Diamond Gulch Mine
Preliminary Assessment Report

Caribou County
State of Idaho

Department of Environmental Quality

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

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List of Acronyms

Acronym	Definition
303 (d)	Section of the Clean Water Act in Idaho
AMSL	Above mean sea level
Ag	Gold
As	Arsenic
Au	Silver
Bi	Bismuth
BLM	United States Bureau of Land Management
Cd	Cadmium
Co	Cobalt
Cr	Chromium
Cu	Copper
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
GPM	gallons per minute
Hg	Mercury
IDLT	Initial Default Target Level
Mo	Molybdenum
Ni	Nickel
PA	Preliminary Assessment
Pb	Lead
ppm	parts per million

Acronym	Definition
Sb	Antimony
Se	Selenium
SFCC	San Francisco Chemical Company
Te	Tellurium
Tl	Thallium
TMDL	Total Maximum Daily Loads
USFS	United States Forest Service
USGS	US Geological Survey
V	Vanadium
Zn	Zinc

Section 1. Introduction

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 Idaho.

The 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

This report presents the results of the preliminary assessment (PA) of the Diamond Gulch Mine and also documents the interagency PA and risk screening activities conducted for this *inactive mine site* located within the boundaries of the *Southeast Idaho Phosphate Mining Resource Area* (Figure 1; the green border outlines the resource area). The interagency PA was prepared by the DEQ, in collaboration with the United States Bureau of Land Management (BLM), the United States Forest Service (USFS), and the Idaho Department of Lands (IDL)—the primary mining administration agencies in southeast Idaho. Site descriptions, conditions, data, and photos are taken directly from the *Orphan Mine Site Preliminary Assessment Screening Report* published in 2004 (DEQ, 2004a). Recommendations from the earlier report have been expanded upon in this report, based on DEQ evaluation of the earlier screening report and any additional information DEQ was able to obtain through literature review. Other than the 2000 BLM Sampling and June 2002 Interagency Site Visit, no other site visit and/or sampling was conducted to complete this PA process.

1.1 Background of the Orphan Mine Assessments

Orphan mine sites consist of those historic mining operations not previously scheduled for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site-specific investigations conducted under the ongoing selenium investigation activities (DEQ, 2007). This PA was conducted to ensure all historic mining sites within the Idaho Phosphate Mining Resource Area have been inspected and evaluated in accordance with the goals and objectives outlined in the *Area Wide Risk Management Plan* (DEQ, 2004b):

- Protecting southeast Idaho's surface water resources by reducing risks to existing aquatic life and sensitive species from selenium and related trace metal concentrations in regional sub-basins and stream segments through (a) compliance with the National Toxics Rule and State Water Quality Regulation

numeric criteria (b) development and demonstration of Best Management Practices (BMPs) to prevent future mining releases and associated risks from selenium and related trace metals in receiving streams and water bodies, and (c) development of a long-term monitoring plan for regional surface water resources to ensure effectiveness of risk reduction measures.

- Protecting wildlife, habitat, and ecological resources in southeast Idaho by reducing subpopulation risks to local wildlife to acceptable levels as established by risk-based action levels and by minimizing wildlife risks through the development and demonstration of effective BMPs for future mines.
- Maintaining and protecting multiple beneficial uses of the Southeast Idaho Phosphate Mining Resource Area by reducing livestock grazing risks and associated losses from selenium exposures in forage and drinking water sources and by preventing potential future public health risks by prohibiting residential land use and development in the immediate vicinity of phosphate mining waste units and/or impacted areas.
- Protecting southeast Idaho's ground water resources by identifying, characterizing, and responding to groundwater contamination sources that may present potential public health or ecological risks and by developing and demonstrating BMPs to control future mining releases and associated risks from selenium and related trace metals in groundwater.

The earlier orphan mine site screening effort (DEQ, 2004a) included preliminary assessment activities at fourteen historic mine sites identified through lease records and literature reviews of past mining activities. Preliminary site inspections and environmental sampling of potentially impacted media (surface water, soil, sediment, and vegetation) was conducted by interagency sampling teams in May and July of 2002. Risk evaluation consisted of reviewing site data in terms of site conditions, areas of impact, potential for continued releases, and regional risk-based action levels developed for the Area Wide Risk Management Plan.

1.2 Site Overview

The Idaho Phosphate Field is located in Bear Lake and Caribou Counties, in the southeast corner of the state. There are a large number of historic mining sites within the phosphate field, although this preliminary assessment addresses only one site.

The Diamond Gulch Mine is situated approximately 10 miles southeast of Soda Springs, at approximately 6,500 to 7,100 feet above mean sea level (AMSL). The Diamond Gulch Mine exists on non-patented land (administered by the USDA Forest Service) at latitude 42.6031º N and longitude -111.4401º W, within Section 33 of Township 9 South & Range 43 East.

The general location of the mine is identified in Figure 1. Figure 2 shows the topography around the site, and Figure 3 presents an aerial view. The former mine can be reached from Soda Springs by driving south along US Highway 30, then east along Road 186.

1.3 Historical Perspective

The San Francisco Chemical Company (SFCC) located the Diamond Placer mining claim on November 14, 1905. Extensive exploration and a formal mineral survey were conducted in 1910 and 1912, respectively. During this time 11 trenches and 4 short tunnels were excavated, moving 11,032 cubic yards of material (Lee, 2000). The mine was not patented under the Mining Law and remained inactive from 1912 to 1956.

In 1956 the SFCC applied to the Bureau of Land Management for a competitive lease of 320 acres. The lease was awarded on May 1, 1957 with an additional forty acres at the request of the US Geological Survey (USGS). The mining of ore began in May 1960. Approximately 84,000 tons of phosphate ore were removed from the mine and shipped to Montpelier, Idaho for processing (Lee, 2000). Mining activities resulted in a total of 32 acres of disturbed land, 1.48 acres for the two connected pits (Causey and Moyle, 2001). The mine was closed at the end of the 1960 season and reclaimed during 1961 and 1962.

Between 1968 and 1987 the ownership of the Diamond Gulch mining lease changed hands at least three times, with Rhone-Poulenc Basic Chemicals, Inc. maintaining the final rights to the lease. Rhone-Poulenc relinquished the lease on May 12, 1993 (Lee, 2000).

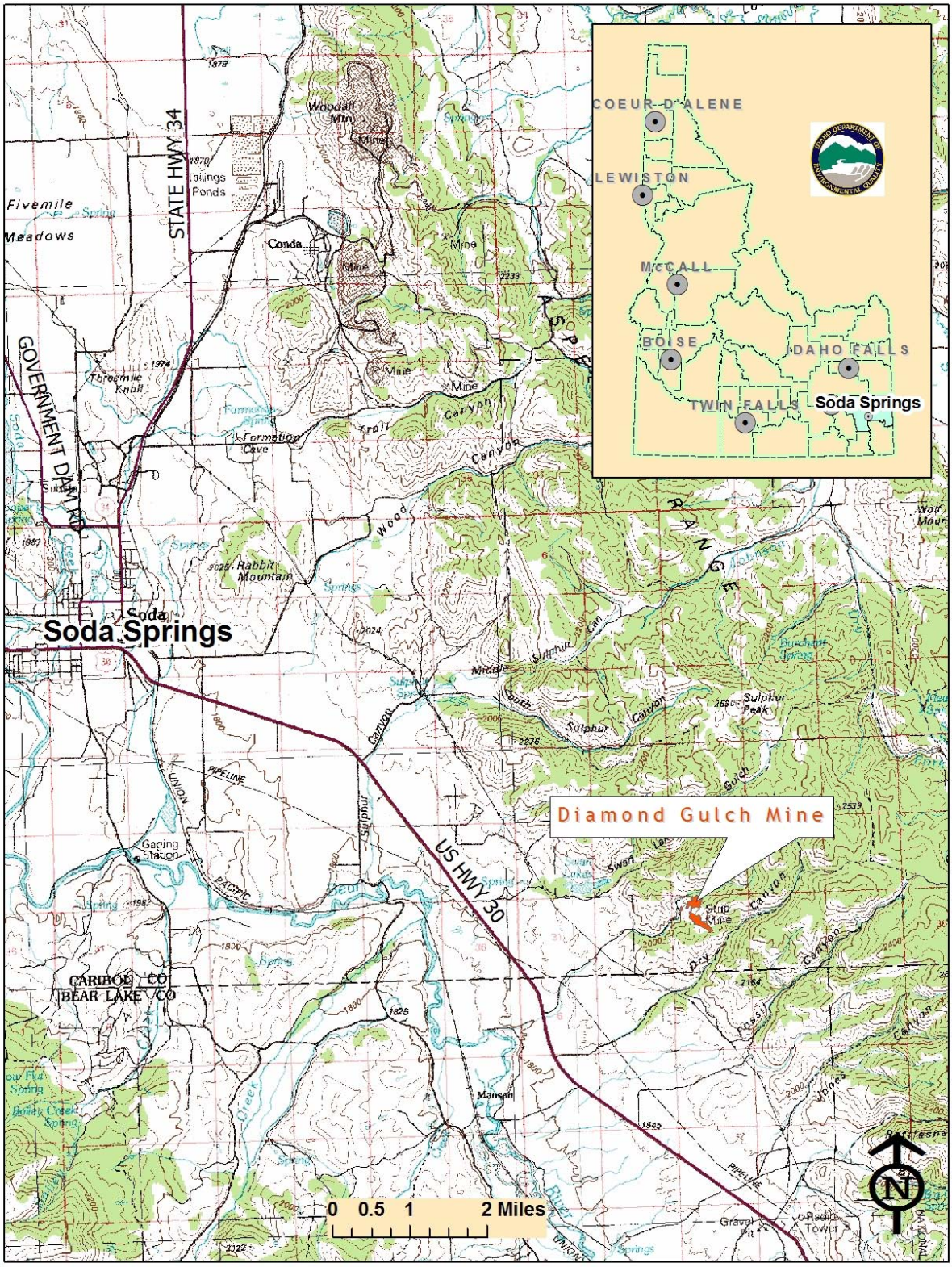

Figure 1. Location of the Diamond Gulch Mine within the state of Idaho.

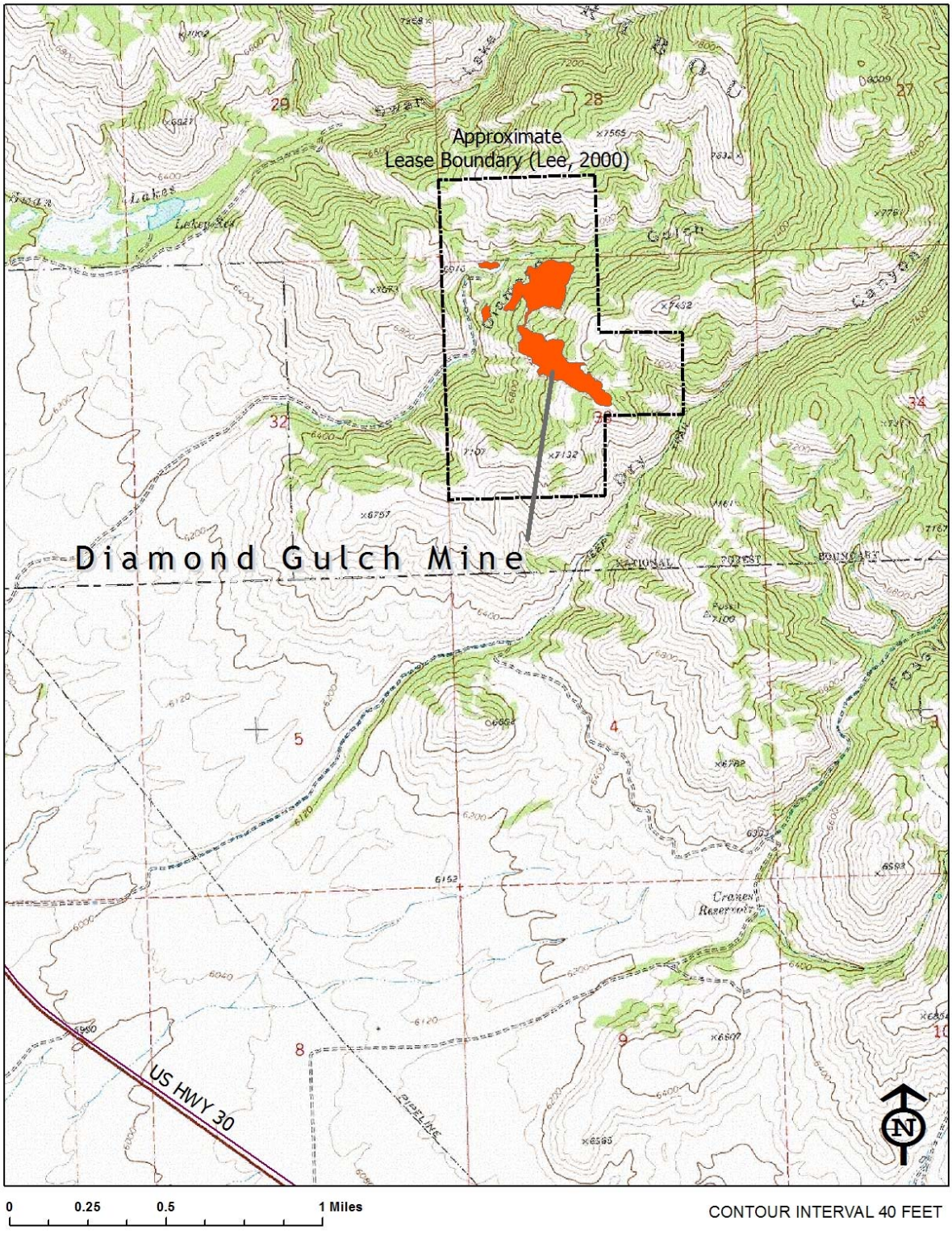

Figure 2. Topographic overview of the Diamond Gulch Mine area.

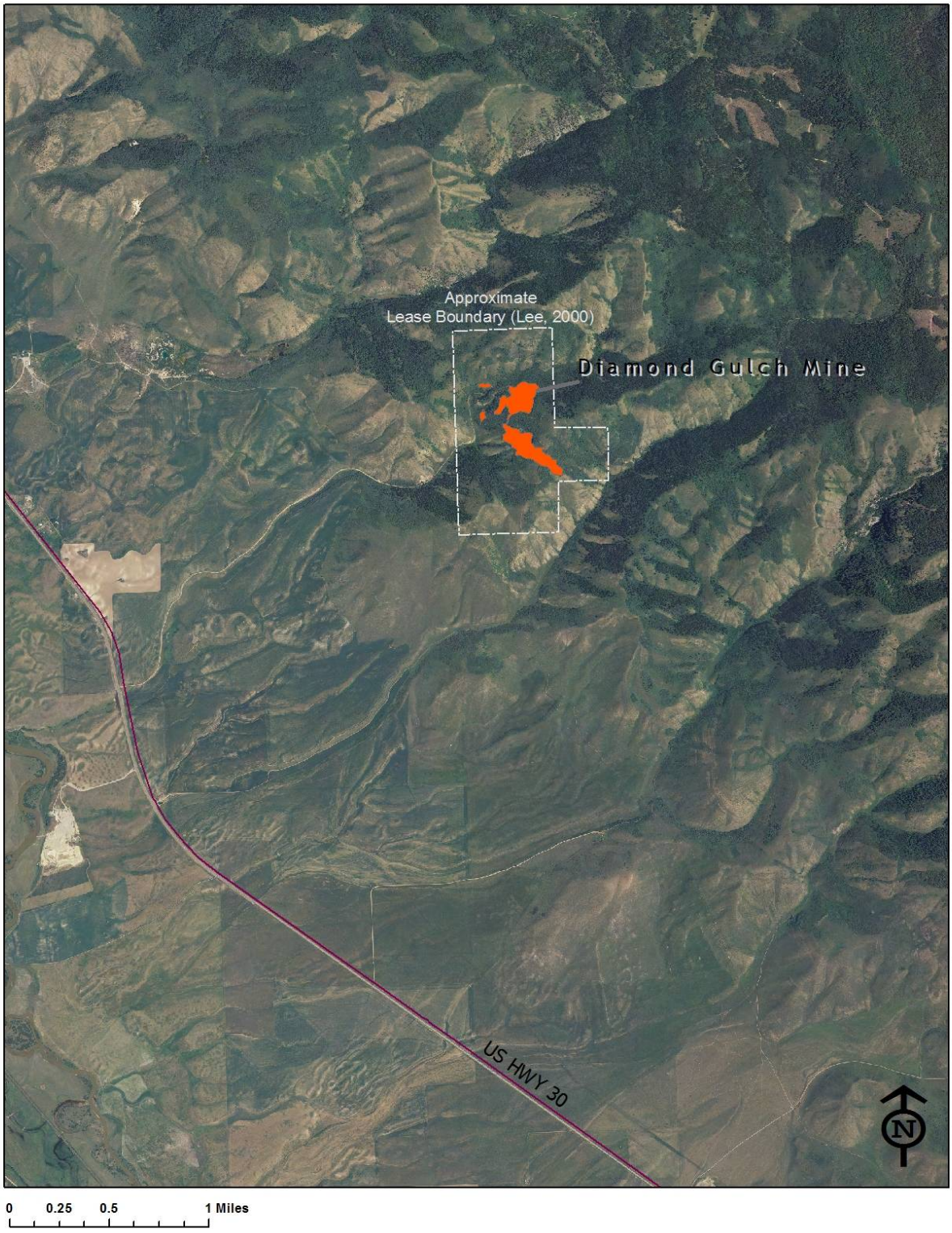

Figure 3. Aerial photograph of the Diamond Gulch Mine area.

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

Physical characteristics of the Diamond Gulch Mine site is presented in the following, along with the mine's operational history and characteristics of the wastes that remain. Figure 4 shows the mine pit in June 1996.

2.1 Ownership

> *"On December 31, 1968, the SFCC* (the mines original owner) *was dissolved with all of their assets and liabilities being assumed by the Stauffer Chemical Company, the company's sole shareholder. Stauffer Chemical Company did no further work at the Diamond Gulch Mine other than maintain the reclamation. During June, 1987, the Stauffer Chemical Company and its operations were acquired by Imperial Chemical Industries, Ltd., a United Kingdom chemical giant. Imperial Chemical Industries immediately sold what had been the Stauffer company and its holdings. By September, 1987, Stauffer's former Idaho operations were firmly in the hands of Rhône-Poulenc Basic Chemicals, Inc., the US subsidiary of the major French minerals processor, Rhône-Poulenc, SA…. The Diamond Gulch Mine remained closed throughout all of these transactions and on May 12, 1993, Rhône-Poulenc relinquished the Federal lease I-07881."*
>
> *Lee, 2000, page 152.*

2.2 Historical Perspective

> *"The mine operated only during the mining season of 1960. About 84,000 tons of phosphate ore were shipped from the mine. Mining proved difficult because of extensive faulting and pinching of the ore bodies. Only the high-grade phosphate ore was sold and the lower-grade phosphatic shales were stockpiled on the lease and at the company's processing facility. Since the SFCC had no facilities to upgrade the phosphatic shales, an effort was made to sell the shales to either the Monsanto Company or the Central Farmers Fertilizer Company as feedstock for electro-processing into elemental phosphorous. Monsanto even engaged in a small drilling and analysis program on the lease but decided that they did not need the ore for their processing. Because of the failure to sell the lower grade shales and other economic and geologic considerations, the mine was closed prior to the 1961 mining season. Reclamation was conducted on the mine site during 1961 and 1962…."*
>
> *Lee, 2000, pages 148 & 152.*

Figure 4. Diamond Gulch Mine June 26, 1996 from Lee, 2000.

2.3 Regional Climate

Climate in southeast Idaho is influenced by major topographic features, including the Pacific Coast, and local mountain ranges. The mountains affect local wind, precipitation, and temperature patterns.

Summer temperatures in the valleys are typically dry with warm to hot temperatures during the day and cooling during the night. Summer precipitation is usually associated with thunderstorms. Fall and winter are dominated by cold, dry continental air and by cyclonic storms. Most precipitation during fall and winter falls as snow accumulating in the valleys and on the surrounding mountains. Spring precipitation usually results from cool marine air flowing in from the south.

The average annual precipitation varies widely throughout the resource area and with elevation. Lifton pumping station, located at the north end of Bear Lake, has an average total annual precipitation of 10.62 inches based and a 1935 to 2007 period of record while on the north end of the resource area Conda reports an annual total average precipitation of 18.91 inches over a period of record from 1948 to 1978 (Western Regional Climate Center, 2007). Precipitation in the surrounding mountains range from 25 to 35 inches annually (BLM, 2000). The heaviest 1-day rainfall during the period of record at Montpelier was 2.50 inches on June 16, 1939. Thunderstorms occur on about 24 days each year, and most occur between May and August (Nature Resource Conservation Service, 2007).

> *"The average seasonal snowfall is 58.3 inches. The greatest snow depth at any one time during the period of record at Montpelier was 31 inches recorded on March*

4, 1952. On an average, 108 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 13.0 inches recorded on December 19, 1951". (Nature Resource Conservation Service, 2007)

The prevailing wind direction is from the west southwest, causing accumulation of snow on east and north facing ridges. Ralston et al. (1980) states that snow melt is the largest source of ground water recharge to the areas bedrock aquifers giving the east and north facing ridges the greatest potential for significant recharge.

2.4 General Geology

The Diamond Gulch Mine lies within the northern region of the Basin and Range Physiographic province, which is characterized by linear, north-trending fault bounded ranges and basins created by extensional techtonism initiated during the last 10 to 20 million years. Ranges in southeastern Idaho are generally composed of deformed Paleozoic and Mesozoic sedimentary rocks, including thick marine clastic units, comprised of cherts and limestones. The valleys are largely in–filled with Quaternary alluvium and colluvium that overlie Pleistocene basalt flows. Thick rhyolite flows of the Snake river Plain regions cover much of the area and complete the geologic sequences in the region.

Massive accumulations of marine sediment occurred during the Paleozoic era over a large area of eastern Idaho. During the Permian Era the Phosphoria Formation was deposited, forming the western phosphate field, part of which is located in the southeastern Idaho phosphate resource area. Figure 5 is a map of the Diamond Gulch Mine and surrounding region showing the generalized geology and faulting.

2.5 Stratigraphy and Lithology

The stratigraphy encountered by mining activities in the area is generally limited to four principal rock units. The stratigraphy, approximate ages and a description of each unit is described below in **Table 1**.

Table 1. Generalized Stratigraphic Setting of the Project Area[1]

Unit Name	Age	Description
Dinwoody Formation	Triassic	Interbedded claystone, limestone, and siltstone; ranges from 1,000 to 2,000 feet thick in project area
Phosphoria Formation	Permian	Composed of cherty mudstone, phosphatic mudstone, chert, phosphorite, limestone, and dolomite; phosphorite is the source of phosphate ore and is typically found in the lowermost portion of the formation.
Grandeur Limestone	Permian Pennsylvanian	Massive limestone that is discontinuous in the project area
Wells Formation	Pennsylvanian	Fine to very fine grain quartzitic to calcareous sandstone; approximately 1,500 to 2,000 feet thick in the project area.
Notes: 1. By convention, geologic units are presented from top to bottom as youngest to oldest.		

At the eastern edge of the resource area the Phosphoria Formation corresponds to an ancient ocean shelf area and is more calcareous and less argillaceous than Phosphoria

Formation outcrops to the west. A deeper water facies to the west is increasing carbonaceous and pyretic and grades into cherts.

The Phosphoria Formation includes four members: Meade Peak Phosphatic Shale, Rex Chert, Cherty Shale, and Retort Phosphatic Shale. The Meade Peak member which ranges in thickness from about 55 to 200 feet is the oldest and is either overlain by the Rex Chert or the Cherty Shale. The Retort member is discontinuous and is found in the north and eastern parts of the resource area. The Meade Peak member of the Phosphoria Formation is the source of the majority of the produced phosphate ore. Concentrations of select target metals in the Meade Peak member are significantly higher that typical concentrations found in other marine sedimentary rock. (Montgomery Watson, 1998 Regional Investigational Report).

2.6 Structure

The Diamond Gulch Mine and surrounding area is located in the Idaho-Wyoming-Utah overthrust belt. The belt extends from the Snake River Plain to near Salt Lake City and is part of the Cordilleran Foreland thrust belt that extends from Alaska to Mexico. Thrusting began in the late Jurassic when movement began on the Paris Thrust, the western most thrust plate. Movement on the Meade and Crawford Thrusts began in the middle to late Cretaceous. Total displacement on the Meade was approximately 24 miles in a west to east direction.

The major thrust plate in the study area is the Meade Overthrust. It generally places older Mississippian limestone on top of the upper Twin Creek Limestone or Preuss Sandstone of Jurassic age. The ore bearing units at the Consolidation Mine consist of Pennsylvanian to Triassic age (Table 1), rock within an overturned syncline. The strata in the mine area are overturned and dip 55˚ westward, as the west limb of a syncline. They strike close to N45º West.

Compressional tectonics ended in the Cretaceous Period. Subsequently, the Resource Area underwent a period of extensional tectonics in the Miocene Epoch during which the high-angle normal faults cut across the older rocks and Mesozoic folds and thrusts. These large and extensive block fault systems formed the north-trending ranges and valleys of the Basin and Range province that distinguishes the landscape today.

2.7 Hydrogeology

The major ground water flow systems within the phosphate mining resource area exist in the valley fill sediments, Thaynes, Dinwoody, and Wells formations. The Phosphoria formation has not been found to support any major ground water flow systems and generally acts as a confining unit between the Dinwoody and Wells formations.

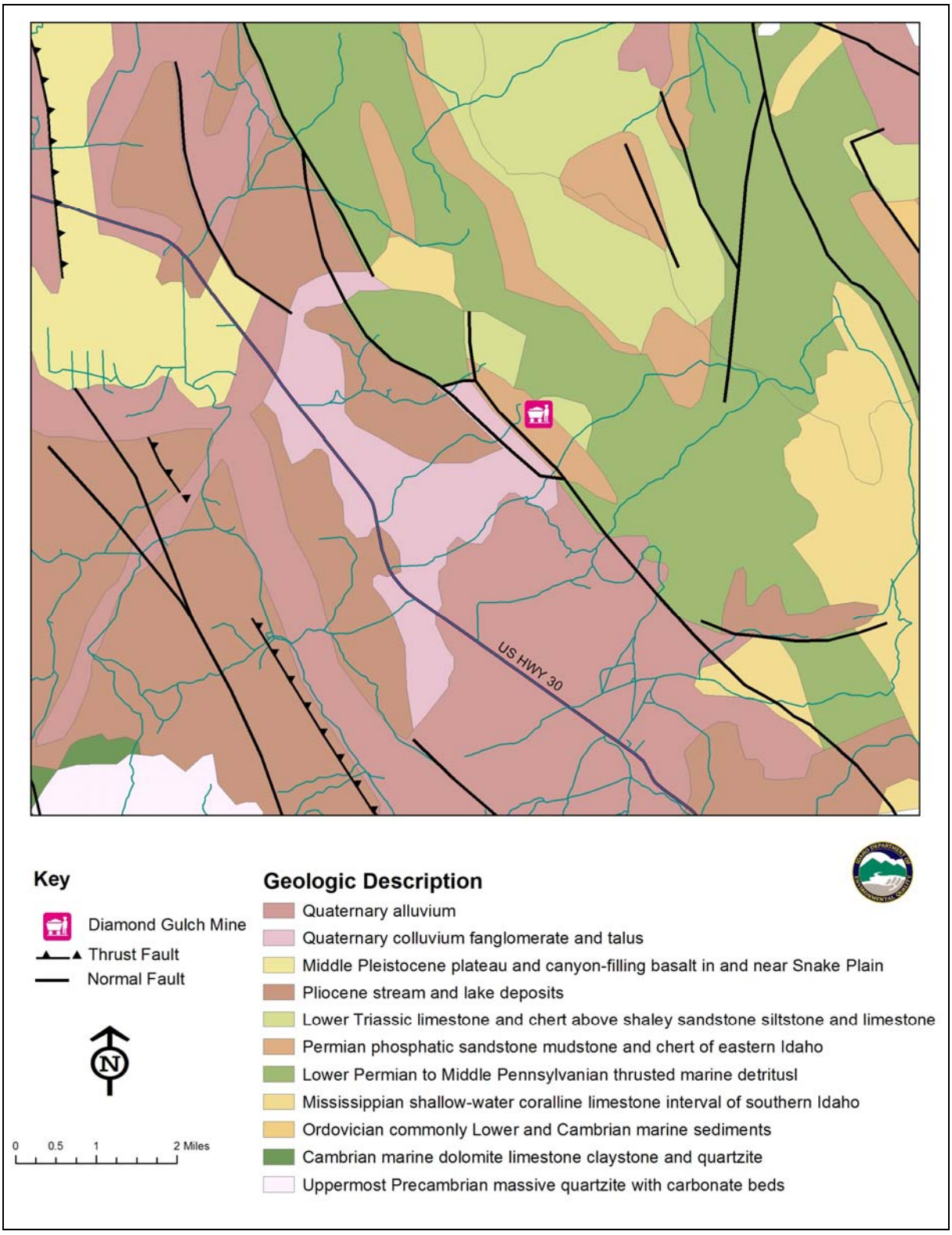

Figure 5. Geologic map of the Diamond Gulch Mine area (Geology of Idaho, Digitized from John G Bond's 1978 Geologic Map of Idaho 1:500,000 Idaho Dept of Lands, Bureau of Mines, University of Idaho Moscow).

Ground water flow in the valley sediments is generally from the valley margins towards the valley center then down valley towards lower elevations. Ground water flow within the bedrock aquifers is often controlled by stratigraphy and structural geology, flowing along the bedding in the direction of dip and/or plunge. Regional and localized faulting may form preferential flow paths or boundaries to ground water flow within the bedrock systems.

2.8 Current and Potential Future Land Uses

The Diamond Gulch Mine is accessible from road 186 that branches from US Highway 30. Current land uses in the area are grazing and recreation; including hiking, camping, horseback riding, off-road vehicle touring, hunting, and fishing.

The land surrounding the mine is owned and managed by the USFS and remains open to future mining claims. Future land use is likely to remain consistent with current uses dependent on federal policy and future mining claims.

2.9 Wetlands

Official wetland surveys for the area could not be found, but aerial photographs as well as direct observation seem to indicate that no wetlands are adjacent to or within the 15 mile down stream target distance limit from Diamond Gulch Mine.

Section 3. Site Overview, Sampling, and Waste Characteristics

An interagency team conducted a site visit to the Diamond Gulch Mine during June 2002 (DEQ, 2004a) in accordance with the goals and objectives in the *Area Wide Risk Management Plan*. The visit included a visual inspection of the mine and the collection of one (1) vegetation sample (wheat grass) and one (1) soil and sediment sample. Samples were analyzed for trace metals and compared to action levels developed for the Area Wide Rick Management Plan (DEQ, 2004b). A composite sample from the Diamond Gulch Mine waste dump(s) consisting of black shake and limestone was collected by the USGS on June 20, 1999 (Moyle and Causey, 2001). It was unclear from the report text if a single waste dump was sampled or if multiple dumps were sampled and composited. The BLM collected 35 soil samples in June 2000 (BLM, 2002), only four of which were sent to a laboratory for analysis. The remainder of the samples were analyzed with a field XRF and are not presented here due to the poor correlation with laboratory analytical results.

3.1 Area Wide Risk Management Plan Action Levels

The Area Wide Risk Management Plan (RMP) was written as a discretionary guidance document to assist Lead and Support Agency representatives with their mine-specific risk management decision-making responsibilities regarding historic mining operation releases and associated impacts from selenium and related trace metals in the Southeast Idaho Phosphate Mining Resource Area. The plan provides removal action goals, objectives, and action levels intended to assist in identifying site-specific areas of concern, focusing regulatory resources, and supporting consistent decision-making using a regional perspective.

The risk-based action levels were developed using deterministic single media dose proportions as the initial basis. These action levels were tested and validated using probabilistic methods that assume simultaneous exposure from all action level media to numerous limited home range surrogate species representing sensitive receptors from the various feeding guilds present in the Resource Area. Due to the limited area of impact and low likelihood of population-level effects, the action level development approach used by DEQ applied slightly less conservative assumptions regarding acceptable hazard quotient ranges than a typical population-level ecological risk assessment might. However, many of the receptor dose model parameters, such as site use, bioavailability and secondary media exposure point concentrations, remained conservatively-biased to represent receptors residing exclusively in impacted areas during toxicologically critical periods such as spawning, nesting, and breeding. The DEQ's risk management decisions focus resources in areas where efforts to minimize potential impacts to ecological subpopulations will provide the greatest benefit.

Action levels were established for the primary media that support sensitive habitats and are most amenable to standard industry measurement and mitigation techniques, which were surface water, groundwater, sediments, fluvial/riparian soils, and vegetation. Elevated

contaminant concentrations in the selected action level media are also indicative of the presence of past and/or ongoing releases.

3.2 Sampling

One (1) vegetation and 1 soil sample were collected during the interagency investigation in June 2002 (DEQ, 2004a), due to what the report refers to as extensive sampling conducted by the Linda Eslick of the BLM (BLM, 2002) during a previous investigation. Water was not noted at the mine during the time of the site visit. The samples were collected from the northwest facing pit floor. The vegetation sample (OS-DIG-VE-01-01) consisted of Wheat Grass. The soil sample (OS-DIG-SO-02-01) was composed of black mudstone with traces of ore. Moyle and Causey (2001) collected a composite soil sample from the mine's waste rock dump(s) in June of 1999.

The Diamond Gulch investigation conducted by the BLM in June 2000, collected and analyzed 35 soil samples from Diamond Gulch Mine, Diamond Gulch drainage (north of the mine), and Dry Canyon drainage (south of the mine). The samples were analyzed using a field XRF with 4 duplicated samples being sent to a laboratory. Only the laboratory analysis samples are presented in this report.

Soil sample DGBLM-016 was collected on June 21, 2000, in Diamond Gulch northeast (up gradient of the mine). DGBLM-020 was collected on June 21, 2000, from just below the head wall of the pit at the end of road 186. DGBLM-024 was collected on June 22, 2000, from the north end of the south workings-pan pit. DGBLM-34, collected on June 27, 2000, from the confluence of the Dry Canyon drainage directly south of the mine.

3.3 Sampling Results

Table 2 through Table 4 summarize the DEQ (2004a), USGS (Moyle and Causey, 2001) and BLM (2002) sampling results. Bolded, blue colored values are in excess of the Area Wide Action Levels for sediment not supporting aquatic life and vegetation as described in the Area Wide Risk Management Plan (DEQ, 2004b). Italicized values in Table 3 are in excess of Idaho's Initial Default Target Levels (IDTL) (DEQ, 2004c).

Table 2 shows that the soils collected from the mine pit exceed the Area Wide action levels for cadmium, chromium, nickel, selenium, vanadium, and zinc. Vegetation exceeded the action levels for cadmium. The composite waste dump sample presented by Moyle and Causey (2001) and summarized in Table 3 exceeded the Area Wide action levels for cadmium, selenium, and zinc; and the IDTL for arsenic, lead, mercury, and silver (DEQ, 2004c).

Soil analysis presented in the BLM (2002) investigation report, summarized in Table 4, showed exceedence of Area Wide action levels for 5 metals at 3 sample locations. Sample DGBLM-016 collected up hydraulic gradient of the mine, had concentrations of cadmium, nickel, and zinc up to 1.3 times the Area Wide action levels. The two samples collected from the mine pits (DGBLM-020 and DGBLM-024) had concentrations of chromium, nickel, selenium, and zinc up to 9 times greater than action levels. DGBLM-024 also exceeded the action level for cadmium by 13.9 times. Analytical results from the Dry

Canyon sample (DGBLM-034) showed metals concentrations below the Area Wide action levels for all metals tested.

3.4 Inspection Findings

The interagency team reported that some erosion control measures were in place; however, there are some areas of observed erosion in the pit and on the waste dumps. Very little modern reclamation has been completed. Volunteer, invasive vegetation is starting to return to the site. (DEQ, 2004a)

Table 2. June 2002 Sample Analysis for Diamond Gulch Mine, Caribou County, Idaho.

	Media	Cd	Co	Cr	Cu	Ni	Se	V	Zn
Area Wide Action Level	Vegetation	**4.2**	**---**	**30.6**	**88.0**	**35.5**	**5.0**	**55.9**	**615**
	Soil	**9.2**	**---**	**187**	**402**	**44**	**7.5**	**72**	**210**
Sample ID									
OS-DIG-VE-01-01	Vegetation (wheat grass)	**6.3**	0.37	13	15	5.9	1.0	32.0	170.0
OS-DIG-SO-02-01	Soil (pit floor)	**130**	2.7	**740**	100	**190**	**25**	**2100**	**1600**

Analyte concentrations are in mg/Kg.
Blue type indicates value exceeds the Area Wide Investigation action levels.

Table 3. Diamond Gulch Mine Soil Sample Results, Moyle and Causey, 2001.

As ppm	Hg ppm	Se ppm	Sb ppm	Te ppm	Tl ppm	Ag ppm	As ppm	Au ppm	Bi ppm	Cd ppm	Cu ppm	Mo ppm	Pb ppm	Zn ppm
17.6	*0.33*	**9.4**	4.5	0.1	1.5	3.3	10	*0.2*	3	**65.7**	69.0	15.2	*10*	**683.0**

Blue type indicates value exceeds the Area Wide Investigation action levels.

Table 4. June 2000 Sample Analysis for Diamond Gulch Mine, BLM, 2002.

	Media	As	Cd	Cr	Cu	Mo	Ni	Se	Zn
Area Wide Action Level	Soil	**---**	**9.2**	**187**	**402**	**---**	**44**	**7.5**	**210**
Sample ID									
DGBLM-016	Soil	12.6	**12.5**	126	30	12	**57**	5.8	**257**
DGBLM-020	Soil (below head wall)	32.3	4.4	**951**	109	29	**344**	**57.4**	**1190**
DGBLM-024	Soil (pit)	41.9	**128**	**1330**	115	41	**400**	**15.9**	**2380**
DGBLM-034	Soil (confluence of next drainage)	9.9	1.2	19	10	10	15.5	5.2	70.7

Analyte concentrations are in mg/Kg.
Blue type indicates value exceeds the Area Wide Investigation action levels.

Section 4. Pathway and Environmental Hazard Assessment

The Diamond Gulch Mine operations were complex and apparently supported only upper ore bed access resulting in low waste generation and little disturbance of middle waste shales. The pit floor and waste dump expose materials exceeding soil action levels and IDTLs but the sparse vegetation is not expected to provide a significant exposure pathway for wildlife (DEQ, 2004a). The vegetation sample indicated a marginal exceedence of action levels for cadmium. A previous BLM preliminary assessment also indicated minimal potential for ecological risks (DEQ, 2004a). No surface water migration pathways were observed at the site during the 2002 site assessment.

4.1 Surface Water

An intermittent stream channel runs below the Diamond Gulch Mine, flowing 3.5 miles to the west where it enters the Bear River. The stream was dry at the time of the 2002 interagency team site inspection.

4.2 Soil/Air Exposure

Direct access to the mine and the waste rock dumps is not known. However, due to the proximity of the mine to public roads and recreational areas, soil ingestion for occasional recreation is considered likely. Additionally, exposure to air borne contaminants is possible.

4.3 Ground Water

No information is currently available concerning ground water directly beneath the Diamond Gulch Mine. However, according to IDWR records, eleven domestic wells are located within a 4 mile radius of the mine (Figure 6). These wells are generally shallow, less than 200 feet in depth, and have shallow water levels. Five of the wells are situated on the opposite (west) side of the Bear River from the mine, near the 4 mile mark, and are not likely to be directly impacted from Diamond Gulch Mine. The remaining six wells are on the east side of the Bear River and potentially down hydraulic gradient from the mine. The closest of these wells is approximately 2.25 miles west of the mine. Depth to water in the 6 wells east of the river ranges from 5 to 58 feet below the measuring point (assumed to be ground surface).

No public water system wells or there zones of capture are located within 4 miles of the mine.

4.3.1 Potential Receptors

Potential receptors include local residents, hunters, cattlemen, trail riders (motorized and non-motorized), campers, and rarely, tourists. Cattle activity surrounding and within the mine site is unknown. Residents, outdoor enthusiasts, and wildlife remain the likeliest

potential receptors, as they reside nearby or use surrounding land for recreational activities, forage, breeding, or bedding areas.

The land within a two (2) mile radius of the mine is primarily owned by the Caribou National Forest with some privately owned land to the west.

4.3.2 Schools, Day-Care Facilities, Private Residences

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

4.3.3 Species of Concern

Animal species listed as a species of concern that are located within a 4-mile radius of the site include the Boreal Owl and Canadian Lynx

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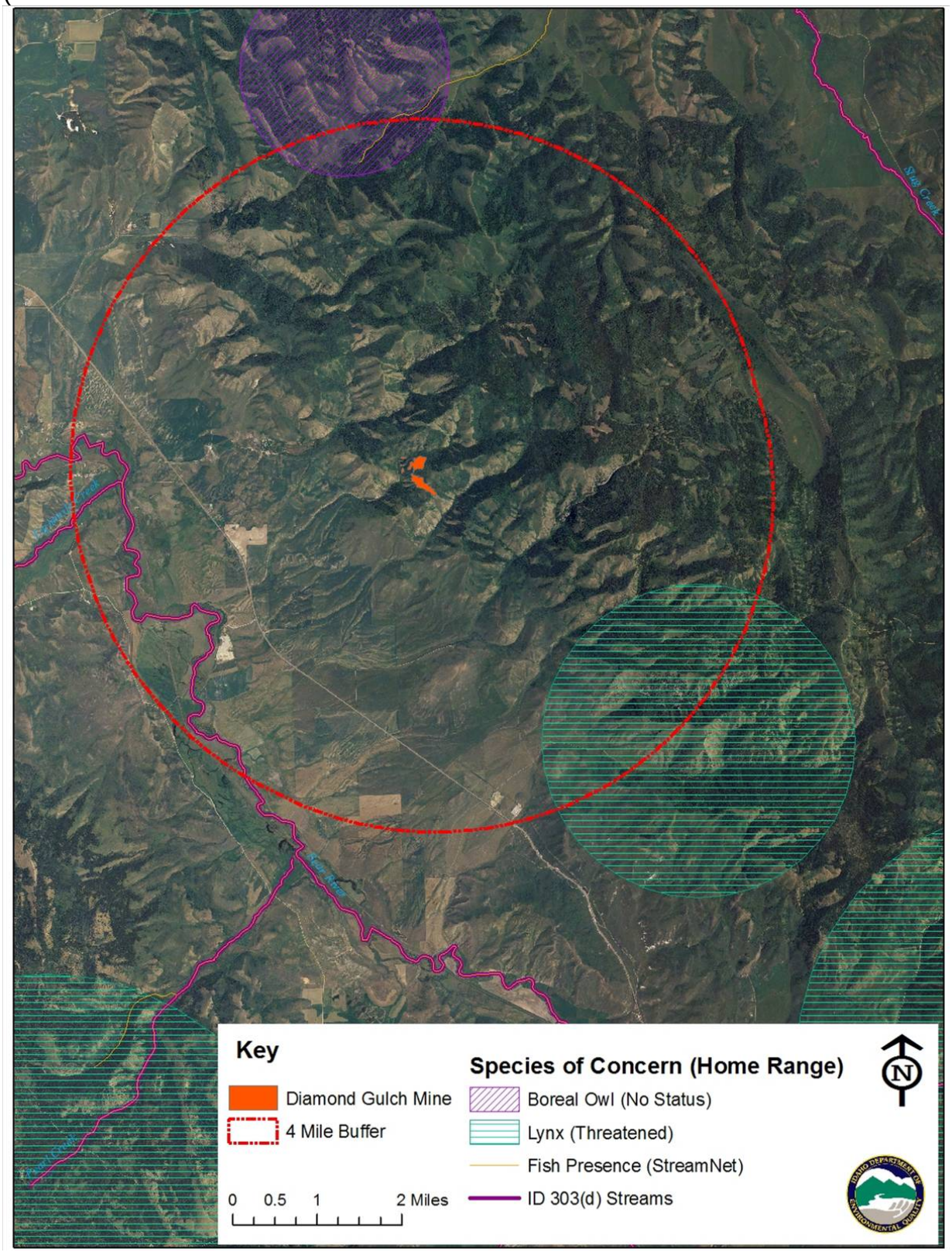
Key
Diamond Gulch Mine
4 Mile Buffer
Species of Concern (Home Range)
Boreal Owl (No Status)
Lynx (Threatened)
Fish Presence (StreamNet)
ID 303(d) Streams
0 0.5 1 2 Miles
N
Slab Creek

Figure 7).

4.3.4 Soil Sample Concentrations

Relative to the Area Wide Action Levels soil exposure at the mine is expected to be elevated for avian and terrestrial receptors through incidental ingestion, due to the metals concentrations measured in the soil samples.

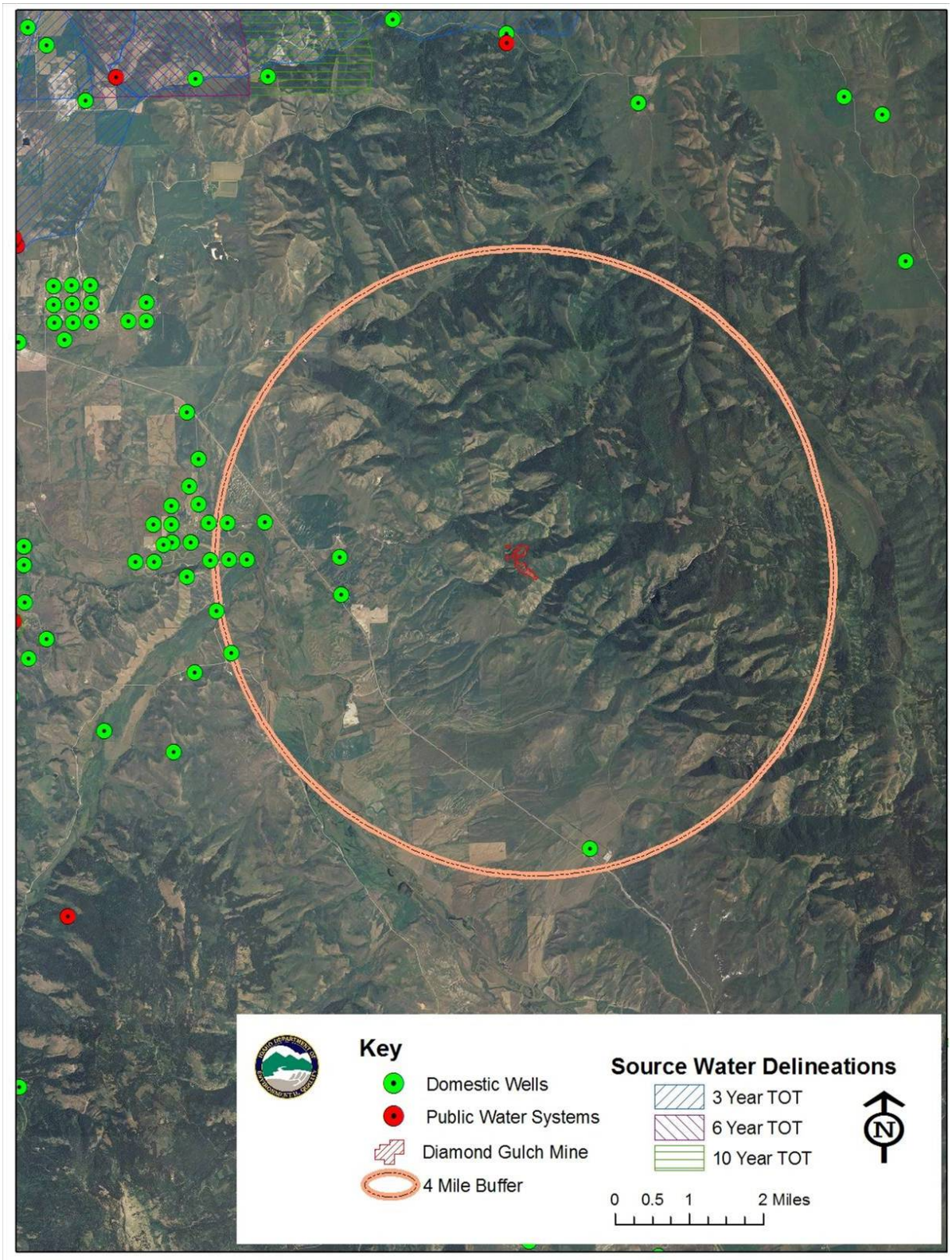

Figure 6. Domestic wells and Public Water System wells located with a four-mile radius of the Diamond Gulch Mine.

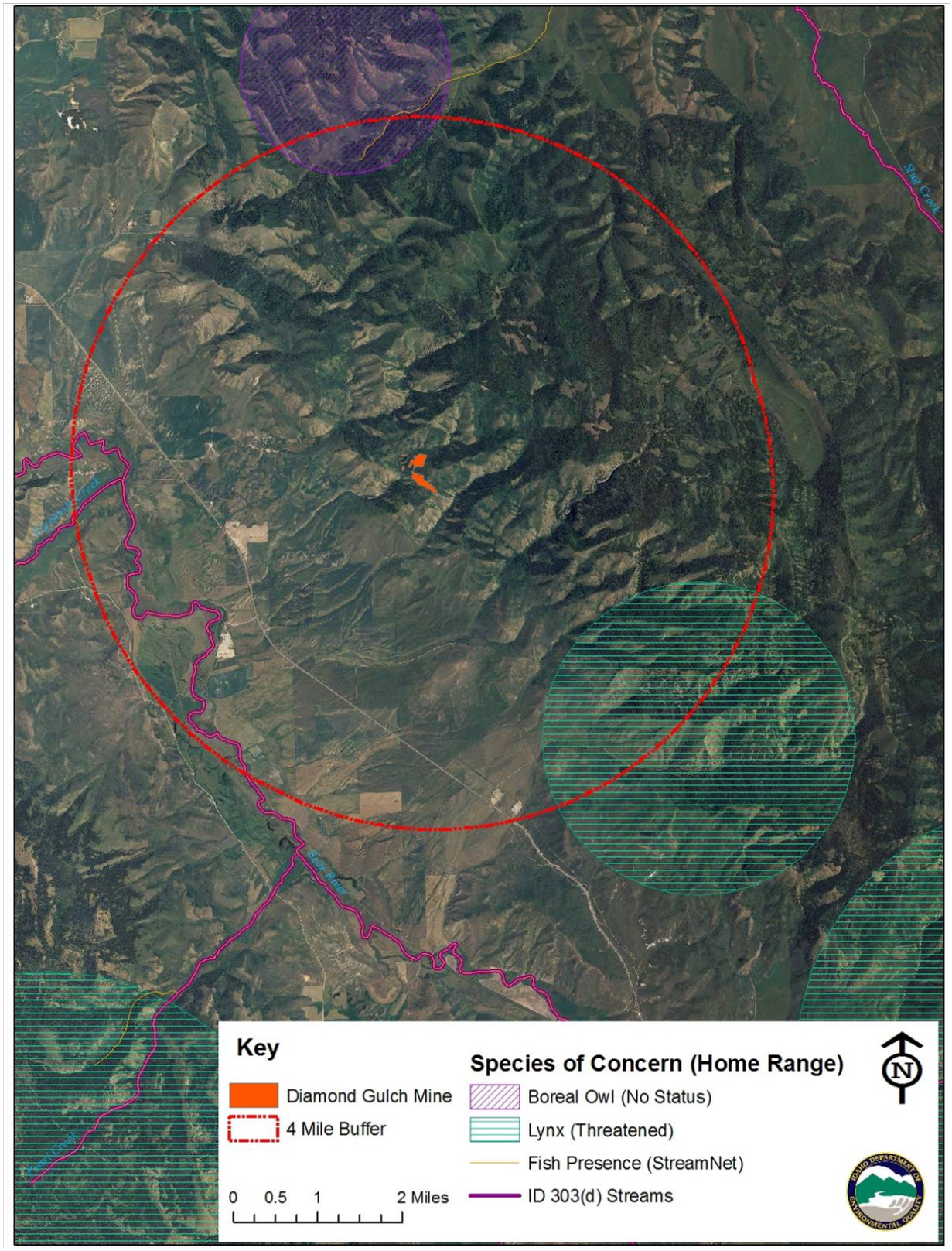

Figure 7. Sensitive species identified in the vicinity of the Preliminary Assessment Site.

Section 5. Conclusions and Recommendations

The recommendations contained herein address not only localized release pathways and associated ecological risks but also any public safety concerns regarding the presence of open adits, portals, or mine shafts. The Diamond Gulch Mine is recommended for site investigations, waste consolidation, potential erosion control, and reclamation improvements.

5.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, no wetlands are within the 15-mile TDL.

5.2 Impacts on Water Quality

Surface and ground water impacts related to the mine are currently unknown. However, the Bear River and domestic wells are located with in 4 miles of the mine. Based on the distance to surface water sources and domestic wells completed in valley sediments containing shallow groundwater, there is a low to moderate potential for the Diamond Valley Mine to impacted local water systems.

5.3 Potential Exposure for Wildlife and Vegetation

The waste rock dumps and mine pit with or without vegetation present potential exposure pathways for wildlife. Native plant species may bio-accumulate high concentrations of metals that may be consumed by the local wildlife. Wind blown soils may also be inhaled or incidentally consumed by local wildlife. Wildlife, such as deer and elk, exposed to elevated concentrations of metals (via water, soil, or plant material) may be harvested and consumed by humans.

5.4 Potential Exposure for Humans

The public may have access to the mine via the roads. There are no reported locked gates or posted signs in proximity to the mine site or waste dumps (DEQ 2004a).

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing on the Bear Rive is common. According to the IDFG database, a number of desirable game fish are native or are stocked in the Bear River (IDFG, 2002).

Human activity around the mine site is believed to be minimal. Mountain bikers, hikers, hunters, snow mobile operators, off-road four wheeling enthusiasts, and various other outdoor recreation enthusiasts may potentially frequent the area.

Fugitive dust and direct contact with the waste piles are the two main mechanisms through which humans could be exposed to the metal concentrations at the site. These sources do not appear to present any immediate threat. Although the waste dumps and pit floor have been shown to have high metal concentrations, exposure for humans to elevated metal concentrations is moderate due to the location of the site.

5.5 Recommendations

Overall, the soil and vegetation samples from the site and surrounding area show elevated metal concentrations with respect to the Area Wide Risk Management Plan criteria. As a result, the agencies performing the 2002 PA recommended additional actions at the Diamond Gulch Mine site in the form of a final evaluation to be incorporated as a component of the upcoming USFS Administrative Order on Consent for Rhodia's Wolley Valley site investigation.

Additional recommendations based on DEQ's current evaluation of the data include the following:

- Re-contouring and re-vegetating those waste piles where natural vegetation has not established itself, and, if necessary, placement of clean soils and re-vegetation of these locations.
- Sampling of near by domestic wells.

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