

Appendix B: Summary of Water Quality and Groundwater Monitoring Sites and Water Quality Monitoring Parameters, Butte Highlands Mine

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Table B-1. Butte Highlands Mine Proposed and Agency-Mitigated Water Quality Monitoring.

Surface Water ¹			
Monitoring Site	Parameter Suite	Monitoring Frequency Proposed Action	Monitoring Frequency Agency-Mitigated Alternative
WS – 1 ²	See Table B3	Monthly	Monthly
WS – 2	See Table B3	Monthly	none
WS – 3	See Table B3	None	Monthly
WS – 4	See Table B3	none	none
WS – 5	See Table B3	Monthly	Monthly
WS – 6 ³	See Table B3	Monthly	Monthly
WS – 7	See Table B3	Monthly	Monthly
WS - 8	See Table B3	monthly	Monthly
WS - 9	See Table B3	None	Monthly
WS - E	See Table B3	none	none
WS – 10 ⁴	Stream Flow		monthly
WS – 11 ⁵	Steam Flow		monthly
WS – 12 ⁵	Stream Flow		monthly
MPDES Outfalls			
001	See Table B4	See Table B-8	
002	See Table B5	See Table B-8	
003	See Table B6	See Table B-8	
004	See Table B7	See Table B-8	
005	See Table B6	See Table B-8	
006	See Table B6	See Table B-8	
Emerald Lake Aqueduct - Fish Creek Flow Augmentation Outfall			
007	Discharge	Monthly	Flow monthly
Wetland Piezometers			
W12-D	Static Water Level	Not Specified	Quarterly
W12-S	Static Water Level	Not Specified	Quarterly
W3-D	Static Water Level	Not Specified	Quarterly
W3-S	Static Water Level	Not Specified	Quarterly
W1-D	Static Water Level	Not Specified	Quarterly
W1-S	Static Water Level	Not Specified	Quarterly
W2-S	Static Water Level	Not Specified	Quarterly
W2-D	Static Water Level	Not Specified	Quarterly
W2-AD	Static Water Level	Not Specified	Quarterly
W2-BS	Static Water Level	Not Specified	Quarterly

¹ Metals analysis for surface water samples will be for total recoverable concentrations except for aluminum which will be for dissolved concentrations

² WS-1 will be monitored for both total recoverable and dissolved metal concentrations

³ WS-6 would be monitored quarterly until LAD system is in operation, than monthly sampling

⁴ Proposed Basin Creek Flume Site

⁵ Proposed Fish Creek Flume Site

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Table B-2. Butte Highlands Mine Proposed and Agency-Mitigated Water Quality Monitoring.

Groundwater			
Monitoring Site	Parameter Suite	Monitoring Frequency (Proposed Action)	Monitoring Frequency (Agency-Mitigated Alternative)
LADMW -1	See Table B3	Quarterly	Quarterly
LADMW -2	See Table B3	Quarterly	Quarterly
LADMW-3	See Table B3	Quarterly	Quarterly if LAD 3 site is developed
MW-15-001 ⁶	Static Water Level	None	Monthly
MW-15-002 ⁷	Static Water Level	None	Monthly
MW15-003 ⁸	Static Water Level	None	Monthly
DWW10-01 ⁹	None	None	None
DWW13-01 ⁹	None	None	None
Mine Supply Well ¹⁰	See Table B3	None	Quarterly
BHMW09-04 ¹¹	Static Water Level	Quarterly	Quarterly
BHMW09-05 ¹¹	Static Water Level	Quarterly	Quarterly
BHMW08-01 ¹¹	Static Water Level	Quarterly	Quarterly
BHMW13-02	Static Water Level	None	Monthly
BHMW09-01 ¹¹	Static Water Level	Quarterly	Quarterly
BHMW09-02 ¹¹	Static Water Level	Quarterly	Quarterly
BHMW13-01	Static Water Level	None	Monthly

⁶ Proposed monitoring well Fish Creek, between WS-11 and WS-12

⁷ Proposed monitoring well adjacent to proposed fish creek augmentation outfall

⁸ Proposed monitoring well Moose Creek Basin, above LAD 1

⁹ Dewatering wells

¹⁰ Mine supply well is not part of the water quality monitoring program

¹¹ Utilizing transducers to collect daily water level readings which are downloaded on a monthly basis

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Table B-3. Butte Highlands Surface and Groundwater Monitoring Analytical Parameters

Parameter	Reporting Value	Units
Surface Water Metals		
Aluminum	0.009	mg/L
Antimony	0.003	mg/L
Arsenic	0.001	mg/L
Barium	0.005	mg/L
Boron	0.001	mg/L
Cadmium	---	mg/L
Chromium	0.00008	mg/L
Cobalt	0.001	mg/L
Copper	0.002	mg/L
Iron	0.02	mg/L
Lead	0.0005	mg/L
Manganese	0.009	mg/L
Mercury	0.001	mg/L
Molybdenum	---	mg/L
Nickel	0.01	mg/L
Platinum	---	mg/L
Selenium	0.001	mg/L
Silver	0.0005	mg/L
Strontium	---	mg/L
Thallium	0.0002	mg/L
Tin	---	mg/L
Titanium	---	mg/L
Uranium	0.002	mg/L
Vanadium	---	mg/L
Zinc	0.01	mg/L
Common Ions and Other Parameters		
Total Alkalinity	0.1	mg/L
Nitrate + Nitrite	0.01	mg/L
Sodium	0.1	mg/L
Sulfate	1	mg/L
Total Dissolved Solids	1	mg/L
pH	0.001	S.U.
Conductivity	0.1	µS/cm
Groundwater Metals		
Aluminum	0.009	mg/L
Arsenic	0.001	mg/L
Copper	0.002	mg/L
Iron	0.02	mg/L
Manganese	0.005	mg/L
Mercury	0.000005	mg/L
Uranium	0.0002	mg/L
Parameters	Reporting Value	Units
Lab & Field pH (s.u.)	0.1	S.U.
Lab & Field EC (µmhos/cm)	0.1	µmhos/cm
Field Temperature	0.1	° C
Lab and Field Turbidity	1	N.T.U.
Field Dissolved Oxygen	0.05	mg/L
Flow Rate (surface water only)	1	gpm
Water Level (groundwater only)	0.1	feet

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Parameter	Reporting Value	Units
TSS	---	mg/l
TDS	---	mg/l
Alkalinity, total	---	mg/l CaCO ₃
Bicarbonate	---	mg/l CaCO ₃
Carbonate	---	mg/l CaCO ₃
Chloride	---	mg/l
Sulfate	---	mg/l
Fluoride	0.1	mg/l
Hardness	---	mg/l CaCO ₃
Ammonia, as N	0.05	mg/l
Total Kjeldahl Nitrogen	---	mg/l
Nitrate+Nitrite, as N	0.01	mg/l
Nitrate, as N	0.01	mg/l
Nitrite, as N	0.01	mg/l
Orthophosphate	---	mg/l
Phosphorus, total	0.001	mg/l
Calcium	---	mg/l
Magnesium	---	mg/l
Potassium	---	mg/l)
Sodium	---	mg/l

Notes:

s.u. = standard units of pH;

C = degrees Celsius;

EC = electrical conductivity;

µmhos/cm = micromhos per centimeter;

NTU = nephelometric turbidity units;

DO = dissolved oxygen;

mg/l = milligrams per liter;

TSS = total suspended solids;

TDS = total dissolved solids;

CaCO₃ = calcium carbonate;

N = nitrogen.

Standards from Circular DEQ-7: Montana Numeric Water Quality Standard;

--- no standard or reporting limit.

MT aquatic life standards apply to total recoverable metals in surface water (except for aluminum).

Human health standards apply to dissolved metals in groundwater and to total recoverable metals in surface water.

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Table B-4. Numeric Discharge Limitations: Outfall 001 ¹

Parameter and Code	Units	Average Monthly	Daily Maximum
Ammonia, Total (as N) (00610)	mg/L	0.011 ²	0.021 ²
Arsenic, Total Recoverable (00978)	µg/L	5.0	10.0
Cadmium, Total Recoverable (01113)	µg/L	0.02 ³	0.05
Chromium, Total Recoverable (01118)	µg/L	0.29 ⁴	0.59 ⁴
Copper, Total Recoverable (01119)	µg/L	1.1 ⁵	2.1
Fluoride (00951)	µg/L	65 ⁶	131 ⁶
Lead, Total Recoverable (01114)	µg/L	0.12 ⁷	0.25 ⁷
Mercury, Total Recoverable (71901)	µg/L	0.006	0.012
Nickel, Total Recoverable (01074)	µg/L	0.13 ⁸	0.26 ⁸
Nitrite +Nitrate (as N) (00630)	mg/L	0.11	0.23
Nitrogen, Total (as N) (00600)	mg/L	0.18	--
pH (00400)	S.U.	7.6	8.3
Phosphorus, Total (as P) (00665)	mg/L	0.012	--
Selenium, Total Recoverable (00981)	µg/L	0.17 ⁹	0.34 ⁹
Total Suspended Solids (TSS) (00530)	mg/L	3.0	6.1
Zinc, Total Recoverable (01094)	µg/L	2.0 ¹⁰	4.1 ¹⁰

Footnotes:

1. See Definitions section at end of permit for explanation of terms.
2. The permittee will be in compliance with the applicable effluent limitation if ammonia does not exceed the RRV of 0.07 mg/L.
3. The permittee will be in compliance with the applicable effluent limitation if cadmium does not exceed the RRV of 0.03 µg/L.
4. The permittee will be in compliance with the applicable effluent limitation if chromium does not exceed the RRV of 10 µg/L.
5. The permittee will be in compliance with the applicable effluent limitation if copper does not exceed the RRV of 2 µg/L.
6. The permittee will be in compliance with the applicable effluent limitation if fluoride does not exceed the RRV of 200 µg/L.
7. The permittee will be in compliance with the applicable effluent limitation if lead does not exceed the RRV of 0.3 µg/L.
8. The permittee will be in compliance with the applicable effluent limitation if nickel does not exceed the RRV of µ2 g/L.
9. The permittee will be in compliance with the applicable effluent limitation if selenium does not exceed the RRV of 1µg/L.

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Table B-5. Numeric Discharge Limitations: Outfall 002 ¹

Parameter and Code	Units	Average Monthly	Daily Maximum
Cadmium, Total Recoverable (01113)	µg/L	0.02 ²	0.03
Copper, Total Recoverable (01119)	µg/L	0.4 ³	0.7 ³
Lead, Total Recoverable (01114)	µg/L	0.1 ⁴	0.1 ⁴
Mercury, Total Recoverable (71901)	µg/L	0.006	0.012
Nitrogen, Total (as N) (00600)	mg/L	0.08	--
pH (00400)	S.U.	7	8.5
Phosphorus, Total (asP) (00665)	mg/L	0.02	--
Selenium, Total Recoverable (00981)	µg/L	0.61 ³	1.23
Total Suspended Solids (TSS) (00530)	mg/L	0.4	0.9
Zinc, Total Recoverable (01094)	µg/L	4.6 ⁶	9.2
Footnotes:			
1. See Definitions section at end of permit for explanation of terms.			
2. The permittee will be in compliance with the applicable effluent limitation if cadmium does not exceed the RRV of 0.03 µg/L.			
3. The permittee will be in compliance with the applicable effluent limitation if copper does not exceed the RRV of 2 µg/L.			
4. The permittee will be in compliance with the applicable effluent limitation if lead does not exceed the RRV of 0.3 µg/L.			
5. The permittee will be in compliance with the applicable effluent limitation if selenium does not exceed the RRV of 1 µg/L.			

Table B-6. Numeric Discharge Limitations: Outfall 003, 005, 006 ¹

Parameter and Code	Units	Average Monthly	Daily Maximum
Arsenic, Total Recoverable (00978)	µg/L	2.0	3.9
Cadmium, Total Recoverable (01113)	µg/L	0.06	0.11
Copper, Total Recoverable (01119)	µg/L	2.1	4.3
Lead, Total Recoverable (01114)	µg/L	1	2
Mercury, Total Recoverable (71901)	µg/L	0.006	0.012
Nitrogen, Total (as N) (00600)	mg/L	0.27	--
pH (00400)	S.U.	7	8.5
Phosphorus, Total (as P) (00665)	mg/L	0.008	--
Selenium, Total Recoverable (00981)	µg/L	0.61 ²	1.23
Total Suspended Solids (TSS) (00530)	mg/L	1.0	2.0
Zinc, Total Recoverable (01094)	µg/L	27.6	55.5
Footnotes:			
1. See Definitions section at end of permit for explanation of terms.			
2. The permittee will be in compliance with the applicable effluent limitation if selenium does not exceed the RRV of 1 µg/L.			

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Table B-7. Numeric Discharge Limitations: Outfall 004¹

Parameter and Code	Units	Average Monthly	Daily Maximum
Arsenic, Total Recoverable (00978)	µg/L	3.0	6.1
Cadmium, Total Recoverable (01113)	µg/L	0.04	0.08
Copper, Total Recoverable (01119)	µg/L	1.42	2.8
Lead, Total Recoverable (01114)	µg/L	0.5	1.0
Mercury, Total Recoverable (71901)	µg/L	0.006	0.012
Nitrogen, Total (as N) (00600)	mg/L	0.14	--
pH (00400)	S.U.	7	8.5
Phosphorus, Total (as P) (00665)	mg/L	0.012	--
Selenium, Total Recoverable (00981)	µg/L	0.61 ³	1.23
Total Suspended Solids (TSS) (00530)	mg/L	1.5	3.0
Zinc, Total Recoverable (01094)	µg/L	14.7	29.5
Footnotes:			
1. See Definitions section at end of permit for explanation of terms.			
2. The permittee will be in compliance with the applicable effluent limitation if copper does not exceed the RRV of 2 µg/L.			
3. The permittee will be in compliance with the applicable effluent limitation if selenium does not exceed the RRV of 1 µg/L.			

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Table B-8. Monitoring Requirements - Monitoring Location 001-006

Parameter and Code	Units	Monitoring Frequency	Sample Type	Basis
pH, maximum	S.U	Weekly	Instantaneous	Effluent Limitation
pH, minimum	S.U.	Weekly	Instantaneous	Effluent Limitation
Temperature	° C	Weekly	Instantaneous	Monitor
Flow Rate		Continuous	Recorded	ARM17.30.1351
Ammonia, Total (as N)	mg/L	Weekly	Grab	Effluent Limitation
Arsenic, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Cadmium, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Chromium, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Copper, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Fluoride (00951)	µg/L	Weekly	Grab	Effluent Limitation
Hardness, Total (as CaCO ₃)	mg/L	Quarterly	Grab	Monitor
Lead, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Mercury, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Nickel, Total Recoverable	µg/L	Weekly	Grab	Effluent Limitation
Total Kjeldahl Nitrogen (00625)	mg/L	Weekly	Grab	Monitor (part of Eff. Limit)
Nitrite-Nitrate (as N) (00630)	mg/L	Weekly	Grab	Effluent Limitation
Nitrogen, Total (as Ni) (00600)	mg/L	Weekly	Calculate	Effluent Limitation
	lbs/day	
Phosphorus, Total (asP) (00665)	mg/L	Weekly	Grab	Effluent Limitation
	lbs/day	
Oil & Grease-Total Recoverable (00552)	mg/L	Quarterly	Grab	Monitor
Selenium, Total Recoverable (00981)	µg/L	Weekly	Grab	Effluent Limitation

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Parameter and Code	Units	Monitoring Frequency	Sample Type	Basis
Sulfate, Total (as SO ₄) (00945)	mg/L	Quarterly	Grab	Monitor
Total Suspended Solids (TSS) (00530)	mg/L	Weekly	Grab	Effluent Limitation
Zinc, Total Recoverable (01094)	µg/L	Weekly	Grab	Effluent Limitation

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