

APPENDIX E

Other Information

In accordance with the requirements of R645-301 and R645-302

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DEQ WATER ANALYSES
HORIZON WELL MONITORING DATA
MACROINVERTEBRATE SAMPLING

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For additional information

MACROINVERTEBRATE STUDIES ON GORDON CREEK,
WEST OF HELPER, CARBON COUNTY, UTAH
Samples collected October 21, 2008

by

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for

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8160 South Highland Drive, A-4
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Three macroinvertebrate samples were collected at two stations on the North Fork of Gordon Creek, on October 21, 2008. The upper station is above the Horizon Mine discharge site and the lower station is located below. Samples were taken using a modified Surber sampler as described in Winget and Mangum (1979). Samples were preserved in 75% EtOH and transported to the entomology laboratory in Provo, Utah. All macroinvertebrates were then sorted, identified, counted and analyzed. Taxonomic determinations were made using the following references: Baumann et al. (1977), Edmunds et al. (1976), Merritt and Cummins (1996), Thorp and Covich (1991) and Wiggins (1996).

Study Area

The total length of the creek sampled was not great since the sampling stations were located 0.5 miles apart. More detailed information about the sampling stations is given below.

STATION 1: North Fork Gordon Creek (Upper)

This station is located 0.3 miles above the discharge point. It was moved a short distance upstream because of beaver activity so that a shallow gravel run could be found.

STATION 2: North Fork Gordon Creek (Lower)

The station was located 0.2 miles downstream of the discharge point. It was moved downstream because of a beaver dam that has appeared at the previous site.

Results

The organisms collected are mostly similar to those that were found in October 2004. Three mayflies occurred: *Baetis*, *Cinygmula*, and *Drunella grandis*. Four stonefly taxa were collected: *Amphinemura mogollonica*, *Isogenoides zionensis*, *Isoperla fulva*, and *Pteronarcella badia*. Caddisflies were represented by three species: *Brachycentrus americanus*, *Hesperophylax*, and *Hydropsyche*. All of these EPT taxa (Ephemeroptera, Plecoptera, and Trichoptera) have been recorded from the North Fork of the Gordon Creek over the past 10 years.

Of special interest was the appearance for the first time of the isopod *Asellus*. This organism is very pollution tolerant and is expanding its range in Utah and the intermountain West. Conversely, scuds of the amphipod genus *Gammarus* were not found.

The Biological Condition Index (BCI) scores were 80 at station one and 89 at station two. There were actually more species present at station one but because there were more with tolerance quotients of 108 at station one the BCI score was lower. In reality, the scores at the two stations were not too different.

Conclusions

The relative health of the North Fork of Gordon Creek macroinvertebrate fauna has not changed much since 2004. Most of the taxa have remained the same even though the total numbers have decreased. The biggest change is the appearance of the isopod genus *Asellus*. It has not been recorded from the creek previously. Since it is very pollution tolerant, it could mean that the overall water quality at station two is getting worse.

Over the past couple of years beavers have changed the overall stream flow pattern of the creek. This probably has and will continue to have a major influence on the macroinvertebrate fauna.

The impact of the mine discharge does influence the health of the creek as shown by the macroinvertebrates. However, because the two sampling stations are so close together and the beaver continue to change the flow patterns, it is difficult to assess the actual effects quantitatively.

Literature Cited

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- Wiggins, G. B. 1996. Larvae of the North American caddisfly genera. Univ. of Toronto Press, 401 pp.
- Winget, R. N. and F. A. Mangum. 1979. Biotic Condition Index: Integrated biological, physical, and chemical stream parameters for management. Aquatic ecosystem inventory: Macroinvertebrate analysis, U. S. Forest Service, Intermountain Region, 51 pp.

Table 1. Macroinvertebrates obtained from North Fork, Gordon Creek, Carbon County, Utah, samples collected October 21, 2008.

Organism	Trophic Level*	Tolerance Quotient	Stations	
			1	2
Ephemeroptera (Mayflies)				
Baetis	C-G	72		1
Cinygmula	Scr	30	23	
Drunella grandis	Shr	32		3
Plecoptera (Stoneflies)				
Amphinemura mogollonica	C-G	6	5	
Isogenoides zionensis	Pred	30	4	15
Isoperla fulva	Pred	48	1	
Pteronarcella badia	Shr	32		1
Trichoptera (Caddisflies)				
Brachycentrus americanus	Scr	54		3
Hesperophylax	Scr	108	1	
Hydropsyche	C-F	108	1	
Coleoptera (Beetles)				
Elmidae	C-G	104	20	3
Diptera (Flies)				
Chironomidae	C-G	108		2
Dicranota	Pred	36	2	
Empididae	Pred	95	1	
Hexatoma	Pred	36	1	2

Table 1 Continued				
Organism	Trophic Level*	Tolerance Quotient	Stations	
			1	2
Diptera (Flies) Cont.				
Stratiomyidae	Pred	108	1	
Tipula	Shr	80	4	16
Hemiptera (Bugs)				
Notonecta	Pred	108	1	
Crustacea (Isopods)				
Asellus	C-G	98	9	
Hirudinea (Leeches)	Pred	108	1	
Annelida (Worms)				
Oligochaeta	C-G	108	1	1
Lumbricidae	C-G	90	11	2

*C-F = collectors-filterers
 C-G = collectors-gatherers
 Pred = predators

Scr = scrapers
 Shr = shredders

Table 2. Summary of macroinvertebrate data from North Fork, Gordon Creek, Carbon County, Utah, samples collected October 21, 2008.

Parameter	Stations	
	1	2
Total number of taxa	17	11
Mean number/square meter	312	176
Standard Deviation	177	81
Grams/square meter	>0.1	>0.1
Dominance Community TQ=CTQd	70	64
Shannon Weaver Index = \bar{d}	3.1	2.7
Average Community TQ=CTQa	76	67
Predicted Community TQ = CTQp	60	60
Percent of Predicted = BCI	80	89

BCI

Above 90
80-90
70-80
Below 70

SCALE

Excellent
Good
Fair
Poor

CTQd

Below 60
60-70
70-80
Above 80

SCALE

Excellent
Good
Fair
Poor

TOTAL SAMPLE STATISTICS

STATION: 1

North Fork Gordon Creek Station 1 Upper, Carbon County, Utah

DATE: 21 10 2008

Repl	Total No. Species	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			IL	UL						
3	17	312	120	505	176.89	32.72	56.67	3.1478	76	70

SPECIES ANALYSIS

STATION: 1 North Fork Gordon Creek Station 1 Upper, Carbon County, Utah DATE: 21 10 08

TAXONOMIC LIST	CLASS	ORDER	FAMILY	GENUS	SPECIES	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 XTQ
INSECTA		EPHEMEROPTERA	HEPTAGENIIDAE	CINYGMULA		83	1.917	30	57
INSECTA		PLECOPTERA	NEMOURIDAE	AMPHINEMURA	MOGOLIONICA	18	1.254	6	7
INSECTA		PLECOPTERA	PERLODIDAE	ISOGENOIDES	ZIONENSIS	14	1.157	30	34
INSECTA		PLECOPTERA	PERLODIDAE	ISOPERIA	FULVA	4	0.555	48	26
INSECTA		TRICHOPTERA	HYDROPSYCHIDAE	HYDROPSYCHE		4	0.555	108	59
INSECTA		TRICHOPTERA	LIMNIPHILIDAE	HESEROPHYLAX		4	0.555	108	59
INSECTA		COLEOPTERA	ELMIDAE			72	1.856	104	193
INSECTA		HEMIPTERA	NOTONECTIDAE	NOTONECTA		4	0.555	108	59
INSECTA		DIPTERA	TIPULIDAE	DICRANOXA		7	0.856	36	30
INSECTA		DIPTERA	TIPULIDAE	HEXATOMA		4	0.555	36	19
INSECTA		DIPTERA	TIPULIDAE	TIPULA		14	1.157	80	92
INSECTA		DIPTERA	EMPIDIDAE			4	0.555	95	52
INSECTA		DIPTERA	STRATIOMYIDAE			4	0.555	108	59
CRUSTACEA		DIPTERA	ASELLIDAE	ASELLIUS		32	1.509	98	147
HIRUDINEA		ISOPODA				4	0.555	108	59
OLIGOCHAETA						4	0.555	108	59
ANNELIDA			LUMBRICIDAE			39	1.596	90	143

MEAN BIOMASS GM/SQM: 0.1 TOTALS: 312 2.494

TOTAL SAMPLE STATISTICS

STATION: 2

North Fork Gordon Creek Station 2 Lower, Carbon County, Utah

DATE: 21 10 08

Repl	Total No. Species	Mean /SQM	Confidence Limits (80 Percent)		Standard Deviation	Percent SE of Mean	Coeff. of Variation	DBAR	CTQA	CTQD
			IL	UL						
3	11	176	88	264	80.70	26.50	45.90	2.6990	67	64

SPECIES ANALYSIS

STATION: 2 North Fork Gordon Creek Station 2 Lower, Carbon County, Utah

DATE: 21 10 08

TAXONOMIC LIST CLASS	ORDER	FAMILY	GENUS	SPECIES	MEAN N/SQM	LOG10 N/SQM	TQ	LOG10 TQ
INSECTA	EPHEMEROPTERA	EPHEMERELLIDAE	DRUNELLA	GRANDIS	11	1.032	32	33
INSECTA	EPHEMEROPTERA	BAETIDAE	BAETIS	ZIONENSIS	4	0.555	72	39
INSECTA	PLECOPTERA	PERLODIDAE	ISOGENOIDES	BADIA	54	1.731	30	51
INSECTA	PLECOPTERA	PTERONARCIIDAE	PTERONARCELLA	AMERICANUS	4	0.555	30	16
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE	BRACHYCENTRUS		11	1.032	54	55
INSECTA	COLEOPTERA	EIMTIDAE			11	1.032	104	107
INSECTA	DIPTEERA	TIPULIDAE	HEXATOMA		7	0.856	36	30
INSECTA	DIPTEERA	TIPULIDAE	TIPULA		57	1.759	80	140
INSECTA	DIPTEERA	CHIRONOMIDAE			7	0.856	108	92
OLIGOCHAETA					4	0		