-dipping beds on the ridge of Kelly Mountains.

Link and Worl, 2001, pp. 12 & 14

In addition to mill tailings, the lower portion of the Gulch nearby the mill appears to contain detritus from adjacent bedrock as well as outwash from mine workings located in the upper Gulch areas. Elk Creek dispersed the tailings throughout the drainage. The tailings appeared light to dark gray and coarse at the surface. Tailings away from, and therefore less influenced by flowing water, were more uniformly dark gray and fine to very fine-grained, especially several inches beneath the surface. Vegetation was sparse over a significant portion of the tailings.

2.3.3 Structure

Fryklund (1950, pp. 65-66) noted the following in regards to the structure of the rocks:

> The most obvious and significant structural features of the area are the major faults or fault zones which divide the area into a number of distinct blocks...The age of the oldest faults are to be placed as pre-intrusive and possibly all the major faulting is pre-intrusive...All of the major faults are probably pre-mineral as well as pre-intrusive.

Umpleby, et al (1930, p. 217) noted a broad anticline southwest of the river:

> Southwest of the river the beds dip generally westward at inclinations that largely range from 20° to 40°. It's thus clear that the sediments form a broad anticline, of which the crest almost coincides with the Big Wood River Valley...The underlying Milligen formations shows a wide range in local dip and strike...

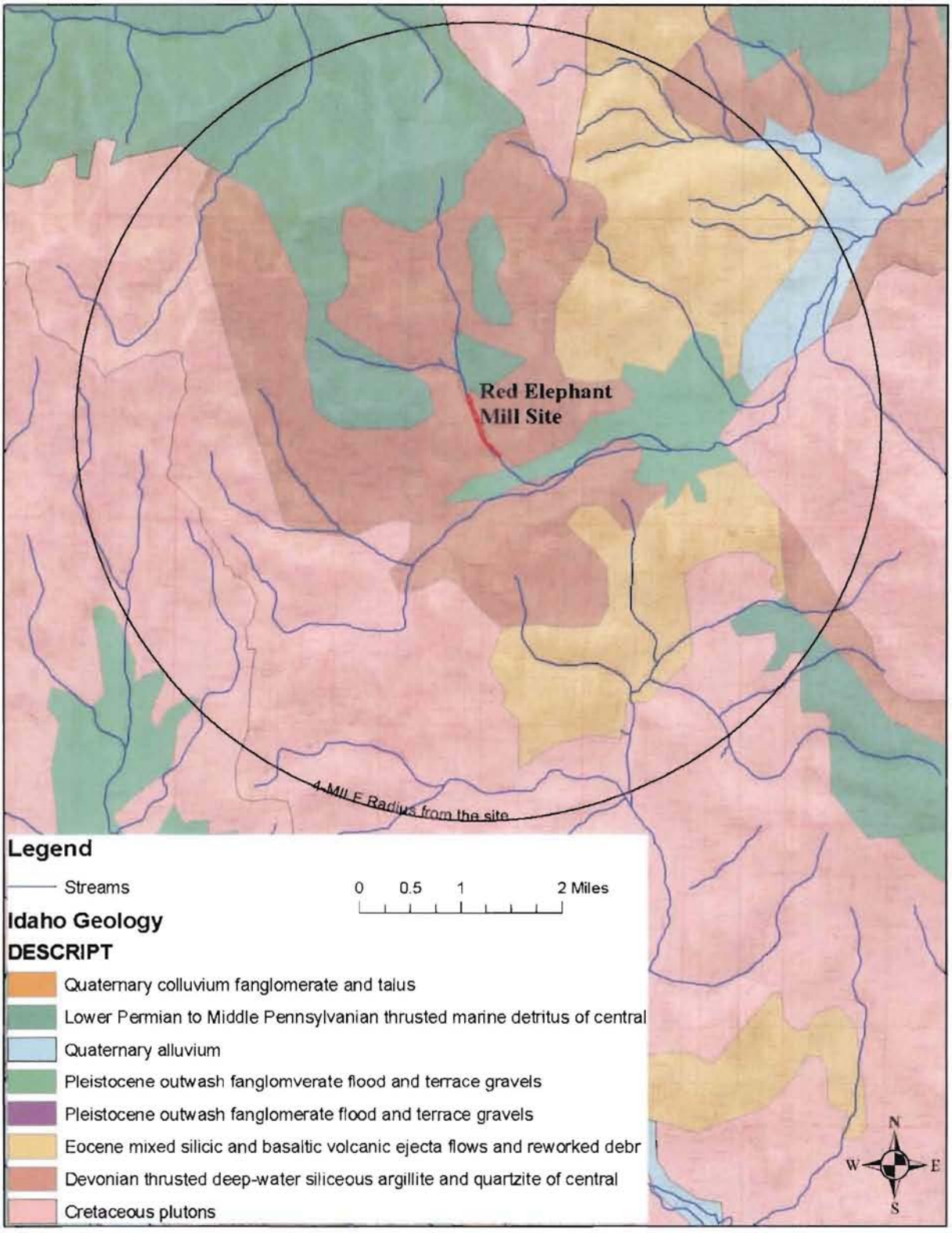

Figure 5. Geologic map of the Red Elephant Mill site area.

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Section 3. Current and Potential Future Land Uses

Current land uses in the area include biking, hiking, hunting, horseback riding and off-road vehicle touring. The Red Elephant Mill site is accessible from the Red Elephant Gulch road. During the course of the field work conducted, the DEQ site investigators observed hikers and mountain bikers traversing the Red Elephant Gulch road.

The final development plans for the site are focused on residential development, Consequently, Mr. Ballschmider has begun to stabilize soils and reestablish riparian vegetation by applying soil amendments on sparsely vegetated areas. In discussions with DEQ, Mr. Ballschmider has also expressed an interest in stabilizing the stream channel and stream banks by revegetation and construction of appropriate stream channel crossings. Mr. Ballschmider is designing a comprehensive site development plan that incorporates risk management for the tailings contaminated portions of the patented mining claims.

3.1 Fish Species Observed

Fish presence/absence studies have not been conducted on Elk Creek to confirm any fish species that may reside in this stream. Visual observations confirm the presence of brook trout [Salvelinus foninalis] in a small stock water pond near the bottom of Red Elephant Gulch. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountainwhitefish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within the Big Wood River (IDFG, 2000).

3.2 Apparent Wetlands

Official wetland surveys for the site that were reviewed (USFWS, 2007), along with aerial photographs and direct observation, indicate that the site contains wetland areas that are approximately 0.5 acre in size.

3.3 Future Land Use

Future land use could potentially include some year-round and/or seasonal homes on the private parcels of property in the sub-basin, owing to its close proximity to Hailey.

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Section 4. Individual Site Overview and Waste Characteristics

As a result of an interview with the site owner regarding potential remediation efforts, DEQ conducted a site investigation on July 10, 2006 and September 14, 2006, which included a visual inspection of the Red Elephant Mill site and collection of two (2) water samples and five (5) soil and sediment samples.

4.1 Sampling Results

Table 1, Table 2, and Table 3 present the results of the sampling. Background samples were collected for sediment, surface water, and soils. If a sample concentration exceeded the background concentration by more than three times, then that constituent was considered elevated. **Boldface** values in the tables indicate the elevated constituents for the site.

Table 1. July and September 2006 total soils analysis data from the Red Elephant Mill site, Blaine County, Idaho.

Analyte	Soil Sample RESUBSS1 (mg/kg)	Soil Sample RESURSS1 (mg/kg)	Background Sample RESSBG2 (mg/kg)	Idaho Initial Default Target Levels under REM (mg/kg)
Arsenic	109	804	286	0.391
Barium	85.9	95	88	896
Cadmium	126	1.68	118	1.35
Chromium	31.9	76.3	26.4	2130
Lead	1000	**9510**	2810	49.6
Mercury	0.101	0.081	0.05	0.00509
Selenium	3	4.5	2.9	2.03
Silver	9.6	83.6	35.3	0.189

Boldface values are considered elevated with respect to background concentrations.

Soil samples were collected from the waste dump and analyzed for metals (samples RESUBSS1 and RESURSS1). Sample RESUBSS1 was collected with a hand auger at approximately 12 inches below the surface of the dump material. Sample RESURSS1 was collected from the surface material of the dump. Analytical results from these two samples indicate lead is an elevated constituent in the soils at the site.

Sediment samples were collected from Elk Creek and analyzed for metals. Sediment sample (RESDBG2) was collected approximately 300 yards upstream from the upper portions of the site. This sample was collected as a background sample. Sediment sample (RG02SD) was collected down stream of the bottom of the site within Elk Creek. As shown in Table 2, elevated concentrations of arsenic, cadmium, lead, mercury, and silver were measured at the downgradient sample location. These parameters are considered elevated with respect to the background concentrations as defined earlier in this section.

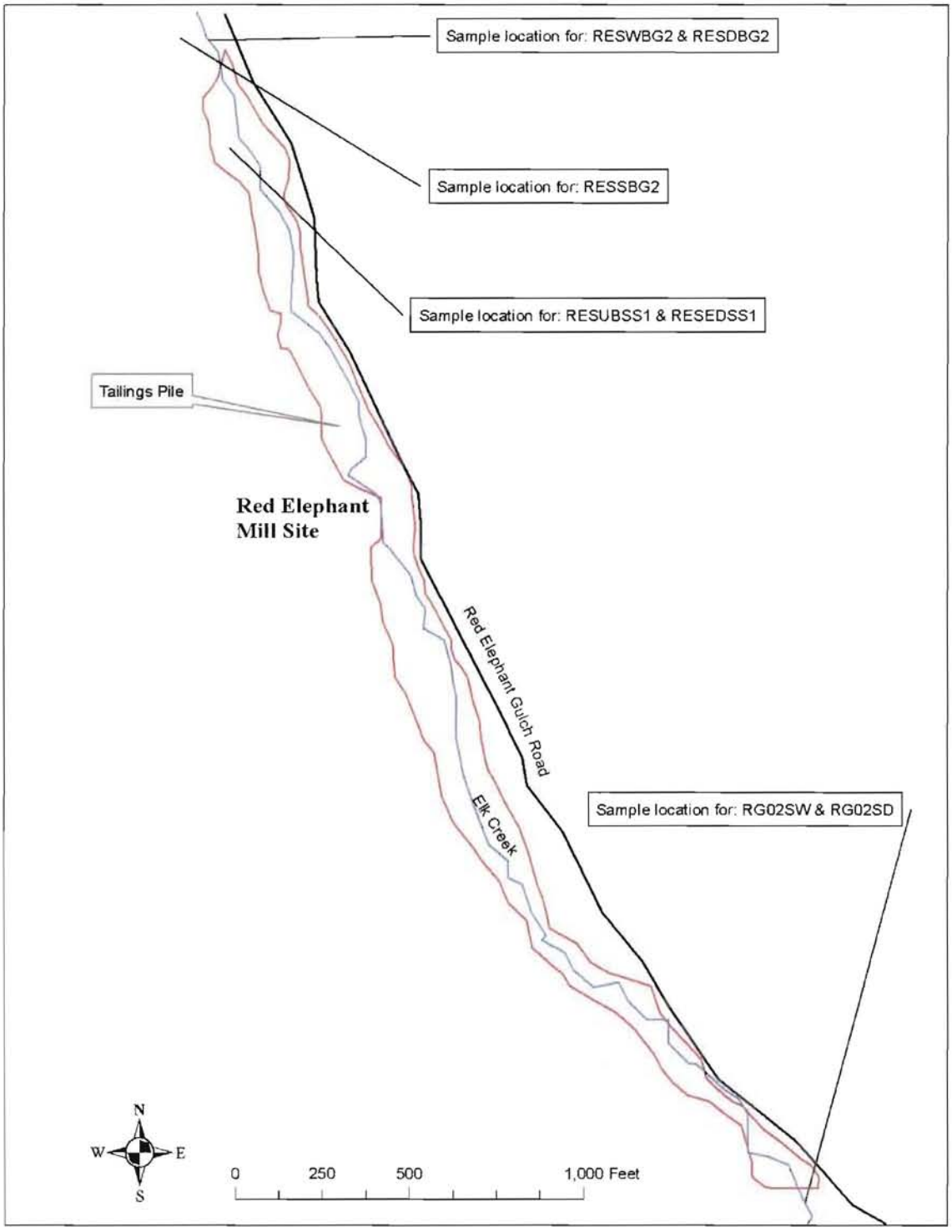

Figure 6. Small-scale sketch of the Red Elephant Mill site and environmental sampling locations.

A potential *Probable Point of Entry* (PPE) exists at the site where the toe of tailings pile contacts Elk Creek.

Table 2. Sediment Sample Results from Elk Creek.

Constituent of Concern	Elk Creek Sediment Sample RG02SD (mg/kg)	BACKGROUND Sediment Sample RESDBG2 (mg/kg)
Arsenic	**324**	40.5
Barium	16.0	72.6
Cadmium	**52**	4.68
Chromium	16.8	21.8
Lead	**8760**	652
Mercury	**1.5**	0.121
Selenium	NA	0.7
Silver	**34.5**	2.5

Field Parameters	
pH	9.05 std. units
Specific Conductance	276 µsiemen/cm
Temperature	10.1 ºC
Dissolved Oxygen	11.14 mg/L
Turbidity	250 NTU

Boldface values are considered elevated with respect to background concentrations.

Table 3. Surface Water Sample Results from Elk Creek.

Constituent of Concern	Elk Creek Water Sample RG02SW (mg/L)	Idaho Water Quality Standards for cold water biota[1] (mg/L)	Background Elk Creek Results RESWBG2 (mg/L)
Arsenic	NA	0.36	<0.003
Barium	NA	NA	<0.01
Cadmium	NA	0.0037	<0.0005
Chromium	NA	0.550	<0.002
Lead	ND	.065	<0.002
Mercury	<0.2	.0021	<0.002
Selenium	NA	.0020	<0.005
Silver	NA	.0034	<0.002

Field Parameters	
pH	9.4 std units
Specific Conductance	282 µsiemen/cm
Temperature	14.1 ºC
Dissolved Oxygen	10.81 mg/L
Turbidity	160 NTU

4.2 Inspection Findings

During DEQ's July 2006 visit, the volume of the mine waste piles associated with the Red Elephant Mill site were mapped at approximately 913,000 cubic feet. The area that the waste rock currently occupies is approximately 10.5 acres. The Red Elephant Mill site waste piles are located along Elk Creek, on the western side of Red Elephant Gulch Road, which allowed DEQ personnel the ability to make good observations and assessments (Photo 1, Photo 2).

Associated with the mill site is one large waste pile that defines the boundaries of the site. The waste pile is located within the stream channel of Elk Creek. All former structures at the site have been reduced to scattered rubble or removed.

Photo 1. View looking east at the Red Elephant Mill site.

Photo 2. View looking south on the Red Elephant Mill Site.

The Red Elephant Mill site has one significant waste pile that was inspected during the DEQ site visit. The waste pile defines the extent of the site and is the main focus of this report.

4.2.1 Waste Pile

The waste pile at the site is oriented north-south as it lies within the flood plain for the north-south flowing Elk Creek. The dimensions and structure of the waste pile vary as the material appears to be partially re-worked by the meandering of Elk Creek. Generally, the waste pile was approximately 3,300 feet long, 200 feet wide, and 5 feet thick. Elk Creek currently flows over the waste pile, and historic channels are evident in the pile.

The composition of the waste pile consisted of silt to coarse gravels, varying from light gray to dark brown in color. Less than 10% organic material was observed in the samples. No distinct segregation of the composition of the waste pile was observed as it appears the tailings have been partially re-worked during the high flow periods of Elk Creek.

Vegetation has been partially re-established on the tailings. Small trees, grasses, and other shrubs have begun to cover the tailings pile (Photo 3). During the site visit, compost

was being land applied in the lower portions of the dump to help develop re-vegetation on the waste dump.

Historic evidence of the mill site operations exist as scattered timber, and metal can be seen in a small area on the tailings pile. This minor amount of rubble is the only remaining evidence of structures that were present on the site. It appears all other structures have been removed or reduced to rubble.

Photo 3. View looking east across Elk Creek at the sampling location for samples RG02SW and GG02SD. This location is the downgradient side of the site.

Section 5. Pathway and Environmental Hazard Assessment

Pathway and environmental hazards were assessed for groundwater, surface water, and soil/air exposure. The findings from these assessments are presented in the following.

5.1 Groundwater

Ground water flow is expected to be controlled structurally within faults and brecciated zones in the country rock, which may become expressed at the surface as springs. However, in the Elk Creek drainage, no springs were witnessed. Densely vegetated portions of the hillsides indicate potential near-surface ground water conditions or springs, but due to the timing of the site visit, no distinct springs could be mapped.

Shallow ground water may also be encountered within the alluvial deposits of the major tributaries to the Big Wood River. This aquifer system provides drinking water to multiple sources along the Croy Creek drainage (Figure 7). The interaction between the shallow alluvial aquifer systems with the deeper country rock aquifer is not known.

Contributions to the aquifers in close proximity to the Red Elephant Mill site will predominantly be as a direct result of precipitation or surface water. Elk Creek is a perennial stream that flows into Croy Creek. Annual precipitation for Hailey, Idaho, located approximately five miles to the east, is 16 inches, predominately during the winter months, with an average annual snowfall of 81 inches (WRCC, 2006).

Dry-season rainfall occurs almost exclusively in relatively short bursts, usually related to thunderstorm activity. It is expected that except for flash flood-type events, almost all dry-season rainfall events would be completely absorbed by the soils and plants, without much, if any, contribution to the ground water. However, because the waste rock pile exists adjacent to Elk Creek, a higher percentage of this rainfall would be expected to drain into the stream.

According to Idaho Department of Water Resources July 2002 records, 93 private drinking water wells are reported to be located within a 4-mile radius of the site. The majority of these wells are located within the Croy Creek drainage, closer to the nearby towns of Hailey and Bellevue (Figure 7). The closest domestic well to the site was located at the bottom of Red Elephant Gulch, directly down gradient from the site. The well was sampled and preliminary results from a related report indicate the water quality from this well has not been impacted from up gradient sources (START, 2007).

No public drinking water systems are located within a 4-mile radius of the site. The closest public water systems are located near the towns of Hailey and Bellevue, over five miles away. Based on historical monitoring data for the public water systems associated with the cities of Hailey and Bellevue, metal contamination does not appear to be concern in the aquifer that supplies these systems (DEQ, 2006).

Due to the location of majority of the wells, it is unlikely that any impacts related to the mining activities could be detected (DEQ, 2006). The wells that are located down gradient of the mine site are completed in the alluvial materials associated with the Elk Creek alluvial deposits, drawing water from a shallow aquifer directly below the site are the wells of greatest concern. Ground water impacts associated with this site might become a greater concern if more shallow wells were located closer to but down gradient of the site. Based on the analytical data collected from the closest well, and due to the current location of the other nearby domestic wells with respect to the site location, it appears these wells are a sufficient distance from the site to avoid any ground water impacts associated with this site.

Ten (10) irrigation wells were identified within a four-mile radius of the site, and the site is not located within a wellhead protection area (DEQ, 2003).

5.2 Surface Water

The Red Elephant Mill site area drains southward towards the east flowing Croy Creek. Overland flow across or in the vicinity of the waste pile would flow directly into Elk Creek. Elk Creek is not currently listed on the EPA §303(d) list of impaired streams, but Croy Creek is currently listed for flow alteration, nutrients, and siltation.

Elk Creek, a tributary to Croy Creek, is the most immediate stream the Preliminary Assessment site could potentially impact. The majority of the mining activity in Red Elephant Gulch occurred in the northern portions of the drainage.

Flowing water was observed in Elk Creek adjacent to the waste pile. During the site visit, the flow rate of Elk Creek was approximately 50 gallons per minute (gpm) near the site. It is unknown as to how much flow Elk Creek receives during spring runoff.

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. Although camping may occur in places along Elk Creek, it is expected that fishing does not occur in this tributary. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountainwhitefish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are, however, present within the Big Wood River (IDFG, 2000).

Figure 7. Domestic wells and public water system wells located with a 4-mile radius of the Red Elephant Mill site.

Figure 8 depicts the drainage patterns of these water bodies as well as the 15-mile downstream Target Distance Limit (TDL) located on the Big Wood River.

There are no surface water intakes for drinking water or any type of industry within the 15-mile TDL. Multiple drinking water wells are located within the 4-mile radius of the Red Elephant Mill site and are discussed further in the *Groundwater* section.

5.3 Soil Exposure and Air

Access to the mill site is restricted by no trespassing signs posted along the Red Elephant Gulch Road. The main access road to Red Elephant Gulch allows public access to the site. The site is located on private property and surrounded by public lands on all sides.

5.3.1 Potential Receptors

Potential receptors include local residents, hunters, anglers, cattlemen, trail riders (motorized and non-motorized), campers, and rarely, tourists. Cattle graze the surrounding area, but their presence within the mine site is minimal. Residents and outdoor enthusiasts remain the highest percentage of potential receptors, as they reside nearby or use surrounding land for recreational activities.

The land within a two (2) mile radius of the site is primarily owned by the Bureau of Land Management (BLM); however, minor amounts of private land exist. The parcel of land occupied by the waste pile is owned by Mr. Jack Ballschmider, a private party.

5.3.2 Schools, Day-Care Facilities, Private Residences

There are no schools, day-care facilities, or private residences within 200 feet of the site, however, BLM or Forest Service workers, in addition to the outdoor recreation enthusiasts, may occasionally be within 200 feet of the site.

5.3.3 Plant Species of Concern

Bugleg goldenweed was the only plant species in the area were listed as a species of concern (F&G, 2002) within a 4-mile radius of the mining site (Figure 9). Animal species listed as a species of concern that are located within a 4-mile radius of the site include Gray Wolf, North American Wolverine, and Long-legged Myotis (F&G, 2002).

5.3.4 Soil Sample Concentrations

Relative to the background concentrations, soil exposure at the site is expected to be elevated for all receptors, due to the high lead concentrations measured in the soil samples.

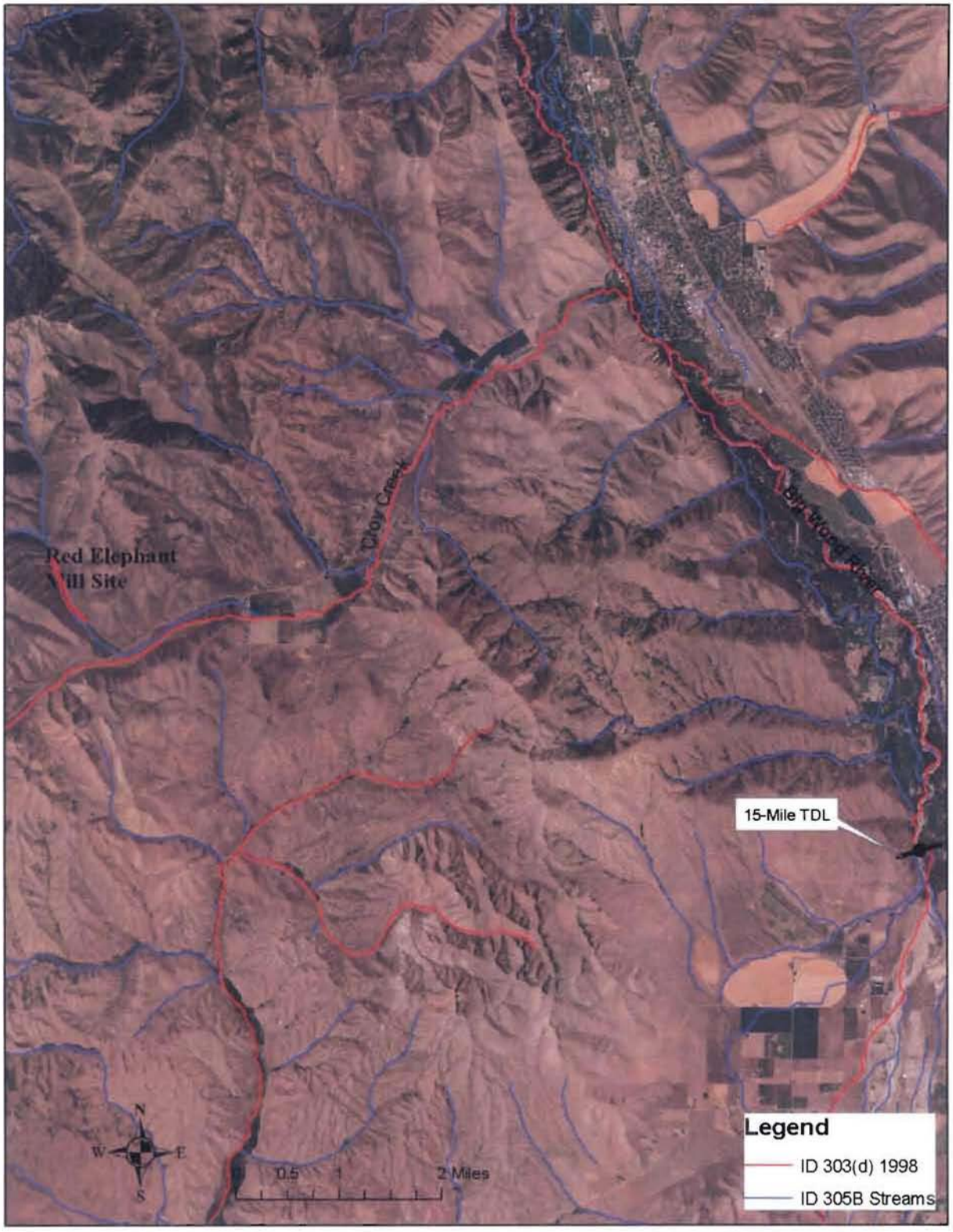

Figure 8. Surface water 15-mile Target Distance Limit from the preliminary assessment site.

Soil samples contained total arsenic concentrations up to 804 mg/kg, barium concentrations up to 95 mg/kg, cadmium concentrations up to 126 mg/kg, chromium

concentrations up to 76.3 mg/kg, lead concentrations up to 9510 mg/kg, mercury concentrations up to 0.101 mg/kg, selenium concentrations up to 4.5 mg/kg, and silver concentrations up to 83.6 mg/kg. Analytical results can be seen in Table 1. Background samples were collected at the site. Based on the concentrations of the samples when compared to three times the background concentrations, the only constituent that appears to be elevated is lead.

Based on the concentrations measured in the soils at the site, it appears remedial action will need to occur to control the exposure and potential transport of the lead elevated tailings at the site. When compared to water quality results, it appears that the contaminants of concern are most mobile as a result of erosion and not by leaching. Therefore, remedial actions should be based on soils and stream channel stabilization, isolation of tailings or eliminating access to direct exposure. This is consistent with the approach being taken by the current owner, although final designs for risk management and timing of implementation are still being developed.

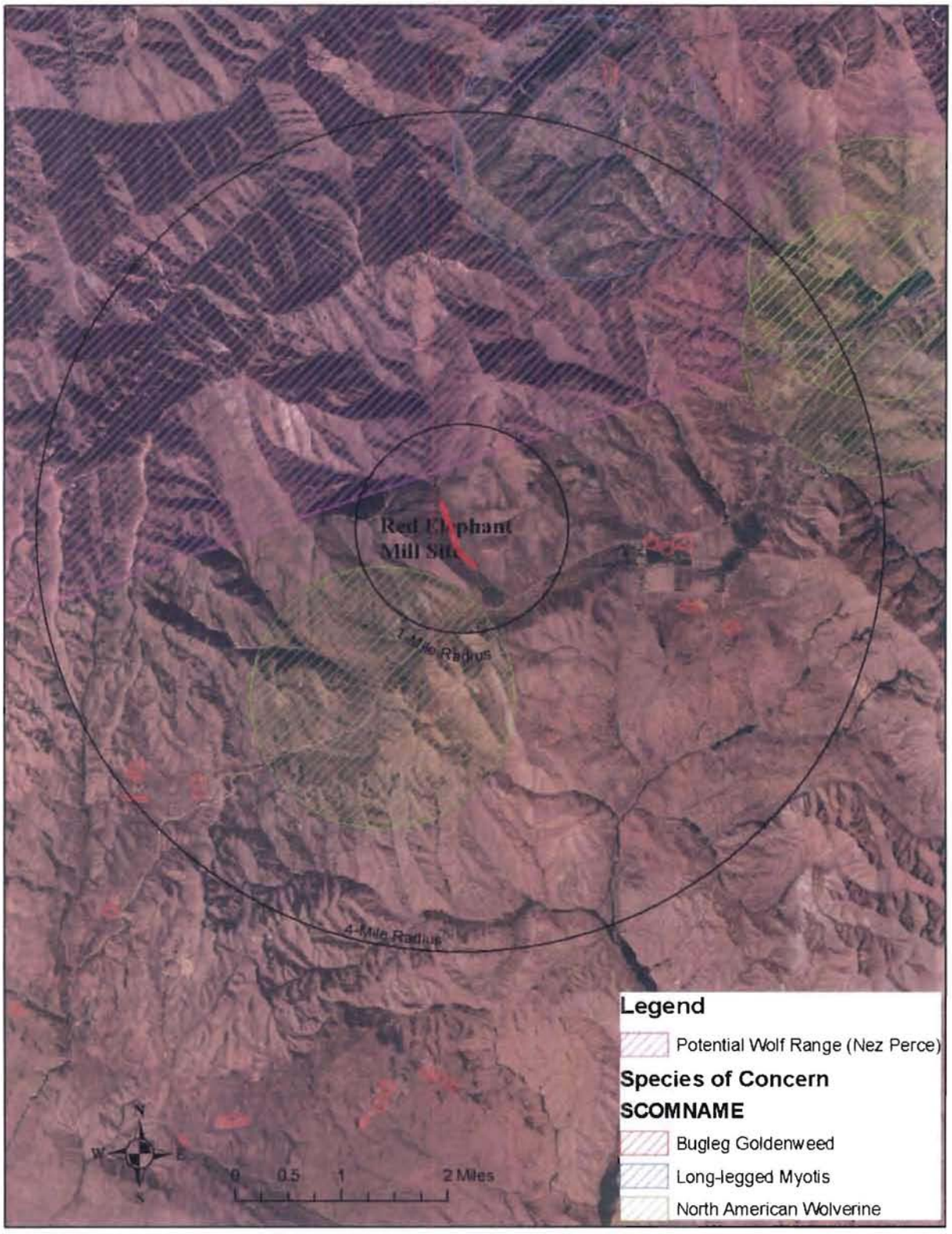

Figure 9. Sensitive species identified in the vicinity of the preliminary assessment site.

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Section 6. Summary and Conclusions

The Red Elephant mine produced primarily silver and lead, although minor zinc, copper and gold values were also realized. The Red Elephant Mill probably operated intermittently between 1904 and 1917. Earlier production (1882-1900) records of the adjacent Red Elephant mine suggest crude ore was shipped directly to the Ketchum smelter for processing. Although the exact nature of early milling processes is unknown, it was reported that the Quincy Junior Mining Co. operated an electrostatic zinc process, at least partly during its history.

The associated mill tailings demonstrate that early milling technologies used on these ores were failures, and that most metals were re-released to the environment in elevated (above background) concentrations. Based on the concentrations measured in the soils at the site, it appears remedial action should be encouraged to control the exposure and potential transport of the contamination in the tailings at the site.

6.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, wetlands exist on the site. Samples were not collected from the wetlands on this site to evaluate any impacts. Due to the limited size of the wetland area (approximately 0.5 acres), the wetland area on the site was not considered a significant area to sample.

6.2 Impacts on Water Quality

The surface water sample collected from Elk Creek indicated metal concentrations were not elevated in this surface water body. Surface water samples collected from Croy Creek just downgradient from the confluence with Elk Creek indicated elevated lead concentrations (14.8 mg/L) exist in that particular water body (START, 2007).

Sediment samples collected from Elk Creek indicate that total arsenic, cadmium, lead, mercury, and silver are all elevated above three times the background concentrations for each constituent. These elevated constituents may have negative impacts on the biological receptors within Elk Creek.

The nature and extent of ground water impacts related to the mine site are currently unknown. However, analytical data collected from the nearest well, a shallow well located at the bottom of Red Elephant Gulch, indicate the ground water has not been impacted by contaminants at the site. Analytical data associated with the public water systems located near the cities of Hailey and Bellevue indicates no metal contamination exists within the producing aquifers for each system. The location and distribution of private domestic wells with respect to the site suggest impacts related to the mine site may be insignificant but cannot be verified due to a lack of analytical data. As future development encroaches closer to the site, new wells drilled within Red Elephant Gulch

would be more susceptible to potential ground water contamination associated with the site.

6.3 Potential Exposure for Wildlife, Livestock, and Vegetation

Potential exposure of tailings pile to wildlife and vegetation from the site is present. In addition, livestock may use the area to graze if future development warrants such activities. The native plant species may bio-accumulate high concentrations of metals that may be consumed by the local wildlife or livestock. The particular plant species that readily bio-accumulate metals should be investigated in greater detail as elevated lead concentrations exist in the tailing pile. Depending on the plant species and livestock exposed to the site, the lead concentrations may be toxic to certain receptors. The wildlife that may be exposed to elevated concentrations of metal (via water, soil, or plant material) may be harvested and consumed by humans.

6.4 Potential Exposure for Humans

Human activity around the site is low, due to no trespassing signs that are posted along the Red Elephant Gulch road near the site. Due to the site location near the main Red Elephant Gulch Road, this area may be frequently used by mountain bikers, hikers, hunters, snowmobile operators, off-road four wheeling, and various other outdoor recreation enthusiasts may also frequent the area via the main access road.

Although elevated lead concentrations were measured in the waste pile, exposure for humans to the elevated metal concentrations is low. Fugitive dust or direct contact with the waste piles appears to be the most significant route of exposure to humans for elevated constituents. Considering the site access is restricted, these exposure levels are limited and not considered a significant factor to address.

Increased risks to humans may exist if human activity was permitted to exacerbate erosion of the tailings pile and stream channel. If exposure to the tailings pile increases, the risk associated with that exposure will increase accordingly. If the site is ever developed as a residential area, the level of exposure/risk would increase significantly. Risk management to prevent direct exposure or transportation of contaminants should be incorporated in any plan to develop the site.

The analytical data indicate that the ground water sampled at the closest domestic well was not elevated with metal concentrations. This fact also needs to be considered in terms of exposure associated to humans. Currently, the risk to humans is low; however, if new ground water wells are completed closer to the site, the risk would need to be re-evaluated as the exposure would increase. If a domestic drinking water supply is developed near the site, consideration of the ground water system up gradient, or outside of the mill site should be considered, and the water produced from the new well should be carefully sampled. If contaminated, a water treatment system may become necessary, or a second and perhaps even a third well may have to be developed to deliver safe drinking water.

6.5 Recommendations

Overall, the soil and sediment samples collected from the site show elevated metal concentrations with respect to background concentrations. The samples that indicated high lead concentrations in the soils were collected in areas that are not accessible to the public. Potential future residents at the site would be exposed to the elevated lead concentrations in the soil are the main concern with the contaminated soils.

Sediment samples collected from Elk Creek and Croy Creek show elevated concentrations of metals (arsenic, cadmium, lead, mercury, and silver). The samples that showed the elevated metal concentrations were collected at the downgradient side of the site. Based on a comparison to the sediment samples collected upgradient of the site, it appears the site is a source of the elevated metals detected in the sediments of Elk Creek.

Based on the analytical data showing elevated lead concentrations in the soils and the elevated metal concentrations measured in the sediments below the site, a remediation plan should be developed to help stabilize the tailings pile. If the tailings pile could be re-vegetated, a significant decrease in the contribution to the surface water and sediment contamination would be expected.

In addition, any future activity at the site should consider the data presented in this report. The risks associated with the site are based on current conditions of the site. If the status of the condition at the site is modified in the future, additional environmental risk analyses should be conducted accordingly.

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