Table 2-1. Bird and Mammal Species Common in Gunnison County

Relative Abundance	Birds		Mammals	
Abundant	Cliff Swallow	*Petrochelidon pyrrhonota*	American Elk	*Cervus elaphus*
	Red-winged Blackbird	*Agelaius phoeniceus*	Big Brown Bat	*Eptesicus fuscus*
Common	American Kestrel	*Falco sparverius*	Deer Mouse	*Peromyscus maniculatus*
	American Pipit	*Anthus rubescens*	House Mouse	*Mus musculus*
	American Robin	*Turdus migratorius*	Little Brown Myotis	*Myotis lucifugus*
	Barn Swallow	*Hirundo rustica*	Mule Deer	*Odocoileus hemionus*
	Belted Kingfisher	*Ceryle alcyon*	American Beaver	*Castor canadensis*
	Black-billed Magpie	*Pica pica*	American Pika	*Ochotona princeps*
	Black-capped Chickadee	*Poecile atricapillus*	Bighorn Sheep	*Ovis canadensis*
	Black-headed Grosbeak	*Pheucticus melanocephalus*	Black Bear	*Ursus americanus*
	Brewer's Blackbird	*Euphagus cyanocephalus*	Bobcat	*Lynx rufus*
	Brewer's Sparrow	*Spizella breweri*	Brush Mouse	*Peromyscus boylii*
	Broad-tailed Hummingbird	*Selasphorus platycercus*	Bushy-tailed Woodrat	*Neotoma cinerea*
	Brown-capped Rosy Finch	*Leucosticte australis*	Common Muskrat	*Ondatra zibethicus*
	Brown-headed Cowbird	*Molothrus ater*	Coyote	*Canis latrans*
	Bullock's Oriole	*Icterus bullockii*	Golden-mantled Ground Squirrel	*Spermophilus lateralis*
	Canada Goose	*Branta canadensis*	Gunnison's Prairie Dog	*Cynomys gunnisoni*
	Cassin's Finch	*Carpodacus cassinii*	Hoary Bat	*Lasiurus cinereus*
	Chipping Sparrow	*Spizella passerina*	Least Chipmunk	*Tamias minimus*
	Clark's Nutcracker	*Nucifraga columbiana*	Long-eared Myotis	*Myotis evotis*
	Common Nighthawk	*Chordeiles minor*	Long-legged Myotis	*Myotis volans*
	Common Raven	*Corvus corax*	Long-tailed Vole	*Microtus longicaudus*
	Cordilleran Flycatcher	*Empidonax occidentalis*	Long-tailed Weasel	*Mustela frenata*
	Dark-eyed Junco	*Junco hyemalis*	Masked Shrew	*Sorex cinereus*
	Dusky Flycatcher	*Empidonax oberholseri*	Meadow Vole	*Microtus pennsylvanicus*
	European Starling	*Sturnus vulgaris*	Mink	*Mustela vison*
	Evening Grosbeak	*Coccothraustes vespertinus*	Montane Shrew	*Sorex monticolus*
	Fox Sparrow	*Passerella iliaca*	Montane Vole	*Microtus montanus*
	Great Blue Heron	*Ardea herodias*	Mountain Cottontail	*Sylvilagus nuttallii*
	Green-tailed Towhee	*Pipilo chlorurus*	Mountain Goat	*Oreamnos americanus*
	Green-winged Teal	*Anas crecca*	Northern Pocket Gopher	*Thomomys talpoides*
	Gunnison Sage Grouse	*Centrocercus minimus*	Pine Squirrel	*Tamiasciurus hudsonicus*
	Hermit Thrush	*Catharus guttatus*	Pronghorn	*Antilocapra americana*
	Horned Lark	*Eremophila alpestris*	Red Fox	*Vulpes vulpes*
	House Sparrow	*Passer domesticus*	Rock Squirrel	*Spermophilus variegatus*
	House Wren	*Troglodytes aedon*	Silver-haired Bat	*Lasionycteris noctivagans*
	Killdeer	*Charadrius vociferus*	Snowshoe Hare	*Lepus americanus*
	Lincoln's Sparrow	*Melospiza lincolnii*	Southern Red-backed Vole	*Clethrionomys gapperi*
	Mallard	*Anas platyrhynchos*	Striped Skunk	*Mephitis mephitis*
	Mountain Bluebird	*Sialia currucoides*	Uinta Chipmunk	*Tamias umbrinus*
	Mountain Chickadee	*Poecile gambeli*	Western Jumping Mouse	*Zapus princeps*
	Mourning Dove	*Zenaida macroura*	Western Small-footed Myotis	*Myotis ciliolabrum*
	Northern Flicker	*Colaptes auratus*	Western Spotted Skunk	*Spilogale gracilis*
	Orange-crowned Warbler	*Vermivora celata*	White-tailed Jackrabbit	*Lepus townsendii*
	Pine Siskin	*Carduelis pinus*	Wyoming Ground Squirrel	*Spermophilus elegans*
	Red-breasted Nuthatch	*Sitta canadensis*	Yellow-bellied Marmot	*Marmota flaviventris*
	Red-tailed Hawk	*Buteo jamaicensis*		
	Ruby-crowned Kinglet	*Regulus calendula*		
	Sage Sparrow	*Amphispiza belli*		
	Sage Thrasher	*Oreoscoptes montanus*		
	Savannah Sparrow	*Passerculus sandwichensis*		
	Song Sparrow	*Melospiza melodia*		
	Spotted Sandpiper	*Actitis macularia*		
	Steller's Jay	*Cyanocitta stelleri*		
	Swainson's Hawk	*Buteo swainsoni*		
	Swainson's Thrush	*Catharus ustulatus*		
	Tree Swallow	*Tachycineta bicolor*		
	Turkey Vulture	*Cathartes aura*		
	Vesper Sparrow	*Pooecetes gramineus*		
	Violet-green Swallow	*Tachycineta thalassina*		
	Virginia's Warbler	*Vermivora virginiae*		
	Warbling Vireo	*Vireo gilvus*		
	Western Meadowlark	*Sturnella neglecta*		
	Western Tanager	*Piranga ludoviciana*		
	Western Wood-Pewee	*Contopus sordidulus*		
	White-breasted Nuthatch	*Sitta carolinensis*		
	White-crowned Sparrow	*Zonotrichia leucophrys*		
	White-throated Swift	*Aeronautes saxatalis*		
	Wilson's Warbler	*Wilsonia pusilla*		
	Yellow Warbler	*Dendroica petechia*		
	Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*		
	Yellow-rumped Warbler	*Dendroica coronata*		
	Northern Mockingbird	*Mimus polyglottos*		
	Redhead	*Aythya americana*		

Table 2-2. State and Federal Listed Species Found in Gunnison County

Status	Common Name	Scientific Name	Occurence	Abundance
State Endangered	Black-footed Ferret	*Mustela nigripes*	Likely to occur	Extirpated
	Boreal Toad	*Bufo boreas*	Known to occur	Rare
	Least Tern	*Sterna antillarum*	Known to occur	Unknown
	Lynx	*Lynx canadensis*	Known to occur	Very Rare
	Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Known to occur	Uncommon
	Whooping Crane	*Grus americana*	Known to occur	Unknown
	Wolverine	*Gulo gulo*	Known to occur	Extirpated
State Threatened	Bald Eagle	*Haliaeetus leucocephalus*	Known to occur	Unknown
	Northern River Otter	*Lutra canadensis*	Known to occur	Casual/Accidental
	Western Burrowing Owl	*Athene cunicularia*	Known to occur	Unknown
State Special Concern	Ferruginous Hawk	*Buteo regalis*	Known to occur	Unknown
	Greater Sandhill Crane	*Grus canadensis tabida*	Known to occur	Unknown
	Gunnison Sage Grouse	*Centrocercus minimus*	Known to occur	Fairly Common
	Long-billed Curlew	*Numenius americanus*	Known to occur	Unknown
	Northern Leopard Frog	*Rana pipiens*	Known to occur	Uncommon
	Northern Pocket Gopher	*Thomomys talpoides*	Known to occur	Common
	Townsend's Big-eared Bat	*Plecotus townsendii*	Known to occur	Uncommon
	Western Snowy Plover	*Charadrius alexandrinus nivosus*	Known to occur	Unknown
Federal Candidate Species	Boreal Toad	*Bufo boreas*	Known to occur	Rare
	Gunnison Sage Grouse	*Centrocercus minimus*	Known to occur	Fairly Common
	Yellow-billed Cuckoo	*Coccyzus americanus*	Known to occur	Very Rare
Federally Endangered	Black-footed Ferret	*Mustela nigripes*	Likely to occur	Extirpated
	Least Tern	*Sterna antillarum*	Known to occur	Unknown
	Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Known to occur	Uncommon
	Whooping Crane	*Grus americana*	Known to occur	Unknown
Federally Threatened	Bald Eagle	*Haliaeetus leucocephalus*	Known to occur	Unknown
	Lynx	*Lynx canadensis*	Known to occur	Very Rare

Table 3-1

Summary of the Screening-Level Ecological Risk Assessment

Exposure Pathway	Approach	COPCs	SLERA Risk Characterization Results	Further Evaluation?
AQUATIC RECEPTORS (BMI, Fish)				
Direct Contact with Surface Water	Hazard Quotient	Al, Cd, Ca, Cu, Pb, Mn, Ni, Ag, Zn	Elk Creek: Cd, Cu, Pb, Mn, and Zn have high chronic risk, Al has less chronic risk, and very low chronic risk for Ni and Ag. Coal Creek: similar to Elk Creek but with lower HQs and a smaller frequency above 1.	Yes
Direct Contact with Sediment	Hazard Quotient	Al, As, Cd, Cu, Pb, Mn, Ag, Zn	Elk Creek: As, Cd, Cu, Pb, and Zn have high chronic risk, Mn and Ag have less chronic risk, and very low chronic risk for Al. Coal Creek: similar to Elk Creek but with lower HQs and a smaller frequency above 1.	Yes
TERRESTRIAL RECEPTORS (Plants, Soil Invertebrates)				
Direct Contact with Soil	Hazard Quotient	Soil Organisms: Al, As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Zn Plants: Al, Sb, As, Cd, Cr, Co, Cu, Pb, Se, Ag, V, Zn	Soil Organisms: Al, As, Cr, Cu, Fe, Pb, Mn, and Zn have high frequency and/or magnitude of HQ exceedences. Plants: Al, As, Cd, Cr, Cu, Pb, Se, Ag, V, and Zn have high frequency and/or magnitude of HQ exceedences.	Yes
WILDLIFE RECEPTORS (Birds, Mammals)				
Ingestion of Surface Water	Hazard Quotient	None	Surface water HQs for all receptors <1. However, data are limited, and SW risks add to risks from soil and diet.	Yes
Ingestion of Sediment, Soil, & Food Items	Hazard Quotient	Al, Sb, As, Cd, Cu, Pb, Mn, Ni, Se, V, Zn	Al, As, Cu, Mn, and Zn have HQ values >1 based on both the NOAEL and LOAEL. Cu, Ni, Se, and V have HQ values >1 based on NOAEL, but not based on LOAEL.	Yes

COPC = Chemicals of Potential Concern
BMI = Benthic macroinvertebrates
HQ = Hazard Quotient

Table 3-2
Assessment and Measurement Endpoints

Receptor	Assessment Endpoint	Measurement Endpoint
Fish	Protection of fish from adverse effects related to exposure to chemicals in surface water.	HQ Approach: Comparison of measured contaminant concentrations in surface water to toxicity benchmarks for the aquatic community.
		Site Toxicity Testing: Comparison of measured survival of fish in site surface water toxicity tests to reference/control survival.
		Community Demographics: Comparison of fish density and biomass for site locations to applicable reference locations.
Benthic Macroinvertebrates	Protection of aquatic invertebrates from adverse effects related to exposure to chemicals in sediment.	HQ Approach: Comparison of measured contaminant concentrations in bulk sediment to toxicity benchmarks for benthic invertebrates.
		HQ Approach: Comparison of measured contaminant concentrations in sediment porewater to toxicity benchmarks for the aquatic community.
		Site Toxicity Testing: Comparison of measured survival and growth endpoints in site sediment toxicity tests (*Hyalella azteca*) to reference/control sediments.
		Community Demographics: Comparison of benthic macroinvertebrate community metrices for site locations to applicable reference locations.
Plants and Soil Invertebrates	Protection of terrestrial plants and soil organisms from adverse effects related to exposure to chemicals in surface soil.	HQ Approach: Comparison of contaminant concentrations in soil to toxicity benchmarks for terrestrial plants and soil organisms.
Birds and Mammals	Protection of birds and mammals from adverse effects on growth, reproduction, or survival related to exposure to chemicals in soil, and dietary items.	HQ Approach: Comparison of estimates intakes from water, sediment, soil, and dietary items to appropriate toxicity reference values (TRVs) for wildlife.

Table 4-1. Studies Providing Data on Surface Water

Panel A: Total Recoverable Concentrations

Study	Location	Number of Sample Locations	Number of Samples
Coal Creek Watershed Coalition (2006)	Coal Creek Immediately Downstream of Elk Creek	1	3
	Coal Creek Downstream of Iron Bog	6	13
	Elk Creek Downstream of Standard Mine	1	3
USEPA (1999, 2005, 2006)	Coal Creek Immediately Downstream of Elk Creek	5	18
	Coal Creek Downstream of Iron Bog	10	47
	Elk Creek at Standard Mine	4	18
	Elk Creek Downstream of Standard Mine	7	35
	Elk Creek-Mine Drainage	2	12
USGS (1995 - 2005)	Coal Creek Downstream of Iron Bog	1	1

Panel B: Dissolved Concentrations

Study	Location	Number of Sample Locations	Number of Samples
Coal Creek Watershed Coalition (2004, 2006)	Coal Creek Immediately Downstream of Elk Creek	3	4
	Coal Creek Downstream of Iron Bog	9	14
	Elk Creek at Standard Mine	3	3
	Elk Creek Downstream of Standard Mine	2	3
USEPA (1999, 2005, 2006)	Coal Creek Immediately Downstream of Elk Creek	5	13
	Coal Creek Downstream of Iron Bog	10	33
	Elk Creek at Standard Mine	4	12
	Elk Creek Downstream of Standard Mine	7	23
	Elk Creek-Mine Drainage	2	8
USGS (1995 - 2005)	Coal Creek Downstream of Iron Bog	2	13

Table 4-2
Surface Water Toxicity Benchmarks for Aquatic Receptors

Panel A: Benchmarks that are Hardness Independent

Analyte	ACUTE					CHRONIC					
	State of Colorado (ug/L) [1]	NAWQC (ug/L) [2]	GLWQI Tier II SAV (ug/L) [3]	USEPA R4 (ug/L) [3]	**Acute Benchmark (ug/L)**	State of Colorado (ug/L) [1]	NAWQC (ug/L) [2]	GLWQI Tier II SCV (ug/L) [3]	USEPA R4 (ug/L) [3]	Other (ug/L) [3]	**Chronic Benchmark (ug/L)**
Aluminum	750	750 (4)	--	750	750	87	87	--	87	--	87
Arsenic	340	340 (5,6)	--	360	340	150	150 (5,6)	--	190	--	150
Calcium	--	--	--	--	no benchmark	--	--	--	--	116,000 LCV Daphnids	116,000

1 CDPHE 2007.
2 USEPA, 2002. National Recommended Water Quality Criteria: 2002. November 2002. EPA 822-R-02-047. Values presented are for dissolved.
3 Suter & Tsao, 1996.
4 Aluminum NAWQC apply to waters with pH of 6.5 - 9.0.
5 NAWQC derived from data for As 3+, but is applied here to total arsenic.
6 NAWQC expressed in terms of the dissolved fraction.

NAWQC = National Ambient Water Quality Criteria
GLQWI = Great Lakes Water Quality Initiative
SAV = Secondary Acute Value
SCV = Secondary Chronic Value
LCV = Lowest Chronic Value

Panel B: Inputs for Computation of Hardness-Dependent Benchmarks (State of Colorado)

Analyte	Hardness-Dependent Parameters				Total/Dissolved Conversion Factors			
	where: Benchmark(tot) = exp(a * ln(H) + b)				where: Benchmark(diss) = Benchmark(tot) * [m-n*(ln(H)]			
	Acute		Chronic		Acute		Chronic	
	a	b	a	b	m	n	m	n
Cadmium	0.915	-3.62	0.800	-4.45	1.1367	0.0418	1.1017	0.0418
Copper	0.942	-1.74	0.855	-1.74	1.0000	0.0000	1.0000	0.0000
Lead	1.27	-1.46	1.27	-4.71	1.4620	0.1457	1.4620	0.1457
Manganese	0.3331	6.4676	0.3331	5.8743	1.0000	0.0000	1.0000	0.0000
Nickel	0.846	2.25	0.846	0.0554	1.0000	0.0000	1.0000	0.0000
Silver	1.72	-7.21	1.72	-10.5	1.0000	0.0000	1.0000	0.0000
Zinc	0.853	1.06	0.853	0.911	1.0000	0.0000	1.0000	0.0000

Sources:
CDPHE 2007.

Table 4-3. HQ Values for Aquatic Receptors from Direct Contact with Surface Water

Panel A: Based on Acute Benchmarks

Analyte	Mine Drainage/On-Site Waters			Elk Creek at Mine			Elk Creek Downstream of Mine			Coal Creek Immediately Downstream of Elk Creek			Coal Creek Downstream of Iron Bog			Coal Creek Upsteam of Elk Creek			Background[a]		
	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0
Aluminum	7/12	0/12	1.2-2.6	1/19	0/19	2-2	0/33	0/33	--	0/20	0/20	--	1/68	0/68	2.8-2.8	0/12	0/12	--	0/27	0/137	--
Cadmium	12/12	12/12	28-69	19/19	10/19	2-34	33/33	5/33	1.3-22	9/20	1/20	1.2-11	23/68	1/68	1.1-13	1/12	0/12	5.6-5.6	1/27	0/139	3.2-3.2
Calcium	*no benchmark*			*no benchmark*			*no benchmark*			*no benchmark*			*no benchmark*			*no benchmark*			*no benchmark*		
Copper	12/12	8/12	4.9-56	12/19	2/19	1.8-17	12/33	1/33	1.5-11	6/20	0/20	1.2-3.6	14/68	1/68	1.1-77	1/12	0/12	4-4	2/27	0/139	2.2-3.2
Lead	12/12	4/12	1.4-20	7/19	0/19	1.2-6.9	5/33	0/33	1.3-4.2	0/20	0/20	--	0/67	0/67	--	0/12	0/12	--	0/27	0/136	--
Manganese	9/12	0/12	1.1-2.9	0/19	0/19	0-0	0/33	0/33	0-0	0/20	0/20	0-0	0/68	0/68	0-0	0/12	0/12	0-0	0/27	0/155	0-0
Nickel	0/12	0/12	--	0/16	0/16	--	0/32	0/32	--	0/18	0/18	--	0/53	0/53	--	0/11	0/11	--	0/26	0/87	--
Silver	0/12	0/12	--	2/19	1/19	3-43	4/33	2/33	1.6-18	2/20	2/20	29-29	6/68	3/68	1.3-29	4/12	1/12	1.3-35	7/27	1/130	1.2-12
Zinc	12/12	12/12	62-140	19/19	10/19	4.2-74	33/33	19/33	2.9-57	14/20	0/20	1.5-5	46/67	1/67	1.1-14	0/12	0/12	--	1/26	0/139	4.4-4.4

Panel B: Based on Chronic Benchmarks

Analyte	Mine Drainage/On-Site Waters			Elk Creek at Mine			Elk Creek Downstream of Mine			Coal Creek Immediately Downstream of Elk Creek			Coal Creek Downstream of Iron Bog			Coal Creek Upsteam of Elk Creek			Background[a]		
	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0
Aluminum	10/12	6/12	2.3-22	5/19	1/19	1.1-17	6/33	0/33	1.1-1.9	2/20	0/20	1.1-1.1	28/68	1/68	1.1-24	1/12	0/12	1.1-1.1	2/27	0/27	1.1-1.2
Cadmium	12/12	12/12	100-280	19/19	13/19	6.7-140	33/33	24/33	5.1-75	16/20	2/20	1.1-35	54/68	6/68	1.1-44	2/12	1/12	1.5-19	7/27	1/27	1.1-12
Calcium	0/8	0/8	--	0/15	0/15	--	0/26	0/26	--	0/17	0/17	--	2/60	0/60	1.2-1.4	0/10	0/10	--	0/22	0/22	--
Copper	12/12	10/12	7.8-85	15/19	3/19	1.1-23	16/33	1/33	1.1-14	7/20	0/20	1.1-4.7	17/68	1/68	1.1-110	1/12	0/12	5.2-5.2	2/27	0/27	3-4.1
Lead	12/12	12/12	35-520	19/19	13/19	1.6-180	19/33	11/33	1.4-110	7/20	0/20	1.6-8	15/67	0/67	1.3-6.2	1/12	0/12	3.3-3.3	1/27	0/27	1.6-1.6
Manganese	10/12	0/12	1.2-5.2	3/19	0/19	1.4-1.8	0/33	0/33	0-0	0/20	0/20	0-0	0/68	0/68	0-0	0/12	0/12	0-0	0/27	0/27	0-0
Nickel	0/12	0/12	--	1/16	0/16	1.6-1.6	0/32	0/32	--	2/18	0/18	1.3-1.3	2/53	0/53	1.3-1.3	1/11	0/11	1.4-1.4	0/26	0/26	--
Silver	11/12	3/12	1.2-20	16/19	12/19	1.4-1200	32/33	5/33	1.2-490	18/20	6/20	3-770	55/68	19/68	1.2-770	12/12	4/12	1.6-930	26/27	19/27	1.1-310
Zinc	12/12	12/12	72-160	19/19	10/19	4.9-87	33/33	20/33	3.4-66	16/20	0/20	1.1-5.8	47/67	2/67	1.1-16	0/12	0/12	--	1/26	0/26	5.1-5.1

-- = All HQs values were below a level of concern.
When available, dissolved concentrations were used in preference to total recoverable concentrations.
Non-detects were evaluated at one-half the detection limit.

[a] Copley Lake outfall, Splains Gulch, and Wildcat Creek

Table 4-4. Studies Providing Data on Sediment

Study	Location	Number of Sample Locations	Number of Samples
USEPA (1999, 2005, 2006)	Coal Creek Immediately Downstream of Elk Creek	5	7
	Coal Creek Downstream of Iron Bog	10	20
	Elk Creek (on-site)	5	14
	Mine Drainage, other on-site waters	4	8

Table 4-5
Bulk Sediment Toxicity Benchmarks for Benthic Macroinvertebrates

Analyte	Threshold Effect Concentrations (TEC)[1]					Probable Effect Concentrations (PEC)[2]				
	Consensus-Based TEC (mg/kg) [a]	ARCS TEL (mg/kg) [b]	Other (mg/kg)		Sediment Screening Benchmark (mg/kg)	Consensus-Based PEC (mg/kg) [a]	ARCS PEL (mg/kg) [b]	Other (mg/kg)		Sediment Screening Benchmark (mg/kg)
Aluminum	--	25,519	--		25,519	--	59,572	--		59,572
Arsenic	9.8	11	--		9.8	33.0	48.0	--		33.0
Cadmium	0.99	0.58	--		1.0	4.98	3.2	--		5.0
Copper	32	28	--		32	149	100	--		149
Lead	36	37	--		36	128	82.0	--		128
Manganese	--	631	--		631	--	1,184	--		1184
Silver	--	--	1.0	NOAA ERL [c]	1.0	--	--	3.7	NOAA ERM [c]	3.7
Zinc	121	98	--		121	459	540	--		459

Notes:
1 The TEC encompasses several types of sediment quality guidelines including the Lowest Effect Level (LEL), the Threshold Effect Level (TEL), the Effect Range Low (ERL), the TEL for Hyalella azetca in 28 day tests (TEL-HA28), and the Minimum Effect Threshold (MET).
2 The PEC encompasses several types of sediment quality guidelines including the Severe Effect Level (SEL), the Probable Effect Level (TEL), the Effect Range Median (ERM), the PEL for Hyalella azetca in 28 day tests (PEL-HA28), and the Toxic Effect Threshold (TET).

Sources Hierarchy:
a MacDonald et al. (2000); consensus-based threshold effect concentration (TEC) and probable effect concentration (PEC).
b Ingersoll, et al. (1996); Threshold Effect Level (TEL) and Probable Effect Level (PEL) for total extraction of sediment (BT) samples from
c Long and Morgan (1990); NOAA Effect Range Low (ERL) and Effect Range Median (ERM).

Table 4-6. HQ Values for Benthic Macroinvertebrates from Direct Contact with Sediment

Panel A: Based on TECs

Analyte	Mine Drainage Other On-Site Waters			Elk Creek at Mine			Elk Creek Downstream of Mine			Coal Creek Immediately Downstream of Elk Creek			Coal Creek Downstream of Iron Bog			Coal Creek Upsteam of Elk Creek			Background[a]		
	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0
Aluminum	0/3	0/3	--	1/8	0/8	1.3-1.3	0/14	0/14	--	0/7	0/7	--	1/20	0/20	1.2-1.2	0/4	0/4	--	0/10	0/10	--
Arsenic	3/3	2/3	2.9-14	6/8	1/8	1.2-16	14/14	0/14	1.1-9.3	7/7	2/7	3.2-18	20/20	2/20	2.3-16	4/4	1/4	5-11	4/10	2/10	1.9-13
Cadmium	3/3	1/3	5.7-30	8/8	5/8	3.8-35	14/14	13/14	1.1-69	7/7	2/7	2.4-13	20/20	7/20	1.8-32	0/4	0/4	--	1/10	0/10	1.1-1.1
Copper	3/3	3/3	10-16	5/8	2/8	1.7-54	13/14	6/14	1.1-19	3/7	0/7	1.1-1.3	12/20	0/20	1.1-8.8	0/4	0/4	--	0/10	0/10	--
Lead	3/3	3/3	26-72	8/8	8/8	23-220	13/14	10/14	1.1-47	6/7	0/7	1.4-4.2	20/20	2/20	1.2-11	1/4	0/4	1.5-1.5	1/10	0/10	1.1-1.1
Manganese	2/3	0/3	2.1-9.3	8/8	2/8	2.2-16	13/14	4/14	1.1-15	7/7	0/7	1.4-6.4	20/20	1/20	1.2-11	3/4	0/4	1.1-1.9	6/10	1/10	1.1-12
Silver	3/3	0/3	1.5-6.6	4/8	1/8	2.4-18	4/14	0/14	1.1-2.4	4/7	0/7	1.7-3.8	13/20	0/20	1-4.5	3/4	0/4	2.8-4	2/10	0/10	1.3-1.4
Zinc	3/3	3/3	12-21	8/8	5/8	4.1-57	14/14	13/14	1.1-59	7/7	3/7	3.3-16	20/20	11/20	2-43	1/4	0/4	1.1-1.1	2/10	0/10	1.1-1.3

Panel B: Based on PECs

Analyte	Mine Drainage Other On-Site Waters			Elk Creek at Mine			Elk Creek Downstream of Mine			Coal Creek Immediately Downstream of Elk Creek			Coal Creek Downstream of Iron Bog			Coal Creek Upsteam of Elk Creek			Background[a]		
	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0
Aluminum	0/3	0/3	--	0/8	0/8	--	0/14	0/14	--	0/7	0/7	--	0/20	0/20	--	0/4	0/4	--	0/10	0/10	--
Arsenic	2/3	0/3	3.2-4.2	3/8	0/8	1.2-4.8	10/14	0/14	1.1-2.7	6/7	0/7	1.5-5.4	15/20	0/20	1.2-4.9	4/4	0/4	1.5-3.2	3/10	0/10	2.3-3.9
Cadmium	3/3	0/3	1.1-5.9	7/8	0/8	1.3-6.9	13/14	2/14	4.2-14	4/7	0/7	1.5-2.7	15/20	0/20	1.2-6.4	0/4	0/4	--	0/10	0/10	--
Copper	3/3	0/3	2.2-3.4	3/8	1/8	2-12	9/14	0/14	1.1-4	0/7	0/7	--	2/20	0/20	1.4-1.9	0/4	0/4	--	0/10	0/10	--
Lead	3/3	2/3	7.2-20	8/8	5/8	6.5-62	13/14	2/14	2-13	1/7	0/7	1.2-1.2	5/20	0/20	1.3-3.2	0/4	0/4	--	0/10	0/10	--
Manganese	2/3	0/3	1.1-5	8/8	0/8	1.2-8.8	13/14	0/14	2.3-8	4/7	0/7	1.4-3.4	17/20	0/20	1.4-6	0/4	0/4	--	3/10	0/10	1.7-6.6
Silver	2/3	0/3	1.6-1.8	2/8	0/8	2.3-4.8	0/14	0/14	--	0/7	0/7	--	1/20	0/20	1.2-1.2	2/4	0/4	1.1-1.1	0/10	0/10	--
Zinc	3/3	0/3	3.3-5.5	8/8	1/8	1.1-15	14/14	8/14	1.3-16	5/7	0/7	1.1-4.2	19/20	2/20	1.1-11	0/4	0/4	--	0/10	0/10	--

TEC = Threshold Effect Concentration

PEC = probable Effect Concentration

-- = All HQs values were below a level of concern.

Non-detects were evaluated at one-half the detection limit.

[a] Copley Lake outfall, Splains Gulch, and Wildcat Creek

Table 4-7. HQ Values for Benthic Invertebrates from Pore Water

Panel A: Based on Acute Benchmarks

Analyte	Elk Creek Downstream of Mine			Coal Creek Immediately Downstream of Elk Creek			Coal Creek Downstream of Iron Bog			Coal Creek Upsteam of Elk Creek			Background[a]		
	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0
Aluminum	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Arsenic	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Cadmium	4/4	0/4	1.8-7	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Copper	0/4	0/4	--	1/5	0/5	1.9-1.9	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Lead	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Manganese	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Silver	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Zinc	4/4	2/4	3.5-15	1/5	0/5	1.3-1.3	1/2	0/2	1.7-1.7	0/1	0/1	--	0/3	0/3	--

Panel B: Based on Chronic Benchmarks

Analyte	Elk Creek Downstream of Mine			Coal Creek Immediately Downstream of Elk Creek			Coal Creek Downstream of Iron Bog			Coal Creek Upsteam of Elk Creek			Background[a]		
	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0	Freq. of HQs > 1.0	Freq. of HQs > 10	Range of HQs > 1.0
Aluminum	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Arsenic	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Cadmium	4/4	3/4	6.7-27	3/5	0/5	1.2-2.1	2/2	0/2	1.6-2.9	0/1	0/1	--	0/3	0/3	--
Copper	2/4	0/4	1.1-1.2	1/5	0/5	2.7-2.7	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Lead	2/4	0/4	1.8-2.3	1/5	0/5	2-2	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Manganese	0/4	0/4	--	0/5	0/5	--	0/2	0/2	--	0/1	0/1	--	0/3	0/3	--
Silver	4/4	0/4	2.6-2.9	3/5	0/5	1.3-5.3	2/2	0/2	4.2-5.7	1/1	0/1	4.1-4.1	3/3	2/3	5.7-18
Zinc	4/4	2/4	4.1-17	1/5	0/5	1.5-1.5	2/2	0/2	1.1-2	0/1	0/1	--	0/3	0/3	--

-- = All HQs values were below a level of concern.
Non-detects were evaluated at one-half the detection limit.

[a] Copley Lake outfall and Splains Gulch

Table 5-1
Soil Toxicity Benchmarks for Plants and Soil Invertebrates

Analytes	Plants			Soil Invertebrates		
	EcoSSL (mg/kg dw)	ORNL (mg/kg dw)	Benchmark (mg/kg dw)	EcoSSL (mg/kg dw)	ORNL (mg/kg dw)	Benchmark (mg/kg dw)
Aluminum	--	50	50	--	--	no benchmark
Antimony	--	5.0	5.0	78	--	78
Arsenic	18	10	18	--	60	60
Barium	--	500	500	330	--	330
Cadmium	32	4.0	32	140	20	140
Chromium	--	1.0	1.0	--	0.40	0.40
Cobalt	13	20	13	--	--	no benchmark
Copper	95	100	95	54	50	54
Lead	120	50	120	1700	500	1,700
Manganese	152	500	152	450	--	450
Mercury	--	0.30	0.30	--	0.10	0.10
Selenium	1.0	1.0	1.0	--	70	70
Silver	--	2.0	2.0	--	--	no benchmark
Thallium	--	1.0	1.0	--	--	no benchmark
Vanadium	--	2.0	2.0	--	--	no benchmark
Zinc	130	50	130	120	100	120

Table 5-2. HQ Values for Plants from Direct Contact with Surface Soil

Analyte	Site		Background[a]	
	Frequency of HQs > 1.0	Range of HQs > 1.0	Frequency of HQs > 1.0	Range of HQs > 1.0
Aluminum	190/190	20-400	1/1	300
Antimony	26/190	1-6	0/1	--
Arsenic	110/190	1-40	0/1	--
Barium	1/190	1-1	0/1	--
Cadmium	12/190	1-3	0/1	--
Chromium	189/190	1-90	1/1	10
Cobalt	14/190	1-3	0/1	--
Copper	91/190	1-30	0/1	--
Lead	170/190	1-500	0/1	--
Manganese	190/190	1-80	1/1	6
Mercury	1/190	1-1	0/1	--
Selenium	96/190	1-70	0/1	--
Silver	110/190	1-50	0/1	--
Thallium	17/190	1-6	0/1	--
Vanadium	190/190	2-20	1/1	10
Zinc	185/190	1-200	0/1	--

-- = All HQs values are less than 1.
Non-detects were evaluated at one-half the detection limit.

[a] Coal Creek immediately upstream of Elk Creek

Table 5-3. HQ Values for Soil Invertebrates from Direct Contact with Surface Soil

Analyte	Site		Background[a]	
	Frequency of HQs > 1.0	Range of HQs > 1.0	Frequency of HQs > 1.0	Range of HQs > 1.0
Arsenic	66/190	1-11	0/1	--
Barium	4/190	1-1.8	0/1	--
Chromium	190/190	2-230	1/1	26
Copper	120/190	1-51	0/1	--
Lead	86/190	1-37	0/1	--
Manganese	183/190	1-27	1/1	2
Mercury	30/190	1-3	0/1	--
Zinc	186/190	1-170	0/1	--

-- = All HQs values are less than 1.
Non-detects were evaluated at one-half the detection limit.

[a] Coal Creek immediately upstream of Elk Creek

Table 6-1. Exposure Factors for Representative Wildlife Species

Category	Feeding Guild	Selected Representative Species	Home Range Size (hectares)	Food Ingestion Rate (kg ww/kg BW/day)	Water Ingestion Rate (L/kg BW/day)	Sediment/ Soil Ingestion Rate (kg dw/kg BW/day)	Dietary Fraction
Avian	Terrestrial Omnivore	American Robin	0.48	1.21	0.14	0.025	50% plants; 50% terrestrial invertebrates
	Terrestrial Insectivore	Northern Flicker	35.5	0.58	0.11	0.012	100% terrestrial invertebrates
	Aerial Insectivore	Cliff Swallow	4,418	0.54	0.20	0.015	100% terrestrial invertebrates
	Aquatic Insectivore	American Dipper	1.5	0.0091	0.0087	0.00004	100% aquatic invertebrates
	Herbivore	Greater-Sage Grouse	1,942	0.10	1.03	0.0007	100% plants
	Piscivore	Belted Kingfisher	130	0.50	0.11	0.0014	100% fish
	Carnivore	Red-tailed Hawk	859	0.10	0.057	0	100% small mammals
Mammalian	Herbivore	Mule Deer	285	0.041	0.044	0.00013	100% plants
	Carnivore	Red Fox	1,038	0.069	0.085	0.00052	75% small mammals; 25% plants
	Carnivore (T&E)	Canada Lynx	15,550	0.070	0.078	0.00053	100% small mammals
	Terrestrial Insectivore	Masked Shrew	0.39	0.97	0.17	0.040	100% terrestrial invertebrates
	Aerial Insectivore	Big Brown Bat	11,100	0.44	0.15	0	100% areial insects*
	Terrestrial Omnivore	Deer Mouse	0.077	0.27	0.15	0.0018	50% plants; 50% terrestrial invertebrates

See Appendix L for detailed information and sources.
*Aerial insects are assumed to be similar to emerging aquatic insects.

Table 6-2. Exposure Point Concentrations Used to Evaluate Potential Risks to Wildlife

Location	Analyte	Exposure Point Concentration (EPC) (a)						
		Surface Water ug/L	Soil mg/kg	Earthworm mg/kg ww	Small Mammals mg/kg ww	Plants mg/kg ww	Benthics mg/kg ww	Fish mg/kg ww
Onsite	Aluminum	8.8E+02	7.4E+03	5.1E+01	1.5E+02	2.2E+02	1.5E+03	1.0E+01
	Antimony	6.9E+00	4.6E+00	7.4E-01	1.5E+00	2.5E-01	2.8E-01	7.8E-03
	Arsenic	1.1E+01	1.2E+02	1.2E+00	2.7E-01	5.0E-01	2.1E+01	9.3E-01
	Barium	9.1E+01	1.3E+02	1.8E+00	2.3E+00	4.2E+00	8.1E+00	9.1E-02
	Beryllium	1.2E+00	1.1E+00	7.9E-03	3.5E-01	1.0E-01	2.2E-01	3.2E-02
	Cadmium	9.6E+01	1.3E+01	1.0E+01	8.7E+00	2.9E+00	3.3E+01	8.1E-01
	Chromium	2.0E+00	9.5E+00	4.8E+00	3.9E-01	2.6E+00	3.2E+00	9.9E-01
	Cobalt	2.5E+01	9.1E+00	1.8E-01	6.0E-02	1.4E-02	2.1E+00	2.5E-02
	Copper	3.2E+02	4.2E+02	4.2E+00	1.5E+01	1.1E+01	1.5E+02	3.0E+00
	Lead	7.0E+02	7.0E+03	1.6E+02	3.9E+01	4.1E+01	1.6E+02	4.7E-01
	Manganese	6.7E+03	2.9E+03	1.6E+01	6.0E+02	5.4E+02	1.3E+03	3.5E+00
	Mercury	1.0E-01	8.2E-02	7.5E-02	1.4E-03	2.0E-02	2.4E-02	1.2E-01
	Nickel	1.2E+01	7.0E+00	5.3E+00	6.2E-01	2.5E+00	3.0E+00	4.4E-01
	Selenium	1.2E+01	1.2E+01	9.1E-01	5.3E-01	2.5E-01	6.3E+00	1.0E+00
	Thallium	3.3E+00	7.7E-01	1.2E-01	2.8E-02	1.0E-01	1.1E-01	1.3E-02
	Vanadium	2.5E+01	1.4E+01	9.4E-02	5.8E-02	1.4E-02	1.1E+00	2.5E-02
	Zinc	2.7E+04	2.4E+03	1.8E+02	5.0E+01	2.2E+02	3.5E+03	7.0E+01
Background	Aluminum	6.7E+01	5.8E+03	4.0E+01	1.5E+02	8.6E+02	7.6E+02	9.4E+00
	Antimony	1.4E+00	3.5E-01	5.6E-02	1.5E+00	2.5E-01	7.8E-01	9.6E-03
	Arsenic	3.6E+00	7.0E+00	1.5E-01	2.7E-01	4.0E-01	2.6E+01	1.0E-01
	Barium	7.1E+01	1.2E+02	1.7E+00	2.3E+00	3.8E+00	2.1E+01	7.1E-02
	Beryllium	5.0E-01	1.1E+00	7.6E-03	3.5E-01	1.0E-01	6.2E-01	3.7E-02
	Cadmium	1.5E+00	2.0E-01	3.7E-01	8.7E+00	2.0E-01	4.0E+00	7.9E-01
	Chromium	2.8E+00	1.9E+00	9.6E-01	3.9E-01	3.6E+00	3.6E+00	1.4E+00
	Cobalt	2.5E+01	6.5E+00	1.3E-01	6.0E-02	1.0E-02	1.7E+00	2.5E-02
	Copper	5.0E+00	1.0E+01	1.6E+00	1.5E+01	8.0E+00	2.0E+01	2.6E+00
	Lead	1.3E+00	2.6E+01	1.8E+00	3.9E+01	1.9E+00	5.8E+00	4.1E-03
	Manganese	7.7E+01	8.6E+02	7.1E+00	6.0E+02	1.9E+02	1.5E+03	3.8E+00
	Mercury	1.0E-01	9.0E-02	7.7E-02	1.4E-03	2.1E-02	3.1E-02	1.6E-01
	Nickel	5.7E+00	2.6E+00	2.0E+00	6.2E-01	2.1E+00	2.2E+00	7.4E-01
	Selenium	2.2E+00	5.0E-01	8.9E-02	5.3E-01	2.5E-01	1.9E+00	6.1E-01
	Thallium	5.0E-01	2.9E-01	4.6E-02	2.8E-02	1.0E-01	3.1E-01	4.1E-03
	Vanadium	2.5E+01	1.0E+01	6.9E-02	5.8E-02	1.0E-02	2.7E+00	2.5E-02
	Zinc	1.6E+02	7.1E+01	5.5E+01	5.0E+01	5.5E+01	4.4E+02	3.4E+01

(a) Values shown in unshaded boxes are based on measured samples. Values shown in shaded boxes are computed using mathematical uptake models, as described in Appendix C.

Background = Coal Creek immediately upstream of Elk Creek, Copley Lake, Splains Gulch, and Wildcat Creek.

Table 6-3. Selected Wildlife Toxicity Reference Values

Analyte	Toxicity Reference Values (mg/kg BW/day)					
	Mammals			Birds		
	NOAEL TRV	LOAEL TRV	Source	NOAEL TRV	LOAEL TRV	Source
Aluminum	1.93	19.3	3	110	--	3
Antimony	0.059	--	1	no TRV	no TRV	
Arsenic	1.04	4.7	1	2.2	22	1
Cadmium	0.77	--	1	1.47	--	1
Copper	2.7	632	2	2.3	52	2
Lead	4.7	--	1	1.63	--	1
Manganese	14	159	2	78	776	2
Nickel	0.13	32	2	1.4	56	2
Selenium	0.05	1.21	2	0.23	0.93	2
Vanadium	4.16	2.1	1	0.3	no TRV	1
Zinc	10	411	2	17	172	2

See Appendix B for details on the selected TRV.

Source:
1 -- USEPA Eco-SSL (2003b)
2 -- Engineering Field Activity West (1998)
3 -- Sample et al. (1996)

Table 6-4. Total HQ Values for Birds and Mammals

Location	Analyte	American Robin	Northern Flicker	Cliff Swallow	American Dipper	Greater-Sage Grouse	Belted Kingfisher	Red-tailed Hawk	Mule Deer	Red Fox	Canada Lynx	Masked Shrew	Big Brown Bat	Deer Mouse
Onsite	Aluminum	NC - 3	NC - 1	NC - 0.01	NC - 0.1	NC - 0.004	NC - 0.01	NC - 0.005	0.06 - 0.6	0.03 - 0.3	0.002 - 0.02	20 - 200	0.1 - 1	3 - 30
	Antimony	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - 0.02	NC - 0.05	NC - 0.004	NC - 20	NC - 0.006	NC - 2
	Arsenic	0.4 - 2	0.1 - 0.9	0.001 - 0.008	0.03 - 0.09	0.001 - 0.001	0.008 - 0.05	0.001 - 5E-04	9E-05 - 0.004	6E-05 - 0.003	4E-06 - 2E-04	0.03 - 6	3E-04 - 0.03	0.004 - 0.4
	Barium	NC - 0.3	NC - 0.1	NC - 0.001	NC - 0.004	NC - 5E-04	NC - 7E-04	NC - 4E-04	NC - 4E-04	NC - 2E-04	NC - 1E-05	NC - 0.1	NC - 2E-04	NC - 0.02
	Beryllium	0.5 - NC	0.05 - NC	5E-04 - NC	0.02 - NC	0.003 - NC	8E-04 - NC	0.003 - NC	0.02 - 0.001	0.009 - 0.001	6E-04 - 1E-04	0.8 - 0.1	0.01 - 6E-04	0.5 - 0.03
	Cadmium	0.3 - 6	0.2 - 4	0.002 - 0.03	0.001 - 0.2	3E-05 - 0.005	0.09 - 0.07	3E-05 - 0.02	2E-05 - 0.02	4E-06 - 0.02	8E-08 - 0.002	0.02 - 10	8E-06 - 0.06	0.003 - 2
	Chromium	0.09 - 2	0.05 - 1	4E-04 - 0.008	5E-04 - 0.01	4E-05 - 0.002	0.001 - 0.05	4E-05 - 6E-04	4E-04 - 0.005	8E-05 - 9E-04	3E-06 - 3E-05	0.2 - 2	1E-04 - 0.002	0.03 - 0.4
	Cobalt	1 - 0.05	0.7 - 0.03	0.005 - 2E-04	0.06 - 0.002	0.002 - 8E-05	0.1 - 5E-04	0.002 - 4E-05	0.001 - 5E-05	0.001 - 5E-05	8E-05 - 3E-06	1 - 0.07	0.007 - 4E-04	0.1 - 0.006
	Copper	0.4 - 8	0.1 - 3	0.001 - 0.03	0.03 - 0.6	0.001 - 0.01	0.008 - 0.2	0.001 - 0.02	9E-05 - 0.02	6E-05 - 0.01	4E-06 - 0.001	0.03 - 8	3E-04 - 0.07	0.004 - 1
	Lead	NC - 200	NC - 100	NC - 0.9	NC - 0.9	NC - 0.1	NC - 0.05	NC - 0.09	NC - 0.07	NC - 0.04	NC - 0.003	NC - 90	NC - 0.04	NC - 8
	Manganese	0.5 - 5	0.05 - 0.5	5E-04 - 0.005	0.02 - 0.2	0.003 - 0.01	8E-04 - 0.008	0.003 - 0.03	0.02 - 0.2	0.009 - 0.1	6E-04 - 0.007	0.8 - 10	0.01 - 0.1	0.5 - 6
	Mercury	0.3 - 2	0.2 - 1	0.002 - 0.008	0.001 - 0.006	3E-05 - 9E-04	0.09 - 0.4	3E-05 - 1E-04	2E-05 - 4E-04	4E-06 - 6E-05	8E-08 - 1E-06	0.02 - 0.3	8E-06 - 1E-04	0.003 - 0.05
	Nickel	0.09 - 4	0.05 - 2	4E-04 - 0.02	5E-04 - 0.02	4E-05 - 0.003	0.001 - 0.04	4E-05 - 0.002	4E-04 - 0.09	8E-05 - 0.02	3E-06 - 8E-04	0.2 - 40	1E-04 - 0.03	0.03 - 8
	Selenium	1 - 4	0.7 - 3	0.005 - 0.02	0.06 - 0.2	0.002 - 0.003	0.1 - 0.6	0.002 - 0.009	0.001 - 0.03	0.001 - 0.03	8E-05 - 0.002	1 - 30	0.007 - 0.2	0.1 - 4
	Thallium	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	4E-04 - 0.001	9E-05 - 3E-04	4E-06 - 1E-05	0.1 - 0.3	1E-04 - 3E-04	0.02 - 0.07
	Vanadium	NC - 1	NC - 0.6	NC - 0.006	NC - 0.03	NC - 0.002	NC - 0.01	NC - 8E-04	2E-04 - 1E-04	2E-04 - 1E-04	1E-05 - 7E-06	0.3 - 0.2	7E-04 - 4E-04	0.02 - 0.01
	Zinc	2 - 20	0.7 - 7	0.006 - 0.06	0.2 - 2	0.001 - 0.05	0.06 - 0.6	0.001 - 0.01	0.003 - 0.1	8E-04 - 0.03	4E-05 - 0.002	0.7 - 30	0.01 - 0.5	0.1 - 6
Background	Aluminum	NC - 6	NC - 0.8	NC - 0.008	NC - 0.06	NC - 0.01	NC - 0.01	NC - 0.005	0.2 - 2	0.04 - 0.4	0.001 - 0.01	10 - 100	0.05 - 0.5	7 - 70
	Antimony	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - 0.02	NC - 0.04	NC - 0.004	NC - 1	NC - 0.02	NC - 0.7
	Arsenic	0.02 - 0.2	0.007 - 0.07	7E-05 - 6E-04	0.01 - 0.1	5E-05 - 4E-04	6E-04 - 0.006	5E-05 - 5E-04	4E-04 - 0.002	2E-04 - 8E-04	1E-05 - 5E-05	0.09 - 0.4	0.007 - 0.03	0.02 - 0.08
	Barium	0.1 - 0.3	0.05 - 0.1	5E-04 - 0.001	0.005 - 0.009	2E-04 - 4E-04	3E-04 - 5E-04	2E-04 - 4E-04	NC - 4E-04	NC - 2E-04	NC - 9E-06	NC - 0.1	NC - 5E-04	NC - 0.02
	Beryllium	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - 9E-04	NC - 0.001	NC - 1E-04	NC - 0.09	NC - 0.002	NC - 0.03
	Cadmium	NC - 0.2	NC - 0.1	NC - 0.001	NC - 0.02	NC - 3E-04	NC - 0.07	NC - 0.02	NC - 0.001	NC - 0.02	NC - 0.002	NC - 0.5	NC - 0.007	NC - 0.1
	Chromium	0.6 - 1	0.1 - 0.2	8E-04 - 0.002	0.007 - 0.01	3E-04 - 0.002	0.04 - 0.07	3E-04 - 6E-04	0.001 - 0.007	2E-04 - 0.001	5E-06 - 3E-05	0.08 - 0.4	4E-04 - 0.002	0.05 - 0.3
	Cobalt	NC - 0.03	NC - 0.02	NC - 2E-04	NC - 0.002	NC - 7E-05	NC - 5E-04	NC - 4E-05	NC - 4E-05	NC - 4E-05	NC - 3E-06	NC - 0.05	NC - 3E-04	NC - 0.005
	Copper	0.1 - 3	0.02 - 0.4	1E-04 - 0.003	0.004 - 0.08	0.001 - 0.006	0.006 - 0.1	0.001 - 0.02	6E-05 - 0.01	5E-05 - 0.01	3E-06 - 8E-04	0.003 - 0.7	4E-05 - 0.01	0.002 - 0.5
	Lead	NC - 2	NC - 0.8	NC - 0.006	NC - 0.03	NC - 0.002	NC - 3E-04	NC - 0.09	NC - 0.002	NC - 0.01	NC - 0.001	NC - 0.6	NC - 0.002	NC - 0.1
	Manganese	0.2 - 2	0.02 - 0.2	2E-04 - 0.002	0.02 - 0.2	0.003 - 0.004	6E-04 - 0.006	0.003 - 0.03	0.006 - 0.07	0.007 - 0.08	6E-04 - 0.007	0.3 - 3	0.01 - 0.1	0.2 - 2
	Mercury	0.3 - 2	0.2 - 1	0.002 - 0.008	0.002 - 0.007	3E-05 - 0.001	0.1 - 0.5	3E-05 - 1E-04	3E-05 - 4E-04	4E-06 - 6E-05	8E-08 - 1E-06	0.02 - 0.3	1E-05 - 2E-04	0.003 - 0.05
	Nickel	0.04 - 2	0.02 - 0.8	1E-04 - 0.006	4E-04 - 0.01	4E-05 - 0.003	0.002 - 0.07	4E-05 - 0.002	3E-04 - 0.08	7E-05 - 0.02	3E-06 - 7E-04	0.06 - 20	9E-05 - 0.02	0.02 - 4
	Selenium	0.2 - 0.9	0.06 - 0.2	5E-04 - 0.002	0.02 - 0.08	0.002 - 0.002	0.08 - 0.3	0.002 - 0.009	0.001 - 0.02	9E-04 - 0.02	7E-05 - 0.002	0.09 - 2	0.002 - 0.05	0.04 - 0.9
	Thallium	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	NC - NC	3E-04 - 0.001	8E-05 - 2E-04	3E-06 - 1E-05	0.04 - 0.1	3E-04 - 9E-04	0.01 - 0.04
	Vanadium	NC - 0.9	NC - 0.5	NC - 0.004	NC - 0.07	NC - 0.002	NC - 0.01	NC - 8E-04	2E-04 - 8E-05	2E-04 - 8E-05	1E-05 - 6E-06	0.2 - 0.1	0.002 - 9E-04	0.02 - 0.008
	Zinc	0.4 - 4	0.2 - 2	0.001 - 0.01	0.02 - 0.2	0.001 - 0.006	0.03 - 0.3	0.001 - 0.01	6E-04 - 0.03	3E-04 - 0.01	2E-05 - 8E-04	0.1 - 6	0.001 - 0.06	0.04 - 2

[a] Ranges presented are the HQ values based on the LOAEL to the NOAEL
NC = Not calculated due to lack of TRV
NOAEL = No Observed Adverse Effect Level
LOAEL = Low Observed Adverse Effect Level

Onsite = vicinity of Standard Mine
Background = Coal Creek immediately upstream of Elk Creek, Copley Lake, Splains Gulch, and Wildcat Creek.