Preliminary Assessment and Site Inspection Report for Hope Mine (aka Elsie K.)

Bonner County

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Department of Environmental Quality

and

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Bonner County

December 2016

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List of Acronyms

amsl	above mean sea level
ATV	all-terrain vehicle
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
EPA	United States Environmental Protection Agency
ft	feet
GIS	geographic information system
IDL	Idaho Department of Lands
IGS	Idaho Geological Survey
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NA	not available
NTU	nephelometric turbidity unit
ORP	oxidation reduction potential
PA	preliminary assessment
PPE	probable point of entry
ppm	parts per million
PWS	public water system
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RSLs	regional screening levels
SAP	Sampling Analysis Plan
SC	specific conductivity
SI	site inspection
SVL	SVL Analytical, Inc.
SWA	source water assessment
TDL	target distance limit
TMDL	total maximum daily load
µs/cm	micro-Siemens per centimeter
USFWS	United States Fish and Wildlife Service

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1 Introduction

This report presents the preliminary assessment and site inspection (PA/SI) results for the Hope Mine site in Bonner County, Idaho. Under a cooperative agreement with the United States Environmental Protection Agency (EPA) Region 10, the Idaho Department of Environmental Quality (DEQ) provides technical support for performing the PA/SI process at various mine and industrial sites located on private, state, or mixed ownership (public and private) lands. Additional information about DEQ's PA program can be found at: *http://www.deq.idaho.gov/preliminary-assessments*.

DEQ initiated the PA program in February 2002 to prioritize and assess 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 can be cost-effectively assessed on a watershed basis.

The purpose of this PA/SI is to assess the threat posed to human health and the environment and determine the need for additional investigation at the Hope Mine site. This PA/SI was performed at the request of the property owner.

The PA/SI process is presented in the following sections:

- Section 2, **Site Description**, compiles desktop research information to present the location, ownership, general geology, and climatology for the site. Desktop research also includes compiling the operational history of past mining activities and current and potential future land uses.
- Section 3, **Sample Collection and Analysis**, describes the sampling locations and presents the analytical results.
- Section 4, **Migration/Exposure Pathways and Targets**, presents observations and potential targets for the surface water pathway, soil exposures, ground water pathway, and air pathway.
- Section 5, **Conclusions and Recommendations**, presents a summary of the PA/SI conclusions and recommendations based on the current conditions at the site and health and safety information.
- Appendix A, **Site Photographs**, includes photos taken during the October 19, 2016 site visit.
- Appendix B, **Analytical Laboratory Report**, includes the environmental sample results from the laboratory.

2 Site Description

The site description for the Hope Mine includes the following information: location and ownership (Section 2.1), general geology (Section 2.2), climatology (Section 2.3), operational history of past mining activities (Section 2.4), and current and potential future land uses (Section 2.5). As part of the desktop research, DEQ uses references from historic reports which often have different spellings for claim names, town sites, and/or geographic features. DEQ retains the spelling and usage from the original source documents.

2.1 Location and Ownership

The Hope Mine site is located on private property north of Clark Fork in Bonner County within the Clark Fork Mining District (Figure 1) and associated with parcel numbers: RP56N02E267051A, RP56N02E352600A, RP56N02E352421A, and RP56N02E350750A.

Directions to the parcels from Clark Fork: from Highway 200 (4th Avenue) go north on Main Street for 0.5 mile, turn left on Lightning Creek Road for 0.2 mile, turn left on Jason Way Road for 0.2 mile, then left on Hope Mine Road until the road ends at Lightning Creek. The center section of the Hope Mine is located in Sections 26 and 35 of Township 56 North, Range 2 East at Latitude 48.165722 and Longitude -116.174903 (WGS84).

Sampling for this assessment was conducted on private property where permission was granted and on Idaho Department of Lands (IDL) property within the bed and banks of the river. DEQ does not warrant the ownership research or location of property boundaries contained in this report. Information regarding ownership and property boundaries was obtained from the parcel maps for Bonner County (Idaho State Tax Commission 2016).

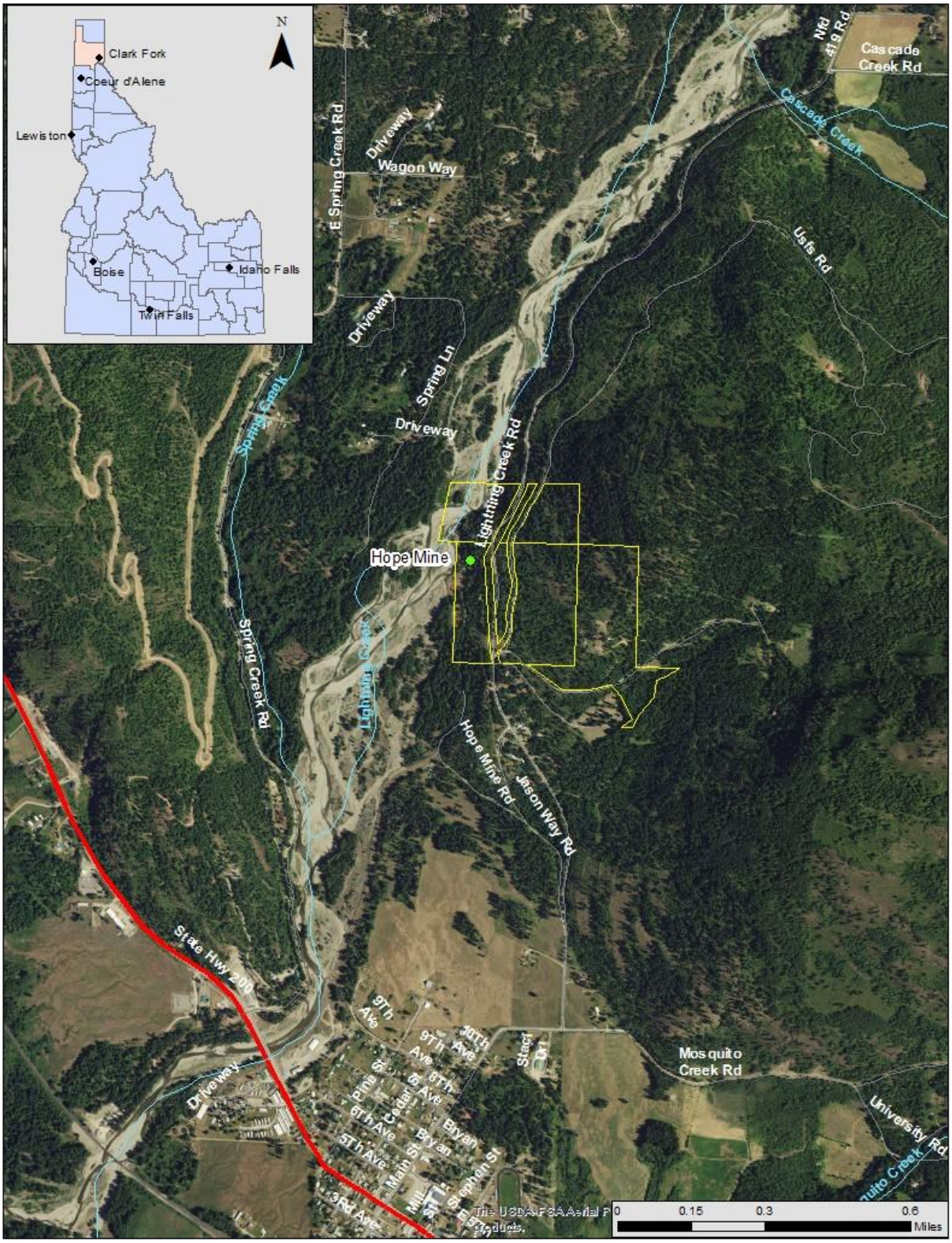

Figure 1. Aerial overview map of the Hope Mine site with parcel boundaries outlined in yellow.

2.2 General Geology

A map of the major lithology for the Hope Mine site is shown in Figure 2. Since DEQ cannot improve or expand upon information included in historic reports, the information below is quoted directly. The following information is quoted directly from Idaho Bureau of Mines and Geology County Report No. 6 *Geology and Mineral Resources of Bonner County* (Savage 1967). The figure referenced in this quote has not been duplicated in this report.

> Hope mine
>
> Location and history. The Hope mine is located on the west side of Middle Mtn. adjacent to Lightning Creek. The site is about 1.3 miles north of Clark Fork, in SW ½ sec. 26, and the NW ¼ sec. 35, T56N, R2E (Fig. 3). This property consists of 14 unpatented claims that are now idle and the old workings inaccessible. Together, the Hope, Lawrence, and Whitedelph mines have accounted for the bulk of the ore which, in the past, has been shipped from the Clark Fork district. For 20 years, from 1903 to 1923, the small Lawrence mine was the only producing mine; then in 1925, the Elsie K vein (later the Hope property), was discovered. In 1926, the Whitedelph mine also began to produce ore. Of the three, the Whitedelph led to production during the 1926 to 1943 period.
>
> In 1923, near the site where the Elsie K vein was discovered, a small hand-sorting ore recovery operation was under way. High grade lead-silver ore was recovered, and small shipments went to the smelter. In 1927, after the discovery of the Elsie K vein, the operation was reorganized as the Hope Mining Co., and a mill was added to the property in 1931 to concentrate lower grades of ore. This operation was reorganized again in 1935 to form the Hope Silver-Lead Mines, Inc. Production of ore and further development continued until 1944 when, because of labor shortages, the mill shut down and production of ore ceased. However, about this time, a new 850-ft two and one-half compartment shaft was constructed in an attempt to reach a "new ore body" on the "Pearl vein". The project was terminated without reaching the envisioned ore body, although the existence of such an ore body was predicted by Lorain (1946), on the basis of a U.S. Bureau of Mines drilling project along Lightning Creek.
>
> Very little work has been done at the Hope mine since the new shaft was sunk. By 1963, most of the milling and mining equipment had been removed from the site, and caving and flooding had sealed off much of the mine. Now that the mine is virtually inaccessible, information must be obtained from Anderson's (1947) report on the Clark Fork area.
>
> Rocks and structures. Mineralization at the Hope mine occurs in the mildly deformed and extensively faulted Striped Peak Formation. In the mineralized zones this rock consists of dark-gray-to-black, thin-bedded shaly argillite and thicker bedded, lighter-colored siltite and quartzite. More typical, reddish-purple Striped Peak rocks lie above the ore bodies. Where mineralized, the rock commonly is grayish green, probably because of alteration. Considerable hydrothermal alteration is also present in a 4 to 40 ft wide diabasic dike that occurs in the area. The stratified rocks strike N 5° to 10° E and dip from 5° to 15° SE; locally the rocks dip as much as 30° SE.
>
> The many low angle thrust faults and normal faults that cross the area appear to be intimately related to the mineralization and ore deposition. The Elsie K discovery vein lies along a thrust fault, and the diabase dike, mentioned above, is also in the thrust zone ("dike" fault). A principal strike-slip fault in the mineralized area has been designated the Norquist fault. This fault may be the equivalent of the Pugh fault on the Whitedelph property west of the Hope mine. Between the "dike" fault and Norquist fault is the "air-raise" fault. Numerous other secondary faults within the area have remained unnamed. Mineralization is present in some degree on most of the fault, and both pre- and post-mineralization movement may be recognized. Low angle thrust faults tend to strike north and south, or may have a slight northeast trend. Their dips are usually eastward at angles of from 10° to 26°. Fault displacement is commonly small, ranging from a few inches to few feet.

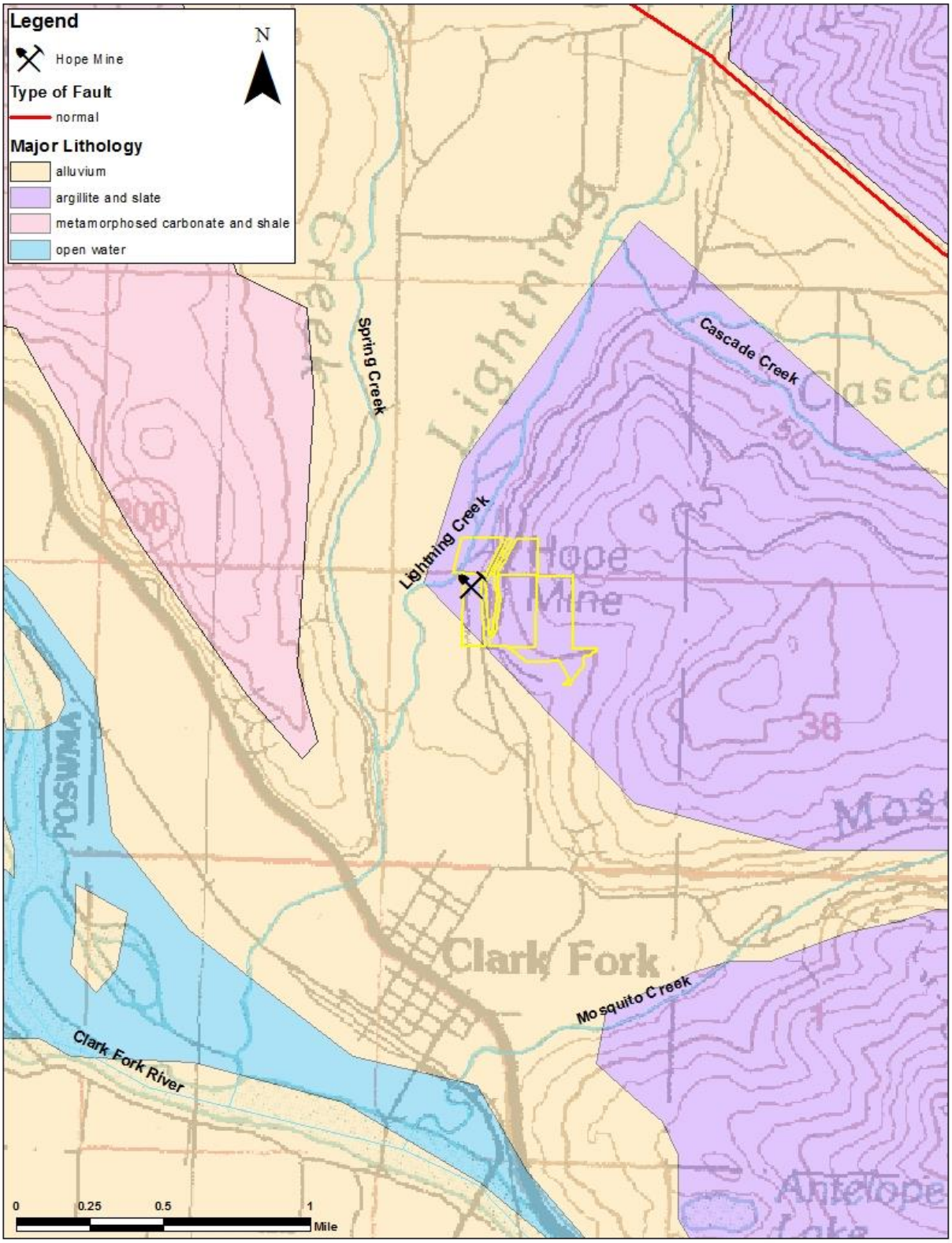

Figure 2. Map of major lithology in the vicinity of the Hope Mine.

The attitude of the "dike" fault, a normal fault, tends to differ from other faults. It strikes N 35° to 40° W and dips 45° to 55° SW. Considerable broken ground and gouge lie along this fault zone; however, stringers of ore contained in the gouge appear to be undisturbed. There is evidence of post-mineralization movement in most of the other mineralized fault zones.

The Norquist fault cuts across a low angle thrust; the former strikes N 70° to 80° E and dips 75° to 80° SE; broken ground is common along this fault. Sulfide masses in the gouge zone have been broken by post-mineral faulting. The amount of displacement on the Norquist fault is unknown.

The "air-raise" fault strikes N 65° W and dips 60° to 80° SW. This attitude is essentially similar to that of the Hope fault to the north. The "air-raise" fault is probably post-mineral in age as it appears to be barren. Hydrothermal alteration, as noted earlier, is common along many faults in this area, but is not present along all of them.

Ore deposits. Ore deposition in the Hope mine occurs most frequently along the low angle thrusts, producing narrow seams of "bedded" and fissure replacement ore in bands up to 5 or 6 inches wide. These veins tend to average 4 inches in width, but they pinch and swell in the fashion characteristic of this mineral province. Lenticular shoots may be 12 to 100 ft long. On the southwest side of the "dike" fault, mineralized veins are close enough in many cases so that they formerly were mined for more than 600 ft along the strike; for example, from the No. 3 level to the surface. Ore 6 to 7 inches in thickness was recovered near the "dike" fault. Between the "air-raise" and Norquist faults, reasonably high-grade ore was recovered from veins ranging from 6 to 32 inches in thickness. Ore suitable for stoping commonly attained 3 to 4 ft in thickness.

The best ore shoots occur where (1) thrust planes flatten out, (2) "where more steeply dipping seams along the foot of the thrust zone have joined the hanging wall seam", or (3) "where steeply dipping seams have come into the foot-wall from below" (Anderson, 1947, p. 100). Locally, ore seams along the footwall lense out into some of the richest shoots. Some late hypogene silver-antimony enrichment adds to the value of these veins. Small masses and stringers of ore occur along both the Norquist and "dike" fault zones, and widespread post-mineral faulting has had both beneficial and harmful effects. In some places the broken ore bodies have been easier to mine and their ore less difficult to hand sort; in other places, the broken ground has made it difficult to mine because extensive timbering is required.

Thinly-bedded shales contain the largest ore bodies in the upper portions of the mine. Deeper, more massive, and thicker siliceous beds yield lower grade ore. If the mine had been extended downward to the underlying Wallace Formation, perhaps even richer silver ore, like that of the Whitedelph mine might have been encountered. The potential below the Wallace is unknown, but conceivably the highest grade ore might occur in brittle silica-rich formations beneath the Wallace.

Ore from the Hope mine has, in the past, contained less silver than ore from the Whitedelph. Except for this and other minor differences, the two properties are similar. In the Hope mine, the relative amounts of minerals vary in different ore shoots. Galena is generally the most abundant ore mineral, and this galena commonly is accompanied by fairly large quantities of sulphantimonides (Anderson, p. 101). Sphalerite is present in small quantities, although there is a slight increase in its volume at depth. Tetrahedrite occurs as microscopic grains. Arsenopyrite and pyrite are fairly widely distributed. Gangue minerals include minor quartz and siderite, and locally, rhodochrosite.

Anderson (p. 102) noted "that ore bodies in two distinct thrust zones have been worked in the southern part of the Hope mine, but have been only partly explored." He pointed out that the prospects of continuation of similar mineralization at greater depths were good, but that the increased cost of deeper mining might limit the practical depth of the mine. With an appreciable increase in the price of silver, and the possibility that the silver content increases with depth, deepening of the mine might now be feasible.

2.3 Climatology

Climate information was obtained from the Western Regional Climate Center (WRCC 2016). The climatological data was collected at the Cabinet Gorge, Idaho Station (101363) (elevation 2,173 feet [ft] above mean sea level [amsl]) which is located 6.5 miles east-southeast of the town of Clark Fork on the Idaho/Montana border.

Based on data collected from 1956 to 2016, total annual precipitation averages 31.92 inches with a total annual snowfall average of 63.1 inches. The driest months of the year are July and August. The average annual high temperature is 56.9°F and the average annual low temperature is 35.4°F. July is the hottest month with an average temperature of 82.6°F. January is the coldest month with an average temperature of 21.8°F.

2.4 Operational History of Past Mining Activities

Information about the operational history of past mining activities helps DEQ understand the levels of production, commodities, and potential waste types at the site. 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 risks, and ecological risks. DEQ uses historical research for several purposes: identify the potential contaminants of concern, estimate the magnitude of waste at the site, locate potentially dangerous physical hazards such as open adits and shafts, and identify historical land uses that coincide with mining. This information is necessary to prepare for the SI field work.

Numerous sources were used during desktop research prior to visiting the site. Since DEQ cannot improve or expand upon information included in historic reports, this information is quoted directly from Idaho Bureau of Mines and Geology Bulletin Report No. 12 *Geology and Ore Deposits of the Clark Fork District, Idaho* (Anderson 1967). The plate referenced in this quote has not been duplicated in this report.

> ELSIE K MINE.
>
> The Elsie K mine ranks next to the Whitedelf as a producer of lead-silver ores during 1927 and 1928. The veins are near the road along the east side of Lightning Creek and escaped notice until 1923, although one vein is crossed by the road and another parallels it for about 600 feet only 20 to 60 feet away. Up to the middle of the summer of 1927, mining had been confined to the vein which lies along the upper side of the road and had been opened for more than 600 feet by drifts from several tunnels with portals at the road level. These workings are all shallow as the vein is "bedded" and dips into the hill at a low angle. A short winze was sunk on the vein and drifting both ways opened up much ore. In the latter part of 1927 a tunnel was begun near the floor of Lightning Creek valley several hundred feet below the outcrop, this tunnel on the vein, a steeply dipping fissure, crossed by the road. Considerable milling ore was encountered in the long tunnel and the reserves, which had previously kept pace only with mining, have been enlarged. Most of the production has been of high-grade, hand-sorted ore, but in 1928 several cars of lower grade ore were sent to outside mills for concentration with very gratifying results. For the past several years the mine has been operated by the Hope Mining Company.
>
> The Elsie K mine is fortunately situated on the road and is less than a mile and three-quarters from the railroad station in the town of Clark Fork. The outcrop and earlier workings are several hundred feet above the west base of Middle Mountain and an easy downhill grade assures rapid and cheap transportation to the station.

The veins, bedded and fissure, that have been explored are characteristically replacement veins. These occur in the upper part of the Wallace formation, not far below some of the red beds that are so characteristic of the Striped Peak. The country rock is particularly thin-bedded, a factor which makes for the development of much gouge with only slight movement, especially as the rocks are grayish to nearly black soft shales. The rocks in the vicinity of the veins and on other parts of Middle Mountain have been extensively faulted, usually by faults of minor displacement, but most of the fissures so far prospected have been very lightly mineralized and the more profitable veins have been those that closely follow the bedding.

The vein minerals consist of clean sulphide minerals without a notable admixture of gangue. Galena is the predominant mineral, but tetrahedrite and sphalerite may readily be recognized as well as minor amounts of quartz and siderite. The tetrahedrite may locally comprise as much as a third of the filling. It is usually distinguished from the galena by its fineness of grain, for the galena has a coarse cubical cleavage. The sphalerite occurs in brownish seams and bands a fraction of an inch thick parallel to the walls of the suphide seams. These sphalerite bands are usually veined by the tetrahedrite and galena and the polished surfaces of specimens reveal that the sphalerite has been fractured or brecciated, and the fractures filled and also enlarged by replacement by either galena or tetrahedrite as shown on Plate IX, B. Little of the early stage siderite remains, but an occasional remnant may be found within the sulphides or more generally in small veinlets in the country rock, unaffected by the later movement which introduced the sulphide minerals. Veinlets of sulphides also invade the wall and enlarge fractures by replacement.

The “bedded” vein only approximately follows the bedding, although the discrepancy can be determined only by very close observation. The vein and bedding trend slightly west of north and dip about 12° to the east. The vein has been explored for more than 600 feet, the early work having been done near its center and south end and the later work near the north end where it terminates against the fissure vein. Its total length is unknown, but it may end on the south against a second fault or fissure whose presence is suggested by a topographic depression. Movement along the bedded fissure has caused brecciation and slippage through a zone several feet wide, but the ore is confined to a narrow high-grade seam from a fraction of an inch to five or six inches wide. Some gouge is developed along the vein, which permits the ore to be readily detached from the walls. The average width of the high-grade seam is about four inches, but a width of even two inches constitutes profitable ore under the economical mining methods due to the softness of the wall and the ease with which it stands without timbering. The ore shoots range from a dozen to a hundred feet in length, having more or less lenticular shapes. In some places, the vein has quartz rootlets or veinlets which join from below. Some of these may represent channels through which the ore solutions reached the fissure. The vein increases in thickness near its north end to six or seven inches, and this is apparently the result of the greater brecciation near the zone of intersection of the bedded and the fissure seams, the additional shattering and porosity providing for a larger ore shoot. It is probable that the fissure served as the channel for the upward moving solutions and that the solutions spread laterally along the “flatter” brecciated zone where there was less gouge to impede their circulation. Apparently some of the solutions escaped through a broken bedded zone on the opposite side of the fissure as well, but this seam, 40 feet higher, has not been developed. Post-mineral movement has caused more gouge along the veins and has fractured the ore, causing slickensides both parallel to the walls and across them. A number of small normal faults may be seen in the drifts. These have steep dips to either the east or west and in some places off-set the vein two or three feet.

The fissure vein strikes N. 50° W. and dips 40° S.W. The gouge zone suggests considerable displacement, but this assumption is not necessary, as the rocks are soft and easily reduced to the consistency of clay. The gouge zone is from 14 to 18 feet wide and the drag relationships indicate that the movement has been normal with downthrow on the south. In the upper workings, the gouge contains some stringers or seamlets of sulphides in ramifying network, which excludes the possibility that the ore is drag ore and the fault post-mineral, although there has been some post-mineral movement. The vein had been explored in 1928 for more than 600 feet by means of a long tunnel. A raise on the vein encountered galena, probably of milling grade, distributed through a zone about a dozen feet wide. Further exploration has encountered more ore and also a lamprophyric dike that failed to show at the surface.

> The occurrence of ore in a clean compact seam in the bedded vein has made milling unnecessary as a rich product can be obtained by hand-sorting. Mining costs are relatively low, as the rocks are easy to drill and the walls stand well without timbering, except along the fissure vein. The blocking of ore has kept pace only with mining, and the reserves are, therefore, difficult to estimate. The work in the long tunnel has shown the existence of ore with greater depth and indicates that the life of the property will be extended for many years. The reserves of milling ore will probably be sufficiently increased in time to justify the construction of a small concentrator.

Idaho Geological Survey (IGS) lists the commodities (and production) for the Hope Mine (aka Elsie K.) as follows: antimony, arsenic, copper (5,001-10,000 lbs), gold (0-50 oz), lead (10,000,001-12,000,000 lbs), silver (100,001-500,000 oz), and zinc (100,001- 500,000 lbs; IGS 2016).

An unknown historical reference states: *By 1963, most of the milling and mining equipment had been removed from the site, and caving and flooding had sealed off much of the mine.*

2.5 Current and Potential Future Land Uses

There are currently no permanent residents at the Hope Mine site. A cabin is built on the foundation of the old mill located on the property and this cabin has been occupied in the past; however, the cabin is now vacant and the landowner currently does not allow use of the cabin. Also, the road to the cabin is gated and locked at the property boundary to restrict access. This site could be accessed via the river if a recreationalist is rafting, boating, or kayaking down the river and pulls off in this area or walks along the cobbles of the flood plain when the river is low. A separate road that passes open adits on this site is not gated because it is used by other private property owners traveling beyond the adit area.

Examples of current land uses could include recreational activities such as hiking, camping, hunting, fishing, swimming, boating, horseback riding, biking, and all-terrain vehicle (ATV) touring. These current uses are likely to continue into the future. Other potential future land uses could also include use of the cabin or other residential developments.

3 Sample Collection and Analysis

A site visit was conducted on October 19, 2016. Sample collection information, field parameters, and analytical results are presented in this section. Photographs are presented in Appendix A. The field crew did not purposely or knowingly trespass on any private holdings during field work.

Sampling and laboratory analysis was conducted in accordance with TerraGraphic's Sampling Analysis Plan (SAP)/Quality Assurance Project Plan (QAPP) for Hope Mine (aka Elsie K.), Bonner County, Preliminary Assessment Activities (TerraGraphics 2016a). All samples were collected, handled, and stored in accordance with the SAP/QAPP and submitted to SVL Analytical, Inc. (SVL) in Kellogg, Idaho.

Soil, sediment, and surface water samples were collected in the immediate vicinity of Hope Mine (Figure 3). Sample locations and descriptions are shown in Table 1. A summary of the laboratory

results and field parameters are presented in Tables 2 and 3. All samples were analyzed for total metals. A copy of the laboratory report is included as Appendix B. Field observations and laboratory results are discussed in the context of migration/exposure pathways and targets in Section 4.

Table 1. Sample Locations and Descriptions.

Sample ID	Location Description	Description
HM-TP-SS1	Tailings Pile	Grab sample of tailings collected from the face of the cut-bank where Lightning Creek has eroded the tailings pile. (Appendix A, Photo 1)
HM-TP-SS2		Duplicate sample of HM-TP-SS1.
HM-TP-SS3		Grab sample of tailings collected from a low spot where water ponds during wet conditions. (Appendix A, Photo 3)
HM-TP-SS4		Grab sample of tailings where top of tailings pile forms front yard of cabin. (Appendix A, Photo 4)
HM-WD1-SS1	Waste Piles	Grab sample from waste material used to build road from Adit #1 to the tailings pile. (Appendix A, Photo 7)
HM-WD2-SS2		Grab sample from waste pile located adjacent to Boot Hill Road and below Adits #2-8. (Appendix A, Photo 8)
HM-BG-SS1	Background Soil Sample	Grab sample collected from road embankment along private road (Silver Creek Road) that is uphill of all mine workings and mine waste.
HM-DS-SD1	Downstream Sediment Sample	Grab sediment sample collected from side branch of Lightning Creek downstream of where the creek contacts the tailings pile. Co-located with surface water sample HM-DS-SW1. (Appendix A, Photo 10)
HM-DS-SD2		Duplicate sample of HM-DS-SD1.
HM-BG-SD1	Upstream Sediment Sample	Grab sediment sample collected from main branch of Lightning Creek upstream of mine waste piles and Adit #1 opening. Co-located with surface water sample HM-BG-SW1. (Appendix A, Photo 11)
HM-DS-SW1	Downstream Surface Water Sample	Surface water sample collected from side branch of Lightning Creek downstream of where the creek contacts the tailings pile. Co-located with sediment sample HM-DS-SD1. (Appendix A, Photo 10)
HM-BG-SW1	Upstream Surface Water Sample	Surface water sample collected from main branch of Lightning Creek upstream of mine waste piles and Adit #1 opening. Co-located with sediment sample HM-BG-SD1. (Appendix A, Photo 11)
HM-BG-SW2		Duplicate of HM-BG-SW1.
HM-BG-SW3	QA/QC Sample	Field blank collected after sampling at upstream surface water location.

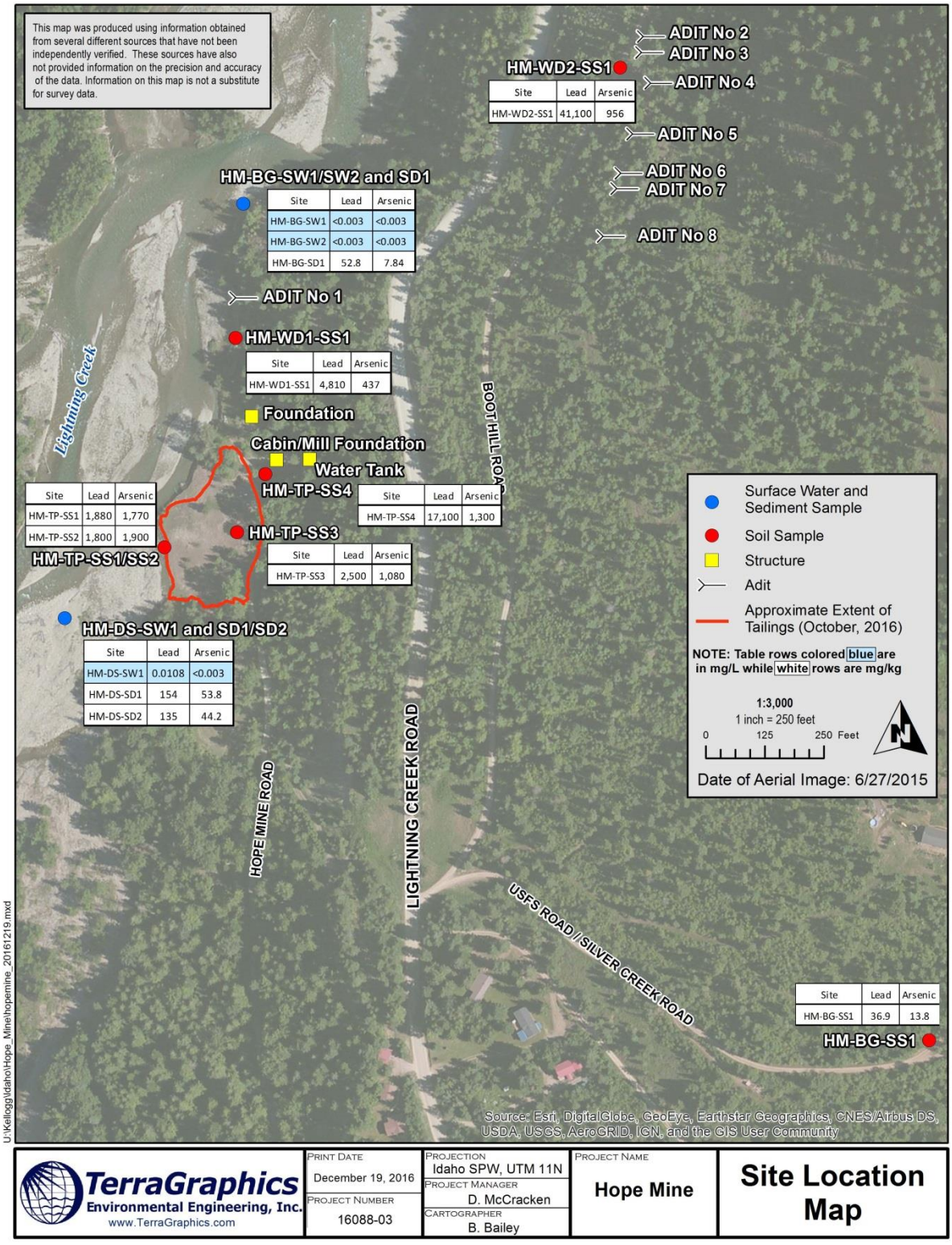

Figure 3. Sample locations and features of the Hope Mine site.

Table 2. Surface water analytical and field parameter results for Hope Mine samples (in mg/L unless otherwise noted in table).

Analyte/Parameter	EPA		DEQ		Sample ID			
	Drinking Water Standard MCL	RSL for Tapwater	Cold Water Biota Standard Acute	Cold Water Biota Standard Chronic	HM-DS-SW1	HM-BG-SW1	HM-BG-SW2 (duplicate)	HM-BG-SW3 (field blank)
Antimony (mg/L)	0.006	0.0078	NA	NA	<0.020	<0.020	<0.020	<0.020
Arsenic (mg/L)	0.01	0.000052	0.34	0.15	<0.00300	<0.00300	<0.00300	<0.00300
Barium (mg/L)	2	3.8	NA	NA	0.0041	0.0034	0.0034	<0.0020
Cadmium (mg/L)	0.005	0.0092	0.00067 to 0.00200 (H)	0.00035 to 0.00075 (H)	<0.0020	<0.0020	<0.0020	<0.0020
Chromium (mg/L)	0.1	NA	NA	NA	<0.0060	<0.0060	<0.0060	<0.0060
Copper (mg/L)	1.0[a]	0.8	0.0079 to 0.0267 (H)	0.0056 to 0.0171 (H)	<0.0100	<0.0100	<0.0100	<0.0100
Iron (mg/L)	0.3[a]	14	NA	NA	<0.100	<0.100	<0.100	<0.100
Lead (mg/L)	0.015[b]	0.015	0.026 to 0.108 (H)	0.0010 to 0.0042 (H)	0.0108	<0.00300	<0.00300	<0.00300
Manganese (mg/L)	0.05[a]	0.43	NA	NA	<0.0080	<0.0080	<0.0080	<0.0080
Mercury (mg/L)	0.002	0.00063	NA	NA	<0.00020	<0.00020	<0.00020	<0.00020
Selenium (mg/L)	0.05	0.1	0.02 (T)	0.005 (T)	<0.0030	<0.0030	<0.0030	<0.0030
Silver (mg/L)	0.1[a]	0.094	0.0008 to 0.0078 (H)	NA	<0.0050	<0.0050	<0.0050	<0.0050
Zinc (mg/L)	5[a]	6	0.058 to 0.175 (H)	0.059 to 0.177 (H)	<0.010	<0.010	<0.010	<0.010
Temperature °C[c]	NA	NA	NA	Cold water aquatic life 22°C or less or a maximum daily average not >19°C[d]. / Salmonid spawning 13°C or less with a miximum daily average not >9°C.	8.87	6.92	6.92	NA
pH (su)	6.5 - 8.5[a]	NA	NA	6.5 - 9.0	5.58	6.12	6.12	NA
ORP (mV)	NA	NA	NA	NA	217.7	158.1	158.1	NA
SC (µS/cm)	NA	NA	NA	NA	23.21	16.70	16.70	NA
Turbidity (NTU)	b	NA	Not >50 NTU instantaneous	Not >50 NTU instantaneous and not >25 NTU over a 10 day period.	0.55	1.55	1.55	NA
DO (mg/L)	NA	NA	NA	>6 ppm	11.13	12.14	12.14	NA

Notes:

Shaded values exceed at least one standard and/or RSL.

(T)-Standard in Total, (H)-Hardness dependent for Cd, Cu, Pb, Ni, Ag, Zn, range presented based on calculated values for all samples (excluding background).

MCL = maximum contaminant level; RSL = regional screening level

[a]Secondary Standard MCL - non-enforceable guideline.

[b]Action level regulated by treatment technique.

[c]Only a snapshot temperature reading was collected. A daily temperature average was not collected.

mg/L=milligrams per liter, su=standard units, mV=millivolts, µS/cm=micro-Siemens per centimeter, NTU=nephelometric turbidity units, °C=degrees Celcius, ppm=parts per million

ORP = oxidation-reduction potential; SC = specific conductivity; DO = dissolved oxygen

NA = not available

Table 3. Soil and sediment analytical results for Hope Mine samples.

Location Description	Sample ID	Sample Type	Date	Analyte (mg/kg)												
				antimony	arsenic	barium	cadmium	chromium	copper	iron	lead	manganese	selenium	silver	zinc	mercury
cutbank face of tailings pile	HM-TP-SS1	grab-soil	10/19/2016	**240** *J+*	**1,770**	29.7 *J+*	**37.4**	4.42	20.3	65,000	**1,880**	**11,900**	<0.30	**12.5**	**3,580**	**1.23**
cutbank face of tailings pile (duplicate)	HM-TP-SS2	grab-soil	10/19/2016	**261** *J+*	**1,900**	37.1 *J+*	**40.3**	5.80	22.2	68,800	**1,800**	**12,500**	<0.30	**12.1**	**3,600**	**1.10**
ponding area on top of tailings pile	HM-TP-SS3	grab-soil	10/19/2016	**209** *J+*	**1,080**	31.8 *J+*	**20.5**	2.21	27.6	60,400	**2,500**	**9,120**	<0.30	**9.67**	**3,350**	**0.410**
tailings pile (front yard of cabin)	HM-TP-SS4	grab-soil	10/19/2016	**545** *J+*	**1,300**	51.5 *J+*	**30.2**	4.32	59.6	47,100	**17,100**	**5,910**	<0.30	**37.0**	**4,280**	**1.09**
waste rock used as road material at adit #1	HM-WD1-SS1	grab-soil	10/19/2016	**197** *J+*	**437**	63.4 *J+*	**3.42**	7.63	37.0	38,500	**4,810**	3,020	<0.30	**11.0**	**629**	**0.338**
waste dump along road below adits #2-8	HM-WD2-SS1	grab-soil	10/19/2016	**376** *J+*	**956**	73.3 *J+*	**69.5**	1.70	41.8	43,000	**41,100**	**9,930**	<0.30	**81.4**	**10,800**	**2.91**
background soil sample uphill of site	HM-BG-SS1	grab-soil	10/19/2016	6.8 *J+*	13.8	222 *J+*	0.54	11.4	36.4	33,600	36.9	1,140	<0.30	0.60	173	<0.033
sediment downstream of tailings pile	HM-DS-SD1	grab-sediment	10/19/2016	3.7 *J+*	**53.8**	49.4 *J+*	0.91	9.00	19.8	20,800	**154**	700	<0.30	0.53	158	<0.033
sediment downstream of tailings pile (duplicate)	HM-DS-SD2	grab-sediment	10/19/2016	4.1 *J+*	**44.2**	45.1 *J+*	0.86	8.14	18.0	19,100	**135**	679	<0.30	<0.50	153	<0.033
sediment (background) upstream of tailings pile	HM-BG-SD1	grab-sediment	10/19/2016	2.0 *J+*	7.84	35.9 *J+*	<0.20	7.43	16.6	18,400	52.8	265	<0.30	<0.50	42.0	<0.033
EPA RSL for Resident Soil[a] (mg/kg)				31	0.68	15,000	71	NA	3,100	50,000	400	1,800	390	390	23,000	9.4
EPA RSL for Industrial Soil[a] (mg/kg)				470	3	220,000	980	NA	47,000	820,000	800	26,000	5,800	5,800	350,000	40
Mean Concentrations in Bonner County, Idaho[b] (ppm)				NA	5.679	NA	NA	NA	16.868	NA	30.791	816.752	0.364	NA	72.310	0.078

Notes:

Gray shaded values exceed regional screening levels (RSLs) for residential soils.

Orange shaded values exceed RSLs for both residential and industrial soils.

Bold = Three times greater than background concentrations when comparing: 1) the soil and sediment sample to the background value at HM-BG-SS1. Where the background value is not-detected the limit of detection was used as the backgound value for calculation purposes.

[a]Based on a target hazard quotient of 1.0. https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016

[b]Significant digits shown as reported by USGS. Mean concentrations are not available for Sb, Ba, Cd, Cr, Fe, and Ag. http://mrdata.usgs.gov/geochem/county.php?place=f16017&el=Pb&rf=northwestern

mg/kg = milligrams per kilogram

ppm = parts per million

<value = result is below the detection limit shown

NA = not available

J+ = The result is an estimated quantity and is biased high.

4 Migration/Exposure Pathways and Targets

The purpose of this PA/SI is to evaluate the Hope Mine to identify if any releases or potentials for release are present to pathways and targets. Pathways and exposure routes that may lead to human or ecological receptors include: surface water pathways and soil exposure (Section 4.1), ground water pathways (Section 4.2), and air pathways (Section 4.3).

4.1 Surface Water Pathways and Soil Exposures

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. For the Hope Mine site, the selected PPE for the surface water migration pathway is Lightning Creek. Surface water flows to Clark Fork River, then to Lake Pend Oreille, and the 15-mile TDL is completed at Lake Pend Oreille. Numerous wetlands are located within a four-mile radius of the mine site (Figure 4).

A tailings pile (approximately 15,000 to 20,000 cubic yards) is located adjacent to Lightning Creek (Figure 3). During the site visit, the field team observed that a side channel of Lightning Creek was in contact with the tailings pile. Erosion over time is evident along the face of the tailings pile (Figure 5) and cobble sized chunks of tailings were observed mixed with creek cobble immediately adjacent to the eroded face of the tailings (Appendix A, Photo 12).

Waste material that forms the road leading from Adit #1 to the mill site shows evidence of erosion during high-flow conditions, but no water was in contact with this road bed waste during the site visit. Waste piles associated with Adits #2-8 were not in contact with surface water and showed no signs of erosion (Appendix A, Photos 13-20).

Standing water was observed in Adits #3 and 4; all other adits were dry. Although there was no discharge from any adits during the site visit, Adit #4 shows indications that water may discharge during higher water levels. There was no evidence that discharge from Adit #4 flows directly to surface water and likely infiltrates into adjacent waste.

Analysis of the surface water pathway, soil exposure, and targets for this PA/SI includes evaluation of analytical results for soil, sediment, and surface water (Sections 4.1.1); sensitive waterways (Section 4.1.2), and identification of sensitive, rare, and threatened plant and animal species (Section 4.1.3).

4.1.1 Soil, Sediment, and Surface Water Analytical Results

Soil and sediment laboratory analytical results were compared to the following criteria: 1) EPA regional screening levels (RSLs) for residential and industrial soil and 2) background concentrations (Table 3). The industrial RSLs may be more applicable to the current use status of this site; however, if residential development is considered in the future, then the residential RSLs should be followed.

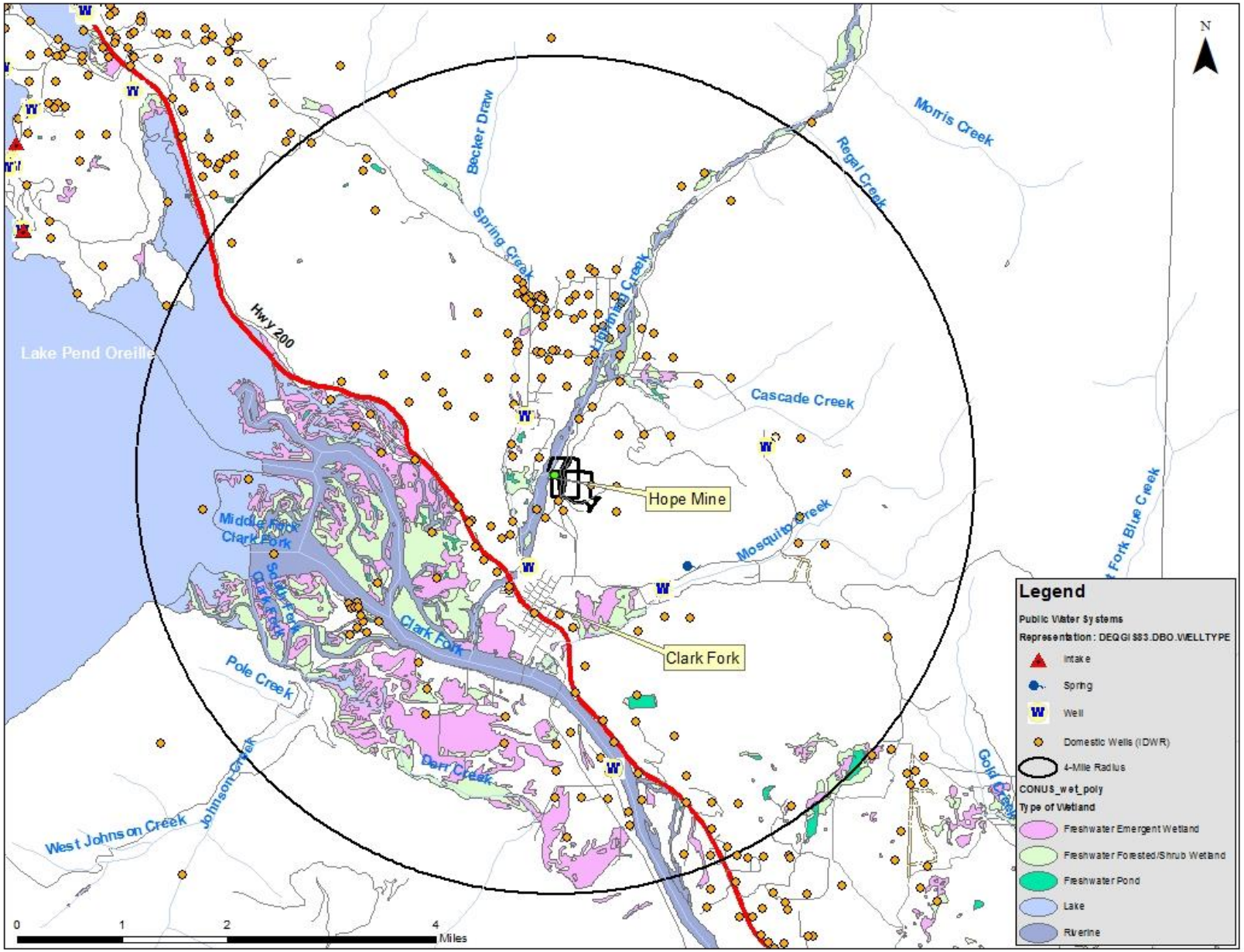

Figure 4. Map of the features supporting evaluation of the surface water and ground water pathways in the area of the Hope Mine.

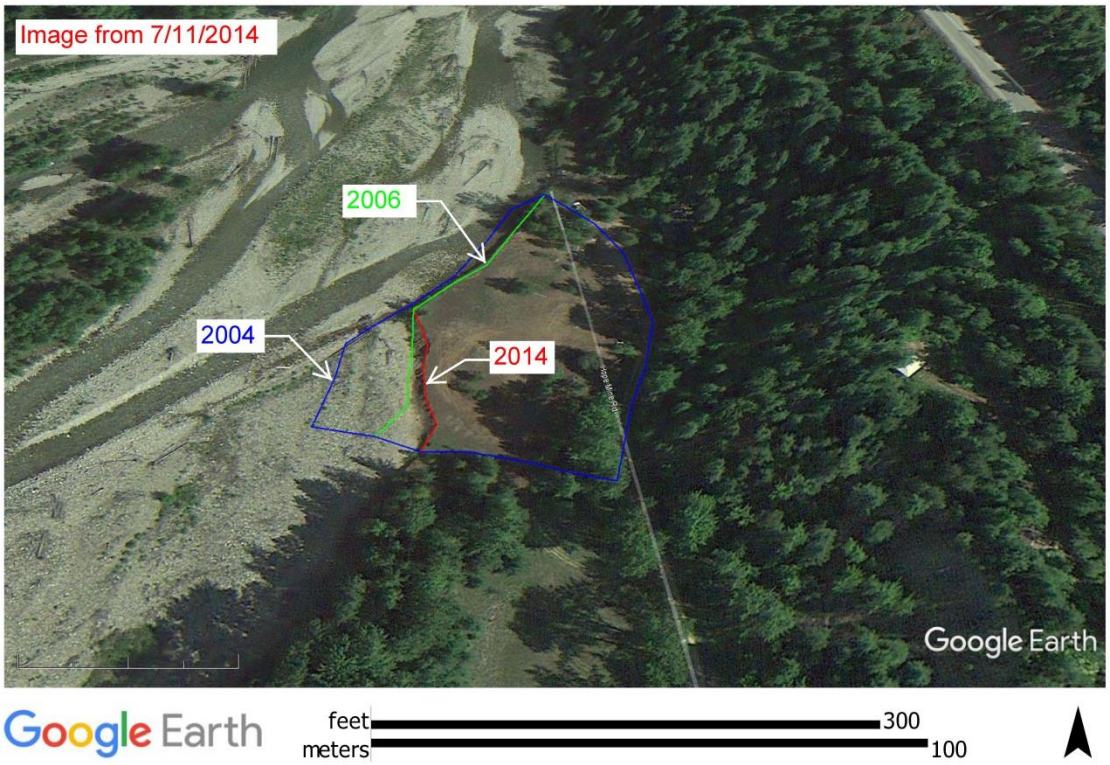

Figure 5. Approximate extent of tailings pile erosion into Lightning Creek over time based on past aerial photos.

Surface water laboratory analytical results were compared to the following criteria: 1) EPA drinking water standards, 2) EPA RSLs for tapwater, 3) DEQ cold water biota standards for acute and chronic, and 4) site-specific background concentrations. Drinking water standards and RSLs for tapwater are used to protect public health by limiting the levels of contaminants present in drinking water. These criteria are most applicable to sites where "unrestricted uses," such as residential development, are expected; therefore, they provide a conservative threshold for remote locations. The cold water biota standards are used to protect and restore the quality of Idaho's surface waters.

The following observations are based on the analytical laboratory results:

- *Tailings Pile:* Four samples (including a duplicate) were collected from the tailings pile from three unique locations. Arsenic, lead, and one antimony sample were above RSLs for both residential and industrial soils. Antimony (at two of three locations), iron (at two of three locations), and manganese were above RSLs for residential soil. All results for antimony, arsenic, cadmium, lead, manganese, silver, zinc, and mercury were more than three times the background sample.

- *Waste Piles*: Two samples were collected from waste rock piles near the adits. Arsenic and lead are above RSLs for both residential and industrial soils. Antimony and manganese are above RSLs for residential soils. Antimony, arsenic, cadmium, lead,

manganese (at one location), silver, zinc, and mercury are more than three times the background level.

- *Sediment Samples*: One sediment sample was collected from upstream of mine waste, and one sample (plus a duplicate) was collected downstream of mine waste. Arsenic is above the RSLs for residential and industrial soils in both upstream and downstream samples with higher concentrations in the upstream samples. Arsenic and lead concentrations are three times the background concentration of soil collected at HM-BG-SS1 for the downstream sediment sample.

- *Surface Water Samples:* One surface water sample (plus a duplicate) was collected from upstream of mine waste, and one surface water sample was collected downstream of mine waste. Barium was detected in both the upstream and downstream samples but was not above any standards. Total lead was detected in the downstream sample only at concentrations above the cold water biota chronic standard. The pH of both upstream and downstream samples was below the acceptable pH ranges compared to the drinking water MCL and cold water biota chronic standard.

- *Quality Assurance/Quality Control (QA/QC):* Samples collected for evaluating QA/QC include one field blank and duplicate samples for surface water, soil, and sediment. None of the target analytes were detected in the field blank. The laboratory and field data are determined to be of acceptable quality and meet the data quality objectives for representativeness and comparability. Accuracy and precision are also considered acceptable. Final data and assigned qualifiers are included in Tables 2 and 3. No laboratory or field data were rejected. Completeness for this sampling event is calculated at 100% (TerraGraphics 2016b).

4.1.2 Sensitive Waterways

The Clean Water Act (CWA) requires that the State of Idaho prepare an Integrated Report listing: (1) current conditions of all state waters (§305(b) list) and (2) waters that are impaired and need a total maximum daily load (TMDL; §303(d) list). §305(b)-listed streams, are shown on Figure 6. Lightning Creek (ID17010213PN011_02, ID17010213PN11_04, and ID1701213PN010_04) was sampled as part of this PA/SI. Lightning Creek is a tributary to the Clark Fork River (Lower Clark Fork River subbasin hydrologic unit code 17010213) and contained in the Lower Clark Fork River hydrologic unit code.

As listed in the final 2012 Integrated Report, Lightning Creek from Cascade Creek to Spring Creek to the mouth is identified as not supporting for both cold water aquatic life and salmonid spawning. Lightning Creek from Cascade Creek to Spring Creek to the mouth has not been assessed for domestic water supply or primary contact recreation.

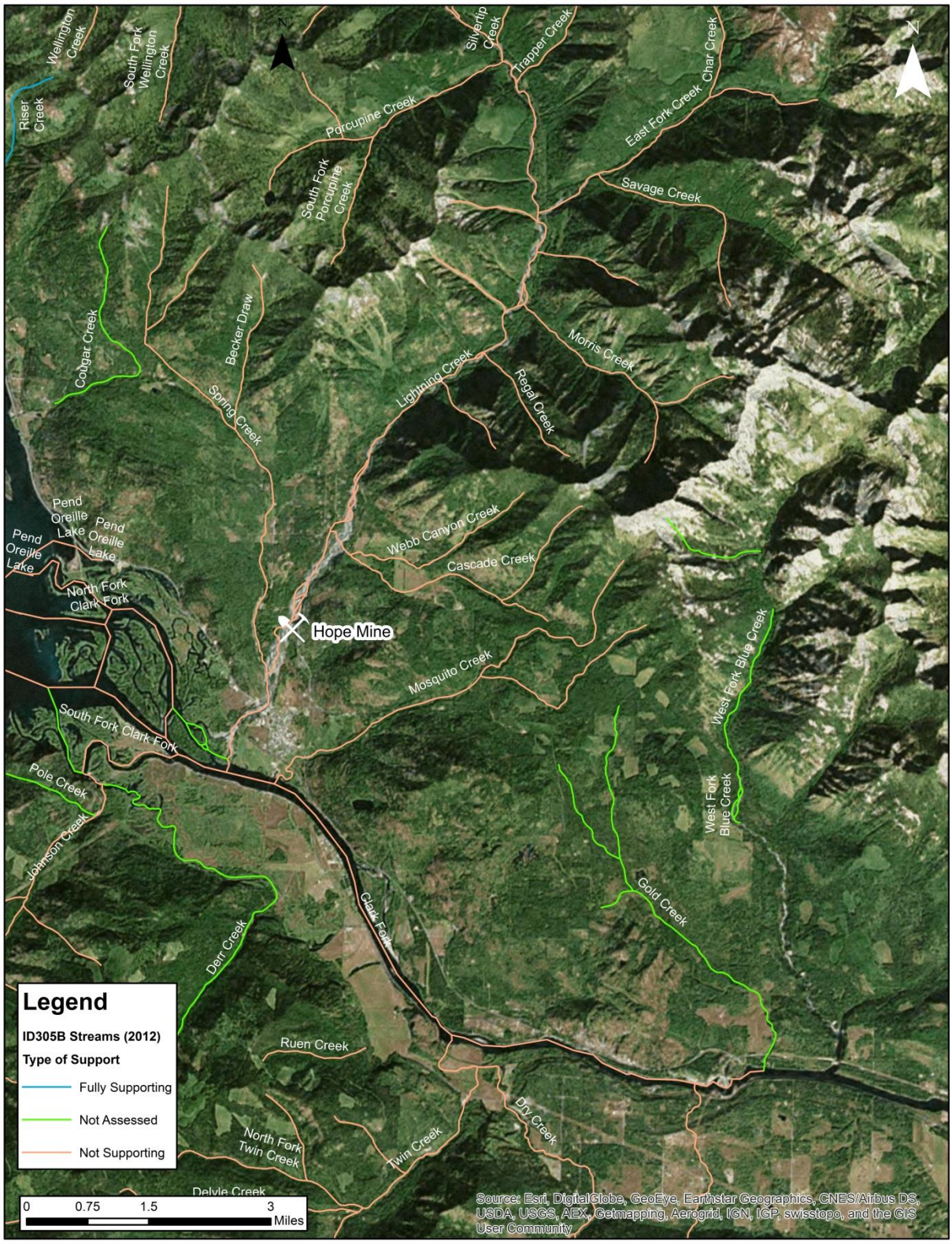

Figure 6. State of Idaho §305(b)-listed streams in the vicinity of the Hope Mine.

4.1.3 Sensitive, Rare, and Threatened Plant and Animal Species

Sensitive species can have large habitat ranges that overlap the vicinity of the Hope Mine site. Based on the resource list obtained during a search of the Information for Planning and Conservation System (USFWS 2016), the following species are identified for Bonner County:

- Birds: Yellow-Billed Cuckoo, *Coccyzus americanus*, threatened species.
- Mammals: Canada Lynx, *Lynx canadensis*, threatened species; Grizzly Bear, *Ursus arctos horribilis*, threatened species; North American Wolverine, *Gulo gulo luscus*, proposed threatened species; Woodland Caribou, *Rangifer tarandus caribou*, endangered species.
- Fish: Bull Trout, *Salvelinus confluentus*, threatened species-designated critical habitat.
- Plants: Whitebark Pine, *Pinus albicaulis*, candidate species.

4.2 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.

Potential drinking water systems within the 4-mile radius of the Hope Mine site include six public water systems (PWS) and 281 domestic wells (Figure 4). Source water assessment (SWA) summary reports are available for the Spring Creek Well (E0005148) and 9th Street Well (E0005147) which are PWS for the City of Clark Fork (PWS#ID1090018); Elk Mountain Academy (PWS#ID1090240) Well #1 (E0009112); and Riverlake RV Resort (PWS#1090115) Well #1 (E0005631). SWA reports have not been completed for the Clark Fork Field Campus Well and Spring. The SWA contains information about the population served by each PWS and susceptibility rankings for potential contaminants. The rankings are high, moderate or low for inorganic, volatile organic, synthetic organic and microbial contaminants based on system construction, potential contaminant inventory/land use, and hydrologic sensitivity (i.e., likelihood that the water supply will become contaminated based on the hydrologic and geologic conditions surround the PWS).

The City of Clark Fork 9th Street Well is located near Lightning Creek and serves approximately 570 people. For this well, a moderate ranking for hydrologic sensitivity and a final susceptibility ranking of moderate was assigned for all of the contaminant categories. All of the other PWS are

not located downgradient of the Hope Mine site. There is one domestic ground water well located in the center of the tailings pile in front of the cabin. This well was drilled in 2005 to a depth of 80 feet; water was encountered at 50 feet below ground surface (IDWR 2006). According to the property owner, this well has not been used as a drinking water source. Instead, a poly-tank was filled with spring water (upstream of the cabin and tailings) to use for drinking water when the cabin was occupied.

The ground water pathway was not assessed as part of this PA/SI.

4.3 Air Pathways

Mine waste remaining at Hope Mine includes an extensive pile of mill tailings, waste material used for road building between the main portal and mill, and multiple waste piles in front of upper adit openings (Adits #2-8). The tailings pile is located adjacent to and in contact with Lightning Creek and is barren of vegetation. The tailings have a sandy consistency with some clay layers observed in the cut bank along the creek. The tailings were very wet during the site visit due to recent, heavy rains and it was not possible to evaluate the probability of fugitive dust; although the presence of fine, clay material suggests that fugitive dust is likely present during dry conditions, especially if disturbed by foot or vehicle traffic. The waste dump piles consist of gravel to cobble sized broken rock with very little fine soils. The piles are surrounded by vegetation; therefore, fugitive dust is likely limited in this area.

The nearest residence is approximately 1,000 feet southeast of the Hope Mine tailings pile. The town of Clark Fork is located within the 4-mile radius which includes the closest school which is a Junior/Senior High School (located approximately 1.25 miles south-southeast) and the closest daycare facility (located approximately 1.50 miles south-southeast).

The air pathway was not assessed as part of this PA/SI.

5 Conclusions and Recommendations

The purpose of this PA/SI is to assess the threat posed to human health and the environment and determine the need for additional investigation at the Hope Mine site. Conducting this PA/SI is important to provide the property owner and recreational users of this area with information about the levels of metals concentrations, possible exposure pathways when recreating in the area, and health and safety education about how to reduce exposures.

The detections of lead, arsenic, and other metals, shown and discussed in Sections 3 and 4 of this PA/SI report, identify a concern for human health and the environment. DEQ recommends **Additional Actions** to further sample and characterize this site. The sample results in this PA/SI report do not represent the extent of contamination; therefore, additional characterization and sampling is necessary to: 1) determine the extent of contamination sources and distribution and 2) identify potential alternatives to address contamination.

DEQ recommends that the landowner works with the Idaho Department of Lands (IDL) to complete additional sampling and characterization under their Abandoned Mine Program (*https://www.idl.idaho.gov/mining/abandoned-mines/index.html*). The results of additional

characterization and sampling will be used to determine potential alternatives to address contamination.

In addition, DEQ recommends keeping the site as recreational-only land use. Persons recreating in this area should be aware of the hazards of historic mining areas, especially health risks associated with prolonged exposures to metals. A summary of health and safety information includes:

- Wash hands after any outdoor activity and before eating or drinking. Use a nail scrub brush to get dirt out of fingernails.
- Do not let children play in loose soil, dust, and muddy areas. Keep children's cuts and scrapes clean and covered. Wash children's toys after playing outside.
- Eat on a clean table or blanket, not on the ground. Do not eat food that has been dropped on the ground.
- When riding ATVs or other off-highway vehicles, wear protective gear such as a bandana, follow at a safe riding distance, and avoid riding through extremely dusty areas to avoid breathing in large amounts of dust.
- After outdoor activity, remove shoes, dust off clothing, and wash separately from other laundry. Wash or dust off any camping or recreational items (tents, bicycles, etc…). Wash your dogs, horses, and other animals that accompanied you. Avoid tracking dust into your garage by washing vehicles and ATVs.
- Stay out of old mine adits and structures. Rotting wood, unstable rock, oxygen-depleted air, falling debris, dust, and mining wastes are potential dangers.

6 References

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Appendix A. Site Photographs

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Photo 1. Cut-bank where Lightning Creek erodes tailings (facing South). Location of sample HM-TP-SS1/SS2.

Photo 2. Erosion of the northwest portion of the tailings into Lightning Creek (facing Northeast). Cabin (old mill site) in background.

Photo 3. Low spot where water ponds on top of tailings (facing Southeast). Location of sample HM-TP-SS3. Children's toys and tree house can be seen on tailings pile.

Photo 4. Front yard of cabin (old mill site) is tailings (facing East). Location of sample HM-TP-SS4.

Photo 5. Center of tailings pile (facing South) showing groundwater well and cabin.

Photo 6. Face of tailings taken from creek bed (facing Southeast).

Photo 7. Waste as road material from adit to tailings (facing North). Location of sample HM-WD1-SS1.

Photo 8. Waste pile by Boot Hill Road and Adits #2-8 (facing S). Location of sample HM-WD2-SS2.

Photo 9. Small waste pile outside of Adit #6 (facing Southwest).

Photo 10. Downstream sediment and surface water location (facing Southwest) (HM-DS-SD1/SD2, HM-DS-SW1).

Photo 11. Upstream sediment and surface water location (facing North) (HM-BG-SD1, HM-BG-SW1/SW2).

Photo 12. Chunks of tailings (medium brown in center and lower right) mixed with creek cobble.

Photo 13. Adit #1 opening located north of tailings pile just above creek level.

Photo 14. Interior view of Adit #2. Entrance is mostly filled by collapsed rubble.

Photo 15. Adit #3 opening.

Photo 16. Adit #4 opening.

Photo 17. Adit #5 opening (collapsed).

Photo 18. Cluster of three small collapsed openings (Adit #6).

Photo 19. Adit #7 opening partially filled.

Photo 20. Adit #8 collapsed opening.

Appendix B. Analytical Laboratory Report

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Work Order: **W6J0427**

IDEQ (Boise)

Page 1 of 2

SVL ANALYTICAL

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SVL JOB #

TEMP on Receipt:

Table 1. -- Matrix Type
1 = Surface Water, 2 = Ground Water
3 = Soil, 4 = Sediment, 5 = Rock, 6 = Rinsate, 7 = Oil
8 = Waste, 9 = Other:

Report to Company: IDEQ and TerraGraphics
Contact: Dana Swift / Shelley Hicks
DEQ Address: 1410 N. Hilton, Boise, ID 83706
TG 108 W. Idaho Ave., Kellogg, ID 83837
Phone Number: 208-373-0296 / 208-786-1206
FAX Number:
E-mail: dana.swift@deq.idaho.gov
shelley.hicks@terragraphic.com

Invoice Sent To: IDEQ
Contact: Dana Swift
Address: 1410 N. Hilton
Boise, ID 83706
Phone Number: 208-373-0296
FAX Number:
PO#:

Project Name: Hope Mine PA
Sampler's Signature: SHyHP

Indicate State of sample origination: ID

	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)	Total Metals		Soil and sediment: Total Metals: method 6010B: Ba, Cd, Cr, Ag, Cu, Fe, Mn, Zn, Sb; method 6020: As, Pb, Se; method 7471: Hg
1	HM-TP-SS1	10/19/16	11:00	SH	3	1	X							X		air dry, sieve to -10 mesh
2	HM-TP-SS2	10/19/16	11:00	SH	3	1	X							X		
3	HM-TP-SS3	10/19/16	11:20	SH	3	1	X							X		
4	HM-WD1-SS1	10/19/16	11:50	SH	3	1	X							X		
5	HM-DS-SD1	10/19/16	12:30	SH	4	1	X							X		
6	HM-DS-SD2	10/19/16	12:30	SH	4	1	X							X		
7	HM-BG-SD1	10/19/16	12:50	SH	4	1	X							X		
8	HM-TP-SS4	10/19/16	13:00	SH	3	1	X							X		
9	HM-WD2-SS1	10/19/16	14:00	SH	3	1	X							X		
10	HM-BG-SS1	10/19/16	14:30	SH	3	1	X							X		

Relinquished by: SHyHP	Date: 10/20/16	Time: 14:00	Received by: S Jacobson	Date: 10-20-16	Time: 1400
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

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

White: LAB COPY Yellow: CUSTOMER COPY

SVL-COC 01/14

CHAIN OF CUSTODY RECORD

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

FOR SVL USE ONLY
SVL JOB # W610427
TEMP on Receipt:

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

Report to Company: IDEQ and Terragraphics
Contact:
Address: see page 1 of 2
Phone Number:
FAX Number:
E-mail:

Invoice Sent To: IDEQ
Contact:
Address: see page 1 of 2
Phone Number:
FAX Number:
PO#:

Project Name: Hope Mine PA
Sampler's Signature: SHyatt

Indicate State of sample origination: ID

	Sample ID (Please take care to distinguish between: 1 and I, 2 and Z, 5 and S, ø and O. Thanks!)	Collection Date	Collection Time	Collected by: (Init.)	Misc. Matrix Type (From Table 1)	Misc. No. of Containers	Preservative(s) Unpreserved	HNO_3 Filtered	HNO_3 Unfiltered	HCl	H_2SO_4	NaOH	Other (Specify)	Analyses Required: Total Metals	Rush Instructions (Days)	Comments
1	HM-DS-SW1	10/19/16	12:25	SH	1	1			X					X		Water: Total Metals: method 200.7: Ba, Cd, Cr, Ag, Cu, Fe, Mn, Zn, Sb method 200.8 As, Pb, Se method 245.1 Hg
2	HM-BG-SW1	10/19/16	12:45	SH	1	1			X					X		
3	HM-BG-SW2	10/19/16	12:45	SH	1	1			X					X		
4	HM-BG-SW3	10/19/16	14:15	SH	7	1			X					X		
5																
6																
7																
8																
9																
10																

Relinquished by: SHyatt Date: 10/20/16 Time: 14:00
Relinquished by: Date: Time:
Received by: S. Jacobson Date: 10-20-16 Time: 14:00
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: 10-20-16 By: CRSeavy

SVL Work No: 1610427

Item	Description	V	VC	NV	NA	Comments
1	Client or project name	✓				IDEQ (Boise)
2	Date and time of receipt at lab	✓				10-20-16 1400
3	Received by	✓				A. Jacobson
4	Temperature blank or cooler temperature				—	Temp. — °C.
5	Were the sample(s) received on ice				—	HNO_3 bottles on ice
6	Custody tape/bottle seals				✓	none
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	✓				Sampled date not marked on sample bags 1-10.
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				✓	Walk-in

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

Additional Comments: _____

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Sampled By	Date Received	Notes
HM-TP-SS1	W6J0427-01	Soil	19-Oct-16 11:00	SH	20-Oct-2016	
HM-TP-SS2	W6J0427-02	Soil	19-Oct-16 11:00	SH	20-Oct-2016	
HM-TP-SS3	W6J0427-03	Soil	19-Oct-16 11:20	SH	20-Oct-2016	
HM-WD1-SS1	W6J0427-04	Soil	19-Oct-16 11:50	SH	20-Oct-2016	
HM-D5-SD1	W6J0427-05	Sediment	19-Oct-16 12:30	SH	20-Oct-2016	
HM-D5-SD2	W6J0427-06	Sediment	19-Oct-16 12:30	SH	20-Oct-2016	
HM-BG-SD1	W6J0427-07	Sediment	19-Oct-16 12:50	SH	20-Oct-2016	
HM-TP-SS4	W6J0427-08	Soil	19-Oct-16 13:00	SH	20-Oct-2016	
HM-WD2-SS1	W6J0427-09	Soil	19-Oct-16 14:00	SH	20-Oct-2016	
HM-BG-SS1	W6J0427-10	Soil	19-Oct-16 14:30	SH	20-Oct-2016	
HM-D5-SW1	W6J0427-11	Surface Water	19-Oct-16 12:25	SH	20-Oct-2016	
HM-BG-SW1	W6J0427-12	Surface Water	19-Oct-16 12:45	SH	20-Oct-2016	
HM-BG-SW2	W6J0427-13	Surface Water	19-Oct-16 12:45	SH	20-Oct-2016	
HM-BG-SW3	W6J0427-14	Rinsate	19-Oct-16 14:15	SH	20-Oct-2016	

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: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-TP-SS1**
SVL Sample ID: **W6J0427-01 (Soil)**

Sampled: 19-Oct-16 11:00
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	1770	mg/kg Dry	7.50	0.235	50	W643240	KWH	11/02/16 13:02	D1,D2,M3
EPA 6020A	**Lead**	1880	mg/kg Dry	1.00	0.165	50	W643240	KWH	11/02/16 13:02	D1,D2,M3
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 08:02	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	240	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 11:23	M1
EPA 6010C	**Barium**	29.7	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 10:12	M1
EPA 6010C	**Cadmium**	37.4	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 10:12	
EPA 6010C	**Chromium**	4.42	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 10:12	
EPA 6010C	**Copper**	20.3	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 10:12	
EPA 6010C	**Iron**	65000	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 10:12	
EPA 6010C	**Manganese**	11900	mg/kg Dry	8.00	2.20	10	W645004	SMB	11/03/16 13:01	D2,M3
EPA 6010C	**Silver**	12.5	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 10:12	
EPA 6010C	**Zinc**	3580	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 10:12	M3
EPA 7471B	**Mercury**	1.23	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:36	

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, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-TP-SS2**
SVL Sample ID: **W6J0427-02 (Soil)**

Sampled: 19-Oct-16 11:00
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	1900	mg/kg Dry	7.50	0.235	50	W643240	KWH	11/02/16 13:10	D1,D2
EPA 6020A	**Lead**	1800	mg/kg Dry	1.00	0.165	50	W643240	KWH	11/02/16 13:10	D1,D2
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 08:11	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	261	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 11:33	
EPA 6010C	**Barium**	37.1	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 10:26	
EPA 6010C	**Cadmium**	40.3	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 10:26	
EPA 6010C	**Chromium**	5.80	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 10:26	
EPA 6010C	**Copper**	22.2	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 10:26	
EPA 6010C	**Iron**	68800	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 10:26	
EPA 6010C	**Manganese**	12500	mg/kg Dry	8.00	2.20	10	W645004	SMB	11/03/16 13:11	D2,M3
EPA 6010C	**Silver**	12.1	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 10:26	
EPA 6010C	**Zinc**	3600	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 10:26	
EPA 7471B	**Mercury**	1.10	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:38	

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: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-TP-SS3**
SVL Sample ID: **W6J0427-03 (Soil)**

Sampled: 19-Oct-16 11:20
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	1080	mg/kg Dry	7.50	0.235	50	W643240	KWH	11/02/16 13:13	D1,D2
EPA 6020A	**Lead**	2500	mg/kg Dry	1.00	0.165	50	W643240	KWH	11/02/16 13:13	D1,D2
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 08:13	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	209	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 11:36	
EPA 6010C	**Barium**	31.8	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 10:29	
EPA 6010C	**Cadmium**	20.5	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 10:29	
EPA 6010C	**Chromium**	2.21	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 10:29	
EPA 6010C	**Copper**	27.6	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 10:29	
EPA 6010C	**Iron**	60400	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 10:29	
EPA 6010C	**Manganese**	9120	mg/kg Dry	8.00	2.20	10	W645004	SMB	11/03/16 13:14	D2,M3
EPA 6010C	**Silver**	9.67	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 10:29	
EPA 6010C	**Zinc**	3350	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 10:29	
EPA 7471B	**Mercury**	0.410	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:40	

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: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-WD1-SS1**
SVL Sample ID: **W6J0427-04 (Soil)**

Sampled: 19-Oct-16 11:50
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	437	mg/kg Dry	7.50	0.235	50	W643240	KWH	11/02/16 13:15	D1,D2
EPA 6020A	**Lead**	4810	mg/kg Dry	1.00	0.165	50	W643240	KWH	11/02/16 13:15	D1,D2
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 08:15	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	197	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 11:39	
EPA 6010C	**Barium**	63.4	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 10:43	
EPA 6010C	**Cadmium**	3.42	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 10:43	
EPA 6010C	**Chromium**	7.63	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 10:43	
EPA 6010C	**Copper**	37.0	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 10:43	
EPA 6010C	**Iron**	38500	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 10:43	
EPA 6010C	**Manganese**	3020	mg/kg Dry	0.80	0.22		W645004	AS	11/03/16 10:43	
EPA 6010C	**Silver**	11.0	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 10:43	
EPA 6010C	**Zinc**	629	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 10:43	
EPA 7471B	**Mercury**	0.338	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:45	

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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AZ:0538, **CA**:2080, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-D5-SD1**
SVL Sample ID: **W6J0427-05 (Sediment)**

Sampled: 19-Oct-16 12:30
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	53.8	mg/kg Dry	0.300	0.009	2	W643240	KWH	11/03/16 07:43	D1
EPA 6020A	**Lead**	154	mg/kg Dry	0.100	0.007	2	W643240	KWH	11/03/16 07:43	D1
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 07:43	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	3.7	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 11:42	
EPA 6010C	**Barium**	49.4	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 10:46	
EPA 6010C	**Cadmium**	0.91	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 10:46	
EPA 6010C	**Chromium**	9.00	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 10:46	
EPA 6010C	**Copper**	19.8	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 10:46	
EPA 6010C	**Iron**	20800	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 10:46	
EPA 6010C	**Manganese**	700	mg/kg Dry	0.80	0.22		W645004	AS	11/03/16 10:46	
EPA 6010C	**Silver**	0.53	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 10:46	
EPA 6010C	**Zinc**	158	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 10:46	
EPA 7471B	Mercury	< 0.033	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:47	

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: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-D5-SD2**
SVL Sample ID: **W6J0427-06 (Sediment)**

Sampled: 19-Oct-16 12:30
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	44.2	mg/kg Dry	0.300	0.009	2	W643240	KWH	11/03/16 07:45	D1
EPA 6020A	**Lead**	135	mg/kg Dry	0.100	0.007	2	W643240	KWH	11/03/16 07:45	D1
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 07:45	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	4.1	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 12:01	
EPA 6010C	**Barium**	45.1	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 11:36	
EPA 6010C	**Cadmium**	0.86	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 11:36	
EPA 6010C	**Chromium**	8.14	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 11:36	
EPA 6010C	**Copper**	18.0	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 11:36	
EPA 6010C	**Iron**	19100	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 11:36	
EPA 6010C	**Manganese**	679	mg/kg Dry	0.80	0.22		W645004	AS	11/03/16 11:36	
EPA 6010C	Silver	< 0.50	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 11:36	
EPA 6010C	**Zinc**	153	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 11:36	
EPA 7471B	Mercury	< 0.033	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:52	

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: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-BG-SD1**
SVL Sample ID: **W6J0427-07 (Sediment)**

Sampled: 19-Oct-16 12:50
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	7.84	mg/kg Dry	0.300	0.009	2	W643240	KWH	11/03/16 07:47	D1
EPA 6020A	**Lead**	52.8	mg/kg Dry	0.100	0.007	2	W643240	KWH	11/03/16 07:47	D1
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 07:47	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	2.0	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 12:04	
EPA 6010C	**Barium**	35.9	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 10:57	
EPA 6010C	Cadmium	< 0.20	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 10:57	
EPA 6010C	**Chromium**	7.43	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 10:57	
EPA 6010C	**Copper**	16.6	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 10:57	
EPA 6010C	**Iron**	18400	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 10:57	
EPA 6010C	**Manganese**	265	mg/kg Dry	0.80	0.22		W645004	AS	11/03/16 10:57	
EPA 6010C	Silver	< 0.50	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 10:57	
EPA 6010C	**Zinc**	42.0	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 10:57	
EPA 7471B	Mercury	< 0.033	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:54	

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: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-TP-SS4**
SVL Sample ID: **W6J0427-08 (Soil)**

Sampled: 19-Oct-16 13:00
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	1300	mg/kg Dry	7.50	0.235	50	W643240	KWH	11/02/16 13:28	D1,D2
EPA 6020A	**Lead**	17100	mg/kg Dry	1.00	0.165	50	W643240	KWH	11/02/16 13:28	D1,D2
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 08:17	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	545	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 12:08	
EPA 6010C	**Barium**	51.5	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 11:00	
EPA 6010C	**Cadmium**	30.2	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 11:00	
EPA 6010C	**Chromium**	4.32	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 11:00	
EPA 6010C	**Copper**	59.6	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 11:00	
EPA 6010C	**Iron**	47100	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 11:00	
EPA 6010C	**Manganese**	5910	mg/kg Dry	0.80	0.22		W645004	AS	11/03/16 11:00	
EPA 6010C	**Silver**	37.0	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 11:00	
EPA 6010C	**Zinc**	4280	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 11:00	
EPA 7471B	**Mercury**	1.09	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 09:56	

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, **ID**:ID00019 & ID00965 (Microbiology), **NV**:ID000192007A, **UT**(**TNI**):ID000192015-1, **WA**:C573

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-WD2-SS1**
SVL Sample ID: **W6J0427-09 (Soil)**

Sampled: 19-Oct-16 14:00
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	956	mg/kg Dry	37.5	1.18	250	W643240	KWH	11/02/16 13:30	D1,D2
EPA 6020A	**Lead**	41100	mg/kg Dry	5.00	0.825	250	W643240	KWH	11/02/16 13:30	D1,D2
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 08:19	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	376	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 12:11	
EPA 6010C	**Barium**	73.3	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 11:39	
EPA 6010C	**Cadmium**	69.5	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 11:39	
EPA 6010C	**Chromium**	1.70	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 11:39	
EPA 6010C	**Copper**	41.8	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 11:39	
EPA 6010C	**Iron**	43000	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 11:39	
EPA 6010C	**Manganese**	9930	mg/kg Dry	8.00	2.20	10	W645004	AS	11/03/16 11:42	D2
EPA 6010C	**Silver**	81.4	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 11:39	
EPA 6010C	**Zinc**	10800	mg/kg Dry	10.0	4.8	10	W645004	AS	11/03/16 11:42	D2
EPA 7471B	**Mercury**	2.91	mg/kg Dry	0.132	0.036	4	W644180	MWD	10/28/16 10:05	D2

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John Kern
Laboratory Director

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-BG-SS1**
SVL Sample ID: **W6J0427-10 (Soil)**

Sampled: 19-Oct-16 14:30
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total) (Sieved)										
EPA 6020A	**Arsenic**	13.8	mg/kg Dry	0.300	0.009	2	W643240	KWH	11/03/16 07:50	D1
EPA 6020A	**Lead**	36.9	mg/kg Dry	0.100	0.007	2	W643240	KWH	11/03/16 07:50	D1
EPA 6020A	Selenium	< 0.30	mg/kg Dry	0.30	0.03	2	W643240	KWH	11/03/16 07:50	D1
Metals (Total) by EPA 6000/7000 Methods (Sieved)										
EPA 6010C	**Antimony**	6.8	mg/kg Dry	2.0	0.5		W645005	AS	11/01/16 12:14	
EPA 6010C	**Barium**	222	mg/kg Dry	0.20	0.14		W645004	AS	11/03/16 11:48	
EPA 6010C	**Cadmium**	0.54	mg/kg Dry	0.20	0.06		W645004	AS	11/03/16 11:48	
EPA 6010C	**Chromium**	11.4	mg/kg Dry	0.60	0.13		W645004	AS	11/03/16 11:48	
EPA 6010C	**Copper**	36.4	mg/kg Dry	1.00	0.16		W645004	AS	11/03/16 11:48	
EPA 6010C	**Iron**	33600	mg/kg Dry	10.0	4.0		W645004	AS	11/03/16 11:48	
EPA 6010C	**Manganese**	1140	mg/kg Dry	0.80	0.22		W645004	AS	11/03/16 11:48	
EPA 6010C	**Silver**	0.60	mg/kg Dry	0.50	0.14		W645004	AS	11/03/16 11:48	
EPA 6010C	**Zinc**	173	mg/kg Dry	1.0	0.5		W645004	AS	11/03/16 11:48	
EPA 7471B	Mercury	< 0.033	mg/kg Dry	0.033	0.009		W644180	MWD	10/28/16 10:00	

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IDEQ (Boise)
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Boise, ID 83706

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-D5-SW1**
SVL Sample ID: **W6J0427-11 (Surface Water)**

Sampled: 19-Oct-16 12:25
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 245.1	Mercury	< 0.00020	mg/L	0.00020	0.000053		W644141	MWD	10/27/16 10:12	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)										
EPA 200.7	Antimony	< 0.020	mg/L	0.020	0.004		W643259	SMB	11/02/16 09:12	
EPA 200.7	**Barium**	0.0041	mg/L	0.0020	0.0005		W643259	SMB	11/02/16 09:12	
EPA 200.7	Cadmium	< 0.0020	mg/L	0.0020	0.0004		W643259	SMB	11/02/16 09:12	
EPA 200.7	Chromium	< 0.0060	mg/L	0.0060	0.0008		W643259	SMB	11/02/16 09:12	
EPA 200.7	Copper	< 0.0100	mg/L	0.0100	0.0013		W643259	SMB	11/02/16 09:12	
EPA 200.7	Iron	< 0.100	mg/L	0.100	0.020		W643259	SMB	11/02/16 09:12	
EPA 200.7	Manganese	< 0.0080	mg/L	0.0080	0.0012		W643259	SMB	11/02/16 09:12	
EPA 200.7	Silver	< 0.0050	mg/L	0.0050	0.0008		W643259	SMB	11/02/16 09:12	
EPA 200.7	Zinc	< 0.010	mg/L	0.010	0.001		W643259	SMB	11/02/16 09:12	
EPA 200.8	Arsenic	< 0.00300	mg/L	0.00300	0.00023	2	W643239	KWH	11/02/16 12:07	
EPA 200.8	**Lead**	0.0108	mg/L	0.00300	0.000075	2	W643239	KWH	11/02/16 12:07	
EPA 200.8	Selenium	< 0.0030	mg/L	0.0030	0.0002	2	W643239	KWH	11/02/16 12:07	

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Boise, ID 83706

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-BG-SW1**
SVL Sample ID: **W6J0427-12 (Surface Water)**

Sample Report Page 1 of 1

Sampled: 19-Oct-16 12:45
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 245.1	Mercury	< 0.00020	mg/L	0.00020	0.000053		W644141	MWD	10/27/16 10:14	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)										
EPA 200.7	Antimony	< 0.020	mg/L	0.020	0.004		W643259	SMB	11/02/16 09:21	
EPA 200.7	**Barium**	0.0034	mg/L	0.0020	0.0005		W643259	SMB	11/02/16 09:21	
EPA 200.7	Cadmium	< 0.0020	mg/L	0.0020	0.0004		W643259	SMB	11/02/16 09:21	
EPA 200.7	Chromium	< 0.0060	mg/L	0.0060	0.0008		W643259	SMB	11/02/16 09:21	
EPA 200.7	Copper	< 0.0100	mg/L	0.0100	0.0013		W643259	SMB	11/02/16 09:21	
EPA 200.7	Iron	< 0.100	mg/L	0.100	0.020		W643259	SMB	11/02/16 09:21	
EPA 200.7	Manganese	< 0.0080	mg/L	0.0080	0.0012		W643259	SMB	11/02/16 09:21	
EPA 200.7	Silver	< 0.0050	mg/L	0.0050	0.0008		W643259	SMB	11/02/16 09:21	
EPA 200.7	Zinc	< 0.010	mg/L	0.010	0.001		W643259	SMB	11/02/16 09:21	
EPA 200.8	Arsenic	< 0.00300	mg/L	0.00300	0.00023	2	W643239	KWH	11/02/16 12:19	
EPA 200.8	Lead	< 0.00300	mg/L	0.00300	0.000075	2	W643239	KWH	11/02/16 12:19	
EPA 200.8	Selenium	< 0.0030	mg/L	0.0030	0.0002	2	W643239	KWH	11/02/16 12:19	

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Boise, ID 83706

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-BG-SW2**
SVL Sample ID: **W6J0427-13 (Surface Water)**

Sampled: 19-Oct-16 12:45
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 245.1	Mercury	< 0.00020	mg/L	0.00020	0.000053		W644141	MWD	10/27/16 10:16	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)										
EPA 200.7	Antimony	< 0.020	mg/L	0.020	0.004		W643259	SMB	11/02/16 09:25	
EPA 200.7	**Barium**	0.0034	mg/L	0.0020	0.0005		W643259	SMB	11/02/16 09:25	
EPA 200.7	Cadmium	< 0.0020	mg/L	0.0020	0.0004		W643259	SMB	11/02/16 09:25	
EPA 200.7	Chromium	< 0.0060	mg/L	0.0060	0.0008		W643259	SMB	11/02/16 09:25	
EPA 200.7	Copper	< 0.0100	mg/L	0.0100	0.0013		W643259	SMB	11/02/16 09:25	
EPA 200.7	Iron	< 0.100	mg/L	0.100	0.020		W643259	SMB	11/02/16 09:25	
EPA 200.7	Manganese	< 0.0080	mg/L	0.0080	0.0012		W643259	SMB	11/02/16 09:25	
EPA 200.7	Silver	< 0.0050	mg/L	0.0050	0.0008		W643259	SMB	11/02/16 09:25	
EPA 200.7	Zinc	< 0.010	mg/L	0.010	0.001		W643259	SMB	11/02/16 09:25	
EPA 200.8	Arsenic	< 0.00300	mg/L	0.00300	0.00023	2	W643239	KWH	11/02/16 12:21	
EPA 200.8	Lead	< 0.00300	mg/L	0.00300	0.000075	2	W643239	KWH	11/02/16 12:21	
EPA 200.8	Selenium	< 0.0030	mg/L	0.0030	0.0002	2	W643239	KWH	11/02/16 12:21	

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John Kern
Laboratory Director

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Client Sample ID: **HM-BG-SW3**
SVL Sample ID: **W6J0427-14 (Rinsate)**

Sampled: 19-Oct-16 14:15
Received: 20-Oct-16
Sampled By: SH

Method	Analyte	Result	Units	RL	MDL	Dilution	Batch	Analyst	Analyzed	Notes
Metals (Total)										
EPA 245.1	Mercury	< 0.00020	mg/L	0.00020	0.000053		W644141	MWD	10/27/16 10:18	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)										
EPA 200.7	Antimony	< 0.020	mg/L	0.020	0.004		W643259	SMB	11/02/16 09:28	
EPA 200.7	Barium	< 0.0020	mg/L	0.0020	0.0005		W643259	SMB	11/02/16 09:28	
EPA 200.7	Cadmium	< 0.0020	mg/L	0.0020	0.0004		W643259	SMB	11/02/16 09:28	
EPA 200.7	Chromium	< 0.0060	mg/L	0.0060	0.0008		W643259	SMB	11/02/16 09:28	
EPA 200.7	Copper	< 0.0100	mg/L	0.0100	0.0013		W643259	SMB	11/02/16 09:28	
EPA 200.7	Iron	< 0.100	mg/L	0.100	0.020		W643259	SMB	11/02/16 09:28	
EPA 200.7	Manganese	< 0.0080	mg/L	0.0080	0.0012		W643259	SMB	11/02/16 09:28	
EPA 200.7	Silver	< 0.0050	mg/L	0.0050	0.0008		W643259	SMB	11/02/16 09:28	
EPA 200.7	Zinc	< 0.010	mg/L	0.010	0.001		W643259	SMB	11/02/16 09:28	
EPA 200.8	Arsenic	< 0.00300	mg/L	0.00300	0.00023	2	W643239	KWH	11/02/16 12:23	
EPA 200.8	Lead	< 0.00300	mg/L	0.00300	0.000075	2	W643239	KWH	11/02/16 12:23	
EPA 200.8	Selenium	< 0.0030	mg/L	0.0030	0.0002	2	W643239	KWH	11/02/16 12:23	

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John Kern
Laboratory Director

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Quality Control - BLANK Data

Method	Analyte	Units	Result	MDL	MRL	Batch ID	Analyzed	Notes
Metals (Total)								
EPA 245.1	Mercury	mg/L	<0.00020	0.000053	0.00020	W644141	27-Oct-16	
EPA 6020A	Arsenic	mg/kg	<0.300	0.009	0.300	W643240	02-Nov-16	D1
EPA 6020A	Lead	mg/kg	<0.100	0.007	0.100	W643240	02-Nov-16	D1
EPA 6020A	Selenium	mg/kg	<0.30	0.03	0.30	W643240	02-Nov-16	D1
Metals (Total) by EPA 6000/7000 Methods								
EPA 6010C	Antimony	mg/kg	<2.0	0.5	2.0	W645005	01-Nov-16	
EPA 6010C	Barium	mg/kg	<0.20	0.14	0.20	W645004	03-Nov-16	
EPA 6010C	Cadmium	mg/kg	<0.20	0.06	0.20	W645004	03-Nov-16	
EPA 6010C	Chromium	mg/kg	<0.60	0.13	0.60	W645004	03-Nov-16	
EPA 6010C	Copper	mg/kg	<1.00	0.16	1.00	W645004	03-Nov-16	
EPA 6010C	Iron	mg/kg	<10.0	4.0	10.0	W645004	03-Nov-16	
EPA 6010C	Manganese	mg/kg	<0.80	0.22	0.80	W645004	03-Nov-16	
EPA 6010C	Silver	mg/kg	<0.50	0.14	0.50	W645004	03-Nov-16	
EPA 6010C	Zinc	mg/kg	<1.0	0.5	1.0	W645004	03-Nov-16	
EPA 7471B	Mercury	mg/kg	<0.033	0.009	0.033	W644180	28-Oct-16	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)								
EPA 200.7	Antimony	mg/L	<0.020	0.004	0.020	W643259	02-Nov-16	
EPA 200.7	Barium	mg/L	<0.0020	0.0005	0.0020	W643259	02-Nov-16	
EPA 200.7	Cadmium	mg/L	<0.0020	0.0004	0.0020	W643259	02-Nov-16	
EPA 200.7	Chromium	mg/L	<0.0060	0.0008	0.0060	W643259	02-Nov-16	
EPA 200.7	Copper	mg/L	<0.0100	0.0013	0.0100	W643259	02-Nov-16	
EPA 200.7	Iron	mg/L	<0.100	0.020	0.100	W643259	02-Nov-16	
EPA 200.7	Manganese	mg/L	<0.0080	0.0012	0.0080	W643259	02-Nov-16	
EPA 200.7	Silver	mg/L	<0.0050	0.0008	0.0050	W643259	02-Nov-16	
EPA 200.7	Zinc	mg/L	<0.010	0.001	0.010	W643259	02-Nov-16	
EPA 200.8	Arsenic	mg/L	<0.00300	0.00023	0.00300	W643239	02-Nov-16	
EPA 200.8	Lead	mg/L	<0.00300	0.000075	0.00300	W643239	02-Nov-16	
EPA 200.8	Selenium	mg/L	<0.0030	0.0002	0.0030	W643239	02-Nov-16	

Quality Control - LABORATORY CONTROL SAMPLE Data

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total)									
EPA 245.1	Mercury	mg/L	0.00489	0.00500	97.8	85 - 115	W644141	27-Oct-16	
EPA 6020A	Arsenic	mg/kg	2.39	2.50	95.7	80 - 120	W643240	02-Nov-16	D1
EPA 6020A	Lead	mg/kg	2.44	2.50	97.7	80 - 120	W643240	02-Nov-16	D1
EPA 6020A	Selenium	mg/kg	2.32	2.50	92.6	80 - 120	W643240	02-Nov-16	D1
Metals (Total) by EPA 6000/7000 Methods									
EPA 6010C	Barium	mg/kg	101	100	101	80 - 120	W645004	03-Nov-16	
EPA 6010C	Cadmium	mg/kg	95.4	100	95.4	80 - 120	W645004	03-Nov-16	
EPA 6010C	Chromium	mg/kg	101	100	101	80 - 120	W645004	03-Nov-16	
EPA 6010C	Copper	mg/kg	100	100	100	80 - 120	W645004	03-Nov-16	
EPA 6010C	Iron	mg/kg	1000	1000	100	80 - 120	W645004	03-Nov-16	
EPA 6010C	Manganese	mg/kg	98.9	100	98.9	80 - 120	W645004	03-Nov-16	
EPA 6010C	Silver	mg/kg	4.92	5.00	98.4	80 - 120	W645004	03-Nov-16	
EPA 6010C	Zinc	mg/kg	96.3	100	96.3	80 - 120	W645004	03-Nov-16	
EPA 7471B	Mercury	mg/kg	0.800	0.833	96.0	80 - 120	W644180	28-Oct-16	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)									
EPA 200.7	Antimony	mg/L	1.03	1.00	103	85 - 115	W643259	02-Nov-16	
EPA 200.7	Barium	mg/L	0.994	1.00	99.4	85 - 115	W643259	02-Nov-16	

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Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Quality Control - LABORATORY CONTROL SAMPLE Data (Continued)

Method	Analyte	Units	LCS Result	LCS True	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total Recoverable--reportable as Total per 40 CFR 136) (Continued)									
EPA 200.7	Cadmium	mg/L	1.00	1.00	100	85 - 115	W643259	02-Nov-16	
EPA 200.7	Chromium	mg/L	1.02	1.00	102	85 - 115	W643259	02-Nov-16	
EPA 200.7	Copper	mg/L	1.01	1.00	101	85 - 115	W643259	02-Nov-16	
EPA 200.7	Iron	mg/L	9.66	10.0	96.6	85 - 115	W643259	02-Nov-16	
EPA 200.7	Manganese	mg/L	0.983	1.00	98.3	85 - 115	W643259	02-Nov-16	
EPA 200.7	Silver	mg/L	0.0486	0.0500	97.3	85 - 115	W643259	02-Nov-16	
EPA 200.7	Zinc	mg/L	0.989	1.00	98.9	85 - 115	W643259	02-Nov-16	
EPA 200.8	Arsenic	mg/L	0.0252	0.0250	101	85 - 115	W643239	02-Nov-16	
EPA 200.8	Lead	mg/L	0.0253	0.0250	101	85 - 115	W643239	02-Nov-16	
EPA 200.8	Selenium	mg/L	0.0243	0.0250	97.1	85 - 115	W643239	02-Nov-16	

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 245.1	Mercury	mg/L	0.00100	<0.00020	0.00100	100	70 - 130	W644141	27-Oct-16	
EPA 245.1	Mercury	mg/L	0.00103	<0.00020	0.00100	103	70 - 130	W644141	27-Oct-16	
EPA 6020A	Arsenic	mg/kg	1810	1770	2.50	R > 4S	75 - 125	W643240	02-Nov-16	D1,D2,M3
EPA 6020A	Lead	mg/kg	1960	1880	2.50	R > 4S	75 - 125	W643240	02-Nov-16	D1,D2,M3
EPA 6020A	Selenium	mg/kg	2.33	<0.30	2.50	90.2	75 - 125	W643240	03-Nov-16	D1
Metals (Total) by EPA 6000/7000 Methods										
EPA 6010C	Antimony	mg/kg	366	240	100	125	75 - 125	W645005	01-Nov-16	
EPA 6010C	Barium	mg/kg	152	29.7	100	122	75 - 125	W645004	03-Nov-16	
EPA 6010C	Cadmium	mg/kg	130	37.4	100	92.9	75 - 125	W645004	03-Nov-16	
EPA 6010C	Chromium	mg/kg	107	4.42	100	102	75 - 125	W645004	03-Nov-16	
EPA 6010C	Copper	mg/kg	121	20.3	100	101	75 - 125	W645004	03-Nov-16	
EPA 6010C	Iron	mg/kg	65800	65000	1000	78.0	75 - 125	W645004	03-Nov-16	
EPA 6010C	Manganese	mg/kg	11800	11900	100	R > 4S	75 - 125	W645004	03-Nov-16	D2,M3
EPA 6010C	Silver	mg/kg	17.4	12.5	5.00	98.3	75 - 125	W645004	03-Nov-16	
EPA 6010C	Zinc	mg/kg	3380	3580	100	R > 4S	75 - 125	W645004	03-Nov-16	M3
EPA 7471B	Mercury	mg/kg	0.767	0.410	0.333	107	75 - 125	W644180	28-Oct-16	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)										
EPA 200.7	Antimony	mg/L	1.04	<0.020	1.00	104	70 - 130	W643259	02-Nov-16	
EPA 200.7	Antimony	mg/L	1.07	<0.020	1.00	107	70 - 130	W643259	02-Nov-16	
EPA 200.7	Barium	mg/L	1.09	0.0808	1.00	101	70 - 130	W643259	02-Nov-16	
EPA 200.7	Barium	mg/L	1.04	0.0041	1.00	103	70 - 130	W643259	02-Nov-16	
EPA 200.7	Cadmium	mg/L	1.07	0.0551	1.00	102	70 - 130	W643259	02-Nov-16	
EPA 200.7	Cadmium	mg/L	1.03	<0.0020	1.00	103	70 - 130	W643259	02-Nov-16	
EPA 200.7	Chromium	mg/L	1.01	<0.0060	1.00	101	70 - 130	W643259	02-Nov-16	
EPA 200.7	Chromium	mg/L	1.05	<0.0060	1.00	105	70 - 130	W643259	02-Nov-16	
EPA 200.7	Copper	mg/L	19.1	18.6	1.00	R > 4S	70 - 130	W643259	02-Nov-16	M3
EPA 200.7	Copper	mg/L	1.05	<0.0100	1.00	105	70 - 130	W643259	02-Nov-16	
EPA 200.7	Iron	mg/L	11.6	1.98	10.0	96.0	70 - 130	W643259	02-Nov-16	
EPA 200.7	Iron	mg/L	10.1	<0.100	10.0	101	70 - 130	W643259	02-Nov-16	
EPA 200.7	Manganese	mg/L	8.77	7.90	1.00	86.9	70 - 130	W643259	02-Nov-16	
EPA 200.7	Manganese	mg/L	1.02	<0.0080	1.00	102	70 - 130	W643259	02-Nov-16	
EPA 200.7	Silver	mg/L	0.0506	<0.0050	0.0500	101	70 - 130	W643259	02-Nov-16	
EPA 200.7	Silver	mg/L	0.0507	<0.0050	0.0500	101	70 - 130	W643259	02-Nov-16	
EPA 200.7	Zinc	mg/L	8.65	8.08	1.00	R > 4S	70 - 130	W643259	02-Nov-16	M3
EPA 200.7	Zinc	mg/L	1.02	<0.010	1.00	101	70 - 130	W643259	02-Nov-16	
EPA 200.8	Arsenic	mg/L	0.0285	0.00372	0.0250	99.2	70 - 130	W643239	02-Nov-16	

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

Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

Quality Control - MATRIX SPIKE Data (Continued)

Method	Analyte	Units	Spike Result	Sample Result (R)	Spike Level (S)	% Rec.	Acceptance Limits	Batch ID	Analyzed	Notes
Metals (Total Recoverable--reportable as Total per 40 CFR 136) (Continued)										
EPA 200.8	Arsenic	mg/L	0.374	0.352	0.0250	89.1	70 - 130	W643239	02-Nov-16	
EPA 200.8	Lead	mg/L	0.0234	<0.00300	0.0250	93.6	70 - 130	W643239	02-Nov-16	
EPA 200.8	Lead	mg/L	0.0230	<0.00300	0.0250	92.2	70 - 130	W643239	02-Nov-16	
EPA 200.8	Selenium	mg/L	0.0264	<0.0030	0.0250	97.9	70 - 130	W643239	02-Nov-16	
EPA 200.8	Selenium	mg/L	0.0261	<0.0030	0.0250	95.7	70 - 130	W643239	02-Nov-16	

Quality Control - MATRIX SPIKE DUPLICATE Data

Method	Analyte	Units	MSD Result	Spike Result	Spike Level	%R	RPD	RPD Limit	Batch ID	Analyzed	Notes
Metals (Total)											
EPA 245.1	Mercury	mg/L	0.00101	0.00100	0.00100	101	0.5	20	W644141	27-Oct-16	
EPA 6020A	Arsenic	mg/kg	1860	1810	2.50	R > 4S	2.6	20	W643240	02-Nov-16	D1,D2,M3
EPA 6020A	Lead	mg/kg	2100	1960	2.50	R > 4S	7.0	20	W643240	02-Nov-16	D1,D2,M3
EPA 6020A	Selenium	mg/kg	2.43	2.33	2.50	93.9	3.9	20	W643240	03-Nov-16	D1
Metals (Total) by EPA 6000/7000 Methods											
EPA 6010C	Antimony	mg/kg	368	366	100	128	0.7	20	W645005	01-Nov-16	M1
EPA 6010C	Barium	mg/kg	157	152	100	127	3.3	20	W645004	03-Nov-16	M1
EPA 6010C	Cadmium	mg/kg	137	130	100	99.8	5.2	20	W645004	03-Nov-16	
EPA 6010C	Chromium	mg/kg	111	107	100	106	3.7	20	W645004	03-Nov-16	
EPA 6010C	Copper	mg/kg	125	121	100	104	3.1	20	W645004	03-Nov-16	
EPA 6010C	Iron	mg/kg	68000	65800	1000	R > 4S	3.2	20	W645004	03-Nov-16	M3
EPA 6010C	Manganese	mg/kg	11900	11800	100	R > 4S	1.0	20	W645004	03-Nov-16	D2,M3
EPA 6010C	Silver	mg/kg	17.9	17.4	5.00	109	3.0	20	W645004	03-Nov-16	
EPA 6010C	Zinc	mg/kg	3560	3380	100	R > 4S	5.2	20	W645004	03-Nov-16	M3
EPA 7471B	Mercury	mg/kg	0.743	0.767	0.333	100	3.1	20	W644180	28-Oct-16	
Metals (Total Recoverable--reportable as Total per 40 CFR 136)											
EPA 200.7	Antimony	mg/L	1.06	1.07	1.00	106	1.2	20	W643259	02-Nov-16	
EPA 200.7	Barium	mg/L	1.02	1.04	1.00	101	2.2	20	W643259	02-Nov-16	
EPA 200.7	Cadmium	mg/L	1.02	1.03	1.00	102	1.3	20	W643259	02-Nov-16	
EPA 200.7	Chromium	mg/L	1.04	1.05	1.00	104	1.4	20	W643259	02-Nov-16	
EPA 200.7	Copper	mg/L	1.04	1.05	1.00	104	1.7	20	W643259	02-Nov-16	
EPA 200.7	Iron	mg/L	9.79	10.1	10.0	97.9	2.7	20	W643259	02-Nov-16	
EPA 200.7	Manganese	mg/L	0.996	1.02	1.00	99.6	2.6	20	W643259	02-Nov-16	
EPA 200.7	Silver	mg/L	0.0499	0.0507	0.0500	99.7	1.7	20	W643259	02-Nov-16	
EPA 200.7	Zinc	mg/L	1.01	1.02	1.00	100	1.0	20	W643259	02-Nov-16	
EPA 200.8	Arsenic	mg/L	0.0282	0.0285	0.0250	98.1	1.0	20	W643239	02-Nov-16	
EPA 200.8	Lead	mg/L	0.0224	0.0234	0.0250	89.8	4.2	20	W643239	02-Nov-16	
EPA 200.8	Selenium	mg/L	0.0263	0.0264	0.0250	97.4	0.4	20	W643239	02-Nov-16	

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Project Name: Hope Mine PA 2016
Work Order: **W6J0427**
Reported: 03-Nov-16 14:50

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 6010C	Antimony	mg/kg	241	240	20.0	3.25	75 - 125	W645005	01-Nov-16	M3
EPA 6010C	Barium	mg/kg	29.8	29.7	2.00	6.70	75 - 125	W645004	03-Nov-16	M3

Notes and Definitions

D1	Sample required dilution due to matrix.
D2	Sample required dilution due to high concentration of target analyte.
M1	Matrix spike recovery was high, 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.
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