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HYDROLOGIC DATA FOR THE MATANUSKA RIVER WATERSHED, SOUTHCENTRAL ALASKA

by

Mary A. Maurer
Alaska Division of Mining & Water Management
Alaska Hydrologic Survey

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INTRODUCTION

The Alaska Department of Natural Resources (ADNR), Division of Mining and Water Management, Alaska Hydrologic Survey collected hydrologic data on ungaged streams in the Matanuska River watershed from 1984 to 1998 to provide water resource information for the Matanuska Valley Moose Range Management Plan (ADNR and Alaska Department of Fish and Game, 1986) and Alaska's Abandoned Mine Lands program. Water is an essential natural resource that sustains fish and wildlife. In addition, an adequate water supply is needed for residential, recreational, commercial, and industrial development within the watershed. The need for water data is expected to increase in conjunction with renewed interest in surface coal mining near Sutton. The purpose of this report is to make previously unpublished Alaska Hydrologic Survey hydrologic data for the Matanuska River watershed available to the public.

WATERSHED DESCRIPTION

The Matanuska River watershed encompasses 2070 square miles within the Cook Inlet drainage basin in Southcentral Alaska. The Matanuska River flows southwestward for 75 miles to its terminus in the Knik Arm of Cook Inlet, about 40 miles northeast of Anchorage, Alaska (fig. 1). The river is glacial and has a broad, braided floodplain with a few bedrock constrictions along its length. The Matanuska Glacier in the Chugach Mountains contributes glacial meltwater and a heavy sediment load to the river during summer months. The largest tributaries flow south from the Talkeetna Mountains (fig. 1). The Chickaloon River is the largest tributary. The middle and lower reaches of Moose Creek, Eska Creek, Granite Creek, Boulder Creek, Kings River and Chickaloon

River lie within the Matanuska Valley Moose Range. Streamflow measurement and water-quality sampling sites are shown on figure 1. Descriptions of specific sampling locations are listed on table 1.

METHODS

Streamflow was measured with a Marsh-McBirney current meter according to U.S. Geological Survey methods (Carter and Davidian, 1968). In-situ water temperature, dissolved oxygen, and specific conductance were measured with a Model 4041 Hydrolab that was pre- and post-calibrated according to the user manual. On-site pH was measured with a Hydrolab or an Orion pH meter. Turbidity was measured with a Model 16800 Hach turbidimeter. Bicarbonate alkalinity was measured on-site by titrating an untreated, unfiltered 100-ml water sample with 0.01639 N sulfuric acid to an end-point of pH 4.5 (U.S. Environmental Protection Agency, 1983).

No quality assurance plan was written for the project. Sample collection and handling procedures of the U.S. Geological Survey (1977) were followed. Pre-cleaned plastic bottles were used. Grab samples were taken approximately mid-depth and mid-channel. All samples were field treated. Samples for total recoverable trace-element analysis were treated with double-distilled 70 percent nitric acid. Samples for dissolved trace-element analysis were filtered through a 0.45-µm membrane filter and acidified with double-distilled 70 percent nitric acid. Samples for major ion analysis were filtered through a

0.45-µm membrane filter. Samples were placed in a cooler with blue ice during transit to the laboratory.

The Alaska Hydrologic Survey water quality laboratory in Fairbanks, Alaska (formerly known as the hydrology laboratory of the Alaska Division of Geological and Geophysical Surveys) performed the major ion and trace element analyses. All samples were analyzed in accordance with the methods of the U.S. Environmental Protection Agency (1983) or the American Public Health Association (1980).

RESULTS AND DISCUSSION

Streamflow and on-site water-quality measurements are shown on table **1.** Water temperatures are relatively cool in the summer, which is typical of mountain streams in southcentral Alaska. The pH ranges from slightly acid to slightly basic. Specific conductance varies among sites, ranging from 68 to 564 µS/cm @ 25°C. During the winter, the specific conductance of streams is a good indicator of the dissolved mineral content in groundwater. The highest specific conductance (564 µS/cm at 25 °C) was measured in Caribou Creek (site 19). Alkalinity ranges from 23 to 70 mg/L, indicating low to moderate acid-neutralizing capacity. Dissolved oxygen concentrations are high except in one spring in the Chickaloon area (site 11).

The major ion and trace element concentrations for three streams are shown on table 2. The majority of analyses have an ion balance error less than 10 percent, which indicates no major analytical errors. The analysis for site 2 has a higher error (13.7%) because the alkalinity titration was performed under difficult cold weather conditions. The calculated total dissolved solid concentration ranges from 64 to 87 mg/L, indicating low dissolved mineral content. Likewise, calculated hardness values range from 52 to 59 mg/L as $CaCO_3$, indicating soft water (Hem, 1985).

Total and dissolved trace element concentrations for streams are either below detection limits or are present in low concentrations (table 2). Arsenic concentrations in streams are low, ranging from 0.9 to 2.1 µg/L. Concentrations of aluminum, barium, and zinc generally are less than 50 µg/L. Boron concentrations range up to several hundred micrograms per liter (µg/L). Generally, total recoverable and dissolved concentrations of trace elements are similar. Iron and aluminum total recoverable concentrations are noticeably higher than dissolved concentrations in the Moose Creek tributary (site 3) under baseflow conditions. A small amount of suspended sediment or inorganic particulate matter could produce these results.

The dissolved major ion concentrations and trace element concentrations for three springs are shown on table 3. Alkalinity for the springs was not determined in the field. A calculated alkalinity value was obtained by solving for the bicarbonate ion (HCO_3^-) in the cation/anion balance. Hardness values are variable. The spring along Chickaloon River

Road (site 22) has a higher mineral content than the other two springs; a hardness value of 159 mg/L as $CaCO_3$ indicates hard water (Hem, 1985).

Trace element concentrations in the springs are similarly low (table 3). Most trace elements are either undetected or have concentrations ranging from 1 to 50 µg/L. Two springs have a boron concentration of 55 µg/L, which is acceptable for all freshwater uses. The arsenic concentration is <5 mg/L in the spring along California Creek Road (site 11). Area residents reportedly use this spring as a public water supply.

A trilinear diagram shows the percentages of total cations (positively charged ions) and anions (negatively charged ions) for four streams and three springs (fig. 2). Upper Moose Creek, Lower Moose Creek, an unnamed tributary to Moose Creek, Eska Creek and the spring along Chickaloon River Road have calcium bicarbonate water. The other two springs in the Chickaloon area have sodium bicarbonate water.

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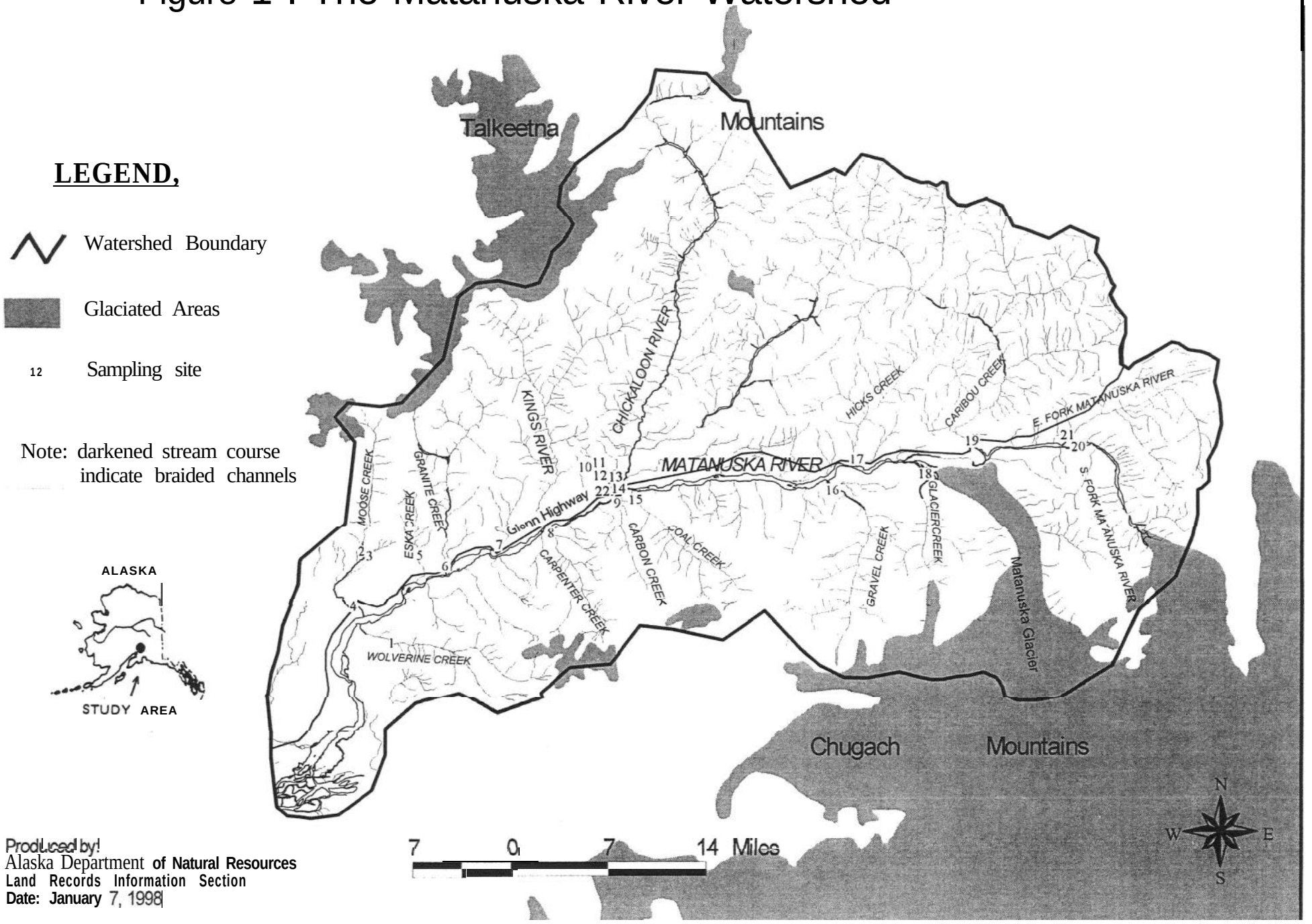
Figure 1 . The Matanuska River Watershed



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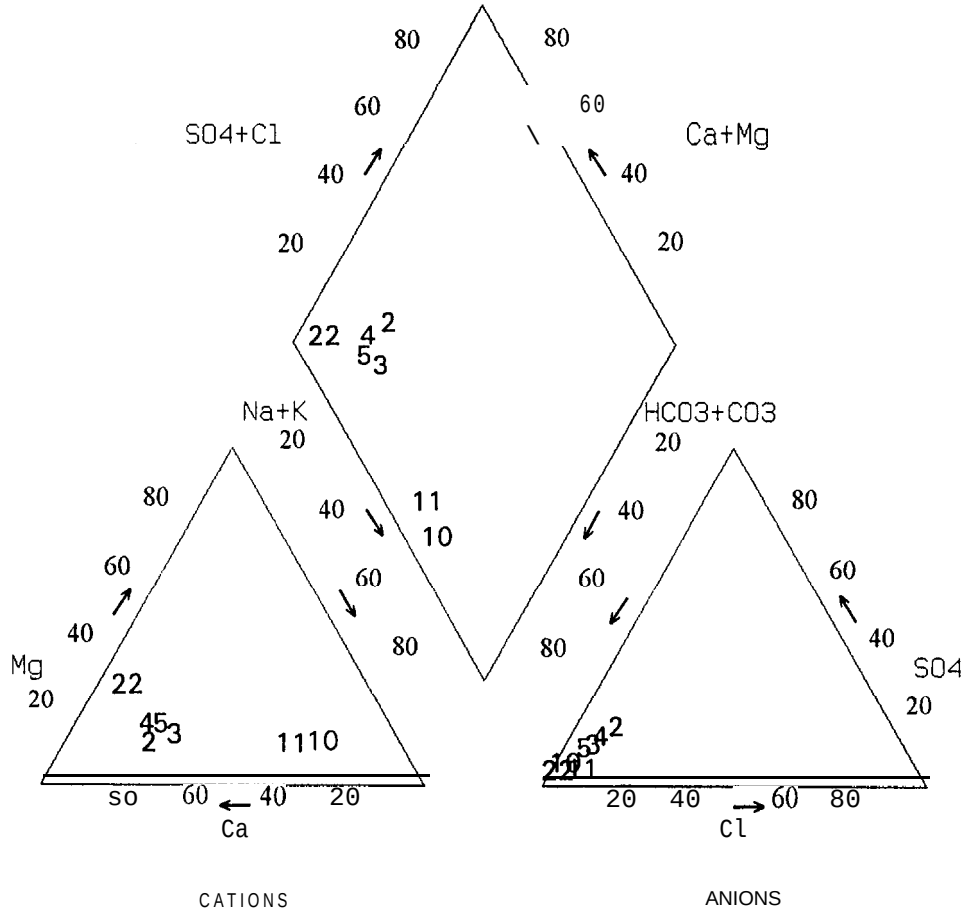

EXPLANATION

Site No.	Location	Water Tvoe
2	Upper Moose Creek	Calcium bicarbonate
3	Moose Creek tributary	Calcium bicarbonate
4	Lower Moose Creek	Calcium bicarbonate
5	Eska Creek	Calcium bicarbonate
10	Spring on Luster property	Sodium bicarbonate
11	Spring along California Creek Road	Sodium bicarbonate
22	Spring along Chickaloon Road	Calcium bicarbonate

Figure 2. Trilinear diagram of water analyses from seven sites in the Matanuska River watershed, 1985-I 991,

Table 1. Streamflow and on-site water-quality measurements taken in the Matanuska River watershed, 1984-l 998.

Site No.	Site	Date	Time	Streamflow (cfs)	Air Temperature (°C)	Water Temperature (°C)	pH (units)	Specific Conductance (µS/cm @25°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (percent saturation)	Alkalinity (mg/L as $CaCO_3$)	Turbidity (NTU)
1	Wolverine Creek	4-l l-84	1020	36	1.7	1 .o	6.5	139	14.9	100	--	--
2	Moose Creek above unnamed tributary	6-21-85	1430	164	12.2	5.7	6.9	68	13.1	100	23	1.0
		8-28-85	1200	172	12.8	--	--	--	--	--	--	--
		4-9-86	1445	5.2	-3.0	0.0	6.1	140	15.7	100	37	--
		6-25-86	1445	113	18.3	--	--	--	--	--	--	--
		1 O-2-86	1530	114	7.2	5.5	--	--	--	--	--	--
		1 l-3-86	1345	38	-1.1	1 .o	--	--	--	--	--	--
		5-21-87	1155	63	--	--	--	--	--	--	--	--
		9-l 7-87	1400	128	--	--	--	--	--	--	--	--
		1 O-29-87	1510	39	--	--	--	--	--	--	--	--
3	Unnamed tributary to Moose Creek	6-21-85	1540	10	12.2	7.1	7.5	199	11.3	97	--	--
		4-9-86	1525	4.1	-5.0	0.0	7.1	151	15.8	100	58	--
4	Moose Creek at Glenn Hwy	4-l l-84	1215	19	3.3	2.1	6.8	156	13.8	100	--	--
		8-l 5-84	1530	145	22	12.3	--	230	--	--	--	--
		6-21-85	1140	198	10	5.6	6.6	81	13.0	100	31	1.8
		4-l 6-86	0945	17	3	0.8	6.4	146	16.1	100	53	--
		6-25-86	1315	151	18.3	--	--	--	--	--	--	--
		1 l-3-86	1225	66	--	--	--	--	--	--	--	--
5	Eska Creek 1.5 mi Jonesville Rd	6-25-85	1015	39	9.5	4.5	6.8	75	13.4	100	34	14
		8-20-85	1245	41	12.8	6.6	7.4	80	12.8	100	39	8.9
		8-28-85	--	32	--	--	--	--	--	--	--	--
		4-7-86	1225	2.3	-7.0	0.1	6.4	142	15.8	100	70	--
		6-25-86	1145	23	15.6	--	--	--	--	--	--	--
		7-21-86	1330	111	20.0	--	--	--	--	--	--	--
		9-29-86	1140	27	4.4	--	--	--	--	--	--	--
		11-13-86	1130	14	--	--	--	--	--	--	--	--
		5-21-87	1520	13	--	--	--	--	--	--	--	--
		5-27-87	1130	11	--	--	--	--	--	--	--	--
		7-l 3-87	0950	53	18.3	--	--	--	--	--	--	--
		9-l 7-87	1225	30	12	--	--	--	--	--	--	--
		5-l 8-98	1500	8.5	--	4.1	6.7	189	13.0	98	--	--

Table 1. Streamflow and on-site water-quality measurements taken in the Matanuska River watershed, 1984-l 998 (continued).

Site No.	Site	Date	Time	Streamflow (cfs)	Air Temper-ature (°C)	Water Temper-ature (°C)	pH (units)	Specific Conductance (µS/cm @25°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (percent saturation)	Alkalinity (mg/L as $CaCO_3$)	Turbidity (NTU)
6	Granite Creek	4-l O-84 7-l 1-85	1620 1515	22 --	-1.1 --	1.8 9.3	6.8 7.7	181 80	14.0 11.1	100 97	-- --	-- 7
7	Kings River	4-l O-84 7-l l-85	1530 1450	52 --	-1.1 --	2.5 9.3	6.9 7.8	196 103	13.9 11 .0	100 96	-- --	-- 24
8	Carpenter Creek	4-12-84	1445	24	1.7	2.2	7.3	199	13.3	100	--	--
9	Carbon Creek	4-12-84	1330	9.7	4.4	2.4	7.4	269	13.1	98	--	--
10	Spring on Luster property	7-l l-85	1300	--	--	8.3	6.9	164	10.6	93	--	--
11	Spring along California Creek Rd	7-l l-85	1335	--	--	3.7	7.2	262	9.1	71	--	--
12	California Creek near Chickaloon	7-l l-85	1400	7.3	--	9.1	em	190	10.8	96	--	--
13	Chickaloon River	4-l 2-84	1400	125	1.7	1.9	7.4	298	13.5	100	--	--
14	Chickaloon River at Glenn Hwy	7-l l-85	1100	--	--	6.9	em	127	12.0	100	--	620
15	Coal Creek	4-l 2-84	1300	26	1.7	1.4	7.5	312	13.6	100	--	--

Table 1. Streamflow and on-site water-quality measurements taken in the Matanuska River watershed, 1984-1998 (continued).

Site No.	Site	Date	Time	Streamflow (cfs)	Air Temperature (°C)	Water Temperature (°C)	pH (units)	Specific Conductance (µS/cm @25°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (percent saturation)	Alkalinity (mg/L as $CaCO_3$)	Turbidity (NTU)
16	Gravel Creek	4-12-84	1230	23	1.7	1.1	7.0	388	14.1	96	--	--
17	Hicks Creek	4-10-84	1350	5.8	2.2	0.1	7.2	536	14.5	100	--	--
18	Glacier Creek	4-12-84	1145	19	3.3	0.0	7.5	344	14.0	94	--	--
19	Caribou Creek	4-10-84	1200	29	4.4	-0.1	7.4	564	14.0	93	--	--
20	South Fork Matanuska River	4-12-84	1000	35	3.3	-0.2	6.6	259	15.4	100	--	--
21	East Fork Matanuska River	4-12-84	1100	11	3.3	2.9	6.7	20'	12.0	87	--	--

— = no measurement made
em = erroneous measurement
[1] questionable reading

Sampling locations:
Site 1: Wolverine Creek, 20 yds upstream of Wolverine Rd bridge
Site 2: Moose Creek upstream of Wishbone Hill, 50 ft above confluence of unnamed tributary (site 3)
Site 3: Unnamed Moose Creek tributary immediately north of Wishbone Hill, 100 ft above mouth
Site 4: Moose Creek, 30 yds downstream of Glenn Hwy bridge
Site 5: Eska Creek, culvert at 1.5 mi Jonesville Rd (50 ft downstream for discharge, 50 ft upstream for QW)
Site 6: Granite Creek, 30 yds downstream of Glenn Hwy bridge
Site 7: Kings River, ¼ mi above Matanuska River confluence
Site 8: Carpenter Creek, 200 yds above Matanuska River confluence
Site 9: Carbon Creek, 200 yds above Matanuska River confluence
Site 10: spring on Luster property, near California Creek
Site 11: spring with pipe outlet, along road near California Creek
Site 12: California Creek, along road opposite pullout
Site 13: Chickaloon River, 2 miles above Matanuska River confluence
Site 14: Chickaloon River, above Glenn Hwy bridge
Site 15: Coal Creek, ⅛ mile above Matanuska River confluence
Site 16: Gravel Creek, 1½ miles above Matanuska River confluence
Site 17: Hicks Creek, at Glenn Hwy bridge
Site 18: Glacier Creek, above Matanuska River confluence
Site 19: Caribou Creek, at Glenn Hwy bridge
Site 20: S.F. Matanuska River, 1 mile above East Fork confluence
Site 21: E.F. Matanuska River, 1 mile above South Fork confluence

Table 2. Laboratory analyses of major ions and trace elements for three streams in the Matanuska River watershed, 1986.

Parameter	Site 2 Upper Moose Creek		Site 3 Moose Creek tributary		Site 4 Lower Moose Creek		Site 5 Eska Creek	
DATE	4-9-86		4-9-86		4-l 6-86		4-7-86	
Major Ions, Dissolved (mg/L)								
Calcium	17.6		17.7		18.2		18.4	
Magnesium	2.0		2.7		3.0		3.2	
Sodium	6.5		9.0		6.2		7.2	
Potassium	0.6		0.7		0.6		0.5	
Alkalinity (as HCO_3^-)	45		71		65		85	
Chloride	1.8		1.8		1.8		1.8	
Sulfate	8.4		8.4		8.4		8.5	
Nitrate (as N)	0.8		0.8		0.8		0.8	
Silica	1.4		1.2		1.5		1.5	
Sum of tons								
Cations (meq/L)	1.34		1.51		1.44		1.51	
Anions (meq/L)	1.02		1.45		1.35		1.68	
Ion Balance error	13.7%[1]		2.1%		3.1%		5.2%	
Total Dissolved Solids, calculated (mg/L)	64		80		75		87	
Hardness, calculated (mg/L as $CaCO_3$)	52		55		58		59	
Trace Elements, (μg/L)	TR	DISS	TR	DISS	TR	DISS	TR	DISS
Aluminum	30	20	144	22	35	21	68	25
Antimony	<10	<10	<10	<10	<10	<10	<10	<10
Arsenic	1.6	1.0	2.1	1.6	1.1	0.9	1.4	1.4
Barium	48	51	35	41	44	43	40	45
Beryllium	C l	<1	<1	<1	<1	C l	C l	<1
Boron	115	142	99	111	158	86	90	63
Cadmium	<10	<10	<10	<10	<10	<10	<10	<10
Chromium	<2	<2	<2	<2	<2	<2	<2	<2
Cobalt	<10	<10	<10	<10	<10	<10	<10	C l 0
Copper	<5	<5	<5	<5	<5	<5	<5	<5
Iron	<30	<30	356	76	<30	<30	33	<30
Lead	<30	<30	<30	<30	<30	<30	<30	<30
Manganese	<5	<5	29	14	<5	<5	<5	<5
Mercury	<1	<1	<1	<1	<1	<1	<1	c l
Molybdenum	<10	<10	<10	<10	<10	<10	<10	<10
Nickel	<50	<50	<50	<50	<50	<50	<50	<50
Selenium	<20	<20	<20	<20	<20	<20	<20	<20
Zinc	21	<20	<20	<20	33	<20	<20	<20

[1] high error due to low air temperature during alkalinity titration
TR = total recoverable concentration
DISS = dissolved concentration

Table 3. Laboratory analyses of major ions and trace elements for three springs in the Matanuska River watershed, 1985 and1 991.

Parameter	Site 10 Spring on Luster property		Site 11 Spring along California Creek Road [1]		Site 22 Spring along Chickaloon River Road [2]	
DATE	7-1 I-85		7-I I-85		1 O-I 6-91	
Major Ions, Dissolved (mg/L)						
Calcium	4.3		8.3		43.7	
Magnesium	1.6		2.2		12.2	
Sodium	15.9		19.7		5.3	
Potassium	0.5		0.7		1.5	
Alkalinity (as HCO_3^-)	58 [3]		79 [3]		191 [3]	
Chloride	1.2		4.0		3.9	
Sulfate	2.8		2.7		8.7	
Nitrate (as N)	--		--		<0.02	
Phosphate (as P)	--		--		<0.1	
Silica	2.9		3.3		--	
Fluoride	--		0.09		0.52	
Hardness, Calculated (mg/L as $CaCO_3$)	17		30		159	
Trace Elements, (µg/L)	TR	DISS	TR	DISS	TR	DISS
Aluminum	--	--	27	--	--	--
Antimony	--	--	--	--	--	--
Arsenic	--	--	<5	--	--	18
Barium	--	5	<1	--	--	--
Beryllium	--	--	--	--	--	--
Boron	--	55	55	--	--	--
Cadmium	--	--	--	--	--	<1
Chromium	--	--	<2	--	--	<1
Cobalt	--	--	--	--	--	--
Copper	--	--	<5	--	--	<1
Iron	--	--	39	--	50	30
Lead	--	--	<30	--	--	--
Manganese	--	--	1	--	<10	<10
Mercury	--	--	--	--	--	--
Molybdenum	--	--	--	--	--	--
Nickel	--	--	--	--	--	<10
Selenium	--	--	<20	--	--	--
Zinc	--	--	21	--	--	--

[1] Area residents reportedly use spring as a public water supply
[2] Spring is located near a fish hatchery, 100 yards above Chickaloon River Road bridge
[3] Calculated value determined by solving for HCO_3^- in cation/anion balance
-- = not analyzed
TR = total recoverable concentration
DISS = dissolved concentration