

APPENDIX B

SURFACE WATER AND GROUNDWATER FLOWS AND PREDICTED WATER QUALITY

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Table B-1a.
Most Probable Case Predictions for Dissolved Copper Concentrations in Groundwater
Idaho Cobalt FEIS

Alternative	Project Phase ⁽¹⁾	Bucktail Drainage ⁽²⁾					Big Flat Creek Drainage ⁽²⁾					TWSF Area		
		Immediate Ram Mine Vicinity		Immediate Sunshine Mine Vicinity		Upper Bucktail Alluvium ⁽³⁾	LAT Area		Copper Concentration mg/L		Groundwater Quality Standard Met?	Copper Concentration mg/L		Groundwater Quality Standard Met?
		Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Copper Concentration mg/L	Groundwater Quality Standard Met?	Groundwater Quality Standard Met?
Alt I - No Action														
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Closure (Year 23)-Day 13210	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Alt II - FCC Proposal														
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.090	Yes	2.652	No	1.84	No	Not Applicable	Not Applicable	0.0027	Yes	Yes	0.0029	Yes	Yes
Closure (Year 23)-Day 13210	0.065	Yes	0.077	Yes	1.50	No	Not Applicable	Not Applicable	0.0029	Yes	Yes	0.0029	Yes	Yes
Alt III - Perpetual Dewatering & LAT														
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Closure (Year 23)-Day 13210	0.036	Yes	0.016	Yes	1.50	No	0.033	Yes	0.003	Yes	Yes	0.003	Yes	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek														
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.0026	Yes	Yes	0.0028	Yes	Yes
Closure (Year 5)-Day 6636	0.043	Yes	0.337	Yes	1.54	No	Not Applicable	Not Applicable	0.0028	Yes	Yes	0.0028	Yes	Yes
Closure (Year 23)-Day 13210	0.044	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.0028	Yes	Yes	0.0028	Yes	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek														
Ram Operations (Pre BT-5)-Day 1521	0.036	Yes	0.016	Yes	7.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.003	Yes	Yes	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.0026	Yes	Yes	0.0028	Yes	Yes
Closure (Year 5)-Day 6636	0.043	Yes	0.337	Yes	1.54	No	Not Applicable	Not Applicable	0.0028	Yes	Yes	0.0028	Yes	Yes
Closure (Year 23)-Day 13210	0.044	Yes	0.016	Yes	1.50	No	Not Applicable	Not Applicable	0.0028	Yes	Yes	0.0028	Yes	Yes

Relative Impacts from IC-P-Derived Dissolved Copper

green = decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Creek; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Creek; Upper Bucktail Alluvium refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck.; LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by IC-P bedrock groundwater capture wells.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

Table B-1b.
Most Probable Case Predictions for Sulfate Concentrations in Groundwater
Idaho Cobalt FEIS

Jun-08
Big Flat Creek Drainage (2)
TWSF Area

		Immediate Ram Mine Vicinity				Bucktail Drainage (2)				Big Flat Creek Drainage (2)			
Alternative	Project Phase (1)	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Mean Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?	Sulfate Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	1.5	Yes	1.0	Yes	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes	1.0	Yes
	Closure (Year 5)-Day 6636	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes	1.0	Yes
	Closure (Year 23)-Day 13210	27	Yes	27	Yes	40	Yes	1.5	Yes	1.0	Yes	1.0	Yes
Alt II - FCC Proposal	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Closure (Year 5)-Day 6636	298	No	126	No	56	Yes	Not Applicable	Not Applicable	123	Yes	123	Yes
	Closure (Year 23)-Day 13210	51	Yes	25	Yes	43	Yes	Not Applicable	Not Applicable	92	Yes	92	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	283	No	1.0	Yes	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	237	Yes	1.0	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	76	Yes	1.0	Yes	1.0	Yes
	Closure (Year 5)-Day 6636	27	Yes	27	Yes	39.5	Yes	76	Yes	169	Yes	169	Yes
	Closure (Year 23)-Day 13210	27	Yes	27	Yes	39.5	Yes	76	Yes	52	Yes	52	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable	Not Applicable	169	Yes	169	Yes
	Closure (Year 5)-Day 6636	298	No	126	No	56	Yes	Not Applicable	Not Applicable	52	Yes	52	Yes
	Closure (Year 23)-Day 13210	52	Yes	25	Yes	43	Yes	Not Applicable	Not Applicable	52	Yes	52	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (Pre BT-5)-Day 1521	27	Yes	27	Yes	200	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Ram Operations-Day 1887	27	Yes	27	Yes	40	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Sunshine Operations-Day 4809	27	Yes	27	Yes	40	Yes	Not Applicable	Not Applicable	1.0	Yes	1.0	Yes
	Closure (Year 5)-Day 6636	298	No	126	No	56	Yes	Not Applicable	Not Applicable	169	Yes	169	Yes
	Closure (Year 23)-Day 13210	52	Yes	25	Yes	43	Yes	Not Applicable	Not Applicable	52	Yes	52	Yes

Relative Impacts from ICP-Derived Sulfate

green = decrease, no change, or negligible increase that is nonmeasurable (NM)

yellow = concentration increase; does not contribute to WQ standards exceedance

orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Sunshine workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to shallow and bedrock groundwater between TWSF and headwaters Big Flat Ck., LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells. Water quality exceedances based on Idaho secondary constituent standard of 250 mg/L for sulfate. On assumed 80% reduction from BMSG Phase II capture system. Water quality exceedances based on Upper Bucktail Alluvium based Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based

Table B-1c.
Most Probable Case Predictions for Dissolved Arsenic Concentrations in Groundwater
Idaho Cobalt FEIS

Alternative	Project Phase ⁽¹⁾	Bucktail Drainage ⁽³⁾						Big Flat Creek Drainage ⁽³⁾					
		Immediate Ram Mine Vicinity Groundwater Arsenic Concentration mg/L	Groundwater Arsenic Concentration mg/L	Quality Standard Met?	Immediate Sunshine Mine Vicinity Groundwater Arsenic Concentration mg/L	Groundwater Arsenic Concentration mg/L	Quality Standard Met?	Upper Bucktail Alluvium Groundwater Arsenic Concentration mg/L	Groundwater Arsenic Concentration mg/L	Quality Standard Met?	LAT Area Arsenic Concentration mg/L	Arsenic Concentration mg/L	TWSF Area Groundwater Quality Standard Met?
Alt I - No Action													
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	0.001	Yes	0.0009	Yes	0.0009	Yes	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes	0.0009	Yes	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes	0.0009	Yes	Yes
Closure (Year 5)-Day 6366	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes	0.0009	Yes	Yes
Closure (Year 23)-Day 13210	0.0038	Yes	0.069	No	0.0004	Yes	0.001	Yes	0.0009	Yes	0.0009	Yes	Yes
Alt II - FCC Proposal													
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable	Not Applicable	0.0009	Yes	0.0009	Yes	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable	Not Applicable	0.0009	Yes	0.0009	Yes	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable	Not Applicable	0.0011	Yes	0.0011	Yes	Yes
Closure (Year 5)-Day 6366	(2)		(2)		(2)		(2)		(2)		(2)		
Closure (Year 23)-Day 13210	(2)		(2)		(2)		(2)		(2)		(2)		
Alt III - Perpetual Dewatering & LAT													
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	<0.0015	Yes	0.0009	Yes	0.0009	Yes	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes	0.0009	Yes	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes	0.0009	Yes	Yes
Closure (Year 5)-Day 6366	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes	0.0009	Yes	Yes
Closure (Year 23)-Day 13210	0.0038	Yes	0.069	No	0.0004	Yes	<0.0015	Yes	0.0009	Yes	0.0009	Yes	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek													
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable	Not Applicable	0.0009	Yes	0.0009	Yes	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable	Not Applicable	0.0009	Yes	0.0009	Yes	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable	Not Applicable	0.0012	Yes	0.0012	Yes	Yes
Closure (Year 5)-Day 6366	(2)		(2)		(2)		(2)		(2)		(2)		
Closure (Year 23)-Day 13210	(2)		(2)		(2)		(2)		(2)		(2)		
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek													
Ram Operations (Pre BT-5)-Day 1521	0.0038	Yes	0.069	No	0.002	Yes	Not Applicable	Not Applicable	0.0009	Yes	0.0009	Yes	Yes
Ram Operations-Day 1887	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable	Not Applicable	0.0009	Yes	0.0009	Yes	Yes
Sunshine Operations-Day 4809	0.0038	Yes	0.069	No	0.0004	Yes	Not Applicable	Not Applicable	0.0012	Yes	0.0012	Yes	Yes
Closure (Year 5)-Day 6366	(2)		(2)		(2)		(2)		(2)		(2)		
Closure (Year 23)-Day 13210	(2)		(2)		(2)		(2)		(2)		(2)		

Relative Impacts from ICP-Derived Dissolved Arsenic

green = decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Arsenic concentrations for groundwater not available from Dynamic Systems Model. DSM results indicate mine water concentrations may exceed 100 parts per billion; however groundwater concentrations are expected to be significantly lower (below drinking water standard of 50 parts per billion) due to chemical attenuation.

(3) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Alluvium between Sunshine Mine Vicinity and Bucktail Alluvium. LAT Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 1521 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase II capture system.

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

Idaho Groundwater Quality Standard for Arsenic=0.05 mg/L.

Table B-1d.
Most Probable Case Predictions for Dissolved Cobalt Concentrations in Groundwater
Idaho Cobalt FEIS

		Bucktail Drainage ⁽²⁾						Big Flat Creek Drainage ⁽²⁾								
		Immediate Ram Mine Vicinity			Upper Bucktail Alluvium ⁽³⁾			LAT Area			Cobalt Concentration mg/L			Groundwater Quality Exceedance?		
Alternative	Project Phase ⁽¹⁾	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	Cobalt Concentration mg/L	Groundwater Quality Exceedance?	
Alt I - No Action	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	0.009	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Closure (Year 5)-Day 6636	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Closure (Year 23)-Day 13210	0.055	NA	0.19	NA	0.70	NA	0.009	NA	0.0016	NA	0.0016	NA	0.0016	NA	
Alt II - FCC Proposal	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Closure (Year 5)-Day 6636	0.126	NA	6.445	NA	1.55	NA	Not Applicable	0.00241	NA	0.00241	NA	0.00241	NA	0.00241	NA
	Closure (Year 23)-Day 13210	0.081	NA	0.330	NA	0.74	NA	Not Applicable	0.0026	NA	0.0026	NA	0.0026	NA	0.0026	NA
Alt III - Perpetual Dewatering & LAT	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	<0.03	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Closure (Year 5)-Day 6636	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA	0.0016	NA	0.0016	NA	
	Closure (Year 23)-Day 13210	0.055	NA	0.19	NA	0.70	NA	<0.03	NA	0.0016	NA	0.0016	NA	0.0016	NA	
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Closure (Year 5)-Day 6636	0.042	NA	0.955	NA	0.82	NA	Not Applicable	0.0058	NA	0.0058	NA	0.0058	NA	0.0058	NA
	Closure (Year 23)-Day 13210	0.042	NA	0.186	NA	0.72	NA	Not Applicable	0.0034	NA	0.0034	NA	0.0034	NA	0.0034	NA
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (Pre BT-5)-Day 1521	0.055	NA	0.19	NA	3.50	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Ram Operations-Day 1887	0.055	NA	0.19	NA	0.70	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Sunshine Operations-Day 4809	0.055	NA	0.19	NA	0.70	NA	Not Applicable	0.0016	NA	0.0016	NA	0.0016	NA	0.0016	NA
	Closure (Year 5)-Day 6636	0.042	NA	0.955	NA	0.82	NA	Not Applicable	0.0058	NA	0.0058	NA	0.0058	NA	0.0058	NA
	Closure (Year 23)-Day 13210	0.042	NA	0.186	NA	0.72	NA	Not Applicable	0.0034	NA	0.0034	NA	0.0034	NA	0.0034	NA

Relative Impacts from ICP-Derived Dissolved Cobalt

green = decrease, no change, or negligible increase that is nonmeasurable (NM)
yellow = concentration increase; does not contribute to WQ standards exceedance
orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells. Reduction from BMSG Phase II capture system. Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).

No Idaho Groundwater Quality Standard exists for Cobalt.

Table B-1e.
Most Probable Case Predictions for Dissolved Nickel Concentrations in Groundwater
Idaho Cobalt FEIS

Alternative	Project Phase ⁽¹⁾	Bucktail Drainage ⁽²⁾						Big Flat Creek Drainage ⁽²⁾					
		Immediate Ram Mine Vicinity		Bucktail Drainage ⁽²⁾		LAT Area		Big Flat Creek Drainage ⁽²⁾		TWSF Area			
Alt I - No Action	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	Nickel Concentration mg/L	Groundwater Quality Standard Met?	
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Ram Operations-Day 1887	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Closure (Year 5)-Day 6636	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Closure (Year 23)-Day 13210	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Alt II - FCC Proposal													
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Closure (Year 5)-Day 6636	0.0080	NA	0.293	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Closure (Year 23)-Day 13210	0.0050	NA	0.010	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Alt III - Perpetual Dewatering & LAT													
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Ram Operations-Day 1887	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Closure (Year 5)-Day 6636	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Closure (Year 23)-Day 13210	0.0025	NA	0.005	NA	0.0014	NA	0.0014	NA	0.0014	NA	0.0014	NA	
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek													
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Closure (Year 5)-Day 6636	0.0020	NA	0.040	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Closure (Year 23)-Day 13210	0.0020	NA	0.003	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek													
Ram Operations (Pre BT-5)-Day 1521	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Ram Operations-Day 1887	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Sunshine Operations-Day 4809	0.0025	NA	0.005	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Closure (Year 5)-Day 6636	0.0020	NA	0.040	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	
Closure (Year 23)-Day 13210	0.0020	NA	0.003	NA	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	

Relative Impacts from ICP-Derived Dissolved Nickel

green = decrease, no change, or negligible increase that is nonmeasurable (NM)

yellow = concentration increase; does not contribute to WQ standards exceedance

orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to shallow and bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; TWSF Area refers to shallow and bedrock groundwater between LAT and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.
Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
No Idaho Groundwater Quality Standard exists for Nickel.

Table B-1f.
Most Probable Case Predictions for Dissolved Zinc Concentrations in Groundwater
Idaho Cobalt FEIS

Alternative	Project Phase ⁽¹⁾	Bucktail Drainage ⁽²⁾				Big Flat Creek Drainage ⁽²⁾			
		Immediate Ram Mine Vicinity Zinc Concentration mg/L	Groundwater Quality Standard Met?	Immediate Sunshine Mine Vicinity Zinc Concentration mg/L	Groundwater Quality Standard Met?	LAT Area Zinc Concentration mg/L	Groundwater Quality Standard Met?	TWSF Area Zinc Concentration mg/L	Groundwater Quality Standard Met?
Alt I - No Action									
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Closure (Year 5)-Day 6636	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Closure (Year 23)-Day 13210	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Alt II - FCC Proposal									
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Closure (Year 5)-Day 6636	0.049	Yes	0.349	Yes	Not Applicable	0.0003	Yes		
Closure (Year 23)-Day 13210	0.045	Yes	0.026	Yes	Not Applicable	0.0001	Yes		
Alt III - Perpetual Dewatering & LAT									
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Closure (Year 5)-Day 6636	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Closure (Year 23)-Day 13210	0.024	Yes	0.023	Yes	0.015	Yes	0.019	Yes	
Alt IV - Comprehensive GW Capture & NPD&ES Big Deer Creek									
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Closure (Year 5)-Day 6636	0.040	Yes	0.098	Yes	Not Applicable	0.00053	Yes		
Closure (Year 23)-Day 13210	0.040	Yes	0.016	Yes	Not Applicable	0.00018	Yes		
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek									
Ram Operations (Pre BT-5)-Day 1521	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Ram Operations-Day 1887	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Sunshine Operations-Day 4809	0.024	Yes	0.023	Yes	Not Applicable	0.0000	Yes		
Closure (Year 5)-Day 6636	0.040	Yes	0.098	Yes	Not Applicable	0.00053	Yes		
Closure (Year 23)-Day 13210	0.040	Yes	0.016	Yes	Not Applicable	0.00018	Yes		

Relative Impacts from ICP-Derived Dissolved Zinc

green = decrease, no change, or negligible increase that is nonmeasurable (NM)

yellow = concentration increase; does not contribute to WQ standards exceedance

orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Ram workings and Bucktail Ck; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; LAT Area refers to shallow and bedrock groundwater between Sunshine and Big Flat Ck.

Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.
Concentrations below detection limit replaced with detection limit for calcuating background (No Action concentrations).
Water quality exceedances based on Idaho secondary constituent standard of 5.0 mg/L for zinc.

Table B-1g.

Most Probable Case Predictions for Dissolved Nitrate Concentrations in Groundwater
Idaho Cobalt FEIS

Jun-08

Alternative	Project Phase ⁽¹⁾	Bucktail Drainage ⁽²⁾						Big Flat Creek Drainage ⁽²⁾					
		Immediate Ram Mine Vicinity		Sunshine Mine Vicinity		LAT Area		Groundwater Quality Standard Met?		Groundwater Quality Standard Met?		TWSF Area	
		Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	Groundwater Quality Standard Met?	Nitrate Concentration mg/L	
Alt I - No Action													
Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Closure (Year 5)-Day 6636	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Closure (Year 23)-Day 13210	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Alt II - FCCC Proposal													
Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Closure (Year 5)-Day 6636	3.20	Yes	3.70	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Closure (Year 23)-Day 13210	0.40	Yes	0.54	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Alt III - Perpetual Dewatering & LAT													
Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Closure (Year 5)-Day 6636	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Closure (Year 23)-Day 13210	0.50	Yes	0.55	Yes	0.30	Yes	0.30	Yes	0.30	Yes	0.30	Yes	
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek													
Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Closure (Year 5)-Day 6636	3.20	Yes	3.70	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Closure (Year 23)-Day 13210	0.40	Yes	0.54	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek													
Ram Operations (Pre BT-5)-Day 1521	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Ram Operations-Day 1887	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Sunshine Operations-Day 4809	0.50	Yes	0.55	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Closure (Year 5)-Day 6636	3.20	Yes	3.70	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	
Closure (Year 23)-Day 13210	0.40	Yes	0.54	Yes	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	0.30	Not Applicable	

Relative Impacts from ICP-Derived Dissolved Nitrate

green = decrease, no change, or negligible increase that is nonmeasurable (NM)

yellow = concentration increase; does not contribute to WQ standards exceedance

orange = substantial increase and/or contributes to WQ standard exceedance

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.

(2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Sunshine Mine Vicinity and Big Flat Creek; Immediate Sunshine Mine Vicinity refers to bedrock groundwater between Sunshine workings and Big Flat Creek; LAT Area refers to shallow and bedrock groundwater between Sunshine workings and Big Flat Creek. Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations). Pre-BT-5 (day 1521) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage.

Idaho Groundwater Quality Standard for Nitrate (as N) = 10 mg/L.

Table B-1h.
Predictions for Dissolved Copper Concentrations in Groundwater
Idaho Cobalt FEIS

Alternative	Project Phase ⁽¹⁾	Immediate Ram Mine Vicinity						Bucktail Drainage ⁽²⁾						Big Flat Drainage ⁽²⁾						TWSF Area			
		Copper Concentration mg/L			Groundwater Quality Standard Met?			Copper Concentration mg/L			Immediate Sunshine Mine Vicinity			Bucktail Drainage ⁽²⁾			Upper Bucktail Alluvium ⁽³⁾			TWSF Area			
		Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	Best Case	Most Probable Case	Worst Case	
Alt I - No Action																							
Ram Operations (Pre BT-5)-Day 152/1	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 23)-Day 132/10	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Alt II - FCC Proposal⁽⁴⁾																							
Ram Operations (Pre BT-5)-Day 152/1	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.052	0.090	0.370	Yes	Yes	Yes	Yes	0.396	2.652	19.51	Yes	No	No	1.54	1.84	4.10	No	No	0.0227	0.0027	0.0028	Yes	Yes
Closure (Year 23)-Day 132/10	0.056	0.065	0.195	Yes	Yes	Yes	Yes	0.024	0.077	0.477	Yes	Yes	Yes	1.50	1.55	No	No	No	0.0229	0.0029	0.0030	Yes	Yes
Alt III - Perpetual Dewatering & LAT																							
Ram Operations (Pre BT-5)-Day 152/1	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 23)-Day 132/10	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek																							
Ram Operations (Pre BT-5)-Day 152/1	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	Yes	0.022	0.037	2.417	Yes	Yes	No	1.50	1.54	No	No	No	0.0226	0.0026	0.0027	Yes	Yes
Closure (Year 23)-Day 132/10	0.041	0.044	0.048	Yes	Yes	Yes	Yes	0.016	0.016	0.02	Yes	Yes	Yes	1.50	1.50	No	No	No	0.0228	0.0028	0.003	Yes	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek																							
Ram Operations (Pre BT-5)-Day 152/1	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	7.50	7.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Ram Operations-Day 1887	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Sunshine Operations-Day 4809	0.036	0.036	0.036	Yes	Yes	Yes	Yes	0.016	0.016	0.016	Yes	Yes	Yes	1.50	1.50	No	No	No	0.003	0.003	0.003	Yes	Yes
Closure (Year 5)-Day 6636	0.041	0.043	0.046	Yes	Yes	Yes	Yes	0.062	0.337	2.417	Yes	Yes	No	1.50	1.54	No	No	No	0.0226	0.0026	0.0027	Yes	Yes
Closure (Year 23)-Day 132/10	0.041	0.044	0.048	Yes	Yes	Yes	Yes	0.016	0.016	0.02	Yes	Yes	Yes	1.50	1.50	No	No	No	0.0228	0.0028	0.003	Yes	Yes

Relative Impacts from ICP-Derived Dissolved Copper

green = decrease, no change, or negligible increase that is nonmeasurable (NM) concentration increase; does not contribute to WQ standards exceedance
 yellow = orange =

(1) Project phases do not apply to Alternative I - No Action and are shown for comparison purposes only.
 (2) Immediate Ram Mine Vicinity refers to bedrock groundwater between Sunshine workings and East and West Forks Bucktail Ck; Upper Bucktail Alluvium refers to BMSG Phase II capture system vicinity; TWSF Area refers to shallow and bedrock groundwater between Sunshine and headwaters Big Flat Ck.

(3) Alt 2 Upper Bucktail Alluvium concentrations represent effects of BMSG Phase II capture system and 75% capture of Sunshine Mine load by ICP bedrock groundwater capture wells.
 Pre-BT-5 (day 152/1) represents conditions prior to onset of BT-5 diversion and other related BMSG cleanup efforts in Bucktail drainage. Decreases in Day 152/1 to 1887 concentration in Upper Bucktail Alluvium based on assumed 80% reduction from BMSG Phase I

Concentrations below detection limit replaced with detection limit for calculating background (No Action concentrations).
 Idaho Groundwater Quality Standard for Copper=1.30 mg/L.

**Table B-2. Percent Change in Base Flow in Streams
FEIS Table**

Stream	Period	Alternatives				
		I	II	III	IV	V
Bucktail Creek	Ram Operations (Pre BT-5)	0 (-21)	-44 (-65)	-44 (-65)	-44 (-65)	-44 (-65)*
	Ram Operations	-100	-100	-100	-100	-100*
	Sunshine Operations	-100	-100	-100	-100	-100*
	Closure (Year 5)	-100	-100	-100	-100	-100*
	Closure (Year 23)	-100	-100	-100	-100	-100*
	Post-closure	-100	-100	-100	-100	-100*
S.F. Big Deer Creek	Ram Operations (Pre BT-5)	0 (-4)	-11 (-10)	-11 (-10)	-11 (-10)	-11 (-10)
	Ram Operations	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Sunshine Operations	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Closure (Year 5)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Closure (Year 23)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
	Post-closure	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)	-25 (-16)*
Big Deer Creek	Ram Operations (Pre BT-5)	0 (-1)	-1 (-2)	-3** (-4)	-1 (-2)	-3** (-4)
	Ram Operations	0 (-1)	-1 (-2)	-3** (-4)	-1 (-2)	-3** (-4)
	Sunshine Operations	0 (-1)	+2 (+1)	-3** (-4)	-1 (-2)	-3** (-4)
	Closure (Year 5)	0 (-1)	0 (-1)	-3** (-4)	0 (-1)	-3** (-4)
	Closure (Year 23)	0 (-1)	0 (-1)	-3** (-4)	0 (-1)	-3** (-4)
	Post-closure	0 (-1)	0 (-1)	0** (-1)	0 (-1)	0** (-1)
Panther Creek	Ram Operations (Pre BT-5)	0	0	0	0	0*
	Ram Operations	0	0	0	0	0*
	Sunshine Operations	0	0	0	0	0*
	Closure (Year 5)	0	0	0	0	0*
	Closure (Year 23)	0	0	0	0	0*
	Post-closure	0	0	0	0	0*
Big Flat Creek	Ram Operations (Pre BT-5)	0	-3	+5**	-3	-3*
	Ram Operations	0	-3	+5**	-3	-3*
	Sunshine Operations	0	-5	+5**	-4	-4*
	Closure (Year 5)	0	-3	+5**	-2	-2*
	Closure (Year 23)	0	-4	+5**	-3	-3*
	Post-closure	0	0	+5**	0	0*
Little Deer Creek	Ram Operations (Pre BT-5)	0	0	+3**	0	0
	Ram Operations	0	0	+3**	0	0
	Sunshine Operations	0	0	+3**	0	0
	Closure (Year 5)	0	0	+3**	0	0
	Closure (Year 23)	0	0	+3**	0	0
	Post-closure	0	0	+3**	0	0
Blackbird Creek	Ram Operations (Pre BT-5)	0	0	0	0	+10**
	Ram Operations	0	0	0	0	+10**
	Sunshine Operations	0	0	0	0	+10**
	Closure (Year 5)	0	0	0	0	+10**
	Closure (Year 23)	0	0	0	0	+10**
	Post-closure	0	0	0	0	0**

- Negative value denotes a reduction in flow; positive value denotes an increase in flow. All values based on DSM model predictions as described in the Water Resources Technical Report (Hydrometrics, 2006) except values in parentheses based on EPA predictions of cumulative effects of BMSG remedial actions and the ICP as described in May 24, 2007 letter from EPA (Lynne McWhorter) to SCNF (Ray Henderson).
- *Flow change is assumed equal to change for alternative 4 DSM version 6.0
- **Flow change is based on DSM version 4.0 results (Hydrometrics, 2006)

Table B-3a.
Idaho Cobalt FEIS - DSM Predicted Nitrate Concentrations in Streams

Most Probable or Expected Case (50th percentile)

Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Fk Big Deer		WQ-22		Big Deer Creek		WQ-24		Big Flat Creek		WQ-2		Panther Creek	
		Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)
Alt I - No action	Ram Operations (pre BT-5)	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.07 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Ram Operations	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.07 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Sunshine Operations	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.07 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 5	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.07 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 23	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.5 Yes	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.07 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.11 Yes	0.15 Yes	0.11 Yes	0.15 Yes	0.11 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Ram Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Sunshine Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 5	3.2 Yes	0.9 NA	3.2 Yes	0.9 NA	3.2 Yes	0.9 NA	0.15 Yes	0.14 Yes	0.15 Yes	0.14 Yes	0.15 Yes	0.14 Yes	0.2 Yes	0.2 Yes	0.19 Yes	0.19 Yes	0.19 Yes	
	Closure Year 23	0.4 Yes	0.1 NA	0.4 Yes	0.1 NA	0.4 Yes	0.1 NA	0.08 Yes	0.08 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Ram Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Sunshine Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 5	0.4 Yes	0.1 NA	0.4 Yes	0.1 NA	0.4 Yes	0.1 NA	0.08 Yes	0.08 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 23	0.4 Yes	0.1 NA	0.4 Yes	0.1 NA	0.4 Yes	0.1 NA	0.08 Yes	0.08 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
Alt IV - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.12 Yes	0.15 Yes	0.11 Yes	0.15 Yes	0.11 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Ram Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Sunshine Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 5	6.8 Yes	3.6 NA	6.8 Yes	3.6 NA	6.8 Yes	3.6 NA	0.15 Yes	0.14 Yes	0.15 Yes	0.14 Yes	0.15 Yes	0.14 Yes	0.2 Yes	0.2 Yes	0.19 Yes	0.19 Yes	0.19 Yes	
	Closure Year 23	0.4 Yes	0.2 NA	0.4 Yes	0.2 NA	0.4 Yes	0.2 NA	0.08 Yes	0.08 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
Alt V - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Ram Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Sunshine Operations	No flow	0.3 NA	No flow	0.3 NA	No flow	0.3 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
	Closure Year 5	6.8 Yes	3.6 NA	6.8 Yes	3.6 NA	6.8 Yes	3.6 NA	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.19 Yes	0.19 Yes	0.19 Yes	
	Closure Year 23	0.4 Yes	0.2 NA	0.4 Yes	0.2 NA	0.4 Yes	0.2 NA	0.08 Yes	0.08 Yes	0.15 Yes	0.07 Yes	0.15 Yes	0.07 Yes	0.2 Yes	0.2 Yes	0.18 Yes	0.18 Yes	0.18 Yes	
Primary Drinking Water Standard		10		10		10		10		10		10		10		10		10	

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BP-J modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of Alternative 2 and 4 nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative 3 nitrate concentrations in Big Flat Creek based on alternative 4 DSM-predicted concentration to water treatment plant and predicted loads to land application compared to agronomic uptake.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV and V with nitrate removal treatment to 6 mg/L (efficiencies of 70 to 90%) during mining.

Table B-3b.
Idaho Cobalt FEIS - DSM Predicted Sulfate Concentrations in Streams
Most Probable or Expected Case (50th percentile)

Alternative	Mine Stage	Ram Spring		Bucktail Creek		So Flk Big Deer		WQ-22		Big Deer Creek		WQ-24		Big Flat Creek		WQ-2		Panther Creek	
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	22	Yes	23.3	NA	22.8	NA	7.3	NA	7.3	NA	7.3	NA	1.6	NA	10.4	NA		
	Ram Operations	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Sunshine Operations	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Closure Year 5			9.3	NA	4.5	NA	4.7	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Closure Year 23	22	Yes	9.3	NA	4.5	NA	4.7	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.3	NA	7.3	NA	7.3	NA	7.3	NA	1.6	NA	10.4	NA		
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.6	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.3	NA	1.6	NA	1.6	NA	1.6	NA	10.0	NA		
	Closure Year 5	298	Yes	32.7	NA	4.5	NA	6.1	NA	13.7	NA	13.7	NA	10.3	NA	10.3	NA		
	Closure Year 23	51	Yes	9.3	NA	4.5	NA	5.2	NA	9.9	NA	9.9	NA	10.2	NA	10.2	NA		
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.3	NA	7.3	NA	7.3	NA	7.3	NA	1.6	NA	10.4	NA		
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Closure Year 5			9.3	NA	4.5	NA	4.7	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Closure Year 23	No flow	No flow	9.3	NA	4.5	NA	4.7	NA	5.2	NA	5.2	NA	5.2	NA	10.2	NA		
Alt IV - Comprehensive Ram Operations (pre BT-5)	No flow	No flow	No flow	23.3	NA	22.3	NA	7.3	NA	7.3	NA	7.3	NA	1.6	NA	10.4	NA		
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Ram Operations & NPDES Big Deer Creek	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Closure Year 5	298	No	32.7	NA	4.5	NA	4.5	NA	5.2	NA	5.2	NA	5.2	NA	10.2	NA		
	Closure Year 23	51	Yes	9.3	NA	4.5	NA	4.7	NA	5.2	NA	5.2	NA	5.2	NA	10.2	NA		
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	23.3	NA	22.3	NA	7.3	NA	7.3	NA	7.3	NA	1.6	NA	10.6	NA		
	Ram Operations	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.3	NA		
	Sunshine Operations	No flow	No flow	9.3	NA	4.5	NA	4.5	NA	1.6	NA	1.6	NA	1.6	NA	10.1	NA		
	Closure Year 5	298	No	32.7	NA	4.5	NA	4.5	NA	5.2	NA	5.2	NA	5.2	NA	10.2	NA		
	Closure Year 23	51	Yes	9.3	NA	4.5	NA	4.7	NA	5.2	NA	5.2	NA	5.2	NA	10.2	NA		
Water Quality Standard - Aquatic Life Criterion	None (5)			None (5)															

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

- (2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.
 Examples of BPJ modifications include:
 Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
 Estimation of Alternative V results based on analogy with Alternatives I and IV.
 Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
 Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II. For Alternatives II and IV, simulations assume water treatment effluent of <50 mg/L and <400 mg/L, respectively.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II.

(5) For comparison, the Federal Secondary Drinking Water Standard is 250 mg/L.

- (6) Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

- (7) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II.

(8) Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II. For Alternatives II and IV, simulations assume water treatment effluent of <50 mg/L and <400 mg/L, respectively.

- (9) Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

Table B-3c.
Idaho Cobalt FEIS - DSM Predicted Zinc Concentrations in Streams
Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer		WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25		
Alternative	Mine Stage	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	Water Quality Standard Concentration (mg/L) (2)	Met? (1)	
Alt I - No action	Ram Operations (pre BT-5)	0.005 Yes	0.003 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Rain Operations	0.005 Yes	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Sunshine Operations															
	Closure Year 5	0.005 Yes	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 23	0.005 Yes	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.003 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Rain Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Sunshine Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 5	0.049 No	No	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 23	0.045 No	No	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.003 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Rain Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Sunshine Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 5	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 23	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	No flow	0.003 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Rain Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Sunshine Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 5	0.040 Partial	Partial	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 23	0.040 Partial	Partial	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	No flow	0.003 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Rain Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Sunshine Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 5	0.040 Partial	Partial	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 23	0.040 Partial	Partial	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
Alt VI - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations	No flow	No flow	0.003 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Rain Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Sunshine Operations	No flow	No flow	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 5	0.040 Partial	Partial	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
	Closure Year 23	0.040 Partial	Partial	0.001 NA	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.003 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	0.002 Yes	
Water Quality Standard - Aquatic Life Criterion		0.0365 Hardness	25	0.0365 Hardness	25	0.0365 Hardness	25	0.0365 Hardness	25	0.0365 Hardness	25	0.0365 Hardness	25	0.0365 Hardness	25	

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount.

It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceeded aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDFQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load produced from the previous month's load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach results in a slight calculated increase in concentration in cases where the previous month's load is less than the current value. This slight increase can also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3d.
Idaho Cobalt FEIS - DSM Predicted Cobalt Concentrations in Streams
Most Probable or Expected Case (50th percentile)

		Ram Spring		Bucktail Creek		So Fk Big Deer WQ-22		Big Deer Creek WQ-24		Big Flat Creek WQ-2		Panther Creek WQ-25		
Alternative	Mine Stage	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1) (3)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	Concentration (mg/L) (2)	Cleanup Value Met? (1)	
Alt I - No action	Ram Operations (pre BT-5)	0.02	Yes	0.13	NA	0.093	No	0.017	Yes	0.021	Yes	0.019	Yes	
	Ram Operations	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	
	Sunshine Operations	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	
	Closure Year 5	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	
	Closure Year 23	0.02	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	
Alt II - FCCC Proposal (4)	Ram Operations (pre BT-5)	No flow	0.13	NA	0.098	No	0.016	Yes	0.021	Yes	0.018	Yes	0.018	Yes
	Ram Operations	No flow	0.06	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes	0.017	Yes
	Sunshine Operations	No flow	0.05	NA	0.003	Yes	0.004	Yes	0.022	Yes	0.017	Yes	0.017	Yes
	Closure Year 5	No	0.136	NA	0.17	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	No	0.081	NA	0.04	NA	0.003	Yes	0.003	Yes	0.022	Yes	0.017	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations	No flow	0.13	NA	0.100	No	0.017	Yes	0.021	Yes	0.019	Yes	0.019	Yes
	Sunshine Operations	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	0.017	Yes
	Closure Year 5	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	0.017	Yes
	Closure Year 23	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	0.017	Yes
Alt IV - Comprehensive GW Capture & NPDES Big Ram Operations	Ram Operations (pre BT-5)	No flow	0.13	NA	0.100	No	0.017	Yes	0.021	Yes	0.018	Yes	0.018	Yes
	Sunshine Operations	No flow	0.06	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	0.017	Yes
	Closure Year 5	No	0.042	Yes	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	No	0.042	Yes	0.05	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	0.13	NA	0.100	No	0.017	Yes	0.021	Yes	0.018	Yes	0.018	Yes
	Ram Operations	No flow	0.06	NA	0.003	Yes	0.005	Yes	0.022	Yes	0.017	Yes	0.017	Yes
	Sunshine Operations	No flow	0.05	NA	0.003	Yes	0.005	Yes	0.021	Yes	0.017	Yes	0.017	Yes
	Closure Year 5	No	0.042	Yes	0.05	NA	0.003	Yes	0.004	Yes	0.021	Yes	0.017	Yes
	Closure Year 23	No	0.042	Yes	0.05	NA	0.003	Yes	0.017	Yes	0.021	Yes	0.017	Yes
Site-specific Blackbird cleanup value		0.086		0.086		0.086		0.086		0.086		0.086		0.086
	Hardness		25		25		25		25		25		25	

Key to Color Shading:
green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow = DSM predicts small concentration increase that is potentially measurable.
red = DSM predicts increase that is likely to be measurable.

Notes:

- (1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.
- "Yes" = observed or model predicted concentrations are lower than cleanup value.
- "Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.
- "No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

- (2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results. Examples of BJJ modifications include:
Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.
Estimation of Alternative V results based on analogy with Alternatives I and IV.
Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.
Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

- (3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.
- (4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture air was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternatives II and IV. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3e.

Idaho Cobalt FEIS - DSM Predicted Nickel Concentrations in Streams
Most Probable or Expected Case (50th percentile)

		Ram Spring	Bucktail Creek	So Fork Big Deer Creek	Big Deer Creek WQ-24	Big Flat Creek WQ-2	Panther Creek WQ-25
Alternative	Mine Stage	Water Quality Standard Met? (1) (mg/L) (2)					
Alt I - No action	Ram Operations (pre BT-5)	Yes	Yes	NA	Yes	Yes	Yes
	Ram Operations	0.002	0.001	NA	0.001	0.001	0.001
	Sunshine Operations	0.002	0.001	NA	0.001	0.001	0.001
	Closure Year 5	0.002	0.001	NA	0.001	0.001	0.001
	Closure Year 23	0.002	0.001	NA	0.001	0.001	0.001
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	0.002	NA	0.002	Yes	0.001
	Ram Operations	No flow	0.001	NA	0.001	Yes	0.001
	Sunshine Operations	No flow	0.001	NA	0.001	Yes	0.001
	Closure Year 5	0.008	Yes	0.004	NA	0.001	Yes
	Closure Year 23	0.005	Yes	0.001	NA	0.001	Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	0.002	NA	0.002	Yes	0.001
	Ram Operations	No flow	0.001	NA	0.001	Yes	0.001
	Sunshine Operations	No flow	0.001	NA	0.001	Yes	0.001
	Closure Year 5	No flow	0.001	NA	0.001	Yes	0.001
	Closure Year 23	No flow	0.001	NA	0.001	Yes	0.001
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow	0.002	NA	0.002	Yes	0.001
	Ram Operations	No flow	0.001	NA	0.001	Yes	0.001
	Sunshine Operations	No flow	0.001	NA	0.001	Yes	0.001
	Closure Year 5	0.002	Yes	0.003	NA	0.001	Yes
	Closure Year 23	0.002	Yes	0.001	NA	0.001	Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow	0.002	NA	0.002	Yes	0.001
	Ram Operations	No flow	0.001	NA	0.001	Yes	0.001
	Sunshine Operations	No flow	0.001	NA	0.001	Yes	0.001
	Closure Year 5	0.002	Yes	0.003	NA	0.001	Yes
	Closure Year 23	0.002	Yes	0.001	NA	0.001	Yes
Water Quality Standard - Aquatic Life Criterion Hardness		0.016	0.016	0.016	0.016	0.016	0.016
		25	25	25	25	25	25

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

"No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BMP modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations or the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3f.
Idaho Cobalt FEIS - DSM Predicted Arsenic Concentrations in Streams
Most Probable or Expected Case (50th percentile)

Alternative	Mine Stage	Ram Spring Concentration (mg/L) (5)	Water Quality Standard Met? (1)	Bucktail Creek Water Quality Standard Met? (1) (3)	So Fk Big Deer WQ-22 Concentration (mg/L) (2)	Big Deer Creek WQ-24 Water Quality Standard Met? (1)	Big Flat Creek WQ-2 Water Quality Standard Met? (1)	Panther Creek WQ-25 Water Quality Standard Met? (1)
Alt I - No action	Ram Operations (pre BT-5)	0.037 Yes	NA	0.0001 Yes	0.0006 Yes	0.0001 Yes	0.0002 Yes	0.001 Yes
	Ram Operations	0.037 Yes	0.0003 NA	0.0001 Yes	0.0005 Yes	0.0005 Yes	0.0002 Yes	0.001 Yes
	Sunshine Operations	0.037 Yes	0.0003 NA	0.0001 Yes	0.0005 Yes	0.0005 Yes	0.0002 Yes	0.001 Yes
	Closure Year 23	0.037 Yes	0.0003 NA	0.0001 Yes	0.0005 Yes	0.0005 Yes	0.0002 Yes	0.001 Yes
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow 0.0009	NA	0.0001 Yes	0.0009 Yes	0.0009 Yes	0.0002 Yes	0.001 Yes
	Ram Operations	No flow 0.0009	NA	0.0001 Yes	0.0010 Yes	0.0010 Yes	0.0002 Yes	0.001 Yes
	Sunshine Operations	No flow 0.0003	NA	0.0001 Yes	0.0010 Yes	0.0010 Yes	0.0002 Yes	0.001 Yes
	Closure Year 5	0.103 Yes (5)	0.0003 NA	0.0001 Yes	0.0010 Yes	0.0010 Yes	0.0002 Yes	0.001 Yes
	Closure Year 23	0.118 Yes (5)	0.003 NA	0.0001 Yes	0.0010 Yes	0.0010 Yes	0.0002 Yes	0.001 Yes
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow 0.0008	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Ram Operations	No flow 0.0003	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Sunshine Operations	No flow 0.0003	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Closure Year 5	No flow 0.0003	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Closure Year 23	No flow 0.0008	NA	0.0001 Yes	0.0009 Yes	0.0009 Yes	0.0002 Yes	0.001 Yes
Alt IV - Comprehensive GW Capture & NPDES Big Deer Creek	Ram Operations (pre BT-5)	No flow 0.0003	NA	0.0001 Yes	0.0005 Yes	0.0005 Yes	0.0002 Yes	0.001 Yes
	Sunshine Operations	No flow 0.0003	NA	0.0001 Yes	0.0005 Yes	0.0005 Yes	0.0002 Yes	0.001 Yes
	Closure Year 5	0.107 Yes (5)	0.060 NA	0.0001 Yes	0.0022 Yes	0.0022 Yes	0.0002 Yes	0.001 Yes
	Closure Year 23	0.122 Yes (5)	0.050 NA	0.0001 Yes	0.0025 Yes	0.0025 Yes	0.0002 Yes	0.001 Yes
Alt V - Comprehensive GW Capture & NPDES Blackbird Creek	Ram Operations (pre BT-5)	No flow 0.0008	NA	0.0001 Yes	0.0009 Yes	0.0009 Yes	0.0002 Yes	0.001 Yes
	Ram Operations	No flow 0.0003	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Sunshine Operations	No flow 0.0003	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Closure Year 5	No flow 0.0003	NA	0.0001 Yes	0.0008 Yes	0.0008 Yes	0.0002 Yes	0.001 Yes
	Closure Year 23	0.107 Yes (5)	0.050 NA	0.0001 Yes	0.0022 Yes	0.0022 Yes	0.0002 Yes	0.001 Yes
Water Quality Standard - Aquatic Life Criterion	Federal Primary Drinking Water Standard	0.15	0.15	0.01	0.15	0.15	0.01	0.15
Idaho Human Health Standard		0.01	0.01	0.01	0.01	0.01	0.01	0.01
		0.05	0.05	0.05	0.05	0.05	0.05	0.05

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = Observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = Observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = Observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

"No flow" = In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM results from version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BMP modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) Concentrations represent predicted effects of Alternative II, IV, and V with post-mining groundwater capture and treatment. For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in concentration in cases where the previous months load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

(5) The DSM does not simulate geochemical reactions that are expected to attenuate arsenic in the groundwater system. Natural attenuation of arsenic is expected to result in arsenic concentrations at Ram Spring and Bucktail Creek that are similar to existing conditions as shown in the no action alternative and that meet water quality standards.

Table B-3g.
Idaho Cobalt FEIS - DSM Predicted Copper Concentrations in Streams
90th percentile Case (90% probability that actual value will be lower than value shown).

		Ram Spring			Bucktail Creek			So Fk Big Deer WQ-22			Big Deer Creek WQ-24			Big Flat Creek WQ-2			Panther Creek WQ-25		
Alternative	Mine Stage	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)		
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	NA	0.065	No	0.012	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial		
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
Alt II - FCCC proposal (4)	Ram Operations (pre BT-5)	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 5	0.370	No	0.64	NA	0.002	Yes	0.008	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial		
	Closure Year 23	0.195	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 5	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 23	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
Alt IV - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 5	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 23	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
Alt V - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 5	No flow	0.046	No	0.03	NA	0.002	Yes	0.004	Yes (4)	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 23	No flow	0.048	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
Alt V - Comprehensive Blackbird Creek	Ram Operations (pre BT-5)	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	0.004	Partial	0.004	Partial	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes	
	Closure Year 5	0.046	No	0.14	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
	Closure Year 23	0.048	No	0.04	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.003	Yes	0.003	Yes		
Water Quality Standard - Aquatic Life Criterion Hardness	25			0.0035		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035			

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.
yellow = DSM predicts small concentration increase that is potentially measurable.
red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount. It is likely that streams would exceed aquatic life criteria at some times but not at others.

In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3h.
Idaho Cobalt FEIS - DSM Predicted Copper Concentrations in Streams
10th percentile Case (90% probability that actual value will be higher than shown)

Alternative	Mine Stage	Ram Spring			Bucktail Creek			So Fk Big Deer WQ-22			Big Deer Creek WQ-24			Big Flat Creek WQ-2			Panther Creek WQ-25		
		Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)	Concentration (mg/L) (2)	Water Quality Standard Met? (1)		
Alt I - No action	Ram Operations (pre BT-5)	0.026	No	0.08	NA	0.065	No	0.012	No	0.002	Yes	0.003	Yes	0.002	Yes	0.004	Partial		
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
Alt II - FCC proposal (4)	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	0.002	Yes	0.003	Yes		
	Ram Operations	No flow	No flow	0.02	NA	0.002	Yes	0.003	Yes										
	Sunshine Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 5	0.052	No	0.03	NA	0.002	Yes	0.003	Yes										
	Closure Year 23	0.050	No	0.03	NA	0.002	Yes	0.003	Yes										
Alt III - Perpetual Dewatering & LAT	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	0.002	Yes	0.003	Yes		
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 5	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 23	No flow	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
Alt IV - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	0.002	Yes	0.003	Yes		
	Ram Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Sunshine Operations	No flow	No flow	0.02	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 5	0.041	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 23	0.041	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
Alt V - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	0.002	Yes	0.003	Yes		
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 5	0.041	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 23	0.041	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
Alt VI - Comprehensive GW Capture & NPDES	Ram Operations (pre BT-5)	No flow	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	0.002	Yes	0.003	Yes		
	Ram Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Sunshine Operations	No flow	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 5	0.041	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
	Closure Year 23	0.041	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes		
Water Quality Standard	Aquatic Life Criterion Hardness	0.0035		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035			
		25		25		25		25		25		25		25		25			

Key to Color Shading:

green = DSM predicts decrease or very small increase in concentration that is calculable but not measurable.

yellow = DSM predicts small concentration increase that is potentially measurable.

red = DSM predicts increase that is likely to be measurable.

Notes:

(1) "No" = observed or model predicted concentrations exceed chronic aquatic life criteria.

"Yes" = observed or model predicted concentrations are lower than chronic aquatic life criteria.

"Partial" = observed or model predicted concentrations exceed chronic aquatic life criteria by a small amount.

It is likely that streams would exceed aquatic life criteria at some times but not at others.

In alternative III, Ram Spring would be substantially dewatered except possibly during the spring snowmelt period.

(2) Concentrations shown are primarily 50th percentile values based on DSM version 6.0. In some instances DSM results have been modified based on best professional judgment to better represent expected results.

Examples of BPJ modifications include:

Substitution of baseline or no-action predicted concentrations where DSM results are less than zero.

Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no-action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modelling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.

Table B-3i.
Idaho Cobalt FEIS - DSM Predicted Copper Concentrations in Streams

Most Probable or Expected Case (50th percentile, 50% probability that actual value will be higher than value shown)

Alternative	Mine Stage	Ram Spring		Bucktail Creek (3)		So Fk Big Deer WQ22		Big Deer Creek WQ24		Big Flat Creek WQ2		Panther Creek WQ-25	
		Water Quality Standard	Concentration (mg/L) (2)	Water Quality Standard	Concentration (mg/L) (1) (3)	Water Quality Standard	Concentration (mg/L) (2)	Water Quality Standard	Concentration (mg/L) (1)	Water Quality Standard	Concentration (mg/L) (2)	Water Quality Standard	Concentration (mg/L) (1)
All I - No action	Ram Operations [pre BT-5]	0.026	No	0.03	NA	0.065	No	0.012	No	0.002	Yes	0.004	Partial
	Ram Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Sunshine Operations	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 5	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.026	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
All II - FCC proposal with post-closure groundwater capture and treatment mitigation	Ram Operations [pre BT-5]	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes	
	Closure Year 5	0.090	No	0.07	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.065	No	0.01	NA	0.002	Yes	0.002	Yes	0.002	Yes	0.003	Yes
All III - Perpetual Dewatering & LAT	Ram Operations [pre BT-5]	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Closure Year 5	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Closure Year 23	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
All IV - Comprehensive GW Capture & NPDES	Ram Operations [pre BT-5]	No flow	0.08	NA	0.068	No	0.011	No	0.002	Yes	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Closure Year 5	0.043	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
All V - Comprehensive GW Capture & NPDES	Ram Operations [pre BT-5]	No flow	0.08	NA	0.068	No	0.012	No	0.002	Yes	0.004	Partial	
	Ram Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Sunshine Operations	No flow	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes	
	Closure Year 5	0.043	No	0.05	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
	Closure Year 23	0.044	No	0.03	NA	0.002	Yes	0.003	Yes	0.002	Yes	0.003	Yes
Water Quality Standard - Aquatic Life Criterion		0.0035		0.0035		0.0035		0.0035		0.0035		0.0035	
	Hardness	25		25		25		25		25		25	

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Estimation of Alternative V results based on analogy with Alternatives I and IV.

Estimation of nitrate concentrations by addition of DSM-predicted concentration change to ambient baseline.

Estimation of Alternative III results based on DSM version 4 results (Hydrometrics, 2005) and analogy with DSM version 6 results for alternatives I and IV.

(3) Bucktail Creek concentrations historically and currently exceed aquatic life criteria due to Blackbird Mine contamination. However, Bucktail Creek has a Use Attainability Analysis (IDEQ, 2002) so water quality standards do not currently apply to the creek. Concentrations calculated by the DSM for Bucktail Creek should be used with caution because the concentrations and chemical mass loads in Bucktail Creek were adjusted in the DSM as needed to adjust (calibrate) concentrations in South Fork Big Deer Creek and Big Deer Creek to current and future concentrations for the no action alternative. In some cases, calibration of the model combined with the load removed by groundwater pumping and treatment results in negative loads and concentrations in Bucktail Creek. In those cases, values presented in the table reflect the no-action alternative.

(4) For modeling calculation purposes, the chemical mass load removal requirement of Alternative IV capture and treatment system was based on the calculated chemical mass load production from the previous model month. This calculation approach results in a slight calculated increase in copper concentration in cases where the previous months copper load is less than the current value. This slight increase can be mitigated by the use of a margin of safety in load removal requirements. This calculation approach may also result in an apparent lower groundwater capture efficiency (and higher surface water concentrations) for Alternative IV in comparison to Alternative II. This is not predicted to occur as the Alternative IV capture system is predicted to have a higher potential efficiency than Alternative II.