

Pre-CERCLA Screening Checklist/Decision Document

**North Star Mine
San Juan County, Colorado**

**July 25, 2019
and
September 24, 2019**

**EPA Region 8
Site Assessment Program
1595 Wynkoop Street
Denver, CO 80202**

Pre-CERCLA Screening – North Star Mine

Pre-CERCLA¹ Screening (PCS) and sampling was conducted at the North Star Mine on July 25, 2019 and September 24, 2019 and by Region 8 Environmental Protection Agency (EPA) Site Assessment Program and other federal and state members of the Colorado Mixed-Ownership Team. Sampling and analysis were completed in accordance with the EPA-approved Sampling and Analysis Plan/Quality Assurance Project Plan: 2019 Colorado Draining Mines Pre-CERCLA Field Screening, prepared by the Colorado Division of Mine Reclamation and Safety, June 2019.

The PCS Checklist/Decision Document, as required by EPA Pre-CERCLA Guidance (Office of Land and Emergency Management (OLEMJ) Directive# 9200.3-107, is included as Attachment A. A sample location figure and summary of soil and water analytical results as reported by the EPA Contract Laboratory is included in Attachment B.

¹ Comprehensive Environmental Response, Compensation, and Liability Act

**North Star Mine
San Juan County, Colorado**

**Attachment A:
Pre-CERCLA Screening Checklist Decision Form**

Attachment A: Pre-CERCLA Screening Checklist/Decision Form



This form is used in conjunction with a site map and any additional information required by the EPA Region to document completion of a Pre-CERCLA Screening (PCS). The form includes a decision on whether a site should be added to the Superfund program's active site inventory for further investigation.

EPA Region: 8		State: Colorado	
EPA ID No. (If Available): Not Applicable			
Site Category: Draining Mines		Select a Site Name (Primary): North Star Mine	
Site Number: Not Applicable			
Date of Site Visit: Jul 25, 2019		Time of Site Visit: 09:42	

Checklist Preparer

Title: USFWS Liaison to USEPA

Name: Robyn Blackburn

Organization: US Fish and Wildlife Service

Street Address: 1595 Wynkoop Street

City: Denver

State: Colorado Zip Code: 80202

Phone: (303) 312-6663

Site Information (Preliminary)

Site Name (Alternate 1): N/A

Site Name (Alternate 2): N/A

Region: 8

State: Colorado County: San Juan

Congressional District: 3

Township & Range:

Section:

Section (1/4):

Section (1/16):

Mine Site Contact

Title:

Name: Not Applicable

Organization:

Street Address:

City:

State: Zip Code:

Phone:

Email:

Spatial Location

Latitude: 37.8075426666667

Longitude: -107.6817951666667

Collection Method: GPS (handheld, Smartphone, other device with < 25m accuracy)

Horizontal Accuracy in Meters: 5

Site Description (of this Spatial Location):

Approximate Center of Site

Preliminary Assessment - Historical Data

CERCLA 105d Petition for Preliminary Assessment: No

Petition Date: Not Applicable

RCRA Subtitle C Site Status: Is site in RCRAInfo?: No

RCRAInfo Handler ID #: Not Applicable

Additional RCRAInfo ID #: Not Applicable

State ID: None

Other ID: DRMS-81

Ownership Type: Private

Site Type: Abandoned Mine Site

Site Sub-Type: Hard Rock Mining

Federal Facility: No

Federal Facility Owner: Not Applicable

Federal Facility Operator: Not Applicable

Formerly Used Defense Site (FUDS): No

Federal Facility Docket: No

Federal Facility Docket Listing Date: Not Applicable

Federal Facility Docket Reporting Mechanism: Not Applicable Native American

Interest: Unknown

Tribe:

Additional Tribe:

Site Description - Physical Setting

Abandoned Mine Site: Yes

Buildings: Buildings Present

Mill or Milling Equipment or Tailing Present: Yes

Steep Waste Piles: Yes

Safety Hazards Present: Yes

Safety Hazards Dangerous slide potential or steep vertical face/wall/cliff (caused by mining operations), Debris/silt causes blockage of drainage or stream may result in flooding, Impounded water body caused by AML operations, Miscellaneous Debris, Open or Unobstructed Shaft/Adit/Cave/Stopes, Standing Water, Steep Vertical Inclines, Surface subsidence such as open stope, pit, caving, potholes, troughs, cracks, vaults, underground mine void

Accessibility (provide details with regard to ability to access the site) Located Along Main Road

Time it takes to reach this site (Hours:Minutes): 5 minutes

Detailed description of how the site was accessed: Outside of Town of Silverton, drive south/west on Highway 550 toward Ouray, driveway turnoff on right is approximately 5 minutes outside of town.

Adjacent to Resident(s): No

Adjacent Residential Features: Not Applicable

Mountainous Steep Terrain: Yes

Vegetation Present: Yes

Vegetation Density: Moderate/Interspersed

Surface Water Body on or Adjacent to the Site: Yes

Open Fields: Yes

Waste Pile Erosion Observed: Yes

Describe Waste Pile Run Off: Highly eroded orange waste observed in adjacent wetland.

Tailings Erosion Observed: Yes

Describe Tailings Run Off: Highly eroded tailings runoff observed in wetlands and near Mineral Creek.

Draining Adits or Seeps Discharge from the Site: Yes

Adits Flow Rate from Site: Significant

Describe Adit Flow from Site: Supposed to run into constructed channel, however beaver dam in portal causes two drainages to run across tailings pile then into Mineral Creek.

Draining Adits or Seeps Discharge Across Waste Piles: Yes

Draining Adits or Seeps Discharge to Adjacent Habitat: Yes

Adit Flows into what habitat: Wetland and Mineral Creek

Habitat Name: Mineral Creek

Physical Setting and Access Features: Accessible with no public recreation use

Physical Setting (Field Notes - provide a brief summary of physical setting including notable safety concerns, waste types, human uses/exposures to wastes, runoff/drainage, and notable habitat/ecological use): Two large waste piles with a draining adit which discharges to Mineral Creek. Many safety concerns which include very steep slopes, subsidence areas, & partially open portals. Good habitat with wildlife use.

Site Description - Land Use

Roads/Trails: Yes

Road/Trail Type: Major Road or Highway

Human Activity: Unknown

Human Activity Type: Not Applicable

Residential: No

Residential Density: Not Applicable

Recreational Use: Unknown

Recreational Density: Not Applicable

Camping: Unknown

Camping Frequency: Unknown

Fishing: Yes

Fishing Frequency: Moderate

Hiking: Yes

Hiking Frequency: Unknown

Biking: Unknown

Biking Frequency: Unknown

Picnicking: Unknown

Picnicking Frequency: Unknown

Ecological Activity: Yes

Ecological Activity: Moderate to Heavy

Observed/likely fishing/consumption of fish/aquatic organisms at the mine site or within ¼ miles downstream: Yes

Are there other observed sensitive environments on-site or downstream of the waste area(s) within ¼ mile? Unknown

Sensitive Environment (wetland, stream, creek, river, known to be in the vicinity of a National Park, designated federal/state wildlife or scenic area, fish hatchery/spawning area, designated for wildlife or game management, known to be used by or designated critical habitat for Threatened or Endangered Species, or any other sensitive environment critical to supporting wildlife): fish populations

Other Sensitive Environments: wetlands

Land Use (Field Notes – provide a brief summary of human/ecological type of use and use level (e.g., heavily used for biking and camping; observed camp fire rings and picnic tables at the site immediately adjacent to the waste runoff; narrow foot trail with difficult steep access to the waste areas and minimal use of the area, etc.): A gate exists off of main road which could restrict some human activity. Observed Moose and calf at base of tailings. Did observe confirmatory evidence of human activity.

Site Surface Description

Draining Adit: Yes **Draining Adit Type:** Draining

Waste Piles: Yes **Number of Waste Piles:** 2

Airborne Release of Fine Material/Dust: No

Surface Water on or Immediately Adjacent: Yes **Water Body Name:** Mineral Creek

Wetlands on or Adjacent to Site: Yes

Forested on or Adjacent to the Site: Yes

Riparian on or Adjacent to the Site: Unknown

Site Surface (Field Notes): Partial cover installed on Lower Pile but has washed away. Standing water pools and highly active adit run off site. Site is surrounded by heavy forested area on one side and wetlands and Mineral Creek on other side.

Site Description (Other)

Groundwater Seeps Observed: Unknown

Primary Drainage Name: Mineral Creek/Animas River

Groundwater Seeps (Field Notes): Not Applicable

Previous Investigations: Yes

Investigation Type: Recon by Other Agency, Safety Closure, Sample Collection

Who Completed Investigations at this Site: Colorado DRMS

Cleanup Activities: Yes **Cleanup Type:** Reclamation

Site Description Cleanup Field Notes: Adit drainage was channelized and a berm was placed inside a gated safety closure in the mine portal.

Who Completed Cleanup Activities at this Site: State

Previous Regulatory Actions (Permitting and Enforcement): State permit when mine was operating

Previous Regulatory Type: Permit

Who Completed Regulatory Actions at this Site: Division of Reclamation and Mine Safety

Institutional Controls: No **Institutional Control Type:** Not Applicable

Institutional Controls (indicate name/entity on signs/controls): No Institutional Controls

Community Interest: Yes **Community Interest Type:** Property owner, town, watershed group

Community Interest (Indicate watershed group or other interest group): Private individual, the Town of Silverton, San Juan County and the Bonita Peak Community Advisory Group

Survey Form

<p>1. An initial search for the site in EPA's Superfund active, archive and non-site inventories should be performed prior to starting a PCS. Is this a new site that does not already exist in these site inventories?</p>	<p style="text-align: center;">Yes</p>
<p>2. Is there evidence of an actual release or a potential to release? Evidence of Potential Release Waste pile material observed in water body or other surrounding environment, Evidence of waste pile runoff/erosion (channels, rills, run off), Draining mine adit water discharge, Draining mine adit discharging into a stream or water body, Draining mine adit discharging into wetlands or surrounding environment, Draining Mine Adit Water discharging over waste material</p>	<p style="text-align: center;">Yes</p>
<p>3. Are there possible targets that could be impacted by a release of contamination at the site?</p>	<p style="text-align: center;">Yes</p>
<p>4. Is there documentation indicating that a target has been exposed to a hazardous substance released from the site?</p>	<p style="text-align: center;">Unknown</p>
<p>5. Is the release of a naturally occurring substance in its unaltered form, or is it altered solely through naturally occurring processes or phenomena, from a location where it is naturally found?</p>	<p style="text-align: center;">No</p>
<p>6. Is the release from products which are part of the structure of, and result in exposure within, residential buildings or business or community structures?</p>	<p style="text-align: center;">No</p>
<p>7. If there has been a release into a public or private drinking water supply, is it due to deterioration of the system through ordinary use?</p>	<p style="text-align: center;">No</p>
<p>8. Are the hazardous substances possibly released at the site, or is the release itself, excluded from being addressed under CERCLA?</p>	<p style="text-align: center;">No</p>
<p>9. Is the site being addressed under RCRA corrective action or by the Nuclear Regulatory Commission?</p>	<p style="text-align: center;">No</p>
<p>10. Is another federal, state, tribe or local government environmental cleanup program other than site assessment actively involved with the site (e.g., state voluntary cleanup program)?</p>	<p style="text-align: center;">No</p>
<p>11. Is there sufficient documentation or evidence that demonstrates there is no likelihood of a significant release that could cause adverse environmental or human health impacts?</p>	<p style="text-align: center;">No</p>
<p>12. Are there OTHER site-specific situations or factors that warrant further CERCLA remedial/integrated assessment or response?</p>	<p style="text-align: center;">No</p>

Preparer's Recommendation

Preparer's Recommendation: Do not add site to the Superfund active site inventory.

Please explain recommendation below: The Site is near the town of Silverton and is co-located with a Colorado Department of Transportation storage building which is on a portion of the property. Waste soil is observed discharging into downgradient wetlands, and high-flowing adit drainage and waste pile run-off are observed entering Mineral Creek. A steep vertical portion of the waste pile exists adjacent to and above Mineral Creek. The waste is relatively loose and directly interfaces with Mineral Creek. A trail next to the waste pile and adit drainage is used by hikers, but access to this trail and the mine area is restricted by a locked gate on a private driveway entrance into the mine area. Although the locked gate prevents vehicles from entering the area, there is pedestrian access and use through the sides of the gate. Inside the gate, there is no residence and the mine area is open with unrestricted access to waste piles and adit drainage. Lead (9,920 mg/kg) and arsenic (480 mg/kg) concentrations in soil are above EPA Residential and Industrial Regional Screening Levels. Adit concentrations are above both acute/chronic Water Quality Standards (WQS) for cadmium, copper, manganese, and zinc. Adit drainage flows across waste piles and discharges into Mineral Creek. Cadmium and zinc concentrations are also above WQS in the adjacent Belcher Gulch which also discharges into Mineral Creek. The adit drainage was observed to be flowing out of a designated drainage channel and across the waste pile due to damming and ponded areas created by beavers. The disruption in the adit drainage caused by the beavers, is being referred to the EPA Removal Program for consideration. The waste pile portion of this site is being considered for a Good Samaritan cleanup project. No viable option has been identified to address the conditions within the mine causing the continuous adit drainage at this site, so the adit drainage portion is being deferred at this time.

Date: March 03, 2020

Site Assessor's Name/Signature: David Fronczak



EPA Regional Review and Pre-CERCLA Screening Decision

EPAs Recommendation: Do not add site to the Superfund active site inventory.

Add site to the Superfund active site inventory for completion of a:

- Standard/full preliminary assessment (PA)
- Abbreviated preliminary assessment (APA)
- Combined Preliminary Assessment/Site Inspection (PA/SI)
- Integrated Removal Assessment and Preliminary Assessment
- Integrated Removal Assessment and Combined PA/SI
- Other Description

Do not add site to the Superfund active site inventory. Site is:

- Not a valid site or incident
- Refer to/being addressed by EPA's Removal Program
- Refer to/being addressed by a State cleanup program
- Refer to/being addressed by Tribal cleanup program
- Refer to/being addressed under Resource Conservation and Recovery Act (RCRA)
- Refer to/being addressed by the Nuclear Regulatory Commission (NRC)
- Other Description

Deferred. Any further assessment or work regarding adit discharge associated with this site is being deferred at this time. The site is being referred to other state agency for consideration.

EPA Region 8 Reviewer's Name: Jean Wyatt

EPA Region 8 Reviewer's Signature:



Date: March 03, 2020

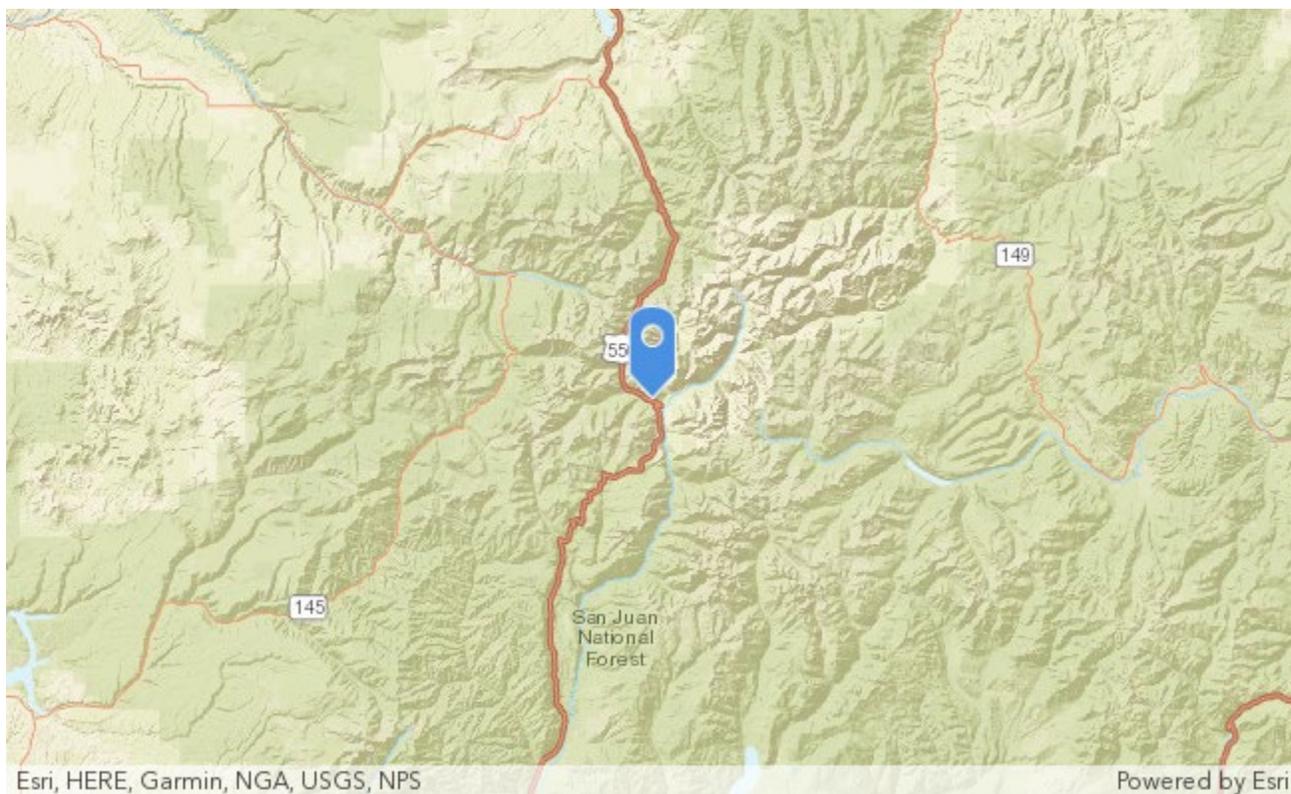
EPA Regional Review and Pre-CERCLA Screening Decision

EPA Region 8 Reviewer's Name:

EPA Region 8 Reviewer's Signature:

Date: Jul 25, 2019

Site Location



Photographs



Facing Portal of Lower Pile



Close up of Beaver Dam inside Lower Pile Portal



Partially Reclaimed Lower Pile With Mineral Creek in Bkgd



Steep Exposed Bank of Lower Pile into Mineral Crk



Lower Mill and Cribbing



Lower Pile Mill with Mineral Creek in Bkgd



Adit flow off pile to Mineral Creek that is redirected out of constructed channel due to Beaver dam in portal



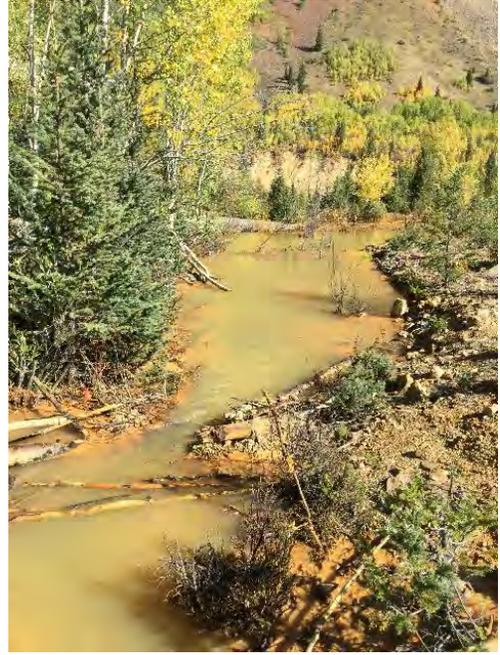
Upper pile

North Star Mine Low Flow Environmental Sampling Photographs (September 2019)

2019 Pre-CERCLA Screening



North Star Level 4 Upstream



NS7_1_DM Downstream



NS7_1 Flume



NS7_1_DM New location, main adit sample location just outside of tunnel

**North Star Mine
San Juan County, Colorado**

**Attachment B:
Pre-CERCLA Sampling and Analysis Summary**

North Star Mine - 2019 Data Summary

Surface Water - High Flow

STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc	Mercury	Hardness ¹
					ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
NS7_1_DM	Total Recoverable Metals	Surface Water	7/25/2019	10:27	855	2.50 U	14.3 D	25.0 UJ	2.00 U	4.40 D	151000	5.00 U	8.60 D	203 D	9620	11.1 JD	24300	4450	2.50 U	780 J	5.00 U	2.50 U	5170	5.00 UJ	21.6 D	10.0 U	1050	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	10:27	51.2	2.50 U	2.50 U	25.0 U	2.00 U	3.70 D	156000	5.00 U	9.16 D	26.3 D	2400	0.500 U	25100	4700	2.50 U	823 J	5.00 U	2.50 U	5250	5.00 U	13.3 D	10.0 U	1040	NA	494
NS7_2_DM	Total Recoverable Metals	Surface Water	7/25/2019	9:15	967	2.50 U	16.2 D	25.0 UJ	2.00 U	4.34 D	151000	5.00 U	8.69 D	211 D	10000	12.3 JD	24400	4450	2.50 U	794 J	5.00 U	2.50 U	5150	5.00 UJ	21.2 D	10.0 U	1060	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	9:15	20.0 U	2.50 U	2.50 U	25.0 U	2.00 U	3.26 D	153000	5.00 U	8.74 D	5.39 D	575	0.500 U	24700	4650	2.50 U	846 J	5.00 U	2.50 U	5240	5.00 U	13.5 D	10.0 U	878	NA	484
NS7_3_DM	Total Recoverable Metals	Surface Water	7/25/2019	9:27	167	2.50 U	2.50 U	25.0 UJ	2.00 U	1.12 D	113000	5.00 U	1.92 D	18.8 D	839	0.693 JD	17600	1090	2.50 U	696 J	5.00 U	2.50 U	4140	5.00 UJ	3.95 D	10.0 U	413	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	9:27	83.3	2.50 U	2.50 U	25.0 U	2.00 U	1.14 D	116000	5.00 U	1.79 D	5.88 D	100 U	0.500 U	17900	1140	2.50 U	740 J	5.00 U	2.50 U	4140	5.00 U	3.31 D	10.0 U	421	NA	363
NS7_4_DM	Total Recoverable Metals	Surface Water	7/25/2019	9:48	597	2.50 U	8.04 JD	25.0 UJ	2.00 U	3.05 D	117000	5.00 U	5.90 D	132 D	6590	7.13 JD	18800	3240	2.50 U	673 J	5.00 U	2.50 U	4220	5.00 UJ	14.2 D	10.0 U	827	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	9:48	20.0 U	2.50 U	2.50 U	25.0 U	2.00 U	2.83 D	119000	5.00 U	6.59 D	6.85 D	1050	0.500 U	19100	3410	2.50 U	755 J	5.00 U	2.50 U	4240	5.00 U	9.72 D	10.0 U	791	NA	375
NSM-SW-OPP-01	Total Recoverable Metals	Surface Water	7/24/2019	14:01	3300	2.50 U	27.9 D	25.0 UJ	2.00 U	4.73 D	139000	5.00 U	6.29 D	375 D	15200	58.1 JD	22300	3340	2.50 U	998 J	5.00 U	2.50 U	5270	5.00 UJ	23.0 D	10.0 U	1270	0.100 U	NA
	Dissolved Metals	Surface Water	7/24/2019	14:01	53.3	0.860 J	0.579 J	12.4	2.00 U	3.79	139000	1.00 U	6.27	16.1	100 U	0.100 U	22300	3390	0.500 U	1060	1.00 U	0.500 U	5230	1.00 U	5.97	2.00 U	977	NA	439
M32	Total Recoverable Metals	Surface Water	7/24/2019	14:48	548	2.50 U	2.50 U	25.0 UJ	2.00 U	0.500 U	21700	5.00 U	1.28 D	2.50 U	644	1.28 JD	1930	86.0	2.50 U	359 J	5.00 U	2.50 U	1260	5.00 UJ	0.500 U	10.0 U	41.5	0.100 U	NA
	Dissolved Metals	Surface Water	7/24/2019	14:48	67.9	0.500 U	0.500 U	20.0	2.00 U	0.213	22100	1.00 U	1.39	1.12	367	0.158 J	1940	85.9	0.500 U	336 J	1.00 U	0.500 U	1280	1.00 U	0.100 U	2.00 U	39.5	NA	63
M33	Total Recoverable Metals	Surface Water	7/24/2019	13:10	526	2.50 U	2.50 U	25.0 UJ	2.00 U	0.500 U	21700	5.00 U	1.21 D	2.50 U	600	1.20 JD	1940	85.6	2.50 U	329 J	5.00 U	2.50 U	1260	5.00 UJ	0.500 U	10.0 U	41.0	0.100 U	NA
	Dissolved Metals	Surface Water	7/24/2019	13:10	56.5	0.500 U	0.500 U	20.0	2.00 U	0.206	22200	1.00 U	1.31	0.974 J	319	0.148 J	1960	85.3	0.500 U	352 J	1.00 U	0.500 U	1270	1.00 U	0.100 U	2.00 U	38.5	NA	63
M32B	Total Recoverable Metals	Surface Water	7/25/2019	9:05	27.5 J	2.50 U	2.50 U	25.0 UJ	2.00 U	0.762 JD	27600	5.00 U	0.500 U	2.50 U	100 U	6.30 JD	4110	20.0	2.50 U	464 J	5.00 U	2.50 U	1550	5.00 UJ	0.549 JD	10.0 U	230	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	9:05	20.0 U	0.500 U	0.500 U	10.4	2.00 U	0.883	27600	1.00 U	0.100 U	1.86	100 U	1.85	4150	14.2	0.500 U	504 J	1.00 U	0.500 U	1550	1.00 U	0.642	2.00 U	236	NA	86
M32C	Total Recoverable Metals	Surface Water	7/25/2019	9:12	20.0 U	2.50 U	2.50 U	25.0 UJ	2.00 U	0.905 JD	27200	5.00 U	0.500 U	2.50 U	100 U	6.67 JD	4120	21.1	2.50 U	463 J	5.00 U	2.50 U	1540	5.00 UJ	0.610 JD	10.0 U	225	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	9:12	20.0 U	0.500 U	0.500 U	10.5	2.00 U	0.885	27700	1.00 U	0.100 U	1.83	100 U	2.42	4150	15.8	0.500 U	490 J	1.00 U	0.500 U	1580	1.00 U	0.655	2.00 U	236	NA	86
M32D	Total Recoverable Metals	Surface Water	7/25/2019	10:37	43.5 J	2.50 U	2.50 U	25.0 UJ	2.00 U	0.817 JD	28100	5.00 U	0.500 U	2.50 U	100 U	1.99 JD	4270	33.1	2.50 U	489 J	5.00 U	2.50 U	1580	5.00 UJ	0.702 JD	10.0 U	250	0.100 U	NA
	Dissolved Metals	Surface Water	7/25/2019	10:37	20.0 U	0.500 U	0.500 U	10.9	2.00 U	0.965	28500	1.00 U	0.100 U	1.33	100 U	0.100 U	4290	23.9	0.500 U	475 J	1.00 U	0.500 U	1580	1.00 U	0.800	2.00 U	254	NA	89
M29	Total Recoverable Metals	Surface Water	6/18/2019	11:58	547	2.5 U	2.5 U	25 U	2 U	0.5 U	21500	5 U	1.36 D	6.64 D	715	3.97 D	1790	94.1	2.5 U	405 J	5 U	2.5 U	1310	5 U	NA	10 U	70.9	NA	NA
	Dissolved Metals	Surface Water	6/18/2019	11:58	86	0.5 U	0.5 U	19.3	2 U	0.25	20700	1 U	1.09	3.45	225 J	0.546	1690	71.7	0.5 U	343 J	1 U	0.5 U	1220	1 U	NA	2 U	58	NA	59

¹ Sample-specific hardness calculated using dissolved calcium and magnesium concentrations for use in assessing hardness-based in accordance with Colorado Water Quality Control Commission, Regulation 31 (https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf)

NA = Not analyzed

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

J = Laboratory quality control review indicates that this result is considered estimated

D = Sample diluted prior to analysis; reported result is for undiluted sample

Surface Water - Low Flow

STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc	Mercury	Hardness ¹
					ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
NS7_1_DM	Total Recoverable Metals	Surface Water	9/24/2019	09:49	835	2.5 U	7.32 JD	25 U	2 U	3.51 D	160000	5 U	9.42 D	167 D	9300	10.6 D	23900	3940	5 U	2.5 U	937 J	5 U	2.5 U	5220	5 U	22.6 D	10 U	856	0.1 U	NA
	Dissolved Metals	Surface Water	9/24/2019	09:49	20 U	1.07	1.14 J	8.74 J	2 U	3.09	159000	1 U	8.69	11.4	2400	0.1 U	24300	3920	3.08	0.5 U	784 J	1 U	0.5 U	5910	1 U	16.1	2 U	863	NA	497
NS7_2_DM	Total Recoverable Metals	Surface Water	9/24/2019	16:19	665	2.5 U	6.86 JD	25 U	2 U	3.28 D	158000	5 U	8.93 D	140 D	8240	9.1 D	23700	3870	5 U	2.5 U	884 J	5 U	2.5 U	5160	5 U	21.4 D	10 U	826	0.1 U	NA
	Dissolved Metals	Surface Water	9/24/2019	16:19	20 U	1.05	0.969 J	8.64 J	2 U	2.62	159000	1 U	8.53	4.72	1570	0.1 U	24200	3890	3.14	0.5 U	796 J	1 U	0.5 U	5880	1 U	16.4	2 U	739	NA	496
NS7_3_DM	Total Recoverable Metals	Surface Water	9/24/2019	09:18	959	2.5 U	9.63 JD	25 U	2 U	3.33 D	158000	5 U	8.88 D	189 D	10200	12.7 D	23600	3760	5 U	2.5 U	941 J	5 U	2.5 U	5140	5 U	22.7 D	10 U	816	0.1 U	NA
	Dissolved Metals	Surface Water	9/24/2019	09:18	20 U	1.07	0.595 J	8.49 J	2 U	2.25	160000	1 U	8.21	2.75	209 J	0.1 U	24600	3820	3.14	0.5 U	805 J	1 U	0.5 U	6010	1 U	16.4	2 U	559	NA	502
NS7_4_DM	Total Recoverable Metals	Surface Water	9/24/2019	09:03	725	2.5 U	5.24 JD	25 U	2 U	3.06 D	146000	5 U	8 D	143 D	7950	9.16 D	21800	3460	5 U	2.5 U	867 J	5 U	2.5 U	4870	5 U	19.4 D	10 U	773	0.1 U	NA
	Dissolved Metals	Surface Water	9/24/2019	09:03	20 U	1.24	0.801 J	9.3 J	2 U	2.53	147000	1 U	7.56	4.98	1440	0.1 U	22400	3490	2.88	0.5 U	756 J	1 U	0.5 U	5450	1 U	14.6	2 U	726	NA	459
NSM-SW-OPP-01	Total Recoverable Metals	Surface Water	9/24/2019	16:42	447	2.5 U	2.5 U	25 U	2 U	2.58 D	139000	5 U	6.86 D	32.7 D	897	3.64 D	21300	2620	5 U	2.5 U	1070	5 U	2.5 U	5240	5 U	6.81 D	10 U	763	0.1 U	NA
	Dissolved Metals	Surface Water	9/24/2019	16:42	83.7	0.701 J	0.5 U	10.5	2 U	2.54	140000	1 U	6.64	12.2	196 J	0.107 J	21900	2660	1.25	0.5 U	1000	1 U	0.5 U	6110	1 U	5.72	2 U	868	NA	439
M32	Total Recoverable Metals	Surface Water	9/24/2019	12:45	2780	2.5 U	2.5 U	26.6 JD	2 U	0.634 JD	70800	5 U	7.27 D	6.2 D	3720	1.87 D	5480	368	NA	2.5 U	645 J	5 U	2.5 U	3330	5 U	NA	10 U	151	NA	NA
	Dissolved Metals	Surface Water	9/24/2019	12:45	143	0.5 U	0.5 U	27	2 U	0.606	67200	1 U	6.73	2.42	2430	0.1 U	5270	348	NA	0.5 U	690 J	1 U	0.5 U	3230	1 U	NA	2 U	140	NA	190
M33	Total Recoverable Metals	Surface Water	9/24/2019	11:40	2650	2.5 U	2.5 U	28 JD	2 U	0.672 JD	71400	5 U	7.27 D	6.86 D																

North Star Mine - 2019 Data Summary

Surface Water - Anions and Alkalinity - High Flow

STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Chloride mg/L	Fluoride mg/L	Nitrate/Nitrite as N mg/L	Sulfate as SO4 mg/L	Total Alkalinity mg CaCO3/L	Dissolved Organic Carbon mg/L
NS7_1_DM	Wet Chemistry	Surface Water	7/25/2019	10:27	5.0 U	1.3 D	2.5 UJ	435 D	57.1	0.5
NS7_2_DM	Wet Chemistry	Surface Water	7/25/2019	09:15	5.0 U	1.4 D	2.5 UJ	431 D	56.2	0.6
NS7_3_DM	Wet Chemistry	Surface Water	7/25/2019	09:27	2.0 U	1.0 D	1.0 UJ	347 D	23.8	0.6
NS7_4_DM	Wet Chemistry	Surface Water	7/25/2019	09:48	2.1 JD	1.0 D	1.0 UJ	340 D	45.0	0.5
NSM-SW-OPP-01	Wet Chemistry	Surface Water	7/24/2019	14:01	5.0 U	1.0 D	2.5 UJ	411 D	27.4	1.0
M32	Wet Chemistry	Surface Water	7/24/2019	14:48	1.0 U	0.2	0.5 UJ	50.8	14.0	0.7
M33	Wet Chemistry	Surface Water	7/24/2019	13:10	1.0 U	0.2	0.5 UJ	50.5	14.1	0.8
M32B	Wet Chemistry	Surface Water	7/25/2019	09:05	1.0 U	0.1 J	0.5 UJ	67.6	20.1	0.6
M32C	Wet Chemistry	Surface Water	7/25/2019	09:42	1.0 U	0.1 J	0.5 UJ	68.3	20.3	0.6
M32D	Wet Chemistry	Surface Water	7/25/2019	10:37	1.0 U	0.1 J	0.5 UJ	70.1	21.0	0.5
M29	Wet Chemistry	Surface Water	6/18/2019	11:58	1 U	0.1 J	0.5 UJ	42.6	17.4	1.5

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

J = Laboratory quality control review indicates that this result is considered estimated

D = Sample diluted prior to analysis; reported result is for undiluted sample

Surface Water - Anions and Alkalinity - Low Flow

STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Chloride mg/L	Fluoride mg/L	Nitrate/Nitrite as N mg/L	Sulfate as SO4 mg/L	Total Alkalinity mg CaCO3/L	Dissolved Organic Carbon mg/L
NS7_1_DM	Wet Chemistry	Surface Water	9/24/2019	09:49	5 U	1.4 D	2.5 UJ	409 D	60.3	0.6
NS7_2_DM	Wet Chemistry	Surface Water	9/24/2019	16:19	5 U	1.5 D	2.5 UJ	407 D	59.6	0.6
NS7_3_DM	Wet Chemistry	Surface Water	9/24/2019	09:18	5 U	1.5 D	2.5 UJ	407 D	61.1	0.6
NS7_4_DM	Wet Chemistry	Surface Water	9/24/2019	09:03	5 U	1.3 D	2.5 UJ	380 D	56.5	0.6
NSM-SW-OPP-01	Wet Chemistry	Surface Water	9/24/2019	16:42	5 U	1 D	2.5 UJ	388 D	26.2	0.9
M32	Wet Chemistry	Surface Water	9/24/2019	12:45	2 U	0.3 JD	1 UJ	188 D	5 U	0.6
M33	Wet Chemistry	Surface Water	9/24/2019	11:40	2 U	0.3 JD	1 UJ	192 D	5 U	0.6
M32C	Wet Chemistry	Surface Water	9/24/2019	11:57	1 U	0.2	0.5 UJ	87.8	22.4	0.7
M32D	Wet Chemistry	Surface Water	9/24/2019	12:44	1 U	0.2	0.5 UJ	95.7	26.3	0.6
M29	Wet Chemistry	Surface Water	9/24/2019	14:25	5.5 D	0.4 D	1 UJ	156 D	5 U	1.1

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North Star Mine - 2019 Data Summary

Field-Measured Water Quality Parameters - High Flow

STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	pH	Temp.	Dissolved Oxygen	Conductivity	ORP	Flow	Flow Measurement
					Stand. Unit	°C	mg/L	µS/cm	mV	cfs	Equipment
NS7_1_DM	In Situ Measure	Surface Water	7/25/2019	10:27	7.10	9.7	7.73	889.0	4.8	0.6094	4" Cutthroat Flume
NS7_2_DM	In Situ Measure	Surface Water	7/25/2019	09:15	7.58	9.5	7.85	882.0	-55.6	0.11852	Bucket fill/flume
NS7_3_DM	In Situ Measure	Surface Water	7/25/2019	09:27	6.45	11.7	7.02	698.0	181	0.004	Bag fill/flume
NS7_4_DM	In Situ Measure	Surface Water	7/25/2019	09:48	7.04	7.6	8.56	729.0	34.1	0.4212	4" Cutthroat Flume
NM-SW-OPP-01	In Situ Measure	Surface Water	7/24/2019	14:01	6.83	15.1	6.82	819.0	73.7	0.1035	4" Cutthroat Flume
M32	In Situ Measure	Surface Water	7/24/2019	14:48	7.40	9.2	9.62	153.6	-18.2	NC	Too deep/unsafe
M33	In Situ Measure	Surface Water	7/24/2019	13:10	7.37	9.7	9.15	149.9	-46.5	294.5	Flow Tracker
M32B	In Situ Measure	Surface Water	7/25/2019	09:05	7.61	4.1	9.22	197.4	108.3	NC	Too braided
M32C	In Situ Measure	Surface Water	7/25/2019	09:42	7.82	4.1	9.35	171.1	107.3	1.924	Flow Tracker
M32D	In Situ Measure	Surface Water	7/25/2019	10:37	7.76	3.4	9.24	202.3	119.7	NC	Too braided
M29	In Situ Measure	Surface Water	6/18/2019	11:58	7.22	5.0	10	137.6	35	NC	Dangerous high flow conditions

NC = Not collected

Field-Measured Water Quality Parameters - Low Flow

STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	pH	Temp.	Dissolved Oxygen	Conductivity	ORP	Flow	Flow Measurement
					Stand. Unit	°C	mg/L	µS/cm	mV	cfs	Equipment
NS7_1_DM	In Situ Measure	Surface Water	9/24/2019	09:49	6.79	8.0	7.86	881.0	19.5	0.3592	2" Cutthroat Flume
NS7_2_DM	In Situ Measure	Surface Water	9/24/2019	16:19	7.38	8.1	8.78	781.0	-39.1	0.197	Bag fill/flume
NS7_3_DM	In Situ Measure	Surface Water	9/24/2019	09:18	7.53	8.4	8.44	873.0	-32.8	0.0918	2" Cutthroat Flume
NS7_4_DM	In Situ Measure	Surface Water	9/24/2019	09:03	7.19	7.4	8.60	821.0	-15.7	0.3921	2" Cutthroat Flume
NM-SW-OPP-01	In Situ Measure	Surface Water	9/24/2019	16:42	6.97	9.5	7.75	791.0	119.7	0.0145	Bag fill/flume
M32	In Situ Measure	Surface Water	9/24/2019	12:45	6.31	9.2	7.86	415.8	121.4	27.7588	Flow Tracker
M33	In Situ Measure	Surface Water	9/24/2019	11:40	6.50	8.1	8.42	421.6	105.2	18.9757	Flow Tracker
M32C	In Situ Measure	Surface Water	9/24/2019	11:57	7.57	4.1	8.57	251.9	-102.8	0.01	Bag fill/flume
M32D	In Situ Measure	Surface Water	9/24/2019	12:44	7.50	3.3	9.80	265.1	-101.3	0.0871	Bag fill/flume
M29	In Situ Measure	Surface Water	9/24/2019	14:25	3.55	15.8	4.2	437.8	407.8	0.01245	Bag fill/flume

NC = Not collected

North Star Mine - 2019 Data Summary

Sediment																											
STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
M32	Total Recoverable Metals	Sediment	9/24/2019	12:45	8760 D	0.354 JD	22.5 D	140 D	0.683 JD	0.621 D	2290 D	3.5 D	12.9 D	74.6 D	40000 D	163 D	4060 D	741 D	0.05 D	5.25 D	528 D	0.542 JD	0.479 D	158 JD	0.476 U	16.1 D	299 D
M33	Total Recoverable Metals	Sediment	9/24/2019	23:40	8170 D	1.02 D	36.4 D	89.1 D	0.626 JD	0.904 D	2370 D	3.4 D	13.6 D	79.3 D	39100 D	801 D	3920 D	1010 D	0.03 JD	5.04 D	655 D	0.52 JD	1.01 D	146 JD	0.488 U	16.6 D	338 D

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

J = Laboratory quality control review indicates that this result is considered estimated

D = Sample diluted prior to analysis; reported result is for undiluted sample

Surface Soil																											
STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
NS01	Total Recoverable Metals	Soil	07/25/2019	10:57	2470 D	473 D	449	220 D	0.498 U	6.15 D	754 D	5.07 D	1.63 D	260 D	25500 D	9920 D	1100 D	153 D	1.91 D	1.34 D	1410 D	3.52 JD	82.3 D	137 JD	1.38 JD	11.8 D	1330 D
NS02	Total Recoverable Metals	Soil	07/25/2019	11:21	2310 D	38.3 D	301	201 D	0.496 U	2.56 D	542 D	1.33 JD	1.91 D	214 D	44700 D	4740 D	1140 D	397 D	0.53 D	1.19 D	2710 D	8.59 JD	24.4 D	207 JD	1.18 JD	45.9 D	696 D
NS03	Total Recoverable Metals	Soil	07/25/2019	11:38	3580 D	48.7 D	210	243 D	0.613 JD	2.95 D	1360 D	1.66 JD	8.41 D	284 D	58800 D	3340 D	1570 D	2900 D	0.24 D	2.8 D	4610 D	4.36 JD	37.3 D	366 JD	1.74 JD	17.7 D	605 D
NS04	Total Recoverable Metals	Soil	07/25/2019	11:52	2400 D	178 D	480	193 D	0.482 U	10.8 D	446 D	1.12 JD	1.37 D	333 D	34700 D	9600 D	812 D	207 D	0.36 D	1.13 D	2340 D	5.44 JD	89.1 D	120 U	1.24 JD	9.3 D	2090 D
NS05	Total Recoverable Metals	Soil	07/25/2019	12:18	1110 D	91.2 D	156	184 D	0.477 U	3.31 D	227 D	1.01 JD	1.2 D	112 D	14900 D	3690 D	379 D	174 D	0.75 D	0.953 JD	983 D	1.96 JD	42.5 D	119 U	0.955 U	4.02 D	660 D
North Star Level 4	Total Recoverable Metals	Soil	9/24/2019	12:19	1510 D	98.3 D	225	236 D	0.994 U	3.36 D	154 JD	1.21 JD	0.825 D	198 D	27700 D	4430 D	485 D	107 D	1.27 JD	0.84 JD	1570 D	4.9 D	58.5 D	248 U	1.86 JD	7.03 D	775 D

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

J = Laboratory quality control review indicates that this result is considered estimated

D = Sample diluted prior to analysis; reported result is for undiluted sample

IVBA and Corresponding Soil Sample TRM Analytical Results										
STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Arsenic	Arsenic	Arsenic	Lead	Lead	Lead
					mg/kg	% IVBA	% RBA	mg/kg	% IVBA	% RBA
NS01	Combined IVBA	Soil	07/25/2019	10:57	12.2	0.5	20	4900	18.2	13
NS02	Combined IVBA	Soil	07/25/2019	11:21	5.61	2.7	21	392	49.4	41
NS03	Combined IVBA	Soil	07/25/2019	11:38	11.7	1.9	21	45.9	8.3	4
NS04	Combined IVBA	Soil	07/25/2019	11:52	9.76	5.6	23	1200	1.4	2.0 U
NS05	Combined IVBA	Soil	07/25/2019	12:18	7.55	2	21	2850	12.5	8
North Star Level 4	Combined IVBA	Soil	9/24/2019	12:19	1.07	4.8	23	804	77.2	65

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

Soil Synthetic Precipitation Leaching Procedure Soil Leachate Sample Results																									
STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	
					ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	
NS01	SPLP	Soil	07/25/2019	10:57	240 B	30 U	2.4	145	0.18 B	11.7	7200	0.5 B	10 U	110	40 B	8330	1200	380	8 U	0.1 B	1.4	0.2 B	5 U	2030	
NS02	SPLP	Soil	07/25/2019	11:21	480	30 U	1.2	84	0.43	5.59	6500	0.5 U	10 U	190	200	810	1100	2400	8 U	1	0.1 U	0.1 B	5 U	950	
NS03	SPLP	Soil	07/25/2019	11:38	230 B	30 U	0.3 B	31 B	0.25 B	2.38	5100	0.5 U	10 U	20 B	30 U	30 U	600 B	560	8 U	0.2 B	0.1 U	0.1 U	5 U	1030	
NS04	SPLP	Soil	07/25/2019	11:52	180 B	30 U	0.5 B	106	0.15 B	1.06	1700	0.5 U	10 U	40 B	30 U	380	300 B	250	8 U	0.2 B	0.6	0.1 B	5 U	180	
NS05	SPLP	Soil	07/25/2019	12:18	140 B	30 U	0.8 B	142	0.11 B	2.34	1300	0.5 U	10 U	50	30 U	1860	200 B	190	8 U	0.4	0.1 U	0.1 U	5 U	400	
North Star Level 4	SPLP	Soil	9/24/2019	12:19	80 B	30 U	0.5 B	153	0.13 B	1.81	1500	0.5 U	10 U	60	30 U	5050	200 U	130	8 U	0.5	0.4 B	0.1 U	5 U	340	

B = Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity (same as a CLP laboratory J qualifier).

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

Acid-base Accounting and Paste pH																	
STATION_ID	ANALYSIS	MATRIX	SAMPLE DATE	SAMPLE TIME	Acid Generation Potential (calc on Sulfur total)	Acid Neutralization Potential (calc)	Acid-Base Potential (calc on Sulfur total)	Neutralization Potential as CaCO3	pH, Saturated Paste	Sulfur HCl Residue	Sulfur HNO3 Residue	Sulfur Organic Residual	Sulfur Pyritic Sulfide	Sulfur Sulfate	Sulfur Total	Total Sulfur minus Sulfate	
					t CaCO3/Kt	t CaCO3/Kt	t CaCO3/Kt	%	standard units	%	%	%	%	%	%	%	
NS01	ABA Paste pH	Soil	07/25/2019	10:57	14.7	0	-14.7	0.1 U	4.7	0.2	0.02 B	0.02 B	0.18	0.27	0.47	0.2	
NS02	ABA Paste pH	Soil	07/25/2019	11:21	22.5	0	-22.5	0.1 U	4.2	0.32	0.01 U	0.01 U	0.32	0.4	0.72	0.32	
NS03	ABA Paste pH	Soil	07/25/2019	11:38	24.7	4	-20.7	0.4 B	5.3	0.42	0.01 B	0.01 B	0.41	0.37	0.79	0.42	
NS04	ABA Paste pH	Soil	07/25/2019	11:52	21.6	1	-20.6	0.1 B	4.5	0.32	0.01 U	0.01 U	0.32	0.37	0.69	0.32	
NS05	ABA Paste pH	Soil	07/25/2019	12:18	15.9	0	-15.9	0.1 U	4.7	0.3	0.02 B	0.02 B	0.28	0.21	0.51	0.3	
North Star Level 4	ABA Paste pH	Soil	9/24/2019	12:19	14.4	0	-14.4	0.1 U	4.7	0.23	0.03 B	0.03 B	0.2	0.23	0.46	0.23	

B = Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity (same as a CLP laboratory J qualifier).

U = Laboratory analysis indicates that the analyte was undetected at the concentration shown

Figure 3

North Star Mine July and September 2019 U.S. EPA Region 8 Surface Water Analytical Results Dissolved Metals

 Surface Water Sample Locations
 Dissolved Metals: units = µg/L
 Total Recoverable Aluminum: units = µg/L
 Flow: units = cfs
 pH: units = standard units
 Hardness: units = mg of CaCO₃/L

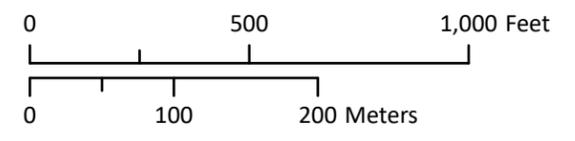
 Minor Streams
 Major Streams

*RED color indicates an exceedance to a Chronic Water Quality Standard.
 RED BOLD color indicates an exceedance to both an Acute and Chronic Water Quality Standard.

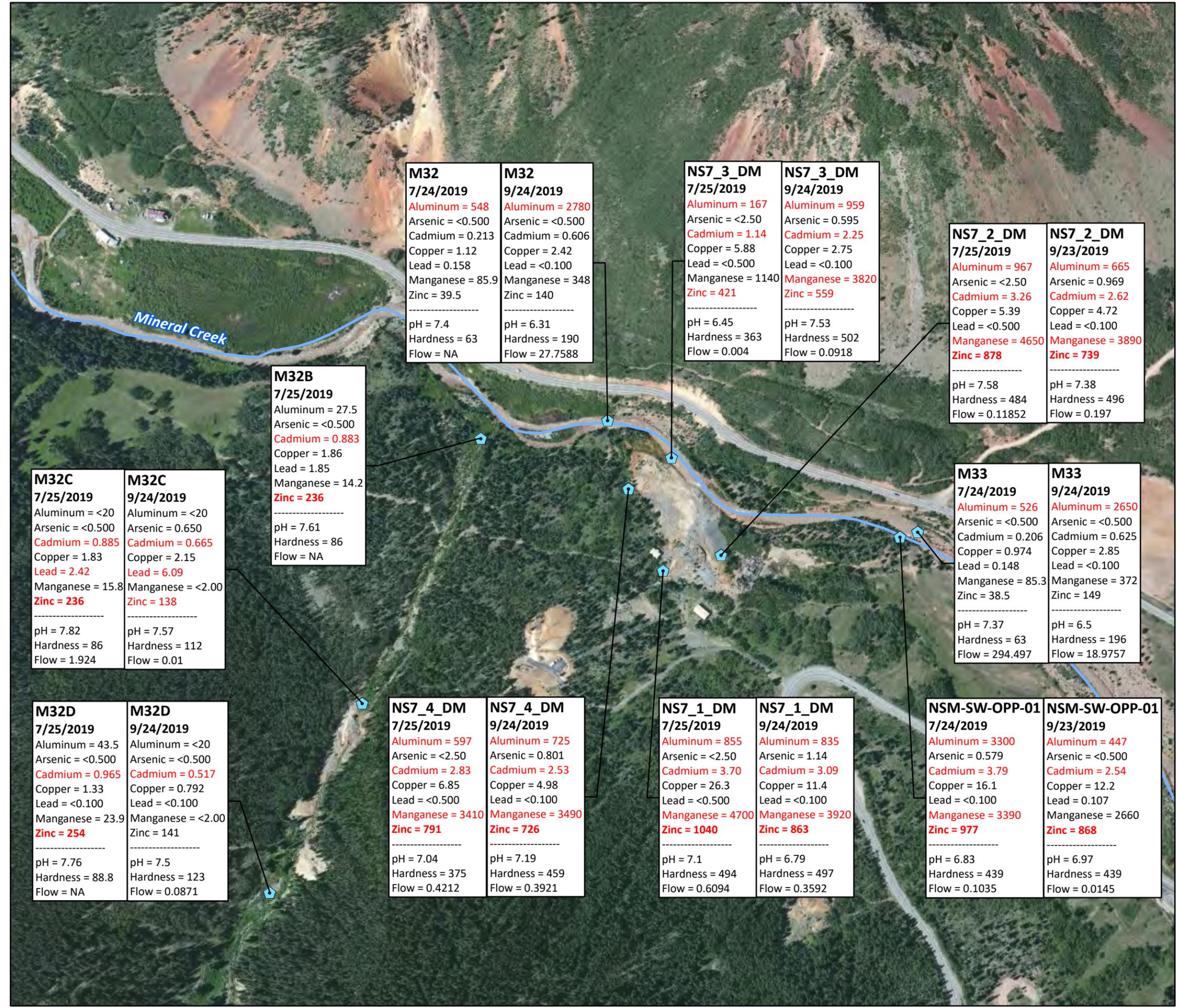
Date: January 23, 2020

Map Projection: UTM Zone 13N, WGS84, Meters

Data Sources:
 Rivers & Creeks: CDOW (2004);
 Sample Locations & Analytical Results: U.S. EPA (2019);
 Base Map: Esri World Imagery (Clarity) Web Service (2020).



Area Enlarged



M32 7/24/2019 Aluminum = 548 Arsenic = <0.500 Cadmium = 0.213 Copper = 1.12 Lead = 0.158 Manganese = 85.9 Zinc = 39.5 ----- pH = 7.4 Hardness = 63 Flow = NA	M32 9/24/2019 Aluminum = 2780 Arsenic = <0.500 Cadmium = 0.606 Copper = 2.42 Lead = <0.100 Manganese = 348 Zinc = 140 ----- pH = 6.31 Hardness = 190 Flow = 27.7588
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NS7_3_DM 7/25/2019 Aluminum = 167 Arsenic = <2.50 Cadmium = 1.14 Copper = 5.88 Lead = <0.500 Manganese = 1140 Zinc = 421 ----- pH = 6.45 Hardness = 363 Flow = 0.004	NS7_3_DM 9/24/2019 Aluminum = 959 Arsenic = 0.595 Cadmium = 2.25 Copper = 2.75 Lead = <0.100 Manganese = 3820 Zinc = 559 ----- pH = 7.53 Hardness = 502 Flow = 0.0918
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NS7_2_DM 7/25/2019 Aluminum = 967 Arsenic = <2.50 Cadmium = 3.26 Copper = 5.39 Lead = <0.500 Manganese = 4650 Zinc = 878 ----- pH = 7.58 Hardness = 484 Flow = 0.11852	NS7_2_DM 9/23/2019 Aluminum = 665 Arsenic = 0.969 Cadmium = 2.62 Copper = 4.72 Lead = <0.100 Manganese = 3890 Zinc = 739 ----- pH = 7.38 Hardness = 496 Flow = 0.197
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M33 7/24/2019 Aluminum = 526 Arsenic = <0.500 Cadmium = 0.206 Copper = 0.974 Lead = 0.148 Manganese = 85.3 Zinc = 38.5 ----- pH = 7.37 Hardness = 63 Flow = 294.497	M33 9/24/2019 Aluminum = 2650 Arsenic = <0.500 Cadmium = 0.625 Copper = 2.85 Lead = <0.100 Manganese = 372 Zinc = 149 ----- pH = 6.5 Hardness = 196 Flow = 18.9757
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M32C 7/25/2019 Aluminum = <20 Arsenic = <0.500 Cadmium = 0.885 Copper = 1.83 Lead = 2.42 Manganese = 15.8 Zinc = 236 ----- pH = 7.82 Hardness = 86 Flow = 1.924	M32C 9/24/2019 Aluminum = <20 Arsenic = 0.650 Cadmium = 0.665 Copper = 2.15 Lead = 6.09 Manganese = <2.00 Zinc = 138 ----- pH = 7.57 Hardness = 112 Flow = 0.01
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M32B 7/25/2019 Aluminum = 27.5 Arsenic = <0.500 Cadmium = 0.883 Copper = 1.86 Lead = 1.85 Manganese = 14.2 Zinc = 236 ----- pH = 7.61 Hardness = 86 Flow = NA

M32D 7/25/2019 Aluminum = 43.5 Arsenic = <0.500 Cadmium = 0.965 Copper = 1.33 Lead = <0.100 Manganese = 23.9 Zinc = 254 ----- pH = 7.76 Hardness = 88.8 Flow = NA	M32D 9/24/2019 Aluminum = <20 Arsenic = <0.500 Cadmium = 0.517 Copper = 0.792 Lead = <0.100 Manganese = <2.00 Zinc = 141 ----- pH = 7.5 Hardness = 123 Flow = 0.0871
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NS7_4_DM 7/25/2019 Aluminum = 597 Arsenic = <2.50 Cadmium = 2.83 Copper = 6.85 Lead = <0.500 Manganese = 3410 Zinc = 791 ----- pH = 7.04 Hardness = 375 Flow = 0.4212	NS7_4_DM 9/24/2019 Aluminum = 725 Arsenic = 0.801 Cadmium = 2.53 Copper = 4.98 Lead = <0.100 Manganese = 3490 Zinc = 726 ----- pH = 7.19 Hardness = 459 Flow = 0.3921
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NS7_1_DM 7/25/2019 Aluminum = 855 Arsenic = <2.50 Cadmium = 3.70 Copper = 26.3 Lead = <0.500 Manganese = 4700 Zinc = 1040 ----- pH = 7.1 Hardness = 494 Flow = 0.6094	NS7_1_DM 9/24/2019 Aluminum = 835 Arsenic = 1.14 Cadmium = 3.09 Copper = 11.4 Lead = <0.100 Manganese = 3920 Zinc = 863 ----- pH = 6.79 Hardness = 497 Flow = 0.3592
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NSM-SW-OPP-01 7/24/2019 Aluminum = 3300 Arsenic = 0.579 Cadmium = 3.79 Copper = 16.1 Lead = <0.100 Manganese = 3390 Zinc = 977 ----- pH = 6.83 Hardness = 439 Flow = 0.1035	NSM-SW-OPP-01 9/23/2019 Aluminum = 447 Arsenic = <0.500 Cadmium = 2.54 Copper = 12.2 Lead = 0.107 Manganese = 2660 Zinc = 868 ----- pH = 6.97 Hardness = 439 Flow = 0.0145
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Figure 4

North Star Mine July/September 2019 U.S. EPA Region 8 Composite Soil Analytical Results Total Recoverable Metals

 Composite Soil Sample Locations
 Analytical Results presented in mg/kg dry weight

 Minor Streams

 Major Streams

*RED color indicates an exceedance of EPA
 Human Health Regional Soil Screening Levels (RSLs).

	Arsenic	Copper	Lead	Manganese	Zinc
Residential	0.68	3100	400	1800	23,000
Industrial	3.0	47,000	800	26,000	350,000

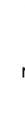
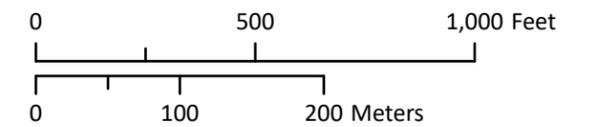
Regional screening Levels for Residential and Industrial are in mg/kg dry weight.

Date: January 28, 2020

Map Projection: UTM Zone 13N, WGS84, Meters

Data Sources:

Rivers & Creeks: CDOW (2004);
 Sample Locations & Analytical Results: U.S. EPA (2019);
 Base Map: Esri World Imagery (Clarity) Web Service (2020).



Area Enlarged

