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Wisconsin Tributary Loadings to the Upper Great Lakes

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

EPA-905/4-75-003 Environmental Monitoring

WISCONSIN TRIBUTARY

LOADINGS TO THE UPPER GREAT LAKES

BY

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Wisconsin Department of Natural Resources
Division of Environmental Protection
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SUMMARY

Intensity of water quality sampling was increased on the Nemadji, Bois Brule, Bad and Montreal Rivers during 1973. Involved were: 1) analysis of water samples from fixed stations on a monthly basis, 2) increased sampling during spring runoff and sampling for an expanded list of parameters three times during the year, and 3) an intensive survey run twice on each river during the summer of 1974. With the exception of localized problems, the data indicates that water is of excellent quality and supports diverse and abundant populations of aquatic organisms.

SUMMARY TRIBUTARY LOADINGS

PARAMETER	Bad River No. of SAMPLES	Bad River Mean Loading (Metric tons/yr)	Bad River Standard Deviation for Loading (Metric tons/yr)	Bois Brule River No. of SAMPLES	Bois Brule River Mean Loading (Metric tons/yr)	Bois Brule River Standard Deviation for Loading (Metric tons/yr)	Montreal River No. of SAMPLES	Montreal River Mean Loading (Metric tons/yr)	Montreal River Standard Deviation for Loading (Metric tons/yr)	Nemadji River No. of SAMPLES	Nemadji River Mean Loading (Metric tons/yr)	Nemadji River Standard Deviation for Loading (Metric tons/yr)
Alkalinity	29	119,355	50,370	31	15,585.5	3,686.5	28	12,848	3,723	25	98,915	39,420
Arsenic	3	ND		2	ND		3	ND		3	ND	
Barium	3	82.49	22.3	2	8.91	.56	3	4.71	.91	33	58	39.05
BOD	28	8,103	12,921	30	649.70	292.73	28	938.05	390.55	24	3,029.5	981.85
Cadmium	4	.73	.95	4	ND		4	.15	.19	4	1.88	2.31
Calcium	3	2,372.5	16,753.5	4	3,285	919.8	3	4,270.5	1,109.6	4	24,783.5	9,052
COD	4	51,465	35,368.5	4	7,592	4,672	4	15,111	3,551.45	4	56,210	21,170
Chloride	25	4,854.5	18,432.5	27	243.09	511	25	1,164.35	941.7	22	56,210	21,170
Chromium	4	11.17	14.05	3	2.31	1.55	4	1.64	1.85	4	20.73	30.73
Copper	4	58.04	105.85	4	1.13	.92	4	85.41	168.72	4	21.68	24.71
Cyanide	3	ND		4	ND		4	2.5	2.77	4	ND	
Fluoride	4	375.95	138.7	5	51.1	26.32	4	93.81	85.05	5	211.33	55.11
Iron	24	4,416.5	5,577.2	27	196.73	196.73	25	423.4	868.7	18	8,577.5	12,045
Lead	4	108.77	199.65	4	ND		4	ND		4	22.23	25.29
Magnesium	3	7,154	4,964	4	1,120.55	320.47	3	1,029.3	675.25	4	4,635.5	3,149.95
Manganese	24	87.23	87.23	27	7.59	3.83	24	97.82	359.89	18	100.01	110.23
Mercury	4	.27	.11	3	.04	.02	4	.07	.03	4	.16	.07
Nickel	4	ND		4	2.08	.76	4	ND		4	21.5	21.17
Nitrogen, Ammonia	29	175.2	130.31	30	21.57	16.72	28	48.18	36.87	24	149.65	111.69
Nitrogen, Kjeldahl	29	1.10	448.95	30	131.4	56.21	28	267.91	69.35	23	930.75	344.92
Nitrogen, Nitrate+Nitrite	19	279.95	208.05	15	27.34	13.29	17	91.61	45.63	20	194.91	125.56
Nitrogen, Organic	29	927.1	423.4	31	108.04	53.65	28	220.09	71.91	24	751.9	363.91
Nitrogen, Total	19	1,379.7	514.65	14	178.49	72.63	17	339.45	100.01	18	1,749.75	423.4
Oil-Grease	1	ND		1	ND		1	ND		1	Nd	
Pesticide, Aldrin	3	ND		3	ND		3	ND		3	ND	
Pesticide, DDD	4	ND		4	ND		4	ND		4	ND	
Pesticide, DDE	4	ND		4	ND		4	ND		4	ND	
Pesticide, DDT	4	.0073	.0037	4	ND		4	ND		4	ND	
Pesticide, Dieldrin	4	ND		4	ND		4	ND		4	ND	
Pesticide, Heptachlor	4	ND		4	ND		4	ND		4	ND	
Pesticide, Heptachlor Epoxide	4	ND		4	ND		4	ND		4	ND	
Pesticide, Lindane	4	ND		4	ND		4	ND		4	ND	
Phenols	27	8.54	5.33	27	1.555		24	2.61	2.32	19	9.13	12.23
Phosphorus, Total	29	171.55	153.3	31	19.137		28	37.23	13.54	25	256.59	303.68
Phosphorus, Soluble	23	48.55	38.69	24	6.9		17	14.51	34.77	23	32.52	23.03
Phthalates, Diethyl Hexyl	4	ND		4	ND		4	ND		4	ND	
Polychlorinated Biphenyl	4	ND		4	ND		4	ND		4	.12	.19
Potassium	3	2,361.55	372.3	4	304.41	32.05	3	536.55	299.3	4	2,941.9	879.65
Selenium	3	4.85	5.26	2	ND	5.26	3	ND		3	ND	
Silica	27	22,228.5	7,446	27	4,197.5	5,183	27	2,817.8	1,259.25	21	14,052.5	4,088
Sodium	3	4,307	2,529.45	4	711.75	105.85	3	1,146.1	540.2	4	3,504	1,898
Solids Total	27	390,550	228,855	29	34,310	8,249	27	39,785	7,774.5	25	459,900	331,785
Solids, Total Dissolved	24	202,940	72,635	26	52,195	80,300	24	43,435	54,750	19	332,880	540,200
Solids Total Suspended	28	159,505	245,280	31	6,679.5	5,402	28	3,544.15	3,401.8	24	234,695	337,260
Sulfate	1	10,731	NA	2	1,281.15	0	1	4,415.5	NA	2	1,321.3	0

INTRODUCTION

Objectives

In cooperation with the International Joint Commission and the Upper Great Lakes Reference Group and supplemental support from the Environmental Protection Agency, the Wisconsin Department of Natural Resources increased surveillance and investigation on major Wisconsin tributaries to Lake Superior during 1973. Primary sampling stations were established on the Bois Brule, Bad and Montreal Rivers during July of 1973 and the Nemadji River station was added to the program in January of 1974.

The three basic phases of this program included the following:

1. The collection of monthly water samples for chemical analysis from the primary station on each of the four rivers. These primary stations are shown and described on Figures N-1, Br-1, Ba-1 and M-1. It is expected that this phase of the program will be continued under the State of Wisconsin Primary Station Monitoring Program after termination of the relatively short-term IJC study.

   Summary data sheets of the information collected during monthly monitoring are included in Appendix A attached to this report.

2. Special procedures for sampling at the primary stations called for an additional four samples during the spring runoff period and sampling for an expanded list of parameters three times during the year.

   Data collected during this phase is also included in the summary data sheets in Appendix A.

3. Great Lakes Reference Study: Study Item V - Local Effects. A subsection of Study Item V outlined an additional and more intensive survey to be run twice on each of the tributaries during the summer of 1974. Sampling at several stations along the course of each river and in Lake Superior in the vicinity of the river mouths was involved. This report provides results and discussion of local effects of these rivers.

Description of Study Area

The four streams involved in this study are the Nemadji, Bois Brule, Bad and Montreal Rivers. All are major streams draining into Lake Superior but differ widely in character.

The Nemadji River originates in Minnesota and flows across northwest Douglas County. The river drains a fairly large watershed (475 square miles) of which 215 square miles are in Douglas County. The 7Q10 low flow at the United States Geological Survey gaging station is 49 cubic feet per second. A highly varied

population of fish and aquatic life inhabits the stream. The Nemadji River watershed is a geologically young area with soil erosion processes occurring naturally at a rapid rate. The main channel and tributaries have dissected the area forming deep ravines. Unstable red clay soils found throughout the watershed erode easily and are subject to slippage along field gullies, roads, railroad cuts and stream banks. In-stream sedimentation, a direct result of erosion, is a serious management problem. Siltation also causes navigation problems in the Duluth-Superior Harbor. The U.S. Army Corps of Engineers continually dredges channels to allow navigation by Great Lakes and ocean-going freighters. Only five percent of the watershed land cover is used for agricultural purposes. This limited land use occurs along the flat ridge tops separating tributaries. The remaining land area is wild forested land (Sather and Johannes, 1972).

The Bois Brule is one of Wisconsin's most famous trout streams. It is approximately 44 miles in length and flows northward along the eastern border of Douglas County into Lake Superior. The river falls a total of 420 feet from its headwaters to Lake Superior. In the upper 26 miles the Brule flows through a broad, flat wilderness bog valley rich in springs. The elevation change in this reach is only 92 feet, an average fall of 3 feet per mile. Below Cedar Island, the river passes through a series of natural shallow lakes formed behind glacial till barriers in the bed of the stream. In this area, the river valley begins to narrow and the bog shoreline changes to firm upland. The gradient increases greatly in this reach. The lower 18 miles has a fall of 328 feet, an average drop of 17 feet per mile. From County Highway B downstream past the ranger station, the river becomes a series of short rapids. The stretch between U.S. Highway 2 and the Copper Range Campground is referred to as the "meadows." Here, the flow is slower and many deep pools provide excellent in-stream cover. From the campground to Lake Superior the river drops very sharply, forming an almost continuous rapids. The river valley in this stretch is narrow with steep, often times exposed red clay banks. Rock riprapping along the toes of these clay slip banks have been moderately successful in stabilizing banks and controlling erosion (Sather and Johannes, 1972).

The Bad River is the main drainage stream of Ashland County and at 70 miles, also the longest. The upper reach of the stream, from the headwaters to Cayuga, has a moderate gradient. Above Mellen, there is a diversion structure which supplies water to a public utility power station of the Lake Superior District Power Company. The impounded area behind this structure is not large enough to be termed a flowage. The middle reach of the river, in the Mellen area, flows through bedrock and boulders. This reach has many rapids and waterfalls, including Copper Falls and Brownstone Falls north of Mellen. The downstream reach of the Bad River is broad and sluggish with a low gradient. Only two lakes are present directly on the river - Caroline Lake and the Bad River Slough. A large number of streams flow into the river, including the White, Potato, Marengo and Tyler Forks Rivers (Sather and Threinen, 1966).

The Montreal River forms the boundary between Michigan and Wisconsin along much of its length. The river is a soft water stream with slightly alkaline, medium brown water. The entire stream is classified as trout water and is inhabited by brook trout, brown trout and some rainbows.

Stream gradient is about 34 feet per mile. Stream flow is controlled by three hydroelectric impoundments - the Superior Falls Flowage and the Saxon Falls Flowage on the main stem, and the Gile Flowage on the West Fork. Flow at the gaging station upstream from the Superior Falls Flowage is extremely variable ranging from 2 to 6,000 cubic feet per second. Flow at this station exceeds 147 cfs 70 percent of the time, but low flow is a problem at certain times. The watershed is predominantly wooded or wild land with 10 to 15 percent exhibiting cleared, agricultural or urban land use (Andrews and Threinen, 1969).

Survey Method

Sampling stations were established at several locations on each stream and adjacent to river mouths (see maps). Two sampling runs were planned, one to reflect spring runoff conditions and the other during normal low flow conditions. Ice conditions prevented sampling on the lake during the peak runoff period, so the first sampling involved only stream stations. Two additional surveys were run including both stream and lake stations.

At each station, field measurements were taken of temperature, pH and dissolved oxygen. Colorimetric comparison was used to measure pH values (Rascher and Betzold pH kit). Temperature and D.O. were measured either by a standard laboratory-grade mercury thermometer and the modified Winkler wet-chemical procedure or through use of an electric temperature-oxygen meter (Yellow Springs Instrument Company Model No. 54 RC). Water samples for chemical analysis were collected in polyethylene containers and submitted to the State Lab of Hygiene for analysis.

Benthological samples for the analysis of macroinvertebrate communities were collected using a variety of techniques. At the river stations, both bottom dredge samples and random hand collections from rocks and debris were utilized to assure sampling from the variety of habitat conditions encountered. River mouth and lake bottom samples were collected using either the Holman or Peterson dredges in an effort to obtain quantitative results.

SURVEY FINDINGS

General chemical analysis results obtained during the survey period are summarized in Tables N-1, Br-1, Ba-1 and M-1. Metals analysis were not obtained during every sample period and a reduced number of stations were involved. The metals data is summarized in Tables N-2, Br-2, Ba-2 and M-2.

Benthological data for this study is expressed in a series of map-graphs for each river involved. These figures also locate the sites of the sampling stations involved.

Nemadji River

One of the most striking characteristics of the Nemadji River is the high solids load carried during spring runoff. This would have to be considered

an expected result because of the abundance of red clay in this watershed. It is unfortunate that lake sampling could not have been conducted during this period to document the extent of lake influence.

An indication of the trophic nature of Superior Bay is reflected in the nutrient data. Although the concentrations of the major nutrients (nitrogen and phosphorus) carried in the Nemadji River are fairly high, the nutrient levels in the bay are substantially higher. This situation is almost certainly the result of municipal and industrial pollution presently being introduced into the St. Louis River, St. Louis Bay and Superior Bay.

Several of the parameters in Table N-1 show that the nutrient and contaminant load is considerably lessened at the three stations (IX, X and XI) outside of Wisconsin and Minnesota points. These stations are located in Lake Superior proper but still definitely show signs of being influenced by the contaminant loading outflowing from Superior Entry.

Biological sampling of the Nemadji River revealed the development of normal stream benthic communities at the three upstream stations (Figure N-1). Intolerant organisms such as stonefly nymphs, mayfly nymphs and caddis fly larvae were well represented and the total benthic community was varied and relatively sparse.

The downstream station at Highway 2-53 shows the change in the river character as it nears Lake Superior. This station is only about 1/2 mile from the river mouth and the stream is wide, slow-moving and relatively deep. The benthic community of sludgeworms (Oligochaeta) with representatives of midge larvae (Chironomidae) and mayfly nymphs (Hexagenia sp.) is probably representative of the general habitat conditions and some response to cultural pollution as the river flows through the City of Superior.

The biological survey of the Superior Harbor area (Figure N-2) graphically illustrates the organic pollution level of this area. This benthic community is dominated by very tolerant sludgeworms (Oligochaeta) and tolerant diptera larvae (primarily midges - Chironomidae). Station I is located in the mouth of the Nemadji River but the characteristics of this area could perhaps best be described as a freshwater estuary environment. The water movement in this area is influenced by wind seiches and other movements of Lake Superior. Therefore, this station cannot be considered as truly representative of Nemadji River water quality.

Stations III and IV on the east end of the Superior Harbor Basin were the only stations where significant numbers of intolerant organisms were found. The occurrence of mayfly nymphs (Hexagenia sp) caddisfly larvae (Phylocentropus sp.) and fingernail clams (Sphaeriidae) in this area may be a response to the relatively clean water of Allouez Bay.

Table N-2 documents the metals concentrations found during this investigation. With only a few exceptions the levels were well below recommendations from the EPA publication, Water Quality Criteria, 1972. The .13 mg/l of lead found at Highway W is especially high with no explanation at this time. One station (I) also showed a slightly high mercury level. Resampling of these stations will be undertaken as time permits.

TABLE N-1

RESULTS OF GENERAL CHEMISTRY ANALYSIS
Nemadji River-Lake Superior

PARAMETER	Date 1974	River Stations(1) Hwy. W	Hwy 35	Hwy C	Hwy 2-53	Lake Stations(2) I	II	III	IV	V	VI	VII	VIII	IX	X	XI
MFCC	4/18	3900	3700	3700	5100	(3)										
(No./100 ml.)	6/18	500	500	600	3900	500	500	100	200		<100	<100	100			
	9/11	<100	50	100	1600	1800	300	100	100	1600	900	900	400	<100	<100	
MFFCC	4/18	20	30	30	400											
(No./100 ml.)	6/18	20	20	20	420	50	50	<10	20		10	<10	10			
	9/11	10	10	30	80	130	10	30	10	30	20	80	<10	<10	10	
BOD	4/18	4.9	4.9	3.3	2.5											
(5-day)	6/18	2.5	2.5	2.0	2.0	2.5	2.5	2.5	3.3	3.3	2.9	2.9	2.9			
	9/11	1.6	2.5	2.9	2.5	2.5	2.5	2.5	2.5	3.3	2.9	2.0	2.9	2.5	2.5	2.0
Total Solids	4/8	1200	1122	1350	1440											
	6/18	170	184	210	174	148	142	132	128	122	128	132	130			
	9/11	158	172	180	214	190	112	102	108	116	212	136	106	52	86	78
Susp. Solids	4/18	1025	932	1155	1330											
	6/18	47	75	85	39	21	10	12	10	8	8	8	7			
	9/11	6	12	14	17	21	9	11	12	9	6	10	10	0	8	10
Vol Susp. Solids	4/18	30	48	50	60											
	6/18	3	5	4	1	5	0	3	2	3	2	1	1			
	9/11	0	2	3	3	3	1	1	2	2	2	3	1	0	1	1
Tot. Org. N.	4/18	1.18	.96	.91	.94											
	6/18	.61	.66	.62	.65	.72	.82	.82	.89	.89	.92	.88	.86			
	9/11	.30	.34	.37	.37	.41	.57	.47	.45	.56	.58	.56	.47	.15	.34	.26
Nitrate N.	4/18	.13	<.10	.10	.05											
	6/18	.01	.01	.01	<.01	.05	.04	.03	.03	.03	.02	.02	.03			
	9/11	.04	.03	.06	.04	.04	.23	.22	.19	.21	.20	.19	.21	.15	.24	.22
Nitrite N	4/18	.015	.015	.013	.013											
	6/18	.007	.007	.006	.007	.012	.01	.013	.012	.01	.01	.009	.01			
	9/11	.001	.001	.001	.001	.003	.017	.012	.011	.016	.016	.023	.012	.002	.008	.005

6/8/76
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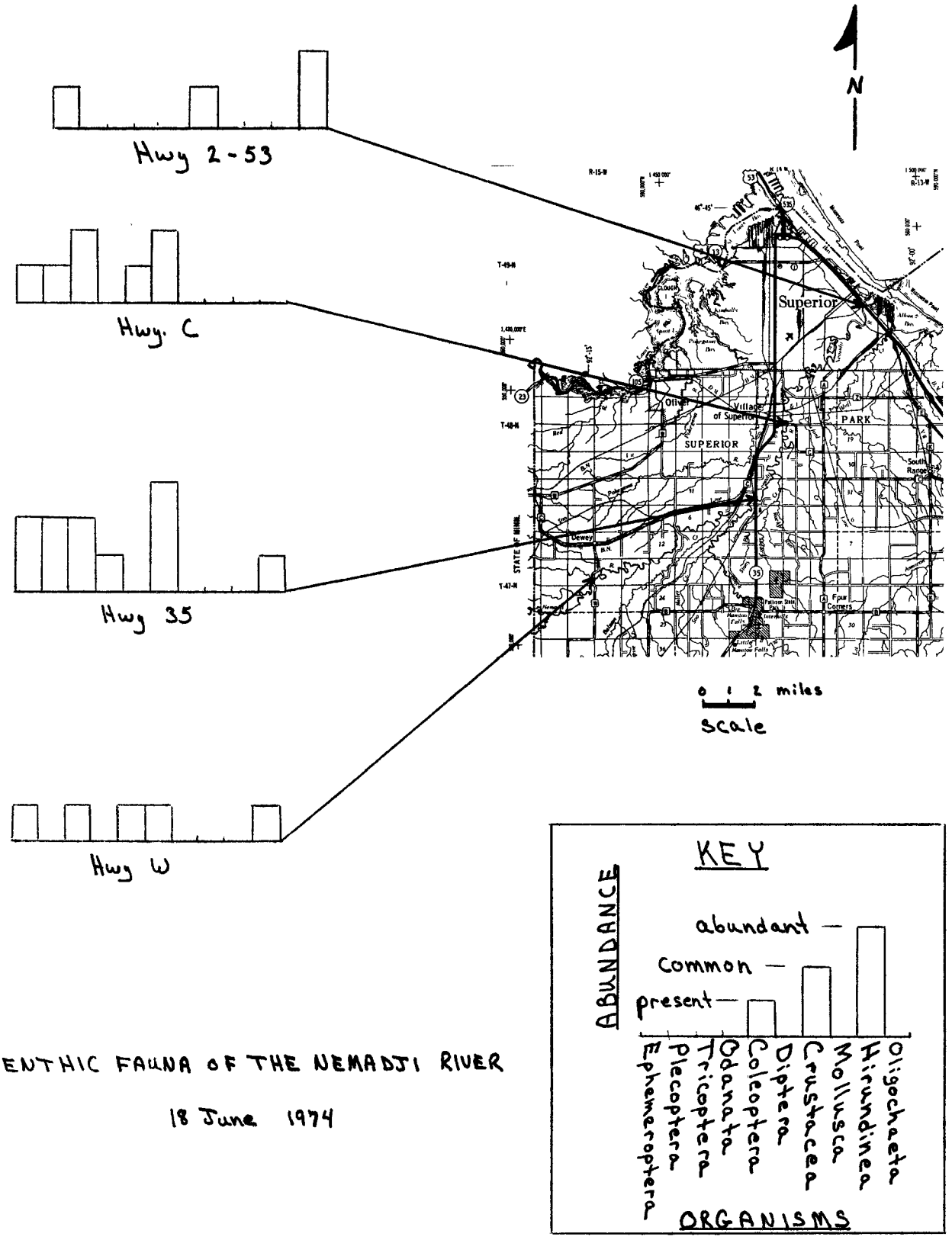
Table N-1 Continued:	Date 1974	Hwy W	Hwy 35	Hwy C	Hwy 2-53	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
NH_3-N	4/18	.14	.12	.13	.19											
	6/18	.03	.04	.03	.07	.13	.14	.17	.18	.19	.18	.23	.19			
	9/11	.02	.02	<.01	<.01	.03	.19	.13	.11	.20	.20	.43	.15	.01	.08	.05
Sol. Phos.	4/18	.026	.028	.028	.034											
	6/18	.038	.024	.012	.018	.038	.036	.046	.050	.034	.034	.030	.034			
	9/11	.024	.008	.008	.011	.014	.043	.038	.037	.051	.048	.046	.038	.001	.019	.012
Tot. Phos.	4/18	.73	.69	.86	1.10											
	6/18	.24	.09	.10	.07	.08	.09	.09	.09	.10	.09	.10	.09			
	9/11	.03	.16	.04	.04	.05	.09	.07	.09	.10	.10	.10	.07	.01	.05	.04
Alkalinity Total ($CaCO_3$)	4/18	44	48	44	48											
	6/18	58	54	60	66	50	42	46	44	42	40	40	40			
	9/11	104	110	112	118	110	54	52	50	52	56	58	50	42	48	42
Silica	6/18	7.2	6.5	≤7.2	6.5	6.1	5.7	5.7	5.7	5.4	5.6	5.5				
	9/11	11.0	10.0	11.2	10.0	10.0	3.8	3.6	3.8	3.8	2.8	3.6	3.2	2.0	2.7	2.4
Chlorides	6/18	1.0	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	3.0	2.0			
	9/11	2.0	1.0	2.0	5.0	1.0	6.0	3.0	4.0	6.0	6.0	7.0	4.0	<1.0	2.0	<1.0
Hardness	4/18	68	64	76	68											
	6/18	68	66	74	77	62	58	56	54	52	52	52	52			
	9/11	117	116	124	124	116	63	60	56	60	60	64	56	44	52	52
Temp. (°C)	4/18	2	3	3	3											
	6/18	13	13	13	15	15	16	17	17	16	16	16	16			
	9/11	13	15	15	15	14	14	13	13	13	13	13	12	12	12	12
D.O.	4/18	12.6	12.8	12.6	12.6											
	6/18	10.4	9.8	9.4	8.5	8.2	7.1	7.8	7.6	7.7	7.8	8.0	7.9			
	9/11	10.8	10.3	9.4	8.2	8.5	9.3	9.5	9.6	9.4	9.5	9.3	9.7	11.2	10.2	10.2
pH (S.U.)	4/18	7.4	7.4	7.5	7.4											
	6/18	7.4	7.4	7.4	7.2	7.2	7.3		7.1	7.2	7.0	7.0	7.1			
	9/11	8.0	7.8	7.8	7.6	7.6	7.4	7.4	7.4	7.4	7.4	7.4	7.3	7.4	7.4	7.4
Turbidity (N.T.U.)	6/18	26	32	41	28	25	17	19	13	5.2	5.2	6.1	4.7			
	9/11	8.3	17	16	19	26	7.3	13	16	7.5	5.8	8.7	9.9	1.1	5.5	8.3
Secchi Disk (Feet)	6/18					1.0	1.5	1.8	1.8	2.3	2.0	1.8	2.3			
	9/11					1.8	2.4	1.8	1.8	2.1	2.6	2.0	1.9	11.2	2.9	2.2



BENTHIC FAUNA OF THE NEMADJI RIVER

18 June 1974

Figure N-1

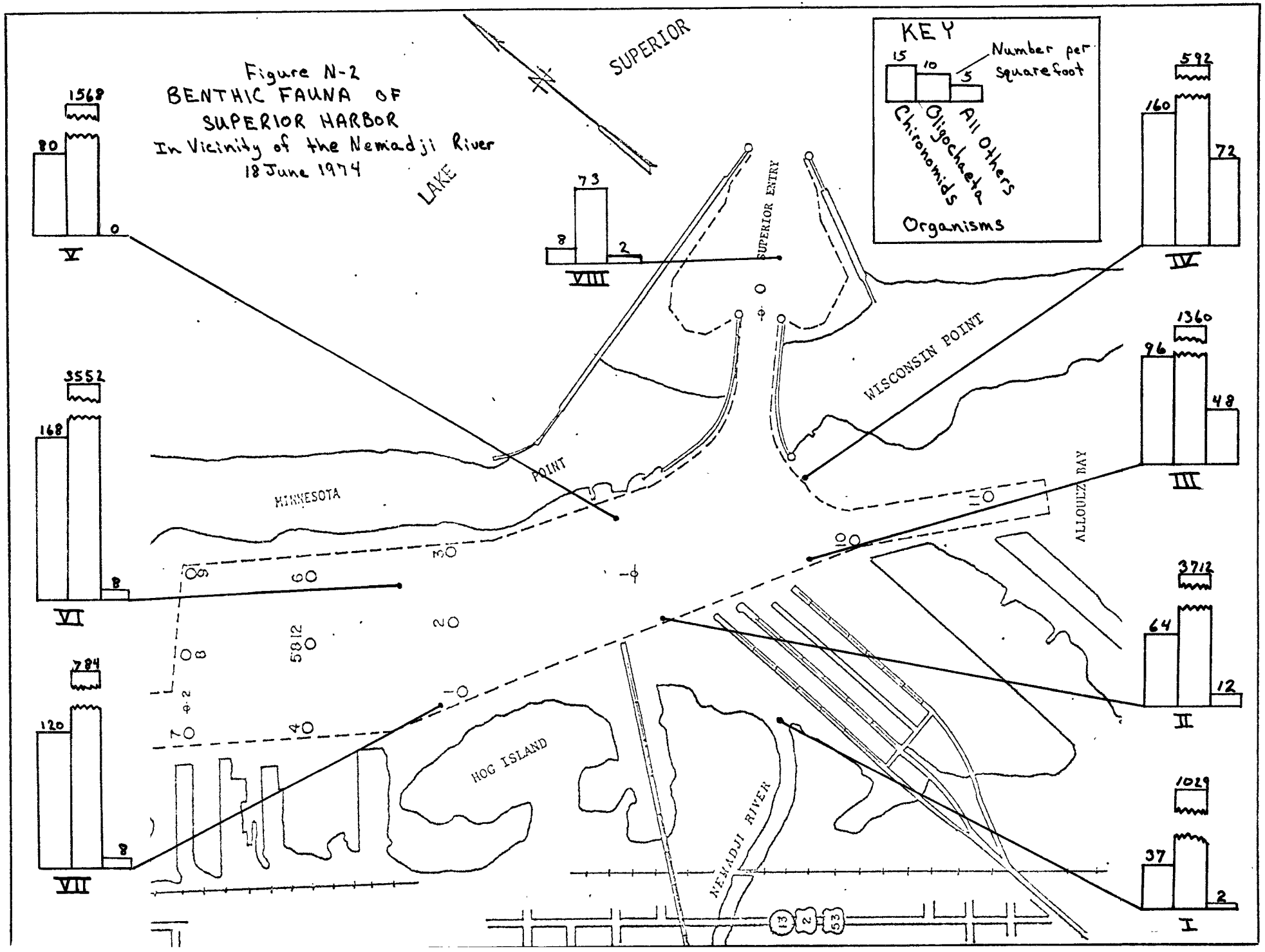


Figure N-2
BENTHIC FAUNA OF
SUPERIOR HARBOR
In Vicinity of the Nemadji River
18 June 1974
KEY
15
10
5
Number per square foot
Chironomids
Oligochaeta
All Others
Organisms
SUPERIOR
LAKE
SUPERIOR ENTRY
WISCONSIN POINT
MINNESOTA
POINT
ALLOUEZ BAY
HOG ISLAND
NEMADJI RIVER
13
2
53
1568
80
0
V
73
8
2
VIII
592
160
72
IV
3552
168
8
VI
1360
96
48
III
784
120
8
VII
3712
64
12
II
1029
37
2
I

TABLE N- 2

METALS CONCENTRATIONS FROM THE NEMADJI RIVER-LAKE SUPERIOR DURING 1974

Station[1]	Date	Metals						
		Cd	Cr	Cu	Pb	Hg	Ni	Zn
Hwy W	4/18	<.002	.09	.04	.13	<.0002	.06	.088
Hwy 35	4/18	<.002	.045	.037	.04	<.0002	.04	.075
Hwy C	2/14	.0002	.0012	.0006	<.002	<.0002	<.01	<.02
	4/18	.002	.05	.043	.04	<.0002	.04	.17
	7/22	.004	.01	.015	<.05	<.0002	.01	.04
Hwy 2-53	4/18	<.002	.055	.046	.03	<.0002	.05	.088
Sta. I	6/18	<.002	.01	.005	.01	.0003	<.01	.02

All values in mg/l

(1) Refer to Figures N-2 and N-3

Bois Brule River

The Bois Brule River has a reputation as an excellent clean water trout stream and the results of this survey tend to bear this out. General water chemistry analyses reveal excellent water quality characteristics (Table Br-1).

The total solids loading does reflect an increase at the lower stations when the river enters the red clay area. However, the concentration only reaches about 1/10th that of the Nemadji River.

An attempt to evaluate the extent of influence on Lake Superior water quality by the Brule River is shown in Table Br-3. In this table the average concentrations of selected parameters is compared for the river mouth station, those stations closest to the mouth (I, II, III and V) and the four stations furthest from the mouth (IV, VI, VII and VIII). Only data from the 6/20 and 9/16 sampling dates was used when collections were made from all sites involved.

Most of the chemical parameter analysis data seems to show a gradual decrease in concentration with distance from the river mouth. However, the turbidity and Secchi disk readings do not follow this pattern. A personal observation during the 9/16 survey would support the secchi disk data, in that the river was visibly less turbid than the near shore lake stations. A probable explanation for this situation would be the significant lake shore erosion taking place on the unstable south shore red clay banks. This problem is undoubtedly "worse" than normal because of the high water level presently being maintained in Lake Superior.

The unusual turbidity readings may possibly be explained by a change in laboratory techniques. During June of 1974, the Wisconsin State Lab of Hygiene implemented the use of a new turbidimeter. The change to this new technique may have resulted in some analysis error. Another potential for error may be the unsuitability of the silicon dioxide method (J.T.U. and N.T.U.) to accurately respond to clay turbidity.

The benthological survey findings as shown in Figures Br-1 and Br-2 again reflect the general high quality of the Bois Brule River. All of the stream stations exhibit a richly diversified benthic fauna indicative of a normal clean water environment.

Sampling difficulties were encountered in attempting to obtain benthic dredge samples near the mouth of the Brule. Our Peterson dredge lacked the necessary extra weights to efficiently penetrate the hard packed sand bottom. The findings of benthic organisms at Station IX (Figure Br-2) is primarily a response to physical habitat conditions in the protected river mouth and should not be considered as a water quality indication in a strict comparison with the lake stations (I - VIII).

The findings of midge larvae (Chironomidae), sludgeworms (Oligochaeta) and mayfly nymphs (Hexagenia sp. and Paraloeptophlebia sp.) at Stations I and II does seem to indicate a slight enrichment factor from the Brule River water. This enrichment factor appears to be extremely localized but this is difficult to interpret because of the aforementioned sampling difficulties.

The metals concentrations found during the Brule River survey (Table Br-2) were quite low and with one exception, well below the recommended levels published in Water Quality Criteria, 1972. The one exception was mercury. Although the mercury concentrations found were low, two stations were shown as having levels over the 0.2 ug/l criteria as recommended by EPA. This condition is not considered a serious problem but resampling will be done to collect more data.

TABLE Br-1

RESULTS OF GENERAL CHEMISTRY ANALYSIS

Bois Brule River-Lake Superior

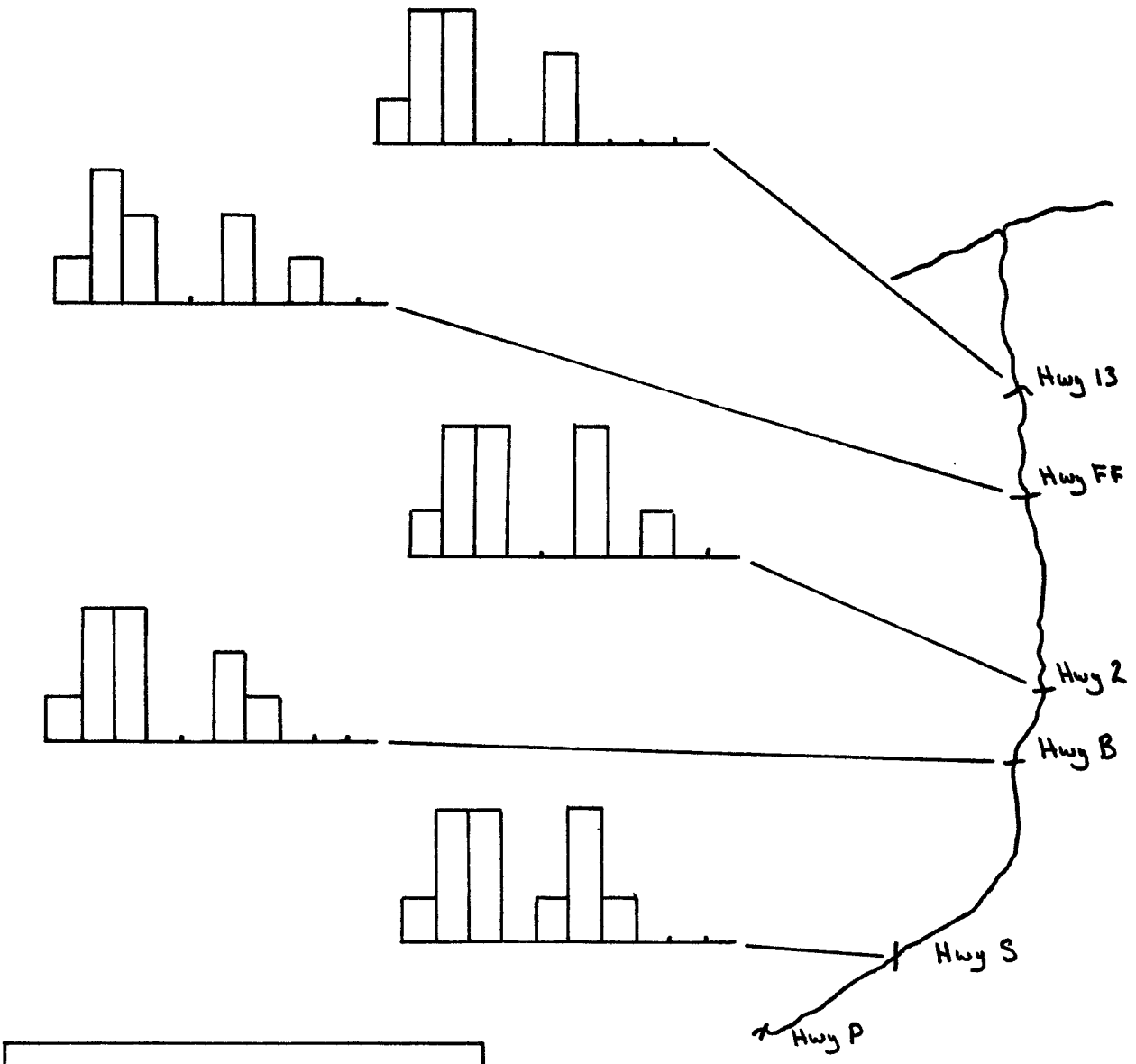
PARAMETER	Date 1974	River Stations(1) Hwy S	Hwy B	Hwy 2	Hwy FF	Hwy 13	Mouth IX	Lake Stations(2) I	II	III	IV	V	VI	VII	VIII
MFCC (No./100 ml)	4/18	1200	200	300	300	1100	800								
	6/20	300	100	800	900	1200	1700	1000	200	100	200	300	100	100	100
	9/16	740	200	550	360	810	760	90	20	30	30	10	10	10	10
MFFCC (No./100 ml)	4/18	10	10	10	10	10	20								
	6/20	20	20	130	20	40	20	10	10	10	10	10	10	10	10
	9/16	10	10	140	10	200	20	10	10	10	10	10	10	10	10
BOD (5 day)	4/18	3.3	2.9	2.5	2.5	3.3	2.5								
	6/20	2.5	2.5	2.9	2.9	2.5	2.9	2.9	2.9	3.3	3.3	3.3	3.3	3.3	2.9
	9/16	1.2	1.6	1.6	1.6	1.2	1.6	1.2	1.2	1.2	1.6	1.2	1.6	1.2	1.6
Total Solids	4/18	70	96	86	114	140	146								
	6/20	68	68	96	110	98	88	100	92	96	96	100	94	88	72
	9/16	58	62	56	98	78	124	86	58	90	66	82	84	62	68
Susp. Solids	4/18	15	14	18	41	70	80								
	6/20	3	6	6	15	20	19	13	5	5	6	9	7	4	7
	9/16	2	3	5	5	10	49	6	8	24	10	19	8	5	13
Vol. Susp. Solids	4/18	8	4	2	2	5	2								
	6/20	3	5	5	7	7	5	5	4	4	5	4	3	3	3
	9/16	0	0	0	1	0	2	0	1	1	1	0	1	0	1
Total Org. N.	4/18	.65	.34	.41	.53	.58	.62								
	6/20	.26	.28	.30	.36	.42	.40	.40	.38	.46	.43	.34	.37	.38	.43
	9/16	.04	.08	.05	.05	.00	.15	.10	.12	.10	.00	.04	.18	.00	.04
Nitrate N.	4/18	.19	.11	.16	.25	.11	.13								
	6/20	.11	.06	.09	.11	.12	.12	.21	.25	.22	.24	.20	.22	.24	.24
	9/16	.04	.02	.27	.02	.02	.26	.01	.27	.26	.26	.27	.03	.27	.27
Nitrite N.	4/18	.006	.003	.005	.006	.007	.009								
	6/20	.003	.002	.003	.004	.005	.005	.006	.007	.008	.007	.006	.007	.007	.007
	9/16	.001	.001	.004	.001	.001	.004	.001	.003	.004	.005	.005	.002	.003	.004

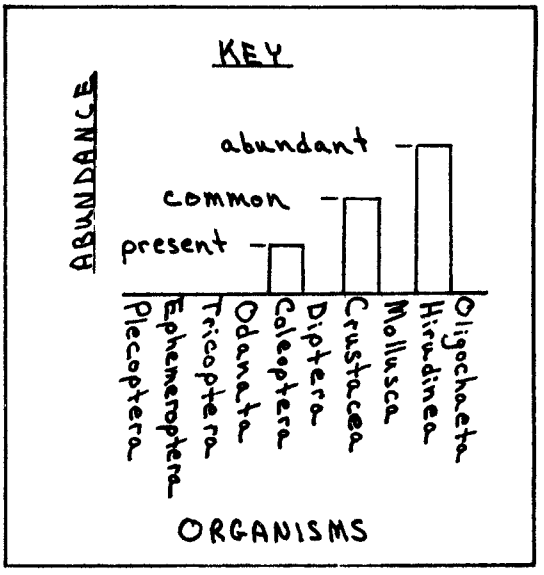
Table Br-1
(Continued)

PARAMETER	Date 1974	Hwy S	Hwy B	Hwy 2	Hwy FF	Hwy 13	Mouth IX	I	II	III	IV	V	VI	VII	VIII
NH_3-N	4/18	.13	.13	.05	.05	.10	.10								
	6/20	.04	.04	.05	.04	.11	.03	.02	.07	.07	.07	.02	.07	.06	.04
	9/16	.11	.06	.13	.13	.19	.05	.08	.04	.07	.18	.14	.13	.17	.13
Sol. Phos.	4/18	.27	.014	.012	.014	.016	.018								
	6/20	.018	.014	.010	.006	.010	.012	.010	.010	.010	.010	.012	.012	.010	.010
	9/16	.024	.014	.008	.011	.014	.014	.014	.005	.009	.01	.012	.012	.005	.008
Total Phos.	4/18	.38	.07	.05	.08	.10	.12								
	6/20	.06	.03	.04	.04	.05	.06	.04	.04	.04	.04	.04	.03	.03	.03
	9/16	.03	.03	.02	.02	.03	.05	.04	.03	.05	.05	.04	.03	.02	.03
Alkalinity Total (C_aCO_3)	4/18	24	40	32	26	28	25								
	6/20	44	52	52	50	50	50	48	44	42	44	48	44	42	50
	9/16	46	52	52	52	56	46	58	40	44	42	42	58	40	44
Silica	6/20	12.8	11.4	11	10.4	11.2	10.4	7.4	3.8	3.7	3.8	6.6	5.2	3.7	3.6
	9/16	13.4	11.2	2.7	11.2	11.8	2.5	11.4	2.0	2.4	2.4	2.4	11.6	2.4	2.4
Chlorides	6/20	0	0	0	1	0	0	0	1	1	36	0	0	1	0
	9/16	0	0	1	0	0	1	0	1	1	1	1	0	1	0
Hardness	4/18	29	41	37	30	32	32								
	6/20	46	2	52	48	51	52	50	48	48	48	50	49	47	47
	9/16	50	54	48	60	68	52	60	48	52	52	48	68	46	48
Temp. (^oC)	4/18	6	9	2	4	4	4								
	6/20	14	15	15	17	17	17	16	14	14	15	16	15	15	15
	9/16	10	11	11.5	12	12	13	13	12	12	12	12	12	12	11
D.O.	4/18	9.2	10.7	11.8	12.5	113.7	12.7								
	6/20	8.8	8.8	9.1	9.4	8.8	9.1	9.5	10.3	10.4	10.4	10.6	10.0	10.2	10.4
	9/16	9.4	10.5	10.6	11.6	11.6	11.6	11.2	11.2	11.0	11.0	11.2	11.0	11.2	11.2
pH (S.U.)	4/18	6.8	7.1	7.1	7.0	7.0	7.0								
	6/20	7.2	7.5	7.4	7.4	7.6	7.6	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
	9/18	7.2	7.4	7.4	7.6	7.6	7.5	7.4	7.4	7.5	7.4	7.4	7.4	7.4	7.4
Turbidity (N.T.U.)	6/20	.78	1.3	2.2	2.8	6.0	1.2	7.8	8.8	8.8	12	12	12	6.8	6.6
	9/16	.97	.48	4.3	1.1	2.3	52	4.0	9.0	32	15	22	2.0	6.2	20
Secchi Disk	6/20						1.7	1.7	2.1	2.0	2.2	2.1	1.7	2.8	3.0
	9/16						3.4	1.0	2.8	1.0	1.8	1.75	1.4	4.0	4.5

All values in mg/l except where specified (1) Refer to Figure Br-1 (2) Refer to Figure Br-2

djt
6/10/76

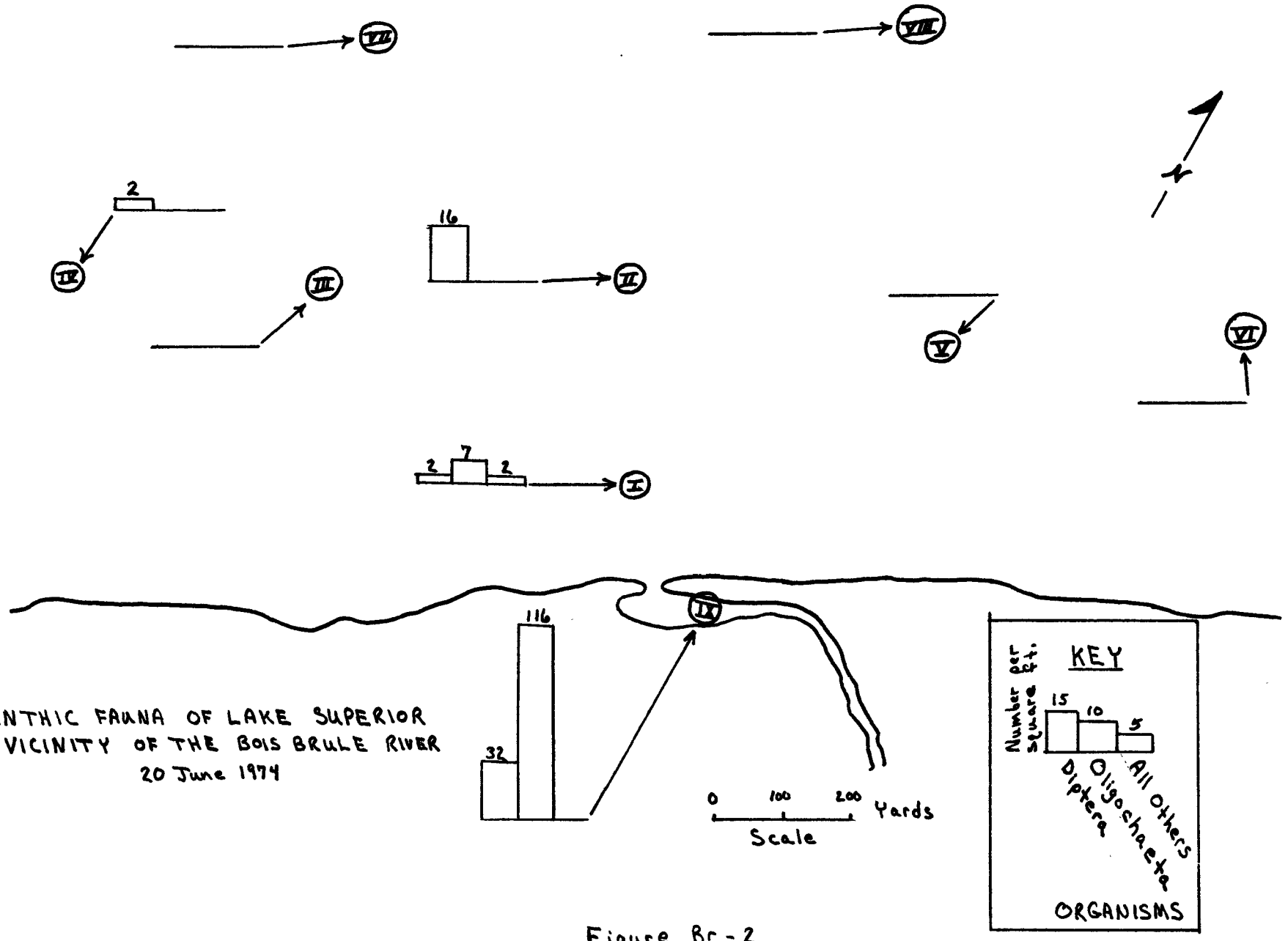




BENTHIC FAUNA OF THE BRULE RIVER

20 June 1974

Figure Br-1



BENTHIC FAUNA OF LAKE SUPERIOR
IN VICINITY OF THE BOIS BRULE RIVER
20 June 1974

Figure Br-2

TABLE Br-2

METALS CONCENTRATIONS FROM THE BRULE RIVER-LAKE SUPERIOR DURING 1974

Station (1)	Date	Metals						
		Cd	Cr	Cu	Ni	Pb	Hg	Zn
Hwy S	4/18	<.002	.01	.005	<.01	<.02	.0004	.009
Hwy B	4/18	<.002	.014	.004	<.01	.03	<.0002	.010
Hwy 2	4/18	<.002	<.01	.002	<.01	<.02	<.0002	.010
Hwy FF	4/18	<.002	<.01	.004	<.01	<.02	<.0002	.071
Hwy 13	4/18	<.002	.01	.006	<.01	<.02	<.0002	.011
Mouth	4/18	<.002	<.01	.011	<.01	<.02	.0002	.065
	6/20	<.0002	<.0008	<.001	<.006	<.005	<.0003	<.05
I	6/20	<.0002	<.0008	<.001	<.006	<.005	<.0003	<.05
III	6/20	<.0002	<.0008	.005	<.006	<.005	.0003	<.05
V	6/20	<.0002	<.0008	<.001	<.006	<.005	<.0003	<.05

All values in mg/l

(1) Refer to Figures Br-2 and Br-3

TABLE Br-3

AVERAGE CONCENTRATIONS FOR SELECTED PARAMETERS AT STATIONS NEAR THE MOUTH OF THE BRULE RIVER
(Refer to Table Br-1)

Parameter	River Mouth IX	Stations Closest to River Mouth (I, II, III, V)	Stations Furthest from River Mouth (IV, VI, VII, VIII)
Total Solids	106	88	79
Total Org. N.	.28	.24	.23
Total Phos.	.055	.038	.031
Silica	6.45	4.96	4.38
Hardness	52	50	50
Turbidity (T.U.)	32	13.0	38.7
Secchi Disk (Ft.)	2.6	1.8	2.7

Bad River

The chemical characteristics of the Bad River system as documented during this project are shown in Table Ba-1. In common with the Nemadji and Brule Rivers, the Bad River watershed contains a significant amount of red clay. This is reflected in the high solids concentrations, particularly during the spring runoff period. In comparison, the Bad River carries more silt load than the Bois Brule but still much less than the Nemadji.

The results from this survey seem to indicate the solids load is reduced between Highway 2 and the river mouth (Station IX). This may be the result of the physical characteristics of the lower river (the river below Highway 2 is almost at lake elevation and becomes wide and slow-moving) enabling the heavier clay particles to settle out. However, assumptions about data from Station IX are difficult because this site could almost be considered a fresh water estuary environment and the water circulation in this area may at times be influenced by wind seiches or other movements of the lake.

Table Ba-3 shows a comparison of water quality data from the river mouth (Station IX) with those stations closest to the mouth (II, III, IV and VII) and those furthest away (I, V, VI and VIII). This data seems to indicate a definite influence on lake water quality from the Bad River within the relatively small area covered by this survey. All of the parameters checked showed decreases in concentrations with distance from the river mouth. The biological survey results indicate that the Bad River and its major tributaries support a rich benthic fauna with intolerant organisms well represented at all stations. The widely diverse populations and relative abundance are indicative of normal clean water environments.

In comparison with the Brule River area, the Lake Superior stations off the Bad River are much more productive. This situation appeared mainly to be the result of physical habitat conditions. The sand bottom was not as hard packed and at several of the stations, was mixed with substantial amounts of clay. In addition, Stations I, VII and IV showed significant amounts of organic debris as a thin bottom covering.

The concentrations of metals found in the Bad River System and Lake Superior during this survey are shown in Table Ba-2. Most of the concentrations are quite low and are below Water Quality Criteria recommendations.

The glaring exception to the above are the high levels of lead found at several locations during the April 22nd sampling. These levels are not related to any known pollutional "point source" and it is suspected that some sampling or analytical error is involved. Resampling of those stations which showed high lead levels will be undertaken in the near future.

One totally unexplainable result is the .6 ug/l concentration of mercury found at Lake Superior Station IV on June 26. This concentration does not appear related to any Bad River influence and is certainly out of line with expected lake water quality. Further sampling of Lake Superior stations will be done in 1975 if our work load permits.

TABLE Ba-1

RESULTS OF GENERAL CHEMISTRY ANALYSIS
Bad River-Lake Superior

Parameter	Date 1974	River Stations(1): Hwy 169	White R. Hwy 13	Marengo River Near Highbridge	Hwy 2	Mouth IX	Lake Stations(2): I	II	III	IV	V	VI	VII	VIII
MFCC (No./100 ml)	4-22	700	700	800	1200	(3)								
	6-26		300			300	<100	<100	100	<100	<100	<100	<100	<100
	9-18	13000	510	1,400	300	170	230	340	60	140	140	200		210
MFFCC (No./100 ml)	4-22	<10	30	20	70									
	6-26	30	<10	60	10	20	10	<10	<10	<10	<10	<10	<10	<10
	9-18	720	20	150	40	<10	<10	<10	<10	<10	<10	<10		<10
BOD (5 day)	4-22	2.5	2.0	2.5	2.5									
	6-26	2.5	1.2	2.5	2.5	2.9	2	2	2.5	2	2	1.6	1.6	2
	9-18	.8	1.2	1.2	2.0	1.2	.8	.8	.8	.8	1.2	1.2		1.6
Total Solids	4-22	88	162	216	342									
	6-26	76	120	124	102	98	58	54	106	62	46	56	52	50
	9-18	44	276	104	138	84	60	64	64	52	54	54		48
Susp. Solids	4-22	25	55	126	266									
	6-26	1	13	12	4	5	0	0	5	0	0	0	0	0
	9-18	3	134	8	25	15	8	12	12	6	5	5		3
Total Susp. Solids	4-22		5	6	13									
	6-26	1	1	3	0	1	0	0	1	0	0	0	0	0
	9-18	0	10	0	0	1	1	2	0	1	1	1		0
Total Org. N	4-22	.62	.62	.60	.78									
	6-26	.60	.27	.38	.48	.43	.19	.14	.40	.13	.16	.14	.16	.19
	9-18	.58	.37	.33	.40	.25	.09	.10	.12	.05	.15	.09		.09
Nitrate - N	4-22	.11	.08	.15	.12									
	6-26	.04	.03	.09	<.01	<.01	.16	.16	.01	.18	.18	.16	.15	.16
	9-18(4)	.02	.03	.07	.05	.18	.25	.24	.24	.25	.25	.25		.25
Nitrite - N	4-22	.003	.007	.006	.008									
	6-26	.005	.004	.004	.005	.005	.003	.003	.005	.003	.003	.003	.004	.003
	9-18(4)				.006									

Table Ba-1
Continued

Parameter	Date 1974	Hwy 169	White R. Hwy 13	Marengo River Near Highbridge	Hwy 2	Mouth IX	I	II	III	IV	V	VI	VII	VIII
NH_3-N	4-22	.13	.14	.14										
	6-26	.10	.04	.02	.04	.03	.09	.01	.02	.02	.01	.04	.08	.05
	9-18	.08	.10	.04	.11	.03	.05	.07	.03	.09	.04	.06		.07
Sol. Phos.	4-22	.010	.026	.020	.024									
	6-26	.012	.012	.012	.010	.004	.003	.004	.012	<.002	<.002	.004	.004	<.002
	9-18	.016	.034	.013	.015	.008	.004	.004	.004	.006	.004	.005		.004
Total Phos.	4-22	.07	.12	.26	.21									
	6-26	.04	.03	.04	.03	.04	.02	.01	.04	.01	.01	.02	.01	.01
	9-18	.03	.105	.10	.04	.03	.02	.02	.02	.02	.015	.02		.015
Alkalinity Total ($CaCO_3$)	4-22	8	40	20										
	6-26	30	86	54	70	62	44	42	60	42	44	44	42	42
	9-18	26	98	66	52	42	42	42	41	40	42	42		42
Silica	6-26	7.6	11.0	9.2	8.9	8.4	2.9	2.6	8.7	2.3	2.5	2.4	2.4	2.5
	9-18	10.0	11.9	9.6	10.6	6.0	2.6	2.8	2.2	2.3	2.2	2.2		2.2
Chlorides	6-26	1	1	1	1	1	1	1	1	2	1	1	1	1
	9-18	0	0	0	0	0	0	0	0	0	0	0		0
Hardness	4-22	18	47	29	28									
	6-26	36	88	56	68	64	48	52	64	44	66	44	44	44
	9-18	38	94	55	56	53	52	56	46	46	46	44		46
Temp. °C	4-22	5	7	6	6									
	6-26	19	19.5	19.5	22	21	16	18	21	17	17	16	18	17
	9-18	14	15	16	13	14	14	14	14	14	13.5	14		14
D.O.	4-22	11.9	11.8	11.6	11.0									
	6-26	9.6	9.3	9.6	8.1	8.4	11	11	8.6	11.2	11	11	11	11
	9-18	10.6	11.6	11.3	10.4	10.6	10.5	10.4	10.4	10.6	10.6	10.5		10.6

Table Ba-1
Continued

Parameter	Date 1974	Hwy 169	White R. Hwy 13	Marengo River Near Highbridge	Hwy 2	Mouth IX	I	II	III	IV	V	VI	VII	VIII
pH (Su)	4-22	7.0	7.2	7.0	7.0									
	6-26	7.0	8.0	7.4	7.4	7.4	7.4	7.4	7.3	7.4	7.4	7.4	7.4	7.4
	9-18	7.2	7.6	7.6	7.4	7.4	7.4	7.4	7.5	7.4	7.4	7.4		7.4
Turbidity (T.U.)	6-26	.77	6.3	3.1	4.7	3.4	.90	.90	5.0	.85	.75	.68	.73	.85
	9-18	.95	57	1.5	18	8.3	3.5	6.5	7.3	3.4	2.2	2.8		1.3
Secchi Disk (feet)	6-26					2.8	10.7	9.0	4.7	14.5	2.2	11.5	13.5	12.5
	9-18					2.0	3.0	2.2	2.0	2.2	14.0	4.8		7.5

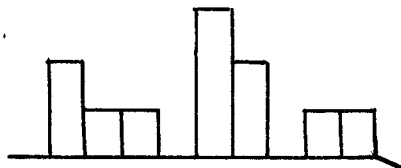
All values in mg/l unless specified

(1) Refer to Figure Ba-2

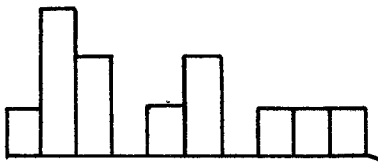
(2) Refer to Figure Ba-3

(3) Blank spaces indicate data not collected on that date

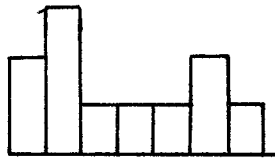
(4) Data for 9/18 includes Nitrate-N and nitrite-N combined



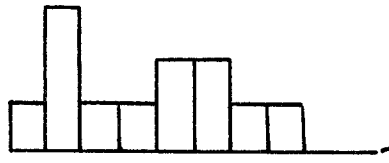
Bad R. at Hwy 2



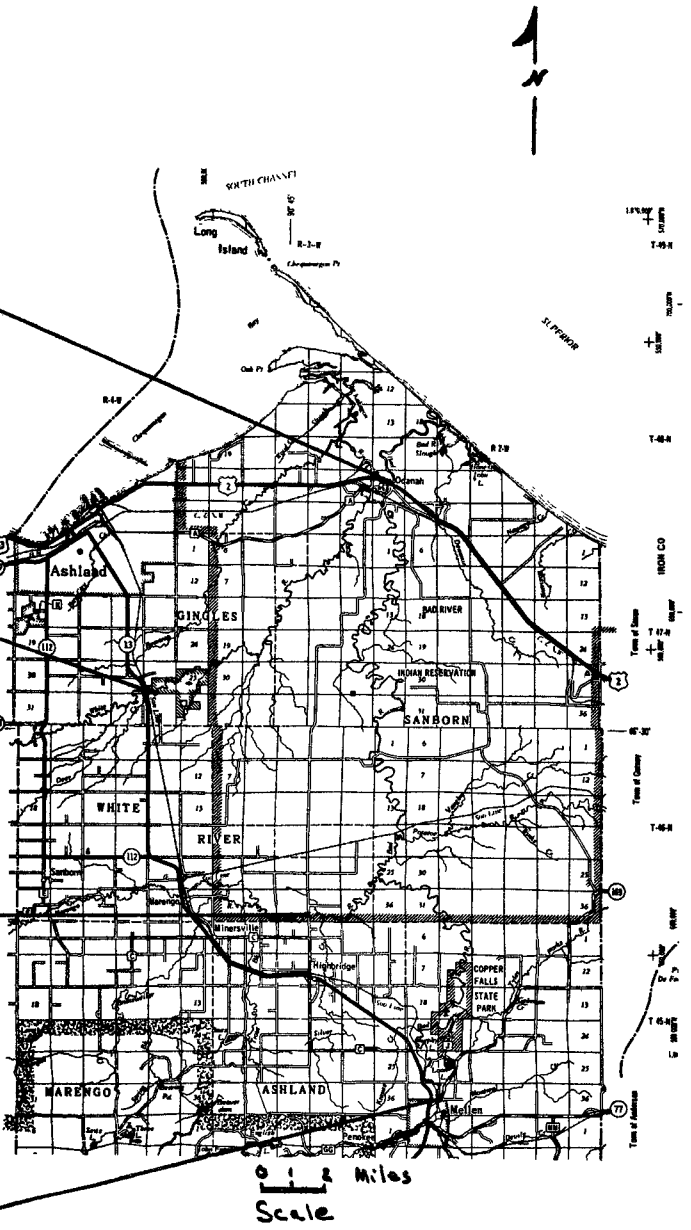
White R. at Hwy 13

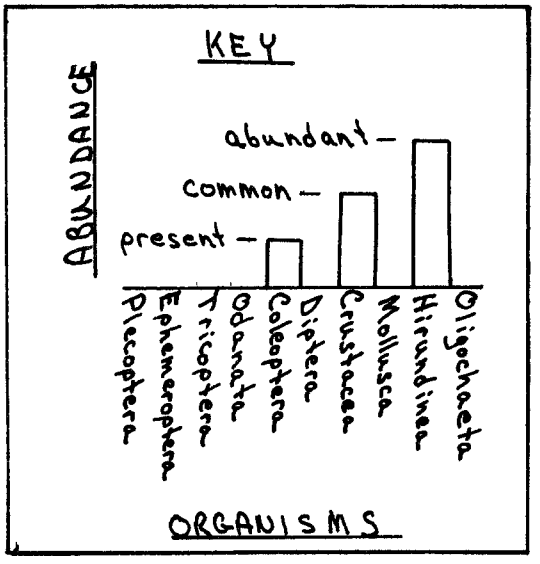


Marengo R. Near Highbridge



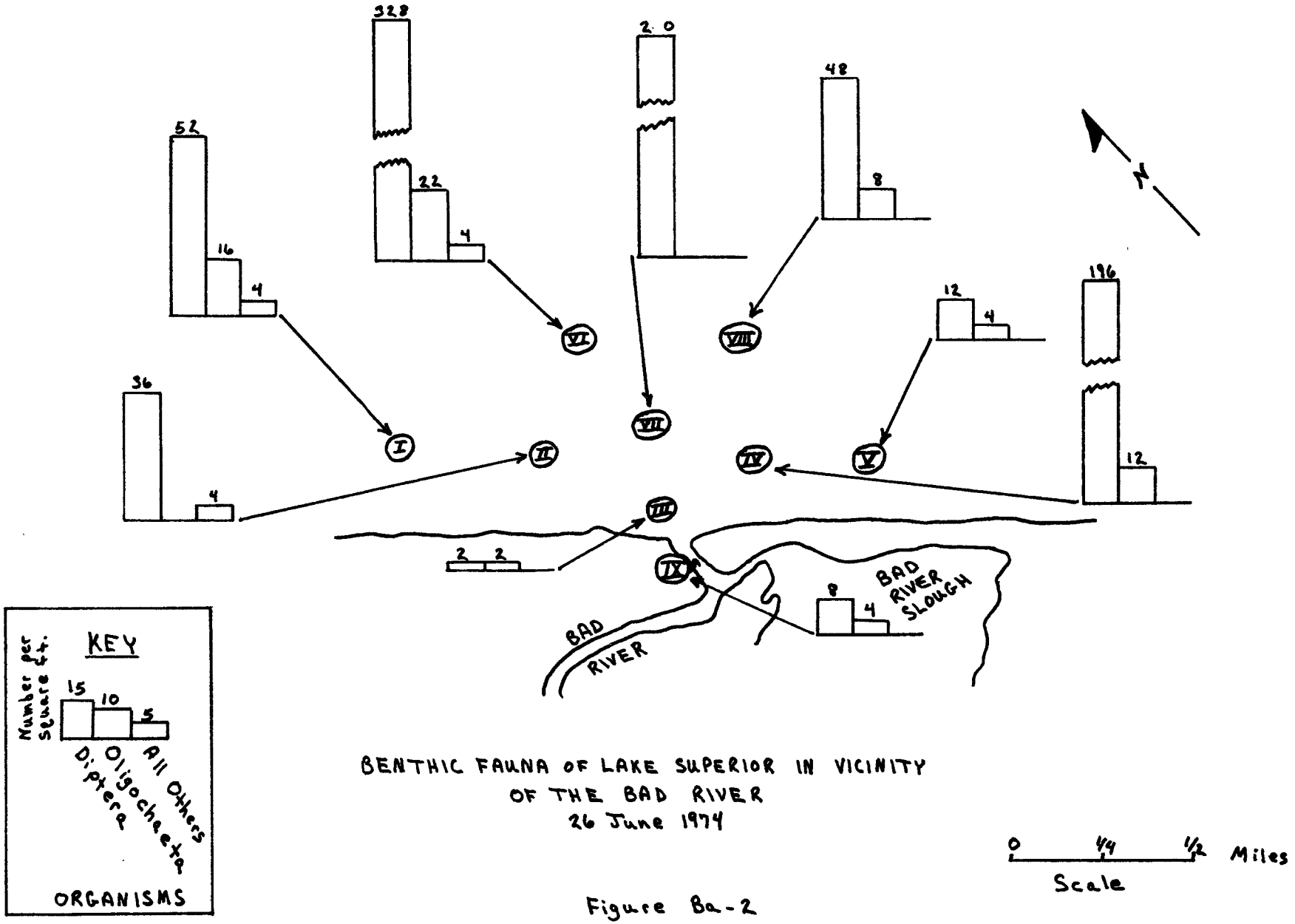
Bad R. at Hwy 169





BENTHIC FAUNA OF THE BAD RIVER WATERSHED
26 June 1974

Figure Ba -1



BENTHIC FAUNA OF LAKE SUPERIOR IN VICINITY OF THE BAD RIVER
26 June 1974

Figure Ba-2

TABLE Ba- 2

METALS CONCENTRATIONS FROM THE BAD RIVER WATERSHED-LAKE SUPERIOR

DURING 1974

Station[1]	Date 1974	Metals						
		Cd	Cr	Cu	Pb	Hg	Ni	Zn
Bad River, Hwy 13	4/22	<.002	.01	.005	.27	<.0002	<.01	.023
Bad River, Hwy. 169	4/22	<.002	<.01	.004	.06	<.0002	<.01	.014
Marengo River- near Highbridge	4/22	.002	.015	.012	.14	<.0002	.01	.064
Potato River, above confluence w/ Bad R.	4/22	.002	.01	.008	.14	<.0002	.01	.026
White R., Hwy 13	4/22	<.002	<.01	.007	<.02	<.0002	.01	.025
Bad River, Hwy 2	2/21	.0001	.0023	.0034	<.002	<.0002	<.01	<.02
	4/19	<.002	.015	.010	<.02	<.0002	<.01	.075
	4/22	<.002	.010	.012	.15	<.0002	.01	.033
	7/29	<.0003	.002	<.002	<.003	.0002	<.005	<.02
Bad River Mouth(IX)	6/26	<.0002	<.0008	<.001	<.005	<.0003	<.006	<.05
Station II	6/26	<.0002	<.0008	.004	<.005	.0006	<.006	<.05
Station IV	6/26	<.0002	<.0008	.003	<.005	<.0003	.015	<.05

All values in mg/l

[1] Refer to Figures Ba-2 and Ba-3

TABLE Ba-3

AVERAGE CONCENTRATIONS FOR SELECTED PARAMETERS AT STATIONS NEAR THE MOUTH OF THE BAD RIVER

Parameter	River Mouth	Stations Closest to Mouth (II,III,IV, & VII)	Stations Furthes from Mouth (I, V, VI, & VII
Total Solids	91	65	53
Total Org. N.	.34	.16	.14
Total Phos.	.035	.018	.016
Silica	7.2	3.33	2.44
Hardness	58	50	49
Turbidity (N.T.U.)	5.8	3.5	1.6
Secchi Disk (Ft.)	2.4	6.9	8.3

Montreal River

General chemical characteristics of the Montreal River and the localized Lake Superior area are shown in Table M-1.

One problem area that becomes immediately apparent is the bacteriological contamination that occurs in and downstream from the Hurley locality. This problem is partly caused by the municipal sewage treatment plant effluents from Hurley and Ironwood, Michigan. However, additional investigative work will be implemented to document any other pollutional sources in this area. It is anticipated that the issuance of WPDES permits to Hurley and the surrounding Wisconsin communities will call for immediate steps to eliminate bacterial contamination of wastewater effluents. It is hoped that this action, along with similar action by the State of Michigan will bring a speedy solution to this problem.

The Montreal River, in contrast to the other major Wisconsin tributaries does not have a significant amount of red clay in the watershed. This fact is demonstrated in the total solids concentrations, which do not reflect the high spring loadings exhibited by the other streams.

A comparison of several chemical parameters for the river mouth and lake stations is shown in Table M-3. This data seems to indicate a localized influence on lake water quality within the relatively small area covered by this survey.

The biological investigation of the Montreal River (Figure M-1) revealed diverse benthic populations at the two stations above the Hurley sewage treatment plant. Intolerant organisms were well represented in these stable benthic communities.

The Highway 2 station, downstream from the Hurley STP exhibited a definite decrease in the presence and numbers of macroinvertebrates considered intolerant of low dissolved oxygen conditions. Although the physical habitat conditions at this site were not ideal for benthic development, it is felt that these findings are directly related to the impact on the stream from the Hurley STP.

A normal, diversified benthic population was again found at the Stateline Road station, approximately two miles downstream from the Hurley-Ironwood area. The biological community is again well represented with intolerant organisms and indicates recovery to well oxygenated conditions. The Highway 122 station is located in a flowage environment and the biological community found during this survey is probably representative and normal for this type of habitat.

Figure M-2 is a representation of benthic organisms found during sampling efforts in Lake Superior near the mouth of the Montreal River. The presence of hard substrate again hampered the collection of dredge samples. The distribution and abundance of the benthic fauna collected did not reveal any pattern indicative of a significant biological impact from the Montreal River outflow.

The metals concentrations found in the Montreal River during this survey are shown in Table M-2. Again most of the concentrations are quite low and fall below recommended levels as stated in Water Quality Criteria, 1972.

The high lead values obtained during the April 24th sampling are at this time unexplained. We are not aware of any "point sources" which contribute lead to the Montreal River. It is suspected that some sampling or analytical error may be involved with these high values. In any case resampling of those stations showing high value is being undertaken as our work load permits.

TABLE M-1

RESULTS OF GENERAL CHEMISTRY ANALYSIS

Montreal River-Lake Superior

		River Stations(1)					Lake Stations(2)								
PARAMETER	1974	Hwy C	Hurley Above STP	Hwy 2	Stateline Road	Hwy 122	Mouth	I	II	III	IV	V	VI	VII	VIII
MFCC (No./100 ml)	4-24	100	2,400	4,000	31,000	3,200	(3)								
	6/27						600	<100	<100	1,600	200	<100	<100	<100	<100
	7/2	700	24,000	38,000	22,000	1,900									
	10/3	-	-	-	-	540									
MFFCC (No./100 ml)	4/24	10	420	870	2,900	360									
	6/27						<10	<10	<10	<10	<10	<10	<10	20	<10
	7/2	50	760	520	540	10									
	10/3	10	1,200	2,900	220	50	10	10	<10	<10	<10	<10	<10	<10	<10
B.O.D. (5 day)	4/24	1.2	1.6	1.6	2.0	1.6									
	6/27						1.8	1.5	1.5	2.2	1.5	1.8	1.5	1.2	1.5
	7/2	1.8	2.9	2.9	4.1	2.5									
	10/3	2.5	2.1	2.8	2.1	2.5	2.51	2.5	1.8	2.5	1.5	1.8	2.1	1.8	1.5
Total Solids	4/24	62	64	70	66	68									
	6/27						76	54	54	72	54	48	54	58	54
	7/2	92	90	94	150	84									
	10/3	76	84	96	110	72	68	58	56	64	48	52	54	52	52
Susp. Solids	4/24	10	6	11	10	18									
	6/27						3	1	3	1	1	1	2	2	2
	7/2	4	3	4	11	4									
	10/3	2	1	3	3	2	3	5	3	3	5	4	4	4	4
Vol. Susp. Solids	4/24	2	2	2	2	3									
	6/27						1	0	0	1	1	0	1	1	1
	7/2	3	3	3	5	4									
	10/3	2	0	2	2	2	2	2	2	2	3	2	1	1	2
Total Org. N	4/24	.60	.60	.63	.60	.58									
	6/27						.48	.16	.16	.42	.22	.16	.12	.16	.15
	7/2	.62	.62	.90	.77	.53									
	10/3	.54	.54	.65	.61	.45	.32	0.0	0.0	.16	.01	0.0	.05	.04	.05

Table M-1
Continued

PARAMETER	Date 1974	River Stations(1) Hwy C	Hurley Above STP	Hwy 2	Stateline Road	Hwy 122	Lake Stations(2) Mouth	I	II	III	IV	V	VI	VII	VIII
Nitrate - N	4/24	.09	.11	.11	.14	.14									
	6/27						.20	.20	.15	.20	.20	.20	.25	.25	.20
	7/2	.08	.08	.13	1.05	.14									
	10/3	.01	.03	.06	.59	.16									
							.17	.24	.24	.21	.24	.24	.24	.24	.24
Nitrite - N	4/24	.005	.005	.005	.006	.005									
	6/27						.009	.003	.003	.008	.004	.004	.003	.003	.003
	7/2	.005	.006	.015	.047	.006									
	10/3(3)														
NH_3 - N	4-24	.10	.10	.08	.10	.10									
	6/27						.05	.02	.01	.06	.02	.01	.05	.10	.02
	7/2	.07	.08	.41	.07	.07									
	10/3	.06	.10	.30	.12	.07	.09	.16	.13	.12	.12	.13	.11	.08	.09
Sol. Phos.	4/24	.010	.016	.018	.032	.036									
	6/27						.060	.002	.002	.036	.004	.002	<.002	.004	<.002
	7/2	.012	.022	.31	.38	.042									
	10/3	.008	.016	.05	.176	.043	.043	.004	.004	.021	.003	.003	.003	.003	.006
Total Phos.	4/24	.04	.04	.06	.07	.08									
	6/27						.08	.01	.01	.07	.02	.02	.008	.01	.003
	7/2	.04	.06	.44	.49	.09									
	10/3	.02	.04	.10	.25	.07	.08	.02	.01	.04	.01	.01	.01	.01	.01
Alkalinity Tot. ($CaCO_3$)	4/24	8	8	10	10	10									
	6/27						32	42	40	34	38	40	40	40	40
	7/2	30	38	42	52	28									
	10/3	28	33	36	42	28	28	40	41	36	42	42	42	42	44
Silica	4/24	6.6	6.8	6.8	6.6	6.8									
	6/27						6.0	1.9	2.2	5.3	2.6	2.4	2.0	2.0	2.0
	7/2	4.8	5.0	5.4	7.2	4.2									
	10.3	5.4	6.1	6.2	7.0	4.6	4.7	2.3	2.1	3.2	1.9	1.7	1.9	2.0	1.8
Dhlorides	4/24		0	0	0										
	6/27						3	1	1	2	1	1	0	1	1
	7/2			5	11	1									
	10/3	0	1	3	6	3	3	0	0	1	0	0	1	1	0
Hardness	4/24	12	14	14	16	20									
	6/27						40	48	44	36	44	46	40	40	52
	7/2	38	42	48	68	32									
	10/3	34	41	44	52	38	34	44	44	41	44	46	44	44	44

Table M-1
Continued

PARAMETER	1974	River Stations(1) Hwy C	Hurley Above STP	Hwy 2	Stateline Road	Hwy 122	Mouth	Lake Stations(2) I	II	III	IV	V	VI	VII	VIII
Temp. °C	4-24	5	4	5	5	4									
	6-27						20	12	12	19	12.5	12	11	12	12
	7-2	22	23	24	23	25									
	10-3	6	6	6	6	8	7	9	10	9	9.5	10	9.5	10	10
D.O.	4-24	10.6	11.0	11.4	12.3	12.5									
	6-27						8.4	11.8	11.4	9.1	11.4	10.8	11.6	10.8	10.8
	7-2	6.2	7.5	6.2	7.5	7.5									
	10-3	11.6	11.6	11.4	12.4	12.4	12.0	11.4	11.4	11.8	11.6	11.5	11.6	11.5	11.0
pH (Su)	4-24	6.8	6.8	6.8	6.9	7.0									
	6-27						7.2	7.4	7.4	7.2	7.4	7.4	7.4	7.2	7.2
	7-2	6.8	6.8	7.1	7.6	7.7									
	10-3	7.2	7.2	7.0	7.2	7.0	7.2	7.2	7.2	7.2	7.2	7.2	7.0	7.2	7.2
Turbidity (T.U.)	4-24														
	6-27						1.7	.8	.75	1.2	.65	.57	.60	.60	.60
	7-2														
	10-3	1.1	1.2	1.4	1.2	1.2	1.4	2.2	2.2	1.2	1.5	1.8	2.2	2.2	1.4
Secchi Disk (ft.)	4-24														
	6-27							12.3	12.3	8.7	9.0	11.0	12.9	14.0	13.8
	7-2														
	10-3							6.8	6.8	4.9	5.1	5.0	5.0	5.0	5.0

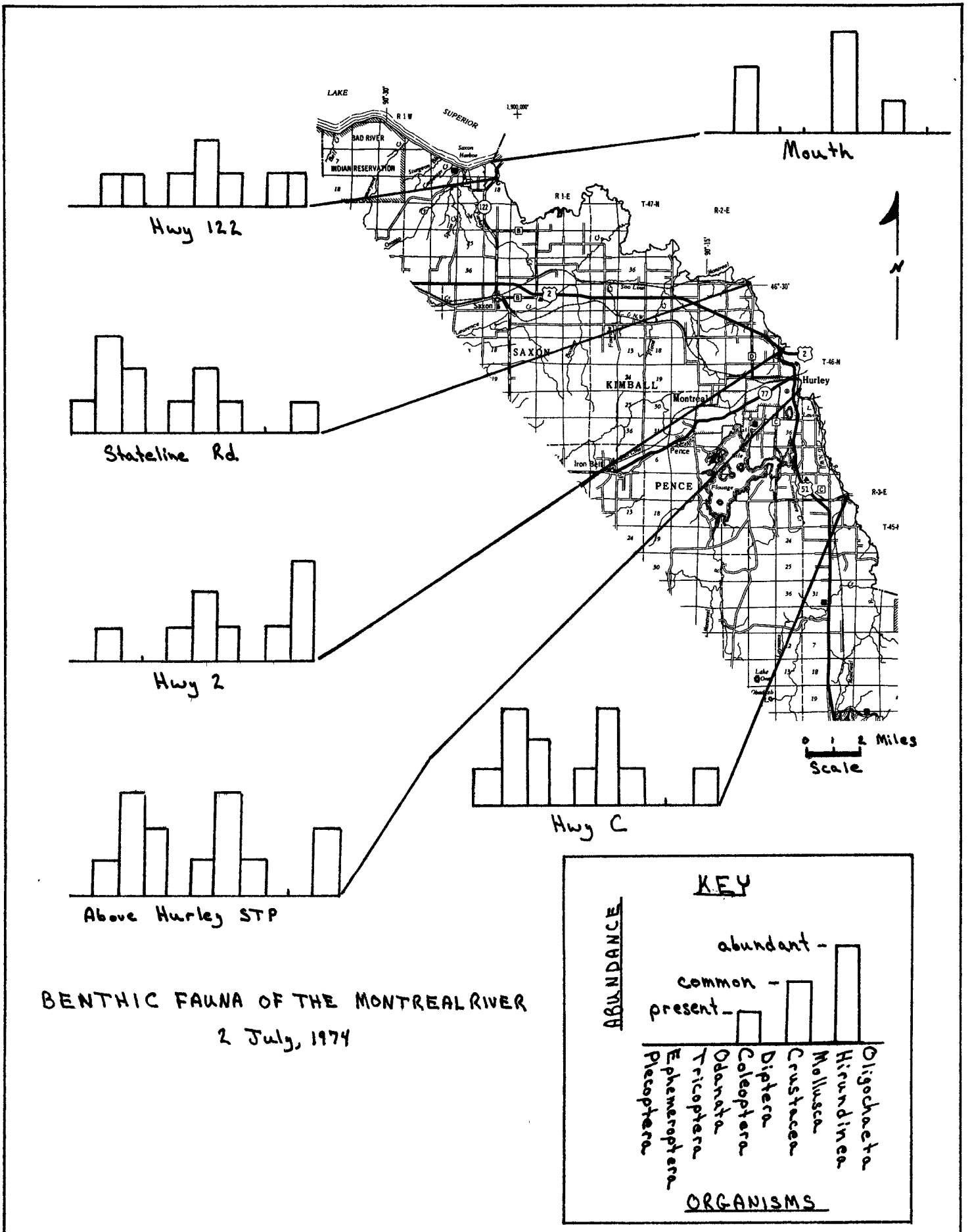
All values in mg/l unless specified

(1) Refer to Figure M-2

(2) Refer to Figure M-3

(3) Blank spaces indicate data not collected on that date

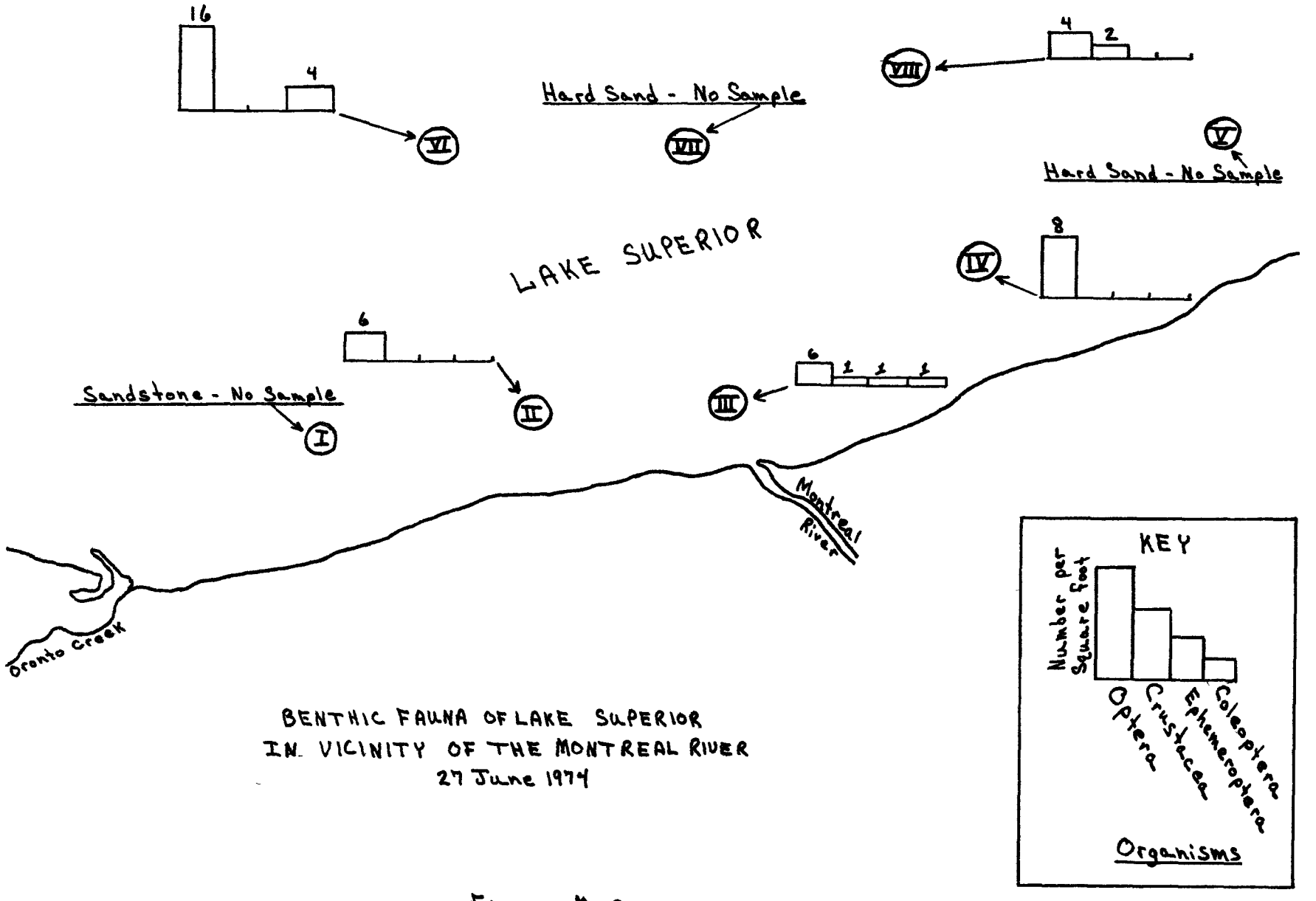
(4) Nitrate-N and nitrite-N values combined for the 10-3 data



BENTHIC FAUNA OF THE MONTREAL RIVER

2 July, 1974

Figure M-1



BENTHIC FAUNA OF LAKE SUPERIOR
IN VICINITY OF THE MONTREAL RIVER
27 June 1974

Figure M-2

TABLE M-2

METALS CONCENTRATIONS FROM THE MONTREAL RIVER-LAKE SUPERIOR DURING 1974

Station[1]	Date	Metals						
		Cd	Cr	Cu	Pb	Hg	Ni	Zn
Hwy G	4/24	.002	.015	.004	.10	<.0002	<.01	.010
Hwy C	4/24	.002	<.01	.003	.25	<.0002	<.01	.010
Hurley (above STP)	4/24	.002	.010	.007	.15	<.0002	<.01	.018
Hwy 2	4/24	.002	<.01	.005	.18	<.0002	<.01	.013
Stateline Rd.	4/24	<.002	<.01	.013	.25	<.0002	<.01	.007
Hwy 122	2/21	.0001	.0014	.0013	<.002	<.0002	<.01	<.02
	4/19	<.002	.01	.077	<.02	<.0002	<.01	.015
	4/24	<.002	<.01	.016	.25	<.0002	<.01	.008
	7/29	<.0003	.002	.002	<.003	.0002	<.005	<.02
River Mouth (Sta. IX)	6/27	<.0002	<.0008	<.001	<.005	<.0002	<.006	<.05
Lake Sta. II	6/27	<.0002	<.0008	<.001	<.005	<.0002	<.006	<.05
Lake Sta. IV	6/27	<.0002	<.0008	<.001	<.005	<.0002	<.006	<.05

All values in mg/l

[1] Refer to Figures M-2 and M-3

TABLE M- 3

AVERAGE CONCENTRATIONS FOR SELECTED PARAMETERS AT STATIONS NEAR THE MOUTH OF THE MONTREAL RIVER[1]

Parameter	Stations				
	River Mouth	III	II & IV	I & V	VI, VII & VIII
Total Solids	72	68	53	53	54
Total Org. N.	.4	.29	.098	.08	.095
Total Phos.	.08	.055	.012	.015	.0085
Silica	5.35	4.25	2.2	2.1	1.95
Hardness	37	39	44	46	44
Turbidity	1.55	1.2	1.28	1.34	1.27
Secchi Disk		6.8	8.3	8.77	9.28

(1) Refer to Table M-1

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2. Sather, L.M. and Threinen, C.W., 1966; Surface Water Resources of Ashland County; Wisconsin Conservation Department; 128 p.

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4. _____, 1973; Water Quality Criteria, 1972. A report of the Committee on Water Quality Criteria, Environmental Studies Board, National Academy of Sciences and National Academy of Engineering, Washington, D. C., 1972.

APPENDIX A

1973 and 1974 DATA SUMMARIES

Nemadji River
Bois Brule River
Bad River
Montreal River

SURFACE WATER QUALITY RECORD

Source: Nemadji River at Highway C Year: 1974

Date	1/28	2/14	3/14	4/10	4/18	4/21	4/23	4/25	6/4	6/18	7/22	9/3	9/11	10/4	11/13	12/12
Field Data																
Temp. °C	1	0	0	1	3	5	4	7	18	13	20	13.5	14.9	9	2	1
D.O. (mg/l)	11.3	11.7	12.5	13.0	12.6	11.4	12.3	12.6	8.3	9.4	8.4	9.8	9.4	11.0	12.7	12.7
pH (su)	7.4	7.4	7.6	7.6	7.5	7.2	7.0	7.0	7.4	7.4	7.8	7.8	7.8	7.8	7.3	7.4
Bacteriological																
MFFCC/100 ml	10	-	30	200	30	20	20	10	50	20		20	30	10	20	10
MFCC/100 ml	-	-	1400	2400	3700	1300	100	400	200	600		1400	100	290		120
Lab Analysis Data																
BOD, 5-day	2.5	1.2	2.1	3.7	3.3	0.8	2.5	2.5	3.4	2.0	2.5	2.5	2.9	.9	1.8	
Total Solids	188	186	180	1352	1350	418	460	320	168	210	362	188	180	190	153	
Suspended Solids	12	8	11	312	1155	292	326	22	36	85	202	9	14	10	21	
Volatile Suspended Solids	-	1	2	21	50	20	21	8	4	9	14	1	3	9	3	
Total Organic Nitrogen	.28	.44	.65	1.25	.91	.73	1.08	.77	.62	.62	.62	.42	.37	.50	.52	
Nitrate Nitrogen	.24	.18	.31	.24	.10	.18	.10	.11	.30	.01	.11	.03	.06	.03	.07	
Ammonia Nitrogen	.10	.04	.14	.10	.13	.11	.16	.07	.07	.03	.01	.04	.01	.0	.03	
Nitrite Nitrogen	.007	.007	.013	.012	.013	.009	.007	.012	.011	.006	.005	.002	.001	.002		
Total Phosphorus	.04	.03	.07	.86	.86	.24	.24	.18	.08	.10	.14	.03	.04	.05	.05	
Soluble Phosphorus	-	.012	-	.030	.028	.006	.022	.036	.034	.012	.019	.012	.008	.006	.010	
Silica	-	13	13.8			10.2		10	7.8	7.2	14	10	11.2	13.2	11	
Total Iron		.92	1.16	37		9.4			1.14	3.4	8.5	1.04	.96	.60	1.76	
Phenol		.005	.005	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	.01	
Manganese			.04	.04		.08			.05	.08	.11	.07	.11	.04	.04	
Chlorides	2	3	5	0		0		0	0	1	3	1	2.0	3	2	
Alkalinity Total ($CaCO_3$)	110	100	90	50	44	41	40	40	64	60	96	106	112	120	63	
Hardness	122	124	100	62	76	52	56	56	72	74	104	118	124	130	76	
Conductivity micro/cm		235	206	163		116			135		240	243	265	264	153	
Color	35	102	80	350		120			100	140	60	30	15	30	120	
Turbidity				32		90			29	41	140	16	16	5.1	25	
pH (su)	7.5	7.7	7.8	7.9	7.4	7.4	7.2	7.2	7.6	7.3	7.8	8.1	7.8	7.8	7.6	

Date	1/28	2/14	3/14	4/10	4/18	4/21	4/23	4/25	6/4	6/18	7/22	9/3	9/11	10/4	11/13	12/12
COD		34				39					31					
Cyanide		.02				.01					.02					
Fluoride		.15				.15					.10					
Magnesium						.08										
Potassium						1.7					3.2					
Sodium						1.8					4.8					
Sulphate		14				2					12					
Calcium						16					29					
Metals (mg/l)																
Arsenic		.02									.002					
Barium		.05									.070					
Cadmium		.0002									.004					
Chromium		.0012									.01					
Copper		.0006									.015					
Lead		.002									.05					
Mercury		.0002									.0002					
Nickel		.01									.01					
Selenium		.002									.01					
Zinc		.02									.04					
Organics (ppb)																
DDT		.004				.04					.01					
DDD		.004				.02					.005					
DDE		.002				.02					.01					
PCB		.04				.3					.04					
Aldrin		.005				.01					.002					
Dieldrin		.002				.01					.005					
Heptachlor		.002				.01					.002					
Heptachlor Epoxide		.002				.01					.002					
Lindane		.001				.005					.002					
Methoxychlor		.01				.02					.01					
Phthalate		.2				.2					.5					
Radiological																
Gross Alpha		1.1									2.6					
Gross Beta		3.9				11.7					12.2 ± 1.6					
H^3		367				380										
Sr^{90}		1.7				5.2 ± 1.0										
Ra^{226}		0.9				2.5										

(Results in mg/l unless specified)

SURFACE WATER QUALITY RECORD

Source: Brule River at Highway 13 Year: 1973

Date-	6/27	7/31	9/5	9/25	10/25	11/20	12/17
Field Data							
Temp. °C	18	18	16	14	12	4	0
D.O. (mg/l)	8.4	10.0	8.8	9.9	10.6	13.0	13.4
pH (su)	7.7	8.0	-	7.4	7.5	7.4	7.2
Bacteriological							
MFFCC/100 ml	20	10	40	80	40	50	10
MFCC/100 ml				100	3300	1200	100
Lab Analysis Data							
BOD, 5-day	2.5	0.9	2.2	2.1	1.5	1.8	2.5
Total Solids	120	210		96	108	90	90
Suspended Solids	16	23	16	8	6	3	4
Volatile Suspended Solids	5	11		0	0	2	4
Total Organic Nitrogen		.31	.47	.28	.40	.05	.15
Nitrate Nitrogen		.03	.01	.04	.10	.06	.14
Ammonia Nitrogen		.03	.01	.04	.05	.05	.08
Nitrite Nitrogen		.004	.005	.003	-	.007	.006
Total Phosphorus		.04	.06	.03	.06	.05	.09
Soluble Phosphorus		.008	-	-	-	.050	.012
Silica				8.1	8.2	7.6	10
Total Iron		.52	1.76	.22	.40	0.2	.36
Phenol			.01	.005	.01	.01	-
Manganese		.05	.04	.04	.045	.04	.04
Chlorides	1	0		0	0	0	8
Alkalinity Total ($CaCO_3$)	56	52	56	58	54	58	60
Hardness	64	68		60	64	53	64
Conductivity micro/cm		146		133	140	137	92
Color	35	30		20	30	20	20
Turbidity		5.8		3.0	7.2	2.8	5.4
pH (su)	7.7	6.8	7.8	7.5	7.6	7.4	7.6

(Results in mg/l unless specified)

SURFACE WATER QUALITY RECORD

Source: Brule River Highway 13 Year: 1974

Date-	1/24	2/18	3/14	4/16	4/18	4/21	4/23	4/25	6/4	6/20	7/22	9/4	9/10	10/4	10/17	11/21
Field Data																
Temp. °C	2	2	1	5	4	9	7	10	20	17	19	13	12	8.5	9	2
D.O. (mg/l)	12.1	13.0	13.5	12.9	13.7	11.9	12.5	11.6	9.5	8.8	10.1	10.9	11.6	12.0	11.0	13.3
pH (su)	7.3	7.5	7.7	7.2	7.0	7.8	7.0	7.1	7.8	7.6	8.0	7.8	7.6	7.4	7.4	7.3
Bacteriological																
MFFCC/100 ml	10		10	20	10	20	10	10	10	40	310	10	200	10	20	30
MFCC/100 ml	300		200	170	1100	300	23000	200	1200	1200	7200	700	810	510	100	550
Lab Analysis Data																
BOD, 5-day	1.5	1.6	0.9	4.1	3.3	1.2	1.6	1.6	3.1	2.5	2.5	1.6	1.2	.6	4.5	1.2
Total Solids	102	100	112	116	140	100	106	112	98	98	118	98	78	96	86	82
Suspended Solids	18	7	15	56	70	35	20	28	13	20	25	6	10	8	5	1
Volatile Suspended Solids		2	3	10	5	6	5	3	3	7	4	0	0	4	1	0
Total Organic Nitrogen	.41	.19	.29	.58	.58	.40	.50	.49	.32	.42	.36	.18		.46	.17	.19
Nitrate Nitrogen	.15	.15	.29	.11	.11	.04	.07	.08	.09	.12	.04	.14	.02	.02	.04	.10
Ammonia Nitrogen	.10	.02	.06	.05	.10	.05	.06	.07	.06	.11	.02	.02	.19	.03	.01	.06
Nitrite Nitrogen	.004	.003	.006	.007	.007	.007	.007	.009	.005	.005	.004	.006	.001	.001	.002	-
Total Phosphorus	.06	.04	.06	.08	.10	.07	.12	.08	.06	.05	.07	.03	.03	.02	.02	.04
Soluble Phosphorus	.024	.014	-	.014	.016	.02	.016	.034	.020	.010	.021	.010	.014	.006	.009	.025
Silica	11	10.2	9.6	9.6	-	-	-	9.4	8.0	11.2	10.8	11	11.8	11.6	11.8	12.2
Total Iron	0.5	.24	.66	2.0	-	1.36	-	-	.46	.70	1.06	.24	.22	.20	.20	.42
Phenol	.005	-	.005	.01	.01	.01	.01	.01	.01	.01	.01	.21	.01	.01	.01	.01
Manganese	.04	-	.04	.04	-	.04	-	-	.05	.05	.05	.04	.04	.04	.04	.04
Chlorides	0	2	2	1	-	1	-	0	0	0	2	0	0	0	0	1
Alkalinity Total ($CaCO_3$)	58	48	59	30	28	36	32	40	52	50	58	60	56	54	56	52
Hardness	60	58	60	38	32	39	40	56	60	51	56	72	68	62	58	56
Conductivity micro/cm	1340	860	121	89	-	92	-	-	105	97	130	130	130	1320	220	113
Color	10	5	20	70	-	70	-	-	30	40	30	20	20	15	20	40
Turbidity (su)	6.2	4	12	14	-	20	-	-	5	6	16	3	2.3	1.7	2.5	7.2
pH (su)	7.1	7.4	7.7	7.2	7.0	7.4	7.3	7.3	6.9	7.8	7.8	7.9	7.9	7.5	7.9	7.8

Date-	1/24	2/18	3/14	4/16	4/18	4/21	4/23	4/25	6/4	6/20	7/22	9/4	9/10	10/4	10/17	11/21
COD		11														
Cyanide		.01			.01						.02					
Fluoride		.10			.10						.10					
Magnesium					3						5					
Potassium					.8						1.0					
Sodium					2.2						2.7					
Sulphate		4			2						3					
Calcium					11						14					
Metals (mg/l)																
Arsenic		.02			.02						-					
Barium		.0265			.029						-					
Cadmium		.0001			.002						.005					
Chromium		.0016			.01						.01					
Copper		.0006			.006						.006					
Lead		.002			.02						.04					
Mercury		.0002			.0002						.0002					
Nickel		.01			.01						.006					
Selenium		.003			.003						-					
Zinc		.02			.011						.02					
Organics (ppb)																
DDT		.004			.01						.01					
DDD		.004			.005						.005					
DDE		.002			.005						.005					
PCB		.04			.02						.04					
Aldrin		.005			.002						.002					
Dieldrin		.002			.005						.005					
Heptachlor		.002			.002						.002					
Heptachlor Epoxide		.002			.002						.002					
Lindane		.001			.002						.002					
Methoxychlor		.01			.02						.002					
Phthalate		0.2			0.2						0.5					
Radiological																
Gross Alpha		2.5			-						4.3					
Gross Beta		2.5			3.5						4.6	±.8				
H^3		2361			410											
Sr^{90}		1.7			35											
Ra^{226}		2.1			2.5											

(Results in mg/l unless specified)

SURFACE WATER QUALITY RECORD

Source: Bad River at Highway 2 Year: 1973

Date-	2/5	2/27	3/20	4/23	5/29	6/27	7/31	9/5	9/25	10/25	11/20	____	____	____	____	____
Field Data																
Temp. °C	0	0	0	10	15	21	20	20	14	12	4					
D.O. (mg/l)	11.6	11.9	13.1	9.4	8.7	7.2	7.2	7.0	9.7	9.3	13.0					
pH (su)	7.2	7.2	7.0	7.2	7.2	7.5	6.5	7.5	7.6	7.4	7.3					
Bacteriological																
MFFCC/100 ml	15	5	5	10		20	10	190	100	30	20					
MFCC/100 ml		300							140	13000	900					
Lab Analysis Data																
BOD, 5-day	2.5	2.5	1.5	3.7	1.8	1.8	4.3	0.9	2.9	2.4	1.5					
Total Solids	112	122	146	128	128	130	132		126	122	106					
Suspended Solids	2	6	53	24	22	10	2.6	62	13	7	5					
Volatile Suspended Solids	0	2	2	2	1	3	13		1	0	3					
Total Organic Nitrogen	.26		.41				.46	.63	.37	.54	.16					
Nitrate Nitrogen	.18		.12				.03	.04	.04	.18	.10					
Ammonia Nitrogen	.10		.60				.03	.01	.05	.07	.06					
Nitrite Nitrogen			.006				.004	.007	.004		.005					
Total Phosphorus	.03		.06				.05	.09	.05	.04	.01					
Soluble Phosphorus			.016				.016				.010					
Silica								7.6	9.0	9.5	8.0					
Total Iron							1.14	3.8	.50	.66	.60					
Phenol								.005	.005	.01	.01					
Manganese							.05	.04	.04	.045	.04					
Chlorides	2	1	0	0	0	0	0	0	0	0	1					
Alkalinity Total ($CaCO_3$)	64	74	29	36	34	74	56	68	70	70	72					
Hardness	72	76	46	40	40	72	68		72	74	86					
Conductivity micro/cm							141	150	158	169	166					
Color (su)	40	40	100	100	120	50	70		45	60	45					
Turbidity								80	15	9.7	5.5					
pH (su)																

(Results in mg/l unless specified)

SURFACE WATER QUALITY RECORD

Source: Bad River at Highway 2 Year: 1974

Date-	1/28	2/21	3/12	3/19	4/19	4/22	4/24	4/26	4/29	5/23	6/26	7/29	9/10	9/17	10/29	12/3
Field Data																
Temp. °C	0	1	1	-	5	6	5	11	14	17	22	23	14	13	10	1
D.O. (mg/1)	-	10.7	12.9	-	12.4	11.0	11.3	11.2	10.2	7.6	8.1	8.2	8.3	10.4	10.3	12.3
pH (su)	7.1	7.1	7.1	-	7.0	7.0	7.0	7.0	7.1	7.7	7.4	7.8	7.8	7.4	8.0	7.3
Bacteriological																
MFFCC/100 ml	320	20	50	-	10	70	30	10	30	10	10	10	30	40	10	30
MFCC/100 ml	500	800	3600	-	400	1200	400	100	400	700	100	100	1400	300	240	350
Lab Analysis Data																
BOD, 5-day	1.8	2.5	3.4	-	2.5	2.5	1.2	3.7	2.5	6.1	2.5	2.8	4	2	0.9	
Total Solids	144	118	132	-	242	342	232	162	120	122	102	112	164	138	122	
Suspended Solids	30	-	19	-	168	266	124	72	33	17	4	12	62	25	7	
Volatile Suspended Solids	8	-	3	-	16	13	8	0	1	3	0	2	4	0	1	
Total Organic Nitrogen	.30	.17	-	.62	.63	.78	.70	.69	.55	.48	.48	.35	.40	.40	.17	
Nitrate Nitrogen	.11	.07	-	.15	.24	.12	.13	.12	.06	.05	.01	.11	.10	.05	.02	
Ammonia Nitrogen	.10	.04	-	.10	.14	.14	.07	.07	.04	.06	.04	.02	.17	.11	.09	
Nitrite Nitrogen	.005	.005	-	.009	.008	.008	.009	.011	.005	.004	.005	.003	.008	.006	-	
Total Phosphorus	.03	.03	-	.05	.15	.21	.15	.10	.06	.04	.03	.04	.07	.04	.04	
Soluble Phosphorus	.014	.018	-	-	.02	.024	.036	.024	.018	.012	.010	.020	.021	.015	.016	
Silica	14	11.8	-	11.8	9.6	-	9.0	9.4	7.2	7.2	8.9	3.6	14	10.6	12	
Total Iron	.78	.38	-	.94	4.0	-	-	-	-	.85	.64	.54	2.5	1.88	2.5	
Phenol	.005	.005	-	.005	.01	.01	.01	.02	.01	.01	-	.01	.01	.01	.01	.02
Manganese	.04	.04	-	.04	.04	-	-	-	-	.04	.05	.05	.11	.04	.04	
Chlorides	3	1	3	-	1	-	0	0	0	0	1	0	0	0	1	
Alkalinity Total ($CaCO_3$)	79	78	58	-	22	2[illegible]	20	22	20	56	70	78	78	52	76	
Hardness	80	80	72	-	30	28	28	28	38	56	68	81	116	56	80	
Conductivity micro/cm	180	158	-	145	83	-	-	-	-	115	-	170	170	120	160	
Color (su)	25	5	80	-	100	-	-	-	80	55	60	30	40	100	40	
Turbidity (JTU)	15	3.5	28	-	65	-	-	-	-	6.1	4.7	12	55	18	6.3	
pH (su)	7.3	7.6	7.6	-	7.5	7.0	7.0	7.3	7.2	7.2	8.0	8.1	7.6	7.6	7.9	

Date-	1/28	2/21	3/12	3/19	4/19	4/22	4/24	4/26	4/29	5/23	6/26	7/29	9/10	9/17	10/29	12/3
COD		10			34							16				
Cyanide		.02			.01											
Fluoride		.15			.10							.20				
Magnesium		-			2							6				
Potassium		-			1.3							1.0				
Sodium		-			1.7							3.3				
Sulphate		5.0			7.0							4				
Calcium		-			9							22				
Metals (mg/l)																
Arsenic		.02			.02							.002				
Barium		.035			.030							.05				
Cadmium		.0001			.002							.0003				
Chromium		.0023			.015							.002				
Copper		.0034			.010							.002				
Lead		.002			.02							.003				
Mercury		.0002			.0002							.0002				
Nickel		.01			.01							.005				
Selenium		.003			.003							.01				
Zinc		.02			.075							.02				
Organics (ppb)																
DDT		.004			.01							.01				
DDD		.004			.005							.005				
DDE		.002			.005							.005				
PCB		.04			.02							.04				
Aldrin		.005			.002							.002				
Dieldrin		.002			.005							.005				
Heptachlor		.002			.002							.002				
Heptachlor Epoxide		.002			.002							.002				
Lindane		.001			.002							.002				
Methoxychlor		.01			.02							.01				
Phthalete		0.2			0.2							0.2				
Radiological																
Gross Alpha		1.1			-							1.3				
Gross Beta		2.9			6.7							5.1				
H^3		367			400											
Sr^{90}					2.1 ± 8											
Ra^{226}		112			2.5											

(Results in mg/l unless specified)

SURFACE WATER QUALITY RECORD

Source: Montreal River at Highway 122 Year: 1973

Date-	2/5	2/27	3/20	4/23	5/29	6/27	7/31	9/5	9/25	10/29	11/20	12/13
Field Data												
Temp. °C	0	0	1	9	16	20	19	21	15	9	4	1
D.O. (mg/l)	13.2	13.2	13.6	10.7	9.8	7.6	8.8	8.4	10.0	12.1	13.3	13.4
pH (su)	7.1	7.1	7.0	7.2	7.7	7.3	7.6	7.5	7.6	7.5	7.6	7.2
Bacteriological												
MFFCC/100 ml	25	70	180	220		210	40	110	90		400	20
MFCC/100 ml	300	2300							3700		2900	200
Lab Analysis Data												
BOD, 5-day	3.7	2.8	1.5	3.7	1.8	2.5	0.9	1.8	2.5	1.5	1.5	0.9
Total Solids	90	104	92	66	104	100	92		108	86	90	96
Suspended Solids	2	1	6	6	6	5	10	5	7	2	1	2
Volatile Suspended Solids	0	1	1	2	0	3	7		1	2	1	2
Total Organic Nitrogen	.54		.41				.57	.66	.59	.62	.54	.62
Nitrate Nitrogen	.07		.28				.09	.16	.14	.20	.23	.24
Ammonia Nitrogen	.24		.72				.05	.01	.05	.13	.10	.14
Nitrite Nitrogen			.007				.004	.006	.007	.008	.007	.009
Total Phosphorus	.08		.05				.07	.09	.07	.08	.21	.06
Soluble Phosphorus			.018				.023			.06	.05	.04
Silica								2.9	2.6	5.0	4.8	7.4
Total Iron							.74	.78	.48	.44	.52	.58
Phenol								.005	.005	.01	.01	.005
Manganese							.05	.04	.04	.02	.04	.04
Chlorides	2	3	0	0	0	0	1	2	3	2	4	4
Alkalinity Total ($CaCO_3$)	40	34	14	22	28	30	24	32	28	34	38	44
Hardness	48	40	33	30	36	36	32		48	44	46	48
Conductivity micro/cm							83	88	106	115	116	130
Color	90	100	100	100	130	110	80		60	80	70	70
Turbidity							2.4	2	3.5	2.5	1.8	2.2
pH (su)	7.3	7.0	6.5	7.2	7.3	7.2	6.6	7.4		6.9	7.4	7.2

(Results in mg/l unless specified)

SURFACE WATER QUALITY RECORD

Source: Montreal River at Highway 122 Year: 1974

Date-	1/28	2/21	3/12	3/19	4/19	4/24	4/26	4/29	5/24	7/2	7/29	9/10	10/3	10/29	12/3
Field Data															
Temp. °C	0	1	1		5	4	10	14	15	25	23.5	15.5	8	11.5	1
D.O. (mg/l)		13.0	13.5		13.2	12.5	11.9	10.0	9.8	7.5	8.3	9.4	12.4	10.2	13.1
pH (su)	7.1	7.2	7.1		7.0	7.0	7.0	7.2	7.8	7.7	7.2	7.8	7.0	7.2	7.2
Bacteriological															
MFFCC/100 ml	10	10	10		230	360	590	220	50	10	10	80	50	10	240
MFEC/100 ml	300	7600	100		5200	3200	2600	3700	2400	1900	600	2900	540	10	1400
Lab Analysis															
BOD, 5-day	1.8	2.0	2.5		2.9	1.6	4.1	3.3	2.8	2.5	3.1	4.1	2.5	1.2	1.5
Total Solids	106	104	102		72	68	72	76	104	84	68	70	72	80	88
Suspended Solids	13	1	5		18	18	4	8	11	4	1	5	2	1	4
Volatile Suspended Solids	5	1	3		4	3	0	2	2	4	1	0	2	0	2
Total Organic Nitrogen	.49	.48		.62	.46	.58	.62	.59	.72	.53	.57	.60	.45	.42	.10
Nitrate Nitrogen	.24	.09		.27	.27	.14	.11	.08	.11	.14	.10	.16	.16	.18	.27
Ammonia Nitrogen	.16	.19		.19	.10	.10	.08	.05	.07	.07	.01	.03	.07	.14	.10
Nitrite Nitrogen	.011	.01		.01	.008	.005	.009	.006	.009	.006	.004	.002			
Total Phosphorus	.09	.15		.08	.07	.08	.06	.06	.10	.09	.09	.08	.07	.07	.07
Soluble Phosphorus	.064	.06			.01	.038	.020	.028	.048	.042	.048	.041	.043	.037	.033
Silica	8.8	7.8		2.4	7.2	6.8	7.0	3.8	6.6	4.2	1.6	4.4	4.6	5.6	1.0
Total Iron	.50	.68		.82	.46				.64	.32	.5	.6	.52	.48	.6
Phenol	.005	.005		.005	.01	.01	.01	.01	.01	.01	.01	.01	.01	-	.02
Manganese	.04	.04		.04	.04				.04	.05	.05	.70		.04	.04
Chlorides	1	3	6		1	0	0	0	2	1	1	1	3	1	4
Alkalinity Total ($CaCO_3$)	38	34	36		14	10	20	20	39	28	36	22	28	26	38
Hardness	46	40	56		23	20	24	32	44	32	33	34	38	34	53
Conductivity micro/cm	110	86		120	59				88	71	79	75	77.5	76	110
Color	80	35	60		60			80	100	70	60	60	40	80	90
Turbidity	2.3	2.4	4.4		7.1				3.5	2		2.7	1.2	2	1.7
pH (su)	7.0	7.2	7.3		7.0	6.7	7.1	7.2	7.7	7.05	7.5	7.1	6.75	7.3	7.6

Date-	1/28	2/21	3/12	3/19	4/19	4/24	4/26	4/29	5/24	7/2	7/29	9/10	10/3	10/29	12/3
COD		45			26						31				
Cyanide		.01			.01						.03				
Fluoride		.10			.15						.10				
Magnesium					1						2				
Potassium											.85				
Sodium											2.1				
Sulphate		3.0			3.0						4				
Calcium					7						10				
Metals (mg/l)															
Arsenic		.02			.02						.002				
Barium		.013			.01						.009				
Cadmium		.0001			.002						.0003				
Chromium		.0014			.01						.002				
Copper		.0013			.077						.002				
Lead		.002			.02						.003				
Mercury		.0002			.0002						.0002				
Nickel		.01			.01						.005				
Selenium		.003			.003						.01				
Zinc		.02			.015						.02				
Organics (ppb)															
DDT															
DDD		.004			.005						.005				
DDE		.002			.005						.005				
PCB		.04			.02						.04				
Aldrin		.005			.002						.002				
Dieldrin		.002			.005						.005				
Heptachlor		.002			.002						.002				
Heptachlor Epoxide		.002			.002						.002				
Lindane		.001			.002						.002				
Methoxychlor		.01			.02						.01				
Phthalate		0.2			0.2						0.2				
Radiological															
Gross Alpha		2.5									2.0 ± .7				
Gross Beta		2.5			2.5						8.7 ± .9				
H^3		367			400										
Sr^{90}					2.5										
Ra^{226}		1.2			2.5										

(Results in mg/l unless specified)

APPENDIX B

1975 DATA SUMMARIES

1975 MONITORING DATA - NEMADJI RIVER NEAR SUPERIOR

Station: 16003

Parameter	Date 2/12	4/3	4/17	4/21	4/24	5/7	6/12
Water Temp. (cent)	0	1	.5	4	5.5	11	12
pH (su)	7.2	7.4	7.4	7.3	7.5	7.2	7.8
BOD, 5-day (mg/l)	2.1	1.5	2.1		2.1	2.1	2.5
Lab pH (su)	7.4	7.3	7.0	7.3	7.1	7.3	7.8
Residue, Total (mg/l)	150	174	632	564	614	246	218
Residue, Tot Nflt (mg/l)	6	10	542	464	512	140	58
Residue, Vol Nflt (mg/l)	6	2	42	32	28	12	9
Phos-Tot (mg/l)	.02	.50	.27	.31	.41	.11	.05
Phos-Dis Ortho (mg/l P)	.011	.018	.03	.054	.074	.036	.023
Org N N (mg/l)	.72	.46	.54	.80	.71	.22	.05
NH_3-N Total (mg/l)	.14	.10	.20	.17	.09	.41	
NO_2 & NO_3 N-Total (mg/l)	.27	.27	.21	.22	.14	.07	.06
T Alk $CaCO_3$ (mg/l)	104	82	52	42	41	48	102
Chloride Cl (mg/l)	3	3	2	0	0	0	1
Color PT-CO	60	140	140	140	140	140	70
Conductivity at 25°C (micromho)	238	210	143	113	140	119	238
Total Hard $CACO_3$ (mg/l)	108	97	57	45	55	58	110
Turbidity (FTU)	7	25	230	170	180	66	35
Silica Total (mg/l)	17	14.3	7.8	7.8	7.0	6.5	10.8
Iron Fe (mg/l)	.44	2	13.8	13.5	14.5	5.2	
Manganese Mn (ug/l)	.04	.04	.26	.24	.22	.09	
Fec Coli (m-fc agar/100 ml)	10		110	30	20		
Phenols (ug/l)	.04		.023	.002	.001		
Tot Coli (mfimendo/100 ml)	100		2900	600	500		170
Cyanide Cn (mg/l				.01			
COD Hi Level (mg/l)				66			
Cadmium Cd Tot (ug/l)				.0005			
Chromium Cr Tot (ug/l)				.003			
Copper Cu Tot (ug/l)				.007			
Lead Pb Tot (ug/l)				1.2			
Mercury Hg Tot (ug/l)				.0002			
Nickel Ni Tot (ug/l)				.02			

Parameter	Date 2/12	4/3	4/17	4/21	4/24	5/7	6/12
Zinc Zn Tot (ug/l)				.05			
Residue Tot Vol (mg/l)				68	74		
Calcium Ca Tot (mg/l)				15			
Magnesium Mg Tot (mg/l)				2			
Potassium K Tot (mg/l)				2			
Sodium Na Tot (mg/l)				2			
Sulfate SO_4 Tot (mg/l)				1			
Fluoride F Tot (mg/l)				.2			
BOD, 6-day (mg/l)				3.4			
Flow (cfs)	78	210a	3600a	3500a	4700a		
Dissolved Oxygen							9.3

a - Data is provisional

1975 MONITORING DATA - BOIS BRULE RIVER NEAR PORT WING

Station: 163002

Parameter	Date 2/12	4/3	4/17	4/21	4/24	5/7	6/12
Water Temp (cent)	1	1	4	6	5	11	12
pH (su)	7.2	7.4	7.2	7.2	7.1	7.1	7.4
BOD, 5-day (mg/l)	2.1	1.8	1.5		1.5	2.1	2.8
Lab pH (su)	7.3	7.3	6.9	6.9	6.6	7.5	7.7
Residue Total (mg/l)	80	104	138	120	114		122
Residue Total Nflt (mg/l)	13	16	53	34	38	30	26
Residue Vol Nflt (mg/l)	6	4	8	4	4	6	4
Phos Tot (mg/l)	.03	.05	.09	.11	.07	.06	.05
Phos Dis Ortho (mg/l P)	.017	.01	.031	.073	.013	.032	.027
Org N N (mg/l)	.67	.15	.53	.47	.33	.17	.34
NH_3N Total (mg/l)	.19	.05	.09	.06	.04	.22	.04
NO_2 & NO_3 Total (mg/l)	.12	.07	.17	.11	.02	.07	.06
T Alk $CaCO_3$ (mg/l)	58	56	34	30	28	46	60
Chloride Cl (mg/l)	1	0	1	1	0	0	1
Color PT-CO	30	35	90	90	80	70	30
Conductivity at 25°C (micromho)	127	131	92	86	77	102	143
Total Hardness $CACO_3$ (mg/l)	64	56	36	34	35	48	60
Turbidity (FTU)	4.6	5.1	32	19	17	15	15
Silica Total (mg/l)	14	12.5	9.5	9.3	8.5	93	12.3
Iron Fe (mg/l)	.36	.48	2.32	.14			
Manganese Mn (ug/l)		.04	.05	.04	.04	.04	50
Fec Coli (m-fc agar/100 ml)			20				420
Phenols (mg/l)	.01	.018	.001		.005		
Cyanide Cn (mg/l)				.01			
Tot Coli (mfimendo/100 ml)			420		100		
COD Hi Level (mg/l)				43			
Zinc Zn Total (ug/l)				.05			
Residue Total Vol (mg/l)				44	48		
Fec Coli (m-fc agar/100 ml)					10		
Iron Fe (mg/l)					1.5	1.08	.36
Flow (cfs)	140	155	269	432	478		
Calcium Ca Total (mg/l)				8			
Magnesium Mg Total (mg/l)				3			
Potassium K Total (mg/l)				1			
Sodium Na Total (mg/l)				2			
Sulfate SO4 Total (mg/l)				4			
Fluoride F Total (mg/l)				.25			
BOD, 6-day (mg/l)				3.1			
Dissolved Oxygen (mg/l)							9.6

1975 MONITORING DATA - MONTREAL RIVER NEAR SAXON

Station: 263001

Parameter	Date 1/30	2/24	4/17	4/21	4/24	5/7	5/8	6/13
Water temp (cent)	1	1	1	5	4	12.5	12.5	15
pH (su)	7	7.4	7.1	7.1	7.1	6.8	6.8	7.4
BOD, 5-day (mg/l)	2.1	1.2	1.8				2.8	
Lab pH (su)	7	7	6.6	6.8			7	
Residue Total (mg/l)	112	86	100	74			76	
Residue Total Nflt (mg/l)	5	7	27	10			3	
Residue Vol Nflt (mg/l)	5	0	6	2			0	
Phos Total (mg/l)	.07	.07	.08	.05			.05	
Phos Dis Ortho (mg/l P)	.042	.045	.02	.023			.032	
Org N N (mg/l)	.22	.32	.36	.42			.34	
NH_3N Total (mg/l)	.45	.13	.47	.07			.05	
NO_2 & NO_3 Total (mg/l)	.27	.27	.32	.25			.12	
T Alk $CaCO_3$ (mg/l)	24	32	22	17			28	
Chloride Cl (mg/l)	4	3	3	1			2	
Color PT-CO	80	80	80	80			80	
Conductivity at 25°C (micromho)	108	96	85	65			82	
Total Hardness $CACO_3$ (mg/l)	40	40	30	22			36	
Turbidity (FTU)	1.4	1.6	14	6			2.3	
Silica Total (mg/l)	8.8	8.8	7.8	6			4.5	
Iron Fe (mg/l)	.6	.64	10.4	.48	.68	.44	.55	
Manganese Mn (ug/l)	.06	.04	.08	.04	.04	.05		90
Fec Coli (m-fc agar/100 ml)	130		1500					
Phenols (mg/l)	.02	.02	.015	.001	.001			1
Dissolved Oxygen (mg/l)								9
Calcium Ca Total (mg/l)				6				
Magnesium Mg Total (mg/l)				2				
Potassium K Total (mg/l)				1				
Sodium Na Total (mg/l)				2				
Sulfate SO_4 Total (mg/l)				5				
Fluoride F Total (mg/l)				.25				
BOD, 6-day (mg/l)				2.5				
Residue Total Vol (mg/l)				42				
DDT (ug/l)				.01				
DDE (ug/l)				.005				
DDD (ug/l)				.005				
Aldrin (ug/l)				.002				

Parameter	1/30	2/24	4/17	4/21	4/24	5/7	5/8	6/13
Heptachlor (ug/l)				.002				
Lindane (ug/l)				.002				
Heptachlor Epoxide (ug/l)				.002				
Tot Coli MFIMENDO (/100 ml)	730		17000					
Cadmium Cd Total (ug/l)				.0002				
Chromium Cr Total (ug/l)				.003				
Copper Cu Total (ug/l)				.003				
Lead Pb Total (ug/l)				.003				
Mercury Hg Total (ug/l)				.0002				
Nickel Ni Total (ug/l)				.02				
Zinc Zn Total (ug/l)				.05				
Cyanide Cn (mg/l)				.01				
COD Hi Level (mg/l)				35				
Flow (cfs)	196	223	970	654	2382			

1975 MONITORING DATA - BAD RIVER AT ODANAH

Station: 023001

Parameter	Date 1/30	2/24	4/14	4/17	4/21	4/24	5/7	5/8	6/13
Water Temp (cent)	0	1		3	4.5	4.5	12	12	15.5
pH (su)	7.2	7.4		7.1	7.0	7.0	7.1	7.1	7.6
BOD, 5-day (mg/l)	1.8			3.1		3.1	2.1		3.1
Lab pH (su)	7.6	7.6		6.8	6.9	6.6	7.2		7.7
Residue Total (mg/l)	134	220		520	262	458	118		136
Residue Total Nflt (mg/l)	10	17		428	172	382	32		7
Residue Vol Nflt (mg/l)	6	3		30	10	16	2		1
Phos Tot (mg/l)	.03	.06		.30	.14	.25	.04		.03
Phos Dis Ortho (mg/l P)	.009	.034		.03	.095	.035	.027		.011
Org N N (mg/l)	.07	.22		.65	.69	.62	.28		.25
NH_3N Total (mg/l)	.23	.05		.27	.08	.07	.06		.01
NO_2 & NO_3 Total (mg/l)	.21	.40		.21	.20	.12	.05		.04
T Alk $CACO_3$	70	98		32	22	24	39		82
Chloride Cl (mg/l)	1	45		1	0	0	2		1
Color PT-CO	40	30		140	140	140	80		30
Conductivity at 25°C (micromho)	156	334		89	71	69	110		175
Total Hardness $CaCO_3$ (mg/l)	73	100		37	29	30	52		82
Turbidity (FTU)	4.8	7.1		130	62	96	16		7.5
Silica Total (mg/l)	15	21.5		8.3	8	7.5	7.3		10
Iron Fe (mg/l)	.52	.64		11	3.6	7.5		3.4	.3
Manganese Mn (ug/l)	.04	.04		.18	.07	.11		.07	
Fec Coli (m-fc agar/100 ml)		10		40		100			20
Phenols (ug/l)		.001		.002	.001	.001			1
Tot Coli MFIMENDO (/100 ml)		260							
Cyanide Cn (mg/l)					.01				
COD Hi Level (mg/l)					41				
Cadmium Cd (ug/l)					.0002				
Chromium Cr Tot (ug/l)					.003				
Copper Cu Tot (ug/l)					.003				
Lead Pb Tot (ug/l)					.19				
Mercury Hg Tot (ug/l)					.0002				
Nickel Ni Tot (ug/l)					.02				
Zinc Zn Tot (ug/l)					.05				
Residue Tot Vol (mg/l)					52	58			
Calcium Ca Tot (mg/l)					8				

Parameter	1/30	2/24	4/14	4/17	4/21	4/24	5/7	5/8	6/13
Magnesium Mg Tot (mg/l)					2				
Potassium K Tot (mg/l)					1				
Sodium Na Tot (mg/l)					1				
Sulfate SO_4 Tot (mg/l)					5				
Fluoride F Tot (mg/l)					.25				
DDT (ug/l)					.01				
DDE (ug/l)					.005				
DDD (ug/l)					.005				
Aldrin (ug/l)					.002				
Heptachlor (ug/l)					.002				
Lindane (ug/l)					.002				
Heptachlor Epoxide (ug/l)					.002				
Dieldrin (ug/l)					.005				
Methoxychlor (ug/l)					.02				
PCBs (ug/l)					.04				
DEHP (ug/l)					.02				
Oil & Grease (mg/l)					.02				
Flow (cfs)	260	230	2000	3520	3660	6330			
BOD, 6-day (mg/l)					3.4				
Dissolved Oxygen (mg/l)									8.5

APPENDIX C

River Flows Near Monitoring Stations (cfs)

Date	Nemadji[1]	Bois Brule[2]	Bad[3]	Montreal[4]
2/05/73			330	189
2/27/73			240	215
3/20/73			2160	211
4/23/73			1180	911
5/29/73			1110	372
6/27/73		163	352	504
7/03/73				
7/31/73		133	376	242
9/05/73		183	447	234
9/25/73		146	262	183
10/25/73		177	243	
10/29/73				185
11/20/73		165	286	161
12/13/73				100
12/17/73		150		
1/24/74		140		
1/28/74	74		190	
2/12/74				
2/14/74	72			
2/18/75		140		
2/21/74			190	161
3/12/74			540	195
3/14/75	210	141		
3/19/74			310	
4/10/74	1000			

Date	Nemadji	Bois Brule	Bad	Mon
4/16/74		335		
4/18/74	3100	412		
4/19/74			3860	1
4/21/74	2400	355		
4/22/74			4990	
4/23/74	1800	347		
4/24/74			3070	1
4/25/74	1000	303		
4/26/74			1890	
4/29/74			1390	
5/23/74			605	
5/24/74				
6/04/74	190	193		
6/18/74	387			
6/20/74		232		
6/26/74			292	
6/27/74				
7/02/74				
7/22/74	157	167		
7/29/74			143	
9/03/74	69			
9/04/74		135		
9/10/74		143	425	
9/11/74	67			
9/13/74				

[1] Nemadji River total stream drainage area = 475 square miles. To determine stream flows and loading to Lake Superior multiply by a factor of 1.13. The Wisconsin drainage area is 215 square miles or 0.45 of the total, with the remainder being in Minnesota. The gaging station is near South Superior.

[2] Bois Brule River total stream drainage area = 190.2 square miles. To determine stream flows and loading to Lake Superior multiply by a factor of 1.59. The flow gaging station is near Brule.

[3] Bad River total stream drainage area = 1,092 square miles. To determine stream flows and loading to Lake Superior multiply by a factor of 1.79. The flow gaging station is near Odanah.

[4] Montreal River total stream drainage area = 277.3 square miles. To determine stream flows and loadings to Lake Superior multiply by a factor of 1.05. The Wisconsin drainage area is 180 square miles or 0.65 of the total - the remainder is in Michigan. Flows listed are at the Superior Falls hydropower plant.

Date	Nemadji	Bois Brule	Bad	Montreal
)/16/74		137		
)/17/74			334	
)/18/74			287	
)/03/74				206*
)/04/74	57*	129*		
)/17/74		138*		
)/29/74			216*	192*
/13/74	246*			
/21/74		163*		
/03/74			390*	
/30/75			260	196
/12/75	78	140		
/24/75			230	223
/03/75	210*	155		
/14/75			2000	
/17/75	3600*	269	3520	970
/21/75	3500*	432	3660	654
/24/75	4700*	478	6330	2382
/07/75	825*	299		
/08/75			907	
/12/75	110*	190	252	200
/13/75				197

ata is provisional

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15. SUPPLEMENTARY NOTES

EPA Project Officer: R. J. Bowden

16. ABSTRACT

Intensity of water quality sampling on four major Wisconsin tributaries was increased to provide data for the International Joint Commission, Upper Lakes Reference Group project entitled "Land Source Inputs to Upper Great Lakes From the U.S." Involved were (1) analysis of water samples from fixed stations on a monthly basis, (2) increased sampling during spring runoff and sampling for an expanded list of parameters three times during the year, and (3) an intensive survey run twice on each river during the summer of 1974. With the exception of localized problems, the data indicates that Lake Superior water off Wisconsin tributaries is of excellent quality and supports diverse and abundant populations of aquatic organisms.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
	Lake Superior Bad River Montreal River Brule River Nemadji River Chemical Parameters Biological Parameters	08H13B

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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