SELECTED WATER QUALITY CHARACTERISTICS OF MINIMALLY IMPACTED STREAMS from MINNESOTA'S SEVEN ECOREGIONS

Addendum to:

Descriptive Characteristics of the
Seven Ecoregions of Minnesota

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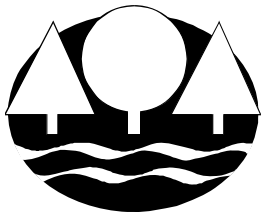

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SELECTED WATER QUALITY CHARACTERISTICS OF MINIMALLY IMPACTED STREAMS FROM MINNESOTA'S SEVEN ECOREGIONS

ADDENDUM TO: DESCRIPTIVE CHARACTERISTICS OF THE SEVEN ECOREGIONS IN MINNESOTA

Data from minimally impacted streams in each ecoregion provide a basis for comparison to existing water quality in streams of concern and an initial basis for establishing water quality goals. For Minnesota, significant differences in water quality have been identified among ecoregions. These differences suggest that evaluating water quality on an ecoregion basis is appropriate and that attainable levels of water quality may vary between regions.

As reported in Fandrei, et al. (1988), least impacted sites were selected for each of the seven ecoregions in Minnesota. STORET stream water quality data for the period from 1970 to 1985 was used to characterize stream water quality in each ecoregion. These least impacted sites, or reference sites, have been used to estimate the attainable water quality for an ecoregion. The streams included in Fandrei, et al. (1988) had the following characteristics: 1) at least four years of data; 2) data collected monthly for at least four years; 3) data that provides a reasonable representation of the ecoregion (drainage area should not include large areas of more than one ecoregion); and 4) no nearby point source discharges. Table 1 lists the least impacted sites by ecoregion. These estimates of attainable water quality have been used since 1988.

Hughes et al. (1986) refer to areas of least impact as "reference watersheds" and feel that reference sites can be used to estimate the best obtainable water quality for a region. The sites in Table 1 are not "reference watersheds" in the classical sense since they were not specifically selected based on their watershed characteristics and then intensively monitored. Rather the data, which is summarized from the streams in Table 1, represent the distribution of values from representative and hopefully, minimally impacted streams in each ecoregion.

TABLE 1. STORET STREAM MONITORING STATIONS DESIGNATED AS LEAST IMPACTED SITES BY ECOREGION

NORTH CENTRAL HARDWOOD FORESTS

SITE	HUC	SEG	ON	LOCATION	COUNTY
RU-0.5	07030005	030	ON	RUSH CREEK CR-56 BY RUSH CITY	CHISAGO
RUM-102	07010207	012	ON	RUM RIVER CSAH-4 E. OF PEASE	MILLE LACS
SN-0	07030004	001	ON	SNAKE R. AT MOUTH E OF PINE CITY	PINE
SU-16	07030005	035	ON	SUNRISE RIVER CSAH-19 AT STACY	CHISAGO
UM-930	07010203	010	ON	MISSISSIPPI R UPSTREAM OF MN-15 BR AT SAUK RAPIDS	BENTON

NORTHERN GLACIATED PLAINS

SITE	HUC	SEG	ON	LOCATION	COUNTY
PT-10	07020002	001	ON	POMME DE TERRE R ABOVE DAM E OF MN-7 AT APPLETON	SWIFT

RO-35	10170204	032	ON	ROCK RIVER CSAH-7 E OF HARDWICK	ROCK
YM-0.5	07020004	022	ON	YELLOW MEDICINE R MN-67 BR 7 MI SE GRANITE FALLS	YELLOW MEDICINE

NORTHERN LAKES AND FORESTS

SITE	HUC	SEG	ON	LOCATION	COUNTY
BRU-0.4	04010101	015	ON	BRULE R UPSTRM OF US-61 AT JUDGE CR MAGNEY PARK	COOK
GR-0.8	04010102	010	ON	GOOSEBERRY R DOWN OF US-61 GOOSEBERRY STATE PARK	LAKE
SL-116	04010201	031	ON	ST. LOUIS R. USH-53 S OF EVELETH	ST LOUIS
UM-1186	07010101	004	ON	MISSISSIPPI R AT MN-6 BRIDGE 8 MI SW OF COHASSET	ITASCA

NORTHERN MINNESOTA WETLANDS

SITE	HUC	SEG	ON	LOCATION	COUNTY
BF-0.5	09030006	001	ON	BIG FORK RIVER BRIDGE ON MN-11, 4 MI E OF LOMAN	KOOCHICHING
LF-0.5	09030005	001	ON	LITTLE FORK R MN-11 BRIDGE, 0.5 MI W OF PELLAND	KOOCHICHING
RP-0.1	09030007	001	ON	RAPID RIVER AT BRIDGE ON MN-11 AT CLEMENTSON	LAKE OF THE WOODS

RED RIVER VALLEY

SITE	HUC	SEG	ON	LOCATION	COUNTY
RE-536	09020104	005	ON	RED RIVER AT BR ON CSAH-18 0.5 MI W OF BRUSHVALE	WILKIN
RL-56	09020303	007	ON	RED LAKE RIVER W. OF GENTILLY	POLK
SK-1.8	09020309	001	ON	SNAKE RIVER AT BRIDGE ON MN-220 N OF BIG WOODS	MARSHALL
TMB-19	09020312	003	ON	TWO RIVERS MIDDLE BR ON US-75, 1 MI N OF HALLOCK	KITTSON

WESTERN CORN BELT PLAINS

SITE	HUC	SEG	ON	LOCATION	COUNTY
CD-24	07080201	021	ON	CEDAR RIVER AT CSAH-2, 0.5 MILES EAST OF LANSING	MOWER
WA-6	07020010	001	ON	WATONWAN R BR ON CSAH-13, 1 MI W OF GARDEN CITY	BLUE EARTH
WDM-3	07100002	013	ON	W FK DES MOINES R CSAH-23 BRIDGE S OF PETERSBURG	JACKSON
WDM-6.5	07100002	013	ON	DES MOINES R.-W FK. S OF JACKSON	JACKSON

Our current effort seeks to update and improve on the data base used in Fandrei et al. (1988). We have elected to focus our attention on two parameters of particular concern to lake water quality - total phosphorus and total suspended solids. Similar analysis could be conducted for other water quality parameters. Our analysis should be viewed as a "stepping stone" which, in this case is intended to improve our ability to evaluate stream water quality impacts on lakes and improve our ability to set water quality goals for these two parameters. We would anticipate "fine tuning" these estimates in the future as data (water quality and flow) becomes available from true "reference streams."

UPDATE OF THE DATA BASE

In order to update and make these estimates more useful, we have expanded the data base to include the period 1970 to 1992 and have also examined summer (June to September) data separately (a season of particular interest for lakes). We also have excluded station CA-13 from the group of least impacted sites for the Western Corn Belt Plains since a significant portion (~ 30-40 percent) of its watershed is in the North Central Hardwood Forests ecoregion.

Each of the Tables 2 through 7 present summaries of water quality for least impacted sites for that ecoregion for each of six time periods. The time periods are: (1) annual data, 1970-1985, (2) annual data, 1970-1992, (3) summer data, 1970-1985, (4) summer data, 1970-1992, (5) annual data, 1986-1992, and (6) summer data, 1986-1992.

COMPARISON OF SUMMER MEANS TO INDIVIDUAL OBSERVATIONS

Total phosphorus and total suspended solids data were selected as examples to compare the distributions of summer means and of summer medians with the distribution of individual observations. Analysis of these two parameters is often done using summer means. Listed below is a comparison of (1) the median for individual summer observations, 1970-1992; (2) the median for summer means by site by year, 1970-1992; and (3) the median for summer medians by site by year, 1970-1992 for total phosphorus and total suspended solids.

Ecoregion	Total Phosphorus (in mg/l) Medians for Individual Observations	Summer Means	Summer Medians	Total Suspended Solids (in mg/l) Medians for Individual Observations	Summer Means	Summer Medians
North Central Hardwood Forests	.100	.108	.100	10	13	11
Northern Glaciated Plains	.220	.235	.224	55	66	59
Northern Lakes and Forests	.040	.039	.039	4	4	3
Northern Minnesota Wetlands	.060	.069	.066	10	14	12
Red River Valley	.220	.233	.220	50	52	58
Western Corn Belt Plains	.270	.288	.280	47	58	50

For total phosphorus, there is no real difference among the three types of medians for a given ecoregion. For total suspended solids, the median for summer means and the median for summer medians tend to be slightly higher than the median for individual observations. This difference is small enough, however, so that any one of these medians can be used in estimating attainable values for the ecoregion.

COMPARISON OF TIME PERIODS

We have elected to focus on total phosphorus and total suspended solids as a basis for comparing the two time periods and summer versus annual data. Box plots (Figure 1) illustrate the distributions for total suspended solids and total phosphorus, for each of the 7 ecoregions. Each plot shows the distributions for (1) annual data, 1970-1985, (2) annual data, 1970-1992, (3) summer data, 1970-1985, and (4) summer data, 1970-1992. The "." on each box indicates the median, the top and bottom of the box are the 75th and 25th percentiles, respectively, and the dashes at the end of the "whiskers" indicate the 95th and 5th percentiles. The width of the box is proportional to the number of observations. The range from the 25th to the 75th percentile is also known as the interquartile (IQ) range. The IQ range is often used as a range of "typical" values.

There is very little difference, if any, in the IQ range, between annual data, 1970-1985 (original time period) and annual data, 1970-1992 (expanded time period) for both parameters. There are very slight decreases between the original time period and the expanded time period in the 75th percentile for total phosphorus in the North Central Hardwood Forests and in the Northern Glaciated Plains. The IQ ranges for summer data for both the original time period and the expanded time period are higher than the IQ ranges for annual data for both parameters.

Examining only the summer data, there are decreases between 1970-1985 and 1970-1992 for the 75th percentile for both total phosphorus and total suspended solids in the North Central

Hardwood Forests. There are also very slight decreases between 1970-1985 and 1970-1992, in the 75th percentile for total phosphorus in the Northern Lakes and Forests and in the Northern Glaciated Plains, and in the 75th percentile for total suspended solids in the Northern Glaciated Plains and in the Western Corn Belt Plains.

CONCLUSIONS AND RECOMMENDATIONS

In the absence of specifically designated and monitored reference sites, existing data from minimally-impacted streams can provide a good basis for evaluating water quality data and estimating attainable water quality for an ecoregion. This analysis is intended to update the previous analysis of water quality of minimally-impacted streams.

These results indicate that summer water quality data should be compared with estimates of water quality based on only summer data and for the entire time period 1970-1992. Although differences between time periods are very slight for annual data, it is preferable to use estimates of attainable water quality based on the expanded time period to better account for year-to-year variability in runoff responses.

Future work on this data set could include the calculation of areal loading rates (phosphorus in particular), for the minimally impacted sites (expanding on the work of Wilson and Walker, 1989). Where possible, it will be essential to pair water quality data with flow to allow for calculation of flow-weighted means and provide a basis for estimating year-to-year variability for the reference sites. This would allow for improved comparisons between data from the minimally-impacted sites and data from streams of different sizes and stream order. This may also be helpful in the calculation of total maximum daily loads (TMDLs).

It will also be important to improve our characterization of reference conditions in each ecoregion - in particular those ecoregions where the "minimally-impacted" sites do not represent true "reference" conditions because of man-induced impacts in the watershed and stream bed. Ultimately this means identifying appropriate reference sites in each region and monitoring water quality, flow and biota over an extended period of time.

REFERENCE

Fandrei, G., S.A. Heiskary, and S. McCollor. 1988. Descriptive Characteristics of the Seven Ecoregions in Minnesota. Minnesota Pollution Control Agency.

Hughes, R.M., D.P. Larsen, and J.M. Omernik. 1986. Regional reference sites: a method for assessing stream potentials. Environ. Manage. LO:629-635.

Wilson, C.B. and W.W. Walker Jr. 1989. Development of lake assessment methods based upon the aquatic ecoregion concept. Lake and Reserv. Manage. 5(2)11-22.

TABLE 2. NORTH CENTRAL HARDWOOD FORESTS

1970-1985 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity (µmhos/cm)	224	297	83	540	450	340	290	250	160	40
pH (SU)	226	7.9	3.1	8.6	8.4	8.	7.9	7.7	7.3	6.9
TSS (mg/L)	226	14.8	24.7	330	42	16	9.4	4.8	2	0.5
T Ammonia (mg/L)	225	0.22	0.15	1.3	0.47	0.21	0.20	0.16	0.08	0.03
NO2 + NO3 (mg/L)	88	0.22	0.61	5.7	0.46	0.28	0.11	0.05	0.02	0.01
T Phosphorus (mg/L)	225	0.14	0.16	1.6	0.36	0.17	0.1	0.07	0.04	0.01
Fecal Coliform (#/100mL)	209	586	2,428	24,000	1,700	330	110	40	20	11
Temperature (C)	223	11	9	27	24	20	12	0.56	0	0
Turbidity (NTU)	151	7.1	7.39	70	18	8.5	5.1	3.0	2.1	1.4
BOD5 (mg/L)	222	2.9	2.2	17	6.7	3.4	2.2	1.5	0.7	0.3

1970-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	276	297.7	83.4	840	440	330	290	250	170	40
pH	130	8.1	0.3	8.9	8.5	8.3	8.1	7.9	7.6	7.2
TSS	278	13.7	22.5	330	41	16	8.8	4.8	2	0.5
T Ammonia	277	0.2	0.2	1.3	0.46	0.2	0.2	0.1	0.04	0.02
NO2 + NO3	139	0.16	0.15	0.65	0.46	0.26	0.1	0.04	0.01	0.01
T Phosphorus	277	0.13	0.15	1.6	0.36	0.15	0.09	0.06	0.04	0.01
Fecal Coliform	271	920	3,277	27,000	4,200	360	110	40	20	4
Temperature(C)	153	12.6	9.4	28	26	21	13	2	0	0
Turbidity	151	7.1	7.4	70	18	8.5	5.1	3.0	2.1	1.4
BOD5	265	2.7	2.1	17	6.3	3.2	2.2	1.5	0.7	0.3

1970-1985 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	83	275	70.8	530	350	310	280	240	140	97
pH	84	8.0	0.31	8.6	8.4	8.2	8.0	7.8	7.5	6.9
TSS	84	21.3	37	330	51	23.5	12	8.2	4.8	3
T Ammonia	84	0.18	0.09	0.59	0.29	0.20	0.20	0.12	0.07	0.04
NO2 + NO3	36	0.08	0.07	0.33	0.22	0.12	0.08	0.03	0.01	0.01
T Phosphorus	84	0.15	0.08	0.37	0.30	0.22	0.11	0.08	0.06	0.05
Fecal Coliform	77	959	2,969	24,000	5,400	700	210	80	20	20
Temperature(C)	83	20.2	4.1	27.2	26	23	21	17.8	13.3	10
Turbidity	54	8.2	5.1	27	18	10	6.6	4.9	2.3	2.1
BOD5	82	2.9	1.7	10.2	6.3	3.6	2.6	1.6	1.2	0.6

TABLE 2. NORTH CENTRAL HARDWOOD FORESTS (Continued)

1970-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	106	278	64	530	350	310	290	250	170	97
pH	56	8.2	0.3	8.7	8.6	8.4	8.2	8.0	7.5	7.3
TSS	107	19	33	330	45	18	10	7.6	4	3
T Ammonia	107	0.16	0.09	0.59	0.23	0.20	0.20	0.08	0.04	0.02
NO2 + NO3	59	0.08	0.06	0.33	0.18	0.12	0.06	0.03	0.01	0.01
T Phosphorus	107	0.13	0.09	0.43	0.30	0.17	0.10	0.07	0.05	0.01
Fecal Coliform	105	1,579	4,417	27,000	10,000	700	230	80	20	4
Temperature(C)	61	22	4	28	27	24	22	20	14	11
Turbidity	54	8.2	5.1	27	18	10	6.6	4.9	2.3	2.1
BOD5	101	2.7	1.6	10.2	6.3	3.3	2.2	1.6	1.1	0.6

1986-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	58	301	82.8	840	360	320	295	260	240	210
pH	58	8.2	0.28	8.9	8.7	8.4	8.1	8.0	7.8	7.6
TSS	58	9.1	6	29	20	13	7.7	4	2.2	1.4
T Ammonia	57	0.09	0.06	0.28	0.2	0.12	0.08	0.05	0.02	0.02
NO2 + NO3	56	0.16	0.16	0.65	0.48	0.24	0.08	0.04	0.01	0.01
T Phosphorus	57	0.08	0.06	0.43	0.13	0.09	0.07	0.05	0.02	0.01
Fecal Coliform	55	2,183	5,366	27,000	5,000	630	140	44	8	4
Temperature(C)	57	14.2	9.9	28	26.5	23.5	15	5	0	0
Turbidity										
BOD5	46	1.8	0.7	3.3	3.1	2.2	1.7	1.3	0.8	0.6

1986-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	25	288	25.8	340	320	310	290	270	250	240
pH	25	8.3	0.24	8.7	8.7	8.5	8.3	8.1	8.0	7.8
TSS	25	10.6	5.3	25.0	20.0	14.0	9.3	7.2	3.8	3.6
T Ammonia	25	0.08	0.04	0.16	0.16	0.09	0.08	0.05	0.02	0.02
NO2 + NO3	25	0.06	0.04	0.16	0.15	0.08	0.06	0.03	0.01	0.01
T Phosphorus	25	0.09	0.08	0.43	0.13	0.09	0.07	0.05	0.04	0.01
Fecal Coliform	24	3,670	7,280	27,000	21,000	1,650	395	42	8	4
Temperature(C)	24	23	3.9	28	27.5	25.5	24	21.5	16	11
Turbidity										
BOD5	20	1.9	0.6	3.2	2.9	2.3	1.8	1.5	1.1	1.1

TABLE 3. NORTHERN GLACIATED PLAINS

1970-1985 Annual

Parameter				MAX			MEDIAN			MIN
	N	**Mean**	**SD**	**100%**	**95%**	**75%**	**50%**	**25%**	**5%**	**0%**
Conductivity	262	885.6	257.4	1,630	1,300	1,100	860	710	460	200
pH	265	8.0	0.27	8.7	8.4	8.2	8.0	7.8	7.5	7.2
TSS	265	50.8	61.1	480	140	65	37	10	3	0.5
T Ammonia	265	0.29	0.25	2.3	0.66	0.3	0.2	0.2	0.1	0.04
NO2 + NO3	122	0.51	0.87	4.3	3.0	0.52	0.18	0.02	0.01	0.01
T Phosphorus	265	0.22	0.19	1.4	0.55	0.27	0.18	0.10	0.04	0.003
Fecal Coliform	234	5,017	39,170	49,000	7,900	700	130	20	20	20
Temperature(C)	265	11.7	9.6	31	25.6	20.5	12	0.56	0	0
Turbidity	172	19.8	23.2	170	52	23.5	15	5.6	2.7	0.3
BOD5	261	3.7	2.4	25	7.4	4.5	3.2	2.4	1.2	0.5

1970-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	**Mean**	**SD**	**100%**	**95%**	**75%**	**50%**	**25%**	**5%**	**0%**
Conductivity	343	908	264.5	2,000	1,400	1,100	880	750	510	120
pH	181	8.1	0.24	8.6	8.4	8.3	8.2	8.0	7.8	7.3
TSS	346	48.1	57.9	480	130	63	34	11	3	0.5
T Ammonia	346	0.26	0.25	2.3	0.66	0.28	0.20	14	0.04	0.02
NO2 + NO3	203	0.55	1	5.7	3	0.51	0.14	0.01	0.01	0.01
T Phosphorus	346	0.2	0.18	1.4	0.53	0.25	0.16	0.09	0.03	0.003
Fecal Coliform	332	3,634	32,938	490,000	4,800	410	100	20	4	4
Temperature(C)	217	13.5	9.7	31	27.5	22	14.5	2.5	0	0
Turbidity	172	19.8	23.2	170	52	23.5	15	5.6	2.7	0.3
BOD5	334	3.7	2.5	25	7.6	4.5	3.2	2.3	1.2	0.5

1970-1985 Summer

Parameter				MAX			MEDIAN			MIN
	N	**Mean**	**SD**	**100%**	**95%**	**75%**	**50%**	**25%**	**5%**	**0%**
Conductivity	104	843.1	225.7	1,400	1,230	965	830	710	440	210
pH	104	8.1	0.24	8.7	8.4	8.3	8.1	8.0	7.7	7.5
TSS	104	79.5	68.6	480	190	98	63	42	14	5
T Ammonia	104	0.2	0.08	0.65	0.27	0.2	0.2	0.17	0.1	0.04
NO2 + NO3	51	0.4	0.8	4.3	1.7	0.52	0.12	0.01	0.01	0.01
T Phosphorus	104	0.26	0.16	1.2	0.53	0.32	0.24	0.18	0.09	0.05
Fecal Coliform	92	2,598	11,767	110,000	13,000	1,025	330	120	40	20
Temperature(C)	104	21	4.4	31	27.5	24.2	21.1	18.9	12.2	10
Turbidity	65	31.8	25.4	160	77	37	23	20	9.1	4.8
BOD5	102	4.3	1.8	11	7.6	5.6	4.1	2.7	2	1.5

TABLE 3. NORTHERN GLACIATED PLAINS (Continued)

1970-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	137	869	220	1,600	1,300	990	840	760	510	210
pH	78	8.2	0.17	8.5	8.5	8.3	8.2	8.1	7.8	7.7
TSS	137	71.4	62.8	480	180	89	55	37	12	5
T Ammonia	137	0.19	0.12	1.03	0.29	0.2	0.2	0.13	0.05	0.02
NO2 + NO3	84	0.42	0.89	4.5	2.5	0.43	0.07	0.01	0.01	0.01
T Phosphorus	137	0.25	0.15	1.2	0.51	0.29	0.22	0.16	0.08	0.04
Fecal Coliform	135	1,996	9,771	110,000	7,900	790	270	110	28	20
Temperature(C)	88	22.2	4.6	31	29	25	23	19.5	13	10.5
Turbidity	65	31.8	25.4	160	77	37	23	20	9.1	4.8
BOD5	132	4.3	2.2	18.0	8.1	5.6	3.8	2.6	2	1.5

1986-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	88	967	268.5	2,000	1,500	1,100	880	810	720	120
pH	88	8.2	0.23	8.6	8.5	8.3	8.2	8.1	7.8	7.3
TSS	88	38.5	43.9	340	100	47	29	12	3.4	0.5
T Ammonia	88	0.17	0.22	1.1	0.62	0.19	0.09	0.06	0.02	0.02
NO2 + NO3	88	0.6	1.1	5.7	3	0.46	0.17	0.01	0.01	0.01
T Phosphorus	88	0.2	0.1	0.6	0.31	0.2	0.13	0.08	0.03	0.01
Fecal Coliform	85	262	798	5,400	860	150	36	12	4	4
Temperature(C)	88	14.4	9.8	31	28	23.3	14.5	5.3	0	0
Turbidity										
BOD5	76	3.6	2.7	18.0	8.1	4.3	2.8	2.3	0.9	0.5

1986-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	36	938	177	1,600	1,300	1,000	870	820	760	750
pH	36	8.2	0.2	8.5	8.5	8.3	8.2	8.1	7.9	7.8
TSS	36	47.1	26.7	140	100	56.5	39	29.5	12	12
T Ammonia	36	0.15	0.20	1.03	0.76	0.16	0.08	0.07	0.02	0.02
NO2 + NO3	36	0.5	0.98	4.5	2.9	0.42	0.02	0.01	0.01	0.01
T Phosphorus	36	0.2	0.09	0.46	0.45	0.23	0.19	0.13	0.06	0.04
Fecal Coliform	35	573	1,176	5,400	4.20	360	180	99	28	27
Temperature(C)	36	23.2	4.6	31	30	26.5	2.4	20	13	12
Turbidity										
BOD5	31	4.3	3.2	18.0	9.0	5.1	3.0	2.4	1.9	1.7

TABLE 4. NORTHERN LAKES AND FORESTS

1970-1985 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	334	202	262	4,600	330	270	220	94	37	27
pH	348	7.56	0.41	8.4	8.1	7.9	7.6	7.3	6.8	6.3
TSS	322	5.2	5.6	41	16	6.4	3.6	2	0.5	0.4
T Ammonia	320	0.17	0.16	2.4	0.3	0.2	0.2	0.09	0.04	0.02
NO2 + NO3	201	0.08	0.11	0.67	0.32	0.09	0.03	0.01	0.01	0.01
T Phosphorus	335	0.05	0.05	0.64	0.10	0.05	0.04	0.02	0.01	0.005
Fecal Coliform	300	46	157	2,400	110	20	20	20	2	2
Temperature(C)	326	9.5	8.5	26	23.3	17.5	8.3	0	0	0
Turbidity	148	4.03	4.76	29	13	4.3	2.5	1.7	1	0.1
BOD5	319	1.4	0.8	5.0	2.8	1.7	1.2	0.8	0.5	0.5

1970-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	396	197	244	4,600	330	270	210	84.5	37	27
pH	247	7.6	0.4	8.4	8.1	7.9	7.7	7.4	7.1	6.3
TSS	384	4.9	5.3	41	15	6	3.3	1.8	0.5	0.4
T Ammonia	382	0.15	0.15	2.4	0.26	0.2	0.14	0.07	0.02	0.02
NO2 + NO3	263	0.08	0.11	0.67	0.35	0.09	0.03	0.01	0.01	0.01
T Phosphorus	397	0.04	0.05	0.64	0.09	0.05	0.04	0.02	0.01	0.005
Fecal Coliform	372	40	142	2,400	110	20	20	11	2	2
Temperature(C)	323	9.5	8.4	26	23	17	8.9	0.5	0	0
Turbidity	148	4	4.8	29	13	4.3	2.5	1.7	1	0.1
BOD5	358	1.3	0.7	5.0	2.8	1.7	1.2	0.8	0.5	0.5

1970-1985 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	120	228	412	4,600	290	260	230	120	40	33
pH	120	7.7	0.35	8.4	8.2	7.9	7.7	7.5	7.05	6.7
TSS	120	4.9	4.5	32.0	14.0	5.8	4.0	2.0	0.8	0.5
T Ammonia	118	0.17	0.24	2.4	0.26	0.2	0.13	0.08	0.04	0.02
NO2 + NO3	76	0.03	0.04	0.31	0.09	0.04	0.01	0.01	0.01	0.01
T Phosphorus	120	0.05	0.05	0.48	0.12	0.06	0.04	0.03	0.02	0.02
Fecal Coliform	109	48	73	490	140	50	20	20	11	2
Temperature(C)	119	18.7	4.1	26	25	22	19.4	16	11.5	8.3
Turbidity	50	3.1	2.5	15	7.5	4.0	2.2	1.5	0.9	0.2
BOD5	119	1.4	0.7	4.3	2.8	1.8	1.2	0.9	0.5	0.5

TABLE 4. NORTHERN LAKES AND FORESTS (Continued)

1970-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	147	218	375	4,600	290	260	230	120	41	33
pH	100	7.7	0.3	8.3	8.1	7.9	7.7	7.5	7.0	6.7
TSS	147	4.6	4.2	32	13	5.6	3.6	2	0.8	0.5
T Ammonia	145	0.14	0.22	2.4	0.22	0.2	0.1	0.06	0.02	0.02
NO2 + NO3	103	0.03	0.04	0.31	0.09	0.03	0.1	0.1	0.1	0.1
T Phosphorus	147	0.05	0.05	0.48	0.11	0.05	0.04	0.03	0.01	0.01
Fecal Coliform	141	42	66	490	130	50	20	20	4	2
Temperature(C)	121	18.3	4.2	26.0	25.0	21.7	19.0	15.0	11.1	9.5
Turbidity	50	3.1	2.5	15	7.5	4	2.2	1.5	0.9	0.2
BOD5	138	1.3	0.7	4.3	2.8	1.6	1.2	0.85	0.5	0.5

1986-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	68	179	103	480	320	260	180	72.5	43	36
pH	68	7.7	526.4	8.3	8.2	8	7.8	7.5	7.3	6.9
TSS	68	3.0	2.2	9.8	7.2	4.0	2.0	1.5	0.8	0.5
T Ammonia	68	.05	.03	0.14	0.11	0.07	0.05	0.02	0.02	0.02
NO2 + NO3	68	0.07	0.12	0.57	0.38	0.07	0.02	0.01	0.01	0.01
T Phosphorus	68	0.03	0.05	0.43	0.06	0.04	0.03	0.01	0.01	0.01
Fecal Coliform	65	11	18	120	44	8	4	4	4	4
Temperature(C)	67	10	8.5	26	25	18	10	1	0	0
Turbidity										
BOD5	42	1	0.43	2.5	1.7	1.3	0.9	0.7	0.5	0.5

1986-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	29	180	106	480	270	260	160	84	43	40
pH	29	7.8	0.3	8.3	8.2	8	7.8	7.6	7.3	7.2
TSS	29	2.8	1.8	7.8	7.2	3.3	2	1.7	0.8	0.8
T Ammonia	29	0.04	0.03	0.12	0.11	0.05	0.04	0.02	0.02	0.02
NO2 + NO3	29	0.02	0.03	0.14	0.07	0.02	0.01	0.01	0.01	0.01
T Phosphorus	29	0.03	0.02	0.06	0.06	0.04	0.02	0.01	0.01	0.01
Fecal Coliform	28	17	26	129	64	18	4	4	4	4
Temperature(C)	28	17.9	5.1	26.0	26.0	22.3	18.5	13.5	10.0	9.5
Turbidity										
BOD5	20	1.0	0.44	2.5	2.0	1.2	0.9	0.8	0.6	0.5

TABLE 5. NORTHERN MINNESOTA WETLANDS

1970-1985 Annual

Parameter				MAX			MEDIAN		MIN	
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	201	191	84	440	340	250	170	120	93	78
pH	201	7.7	0.53	8.4	8.1	7.9	7.7	7.5	7.2	1.3
TSS	202	18.2	36	350	50	17	9.6	5	1.2	0.5
T Ammonia	201	0.2	0.1	0.96	0.26	0.2	0.2	0.2	0.08	0.03
NO2 + NO3	47	0.05	0.07	0.28	0.2	0.08	0.02	0.01	0.01	0.01
T Phosphorus	198	0.08	0.09	0.8	0.19	0.09	0.06	0.04	0.03	0.01
Fecal Coliform	180	87	292	3,500	270	50	20	20	20	20
Temperature(C)	197	9.4	8.9	28	23.9	17.2	7.8	0	0	0
Turbidity	152	9.4	13.7	150	21	10	6	4.1	2.9	1.6
BOD5	190	1.7	0.91	7.1	3.3	2.2	1.5	1.1	0.55	0.5

1970-1992 Annual

Parameter				MAX			MEDIAN		MIN	
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	249	193	85	40	370	250	170	120	94	78
pH	96	7.7	0.25	8.4	8.2	7.9	7.7	7.6	7.3	7.2
TSS	250	17.1	33.6	350	50	16	8.6	4.8	1.6	0.5
T Ammonia	249	0.17	0.1	0.96	0.26	0.2	0.2	0.1	0.04	0.02
NO2 + NO3	95	0.06	0.09	0.46	0.28	0.08	0.02	0.01	0.01	0.01
T Phosphorus	246	0.08	0.08	0.8	0.17	0.09	0.06	0.04	0.03	0.01
Fecal Coliform	237	70	256	3,500	230	40	20	20	4	4
Temperature(C)	111	10.7	9.5	29	26	20	9	0	0	0
Turbidity	152	9.4	13.7	150	21	10	6	4.1	2.9	1.6
BOD5	232	1.7	0.9	7.1	3.2	2.1	1.5	1.1	0.55	0.5

1970-1985 Summer

Parameter				MAX			MEDIAN		MIN	
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	74	179	60	340	280	230	170	130	100	92
pH	74	7.8	0.3	8.3	8.2	8	7.8	7.6	7.2	7
TSS	74	17.2	13	68	48	21	13	8	4	3.6
T Ammonia	73	0.18	0.04	0.26	0.2	0.2	0.2	0.2	0.08	0.06
NO2 + NO3	17	0.02	0.02	0.07	0.07	0.04	0.01	0.01	0.01	0.01
T Phosphorus	70	0.08	0.06	0.55	0.14	0.09	0.07	0.05	0.03	0.02
Fecal Coliform	68	140	438	3,500	490	95	20	20	20	20
Temperature(C)	72	19.2	4.8	28.0	26.7	22.4	20.6	16.1	11.0	7.8
Turbidity	55	9.3	6.5	36	20	12	7	4.8	3.4	3.1
BOD5	71	1.6	0.65	3.5	2.7	2	1.6	1.2	0.44	0.5

TABLE 5. NORTHERN MINNESOTA WETLANDS (Continued)

1970-1992 Summer

Parameter				MAX			MEDIAN		MIN	
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	95	191.2	74.2	480	340	230	180	140	100	92
pH	39	7.9	0.3	8.4	8.3	8.0	7.9	7.6	7.4	7.4
TSS	95	15.3	12.2	68	45	20	11	7	4	1.8
T Ammonia	94	0.16	0.06	0.26	0.2	0.2	0.2	0.1	0.05	0.02
NO2 + NO3	38	0.03	0.07	0.46	0.07	0.03	0.01	0.01	0.01	0.01
T Phosphorus	91	0.7	0.06	0.55	0.14	0.09	0.06	0.05	0.03	0.02
Fecal Coliform	89	113	386	3,500	330	76	20	20	4	4
Temperature(C)	39	20.8	5.2	29	28	23.5	22	19	10.5	10
Turbidity	55	9.3	6.5	36	20	12	7	4.8	3.4	3.1
BOD5	86	1.6	0.6	3.5	2.7	1.9	1.5	1.2	0.6	0.5

1986-1992 Annual

Parameter				MAX			MEDIAN		MIN	
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	66	198.4	87	480	370	250	175	130	100	95
pH	66	7.7	0.3	8.4	8.2	7.9	7.7	7.6	7.4	7.3
TSS	66	17.5	40.7	310	50	13	6.9	4.4	1.8	0.5
T Ammonia	66	0.08	0.05	0.32	0.16	0.1	0.06	0.04	0.02	0.02
NO2 + NO3	66	0.07	0.1	0.46	0.29	0.09	0.02	0.01	0.01	0.01
T Phosphorus	66	0.07	0.08	0.55	0.16	0.07	0.05	0.04	0.02	0.01
Fecal Coliform	54	17	28	180	60	16	8	4	4	4
Temperature(C)	63	11.9	9.7	29	27.5	20	10.5	0.5	0	0
Turbidity										
BOD5	51	1.5	0.7	4.6	2.2	1.8	1.4	1.1	0.5	0.5

1986-1992 Summer

Parameter				MAX			MEDIAN		MIN	
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	27	224	95	480	410	260	200	150	120	100
pH	27	7.9	0.27	8.4	8.3	8	7.9	7.6	7.4	7.4
TSS	27	10.7	8.1	37	26	13	8.1	6	3	1.8
T Ammonia	27	0.07	0.04	0.17	0.16	0.08	0.06	0.05	0.02	0.02
NO2 + NO3	27	0.03	0.09	0.46	0.04	0.02	0.01	0.01	0.01	0.01
T Phosphorus	27	0.07	0.1	0.55	0.10	0.07	0.05	0.04	0.02	0.02
Fecal Coliform	21	26	39	180	76	28	12	4	4	4
Temperature(C)	24	21	5.4	29.0	28.0	24.5	21.5	18.0	10.5	10.5
Turbidity										
BOD5	18	1.5	0.3	2.1	2.1	1.8	1.4	1.3	0.8	0.8

TABLE 6. RED RIVER VALLEY

1970-1985 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	256	584	216	1,400	1,100	655	520	445	350	230
pH	255	8.1	0.3	8.9	8.6	8.3	8.1	7.9	7.5	7.3
TSS	256	41.9	61.2	720	110	56	28	10	3.6	0.5
T Ammonia	255	0.45	0.91	8.3	2.1	0.29	0.2	0.15	0.08	0.02
NO2 + NO3	132	0.25	0.4	2.4	1.3	0.2	0.08	0.01	0.01	0.01
T Phosphorus	255	0.31	0.42	3.50	1.10	0.32	0.20	0.12	0.06	0.02
Fecal Coliform	223	870	3,842	33,000	2,400	230	70	20	20	20
Temperature(C)	256	10.8	9.2	29	25	19.8	10.3	0	0	0
Turbidity	139	18.5	21	170	48	23	12	6	3.3	1.5
BOD5	246	3.7	3.4	30	9.4	4.2	2.7	1.8	0.9	0.5

1979-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	322	575	201	1,400	1,100	640	520	440	360	230
pH	187	8.2	0.26	8.8	8.7	8.4	8.2	8	7.8	7.5
TSS	322	42.9	57.3	720	110	59	28	11	3.8	0.5
T Ammonia	321	0.4	0.8	8.3	1.5	0.25	0.2	0.12	0.05	0.02
NO2 + NO3	198	0.3	0.5	3.2	1.3	0.21	0.07	0.01	0.01	0.01
T Phosphorus	321	0.30	0.4	3.50	0.75	0.30	0.19	0.11	0.06	0.02
Fecal Coliform	304	667	3,307	33,000	1,300	220	50	20	4	4
Temperature(C)	215	12.1	9.6	30	26.5	21	12	0	0	0
Turbidity	139	18.5	21	170	48	23	12	6	3.3	1.5
BOD5	299	3.5	3.1	30	9.1	4.1	2.7	1.8	0.9	0.5

1970-1985 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	102	547	141	1,060	770	640	530	440	360	330
pH	101	8.1	0.35	8.9	8.7	8.3	8.2	7.9	7.4	7.3
TSS	102	59.1	74.3	720	120	74	49	26	6.8	2.8
T Ammonia	101	0.32	0.57	4.5	1	0.2	0.2	0.14	0.07	0.03
NO2 + NO3	52	0.12	0.3	2	0.41	0.13	0.03	0.01	0.01	0.01
T Phosphorus	101	0.36	0.49	3.50	0.98	0.36	0.25	0.17	0.09	0.02
Fecal Coliform	89	400	1,439	13,000	1,300	260	130	20	20	20
Temperature(C)	102	19.9	4.9	29	26.1	23	20.8	16.7	9.5	7.8
Turbidity	56	21.8	13.9	67.0	48.0	27.5	18.5	12.5	3.4	1.5
BOD5	99	4	3.2	21.0	11.0	4.7	3.0	2.0	1.4	0.7

TABLE 6. RED RIVER VALLEY (Continued)

1970-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	133	538	134	1,060	770	630	510	440	360	330
pH	80	8.3	0.27	8.8	8.75	8.4	8.3	8.1	7.8	7.7
TSS	133	58.2	66.6	720	120	74	50	28	10	2.8
T Ammonia	132	0.3	0.5	4.5	0.91	0.2	0.17	0.08	0.04	0.02
NO2 + NO3	83	0.1	0.25	2	0.28	0.1	0.02	0.01	0.01	0.01
T Phosphorus	132	0.30	0.4	3.50	0.74	0.33	0.22	0.14	0.08	0.02
Fecal Coliform	125	340	1,222	13,000	790	240	130	48	20	12
Temperature(C)	85	21.6	4.8	30	28	25	23	20	12	9
Turbidity	56	21.8	13.9	67	48	27.5	18.5	12.5	3.4	1.5
BOD5	122	3.8	2.9	21	9.4	4.5	2.8	2.0	1.4	0.7

1986-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	84	577	160.7	1,200	920	650	545	470	400	370
pH	84	8.2	0.3	8.8	8.7	8.5	8.3	8.0	7.7	7.5
TSS	84	44	38	170	120	64	33	15	6.2	2
T Ammonia	84	0.2	0.2	0.9	0.54	0.22	0.12	0.06	0.02	0.02
NO2 + NO3	84	0.29	0.55	3.2	1.4	0.28	0.07	0.01	0.01	0.01
T Phosphorus	84	0.17	0.12	0.59	0.42	0.22	0.14	0.09	0.05	0.02
Fecal Coliform	73	98.7	189	1,300	500	99	36	4	4	4
Temperature(C)	82	13.5	10	30	27	23	14.3	4	0	0
Turbidity										
BOD5	62	2.7	1.6	11.0	5.7	3.1	2.3	1.8	0.9	0.8

1986-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	37	540	118	720	720	660	510	440	380	370
pH	37	8.3	0.29	8.8	8.8	8.5	8.4	8.1	7.8	7.7
TSS	37	56.6	32.6	130	120	78	54	34	12	10
T Ammonia	37	0.08	0.04	0.18	0.17	0.1	0.08	0.06	0.02	0.02
NO2 + NO3	37	0.06	0.11	0.61	0.23	0.06	0.01	0.01	0.01	0.01
T Phosphorus	37	0.17	0.08	0.42	0.31	0.21	0.14	0.11	0.07	0.07
Fecal Coliform	32	182	242	1,300	600	210	95.5	66	36	12
Temperature(C)	35	22.5	5.2	30	28	26	24	20.5	10	10
Turbidity										
BOD5	26	2.9	1.3	6.2	5.7	3.1	2.6	2.2	1.6	1.4

TABLE 7. WESTERN CORN BELT PLAINS

1970-1985 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	327	695	279	2,700	1,100	820	670	530	320	130
pH	329	8	0.31	8.8	8.4	8.2	8	7.7	7.4	7.1
TSS	330	47	64	720	130	62	28	10	2.9	0.5
T Ammonia	330	0.4	0.4	3	1.3	0.42	0.2	0.2	0.08	0.03
NO2 + NO3	114	4.2	3.4	12	9.6	6.9	3.8	1.1	0.01	0.01
T Phosphorus	330	0.29	0.23	3.49	0.57	0.34	0.25	0.18	0.11	0.04
Fecal Coliform	293	1,637	7,180	110,000	5,400	1,100	270	80	20	5
Temperature(C)	325	11.1	9	30	25	18.9	12.2	0.5	0	0
Turbidity	241	16.8	22.6	290	41	22	12	5.2	2.6	0.4
BOD5	326	4.7	3.8	34	12	5.9	3.9	2.4	1.1	0.5

1970-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	427	698	271	2,700	1,110	820	660	530	340	130
pH	195	8.1	0.24	8.8	8.5	8.2	8.1	8	7.7	7.4
TSS	430	45.3	60.8	720	130	61	27	10	3	0.5
T Ammonia	430	0.4	0.4	3.9	1.3	0.4	0.2	0.15	0.04	0.02
NO2 + NO3	214	4.8	4.1	20	12	7.4	3.9	1.4	0.01	0.01
T Phosphorus	430	0.28	0.22	3.49	0.56	0.33	0.24	0.16	0.09	0.01
Fecal Coliform	416	1,381	6,179	110,000	5,400	790	230	70	20	4
Temperature(C)	232	12.8	9.2	33	26	20	14.5	3.5	0	0
Turbidity	241	16.8	22.6	290	41	22	12	5.2	2.6	0.4
BOD5	418	4.3	3.5	34.0	11.0	5.5	3.6	2.0	1.0	0.5

1970-1985 Summary

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	125	647	196	1,100	920	800	660	530	230	130
pH	127	8	0.3	8.8	8.5	8.3	8	7.8	74	7.1
TSS	127	73.2	84.2	720	200	88	53	28	13	0.5
T Ammonia	127	0.21	0.13	1.1	0.44	0.2	0.2	0.2	0.08	0.06
NO2 + NO3	50	3.6	3.3	11	9.6	5.8	2.6	0.4	0.01	0.01
T Phosphorus	127	0.30	0.30	3.50	0.57	0.36	0.28	0.22	0.14	0.09
Fecal Coliform	111	2,868	11,366	110,000	13,000	1,300	460	130	40	20
Temperature(C)	126	20	4.3	30	26	22.8	20	17.2	12.2	8.3
Turbidity	88	25.3	32.7	290	54	27	19	13.5	6.3	2.5
BOD5	125	5.5	4.0	33.0	12.0	7.0	4.8	2.8	1.5	0.5

TABLE 7. WESTERN CORN BELT PLAINS (Continued)

1970-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	166	655	192	1,100	940	810	645	530	320	130
pH	86	8.1	0.23	8.6	8.5	8.3	8.15	8.0	7.8	7.4
TSS	168	68.2	79.2	720	200	75.5	47	26	12	0.5
T Ammonia	168	0.2	0.13	1.1	0.43	0.2	0.2	0.11	0.05	0.02
NO2 + NO3	91	4.2	4.24	18	12	6.5	2.6	0.89	0.01	0.01
T Phosphorus	168	0.30	0.29	3.50	0.56	0.35	0.27	0.21	0.11	0.07
Fecal Coliform	166	2,343	9,497	110,000	9,200	1,200	335	130	40	20
Temperature(C)	96	21.2	4.2	33	28	24	21.3	18	14	12
Turbidity	88	25.3	32.7	290	54.0	27.0	19.0	13.5	6.3	2.5
BOD5	163	5.0	3.8	33	12.0	6.6	4.3	2.2	1.2	0.5

1986-1992 Annual

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	107	697	237	1,700	1,200	830	600	550	400	280
pH	107	8.1	0.2	8.8	8.5	8.3	8.1	8	7.8	7.6
TSS	107	37.9	46.6	310	120	45	20	9.4	3.6	2.2
T Ammonia	107	0.28	0.49	3.9	1.07	0.27	0.11	0.05	0.03	0.02
NO2 + NO3	107	5.5	4.7	20	14	8.9	4	1.6	0.01	0.01
T Phosphorus	107	0.23	0.15	0.96	0.50	0.29	0.20	0.13	0.09	0.01
Fecal Coliform	104	822	2,618	22,000	4,800	380	125	50	4	4
Temperature(C)	107	13.4	8.8	33	26	21	15	5	0	0
Turbidity										
BOD5	95	2.8	1.9	8.1	7.0	3.8	2.0	1.4	0.9	0.6

1986-1992 Summer

Parameter				MAX			MEDIAN			MIN
	N	Mean	SD	100%	95%	75%	50%	25%	5%	0%
Conductivity	44	666	178	1,000	990	820	580	545	440	360
pH	44	8.2	0.23	8.6	8.6	8.3	8.2	8	7.8	7.8
TSS	44	50.9	57.6	310	150	58	36	18	8.4	8.2
T Ammonia	44	0.12	0.1	0.55	0.32	0.15	0.1	0.06	0.03	0.02
NO2 + NO3	44	5	5	18	16	8.3	3.0	1.5	0.01	0.01
T Phosphorus	44	0.25	0.13	0.72	0.44	0.31	0.24	0.15	0.1	0.07
Fecal Coliform	43	1,443	3,631	22,000	5,200	1,100	310	220	72	60
Temperature(C)	44	21.5	3.8	33.0	28.0	24.0	21.3	19.0	16.0	14.0
Turbidity										
BOD5	39	3	2.0	8.1	8.1	4.3	2.2	1.6	0.8	0.8