

Hot Springs Mine Preliminary Assessment Report

Bear Lake County
State of Idaho



Department of Environmental Quality

August 2007

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

Hot Springs Mine
Preliminary Assessment Report
August 2007

Table of Contents

List of Acronyms	v
Section 1. Introduction	1
1.1 Background of the Inactive Mine Assessments.....	1
1.2 Overview	2
Section 2. Site Description, Operational History, and Waste Characteristics	5
2.1 Ownership	5
2.2 Historical Perspective	5
2.3 Regional Climate	6
2.4 General Geology	6
2.5 Stratigraphy and Lithology.....	7
2.6 Structure.....	7
2.7 Hydrogeology	8
2.8 Current and Potential Future Land Uses.....	8
2.9 Area Fish Species	8
2.10 Wetlands	9
Section 3. Site Overview, Sampling, and Waste Characterization	13
3.1 Area Wide Risk Management Plan Action Levels	13
3.2 Sampling	14
3.3 Sampling Results	14
3.4 Inspection Findings	15
Section 4. Pathway and Environmental Hazard Assessment	19
4.1 Surface Water	19
4.2 Soil/Air Exposure.....	19
4.3 Groundwater.....	19
4.3.1 Potential Receptors	20
4.3.2 Schools, Day-Care Facilities, Private Residences	20
4.3.3 Plant and Animal Species of Concern.....	20
4.3.4 Soil Sample Concentrations	20

Section 5. Conclusions and Recommendations	25
5.1 Presence of Wetlands	25
5.2 Impacts on Water Quality	25
5.3 Potential Exposure for Wildlife and Vegetation	25
5.4 Potential Exposure for Humans.....	25
5.5 Recommendations	26
References.....	27
Appendix: Photographs.....	29
Report Index	35

List of Figures

Figure 1. Location of the Hot Springs Mine within the state of Idaho and delineation of the Southeast Idaho Phosphate Mining Resource Area (green boundary)	3
Figure 2. Aerial overview of the Hot Springs Mine area.	4
Figure 3. Geologic Map of Hot Springs Mine Area (Bond,1978).	10
Figure 4. Wetlands in the Hot Springs Mine Area	11
Figure 5. Hot Springs Mine Sample Locations from DEQ, 2004a.	16
Figure 6. Domestic and Public Water System wells within a 4-mile radius of the Mine.....	22
Figure 7. Species of Concern within the Hot Springs Mine Area.....	23

List of Tables

Table 1. Generalized Stratigraphic Setting of Project Area ¹	7
Table 2. Hot Springs Mine Soil Sampling Analytical Results.....	17
Table 3. Hot Springs Mine Vegetation Sampling Analytical Results.....	17
Table 4. Plant and Animal Species of Concern in the Hot Springs Mine Area	21

List of Acronyms

Acronym	Definition
bgs	below ground surface
BLM	United States Bureau of Land Management
Cd	Cadmium
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cr	Chromium
Co	Cobalt
Cu	Copper
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
Ni	Nickel
PA	Preliminary Assessment
RMP	Area Wide Risk Management Plan
SDWIS	Safe Drinking Water Information System
Se	Selenium
SFCC	San Francisco Chemical Company
TDL	Target Distance Limit
USFS	United States Forest Service
USGS	United States Geological Survey
V	Vanadium
Zn	Zinc

Hot Springs Mine
Preliminary Assessment Report
August 2007

This page intentionally left blank for correct double-sided printing.

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 Hot Springs 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. A site visit and sampling were not conducted as part of this PA process.

1.1 Background of the Inactive Mine Assessments

Inactive 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 subbasins 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.

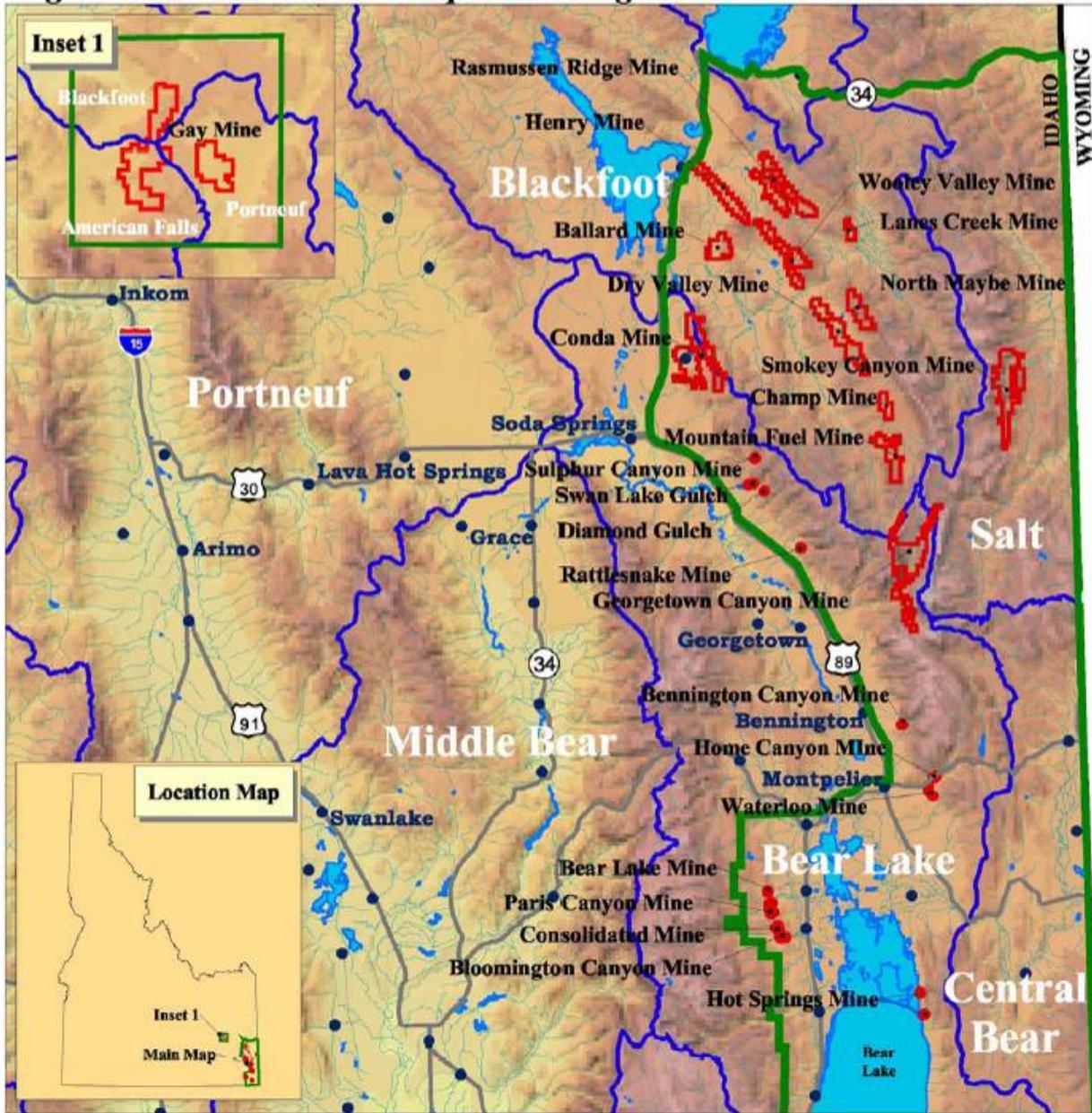
- Protecting wildlife, habitat, and ecological resources in southeast Idaho by reducing subpopulation risks to local wildlife to acceptable levels as established by risk-based action levels and by minimizing wildlife risks through the development and demonstration of effective BMPs for future mines.
- 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 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 Overview

The Hot Springs Mine is located in Bear Lake County, Sections 1, 12, 13, and 24 of Township 15 South, Range 44 East, approximately 7 aerial miles east of Saint Charles, Idaho (Figure 2). The former mine can be reached from Saint Charles by driving east along Beach Road.

Hot Springs Mine
 Preliminary Assessment Report
 August 2007



10 0 10 20 30 Miles

Restriction of Liability: Neither the State of Idaho nor the Idaho Department of Environmental Quality, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information or data provided. Metadata is provided for all data sets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical errors. The Department of Environmental Quality may update, modify, or revise the data used at any time, without notice.

Explanation

Resource Area Boundaries	Orphan Mine Sites
Mine Boundaries	Towns
Watershed Boundaries	Streams
Lakes	Major Roads

February 2, 2004



Figure 1. Location of the Hot Springs Mine within the state of Idaho and delineation of the Southeast Idaho Phosphate Mining Resource Area (green boundary).

Hot Springs Mine
Preliminary Assessment Report
August 2007

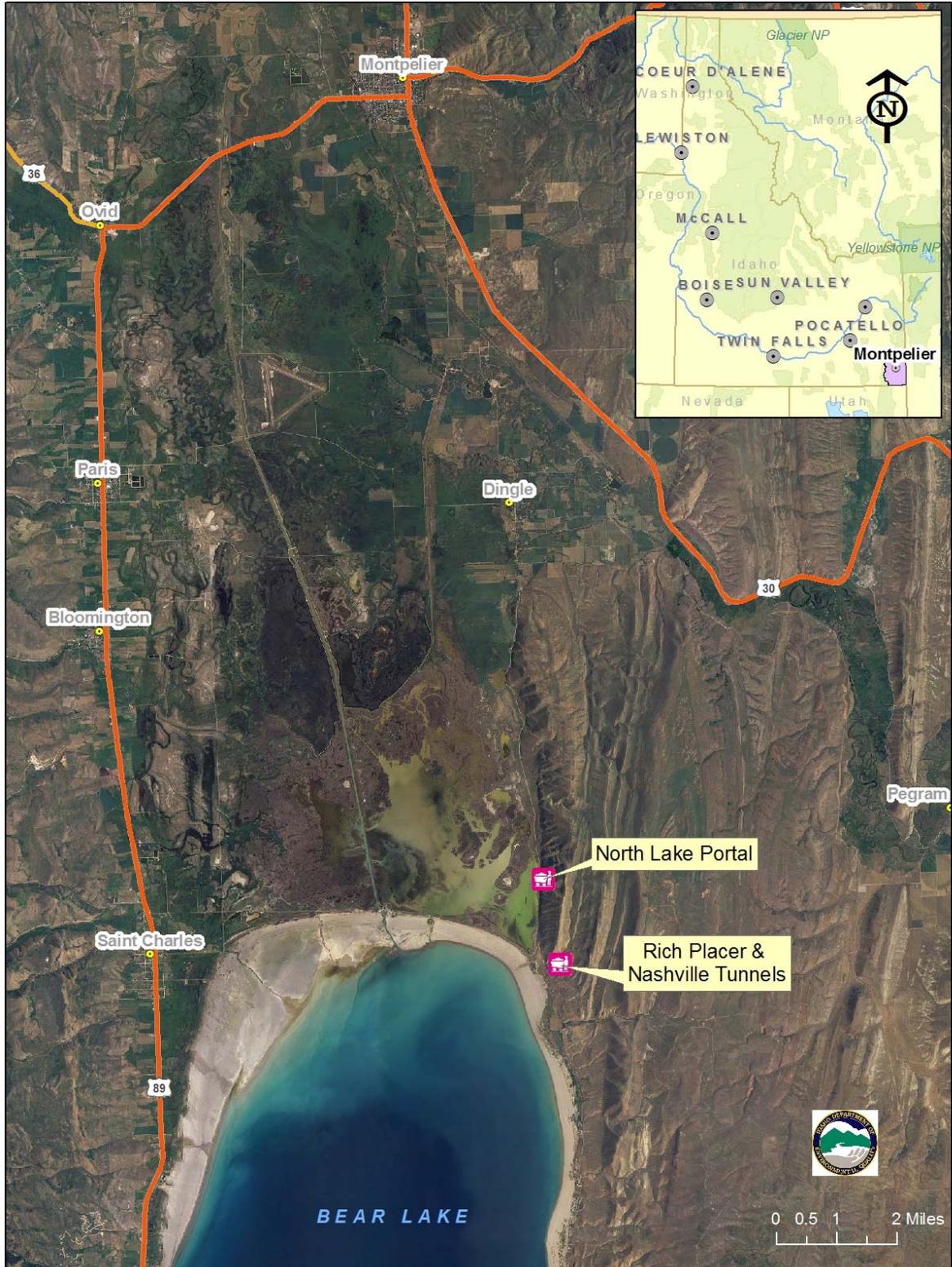


Figure 2. Aerial overview of the Hot Springs Mine area.

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

Physical characteristics of the Hot Springs Mine site are presented in the following, along with the mines' operational histories and characteristics of the wastes that remain.

2.1 Ownership

The Hot Springs Mine property is currently owned by Rhodia, Inc. The original claims were staked by Morse Duffield and Lewis Jeffs in 1907 and 1911 and patented between 1911 and 1917. By 1921 the mine was sold to the San Francisco Chemical Company (SFCC) which was reorganized into the Stauffer Chemical Company in 1969. The Rhone-Poulenc Basic Company acquired the mine in 1987 and was reorganized to form Rhodia, Inc. P.O. Box 3146, Butte, MT 59702, in 1998.

2.2 Historical Perspective

The Hot Springs Mine is located in Bear Lake County, Idaho in Section 1, 12, 13, and 24 of Township 15 South, Range 44 East. Discovered by Morse Duffield and Lewis Jeffs, work was well underway by 1911 including construction of a mill. The original claims were staked between 1907 and 1911, and patented between 1911 and 1917. On the south end of the mountain are two former adits; the Nashville tunnel originally owned by Duffield and Jeffs, and the Rich Placer tunnel originally owned by the Union Phosphate Company. These two tunnels are located only about 75 feet apart, and each owner individually worked their tunnel. In 1911, the Union Phosphate Company sold their claim to Duffield and Jeffs, and by 1916, over 700 feet of underground workings existed. On the west side of the ridge, the North Lake tunnel was just under construction in 1911. The tunnel was abandoned in 1912 at 220 feet. It was later reopened and extended to the ore.

By 1921, the exploration work was deserted and the property sold to the SFCC. In 1954, the SFCC started working the mine again, but found that the ore was too hard and caused damage to the rods at the mill. Thus, in 1956, work at the Hot Springs mine was suspended indefinitely.

In 1969 the SFCC reorganized into the Stauffer Chemical Company, who held the claims until 1987, when Rhone-Poulenc Basic Chemicals Company acquired them. In 1998, Rhone-Poulenc reorganized and formed Rhodia, Inc., who still owns the mining claims to the Hot Springs mine.

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 average maximum temperatures in the low 80's (°F) and average minimum temperatures in low to mid 40's (°F). Summer precipitation is usually associated with thunderstorms. Fall and winter are dominated by cold, dry continental air and by cyclonic storms. The average maximum temperatures during February are in the low 30's (°F) with the average minimums below 10 °F. 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 on 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 Hot Springs 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 tectonism initiated during the last 10 to 20 million years (Figure 3). Ranges in southeastern Idaho are generally composed of deformed Paleozoic and Mesozoic sedimentary rocks, including thick marine clastic units, comprising cherts and limestones. The valleys are largely in-filled with Quaternary alluvium and colluvium that overlie Pleistocene basalt flows. Middle Pleistocene 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 large areas of eastern Idaho. During the Permian Era, the Phosphoria Formation was deposited, forming the western phosphate field, part of which is located in the Idaho Phosphate Mining Resource Area.

2.5 Stratigraphy and Lithology

The stratigraphy of the area is characterized by Paleozoic and Mesozoic sediments overlain by Pleistocene igneous extrusions. The stratigraphy most 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 are summarized in Table 1.

Table 1. Generalized Stratigraphic Setting of Project Area¹.

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, 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 and is more calcareous and less argillaceous than Phosphoria Formation outcrops to the west.

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 phosphate minerals in the Meade Peak member are significantly higher than typical concentrations found in other marine sedimentary rock. (Montgomery Watson, 1998)

2.6 Structure

The Hot Springs Mine and the surrounding area are located in the Idaho-Wyoming-Utah Overthrust belt, which 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. Folding

and thrusting occurred during the late Jurassic to early Cretaceous when movement began on the Paris Thrust, the westernmost thrust plate.

Compressional tectonics ended in the Cretaceous Period. Subsequently, the resource area underwent a period of extensional tectonics in the Miocene Epoch during which 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.

The major thrust plate in the study area is the Paris Overthrust. The ore bearing units at the mine consist of Pennsylvanian to Triassic age rock (Table 1) within an overturned syncline. The strata in the mine area are overturned and dip 70° to 80° westward and strike approximately north.

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.

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

Current land uses in the area include, a national wildlife refuge, a commercial business relying on the local hot spring(s), boating, fishing, swimming, biking, hiking, horseback riding, off-road vehicle touring, and grazing.

Future land uses is likely to remain consistent with current practices on public lands, water ways, and wet lands in the area. Future land use on private parcels of property could potentially include some year-round and/or seasonal homes as is typical else where around Bear Lake.

2.9 Area Fish Species

According to the Idaho Department of Fish and Game (IDFG) database, fish in Bear Lake include mountain whitefish, Bear Lake whitefish, Bonneville cisco, Bonneville whitefish, Bonneville cutthroat trout, Utah chub, longnose dace, speckled dace, redbreast shiner, Utah sucker, mountain sucker, Paiute sculpin, mottled sculpin, Bear Lake sculpin, rainbow (hatchery) trout, and brook trout, brown trout, tiger muskie, green sunfish,

bluegill, smallmouth bass, largemouth bass, black crappie, white crappie, yellow perch, walleye, common carp, and channel catfish (IDFG, 2002).

2.10 Wetlands

Official wetland surveys for the area indicate that the Hot Springs Mine is adjacent to a large wetland that is part of the Bear Lake National Wildlife Refuge. The wetlands located within the 15 mile target distance limit (TDL) just to the west of the mine are approximate 38,689 total acres in size and support a number of sensitive plant and animal species. The majority of the total acreage is occupied by the Beal Lake National Wildlife Refuge which extends beyond the 15 mile TDL.

Hot Springs Mine
 Preliminary Assessment Report
 August 2007

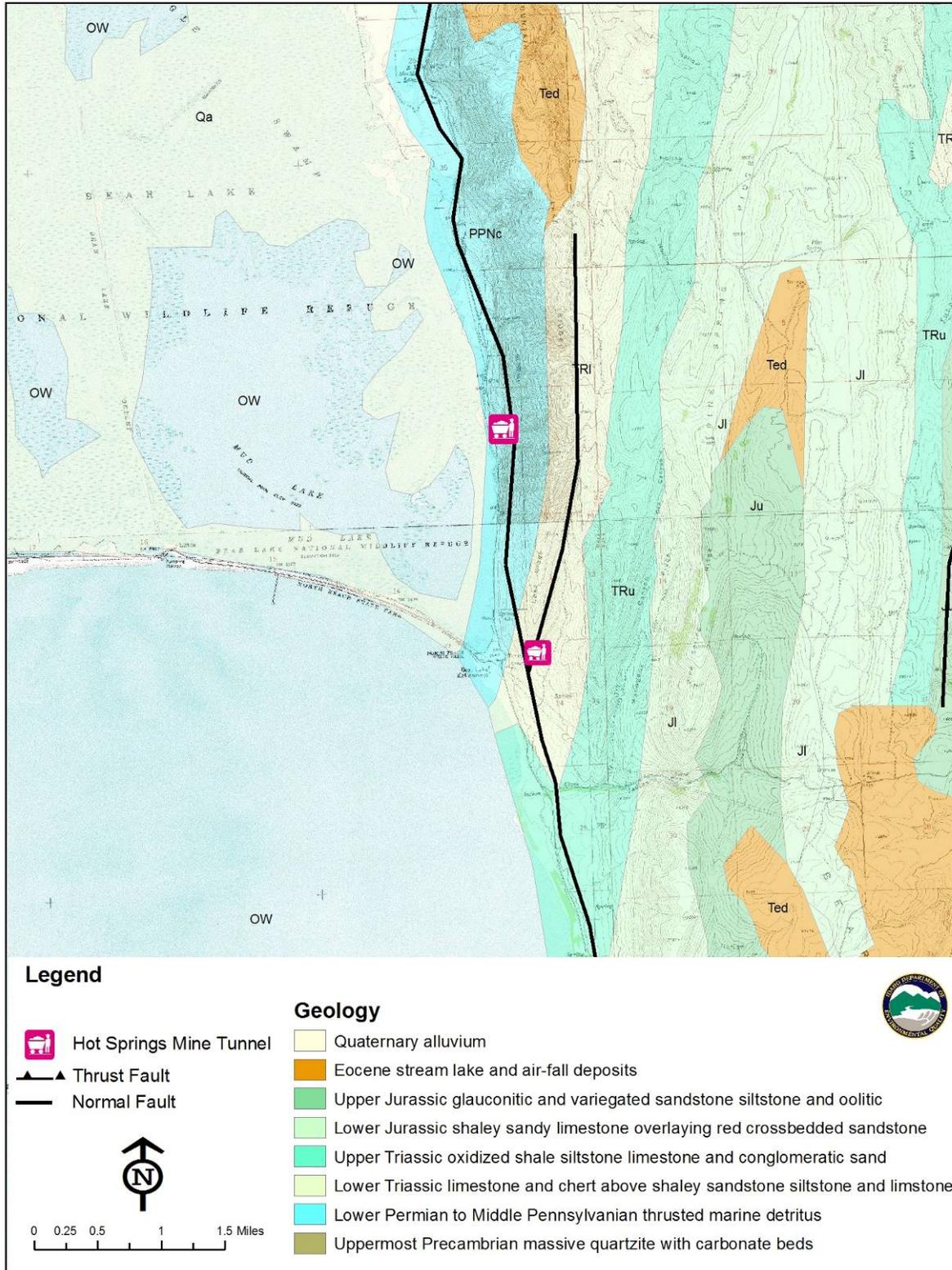


Figure 3. Geologic Map of Hot Springs Mine Area (Bond, 1978).

Hot Springs Mine
Preliminary Assessment Report
August 2007

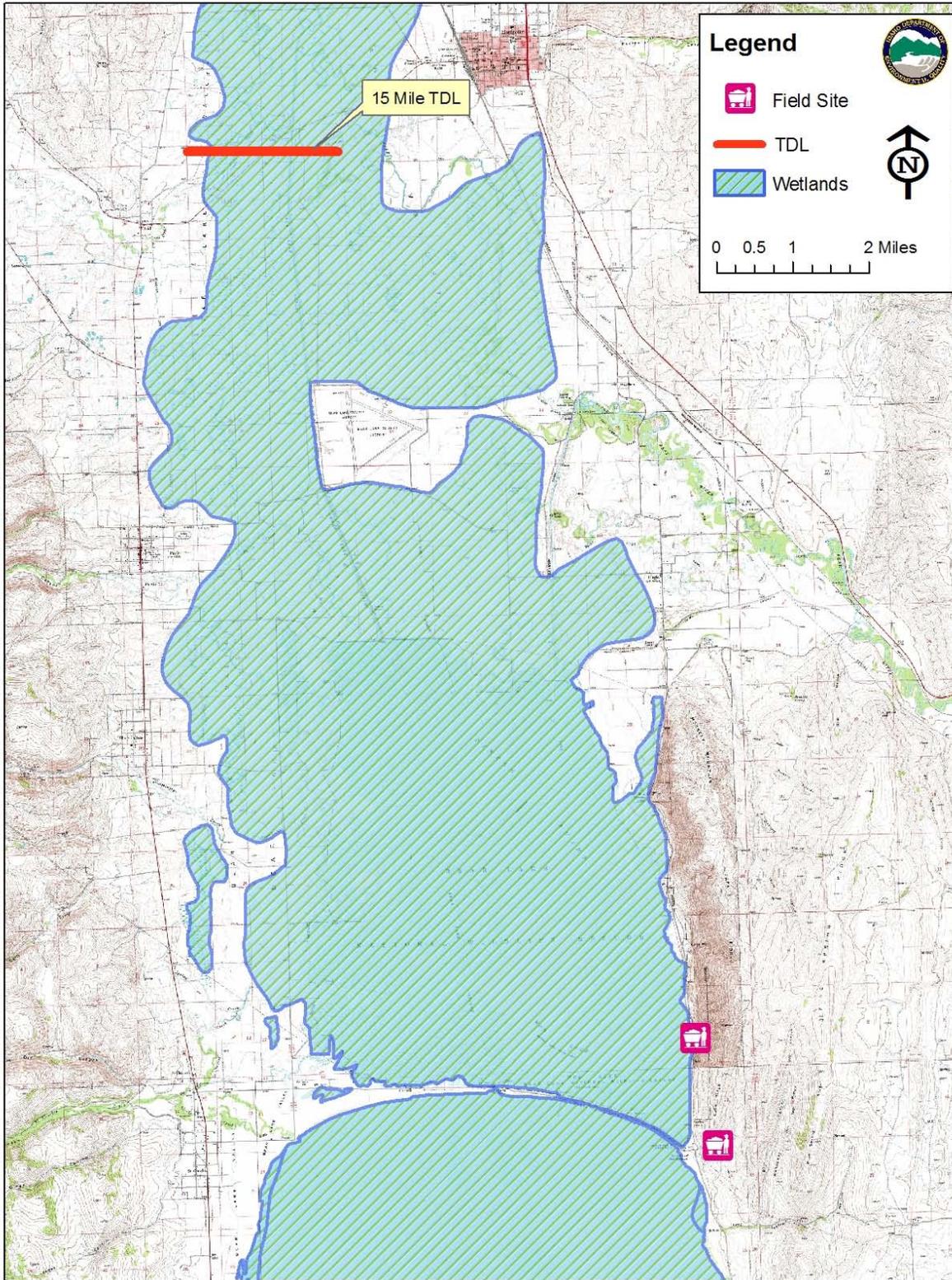


Figure 4. Wetlands in the Hot Springs Mine Area

Hot Springs Mine
Preliminary Assessment Report
August 2007

This page intentionally left blank for correct double-sided printing.

Section 3. Site Overview, Sampling, and Waste Characterization

An interagency team conducted a site visit to the Hot Springs Mine during May 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 three (3) vegetation samples (grasses), five (5) soil and sediment samples and one (1) duplicate soil sample. Sampling locations are shown in Figure 5 and Photos 9.2, 9.3, 9.6, and 9.7 in the Appendix. Samples were analyzed for trace metals and compared to action levels developed for the Area Wide Risk Management Plan (DEQ, 2004b).

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

Eight samples and one duplicate were collected at the Hot Springs Mine: four and a duplicate at the North Lake tunnel and four in the discovery area. The first samples were collected at the same location on the top surface of the black shale waste dump. Sample OS-HSM-SO-01-01 is a soil sample composed of almost all black shale. A duplicate (OS-HSM-SO-01-02) soil sample was also collocated. Sample OS-HSM-VE-02-01 was of rabbit brush (vegetation sample) from the same location. The next two samples were taken in a low, moist area, which appeared to be a water collection basin for the disturbed area. Sample OS-HSM-SO-03-01 is a soil sample composed of 90% brown soil and 10% black shale. The vegetation sample (OS-HSM-VE-04-01) is of Great Basin wild rye.

The next four samples were collected in the discovery area of the Hot Springs Mine. They were located in the potential migration path down gradient of the discovery area. Sample OS-HSM-SO-05-01 is a soil sample collected about 2 feet below the Rich Placer [eastern] black shale waste dump. It is composed of a mix of black soil and black shale. The next two samples were collected about 60 feet down the dry stream channel from the Nashville [western] waste dump. Sample OS-HSM-SO-06-01 is a soil sample composed of mostly brown soil from a pea gravel streambed. Sample OS-HSM-VE-07-01 is a collocated vegetation sample of Great Basin wild rye. The last sample, OS-HSM-SO-08-01, is a soil sample collected another 100 feet downgradient of the previous sample. It is composed of 50% brown soil, 40% pea gravel, and 10% tan shale.

3.3 Sampling Results

The first sample, designated OS-HSM-SO-01-01 (Appendix Photo 9.2), and its duplicate OS-HSM-SO-01-02 were from the black shale waste dump near the North Lake tunnel. Analysis of the samples showed concentrations of cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), selenium (Se), vanadium (V), and zinc (Zn) 4.7 to 28 times greater than the action levels set by the RMP (DEQ 2004b). The analysis of vegetation sample OS-HSM-VE-02-01 showed concentrations of Cd and Se 1.5 to 1.7 times the RMP action levels for vegetation.

Analysis of soil sample OS-HSM-SO-03-01 showed concentrations of Cd, Ni, V, and Zn 2.0 to 4.3 times greater than the action levels. The vegetation sample, OS-HSM-VE-04-01, collected from the same location had no analytes above the action levels.

Soil sample OS-HSM-SO-05-01 contained Cd, Cr, Ni, Se, V, and Zn at levels up to 61 times the RMP action levels. The largest exceedance was seen in Se. Copper (Cu) was detected at levels well below the action levels.

Soil sample OS-HSM-SO-06-01, collected to the west and down stream of OS-HSM-SO-05-01, had exceeded action levels for all of the same trace metals as the prior sample; however, concentrations were lower in each case. Se exceeded the action level by 21 times at this location. Vegetation sample OS-HSM-VE07-01, collected at the same location as OS-HSM-SO-06-01, contained Se at 52 times the vegetation action level. All other analytes were below the RMP action levels.

Soil sample OS-HSM-SO-08-01, located to the west of OS-HSM-SO-06-01 and further down stream from the Nashville and Rich Placer tunnels, had lower concentrations for nearly all the analytes than the prior sample location with action levels exceeded for Cd, Cr, Ni, Se, V, and Zn. Se was nearly 12 times greater than the soil action level.

3.4 Inspection Findings

The Hot Springs mine is located on a ridge on the east side of Bear Lake National Wildlife Refuge. The North Lake tunnel, located on the west face, lies approximately 65 feet up the face of the mountain. The adit was partially filled-in between 2001 and 2003 by the current mine owner, Rhodia, Inc. The adit runs 1700 feet due east to the lower ore. It drifts about 300 feet north along the lower ore horizon and about 150 feet south along the same horizon. At the east end of the adit, there is a 1,200 foot rise to the surface on the east side of the mountain. The surface opening of the rise is said to be sealed. Evidence of a foundation is located at the foot of the North Lake tunnel with a number of old rail car tracks lead out.

A large waste dump, approximately 300 feet long north to south, and 50 feet from east to west, lies between the North Lake tunnel and Bear Lake Road. About 25 percent of the dump lies north of the adit and is comprised almost completely of limestone. The remaining portion of the dump, south of the adit, is said to be mainly limestone with thin veneer of black shale.

The discovery area lies south of the North Lake tunnel on the west-facing side of the ridge. Access to the area requires entry through private property and four-wheel drive vehicles. There are two production adits; the Nashville tunnel on the west and the Rich Placer tunnel on the east. They are located about 50 feet up slope from the valley floor and are approximately 100 feet apart. Below each tunnel is a waste dump. Each dump is about 25 feet wide and about 20 feet in depth. The dumps are mostly black shale and are vegetated on the flat tops, but not on the side slopes. The original discovery adit lies up slope to the northeast of the Rich Placer tunnel and is collapsed shut.

Below the Nashville and Rich Placer tunnels lies a dry streambed that runs to the west, winding eventually to Bear Lake. The U.S. Fish and Wildlife Service have expressed concern with the Hot Springs Mine due to its potential to release runoff constituents to the Bear Lake National Wildlife Refuge (**Figure 6**).

Hot Springs Mine
 Preliminary Assessment Report
 August 2007



Figure 5. Hot Springs Mine Sample Locations from DEQ, 2004a.

Hot Springs Mine
Preliminary Assessment Report
August 2007

Table 2. Hot Springs Mine Soil Sampling Analytical Results

Sample ID	Media	Metal Concentrations in Parts Per Million (ppm)								Species/Type
		Cd	Co	Cr	Cu	Ni	Se	V	Zn	
OS-HSM-SO-01-01	Soil	190	3.9	880	120	370	74	2000	2900	Composite sample from black shale waste dump
OS-HSM-SO-01-02	Soil	150	3.1	760	100	320	72	2000	2800	Composite sample from black shale waste dump
OS-HSM-SO-03-01	Soil	25	4	180	30	90	6.2	310	520	90% soil 10% black shale
OS-HSM-SO-05-01	Soil	75	3.2	700	87	180	460	970	1200	Black shale waste
OS-HSM-SO-06-01	Soil	52	4.3	470	61	130	160	610	880	Streambed soil
OS-HSM-SO-08-01	Soil	34	6	280	47	100	88	370	560	50% soil, 40% gravel, 10% tan shale
Areawide Risk Criteria		9.2		187.0	402	44	7.5	72	210	

Table 3. Hot Springs Mine Vegetation Sampling Analytical Results

Sample ID	Media	Metal Concentrations in Parts Per Million (ppm)								Species/Type
		Cd	Co	Cr	Cu	Ni	Se	V	Zn	
OS-HSM-VE-02-01	Vegetation	6.5	0.2	0.52	17	2.9	8.3	0.75	89	Rabbit brush
OS-CMS-VE-04-01	Vegetation	<0.4	1.1	<0.4	15	<2.0	1.2	<0.4	26	Wild rye grass
OS-HSM-VE-07-01	Vegetation	<0.4	0.26	<0.4	16	<2.0	260	<0.4	28	Wild rye grass
Areawide Risk Criteria		4.2		30.6	88.0	35.5	5.0	55.9	615.0	

This page intentionally left blank for correct double-sided printing.

Section 4. Pathway and Environmental Hazard Assessment

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

4.1 Surface Water

An intermittent stream channel runs below the Nashville and Rich Placer tunnels, winding to the west and Bear Lake. The stream was dry during the May 2002 site visit based on photograph 9.7 (Appendix).

Bear Lake and the Bear Lake National Wildlife Refuge wetlands are located adjacent to the mine. Bear Lake can be seen in the foreground of photograph 9.4.

4.2 Soil/Air Exposure

Access to the discovery area of the mine is restricted by private property and requires four-wheel drive vehicles. Access to the North Lake tunnel and waste rock dump is not restricted and a dirt road runs near or across the toe of the dump.

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 Groundwater

Idaho Department of Water Resources (IDWR) records show ground water flow in the area moves from the highlands toward the Bear Lake Valley floor. This flow is consistent with the topography of the area. It should be noted that the mine is located on or close to a fault (Figure 3), which may also affect local ground water flow patterns. Two springs in the area are located approximately 0.3 to 0.4 mile north and south of the Nashville tunnel. The spring to the north is noted on USGS topographic maps as a hot spring and the spring to the south is the source of hot water for the Bear Lake Hot Springs pool located to the west of the mine. Both hot springs are on or near faults

Water levels from domestic wells nearest to the site are approximately 16 feet below ground surface (bgs).

According to IDWR records, 6 domestic water wells are reported to be located within a 4-mile radius of the site (Figure 6). All of these wells are located south of the mine along the east shore of Bear Lake. Two public water systems are located within a 4-mile radius of the site:

- Bear Lake Hot Springs spring is located 0.3 miles S of the mine. According to Safe Drinking Water Information System (SDWIS) data (DEQ, 2006), this system is a non-community system, services 25 users, and has no water issues.
- East Shore Subdivision well is 4 miles south of the mine. According to SDWIS, the system services 30 users.

The public water wells shown in Figure 6 are likely cross-gradient from any of the mining activities; the blue hatching, seen at the bottom of Figure 3, represents the 3 year travel time for groundwater to migrate from the perimeter of the hatching to the extraction well. This gives a relative groundwater travel time for the area south of the mine. Wells appear to be completed in the alluvial materials associated with the Bear Lake Valley. Here groundwater is very shallow and would travel at a much faster rate than in the surrounding highlands.

4.3.1 Potential Receptors

Potential receptors include local residents, ranchers, hunters, anglers, trail riders (motorized and non-motorized), campers, and 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-mile radius of the site is a mix of private, BLM, and US Fish and Wildlife land. The parcels of land occupied by the mine and waste dumps are owned by private parties.

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 U.S Fish and Wildlife workers, in addition to outdoor recreation enthusiasts, may occasionally be within 200 feet of the site.

4.3.3 Plant and Animal Species of Concern

Two plant and seventeen animal species are listed as species of concern in the proximity of the site (F&G, 2002). Table 4 lists all plant and animal species within a four mile radius and the 15 mile TDL of the mine. Figure 7 shows the status of these species.

4.3.4 Soil Sample Concentrations

Soil sample contained the following concentrations:

- Selenium (Se) from 6.2 to 460 mg/kg
- Copper (Cu) from 30 to 120 mg/kg
- Cobalt (Co) from 3.1 to 6.0 mg/kg
- Cadmium (Cd) from 25 to 190 mg/kg

Hot Springs Mine
Preliminary Assessment Report
August 2007

- Chromium (Cr) from 180 to 880 mg/kg
- Vanadium (V) from 310 to 2000 mg/kg
- Nickel (Ni) from 90 to 370 mg/kg
- Zinc (Zn) from 520 to 2900 mg/kg

Complete analytical results are presented in Table 2. Arsenic was not analyzed for during this sampling event.

Table 4. Plant and Animal Species of Concern in the Hot Springs Mine Area

Common Name	Scientific Name	Classification	Ecological Concern
Purple Meadow Rue	<i>Thalictrum dasycarpum</i>	Vascular Plant	
Western Glasswort	<i>Salicornia rubra</i>	Vascular Plant	
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Vertebrate Animal	Wintering Area
Black Tern	<i>Chlidonias niger</i>	Vertebrate Animal	Colonial Breeding Area
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	Vertebrate Animal	Colonial Breeding Area
California Gull	<i>Larus californicus</i>	Vertebrate Animal	Colonial Breeding Area
Caspian Tern	<i>Sterna caspia</i>	Vertebrate Animal	Colonial Breeding Area
Cattle Egret	<i>Bubulcus ibis</i>	Vertebrate Animal	Colonial Breeding Area
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Vertebrate Animal	Colonial Breeding Area
Eared Grebe	<i>Podiceps nigricollis</i>	Vertebrate Animal	Colonial Breeding Area
Forster's Tern	<i>Sterna forsteri</i>	Vertebrate Animal	Colonial Breeding Area
Franklin's Gull	<i>Larus pipixcan</i>	Vertebrate Animal	Colonial Breeding Area
Northern Leopard Frog	<i>Rana pipiens</i>	Vertebrate Animal	Museum Specimen
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	Vertebrate Animal	Historic Eyre
Snowy Egret	<i>Egretta thula</i>	Vertebrate Animal	Colonial Breeding Area
Trumpeter Swan	<i>Cygnus buccinator</i>	Vertebrate Animal	Wintering Area
Western Grebe	<i>Aechmophorus occidentalis</i>	Vertebrate Animal	Colonial Breeding Area
White-faced Ibis	<i>Plegadis chihi</i>	Vertebrate Animal	Colonial Breeding Area
Whooping Crane	<i>Grus americana</i>	Vertebrate Animal	Staging Area

Hot Springs Mine
Preliminary Assessment Report
August 2007

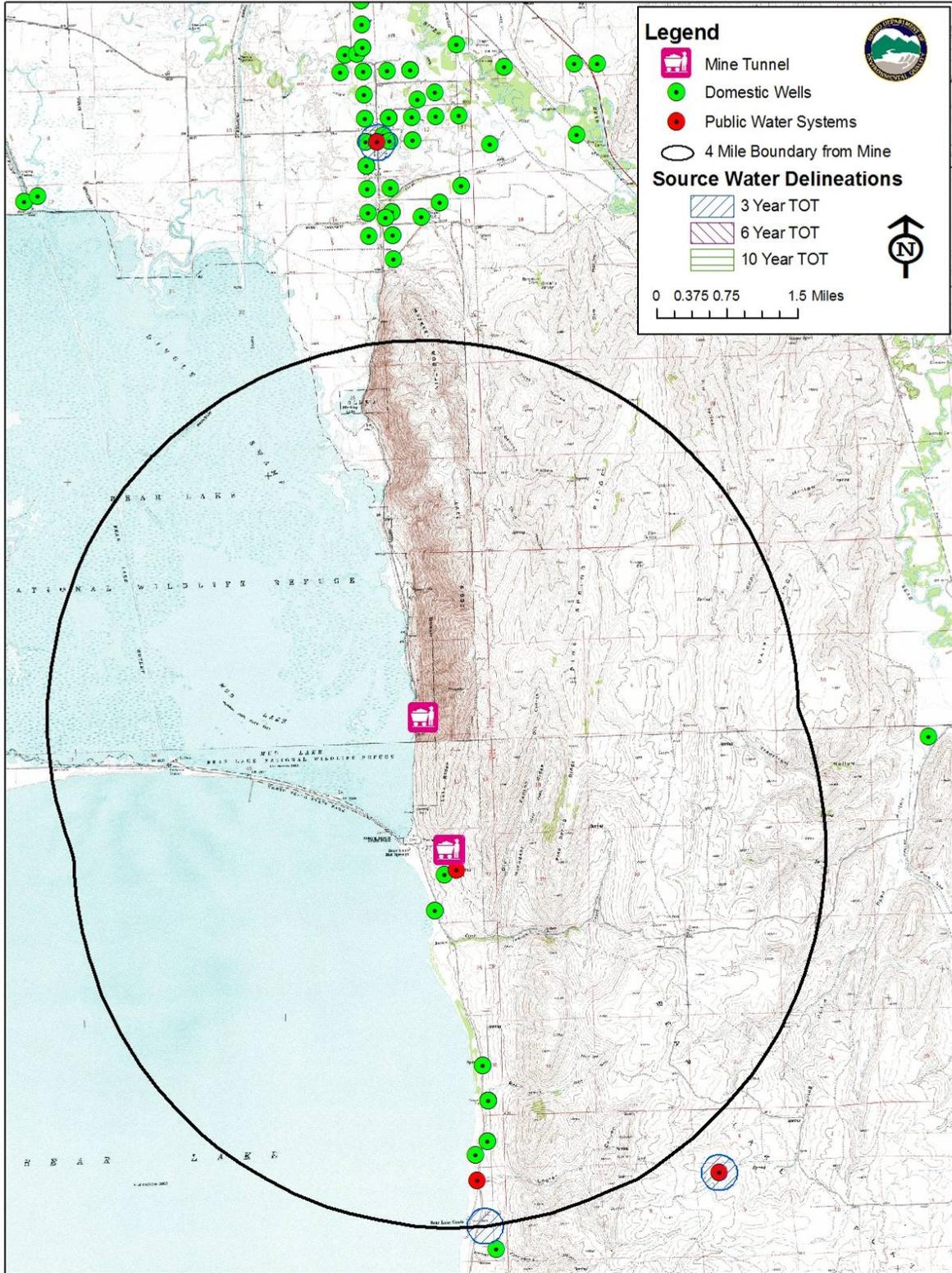


Figure 6. Domestic and Public Water System wells within a 4-mile radius of the Mine.

Hot Springs Mine
Preliminary Assessment Report
August 2007

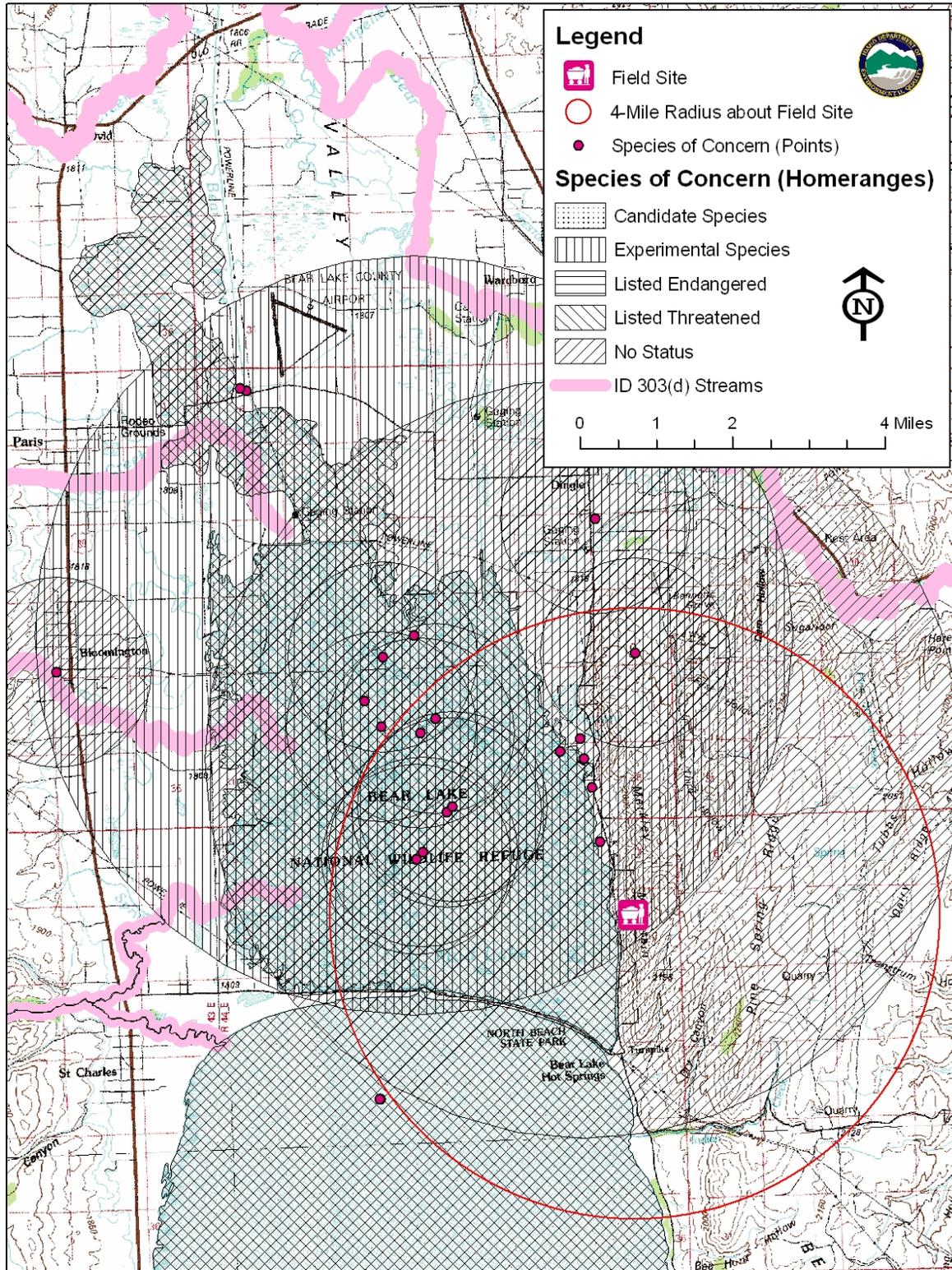


Figure 7. Species of Concern within the Hot Springs Mine Area.

This page intentionally left blank for correct double-sided printing.

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 Hot Springs 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, approximately 38,689 total acres of wetlands exist near the site or within the 15-mile TDL. Due to the location of the North Lake waste dump on the edge of the largest of these wetlands impacts to wetland areas due to historic mining activities at this mine are likely.

5.2 Impacts on Water Quality

Surface and ground water impacts related to the mine are currently unknown. However, Bear Lake, Bear Lake Wildlife Refuge wetland, and several domestic and a public water supply wells are located near the mine. Based on the distance to surface water sources and domestic wells completed in valley sediments containing very shallow groundwater, there is a high potential for the Hot Springs Mine to impacted local water systems.

5.3 Potential Exposure for Wildlife and Vegetation

The waste rock piles 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. Wildlife, such as deer and elk, that may be 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 has access to the mine via the roads. There are no reported locked gates or posted signs in proximity to the mine site, but private property must be crossed to access at the majority of the waste dumps (DEQ 2004a).

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. According to the IDFG database, a large number of desirable game fish are native or are stocked in Bear Lake (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 because access is not restricted.

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 piles 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 showed 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 Hot Springs Mine site in the form of further site investigation, waste consolidation erosion controls, closing adits and openings on the site, and reclamation improvements.

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

- Relocate the North Lake waste dump to the Nashville and Rich Placer waste dumps and cap dumps.
- 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 and public wells
- Sampling of surface water near the toe of the North Lake waste dump and surface water and soil sample near the point the intermittent stream enters Bear Lake.

References

- Bond J.G., 1978. Geology of Idaho, Geologic Map of Idaho 1:500,000. Idaho Department of Lands, Bureau of Mines, University of Idaho, Moscow.
- Bureau of Land Management, 2000. Final Environmental Impact Statement, Dry Valley Mine – South Extension Project.
- Idaho Department of Environmental Quality (DEQ), 2007. Mine Waste Management in Idaho: Selenium Investigations in Southeast Idaho. Available URL: http://www.deq.idaho.gov/waste/prog_issues/mining/selenium.cfm
- Idaho Department of Environmental Quality (DEQ), 2006. Safe Drinking Water Information System (SDWIS).
- Idaho Department of Environmental Quality (DEQ), 2004a. Orphan Mine Site Preliminary Assessment Screening Report. Prepared jointly by DEQ, Idaho Department of Lands, U.S. Bureau of Land Management, and the U.S. Forest Service. Available URL: http://giscenter-ims.isu.edu/SISP/Area_Wide_Reports.html
- Idaho Department of Environmental Quality (DEQ), 2004b. Area Wide Risk Management Plan: Removal Action Goals and Objectives, and Action Levels for Addressing Releases and Impacts from Historic Phosphate Mining Operations in Southeast Idaho. Available URL: http://giscenter-ims.isu.edu/SISP/Area_Wide_Reports.html
- Idaho Department of Environmental Quality (DEQ), 1998. 1998 303(d) list. Available URL: http://www.deq.idaho.gov/water/data_reports/surface_water/monitoring/integrated_report.cfm#2002
- Idaho Department of Fish and Game (IDFG), 2002. Available URL: http://www2.state.id.us/fishgame/info/cdc/plants/vasc_plants&status_n-r.htm
- Idaho Department of Water Resources (IDWR), 1997. COVERAGE IDOWN -- Idaho Surface Ownership.
- IDWR2, 2002. GIS shape file of well database.
- Montgomery Watson, 1998. Regional Investigation Report. Cited from Draft Final Investigation Report for central Farmers Fertilizer Facility, Georgetown Canyon, August 2006.
- Natural Resource Conservation Service, 2007. Climate Narrative for Bear Lake County, Idaho <ftp://ftp.wcc.nrcs.usda.gov/support/climate/soil-nar/id/bearlake.doc>
- Ralston, D.R., T.D. Brooks, M.R. Cannon, T.F. Corbet, Jr., H. Singh, G.V. Winter, 1980. Interactions of Mining and Water Resources in the southeastern Idaho Phosphate Field. Idaho Water Resources Research Institute, University of Idaho, Moscow, Idaho.
- United States Geological Survey (USGS), 1991. Digital map file of major land uses in the United States.
- United States Geological Survey (USGS), 2000. A History of Phosphate Mining in Southeast Idaho. Available URL: <http://pubs.usgs.gov/of/2000/of00-425/>
- Western Regional Climate Center, 2007. Lifton Pumping Station, Idaho (105275) and Conda, Idaho (102071), August 6; Available URL: <http://www.wrcc.dri.edu/cgi-bin/>

Hot Springs Mine
Preliminary Assessment Report
August 2007

This page intentionally left blank for correct double-sided printing.

Appendix: Photographs

The following photographs were taken during the Preliminary Assessment (DEQ, 2004a).

Hot Springs Mine
Preliminary Assessment Report
August 2007



Photo 9.1
Hot Springs Mine, partially open North Lake Tunnel. View to east.



Photo 9.2
Hot Springs Mine, sample location for OS-HSM-SO-01-01 and OS-HSM-VE-02-01. Black waste shale dump with volunteer vegetation. View to northeast.

Hot Springs Mine
Preliminary Assessment Report
August 2007



Photo 9.3
Hot Springs Mine, sample location for OS-HSM-SO-03-01 and OS-HSM-VE-04-01. Low area below North Lake Tunnel waste dump. View to north.



Photo 9.4
“Discovery Area” at Hot Springs Mine. Bear Lake at left center, twin waste dumps at right center, and overturned chert at top right. View to northwest.

Hot Springs Mine
Preliminary Assessment Report
August 2007



Photo 9.5
Hot Springs Mine, Nashville Tunnel on left and Rich Placer Tunnel on right. View to north.



Photo 9.6
Hot Springs Mine, sample location OS-HSM-SO-05-01, just off toe of Rich Placer waste dump.

Hot Springs Mine
Preliminary Assessment Report
August 2007



Photo 9.7

Hot Springs Mine, sample location for OS-HSM-SO-06-01 and OS-HSM-VE-07-01. Samples from dry streambed, view to southwest.

Hot Springs Mine
Preliminary Assessment Report
August 2007

This page intentionally left blank for correct double-sided printing.

Report Index

- action levels, 2, 14, 15, 16
- aquatic life, 2
- Area Wide Risk Management Plan, v, 2, 14, 27, 28
- Beach Road, 2
- Bear Lake, 9
- Bear Lake National Wildlife Refuge, 10, 16
- Bear Lake sculpin, 10
- Best Management Practices (BMPs), 2
- biking, 9
- black crappie, 10
- Bloomington, 21
- bluegill, 10
- boating, 9
- Bonneville Cutthroat Trout, 9
- brook trout, 10
- brown trout, 10
- Bureau of Land Management (BLM), 1
- channel catfish, 10
- Cherty Shale, 8
- City of Bloomington, 21
- common carp, 10
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 1
- Dinwoody Formation, 8
- domestic wells, 20, 26
- fishing, 9
- Forest Service (USFS), 1
- Grandeur Limestone, 8
- green sunfish, 10
- ground water flow, 20
- hiking, 9
- Hot Springs Mine, 2
- Idaho Department of Water Resources (IDWR), 20
- Idaho Phosphate Mining Resource Area, 1, 2, 4, 8
- Idaho-Wyoming-Utah Overthrust belt, 9
- largemouth bass, 10
- limestone, 8, 16
- longnose dace, 9
- Mesozoic, 7, 8
- Middle Pleistocene, 7
- Mineral Hill Mining District, 1
- mottled sculpin, 9
- mountain sucker, 9
- mountain whitefish, 9
- National Toxics Rule, 2
- North Lake tunnel, 6, 16
- off-road vehicle, 9
- orphan mine site, 1, 2
- Paiute sculping, 9
- Paleozoic, 7, 8
- Paris Overthrust, 9
- Permian Era, 8
- Phosphoria Formation, 8
- redside shiner, 9
- Rex Chert, 8
- rhyolite, 7
- Saint Charles, 2
- schools, 21
- sedimentary rocks, 7
- selenium, 1, 2, 28
- smallmouth bass, 10
- soil ingestion, 20
- speckled dace, 9
- swimming, 9
- tiger muskie, 10
- Utah chub, 9
- Utah sucker, 9
- walleye, 10
- waste piles, 26, 27
- Wells Formation, 8
- wetland, 10, 26
- white crappie, 10
- yellow perch, 10