Preliminary Assessment and Site Inspection Report for

Muldoon Mines

(aka Solid Muldoon, Stonewall Jackson, Mountain Boy, and Champion Prospect)

and

Solid Muldoon, Stonewall Jackson, and Mountain Boy Mill Sites

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Blaine County

State of Idaho
Department of Environmental Quality

February 2013



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Blaine County

February 2013

Prepared by
Idaho Department of Environmental Quality
Mine Waste Program
1410 N. Hilton
Boise, Idaho 83706

Acknowledgments

DEQ would like to thank Scott Corkery for permitting access to the mine site. DEQ would also like to thank Jeff Gabardi from the United States Forest Service for his assistance.

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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

C.L. "Butch" Otter, Governor
Curt Fransen, Director

February 4, 2013

Mr. Ken Marcy
U.S. Environmental Protection Agency
12928 SW 276th Street
Vashon, WA 98070

Subject: Preliminary Assessment and Site Inspection (PA/SI) Report for the Muldoon Mines, Blaine County, Idaho

Dear Mr. Marcy:

The Department of Environmental Quality (DEQ) has a cooperative agreement with Region 10 of the United States Environmental Protection Agency (EPA) to provide technical support for completion of preliminary assessments at various mines on private or state lands.

The Muldoon mines and mill site claims are part of the Little Wood River (aka Muldoon) Mining District located in Blaine County, Idaho. The Mountain Boy Mine is located in Township 3 North, Ranges 21 and 22 East, Sections 1 and 6. The Champion Prospect is located in Township 3 North, Range 22 East, Section 7.The Solid Muldoon and Stonewall Jackson Mines are located in Township 3 North, Ranges 21 and 22 East, Sections 12 and 7. The mill site claims (Solid Muldoon, Stonewall Jackson, and Mountain Boy) are located in Township 3 North, Range 21 East, Section 24.

This group of mines and mill sites (with the exception of the Champion Prospect) are located on private patented lands. DEQ completed field inspections and site assessment work in September 2012. Attached you will find the PA/SI for the Muldoon Mines. Below is a summary of the conclusions and recommendations for the agencies and landowners involved.

Generally speaking, toxicological risks to human and ecological receptors are limited to exposures in the soils and sediment. Surface and ground water quality at the Solid Muldoon Mine and Mill site appears to be within acceptable ranges.

Soil sample SMWD3SS1 collected from waste dump no. 3 at the Solid Muldoon Mine exceeded the initial default target levels (IDTLs) for chromium, lead, manganese, selenium, silver, and mercury. Arsenic, cadmium, and zinc exceeded both the IDTLs and human health screening levels (HHSLs) in the soil sample.

The concentrations of arsenic, cadmium, copper, lead, and zinc also exceeded ecological risk benchmarks for the majority of listed animal receptors for waste dump no. 3. However, the ecological risk is relatively low for certain receptors (grazing animals, wolves) because they cover a large range and the mine and mill site is concentrated in a small area.

Sediment sample MCPPESD1 for the probable point of entry to Muldoon Creek from Solid Muldoon mining influences exceeded the IDTLs for cadmium, chromium, lead, and manganese. Arsenic exceeded both the IDTLs and HHSLs in the sediment sample. However, the Muldoon Creek background sediment sample MCBGSD1 exceeded the IDTLs for chromium, lead, and manganese. Arsenic exceeded both the IDTLs and HHSLs in the background sediment sample.

There is one open shaft on the Solid Muldoon claim which could pose a physical hazard and should be fenced off to restrict access.

Based on existing conditions and uses, historic information, data observations made during the site visit, analysis of the mine wastes, potential pathways of contaminants to receptors, and potential exposures to ecological and human receptors, **DEQ has made a No Remedial Action Planned (NRAP) determination for the Muldoon mines.**

A link to the Preliminary Assessment and Site Inspection Report for the site can also be found on DEQ's Preliminary Assessment Web page at:

http://www.deq.idaho.gov/waste-mgmt-remediation/remediation-activities/mining-preliminary-assessments.aspx

If you have any questions about these sites, the report, or DEQ's recommendations, please do not hesitate to call me at (208) 373-0563.

Respectfully,

Tina Elayer
Mine Waste Program Specialist

attachments

cc: Scott Corkery
Jeff Gabardi, USFS
Muldoon Mines PA File

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List of Acronyms

ATV	all-terrain vehicle
BLM	United States Bureau of Land Management
CWA	Clean Water Act
cy	cubic yards
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
GIS	geographic information system
GLO	General Land Office
gpm	gallons per minute
HHSLs	human health medium-specific screening levels
HRS	Hazard Ranking Score
IDFG	Idaho Department of Fish and Game
IDTLs	initial default target levels
IGS	Idaho Geological Survey
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliters
NAIP	National Agriculture Imagery Program
NOAA	National Oceanic and Atmospheric Administration
NRAP	No Remedial Action Planned
ORV	off-road vehicle
PA	preliminary assessment
PPE	probable point of entry
PWS	public water system
RCRA	Resource Conservation and Recovery Act
RMP	risk management plan
SI	site inspection
SVL	SVL Analytical, Inc.
TDL	target distance limit
TMDL	total maximum daily load
USFS	United States Forest Service
USGS	United States Geological Survey

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1 Introduction

This report presents the results of the preliminary assessment and site inspection (PA/SI) for the Mountain Boy, Solid Muldoon, and Stonewall Jackson Mines, Champion Prospect, and associated mill sites (Muldoon mines). The United States Environmental Protection Agency (EPA) Region 10 has a cooperative agreement with the Idaho Department of Environmental Quality (DEQ) to provide technical support for completing preliminary assessments at various mines on private, state, or mixed ownership (public and private) lands. DEQ also completes site assessments in response to complaints or information about sites possibly contaminated with hazardous waste. These sites include abandoned mines, rural airfields that have served as bases for aerial spraying, old landfills, illegal dumps, and abandoned industrial facilities with 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. In recent years, this priority focuses DEQ's efforts in areas where residential and recreational developments are encroaching on historic mining districts. Priority is also given to mining districts where groups or clusters of sites, like those found in the Muldoon Canyon, can be cost-effectively assessed on a watershed basis.

See the following webpage for additional information about DEQ's Preliminary Assessment Program: *http://www.deq.idaho.gov/waste-mgmt-remediation/remediation-activities/mining-preliminary-assessments.aspx*.

The Muldoon mines and mill sites are part of the Little Wood River (aka Muldoon) Mining District located in Blaine County, Idaho (Figure 1). The Mountain Boy Mine is located in Township 3 North, Ranges 21 and 22 East, Sections 1 and 6. The Champion Prospect is located in Township 3 North, Range 22 East, Section 7. The Solid Muldoon and Stonewall Jackson Mines are located in Township 3 North, Ranges 21 and 22 East, Sections 12 and 7. The mill sites (Solid Muldoon, Stonewall Jackson, and Mountain Boy) are located in Township 3 North, Range 21 East, Section 24.

On September 25, 2012, DEQ visited the claims and performed a site assessment. DEQ did not purposely or knowingly trespass on any private holdings.

During the site assessments, DEQ used references from several different documents, including United States Geological Survey (USGS) maps, county tax rolls, and historical reports. These documents often have numerous spellings for claim names, town sites, and/or geographic features. DEQ retained the source's spelling and usage.

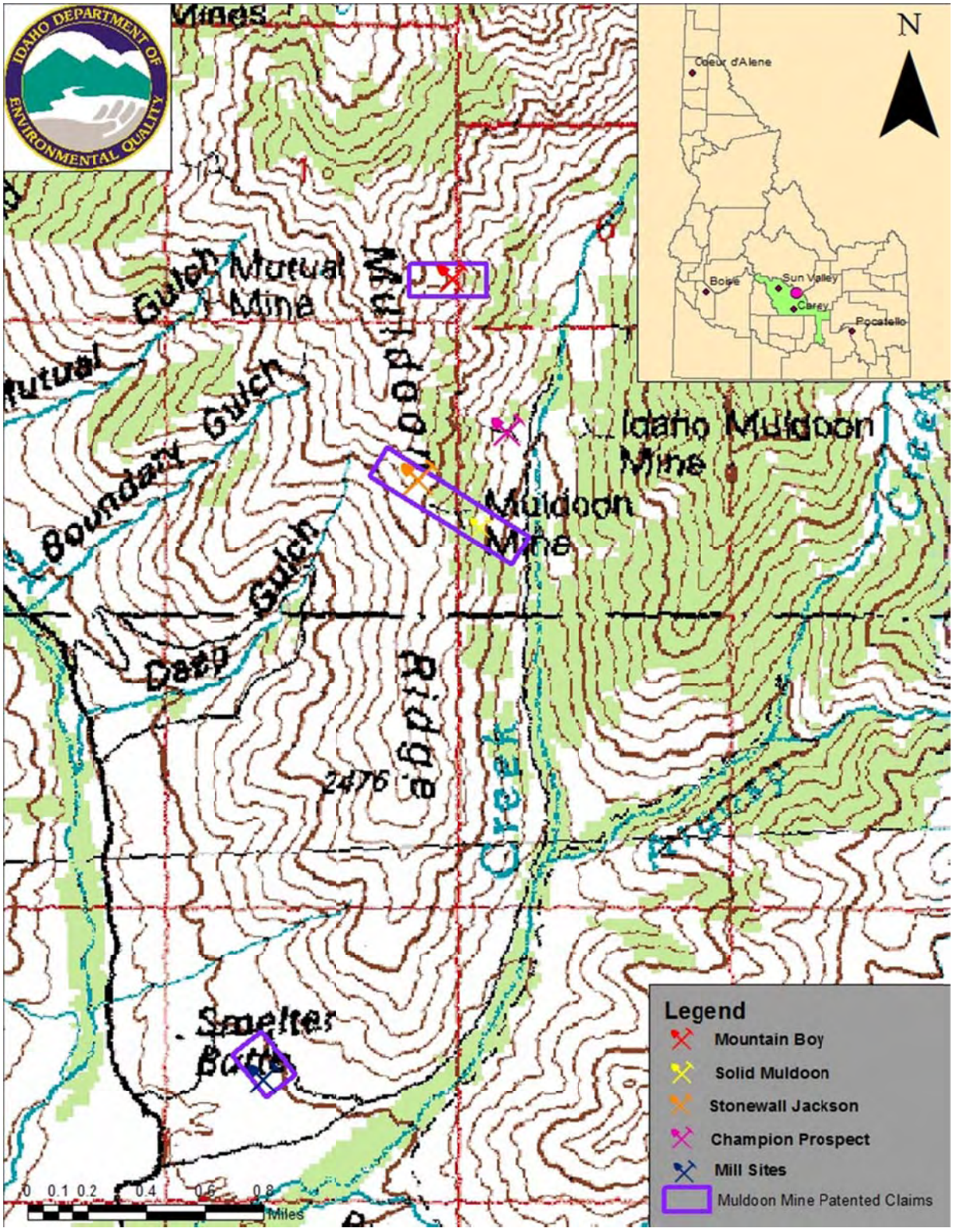


Figure 1. Topographic overview map of the Muldoon mines and mill sites.
(Source: USGS 100K Quad Maps)

2 Ownership

DEQ does not warrant the ownership research or location of property boundaries contained in this report. The information regarding ownership and property boundaries was obtained from the Blaine County Assessor's Office and the United States Bureau of Land Management (BLM) General Land Office (GLO) records (Figure 2).

The Muldoon mines are located on private land owned by Scott Corkery and are surrounded by United States Forest Service (USFS) land. The Champion Prospect is located on USFS land. The mill sites are on private land owned by Scott Corkery. The property surrounding the mill sites is owned by a different private party

For the ownership described below, the *Partial Determination* is meant to convey a very brief summary of DEQ's assessment of individual claims and parcels relative to human health and ecological risk factors associated with toxicological responses to mine wastes. A determination of *No Remedial Action Planned*, or NRAP**,** means that based on current conditions at the site, DEQ did not find any significant evidence indicating the potential of adverse toxicological effects to human or ecological receptors on the parcel of land and no additional work is necessary to manage those potential effects. This determination says nothing about risks associated with physical hazards such as open adits, open shafts, high walls, or unstable ground.

A *Calculate HRS* determination indicates that DEQ has found sufficient evidence to warrant a Hazard Ranking System (HRS) score calculation by EPA's contractors. It also indicates that DEQ has concluded and recommended that additional site assessment and/or remedial actions are necessary to prevent adverse effects to human or ecological receptors. The conclusions and recommendations for the Muldoon mines and mill sites are in Section 11 of this report.

Owner	Mine Name	Parcel Number	Partial Determination
Scott Corkery June Schlunegger Trustees to George C. Castle HC 35 Box 35 Boise, ID 83706	Solid Muldoon, Stonewall Jackson, and Mountain Boy Mines Solid Muldoon, Stonewall Jackson, and Mountain Boy Mill Sites	RP1M000000041A	NRAP
USFS P.O. Box 2356 Ketchum, ID 83340	Champion Prospect	RP03N220070030	NRAP

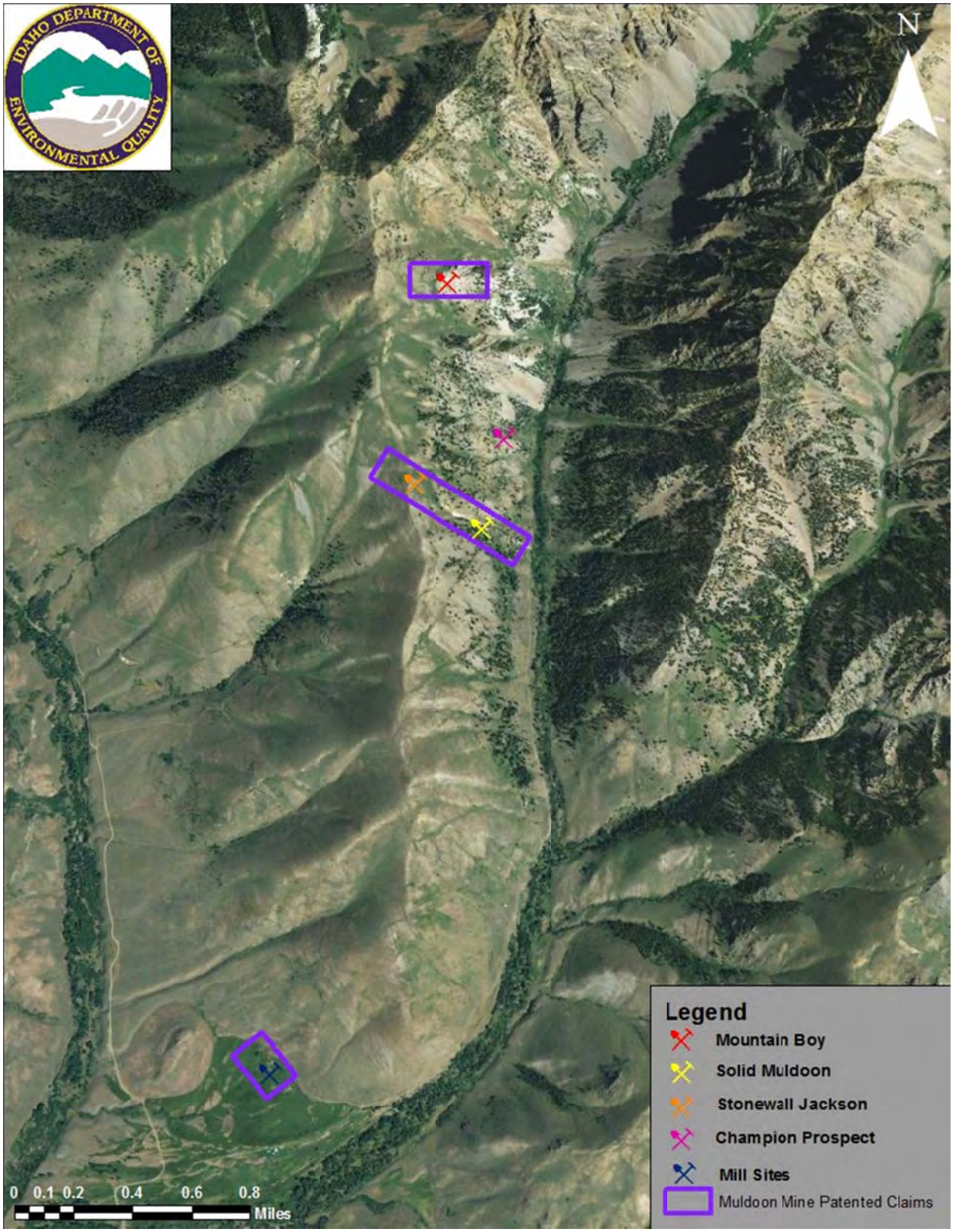


Figure 2. Aerial photograph overlain by Blaine County parcel data for Muldoon mines.
(Source: 2009 Natural Color 1-meter National Agriculture Imagery Program [NAIP] Idaho)

3 Location

Access to the Muldoon mines was granted to DEQ by Scott Corkery, Trustee to George C. Castle. The data and observations made during the site visit were used to come to specific conclusions regarding this property and to some extent regarding cumulative effects of all public and private mining properties in the watershed.

The Muldoon mines are located approximately 22 air miles north, northeast of Hailey, Idaho in the Muldoon Creek sub-drainage.

The most direct route to access the Muldoon mines is from Carey, Idaho. Drive north on the Little Wood Reservoir Road (3.7 miles) to Barton Road (0.5 mile), then back on Little Wood Reservoir Road (5.8 miles) to Flat Top Road (0.9 mile) to Muldoon Creek Road (2 miles) to Muldoon Canyon. The mill sites are located at the base of Smelter Butte. There will be a right fork along Muldoon Creek into the canyon. The Solid Muldoon Mine site is located approximately 3 miles north of Muldoon Canyon.

4 Mine Site History

DEQ uses historical research for several purposes. Initially, historical information highlights potential contaminants of concerns, the magnitude of waste sites, and potentially dangerous physical hazards such as open adits and shafts. DEQ also uses the information to properly identify mine and mill facilities, unravel inconsistencies that may exist in property boundaries and ownership, and identify historical land uses that coincide with mining.

The historical information helps DEQ understand the relative levels of production, commodities, and potential waste types necessary to prepare for site assessment field work. As indicated in the history, the Muldoon mines and mill sites encompass additional areas besides the Solid Muldoon Mine.

DEQ realizes many of the mine sites described in the histories are particularly important to both the federal government and State of Idaho. This information documents the relative importance of historic mining districts and workings as they are reevaluated from the perspective of economics, multiple land use, human health, and ecological risks.

Numerous sources were used during the “desktop” research prior to visiting the site. DEQ could not improve or expand upon this report by writing additional historical or geological text, therefore they are directly quoted below.

> A year after a notable mining rush to Wood River had brought thousands of fortune hunters to search for lead silver there, Jesse Elliott located a Little Wood River prospect which expanded lead production to Muldoon. Following Elliott's discovery in May of 1881, promotion in Philadelphia brought eastern capital to that area early in 1882. Muldoon obtained a post office, February 15, and townsite lots were sold to eager settlers on April 13. By May that incipient city had two tents and a cabin. As soon as a road was completed there early in May, freighters began hauling in a smelter. Twelve tents, housing three stores, three restaurants, and three saloons, marked the progress of civilization in Muldoon as soon as a road was opened. Late in May, Muldoon had a dozen saloons to accommodate a population of almost 500. Forty men immediately went to work on a smelter for the same Philadelphia company which had opened one in Ketchum a year before. Others dug charcoal pits and built a sawmill. Once equipped with a sawmill, Muldoon gained permanent buildings. Much like Ketchum, Muldoon began as a modern, progressive camp.

Their Philadelphia smelter followed Ketchum's plant in having an early electric light plant--an installation which preceded those of Hailey and Boise. Mining commenced by mid-June. After four hundred tons of Fish Creek iron ore arrived to enable smelting to proceed, processing of lead got underway after more than a month's delay. Problems in completing a tram accounted for their late start. Two water jacket furnaces, each capable of smelting forty tons of ore each day, had been brought in from San Francisco's Pacific Iron Works. One, though, would have been enough. So Philadelphia investors went about purchasing more mines to match their smelter capacity. They already had spent almost $75,000 on their smelters and tram system which brought ore down 1,200 feet from their mine to a two-mile road leading to their smelter, which started about September 30. After a month's smelting, twenty tons of bullion was hauled out to Blackfoot for rail shipment. By spring they had a 3,000-ton reserve, and when lime became available to repair enough charcoal kilns to enable smelting to resume, additional production became possible.

Frontier life in Muldoon had serious drawbacks in 1882. On August 27, after unsuccessful complaints concerning their company boarding house, miners there discarded their Sunday dinner into Muldoon Creek and insisted that a new cook be employed. Their cook was not amused, and company officials responded that no one else could be found to take on that job. Then on September 17 a violent wind blew a lodging house down, leaving that facility totally wrecked. The owner moved on to Ketchum. In spite of such unpleasant conditions, sixteen men mined there that winter. In April, 1883, J. W. Ballentine came out from Pittsburgh to organize operations at Muldoon more efficiently. That spring he had twenty charcoal kilns in production there. Then he contracted for a forty-mule pack train to bring eight tons of upper Fish Creek iron ore six miles each day to a wagon road. Freighters hauled his iron another six miles to Muldoon. By August, seven hundred tons of iron and two hundred tons of galena had been packed in for smelting. Low wages held employment down to a small number of miners, largely because little silver was available and lead prices were low enough that operations were marginal at best. By October, Ballentine's cost ratio turned negative. Running out of operating funds, he had to shut down entirely in October. In November he managed to add ten miners to his staff of four; encouraged by finding some carbonate ore rich in silver as well as lead, they undertook a lot of additional development which incidentally provided an ore reserve of more than four hundred tons that winter.

By May of 1884, they had blocked out enough low grade values to justify an investment in a fifty-ton concentrator. That spring Ballentine returned to Pennsylvania long enough to obtain a lease, June 1, that would enable him to enlarge his plant and operate Muldoon's mine with a partner. Returning from Philadelphia in June, Ballentine arranged to have his concentrator fabricated in Hailey in order to save time and obtain better service. With a concentrator to supply his second smelter, he anticipated running at full capacity--a welcome change. Modest development work on other neighboring mines promised additional ore to help make his enterprise a success. None of these operations transpired, though. A year later, after Ballentine's enterprise failed, he arranged to resume his management position for Muldoon's Philadelphia smelter. By October of 1885 he completed a large moving project, hauling all his tram and mining equipment from Muldoon to a more promising North Star lode on the east fork of Wood River. Then in 1886 he went into cattle ranching at Muldoon. His Philadelphia Mining and Smelter Company did not give up altogether, however. They proceeded on December 6, 1886, to patent several Muldoon claims.

A year later, S. S. Wilson revived interest in Muldoon with his Bear Gulch Black Spar mineral discovery. Selling part of his interest for $30,000 to Saint Louis investors, he managed to employ ten miners, January 23, 1888. Experience as a California placer miner from 1849 to 1855, and as a quartz miner since, helped him to promote his new property. By May 1, 1888, he had 300 tons of ore ready to mill and two more carloads ready to ship to a smelter. His ten miners kept on working through 1888, but declining lead-silver prices discouraged an effort to construct a concentrator. Operations were shut down altogether from December 1888, until April, 1889. Although a sawmill was brought in to Muldoon, 1889 proved to be a pretty quiet year there until a vast August forest fire burned out the smelters (which had not operated since 1884 anyway) and houses. Some development work continued in small Muldoon properties that fall. But irregular ore shoots in complex fissure veins made development very difficult. Inability to operate a smelter without a greater variety of ore--which hardly could be imported into an isolated camp like Muldoon-compounded the problem of trying to mine there.

Since Muldoon's lead-silver lode extended for several miles, a number of companies continued to attempt to devise a satisfactory technology for operating there. They failed repeatedly. Undeterred by disaster, promoters of Muldoon properties kept on trying to mine there. J. E. Smylie's Lake Creek bonanza discovery east of Copper Basin on upper Lost River only nine miles from Muldoon encouraged a mining revival in September, 1891. By the spring of 1892, several Muldoon properties had accumulated some modest ore reserves. Yet they needed a direct road to a smelter in order to try to operate. In spite of that problem, enough Muldoon properties looked good enough in 1892 that William Hyndman took over the Philadelphia mining property there the next year. Frank E. Johnesse tried to promote another group of new Muldoon claims in 1896. By that time, Muldoon was being viewed retrospectively as a famous old producer. Muldoon's greatness, unfortunately, derived from magnificent production that had been anticipated rather than achieved. Development activity in 1901 and 1902 brought renewed promise to Muldoon. Finally in 1906, about sixty miners revived that unfortunate camp. Then a spectacular catastrophe created some genuine excitement there: During the night while no one was working, a great body of water broke into the tunnel, presumably at the face which had just passed a porphyry dike, and the flood continued for about forty hours under enormous pressure. The pressure and volume was such that it washed away the car, tools, shop, and a big dump which had been accumulating for a year, as if by magic. Just below the dump a grove of large fir trees, some of them three feet in diameter, were cut out and uprooted by the escaping flood and tossed aside like straws. It cut a gully down the side of the mountain to bedrock in places thirty feet deep, rolling over and pushing aside boulders of many tons weight in its course. It raised the creek out of its banks for four miles. The water was discolored and muddy like yellowish tailings. After forty hours the flow gradually decreased until at the present time there is a stream about one-and-a-half inches deep flowing out of the mouth of the tunnel. The tunnel is filled with mud and debris that tapers back to the roof at a point about seventy feet in beyond the entrance. Many pieces of what appears to be calcite casing and quartz crystals are mixed with the debris in the tunnel together with pieces of galena and carbonate ore. A spring which was formerly flowing on the surface nearly over this tunnel and which has been drained by it, has commenced to flow again, which leads to the assumption that the underground reservoir is not yet completely drained but simply choked and dammed up and when opened will flow again. A crew of men have been put to work to clean up this tunnel and underground mystery.

Work at Muldoon went right on after this mishap. That month Robert T. Tustin--who kept Muldoon active until 1912--started building cabins for an extensive new operation. Supported by Arizona capital, he started bringing in a new hundred-ton mill the next spring. Lack of a road better than an existing steep grade over from Bellevue held him back: a four-horse team could not haul more than 1,500 pounds up that hill. On May 26, 1908, he got Hailey support for a superior alternate route. Construction began in June, but in August this ambitious project had to be suspended for lack of funds. Five hundred dollars were raised to finish a one-lane road with turnouts, but two hundred dollars more were needed. Eventually Hailey's road was completed in November, just in time to be closed by snow. Tustin finally went ahead with his mill project without waiting for a better road. In September, 1908, he had fifty or sixty miners and builders employed with a payroll of $7,000 to $8,000 a month. Wages ran four to seven dollars a day. With hydroelectric power, his new mill, tramway, and assay office would be thoroughly modern. New bunkhouses also were necessary to accommodate Tustin's large crew. Another property six miles from Muldoon also was active in September of 1908. A force of eight or ten men built a new camp there that winter. Although work had to be suspended for a time in January, 1909, because of the winter weather, construction was completed in time for milling to commence that summer. During an initial season, Tustin's hydroelectric mill (driven by a 200-foot head of water that ran 2,700 feet through a 22-inch pipe to a generator) was "producing a very high grade product."

By September, Muldoon had stage service to Bellevue (since Hailey's road never was reopened), and Muldoon ranchers and farmers profited considerably by having a local market for their products as well as better access to Wood River. Shutdowns in 1910 and 1911 resulted from problems of operating an unreliable, low-grade mine with a cost-ratio rarely more than borderline at best. Only twenty miners even tried to resume work in 1911. If they did not have to invest eight dollars a ton hauling out their concentrates, they might have had a chance. But late that season, Muldoon's mining machinery and equipment was consigned to a mill between Hailey and Ketchum. In 1912, Tustin decided he would do better trying to revive Bayhorse instead of attempting to restore Muldoon. With production of only about $200,000 in an initial era (1882-1884) and not a lot added from 1908 to 1910, Muldoon never lived up to

> an early reputation which depended mainly upon extensive capital investment rather than recovery of lead and silver. Attractive enough to be built up twice, Muldoon's major contribution turned out to be machinery which became available for other mines near Hailey. Muldoon finally emerged as a superlative livestock country after sheep and cattle ranching (which commenced there to supply mining markets) supplanted lead and silver as a major element in Little Wood River's local economy. (Idaho State Historical Society Reference Series #158, 1980)

5 Climatology

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 collected at the Hailey Airport (elevation 5,328 above mean sea level [amsl]), 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 the watershed, vegetation, and other factors.

The region 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 43ºF. The lowest temperature recorded for this period was -28ºF in 1962. The highest temperature for this period of record was 100ºF in 1953. January is the coldest month with an average temperature of 19.5ºF. July is the hottest month with an average temperature of 67ºF.

6 General Geology

The following information was used to identify the composition of geology and lithology for the area:

> Most of the Little Wood River district is underlain by Paleozoic sedimentary rocks, which are concealed in part beneath a blanket of Challis volcanics (Oligocene or Miocene), by flows of basalt (Quaternary), by deposits of morainic and outwash character (Pleistocene), and by stream alluvium (Recent). In the mineralized area the rocks belong chiefly to the Wood River (?) formation (Pennsylvanian), which is in fault contact with Challis volcanics along Copper Creek on the west and probably also along Muldoon and Argosy Creeks on the south. The Wood River formation has been folded, broken by faults both before and after blanketing by Challis volcanics, and has been intruded by Tertiary magma. Upper valleys hold morainic deposits and lower courses are floored with glacial outwash and deposits made by the present streams. (Umpleby et al. 1930, p. 8)

The following is further detail regarding location, development, and geological features of the Solid Muldoon Mine (old Muldoon Mine):

> The old Muldoon mine is on the west side of the canyon of Muldoon Creek less than 3 miles above the canyon’s mouth at an altitude between 6,800 and 8,000 feet. It is contained in Sec. 12, T. 3N., R. 21E., and in Sec. 7, T. 3N., R. 22 E., Boise meridian.
>
> The early history of the district is virtually the history of the Muldoon mine and need not be repeated. Most of the $200,000 production came between 1881 and 1886 with intermediate activity and production in later years. No work has been done for a long time and present ownership was not learned.

> Workings were generally in accessible when the mine was visited by Finch in 1913 and remain so today. The development comprises several thousand feet of drifts and crosscuts on 5 levels. According to Finch[21], the lowest level, the No. 7, is reported to be about 225 feet long and to have two crosscuts, each 100 feet long, driven from the main drift. Several other crosscuts are reported to extend from these two 100-foot crosscuts. The No. 6 level is about 250 feet above and is about 700 feet long with a 200-foot cross cut to the north and a 400-foot cross cut to the south, each started about 400 feet from the portal. Level No. 5, which is 70 feet above the No. 6, is about 1,000 feet long. It has several cross-cuts measuring up to 100 feet extending from it, also one large stope several sets wide, 50 feet long, and 200 feet high. Level No. 4, which is 60 feet above No. 5, is 500 feet long and has several short crosscuts on each side and at least three large stopes. Level No. 3 is reported to be 500 feet long and to have four stopes to the surface. No data are available on Level No. 2, except that all ore was stoped to the surface.
>
> The ore occurred as a replacement deposit along bedding in the quartzitic and slaty rocks of the Wood River formation, particularly along the contact of quartzite and porphyry, which is reported to have formed the hanging wall of the deposit. In the mine the strata strike No. 8°-45°W. and dip 23°-40°NE. It is presumed that the deposit had a corresponding strike and dip. Ore was found in altered rocks of different kinds including the porphyry. Ore on the two lower levels is reported to have consisted largely of disseminated grains in quartzite, none of it of milling grade. The grade of ore improved upward and on the No. 5 level ore was stoped which contained 50 to 60 per cent lead and 45 ounces of silver to the ton. The most and best ore, however, was found on the No. 4 level. At the surface the ore body was 12 to 20 feet wide and is reported to have contained 70 per cent lead. No data were found pertaining to the length of the ore body, except that the stope on the No. 5 level was 50 feet long and that there were three large stopes on the No. 4 level.
>
> The ore consisted of argentiferous galena, pyrite, and some sphalerite, and chalcopyrite with quartz in altered rocks of different kinds. (Anderson and Wagner 1946, p. 21)

Figure 3 is a map of the major lithology in the vicinity of the Muldoon mines. The lithology shown in the map typically represents surface expressions.

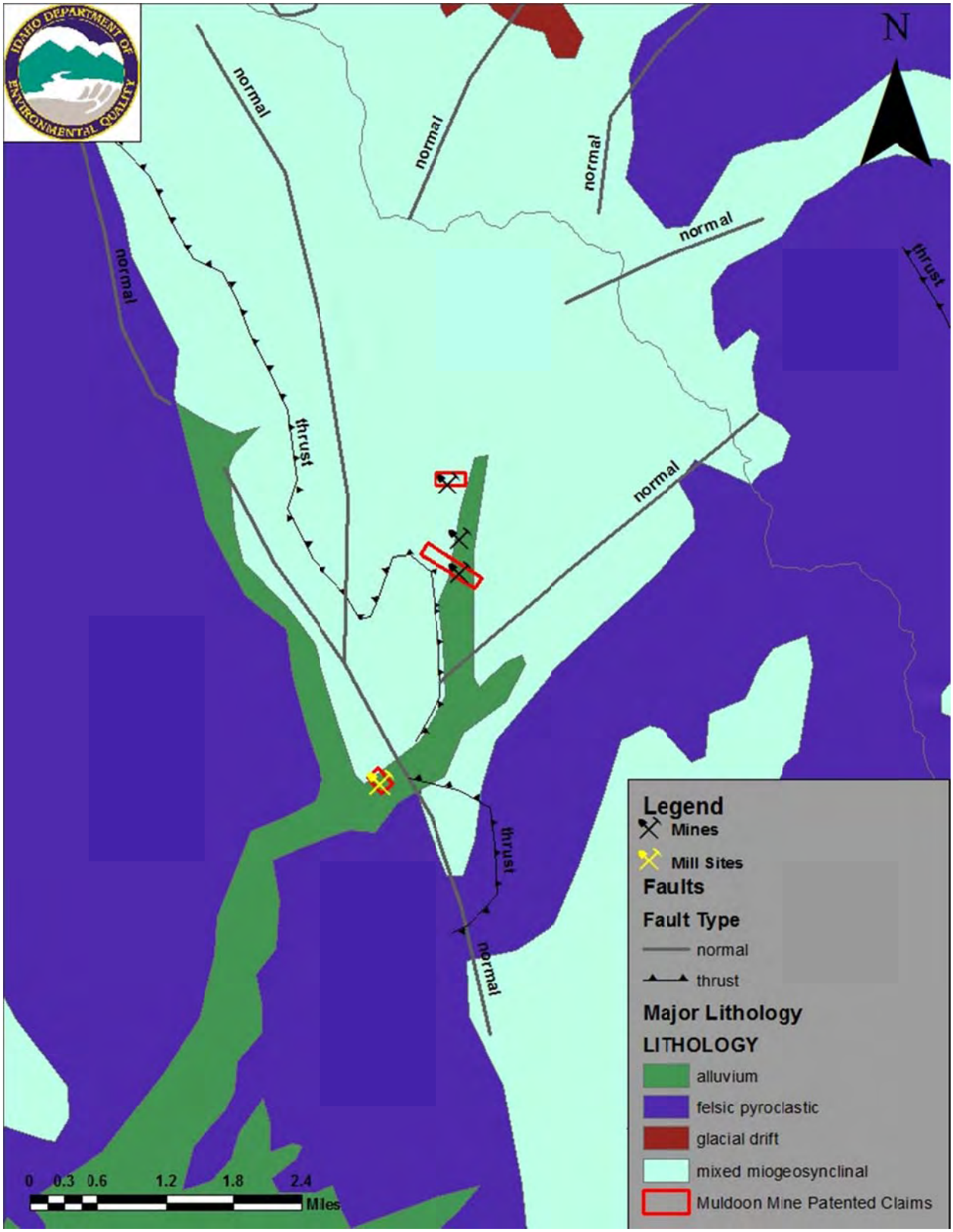


Figure 3. Map of major lithology in the vicinity of the Muldoon mines and mill sites.
(Source: ArcSDE.deqgis83.DBO.major lithology)

7 Current and Potential Future Land Uses

Although there is a permanent resident located at the base of the canyon who restricts access on his property, public access to the Muldoon mines in Muldoon Canyon is unrestricted.

Current land uses in the Muldoon Creek sub-drainage and adjacent tributary areas include recreational activities such as biking, hiking, hunting, horseback riding, and off-road vehicle (ORV) touring.

The other current land use in the area is cattle grazing as was observed at the time of the preliminary assessment. More observations of cattle grazing were made next to Muldoon Creek. The Solid Muldoon Mine did not show signs of cattle grazing.

A reconnaissance survey by the USFS was conducted on May 23, 2006 on the Solid Muldoon, Stonewall Jackson, and Mountain Boy patented claims. The George Castle Estate, owner of the claims, was considering selling or donating the claims to the USFS. The purpose of the survey was to characterize the physical and potential environmental hazards associated with each of the claims in order to determine which claims the USFS would be interested in acquiring.

Current uses are likely to continue into the future.

8 Mine Site Conditions

The photographs and descriptions in the following sections were gathered and observed by DEQ during the field visit on September 25, 2012.

8.1 Mountain Boy Mine

The Mountain Boy Mine was not assessed by DEQ. There was uncertainty as to the exact location of the mine. The terrain was also extremely steep and safety was a factor at the time of the visit as there were numerous thunderstorms progressing through the canyon. Historical documentation provided information regarding possible sources. Observations were made at the base of the canyon regarding possible pathways from the mine site. None were observed.

The following information is from a 2006 USFS report:

> An open adit was found near the center of the claim. The adit measures 6 feet high, 4 feet wide, and has a depth of at least 30 feet. Due to the steep terrain of this adit, a foam plug is the only way to secure it. This plug would take an estimated 4 yd^3 of foam. (USFS 2006))

This was the only information provided from the report regarding hazards at the Mountain Boy Mine site. It is assumed the waste dump associated with the adit was small (<100 cubic yards [cy]) and not seen as a hazard.

Photo 1 shows the area where Mountain Boy Mine was thought to be located.



Photo 1. Northwest view of area where Mountain Boy Mine was possibly located.

8.2 Champion Prospect

The Champion Prospect is located on USFS administered lands at the end of Muldoon Creek Road. The adit is open and measures 5 feet wide and 5 feet high with a depth of at least 50 feet. This adit is accessible by all-terrain vehicle (ATV) and appears to have rock stable enough to construct a steel grate. USFS (2006) estimated 45 feet of steel would be needed to close adit.

Photo 2 shows the Champion Prospect adit.



Photo 2. View facing southwest of the Champion Prospect adit.

The Champion Prospect waste dump, located at Lat. 43.61327N° and Long. -113.88745W°, is less than 1,000 cy (40 x 50 x 24 ft) and is a mix of host rock with iron staining. Some fines mixed in appear to be cemented. Some vegetation is encroaching on the waste dump. No perennial streams are in the immediate vicinity. There was no evidence of significant erosion and no smell of sulfur noted in the area at the time of the preliminary assessment.

Photo 3 shows the Champion Prospect waste dump.



Photo 3. View facing south of the Champion Prospect waste dump.

8.3 Solid Muldoon Mine (Stonewall Jackson Mine)

The Solid Muldoon Mine is the largest of the Muldoon mines owned by Scott Corkery and the one with the most significant mining features. The Moye et al. 1994 site inspection report from the Idaho Geological Survey (IGS) noted that this was an interesting site. IGS observed acid mine drainage (pH readings of 5.6 and 5.9) emitting from two of the adits. However, the pH increased within a short distance downstream. By the time the water reached the base of the hill, it had a pH of 7.2. It is also worth mentioning that IGS saw no evidence that the flow plume at periods of highest water reaches Muldoon Creek.

Photo 4 shows Solid Muldoon waste dumps.



Photo 4. View facing west of the Solid Muldoon waste dumps from Muldoon Canyon Road.

Photo 5 and Photo 6 show a remnant (boiler) from the Solid Muldoon mill.



Photo 5. Remnant (boiler) at Solid Muldoon mill.



Photo 6. Close-up view of remnant (boiler) at Solid Muldoon mill.

The Solid Muldoon Mine mill foundation and waste dump no. 1 are located within 50 feet of Muldoon Canyon Road. Photo 7 and Photo 8 show what remains of the Solid Muldoon mill (Lat. 43.60328°N and Long. -113.88793°W).



Photo 7. Standing water below the remains of the Solid Muldoon mill foundation.



Photo 8. View facing waste of the Solid Muldoon mill ruins.

Photo 9 is looking down from the top of Solid Muldoon waste dump no. 1 which is less than 1,000 cy. The waste dump is tan and brown in color with fines and coarse fragments. There is some sulfur smell. It appears there is movement of waste from the site; however, no pathway of waste was observed across the road to the creek. No adit was observed associated with waste dump no. 1.



Photo 9. View facing east from the top of Solid Muldoon waste dump no. 1.

Photo 10 shows a possible collapsed adit at the Solid Muldoon Mine site. There is also water flowing of at least 1 gallon per minute (gpm) at this location (Lat. 43.60320°N and Long. -113.88867°W). After a few feet the water infiltrated into the hillside.



Photo 10. View facing southwest of a possible collapsed adit at the Solid Muldoon Mine site.

Photo 11, Photo 12, and Photo 13 are of Solid Muldoon waste dump no. 2. The waste dump is less than 1,000 cy (72 x 24 x 50 ft), darker in color, and mostly coarse shale. There is no visual indication of ore/oxidation. However, there is some sulfur smell. Photo 11 also shows a possible shaft (shaft no. 1) at Lat. 43.60334°N and Long. -113.88849°W. This also the possible location of an adit.



Photo 11. View facing northwest of possible Solid Muldoon shaft no. 1.



Photo 12. View facing west of Solid Muldoon waste dump no. 2.



Photo 13. View facing north of Solid Muldoon waste dump no. 2 (looking up valley).

Photo 14 shows Solid Muldoon collapsed adit no. 3 (Lat. 43.60393°N and Long. -113.88965°W). There is water flowing at 3-5 gpm from collapsed adit no. 3 with orange sediment/red staining (red algae) and healthy vegetation. This adit was identified as Adit 2 in the IGS report (Moye et al. 1994).



Photo 14. View facing west of Solid Muldoon collapsed adit no. 3.

Photo 15 shows where surface water sample SMAD3SW1 was taken on September 25, 2012 at 11:45 a.m. The parameters recorded from the IGS visit included: a pH reading of 5.6, conductivity at 42, and the flow rate was less than 3 gpm (Moye et al. 1994).

Field Parameters for Solid Muldoon Adit No. 3 Surface Water Sample SMAD3SW1	
pH	7.03 su
Conductivity	0.267 µs/cm
Turbidity	222 NTU
Dissolved Oxygen	1.33 mg/L
Temperature	8.7°C
Salinity	0.01 mg/L



Photo 15. Sample point for surface water sample SMAD3SW1 at Solid Muldoon adit no. 3.

Photo 16 shows Solid Muldoon waste dump no. 3 (Lat. 43.60387°N and Long. -113.88935°W) where soil sample SMWD3SS1 was taken on September 25, 2012 at 11:38 a.m. The waste dump consists mostly of black sand with some red sand and is approximately 1,667 cy (30 x 100 x 30 ft).



Photo 16. View facing northwest of Solid Muldoon waste dump no. 3.

Photo 17 shows Solid Muldoon collapsed adit no. 4. This adit was identified as Adit 1 in the IGS report (Moye et al. 1994). The adit is collapsed with water discharging from the mouth.



Photo 17. View looking west at Solid Muldoon collapsed adit no. 4.

Photo 18 shows the drainage from Solid Muldoon collapsed adit no. 4, and where surface water sample SMAD4SW2 was collected (Lat. 43.604438°N and Long. -113.89003°W). Water was flowing from the collapsed adit at a rate of 4-5 gpm. Filamentous algae and iron precipitates

were also noted in the discharge and channel flowing down the hillside. The parameters recorded from the IGS visit included: a pH reading of 5.9, conductivity at 22, and the flow rate was less than 5 gpm (Moye et al. 1994).

Field Parameters for Solid Muldoon Adit No. 4 Surface Water Sample SMAD3SW1	
pH	7.75 su
Conductivity	0.335 µs/cm
Turbidity	25 NTU
Dissolved Oxygen	8.07 mg/L
Temperature	9.7°C
Salinity	0.01 mg/L



Photo 18. Drainage from Solid Muldoon adit no. 4 where surface water sample SMAD4SW2 was collected.

Photo 19 shows the vegetation on the top of Solid Muldoon waste dump no. 4 appears to be stressed. However, there is extremely dense riparian growth at the mouth of the collapsed adit.



Photo 19. View facing southwest of Solid Muldoon adit no. 4 and the top of waste dump no. 4.

The same plant species that are present on the top of waste dump no. 4 are also in the drainage channel that runs down the hillside (Photo 20). The red coloration on the rocks indicates the flow is much greater seasonally. The water discharging from adit no. 3 and adit no. 4 merges into one stream and infiltrates into the ground before the road and north of Solid Muldoon waste dump no. 1. Figure 4 in Section 9 shows the red stained area where the stream flows in proximity to the waste dumps.



Photo 20. Solid Muldoon adit no. 3 and adit no. 4 drainage.

Solid Muldoon waste dump no. 4 (Photo 21) has black striation with white and predominantly brown and orange arsenopyrite coloration. The waste dump is approximately 331 cy (32 x 28 x 20 ft) and located at Lat. 43.60444°N and Long. -113.88988°W.



Photo 21. Solid Muldoon waste dump no. 4.

Photo 22 shows Solid Muldoon adit no. 5 is collapsed (Lat. 43.60408°N and Long. -113.89024°W).



Photo 22. View facing southwest of Solid Muldoon collapsed adit no. 5.

Photo 23 is Solid Muldoon waste dump no. 5 which is less than 1,000 cy and consists of iron oxide and country rock.



Photo 23. Solid Muldoon waste dump no. 5.

Photo 24 is Solid Muldoon collapsed adit no. 6. Rocks and brown placard cover the small opening (Lat. 43.60446°N and Long. -113.89135°W).



Photo 24. Solid Muldoon collapsed adit no. 6.

Solid Muldoon waste dump no. 6 is approximately 3,240 cy (50 x 50 x 70 ft) with a mix of tan and iron oxide shale (Photo 25).



Photo 25. Solid Muldoon waste dump no. 6.

Photo 26 shows both Solid Muldoon waste dumps no. 6 and no. 7.



Photo 26. Looking up at Solid Muldoon waste dumps no. 6 and no. 7.

Solid Muldoon waste dump no. 7 is located at Lat. 43.60475°N and Long. -113.89225°W. The waste dump consists of country rock and is approximately 7,000 cy (72 x 50 x 70 ft). Photo 27 shows Solid Muldoon adit no. 7 which is open and dry near waste dump no. 7.



Photo 27. Solid Muldoon waste dump no. 7 and adit no. 7.

Photo 28 is a close-up of open Solid Muldoon adit no. 7. The adit is dry and may pose a physical hazard.



Photo 28. Close-up view of Solid Muldoon adit no. 7.

Photo 29 is of Solid Muldoon adit no. 8 which is thought to be a stope. The area is dry with no signs of discharge.



Photo 29. Solid Muldoon adit no. 8 (stope).

Photo 30 and Photo 31 show Solid Muldoon waste dump no. 8. The waste dump is less than 500 cy (50 x 20 x 40 ft) and consists of country rock (43.604882°N and Long. -113.89235°W).



Photo 30. View facing southwest of Solid Muldoon waste dump no. 8.



Photo 31. View facing east from the top of Solid Muldoon waste dump no. 8.

Photo 32 is of open shaft no. 2 that was observed adjacent to waste dump no. 8 (Lat. 43.60526°N and Long. -113.89278°W). This shaft could pose a physical hazard and should be fenced off to restrict access.



Photo 32. View facing south of Solid Muldoon open shaft no. 2.

Photo 33 was taken looking down the shaft facing east. The adit (stope) in the picture is the back side of adit 8.



Photo 33. Solid Muldoon open shaft no. 2.

Photo 34 is the Solid Muldoon waste dump no. 9 (Lat. 43.605173°N and Long. -113.89299°W). The waste dump consists of country rock and is less than 1,000 cy (48 x 20 x 20 ft).



Photo 34. Solid Muldoon waste dump no. 9.

Photo 35 is the Solid Muldoon waste dump no. 10 (Lat. 43.60545°N and Long. -113.89282°W). The waste dump is less than 1,000 cy (50 x 8 x 30 ft) and consists of country rock. Solid Muldoon adit no. 10 is closed and dry (no picture of adit).



Photo 35. Solid Muldoon waste dump no. 10.

8.4 Background and Probable Point of Entry Sample Locations

Photo 36 and Photo 37 show the area of Muldoon Canyon and Muldoon Canyon Road. The following photographs and descriptions were gathered and observed during the field visit on September 25, 2012.



Photo 36. View facing north looking up Muldoon Canyon.



Photo 37. Close-up view facing north of Muldoon Canyon Road.

Photo 38 is Muldoon Creek where background surface water sample MCBGSW1 and background sediment sample MGBGSD1 (Lat. 43.60568°N and Long. -113.88630°W) were taken.

Muldoon Creek Background Surface Water Sample MCBGSW1	
pH	6.82 su
Conductivity	0.063 µs/cm
Turbidity	3 NTU
Dissolved Oxygen	11.80 mg/L
Temperature	7.9°C
Salinity	0.0 mg/L



Photo 38. Muldoon Creek where surface water sample MCBGSW1 and sediment sample MGBGSD1 were collected.

There was ample evidence that the base of Muldoon Canyon is used for livestock grazing (Photo 39). Although no cows were observed at the time of the assessment, cow manure was abundant along Muldoon Creek. There were also campfire rings located in the flat areas along Muldoon Creek.



Photo 39. Campfire ring and evidence of livestock grazing.

Surface water probable point of entry (PPE) sample MCPPESW1 and sediment PPE sample MCPPESD1 were taken downstream approximately 620 south of Solid Muldoon waste dump no. 1 (Photo 40).

Muldoon Creek Probable Point of Entry Surface Water Sample MCPPESW1	
pH	7.21 su
Conductivity	0.076 µs/cm
Turbidity	3 NTU
Dissolved Oxygen	12.10 mg/L
Temperature	8.0°C
Salinity	0.0 mg/L



Photo 40. Muldoon Creek PPE sample location.

There were a few dilapidated structures located along the creek and north of the Solid Muldoon Mine site. They have been reduced to foundations. Photo 41 and Photo 42 show the structure located east of the Solid Muldoon Mine next to Muldoon Creek. Vegetation has reclaimed the area of disturbance.



Photo 41. Abandoned structure foundation near Muldoon Creek.



Photo 42. Abandoned structure and vegetation adjacent to Muldoon Creek.

8.5 Muldoon Smelter and Mill Sites

At the time of the May 23, 2006 USFS visit there were approximately 20 separate brick charcoal kilns in varying conditions. Several of the kilns were in fair shape with sidewalls and some window openings still intact. The rest of the kilns had nothing but their brick foundations left.

None of the kilns posed a significant physical safety hazard. There was a recommendation from USFS to make the area an interpretive site due to their proximity to a major forest road and their historical significance (USFS 2006).

At the time of the September 25, 2012 DEQ visit there was one charcoal kiln left (Photo 43) at Lat. 43.57786°N and Long. -113.90566°W.



Photo 43. Charcoal kiln.

The only remnant of the smelter operation is a slag pile located on a bench to the north of the charcoal kilns. The slag pile is approximately <500 cy. There was no evidence of acid drainage or metal contamination around the slag pile. At the time of the 2006 USFS visit there was a very small amount of discolored vegetation at the toe of the slag pile. As shown in Photo 44, the vegetation appears healthy. No samples were collected.



Photo 44. Slag pile of less than 500 cy.

9 Sample Collection and Analysis

The following section discusses the types of samples collected and the results from the analysis.

9.1 Collection

A total of seven samples were collected from the Solid Muldoon Mine and Muldoon Creek:

- Soil (SMWD3SS1)—Solid Muldoon waste dump no. 3
- Sediment (MCBGSD1)—Background sediment sample from Muldoon Creek
- Sediment (MCPPESD1)—Sediment sample from Solid Muldoon PPE in Muldoon Creek
- Surface water (MCBGSW1)—Background surface water sample from Muldoon Creek
- Surface water (SMAD3SW1)—Solid Muldoon adit no. 3 seep
- Surface water (SMAD4SW1)—Solid Muldoon adit no. 4 seep
- Surface water (MCPPESW1)—Water sample from creek after possible influence from Solid Muldoon Mine

The soil and sediment samples were collected and placed in a properly marked Ziploc bag. The sample was then placed in a similarly marked cloth bag and recorded on the chain-of-custody form prior to shipping to SVL Analytical, Inc. (SVL). The portion of the sample that passed through a 9 mesh sieve was sent for laboratory analysis.

After the samples were bagged and tagged, nitrile gloves and disposable plastic spoons were discarded into a sealable waste bag.

Prior to collecting field samples for water quality analysis, a gloved technician labeled and triple rinsed laboratory-prepared sample bottles before filling the bottles with grab samples. The bottles were acidified with 10 milliliters (mL) of nitric acid, closed, dried, and placed in a cooler with ice.

Background surface water sample MCBGSW1 and background sediment sample MCBGSD1 were taken from Muldoon Creek north of the Solid Muldoon Mine. The water appeared clear and was flowing in Muldoon Creek at approximately 500 gpm. Sediment sample MCBGSD1 consisted of dark brown to buff gravels, fine grains, and silt. Approximately 10 percent of the collected material passed through 9 mesh and there was approximately less than two percent organic detritus.

The remaining samples were collected from two adits, a waste dump, and Muldoon Creek at the PPE to Muldoon Creek.

Surface water sample SMAD3SW1 was collected on the hillside from Solid Muldoon adit no. 3. The water was discharging from the adit at a rate of 3-5 gpm. The water collected had a reddish/orange tint.

Surface water sample SMAD4SW1 was collected on the hillside from Solid Muldoon adit no. 4. The water was discharging from the adit at a rate of 4-5 gpm. The water collected was clear even with a significant amount of filamentous algal growth and surface iron oxide sludge at the collection point.

The soil (waste) sample was collected from Solid Muldoon waste dump no. 3. Soil sample SMWD3SS1 contained mostly black sands with some red sands. Approximately 90 percent of the material passed through 9 mesh.

Surface water sample MCPPESW1 and sediment sample MCPPESD1 were collected at the assumed PPE as there was no evidence of a complete surface water pathway at the time of the assessment. The samples were collected from the creek approximately 620 feet south of Solid Muldoon waste dump no. 1.

In accordance with EPA chain-of-custody procedures, DEQ submitted the samples to SVL in Kellogg, Idaho, for analysis of the Resource Conservation and Recovery Act (RCRA) suite of eight heavy metals along with copper, zinc, manganese, iron, and antimony. A copy of the laboratory report is included as Appendix A. Figure 4 shows the soil and surface water sample locations. A summary of the laboratory results is included in the tables in sections 9.2 and 9.3.

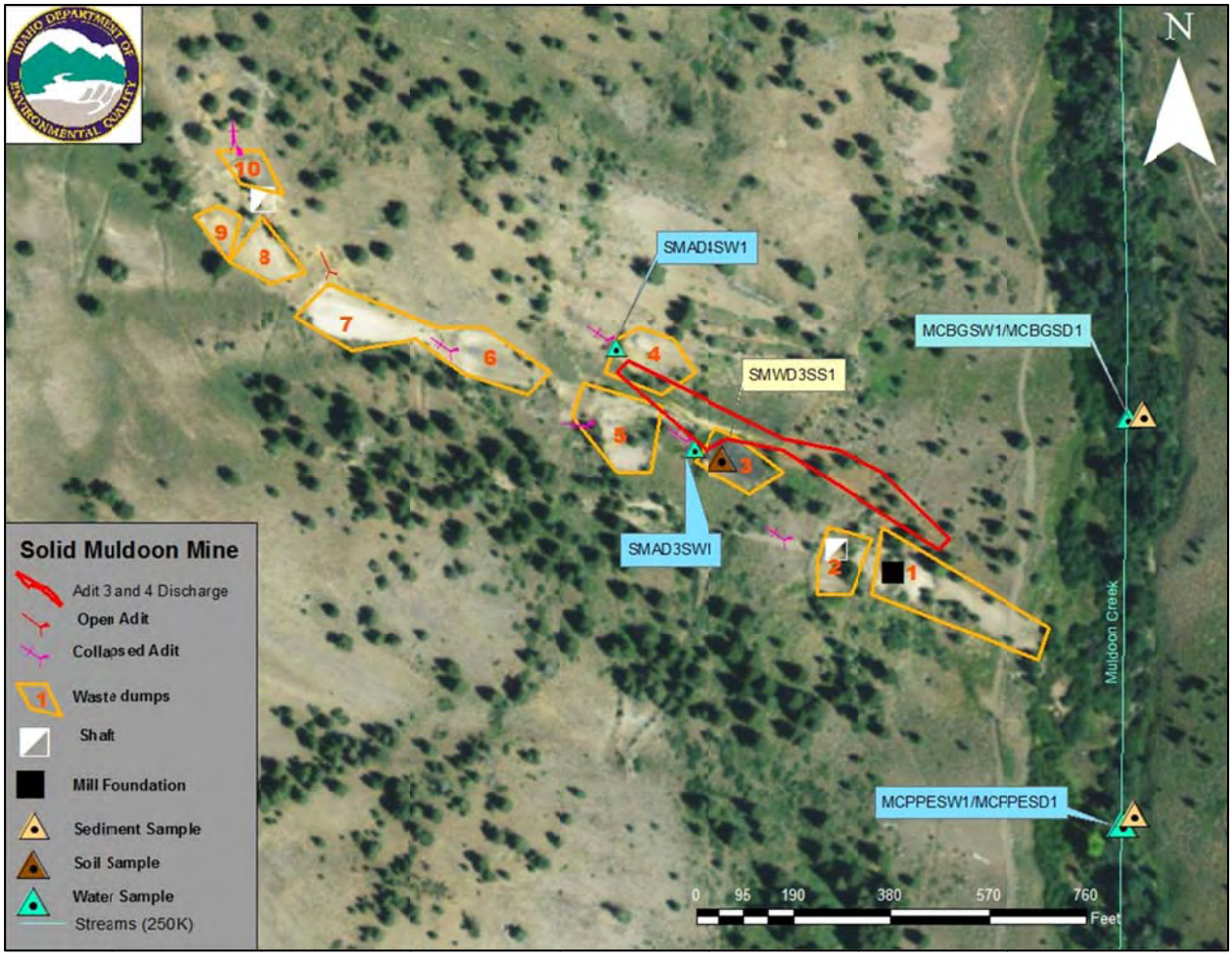


Figure 4. Sample locations and features of the Solid Muldoon Mine.
(Source: Digital Orthoimagery Series of Idaho [2011, 1-meter, Natural Color + IR])

9.2 Soil Sample Analysis

Soil sample SMWD3SS1, background sediment sample MCBGSD1, and PPE sediment sample MCPPESD1 were analyzed at SVL utilizing EPA 6000/7000 method 6010B for all metals except mercury, where method 7471A was used. Laboratory analytical results were compared to and are discussed below relative to Idaho's initial default target levels (IDTLs), EPA Region 6 human health screening levels (HHSLs), and BLM's wildlife and livestock *Risk Management Criteria for Metals at BLM Mining Sites* (BLM 2004).

The IDTLs are risk-based target levels that have been developed by DEQ for certain chemicals using conservative input parameters, a target acceptable risk of 10^{-5}, and a hazard quotient of 1. These levels, although used for comparison even at remote locations, are more applicable to sites where "unrestricted uses," such as residential development, are expected. Similarly, the EPA Region 6 HHSLs are human health-based risk levels derived for screening where residents are at risk for exposure.

The Muldoon Creek background sediment sample MCBGSD1 exceeded the IDTLs for chromium, lead, and manganese. Arsenic exceeded both the IDTLs and HHSLs in the background sediment sample.

The waste dump no. 3 soil sample SMWD3SS1 at the Solid Muldoon Mine exceeded the IDTLs for chromium, lead, manganese, selenium, silver, and mercury. Arsenic, cadmium, and zinc exceeded both the IDTLs and HHSLs in the soil sample.

The sediment sample MCPPESD1 for the PPE to Muldoon Creek from Solid Muldoon mining influences exceeded the IDTLs for cadmium, chromium, lead, and manganese. Arsenic exceeded both the IDTLs and HHSLs in the sediment sample.

Table 1 summarizes laboratory analytical results for the soil samples collected.

Table 1. Solid Muldoon Mine soil sample analysis (in milligrams per kilogram [mg/kg]).

Metals	IDTLs (mg/kg)	HHSLs (mg/kg)	Muldoon Creek Background Sediment Sample MCBGSD1 (mg/kg)	Solid Muldoon Waste Dump Soil Sample SMWD3SS1 (mg/kg)	Muldoon Creek PPE Sediment Sample MCPPESD1 (mg/kg)
Antimony	4.77	31	<2.0	3.4	<2.0
Arsenic	**0.391**	**23**	35.7	276	48.9
Barium	896	1,600	123	430	307
Cadmium	**1.35**	**39**	1.15	60.0	1.82
Chromium	**7.9**	210	10.6	42.2	16.1
Copper	921	2,900	22.4	149	29.8
Iron	—	55,000	7,830	47,100	10,900
Lead	**49.6**	—	77.3	172	99.9
Manganese	**223**	3,600	229	2,460	301
Selenium	**2.03**	23	<4.0	16.9	<4.0
Silver	**0.189**	390	<0.50	1.53	<0.50
Zinc	**886**	**390**	173	9,820	287
Mercury	**0.00509**	23	<0.033	0.290	<0.033

Note: **Orange** shaded values exceeded Idaho initial default target levels (IDTLs); **yellow** shaded values exceeded human health screening levels (HHSLs); and **pink** shaded values exceeded both IDTLs and HHSLs. Limits exceeded are indicated in **bold**.

A background soil sample was not collected from the Solid Muldoon Mine site because the whole area appeared to have some mining influence. The Muldoon Creek background sediment sample exceeded the IDTLs by 91 times. At the time of the DEQ visit, a complete surface water pathway was not observed from the Solid Muldoon Mine waste dumps to Muldoon Creek. However, in aerial photographs it appears the material from Solid Muldoon waste dump no. 1 is moving from the site.

Table 2 identifies for which species the metals analysis exceeded the BLM benchmarks. As an example, soil sample SMWD3SS1 exceeded the BLM benchmark for arsenic for sheep.

Table 2. Wildlife and livestock risk management criteria for metals in soils (all in milligrams per kilogram [mg/kg]).

Metals	Elk	Mule Deer	Deer Mine	Cotton-tail Rabbits	Canada Goose	Mallard	Robin	Cattle	Sheep	Median Values	Solid Muldoon Waste Dump Soil Sample SMWD3SS1
Antimony											
Arsenic	**328**	**200**	**230**	438	**61**	**116**	**4**	419	**275**	**275**	276
Barium											
Cadmium	**3**	**3**	**7**	**6**	**2**	**1**	**0.3**	**15**	**12**	**8**	60
Chromium											
Copper	**131**	**102**	640	358	161	**141**	**7**	413	**136**	**136**	149
Iron											
Lead	**127**	**106**	**142**	172	**34**	**59**	**6**	244	**125**	**125**	172
Manganese											
Selenium											
Silver											
Zinc	**275**	**222**	**419**	**373**	**271**	**196**	**43**	**1,082**	**545**	**307**	9,820
Mercury	11	11	2	15	6	4	1	45	8	8	0.290

Source: BLM 2004
Note: Shaded values indicate metals concentrations exceeded a BLM risk management criteria. Criteria exceeded are indicated in bold.

9.3 Water Quality Sample Analysis

Significant interaction occurs between surface water and ground water systems, with the latter being more influential on the former. However, as discussed below and as indicated by field parameters and laboratory analyses, although metals are present locally, buffering capacity in host rock in the water column stifles migration of metals through the local surface water and ground water systems.

Table 3 summarizes laboratory analytical results for surface water samples collected including: a background sample collected from Muldoon Creek above the PPE and the PPE along Muldoon Creek below the influence of the waste dumps.

Surface water sample MCBGSW1 was collected from Muldoon Creek in the canyon north of the waste dumps from the Solid Muldoon Mine site. The water was clear. An unfiltered sample was collected and nitric acid was used as a preservative that was added to the sample containers. The sample did not exceed any water quality standards.

Surface water sample SMAD3SW1 was collected on the hillside from Solid Muldoon adit no. 3. The water sample exceeded all of the standards for cadmium. Iron and manganese exceeded DEQ's ground water and drinking water standards. Zinc exceeded the DEQ cold water biota standard for both acute and chronic.

Surface water sample SMAD4SW1 was collected on the hillside from Solid Muldoon adit no. 4. The water sample exceeded all of the standards for cadmium. Iron and manganese exceeded DEQ's ground water and drinking water standards. Zinc exceeded the DEQ cold water biota standard for both acute and chronic.

Surface water sample MCPPESW1 was collected from Muldoon Creek in the canyon south of the waste dumps associated with the Solid Muldoon Mine site. The water was clear. An unfiltered sample was collected and nitric acid was used as a preservative that was added to the sample containers. The sample did not exceed any water quality standards.

The values shown in Table 3 are unremarkable because the water from the two adits merges and there is a rise in pH levels as the water travels downhill. There is no evidence of a complete pathway from the adits to Muldoon Creek. The water in Muldoon Creek meets all of the water quality standards.

Table 3. Total recoverable metals analysis from the Solid Muldoon adits and Muldoon Creek. (Concentrations expressed in milligrams per liter [mg/L] unless otherwise noted.)

Description	DEQ Ground Water Standard(T)	DEQ Drinking Water Standard MCL	DEQ Cold Water Biota Standard Acute	DEQ Cold Water Biota Standard Chronic	MCBGSW1	SMAD3SW1	SMAD4SW1	MCPPESW1
Antimony	0.006	0.006	—	—	<0.020	<0.020	<0.020	<0.020
Arsenic	0.05	0.01	0.34	0.15	<0.025	<0.025	<0.025	<0.025
Barium	2	2	—	—	0.0448	0.0392	0.0735	0.0552
Cadmium	**0.005**	**0.005**	**0.00013 (H)**	**0.0006 (H)**	<0.0020	0.0058	0.0243	<0.0020
Chromium (Total)	0.1	0.1	—	—	<0.0060	<0.0060	<0.0060	<0.0060
Copper	1.3[a]	1.3[b]	0.017 (H)	0.0011 (H)	<0.010	<0.010	<0.016	<0.010
Iron	**0.3[a]**	**0.3[a]**	—	—	<0.060	10.0	1.02	<0.118
Lead	0.015	0.15	0.065 (H)	0.00025 (H)	<0.0075	<0.0075	<0.0075	<0.0075
Manganese	**0.05**	**0.05[a]**	—	—	<0.0040	0.361	0.255	<0.0058
Selenium	0.05	0.05	0.02 (T)	0.005 (T)	<0.040	<0.040	<0.040	<0.040
Silver	0.1[a]	0.1[a]	0.0034 (H)	—	<0.0050	<0.0050	<0.0050	<0.0050
Zinc	5[a]	5[a]	**0.12 (H)**	**0.12 (H)**	0.0199	1.49	4.93	0.0216
Mercury	0.002	0.002	—	—	<0.00020	<0.00020	<0.00020	<0.00020
pH	6.5 – 8.5[c]	6.5 – 8.5[a]	—	6.5 – 9.0 su	6.82	7.03	7.75	7.21
Conductivity	—	—	—	—	0.063	0.267	0.335	0.076
Turbidity	—	[d]	Not >50 NTU instantaneous	Not >50 NTU instantaneous and no >25 NTU over a 10 day period	3	222	25	3
Dissolved Oxygen	—	—	—	>6 ppm	11.8	1.33	8.07	12.1
Temperature	—	—	—	Cold water aquatic life 22°C or less or a maximum daily average not >19°C Salmonid spawning 13°C or less with a maximum daily average not >9°C	7.9°C	8.7°C	9.7°C	8.0°C
Salinity	—	—	—	—	0	0.01	0.01	0

Note: (T)—Standard in Total, (H)—Hardness dependent Cd, Cu, Pb, Ag, Zn at 100 mg/L
Note: Shaded values indicate exceedances of DEQ's water quality standards. Criteria exceeded are indicated in bold.
[a] Secondary Standard Maximum Contaminant Level (MCL) – non-enforceable guideline.
[b] Action level.
[c] No units apply.
[d] §141.13(a) One turbidity unit (TU), as determined by a monthly average pursuant to §141.22, except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the State that the higher turbidity does not do any of the following:

(1) Interfere with disinfection;
(2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or
(3) Interfere with microbiological determinations.

§141.13(b) Five turbidity units based on an average for two consecutive days pursuant to §141.22.

10 Pathways and Receptors

The purpose of the PA/SI is to identify sources of contamination, like waste dumps or adits with water emitting and discharging into a surface water pathway. Four types of pathways exist: groundwater, surface water, air, and soil. These types of pathways may lead to receptors, which may be human or ecological.

The following sections identify environmental hazards as they pertain to pathways and types of exposures to the receptors.

10.1 Ground Water Pathways

In areas where historic mines are close to residential areas, contamination of drinking water systems may come from two types of mine sources (ore bodies and waste dumps) and along three ground water pathways illustrated by the following three scenarios:

- Heavy metals can leach from tailing piles and waste rock dumps, enter ephemeral or perennial drains, and contaminate the area's shallow ground water system.
- Heavy metals can leach from the local ore bodies and be transported through the geologic structure to the shallow ground water.
- Heavy metals can leach out of the ore bodies and be discharged from the underground workings as adit water, which is then conveyed through ephemeral and perennial drains to the shallow ground water system.

Surface water and sediment samples collected from Muldoon Creek under low flow conditions provide no indication of significant impacts from historical waste dumps and adit drainage occurring in the area.

10.2 Surface Water Pathways

The surface water migration pathway target distance limit (TDL) begins at the probable point of entry (PPE) of surface water runoff from a site to a surface water body and extends downstream for 15 miles. The TDL for the Muldoon mines follows Muldoon Creek until it runs into the Little Wood River. A map showing the source water delineation, including the 15-mile surface water TDL for the Muldoon mines, is shown in Figure 5.

10.3 Domestic Wells and Public Water Supplies

There are no domestic wells or drinking water supplies located on the mine sites. The closest domestic well is located within two miles of the mine sites; however, it is located in a different drainage. There are a total of two domestic wells and one public water system (PWS) within the four mile radius (Figure 5).

The PWS is the USFS Garfield Guard Station (ID5420079) and is a well. There is no source water assessment available for the Garfield Guard Station. The PWS is also located in a different drainage and is up gradient from the mine sites.

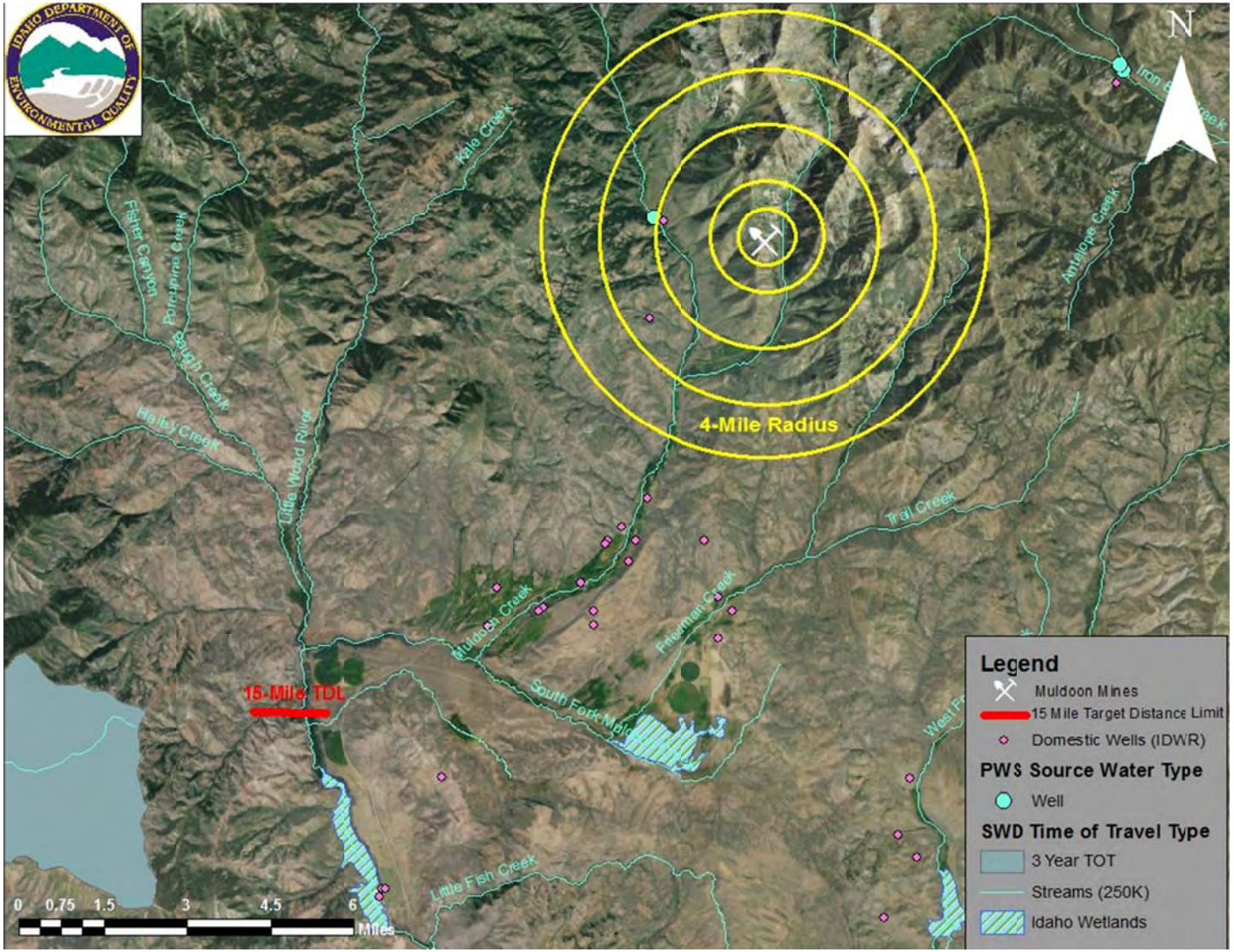


Figure 5. Map of the domestic wells and public water systems, including the 15-mile surface water TDL for the Muldoon mines.

There are no significant wetlands within the 4-mile radius. (Source: 2009 Natural Color 1-meter NAIP Idaho.)

10.4 Air Quality Pathways

The mine waste dumps located at the Muldoon mine sites are generally small features relative to the surrounding area. The waste dumps are mainly comprised of country rock and do not appear to emit fugitive dust. The lowest waste dump shows some movement of waste, however it is most likely caused when there are large rain events and not by wind. Therefore, the air pathway is not a likely pathway for the contaminants to reach humans or the general environment.

10.5 Soil Exposures

According to DEQ'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 IDTLs 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.

Exposure to the surface of the waste dump that exceeded metals and/or arsenic risk levels is possible, but improbable for humans. No residences exist on the section and the nearest residence is approximately three miles from the nearest possible source of contamination.

Exposure for wildlife is possible. However, the contaminated waste dump comprises less than an eighth of an acre of surface in multiple sections. Although the waste dump is exposed, it is located on a steep hillside and harbors little vegetation for cover or feed. The dump is a degraded area and wildlife is less likely to occupy the area for any length of time.

The soil exposure pathways are not complete for full-time residents

10.6 Residences, Schools, and Day Care Facilities

The nearest residence is roughly three miles south from the mine sites. No schools or day care facilities are located within four miles of the mine sites.

10.7 Wetlands

There are no classified wetlands within a four mile radius.

10.8 Sensitive, Rare, and Threatened Plant and Animal Species

Most of the sensitive species have huge ranges that overlap onto the Muldoon mines. Due to the size of those ranges, these species may not receive significant exposure time or doses to heavy metals.

It is possible one or all of these plant species could grow on soils with elevated metals. One rare or sensitive plant species, bugleg goldenweed, is documented to exist within the 4-mile radius of the Muldoon mines (Figure 6):

- No Status:
  - Bugleg goldenweed (*Pyrrocoma insecticruris*)
  - Wedge-leaf saxifrage (*Saxifraga adscendens ssp. oregonensis*)
  - Mt. Shasta sedge (*Carex straminiformis)*

Below is a list of animals of concern listed within the 4-mile radius and general area of the Muldoon mines. The nongame animals are listed as "species of concern" and have no status. Game animals are regulated by the Idaho Department of Fish and Game (IDFG). However, due to the lack of tailing impoundments, presence of well-vegetated dumps, and unremarkable water chemistry results, a significant source for exposure is unlikely (Figure 6).

- No status:
  - Long-toed salamander (*Ambystoma macrodactylum*)
  - Columbia spotted frog (*Rana luteiventris*)
  - North American wolverine (*Gulo gulo luscus*)
  - Ferruginous hawk (*Buteo regalis*)
- Recently delisted in Idaho:
  - Gray wolf (*Canis lupus*) – Little Wood River Pack
  - Gray wolf (*Canis lupus*) – Nez Perce Pack



Figure 6. Sensitive plant and animal species in and around the Muldoon mines.

(Sources: Spatial Database Engine Feature Dataset, Animal Conservation Database; Idaho DEQ GIS ArcSDE 9.2 Geodatabase)

10.9 Fisheries

The following fish species have been observed by IDFG within the 4-mile radius of the Muldoon mines (Figure 7).

- Wood River sculpin (*Cottus leiopomus*)
- Rainbow trout (*Oncorhynchus mykiss*)
- Brook trout (*Salvelinus fontinalis*)
- Longnose dace (*Rhinichthys cataractae*)
- Speckled dace (*Rhinichthys osculus*)
- Bridgelip sucker (*Catostomus columbianus*)

Results of the water chemistry analysis for the Solid Muldoon Mine are not remarkable. Surface water sample MCPPESW1 was collected from Muldoon Creek in the canyon south of the waste dumps from the Solid Muldoon Mine site. The sample did not exceed any water quality standards.

10.10 Sensitive Waterways

The Clean Water Act (CWA) requires the state to prepare a report, listing (1) the current conditions of all state waters and (2) those waters that are impaired and need a total maximum daily load (TMDL). The first list is called the §305(b) list and the second is the §303(d) list. Both lists are named in accordance with the sections of the CWA where they are defined; together they are known as the Integrated Report. Although they are maintained as separate lists and presented separately in the Integrated Report, impaired waters are just some of the state's waters, so waters on the §303(d) list are actually a subset of those on the §305(b) list.

Muldoon Creek (ID17040221SK014_02, Muldoon Creek- source to mouth) is a perennial stream that is a tributary to the Little Wood River (subbasin HUC- 17040221). Both water bodies are contained in the Little Wood HUC. Both are listed on the State of Idaho 305(b) list for impaired waters. Muldoon Creek is listed as not supporting cold water aquatic life and salmonid spawning due to temperature. Muldoon Creek is fully supporting for secondary contact recreation. Wildlife habitat was not assessed.

The Little Wood River (ID17040221SK013_05, Little Wood River-Muldoon Cr. to Little Wood River Reservoir) is a perennial stream that is fully supporting for cold water aquatic life and salmonid spawning. Primary contact recreation and wildlife habitat was not assessed.

Figure 8 illustrates the §303(d)-listed streams in the area.

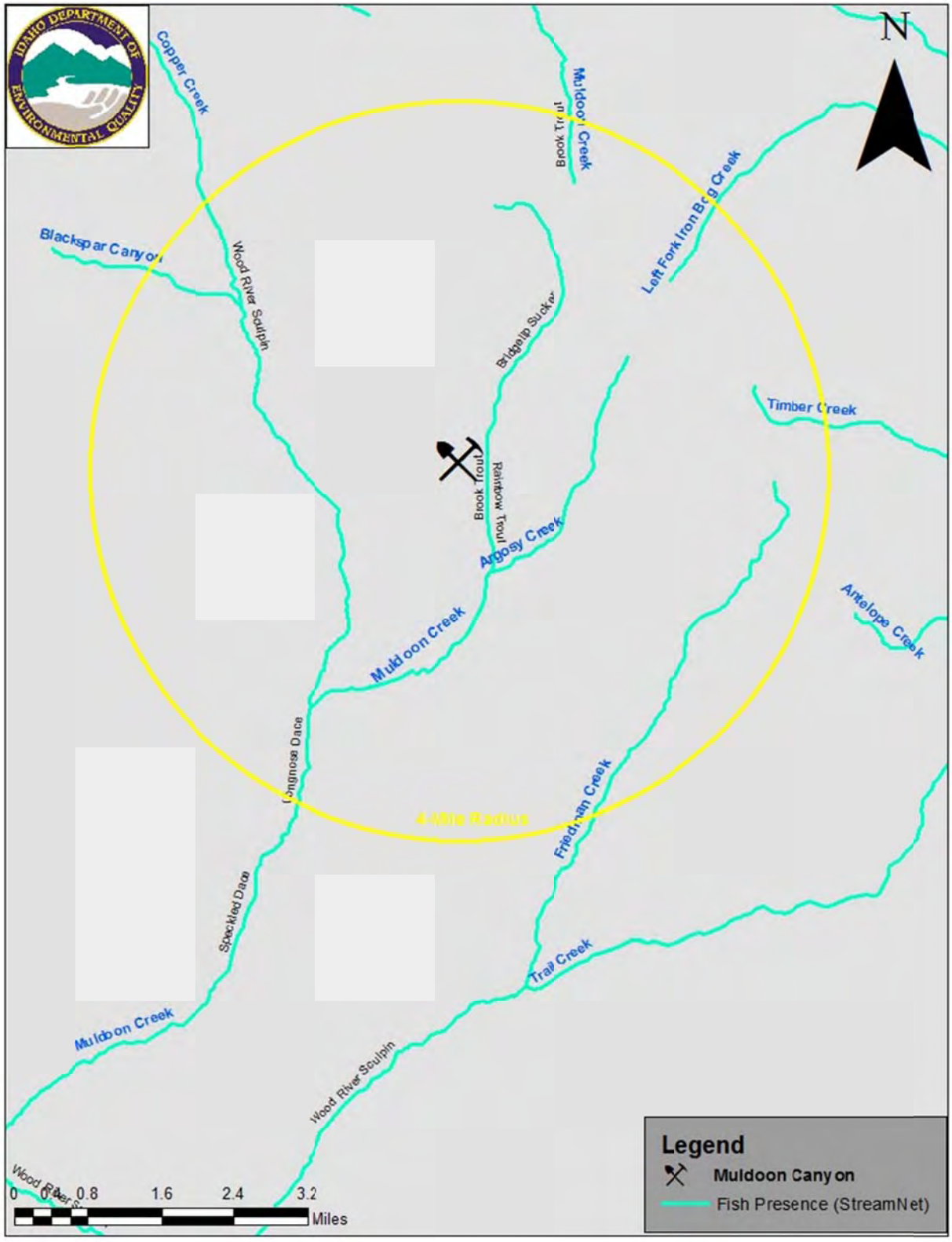


Figure 7. Fisheries within a 4-mile radius and in the vicinity of the Muldoon Canyon mines.
(Source: Idaho DEQ GIS ArcSDE 9.3.1 Geodatabase)

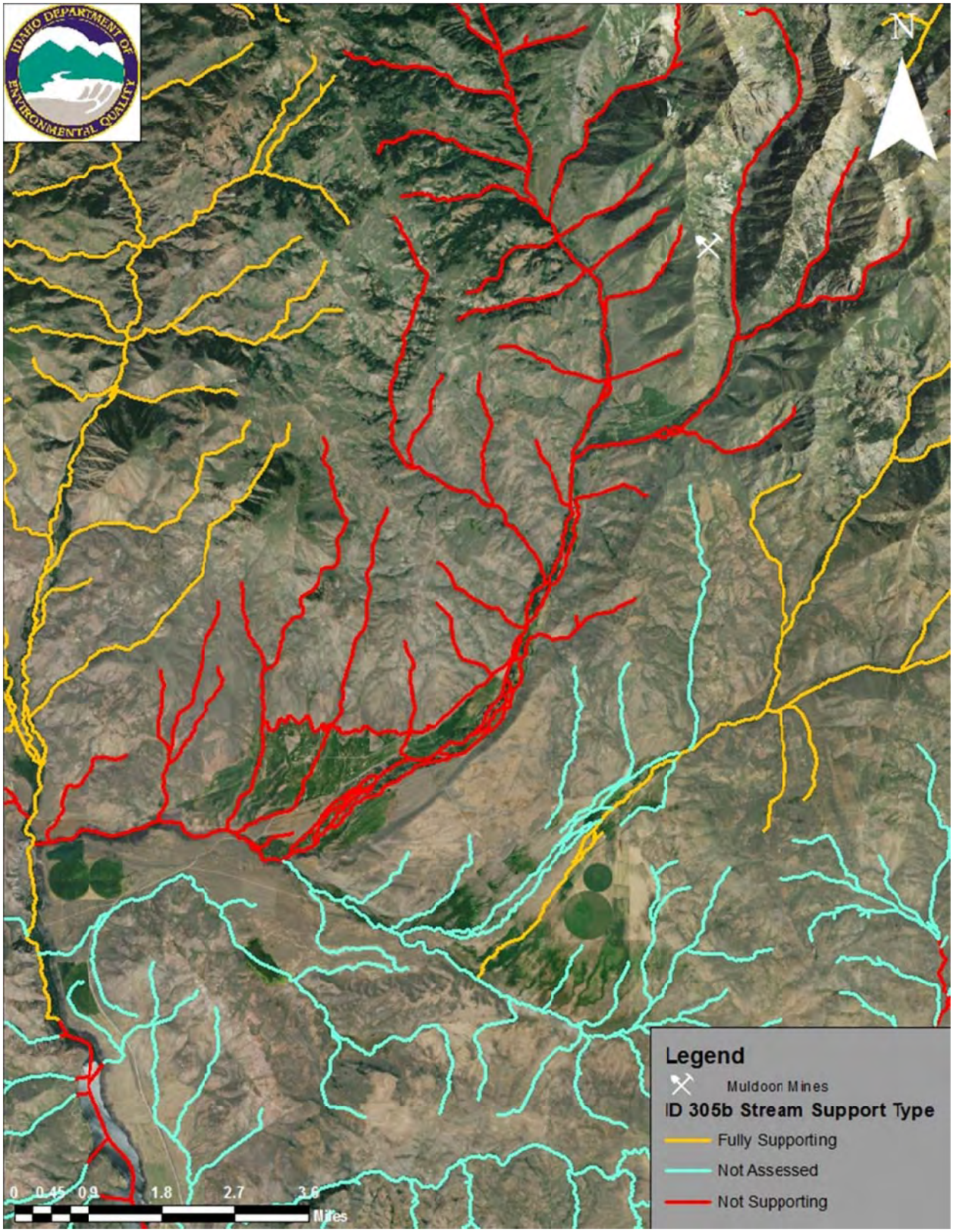


Figure 8. State of Idaho §303(d) map for impaired waters.

Muldoon Creek is not supporting for cold water aquatic life and salmonid spawning due to temperature. (Source: DEQ.GIS.ArcSDE 9.3 Geodatabase, NAIP 2004)

10.11 Livestock Receptors

There were numerous indications the Muldoon Canyon area is used for livestock grazing. The Muldoon mine parcels in the canyon are not located within a BLM Grazing Allotment, although there were signs that cows were openly grazing along Muldoon Creek and at the base of the Solid Muldoon Mine site.

The smelter site (mill site parcels) is located within the BLM Grazing Allotment - Muldoon. The Muldoon allotment covers 13,550.085648 GIS acres. However, there is one pile of slag remaining at the smelter site which is approximately <500 cy in size. Due to the size of the grazing area, it is unlikely livestock would receive significant exposure time or doses to heavy metals

11 Summary and Conclusions

Generally speaking, toxicological risks to human and ecological receptors are limited to exposures in the soils and sediment. Surface and ground water quality at the Solid Muldoon Mine and Mill site appears to be within acceptable ranges.

Soil sample SMWD3SS1 collected from waste dump no. 3 at the Solid Muldoon Mine exceeded the IDTLs for chromium, lead, manganese, selenium, silver, and mercury. Arsenic, cadmium, and zinc exceeded both the IDTLs and HHSLs in the soil sample.

The concentrations of arsenic, cadmium, copper, lead, and zinc also exceeded ecological risk benchmarks for a majority of listed animal receptors for waste dump no. 3. However, the ecological risk is relatively low for certain receptors (grazing animals, wolves) because they cover a large range and the mine and mill site is concentrated in a small area.

Sediment sample MCPPESD1 for the probable point of entry to Muldoon Creek from Solid Muldoon mining influences exceeded the IDTLs for cadmium, chromium, lead, and manganese. Arsenic exceeded both the IDTLs and HHSLs in the sediment sample. However, the Muldoon Creek background sediment sample MCBGSD1 exceeded the IDTLs for chromium, lead, and manganese. Arsenic exceeded both the IDTLs and HHSLs in the background sediment sample.

Based on existing conditions and uses, historic information, data observations made during the site visit, analysis of the mine wastes, potential pathways of contaminants to receptors, and potential exposures to ecological and human receptors, DEQ has made a No Remedial Action Planned (NRAP) determination for the identified Muldoon mines.

12 References

Anderson, A.L. and W.R. Wagner. 1946. "A Geological Reconnaissance in the Little Wood River (Muldoon) District, Blaine County, Idaho." Idaho Bureau of Mines and Geology. University of Idaho.

Bell, R.N. 1913. *Fourteenth Annual Report of the Mining Industry of Idaho for the Year 1912*.

BLM (US Bureau of Land Management). 2004. *Risk Management Criteria for Metals at BLM Mining Sites.* Denver, CO: BLM, National Science and Technology Center. Technical Note 390. BLM/RS/ST-97/001 + 1703.

BLM (US Bureau of Land Management). 2011. *Land Patent Details—BLM GLO Records*.

DEQ (Idaho Department of Environmental Quality). 2011. *Idaho's 2010 Integrated Report*. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report.aspx#2012-IR.*

DEQ (Idaho Department of Environmental Quality). 2011. Safe Drinking Water Information System (SDWIS).

DEQ and EPA (Idaho Department of Environmental Quality and US Environmental Protection Agency). 2003. *South Fork Clearwater River Subbasin Assessment and Total Maximum Daily Loads*. Boise, ID: DEQ.

Idaho State Historical Society Reference Series #158 (1980). "Muldoon." *http://www.history.idaho.gov/sites/default/files/uploads/reference-series/0158.pdf*

Lindgren, W. 1900. "The Gold and Silver Veins of Silver City, De Lamar and Other Mining Districts in Idaho." In *Twentieth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1898–1899, Part 3: Precious Metal Mining Districts,* 65–256.

Moye, F.J., V.E. Mitchell, and E.H. Bennett. 1994. *Site Inspection Report for the Abandoned and Inactive Mines in Idaho on U.S. Forest Service Lands (Region 4), Chapter Eight: Sawtooth National Forest, Part A: Ketchum Ranger District, Section VII: Properties in the Little Wood River Mining District, Blaine County, Idaho*. Moscow, ID: Idaho Geological Survey Staff Report. Prepared for the US Forest Service Under Participating Agreement No. 110451089201.

Umpleby, J.B., L.G. Westgate, and C.P. Ross. 1930. Geology and Ore Deposits of the Wood River Region, Idaho with a description of the Minnie Moore and near-by mines by E.F. Hewett. Washington, DC: US Government Printing Office. Geological Survey Bulletin 814.

USFS (US Forest Service). 2006. Solid Muldoon, Stonewall Jackson, and Mountain Boy Patented Claim Inspections.

WRCC (Western Regional Climate Center). 2012. *http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?idhail*

12.1 GIS Coverages

Animal Conservation Database. Using: ArcMap GIS. Version 10. Redlands, CA: Environmental Systems Research Institute, Inc., 1992–1999.

Digital Orthoimagery Series of Idaho (2011, 1-meter, Natural Color + IR).

IDFG (Idaho Department of Fish and Game). 2002. Fisheries information GIS layer.

IDWR (Idaho Department of Water Resources). 1997. COVERAGE IDOWN—Idaho Surface Ownership.

IDWR (Idaho Department of Water Resources). 2010. GIS shapefile of well database.

Major Lithology (DEQGIS83.DBO). Using: ArcMap GIS. Version 10. Redlands, CA: Environmental Systems Research Institute, Inc., 1992–1999.

NAIP (National Agricultural Imagery Program). 2004. Using: ArcMap GIS. Version 10. Redlands, CA: Environmental Systems Research Institute, Inc., 1992–1999.

NAIP (National Agricultural Imagery Program). 2009. Using: ArcMap GIS. Version 10. Redlands, CA: Environmental Systems Research Institute, Inc., 1992–1999.

USGS (US Geological Society). 100K Quad Map. Using: ArcMap GIS. Version 10. Redlands, CA: Environmental Systems Research Institute, Inc., 1992-1999.

Appendix A. Laboratory Sample Reports

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CHAIN OF CUSTODY RECORD

SVL Analytical, Inc. • One Government Gulch • Kellogg, ID 83837 • (208) 784-1258 • FAX: (208) 783-0891

Page 1 of 1

W2J0073

FOR SVL USE ONLY
SVL JOB #

TEMP on Receipt: 6.0

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil/Sediment, 4 = Rinsate, 5 = Oil
6 = Waste, 7 = Other_____

Report to Company: IDEQ	**Invoice Sent To:** Tina Elayer
Contact: Tina Elayer	Contact:
Address: 1410 N. Hilton Boise, ID. 83706	Address: Same
Phone Number: 208-373-0563	Phone Number:
FAX Number: 208-373-0154	FAX Number:
E-mail: tina.elayer@deq.id.gov	PO#:

Project Name: Muldoon Canyon

Sampler's Signature: Tina Elayer

Indicate State of sample origination: ID **USACE?** ☐ Yes ☒ No

	Sample ID	Collection			Misc.		Preservative(s)							Analyses Required							Rush Instructions (Days)	Comments
	Please take care to distinguish between: 1 and I, 2 and Z, 5 and S, Ø and O. Thanks!	Date	Time	Collected by: (Init.)	Matrix Type (From Table 1)	No. of Containers	Unpreserved	HNO_3 Filtered	HNO_3 Unfiltered	HCl	H_2SO_4	NaOH	Other (Specify)	RCRA 8	Copper (Cu)	Iron (Fe)	Manganese (Mn)	Zinc (Zn)	Antimony (Sb)			Total metal on water. Soil/sed samples sieved to 10 mesh.
1	SMAD3SW1	9/25/12	11:45	TE	1	1			X					X								
2	SMAD4SW1	9/25/12	12:50	TE	1	1			X													
3	MCBGISW1	9/25/12	14:30	TE	1	1			X													
4	MCPPESW1	9/25/12	14:40	TE	1	1			X													
5	MCBGISD1	9/25/12	14:30	TE	3	1	X															
6	MCPPESD1	9/25/12	14:40	TE	3	1	X															
7	SMWD3SS1	9/25/12	11:38	TE	3	1	X							X								
8																						
9																						
10																						

Relinquished by: Tina Elayer	Date: 10/1/12	Time: 3:00pm	Received by:	Date: 10-3-12	Time: 12:08
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

* Sample Reject: ☐ Return ☐ Dispose ☒ Store (30 Days)

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 9/05

SAMPLE RECEIPT/CHAIN-OF -CUSTODY CHECKLIST

The following items were checked for completeness, correctness, and compliance to project specifications using the Chain-of-Custody (COC) and other supporting information.

Date of acceptance: 10/3/12 By: CRSeavy

SVL Work No: W2J0073

Item	Description	V	VC	NV	NA	Comments
1	Client or project name	✓				IDEQ
2	Date and time of receipt at lab	✓				10-3-12 12:08
3	Received by	✓				Mark Dyce
4	Temperature blank or cooler temperature	✓				Temp. 6.0 °C.
5	Were the sample(s) received on ice	✓				Yes
6	Custody tape/bottle seals				✓	no
7	Condition of samples upon receipt (leaking; bubbles in VOA vials	✓				Good
8	*Sample numbers/IDs* agree with COC	✓				
9	Sample date & time agree with COC	✓				
10	Number of containers for each sample	✓				
11	The correct preservative for the analysis requested	✓				
12	Did an SVL employee preserve sample(s) upon receipt				✓	
13	Type of container for each sample / volume received	✓				
14	Analysis requested for each sample	✓				
15	Sample matrix description	✓				
16	COC properly completed & legible	✓				
17	Corrections properly made (initials & date)				✓	
18	Additional comments or records of sample condition or treatment (unlisted or missing samples at laboratory, aliquot taken, sample hold, samples subcontracted, communications between client and laboratory)				✓	
19	Shipper's air bill	✓				

V- Verified VC- Verified Corrections Made NV-Not Verified NA- Not Applicable

Additional Comments: _____

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

Sample Receipt Confirmation

Work Order

W2J0073

Date Due: 17-Oct-12 (10 day TAT)
Received: 03-Oct-12 12:08

Client: **IDEQ (Boise)**
Project: **Boise / MULDOON CANYON**
Project Manager: **Christine Meyer**

Report To:

IDEQ (Boise)
Tina Elayer
1410 N. Hilton
Boise, ID 83706
Phone: 208- 373-0480
Fax: -

Invoice To:

IDEQ (Boise)
Tina Elayer
1410 N. Hilton
Boise, ID 83706
Phone: 208- 373-0480
Fax: -

Cooler information for **Default Cooler** Temp: 6.0°C Q6: Cooler temp outside 0-6°C **No**

Custody Seals **No** Containers Intact **Yes** COC/Labels Agree **Yes** Preservation Confirmed **Yes** Received On Ice **Yes**

Sample information and analyses assigned	Comments	Removed Analyte
W2J0073-01 **SMAD3SW1 [Surface Water] 25-Sep-12 11:45 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb		
W2J0073-02 **SMAD4SW1 [Surface Water] 25-Sep-12 12:50 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb		
W2J0073-03 **MCBGSW1 [Surface Water] 25-Sep-12 14:30 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb		
W2J0073-04 **MCPPESW1 [Surface Water] 25-Sep-12 14:40 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb		
W2J0073-05 **MCBGSD1 [Soil] 25-Sep-12 14:30 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb soil		
W2J0073-06 **MCPPESD1 [Soil] 25-Sep-12 14:40 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb soil		
W2J0073-07 **SMWD3SS1 [Soil] 25-Sep-12 11:38 Pacific** IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb soil		

Samples will be disposed 30 days from report date (45 for soils). Longer archiving must be requested.
Please contact Crystal Sevy (208-784-1258) if you have questions regarding the receipt of these samples.

Printed: 10/3/2012 04:36 PM

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

Sample Receipt Confirmation

Work Order

W2J0073

Date Due: 17-Oct-12 (10 day TAT)

Received: 03-Oct-12 12:08

Client: **IDEQ (Boise)**

Project Manager: **Christine Meyer**

Project: **Boise / MULDOON CANYON**

Analysis groups included in this work order

IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb

T 7470A Hg	TR 6010B Ag	TR 6010B As	TR 6010B Ba
TR 6010B Cd	TR 6010B Cr	TR 6010B Cu	TR 6010B Fe
TR 6010B Mn	TR 6010B Pb	TR 6010B Sb	TR 6010B Se
TR 6010B Zn			

IDEQ - Boise RCRA + Cu/Fe/Mn/Zn/Sb soil

Percent Solids	T 6010B Ag	T 6010B As	T 6010B Ba
T 6010B Cd	T 6010B Cr	T 6010B Cu	T 6010B Fe
T 6010B Mn	T 6010B Pb	T 6010B Sb	T 6010B Se
T 6010B Zn	T 7471A Hg		

Solid samples will be analyzed on an as-received, wet-weight basis unless otherwise instructed.

Work Order Comments:

Reviewed By

Date

Samples will be disposed 30 days from report date (45 for soils). Longer archiving must be requested.

Please contact Crystal Sevy (208-784-1258) if you have questions regarding the receipt of these samples.

Printed: 10/3/2012 04:36 PM

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

Sample Receipt Confirmation

Work Order

W2J0073

Date Due: 17-Oct-12 (10 day TAT)

Received: 03-Oct-12 12:08

Client: **IDEQ (Boise)**

Project Manager: **Christine Meyer**

Project: **Boise / MULDOON CANYON**

	W2J0073-01 SMAD3SW1 Water	W2J0073-02 SMAD4SW1 Water	W2J0073-03 MCBGSW1 Water	W2J0073-04 MCPPESW1 Water	W2J0073-05 MCBGSD1 Solid	W2J0073-06 MCPPESD1 Solid	W2J0073-07 SMWD3SS1 Solid
T 6010B Ag					X	X	X
T 6010B As					X	X	X
T 6010B Ba					X	X	X
T 6010B Cd					X	X	X
T 6010B Cr					X	X	X
T 6010B Cu					X	X	X
T 6010B Fe					X	X	X
T 6010B Mn					X	X	X
T 6010B Pb					X	X	X
T 6010B Sb					X	X	X
T 6010B Se					X	X	X
T 6010B Zn					X	X	X
TR 6010B Ag	X	X	X	X			
TR 6010B As	X	X	X	X			
TR 6010B Ba	X	X	X	X			
TR 6010B Cd	X	X	X	X			
TR 6010B Cr	X	X	X	X			
TR 6010B Cu	X	X	X	X			
TR 6010B Fe	X	X	X	X			
TR 6010B Mn	X	X	X	X			
TR 6010B Pb	X	X	X	X			
TR 6010B Sb	X	X	X	X			
TR 6010B Se	X	X	X	X			
TR 6010B Zn	X	X	X	X			
T 7470A Hg	X	X	X	X			
T 7471A Hg					X	X	X
Percent Solids					X	X	X

Samples will be disposed 30 days from report date (45 for soils). Longer archiving must be requested.

Please contact Crystal Sevy (208-784-1258) if you have questions regarding the receipt of these samples.

Printed: 10/3/2012 04:36 PM

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Sampled By	Date Received
SMAD3SW1	W2J0073-01	Surface Water	25-Sep-12 11:45	TE	03-Oct-2012
SMAD4SW1	W2J0073-02	Surface Water	25-Sep-12 12:50	TE	03-Oct-2012
MCBGSW1	W2J0073-03	Surface Water	25-Sep-12 14:30	TE	03-Oct-2012
MCPPESW1	W2J0073-04	Surface Water	25-Sep-12 14:40	TE	03-Oct-2012
MCBGSD1	W2J0073-05	Soil	25-Sep-12 14:30	TE	03-Oct-2012
MCPPESD1	W2J0073-06	Soil	25-Sep-12 14:40	TE	03-Oct-2012
SMWD3SS1	W2J0073-07	Soil	25-Sep-12 11:38	TE	03-Oct-2012

Solid samples are analyzed on an as-received, wet-weight basis, unless otherwise requested.
Sample preparation is defined by the client as per their Data Quality Objectives.
This report supercedes any previous reports for this Work Order. The complete report includes pages for each sample, a full QC report, and a notes section.
The results presented in this report relate only to the samples, and meet all requirements of the NELAC Standards unless otherwise noted.

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **SMAD3SW1**
SVL Sample ID: **W2J0073-01 (Surface Water)**

Sampled: 25-Sep-12 11:45
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 7470A	Mercury	< 0.00020	mg/L	0.00020	0.000054		W241191	STA	10/12/12 11:29	
Metals (Total Recoverable)										
EPA 6010B	Antimony	< 0.020	mg/L	0.020	0.009		W240271	AS	10/14/12 12:25	
EPA 6010B	Arsenic	< 0.025	mg/L	0.025	0.007		W240271	AS	10/14/12 12:25	
EPA 6010B	**Barium**	0.0392	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:25	
EPA 6010B	**Cadmium**	0.0058	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:25	
EPA 6010B	Chromium	< 0.0060	mg/L	0.0060	0.0015		W240271	AS	10/14/12 12:25	
EPA 6010B	Copper	< 0.010	mg/L	0.010	0.003		W240271	AS	10/14/12 12:25	
EPA 6010B	**Iron**	10.0	mg/L	0.060	0.018		W240271	AS	10/14/12 12:25	
EPA 6010B	Lead	< 0.0075	mg/L	0.0075	0.0027		W240271	AS	10/14/12 12:25	
EPA 6010B	**Manganese**	0.361	mg/L	0.0040	0.0014		W240271	AS	10/14/12 12:25	
EPA 6010B	Selenium	< 0.040	mg/L	0.040	0.011		W240271	AS	10/14/12 12:25	
EPA 6010B	Silver	< 0.0050	mg/L	0.0050	0.0014		W240271	AS	10/14/12 12:25	
EPA 6010B	**Zinc**	1.49	mg/L	0.0100	0.0026		W240271	AS	10/14/12 12:25	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.



John Kern
Laboratory Director

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **SMAD4SW1**
SVL Sample ID: **W2J0073-02 (Surface Water)**

Sampled: 25-Sep-12 12:50
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 7470A	Mercury	< 0.00020	mg/L	0.00020	0.000054		W241191	STA	10/12/12 11:37	
Metals (Total Recoverable)										
EPA 6010B	Antimony	< 0.020	mg/L	0.020	0.009		W240271	AS	10/14/12 12:37	
EPA 6010B	Arsenic	< 0.025	mg/L	0.025	0.007		W240271	AS	10/14/12 12:37	
EPA 6010B	**Barium**	0.0735	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:37	
EPA 6010B	**Cadmium**	0.0243	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:37	
EPA 6010B	Chromium	< 0.0060	mg/L	0.0060	0.0015		W240271	AS	10/14/12 12:37	
EPA 6010B	**Copper**	0.016	mg/L	0.010	0.003		W240271	AS	10/14/12 12:37	
EPA 6010B	**Iron**	1.02	mg/L	0.060	0.018		W240271	AS	10/14/12 12:37	
EPA 6010B	Lead	< 0.0075	mg/L	0.0075	0.0027		W240271	AS	10/14/12 12:37	
EPA 6010B	**Manganese**	0.255	mg/L	0.0040	0.0014		W240271	AS	10/14/12 12:37	
EPA 6010B	Selenium	< 0.040	mg/L	0.040	0.011		W240271	AS	10/14/12 12:37	
EPA 6010B	Silver	< 0.0050	mg/L	0.0050	0.0014		W240271	AS	10/14/12 12:37	
EPA 6010B	**Zinc**	4.93	mg/L	0.0100	0.0026		W240271	AS	10/14/12 12:37	

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John Kern
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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **MCBGSW1**
SVL Sample ID: **W2J0073-03 (Surface Water)**

Sampled: 25-Sep-12 14:30
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 7470A	Mercury	< 0.00020	mg/L	0.00020	0.000054		W241191	STA	10/12/12 11:39	
Metals (Total Recoverable)										
EPA 6010B	Antimony	< 0.020	mg/L	0.020	0.009		W240271	AS	10/14/12 12:41	
EPA 6010B	Arsenic	< 0.025	mg/L	0.025	0.007		W240271	AS	10/14/12 12:41	
EPA 6010B	**Barium**	0.0488	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:41	
EPA 6010B	Cadmium	< 0.0020	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:41	
EPA 6010B	Chromium	< 0.0060	mg/L	0.0060	0.0015		W240271	AS	10/14/12 12:41	
EPA 6010B	Copper	< 0.010	mg/L	0.010	0.003		W240271	AS	10/14/12 12:41	
EPA 6010B	Iron	< 0.060	mg/L	0.060	0.018		W240271	AS	10/14/12 12:41	
EPA 6010B	Lead	< 0.0075	mg/L	0.0075	0.0027		W240271	AS	10/14/12 12:41	
EPA 6010B	Manganese	< 0.0040	mg/L	0.0040	0.0014		W240271	AS	10/14/12 12:41	
EPA 6010B	Selenium	< 0.040	mg/L	0.040	0.011		W240271	AS	10/14/12 12:41	
EPA 6010B	Silver	< 0.0050	mg/L	0.0050	0.0014		W240271	AS	10/14/12 12:41	
EPA 6010B	**Zinc**	0.0199	mg/L	0.0100	0.0026		W240271	AS	10/14/12 12:41	

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John Kern
Laboratory Director

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **MCPPESW1**
SVL Sample ID: **W2J0073-04 (Surface Water)**

Sampled: 25-Sep-12 14:40
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 7470A	Mercury	< 0.00020	mg/L	0.00020	0.000054		W241191	STA	10/12/12 11:40	
Metals (Total Recoverable)										
EPA 6010B	Antimony	< 0.020	mg/L	0.020	0.009		W240271	AS	10/14/12 12:45	
EPA 6010B	Arsenic	< 0.025	mg/L	0.025	0.007		W240271	AS	10/14/12 12:45	
EPA 6010B	**Barium**	0.0552	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:45	
EPA 6010B	Cadmium	< 0.0020	mg/L	0.0020	0.0006		W240271	AS	10/14/12 12:45	
EPA 6010B	Chromium	< 0.0060	mg/L	0.0060	0.0015		W240271	AS	10/14/12 12:45	
EPA 6010B	Copper	< 0.010	mg/L	0.010	0.003		W240271	AS	10/14/12 12:45	
EPA 6010B	**Iron**	0.118	mg/L	0.060	0.018		W240271	AS	10/14/12 12:45	
EPA 6010B	Lead	< 0.0075	mg/L	0.0075	0.0027		W240271	AS	10/14/12 12:45	
EPA 6010B	**Manganese**	0.0058	mg/L	0.0040	0.0014		W240271	AS	10/14/12 12:45	
EPA 6010B	Selenium	< 0.040	mg/L	0.040	0.011		W240271	AS	10/14/12 12:45	
EPA 6010B	Silver	< 0.0050	mg/L	0.0050	0.0014		W240271	AS	10/14/12 12:45	
EPA 6010B	**Zinc**	0.0216	mg/L	0.0100	0.0026		W240271	AS	10/14/12 12:45	

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John Kern
Laboratory Director

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **MCBGSD1**
SVL Sample ID: **W2J0073-05 (Soil)**

Sampled: 25-Sep-12 14:30
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	Antimony	< 2.0	mg/kg	2.0	0.7		W240301	AS	10/11/12 17:22	
EPA 6010B	**Arsenic**	35.7	mg/kg	2.5	0.8		W240301	AS	10/11/12 17:22	
EPA 6010B	**Barium**	123	mg/kg	0.200	0.019		W240301	AS	10/11/12 17:22	
EPA 6010B	**Cadmium**	1.15	mg/kg	0.20	0.03		W240301	AS	10/11/12 17:22	
EPA 6010B	**Chromium**	10.6	mg/kg	0.60	0.13		W240301	AS	10/11/12 17:22	
EPA 6010B	**Copper**	22.4	mg/kg	1.00	0.29		W240301	AS	10/11/12 17:22	
EPA 6010B	**Iron**	7830	mg/kg	6.0	1.9		W240301	AS	10/11/12 17:22	
EPA 6010B	**Lead**	77.3	mg/kg	0.75	0.25		W240301	AS	10/11/12 17:22	
EPA 6010B	**Manganese**	229	mg/kg	0.40	0.16		W240301	AS	10/11/12 17:22	
EPA 6010B	Selenium	< 4.0	mg/kg	4.0	1.2		W240301	AS	10/11/12 17:22	
EPA 6010B	Silver	< 0.50	mg/kg	0.50	0.05		W241272	AS	10/14/12 10:55	
EPA 6010B	**Zinc**	173	mg/kg	1.00	0.21		W240301	AS	10/11/12 17:22	
EPA 7471A	Mercury	< 0.033	mg/kg	0.033	0.008		W241051	STA	10/10/12 16:10	
Percent Solids										
Percent Solids	**% Solids**	79.8	%	0.1			W240306	HLC	10/09/12 08:45	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.

John Kern
Laboratory Director

SVL holds the following certifications:
AZ:0538, **CA**:2080, **FL**(**NELAC**):E87993, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **WA**:1268

One Government Gulch - PO Box 929 Kellogg ID 83837-0929 (208) 784-1258 Fax (208) 783-0891

IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **MCPPESD1**
SVL Sample ID: **W2J0073-06 (Soil)**

Sampled: 25-Sep-12 14:40
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	Antimony	< 2.0	mg/kg	2.0	0.7		W240301	AS	10/11/12 17:28	
EPA 6010B	**Arsenic**	48.9	mg/kg	2.5	0.8		W240301	AS	10/11/12 17:28	
EPA 6010B	**Barium**	307	mg/kg	0.200	0.019		W240301	AS	10/11/12 17:28	
EPA 6010B	**Cadmium**	1.82	mg/kg	0.20	0.03		W240301	AS	10/11/12 17:28	
EPA 6010B	**Chromium**	16.1	mg/kg	0.60	0.13		W240301	AS	10/11/12 17:28	
EPA 6010B	**Copper**	29.8	mg/kg	1.00	0.29		W240301	AS	10/11/12 17:28	
EPA 6010B	**Iron**	10900	mg/kg	6.0	1.9		W240301	AS	10/11/12 17:28	
EPA 6010B	**Lead**	99.9	mg/kg	0.75	0.25		W240301	AS	10/11/12 17:28	
EPA 6010B	**Manganese**	301	mg/kg	0.40	0.16		W240301	AS	10/11/12 17:28	
EPA 6010B	Selenium	< 4.0	mg/kg	4.0	1.2		W240301	AS	10/11/12 17:28	
EPA 6010B	Silver	< 0.50	mg/kg	0.50	0.05		W241272	AS	10/14/12 11:00	
EPA 6010B	**Zinc**	287	mg/kg	1.00	0.21		W240301	AS	10/11/12 17:28	
EPA 7471A	Mercury	< 0.033	mg/kg	0.033	0.008		W241051	STA	10/10/12 16:16	
Percent Solids										
Percent Solids	**% Solids**	77.8	%	0.1			W240306	HLC	10/09/12 08:45	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.



John Kern
Laboratory Director

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Client Sample ID: **SMWD3SS1**
SVL Sample ID: **W2J0073-07 (Soil)**

Sampled: 25-Sep-12 11:38
Received: 03-Oct-12
Sampled By: TE

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	**Antimony**	3.4	mg/kg	2.0	0.7		W240301	AS	10/11/12 17:34	
EPA 6010B	**Arsenic**	276	mg/kg	2.5	0.8		W240301	AS	10/11/12 17:34	
EPA 6010B	**Barium**	430	mg/kg	0.200	0.019		W240301	AS	10/11/12 17:34	
EPA 6010B	**Cadmium**	60.0	mg/kg	0.20	0.03		W240301	AS	10/11/12 17:34	
EPA 6010B	**Chromium**	42.2	mg/kg	0.60	0.13		W240301	AS	10/11/12 17:34	
EPA 6010B	**Copper**	149	mg/kg	1.00	0.29		W240301	AS	10/11/12 17:34	
EPA 6010B	**Iron**	47100	mg/kg	6.0	1.9		W240301	AS	10/11/12 17:34	
EPA 6010B	**Lead**	172	mg/kg	0.75	0.25		W240301	AS	10/11/12 17:34	
EPA 6010B	**Manganese**	2460	mg/kg	0.40	0.16		W240301	AS	10/11/12 17:34	
EPA 6010B	**Selenium**	16.9	mg/kg	4.0	1.2		W240301	AS	10/11/12 17:34	
EPA 6010B	**Silver**	1.53	mg/kg	0.50	0.05		W241272	AS	10/14/12 11:05	
EPA 6010B	**Zinc**	9820	mg/kg	10.0	2.10	10	W240301	AS	10/11/12 18:25	D2
EPA 7471A	**Mercury**	0.290	mg/kg	0.033	0.008		W241051	STA	10/10/12 16:17	
Percent Solids										
Percent Solids	**% Solids**	86.3	%	0.1			W240306	HLC	10/09/12 08:45	

This data has been reviewed for accuracy and has been authorized for release by the Laboratory Director or designee.



John Kern
Laboratory Director

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Quality Control - BLANK Data

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
Metals (Total)								
EPA 7470A	Mercury	mg/L	<0.00020	0.000054	0.00020	W241191	12-Oct-12	
Metals (Total) by EPA 6000/7000 Methods								
EPA 6010B	Antimony	mg/kg	<2.0	0.7	2.0	W240301	11-Oct-12	
EPA 6010B	Arsenic	mg/kg	<2.5	0.8	2.5	W240301	11-Oct-12	
EPA 6010B	Barium	mg/kg	<0.200	0.019	0.200	W240301	11-Oct-12	
EPA 6010B	Cadmium	mg/kg	<0.20	0.03	0.20	W240301	11-Oct-12	
EPA 6010B	Chromium	mg/kg	<0.60	0.13	0.60	W240301	11-Oct-12	
EPA 6010B	Copper	mg/kg	<1.00	0.29	1.00	W240301	11-Oct-12	
EPA 6010B	Iron	mg/kg	<6.0	1.9	6.0	W240301	11-Oct-12	
EPA 6010B	Lead	mg/kg	<0.75	0.25	0.75	W240301	11-Oct-12	
EPA 6010B	Manganese	mg/kg	<0.40	0.16	0.40	W240301	11-Oct-12	
EPA 6010B	Selenium	mg/kg	<4.0	1.2	4.0	W240301	11-Oct-12	
EPA 6010B	Silver	mg/kg	<0.50	0.05	0.50	W241272	14-Oct-12	
EPA 6010B	Zinc	mg/kg	<1.00	0.21	1.00	W240301	11-Oct-12	
EPA 7471A	Mercury	mg/kg	<0.033	0.008	0.033	W241051	10-Oct-12	
Metals (Total Recoverable)								
EPA 6010B	Antimony	mg/L	<0.020	0.009	0.020	W240271	14-Oct-12	
EPA 6010B	Arsenic	mg/L	<0.025	0.007	0.025	W240271	14-Oct-12	
EPA 6010B	Barium	mg/L	<0.0020	0.0006	0.0020	W240271	14-Oct-12	
EPA 6010B	Cadmium	mg/L	<0.0020	0.0006	0.0020	W240271	14-Oct-12	
EPA 6010B	Chromium	mg/L	<0.0060	0.0015	0.0060	W240271	14-Oct-12	
EPA 6010B	Copper	mg/L	<0.010	0.003	0.010	W240271	14-Oct-12	
EPA 6010B	Iron	mg/L	<0.060	0.018	0.060	W240271	14-Oct-12	
EPA 6010B	Lead	mg/L	<0.0075	0.0027	0.0075	W240271	14-Oct-12	
EPA 6010B	Manganese	mg/L	<0.0040	0.0014	0.0040	W240271	14-Oct-12	
EPA 6010B	Selenium	mg/L	<0.040	0.011	0.040	W240271	14-Oct-12	
EPA 6010B	Silver	mg/L	<0.0050	0.0014	0.0050	W240271	14-Oct-12	
EPA 6010B	Zinc	mg/L	<0.0100	0.0026	0.0100	W240271	14-Oct-12	

Quality Control - LABORATORY CONTROL SAMPLE Data

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total)									
EPA 7470A	Mercury	mg/L	0.00524	0.00500	105	80 - 120	W241191	12-Oct-12	
Metals (Total) by EPA 6000/7000 Methods									
EPA 6010B	Antimony	mg/kg	88.3	100	88.3	80 - 120	W240301	11-Oct-12	
EPA 6010B	Arsenic	mg/kg	87.3	100	87.3	80 - 120	W240301	11-Oct-12	
EPA 6010B	Barium	mg/kg	95.4	100	95.4	80 - 120	W240301	11-Oct-12	
EPA 6010B	Cadmium	mg/kg	89.0	100	89.0	80 - 120	W240301	11-Oct-12	
EPA 6010B	Chromium	mg/kg	95.7	100	95.7	80 - 120	W240301	11-Oct-12	
EPA 6010B	Copper	mg/kg	93.3	100	93.3	80 - 120	W240301	11-Oct-12	
EPA 6010B	Iron	mg/kg	899	1000	89.9	80 - 120	W240301	11-Oct-12	
EPA 6010B	Lead	mg/kg	89.6	100	89.6	80 - 120	W240301	11-Oct-12	
EPA 6010B	Manganese	mg/kg	95.2	100	95.2	80 - 120	W240301	11-Oct-12	
EPA 6010B	Selenium	mg/kg	83.4	100	83.4	80 - 120	W240301	11-Oct-12	
EPA 6010B	Silver	mg/kg	4.61	5.00	92.3	80 - 120	W241272	14-Oct-12	
EPA 6010B	Zinc	mg/kg	86.2	100	86.2	80 - 120	W240301	11-Oct-12	
EPA 7471A	Mercury	mg/kg	0.858	0.833	103	80 - 120	W241051	10-Oct-12	
Metals (Total Recoverable)									
EPA 6010B	Antimony	mg/L	1.00	1.00	100	80 - 120	W240271	14-Oct-12	

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Quality Control - LABORATORY CONTROL SAMPLE Data (Continued)

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total Recoverable) (Continued)									
EPA 6010B	Arsenic	mg/L	1.01	1.00	101	80 - 120	W240271	14-Oct-12	
EPA 6010B	Barium	mg/L	0.948	1.00	94.8	80 - 120	W240271	14-Oct-12	
EPA 6010B	Cadmium	mg/L	0.993	1.00	99.3	80 - 120	W240271	14-Oct-12	
EPA 6010B	Chromium	mg/L	1.02	1.00	102	80 - 120	W240271	14-Oct-12	
EPA 6010B	Copper	mg/L	1.04	1.00	104	80 - 120	W240271	14-Oct-12	
EPA 6010B	Iron	mg/L	9.96	10.0	99.6	80 - 120	W240271	14-Oct-12	
EPA 6010B	Lead	mg/L	1.01	1.00	101	80 - 120	W240271	14-Oct-12	
EPA 6010B	Manganese	mg/L	1.06	1.00	106	80 - 120	W240271	14-Oct-12	
EPA 6010B	Selenium	mg/L	0.975	1.00	97.5	80 - 120	W240271	14-Oct-12	
EPA 6010B	Silver	mg/L	0.0477	0.0500	95.4	80 - 120	W240271	14-Oct-12	
EPA 6010B	Zinc	mg/L	0.964	1.00	96.4	80 - 120	W240271	14-Oct-12	

Quality Control - MATRIX SPIKE Data

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total)										
EPA 7470A	Mercury	mg/L	0.00102	<0.00020	0.00100	102	75 - 125	W241191	12-Oct-12	
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	Antimony	mg/kg	141	40.4	100	100	75 - 125	W240301	11-Oct-12	
EPA 6010B	Arsenic	mg/kg	3950	4510	100	R > 4S	75 - 125	W240301	11-Oct-12	M3
EPA 6010B	Barium	mg/kg	132	45.0	100	87.0	75 - 125	W240301	11-Oct-12	
EPA 6010B	Cadmium	mg/kg	373	337	100	35.6	75 - 125	W240301	11-Oct-12	M2
EPA 6010B	Chromium	mg/kg	100	23.5	100	76.7	75 - 125	W240301	11-Oct-12	
EPA 6010B	Copper	mg/kg	11600	15800	100	R > 4S	75 - 125	W240301	11-Oct-12	D2,M3
EPA 6010B	Iron	mg/kg	125000	162000	1000	R > 4S	75 - 125	W240301	11-Oct-12	D2,M3
EPA 6010B	Lead	mg/kg	83.6	2.99	100	80.6	75 - 125	W240301	11-Oct-12	
EPA 6010B	Manganese	mg/kg	10400	11300	100	R > 4S	75 - 125	W240301	11-Oct-12	D2,M3
EPA 6010B	Selenium	mg/kg	518	582	100	R > 4S	75 - 125	W240301	11-Oct-12	M2
EPA 6010B	Silver	mg/kg	4.87	<0.50	5.00	97.5	75 - 125	W241272	14-Oct-12	
EPA 6010B	Zinc	mg/kg	13700	16500	100	R > 4S	75 - 125	W240301	11-Oct-12	D2,M3
EPA 7471A	Mercury	mg/kg	0.192	<0.033	0.167	104	75 - 125	W241051	10-Oct-12	
Metals (Total Recoverable)										
EPA 6010B	Antimony	mg/L	1.04	<0.020	1.00	104	75 - 125	W240271	14-Oct-12	
EPA 6010B	Arsenic	mg/L	1.07	<0.025	1.00	105	75 - 125	W240271	14-Oct-12	
EPA 6010B	Barium	mg/L	0.978	0.0392	1.00	93.9	75 - 125	W240271	14-Oct-12	
EPA 6010B	Cadmium	mg/L	1.01	0.0058	1.00	101	75 - 125	W240271	14-Oct-12	
EPA 6010B	Chromium	mg/L	1.03	<0.0060	1.00	103	75 - 125	W240271	14-Oct-12	
EPA 6010B	Copper	mg/L	1.05	<0.010	1.00	105	75 - 125	W240271	14-Oct-12	
EPA 6010B	Iron	mg/L	19.8	10.0	10.0	98.1	75 - 125	W240271	14-Oct-12	
EPA 6010B	Lead	mg/L	1.02	<0.0075	1.00	102	75 - 125	W240271	14-Oct-12	
EPA 6010B	Manganese	mg/L	1.44	0.361	1.00	108	75 - 125	W240271	14-Oct-12	
EPA 6010B	Selenium	mg/L	1.03	<0.040	1.00	103	75 - 125	W240271	14-Oct-12	
EPA 6010B	Silver	mg/L	0.0481	<0.0050	0.0500	96.1	75 - 125	W240271	14-Oct-12	
EPA 6010B	Zinc	mg/L	2.40	1.49	1.00	90.7	75 - 125	W240271	14-Oct-12	

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IDEQ (Boise)
1410 N. Hilton
Boise, ID 83706

Project Name: Boise / MULDOON CANYON
Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Quality Control - MATRIX SPIKE DUPLICATE Data

Method	Analyte	Units	MSD Result	Spike Result	Spike Level	RPD	RPD Limit	Batch ID	Analyzed	Notes
Metals (Total)										
EPA 7470A	Mercury	mg/L	0.00105	0.00102	0.00100	2.9	20	W241191	12-Oct-12	
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	Antimony	mg/kg	126	141	100	10.9	20	W240301	11-Oct-12	
EPA 6010B	Arsenic	mg/kg	3660	3950	100	7.6	20	W240301	11-Oct-12	
EPA 6010B	Barium	mg/kg	148	132	100	11.7	20	W240301	11-Oct-12	
EPA 6010B	Cadmium	mg/kg	343	373	100	8.1	20	W240301	11-Oct-12	
EPA 6010B	Chromium	mg/kg	101	100	100	1.0	20	W240301	11-Oct-12	
EPA 6010B	Copper	mg/kg	12100	11600	100	3.5	20	W240301	11-Oct-12	D2
EPA 6010B	Iron	mg/kg	79900	125000	1000	44.3	20	W240301	11-Oct-12	R4
EPA 6010B	Lead	mg/kg	84.6	83.6	100	1.3	20	W240301	11-Oct-12	
EPA 6010B	Manganese	mg/kg	8330	10400	100	22.4	20	W240301	11-Oct-12	R4
EPA 6010B	Selenium	mg/kg	466	518	100	10.7	20	W240301	11-Oct-12	
EPA 6010B	Silver	mg/kg	4.53	4.87	5.00	7.3	20	W241272	14-Oct-12	
EPA 6010B	Zinc	mg/kg	14300	13700	100	3.8	20	W240301	11-Oct-12	D2
EPA 7471A	Mercury	mg/kg	0.185	0.192	0.167	3.5	20	W241051	10-Oct-12	
Metals (Total Recoverable)										
EPA 6010B	Antimony	mg/L	1.04	1.04	1.00	0.0	20	W240271	14-Oct-12	
EPA 6010B	Arsenic	mg/L	1.07	1.07	1.00	0.5	20	W240271	14-Oct-12	
EPA 6010B	Barium	mg/L	0.988	0.978	1.00	1.0	20	W240271	14-Oct-12	
EPA 6010B	Cadmium	mg/L	1.01	1.01	1.00	0.0	20	W240271	14-Oct-12	
EPA 6010B	Chromium	mg/L	1.03	1.03	1.00	0.2	20	W240271	14-Oct-12	
EPA 6010B	Copper	mg/L	1.05	1.05	1.00	0.0	20	W240271	14-Oct-12	
EPA 6010B	Iron	mg/L	20.2	19.8	10.0	1.7	20	W240271	14-Oct-12	
EPA 6010B	Lead	mg/L	1.02	1.02	1.00	0.0	20	W240271	14-Oct-12	
EPA 6010B	Manganese	mg/L	1.44	1.44	1.00	0.1	20	W240271	14-Oct-12	
EPA 6010B	Selenium	mg/L	1.03	1.03	1.00	0.3	20	W240271	14-Oct-12	
EPA 6010B	Silver	mg/L	0.0481	0.0481	0.0500	0.1	20	W240271	14-Oct-12	
EPA 6010B	Zinc	mg/L	2.45	2.40	1.00	1.9	20	W240271	14-Oct-12	

Quality Control - POST DIGESTION SPIKE Data

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010B	Cadmium	mg/kg	422	337	100	85.1	75 - 125	W240301	11-Oct-12	
EPA 6010B	Selenium	mg/kg	687	582	100	105	75 - 125	W240301	11-Oct-12	

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Work Order: **W2J0073**
Reported: 16-Oct-12 12:42

Notes and Definitions

D2	Sample required dilution due to high concentration of target analyte.
M2	Matrix spike recovery was low, but the LCS recovery was acceptable.
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to spike level. The LCS was acceptable.
R4	MS/MSD RPD exceeded the method acceptance limit.
LCS	Laboratory Control Sample (Blank Spike)
RPD	Relative Percent Difference
UDL	A result is less than the detection limit
R > 4S	% recovery not applicable, sample concentration more than four times greater than spike level
<RL	A result is less than the reporting limit
MRL	Method Reporting Limit
MDL	Method Detection Limit
N/A	Not Applicable