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SUMMARY OF INORGANIC WATER QUALITY SAMPLING IN THE FAIRBANKS RAILROAD INDUSTRIAL AREA, FAIRBANKS, ALASKA: 1994-1995

by

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INTRODUCTION

The Minnie Street Land Users Group (MSLUG) was formed in March, 1993 in an effort to coordinate the evaluation of hydrocarbon levels in the Railroad Industrial Area in Fairbanks, Alaska. MSLUG is a private group comprised of current and former land users, primarily business operators and lessees. This project is a result of this coordination between the Alaska Railroad Corporation, the United States Geological Survey, the Alaska Division of Mining and Water Management (formerly the Alaska Division of Water) Hydrologic Survey Section, and the members of MSLUG. The details of this project are presented by the U.S. Geological Survey (USGS, 1995; to be published). Additionally, inorganic water chemistry data collected during a preliminary site investigation is presented elsewhere (Vohden, 1994).

The study site (Figure 1) comprises approximately 300 acres near downtown Fairbanks, Alaska. During the course of the study, various wells were sampled for inorganic and organic parameters. Two surface water sites were also monitored, The Chena River near the study site and the Tanana River near the USGS gage station were sampled for inorganic parameters. Inorganic water chemistry data collected between April 1994 and April 1995 will be presented in this document.

METHODS

Field

All sampling was done in accordance with methods established by the U.S. Environmental Protection Agency (1982) and the U.S. Geological Survey. Field sampling personnel included Division of Mining and Water staff as well at U.S. Geological Survey personnel. Wells were purged using a peristaltic pump attached to a new section of 3/8" ID polyethylene tubing which was discarded after each well sampling. The wells were sampled as soon as the temperature, pH and conductivity values stabilized. These field parameters were monitored using a Hydrolab instrument with a flow-through cell attached to the pump

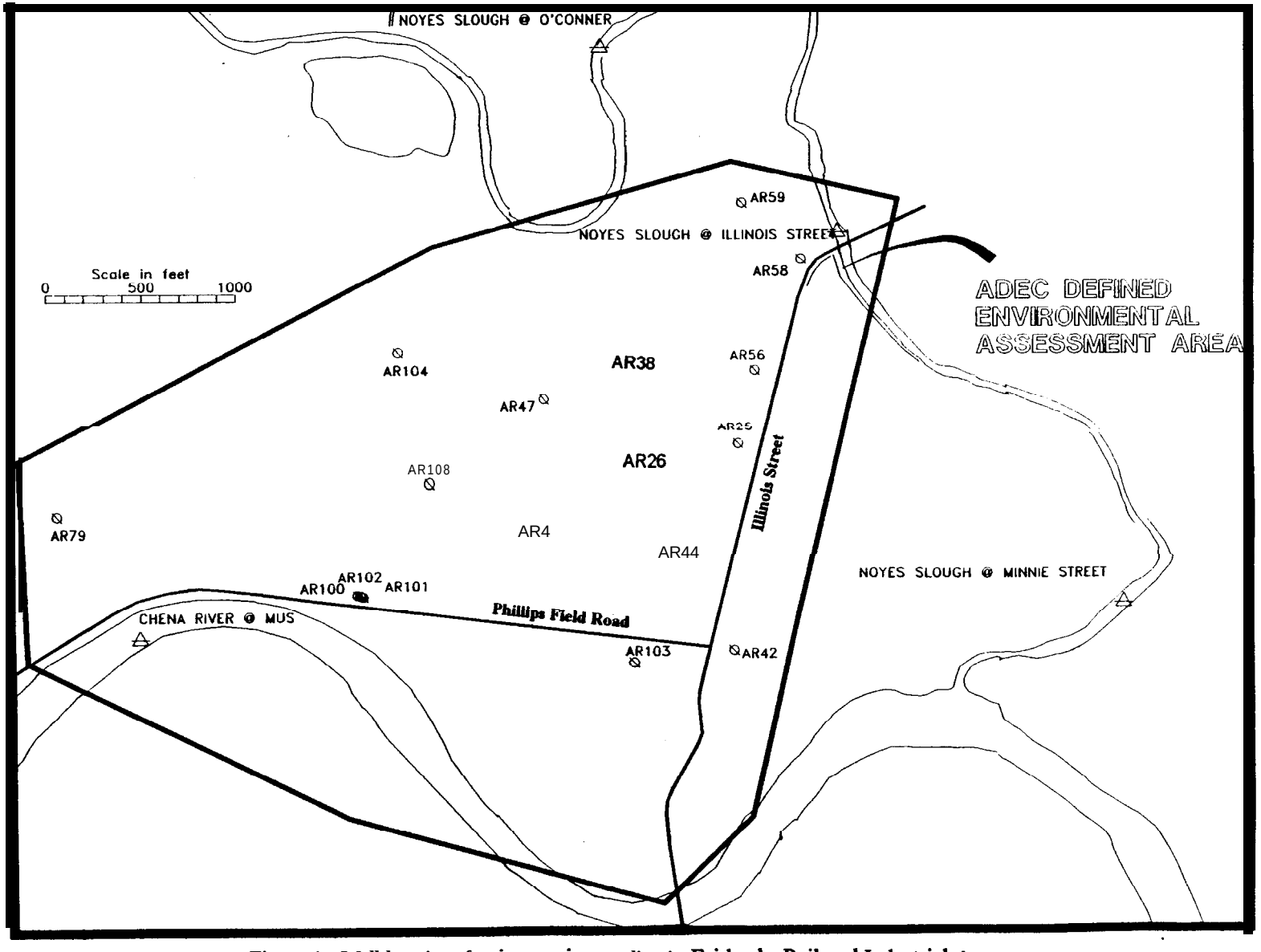

Figure 1. Well locations for **inorganic** sampling in **Fairbanks Railroad Industrial** Area.

outlet such that a closed system is created between the well and the instrument. Inorganic samples were collected and filtered if necessary, directly from the peristaltic pump. Samples were filtered with disposable 0.45 micron filter units. Individual Teflon bailers were lowered into the wells using disposable nylon line and were only used for one well until laboratory cleaning. Organic samples were collected using a controlled flow bottom attachment on the bailers. Alkalinity titrations were done in the field immediately after sample collection. After collection of samples from any given well, the purge tubing, filter, and bailer line were discarded; bailers were re-bagged for laboratory cleaning.

Analytical

All samples were analyzed by the Alaska Division of Mining and Water Management, Water Quality Laboratory located in Fairbanks, Alaska. Analytical methods are listed in Table 1. For all parameters, calibrations were performed using NIST traceable standards where applicable. General data reduction procedures are described in Standard Methods (APHA, 1991).

Table 1. Analytical methods utilized.

Parameter	EPA Method	Description	Detection Limit
Alkalinity	310.1	titration	0.1 mg/L as $CaCO_3$
Calcium	AES 0029	DCP	0.01 mg/L
Chloride	300.0	ion chromatography	0.01 mg/L
Conductivity	120.1	whetstone bridge	----
Iron	AES 0029	DCP	0.03 mg/L
Magnesium	AES 0029	DCP	0.01 mg/L
Nitrate	300.0	ion chromatography	0.02 mg/L as NO_3
pH	150.1	electrometric	- -
Phosphate	300.0	ion chromatography	0.05 mg/L
Potassium	258.1	flame AA	0.01 mg/L
Sodium	273.1	flame AA	0.1 mg/L
Sulfate	300.0	ion chromatography	0.01 mg/L

RESULTS

Four sampling events were completed: April 1994 before breakup, July 1994, September 1994 just before freeze-up, and April 1995 before breakup. Results from the four sampling events is found in Appendix A. Wells that had been analyzed previously and which indicated the presence of higher levels of organic contaminants were not submitted for anion analysis but were processed for cation analysis. As shown in Figure 2, the groundwater can be classified in general as sodium-bicarbonate type. Overall there are not many significant outliers in this diagram and the data have therefore been pooled for visual purposes. Groundwater is also generally hard to very hard, with calculated hardness values ranging from 123 to 876 mg/L as $CaCO_3$.

Well AR103 is anomalous in the extent of nitrate contamination, On the map this well is along a similar corridor as is well AR105 that had above average chloride, nitrate and sodium values than were expected, as discussed previously (Vohden, 1994). Well AR47 is also high in nitrate, for unknown reasons. Because of the historic use of the area, it is possible that septic leachate could be influencing all three wells, although this has not been investigated further. Iron was analyzed in the April 1995 samples only (Table 2). Dissolved iron was taken from filtered acidified samples, and total iron was taken from unfiltered acidified samples and subjected to a mild acid digestion.

Table 2. Results of iron analysis from April 1995 sampling event (values in mg/L).

Well	dissolved Fe	total Fe
AR4	0.46	0.67
AR 25	0.49	0.54
AR26	5.37	6.45
AR 44	1.36	4.46
AR76	8.90	9.50
AR 101	5.44	8.18
AR 108	4.41	5.73
Chena River	0.74	2.29
Tanana River	0.52	2.31

There is quite a lot of variability in the iron content of the groundwater, however the two rivers are comparable in terms of iron content.

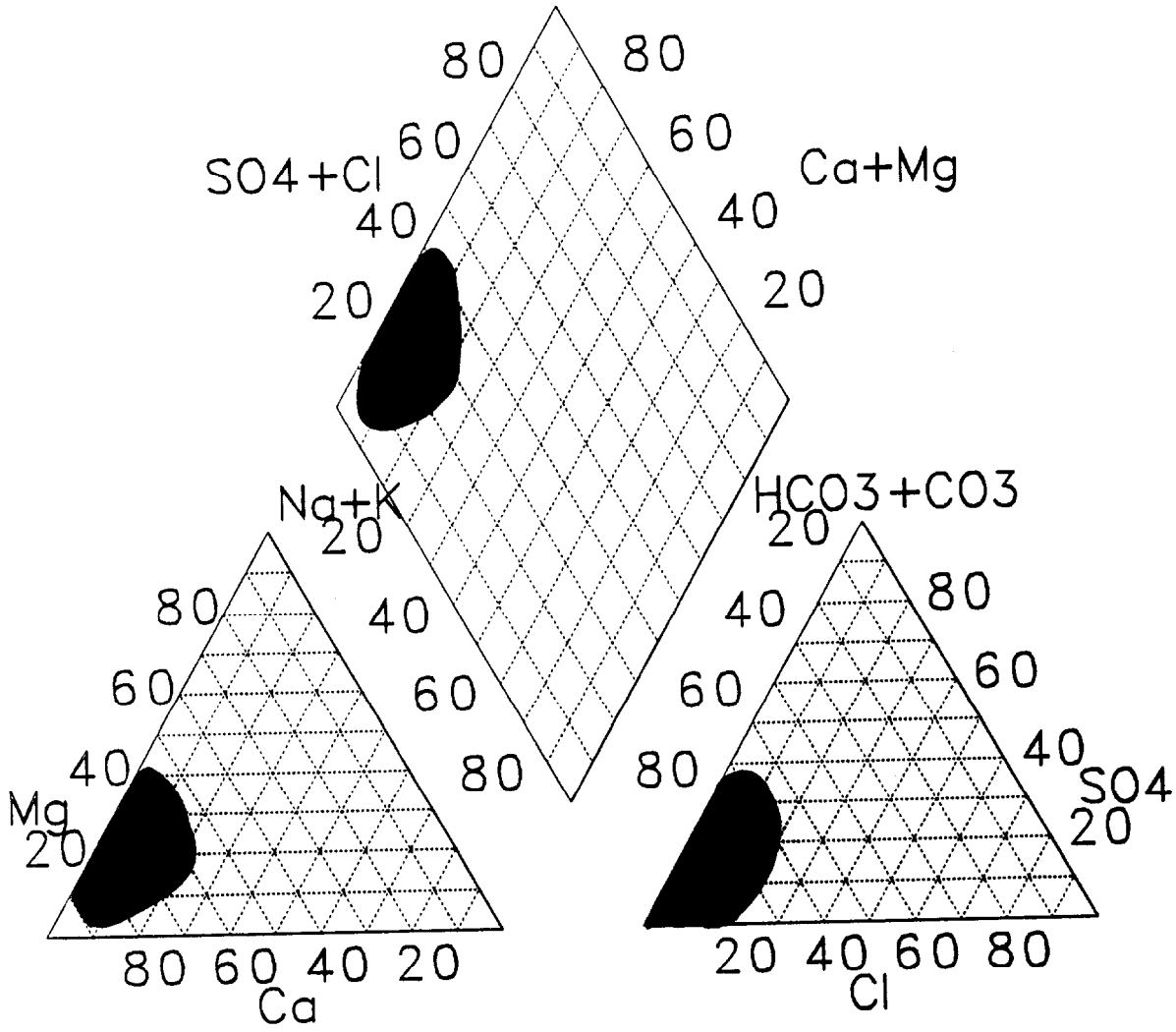

Figure 2. Piper diagram outlining the general trend of the inorganic groundwater **chemistry** towards the **calcium-bicarbonate classification.**

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Appendix A.

	Alkalinity	Chloride	Nitrate	Phosphate	Sulfate	Calcium	Magnesium	Sodium	Potassium	Hardness
AR4										
11 -Apr-95	207	7.31	0.16	<0.05	27.9	62.8	14.2	10.6	5.19	215
AR 25										
5-Apr-94	419	12.9	5.25	40.05	73.2	132	33.8	13.4	6.48	469
2%Jul-94	351	11.2	0.07	co.05	56.1	104	27.9	11.2	6.80	375
2 1 -Sep-94	364	9.84	3.45	<0.05	62.5	114	28.2	16.8	6.54	401
11 -Apr-95	417	6.13	5.35	<0.05	71.2	142	29.6	12.6	6.97	477
AR26										
11 -Apr-95	865	2.27	co.02	<0.05	26.4	161	115	14.6	11.0	876
AR 42										
29-Jul-94	165	3.04	co.02	co.05	25.3	52.6	15.0	5.52	3.48	193
2 1 -Sep-94	179	2.90	co.02	co.05	15.0	50.1	13.4	5.57	3.55	180
AR44										
11 -Apr-95	---------- not analyzed ----------					136	25.5	19.5	8.78	445
AR 47										
5-Apr-94	100	32.2	28.9	<0.05	48.2	58.4	12.1	14.2	16.5	196
28-Jul-94	189	14.3	15.9	co.05	42.7	69.0	19.9	14.9	12.2	254
21-Sep-94	198	19.8	18.1	co.05	30.5	72.7	21.5	17.6	9.59	270
AR 49										
5-Apr-94	400	7.35	0.07	co.05	2.40	86.9	25.6	11.7	5.91	322
AR 58										
5-Apr-94	253	10.7	0.08	co.05	36.0	69.8	22.7	6.81	4.41	268
2%Jul-94	228	9.59	0.19	co.05	40.3	65.0	19.7	8.23	5.10	243
21-Sep-94	253	12.5	0.34	co.05	42.8	74.7	23.1	8.76	3.61	282
AR76										
11 -Apr-95	---------- not analyzed ----------					79.8	18.7	10.8	6.19	276
AR79										
5-Apr-94	376	19.9	0.66	<0.05	51.8	117	27.2	9.25	6.42	404
28-Jul-94	357	17.0	co.02	<0.05	37.3	107	24.5	9.60	6.87	368
21-Sep-94	353	15.5	0.14	co.05	37.0	118	24.8	10.6	5.36	397

All values in mg/L except alkalinity (mg/L as CaC03) and hardness (mg/L as CaCO3). Also, hardness is determined by calculation.

	Alkalinity	Chloride	Nitrate	Phosphate	Sulfate	Calcium	Magnesium	Sodium	Potassium	Hardness
AR 100										
5-Apr-94	150	1.53	co.02	<0.05	14.2	36.5	8.44	4.86	3.38	126
28-Jul-94	152	9.58	co.02	<0.05	18.1	41.3	9.94	10.6	6.34	144
2 1 -Sep-94	163	3.18	co.02	co.05	17.2	43.3	9.60	5.78	3.65	148
AR 101										
5-Apr-94	140	1.32	<0.02	<0.05	11.9	36.4	7.72	4.34	3.39	123
28-Jul-94	128	1.15	co.02	<0.05	11.4	37.1	8.26	4.97	3.88	127
2 1 -Sep-94	12.5	1.82	co.02	co.05	12.9	39.8	8.61	4.40	3.49	135
11 -Apr-95	140	1.48	co.02	co.05	12.3	38.2	8.38	5.59	3.78	130
AR 102										
5-Apr-94	341	16.7	0.07	co.05	40.6	90.9	24.9	21.4	6.09	330
28-Jul-94	307	14.1	0.16	co.05	38.2	109	23.3	19.8	7.27	368
2 1 -Sep-94	325	17.4	0.16	co.05	40.8	96.7	24.0	21.9	4.82	340
11-Apr-95	301	6.26	0.04	co.05	37.6	89.1	21.8	17.0	5.98	312
AR103										
S-Apr-94	569	4.62	12.4	co.05	32.8	148	43.6	10.5	15.3	549
28-Jul-94	533	23.3	21.0	<0.05	59.0	163	43.8	13.1	18.8	587
2 1 -Sep-94	593	14.7	9.8	co.05	39.8	151	39.8	29.9	13.6	541
AR 104										
S-Apr-94	343	10.4	0.83	co.05	39.1	104	23.6	9.61	6.67	357
28-Jul-94	306	8.27	5.7s	co.05	44.9	106	22.3	9.19	7.33	357
21-Sep-94	298	8.53	3.40	<0.05	42.2	108	23.1	10.8	4.71	365
AR 108										
S-Apr-94	244	4.16	co.02	40.05	7.78	66.3	15.4	5.15	4.65	229
28-Jul-94	221	5.32	co.02	co.05	5.18	60.4	13.9	5.87	5.04	208
2 1 -Sep-94	203	5.81	<0.02	co.05	5.76	60.8	13.1	6.15	3.35	206
11-Apr-95	236	2.59	co.02	co.05	6.91	67.4	15.0	6.07	4.98	230
Chena River										
S-Apr-94	107	0.90	0.15	co.05	16.1	29.7	7.17	2.40	1.78	104
28-Jul-94	81	0.35	0.05	co.05	19.2	25.8	5.82	2.69	2.41	88
2 I -Sep-94	70.8	0.32	0.07	co.05	17.7	25.3	5.79	2.60	2.47	87
11-Apr-95	91.5	1.08	0.14	<0.05	16.5	27.3	6.98	2.55	1.72	97
Tanana River										
5-Apr-94	131	1.32	0.17	co.05	18.2	42.1	6.52	3.55	2.21	132
28-Jul-94	105	1.07	0.13	co.05	42.9	38.6	8.91	4.57	2.37	133
2 1 -Sep-94	107	1.25	0.15	<0.05	42.5	37.1	8.80	4.69	2.28	129
12-Apr-95	111	1.04	0.10	co.05	33.7	40.7	7.15	4.26	2.29	131

All values in mg/L except alkalinity (mg/L as CaC03) and hardness (mg/L as CaC03). Also, hardness is determined by calculation.