



Weston Solutions, Inc.
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October 3, 2017

Duane Newell
On-Scene Coordinator
United States Environmental Protection Agency, Region VIII
Mail Code: 8EPR-ER
1595 Wynkoop Street
Denver, CO 80202

Re: Jumbo Mine – Letter Report
Montezuma, Summit, Colorado
TDD: 1706-12
DCN: W0499.1A.01415
WO#: 20408.012.001.0499.00

Dear Mr. Newell

The United States Environmental Protection Agency (U.S. EPA) tasked the Weston Solutions, Inc., (WESTON®) Superfund Technical Assessment and Response Team (START) under Technical Direction Document (TDD) 0001/1706-12 to support U.S. EPA's site assessment at the Jumbo Mine site (the Site) in Montezuma, Summit County, Colorado. The assessment was initiated to determine whether there existed immediate threats to human health and the environment due to heavy metals contamination from historic mining operations at the Site.

SITE DESCRIPTION

The Site (39.598043° north and -105.853344° west) is located at the abandoned Jumbo Mine, approximately 5 miles from the town of Montezuma, Summit County, Colorado. (Attachment A, Figure 1). There is one building onsite.

BACKGROUND

The Site is the Jumbo Mine located in Montezuma, Summit County, Colorado. Historic mining operations in the area encompassing Peru Creek and the Snake River have contaminated soil, groundwater, and surface water with heavy metals. A removal action was conducted at the Pennsylvania Mine in 2013 to alleviate some of the metal loading that was being discharged to Peru Creek from mining impacted areas around the Pennsylvania Mine. Subsequent investigations have identified the Jumbo Mine and surrounding waste rock as contributing sources of metal pollution in Peru Creek and the Snake River.



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SITE ASSESSMENT ACTIVITIES

On August 28, 2017, U.S. EPA On-Scene Coordinator Martin McComb, and START members Michael Cherny and Joe Rudi mobilized to the site to perform a rapid assessment of the site. Prior to entering the site, the land owner had signed an Access Agreement allowing the U.S. EPA and its contractors access to the Site in order to conduct the necessary site assessment activities.

START began the site assessment by conducting a visual assessment of the waste rock pile and adit. An assessment was also made of the adit confluence with Peru Creek. A photograph log showing these areas is included as Attachment B.

START sampled a total of eight surface water locations on the site. Four samples were collected from the outfall of the adit down to the confluence with Peru Creek. Two surface water samples were collected in Peru Creek, one above and one below the confluence. Two more surface water samples were taken at seeps located at the toe of the waste rock pile. All sample locations were recorded using a Trimble GPS unit and can be found in Figure 2 of Attachment A. All surface water sample results can be found in Attachment D. Table 1 below shows the field screening parameters of the surface water samples.

Table 1:
Surface Water Field Screening Parameters

Sample ID	Temperature (°C)	DO (mg/l)	Conductivity (µS/cm)	PH (SU)	ORP (mV)
JM-SW01	11.27	8.21	0.164	4.63	229
JM-SW02	14.39	8.34	0.161	5.61	205
JM-SW03	14.03	7.55	0.162	4.61	292
JM-SW04	9.83	8.65	0.119	4.59	369
JM-SW05	10.30	8.44	0.161	4.93	298
JM-SW06	10.65	8.19	0.160	4.97	321
JM-SW07	11.93	7.42	0.117	4.54	366
JM-SW08	14.69	6.53	0.179	2.89	468

START was also tasked with collecting soil samples of the waste pile to be analyzed for TCLP TAL Metals. Three TCLP samples were collected from the waste rock pile and sent to ESC labs for analysis. START proceeded to take 10 In Situ XRF readings throughout the waste rock pile for onsite screening purposes. START also collected 10 soil samples from around the waste rock pile that were analyzed with the XRF. All sample locations were recorded using a Trimble GPS unit and can be found on Figure 2 of Attachment A. These samples were screened by running the



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sample through a size 10 tin sieve and then analyzing the resulting soil that passed through the sieve with an XRF. Per the Manufacturer, the Innov-Alpha-Series XRF states that elements which are shown non detect are below the instrument level of detection (LOD). The instrument's LOD is three times the error on the counting statistic of the measurement. The XRF LOD may be lower than the lab LOD.

All surface soil screening results can be found in Attachment C. Of the ten soil samples that were screened with the XRF, three samples (JM-WR-03, JM-WR-04, and JM-WR-06) were sent to an analytical laboratory for analysis. The XRF results for a given analyte were generally higher than the laboratory result. This could be due to the fact that the XRF measures concentrations on a dry weight basis while the laboratory measured concentrations relative to the wet weight. All surface soil sample analytical results can be found in Attachment D. A data validation report describing QC sample analysis, validation qualifiers, and an XRF correlational analysis is presented in Attachment E.

For the XRF correlation analysis, the XRF results and laboratory results were log normalized and plotted to determine a relationship as specified in EPA Method 6200. Comparing the log normalized validated laboratory analytical results with the log normalized XRF results for arsenic, copper, iron, lead, and zinc, linear trend lines were produced for each analyte as shown in Graph 1. The closer the slope is to 1.0, the stronger the accuracy between the laboratory analytical results and the XRF analytical results. Based on recommendations presented in the Quality Assurance Project Plan (QAPP) for Region 8 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Removal and Emergency Response Activities in Colorado, Utah, Wyoming, Montana, North Dakota, and South Dakota (WESTON 2013), the correlation coefficient between XRF and Atomic Absorption / Inductively Coupled Plasma (AA/ICP) analysis should be 0.7 or greater. Based on the results of the XRF correlational analysis that was performed as part of the data validation process, there was a good linear correlation coefficient (above 0.7) for arsenic, copper, iron, lead, and zinc. Since the correlation values were all within the acceptable range as specified by the Region 8 QAPP, the results of the XRF can be used to approximate the analytical concentration for the analytes listed above. A graph showing the linear correlation values as well as equations of the best fit lines for the evaluated analytes, which can be used to estimate analytical concentrations, is presented in Graph 1 below and summarized in Attachment E. It should be noted that x and y in the best fit line equations below correspond to the natural log of the XRF result and the natural log of the analytical laboratory result respectively.

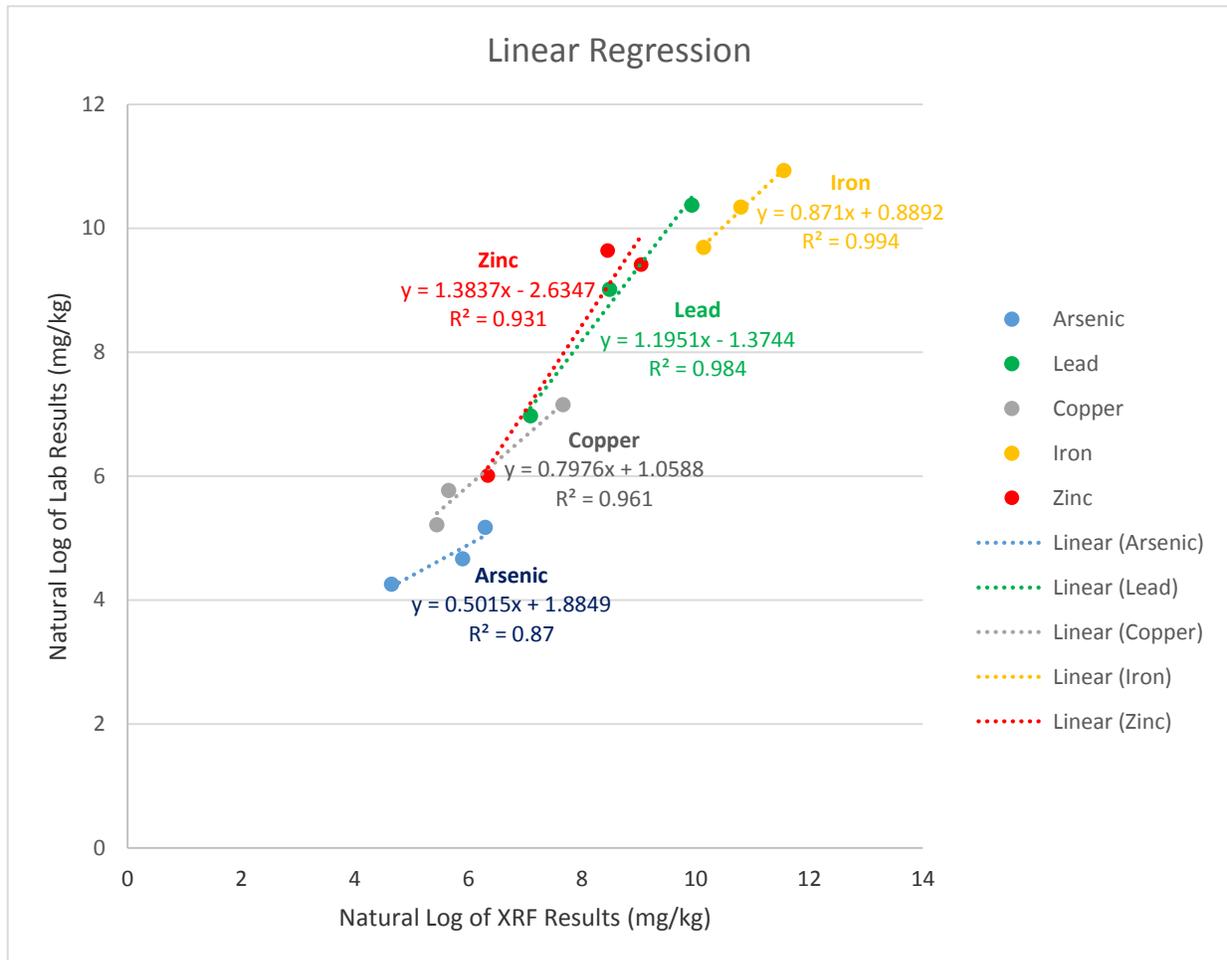


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Graph 1:
XRF Linear Regression Analysis



START also performed a pH precipitate field pilot study to assess limestone treatment efficacy of the adit outfall water. Although no precipitate was observed in the field during the titration of adit water with sodium hydroxide, significant reductions in dissolved metal concentrations are present in the samples collected after the pH was adjusted to 9.5 (su). Adjustment of pH had the greatest effect on six metals: aluminum, cadmium, copper, iron, lead, and zinc.

At a pH of 8.5, the dissolved metal concentrations began to decrease and the lowest metal concentrations were noted at a pH of 9.5. At a pH of 10.5, dissolved metal concentrations were greater than or equal to the concentrations in the adit water since metals were forming hydroxide complexes and becoming soluble again. A pH around 9.5 would provide optimal precipitation of

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metals based on this bench test. The most notable changes in water chemistry at a pH of 9.5 were a 45X decrease in lead and 14.6X decrease in copper levels compared with the original adit water concentrations. Additional assessment may be performed to fine tune the pH for precipitation.

Upon completion of the site assessment activities, EPA and START demobilized from the site on August 28, 2017, at approximately 1800 hours.

CONCLUSIONS

As a result of this rapid assessment, the chemical characteristics of the waste rock pile and the adit outfall from the Jumbo Mine site have been determined and the effectiveness of lime treatment to remove metals from the adit discharge has been evaluated. The overall condition of the site has also been documented.

Very truly yours,

WESTON SOLUTIONS, INC.

James Fieman
START Project Leader



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Attachment:

A – Figures

B – Photo Log

C – Field Screening Results

D – Analytical Results

E – Data Validation Report

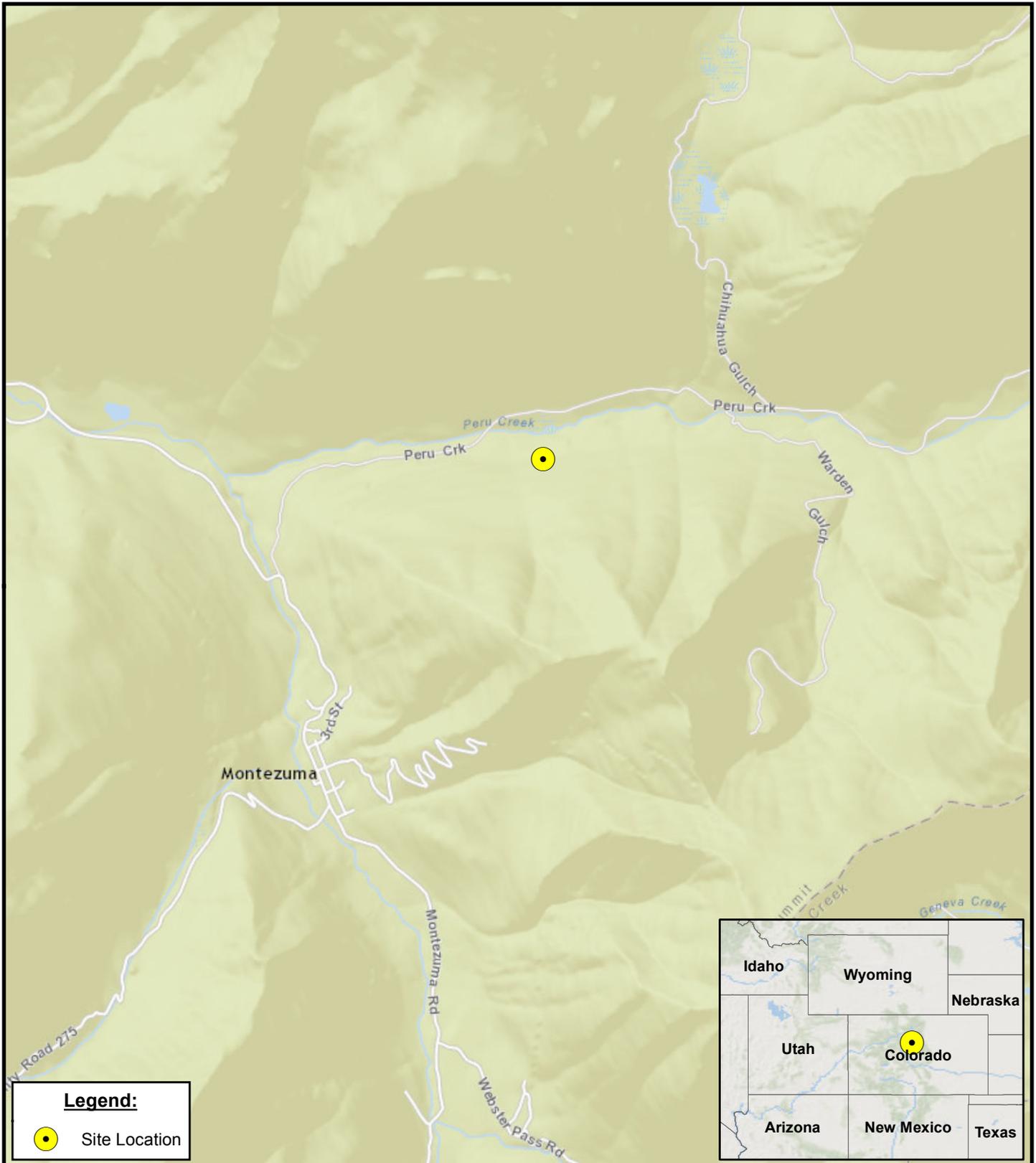
cc: Robert Reed, Project Manager
START DCN File



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Attachment A

Figures



Legend:

 Site Location

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Projection: Mercator Auxiliary Sphere
 Datum: WGS 1984

Source:
 Background: ESRI Street Imagery (2017)



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 U.S. EPA - Region 8



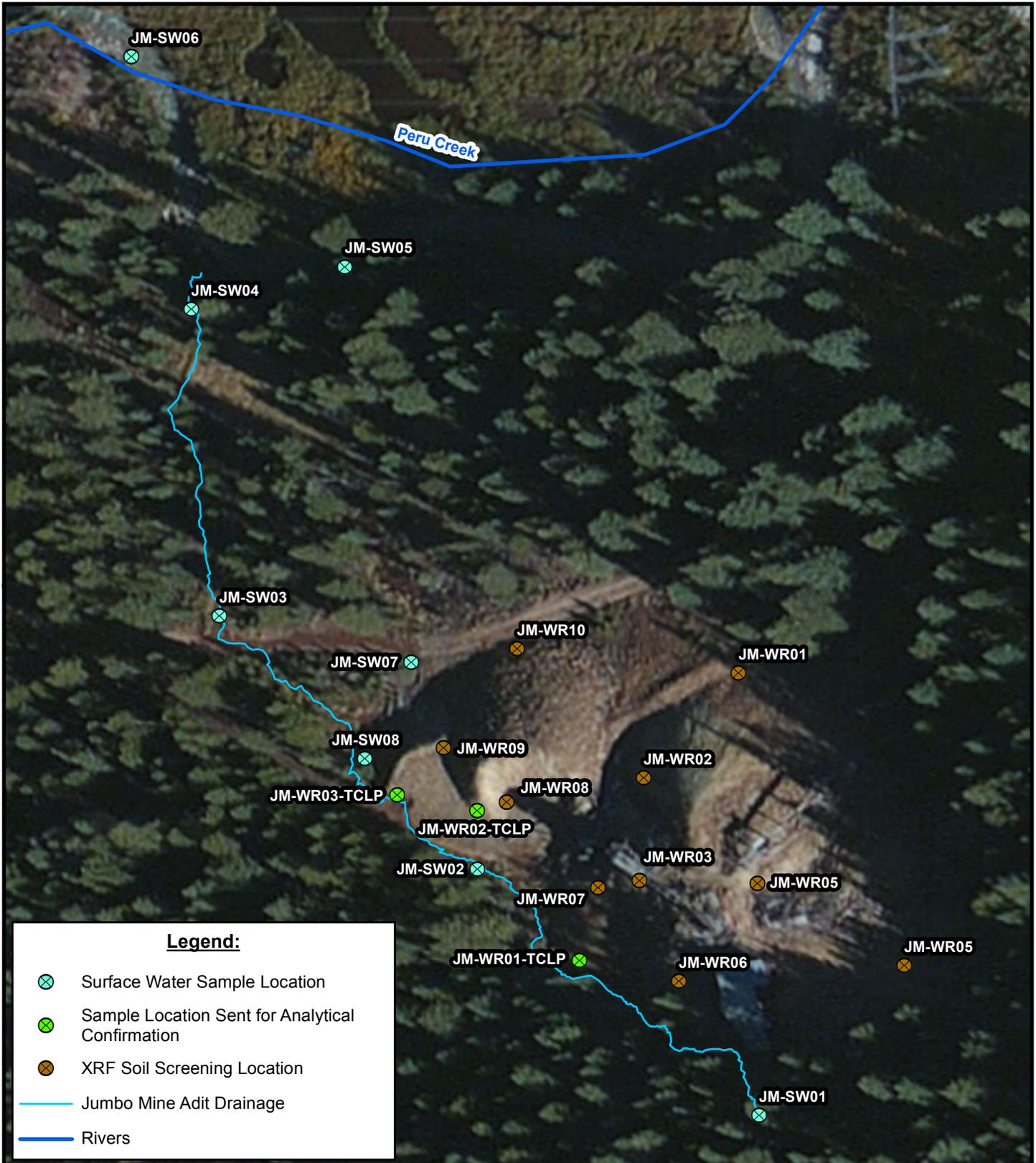
Contract: EP-S8-13-01
 TO/TDD: 0001/1706-12

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**FIGURE 1
 JUMBO MINE
 SITE LOCATION MAP
 SUMMIT COUNTY, COLORADO**

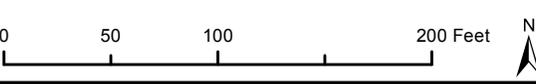
Date: 8/31/2017



Legend:

- Surface Water Sample Location
- Sample Location Sent for Analytical Confirmation
- XRF Soil Screening Location
- Jumbo Mine Adit Drainage
- Rivers

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Projection: Mercator Auxiliary Sphere
 Datum: WGS 1984
Source:
 Sample Locations: Weston GPS (2017)
 Adit Channel Location: Weston GPS (2017)
 Rivers: USGS NHD (2015)
 Background: ESRI World Imagery (2017)



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FIGURE 2
JUMBO MINE
ADIT DRAINAGE CHANNEL AND
WASTE ROCK SAMPLE LOCATIONS
SUMMIT COUNTY, COLORADO

Date: 9/1/2017



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Attachment B

Photo Log

Project Name: Jumbo Mine	Site Location: Montezuma, CO.	TDD No. 0001-1706-12
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Photo No. 1	Date: 08/28/17
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Direction Photo Taken:

Northwest

Description:

General site view including part of the waste rock pile.

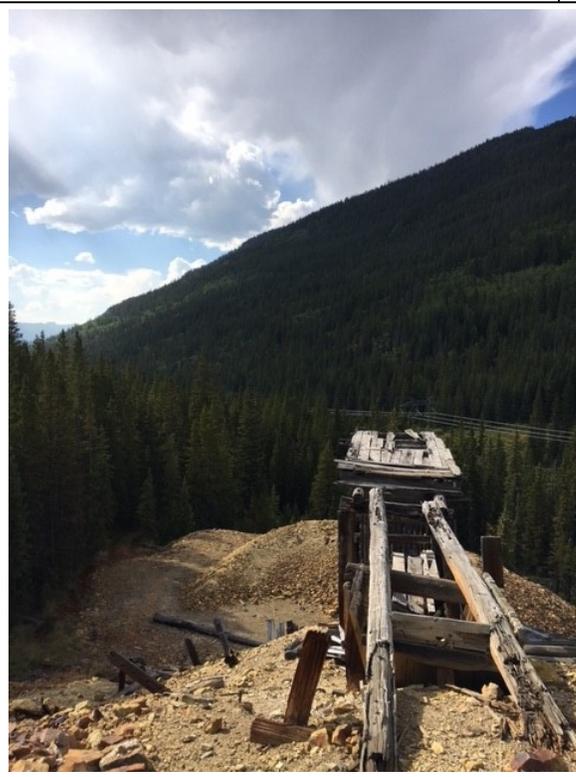


Photo No. 2	Date: 08/28/17
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Direction Photo Taken:

Northwest

Description:

General site view from the top of the waste pile.



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 3	Date: 08/28/17
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Direction Photo Taken: East

Description: General view of the top of waste pile.



Photo No. 4	Date: 08/28/17
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Direction Photo Taken: East

Description: General view of the top of waste pile.



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 5	Date: 08/28/17
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Direction Photo Taken:

West

Description:

General view of the top of waste pile and the trail.



Photo No. 6	Date: 08/28/17
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Direction Photo Taken:

West

Description:

General view from the waste pile including the Adit outfall water



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 7	Date: 08/28/17
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Direction Photo Taken: Down

Description: Beginning of the mine Adit outfall water



Photo No. 8	Date: 08/28/17
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Direction Photo Taken: South East

Description: Adit outfall water pathway next to the toe of the waste rock pile.



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 9	Date: 08/28/17
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Direction Photo Taken:

West

Description:

Adit outfall water pathway over the main access trail.



Photo No. 10	Date: 08/28/17
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Direction Photo Taken:

North

Description:

View of the adit creek from the main trail down to the confluence



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 11	Date: 08/28/17
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Direction Photo Taken: North
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Description: Confluence of the Adit outfall water and Peru Creek
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Photo No. 12	Date: 08/28/17
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Direction Photo Taken: Down

Description: PH precipitate field pilot study to assess limestone treatment efficacy of the Adit outfall water.



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 13	Date: 08/28/17
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Direction Photo Taken:

Down

Description:

PH precipitate field pilot study to assess limestone treatment efficacy of the Adit outfall water.

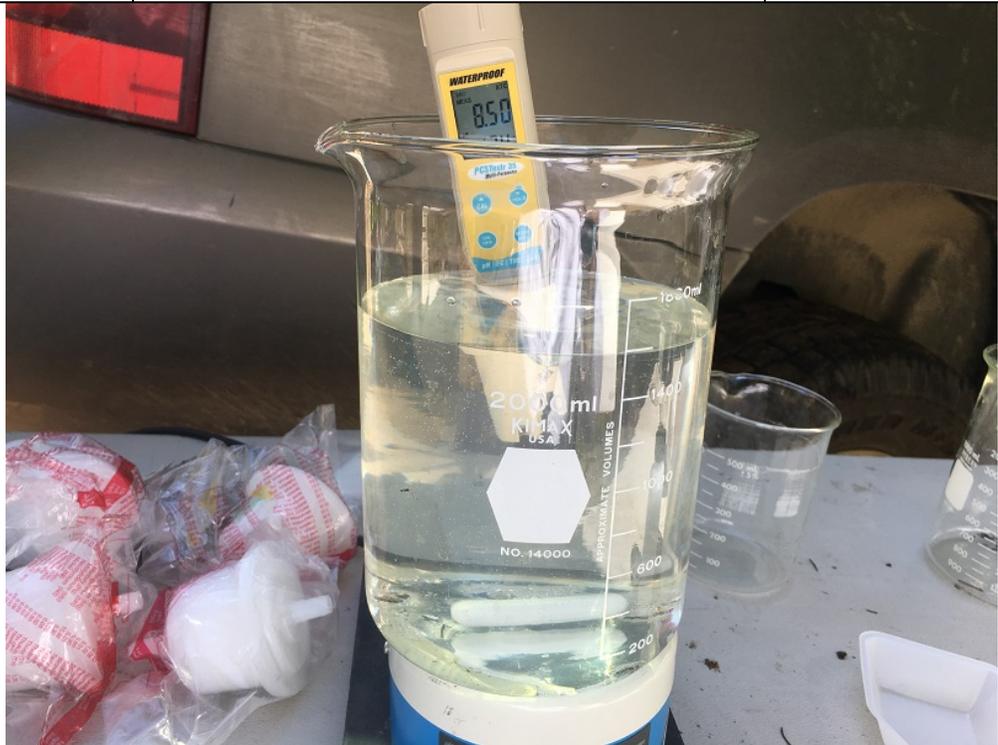


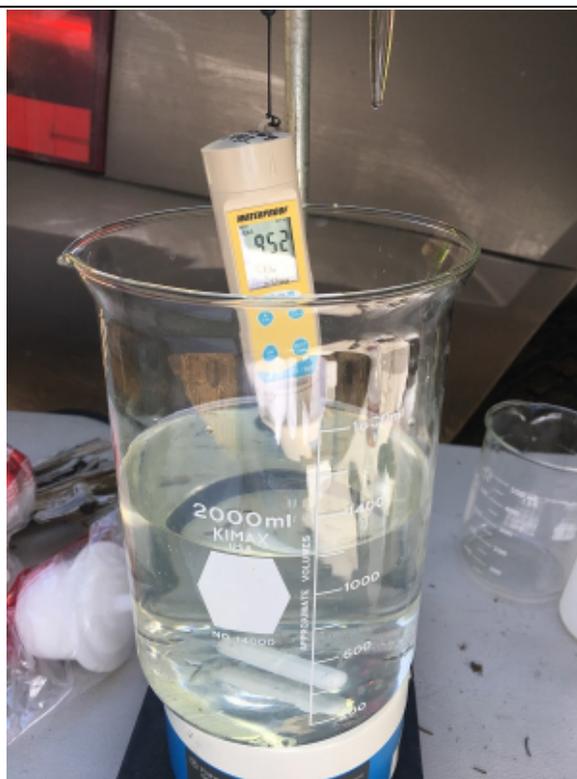
Photo No. 14	Date: 08/28/17
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Direction Photo Taken:

Down

Description:

PH precipitate field pilot study to assess limestone treatment efficacy of the Adit outfall water.



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 15	Date: 08/28/17
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Direction Photo Taken:

Down

Description:

PH precipitate field pilot study to assess limestone treatment efficacy of the Adit outfall water.



Photo No. 16	Date: 08/28/17
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Direction Photo Taken:

South

Description:

Seep location at the toe of the waste rock pile.



Project Name: Jumbo Mine	Site Location: Montezuma, CO	TDD No. 0001-1706-12
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Photo No. 17	Date: 08/28/17
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Direction Photo Taken:

West

Description:

Seep location at the toe of the waste rock pile.





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Attachment C

In Situ XRF Screening Results

Jumbo Mine Waste Rock

Table 1

In Situ XRF Results

Metals

In-Situ Reading	1	2	3	4	5	6	7	8	9	10
Date	8/28/2017	8/28/2017	8/28/2017	8/28/2017	8/28/2017	8/28/2017	8/28/2017	8/28/2017	8/28/2017	8/28/2017
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Antimony	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	153	<LOD	<LOD
Arsenic	96	39	163	<LOD	237	220	<LOD	<LOD	<LOD	<LOD
Barium	<LOD	<LOD	573	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Cadmium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Chromium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Cobalt	1,459	<LOD	<LOD	<LOD	412	<LOD	<LOD	635	<LOD	599
Copper	389	<LOD	140	273	137	48	64	525	44	126
Gold	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Iron	91,394	12,108	26,633	15,053	39,695	25,945	9,714	34,363	13,343	47,418
Lead	808	587	2,447	3,155	2,440	2,250	1,389	12,561	1,600	1,148
Manganese	1,212	<LOD	<LOD	<LOD	258	<LOD	<LOD	<LOD	<LOD	2,600
Mercury	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Molybdenum	<LOD	<LOD	<LOD	15	<LOD	<LOD	<LOD	21	<LOD	<LOD
Nickel	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Rubidium	131	179	189	186	222	231	218	157	228	156
Selenium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Silver	<LOD	<LOD	<LOD	<LOD	<LOD	67	<LOD	<LOD	<LOD	<LOD
Strontium	149	60	42	41	37	39	21	66	36	250
Tin	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Titanium	3,598	<LOD	<LOD	<LOD	1,249	1,378	<LOD	<LOD	<LOD	3,096
Zinc	2,230	99	2,369	3,207	434	168	922	13,251	153	752
Zirconium	182	76	71	62	77	86	66	57	65	183

**Jumbo Mine Waste Rock
XRF Sample Results
Metals**

Table 2

Sample ID Date Units	JM-WR01 8/29/2017 ppm			JM-WR02 8/29/2017 ppm			JM-WR03 8/29/2017 ppm			JM-WR04 8/29/2017 ppm			JM-WR05 8/29/2017 ppm		
Antimony	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	146	<LOD	163	<LOD	<LOD	<LOD	<LOD	177
Arsenic	393	322	425	109	142	131	275	368	447	423	633	571	234	447	231
Barium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	1,148	747	1,074	1,148	1,621	973	<LOD	<LOD	991
Cadmium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Chromium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Cobalt	1,305	840	1,276	<LOD	323	<LOD	<LOD	404	306	612	616	<LOD	639	<LOD	479
Copper	172	144	132	84	74	66	259	290	304	2,071	1,945	2,388	322	414	327
Gold	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Iron	117,976	107,117	108,842	26,127	30,481	26,353	23,505	24,875	27,589	47,965	49,215	49,413	41,185	44,461	40,047
Lead	3,023	2,812	2,891	1,693	1,740	1,391	4,617	4,868	5,067	20,247	21,175	20,287	6,640	6,708	6,671
Manganese	361	<LOD	<LOD	<LOD	193	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	237	<LOD	<LOD	<LOD
Mercury	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	67	<LOD	<LOD	<LOD	58	<LOD	<LOD
Molybdenum	16	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	15	19	17	<LOD	17	15	<LOD
Nickel	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Rubidium	164	146	140	191	209	207	198	198	219	193	195	207	190	198	165
Selenium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	21	24	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Silver	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	74	80	<LOD	68	<LOD
Strontium	167	173	171	58	61	71	63	53	68	89	64	82	60	71	81
Tin	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Titanium	4,390	5,212	4,235	<LOD	1,156	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	1368	<LOD	<LOD
Zinc	281	183	256	232	1,010	243	2,669	4,902	6,459	8,746	6,974	9,569	2,664	4,002	2,249
Zirconium	209	169	191	69	62	53	58	51	67	62	71	62	69	78	49

**Jumbo Mine Waste Rock
XRF Sample Results
Metals**

Table 2

Sample ID Date Units	JM-WR06 8/29/2017 ppm			JM-WR07 8/29/2017 ppm			JM-WR08 8/29/2017 ppm			JM-WR09 8/29/2017 ppm			JM-WR10 8/29/2017 ppm		
Antimony	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Arsenic	122	83	107	253	298	214	224	178	218	192	289	185	253	287	285
Barium	<LOD	<LOD	<LOD	552	924	952	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Cadmium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Chromium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Cobalt	1,107	1,010	958	307	318	<LOD	312	388	407	<LOD	<LOD	<LOD	519	606	<LOD
Copper	249	205	238	574	245	164	159	138	117	272	215	238	50	72	51
Gold	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Iron	101,158	103,557	108,849	26,678	26,104	26,069	33,536	30,573	31,453	26,311	29,637	26,942	46,957	46,754	43,930
Lead	1,216	1,262	1,128	5,331	5,244	5,144	4,683	4,547	4,805	5,895	7,008	6,188	5,185	5,111	5,345
Manganese	302	417	424	<LOD	<LOD	168	159	151	223	<LOD	179	158	249	<LOD	206
Mercury	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	54	<LOD	<LOD	<LOD	<LOD
Molybdenum	<LOD	<LOD	19	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	15	<LOD	<LOD
Nickel	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Rubidium	161	162	166	249	241	225	247	237	251	260	246	261	200	188	170
Selenium	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Silver	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	55	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Strontium	180	173	219	46	67	72	41	40	44	34	29	28	118	112	97
Tin	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD
Titanium	3,860	3,091	4,151	1,337	<LOD	<LOD	1,646	1,242	1,347	1,281	1,534	<LOD	2,847	2,744	3,340
Zinc	524	526	650	1,454	1,996	1,929	235	275	671	910	862	810	322	355	532
Zirconium	174	162	169	84	86	72	80	73	90	82	76	79	126	132	115



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Attachment D

Analytical Results

**Attachment D Table 1
Surface Water Analytical Results**

Analyte:	MDL:	RML:	Units:	Sample #:		JM-SW01		JM-SW02		JM-SW03	
				Sample Date:	08/28/2017	08/28/2017	08/28/2017	08/28/2017	08/28/2017		
ALUMINUM	0.035	20	mg/L	0.035	U	0.035	U	0.035	U		
ALUMINUM, DISSOLVED	0.035	20	mg/L	0.256		0.281		0.258			
ANTIMONY	0.000754	0.006	mg/L	0.000754	U	0.00126	J	0.000754	U		
ANTIMONY, DISSOLVED	0.000754	0.006	mg/L	0.000754	U	0.000754	U	0.000754	U		
ARSENIC	0.0065	0.01	mg/L	0.0065	U	0.0065	U	0.0065	U		
ARSENIC, DISSOLVED	0.0065	0.01	mg/L	0.0065	U	0.00684	J	0.0065	U		
BARIUM	0.0017	2	mg/L	0.0175		0.0175		0.0176			
BARIUM, DISSOLVED	0.0017	2	mg/L	0.0182		0.0183		0.0177			
BERYLLIUM	0.0007	4000	mg/L	0.000719	J	0.000856	J	0.0007	U		
BERYLLIUM, DISSOLVED	0.0007	4000	mg/L	0.00108	J	0.001	J	0.000812	J		
CADMIUM	0.0007	0.005	mg/L	0.0139		0.0138		0.0132			
CADMIUM, DISSOLVED	0.0007	0.005	mg/L	0.0134		0.0133		0.0126			
CALCIUM	0.0463	N/A	mg/L	17.1		16.9		16.5			
CALCIUM, DISSOLVED	0.0463	N/A	mg/L	16.7		16.6		16.2			
CHROMIUM	0.0014	0.1	mg/L	0.0014	U	0.0014	U	0.0014	U		
CHROMIUM, DISSOLVED	0.0014	0.1	mg/L	0.0014	U	0.0014	U	0.0014	U		
COBALT	0.0023	0.006	mg/L	0.00288	J	0.00243	J	0.0023	U		
COBALT, DISSOLVED	0.0023	0.006	mg/L	0.0023	U	0.0023	U	0.0023	U		
COPPER	0.0053	1.3	mg/L	0.122		0.125		0.112			
COPPER, DISSOLVED	0.0053	1.3	mg/L	0.119		0.116		0.109			
IRON	0.0141	14	mg/L	1.32		5.94		0.655			
IRON, DISSOLVED	0.0141	14	mg/L	0.492		0.878		0.0833	J		
LEAD	0.00024	0.015	mg/L	0.335		0.434		0.248			
LEAD, DISSOLVED	0.00024	0.015	mg/L	0.278		0.289		0.217			
MAGNESIUM	0.0111	N/A	mg/L	2.25		2.27		2.22			
MAGNESIUM, DISSOLVED	0.0111	N/A	mg/L	2.22		2.2		2.13			
MANGANESE	0.0012	0.43	mg/L	3.41		3.39		3.06			
MANGANESE, DISSOLVED	0.0012	0.43	mg/L	3.31		3.3		2.98			
MERCURY	0.000049	0.002	mg/L	0.000049	U	0.000049	U	0.000049	U		
MERCURY, DISSOLVED	0.000049	0.002	mg/L	0.000049	U	0.000049	U	0.000049	U		
NICKEL	0.0049	0.39	mg/L	0.0049	U	0.0049	U	0.0049	U		
NICKEL, DISSOLVED	0.0049	0.39	mg/L	0.0049	U	0.0049	U	0.0049	U		
POTASSIUM	0.102	N/A	mg/L	1.07		1.07		0.973	J		
POTASSIUM, DISSOLVED	0.102	N/A	mg/L	1.01		1.01		0.945	J		
SELENIUM	0.00038	0.05	mg/L	0.00038	U	0.00038	U	0.00038	U		
SELENIUM, DISSOLVED	0.00038	0.05	mg/L	0.00038	U	0.00038	U	0.00038	U		
SILVER	0.0028	0.094	mg/L	0.0028	U	0.0028	U	0.0028	U		
SILVER, DISSOLVED	0.0028	0.094	mg/L	0.0028	U	0.0028	U	0.0028	U		
SODIUM	0.0985	N/A	mg/L	3.36		3.33		3.27			
SODIUM, DISSOLVED	0.0985	N/A	mg/L	3.46		3.42		3.24			
THALLIUM	0.00019	0.002	mg/L	0.00019	U	0.00019	U	0.00019	U		
THALLIUM, DISSOLVED	0.00019	0.002	mg/L	0.00019	U	0.00019	U	0.00019	U		
VANADIUM	0.0024	0.086	mg/L	0.0024	U	0.0024	U	0.0024	U		
VANADIUM, DISSOLVED	0.0024	0.086	mg/L	0.0024	U	0.0024	U	0.0024	U		
ZINC	0.0059	0.6	mg/L	5.33		5.28		5.1			
ZINC, DISSOLVED	0.0059	0.6	mg/L	5.47		5.49		5.27			

Notes:

U = Not Detected

J = Estimated

**Attachment D Table 1
Surface Water Analytical Results**

Analyte:	MDL:	RML:	Units:	Sample #:		JM-SW05		JM-SW05D	
				Sample Date:	Result	Qualifier	Result	Qualifier	Result
				08/28/2017		08/28/2017		08/28/2017	
ALUMINUM	0.035	20	mg/L	0.035	U	4.24		4.14	
ALUMINUM, DISSOLVED	0.035	20	mg/L	0.145	J	3.33		3.35	
ANTIMONY	0.000754	0.006	mg/L	0.000754	U	0.000754	U	0.000754	U
ANTIMONY, DISSOLVED	0.000754	0.006	mg/L	0.000754	U	0.000754	U	0.000754	U
ARSENIC	0.0065	0.01	mg/L	0.0065	U	0.0065	U	0.0065	U
ARSENIC, DISSOLVED	0.0065	0.01	mg/L	0.0065	U	0.0065	U	0.0065	U
BARIUM	0.0017	2	mg/L	0.0157		0.0353		0.0352	
BARIUM, DISSOLVED	0.0017	2	mg/L	0.0155		0.035		0.0349	
BERYLLIUM	0.0007	4000	mg/L	0.0007	U	0.0007	U	0.0007	U
BERYLLIUM, DISSOLVED	0.0007	4000	mg/L	0.0007	U	0.0007	U	0.0007	U
CADMIUM	0.0007	0.005	mg/L	0.00936		0.00647		0.00656	
CADMIUM, DISSOLVED	0.0007	0.005	mg/L	0.00886		0.00613		0.0061	
CALCIUM	0.0463	N/A	mg/L	16.6		24.7		24.7	
CALCIUM, DISSOLVED	0.0463	N/A	mg/L	16		21.8		21.8	
CHROMIUM	0.0014	0.1	mg/L	0.0014	U	0.0014	U	0.0014	U
CHROMIUM, DISSOLVED	0.0014	0.1	mg/L	0.0014	U	0.0014	U	0.0014	U
COBALT	0.0023	0.006	mg/L	0.0023	U	0.00656	J	0.00661	J
COBALT, DISSOLVED	0.0023	0.006	mg/L	0.0023	U	0.00626	J	0.00634	J
COPPER	0.0053	1.3	mg/L	0.0543		0.0675		0.0672	
COPPER, DISSOLVED	0.0053	1.3	mg/L	0.0383		0.0675		0.0658	
IRON	0.0141	14	mg/L	0.743		0.517		0.491	
IRON, DISSOLVED	0.0141	14	mg/L	0.265		0.411		0.404	
LEAD	0.00024	0.015	mg/L	0.142		0.0114		0.0115	
LEAD, DISSOLVED	0.00024	0.015	mg/L	0.0738		0.0107		0.0106	
MAGNESIUM	0.0111	N/A	mg/L	2.3		7.32		7.34	
MAGNESIUM, DISSOLVED	0.0111	N/A	mg/L	2.15		6.84		6.85	
MANGANESE	0.0012	0.43	mg/L	2.77		1.75		1.75	
MANGANESE, DISSOLVED	0.0012	0.43	mg/L	2.67		1.7		1.71	
MERCURY	0.000049	0.002	mg/L	0.000049	U	0.000049	U	0.000049	U
MERCURY, DISSOLVED	0.000049	0.002	mg/L	0.000049	U	0.000049	U	0.000049	U
NICKEL	0.0049	0.39	mg/L	0.0049	U	0.016		0.0161	
NICKEL, DISSOLVED	0.0049	0.39	mg/L	0.0049	U	0.0172		0.0165	
POTASSIUM	0.102	N/A	mg/L	1.05		0.872	J	0.904	J
POTASSIUM, DISSOLVED	0.102	N/A	mg/L	1.02		0.828	J	0.86	J
SELENIUM	0.00038	0.05	mg/L	0.00038	U	0.00112	J	0.00121	J
SELENIUM, DISSOLVED	0.00038	0.05	mg/L	0.00038	U	0.0011	J	0.00105	J
SILVER	0.0028	0.094	mg/L	0.0028	U	0.0028	U	0.0028	U
SILVER, DISSOLVED	0.0028	0.094	mg/L	0.0028	U	0.0028	U	0.0028	U
SODIUM	0.0985	N/A	mg/L	8.65		2.32		2.31	
SODIUM, DISSOLVED	0.0985	N/A	mg/L	8.57		2.3		2.26	
THALLIUM	0.00019	0.002	mg/L	0.00019	U	0.00019	U	0.00019	U
THALLIUM, DISSOLVED	0.00019	0.002	mg/L	0.00019	U	0.00019	U	0.00019	U
VANADIUM	0.0024	0.086	mg/L	0.0024	U	0.02	U	0.02	U
VANADIUM, DISSOLVED	0.0024	0.086	mg/L	0.0024	U	0.0024	U	0.0024	U
ZINC	0.0059	0.6	mg/L	3.66		1.42		1.42	
ZINC, DISSOLVED	0.0059	0.6	mg/L	3.72		1.47		1.47	

Notes:

U = Not Detected

J = Estimated

**Attachment D Table 1
Surface Water Analytical Results**

Analyte:	MDL:	RML:	Units:	Sample #:		JM-SW06		JM-SW07		JM-SW08	
				Sample Date:	08/28/2017	08/28/2017	08/28/2017	08/28/2017	08/28/2017		
				Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
ALUMINUM	0.035	20	mg/L	4.11		0.0782	J	0.035	U		
ALUMINUM, DISSOLVED	0.035	20	mg/L	3		0.334		0.279			
ANTIMONY	0.000754	0.006	mg/L	0.000754	U	0.000754	U	0.000882	J		
ANTIMONY, DISSOLVED	0.000754	0.006	mg/L	0.000754	U	0.000754	U	0.000754	U		
ARSENIC	0.0065	0.01	mg/L	0.0065	U	0.0065	U	0.00774	J		
ARSENIC, DISSOLVED	0.0065	0.01	mg/L	0.0065	U	0.0065	U	0.0065	U		
BARIIUM	0.0017	2	mg/L	0.0354		0.0178		0.0183			
BARIIUM, DISSOLVED	0.0017	2	mg/L	0.0348		0.0177		0.0172			
BERYLLIUM	0.0007	4000	mg/L	0.0007	U	0.000749	J	0.0007	U		
BERYLLIUM, DISSOLVED	0.0007	4000	mg/L	0.0007	U	0.000806	J	0.000855	J		
CADMIUM	0.0007	0.005	mg/L	0.00666		0.0141		0.0134			
CADMIUM, DISSOLVED	0.0007	0.005	mg/L	0.00643		0.0132		0.0128			
CALCIUM	0.0463	N/A	mg/L	24.7	J	16.7		16.8			
CALCIUM, DISSOLVED	0.0463	N/A	mg/L	21.7		16.1		16.2			
CHROMIUM	0.0014	0.1	mg/L	0.0014	U	0.0014	U	0.0014	U		
CHROMIUM, DISSOLVED	0.0014	0.1	mg/L	0.0014	U	0.0014	U	0.0014	U		
COBALT	0.0023	0.006	mg/L	0.00652	J	0.0023	U	0.0023	U		
COBALT, DISSOLVED	0.0023	0.006	mg/L	0.00633	J	0.0023	U	0.0023	U		
COPPER	0.0053	1.3	mg/L	0.0666		0.125		0.118			
COPPER, DISSOLVED	0.0053	1.3	mg/L	0.0674		0.124		0.113			
IRON	0.0141	14	mg/L	0.494		0.923		3.97			
IRON, DISSOLVED	0.0141	14	mg/L	0.352		0.101		0.192			
LEAD	0.00024	0.015	mg/L	0.0106		0.251		0.376			
LEAD, DISSOLVED	0.00024	0.015	mg/L	0.0105		0.257		0.268			
MAGNESIUM	0.0111	N/A	mg/L	7.39	J	2.29		2.31			
MAGNESIUM, DISSOLVED	0.0111	N/A	mg/L	6.86		2.13		2.2			
MANGANESE	0.0012	0.43	mg/L	1.75	J	3.27		3.25			
MANGANESE, DISSOLVED	0.0012	0.43	mg/L	1.7		3.15		3.16			
MERCURY	0.000049	0.002	mg/L	0.000049	U	0.000049	U	0.000049	U		
MERCURY, DISSOLVED	0.000049	0.002	mg/L	0.000049	U	0.000049	U	0.000049	U		
NICKEL	0.0049	0.39	mg/L	0.0162		0.0049	U	0.0049	U		
NICKEL, DISSOLVED	0.0049	0.39	mg/L	0.0169		0.0049	U	0.0049	U		
POTASSIUM	0.102	N/A	mg/L	0.871	J	1.03		0.999	J		
POTASSIUM, DISSOLVED	0.102	N/A	mg/L	0.82	J	1		0.941	J		
SELENIUM	0.00038	0.05	mg/L	0.00117	J	0.00038	U	0.00038	U		
SELENIUM, DISSOLVED	0.00038	0.05	mg/L	0.00125	J	0.00038	U	0.00038	U		
SILVER	0.0028	0.094	mg/L	0.0028	U	0.0028	U	0.0028	U		
SILVER, DISSOLVED	0.0028	0.094	mg/L	0.0028	U	0.0028	U	0.0028	U		
SODIUM	0.0985	N/A	mg/L	2.29		3.59		3.3			
SODIUM, DISSOLVED	0.0985	N/A	mg/L	2.5		3.58		3.24			
THALLIUM	0.00019	0.002	mg/L	0.00019	U	0.00019	U	0.00019	U		
THALLIUM, DISSOLVED	0.00019	0.002	mg/L	0.00019	U	0.00019	U	0.00019	U		
VANADIUM	0.0024	0.086	mg/L	0.0024	U	0.0024	U	0.0024	U		
VANADIUM, DISSOLVED	0.0024	0.086	mg/L	0.0024	U	0.0024	U	0.0024	U		
ZINC	0.0059	0.6	mg/L	1.44	J	5.42		5.21			
ZINC, DISSOLVED	0.0059	0.6	mg/L	1.47		5.54		5.33			

Notes:

U = Not Detected

J = Estimated

**Attachment D Table 2
Soil Analytical Results**

Analyte:	RML:	Units:	Sample #:			JM-TCLP01			JM-TCLP02			JM-TCLP03		
			Sample Date:			08/28/2017			08/28/2017			08/28/2017		
			Result	Qualifier	Reporting Limit	Result	Qualifier	Reporting Limit	Result	Qualifier	Reporting Limit			
ALUMINIUM	77000	mg/kg	2	U	2	2	U	2	2	U	2			
ANTIMONY	31	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
ARSENIC	35	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
BARIUM	15000	mg/kg	0.448		0.1	0.309		0.1	0.465		0.1			
BERYLLIUM	160	mg/kg	0.02	U	0.02	0.02	U	0.02	0.02	U	0.02			
CADMIUM	71	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
CALCIUM	N/A	mg/kg	10	U	10	10	U	10	10	U	10			
CHROMIUM	30	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
COBALT	23	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
COPPER	3100	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
IRON	55000	mg/kg	1	U	1	1	U	1	1	U	1			
LEAD	400	mg/kg	4.65		0.1	1.27		0.1	6.81		0.1			
MAGNESIUM	N/A	mg/kg	10	U	10	10	U	10	10	U	10			
MANGANESE	1800	mg/kg	0.1	U	0.1	0.1	U	0.1	0.281	J	0.1			
MERCURY	11	mg/kg	0.01	U	0.01	0.01	U	0.01	0.01	U	0.01			
NICKEL	1500	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
POTASSIUM	N/A	mg/kg	10	U	10	10	U	10	10	U	10			
SELENIUM	390	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
SILVER	390	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
SODIUM	N/A	mg/kg												
THALLIUM	0.78	mg/kg	0.1	U	0.1	0.1	U	0.1	0.1	U	0.1			
VANADIUM	390	mg/kg	0.2	U	0.2	0.2	U	0.2	0.2	U	0.2			
ZINC	2300	mg/kg	2.67		0.5	0.5	U	0.5	5.4		0.5			

Notes:

U = Not Detected

J = Estimated

J+ = Estimated (Biased High)

J- = Estimated (Biased Low)

**Attachment D Table 2
Soil Analytical Results**

Analyte:	RML:	Units:	Sample #:			Sample Date:			Sample #:			Sample Date:		
			JM-WR03			JM-WR04			JM-WR04D			JM-WR06		
			08/28/2017			08/28/2017			08/28/2017			08/28/2017		
			Result	Qualifier	Reporting Limit	Result	Qualifier	Reporting Limit	Result	Qualifier	Reporting Limit	Result	Qualifier	Reporting Limit
ALUMINUM	77000	mg/kg	704	J+	35	797		35	1060		35	7490		3.5
ANTIMONY	31	mg/kg	52.4		7.5	73.6		7.5	83.3		7.5	12.2		0.75
ARSENIC	35	mg/kg	106		6.5	177		6.5	185		6.5	70.6		0.65
BARIUM	15000	mg/kg	1110		1.7	1760		1.7	1840		1.7	149		0.17
BERYLLIUM	160	mg/kg	0.7	U	0.7	0.7	U	0.7	0.7	U	0.7	0.374		0.07
CADMIUM	71	mg/kg	35.2	J-	0.7	28.4		0.7	37.5		0.7	0.778		0.07
CALCIUM	N/A	mg/kg	46.3	U	46.3	46.3	U	46.3	46.3	U	46.3	686		4.63
CHROMIUM	30	mg/kg	1.4	U	1.4	1.4	U	1.4	1.4	U	1.4	10.8		0.14
COBALT	23	mg/kg	2.3	U	2.3	2.3	U	2.3	2.3	U	2.3	1.83		0.23
COPPER	3100	mg/kg	320		5.3	1280		5.3	1310		5.3	184		0.53
IRON	55000	mg/kg	16200		14.1	31100		14.1	29300		14.1	55900		7.05
LEAD	400	mg/kg	8220		1.9	32000		1.9	47800		1.9	1070		0.19
MAGNESIUM	N/A	mg/kg	11.1	U	11.1	11.1	U	11.1	11.1	U	11.1	2050		1.11
MANGANESE	1800	mg/kg	15.3		1.2	38.3		1.2	23.5		1.2	246		0.12
MERCURY	11	mg/kg	0.703	J-	0.0028	0.758		0.0028	1.11		0.0056	0.316		0.0028
NICKEL	1500	mg/kg	4.9	U	4.9	4.9	U	4.9	4.9	U	4.9	5.79		0.49
POTASSIUM	N/A	mg/kg	1720	J-	102	1640		102	1830		102	2410		10.2
SELENIUM	390	mg/kg	7.4	U	7.4	7.4	U	7.4	7.4	U	7.4	3.7	U	3.7
SILVER	390	mg/kg	27.1	J	2.8	101	J	2.8	207	J	2.8	3.14		0.28
SODIUM	N/A	mg/kg	98.5	U	98.5	98.5	U	98.5	98.5	U	98.5	135		9.85
THALLIUM	0.78	mg/kg	6.5	U	6.5	6.5	U	6.5	6.5	U	6.5	0.65	U	0.65
VANADIUM	390	mg/kg	2.4	U	2.4	2.4	U	2.4	2.4	U	2.4	19.5		0.24
ZINC	2300	mg/kg	15400		5.9	12300		5.9	16300		5.9	408		0.59

Notes:

U = Not Detected

J = Estimated

J+ = Estimated (Biased High)

J- = Estimated (Biased Low)

**Attachment D Table 3
Lime Precipitation Bench Test Results**

Analyte:	MDL:	RML:	Sample #:	JM-BT-8.5		JM-BT-9.5		JM-BT-10.5	
			Sample Date:	08/28/2017	08/28/2017	08/28/2017	08/28/2017	08/28/2017	
			Units:	Result	Qualifier	Result	Qualifier	Result	Qualifier
ALUMINUM, DISSOLVED	35	20000	ug/L	122	J	80.1	J	313	
ANTIMONY, DISSOLVED	0.754	7.8	ug/L	0.754	U	0.754	U	0.754	U
ARSENIC, DISSOLVED	6.5	10	ug/L	6.5	U	6.5	U	6.5	U
BARIUM, DISSOLVED	1.7	2000	ug/L	17.6		17		18.7	
BERYLLIUM, DISSOLVED	0.7	4	ug/L	0.7	U	0.7	U	0.7	U
CADMIUM, DISSOLVED	0.7	5	ug/L	9.86		5.02		13	
CALCIUM, DISSOLVED	46.3	N/A	ug/L	16500		16400		16300	
CHROMIUM, DISSOLVED	1.4	100	ug/L	1.4	U	1.4	U	1.4	U
COBALT, DISSOLVED	2.3	6	ug/L	2.3	U	2.3	U	2.3	U
COPPER, DISSOLVED	5.3	1300	ug/L	19.6		8.15	J	114	
IRON, DISSOLVED	14.1	14000	ug/L	137		14.1	U	1300	
LEAD, DISSOLVED	0.24	15	ug/L	35.3		6.14		305	
MAGNESIUM, DISSOLVED	11.1	N/A	ug/L	2160		2180		2150	
MANGANESE, DISSOLVED	1.2	430	ug/L	3150		2900		3180	
MERCURY, DISSOLVED	0.049	2	ug/L	0.049	U	0.049	U	0.049	U
NICKEL, DISSOLVED	4.9	390	ug/L	4.9	U	4.9	U	4.9	U
POTASSIUM, DISSOLVED	102	N/A	ug/L	1000		981	J	1010	
SELENIUM, DISSOLVED	0.38	50	ug/L	0.38	U	0.38	U	0.38	U
SILVER, DISSOLVED	2.8	94	ug/L	2.8	U	2.8	U	2.8	U
SODIUM, DISSOLVED	98.5	N/A	ug/L	17700		21800		32000	
THALLIUM, DISSOLVED	0.19	2	ug/L	0.19	U	0.19	U	0.19	U
VANADIUM, DISSOLVED	2.4	86	ug/L	2.4	U	2.4	U	2.4	U
ZINC, DISSOLVED	5.9	600	ug/L	2370		1290		5350	

Notes:

U = Not Detected

J = Estimated



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Attachment E

Data Validation Report

**Jumbo Mine
DATA VALIDATION REPORT**

Date: October 3, 2017

Laboratory: ESC Lab Sciences Laboratory-Mount Joliet, TN

Laboratory Project #: L932739

Data Validation Performed By: Diane Quigley (Weston)

Weston Work Order #: 20408.012.001.00499

This data validation report has been prepared by Weston. This report documents the data validation for 12 water samples, three waste rock samples, and four soil samples including two field duplicates collected for the Jumbo Mine. Samples were analyzed for the parameters below following the stated methods:

- Metals – Totals and Dissolved Metals Method 6010B (ICP) and 6020 (ICPMS)/ Hg 7471 soil and 7470A water, 1311 for TCLP extraction

The data validation was conducted in general accordance with the most recent version of the U.S. EPA “Contract Laboratory Program National Functional Guidelines for Superfund Organic and Inorganic Methods Data Review” and the applicable methods listed above.

General

1. Samples

The following table summarizes the samples for which this data validation is being conducted.

Samples	Lab ID L932739-	Analysis	Date Collected
JM-SW01	01	Total and Dissolved Metals/Hg	08/28/17
JM-SW02	02	Total and Dissolved Metals/Hg	08/28/17
JM-SW03	03	Total and Dissolved Metals/Hg	08/28/17
JM-SW-04	04	Total and Dissolved Metals/Hg	08/28/17
JM-SW05	05	Total and Dissolved Metals/Hg	08/28/17
JM-SW05D	06	Total and Dissolved Metals/Hg	08/28/17
JM-SW06	07	Total and Dissolved Metals/Hg	08/28/17
JM-SW07	08	Total and Dissolved Metals/Hg	08/28/17
JM-SW08	09	Total and Dissolved Metals/Hg	08/28/17
JM-BT-8.5	10	Total and Dissolved Metals/Hg	08/28/17
JM-BT-9.5	11	Total and Dissolved Metals/Hg	08/28/17
JM-BT-10.5	12	Total and Dissolved Metals/Hg	08/28/17
JM-TCLP01	13	TCLP METALS/HG	08/28/17
JM-TCLP02	14	TCLP METALS/HG	08/28/17
JM-TCLP03	15	TCLP METALS/HG	08/28/17
JM-WR03	16	Total Metals/Hg 6010/7471	08/28/17

Samples	Lab ID L932739-	Analysis	Date Collected
JM-WR04	17	Total Metals/Hg 6010/7471	08/28/17
JM-WR04D	18	Total Metals/Hg 6010/7471	08/28/17
JM-WR06	19	Total Metals/Hg 6010/7471	08/28/17

2. Holding Times / Sample Receipt/Percent Solids

All samples were received by the laboratory on 08/30/17 in good condition, properly preserved. All samples were analyzed within hold times.

The laboratory was contacted on September 18, 2017 to inquire whether a percent solids analysis was run on soil samples JM-WR03, JM-WR04, JM-WR04D, and JM-WR06 and they replied that those metals/Hg results are in wet weight: a percent solids test was not run.

METALS/MERCURY Total/Dissolved/TCLP

1. Blanks

Total Metals MBR3246203-1 (assoc. water samples 01-09) contained vanadium (3.08 J ug/l) below the RL. The positive results for vanadium were qualified as undetected (U) in samples L932739-05 and -06) since sample concentrations were below the RL and below ten times the blank level.

Dissolved Metals MB R3246196-1 (assoc. samples 01-12) contained dissolved magnesium (52.1 J ug/L) below the RL. Since associated sample concentrations were above the RL and much greater than ten times the blank level, no action was taken.

Total soil metals MB R3246216-1 (assoc. samples 16-19) contained iron (1500 J ug/kg) below the RL. Since associated sample concentrations were above the RL and much greater than ten times the blank level, no action was taken.

TCLP metals MB R346206-1 (assoc. samples 13-15) contained manganese (0.0421 J mg/l) below the RDL. The positive result for TCLP manganese in sample JM-TCLP03 was estimated (J) since it was above the RDL but below ten times the method blank concentration and may be biased high.

2. LCS/LCSDs Results

All LCSs had recoveries within required control limits.

3. Matrix Spike/Matrix Spike Duplicate

Total and dissolved metals/mercury MS and MSDs were performed on water samples JM-SW06 (assoc. total samples 01-09: associated dissolved samples 01-12) and JM-

TCLP01: recoveries/RPD were within QC limits. The total MS and MSD for soil samples were performed on sample JM-WR03 and mercury recovered below QC limits in the MS (43%). The laboratory qualified the mercury result as “J6” in parent sample JM-WR03 and the validator replaced with a “J-“ due to a potential low bias. Professional judgment was used in not qualifying all batch soil samples since LCS and LCSD were within QC limits.

Total metals soil MS and MSD were performed on sample JM-WR03 (assoc. samples All soils) and the following compounds had recoveries/RPDs outside QC limits: aluminum (-/128%), cadmium (-/74%), potassium (69/74%) and silver (377/52%, RPD 91). Barium, Iron, Lead, and zinc recoveries and/or RPDs were outside QC limits but since the parent sample concentration was greater than four times the spiked amount, no action was taken. The positive results for aluminum and silver were estimated (J+ and J respectively) due to potential high bias; cadmium and potassium “J-“ due to potential low bias in parent sample JM-WR03.

The TCLP MS and MSD were performed on non-Weston samples, therefore, an evaluation was not made and no qualifications were applied since matrix similarity could not be determined.

4. **Duplicate/Serial Dilution**

No laboratory duplicates or serial dilution data were submitted, however, calcium, magnesium, manganese and zinc were qualified in sample JM-SW06 with “O1” which was defined as serial dilution or post digestive spike not meeting QC criteria.

The laboratory was contacted on September 18, 2017 to confirm that qualification. The laboratory responded on September 19, 2017 that the following analytes did not meet serial dilution criteria of less than 10%: Calcium (22%), Magnesium (16%), Manganese (16%) and Zinc (17%). Professional judgment was used in estimating the positive results for these analytes in parent sample JM-SW06 only: direction of bias uncertain.

5 **Field Duplicate**

Samples JM-SW05/JM-SW05D and JM-WR04/JM-WR04D are field duplicate pair and all criteria were met with the following exception: silver (RPD 69%) in JM-WR04 and JM-WR04D. The positive results for silver were estimated (J) in samples JM-WR04 and JM-WR04D: direction of bias uncertain.

Criteria used was %RPDs less than 50% for soil samples and less than 30% for waters when concentrations are five times the PQL. When below five times the PQL, the absolute difference must be less than two times the PQL.

6. **Sample Dilutions/Miscellaneous**

The following metals samples required a tenfold dilution resulting in elevated RLs: JM-WR03, JM-WR04 and JM-WR04D. Sample JM-WR04D also required a two-fold dilution for mercury.

7. **Comparability of XRF to Laboratory Results**

On site XRF was performed on ten soil samples and three of these samples (JM-WR03 JM-WR04, and JM-WR06) were sent to the off-site laboratory for analysis. A linear regression was performed as directed in Method 6200 for five analytes, iron, lead, zinc, copper, and arsenic. The results are presented in Graph 1 in the trip report. All analytes demonstrated a good linear correlation of the XRF results and laboratory results, with the correlation coefficient (r) values ranging from 0.938 to 0.997. The high correlation coefficient indicates the XRF data meet the criteria to be considered screening level data. The correlation coefficient calculated is 0.997 for iron, 0.992 for lead, 0.981 for copper, 0.965 for zinc, and 0.938 for arsenic.

Overall Assessment

Based on the quality control data presented and this validation review and the required qualifications noted above, all of the results are acceptable for use.