



Weston Solutions, Inc.
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February 26, 2018

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 County, Colorado
TDD: 1706-12
DCN: W0499.1A.01572
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 and removal action at the Jumbo Mine site (the Site) in Montezuma, Summit County, Colorado. The removal action was initiated after it was determined that significant metal loading was being introduced to the Snake River from the draining Jumbo Mine adit and subsequent waste rock pile.

SITE DESCRIPTION

The Site (39.598043° north and -105.853344° west) is located approximately 5 miles from the town of Montezuma, Summit County, Colorado. (Attachment A, Figure 1). The area around the Site is mostly forested, and there is one building onsite.

BACKGROUND

The Site is located in Montezuma, Summit County, Colorado. Historic mining operations in the area encompassing Peru Creek and the Snake River have contaminated soil, groundwater, and
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U.S. EPA

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surface water with heavy metals. A removal action was conducted at the nearby Pennsylvania Mine in 2013. This removal action was performed 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.

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. The site assessment identified the waste rock pile and draining mine adit of the Jumbo Mine as significant sources of metal loading to Peru Creek and the Snake River. A treatability study of the draining water from the Jumbo Mine adit was also performed which determined if pH adjustment would improve water quality and decrease metal loading into Peru Creek. Site assessment activities and an assessment of the findings are presented in the Jumbo Mine Trip Report submitted to EPA on October 3, 2017. This report is maintained as part of the site administrative record. A removal action at the site was initiated as a result of the findings presented in the site assessment report.

REMOVAL ACTION ACTIVITIES

The removal action at the Jumbo Mine site consisted of reconstructing the adit drainage channel around the waste rock pile, installing an impermeable lining in the newly constructed channel, rerouting drainage from the toe of the waste rock pile into the constructed channel, and placing limestone in the channel bed to increase the pH as the adit and toe drainage flows downstream.

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February 26, 2018

START member James Fieman documented site conditions before and after the removal action with photos of the site during and after the removal action. A photolog is presented in Attachment B. Figures depicting the path of the original and constructed channels with sample locations are presented in Figures 2-3. A post-construction sampling event was conducted on 10/25/2017 to determine if the removal action provided increased water quality, and a decrease in metal loading entering Peru Creek and the Snake River. Water quality parameters taken before and after the removal action are presented in Attachment C. Analytical results from before and after the removal action are presented in Attachment D.

REMOVAL ACTION ANALYSIS

The water quality parameters and analytical results from before and after channel construction were analyzed to determine the effectiveness of the removal action on improving water quality of the Jumbo Mine adit and toe drainage prior to entering Peru Creek. The analysis was focused on samples taken from the Jumbo Mine adit, and samples taken below the dirt access road which is the furthest downstream point of the newly constructed channel. These two locations were chosen for comparison since it is anticipated that the poorest water quality before and after the removal action would occur at the draining Jumbo Mine adit, and the maximum improvement in water quality as a result of the removal action would be visible at the furthest downstream point of the constructed channel. Water quality parameters at the Jumbo Mine adit and downstream of the access road before and after the removal action are presented in Attachment C. The analytical results between these two locations are presented in Attachment D. The analytical results were used to determine the percent removal between the adit and downstream of the access road for contaminants of concern. The percent removal of metals between these two locations before and after the removal action can be used as an indicator of the newly constructed channel's effectiveness on reducing metal loading into Peru Creek. The percent removal comparison between the adit drainage and downstream of the access road can be found in Attachment E.



Mr. Newell
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The water quality parameters showed a significant improvement between the upstream and downstream locations of the constructed channel. The pH was increased by over one standard unit, and the dissolved oxygen increased by 92.5%. Both are indicators of improved water quality as a result of the constructed channel. In contrast, water quality parameters worsened from upstream to downstream before the removal action with the pH and dissolved oxygen decreasing as the water flowed downstream. This shows that the newly constructed channel reverses what the previous trend was from upstream to downstream, and provides noticeable improvements to water quality parameters compared to conditions before the removal action.

Analytical results showed that metal concentrations decreased as a result of the newly constructed channel, demonstrating the removal action's effectiveness on reducing metal loading into Peru Creek. Metal concentrations between the draining Jumbo Mine adit and the access road decreased most notably after the removal action for both total and dissolved aluminum, copper, and lead. The constructed channel greatly increased the percent removal for total and dissolved aluminum (42.86% and 82.30% respectively) compared to conditions before the removal action where virtually no removal of total or dissolved aluminum occurred. The constructed channel showed a 16.5% removal rate for total copper, and 25.3% removal rate for dissolved copper. Total and dissolved lead were also significantly reduced by 29.3% and 58.0% respectively. Other metals showed smaller removal efficiencies than those noted above but overall, the concentrations of total and dissolved metals entering Peru Creek decreased for all contaminants of concern due to the removal action. The pre and post removal action percent removals for all analytes can be found in Attachment E.

CONCLUSIONS

As a result of the removal action conducted by EPA, it is anticipated that a significant reduction in metal loading, and an overall improvement in water quality will occur in Peru Creek. Continued sampling and monitoring of the site would help to determine the long term

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effectiveness of the removal action at the Jumbo Mine site on improving water quality in Peru Creek, and ultimately the Snake River.

Very truly yours,

WESTON SOLUTIONS, INC.

James Fieman
START Project Leader



Mr. Newell
U.S. EPA

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February 26, 2018

Attachment:

A – Figures

B – Photo Log

C – Water Quality Parameters Pre and Post Removal Action

D – Analytical Results Pre and Post Removal Action

E – Percent Removals Pre and Post Removal Action

F – Data Validation Report

cc: Robert Reed, Project Manager
START DCN File



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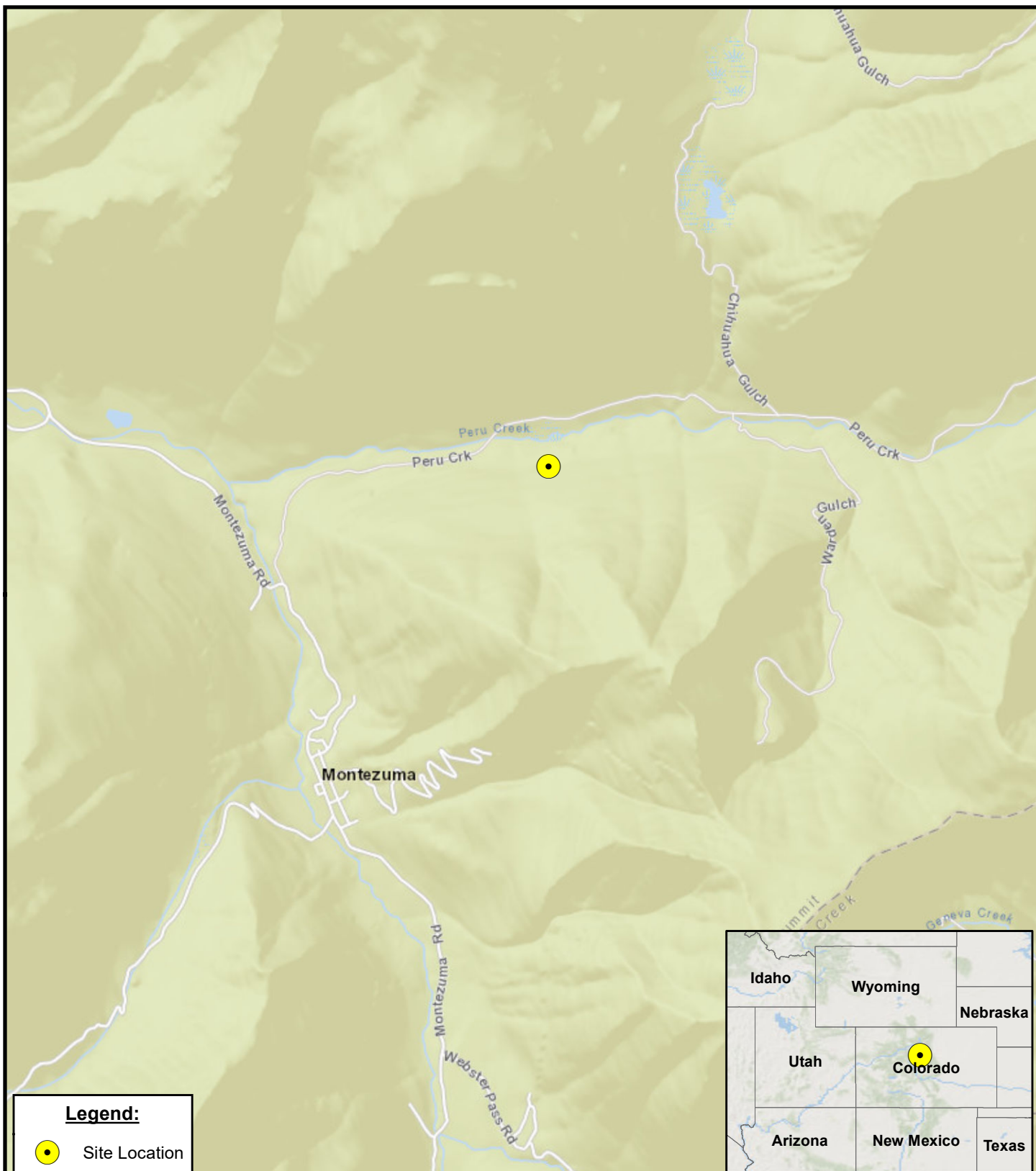
Lakewood, Colorado 80215

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Attachment A

Figures



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

Source:
 Background: ESRI Street Imagery (2017)

0 0.25 0.5 1 Mile



Prepared for:
 U.S. EPA - Region 8



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

Prepared By:
 Weston Solutions, Inc.
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FIGURE 1 JUMBO MINE SITE LOCATION MAP SUMMIT COUNTY, COLORADO

Date: 2/26/2018



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)

0 50 100 200 Feet



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

Date: 2/26/2018



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)
 Culvert Locations: Weston GPS (2017)
 Rivers: USGS NHD (2015)
 Background: ESRI World Imagery (2017)

0 37.5 75 150 Feet



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**FIGURE 3
 JUMBO MINE
 POST REMOVAL ACTION
 ADIT DRAINAGE CHANNEL AND
 SAMPLE LOCATIONS
 SUMMIT COUNTY, COLORADO**

Date: 2/26/2018



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Attachment B

Photo Log

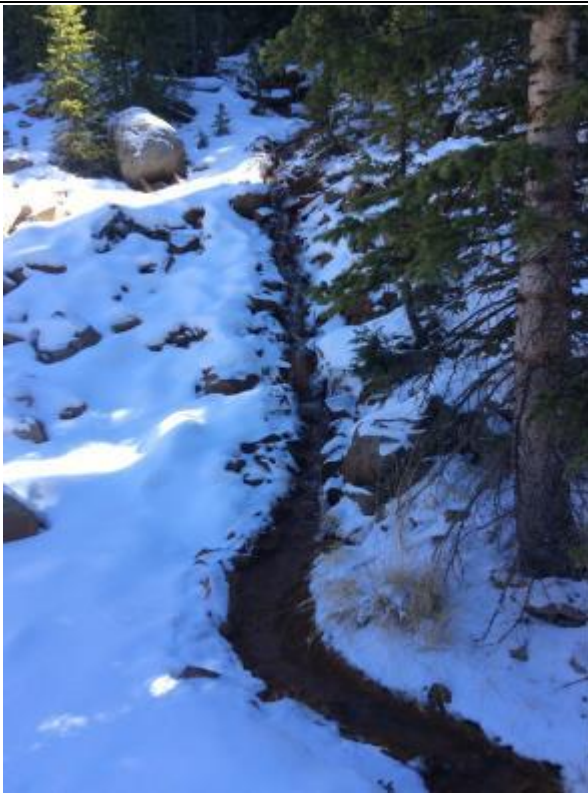

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 1	Date: 10/10/2017			
Direction Photo Taken:				
Description: Jumbo Mine adit before removal action began.				
Photo No. 2	Date: 10/10/2017			
Direction Photo Taken:				
Description: Mouth of the Jumbo Mine discharge channel before removal action began.				



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 3	Date: 10/10/2017	
Direction Photo Taken:		
Description: View of the mouth of the Jumbo Mine discharge channel standing next to the onsite cabin structure before the removal action began.		
Photo No. 4	Date: 10/10/2017	
Direction Photo Taken:		
Description: Section 1 of the Jumbo Mine adit discharge channel before the removal action began. ERRS contractors clearing debris from the adjacent cabin structure so construction could begin.		



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 5	Date: 10/10/2017	
Direction Photo Taken:		
Description: Section 2 of the Jumbo Mine adit discharge channel before the removal action.		
Photo No. 6	Date: 10/10/2017	
Direction Photo Taken:		
Description: Section 3 of the Jumbo Mine adit discharge channel before the removal action.		



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 7	Date: 10/10/2017	
Direction Photo Taken:		
Description: Section 4 of the adit discharge channel before the removal action, directly upstream of the confluence with the waste rock pile toe drainage.		
Photo No. 8	Date: 10/10/2017	
Direction Photo Taken:		
Description: Flat area where the Jumbo Mine adit drainage meets the waste rock toe drainage. Before the removal action.		

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 9	Date: 10/10/2017	
Direction Photo Taken:		
Description: Channel segment carrying water from the waste rock toe drainage. Before the removal action.		
Photo No. 10	Date: 10/10/2017	
Direction Photo Taken:		
Description: Section 5 of the Jumbo Mine adit drainage channel before the removal action. Photo taken from the dirt road leading up to the adit.		

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 11	Date: 10/10/2017	
Direction Photo Taken:		
Description: Existing structures remaining from historic mining activities at the Jumbo Mine site.		
Photo No. 12	Date: 10/10/2017	
Direction Photo Taken:		
Description: Existing structures remaining from historic mining activities at the Jumbo Mine site.		

Project Name:
Jumbo Mine 2017 Support

Site Location:
Montezuma, CO

Project No.
0001/1706-12

Photo No.
13

Date:
10/10/2017

Direction Photo Taken:

Description:

Existing structures remaining from historic mining activities at the Jumbo Mine site.



Photo No.
14

Date:
10/10/2017

Direction Photo Taken:

Description:

Existing structures remaining from historic mining activities at the Jumbo Mine site.



Project Name:
Jumbo Mine 2017 Support

Site Location:
Montezuma, CO

Project No.
0001/1706-12

Photo No.
15

Date:
10/10/2017

Direction Photo Taken:

Description:

Existing structures remaining from historic mining activities at the Jumbo Mine site.



Photo No.
16

Date:
10/10/2017

Direction Photo Taken:

Description:

Existing structures remaining from historic mining activities at the Jumbo Mine site.



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 17	Date: 10/10/2017	
Direction Photo Taken:		
Description: Existing structures remaining from historic mining activities at the Jumbo Mine site.		

Photo No. 18	Date: 10/10/2017	
Direction Photo Taken:		
Description: Existing structures remaining from historic mining activities at the Jumbo Mine site.		

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 19	Date: 10/10/2017	
Direction Photo Taken:		
Description: Existing structures remaining from historic mining activities at the Jumbo Mine site.		
Photo No. 20	Date: 10/10/2017	
Direction Photo Taken:		
Description: View of the small pond created next to the draining Jumbo Mine adit at the beginning of channel construction. A pump was placed in the pond to redirect the adit drainage around the new channel during construction.		

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 21	Date: 10/10/2017			
Direction Photo Taken:				
Description: Beginning of channel excavation for the new constructed adit drainage channel.				

Photo No. 22	Date: 10/10/2017			
Direction Photo Taken:				
Description: Beginning of channel excavation for the new constructed adit drainage channel at the beginning of the removal action.				



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 23	Date: 10/25/2017	
Direction Photo Taken:		
Description: View of the start of the newly constructed Jumbo Mine drainage channel once the removal action was completed.		
Photo No. 24	Date: 10/25/2017	
Direction Photo Taken:		
Description: Water quality parameters being taken from the pond at the start of the Jumbo Mine adit discharge channel after the removal action was completed. A water sample was collected from the pond to determine the effect of the removal action on improving water quality.		



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 25	Date: 10/25/2017	<div data-bbox="126 407 337 464"> Direction Photo Taken: </div> <div data-bbox="126 617 293 653"> Description: </div> <div data-bbox="126 678 418 953"> Horiba instrument display showing the water quality parameters collected at the pond next to the start of the Jumbo Mine adit drainage channel after the removal action. </div> <div data-bbox="695 321 1276 1104" data-label="Image">  </div>
Photo No. 26	Date: 10/25/2017	<div data-bbox="126 1192 337 1255"> Direction Photo Taken: </div> <div data-bbox="126 1409 293 1444"> Description: </div> <div data-bbox="126 1467 412 1625"> Section 1 of the Jumbo Mine adit discharge channel after the removal action was completed. </div> <div data-bbox="695 1110 1276 1892" data-label="Image">  </div>



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 27	Date: 10/25/2017	
Direction Photo Taken:		
Description: Section 1 of the Jumbo Mine adit discharge channel facing the onsite cabin structure adjacent to the adit after the removal action was completed.		
Photo No. 28	Date: 10/25/2017	
Direction Photo Taken:		
Description: Section 2 of the Jumbo Mine adit discharge channel after the removal action was completed.		



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 29	Date: 10/25/2017	
Direction Photo Taken:		
Description: Section 3 of the Jumbo Mine adit discharge channel after the removal action was completed.		
Photo No. 30	Date: 10/25/2017	
Direction Photo Taken:		
Description: Section 4 of the Jumbo Mine adit discharge channel after the removal action was completed. A culvert was constructed to transport the discharge water to the confluence with the waste rock pile toe drainage.		



Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 31	Date: 10/25/2017	
Direction Photo Taken:		
Description: View of the Jumbo Mine adit discharge channel and the waste rock pile toe drainage channel confluence after the removal action was completed. A ponding area was constructed at the confluence to allow for extra particulate precipitation.		
Photo No. 32	Date: 10/25/2017	
Direction Photo Taken:		
Description: Section 6 of the Jumbo Mine adit discharge channel after the removal action was completed. Photo taken from the dirt road leading up to the Jumbo Mine adit where a culvert was installed to transport the adit drainage under the roadway.		

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 33	Date: 10/25/2017	
Direction Photo Taken:		
Description: View from the bottom of the constructed Jumbo Mine drainage channel after the removal action was completed.		
Photo No. 34	Date: 10/25/2017	
Direction Photo Taken:		
Description: Downstream orifice of the culvert at the end of the constructed channel. A sample to evaluate the removal action on improving water quality was collected at the effluent of the culvert.		

Project Name: Jumbo Mine 2017 Support	Site Location: Montezuma, CO	Project No. 0001/1706-12
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Photo No. 35	Date: 10/25/2017	<div data-bbox="695 321 1279 1104" data-label="Image">  </div> <div data-bbox="131 621 293 651" data-label="Section-Header"> Description: </div> <div data-bbox="131 680 415 924" data-label="Text"> <p>Horiba instrument display showing the water quality parameters collected at the downstream end of the Jumbo Mine adit drainage channel after the removal action.</p> </div>
Photo No. 36	Date: 10/25/2017	<div data-bbox="467 1113 1516 1898" data-label="Image">  </div> <div data-bbox="131 1413 293 1442" data-label="Section-Header"> Description: </div> <div data-bbox="131 1472 415 1591" data-label="Text"> <p>Newly constructed gate at the start of the dirt road leading up to the Jumbo Mine adit.</p> </div>



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Attachment C

Water Quality Parameters Pre and Post Removal Action

Attachment C:
Water Quality Parameters Pre and Post Removal Action

Sample #	JM-SW01	JM-SW03	JM-ADIT-10252017	JM-TREATED-10252017
Location:	JM-SW01	JM-SW03	JM-Adit	JM-TREATED
Sample Date:	8/28/2017	8/28/2017	10/25/2017	10/25/2017
Temperature (°C)	11.27	14.03	3.33	2.53
pH	4.63	4.61	3.46	5.15
Dissolved O₂ (mg/L)	8.21	7.55	6.46	12.44
Conductivity (mS/cm)	0.164	0.162	0.196	0.192
ORP (mV)	229	292	467	285



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Attachment D

Analytical Results Pre and Post Removal Action

Attachment D:
Analytical Results Pre and Post Removal Action

		Sample ID:	JM-SW01	JM-SW03	JM-ADIT-10252017	JM-TREATED-10252017
		Sample Location:	JM-SW01	JM-SW03	JM-ADIT	JM-TREATED
		Sample Date:	8/28/2017 12:20	8/28/2017 12:50	10/25/2017 14:28	10/25/2017 13:52
Analyte	Units	MDL				
Aluminum	ug/l	35	35 U	35 U	84 J	48 J
Aluminum,Dissolved	ug/l	35	256	258	217	38.4 J
Antimony	ug/l	0.754	0.754 U	0.754 U	0.754 U	0.754 U
Antimony,Dissolved	ug/l	0.754	0.754 U	0.754 U	0.754 U	0.754 U
Arsenic	ug/l	6.5	6.5 U	6.5 U	6.5 U	6.5 U
Arsenic,Dissolved	ug/l	6.5	6.5 U	6.5 U	6.5 U	6.5 U
Barium	ug/l	1.7	17.5	17.6	18	19
Barium,Dissolved	ug/l	1.7	18.2	17.7	16.7	18.1
Beryllium	ug/l	0.7	0.719 J	0.7 U	1.04 J	0.7 U
Beryllium,Dissolved	ug/l	0.7	1.08 J	0.812 J	0.751 J	0.754 J
Cadmium	ug/l	0.7	13.9	13.2	15.4	14.9
Cadmium,Dissolved	ug/l	0.7	13.4	12.6	15.6	14.9
Calcium	ug/l	46.3	17100	16500	17300	18300
Calcium,Dissolved	ug/l	46.3	16700	16200	18000	18800
Chromium	ug/l	1.4	1.4 U	1.4 U	1.4 U	1.4 U
Chromium,Dissolved	ug/l	1.4	1.4 U	1.4 U	1.4 U	1.4 U
Cobalt	ug/l	2.3	2.88 J	2.3 U	2.3 U	2.3 U
Cobalt,Dissolved	ug/l	2.3	2.3 U	2.3 U	2.38 J	2.3 U
Copper	ug/l	5.3	122	112	139	116
Copper,Dissolved	ug/l	5.3	119	109	133	99.3
Iron	ug/l	14.1	1320	655	1520	957
Iron,Dissolved	ug/l	14.1	492	83.3 J	251	139
Lead	ug/l	0.24	335	248	375	265
Lead,Dissolved	ug/l	0.24	278	217	336	141
Magnesium	ug/l	11.1	2250	2220	2360 J	2590
Magnesium,Dissolved	ug/l	11.1	2220	2130	2340	2650
Manganese	ug/l	1.2	3410	3060	3220	3190
Manganese,Dissolved	ug/l	1.2	3310	2980	3360	3350

Notes:

U = Analyte was not detected

J = Analyte was positively identified but concentration was estimated

Attachment D:
Analytical Results Pre and Post Removal Action
(Continued)

		Sample ID:	JM-SW01	JM-SW03	JM-ADIT-10252017	JM-TREATED-10252017
		Sample Location:	JM-SW01	JM-SW03	JM-ADIT	JM-TREATED
		Sample Date:	8/28/2017 12:20	8/28/2017 12:50	10/25/2017 14:28	10/25/2017 13:52
Analyte	Units	MDL				
Mercury	ug/l	0.049	0.049 U	0.049 U	0.049 U	0.049 U
Mercury,Dissolved	ug/l	0.049	0.049 U	0.049 U	0.049 U	0.049 U
Nickel	ug/l	4.9	4.9 U	4.9 U	4.9 U	4.9 U
Nickel,Dissolved	ug/l	4.9	4.9 U	4.9 U	4.9 U	4.9 U
Potassium	ug/l	102	1070	973 J	1000 BJ	1180 J
Potassium,Dissolved	ug/l	102	1010	945 J	970 J	946 J
Selenium	ug/l	0.38	0.38 U	0.38 U	0.38 U	0.38 U
Selenium,Dissolved	ug/l	0.38	0.38 U	0.38 U	0.38 U	0.38 U
Silver	ug/l	2.8	2.8 U	2.8 U	2.8 U	2.8 U
Silver,Dissolved	ug/l	2.8	2.8 U	2.8 U	2.8 U	2.8 U
Sodium	ug/l	98.5	3360	3270	3410 J	3270 J
Sodium,Dissolved	ug/l	98.5	3460	3240	3240 J	3300 J
Thallium	ug/l	0.19	0.19 U	0.19 U	0.19 U	0.19 U
Thallium,Dissolved	ug/l	0.19	0.19 U	0.19 U	0.19 U	0.19 U
Vanadium	ug/l	2.4	2.4 U	2.4 U	2.4 U	2.4 U
Vanadium,Dissolved	ug/l	2.4	2.4 U	2.4 U	2.4 U	2.4 U
Zinc	ug/l	5.9	5330	5100	6050	5900
Zinc,Dissolved	ug/l	5.9	5470	5270	5890	5720

Notes:

U = Analyte was not detected

J = Analyte was positively identified but concentration was estimated



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Attachment E

Percent Removals Pre and Post Removal Action

Attachment E:
Percent Removal Comparison Pre and Post Removal Action

Comparison Type	Post Removal Action (Upstream to Downstream)	Pre Removal Action (Upstream to Downstream)	Difference Between Pre and Post Removal Action
Analyte	Percent Removal		
Aluminum	42.9%	0.0%	42.9%
Aluminum,Dissolved	82.3%	-0.8%	83.1%
Antimony	0.0%	0.0%	0.0%
Antimony,Dissolved	0.0%	0.0%	0.0%
Arsenic	0.0%	0.0%	0.0%
Arsenic,Dissolved	0.0%	0.0%	0.0%
Barium	-5.6%	-0.6%	-5.0%
Barium,Dissolved	-8.4%	2.7%	-11.1%
Beryllium	32.7%	2.6%	30.0%
Beryllium,Dissolved	-0.4%	24.8%	-25.2%
Cadmium	3.2%	5.0%	-1.8%
Cadmium,Dissolved	4.5%	6.0%	-1.5%
Calcium	-5.8%	3.5%	-9.3%
Calcium,Dissolved	-4.4%	3.0%	-7.4%
Chromium	0.0%	0.0%	0.0%
Chromium,Dissolved	0.0%	0.0%	0.0%
Cobalt	0.0%	20.1%	-20.1%
Cobalt,Dissolved	3.4%	0.0%	3.4%
Copper	16.5%	8.2%	8.4%
Copper,Dissolved	25.3%	8.4%	16.9%
Iron	37.0%	50.4%	-13.3%
Iron,Dissolved	44.6%	83.1%	-38.4%
Lead	29.3%	26.0%	3.4%
Lead,Dissolved	58.0%	21.9%	36.1%
Magnesium	-9.7%	1.3%	-11.1%
Magnesium,Dissolved	-13.2%	4.1%	-17.3%
Manganese	0.9%	10.3%	-9.3%
Manganese,Dissolved	0.3%	10.0%	-9.7%

Attachment E:
Percent Removal Comparison Pre and Post Removal Action
(Continued)

Comparison Type	Post Removal Action (Upstream to Downstream)	Pre Removal Action (Upstream to Downstream)	Difference Between Pre and Post Removal Action
Analyte	Percent Removal		
Mercury	0.0%	0.0%	0.0%
Mercury,Dissolved	0.0%	0.0%	0.0%
Nickel	0.0%	0.0%	0.0%
Nickel,Dissolved	0.0%	0.0%	0.0%
Potassium	-18.0%	9.1%	-27.1%
Potassium,Dissolved	2.5%	6.4%	-4.0%
Selenium	0.0%	0.0%	0.0%
Selenium,Dissolved	0.0%	0.0%	0.0%
Silver	0.0%	0.0%	0.0%
Silver,Dissolved	0.0%	0.0%	0.0%
Sodium	4.1%	2.7%	1.4%
Sodium,Dissolved	-1.9%	6.4%	-8.2%
Thallium	0.0%	0.0%	0.0%
Thallium,Dissolved	0.0%	0.0%	0.0%
Vanadium	0.0%	0.0%	0.0%
Vanadium,Dissolved	0.0%	0.0%	0.0%
Zinc	2.5%	4.3%	-1.8%
Zinc,Dissolved	2.9%	3.7%	-0.8%



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Attachment F

Data Validation Report

**Jumbo Mine
DATA VALIDATION REPORT**

Date: December 1, 2017

Laboratory: ESC Lab Sciences Laboratory-Mount Joliet, TN

Laboratory Project #: L946864

Data Validation Performed By: Diane Quigley (Weston)

Weston Work Order #: 20408.012.001.0499.00

This data validation report has been prepared by Weston. This report documents the data validation for two water samples 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 7470A water

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 L946864-	Analysis	Date Collected
JM-TREATED-10252017	01	Total and Dissolved Metals/Hg	10/25/17
JM-ADIT-10252017	02	Total and Dissolved Metals/Hg	10/25/17

2. Holding Times / Sample Receipt/Percent Solids

All samples were received by the laboratory on 10/27/17 in good condition, properly preserved. All samples were analyzed within hold times.

METALS/MERCURY Total/Dissolved

1. Blanks

Potassium (119 J ug/l) and sodium (432 J ug/l) were detected in total metals blank MBR3262332-1 (associated samples ALL). The positive result for total potassium and total sodium were estimated in sample JM-TREATED-10252017 since sample concentrations were greater than the RL but below ten times the blank level. The positive potassium result in sample JM-ADIT-10252017 was qualified as undetected (U) since it

was less than the RL and the positive result for sodium was estimated (J) since it was greater than the RL but less than ten times the blank level.

Dissolved magnesium (27.1 J ug/l) and dissolved sodium (651 J ug/l) were detected in dissolved metals method blank MB R3261997-1 (assoc. samples ALL). The positive results for dissolved sodium were estimated (J) in both samples since the sample concentrations were greater than the RL but less than ten times the blank level. No action was necessary for dissolved magnesium since sample concentrations were greater than the RL and greater than ten times the blank level.

2. **LCS/LCSDs Results**

All LCSs had recoveries within required control limits.

3. **Matrix Spike/Matrix Spike Duplicate**

A total mercury MS and MSD were performed on a non-Weston sample. Since sample similarity could not be determined, no evaluation was made. The dissolved mercury MS and MSD were performed on sample JM-TREATED-10252017 and all QC criteria were met.

The total metals MS and MSD were performed on sample JM-ADIT-10252017 and all QC criteria were met. The dissolved metals MS and MSD were performed on a non-Weston sample and was not evaluated.

4. **Duplicate/Serial Dilution**

No laboratory duplicates or serial dilution data were submitted, however, total magnesium was flagged by the laboratory in sample JM-ADIT-10252017 with “O1” which was defined as serial dilution not meeting QC criteria. The positive total magnesium result was estimated (J) in sample JM-ADIT-10252017.

5. **Field Duplicate**

No field duplicate was submitted with this data set.

6. **Sample Dilutions/Miscellaneous**

No samples required dilution.

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.