Bloomington Canyon Mine
Preliminary Assessment Report

Bear Lake County
State of Idaho

Department of Environmental Quality

October 2007

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

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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

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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 Bloomington Canyon 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 Orphan 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 Bloomington Canyon Mine site is located in Bear Lake County, Section 21, Township 14 South, Range 43 East, approximately 1 mile west of Bloomington, Idaho (Figure 2). The site is located on the south-facing slope within Bloomington Canyon, on private land and can be reached from Bloomington by driving east along Bloomington Creek Road for approximately one mile. The public has access to the mine from the main road. There are no locked gates or posted signs in the proximity of the mine site.

The topography around the site is illustrated by Figure 2; Figure 3 shows the proximity of domestic and public water system wells within four miles of the site and surface water time of travel (TOT) delineations for 3, 6, and 10-year spans.

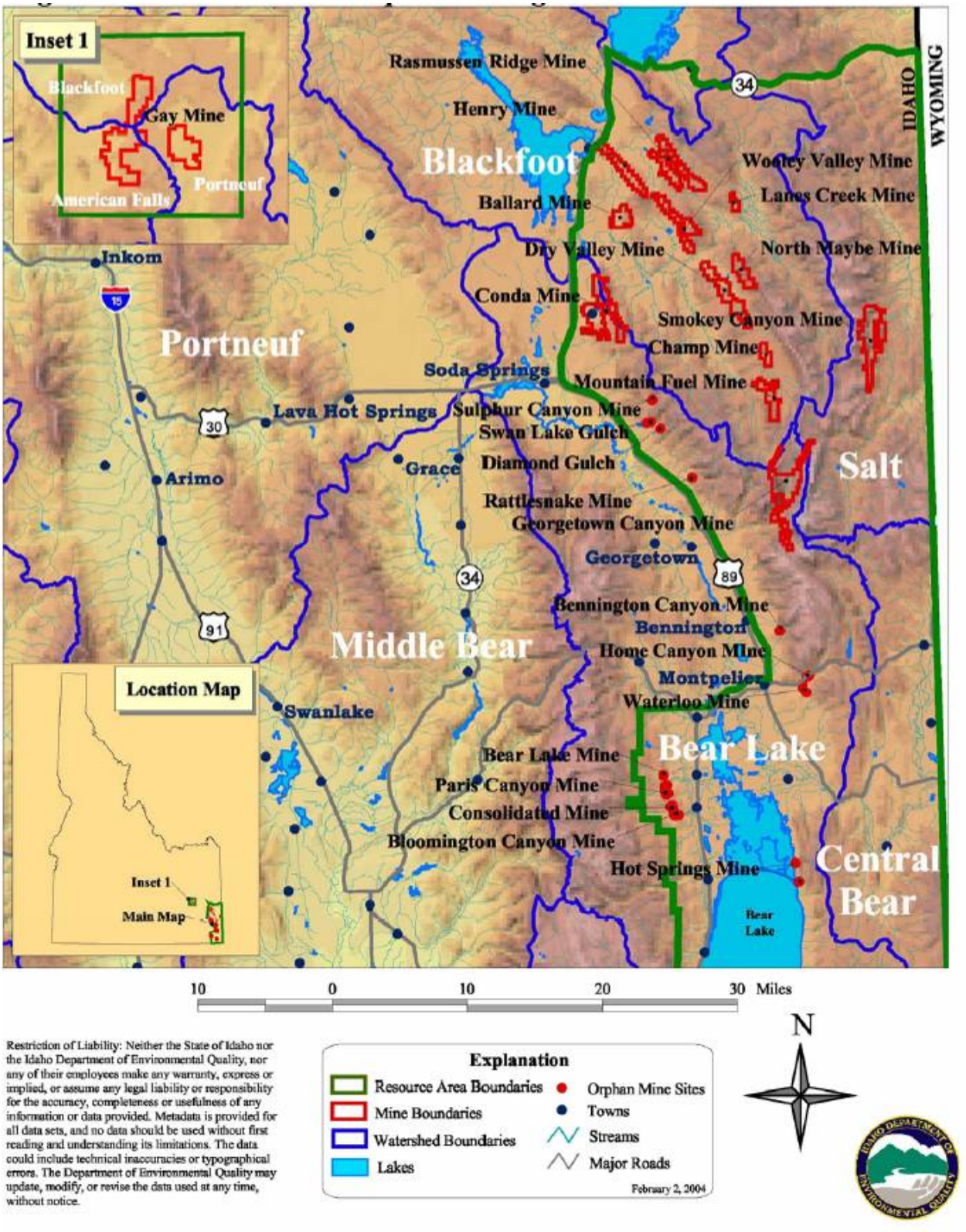

Figure 1. Location of the Bloomington Canyon Mine and delineation of the Southeast Idaho Phosphate Mining Resource Area (green boundary).

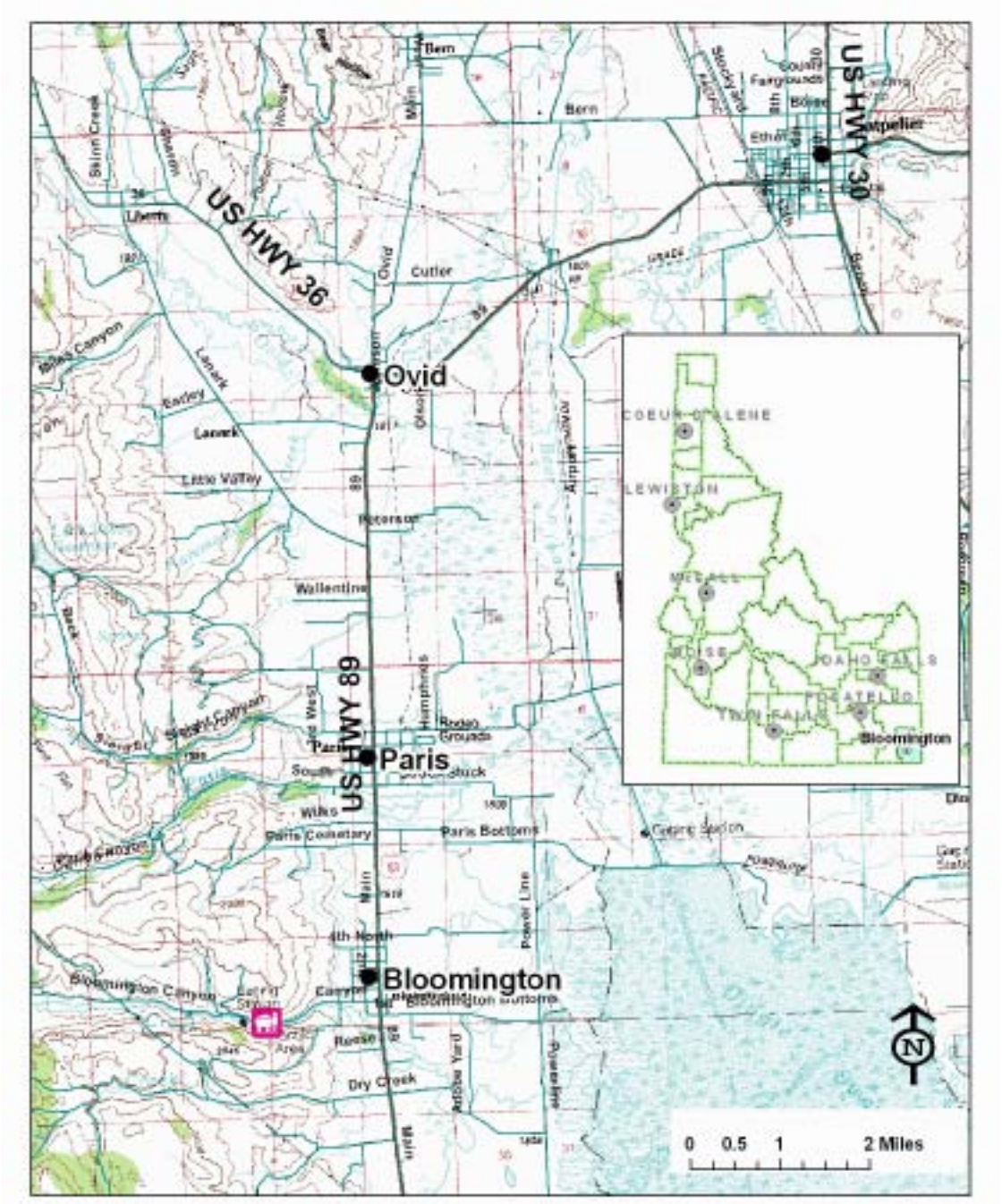

Figure 2. Topographic overview of the Bloomington Canyon Mine area.

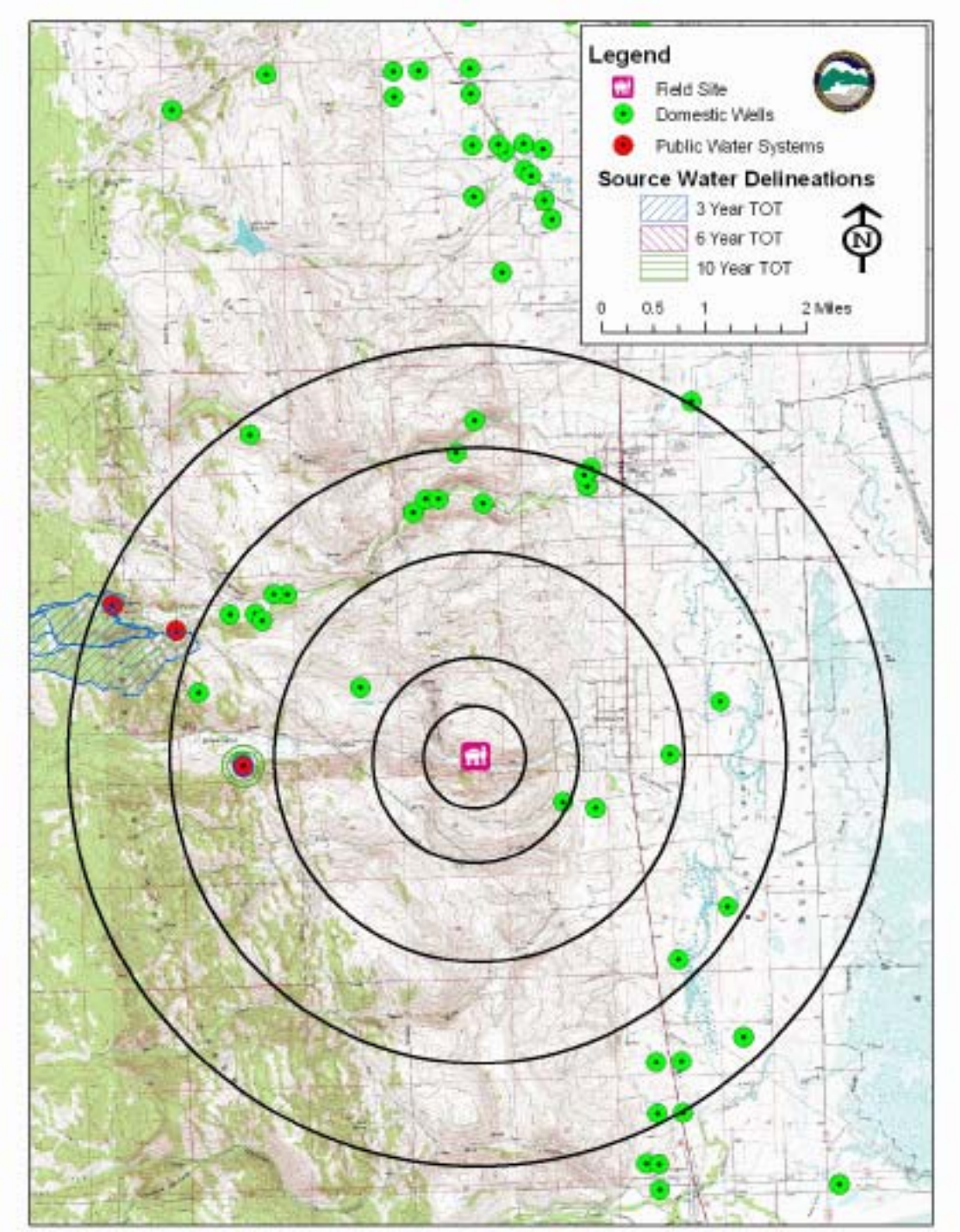

Figure 3. Domestic and public water system wells within a 4-mile radius.

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

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

2.1 Ownership

The Bloomington Canyon Mine property is on private property located on the south slope of Bloomington Canyon. The Ruby Company was granted the initial phosphate mining lease; they sold their interest to Earth Sciences Inc. (ESI) in 1973. In 1984, ESI sold the federal lease to the Conda Partnership. ESI reclaimed the lease in 1993.

Currently, the site is located on private land owned by ESI and leased by Ray McKay Bateman. ESI and the Bateman family granted site access for the initial PA in 2002. According to the Bear Lake County Tax Assessor, the current owner of record is Earth Sciences, Inc., 8100 S. Parkway, Suite B-2, Littleton, Colorado, 80120.

2.2 Historical Perspective

The first development of the phosphate ore in the Canyon was reported by Richards and Mansfield (1911) as several prospects that were opened in the phosphate shales. Mansfield reported that the discovery of *phosphate float material* on the south side of the Canyon led to the opening of two pits by H. H. Broomhead of Bloomington. However, development of the Consolidated Mine in 1930, in Little Canyon, a branch of Bloomington Canyon to the north less than a mile away, did not encourage further exploration and development of the phosphate in the canyon proper, but several declines to the ore bearing zones were opened during Wyodak Coal's vanadium exploration in 1942 and 1943; their T14S decline was approximately 741 feet in length.

In November 1961, the Ruby Company, which would become Simplot Industries, Inc. in 1966 (USGS, 2000), applied for and was granted a phosphate mining lease (I-02982). A phosphate lease sale was held on June 7, 1962 with the Ruby Company as the high bidder. A phosphate lease, I-012982, was issued to the Ruby Company on July 1, 1962 for Lot 4 and the SW1/4 SE1/4 of Section 21, T14S, R43E. The Ruby Company did not develop the lease.

ESI performed some preliminary exploration work on the lease in 1972, while the sale of the mine was being negotiated with Simplot. The Ruby Company sold their lease to ESI in 1973. The preliminary exploration consisted of an 8 x 8 1/2 foot tunnel driven about 150 feet deep into an outcrop just west of the Wyodak T14S incline to collect bulk samples. In August 1973, this tunnel was extended to the west and north until a major fault was encountered about 700 feet from the portal. An offset drift was driven 190

eastward to intercept the vanadiferous zone. This work was concluded in 1974 and is referred to as the 1974 tunnel.

In 1975, ESI located a new portal a few hundred feet east of the T14S incline. This development work consisted of about 2,700 feet of underground workings and is called the 1975 tunnel (Figure 4). The purpose of the 1975 tunnel was to prove the success of a continuous mining machine in excavating phosphate ore, to provide bulk samples, and to determine existing mining conditions in the phosphate rock. The vanadiferous phosphate ore mined in 1973-1975, was shipped to a processing plant in Wyoming.

In 1984, the federal lease was sold to the Conda partnership. They did no work on the property and the lease was returned to ESI in 1993, at which point ESI reclaimed the portal area.

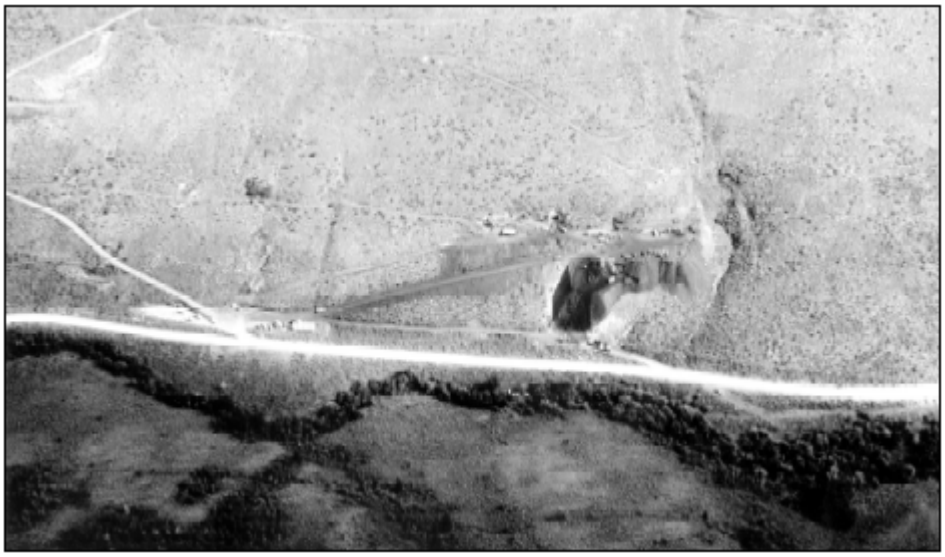

Figure 4. Bloomington Canyon Mine, August 12, 1975, showing 1974 and 1975 tunnels.

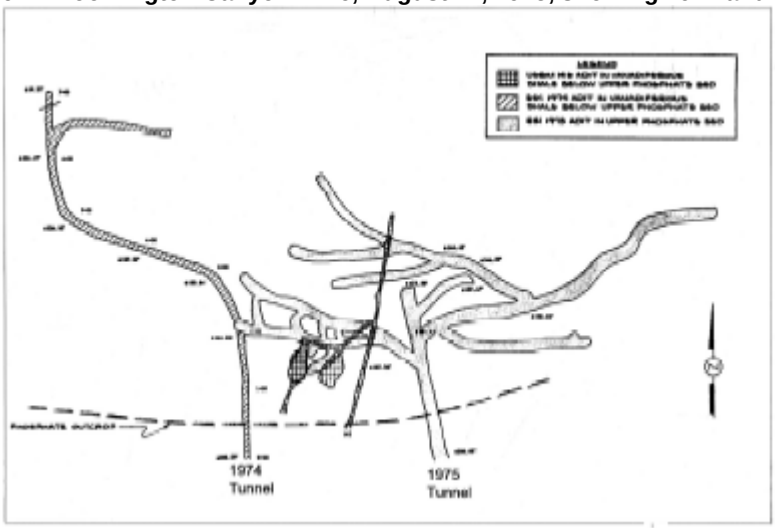

Figure 5, Underground mine map, Bloomington Canyon Mine, October 1975.

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 80s (˚F) and average minimum temperatures in low to mid 40s (˚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 30s (˚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, approximately 6 miles southeast of the site, 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) state 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 Bloomington Canyon Mine lies within the northern region of the Basin and Range physiographic province and is characterized by linear, north-trending fault-bounded ranges and basins created by extensional techtonism initiated during the last 10 to 20 million years (Figure 6). 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 ---Ownership

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 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, units are presented from top to bottom, as youngest to oldest.		

At the eastern edge of the resource area, the Phoshporia 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 that typical concentrations found in other marine sedimentary rock. (Montgomery Watson, 1998)

2.6 Structure

The Bloomington Canyon 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. Thrusting began as movement on the Paris Thrust, the westernmost thrust plate during the late Jurassic to early Cretaceous.

The major thrust plate in the study area is the Paris Overthrust. The ore bearing units at the Consolidation Mine less than one mile from the Bloomington 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, in the west limb of a syncline. They strike close to N45ºW.

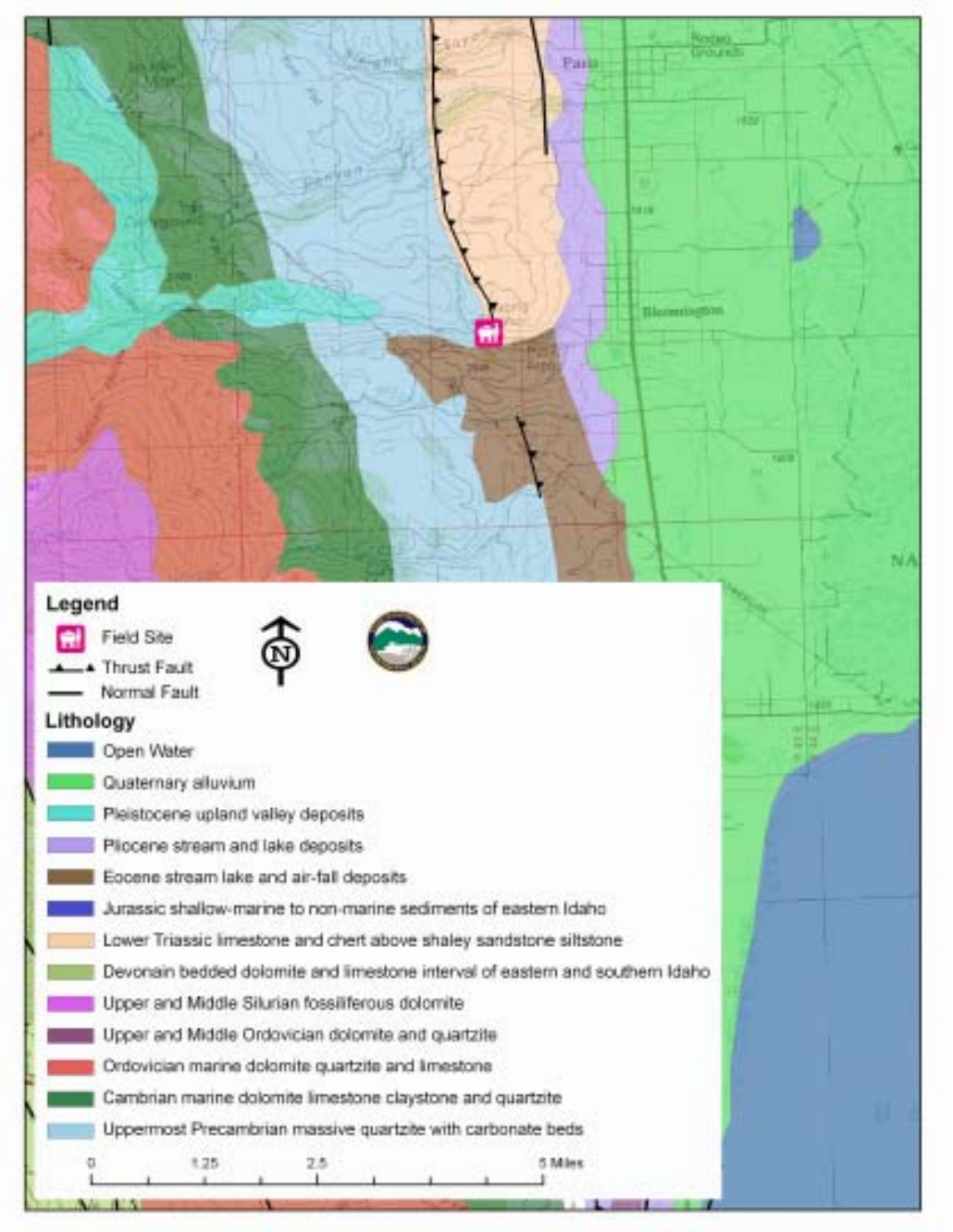

Figure 6. Geologic Map of Bloomington Canyon Mine Area.

2.7 Hydrogeology

The major ground water flow systems within the phosphate mining resource area exist in the valley fill sediments, which consist of 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

Future land use could potentially include some year-round and/or seasonal homes on the private parcels of property. However, given the sparse population density in the area and the predominately sagebrush vegetation type, this land use is not anticipated in the near future.

2.9 Area Fish Species

According to the Idaho Department of Fish and Game (IDFG) database, fish in Bloomington Creek include redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], Bonneville cutthroat trout [Oncorhynhus clarki Utah], rainbow (hatchery) trout, and brook trout [Salvelinus foninalis] (IDFG, 2002).

2.10 Wetlands

Official wetland surveys for the area indicate that Little Canyon contains no wetland areas. However, within a 15-mile radius there are approximately 13,100 acres of wetlands.

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 on Figure 7, and Photos 11.5, 11.6, 11.7, and 11.8 in the Appendix. Samples were analyzed for trace metals and compared to action levels developed for the Area Wide Rick 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 were taken at the site, as listed in Table 2 and Table 3: four soil, three vegetation and one duplicate:

- The first sample, designated OS-BLO-SO-01-01 (Appendix Photo 10.5), was taken from the top of the dump. The sample was composed of about 70% black shale and 30% tan sandstone and limestone. The vegetation sample collected from the same location (OS-BLO-VE-02-01) was of bitterbrush.
- Samples OS-BLO-SO-03-01 and OS-BLO-VE-04-01 were taken southwest of the dump, between the berm and Bloomington Canyon Road. The area was highly vegetated with sagebrush. The soil sample was composed of brown, dry "fluffy" , organic soil with about 10% rounded gravel. Western Yarrow was collected for the vegetation sample.
- The next two samples were collected in the drainage east of the waste dump and below the berm. The soil sample, OS-BLO-SO-05-01, was composed of 30% brown soil, 20% brown clay and 50% well rounded carbonate gravel. A duplicate sample, OS-BLO-SO-05-02, was also collected. Wild Geranium was collected as vegetation sample OS-BLO-SO-06-01.
- The final sample was a soil sample taken from across the road at the mouth of the culvert approximately 30 feet north of the stream edge. The soil sample, OS-BLO-SO-07-01, was composed of dark brown to black, highly organic, clay rich soil. Analytical results are presented in Table 2.

3.3 Sampling Results

Samples OS-BLO-SO-01-01(soil) and OS-BLO-VE 02-01 (vegetation) were collected for the top of the waste pile. The soil sample showed elevated concentrations of cadmium (Cd), chromium (Cr), nickel (Ni), selenium (Se), vanadium (V), and zinc (Zn). The vegetation sample consisting of Bitter Brush, which showed slightly elevated concentrations of Selenium.

Samples OS-BLO-SO-03-01 and OS-BLE-VE-04-01 were collected southwest of the waste pile and between the berm and Bloomington Canyon Road. Analytical results from the soil samples show that all metal concentrations were below Area Wide Risk Criteria (AWRC). Metal concentrations in the vegetation sample (Western Yarrow) were also below AWRC.

Table 2. Bloomington Canyon 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-BLO-SO-01-01	Soil	77	5.5	790	84	93	14	1000	590	Waste rock dump
OS-BLO-SO-03-01	Soil	7	10	140	27	28	1	100	110	Between berm and road
OS-BLO-SO-05-01	Soil	14	9.3	140	24	55	2.8	130	330	East drainage
OS-BLO-SO-05-02	Soil	13	8.6	130	22	51	4.3	130	290	Duplicate
OS-BLO-SO-07-01	Soil	130	4	830	93	140	59	1500	1200	Across road
Areawide Risk Criteria		**9.2**		**187.0**	**402**	**44**	**7.5**	**72**	**210**	

Table 3. Bloomington Canyon 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-BLO-VE-02-01	Vegetation	2.7	0.38	13	9.2	8.4	7.6	17	98	Bitterbrush
OS-BLO-VE-04-01	Vegetation	0.99	0.3	1.3	16	<2.0	0.77	1.2	22	Western yarrow
OS-BLO-VE-06-01	**Vegetation**	**0.42**	**0.26**	**1.8**	**13**	**3.4**	**4.2**	**2.3**	**39**	**Geranium**
Areawide Risk Criteria		**4.2**		**30.6**	**88.0**	**35.5**	**5.0**	**55.9**	**615.0**	

Figure 7, sampling locations at the Bloomington Canyon Mine.

3.4 Inspection Findings

DEQ conducted a site visit to the mine during July 2002. The visit included a visual inspection of the Bloomington Canyon Mine and collection of eight samples: four soil samples, three vegetation samples and one duplicate sample. Several of these sampling locations are shown in Photos 11.6 through 11.9.

Visual observations from the interagency site inspection in 2002 indicate that the Bloomington Mine was solely an underground operation, consisting mainly of two open declines about 200 feet apart, one large contoured waste dump, and a reclaimed road. Bloomington Creek flows easterly within 200 feet of the waste dump.

The waste dump is large; several hundred feet from east to west and approximately 200 feet north to south. Volume of the waste pile would be approximately 22,000 cubic yards, according to field measurements and approximate measurements from a Google Earth photo. The thickness was estimated to be relatively thin, less than 15 feet deep. The waste dump and access road from the west has been contoured to the slope. The eastern half of the waste dump is moderately vegetated and composed of a mixture of Phosphoria Formation lithologies. The west half of the dump has almost no vegetation and is composed of mainly black shale.

Most of the area has been strongly eroded. A stone and earth berm separates the waste dump from the Bloomington Canyon Road. Erosion of black shale washing over the berm and onto the road is evident.

There are three declines at the mine: the centrally located T14S vanadium tunnel, the 1974 tunnel, and the 1975 tunnel. The T14S tunnel has been dozed closed and is no longer evident. At one time, both the 1974 and 1975 tunnels appear to have been closed, however, both tunnels are currently open enough for human entry (DEQ 2002). The openings at the 1974 and 1975 tunnels are approximately 2 feet and 4 feet in circumference respectively.

Directly east of the site is a small drainage that runs past the site into Bloomington Creek. Directly south of the site is a culvert that runs under the road and into Bloomington Creek.

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Section 4. Pathway and Environmental Hazard Assessment

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

4.1 Surface Water

Bloomington Creek headwaters are located approximately eight miles west of the mine site in the Bear River Range. The creek flows east within 200 feet of the mine and east into Bear Lake Valley approximately one mile east of the site near the town of Bloomington. Bloomington Creek is designated as a 303(d) stream for not meeting water quality standards for sediment (DEQ, 1998).

There are approximately 13,000 acres of wetland within the 15 mile Target Distance Limit (TDL) of the site. This area encompasses the large wetlands north and around the northern perimeter of Bear Lake.

4.2 Soil/Air Exposure

The mine is located on Bloomington Creek Road; access to the mine site is not restricted or posted, so the public has easy access to the mine adits and waste rock. Waste rock has been noted on the road, so it is assumed that dust-containing metals would occur at the site and along the road, depending on wind conditions. Likewise, easy access to the site would complete the soil ingestion pathway for casual visitors and other recreationists.

4.3 Groundwater

Idaho Department of Water Resources (IDWR) records show ground water flow in the area moves from the highlands eastward 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 6), which may also affect local ground water flow patterns.

It has not been determined whether the mine is located along a gaining or losing section of Bloomington Creek.

Water levels from domestic wells nearest to the site vary from 218 feet below ground surface (bgs) on the ridge east of the mine to approximately 18 feet bgs along Bloomington Creek, to approximately 3 feet bgs on the valley floor.

According to IDWR records, 32 domestic water wells are reported to be located within a 4-mile radius of the site (Figure 3). The majority of these wells are located along Bear Lake Valley, close to the nearby towns of Bloomington and Paris. Three public water systems are located within a 4-mile radius of the site:

- The City of Bloomington spring well is located slightly more than 2 miles west of the site. According to Safe Drinking Water Information System (SDWIS) data (DEQ, 2006), this system services 585 users and has no water issues.
- The City of Paris spring well is 3.1 miles WNW of the site. According to SDWIS, the system services 251 users and has had detections of selenium (1982 and 1999), arsenic (1996) and cyanide (1992). However, all the detections have been below Maximum Contaminant Levels (MCLs).
- The USFS Paris Springs Campground spring well is located 3.8 miles WNW of the mine. According to SDWIS, the spring well services 25 users and has had no water issues. This well is sampled for nitrates only.

The public water wells shown in Figure 3 are up-gradient from any of the mining activities; the blue hatching represents 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 west of the mine. East of the mine site, 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, hunters, anglers, cattlemen, trail riders (motorized and non-motorized), campers, and, rarely, tourists. Cattle activity surrounding and within the mine site is unknown. Residents and outdoor enthusiasts remain the likeliest potential receptors, as they reside nearby or use surrounding land for recreational activities.

The land within a two-mile radius of the site is primarily BLM land, but minor amounts of private land exist. The parcels of land occupied by the mines 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 Forest Service 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

Species of concern in the proximity of the site are listed Table 4. Species of concern within four miles of the site include the Northern Leopard Frog, Big Eared Bat, and the Flammulated Owl.

Red Glasswort and Purple Meadow-rue are the only plant species of concern within the 15 mile TDL of the site. Animal species listed as a species of concern located within the 15 mile TDL include the California Gull, Eared Grebe, Western Grebe, Northern Leopard Frog, Double-crested Cormorant, Snowy Egret, Cattle Egret, White-faced Ibis, Franklin's Gull, Caspian Tern, Black Tern, Flammulated Owl, Townsend's Big-eared Bat, Black-

crowned Night-heron, Forster's Tern, Whooping Crane, Bald Eagle, and Trumpeter Swan (F&G, 2002).

4.3.4 Soil Sample Concentrations

Soil samples contained the following concentrations:

- Selenium (Se) from 2.8 to 59 mg/kg
- Copper (Cu) from 22 to 93 mg/kg
- Cadmium (Cd) from 7 to 130 mg/kg
- Chromium (Cr) from 130 to 830 mg/kg
- Vanadium (V) from 100 to 1,200 mg/kg
- Nickel (Ni) from 28 to 140 mg/kg
- Zinc (Zn) from 110 to 1,200 mg/kg

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

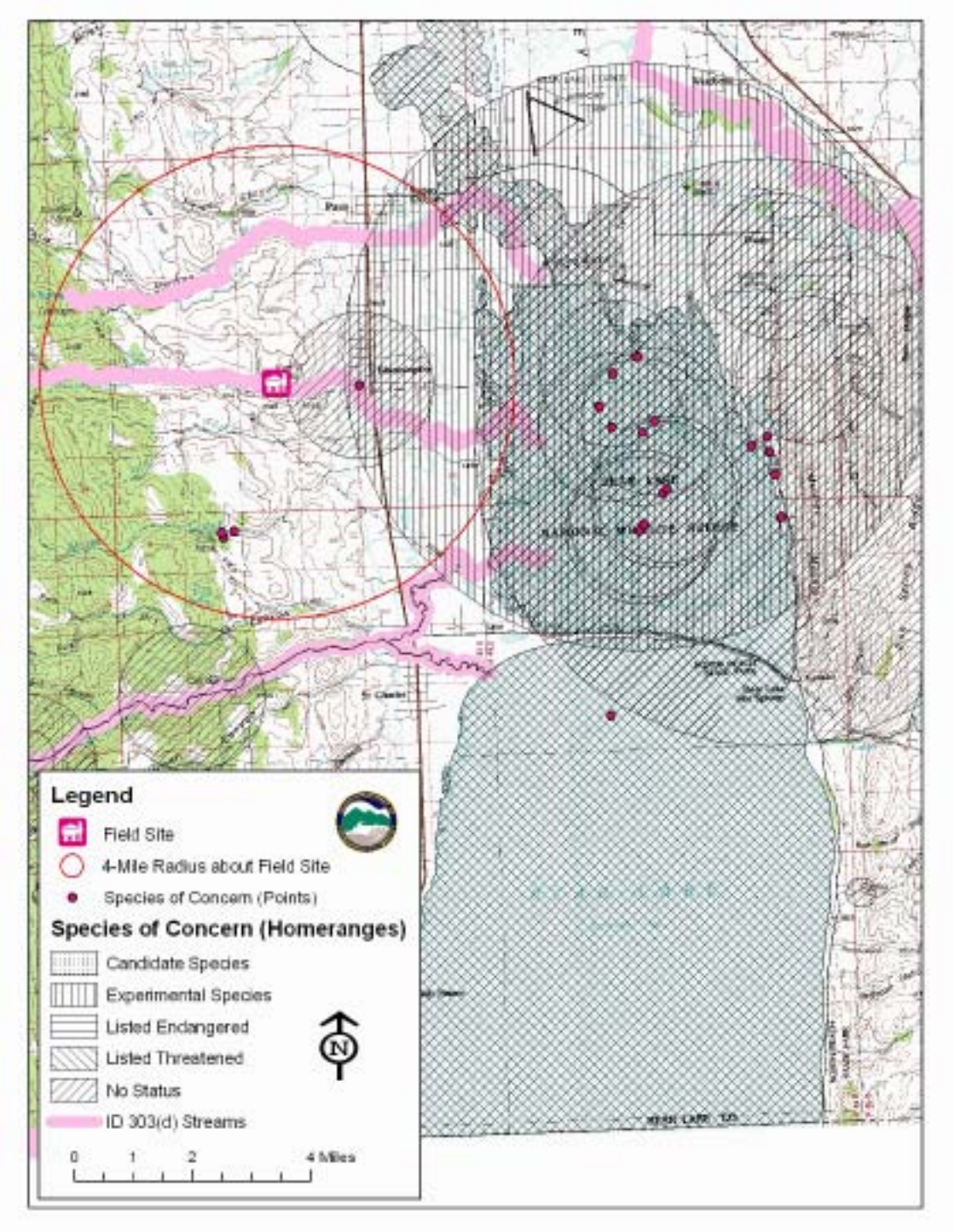

Figure 8, Species of Concern within the Bloomington Canyon mining area.

Table 4. Plant and animal species of concern in the Bloomington Canyon mining area.

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

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Section 5. Conclusions and Recommendations

The recommendations contained herein address localized release pathways, associated ecological risks, and public safety concerns regarding the presence of open adits, portals, or mine shafts. The Bloomington Canyon Mine is recommended for additional sampling, potential erosion control, and reclamation improvements. Additional actions, in the form of further site investigations, waste consolidation, erosion controls, and reclamation improvements, are also recommended.

5.1 Presence of Wetlands

Based on official wetland surveys and aerial photographs of the area, approximately 13,100 acres of wetlands exist near the site or within the 15-mile TDL.

5.2 Impacts on Water Quality

Surface water samples were not collected at the site. Samples collected up Little Canyon just west of the mine showed elevated concentrations of selenium (24 µg/l) above the Area Wide Risk Management Plan criteria for riparian habitat use and state water quality rule for regulated surface water (5 µg/l). As this was the only surface water quality sample collected in the area, it is not known what impacts intermittent flows from Little Canyon or waste rock from the mine may have on Bloomington Creek.

Ground water impacts related to the mine site are currently unknown. However, there are no known impacts, and the nearby public water systems are located west/northwest and up-gradient from the site. Potential down-gradient receptors are approximately one mile away. According to driller's logs, these wells are located in valley sediments, containing very shallow groundwater, which may represent an entirely different aquifer system than the Bloomington Canyon Mine.

5.3 Potential Exposure for Wildlife and Vegetation

The waste rock piles may present potential exposure for wildlife and vegetation. According the 2002 PA (DEQ 2004), vegetation on the waste piles varies while exhibiting significant erosion. 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 Bloomington Canyon Road. There are no fences or other barriers around the property (DEQ 2004a).

Commercial or subsistence fishing does not occur within the 15-mile downstream distance, but sport fishing does. According to the IDFG database, redband rainbow trout, Bonneville cutthroat trout, rainbow (hatchery) trout, and brook trout are present in Bloomington Creek (IDFG, 2000).

Human activity around the mine site is likely moderate, due to its proximity to the road and potential access to Bloomington Creek for fishing. 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 may present a threat from dust emissions from the waste rock on the road. Although the waste piles have been shown to have high metal concentrations, exposure for humans to elevated metal concentrations is low due to the remoteness of the site.

5.5 Recommendations

Overall, the soil, vegetation, and surface water 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 Bloomington Canyon 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:

- Observation of erosion from the waste piles to determine the extent of this material, determine the degree of impact to Bloomington Creek road, and to determine if the waste rock has reached Bloomington Creek itself.
- Re-contouring and re-vegetating those waste piles where natural vegetation has not established itself, and, if necessary, re-working the berm to prevent the waste rock from reaching the road.
- Sampling of Bloomington Creek up-gradient and down-gradient of the Bloomington Mine site to determine potential impacts.

References

Bureau of Land Management, 2000. Final Environmental Impact Statement, Dry Valley Mine – South Extension Project.

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 Fish and Game (IDFG), 2000. Redband Trout Distribution. Available URL: http://www2.state.id.us/fishgame/info/cdc/plants/vasc_plants&status_n-r.htm

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 Water Resources (IDWR), 1997. COVERAGE IDOWN -- Idaho Surface Ownership.

IDWR2, 2002. GIS shapefile 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

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/

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Appendix: Photographs

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

Photo 11.1
Bloomington Canyon Mine. View to north.

Photo 11.2
Bloomington Canyon Mine, 1974 Tunnel opening. View to north.

Photo 11.3
Bloomington Canyon Mine, T14S (Wyodak) Tunnel dozed closed. View to north.

Photo 11.4
Bloomington Canyon Mine, 1975 Tunnel opening. View to north.

Photo 11.5
Bloomington Canyon Mine, sample location for OS-BLO-SO-01-01 and OS-BLO-VE-01-01.
View to west.

Photo 11.6
Bloomington Canyon Mine, sample location for OS-BLO-SO-03-01 and OS-BLO-VE-04-01.
Erosion of black shale at the top of photo. View to northeast

Photo 11.7
Bloomington Canyon Mine, sample location for OS-BLO-SO-05-01 and OS-BLO-VE-06-01. Bloomington Canyon road on left side of photo. View to west.

Photo 11.8
Bloomington Canyon Mine, Sample location for OS-BLO-SO-07-01. Sample in Bloomington Creek flood plain. View to northwest.

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