Wood River Zinc

Millsite

Preliminary Assessment Report

Blaine County
State of Idaho

Department of Environmental Quality

February 2008

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

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1410 North Hilton • Boise, Idaho 83706 • (208) 373-0502

C.L. "Butch" Otter, Governor
Toni Hardesty, Director

February 7, 2008

Mr. Jeff Gabardi
USDA. Sawtooth National Forest
2647 Kimberly Road East
Twin Falls, Idaho 83301

Maggie Manderbach
USDA Forest Service Region IV
324 25th Street
Ogden, Utah 84401

RE: Preliminary Assessment of the Wood River Zinc Millsite, Section 33 T 3 N, R 17 E (N 43 33.100' W 114 25.887').

Dear Mr. Gabardi and Ms. Manderbach:

The Idaho Department of Environmental Quality (IDEQ) was completing field work for Preliminary Assessments of mines and patented mining claims in the Big Wood River basin, when we discovered the abandoned Wood River Zinc Millsite, which appears to be located on U.S.D.A. Sawtooth National Forest (Forest Service) administered lands. IDEQ's interest has arisen from the fact that there are historic mill facilities and tailings at this site as well as Forest Service established campgrounds and parking facilities adjacent to the mill.

Based on existing conditions and uses, historic information, data observations made during the site visit, and analysis of the mill tailings, potential pathways of contaminants to receptors, and potential exposures to ecological and human receptors, IDEQ recommends that consideration be given to implementing site restrictions until a more detailed Site Investigation and Risk Analyses can be conducted.

Furthermore, it appears that regardless of the toxicological affects of heavy metals contaminants in mill tailings, unwarranted and unauthorized releases of sediment are occurring from the site into Deer Creek. This sediment carries elevated concentrations of arsenic, cadmium, lead, mercury and zinc that exceed either IDEQ's *Initial Default Target Levels* (IDTLs) or U.S. Environmental Protection Agency Region Six's Human Health Screening Levels (HHSLs) which may be indicators of the existence of human health or ecological risks. Ongoing releases conflict with Idaho Water Quality Standards and Wastewater Treatment Requirements. Therefore some level of best management practices should be implemented at the site to control these releases.

IDEQ very much appreciates your cooperation on this site. When you have time to formulate your questions and comments, please call me at (208) 373-0554. I would very much like to incorporate your comments and or suggestions.

Sincerely,

Bruce A. Schuld
Mine Waste Projects Coordinator
Waste Management and Remediation Division

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Attachment

cc: file

SECTION 1

Ownership

Based on a limited search, there are no current owners of the unpatented mill site claims. However, the facilities are located on USDA Forest Service (Forest Service) administered lands, and have apparently been developed and/or maintained for multiple-use by the Forest Service.

Contacts:

Mr. Jeff Gabardi
U.S.D.A. Sawtooth National Forest
2647 Kimberly Road East
Twin Falls, Idaho 83301
(208) 737-3205

Maggie Manderbach
USDA Forest Service Region IV
324 25th Street
Ogden, Utah 84401
(801) 625-5271

SECTION 2

Introduction

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

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

In February 2002, DEQ initiated a Preliminary Assessment Program to evaluate and prioritize assessment of such potentially contaminated sites. Due to accessibility and funding considerations, priority is given to sites where potential contamination poses the most substantial threat to human health or the environment. Priority was also given to mining districts where groups or clusters of sites could be assessed on a watershed basis.

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

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

Access by vehicle to the Wood River Zinc Mill is on the Deer Creek Road that takes off west from highway 75 just two miles north of Hailey, Idaho. From Highway 75, it is approximately six miles to the mill site, which actually straddles the Deer Creek Road.

As this site is on public lands and it is frequently used for recreation by the public, IDEQ staff did not formally request legal access to conduct a site visit.

SECTION 3

Mine Site History

The amount of history IDEQ found on the site was limited. However, it appears that Wood River Zinc Company constructed the mill to custom mill ores from its War Dance and the Jolly Sailor mines, and other mines such as the Dollar Hide Group. No production records have as yet to be found specific to the mill.

The Salt Lake Mining Review (June 15, 1905) reported that according to the Hailey Times,

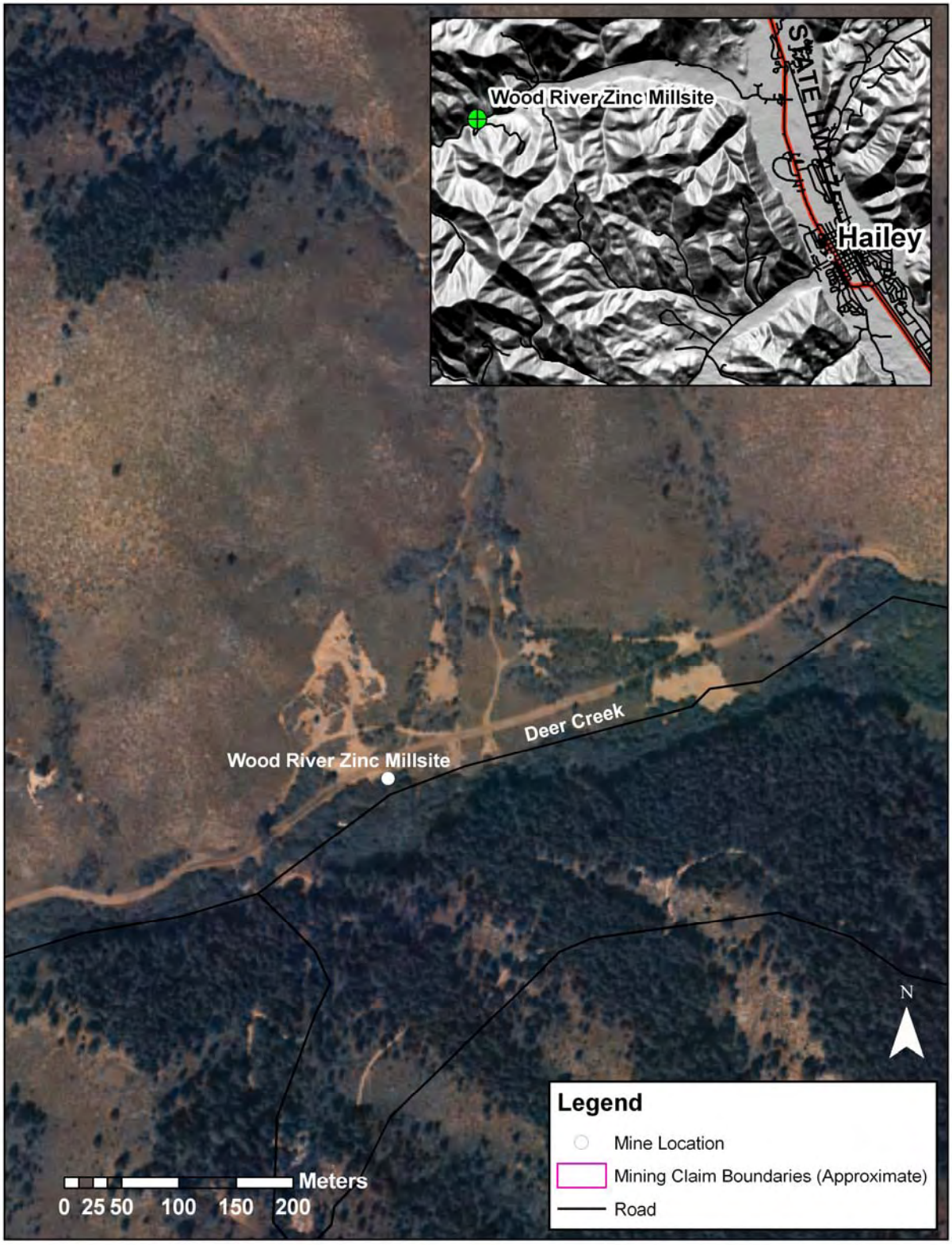
> *"Fred W.B. Johnson went up Deer Creek yesterday to select a site for the 200 ton mill to be built by the Wood River Zinc Company. Mr. Johnson selected a site at the junction of War Dance Gulch with Deer Creek. It is on the slope of a hill, sheltered from all winds, safe from snow slides, away from the slide rock, where a minimum of grading will be required, and that will admit expansion in either a northerly or southerly or an easterly direction."*

In the same edition of the Salt Lake Mining review, it was reported that,

> *"John Williams, manager of the Wood River Zinc Company, and Frank C. Mandell and an assistant, were at War Dance Mines today, making a preliminary survey for the new tunnel that is proposed to be driven from the Jolly Sailor side of the mine."* and *"C.C Ruthrauff left today for his Dollarhide group of mines, to begin the regular shipment of first class ore to the smelters, and second and third class ore to the Wood River Zinc Company's mill."*

In 1921 the 23rd Annual (Inspector of Mines) report of the Mining Industry of Idaho, the Inspector noted:

> *"WAR DANCE MINING ASSOCIATION Officers: Andrew Prader, Supt. Hailey Property: Lease and bond on War Dance Group of 23 unpatented claims, in the Mineral Hill District. Deer Creek Hailey. Plant: Gas driven compressor and small mine equipment. Development: Approximately 7000 feet of underground workings. Ore: Principally lead-silver. Men Employed: Average 4. Remarks: This company has been actively engaged in prospecting the War Dance Group for past three years."*


Wood River Zinc Millsite
Hailey
Deer Creek
Wood River Zinc Millsite
N
Legend
Mine Location
Mining Claim Boundaries (Approximate)
Road
Meters
0 25 50 100 150 200

In 1922 the War Dance Mining Association apparently evolved into the War Dance Mining Company with offices in Auburn California. Apparently the company extended the working to a total of 10,000 feet of tunneling, but the inspector still noted this work as "Assessment"

After 1922 there are no references that IDEQ has found relative to exploration or production at the War Dance Group or the Wood River Zinc Mill site, except for Umpleby, Westgate and Ross (1930) who reported:

> *"The War Dance and Jolly Sailor mines, (are) now consolidated under the ownership of James Burns and Associates, are in Sections 28 and 29, T 3 N, R 17 E. The Jolly Sailor lies west of the War Dance. Its workings have long been abandoned little value having been found in them. The only production from the Jolly Sailor recorded by Daft is 0.47 tons containing 58 ounces of silver and 518 pounds of Lead, mined in 1882. The War Dance yielded lead silver ore of a gross value of $126,018 in the eighties, and intermittent work has been done on it since then. In 1913 and 1914 materials from the dump was jigged for zinc by using water from one of the tunnels, and mining has been continued intermittently since then."*

Production from the mine reported as of 1903 was 1,031.1 tons of concentrates containing 88,501 ounces of silver, 1,342 pounds of lead and 900 pounds of copper. From 1904 to 1918 approximately 1,154 tons of ore were sold or treated, with 120 tons shipped directly to the smelter, and 743 tons were concentrated in Wood River Zinc mill which produced 1.20 ounce of gold, 3,212 ounces of silver, 36,932 pounds of lead, and 305,777 pounds of zinc.

It was also reported (Umpleby et al) that:

> *"Late in 1923 a vein of arsenic ore was found on the War Dance ground. It has been exposed to a number of shallow cuts on the hillside northwest of the Jolly Sailor Tunnel. The ore contains arsenopyrite partly oxidized to scorite and other minerals. In the winter of 1923-24 R.B. French, working under lease, drove a short cross cut and short irregular raises from the Jolly Sailor tunnel under the old War Dance workings."*
>
> *The underground workings in the War Dance mine were estimated by Campbell to exceed 10,000 feet. There are six tunnels, only the lower two of which are now open for any considerable distance. The principal work was done from a drift to the north from the No. 5 tunnel and from drifts on two levels below and connected by winzes with this drift. In recent years a sixth tunnel, 1,300 feet long, starting on the Jolly Sailor ground, and a raise connecting this with the old workings just mentioned have been driven. Much of the old workings is now inaccessible, but there are small stopes on the fifth level, the two intermediate levels below it, and probably also on the upper levels. The principal production is reported to have come from a stope on a lens shaped mass sixteen feet wide, thirty feet high and forty feet long.*

SECTION 4

Climate

Climate information provided in this section is based on a climatological summary for Hailey, Idaho which was obtained from the National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center. The climatological data was collected at the Hailey Airport (elevation 5,328 amsl), and is for the period of 1951 through 1980. Each site for which this data is used is subject to more localized meteorological conditions that result from difference in elevation, orientation of slopes in watershed, vegetation and other factors.

The area around the site is characterized by short cool dry summers and very cold winters. The total annual precipitation measured at the Hailey Airport averages 16.2 inches. The majority of precipitation occurs as snow. Total annual snowfall averages 78.2 inches with most snowfall occurring in December and January. The driest months are July, August and September.

Based on records from 1951 to 1980, the average annual temperature measured at the Hailey Airport is 43 degrees Fahrenheit (F). The lowest temperature recorded for this period was – 28 degrees F in 1962. The highest temperature for this period of record was 100 degrees F in 1953. January is the coldest month with an average temperature of 19.5 degrees F. July is the hottest month with an average temperature of 67 degrees F.

SECTION 5

General Geology

Generally speaking the Wood River Zinc Millsite, the Jolly Sailor Mine and the War Dance Mine are hosted by sheared and altered quart monzonite intrusives. The lower portions of the ephemeral drainages contain thick layers of colluvial fill, which are predominantly sandy remnants of the decomposed quartz monzonite. The colluvium is extremely erodible, and deeply incised by both seasonal runoff in War Dance Gulch and perennial flows in Deer Creek.

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

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

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

Where it is presumed that much of the ore from the War Dance and Jolly Sailor mines was treated or processed at the mill site, some discussion of the geology surrounding the mines is appropriate, particularly with respect to the mineralogy of the ore. It was reported (Umpleby et al) that:

> *Both properties (War Dance and Sailor) are in a rather dark phase of quartz monzonite a short distance southwest of the contact with the Wood River formation. In places along the main drift on the fifth level, especially on the hanging-wall side of the vein, there are blocks of dark fine grained altered rock of sedimentary origin, containing irregular veinlets and small masses of zeolite, probably laumonite.*
>
> *The principal vein in the inaccessible part of the drift on the fifth level of the War Dance mine strikes north and dips about 45 degrees west. Beyond this part the drift appears to swing west. A short distance south of this turn another vein branches off on the hanging wall side with a strike of about N 60 W. The small stopes on the two levels below are probably on this vein. On these levels, there are short crosscuts that extend east to another vein, presumably the one followed by the main drift on the fifth level. The quartz monzonite between these two veins is sheared and somewhat altered. No ore has been found on the sixth or Jolly Sailor level, but a narrow zone of crushed and somewhat mineralized rock is exposed. This zone may be a continuation of a vein that crops out on the hillside above, which in turn is supposed to be an extension of the vein that was prospected unsuccessfully in the old Jolly Sailor workings. The exposures on the hillside show banded quartz with a few grains of arsenopyrite and faint copper stains on cracks.*
>
> *The ore on the dumps and piles underground is all the same general character and evidently came from the two veins in the War Dance workings. Much of it is distinctly banded. The minerals noted are quartz, galena, sphalerite, and pyrite.*

To the north of the mines a thrust fault separates the overlying sediments with the underlying intrusives. In discussion of the Red Elephant and Bullion areas, which are very similar in nature to the War Dance area, Link and Worl (2001) described geologic and historic information relating to stratigraphy and mineralization relationships within Dollarhide sedimentary sequences in the Mineral Hill district.

The Bullion mineralized area...is underlain by the lower and middle members of the Pennsylvanian and Permian Dollarhide Formation, which is folded into upright and west-overturned map scale folds….The lower member of the Dollarhide Formation, hosts most of the mineralized rock (Skipp and others, 1994). Fryklund (1950), following Umpleby and others (1930), labeled these rocks as Wood River Formation, though he notes, "it is possible that Milligen formation is also present" (p. 64). An unpublished map (circa 1970) of W.E. Hall labels the dark-colored rocks in the Bullion area as Milligen Formation. Hall (1985) showed the rocks as Dollarhide Formation, and Wavra and Hall (1989) showed them as upper member, Dollarhide Formation.

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

In the Bullion area the middle member of the Dollarhide Formation (regionally about 300 m [984 ft] thick) contains silicified sandstone that crops out as light-gray to brown quartzite that forms the high ridge between Red Elephant and Bullion Gulches. These rocks were shown as Wood River Formation on the map of Hall (1985). The mineralized veins of the Bullion area do not extend southward into the middle member Dollarhide Formation. The middle member, much less silicified, is also present in west-dipping beds on the ridge of Kelly Mountains. Link and Worl, 2001, pp. 12 & 14

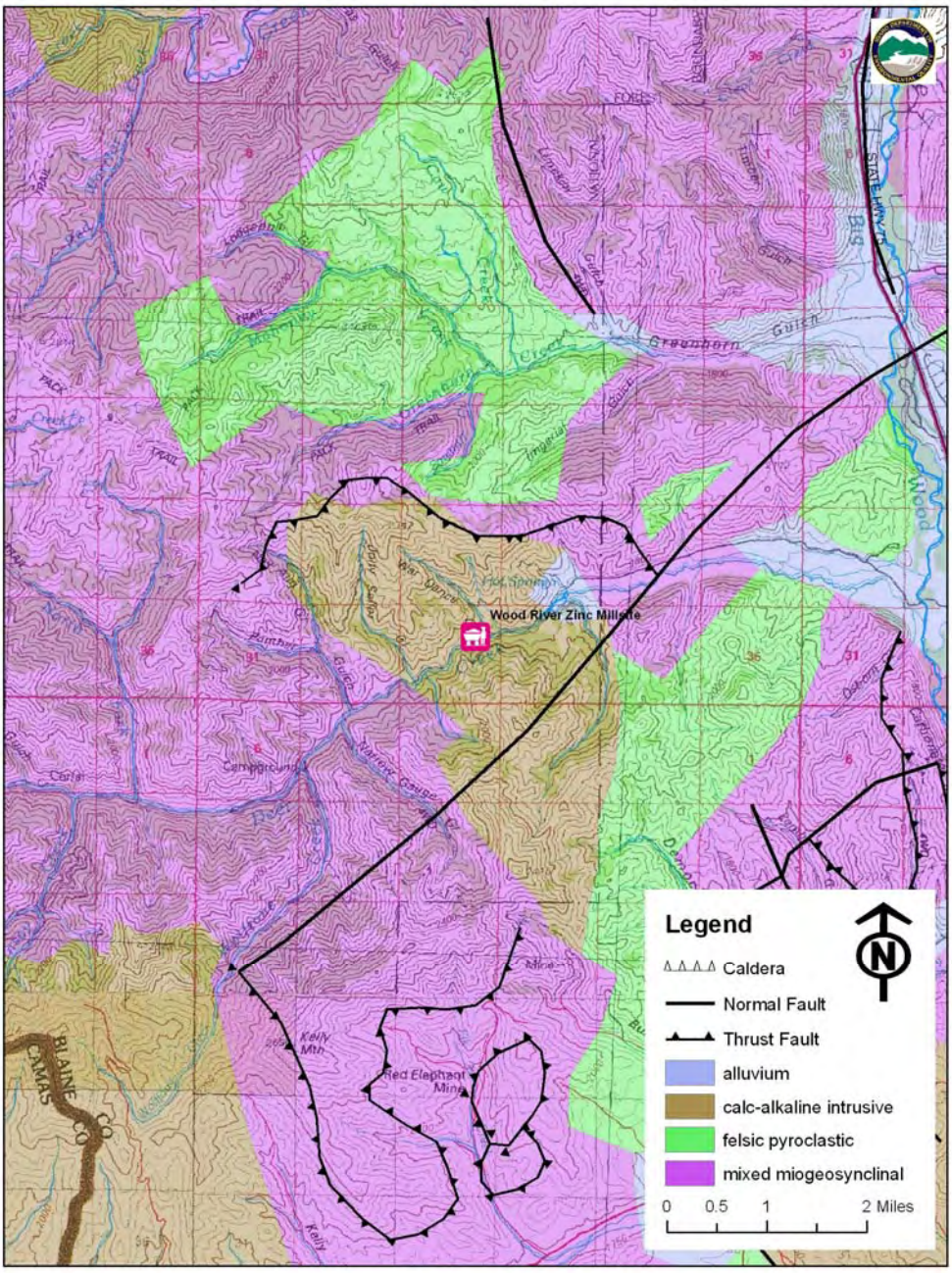
Structure

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

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

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

Southwest of the river the beds dip generally westward at inclinations that largely range from 20º to 40º. It's thus clear that the sediments form a broad anticline, of which the crest almost coincides with the Big Wood River Valley.


Wood River Zinc Millsite
Legend
Caldera
Normal Fault
Thrust Fault
alluvium
calc-alkaline intrusive
felsic pyroclastic
mixed miogeosynclinal
0 0.5 1 2 Miles
N
BLAINE CO
CAMAS CO
Kelly Mtn
Red Elephant Mine
Greenhorn Gulch

SECTION 6

Current and Future Potential Beneficial Uses

There is an extensive day and overnight use of the mill site for camping, recreational vehicle parking and off road vehicles. There are at least four routinely used campsites, which are designated for this use by the USDA Forest Service. Although none of the sites have been developed with such amenities as bathrooms, tables and permanent fire rings, they are none the less designated by the Forest Service as administered camp sites.

From the level of wear and tear on the surface area, the mill site and tailings piles appear particularly attractive to ATVs and motorcycles as a race track. This area is several acres in size and its use appears to hold back natural revegetation by sage brush, rabbit brush and other upland flora.



ATVs and motorcycles frequently use the Wood River Zinc Mill site, which is particularly attractive because of the tailings sandy characteristics.

Other uses include mountain biking, hiking, hunting, horseback riding, and fire wood collection.



One of several USDA established camp sites adjacent to the Wood River Zinc Mill site, and War Dance Gulch.

This site is very accessible, and there is evidence of prolonged use by campers, particularly contractors and construction workers on temporary work projects in the Ketchum, Hailey, and Sun Valley area. Trash including bars of soap and towels are indications that these campers use the adjacent Deer Creek to bathe, and use of Deer Creek as a water source is probable since there are no drinking water supplies developed for the campsites.

The frequently trafficked Deer Creek road passes through the site across the tailings piles below the mill. The level of traffic for this road was not determined.



Looking north from the Probable point of Entry (PPE), you can see how the Deer Creek Road traverses the mill site and tailings piles.

The area immediately below the mill foundations is frequently used for parking and for loading and unloading motorcycles and ATVs from trailers. It serves as a trailhead for the War Dance Gulch trail. Some use and access restrictions are in place.



Gate which restricts access to south side of Deer Creek. Gate is located just upstream from the mill site.



USDA Public Notice on Wood River Zinc Mill site.

SECTION 7
Site Conditions and Waste Characterization

The mill site is easily accesses as the Deer Creek Road is located in tailings at the base of the facilities. The facility is overshadowed by relatively insignificant mineral explorations that were driven, apparently, on minor alterations in the quartz monzonite.



Numerous workings appear above the Wood River Zinc Mill site. These workings were not assessed because it was not known if they were on private or public lands, and the dump sizes indicate that they are, perhaps, insignificant. These sites should be assessed in the future. Presumably these are part of the War Dance Mine Group.



Wood River Zinc Company Mill Foundations



Uphill side of the Wood River Zinc Company Mill foundation.



Mill footings in the mid section of the Wood River Zinc Company Mill.

Soil Sample Collection

Three soil samples were collected around the mill site. Each sample was approximately five pounds in size and was screened through a No. 10 sieve screen. Approximately 95% of each sample passed through the screen. The material passing was mixed in a clean bucket prior to placing it in a one gallon zip lock bag, which was then placed in a cloth mineral sample bag. Both bags were appropriately marked, and then documented on Chain of Custody Forms for submittal to SVL laboratories.

The three samples were hoped to provide screening level analysis of a background soil, mill tailings, and sediment just prior to discharge from the site into Deer Creek. Each sample was remarkably similar in appearance. Each was fine to coarse grained pink or buff colored sand. There were no visible indications of sulfide minerals. The background sample had a minimal (<5%) amount of organic materials, which were mostly twigs that were removed during screening. The background sample also had a few larger (½" – 1") particles which appear to be quartz.

Wood River Zinc Millsite Soil Sample Analysis

Description	IDEQ IDTL Values	EPA Region 6 Human Health Screening Levels 2007	Wood River Zinc Background Soil Sample VKMBGSS-1	Wood River Zinc Tailings Sample VKMSSS-1	Wood River Zinc PPE Soil Sample VKMSPPESS-1
Aluminum		**76000**			
Antimony	4.77	**31**			
Arsenic	0.391	**0.39**	**19.2**	**258**	**24.8**
Barium	896	**5400**	170	138	130
Beryllium	1.63	**1500**			
Cadmium	1.35	**37**	1.02	11.1	2.02
Calcium		**NA**			
Chromium	7.9	**210**	11.3	18.6	17.5
Cobalt		**900**			
Copper	921	**3100**	7.1	35.7	8.3
Iron		**23000**	16900	**28100**	13200
Lead	49.6	**400**	21.5	**1490**	102
Magnesium		**NA**			
Manganese	223	**1800**			
Mercury	0.00509	**23**	<0.033	2.12	0.143
Nickel	59.1	**NA**			
Potassium		**NA**			
Selenium	2.03	**390**	< 4	<4	<4
Silver	0.189	**390**	< 0.05	10.8	0.7
Vanadium		**550**			
Zinc	886	886	92.4	**1030**	359

Soils Analysis

Background levels of total arsenic exceeded both Idaho's *Initial Default Target Levels* (IDTLs) and EPA Region 6's Preliminary Human Health Screening Levels (HHSL). The IDTLs are risk-based target levels for certain chemicals that have been developed by DEQ using conservative input parameters, a target acceptable risk of 10^{-6}, and a *Hazard Quotient* of 1. These numbers, although used for comparison even at remote locations, are more applicable to sights were it is expected to see "unrestricted uses" such as residential development. Similarly, the Region 6 HHSLs are human health based risk derived for screening where residents are at risk for exposure. These concentrations are not unusual for a location or facility in a historic mining district.

Concentrations of total arsenic, total lead and total zinc in the mill tailings exceeded both the IDTL's and HHSL's. Concentrations of total cadmium, total chromium, total mercury and total silver, fell somewhat in between the IDTL's and HHSL's.

Surface Water Sample Collection

Although there was no water flowing on the site, a water sample was collected in Deer Creek below the PPE. The sample was preserved with nitric acid and frozen until submittal for totals metals analysis for eleven metals. Furthermore, field parameters were collected and: pH = 7.8 su, Dissolved Oxygen = 11.0 mg/l, Conductivity = 1.8 mS/cm, Temperature = 11.2 C, Turbidity = 10 NTU, and Salinity = 3.8%.

Surface Water Analysis

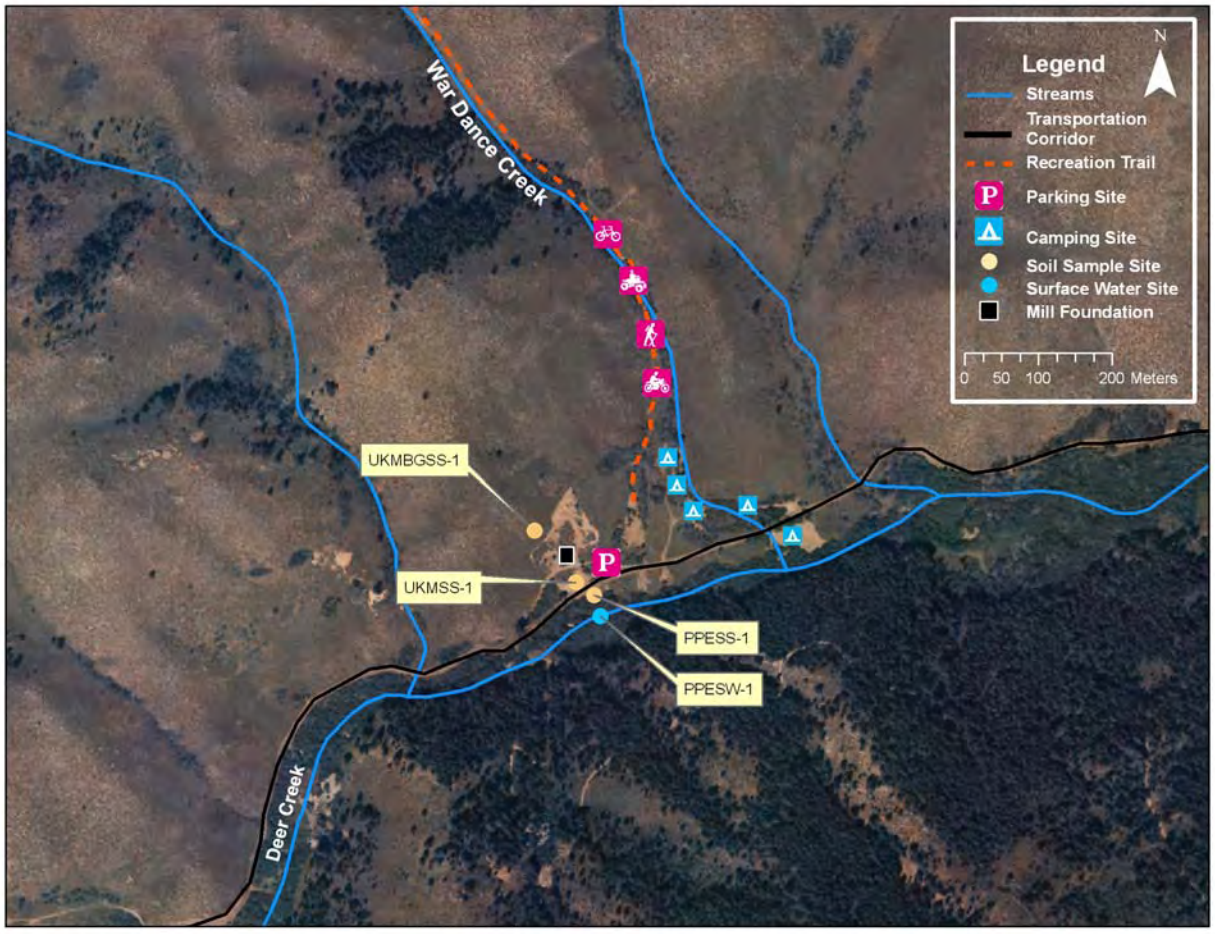
Field parameters and water chemistry of the surface water collected are unremarkable. They meet all of the appropriate water quality standards and are indicative that at this location, no adverse affects from metals production is occurring on a prolonged basis. This sample analysis is limited in that it is one moment in time during which the area has experience significant drought conditions. Seasonal runoff and overland flows from the site are likely to change these results seasonally. Furthermore, it should be noted that criteria for human health and drinking water is expressed in "Totals" concentration, Aquatic life criteria is expressed in "Dissolved" concentrations, and sample values are derived from "Totals" analysis. This is to provide screening level analysis only. If more precise risk analysis were warranted for human health and ecological pathways and exposure to water, both totals and dissolved analysis of metals in water would be warranted. Additional analysis for hardness would also be warranted for hardness dependent parameters.

Deer Creek Surface Water Below PPE

Description	IDEQ Ground Water Standard (Totals)	IDEQ Drinking Water Standard (Totals)	IDEQ Cold Water Biota Standard Acute (Dissolved)	IDEQ Cold Water Biota Standard Chronic (Dissolved)	Wood River Zinc Deer Creek blw PPE UKMSPPESW-1 TOTALS
Aluminum	0.05				
Arsenic	0.05	0.00002	0.36	0.19	<0.025
Barium					0.0171
Cadmium	0.01		0.0037	0.001	< 0.002
Chromium	0.05		0.157	0.18	<0.060
Copper	1		0.017	0.0106	<0.010
Iron	0.3				<0.060
Lead	0.05		0.065	0.0025	<0.0075
Mercury	0.002	0.00014	0.00204	0.000012	<0.00020
Nickel		0.61	1.4	0.16	
Selenium	0.01		0.02	0.005	<0.04
Silver	0.05		0.0034		<0.005
Zinc	5		0.11	0.10	<0.010

SECTION 8

Pathways and Environmental Hazards



Surface Water Pathways

Although water quality analysis indicates that there was no delivery of heavy metals or sediment at the time of sample collection, surface water pathways to ecological receptors appears to be complete as indicated by erosional features, which may be traced directly from the footings of the mill buildings, to Deer Creek. There are significant wetlands and aquatic species of concern in this watershed. However, there are no surface water intakes for public drinking water supplies within a four mile radius.



The Wood River Zinc Mill tailings piles are eroded by several mechanisms.

Mill tailings through which the Deer Creek Road was constructed are a source for metals laden sediment production. Three predominant mechanisms for sediment production were noted. First the tailings are subject to rapid spring runoff from both the mill site and the Deer Creek Road. Second, sediment production is enhanced when Deer Creek road is graded as a function of the road's routine maintenance. This maintenance breaks up any natural bonding that may occur in the fines on the roadway. Lastly, frequent use of the tailings area by ATVs also destabilizes the tailings making them more susceptible to transport.



Once the tailings are eroded, they travel quickly across the fifty or so feet into Deer Creek.



Looking down into Deer Creek at the PPE one can see how tailings are delivered the very short distance from tailings piles into the creek.

Ground Water Pathways

During the cleanup activities of the nearby mines, specifically the Minnie Moore and Triumph mines, some of the first concerns were related to potential human health risks as a result of contamination of public and private drinking water supplies. Generally speaking, contamination of drinking water systems was thought likely to occur from two types of sources (ore bodies and waste dumps) and along three pathways, as illustrated by the following three scenarios. First, heavy metals are leached from tailings piles and waste rock dumps, enter ephemeral or perennial drains and then contaminate the area's shallow ground water system. Second, heavy metals leach from the local ore bodies and are transported through the geologic structure to the shallow ground water. Third, heavy metals could leach out of the ore bodies, and be discharged from the underground workings as adit water, that is then conveyed through ephemeral and perennial drains to the shallow ground water systems.

For the purposes of completing Preliminary Assessments, Source Water Assessments (completed for local public drinking water supplies) were used to identify any known affects to those systems. Although IDEQ's Source Water Assessments were used to evaluate potential affects of this mine on public drinking water supplies no inferences can be made about the affects that this and adjoining mines have on local private wells.

Source water assessments provide information on the potential contaminant threats to public drinking water sources. In the Big Wood River Valley Idaho, most of those sources (>95%) are ground water (IDEQ 2000). Each source water assessment:

- Defines the zone of contribution, which is that portion of the watershed or subsurface area contributing water to the well or surface water intake (**source area delineation**).

- Identifies the significant potential sources of drinking water contamination in those areas (**contaminant source inventory**).

- Determines the likelihood that the water supply will become contaminated (**susceptibility analysis**).

Each assessment is summarized in a report that describes the above information and provides maps of the location of the public water system, the source area delineation, and the locations of potential contaminant sources. Idaho began developing source water assessments in 1999, and in May 2003 met its obligation under the amendments of the Safe Drinking Water Act by completing delineations for all 2100+ public water systems that were active in Idaho as of August 1999 (IDEQ 2000). Source water assessments for new public drinking water systems are being developed as those systems come online. Each public water system is provided with two copies of its final assessment report. Four source water assessments for drinking water supplies have been used in this Preliminary Assessment Process to evaluate the potential impacts to both public and private drinking water supplies in and around Sun Valley, Ketchum, Hailey and Bellevue, Idaho.

The information extrapolated from these source water assessment reports is based on data that existed at the time of their writing, and the professional judgment of IDEQ staff. Although reasonable efforts were made to present accurate information, no guarantees, including expressed or implied warranties of any kind are made with respect to these reports or this Preliminary Assessment by the State of Idaho or any of its agents who also assume no legal responsibility for accuracy of presentation, comments or other information in these publications or this Preliminary Assessment report. The results should not be used as an absolute measure of risk, and they should not be used to undermine public confidence in public drinking water systems.

The Source Area delineation process establishes the physical area around a well or surface water intake that becomes the focal point of the source water assessment. The process includes mapping the boundaries of the zone of contribution (the area contributing water to the well or to the surface water intake) into time of travel zones (TOT) indicating the number of years necessary for a particle of water to reach a well or surface water intake (IDEQ 2000). The size and shape of the source water assessment area depend on the delineation method used, local hydrogeology, and volume of water pumped from the well or surface water intake.

IDEQ used a refined computer model approved by EPA to determine the 3-year (Zone 1B), 6-year (Zone 2), and 10 year (Zone 3) time of travel associated with the Big Wood River Aquifer and its sources (IDEQ 2000). This information is illustrated in Figure 4.

This process involves collecting, recording, and mapping existing data and geographical information system (GIS) coverage to determine potential contaminant sources (e.g., gas stations) within the delineated source water assessment area. The potential contaminant source inventory is one of three factors used in the susceptibility analysis to evaluate the overall potential risk to the drinking water supply (IDEQ 2000). The inventory process goal is to locate and describe those facilities, land uses, and environmental conditions that are potential sources of ground water or surface water contamination.

This susceptibility analytical process determines the susceptibility of each public water system well or surface water intake to potential contamination within the delineated source water assessment area. It considers hydrogeologic characteristics, land use characteristics, potentially significant contaminant sources, and the physical integrity of the well or surface water intake. The outcome of the process is a relative ranking into one of three susceptibility categories: high, moderate, and low. The rankings can be used to set priorities for drinking water protection efforts (IDEQ 2000).

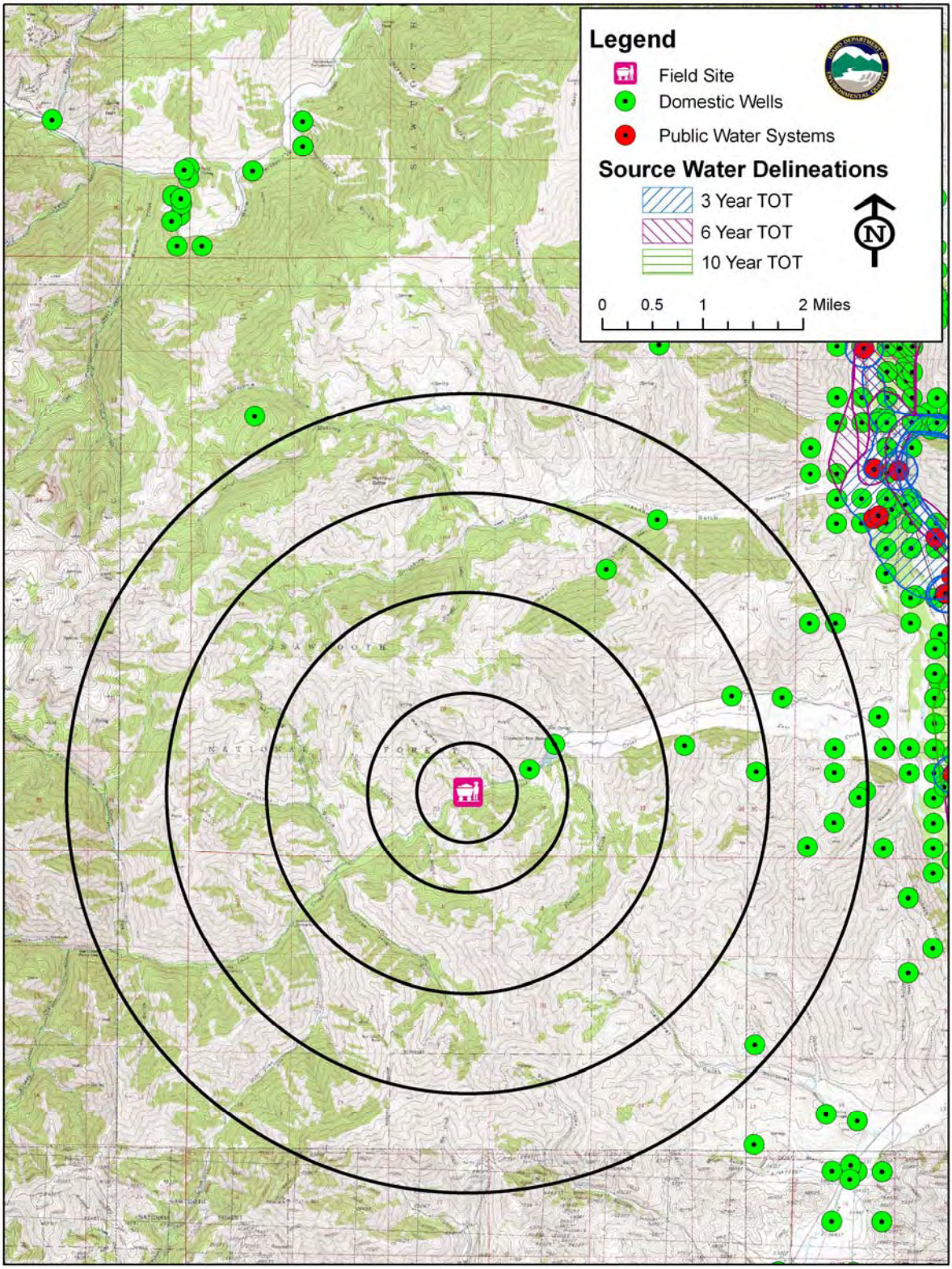
There are numerous public and private drinking water supplies in the Big Wood River Basin. The Sun Valley Water and Sewer District operates and maintains nine wells in two groupings (IDEQ 2000). The City of Ketchum drinking water system consists of seven wells in two groupings. The City of Hailey's drinking water system consists of six wells and a spring (IDEQ 2000).The City of Bellevue drinking water system consists of two wells and three springs (IDEQ 2000).

Generally speaking, public drinking waters systems in the Big Wood River Valley are rated as moderate to high (IDEQ 2000). Multiple factors affect the likelihood of movement of contaminants from the sources to the aquifer, which lead to this moderate to high score. Soils in the area are poorly to moderately drained. The vadose zone is predominantly gravel, which increases the score. On the valley floors the average depth to ground water is twenty to fifty feet.

To date, routine water quality monitoring of public drinking water indicates that there are no significant volumes of heavy metals migrating through the regional or localized ground water systems. There is no current, long term or recurring water chemistry problems in the City of Ketchum's drinking water sources. Arsenic, nickel, antimony, barium, selenium, chromium, cyanide and nitrate have been detected in Ketchum's wells, but all were well below MCLs (IDEQ 2000). There is no long term or recurring water chemistry problems in the City of Hailey's drinking water sources. Manganese, zinc, chromium, and mercury have been detected in Hailey's wells, but all were well below MCLs (IDEQ 2001). Currently, there are no data that indicate that any metal concentrations have exceeded MCLs in the Bellevue drinking water systems (IDEQ 2000).

Air Quality Pathways

The most likely air quality pathway would be that relative to fugitive dust emissions. Although small "dust devils" were observed at the site, delivery of dust from the site to local residents is not likely because of the distance (+1/2 mile) to those residents. However, exposure to metals laden dust is likely for campers and other recreational receptors that frequent this site. This is particularly true when recreational vehicles utilize the trails and tailings piles as motocross tracks.


Legend
Field Site
Domestic Wells
Public Water Systems
Source Water Delineations
3 Year TOT
6 Year TOT
10 Year TOT
N
0
0.5
1
2 Miles

Soil Exposure

When compared to the Idaho *Initial Default Target Levels* (IDTLs) for "unrestricted uses", particularly residential, risk is considered to be elevated for all receptors, due to the high concentrations measured in the tailings sample below the mill foundation. No speculation can be made for exposures in the campsites. However, metals concentrations in tailings close to the campsites suggests that characterization of soils in these camp sites, trails ad roadways may be prudent.

IDTLs are risk-based target levels for certain chemicals that have been developed by DEQ using conservative input parameters, a target acceptable risk of 10^{-6}, and a *Hazard Quotient* of 1. These values are designed to aid in the development of clean-up goals that would allow the closure of a site based on the risks associated with various receptors for specific media to be less than 10^{-6}.



Deer Creek Dispersed Campsite #4 Next to Wood River Zinc Mill site.

According to IDEQ's Risk Evaluation Manual if pathways are determined to be complete, or if pathways are anticipated to become complete as a result of future uses, and the IDTL's are exceeded for any constituents, two options should be considered:

1. Adopt the IDTLs as the cleanup levels and develop a *Risk Management Plan* (RMP).
2. Perform a more detailed, site-specific evaluation, which includes developing site-specific background concentrations for comparative purposes.



Typical fire ring in dispersed camp site at Wood River Zinc Mill site.

Domestic Wells and Public Water Supplies

There are only two domestic drinking water supplies and no public drinking water supplies within a four mile radius of the mine. The two domestic drinking water supplies are located approximately 1 mile from the site are more likely affected by watershed wide sources of contaminants than by this mine site.

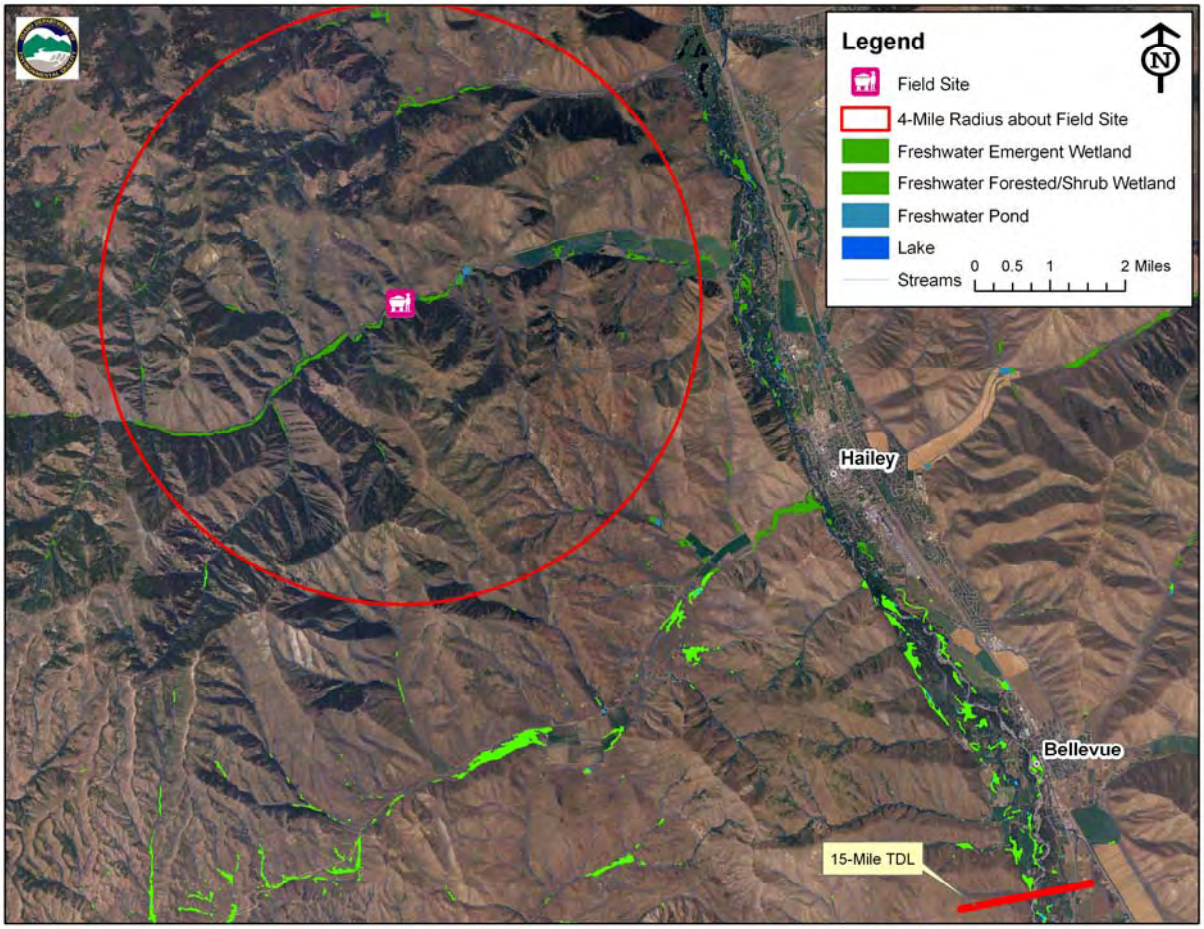
Sensitive Species (Plant and Animal)

Although the site is located within a defined range and habitat for wolves, the size of the dumps relative to the total range is very minuscule and therefore unlikely to be a significant source for exposure.

However, release of tailings to Deer Creek during seasonal runoff may adversely affect wetlands and aquatic species adjacent to or in Deer Creek. The risk of these affects should be more closely evaluated by additional sampling and receptor analysis.

Wetlands

There are significant wetlands along Deer Creek adjacent to and below the mill site. And there is considerable evidence of erosion of mill tailings and delivery to Deer Creek. Therefore, it appears that overland delivery of mill tailings to Deer Creek below may pose significant ecological risk.



Fisheries

Fish density and diversity studies have not been conducted on Deer Creek to confirm any fish species that may reside in this stream. Visual observations confirm the presence of brook trout [Salvelinus foninalis] in Deer Creek. Redband rainbow trout [*Oncorhynchhus mykiss* gairdneri], mountain white fish [Prosopium williamsoni], wood river sculpin [Cottus leiopomus], and brook trout [Salvelinus foninalis] are present within the Big Wood River (IDFG, 2000).

Sensitive Waterways

There are no Clean Water Act 303(d) listed streams immediately down gradient from the site, which might be adversely affected by contaminant delivery from the site.

Residences, Schools and Day Care Facilities

The nearest residence is approximately 1 mile due east of the mill site.

The nearest Day Care or School Facility is more than 6 miles due east of the mill site.

Livestock Receptors

There were very few indications that the area is used for livestock grazing, which is presumably for sheep. However, there are indications that hunters have seasonally grazed horses and mules.

Summary and Conclusions

Based on existing conditions and uses, historic information, data observations made during the site visit, and analysis of the mine wastes, potential pathways of contaminants to receptors, and potential exposures to ecological and human receptors, IDEQ recommends that consideration be given to implementing site restrictions until a more detailed Site Investigation and Risk Analyses can be conducted.

Furthermore, it appears that regardless of the toxicological affects of heavy metals contaminants in mill tailings, unwarranted and unauthorized releases of sediment are occurring from the site into Deer Creek. These sediments carry elevated concentrations of arsenic, cadmium, lead, mercury and zinc that exceed either IDEQ's IDTLs or EPA Region Six's HHSLs which may be indicators of the existence of human health or ecological risks. Therefore, ongoing releases conflict with Idaho Water Quality Standards and Wastewater Treatment Requirements. Therefore some level of best management practices should be implemented at the site to control these releases.

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