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flows in the particular subwatershed reach, development alternatives, and the two rainfall events. Information presented in these summaries include peak discharge in and out of the subwatershed, the peak elevation of a reservoir at the end of the subwatershed district, subwatershed time to peak, and storage used within the modeling process. The summary also provides information on the description of the outlet structure at the end of the subwatershed, a summary of available hydrologic information, and a description of stormwater storage areas within the subwatershed.

D. WATER QUALITY

The Rice Creek Watershed District has had a water quality monitoring program for approximately a decade. During that time, they have monitored 13 water quality stations and have monitored 16 lakes (Map 4).

Of the 13 stream water quality monitoring stations, there are nine on Rice Creek and two each on Clearwater and Hardwood Creeks (Table 5). Table 5 also indicates that the water quality parameters monitored at the stream stations, flow, dissolved oxygen, and temperature, are monitored 12 times a year. the remaining parameters are monitored six times per year. Results of these surveys are presented on a sub-basin basis in the following section of the report.

The Watershed District also monitors 16 lakes through its standard monitoring program and through the Clean Lakes Monitoring Program. Table 6 shows the lakes and parameters monitored. These lakes are sampled twic a year, once in June and once in September. The results are presented in a separate section on a subwatershed basis.

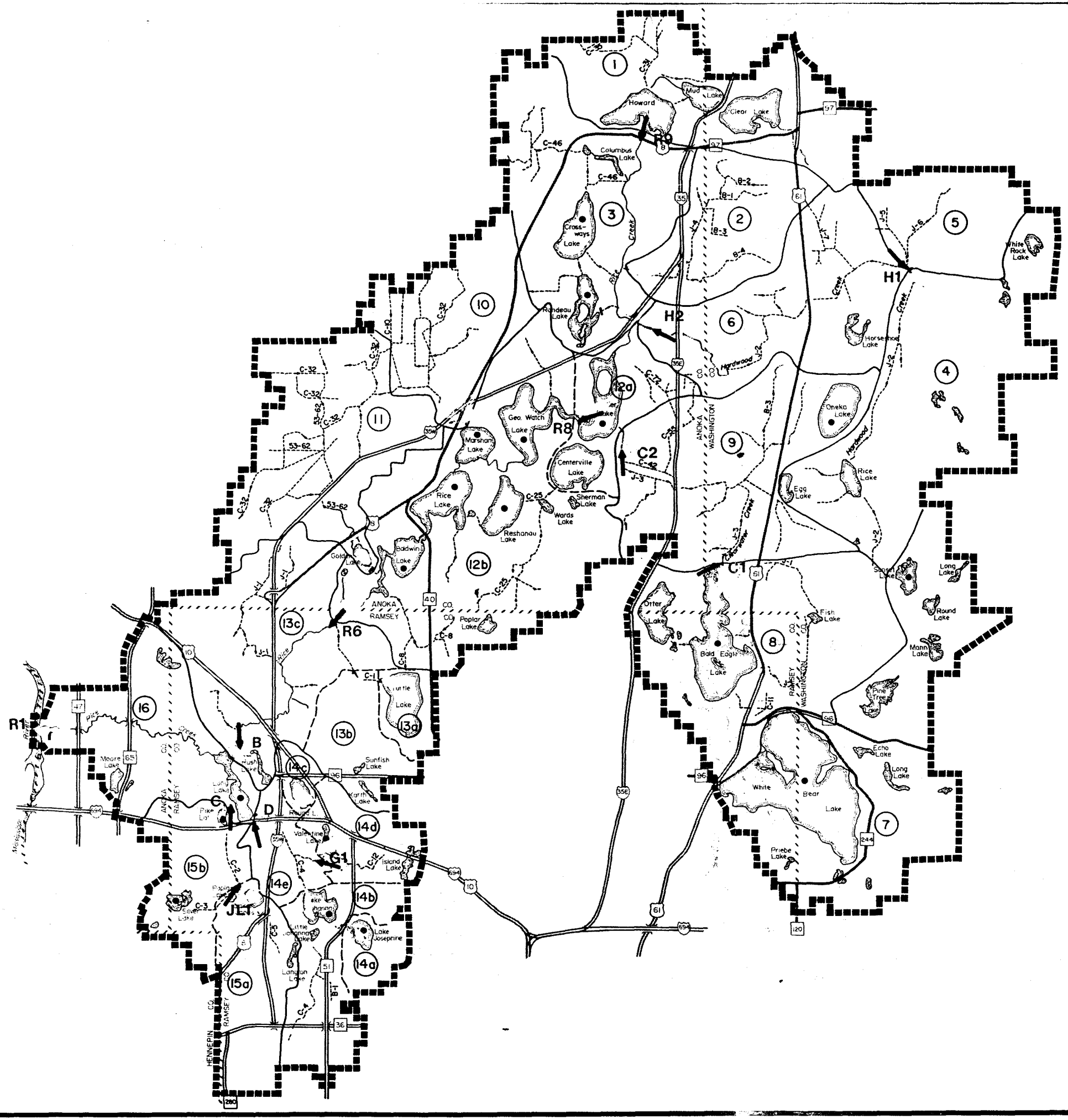
WATER RESOURCE MANAGEMENT PLAN

RICE CREEK WATERSHED DISTRICT

WATER QUALITY MONITORING STATIONS

R1 Stream Station

• Lake Station



1 0 2

1/2 1

Scale in Miles

NORTH

E. A. HICKOK AND ASSOCIATES

WAYZATA, MINNESOTA

TABLE 5

STREAM MONITORING PROGRAM

Stream Stations

Rice Creek Outlet
Rice Creek at Minnesota 65
Rice Creek at County Road I
Rice Creek at Lexington Avenue
Rice Creek at Rice Lake Outlet
Rice Creek at Peltier Lake Outlet
Rice Creek at Rondeau Lake Outlet
Rice Creek at Howard Lake Otlet
Rice Creek at Anoka CD53-62 (Golden Lake)
Clearwater Creek at Bald Eagle Lake Outlet
Clearwater Creek at County Road 14
Hardwood Creek at Harrow Avenue
Hardwood Creek at County Road 21

Parameters

Flow, cfs
Dissolved Oxygen, mg/l
Temperature, °C
pH
Conductivity, umhos/cm
Chloride, mg/l
Total Suspended Solids, mg/l
Nitrate-Nitrogen, mg/l
Ammonia Nitrogen, mg/l
Total Kjeldahl Nitrogen, mg/l
Ortho-Phosphorus, mg/l
Total Phosphorus, mg/l

TABLE 6

LAKE MONITORING PROGRAM

Name of Lake
Baldwin
Rice
Reshanau
Marshan
George Watch
Rondeau
Tamarac
Silver
Sunset
Oneka
White Bear Lake
Long Lake
Valentine
Johanna
Josephine
Pike

Parameters
Depth at Sample Site, m
Secchi Disc, cm
Dissolved Oxygen and Temperature Profile
pH
Conductivity, umhos/cm
Chlorophyll, ug/l
Chloride, mg/l
Ortho-Phosphorus, mg/l
Total Phosphorus, mg/l
Nitrate-Nitrogen, mmg/l
Ammonia-Nitrogen, mg/l

The water quality data from the lake monitoring program was used in order to determine the trophic index of each lake. The Carlson Trophic State Index was used to determine the trophic status of the lake in the District. The following is the formula:

$$TSI\ (TP) = 4.14 + 14.43\ LN\ (TP)$$

In general, Trophic State Index values from 0 to 40 indicate the lake is nutrient poor or oligotrophic, and this indicates that the quality of water is extremely good. Trophic State Index values from 40 to 50 indicate that moderae nutrient concentrations are available in the lake and that water quality is becoming degraded, however, at a moderate rate. Index values from 50 to 100 indicate that the lake has an excess amount of nutrients and that water quality is generally poor. It should also be noted that generally speaking, a change of 10 Trophic State Index units is needed in order to observe a change in the Trophic State of a given lake.

E. SUBWATERSHED SUMMARY

The following section is a subwatershed summary of available water quantity and quality information for the Rice Creek Watershed District. The computer model TR-20 was used to determine water quantities within the District's drainage system. The model has the capabilities to describe flows within the Rice Creek hydrologic system for several hypothetical cases, including undeveloped conditions, existing development conditions, and projected conditions in the year 2000. A summary of the modeling results for each subwatershed follows. Table 7 defines the terms used in the hydrologic modeling. The water quality monitoring information from the Rice Creek Watershed District is also summarized by subwatershed. The summary includes

TABLE 7

HYDROLOGIC DEFINITIONS

Time of Concentration: Time it takes for all parts of the subwatershed to contribute drainage to the subwatershed's outlet.

$Qpeak_{in}$ (cfs): The peak runoff rate from the subwatershed to its outlet or reservoir assuming no stormwater storage areas were present in the subwatershed.

$Qpeak_{out}$ (cfs): The peak stormwater runoff discharge rate leaving the subwatershed -- usually after it has been routed through the subwatershed's reservoir. If no storage is assumed, the $Qpeak_{in} = Qpeak_{out}$.

Peak Elevation in Reservoir (ft): This is the peak elevation anticipated in the reservoir for either a 1-year or 100-year, 24-hour duration rainfall event.

This elevation should not be taken to be a 100-year flood elevation for insurance purposes.

Peak Time (hrs): Time it takes from the beginning of the 24-hour duration storm for the reservoir to reach its peak elevation.

Storage Used (acre-feet): Amount of water stored in the reservoir when it reaches its peak elevation.

100-Year Return Frequency Rainfall Event: A rainfall event that has a one percent of occurrence any given year. For this area, 5.9 inches of rain in 24 hours has been establised as a 100-year return frequency rainfall event.

1-Year Return Frequency Rainfall Event: A rainfall event that has chance of occurring once in any given year. for this area, 2.3 inches of rainfall in 24 hours is a 1-year return frequency rainfall event.

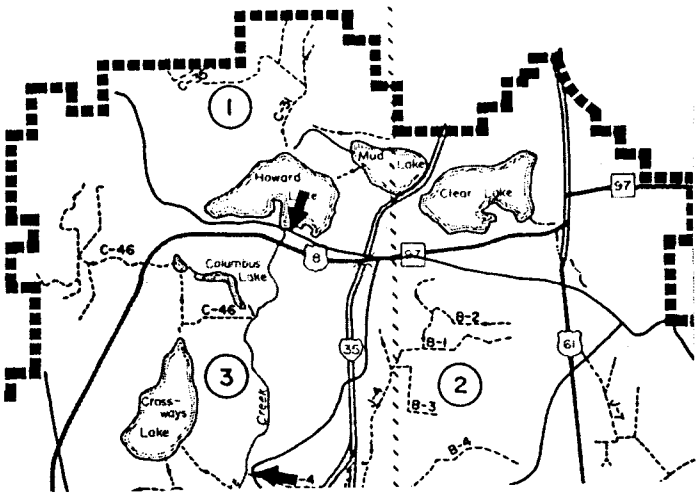
Type II Distribution: This is the rainfall distribution that is typically expected to occur east of the Cascade and Sierra-Nevada Mountains.

information for lakes and streams. Total phosphorus loadings and transparencies are shown graphically for each lake in the monitoring system. For each stream monitoring station, the phosphorus loading and total suspended solids loadings are shown graphically. The following is a summary of quantity and quality information by subwatershed within the Rice Creek Watershed District.

Subwatershed No. 1, Howard Lake, is approximately 10.75 square miles. Lakes within this subwatershed district include Howard, Mud, and Clear Lakes. The water quantity modeling effort indicates there will be little increase in peak discharge as a result of the projected development. It appears that storage in Howard, Mud, and Clear Lakes are able to accommodate development adequately. There are no water quality monitoring stations in any of the three lakes within this subwatershed district. Station R9 is at the outlet of Howard Lake and can provide an indication of the water quality of that lake. From the Trophic State Index, that water quality is generally poor, with a slight improvement within the last six years. However, the total suspended solids at this station have increased slightly.

WATERSHED NO: 1
WATERSHED NAME: Howard Lake

AREA OF
SUBWATERSHED (sq mi): 10.75



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 10.75

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	285.	575	684
Q $Peak_{out}$ (cfs)	3	6	6
Peak Elevation in Reservoir (ft)	886.37	886.59	886.60
Peak Time (hrs)	35.0	34.0	33.0
Storage Used (ac-ft)	202.1	341.1	347.4
100-YEAR:			
Q $Peak_{in}$ (cfs)	2551.	3540	3976
Q $Peak_{out}$ (cfs)	18	24	25
Peak Elevation in Reservoir (ft)	887.89	888.21	888.26
Peak Time (hrs)	33.5	32.3	31.4
Storage Used	1490.0	1852.0	1912.0

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 2.2

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 172.3

Description of Outlet Structure:

Six-foot wide box culvert under Lake Drive N.E., approximately one mile west of I-35. Invert elevation 886.05.

Hydrologic Information Available for Subwatershed:

"Flood Insurance Study for Unincorporated Areas of Anoka County," dated January 1980.

"Flood Insurance Study for the City of Forest Lake," dated February 1979.

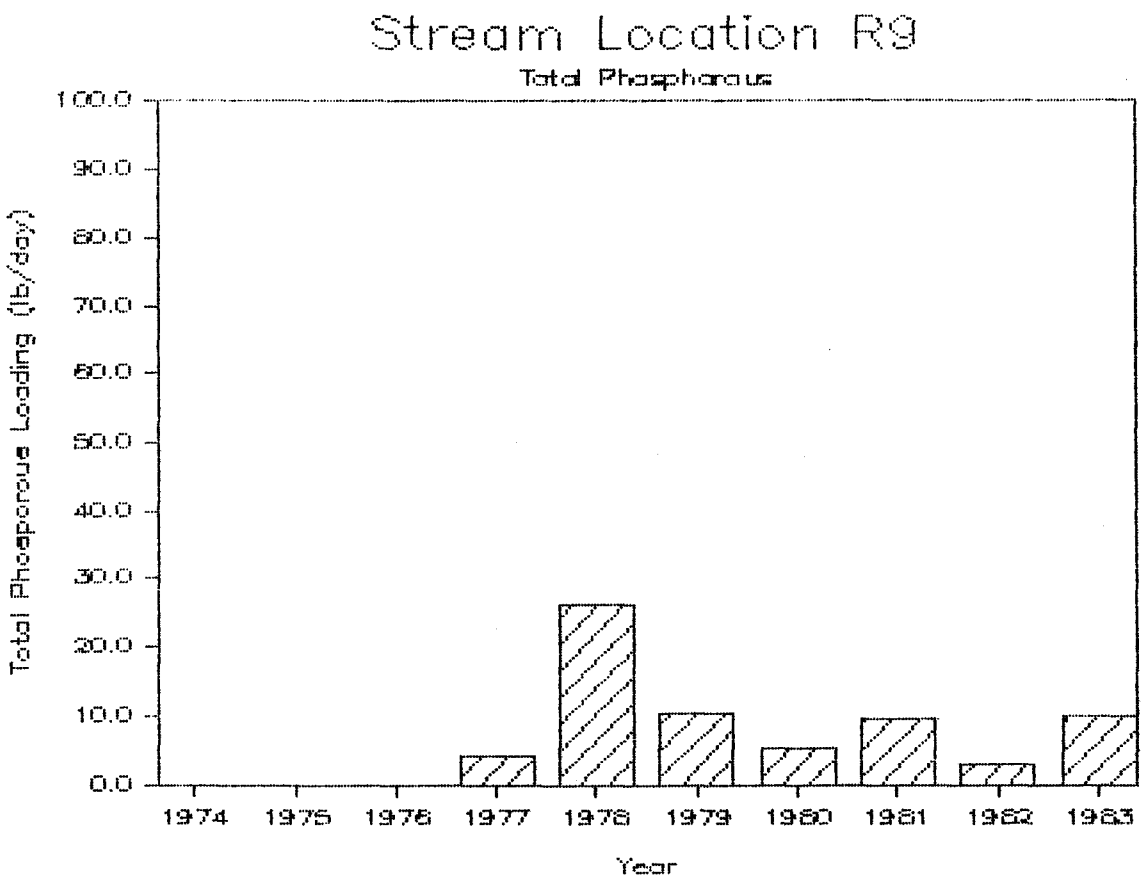
Description of Stormwater Storage Areas Modeled within Watershed:

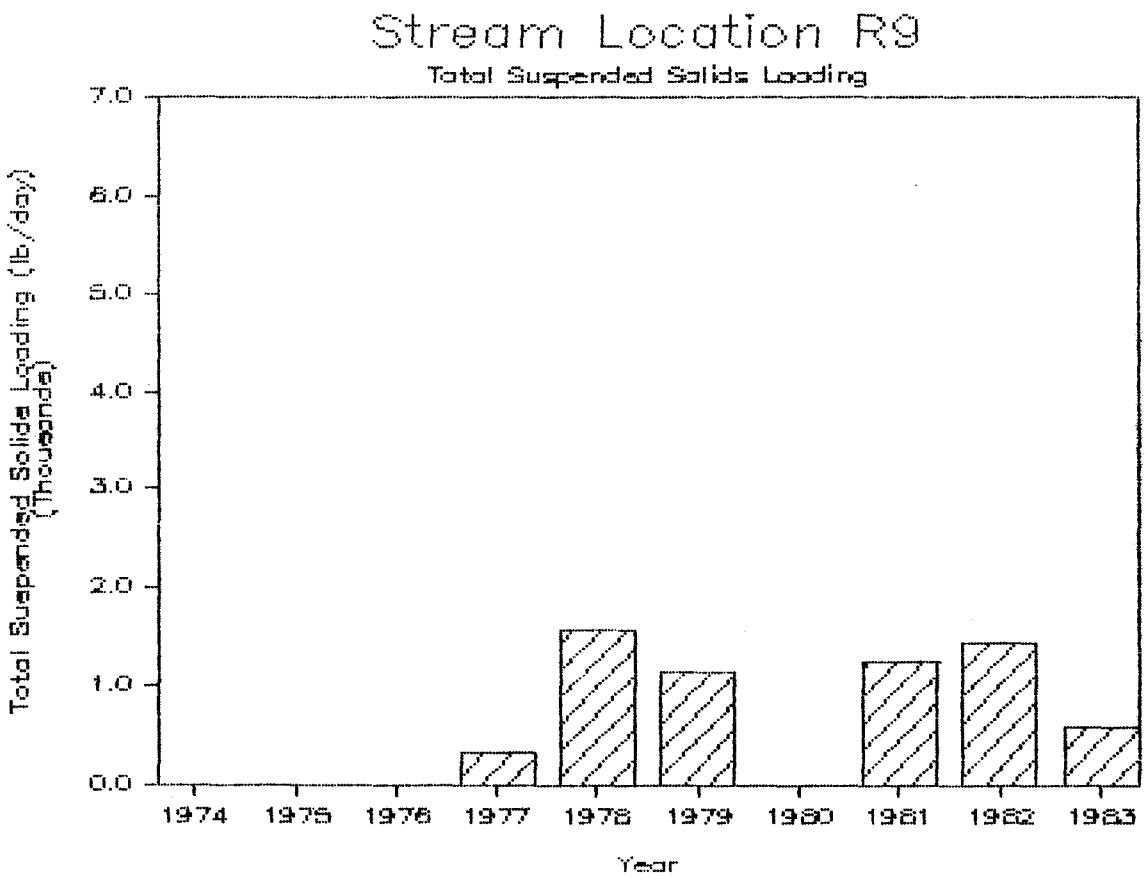
Clear Lake, Howard Lake, and Mud Lake along with adjacent wetland areas.

WATER QUALITY DATA

STREAM LOCATION R9

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	29	29
	Maximum	--	24.9	19.0
	Minimum	--	1.0	1.0
	Mean	--	8.8	6.7
Dissolved Oxygen (mg/l)	Number	0	11	29
	Maximum	--	14.7	18.6
	Minimum	--	5.7	2.1
	Mean	--	11.3	9.8
Water Temperature (°C)	Number	0	12	29
	Maximum	--	27.0	27.0
	Minimum	--	2.0	3.0
	Mean	--	17.7	16.3
Total Kjeldahl Nitrogen (lb/D)	Number	0	7	15
	Maximum	--	498.7	294.5
	Minimum	--	66.5	16.7
	Mean	--	219.4	130.6
Ortho-Phosphorus (lb/D)	Number	0	18	15
	Maximum	--	6.5	9.5
	Minimum	--	0.1	0.7
	Mean	--	2.1	3.6
Total Phosphorus (lb/D)	Number	0	18	15
	Maximum	--	47.7	18.2
	Minimum	--	2.0	0.8
	Mean	--	12.2	8.0
pH	Number	12	19	15
	Maximum	8.9	10.5	8.6
	Minimum	6.9	7.9	7.2
	Mean	8.1	8.8	8.1
Turbidity Turbidity Meter Hach (FTU)	Number	9	0	0
	Maximum	70.0	--	--
	Minimum	3.0	--	--
	Mean	23.9	--	--
Total Non-Filterable Residue (lb/D)	Number	0	17	14
	Maximum	--	4470.4	4466.0
	Minimum	--	21.0	167.2
	Mean	--	979.5	1063.1
Total Chloride (lb/D)	Number	0	6	15
	Maximum	--	1513.0	2038.9
	Minimum	--	782.1	384.6
	Mean	--	1062.6	959.4

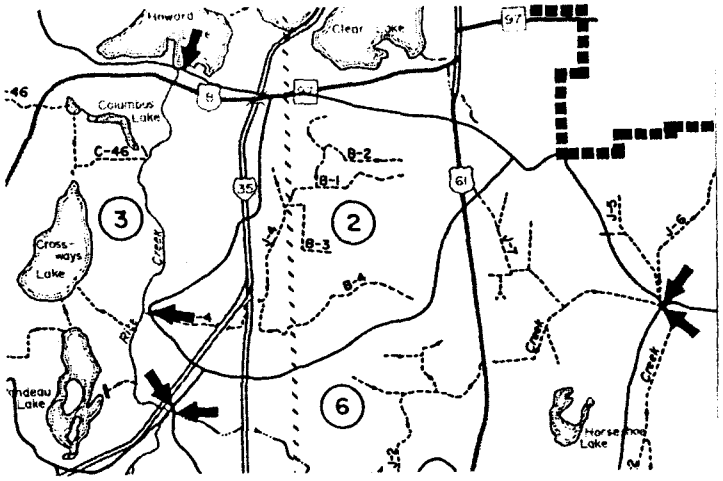

Stream Location R9
Total Phosphorous
Total Phosporous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location R9
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No 2, I-35W, is approximately 6.28 square miles. There are no lakes within this subwatershed. From the water quantity modeling effort, storage occurs in this subwatershed primarily due to the flat topography and poor drainage system. If this drainage system is improved, storage will be diminished. There are no lake or stream water quality monitoring stations within this subwatershed.

WATERSHED NO: 2
WATERSHED NAME: I-35W

AREA OF SUBWATERSHED (sq mi): 6.28



TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 6.28

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	82	161	164
Q $Peak_{out}$ (cfs)	41	64	65
Peak Elevation in Reservoir (ft)	---- No Peak Elevation Established ---		
Peak Time (hrs)	45.7	42.8	42.4
Storage Used (ac-ft)	82.0	161.0	162.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	493	1712	727
Q $Peak_{out}$ (cfs)	124	148	149
Peak Elevation in Reservoir (ft)	---- No Peak Elevation Established ---		
Peak Time (hrs)	52.1	48.2	47.6
Storage Used	660.0	910.3	915.3

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 23.6

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 144.9

Description of Outlet Structure:

Six-foot round RCP with invert elevation 886.1. Culvert crosses I-35W immediately south of junction with I-35E in Columbus Township.

Hydrologic Information Available for Subwatershed:

"Flood Insurance Study for the City of Hugo," dated December 1982.

Description of Stormwater Storage Areas Modeled within Watershed:

Wetland areas on east side of I-35W in

N1/2 of Sec 1, T131N, R22W
E1/2 of Sec 36, T32N, R22W
E1/2 of Sec 25, T32N, R22W

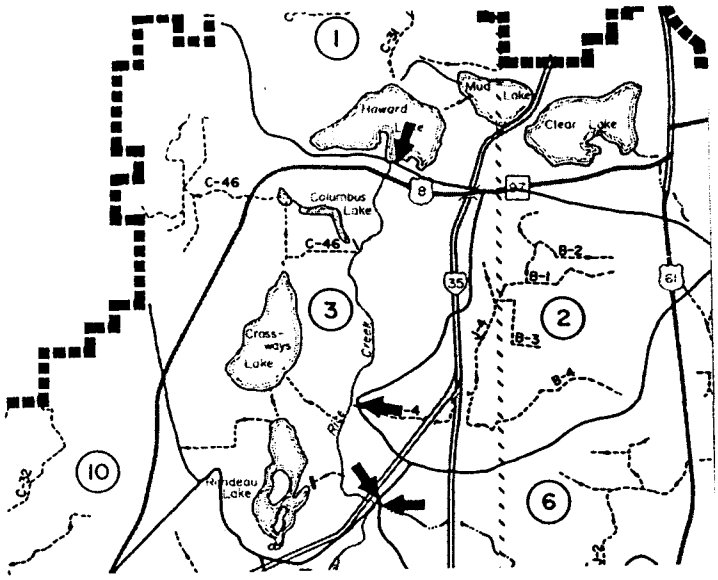
Note: Stormwater storage areas were delineated using approximate methods.

Subwatershed No. 3, Rondeau Lake, is approximately 12.76 square miles. Lakes within this subwatershed district include Columbus, Crossways (Tamarac), and Rondeau. The water quality modeling effort indicates that this subwatershed provides a significant amount of storage that is created by the Peltier Lake and Dam. There are two water quality monitoring stations within this subwatershed, one at Crossways Lake and one at Rondeau Lake. Water quality of Crossways Lake is generally poor, but fairly significant improvements have been observed within the last three years, especially chlorophyll-a. The data from Rondeau Lake indicates moderate nutrient concentrations. Compared to most other lakes within the Watershed District, the water quality is quite good. The lake is not directly affected by flow in Rice Creek due to a road around the perimeter preventing a flow-through situation; however, it appears that during high water, this lake's water quality may be compromised.

WATERSHED NO: 3
WATERSHED NAME: Rondeau Lake

AREA OF SUBWATERSHED (sq mi): 12.76

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 29.79



	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)		Stormwater storage areas in Watershed No. 3 are influenced by storage areas in Watershed No. 12a. See Watershed No. 12a for more information.	
Q $Peak_{out}$ (cfs)			
Peak Elevation in Reservoir (ft)			
Peak Time (hrs)			
Storage Used (ac-ft)			
100-YEAR:			
Q $Peak_{in}$ (cfs)	1090	1151	1339
Q $Peak_{out}$ (cfs)			
Peak Elevation in Reservoir (ft)			
Peak Time (hrs)			
Storage Used (ac-ft)			

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): See Watershed No. 12a

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): See Watershed No. 12a

Description of Outlet Structure:

Three 10-foot wide by 6-foot high box culverts under I-35W. Invert elevation of 880.4.

Hydrologic Information Available for Subwatershed:

"Hydrologic Report for the City of Lino Lakes," dated May 7, 1980.

Description of Stormwater Storage Areas Modeled within Watershed:

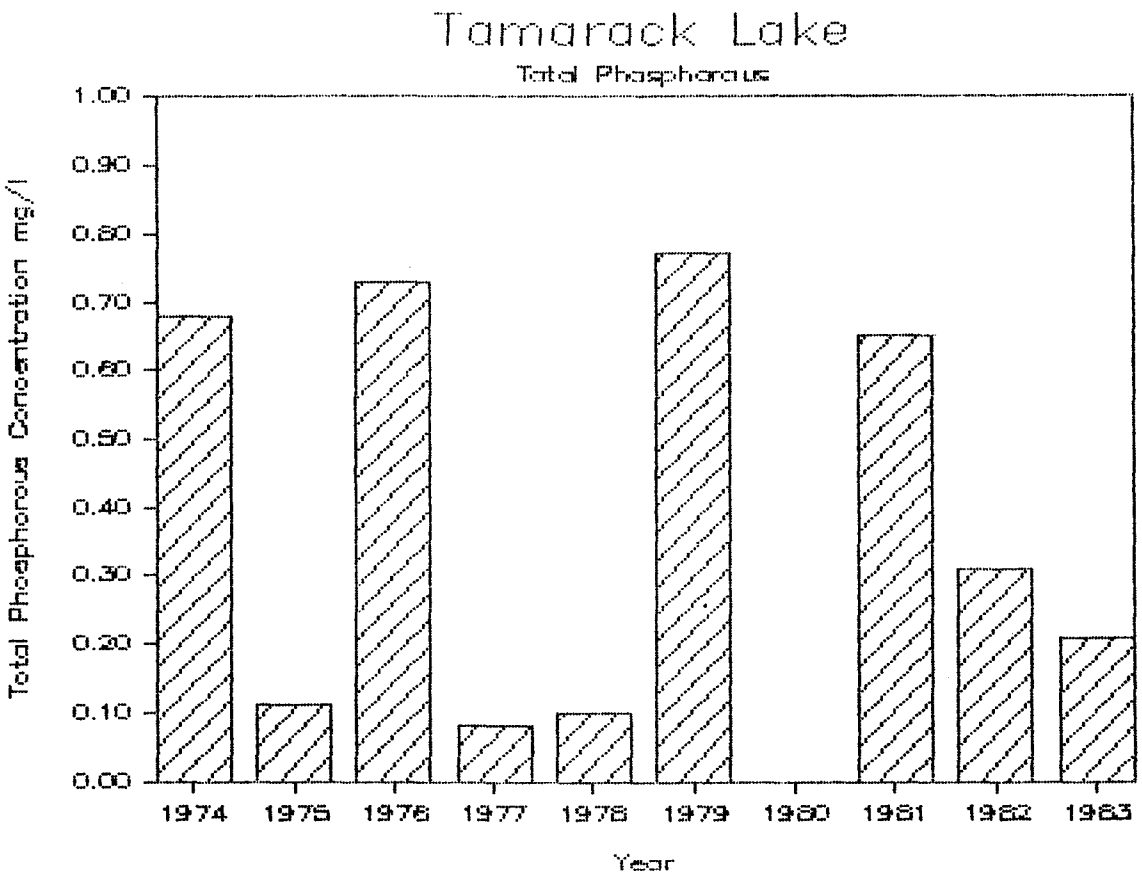
Rondeau Lake, Columbus Lake, and backwater areas of Rice Creek up to Howard Lake.

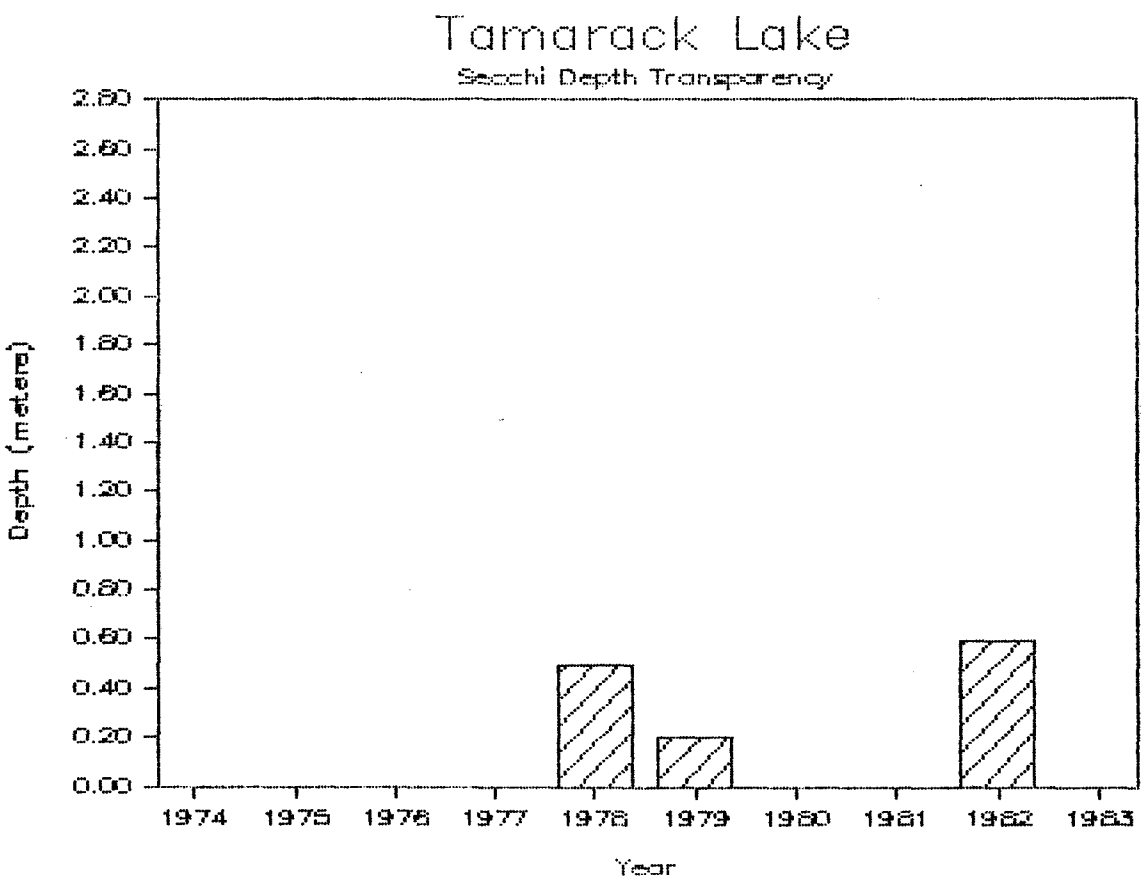
Note: The Peltier Lake Dam backs up water to its runout elevation at 884.60 which inundates areas in Watershed No. 3. For this reason, storage areas identified in Watershed No. 3 are included in the Watershed No. 12a flood routing. See Watershed No. 12a for more information.

WATER QUALITY DATA

TAMARACK LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	10	6
	Maximum	0.410	0.754	0.360
	Minimum	0.006	0.027	0.060
	Mean	0.162	0.251	0.143
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	1.30	0.79	0.34
	Minimum	0.05	0.06	0.05
	Mean	0.45	0.62	0.19
Chlorophyll-a (ug/l)	Number	6	6	6
	Maximum	216.0	33.0	16.0
	Minimum	3.0	1.0	1.0
	Mean	48.7	12.5	5.5
Conductivity at 25° C (micromho)	Number	7	6	6
	Maximum	410.0	500.0	390.0
	Minimum	115.0	310.0	180.0
	Mean	247.8	369.2	291.7
Secchi Depth Transparency (meters)	Number	0	2	1
	Maximum	--	0.20	0.60
	Minimum	--	0.50	0.60
	Mean	--	0.35	0.60
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	65.0	8.0
	Minimum	--	35.0	5.0
	Mean	--	50.0	7.0
Total NH_3 + NH_4-N (mg/l)	Number	7	6	6
	Maximum	1.06	0.77	0.40
	Minimum	0.20	0.24	0.07
	Mean	0.86	0.51	0.17
Dissolved Oxygen (mg/l)	Number	5	6	5
	Maximum	8.5	7.2	10.5
	Minimum	4.3	0.4	4.2
	Mean	5.8	3.1	6.9
Temperature (°C)	Number	5	6	5
	Maximum	24.0	23.0	22.0
	Minimum	14.0	15.0	15.0
	Mean	19.4	19.2	16.8
pH	Number	5	6	6
	Maximum	8.2	8.5	9.7
	Minimum	6.9	7.2	7.0
	Mean	7.6	7.6	8.0

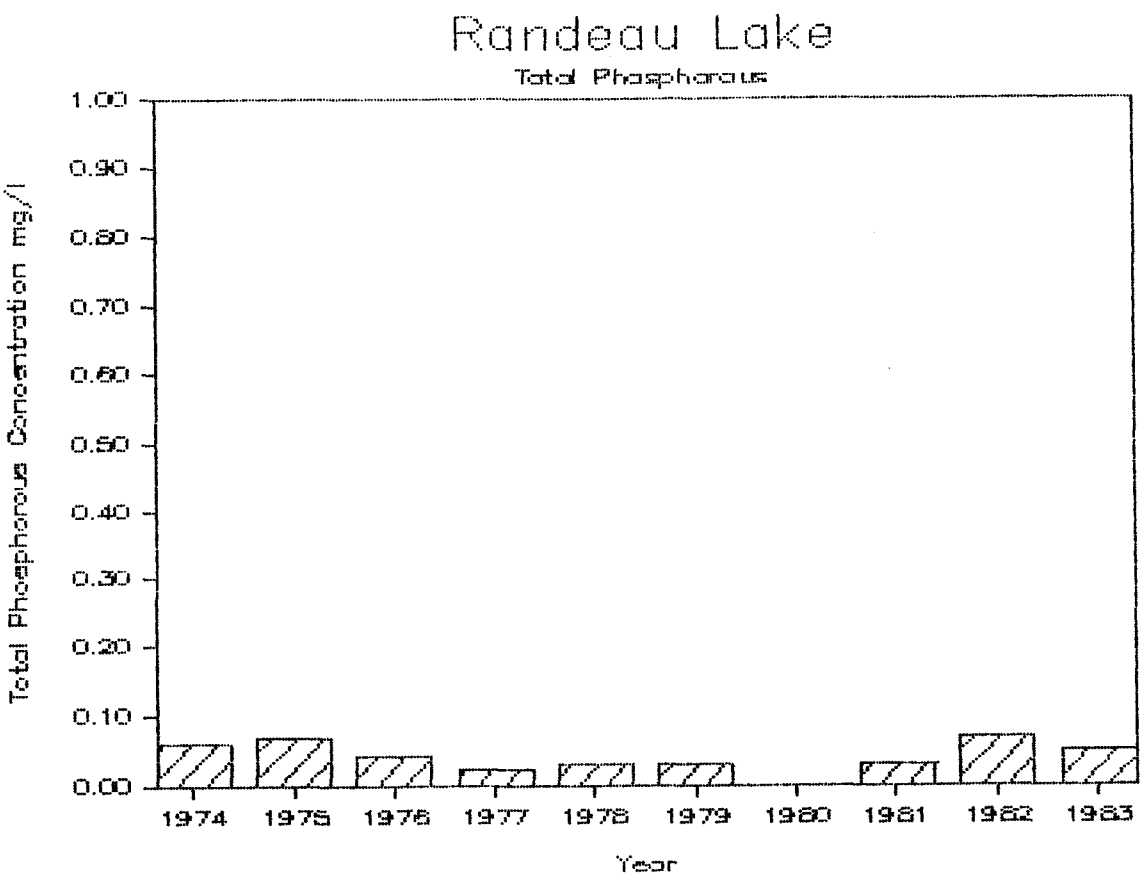

Tamarack Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

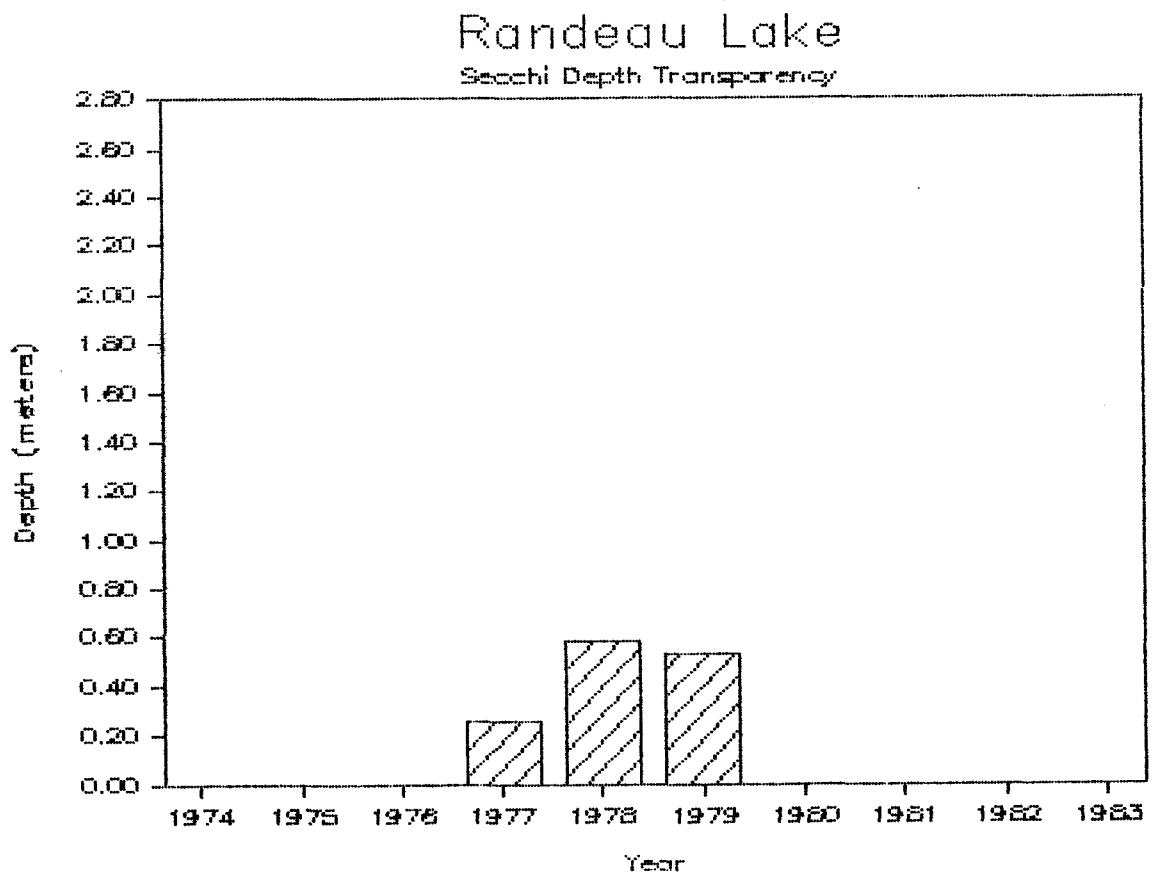

Tamarack Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

RANDEAU LAKE

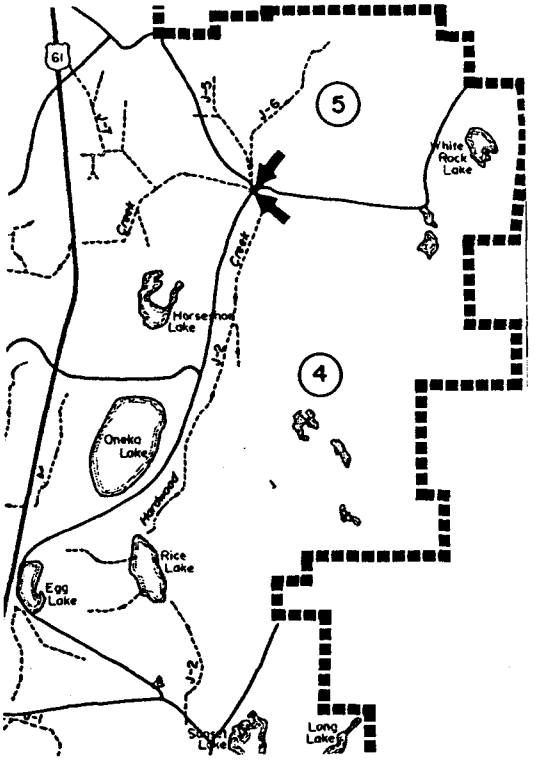
		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.030	0.010	0.030
	Minimum	0.010	0.010	0.010
	Mean	0.013	0.010	0.018
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.12	0.04	0.10
	Minimum	0.02	0.01	0.02
	Mean	0.06	0.03	0.05
Chlorophyll-a (ug/l)	Number	7	6	6
	Maximum	300.0	14.0	18.0
	Minimum	5.0	1.0	1.0
	Mean	63.0	6.7	5.3
Conductivity at 25° C (micromho)	Number	7	6	6
	Maximum	375.0	425.0	280.0
	Minimum	219.0	340.0	220.0
	Mean	258.3	372.5	243.3
Secchi Depth Transparency (meters)	Number	0	5	2
	Maximum	--	0.61	6.00
	Minimum	--	0.21	0.60
	Mean	--	0.43 (Bottom)	3.30 (Bottom)
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	50.0	10.0
	Minimum	--	45.0	5.0
	Mean	--	47.5	6.8
Total NH_3 + NH_4-N (mg/l)	Number	7	6	6
	Maximum	2.32	0.58	0.15
	Minimum	0.02	0.06	0.01
	Mean	0.90	0.33	0.09
Dissolved Oxygen (mg/l)	Number	7	6	5
	Maximum	9.3	7.6	13.1
	Minimum	2.9	4.0	5.1
	Mean	5.4	5.5	8.0
Temperature (°C)	Number	6	6	5
	Maximum	28.0	24.0	23.0
	Minimum	13.0	19.5	16.0
	Mean	20.4	20.9	20.5
pH	Number	7	6	6
	Maximum	8.7	8.8	8.2
	Minimum	6.7	7.5	7.2
	Mean	7.5	7.9	7.7


Randeau Lake
Total Phasphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Randeau Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatersheds No. 4 and 5 combined, Hardwood Creek East and Hardwood Creek North, is approximately 19.52 square miles and contains two lakes: Egg Lake and Rice Lake. The gradient of Hardwood Creek which runs through this area is quite flat. It results in a very limited discharge capacity for the area. The storage capacity of this system aids in the prevention of high flows downstream. There are no water quality monitoring stations in the lakes in these subwatersheds. There is a water quality monitoring station on Hardwood Creek near the end of the drainage system. The total phosphorus from this subwatershed is slightly increasing, as well as the total suspended solids. Pollutant loadings from this subwatershed are very dependent upon rainfall. Concentrations of total suspended solids and total phosphorus have reduced, but loadings are up due to high flows. Chloride loadings to this subwatershed are also up slightly over the last six years.

WATERSHED NO: 4 and 5 Combined
WATERSHED NAME: Hardwood Creek East and Hardwood Creek North



AREA OF SUBWATERSHED (sq mi): 19.52

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 19.52

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	47	256	275
Q $Peak_{out}$ (cfs)	2	6	6
Peak Elevation in Reservoir (ft)	--- No Peak Elevation Established ----		
Peak Time (hrs)	71.0	65.1	63.2
Storage Used (ac-ft)	55.9	347.0	349.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	666	1374	1467
Q $Peak_{out}$ (cfs)	31	84	85
Peak Elevation in Reservoir (ft)	--- No Peak Elevation Established ----		
Peak Time (hrs)	70.7	65.8	61.2
Storage Used (ac-ft)	1266.0	2383.0	2403.0

WATERSHED NO: 4 and 5 Combined
WATERSHED NAME: Hardwood Creek East and Hardwood Creek North

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 4.3

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 122

Description of Outlet Structure:

Harrow Avenue Bridge crossing and Hardwood Creek in Sec 33, T32N, R22W.

Hydrologic Information Available for Subwatershed:

"Flood Insurance Study for the City of Hugo," dated December 1982.

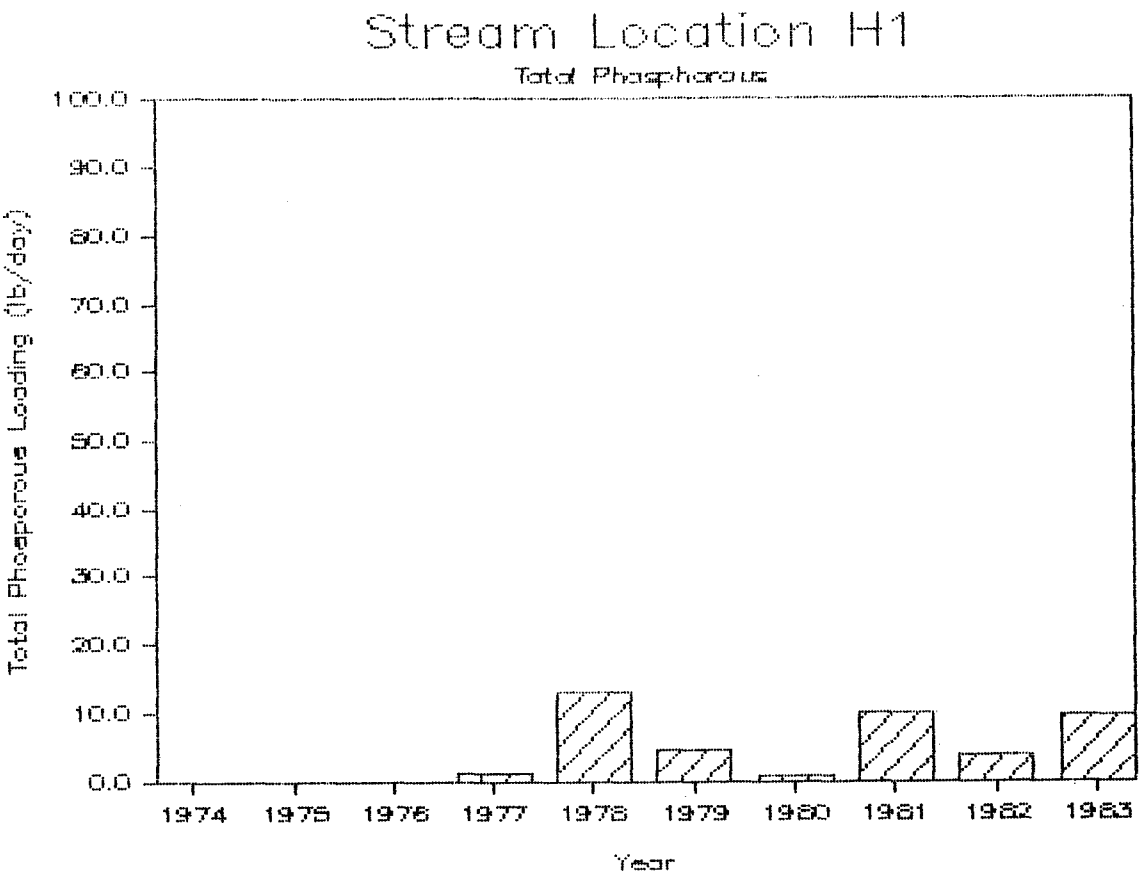
Description of Stormwater Storage Areas Modeled within Watershed:

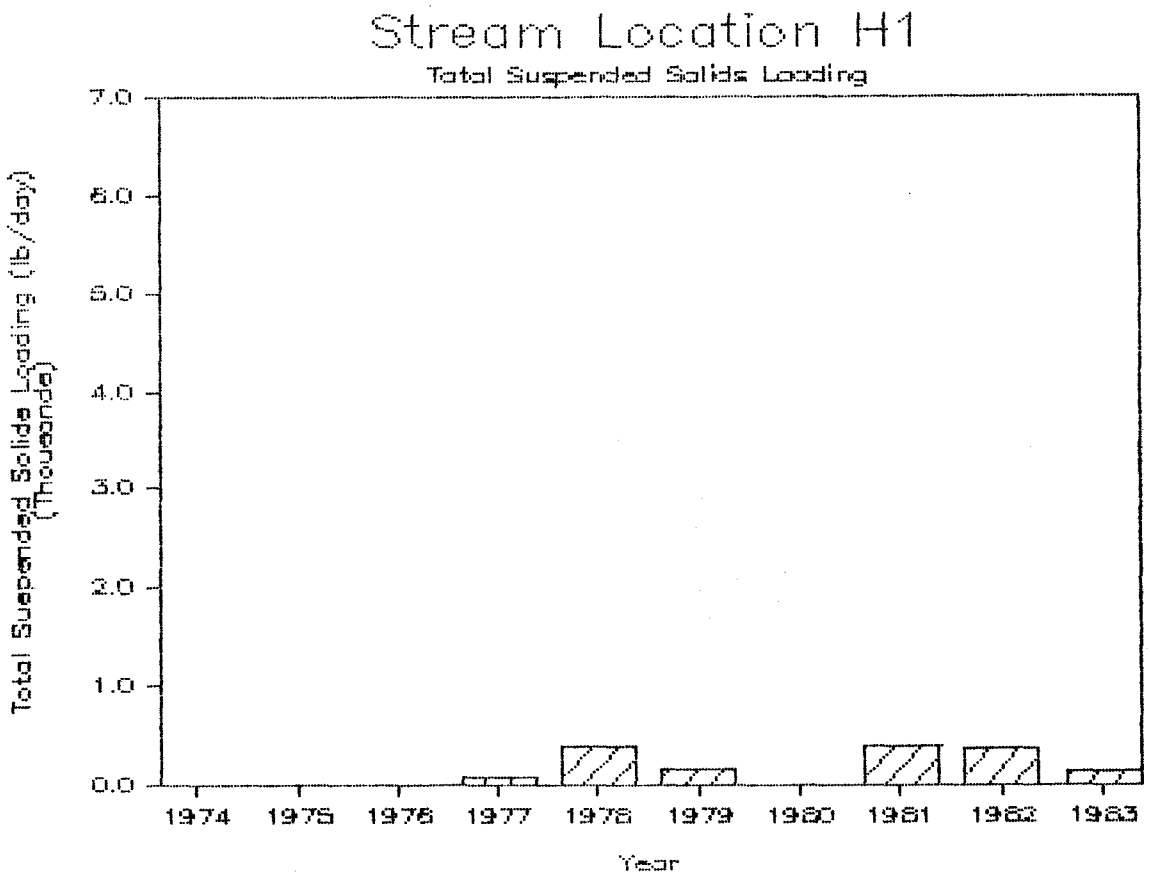
Wetland Areas in Sec 26, 34, and 35, T32N, R21W and Sec 3, T31N, R21W.

WATER QUALITY DATA

STREAM LOCATION H1

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	27	27
	Maximum	--	19.5	33.0
	Minimum	--	0.0	0.0
	Mean	--	5.7	9.8
Dissolved Oxygen (mg/l)	Number	0	9	29
	Maximum	--	13.4	14.3
	Minimum	--	1.0	1.5
	Mean	--	6.4	6.1
Water Temperature (°C)	Number	0	9	29
	Maximum	--	24.0	25.0
	Minimum	--	1.0	2.0
	Mean	--	16.3	14.9
Total Kjeldahl Nitrogen (lb/D)	Number	0	12	13
	Maximum	--	173.9	157.3
	Minimum	--	0.0	11.0
	Mean	--	66.0	82.8
Ortho-Phosphorus (lb/D)	Number	0	14	13
	Maximum	--	25.0	20.0
	Minimum	--	0.0	1.0
	Mean	--	5.2	5.7
Total Phosphorus (lb/D)	Number	0	13	13
	Maximum	--	27.8	23.2
	Minimum	--	0.0	1.3
	Mean	--	7.5	7.9
pH	Number	10	16	15
	Maximum	9.0	8.1	8.0
	Minimum	6.8	7.2	7.2
	Mean	7.7	7.7	7.6
Turbidity Turbidity Meter Hach (FTU)	Number	7	0	0
	Maximum	35.0	--	--
	Minimum	2.0	--	--
	Mean	9.3	--	--
Total Non-Filterable Residue (lb/D)	Number	0	15	14
	Maximum	--	718.5	768.6
	Minimum	--	0.0	37.8
	Mean	--	209.5	272.6
Total Chloride (lb/D)	Number	0	14	13
	Maximum	--	1143.5	1536.1
	Minimum	--	0.0	36.7
	Mean	--	331.1	488.9


Stream Location H1
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

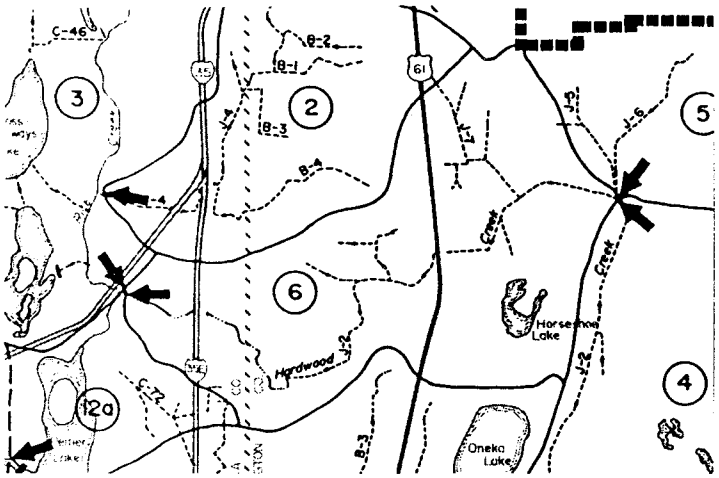

Stream Location H1
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No 6, Hardwood Creek West, is approximately 8.71 square miles. Horseshoe Lake is within this subwatershed. Modeling indicates that there will be a slight increase in flows from present-day conditions to the year 2000 conditions. A significant increase in flow rate could occur if the capacity of the Hardwood Creek channel is increased and no additional downstream storage is provided. There are no lake water quality monitoring stations within this subwatershed; however, there is a stream water quality monitoring station, H2. Based on the observations from this monitoring data, suspended solids and total phosphorus loadings are up significantly in 1981 and 1983 from 1977 and 1980.

WATERSHED NO: 6
WATERSHED NAME: Hardwood Creek West

AREA OF
SUBWATERSHED (sq mi): 8.71

TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 28.23



	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	61	208.	214.
Q $Peak_{out}$ (cfs)	34	108.	109.
Peak Elevation in Reservoir (ft)	--- Peak Elevation Not Established ---		
Peak Time (hrs)	35.2	32.6	32.2
Storage Used (ac-ft)	39.0	135.0	136.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	690.	1185.	1215.
Q $Peak_{out}$ (cfs)	352.	534.	539.
Peak Elevation in Reservoir (ft)	--- Peak Elevation Not Established ---		
Peak Time (hrs)	33.8	32.5	32.0
Storage Used (ac-ft)	473.1	795.0	798.0

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 18.9

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 91.3

Description of Outlet Structure:

Two 88-inch span arch culverts. Invert elevation is 889.8.

Hydrologic Information Available for Subwatershed:

"Flood Insurance Study for the City of Hugo," dated December 1982.

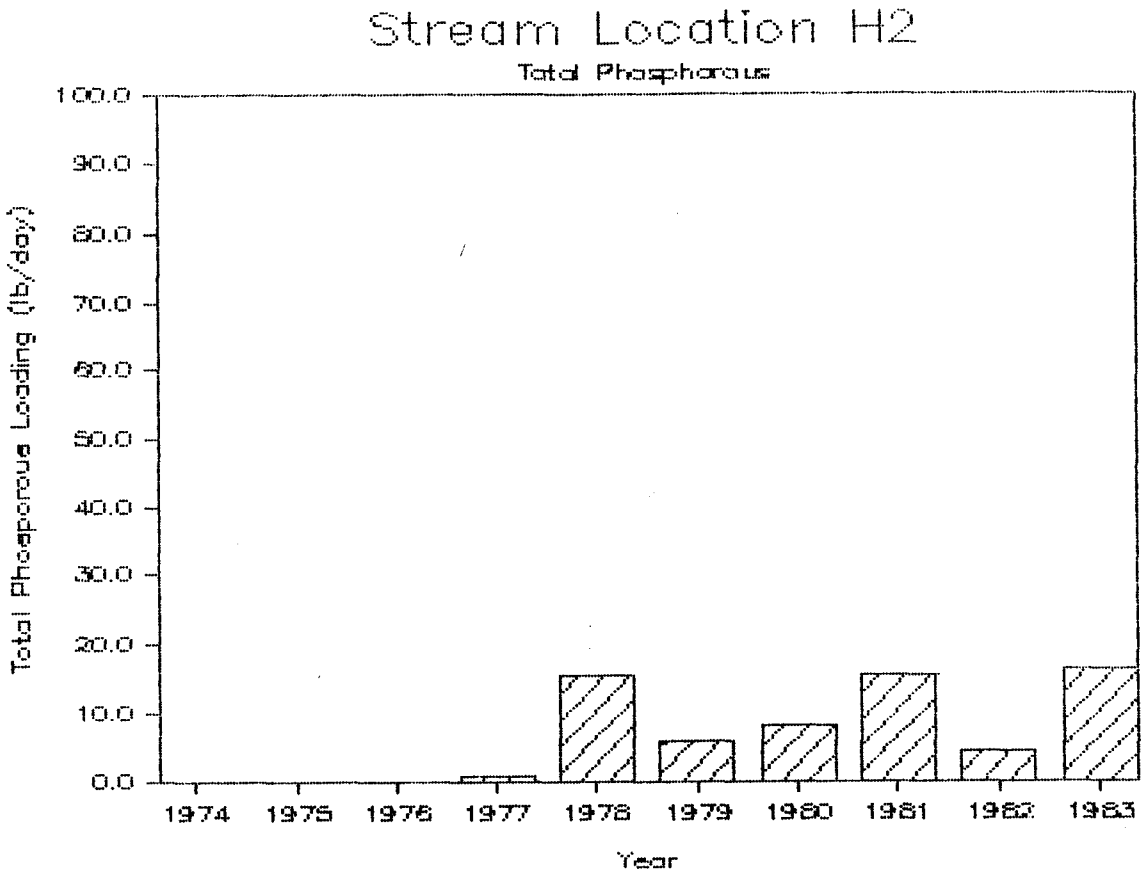
Description of Stormwater Storage Areas Modeled within Watershed:

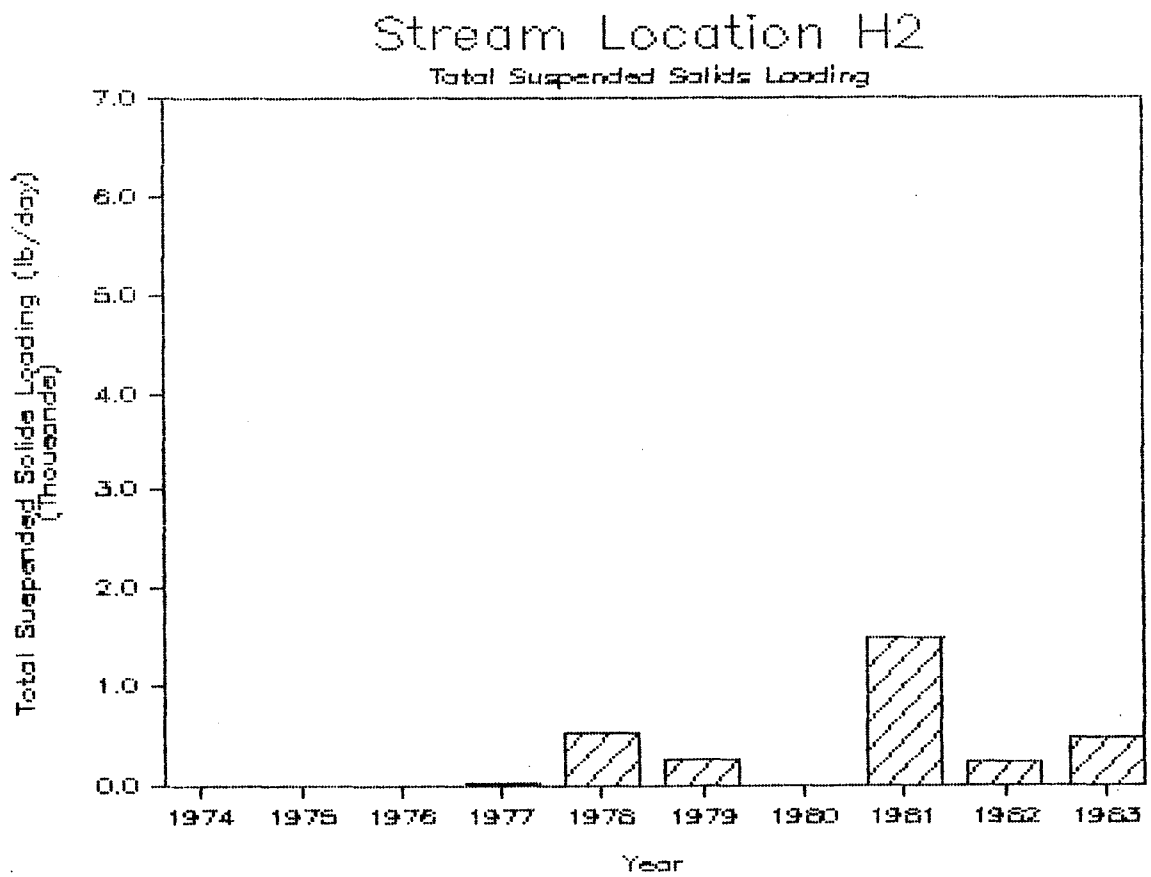
Wetland area in Sec 1, T131N, R22W.

WATER QUALITY DATA

STREAM LOCATION H2

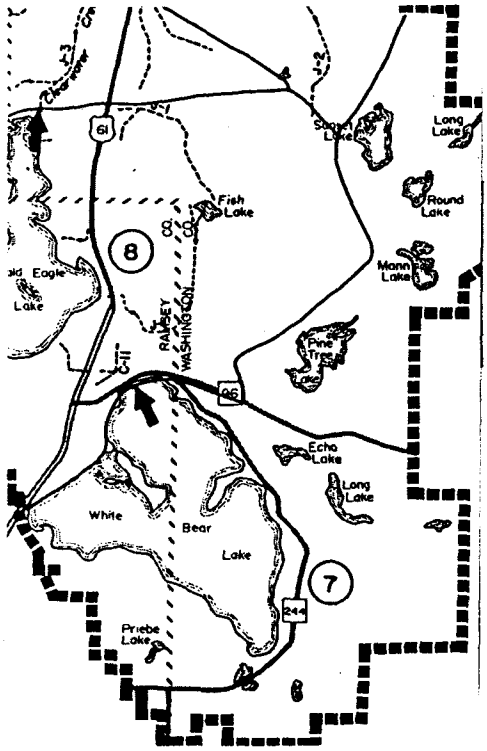
		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	28	28
	Maximum	--	23.2	57.0
	Minimum	--	0.0	0.0
	Mean	--	6.6	13.7
Dissolved Oxygen (mg/l)	Number	0	8	29
	Maximum	--	13.2	12.0
	Minimum	--	6.0	2.0
	Mean	--	9.3	13.2
Water Temperature (°C)	Number	0	10	29
	Maximum	--	25.0	24.0
	Minimum	--	3.0	0.0
	Mean	--	16.9	14.8
Total Kjeldahl Nitrogen (lb/D)	Number	0	11	13
	Maximum	--	238.4	320.4
	Minimum	--	0.0	0.0
	Mean	--	93.2	134.1
Ortho-Phosphorus (lb/D)	Number	0	16	14
	Maximum	--	25.9	226.5
	Minimum	--	0.0	0.0
	Mean	--	5.3	23.5
Total Phosphorus (lb/D)	Number	0	16	14
	Maximum	--	30.2	37.8
	Minimum	--	0.0	0.0
	Mean	--	7.6	13.2
pH	Number	9	15	15
	Maximum	8.0	8.3	8.2
	Minimum	7.2	7.6	7.6
	Mean	7.6	7.9	7.8
Turbidity Turbidity Meter Hach (FTU)	Number	7	0	0
	Maximum	42.0	--	--
	Minimum	5.0	--	--
	Mean	10.7	--	--
Total Non-Filterable Residue (lb/D)	Number	0	14	13
	Maximum	--	1298.8	3346.8
	Minimum	--	0.0	0.0
	Mean	--	306.9	808.8
Total Chloride (lb/D)	Number	0	5	14
	Maximum	--	2783.2	2589.0
	Minimum	--	296.7	0.0
	Mean	--	930.2	755.9


Stream Location H2
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location H2
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No. 7, White Bear Lake, is approximately 18.04 square miles. The dominant lake within this subwatershed is White Bear Lake. The water quantity modeling effort indicates that White Bear Lake provides adequate water storage for the entire subwatershed. Water quality monitoring data indicates that the water quality of White Bear Lake is good, with a Trophic State Index of approximately 53. The water quality of White Bear Lake is as good or better than any in the Watershed District. White Bear Lake has a relatively small tributary drainage area for its size, which tends to keep this lake clean. Water quality within White Bear Lake has remained relatively constant throughout the duration of the monitoring program. Chlorophyll-a values have reduced somewhat, which indicates some improvement in measured water quality. Sunset Lake, also in this subwatershed, has a Trophic State Index of approximately 70, but the water quality has been improving slightly over the last decade.

WATERSHED NO: 7
WATERSHED NAME: White Bear Lake



AREA OF SUBWATERSHED (sq mi): 18.04

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 18.04

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	93	885	1010
Q $Peak_{out}$ (cfs)	1	4	4
Peak Elevation in Reservoir (ft)	924.84	925.1	925.12
Peak Time (hrs)	51.0	44.0	42.0
Storage Used (ac-ft)	106.6	799.5	852.8
100-YEAR:			
Q $Peak_{in}$ (cfs)	1616	4217	4628.
Q $Peak_{out}$ (cfs)	8	21	22.
Peak Elevation in Reservoir (ft)	925.43	926.14	926.17
Peak Time (hrs)	49.0	42.6	40.8
Storage Used (ac-ft)	1678.9	3616.3	3700

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 1.2

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 200.4

Description of Outlet Structure:

Three 24-inch RCP culverts at 924.8.

Hydrologic Information Available for Subwatershed:

"Flood Insurance Study for the City of Mahtomedi," dated June 24, 1977.

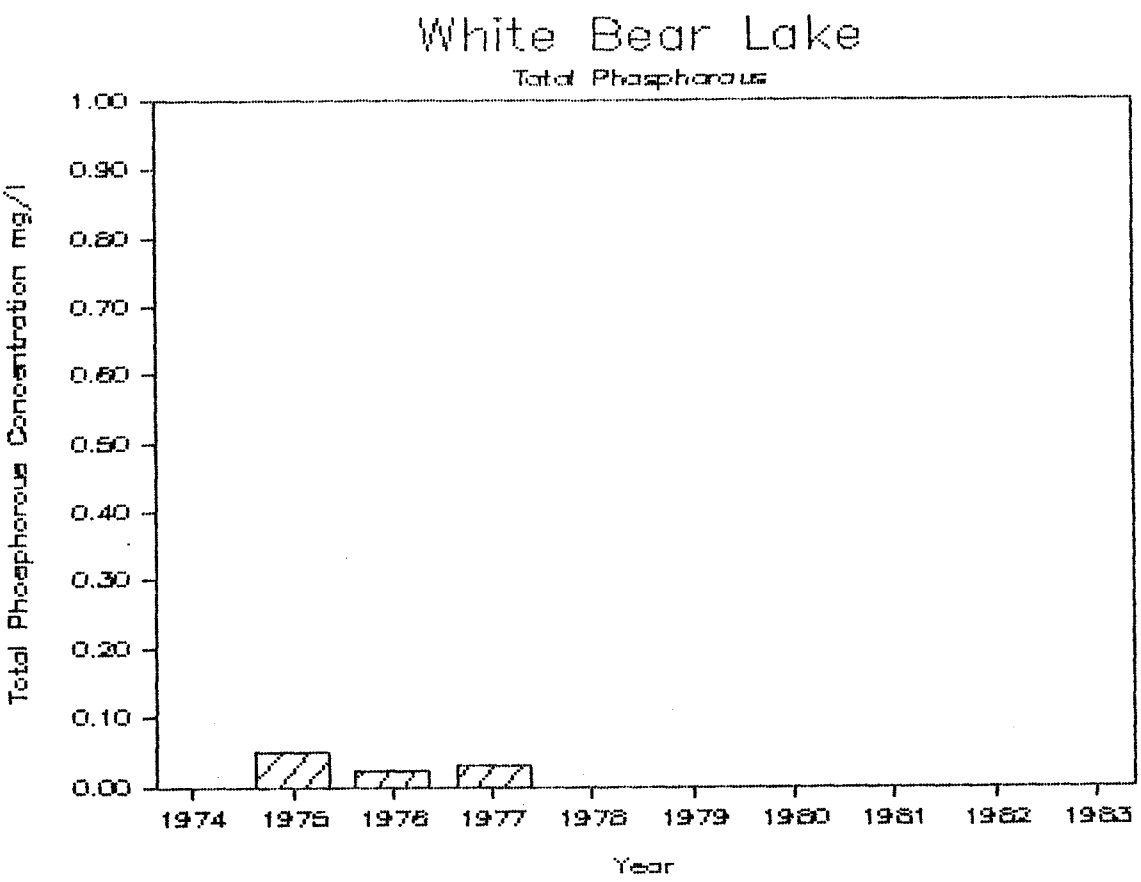
Description of Stormwater Storage Areas Modeled within Watershed:

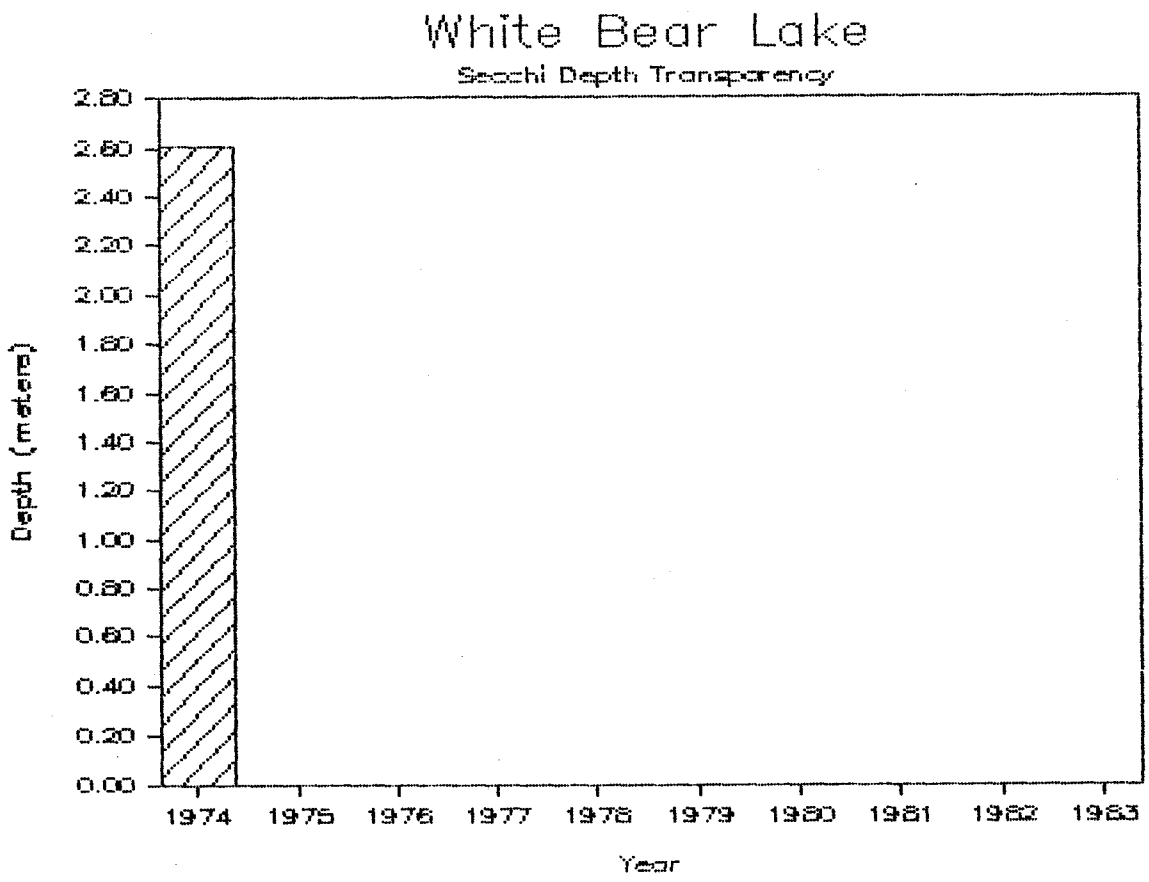
White Bear Lake.

WATER QUALITY DATA

WHITE BEAR LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	15	2	0
	Maximum	0.048	0.040	--
	Minimum	0.001	0.010	--
	Mean	0.005	0.025	--
Total Phosphorus (mg/l)	Number	15	2	0
	Maximum	0.13	0.05	--
	Minimum	0.02	0.01	--
	Mean	0.04	0.03	--
Chlorophyll-a (ug/l)	Number	15	2	0
	Maximum	20.0	2.0	--
	Minimum	2.0	1.0	--
	Mean	9.1	1.5	--
Conductivity at 25° C (micromho)	Number	15	2	0
	Maximum	350.0	260.	--
	Minimum	240.0	230.	--
	Mean	291.0	245.0	--
Secchi Depth Transparency (meters)	Number	15	2	0
	Maximum	3.60	4.20	--
	Minimum	1.90	2.60	--
	Mean	2.85	3.40	--
Total Chloride (mg/l)	Number	0	2	0
	Maximum	--	15.0	--
	Minimum	--	15.0	--
	Mean	--	15.0	--
Total NH_3 + NH_4-N (mg/l)	Number	15	2	0
	Maximum	0.33	0.20	--
	Minimum	0.01	0.12	--
	Mean	0.12	0.16	--
Dissolved Oxygen (mg/l)	Number	73	41	0
	Maximum	12.4	9.1	--
	Minimum	0.4	0.2	--
	Mean	4.8	5.7	--
Temperature (°C)	Number	73	41	0
	Maximum	23.0	21.5	--
	Minimum	11.0	13.5	--
	Mean	16.6	16.6	--
pH	Number	15	2	0
	Maximum	8.8	8.2	--
	Minimum	7.9	7.9	--
	Mean	8.4	8.1	--

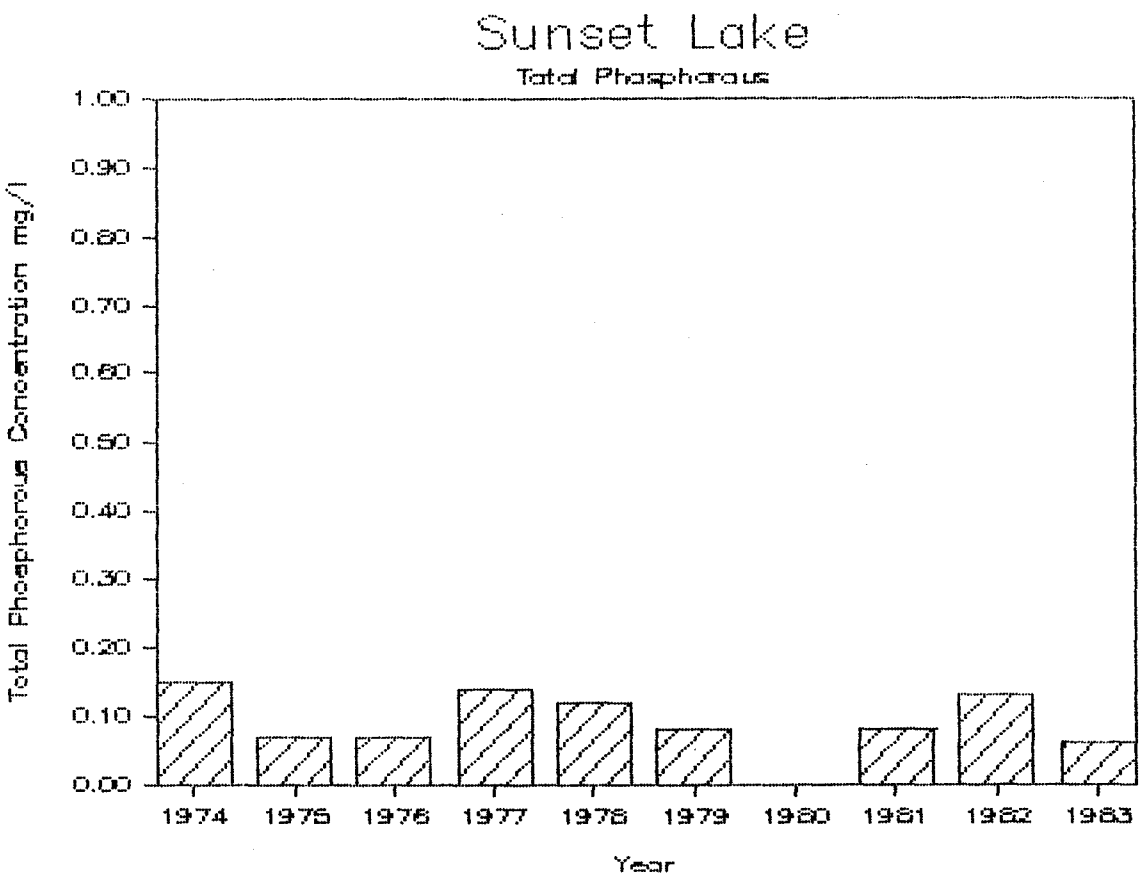

White Bear Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

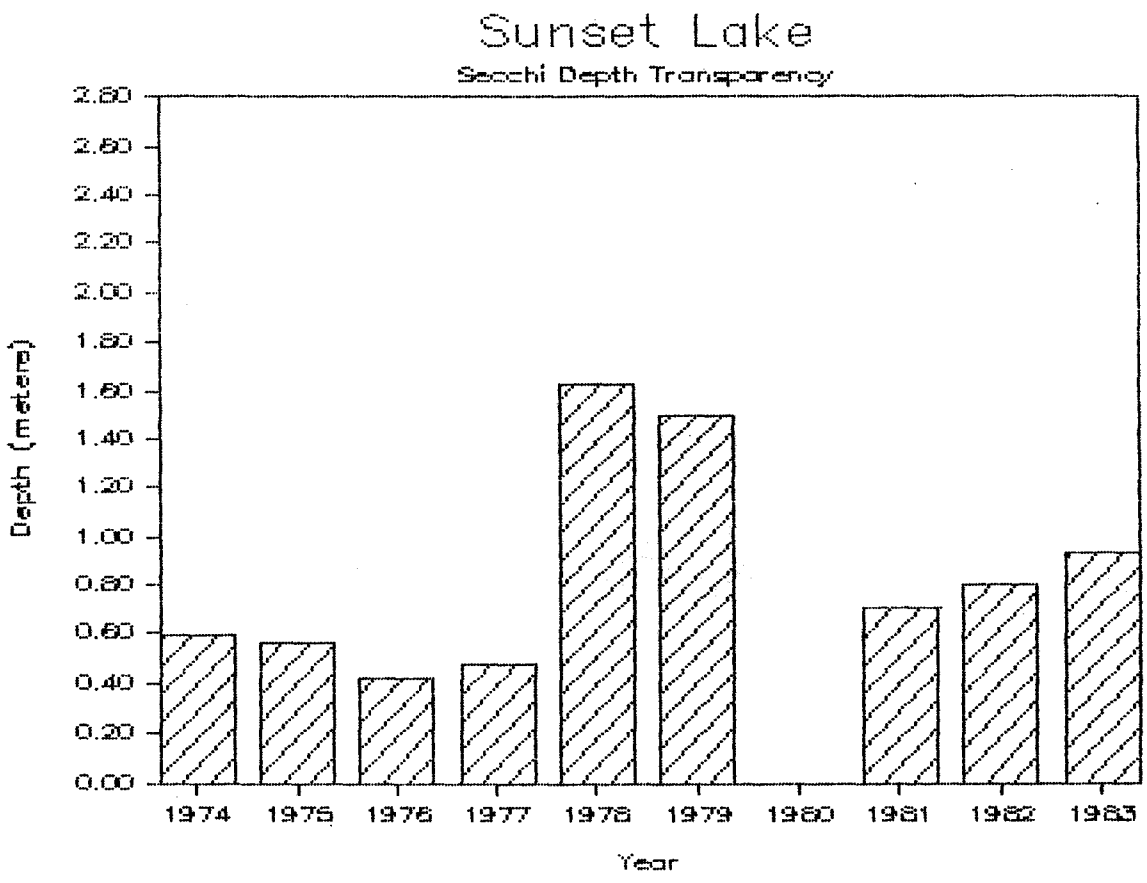

White Bear Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

SUNSET LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	10	7
	Maximum	0.037	0.045	0.150
	Minimum	0.001	0.002	0.030
	Mean	0.020	0.015	0.070
Total Phosphorus (mg/l)	Number	7	10	7
	Maximum	0.23	0.20	0.14
	Minimum	0.05	0.05	0.02
	Mean	0.15	0.11	0.09
Chlorophyll-a (ug/l)	Number	7	9	7 0
	Maximum	73.0	58.0	70.0
	Minimum	9.0	12.0	6.0
	Mean	43.1	32.8	32.9
Conductivity at 25° C (micromho)	Number	7	10	7
	Maximum	180.0	200.0	160.0
	Minimum	100.0	160.0	130.0
	Mean	134.1	175.0	147.1
Secchi Depth Transparency (meters)	Number	7	6	5
	Maximum	0.74	2.50	1.00
	Minimum	0.42	0.37	0.68
	Mean	0.53	1.20	0.83
Total Chloride (mg/l)	Number	0	5	7 0
	Maximum	--	45.0	8.0
	Minimum	--	25.0	3.0
	Mean	--	35.0	5.7
Total $NH_3 + NH_4$-N (mg/l)	Number	7	10	7
	Maximum	1.11	1.10	0.52
	Minimum	0.40	0.11	0.03
	Mean	0.67	0.49	0.15
Dissolved Oxygen (mg/l)	Number	7	10	14
	Maximum	10.8	12.5	13.8
	Minimum	6.2	1.0	5.1
	Mean	9.0	7.2	8.9
Temperature (°C)	Number	7	10	13
	Maximum	27.0	23.0	23.0
	Minimum	15.0	20.0	14.5
	Mean	21.6	21.1	18.9
pH	Number	7	10	7
	Maximum	8.9	10.2	9.3
	Minimum	7.5	7.6	7.5
	Mean	8.3	8.5	8.4

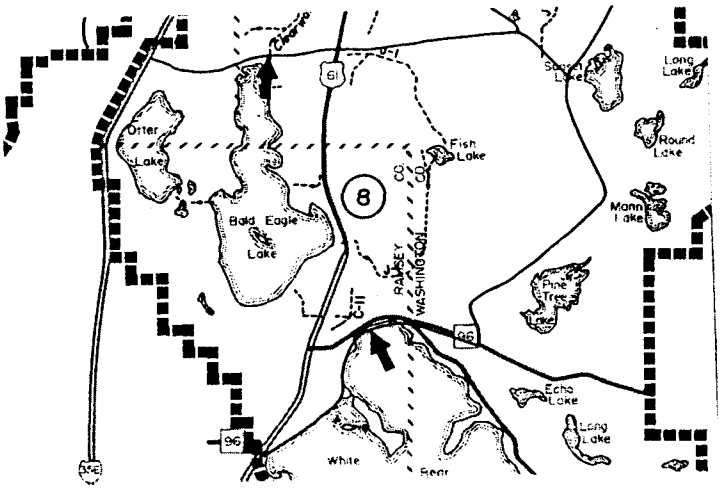

Sunset Lake
Total Phasphoraus
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Sunset Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No. 8, Bald Eagle Lake, has an aproximate drainage area of 13.35 square miles. Two lakes within this subwatershed include Bald Eagle Lake and Otter Lake. The water quantity modeling effort indicates there is significant storage available in Otter and Bald Eagle Lakes; however, the lake outlet structure is capable of lowering the lake level quite rapidly and the downstream channel capacity is relatively low. Although there is no operating plan for the outlet of Bald Eagle Lake, such a plan be helpful in providing storage to prevent downstream flooding. There are no water quality samples available for Otter Lake. There has been a water quality monitoring program on Bald Eagle Lake for approximately a decade. There is additional information available on water quality from Station C1 for Clear Water Creek. Water quality in Bald Eagle Lake is generally good compared to other lakes within the District, but is still considered mesotrophic. It appears that water quality in 1974-76 was better than through 1977-80, but has been improving recently.

WATERSHED NO: 8
WATERSHED NAME: Bald Eagle Lake

AREA OF SUBWATERSHED (sq mi): 13.35



TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 31.39

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	274.	615.	711.
Q $Peak_{out}$ (cfs)	3.6	6.6	7.0
Peak Elevation in Reservoir (ft)	910.82	911.02	911.04
Peak Time (hrs)	49.0	46.0	43.0
Storage Used (ac-ft)	311.5	594.7	623.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	1905.	2922.	3268.
Q $Peak_{out}$ (cfs)	77.	116.	121.
Peak Elevation in Reservoir (ft)	911.96	912.36	912.42
Peak Time (hrs)	43.1	38.1	36.3
Storage Used (ac-ft)	1950	2545	2635

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 3.7

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 190.6

Description of Outlet Structure:

Five 50-inch by 31-inch CMP arch culverts with invert elevations at 910.6.

Hydrologic Information Available for Subwatershed:

"Comprehensive Stormwater Management Plan for the County Road H2-Stillwater Street Area," prepared for the Township of White Bear and dated November 1979.

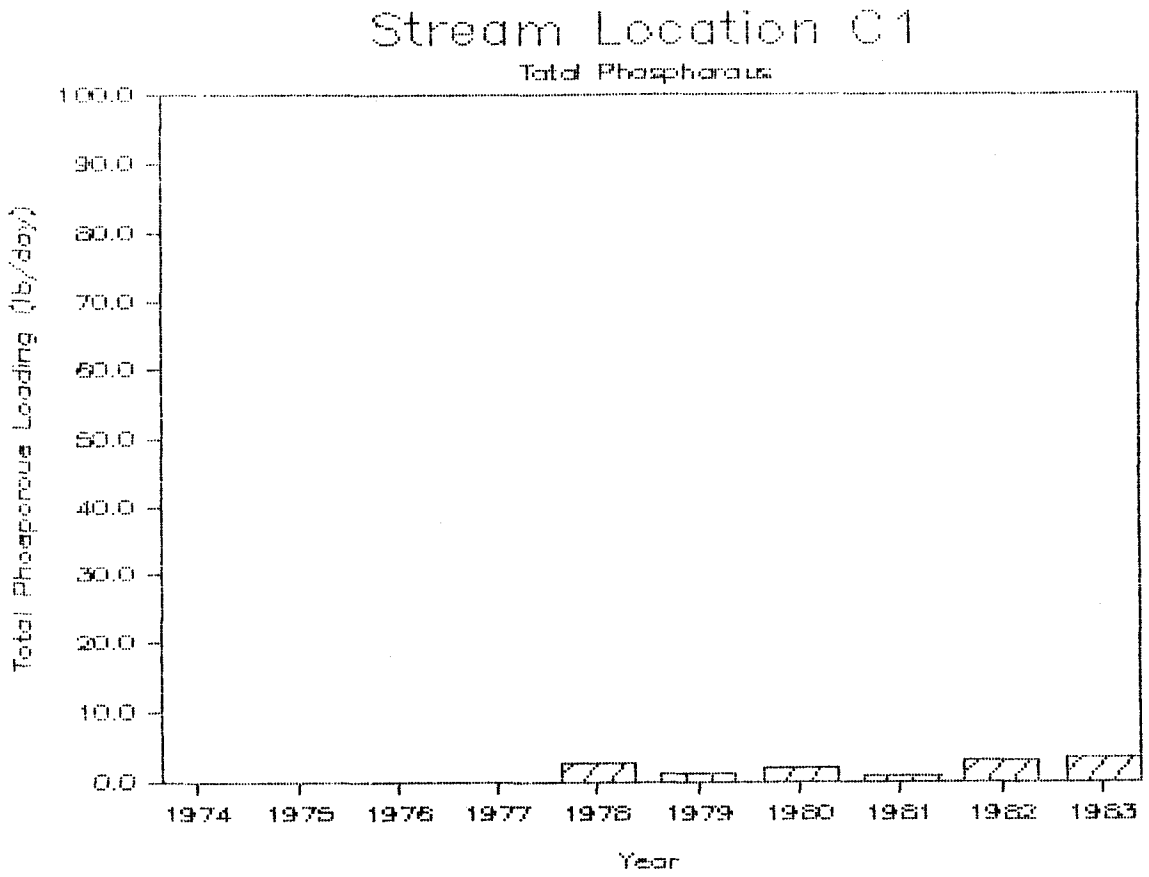
Description of Stormwater Storage Areas Modeled within Watershed:

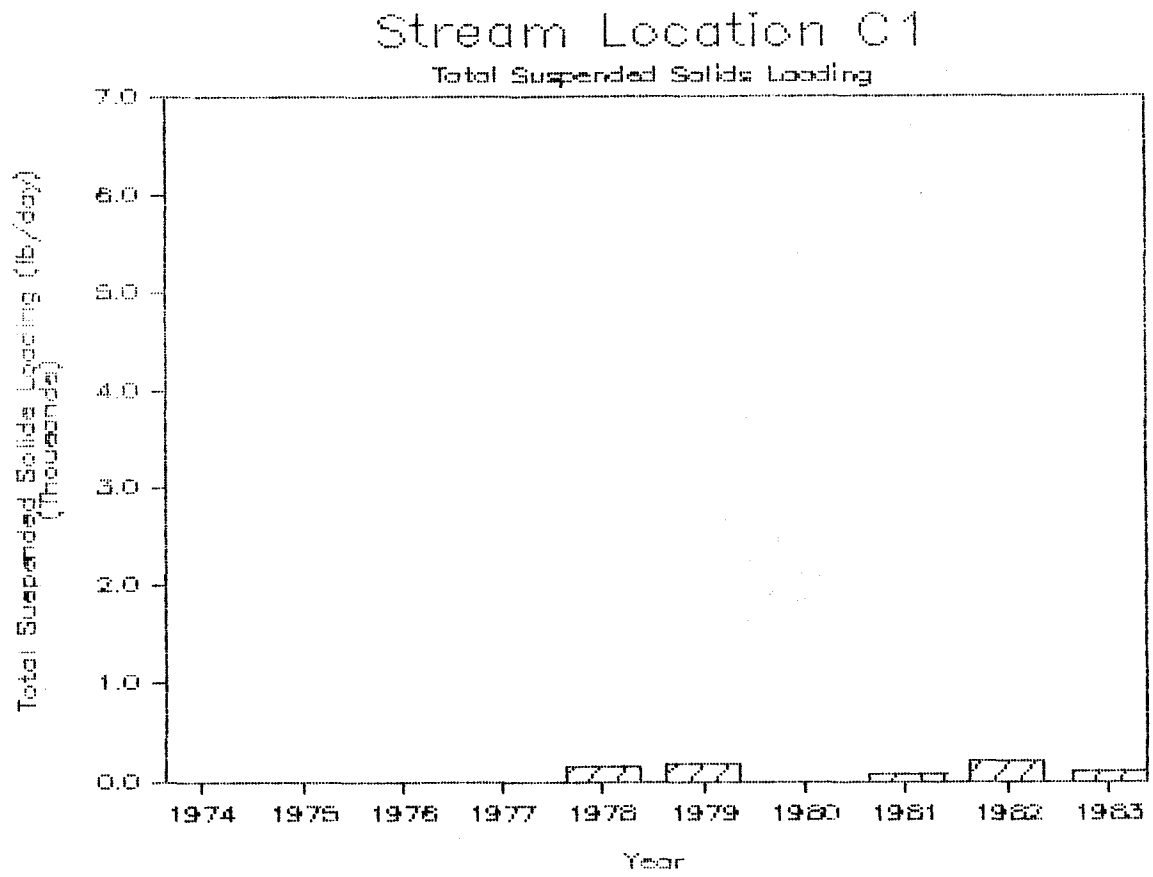
Bald Eagle Lake and Otter Lake.

WATER QUALITY DATA

STREAM LOCATION C1

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	23	28
	Maximum	--	10.9	22.0
	Minimum	--	0.0	0.0
	Mean	--	2.3	5.9
Dissolved Oxygen (mg/l)	Number	0	7	28
	Maximum	--	13.2	15.4
	Minimum	--	4.8	3.5
	Mean	--	10.1	8.7
Water Temperature (°C)	Number	0	10	28
	Maximum	--	26.0	26.0
	Minimum	--	4.0	3.0
	Mean	--	18.9	16.3
Total Kjeldahl Nitrogen (lb/D)	Number	0	8	14
	Maximum	--	135.2	143.5
	Minimum	--	0.0	0.0
	Mean	--	42.4	45.4
Ortho-Phosphorus (lb/D)	Number	0	11	15
	Maximum	--	1.2	4.1
	Minimum	--	0.0	0.0
	Mean	--	0.3	0.91
Total Phosphorus (lb/D)	Number	0	11	14
	Maximum	--	6.5	12.3
	Minimum	--	0.0	0.0
	Mean	--	1.7	2.4
pH	Number	6	11	15
	Maximum	8.3	8.7	9.1
	Minimum	7.0	7.3	7.5
	Mean	7.6	8.1	8.0
Turbidity Turbidity Meter Hach (FTU)	Number	6	0	0
	Maximum	14.0	--	--
	Minimum	2.0	--	--
	Mean	6.5	--	--
Total Non-Filterable Residue (lb/D)	Number	0	9	14
	Maximum	--	573.9	242.7
	Minimum	--	0.0	0.0
	Mean	--	171.4	74.2
Total Chloride (lb/D)	Number	0	5	14
	Maximum	--	617.0	2152.1
	Minimum	--	12.4	0.0
	Mean	--	366.2	741.3

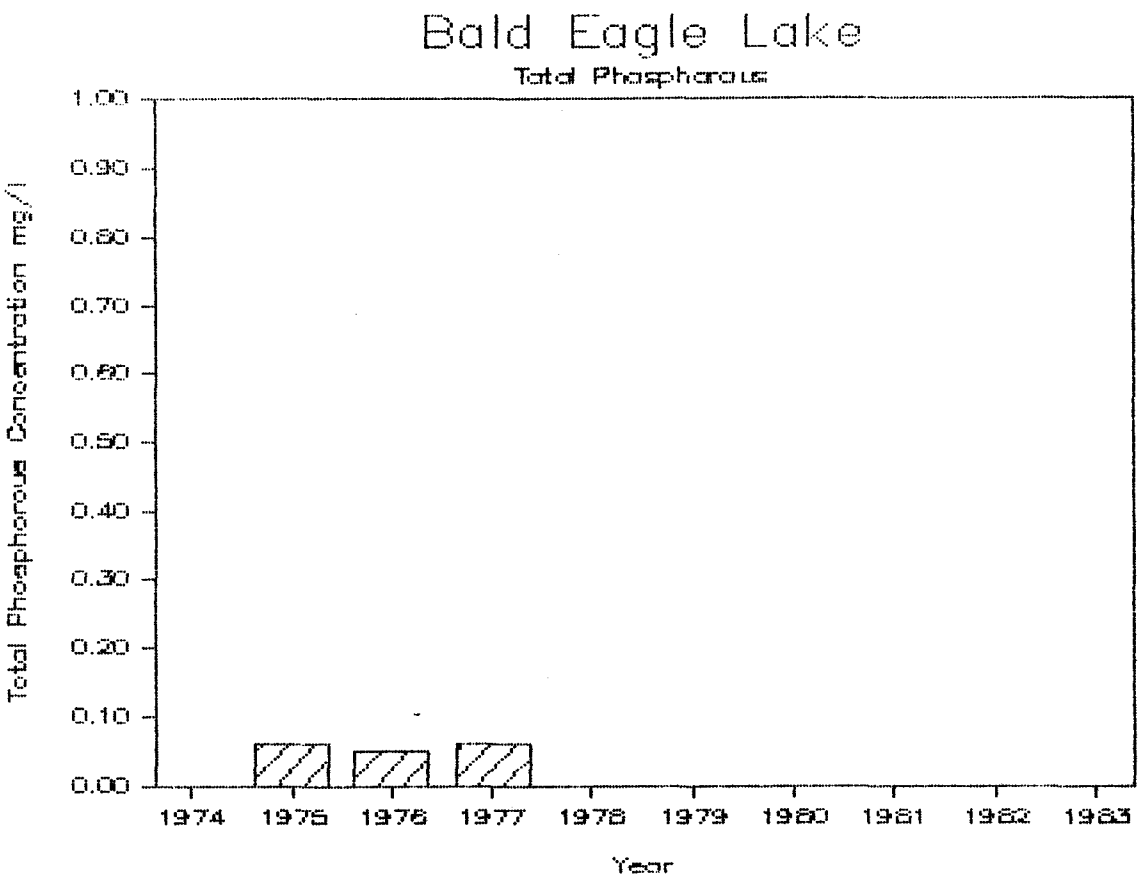

Stream Location C1
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

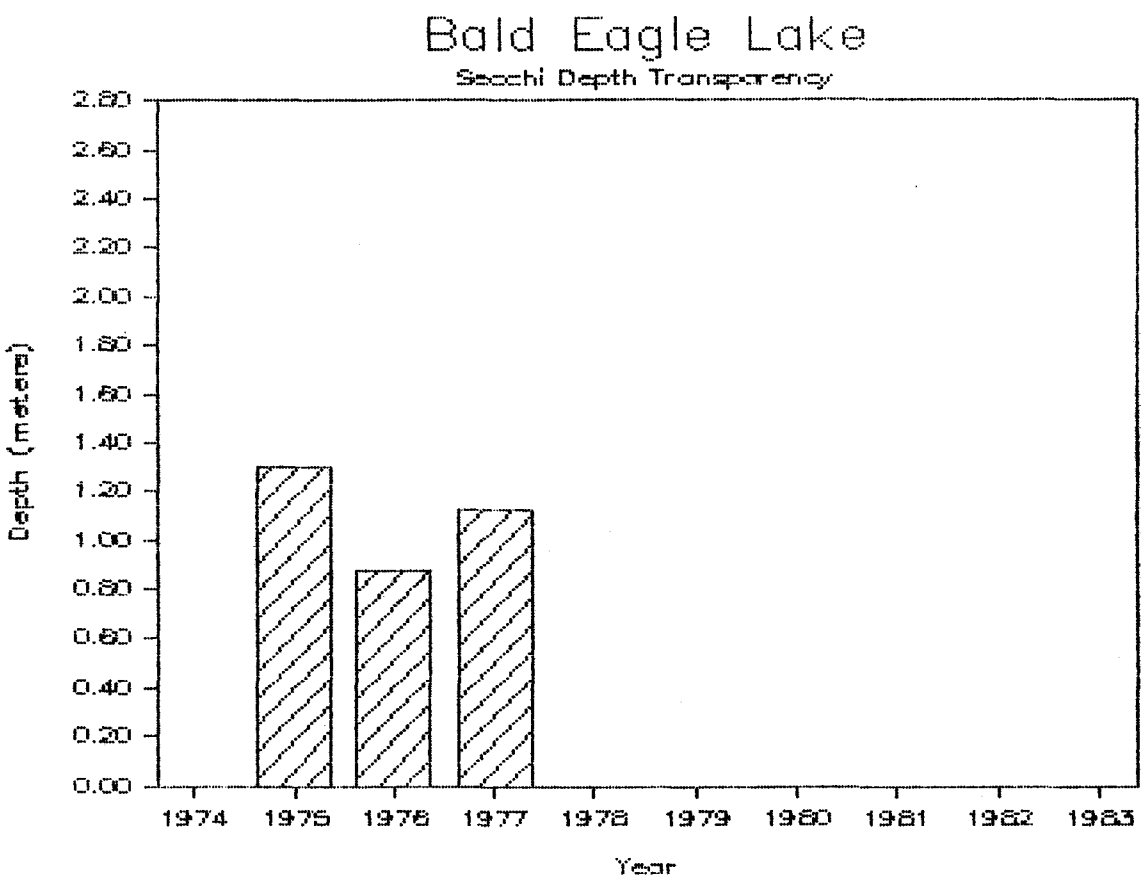

Stream Location C1
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

BALD EAGLE LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	10	0	0
	Maximum	0.084	--	--
	Minimum	0.002	--	--
	Mean	0.016	--	--
Total Phosphorus (mg/l)	Number	10	0	0
	Maximum	0.09	--	--
	Minimum	0.03	--	--
	Mean	0.06	--	--
Chlorophyll-a (ug/l)	Number	10	0	0
	Maximum	31.0	--	--
	Minimum	9.0	--	--
	Mean	21.5	--	--
Conductivity at 25° C (micromho)	Number	10	0	0
	Maximum	410.0	--	--
	Minimum	300.0	--	--
	Mean	364.0	--	--
Secchi Depth Transparency (meters)	Number	10	0	0
	Maximum	2.30	--	--
	Minimum	0.50	--	--
	Mean	1.13	--	--
Total Chloride (mg/l)	Number	0	0	0
	Maximum	--	--	--
	Minimum	--	--	--
	Mean	--	--	--
Total NH_3 + NH_4-N (mg/l)	Number	10	0	0
	Maximum	0.78	--	--
	Minimum	0.01	--	--
	Mean	0.33	--	--
Dissolved Oxygen (mg/l)	Number	33	0	0
	Maximum	12.2	--	--
	Minimum	0.5	--	--
	Mean	6.2	--	--
Temperature (°C)	Number	33	0	0
	Maximum	24.0	--	--
	Minimum	15.0	--	--
	Mean	20.3	--	--
pH	Number	10	0	0
	Maximum	8.5	--	--
	Minimum	8.0	--	--
	Mean	8.3	--	--

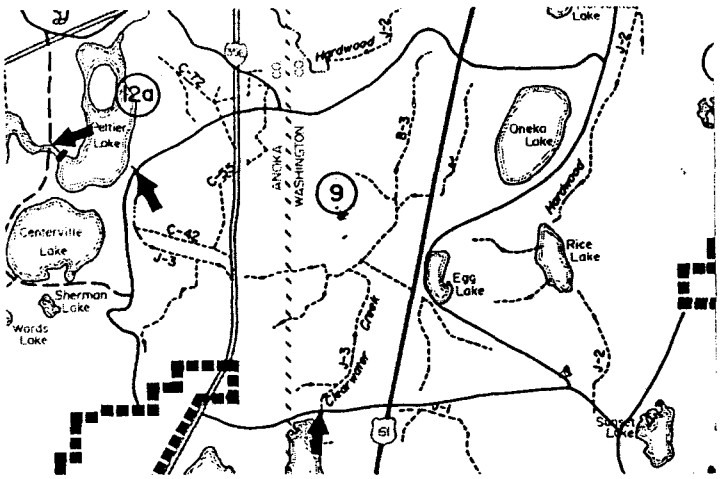

Bald Eagle Lake
Total Phasphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Bald Eagle Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No. 9, Clearwater Creek, has an area of approximately 12.35 square miles. Oneka Lake is the only lake within subwatershed. The water quantity modeling effort indicates that available storage is only in the creek channel with little outside reservoir storage present. In order to reduce potential flooding along Clearwater Creek, it may be necessary to increase channel storage. There is a water quality monitoring station at Oneka Lake. Water quality at Oneka Lake is generally good; however, recent data shows a trend toward being degraded. There are still relatively high transparencies. The watershed area tributary to the lake is small and Oneka Lake is at the top of a subwatershed. Groundwater supports lake levels. Stream water quality monitoring station C2 is also within this subwatershed. There is an increasing loading of total suspended solids and total phosphorus. This may be indicative of increased erosion within this subwatershed.

WATERSHED NO: 9
WATERSHED NAME: Clearwater Creek

AREA OF SUBWATERSHED (sq mi): 12.35



TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 43.74

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	154.	489.	608.
Q $Peak_{out}$ (cfs)	126.	372.	441.
Peak Elevation in Reservoir (ft)	894.63	898.7	899.9
Peak Time (hrs)	24.34	21.0	19.1
Storage Used (ac-ft)	2.7	15.6	19.7
100-YEAR:			
Q $Peak_{in}$ (cfs)	1694.	3294.	3938.
Q $Peak_{out}$ (cfs)	1146.	1849.	2014.
Peak Elevation in Reservoir (ft)	905.3	905.94	906.1
Peak Time (hrs)	24.9	21.4	20.4
Storage Used (ac-ft)	590	607	676

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 42.3

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 49.1

Description of Outlet Structure:

80-inch by 108-inch CMP at Clearwater Creek's crossing of County Road 14. Invert elevation at 891.3.

Hydrologic Information Available for Subwatershed:

"Special Flood Hazard Information for Clearwater Creek," prepared for the RCWD by the Corps of Engineers, dated June 1975.

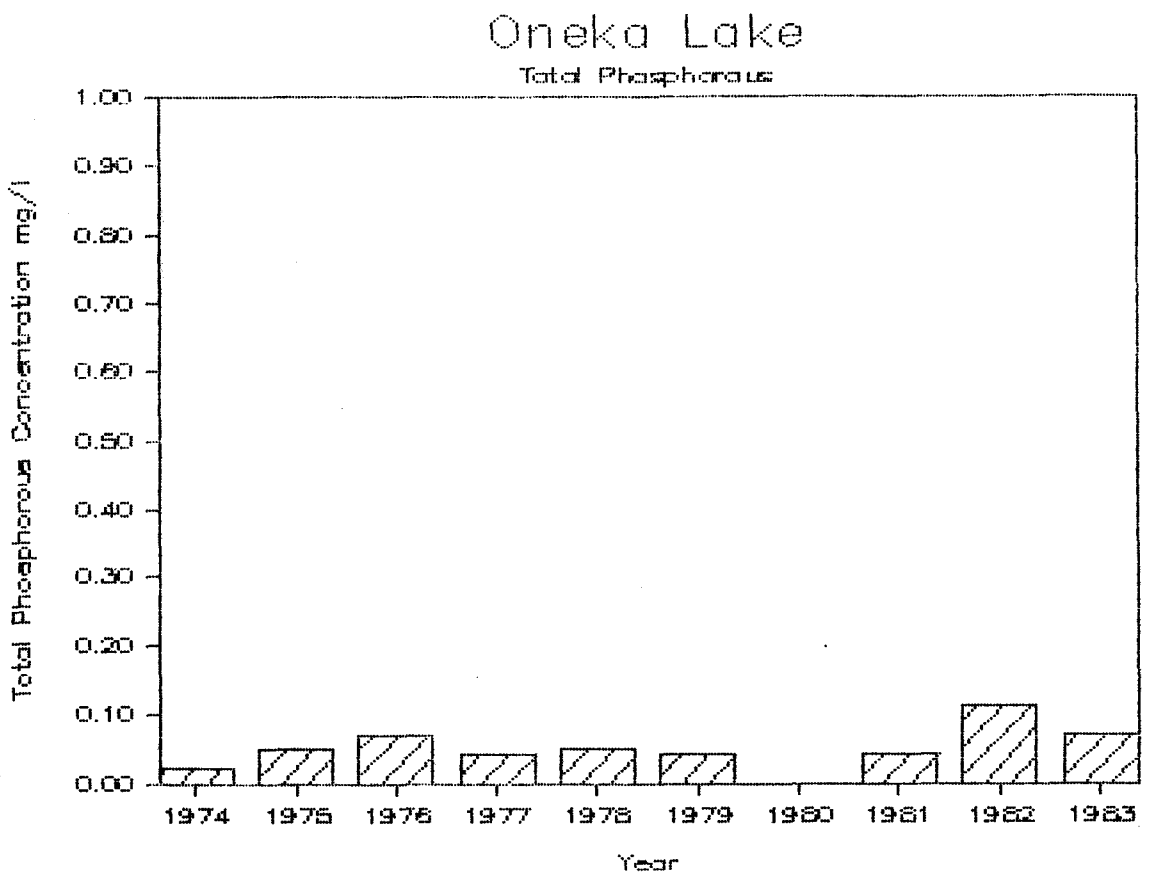
Description of Stormwater Storage Areas Modeled within Watershed:

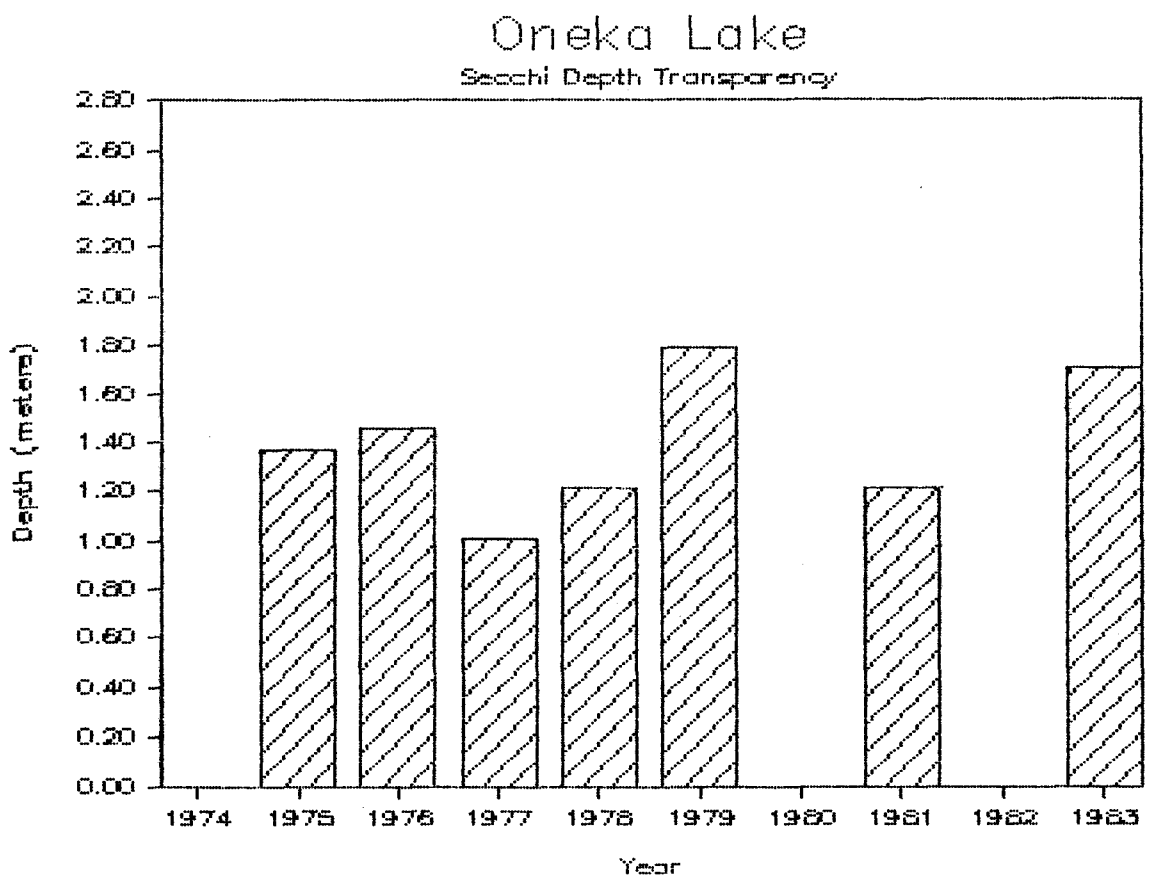
Backwater areas in channel of Clearwater Creek upstream of County Road 14.

WATER QUALITY DATA

ONEKA LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	6	6	6
	Maximum	0.070	0.020	0.110
	Minimum	0.010	0.010	0.010
	Mean	0.020	0.012	0.050
Total Phosphorus (mg/l)	Number	6	6	6
	Maximum	0.11	0.06	0.12
	Minimum	0.02	0.02	0.03
	Mean	0.05	0.04	0.07
Chlorophyll-a (ug/l)	Number	6	6	6
	Maximum	23.0	42.0	6.0
	Minimum	2.0	3.0	1.0
	Mean	10.5	15.2	9.5
Conductivity at 25° C (micromho)	Number	6	6	6
	Maximum	75.0	170.0	280.0
	Minimum	55.0	80.0	64.0
	Mean	63.3	107.5	125.8
Secchi Depth Transparency (meters)	Number	6	6	3
	Maximum	5.00	2.75	1.90
	Minimum	1.20	0.82	1.21
	Mean	2.00	1.33	1.52
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	40.0	7.0
	Minimum	--	25.0	3.0
	Mean	--	32.5	3.8
Total NH_3 + NH_4-N (mg/l)	Number	6	6	6
	Maximum	1.40	0.61	0.76
	Minimum	0.01	0.04	0.02
	Mean	0.49	0.36	0.19
Dissolved Oxygen (mg/l)	Number	6	6	10
	Maximum	10.8	10.4	14.0
	Minimum	5.3	5.8	1.8
	Mean	8.4	8.3	9.3
Temperature (°C)	Number	6	6	10
	Maximum	26.0	23.0	23.5
	Minimum	12.0	18.0	11.0
	Mean	21.5	20.7	18.7
pH	Number	6	6	6
	Maximum	9.8	9.2	9.7
	Minimum	7.3	7.4	7.7
	Mean	8.3	8.3	8.7

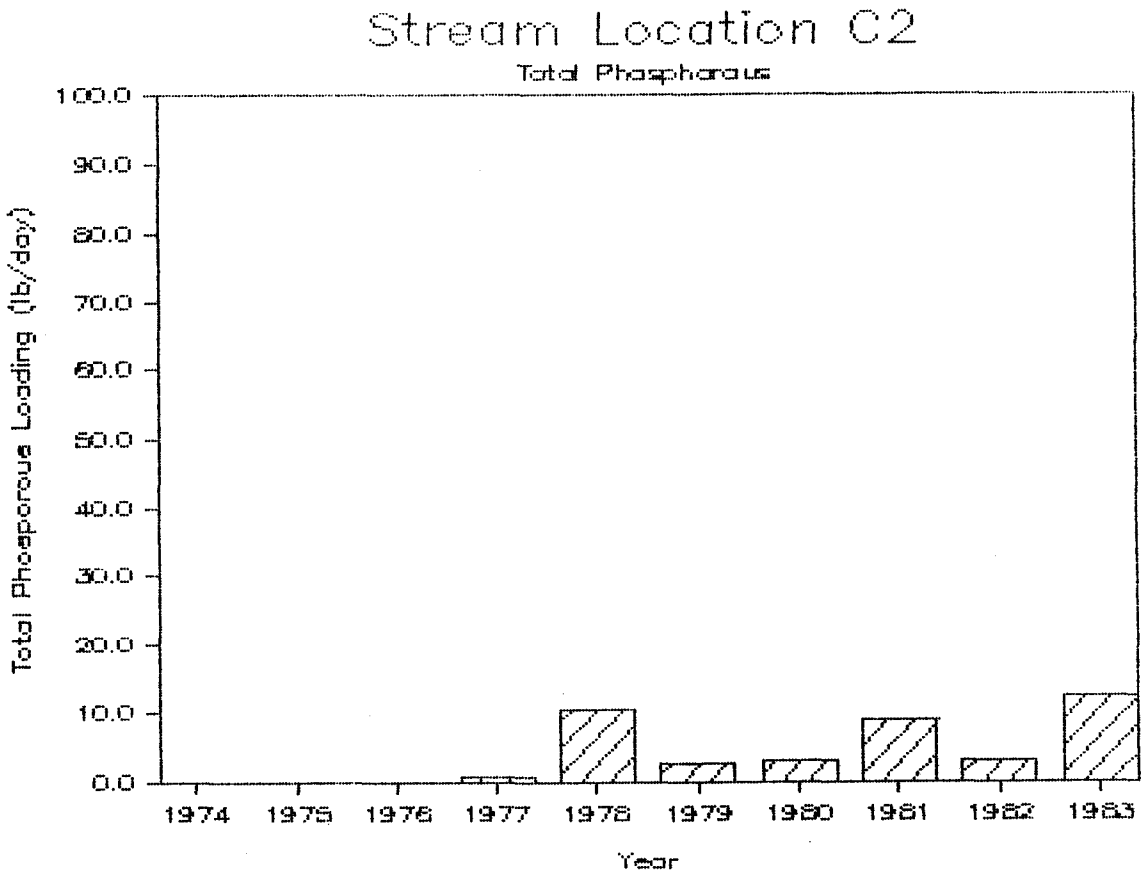

Oneka Lake
Total Phasphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

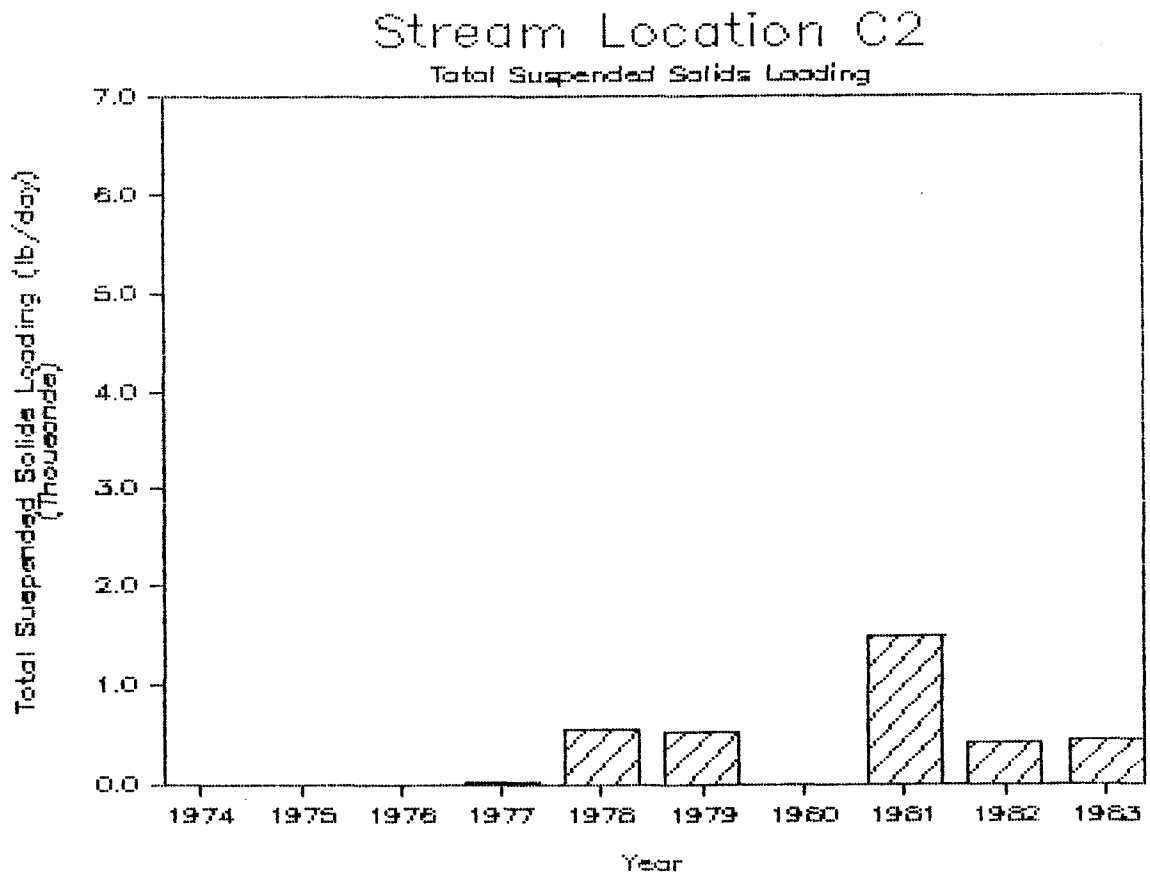

Oneka Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

STREAM LOCATION C2

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	29	28
	Maximum	--	29.7	50.0
	Minimum	--	0.0	0.2
	Mean	--	6.9	11.9
Dissolved Oxygen (mg/l)	Number	0	11	29
	Maximum	--	16.2	17.4
	Minimum	--	6.4	3.2
	Mean	--	11.1	9.1
Water Temperature (°C)	Number	0	12	29
	Maximum	--	25.0	25.0
	Minimum	--	3.0	3.0
	Mean	--	16.1	15.1
Total Kjeldahl Nitrogen (lb/D)	Number	0	15	14
	Maximum	--	368.4	313.6
	Minimum	--	1.5	10.4
	Mean	--	94.9	112.2
Ortho-Phosphorus (lb/D)	Number	0	18	14
	Maximum	--	11.5	26.6
	Minimum	--	0.1	0.6
	Mean	--	1.9	4.9
Total Phosphorus (lb/D)	Number	0	18	14
	Maximum	--	27.7	33.7
	Minimum	--	0.1	0.7
	Mean	--	4.9	8.4
pH	Number	11	19	15
	Maximum	8.5	8.3	8.5
	Minimum	6.9	5.3	7.2
	Mean	7.6	7.8	7.9
Turbidity Turbidity Meter Hach (FTU)	Number	3	0	0
	Maximum	9.0	--	--
	Minimum	5.0	--	--
	Mean	6.3	--	--
Total Non-Filterable Residue (lb/D)	Number	0	17	14
	Maximum	--	2148.9	4013.0
	Minimum	--	6.5	12.9
	Mean	--	391.4	821.0
Total Chloride (lb/D)	Number	0	6	14
	Maximum	--	2734.6	4013
	Minimum	--	161.8	181.2
	Mean	--	1015.4	1520.4

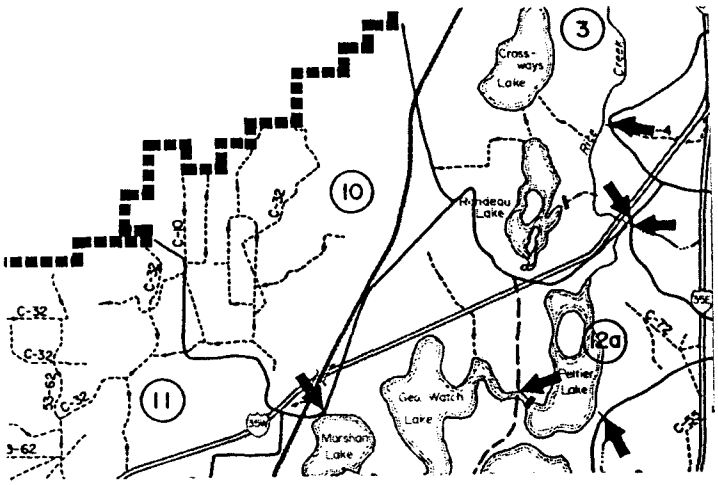

Stream Location C2
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location C2
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No. 10, Lino Lakes, is approximately 6.62 square miles. There are no lakes within this subwatershed. When this subwatershed was modeled using TR-20, no storage areas were used, however, some storage does exist within the county ditches of the subwatershed. In order to do a detailed modeling of this subwatershed, additional field work would be required. Currently, the Watershed District does not have any water quality monitoring stations in this subwatershed.

WATERSHED NO: 10
WATERSHED NAME: Lino Lakes

AREA OF
SUBWATERSHED (sq mi): 6.62



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 6.62 ~~112.98~~

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	91.	136.	151.
Q $Peak_{out}$ (cfs)	91.	136.	151.
Peak Elevation in Reservoir (ft)	---- No Peak Elevation Established ---		
Peak Time (hrs)	28.74	26.5	24.6
Storage Used (ac-ft)	---- No Peak Elevation Established ---		
100-YEAR:			
Q $Peak_{in}$ (cfs)	604.	759.	854.
Q $Peak_{out}$ (cfs)	604.	759.	854.
Peak Elevation in Reservoir (ft)	---- No Peak Elevation Established ---		
Peak Time (hrs)	27.42	25.52	23.7
Storage Used (ac-ft)	---- No Storage Reservoirs Modeled ---		

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 6.71

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi):

No storage reservoirs modeled.

Description of Outlet Structure:

Hydrologic Information Available for Subwatershed:

"Flood Insurance Study for the City of Lino Lakes," dated May 1982.

Description of Stormwater Storage Areas Modeled within Watershed:

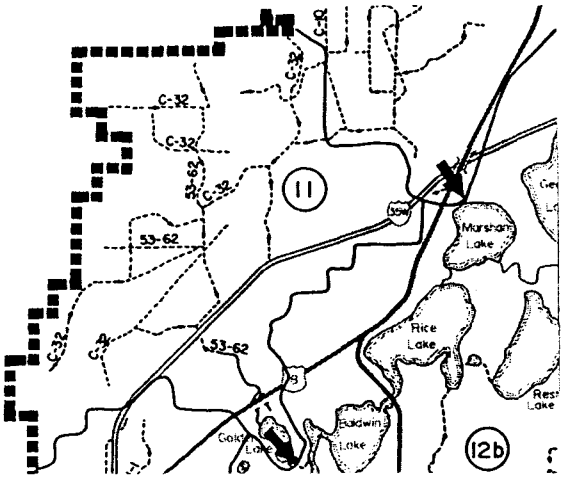
None identified.

Note: The peak discharge rates shown for this watershed are based on the assumption that no storage or significant restriction is present in downstream drainage channels. This is not entirely true and a more detailed analysis is required to more accurately establish the discharge rates from this subwatershed.

Subwatershed No. 11, Blaine, is approximately 10.28 square miles. Golden Lake is the only lake within the subwatershed. No storage areas were modeled, but some storage is present in the flat plains of the subwatershed. Detailed field work will be required to determine the area and extent of storage. The downstream outlet of the subwatershed is Golden Lake. Water quality is a particular concern and an EPA Clean Lakes Grant has been approved for the lake. There is only limited data available for Golden Lake. The Trophic State Index for the lake is 70, and the secchi disc values for the lake range from 1.21 meters to 0.54 meters, according to the diagnostic-feasibility study for the lake.

WATERSHED NO: 11
WATERSHED NAME: Blaine

AREA OF
SUBWATERSHED (sq mi): 10.28



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 10.28

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	147.	302.	321.
Q $Peak_{out}$ (cfs)	147.	302.	321.
Peak Elevation in Reservoir (ft)	---- No Storage Reservoirs Modeled ---		
Peak Time (hrs)	23.91	21.74	20.9
Storage Used (ac-ft)	---- No Storage Reservoirs Modeled ---		
100-YEAR:			
Q $Peak_{in}$ (cfs)	1169	1671	1788
Q $Peak_{out}$ (cfs)	1169	1671	1788
Peak Elevation in Reservoir (ft)	---- No Storage Reservoirs Modeled ---		
Peak Time (hrs)	22.4	21.0	20.2
Storage Used (ac-ft)	---- No Storage Reservoirs Modeled ---		

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 162.5

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi):

No storage reservoirs modeled.

Description of Outlet Structure:

Dam at Golden Lake Outlet.

Hydrologic Information Available for Subwatershed:

"Comprehensive Storm Drainage Plan for the City of Blaine," dated April 1975.

Description of Stormwater Storage Areas Modeled within Watershed:

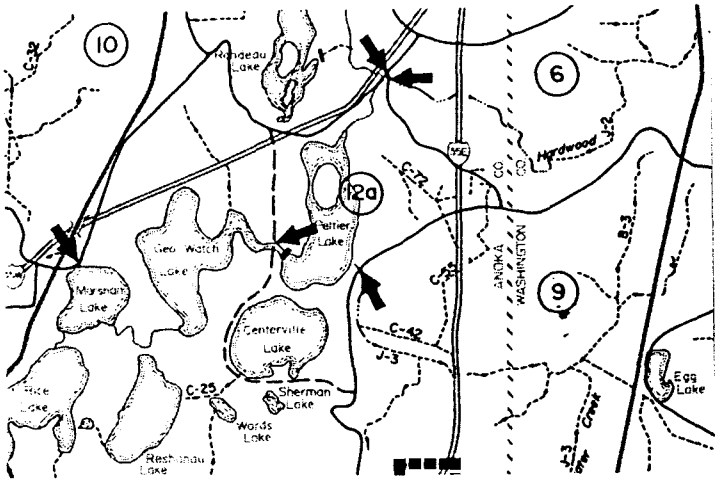
No reservoirs modeled.

Note: A more detailed modeling effort is required for this watershed.

Subwatershed No. 12A, Peltier Lake, is approximately 4.60 square miles. There are two lakes within this subwatershed: Peltier Lake and Centerville Lake. Peltier Lake dam provides for storage of stormwater in upstream lakes and Rice Creek in watersheds 12A and 3. The storage provided behind the dam is primarily a function of the large area that is inundated upstream rather than a restrictive outlet being present. The water quality of Peltier Lake has been monitored for approximately 10 years. The Trophic State Index for Peltier Lake is 84, which indicates the water is generally of poor quality. There has been an increase in chlorophyll concentrations recently. Total phosphorus concentrations are increasing slightly, and the secchi depth readings have been declining. There is also a stream water quality monitoring station within the subwatershed. This station indicates that phosphorus loading from the lake has remained relatively constant.

WATERSHED NO: 12A
WATERSHED NAME: Peltier Lake

AREA OF
SUBWATERSHED (sq mi): 4.60



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 106.36

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	139/297	584/615	625.6/783
Q $Peak_{out}$ (cfs)	100.66	206.6	210.
Peak Elevation in Reservoir (ft)	884.93	885.15	885.15
Peak Time (hrs)	58.80	50.7	49.5
Storage Used (ac-ft)	576.7	1003.8	1015.8
100-YEAR:			
Q $Peak_{in}$ (cfs)	1104.6/ 2210.43	2127.28/ 2962	2271.7/ 3031.9
Q $Peak_{out}$ (cfs)	980.59	1290.84	1311.8
Peak Elevation in Reservoir (ft)	886.18	886.50	886.52
Peak Time (hrs)	48.4	45.28	44.2
Storage Used (ac-ft)	3280.4	4257.0	4334.

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 12.1

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 245.2

Includes Watershed No. 12a and Watershed No. 3.

Description of Outlet Structure:

150-foot wide dam with spillway invert elevation at 884.60.

Hydrologic Information Available for Subwatershed:

"Hydrologic Report for the City of Lino Lakes," dated May 1980.

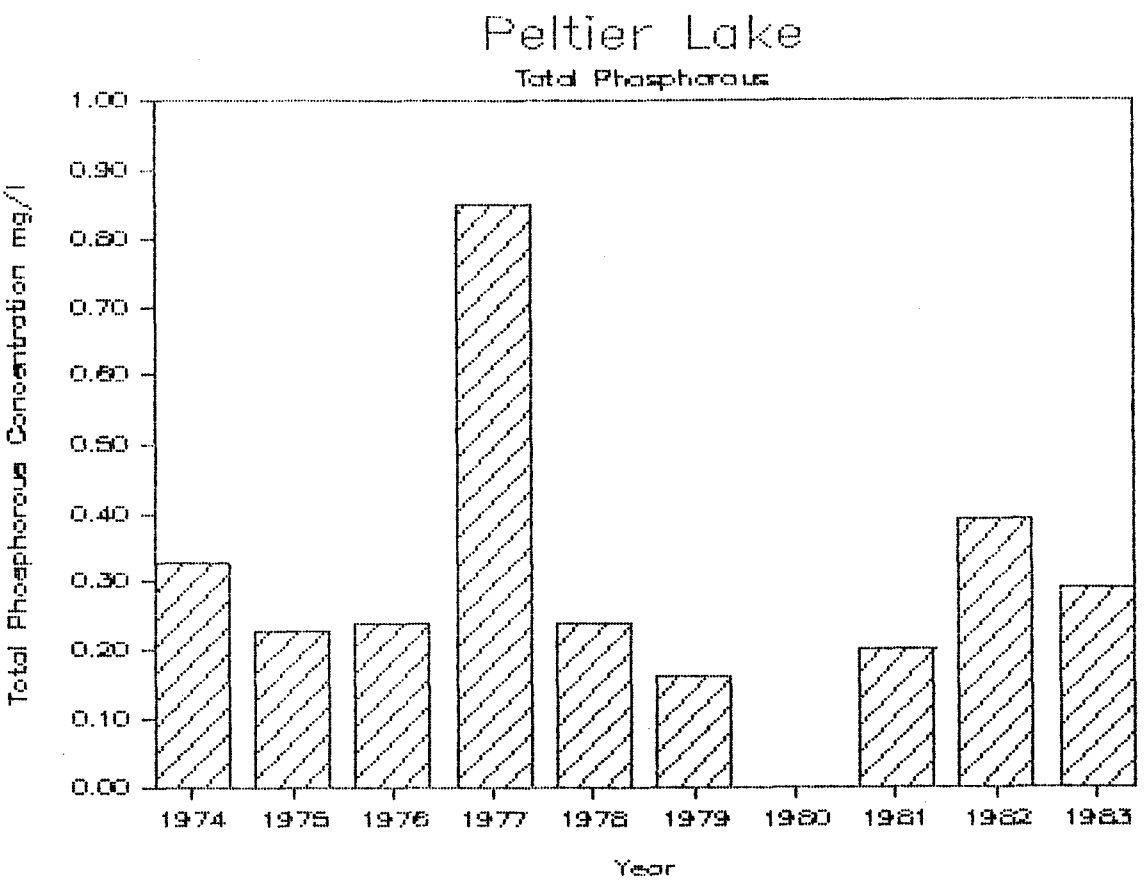
Description of Stormwater Storage Areas Modeled within Watershed:

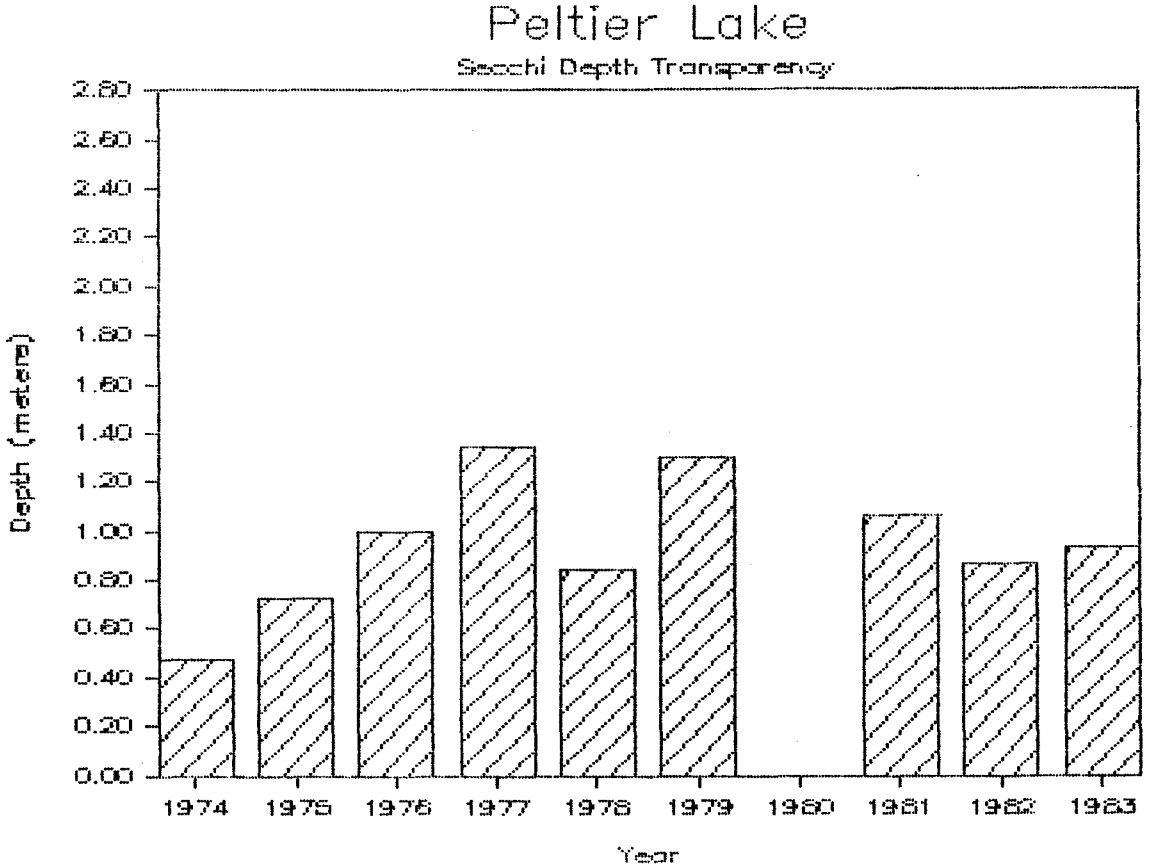
Peltier Lake, Centerville Lake, Rondeau Lake, Crossways Lake, and backwater areas of Rice Creek upstream of I-35W.

WATER QUALITY DATA

PELTIER LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	10	6
	Maximum	0.410	0.754	0.360
	Minimum	0.006	0.027	0.060
	Mean	0.162	0.251	0.143
Total Phosphorus (mg/l)	Number	7	10	6
	Maximum	0.46	0.93	0.57
	Minimum	0.15	0.13	0.17
	Mean	0.26	0.33	0.26
Chlorophyll-a (ug/l)	Number	7	10	6
	Maximum	49.0	52.0	102.0
	Minimum	15.0	10.0	12.0
	Mean	31.1	31.0	42.3
Conductivity at 25° C (micromho)	Number	7	10	5
	Maximum	440.0	525.0	350.0
	Minimum	200.0	380.0	290.0
	Mean	312.9	427.5	316.0
Secchi Depth Transparency (meters)	Number	7	6	3
	Maximum	1.52	1.83	1.14
	Minimum	0.46	0.76	0.60
	Mean	1.04	1.16	0.93
Total Chloride (mg/l)	Number	0	4	6
	Maximum	--	75.0	18.0
	Minimum	--	55.0	13.0
	Mean	--	61.3	15.5
Total NH_3 + NH_4-N (mg/l)	Number	7	10	6
	Maximum	4.20	1.88	0.59
	Minimum	0.15	0.26	0.03
	Mean	1.31	0.74	0.25
Dissolved Oxygen (mg/l)	Number	7	10	6
	Maximum	9.6	8.8	11.2
	Minimum	3.8	0.5	1.3
	Mean	7.1	5.8	7.3
Temperature (°C)	Number	7	10	6
	Maximum	26.0	24.0	21.0
	Minimum	16.0	19.0	17.0
	Mean	20.6	21.2	19.0
pH	Number	7	10	6
	Maximum	9.0	8.9	8.9
	Minimum	7.3	7.2	8.0
	Mean	8.3	8.1	8.4

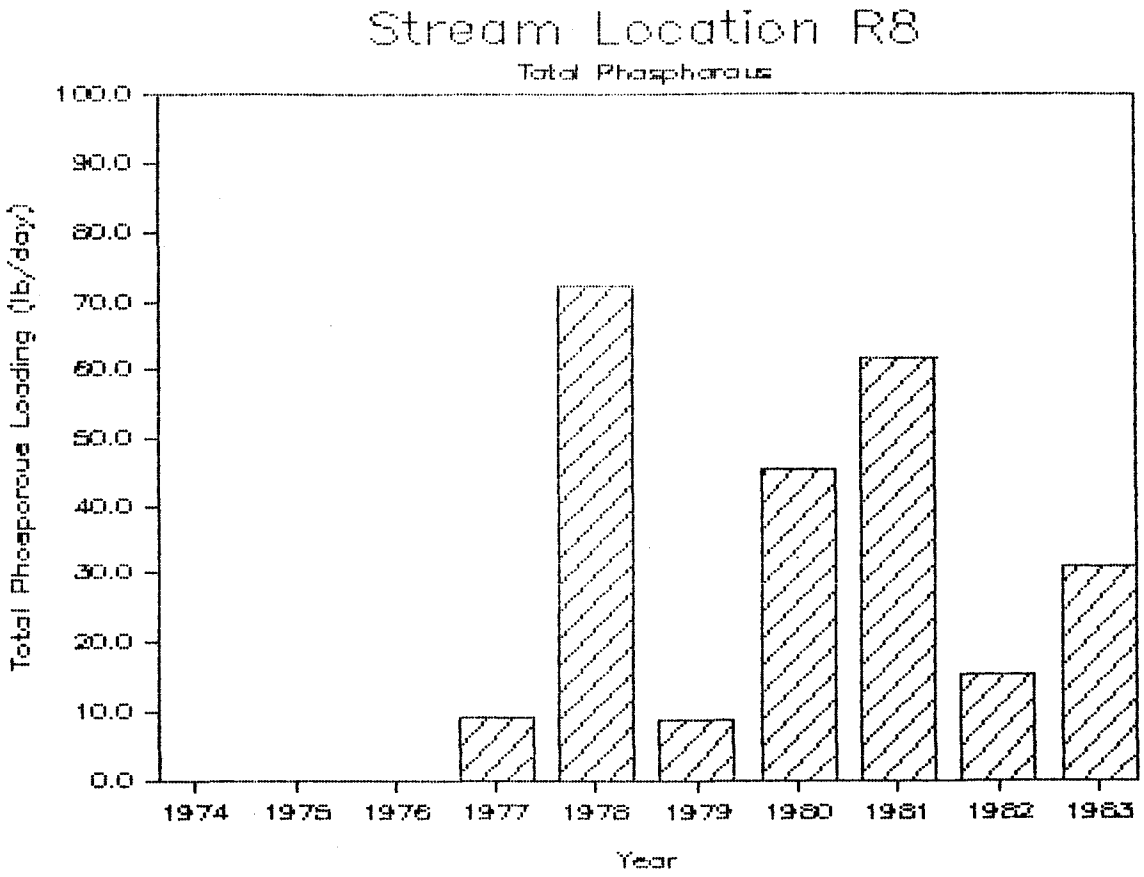

Peltier Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

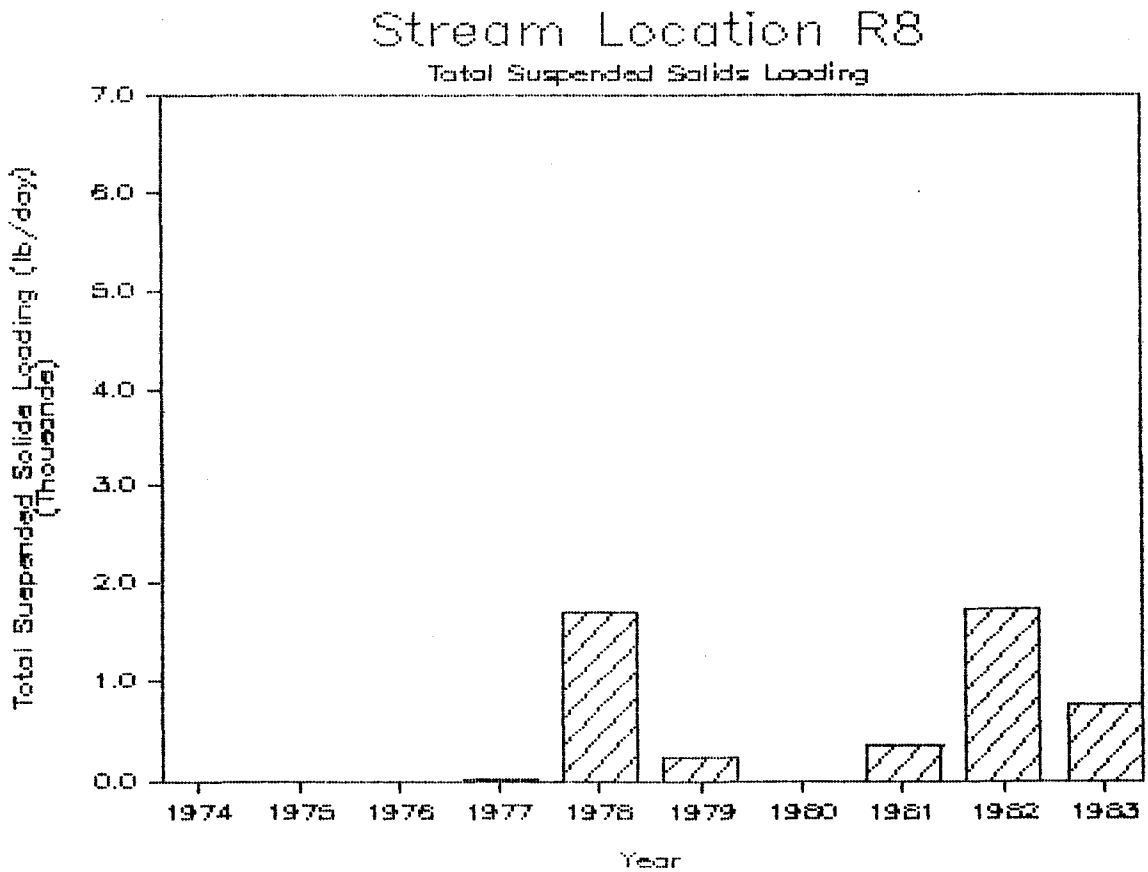

Peltier Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

STREAM LOCATION R8

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	30	26
	Maximum	--	75.1	175.0
	Minimum	--	0.0	0.0
	Mean	--	16.1	41.5
Dissolved Oxygen (mg/l)	Number	0	10	29
	Maximum	--	13.5	15.0
	Minimum	--	2.8	6.0
	Mean	--	8.1	10.3
Water Temperature (°C)	Number	0	12	29
	Maximum	--	27.0	28.5
	Minimum	--	3.0	2.5
	Mean	--	17.0	16.4
Total Kjeldahl Nitrogen (lb/D)	Number	0	11	11
	Maximum	--	850.7	996.8
	Minimum	--	0.0	0.0
	Mean	--	406.6	364.9
Ortho-Phosphorus (lb/D)	Number	0	16	13
	Maximum	--	81.2	96.3
	Minimum	--	0.0	0.0
	Mean	--	16.5	22.5
Total Phosphorus (lb/D)	Number	0	16	13
	Maximum	--	95.2	133.0
	Minimum	--	0.0	0.0
	Mean	--	36.5	35.6
pH	Number	10	16	16
	Maximum	9.2	8.9	8.7
	Minimum	6.9	7.4	7.6
	Mean	7.8	8.2	8.2
Turbidity Turbidity Meter Hach (FTU)	Number	7	0	0
	Maximum	25.0	--	--
	Minimum	2.0	--	--
	Mean	10.9	--	--
Total Non-Filterable Residue (lb/D)	Number	0	14	17
	Maximum	--	4034.5	1682.9
	Minimum	--	0.0	0.0
	Mean	--	836.5	978.3
Total Chloride (lb/D)	Number	0	6	13
	Maximum	--	7696.4	6990.3.6
	Minimum	--	0.0	0.0
	Mean	--	1983.3	2901.7

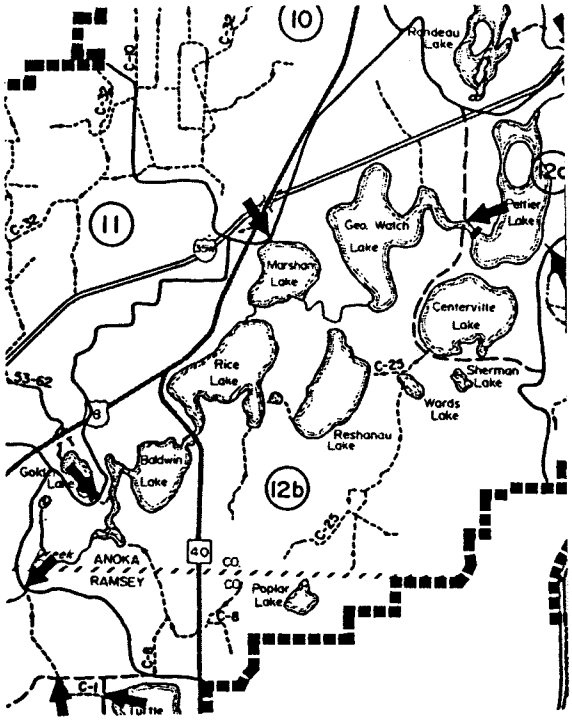

Stream Location R8
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location R8
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed No. 12B has approximately 19.15 square miles. The lakes within the subwatershed include George Watch, Marshan (Forsham), Reshanau, Rice, and Baldwin. The modeling effort for this subwatershed indicates that there is a relatively dramatic increase in inflow rates between the existing condition and proposed development conditions. However, the peak elevations within this subwatershed tend to increase at a relatively low rate, and discharge rates will virtually not increase. Water quality in George Watch Lake is generally affected by the flow-through of Rice Creek. Chlorophyll concentrations appear to have decreased rather dramatically over the last 10 years. The Trophic State Index has also improved. Water quality information shows a similar patter for Forsham Lake (Marshan) with a reduction in phosphorus as well as chlorophyll, and an improvement in the Trophic Stae Index. Water quality information from Reshanau Lake shows the level of total phosphorus is less than the other lakes within the subwatershed, but is rising slightly. Chlorophyll levels are moving slightly downward; however, this reduction is slight enough so that most likely no change would be observed by recreational users of this lake. Rice Lake water quality has significantly improved over the last decde, wit the Tropic State Index changing from 90 in 1974-76 to 77 in 1981-83. Water quality information from Baldwin Lake tends to show the same pattern with recent improvements observed in total phosphorus and chlorophyll and an improvement in the Trophic State Index from 93 in 1974-76 to 83 in 1976-81. Water quality information from stream station R6 indicates a relatively dramatic drop in phosphorus loadings.

There is a general trend towards better water quality within this subwatershed, with reduced nutrient loading downstream and reduced pollutant concentrations in the lakes.

WATERSHED NO: 12B
WATERSHED NAME: Baldwin Lake



AREA OF SUBWATERSHED (sq mi): 19.15

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 142.41

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	99.	417.	526.
Q $Peak_{out}$ (cfs)	17.	33.	33.
Peak Elevation in Reservoir (ft)	879.83	880.64	880.67
Peak Time (hrs)	236.0	226.0	225.0
Storage Used (ac-ft)	1311.4	2636.0	2685.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	1083	4623	5396
Q $Peak_{out}$ (cfs)	130	147	148
Peak Elevation in Reservoir (ft)	883.01	883.85	883.88
Peak Time (hrs)	30.6	265.0	267.0
Storage Used (ac-ft)	10,362.9	14,806.0	14.965.2

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 1.03

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 773

Description of Outlet Structure:

Rice Creek at its crossing with Lexington Avenue in Shoreveiw. Normal water level 879.0

Hydrologic Information Available for Subwatershed:

"Hydrologic Report for the City of Lino Lakes," dated May 1980.

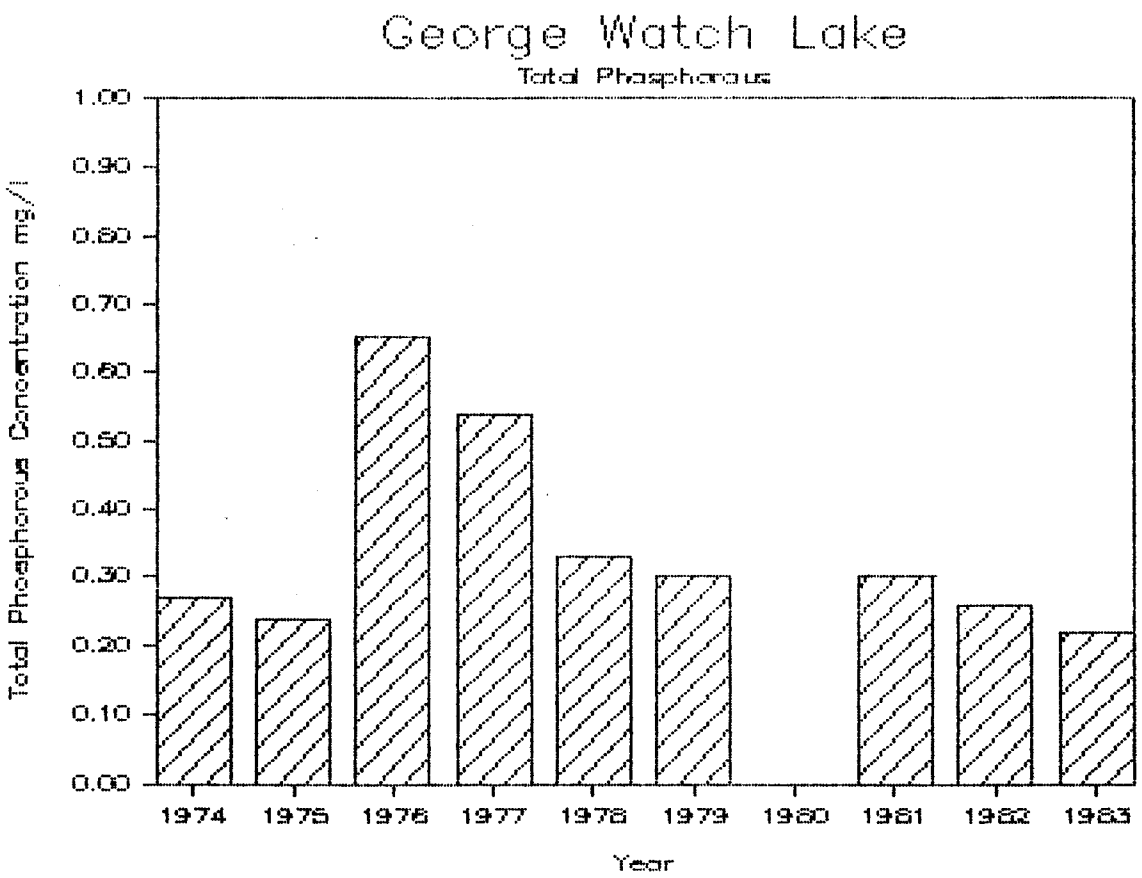
Description of Stormwater Storage Areas Modeled within Watershed:

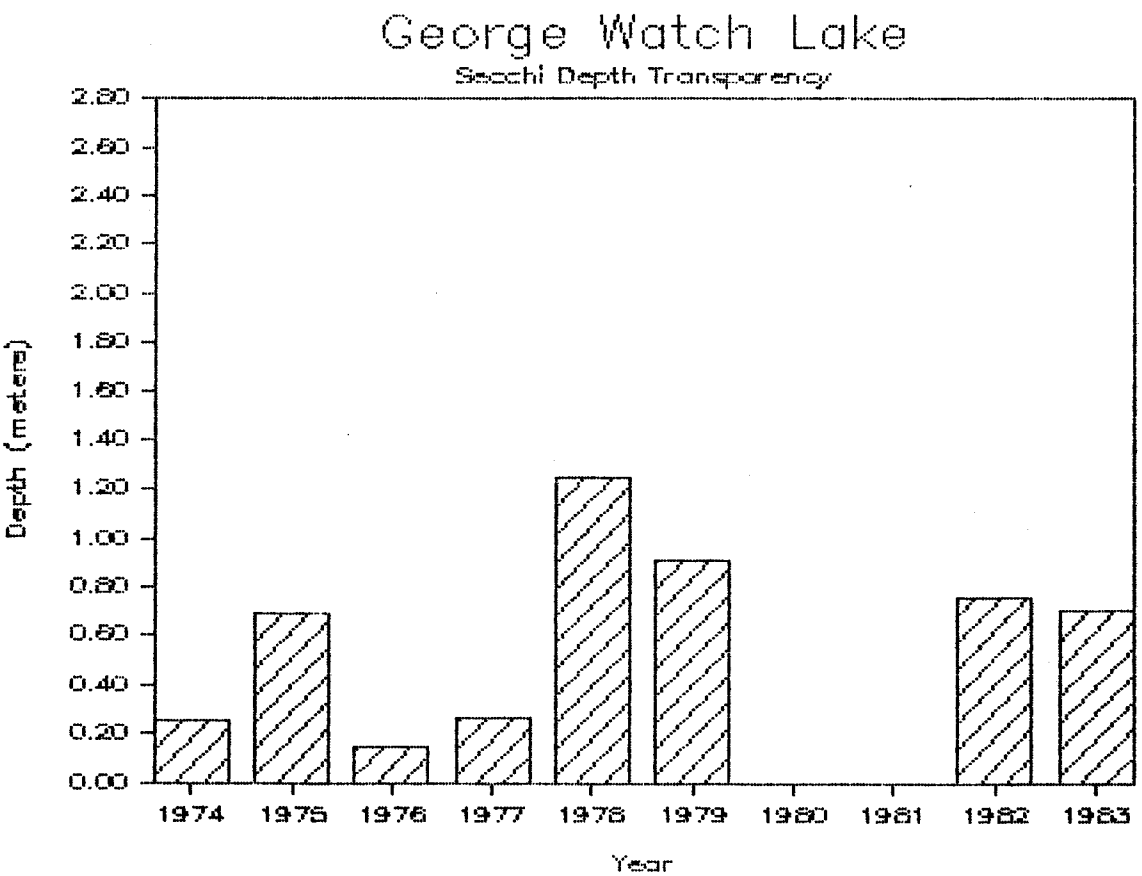
Baldwin, Rice, Marshan, Reshanau, George Watch.

WATER QUALITY DATA

GEORGE WATCH LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	6	6	6
	Maximum	0.350	0.239	0.180
	Minimum	0.006	0.117	0.069
	Mean	0.121	0.200	0.112
Total Phosphorus (mg/l)	Number	6	6	6
	Maximum	0.65	0.76	0.39
	Minimum	0.16	0.14	0.20
	Mean	0.32	0.39	0.26
Chlorophyll-a (ug/l)	Number	5	60	6
	Maximum	144.0	534.0	130.0
	Minimum	21.0	4.0	7.0
	Mean	81.2	166.0	36.3
Conductivity at 25° C (micromho)	Number	6	6	6
	Maximum	320.0	500.0	370.0
	Minimum	220.0	350.0	250.0
	Mean	268.3	412.5	303.3
Secchi Depth Transparency (meters)	Number	6	6	4
	Maximum	1.09	1.52	1.00
	Minimum	0.15	0.15	0.01
	Mean	0.45	0.81	0.54
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	65.0	17.0
	Minimum	--	40.0	12.0
	Mean	--	52.5	14.3
Total NH_3 + NH_4-N (mg/l)	Number	6	6	6
	Maximum	1.96	6.32	0.87
	Minimum	0.49	0.44	0.05
	Mean	1.19	1.86	0.44
Dissolved Oxygen (mg/l)	Number	6	6	9
	Maximum	13.2	9.1	10.8
	Minimum	7.1	3.1	5.6
	Mean	9.9	6.4	8.1
Temperature (°C)	Number	6	6	9
	Maximum	30.0	23.0	21.5
	Minimum	14.0	18.2	15.5
	Mean	21.5	20.5	19.7
pH	Number	6	6	6
	Maximum	10.3	11.0	8.6
	Minimum	7.5	7.5	8.0
	Mean	8.6	8.8	8.2

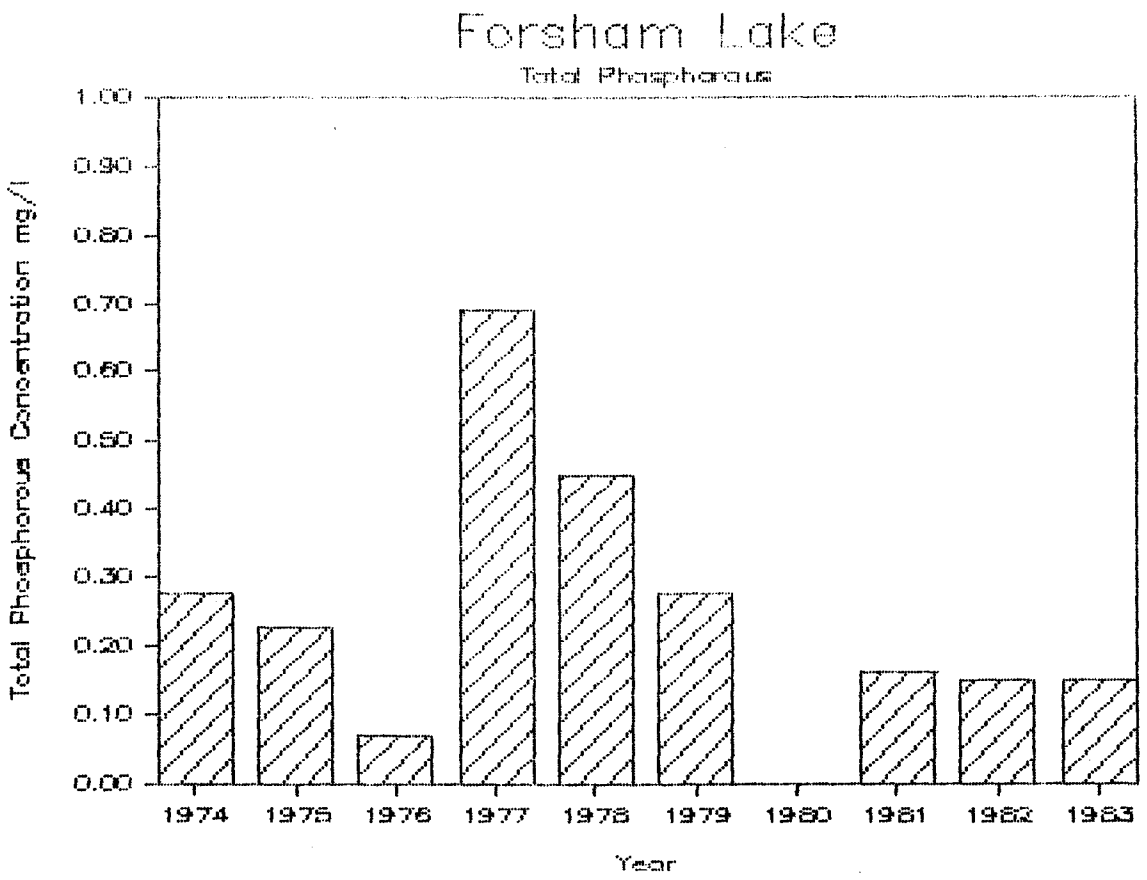

George Watch Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

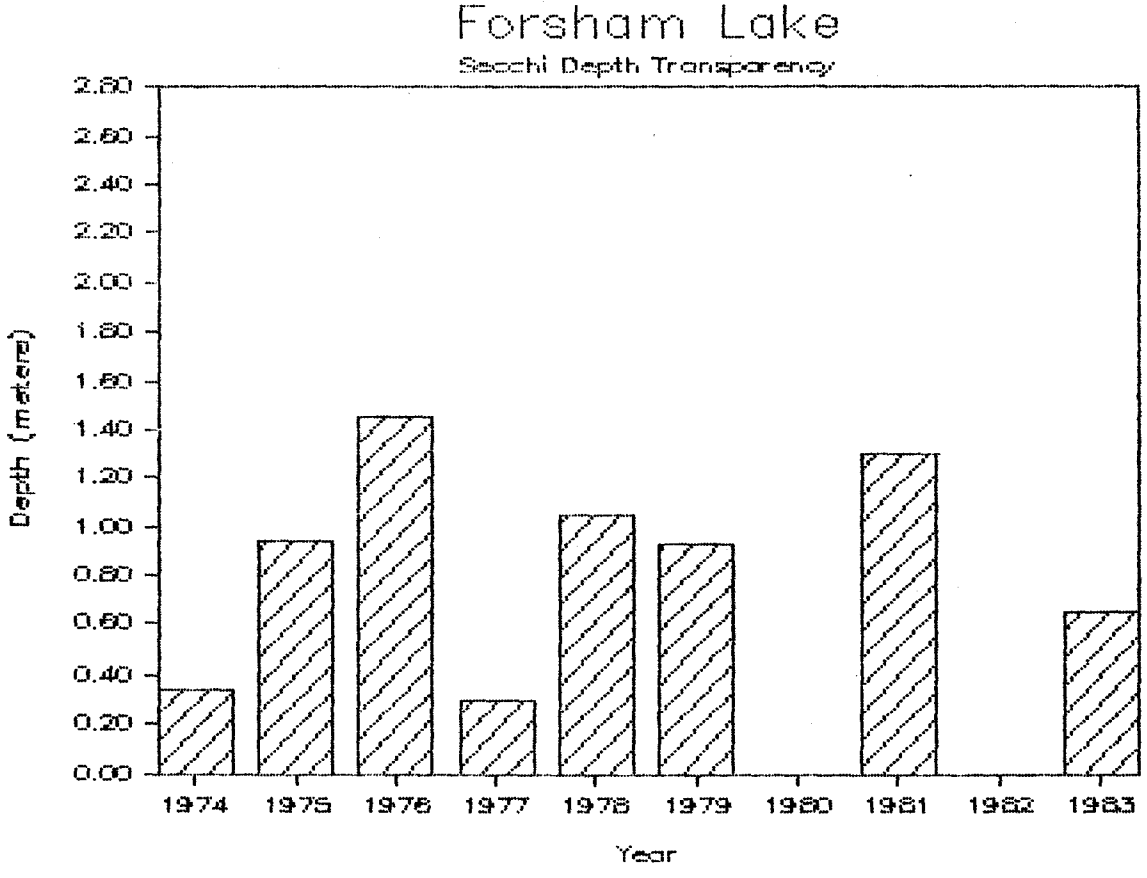

George Watch Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

FORSHAM LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	5	6	6
	Maximum	0.380	0.520	0.090
	Minimum	0.007	0.084	0.030
	Mean	0.133	0.310	0.052
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.42	0.86	0.20
	Minimum	0.03	0.13	0.11
	Mean	0.20	0.47	0.15
Chlorophyll-a (ug/l)	Number	7	6	6
	Maximum	133.0	385.0	128.0
	Minimum	6.0	3.0	6.0
	Mean	74.6	74.3	42.5
Conductivity at 25° C (micromho)	Number	7	6	6
	Maximum	335.0	650.0	360.0
	Minimum	70.0	300.0	270.0
	Mean	236.4	488.3	298.3
Secchi Depth Transparency (meters)	Number	6	6	3
	Maximum	1.60	1.52	1.30
	Minimum	0.35	0.30	0.55
	Mean	1.02	0.76	0.87
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	55.0	16.0
	Minimum	--	45.0	14.0
	Mean	--	50.0	45.5
Total NH_3 + NH_4-N (mg/l)	Number	7	6	4
	Maximum	1.82	1.50	1.44
	Minimum	0.20	0.36	0.08
	Mean	0.78	0.89	0.32
Dissolved Oxygen (mg/l)	Number	7	6	6
	Maximum	9.8	12.4	13.6
	Minimum	5.3	1.0	4.4
	Mean	8.1	5.6	9.0
Temperature (°C)	Number	7	6	7
	Maximum	25.0	25.0	21.0
	Minimum	10.0	21.0	18.0
	Mean	20.9	22.4	19.6
pH	Number	7	6	6
	Maximum	9.8	9.3	9.4
	Minimum	7.5	7.2	7.3
	Mean	8.1	8.2	8.4

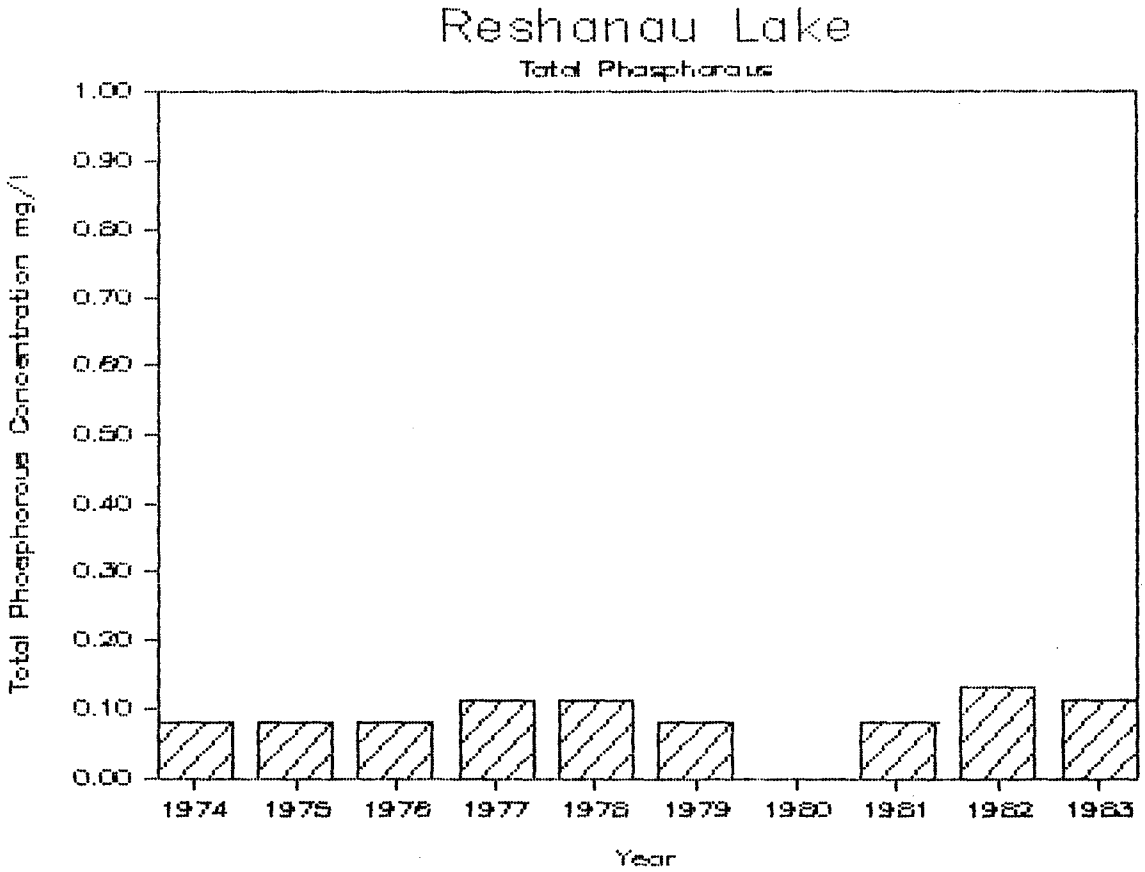

Forsham Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

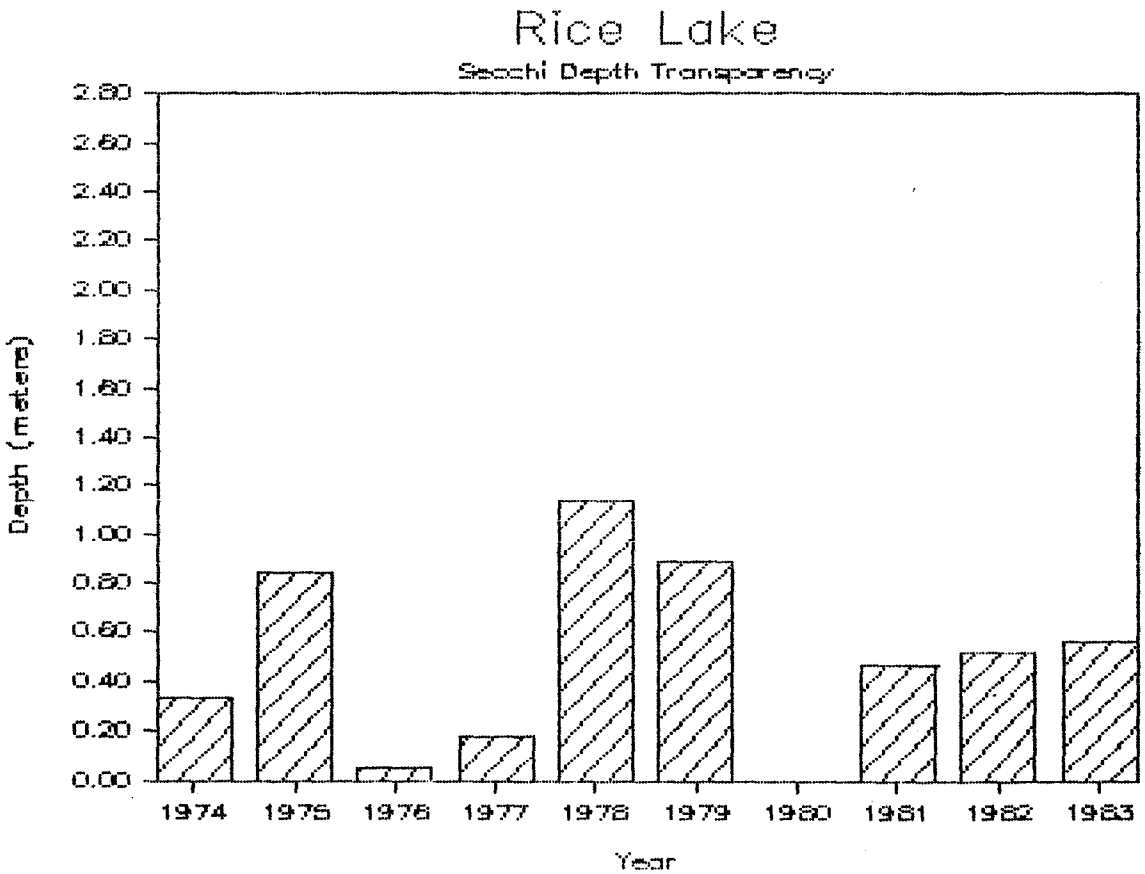

Forsham Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

RESHANAU LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.050	0.091	0.080
	Minimum	0.001	0.003	0.030
	Mean	0.017	0.032	0.050
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.15	0.18	0.21
	Minimum	0.01	0.04	0.05
	Mean	0.08	0.10	0.11
Chlorophyll-a (ug/l)	Number	7	6	6
	Maximum	61.0	74.0	78.0
	Minimum	6.0	4.0	1.0
	Mean	31.0	32.8	27.2
Conductivity at 25° C (micromho)	Number	7	6	5
	Maximum	350.0	450.0	350.0
	Minimum	180.0	220.0	210.0
	Mean	266.4	347.7	260.0
Secchi Depth Transparency (meters)	Number	7	6	5
	Maximum	2.59	1.52	3.20
	Minimum	0.23	0.30	0.38
	Mean	0.73	0.64	1.10
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	60.0	12.0
	Minimum	--	55.0	8.0
	Mean	--	57.5	10.3
Total NH_3 + NH_4-N (mg/l)	Number	7	6	6
	Maximum	1.05	0.91	0.66
	Minimum	0.01	0.22	0.09
	Mean	0.59	0.67	0.22
Dissolved Oxygen (mg/l)	Number	7	6	12
	Maximum	10.6	12.8	13.2
	Minimum	7.6	7.0	3.2
	Mean	9.1	9.9	8.4
Temperature (°C)	Number	7	6	12
	Maximum	26.0	24.0	22.0
	Minimum	15.0	20.5	13.0
	Mean	21.0	22.0	18.3
pH	Number	7	6	6
	Maximum	9.6	10.4	9.2
	Minimum	7.7	8.0	7.6
	Mean	8.4	8.9	8.5

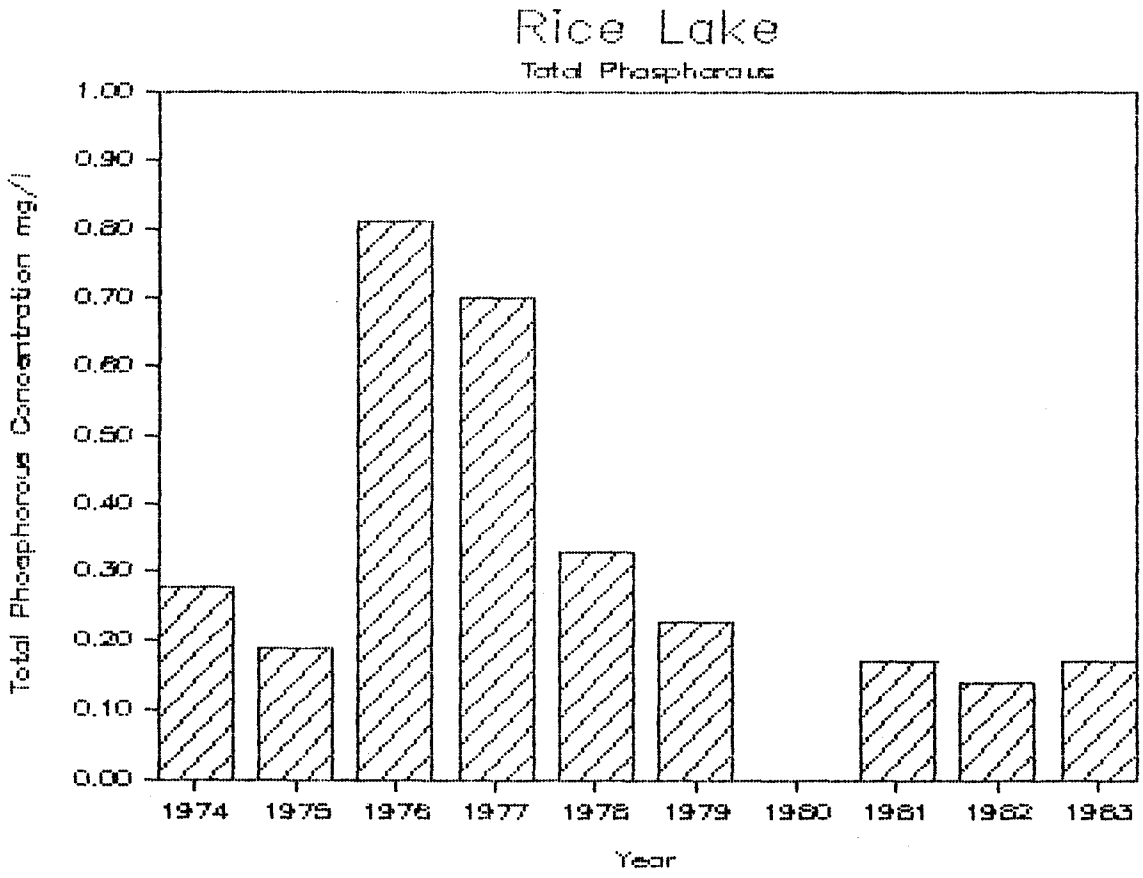

Reshanau Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

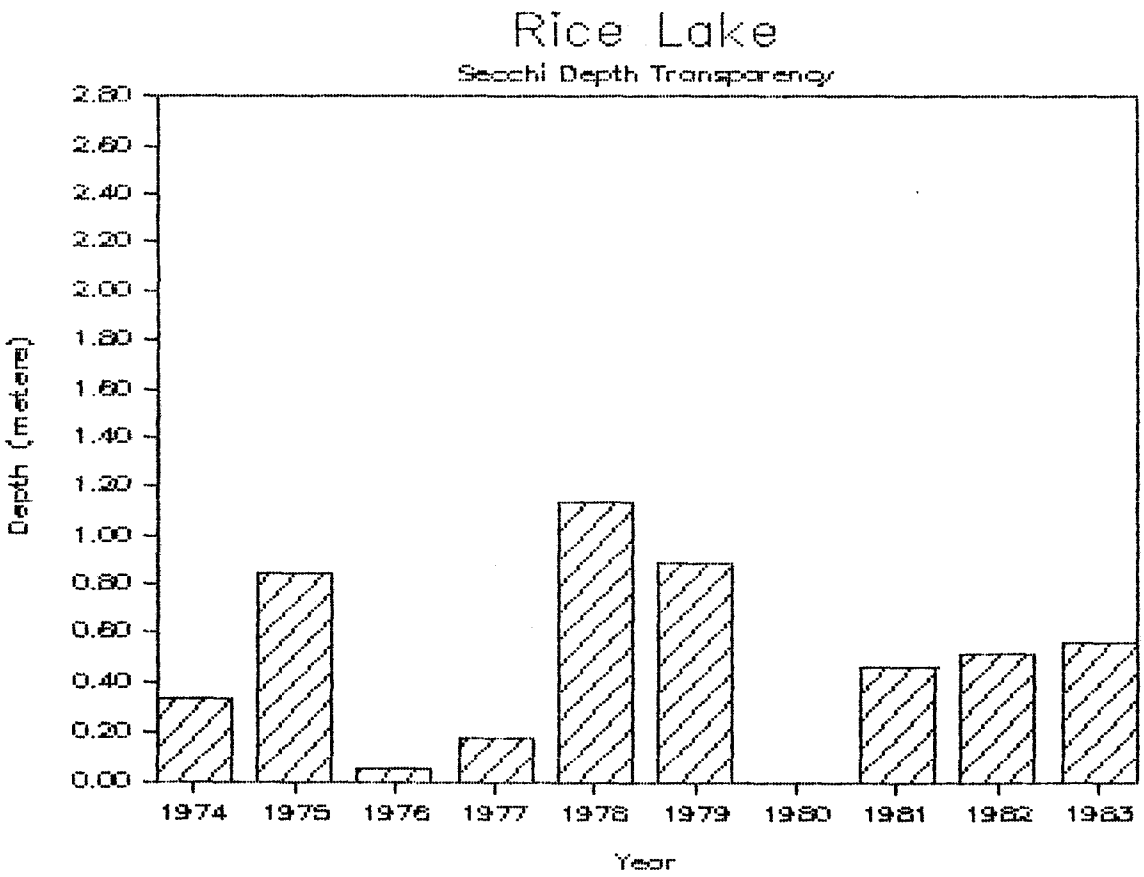

Rice Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

RICE LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.310	0.389	0.090
	Minimum	0.001	0.017	0.030
	Mean	0.113	0.190	0.058
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	1.25	0.79	0.20
	Minimum	0.07	0.10	0.11
	Mean	0.39	0.42	0.16
Chlorophyll-a (ug/l)	Number	7	6	6
	Maximum	493.0	610.0	139.0
	Minimum	26.0	4.0	5.0
	Mean	169.7	162.5	39.3
Conductivity at 25° C (micromho)	Number	7	6	6
	Maximum	395.0	600.0	340.0
	Minimum	270.0	340.0	270.0
	Mean	322.5	435.8	300.0
Secchi Depth Transparency (meters)	Number	7	6	5
	Maximum	1.37	1.52	0.70
	Minimum	0.01	0.06	0.38
	Mean	0.47	0.73	0.53
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	55.0	16.0
	Minimum	--	55.0	12.0
	Mean	--	55.0	14.3
Total NH_3 + NH_4-N (mg/l)	Number	7	6	6
	Maximum	2.13	4.65	1.20
	Minimum	0.10	0.28	0.07
	Mean	0.95	1.40	0.54
Dissolved Oxygen (mg/l)	Number	7	6	9
	Maximum	10.2	13.0	12.5
	Minimum	6.3	4.0	4.1
	Mean	8.7	7.9	8.1
Temperature (°C)	Number	7	6	9
	Maximum	25.0	23.0	22.0
	Minimum	11.0	21.0	16.5
	Mean	20.0	21.8	19.6
pH	Number	7	6	6
	Maximum	9.9	10.9	9.0
	Minimum	7.5	7.5	7.5
	Mean	8.6	8.8	8.4

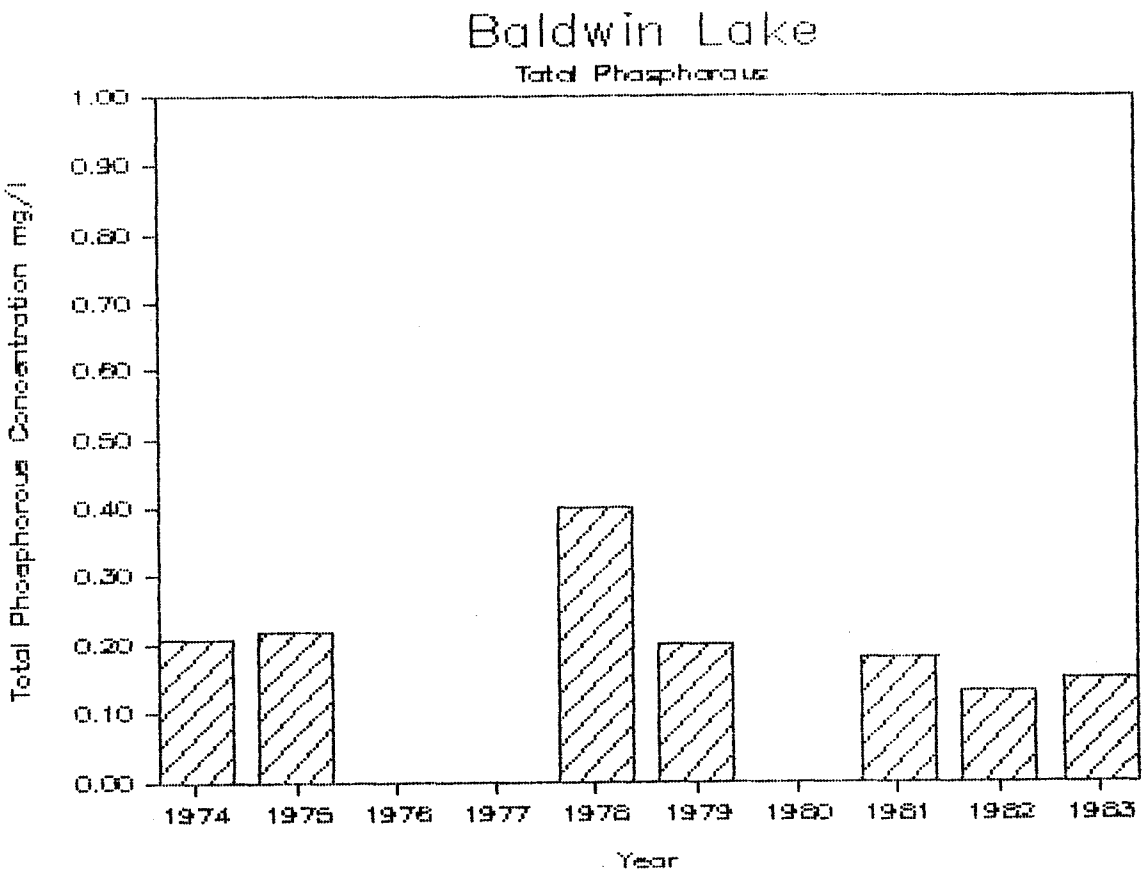

Rice Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

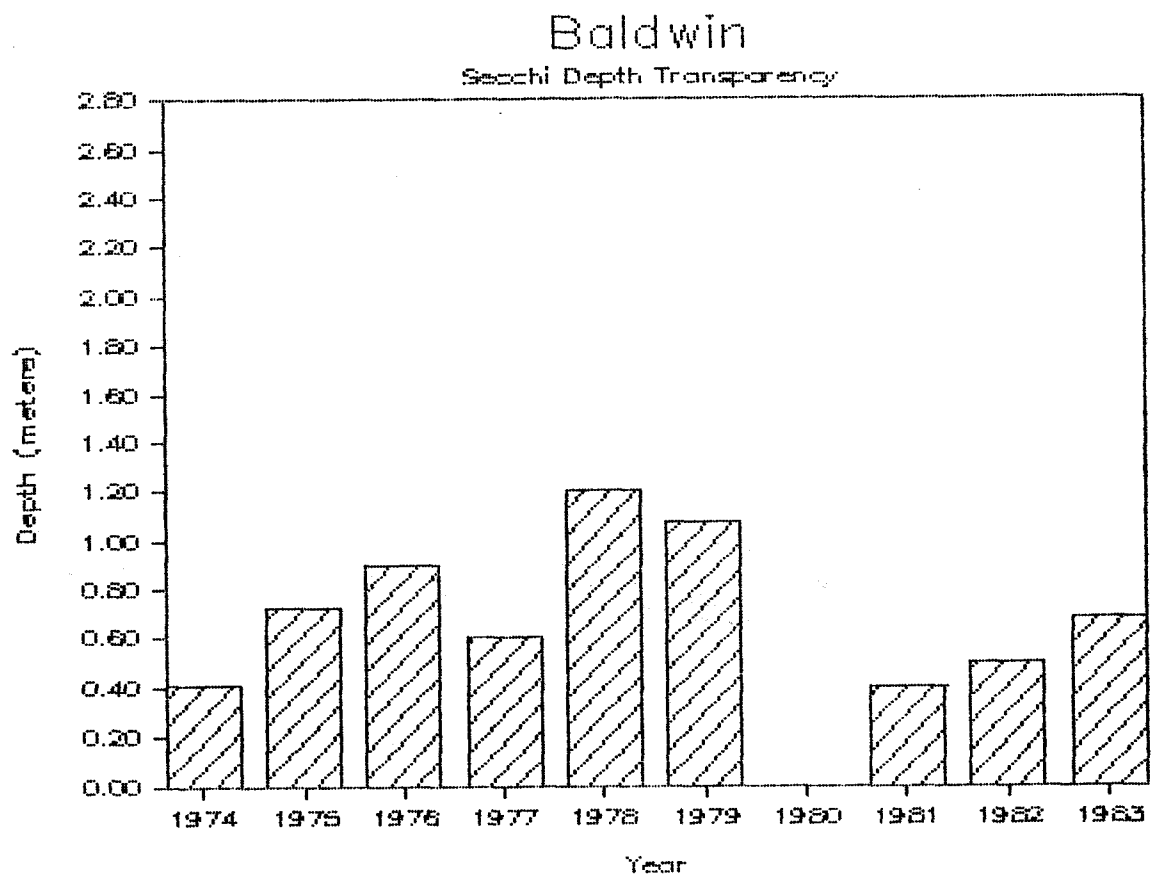

Rice Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

BALDWIN LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.320	0.383	0.070
	Minimum	0.001	0.016	0.040
	Mean	0.107	0.195	0.052
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	2.20	1.59	0.22
	Minimum	0.00	0.09	0.11
	Mean	0.47	0.62	0.15
Chlorophyll-a (ug/l)	Number	7	6	6
	Maximum	231.0	490.0	163.0
	Minimum	15.0	1.0	3.0
	Mean	92.9	109.4	48.7
Conductivity at 25° C (micromho)	Number	7	6	6
	Maximum	350.0	600.0	350.0
	Minimum	279.0	325.0	280.0
	Mean	300.6	439.0	315.0
Secchi Depth Transparency (meters)	Number	6	5	5
	Maximum	1.68	1.32	0.75
	Minimum	0.08	0.30	0.40
	Mean	0.52	0.93	0.47
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	50.0	16.0
	Minimum	--	40.0	10.0
	Mean	--	45.0	13.2
Total NH_3 + NH_4-N (mg/l)	Number	7	6	6
	Maximum	2.13	7.29	1.00
	Minimum	0.24	0.43	0.08
	Mean	1.13	2.59	0.44
Dissolved Oxygen (mg/l)	Number	6	6	9
	Maximum	12.6	12.8	12.8
	Minimum	6.3	4.2	6.1
	Mean	8.7	8.4	8.0
Temperature (°C)	Number	6	6	8
	Maximum	25.0	24.0	22.0
	Minimum	11.0	20.0	15.5
	Mean	20.2	21.8	16.9
pH	Number	7	6	6
	Maximum	9.9	10.8	9.1
	Minimum	7.4	7.4	7.6
	Mean	8.4	8.7	8.4

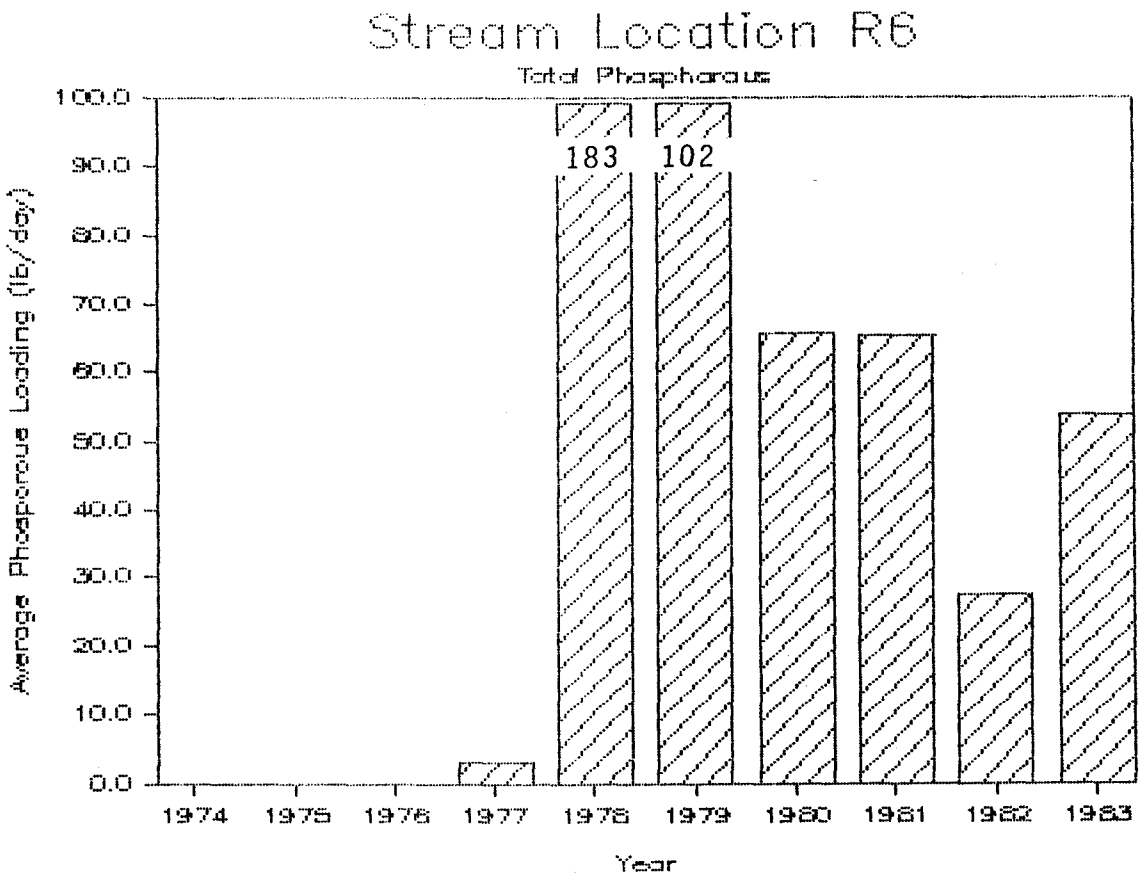

Baldwin Lake
Total Phasphoraus
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

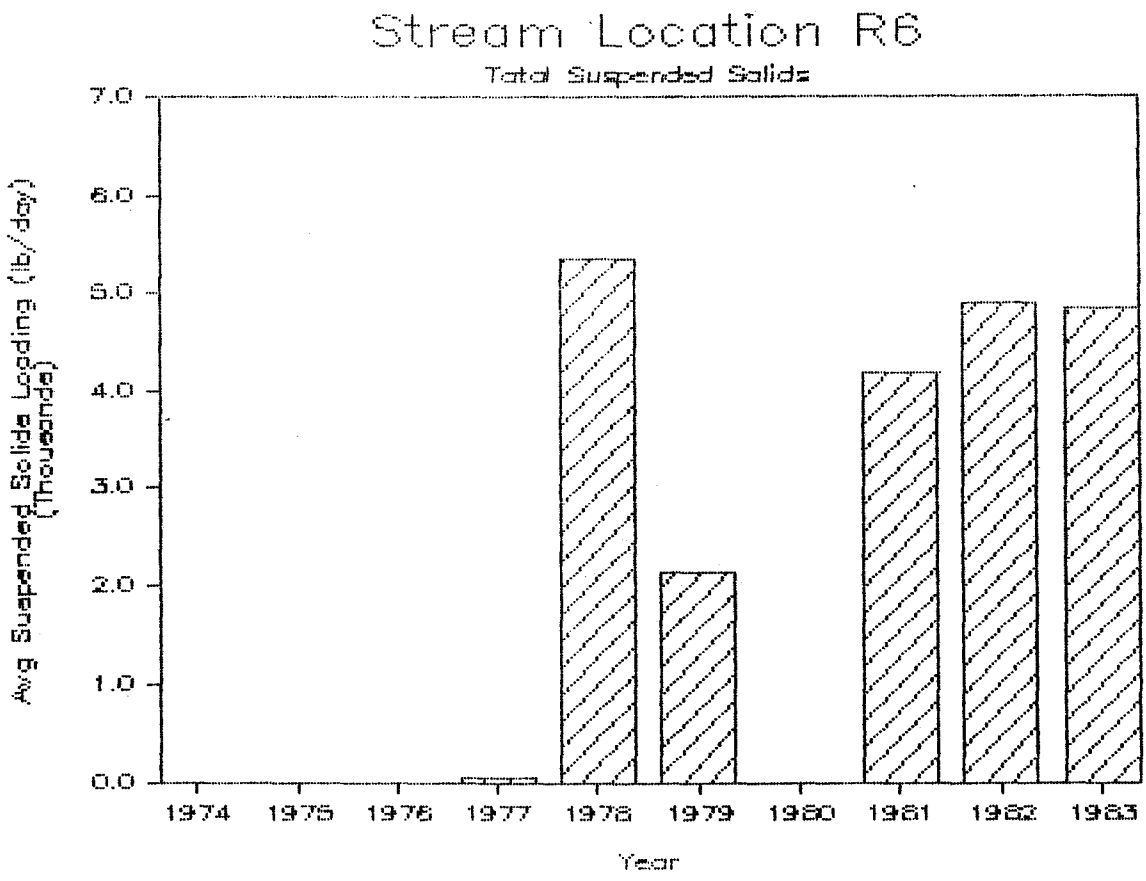

Baldwin
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

STREAM LOCATION R6

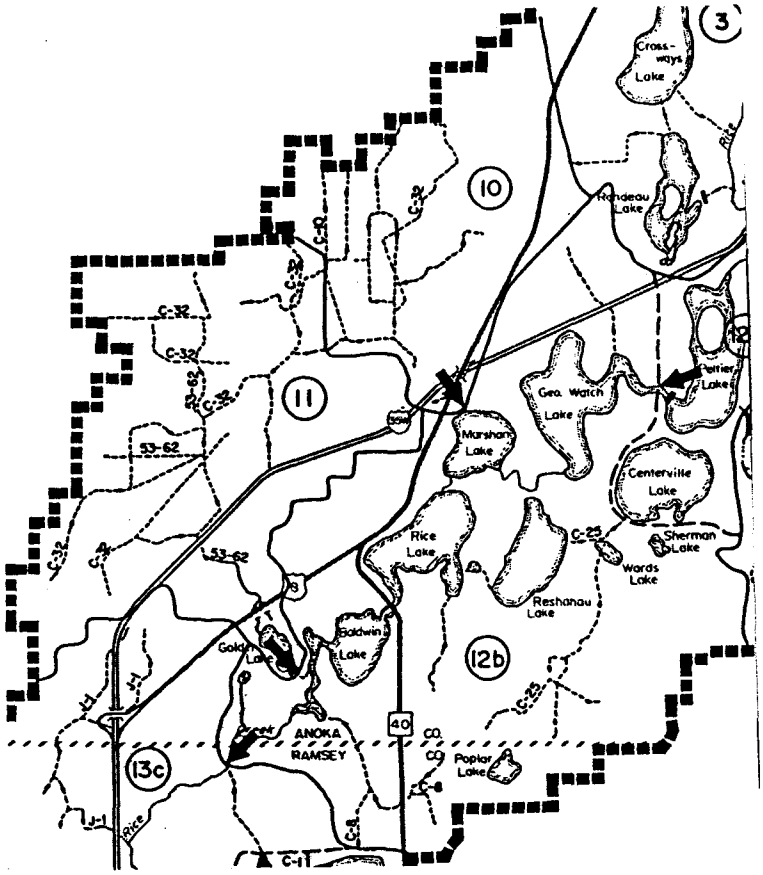
		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	29	28
	Maximum	--	196.8	134.0
	Minimum	--	0.0	3.0
	Mean	--	53.9	58.9
Dissolved Oxygen (mg/l)	Number	0	12	29
	Maximum	--	13.5	15.2
	Minimum	--	0.1	3.9
	Mean	--	7.7	8.4
Water Temperature (°C)	Number	0	14	14
	Maximum	--	2121.7	1739.5
	Minimum	--	0.0	201.7
	Mean	--	787.3	860.1
Total Kjeldahl Nitrogen (lb/D)	Number	0	14	14
	Maximum	--	2121.7	1739.5
	Minimum	--	0.0	201.7
	Mean	--	787.3	860.1
Ortho-Phosphorus (lb/D)	Number	0	18	14
	Maximum	--	434.0	44.5
	Minimum	--	0.0	3.5
	Mean	--	76.9	20.9
Total Phosphorus (lb/D)	Number	0	18	14
	Maximum	--	472.6	148.9
	Minimum	--	0.0	10.4
	Mean	--	103.2	53.2
pH	Number	13	18	15
	Maximum	8.3	8.6	8.2
	Minimum	6.8	7.4	7.4
	Mean	7.8	7.9	7.9
Turbidity Turbidity Meter Hach (FTU)	Number	0	0	0
	Maximum	--	--	--
	Minimum	--	--	--
	Mean	--	--	--
Total Non-Filterable Residue (lb/D)	Number	0	16	13
	Maximum	--	13,342.6	12,060.5
	Minimum	--	0.0	323.6
	Mean	--	2819.3	4593.0
Total Chloride (lb/D)	Number	0	6	14
	Maximum	--	8276.2	12,157.6
	Minimum	--	2276.2	2110.0
	Mean	--	5269.8	5384.4


Stream Location R6
Total Phosphorous
Average Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
183
102
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location R6
Total Suspended Solids
Avg Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatersheds 10, 11, and 12B, Lino Lakes, Blaine, and Baldwin Lake, have been discussed in more detail in previous sections; however, because of their effect on the creek, they have been modeled together. No significant increase in flow rates out of the subwatershed will occur from existing development conditions to future development conditions in the year 2000 in spite of increased rates of inflow to the subwatershed.

WATERSHED NO(S): 10, 11, and 12b
WATERSHED NAME(S): Lino Lakes, Blaine, Baldwin Lake



AREA OF SUBWATERSHED(S) (sq mi):

6.62, 10.28, and 19.15, respectively.

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 142.41

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	338.	857.	1029.
Q $Peak_{out}$ (cfs)	17.	33.	34.
Peak Elevation in Reservoir (ft)	879.83	880.64	880.67
Peak Time (hrs)	236.0	226.0	225.0
Storage Used (ac-ft)	1311.4	2636.0	2685.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	2879	4623	5396
Q $Peak_{out}$ (cfs)	130	147	148
Peak Elevation in Reservoir (ft)	883.01	883.85	883.88
Peak Time (hrs)	218.0	265.0	267.0
Storage Used (ac-ft)	10,362.9	14,806.0	14.965.2

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 1.03

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 410.7

Description of Outlet Structure:

Rice Creek at its crossing with the Lexington Avenue bridge in Shoreveiw.

Hydrologic Information Available for Subwatershed:

"Hydrologic Report for the City of Lino Lakes," dated May 1980.

Description of Stormwater Storage Areas Modeled within Watershed:

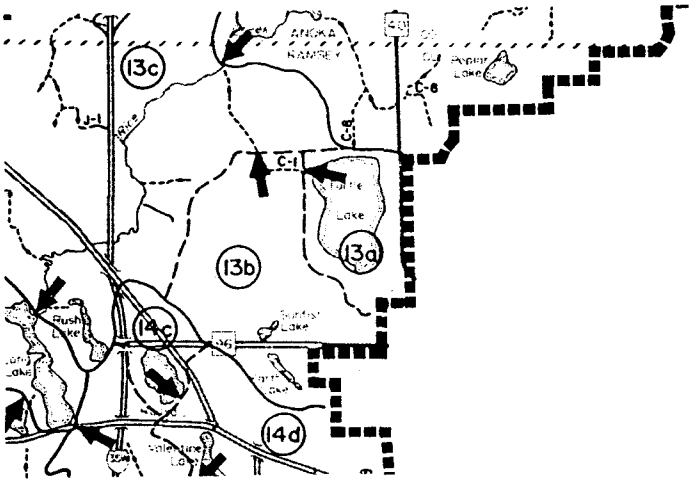
Baldwin, Rice, Marshan, Reshanau, George Watch.

Watersheds 13A, 13B, and 13C, Marsden Lake, Turtle Lake, and Upper Rice Creek, cover an area approximately 2.28, 1.3, and 11.3 square miles, respectively. The lakes within this subwatershed include Turtle, Sunfish, and Karth Lakes. The Marsden Lake marsh appears to provide adequate storage for upstream areas. Turtle Lake provides adequate storage for areas tributary to it. Watershed B lacks any large stormwater storage areas. Development within areas of this subwatershed could dramatically increase discharge rates leaving this subwatershed. A Comprehensive Stormwater Management Plan considering all small ponds in the area should be completed to prevent this from occurring. Water quality information from Turtle Lake indicates that it is in very good condition and the lake has a Trophic State Index in the range of 40 to 50, and that the water quality is remaining fairly constant.

WATERSHED NO: 13A
WATERSHED NAME: Marsden Lake

AREA OF SUBWATERSHED (sq mi): 2.28

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 3.58



	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	25.	195.	312.
Q $Peak_{out}$ (cfs)	2.	8.	10.
Peak Elevation in Reservoir (ft)	885.24	886.7	887.2
Peak Time (hrs)	27.05	26.0	25.6
Storage Used (ac-ft)	15.4	57.0	74.5
100-YEAR:			
Q $Peak_{in}$ (cfs)	636.	1421.	1758.
Q $Peak_{out}$ (cfs)	20.	25.	26.
Peak Elevation in Reservoir (ft)	888.48	889.11	889.3
Peak Time (hrs)	26.6	26.2	26.0
Storage Used (ac-ft)	208.0	350.3	394.0

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 7.0

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 153.5

Description of Outlet Structure:

Two 24-inch CMPs with invert elevations at 884.47.

Hydrologic Information Available for Subwatershed:

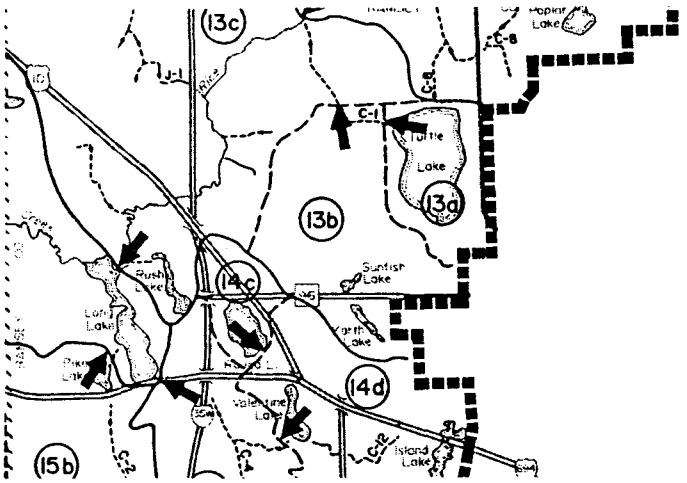
"Comprehensive Stormwater Management Plan for the Ramsey County Ditch No. 1 Watershed," dated July 1983.

Description of Stormwater Storage Areas Modeled within Watershed:

Wetland area to the south of County Road I and west of Lexington Avenue in Arden Hills.

WATERSHED NO: 13B
WATERSHED NAME: Turtle Lake

AREA OF SUBWATERSHED (sq mi): 1.3



TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 1.3

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	147.	314.	325.0
Q $Peak_{out}$ (cfs)	1.	2.	2.
Peak Elevation in Reservoir (ft)	892.22	892.26	892.26
Peak Time (hrs)	28.0	26.0	26.0
Storage Used (ac-ft)	22.6	45.2	45.3
100-YEAR:			
Q $Peak_{in}$ (cfs)	893.03	1115.83	1044.
Q $Peak_{out}$ (cfs)	2.3	3.1	3.2
Peak Elevation in Reservoir (ft)	892.51	892.62	892.62
Peak Time (hrs)	27.0	26.0	26.
Storage Used (ac-ft)	228.0	280.2	280.2

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 2.38

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 215.4

Description of Outlet Structure:

Three-foot wide weir with grate; weir bottom at 892.0.

Hydrologic Information Available for Subwatershed:

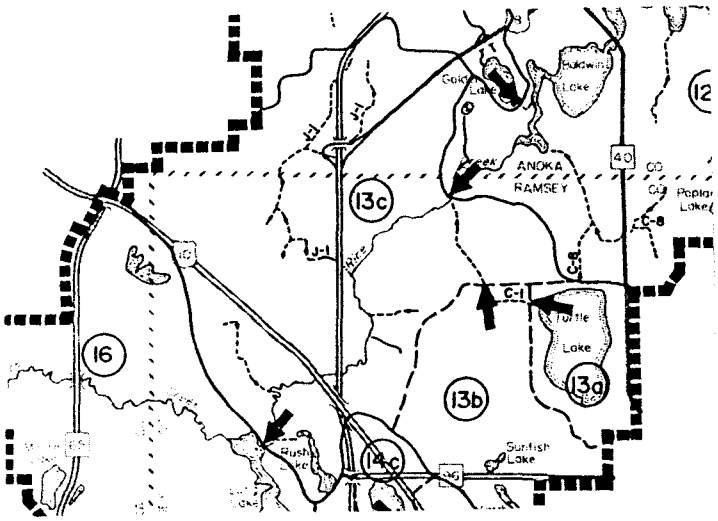
"Comprehensive Stormwater Management Plan for the Ramsey County Ditch No. 1 Watershed," dated July 1983.

Description of Stormwater Storage Areas Modeled within Watershed:

Turtle Lake.

WATERSHED NO: 13C
WATERSHED NAME: Upper Rice Creek

AREA OF
SUBWATERSHED (sq mi): 11.38



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 145.99

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	104.	419.	563.
Q $Peak_{out}$ (cfs)	81.	290.	374.
Peak Elevation in Reservoir (ft)	---- No Peak Elevation Established ----		
Peak Time (hrs)	19.6	15.5	17.5
Storage Used (ac-ft)	--- No Storage Reservoirs Designated --		
100-YEAR:			
Q $Peak_{in}$ (cfs)	1496.	3440.	3985.
Q $Peak_{out}$ (cfs)	1349.	2883.	3340.
Peak Elevation in Reservoir (ft)	---- No Peak Elevation Established ----		
Peak Time (hrs)	20.3	16.9	16.4
Storage Used (ac-ft)	--- No Storage Reservoirs Designated --		

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 19.7

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi):

No designated storage area.

Description of Outlet Structure:

No designated outlet or storage reservoirs.

Hydrologic Information Available for Subwatershed:

"Floodplain Information for Rice Creek in Moundsview, Arden Hills, and Shoreview," dated June 1975.

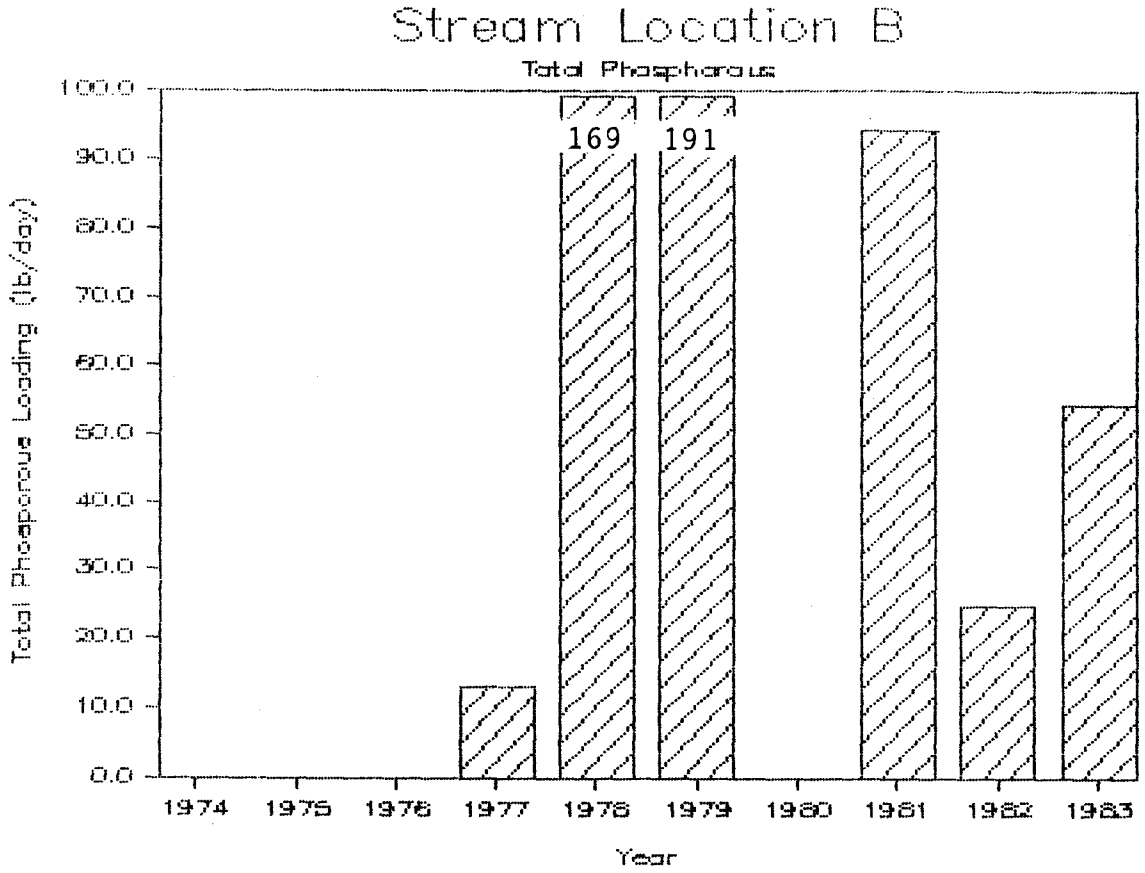
Description of Stormwater Storage Areas Modeled within Watershed:

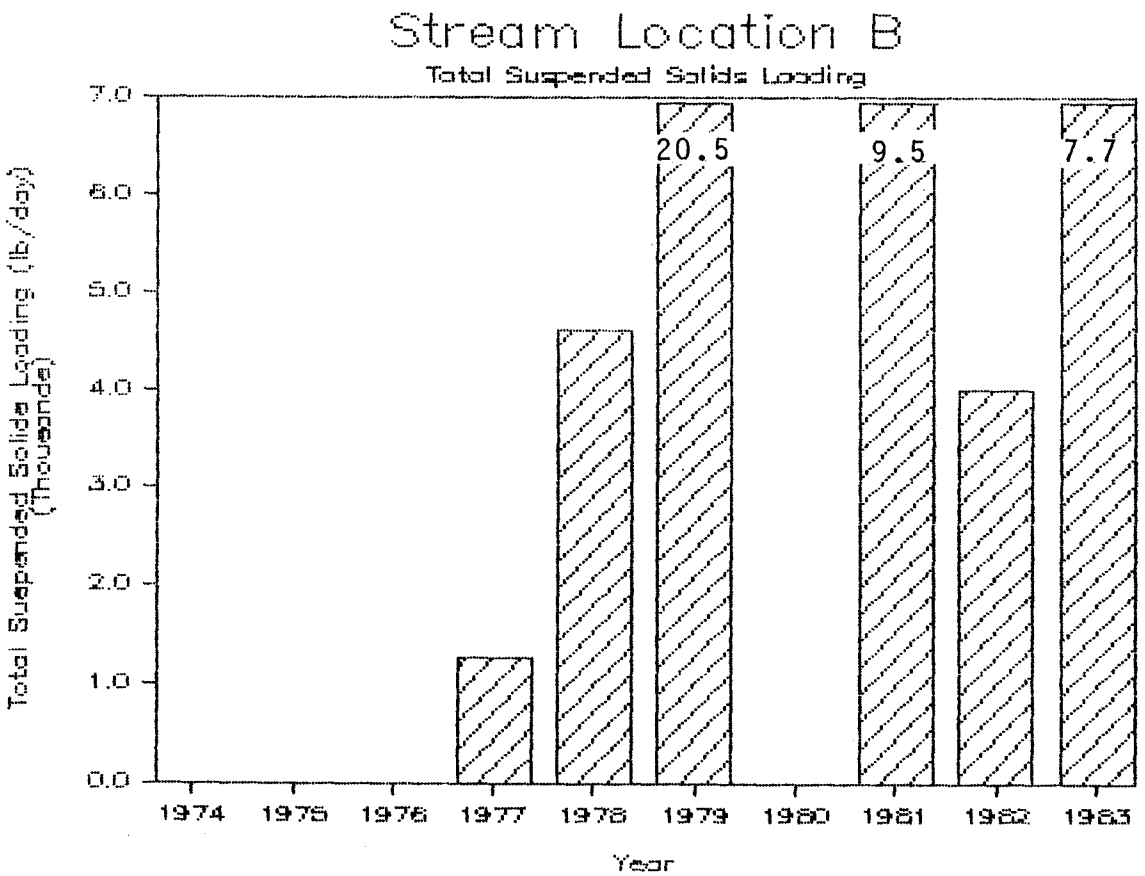
Storage available in channel of Rice Creek.

WATER QUALITY DATA

STREAM LOCATION B

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	16	25
	Maximum	--	451.3	215.0
	Minimum	--	8.3	2.8
	Mean	--	92.0	79.2
Dissolved Oxygen (mg/l)	Number	0	13	42
	Maximum	--	12.0	14.2
	Minimum	--	1.4	4.2
	Mean	--	7.7	7.5
Water Temperature (°C)	Number	0	16	24
	Maximum	--	3651.3	2767.0
	Minimum	--	82.6	21.1
	Mean	--	815.0	936.6
Total Kjeldahl Nitrogen (lb/D)	Number	0	16	24
	Maximum	--	3651.3	2767.0
	Minimum	--	82.6	21.1
	Mean	--	869.3	935.5
Ortho-Phosphorus (lb/D)	Number	0	15	25
	Maximum	--	207.7	68.0
	Minimum	--	0.9	0.8
	Mean	--	56.1	24.5
Total Phosphorus (lb/D)	Number	0	16	25
	Maximum	--	676.4	487.1
	Minimum	--	3.6	3.5
	Mean	--	113.4	70.5
pH	Number	0	16	49
	Maximum	--	8.1	8.3
	Minimum	--	7.4	7.4
	Mean	--	7.7	7.9
Turbidity Turbidity Meter Hach (FTU)	Number	0	0	46
	Maximum	--	--	740.0
	Minimum	--	--	1.2
	Mean	--	--	51.0
Total Non-Filterable Residue (lb/D)	Number	0	16	25
	Maximum	--	34,078.9	22,653.8
	Minimum	--	248.1	604.1
	Mean	--	5351.4	8021.0
Total Chloride (lb/D)	Number	0	0	24
	Maximum	--	--	24,352.9
	Minimum	--	--	286.9
	Mean	--	--	8471.8

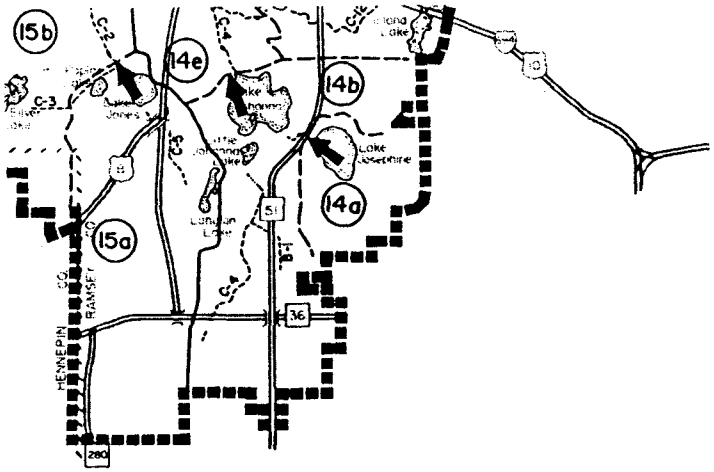

Stream Location B
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
169
191
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location B
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
20.5
9.5
7.7
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 14A, Lake Josephine, is approximately 1.31 square miles. The major lake in the subwatershed is Lake Josephine. According to modeling efforts, Lake Josephine accommodates drainage adequately. Water quality information from Lake Josephine indicates that lake transparencies are improving. The total phosphorus concentration is holding relatively steady or dropping slightly. The general water quality of Lake Josephine appears to be improving slightly.

WATERSHED NO: 14A
WATERSHED NAME: Lake Josephine

AREA OF
SUBWATERSHED (sq mi): 1.31



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 1.31

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	26.	124.	124.
Q $Peak_{out}$ (cfs)	1.	3.	3.
Peak Elevation in Reservoir (ft)	883.6	883.7	883.7
Peak Time (hrs)	31.0	27.0	26.9
Storage Used (ac-ft)	38.3	54.	55.
100-YEAR:			
Q $Peak_{in}$ (cfs)	295.	712.	758.
Q $Peak_{out}$ (cfs)	10.	13.	13.
Peak Elevation in Reservoir (ft)	884.36	884.86	884.9
Peak Time (hrs)	30.	26.6	26.5
Storage Used (ac-ft)	151	223.	229.

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 9.9

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 170

Description of Outlet Structure:

Six-foot long rectangular weir; weir crest at elevatoin 883.36.

Hydrologic Information Available for Subwatershed:

"Surface Water Management Study for the Lake Johanna Watershed," dated January 1978 and revised July 1978.

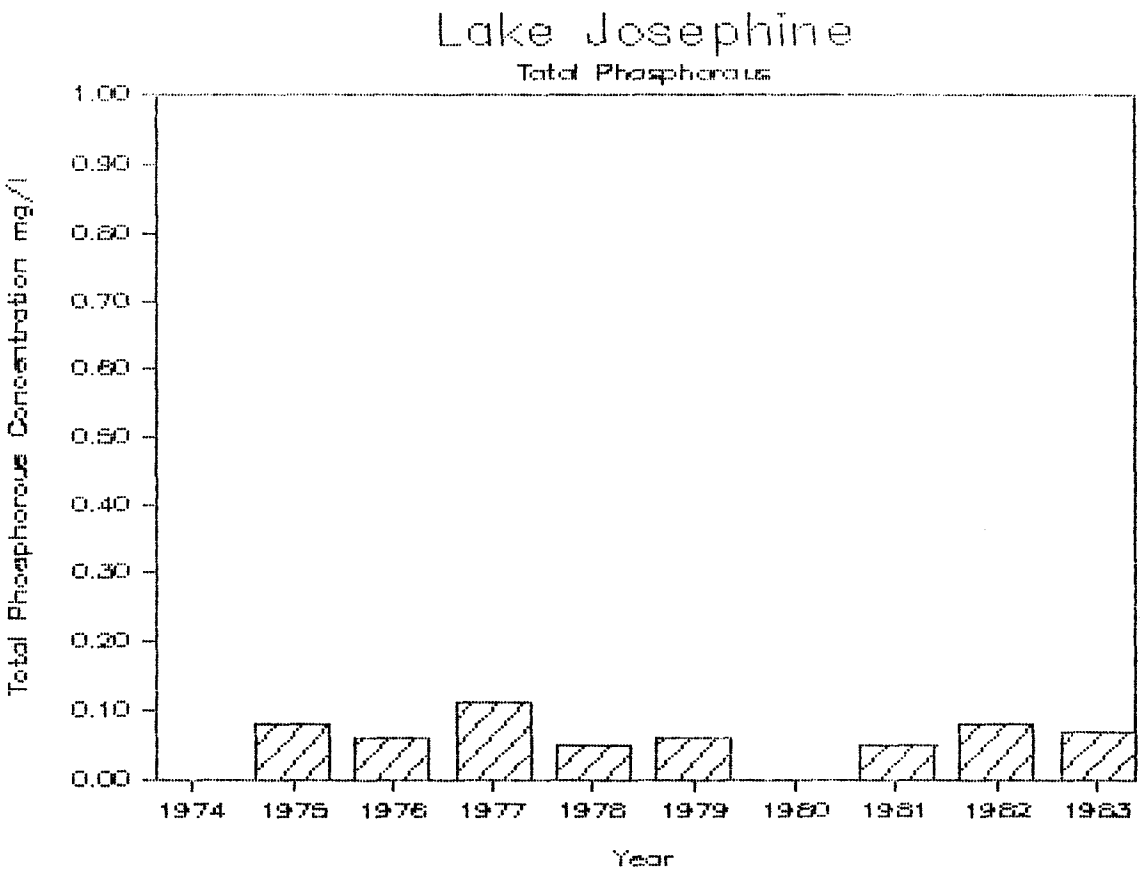
Description of Stormwater Storage Areas Modeled within Watershed:

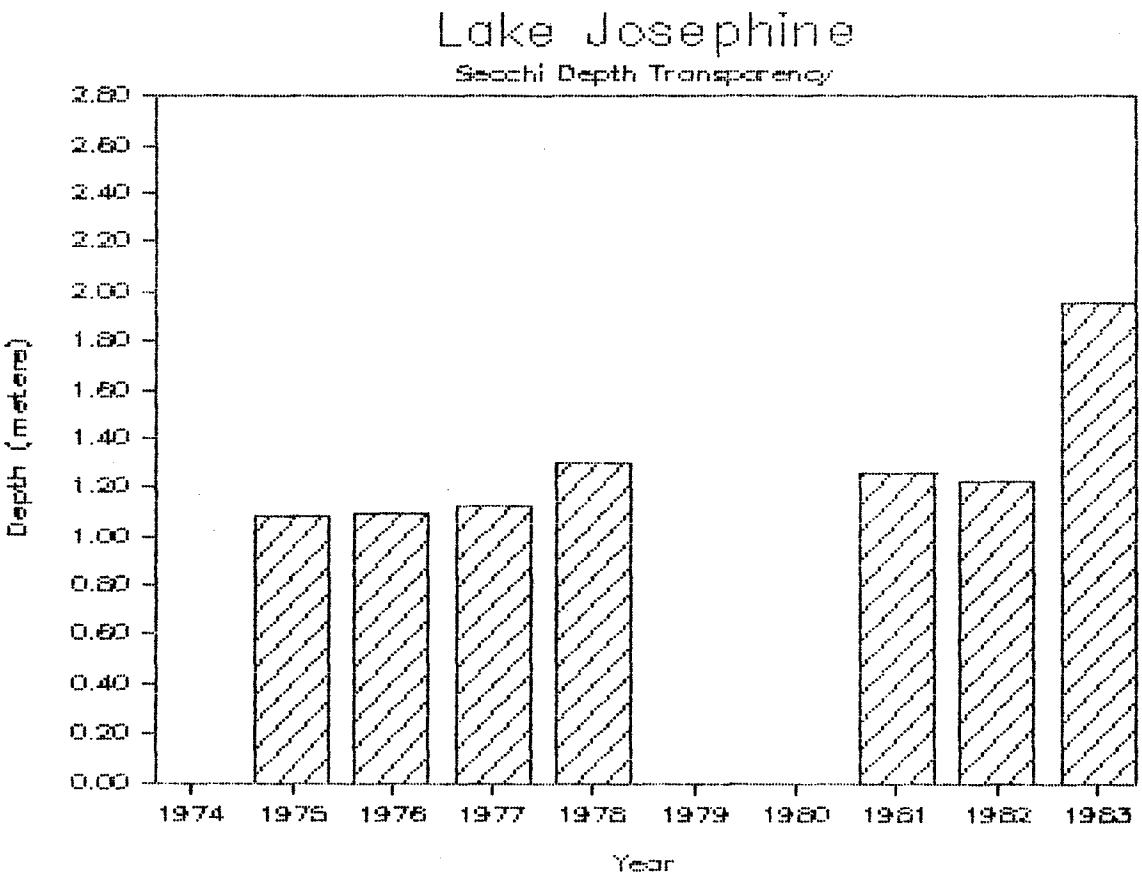
Lake Josephine and Little Josephine wetlands.

WATER QUALITY DATA

LAKE JOSEPHINE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	10	7	207
	Maximum	0.101	0.140	0.276
	Minimum	0.006	0.002	0.010
	Mean	0.028	0.035	0.034
Total Phosphorus (mg/l)	Number	10	7	205
	Maximum	0.17	0.23	0.28
	Minimum	0.04	0.03	0.01
	Mean	0.07	0.08	0.07
Chlorophyll-a (ug/l)	Number	10	7	43
	Maximum	24.0	84.0	42.0
	Minimum	6.0	1.0	0.02
	Mean	12.6	16.0	7.9
Conductivity at 25° C (micromho)	Number	10	0	0
	Maximum	400.0	--	--
	Minimum	240.0	--	--
	Mean	321.0	--	--
Secchi Depth Transparency (meters)	Number	10	6	34
	Maximum	2.40	2.60	3.60
	Minimum	0.60	0.40	0.69
	Mean	1.09	1.22	1.49
Total Alkalinity $CaCO_3$ (mg/l)	Number	0	8	205
	Maximum	--	156.0	182.0
	Minimum	--	74.0	11.0
	Mean	--	119.2	125.3
Total Kjeldahl Nitrogen (mg/l)	Number	0	8	208
	Maximum	--	1.50	4.20
	Minimum	--	0.91	0.30
	Mean	--	1.33	1.33
Dissolved Oxygen (mg/l)	Number	38	58	421
	Maximum	10.8	11.3	15.2
	Minimum	0.4	0.3	0.02
	Mean	4.4	5.3	5.3
Temperature (°C)	Number	38	59	421
	Maximum	25.0	26.0	28.5
	Minimum	12.0	1.0	0.0
	Mean	17.6	13.6	12.5
pH	Number	10	8	206
	Maximum	8.7	8.6	8.6
	Minimum	7.3	7.3	7.0
	Mean	8.2	7.9	7.9

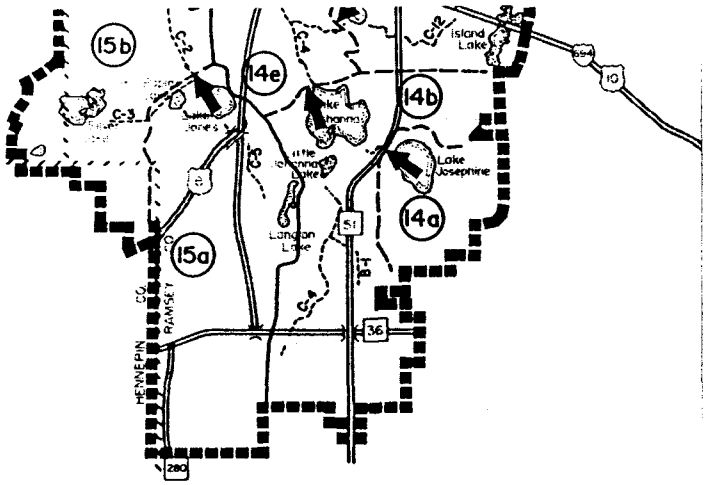

Lake Josephine
Total Phosphorus
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Lake Josephine
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 14B, Lake Johanna, is approximately 4.25 square miles. The large capacity outlet for the lake results in little water being stored. Downstream storage is available, but is limited. Water quality information from Lake Johanna indicates that measured water quality has been improving slightly over the last decade but that no significant improvement would have been observed by the public using the lake.

WATERSHED NO: 14B
WATERSHED NAME: Lake Johanna

AREA OF
SUBWATERSHED (sq mi): 4.25



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 5.56

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	40.	347.	380.
Q $Peak_{out}$ (cfs)	2.	30.	34.
Peak Elevation in Reservoir (ft)	887.5	877.9	878.0
Peak Time (hrs)	37.0	29.7	26.5
Storage Used (ac-ft)	44.0	131.0	153.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	590.	1831.	1962.
Q $Peak_{out}$ (cfs)	179.	490.	513.
Peak Elevation in Reservoir (ft)	878.72	879.5	879.6
Peak Time (hrs)	26.5	19.1	18.9
Storage Used (ac-ft)	320.0	504.0	526.4

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 88.0

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 119.0

Description of Outlet Structure:

Eight-foot long weir at 887.3; 60-foot long weir at 877.8. Outlet located on the north end of Lake Johanna crossing under Lake Johanna Boulevard.

Hydrologic Information Available for Subwatershed:

"Surface Water Management study for the Lake Johanna Watershed," dated January 1978 and revised July 1978.

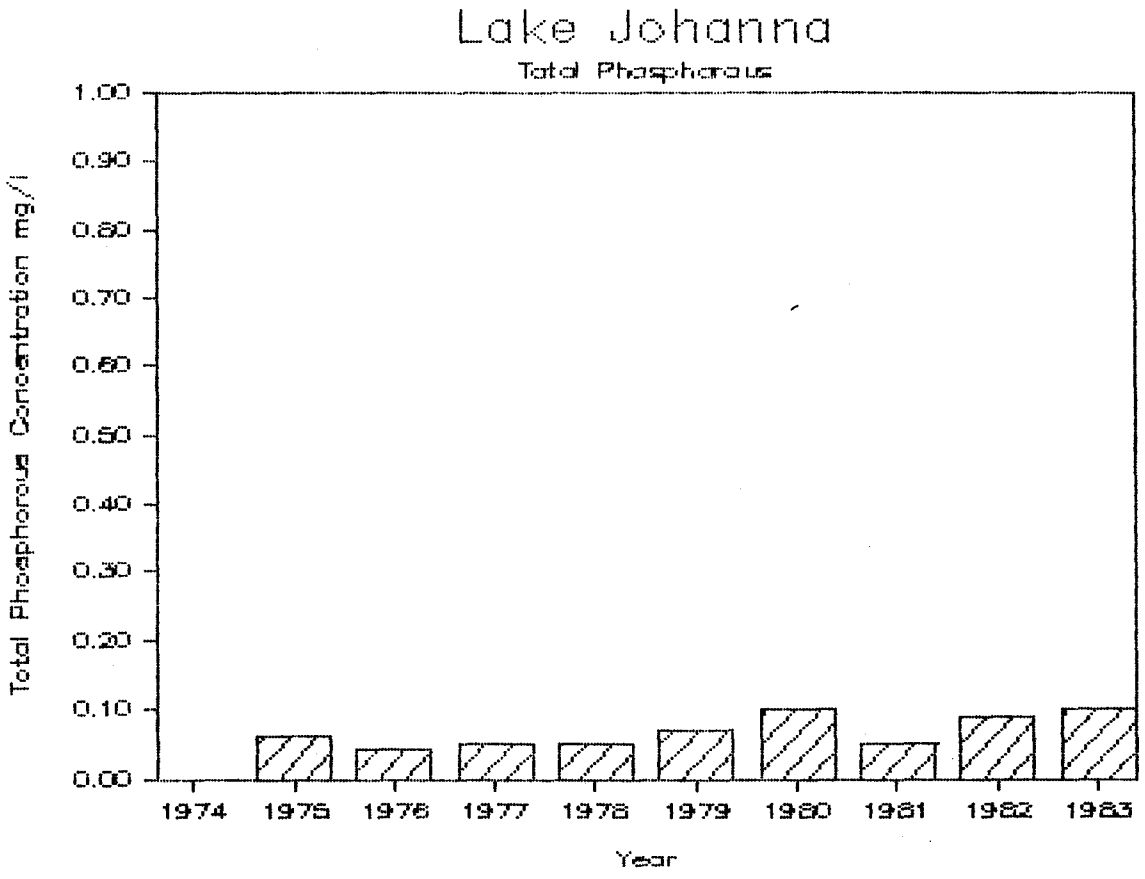
Description of Stormwater Storage Areas Modeled within Watershed:

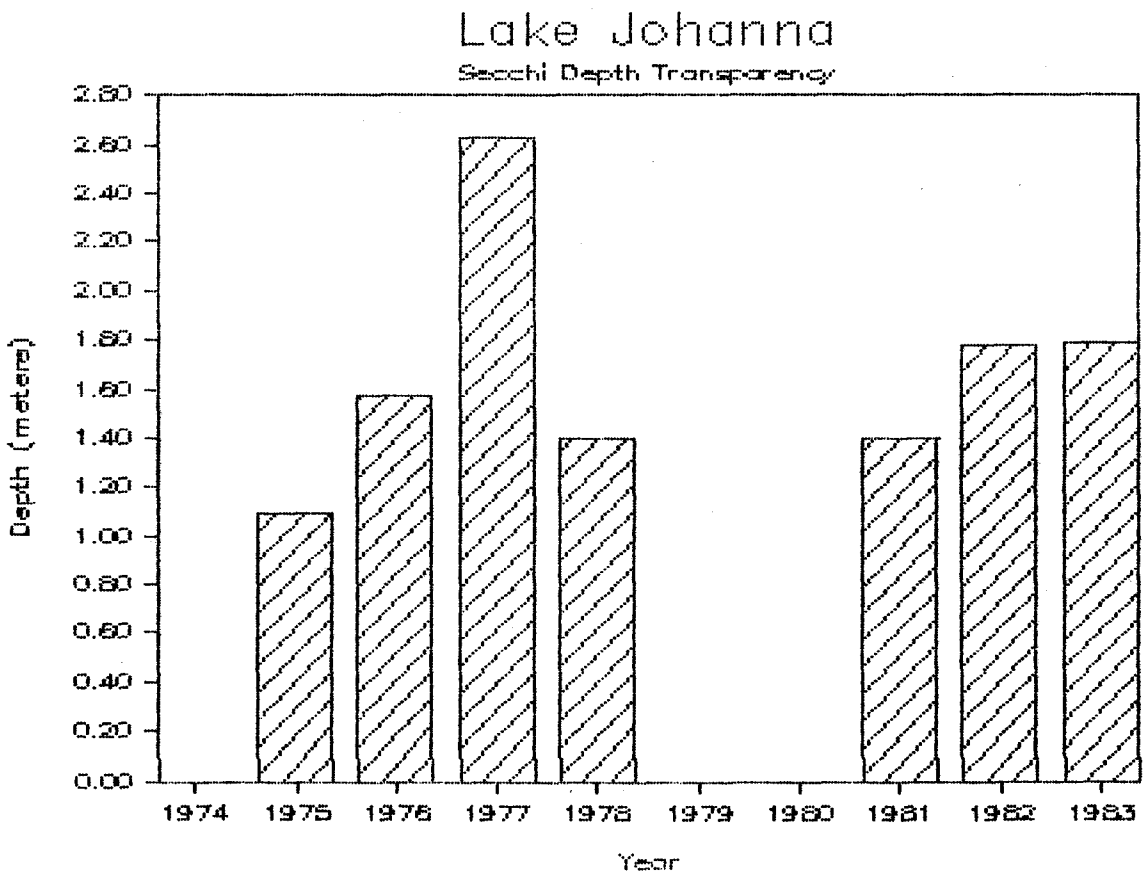
Lake Josephine.

WATER QUALITY DATA

LAKE JOHANNA

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	10	8	400
	Maximum	0.032	0.050	0.480
	Minimum	0.003	0.008	0.005
	Mean	0.013	0.023	0.050
Total Phosphorus (mg/l)	Number	10	8	400
	Maximum	0.09	0.10	0.51
	Minimum	0.04	0.02	0.01
	Mean	0.05	0.06	0.08
Chlorophyll-a (ug/l)	Number	10	7	115
	Maximum	29.0	68.0	58.0
	Minimum	8.0	1.0	0.1
	Mean	16.7	14.1	12.1
Conductivity at 25° C (micromho)	Number	10	0	0
	Maximum	500.0	--	--
	Minimum	375.0	--	--
	Mean	450.0	--	--
Secchi Depth Transparency (meters)	Number	10	6	64
	Maximum	2.40	4.30	4.70
	Minimum	0.70	0.70	0.80
	Mean	1.29	2.02	1.70
Total Alkalinity $CaCO_3$ (mg/l)	Number	0	8	398
	Maximum	--	122.0	171.0
	Minimum	--	88.0	67.0
	Mean	--	103.0	104.8
Total Kjeldahl Nitrogen (mg/l)	Number	0	8	385
	Maximum	--	1.50	4.70
	Minimum	--	0.78	0.02
	Mean	--	1.14	1.28
Dissolved Oxygen (mg/l)	Number	35	78	668
	Maximum	12.8	11.3	13.8
	Minimum	0.4	0.1	0.01
	Mean	5.5	4.6	6.1
Temperature (°C)	Number	35	79	671
	Maximum	25.0	25.0	29.0
	Minimum	12.0	1.0	0.5
	Mean	18.8	11.0	13.4
pH	Number	10	8	392
	Maximum	9.0	8.8	8.8
	Minimum	7.4	7.3	5.0
	Mean	8.4	7.9	8.0

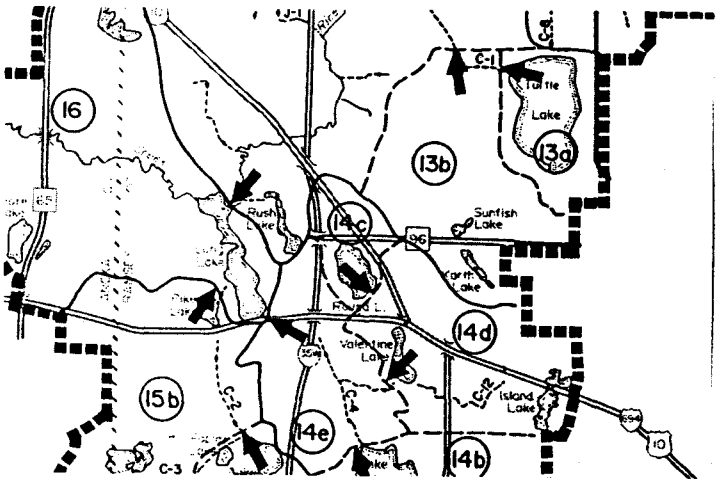

Lake Johanna
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Lake Johanna
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 14C, Round Lake, is approximately 0.83 square miles. From the water quantity modeling effort, Round Lake can store all water discharged to it from its subwatershed. There is no recent water quality information available for Round Lake.

WATERSHED NO: 14C
WATERSHED NAME: Round Lake

AREA OF
SUBWATERSHED (sq mi): 0.83



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 0.83

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	33.	143.	149.
Q $Peak_{out}$ (cfs)	2.	3.7	3.9
Peak Elevation in Reservoir (ft)	889.10	889.22	889.23
Peak Time (hrs)	26.5	25.2	25.1
Storage Used (ac-ft)	12.8	28.2	29.4
100-YEAR:			
Q $Peak_{in}$ (cfs)	331.	717.	703.
Q $Peak_{out}$ (cfs)	13.	19.	19.
Peak Elevation in Reservoir (ft)	889.78	890.07	890.08
Peak Time (hrs)	26.0	24.8	24.7
Storage Used (ac-ft)	99.8	137.9	139.4

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 22.6

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 166.0

Description of Outlet Structure:

Five-foot wide weir with top of weir at 889.0.

Hydrologic Information Available for Subwatershed:

"Surface Water Management study for the Lake Johanna Watershed," dated January 1978 and revised July 1978.

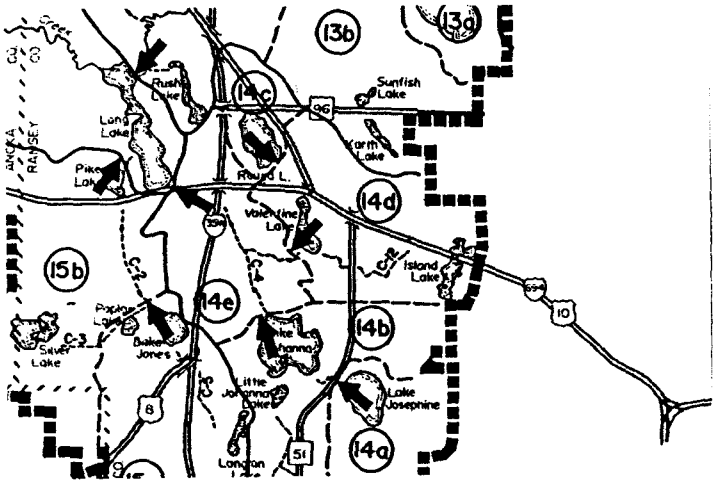
Description of Stormwater Storage Areas Modeled within Watershed:

Round Lake.

Subwatershed 14D, Valentine Lake, is approximately 2.4 square miles. The major lake is Valentine Lake. This lake receives significant amounts of untreated runoff from County Ditch 12 and taking into consideration this lake alone, when developed, a significant increase in discharge rate could occur. Detailed investigations may be warranted in order to determine retention abilities of the upstream Land O'Lakes pond and the MnDOT pond within the subwatershed to provide a more accurate representation. Water quality information from Valentine Lake indicates that water quality appears to be degrading over the last six years, with an increase in total phosphorus, chlorophyll and an increase in the Trophic State Index.

WATERSHED NO: 14D
WATERSHED NAME: Valentine Lake

AREA OF SUBWATERSHED (sq mi): 2.42



TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 3.25

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	40.	332.	637.
Q $Peak_{out}$ (cfs)	4.4	13.	36.
Peak Elevation in Reservoir (ft)	876.03	876.76	877.6
Peak Time (hrs)	29.2	25.2	23.8
Storage Used (ac-ft)	26.0	69.0	115.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	558.	1928.	2260.
Q $Peak_{out}$ (cfs)	74.	98.	111.
Peak Elevation in Reservoir (ft)	879.19	880.80	882.17
Peak Time (hrs)	26.34	24.0	23.8
Storage Used (ac-ft)	226.0	336.0	443.6

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 30.15

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 139

Description of Outlet Structure:

Two 36-inch RCP culverts with invert elevations at 875.7 and 876.0.

Hydrologic Information Available for Subwatershed:

"Surface Water Management study for the Lake Johanna Watershed," dated January 1978 and revised July 1978.

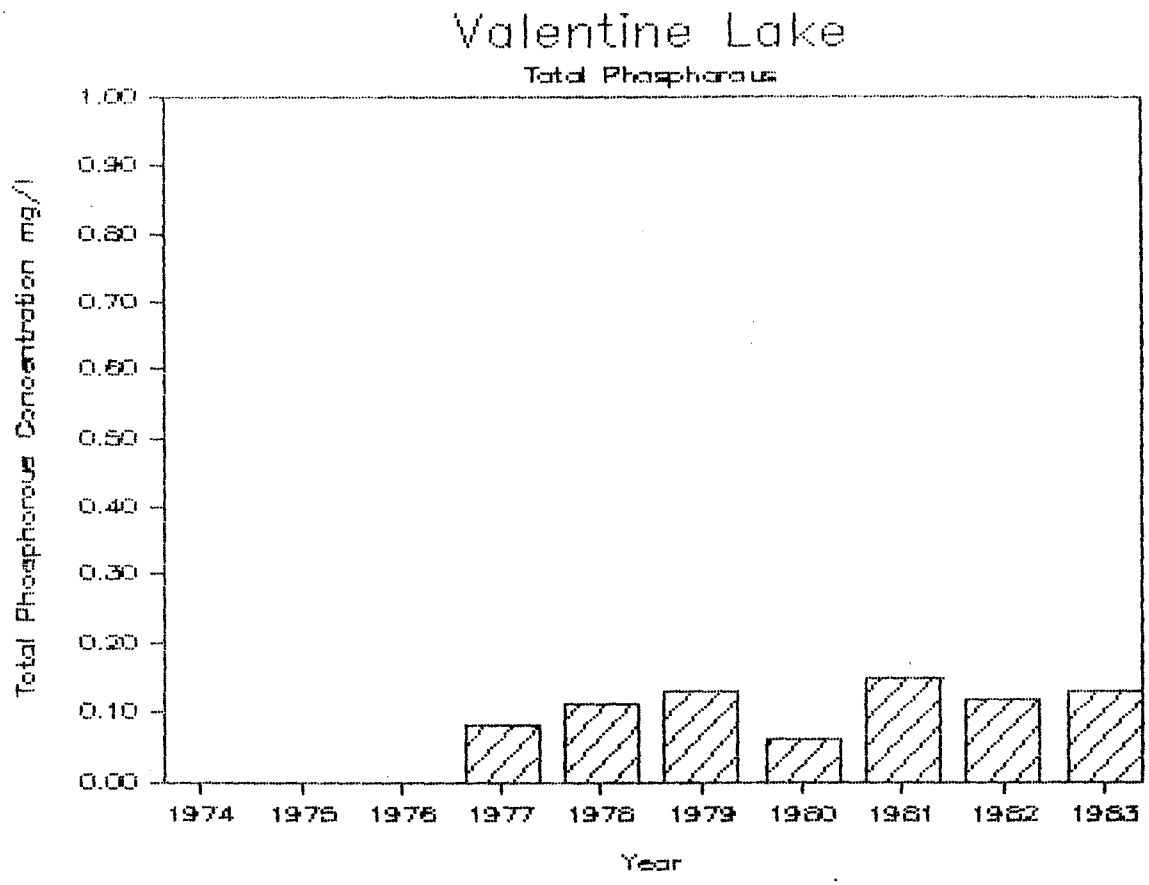
Description of Stormwater Storage Areas Modeled within Watershed:

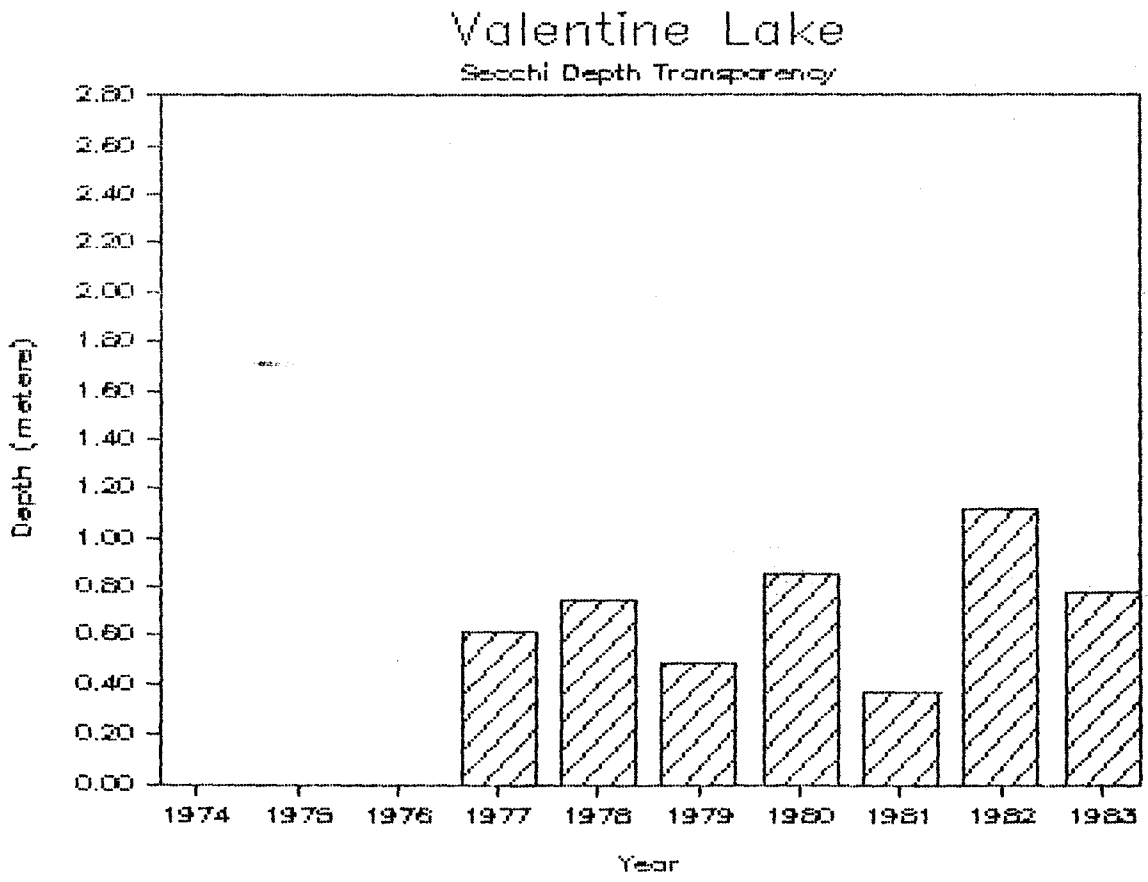
Valentine Lake.

WATER QUALITY DATA

VALENTINE LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	0	14	158
	Maximum	--	0.080	0.290
	Minimum	--	0.007	0.010
	Mean	--	0.031	0.073
Total Phosphorus (mg/l)	Number	0	14	160
	Maximum	--	0.18	0.40
	Minimum	--	0.03	0.03
	Mean	--	0.10	0.13
Chlorophyll-a (ug/l)	Number	0	13	46
	Maximum	--	49.0	97.0
	Minimum	--	1.0	0.1
	Mean	--	19.6	29.9
Conductivity at 25° C (micromho)	Number	0	0	0
	Maximum	--	--	--
	Minimum	--	--	--
	Mean	--	--	--
Secchi Depth Transparency (meters)	Number	0	11	32
	Maximum	--	1.20	2.44
	Minimum	--	0.30	0.20
	Mean	--	0.65	0.81
Total Alkalinity $CaCO_3$ (mg/l)	Number	0	14	155
	Maximum	--	145.0	850.0
	Minimum	--	23.0	74.0
	Mean	--	105.6	116.3
Total Kjeldahl Nitrogen (mg/l)	Number	0	14	156
	Maximum	--	2.40	5.30
	Minimum	--	1.00	0.60
	Mean	--	1.78	1.81
Dissolved Oxygen (mg/l)	Number	0	50	168
	Maximum	--	15.6	17.5
	Minimum	--	0.3	0.01
	Mean	--	7.4	6.6
Temperature (°C)	Number	0	50	168
	Maximum	--	25.0	30.0
	Minimum	--	2.0	0.5
	Mean	--	12.4	15.5
pH	Number	0	14	160
	Maximum	--	8.8	9.3
	Minimum	--	7.0	7.0
	Mean	--	7.9	8.0

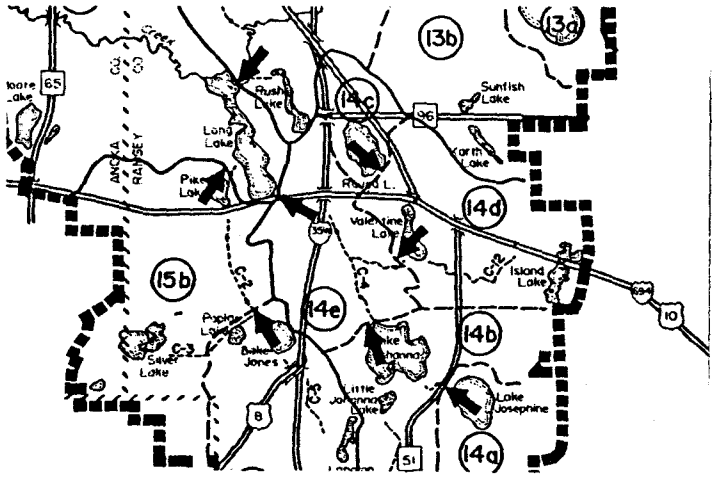

Valentine Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Valentine Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 14E is approximately 1.31 square miles. There are no lakes within this subwatershed. According to the water quantity modeling effort and observation of the the E-2 wetland periodically, it is hydraulically overloaded. Stream water quality information from stations D and G-2 indicate there is an increase in the daily loading and concentration of total phosphorus and total suspended solids within recent years. Water quality is showing signs of degradation, but additional year-by-year analysis is required to determine the effect of treatment systems recently placed within the subwatershed. Stream station D measures quality from the entire Subwatershed 14. Stream station G measures water quality between Subwatershed 14-D and 14-E.

WATERSHED NO: 14E
WATERSHED NAME: E2 Wetland

AREA OF
SUBWATERSHED (sq mi): 1.31



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 10.12

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	53.	161.	184.
Q $Peak_{out}$ (cfs)	11.	30.	43.
Peak Elevation in Reservoir (ft)	870.14	871.3	872.05
Peak Time (hrs)	25.1	39.0	37.8
Storage Used (ac-ft)	15.9	50.5	83.2
100-YEAR:			
Q $Peak_{in}$ (cfs)	655.	971.	999.
Q $Peak_{out}$ (cfs)	225.	562.	599.
Peak Elevation in Reservoir (ft)	874.04	874.65	874.7
Peak Time (hrs)	30.70	23.2	22.7
Storage Used (ac-ft)	215.6	301.0	308.0

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 55.5

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 230

Description of Outlet Structure:

Three-foot wide weir at 869.0 in conjunction with a 60-foot wide weir at 873.0.

Hydrologic Information Available for Subwatershed:

"Surface Water Management study for the Lake Johanna Watershed," dated January 1978 and revised July 1978.

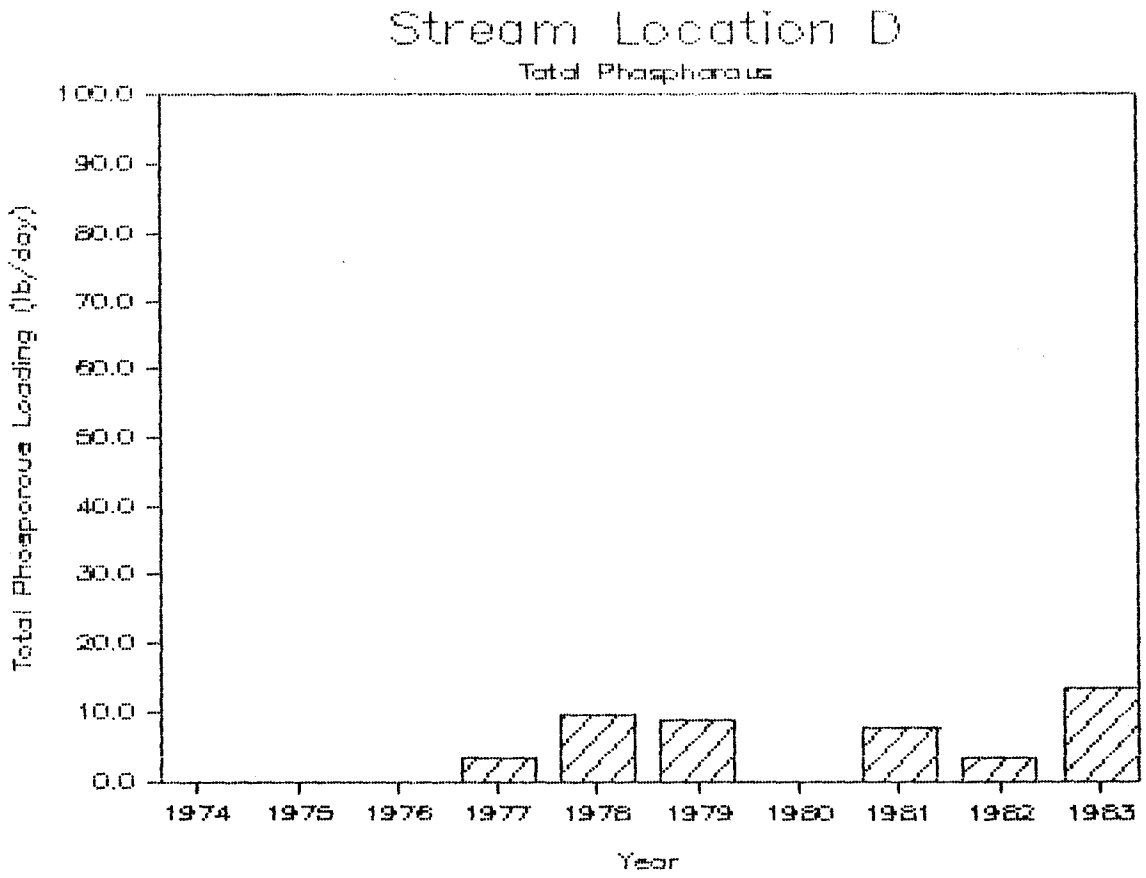
Description of Stormwater Storage Areas Modeled within Watershed:

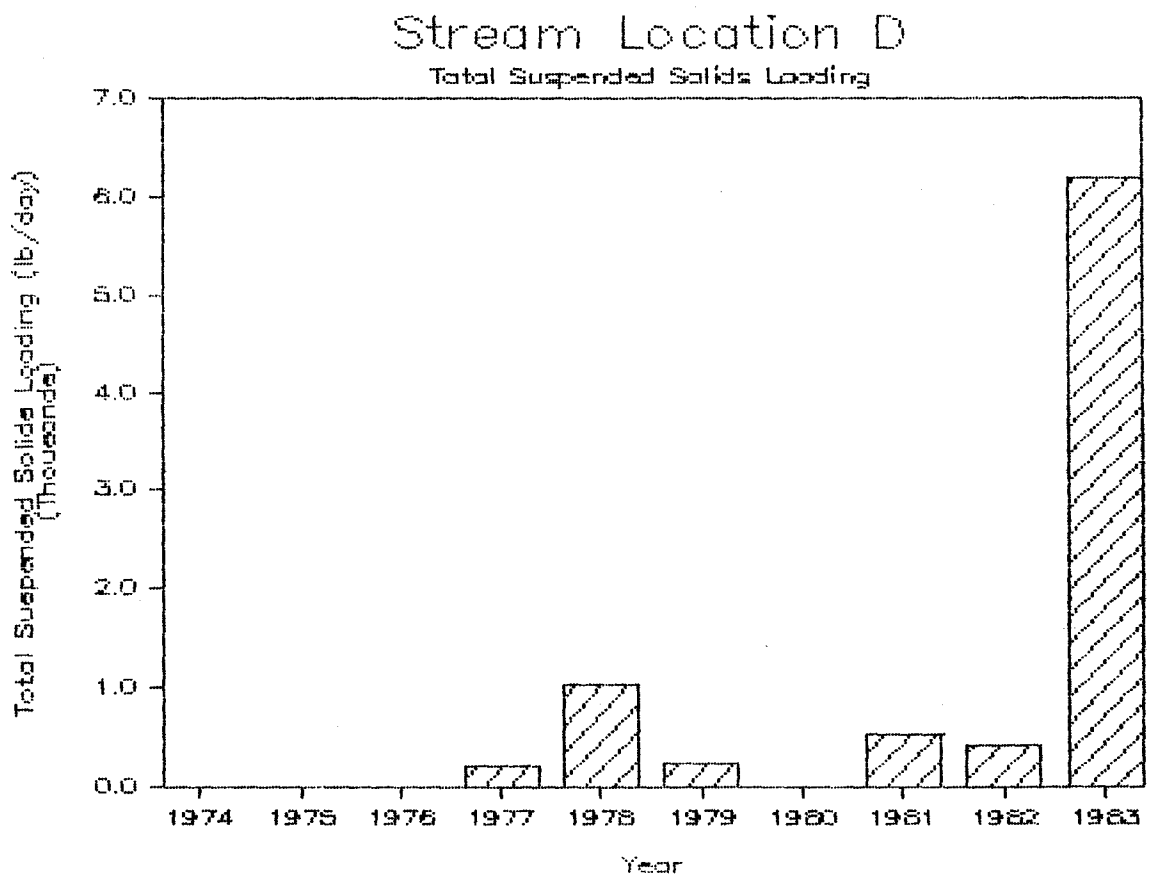
Wetland areas from County Road F to Lake Johanna.

WATER QUALITY DATA

STREAM LOCATION D

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	14	42
	Maximum	--	32.0	51.6
	Minimum	--	0.1	0.1
	Mean	--	7.6	6.1
Dissolved Oxygen (mg/l)	Number	0	12	41
	Maximum	--	11.4	12.0
	Minimum	--	0.5	2.2
	Mean	--	6.7	6.5
Water Temperature (°C)	Number	0	12	42
	Maximum	--	26.5	27.5
	Minimum	--	2.0	0.5
	Mean	--	15.3	16.1
Total Kjeldahl Nitrogen (lb/D)	Number	0	14	40
	Maximum	--	293.4	640.1
	Minimum	--	1.5	1.0
	Mean	--	61.3	62.7
Ortho-Phosphorus (lb/D)	Number	0	14	42
	Maximum	--	12.6	72.8
	Minimum	--	0.01	0.02
	Mean	--	2.7	5.0
Total Phosphorus (lb/D)	Number	0	14	42
	Maximum	--	46.6	72.8
	Minimum	--	0.03	0.04
	Mean	--	6.8	7.4
pH	Number	0	14	49
	Maximum	--	8.1	8.2
	Minimum	--	7.3	7.2
	Mean	--	7.6	7.6
Turbidity Turbidity Meter Hach (FTU)	Number	0	0	46
	Maximum	--	--	2600.0
	Minimum	--	--	1.2
	Mean	--	--	82.6
Total Non-Filterable Residue (lb/D)	Number	0	14	42
	Maximum	--	5868.4	36,310.9
	Minimum	--	3.2	1.6
	Mean	--	608.8	1580.6
Total Chloride (lb/D)	Number	0	0	40
	Maximum	--	--	19,621.4
	Minimum	--	--	62.6
	Mean	--	--	2581.0

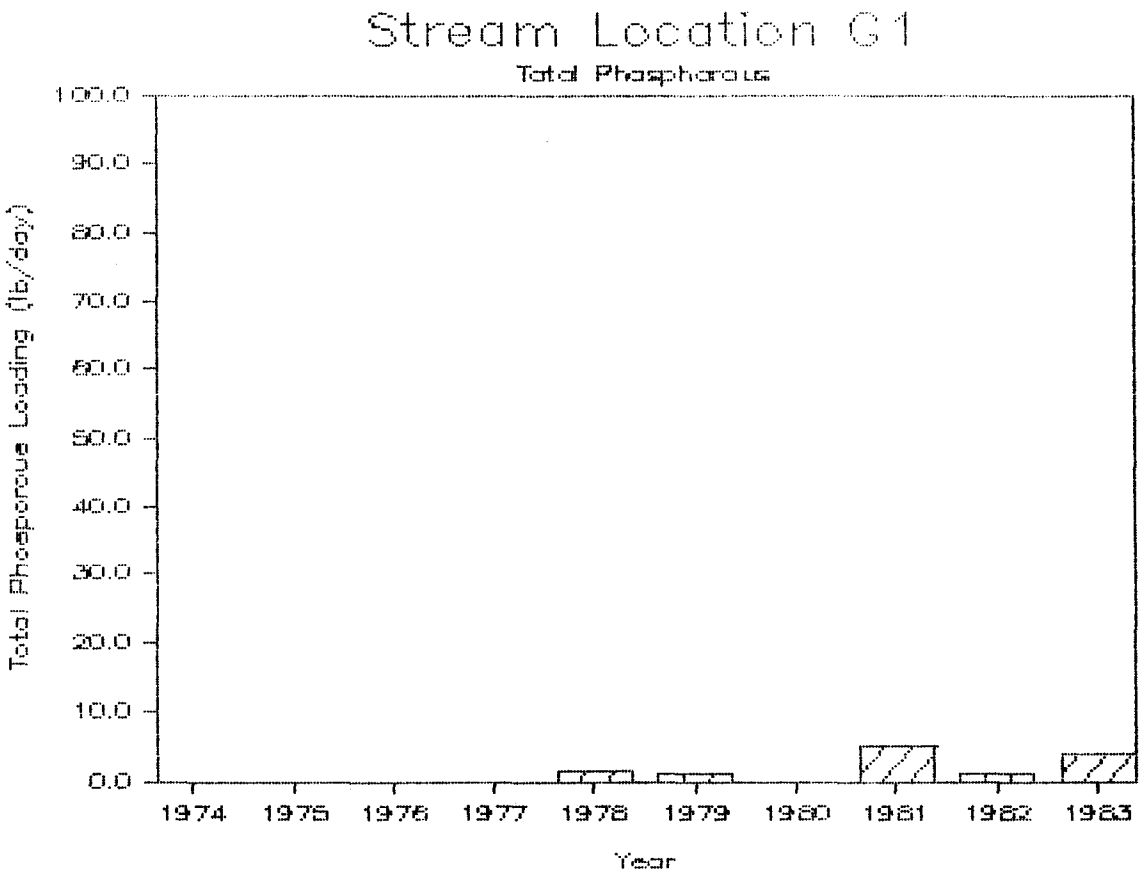

Stream Location D
Total Phasphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

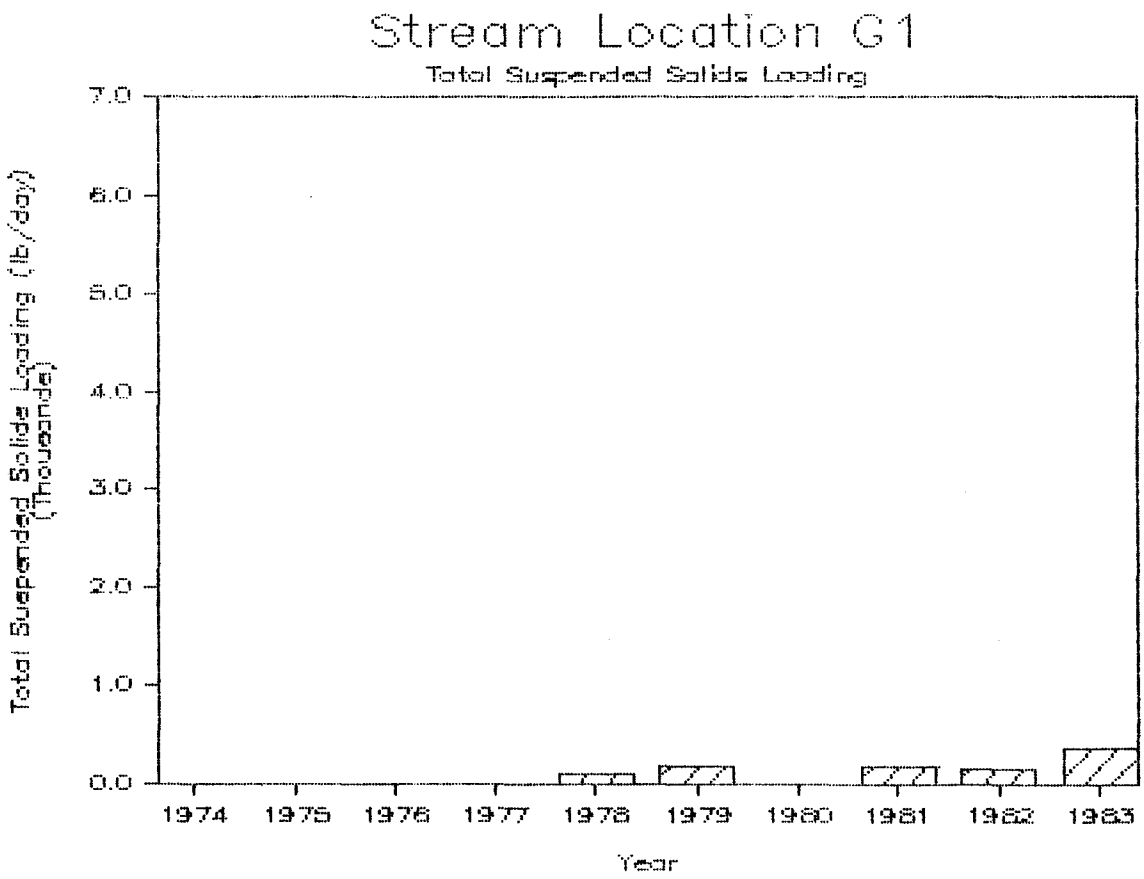

Stream Location D
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

STREAM LOCATION G1

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	16	39
	Maximum	--	6.2	10.0
	Minimum	--	0.1	0.1
	Mean	--	2.3	2.8
Dissolved Oxygen (mg/l)	Number	0	13	41
	Maximum	--	11.2	12.0
	Minimum	--	2.0	0.8
	Mean	--	5.3	5.4
Water Temperature (°C)	Number	0	13	41
	Maximum	--	28.5	27.0
	Minimum	--	3.0	0.5
	Mean	--	16.5	16.1
Total Kjeldahl Nitrogen (lb/D)	Number	0	16	37
	Maximum	--	33.4	107.9
	Minimum	--	0.7	1.6
	Mean	--	14.9	27.4
Ortho-Phosphorus (lb/D)	Number	0	16	39
	Maximum	--	1.2	27.6
	Minimum	--	0.01	0.02
	Mean	--	0.3	1.9
Total Phosphorus (lb/D)	Number	0	16	39
	Maximum	--	3.7	67.3
	Minimum	--	0.03	0.1
	Mean	--	1.3	3.6
pH	Number	0	16	47
	Maximum	--	8.4	8.1
	Minimum	--	7.2	6.9
	Mean	--	7.6	7.6
Turbidity Turbidity Meter Hach (FTU)	Number	0	--	45
	Maximum	--	0	130.0
	Minimum	--	0	1.4
	Mean	--	0	27.7
Total Non-Filterable Residue (lb/D)	Number	0	16	39
	Maximum	--	776.7	1402.4
	Minimum	--	2.7	6.5
	Mean	--	144.8	219.4
Total Chloride (lb/D)	Number	0	--	37
	Maximum	--	0	4530.8
	Minimum	--	0	44.2
	Mean	--	0	921.2

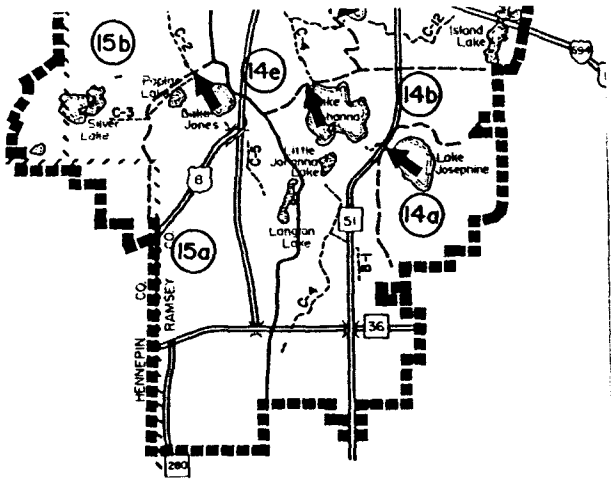

Stream Location G1
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location G1
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 15A, Jones Lake, is approximately 3.61 square miles. Based on information from the water quantity modeling effort, the Jones Lake wetland cannot accommodate its tributary drainage areas by itself. There is no water quality information on Jones Lake prior to 1983. In 1983, station JL-1, which is at the Jones Lake outlet, was sampled and indicated a phosphorus loading of 0.9 pounds per day.

WATERSHED NO: 15A
WATERSHED NAME: Jones Lake

AREA OF
SUBWATERSHED (sq mi): 3.61



TOTAL DRAINAGE AREA
TRIBUTARY TO
SUBWATERSHED
OUTLET (sq mi): 3.61

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	21.	248.	290.
Q $Peak_{out}$ (cfs)	7.8	130.3	146.8
Peak Elevation in Reservoir (ft)	893.03	894.28	894.39
Peak Time (hrs)	33.1	18.3	17.7
Storage Used (ac-ft)	18.0	54.8	58.7
100-YEAR:			
Q $Peak_{in}$ (cfs)	339.	1376.	1527.
Q $Peak_{out}$ (cfs)	261.5	440.1	449.0
Peak Elevation in Reservoir (ft)	895.36	898.22	898.43
Peak Time (hrs)	24.2	19.3	18.8
Storage Used (ac-ft)	95.8	326.2	351.2

WATERSHED NO: 15A
WATERSHED NAME: Jones Lake

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 121.9

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi): 90

Description of Outlet Structure:

One-foot wide weir at 891.5; 24-foot wide weir at 893.0.

Hydrologic Information Available for Subwatershed:

"Pike Lake Flood Study," dated June 1974.

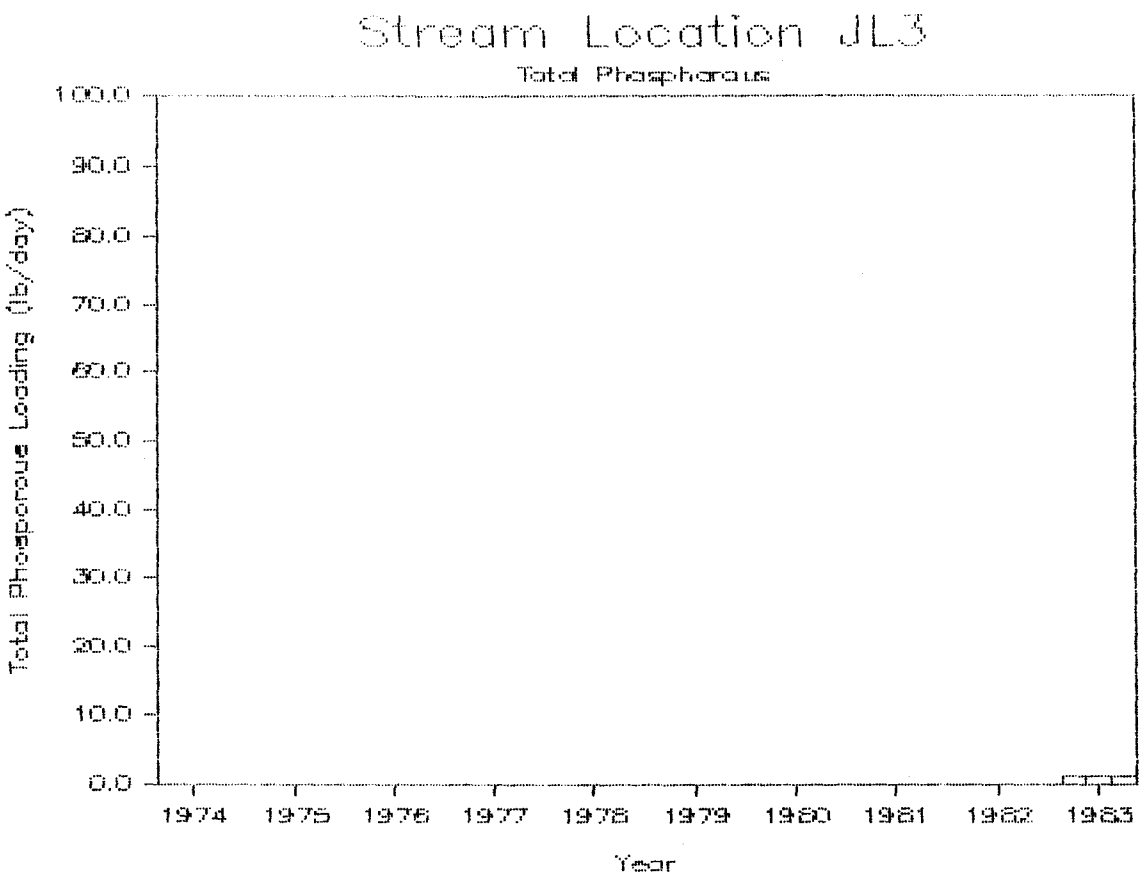
Description of Stormwater Storage Areas Modeled within Watershed:

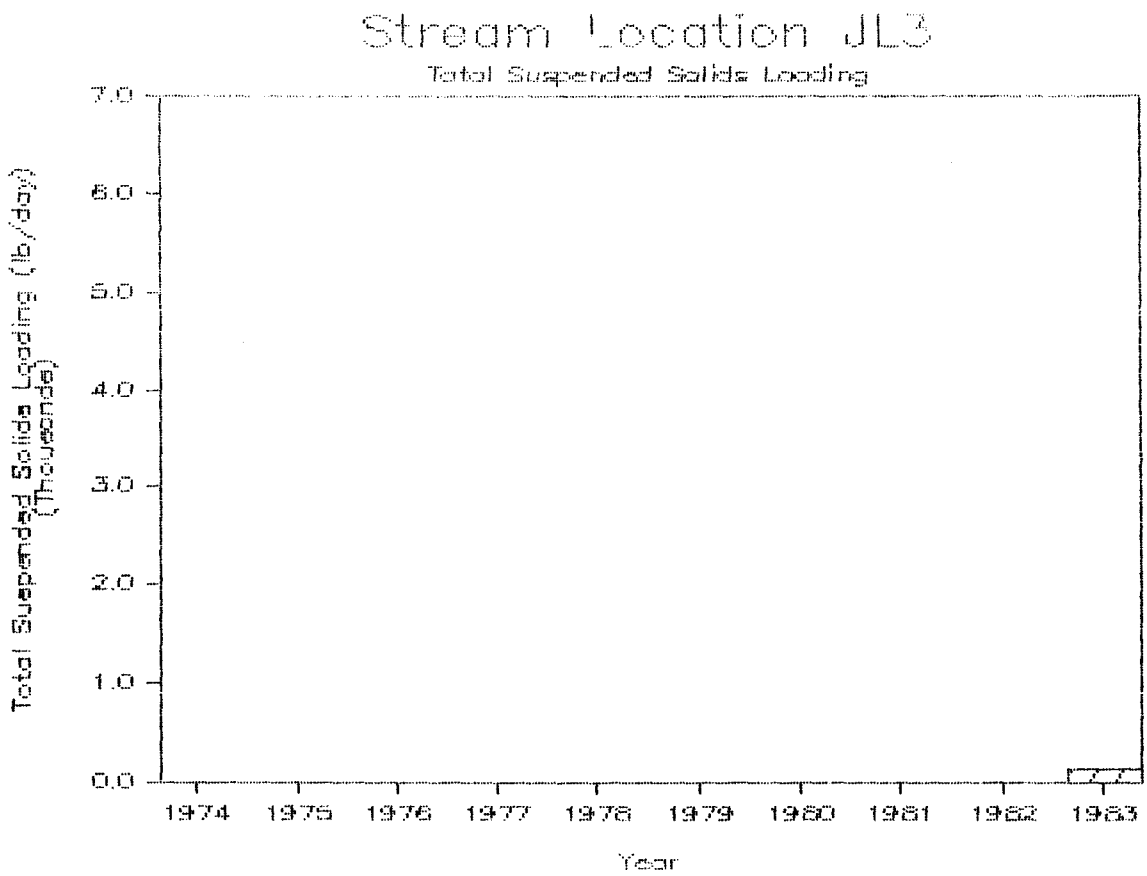
Jones Lake.

WATER QUALITY DATA

STREAM LOCATION ~~JL1~~ JL3

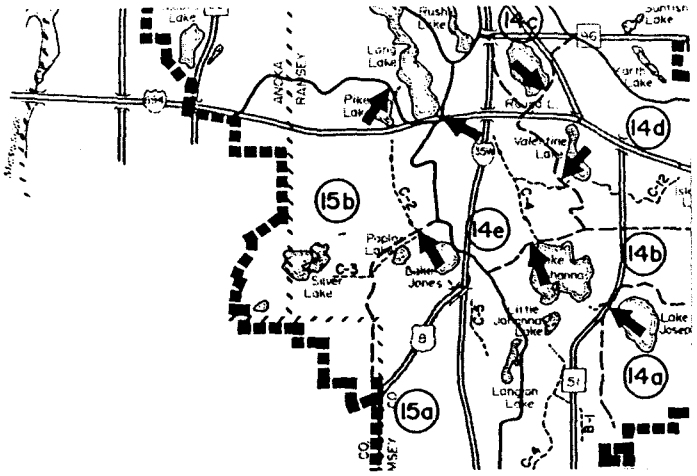
		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	0	8
	Maximum	--	--	1.5
	Minimum	--	--	0.1
	Mean	--	--	0.5
Dissolved Oxygen (mg/l)	Number	0	0	8
	Maximum	--	--	11.4
	Minimum	--	--	1.6
	Mean	--	--	6.2
Water Temperature (°C)	Number	0	0	8
	Maximum	--	--	22.5
	Minimum	--	--	5.0
	Mean	--	--	14.4
Total Kjeldahl Nitrogen (lb/D)	Number	0	0	8
	Maximum	--	--	25.9
	Minimum	--	--	0.5
	Mean	--	--	7.3
Ortho-Phosphorus (lb/D)	Number	0	0	8
	Maximum	--	--	2.3
	Minimum	--	--	0.05
	Mean	--	--	0.6
Total Phosphorus (lb/D)	Number	0	0	8
	Maximum	--	--	3.2
	Minimum	--	--	0.06
	Mean	--	--	0.9
pH	Number	0	0	8
	Maximum	--	--	7.7
	Minimum	--	--	6.6
	Mean	--	--	7.2
Turbidity Turbidity Meter Hach (FTU)	Number	0	0	8
	Maximum	--	--	200.0
	Minimum	--	--	22.0
	Mean	--	--	78.0
Total Non-Filterable Residue (lb/D)	Number	0	0	8
	Maximum	--	--	679.6
	Minimum	--	--	3.8
	Mean	--	--	123.3
Total Chloride (lb/D)	Number	0	0	8
	Maximum	--	--	105.2
	Minimum	--	--	5.4
	Mean	--	--	44.8


Stream Location JL3
Total Phasphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location JL3
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 15B, Pike Lake, is approximately 4.06 square miles. Lakes within this subwatershed include Silver and Pike Lakes. The modeling effort for this subwatershed did not take into consideration many small retention ponds in the City of New Brighton. A Comprehensive Stormwater Management Plan for the City of New Brighton should be reviewed for additional detailed information on areas in Subwatershed 15A and 15B. Water quality information from Pike Lake indicates there is no significant change in water quality observed over the last six years. The stream station C outlet from Pike Lake indicates total phosphorus and total suspended solids have been reduced significantly. Water quality from Silver Lake varies considerably from year to year. It is difficult to discern any trends in water quality information over the last decade.

WATERSHED NO: 15B
WATERSHED NAME: Pike Lake



AREA OF SUBWATERSHED (sq mi): 4.06

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 7.67

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	38.	479.	579.
Q $Peak_{out}$ (cfs)	20.	179.	198.
Peak Elevation in Reservoir (ft)	866.94	868.3	868.48
Peak Time (hrs)	26.5	19.8	19.3
Storage Used (ac-ft)	683.0	1185.0	1250.0
100-YEAR:			
Q $Peak_{in}$ (cfs)	696.	2876.	3222.
Q $Peak_{out}$ (cfs)	474.	885.	910.6
Peak Elevation in Reservoir (ft)	870.00	872.29	872.40
Peak Time (hrs)	22.3	16.4	16.2
Storage Used (ac-ft)	1945.0	2390.0	2774.0

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi):	115.0
Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi):	589.0

Description of Outlet Structure:

Two 10-foot wide box culverts with invert elevation at 866.54.

Hydrologic Information Available for Subwatershed:

"Pike Lake Flood Study," dated June 1974.

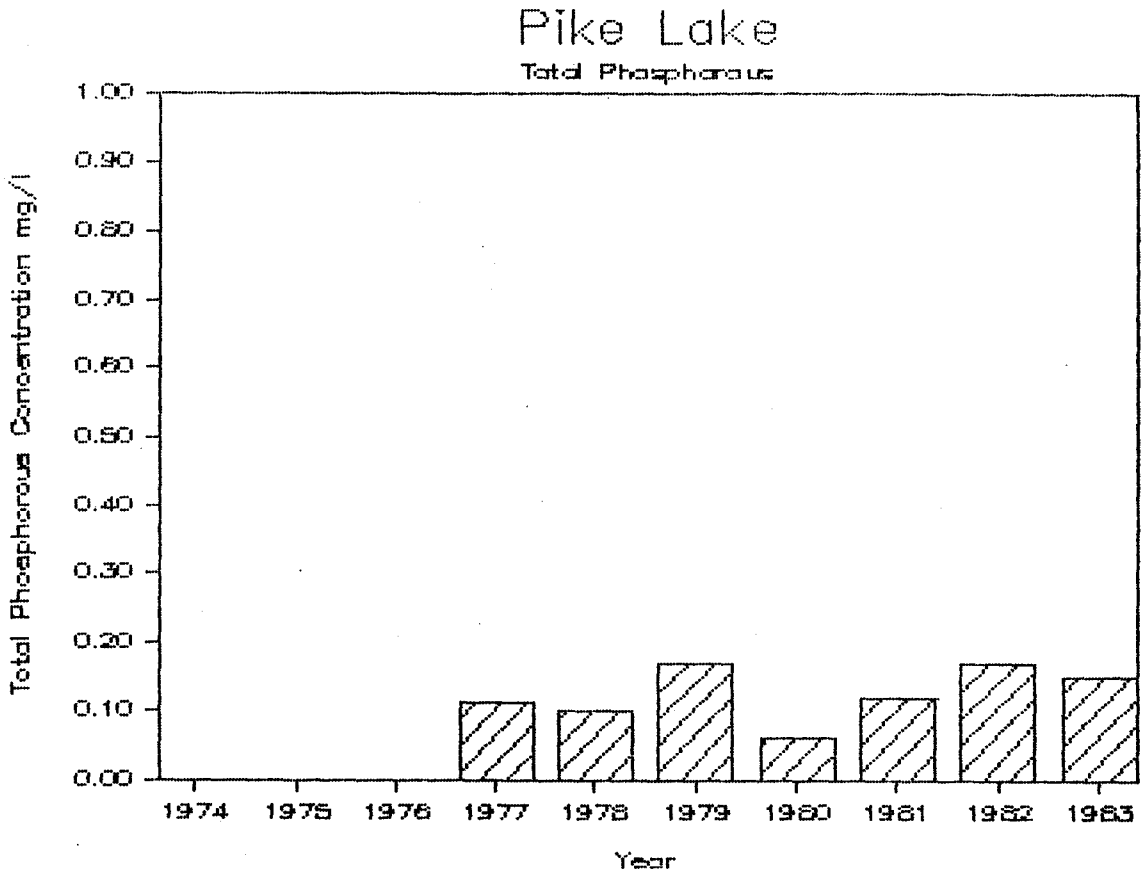
Description of Stormwater Storage Areas Modeled within Watershed:

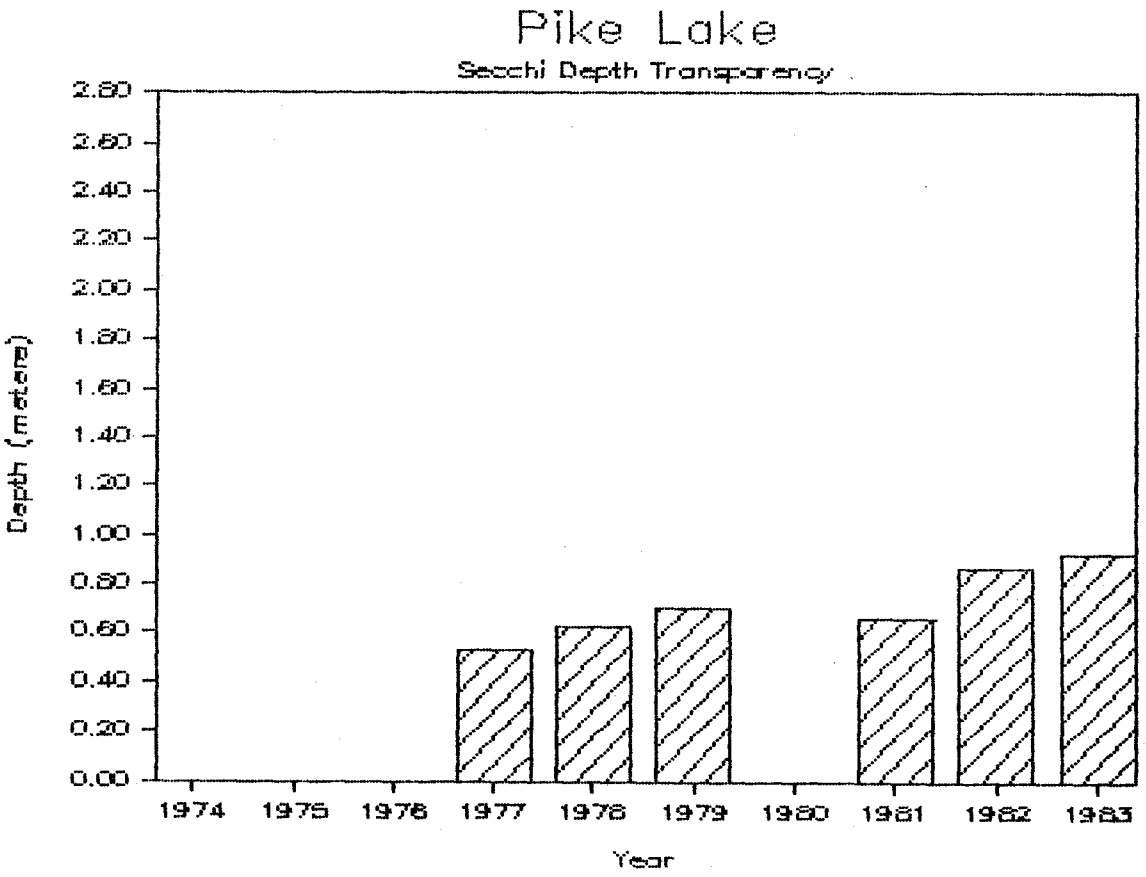
Pike Lake.

WATER QUALITY DATA

PIKE LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	0	14	195
	Maximum	--	0.170	0.850
	Minimum	--	0.008	0.010
	Mean	--	0.041	0.072
Total Phosphorus (mg/l)	Number	0	14	195
	Maximum	--	0.29	1.70
	Minimum	--	0.05	0.01
	Mean	--	0.13	0.15
Chlorophyll-a (ug/l)	Number	0	13	48
	Maximum	--	60.0	95.0
	Minimum	--	3.0	1.0
	Mean	--	23.6	33.2
Conductivity at 25° C (micromho)	Number	0	0	0
	Maximum	--	--	--
	Minimum	--	--	--
	Mean	--	--	--
Secchi Depth Transparency (meters)	Number	0	10	35
	Maximum	--	1.30	2.40
	Minimum	--	0.20	0.46
	Mean	--	0.67	0.83
Total Alkalinity $CaCO_3$ (mg/l)	Number	0	14	195
	Maximum	--	155.0	242.0
	Minimum	--	8.0	52.0
	Mean	--	105.9	120.3
Total Kjeldahl Nitrogen (mg/l)	Number	0	14	190
	Maximum	--	2.10	16.0
	Minimum	--	1.10	0.77
	Mean	--	1.57	1.77
Dissolved Oxygen (mg/l)	Number	0	72	207
	Maximum	--	15.8	20.0
	Minimum	--	0.3	0.01
	Mean	--	6.7	6.1
Temperature (°C)	Number	0	73	204
	Maximum	--	28.0	28.5
	Minimum	--	0.0	0.5
	Mean	--	17.2	14.9
pH	Number	0	14	195
	Maximum	--	8.5	9.0
	Minimum	--	7.1	7.0
	Mean	--	7.9	7.9

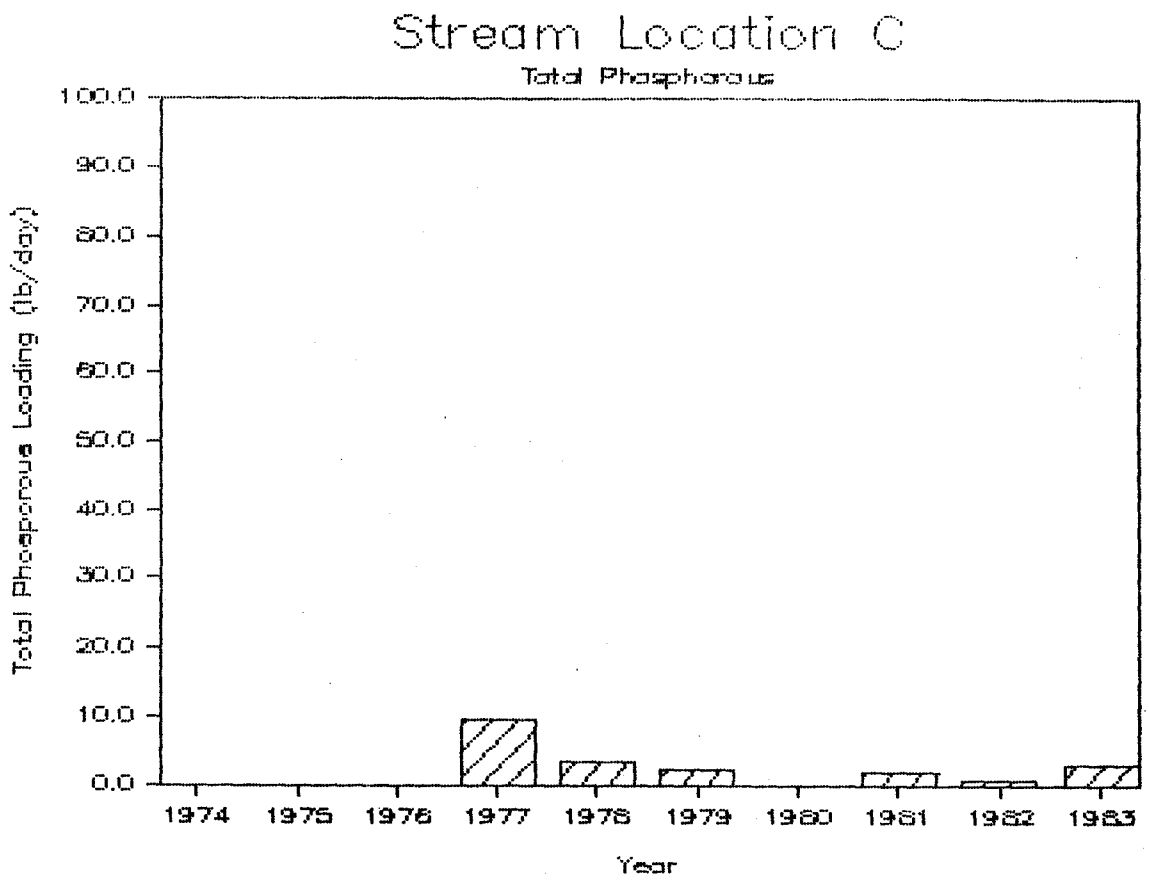

Pike Lake
Total Phasphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

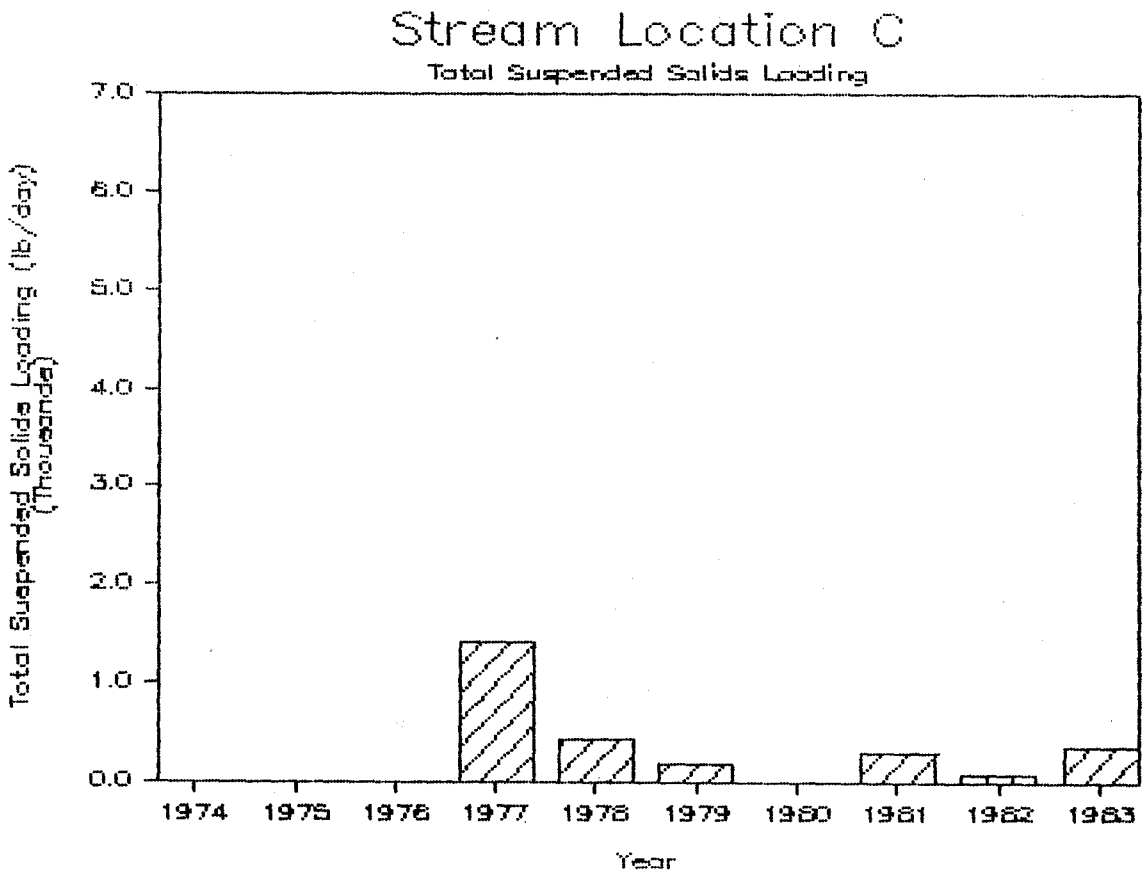

Pike Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

STREAM LOCATION C

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	15	26
	Maximum	--	30.0	14.7
	Minimum	--	0.1	0.2
	Mean	--	6.5	4.1
Dissolved Oxygen (mg/l)	Number	0	13	42
	Maximum	--	16.0	13.6
	Minimum	--	3.2	4.5
	Mean	--	9.6	9.1
Water Temperature (°C)	Number	0	14	43
	Maximum	--	28.0	30.5
	Minimum	--	0.0	0.0
	Mean	--	15.7	18.3
Total Kjeldahl Nitrogen (lb/D)	Number	0	15	25
	Maximum	--	200.6	126.9
	Minimum	--	0.8	1.6
	Mean	--	48.9	35.9
Ortho-Phosphorus (lb/D)	Number	0	14	26
	Maximum	--	9.1	4.6
	Minimum	--	0.01	0.1
	Mean	--	1.4	1.1
Total Phosphorus (lb/D)	Number	0	15	26
	Maximum	--	38.8	7.9
	Minimum	--	0.06	0.2
	Mean	--	5.2	2.1
pH	Number	0	16	49
	Maximum	--	9.4	8.9
	Minimum	--	7.6	7.2
	Mean	--	8.2	8.2
Turbidity Turbidity Meter Hach (FTU)	Number	0	0	46
	Maximum	--	--	100.0
	Minimum	--	--	2.2
	Mean	--	--	28.8
Total Non-Filterable Residue (lb/D)	Number	0	15	26
	Maximum	--	6148.9	1347.9
	Minimum	--	4.9	12.4
	Mean	--	721.2	255.9
Total Chloride (lb/D)	Number	0	0	26
	Maximum	--	--	7767.0
	Minimum	--	--	63.6
	Mean	--	--	1376.9

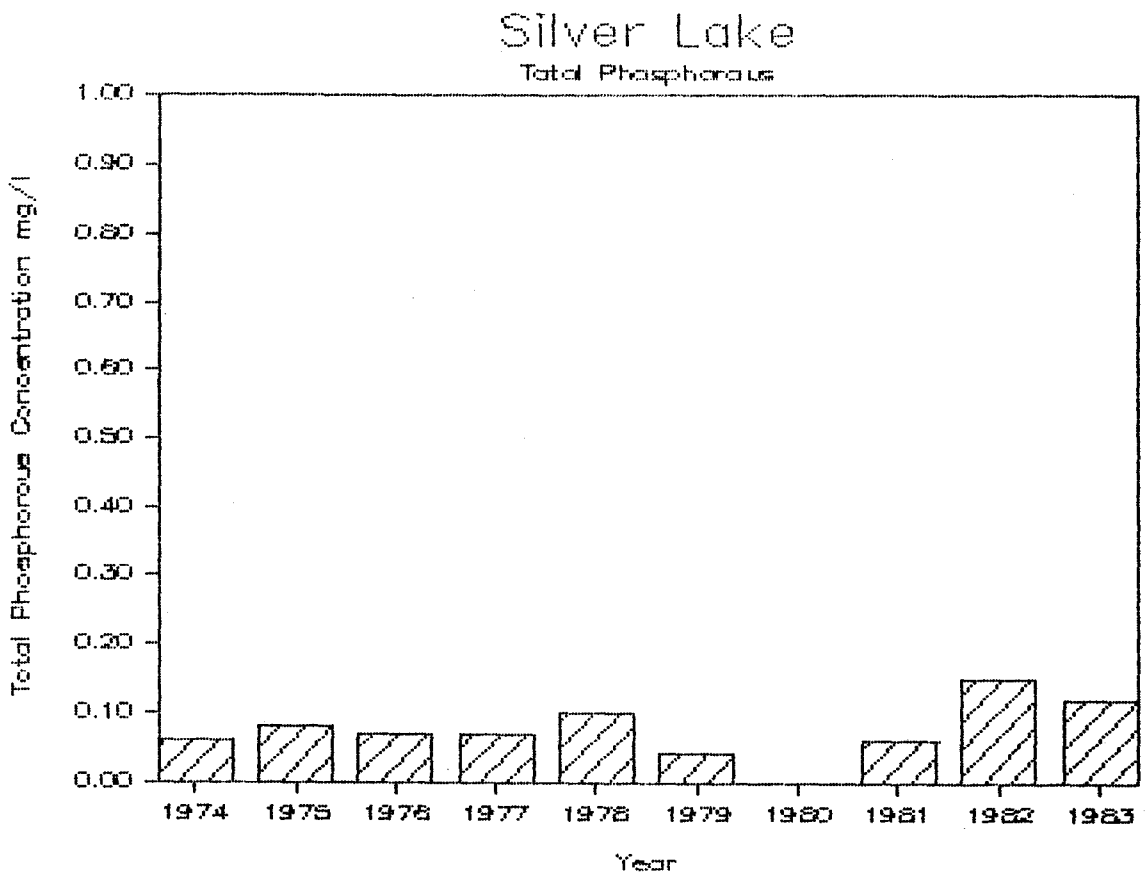

Stream Location C
Total Phosphorous
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

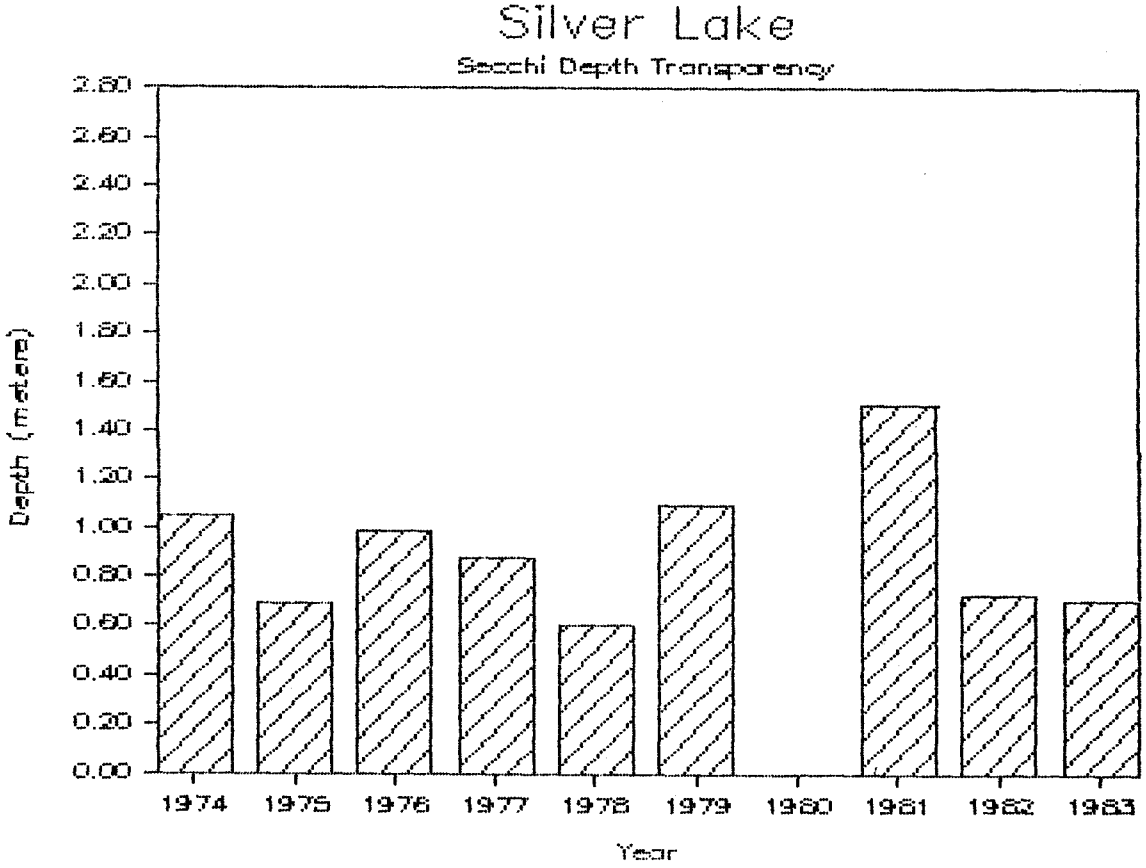

Stream Location C
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

SILVER LAKE

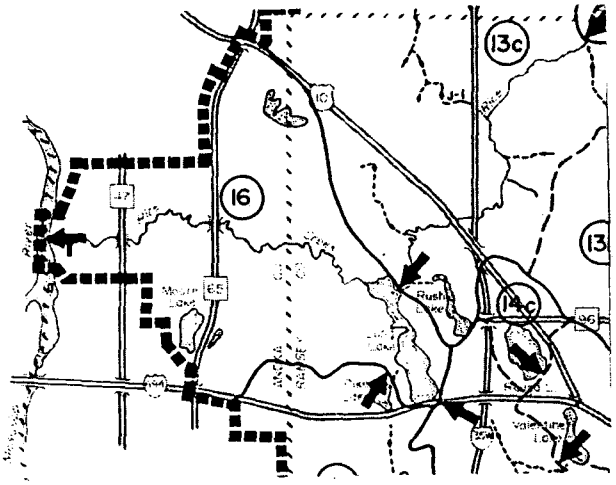
		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.030	0.050	0.150
	Minimum	0.010	0.010	0.040
	Mean	0.020	0.026	0.087
Total Phosphorus (mg/l)	Number	7	6	6
	Maximum	0.09	0.10	0.22
	Minimum	0.03	0.04	0.02
	Mean	0.07	0.07	0.11
Chlorophyll-a (ug/l)	Number	7	6	6
	Maximum	38.0	50.0	86.0
	Minimum	3.0	14.0	8.0
	Mean	19.4	22.5	38.8
Conductivity at 25° C (micromho)	Number	7	6	6
	Maximum	420.0	585.0	320.0
	Minimum	275.0	310.0	250.0
	Mean	317.0	407.3	273.3
Secchi Depth Transparency (meters)	Number	7	6	6
	Maximum	1.14	1.67	2.43
	Minimum	0.52	0.51	0.50
	Mean	0.88	0.86	0.98
Total Chloride (mg/l)	Number	0	2	6
	Maximum	--	118.0	44.0
	Minimum	--	75.0	5.0
	Mean	--	96.5	32.8
Total $NH_3 + NH_4$-N (mg/l)	Number	7	6	6
	Maximum	1.37	0.88	0.59
	Minimum	0.01	0.18	0.05
	Mean	0.59	0.44	0.19
Dissolved Oxygen (mg/l)	Number	7	6	28.
	Maximum	12.2	12.2	11.2
	Minimum	3.8	5.8	0.1
	Mean	8.1	9.3	4.8
Temperature (°C)	Number	7	6	28
	Maximum	27.0	22.0	21.0
	Minimum	17.0	21.0	7.5
	Mean	21.6	21.6	14.5
pH	Number	7	6	6
	Maximum	8.8	8.4	9.0
	Minimum	7.6	7.5	7.7
	Mean	8.3	8.0	8.7


Silver Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Silver Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

Subwatershed 16, Lower Rice Creek, has an area of approximately 7.35 square miles. The major lake within this subwatershed is Long Lake. Water quality modeling efforts indicate there is available channel storage within Rice Creek. Water quality information for Long Lake (north and south basins combined) indicates there has been a slight improvement throughout the lake in total phosphorus, chlorophyll, secchi depth, and total suspended solids. Station R1 at the outlet of Rice Creek to the Mississippi River indicates there has been a reduction in the total phosphorus loadings over the last six years; however, total suspended solids have nearly doubled over the same time period, indicating considerable erosion during that time.

WATERSHED NO: 16
WATERSHED NAME: Lower Rice Creek



AREA OF SUBWATERSHED (sq mi): 7.35

TOTAL DRAINAGE AREA TRIBUTARY TO SUBWATERSHED OUTLET (sq mi): 182.51

	UNDEVELOPED	EXISTING	YEAR 2000
1-YEAR:			
Q $Peak_{in}$ (cfs)	59.	602.	619.
Q $Peak_{out}$ (cfs)	59.	603.	619.
Peak Elevation in Reservoir (ft)	---- No Storage Reservoirs Modeled ---		
Peak Time (hrs)	17.5	14.1	14.0
Storage Used (ac-ft)	---- No Storage Reservoirs Modeled ---		
100-YEAR:			
Q $Peak_{in}$ (cfs)	1173.	3698.	3760.
Q $Peak_{out}$ (cfs)	1173.	3698.	3760.
Peak Elevation in Reservoir (ft)	---- No Storage Reservoirs Modeled ---		
Peak Time (hrs)	16.13	13.88	13.8
Storage Used (ac-ft)	---- No Storage Reservoirs Modeled ---		

100-Year:

Existing $Qpeak_{out}$/Total Tributary Drainage Area (cfs/sq mi): 20

Storage Used (Existing)/Area of Subwatershed (ac-ft/sq mi):

No reservoirs modeled.

Description of Outlet Structure:

Rice Creek at its crossing at East River Road.

Hydrologic Information Available for Subwatershed:

"Floodplain Information for Rice Creek in Fridley and New Brighton," dated November 1971.

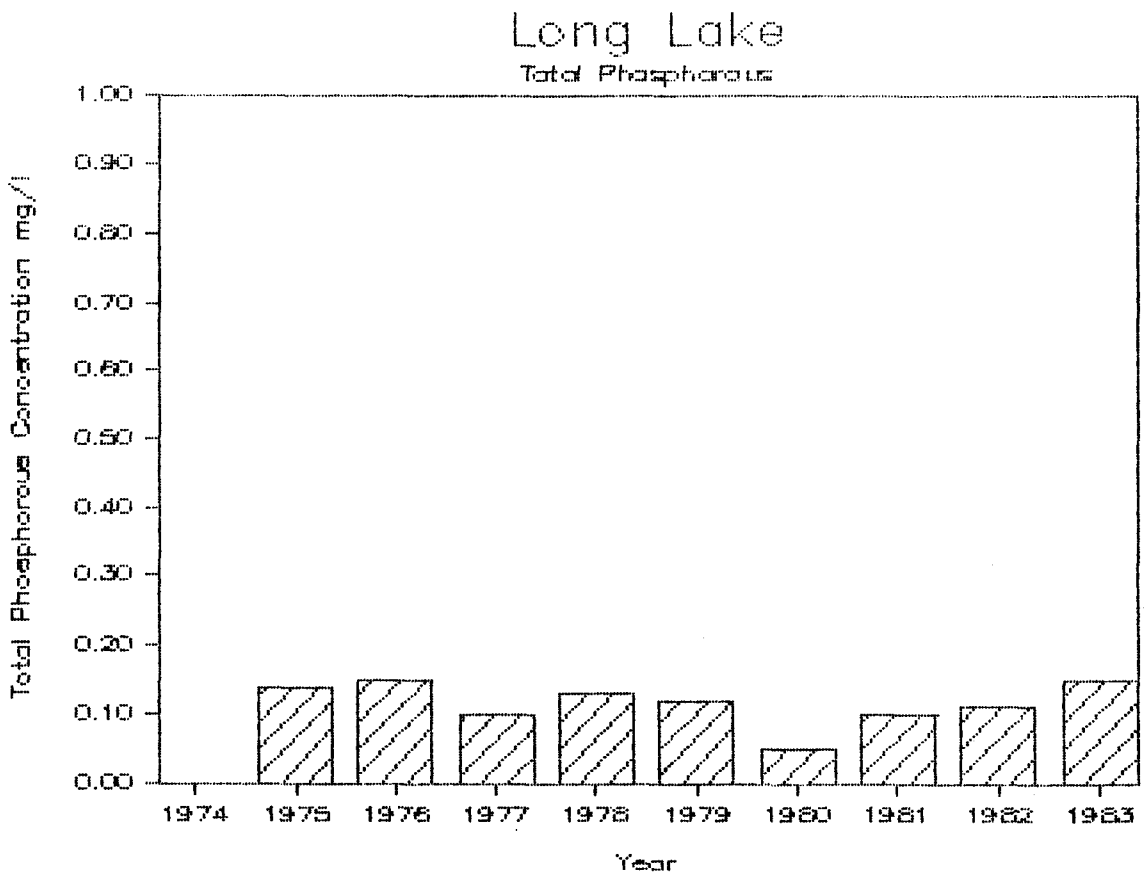
Description of Stormwater Storage Areas Modeled within Watershed:

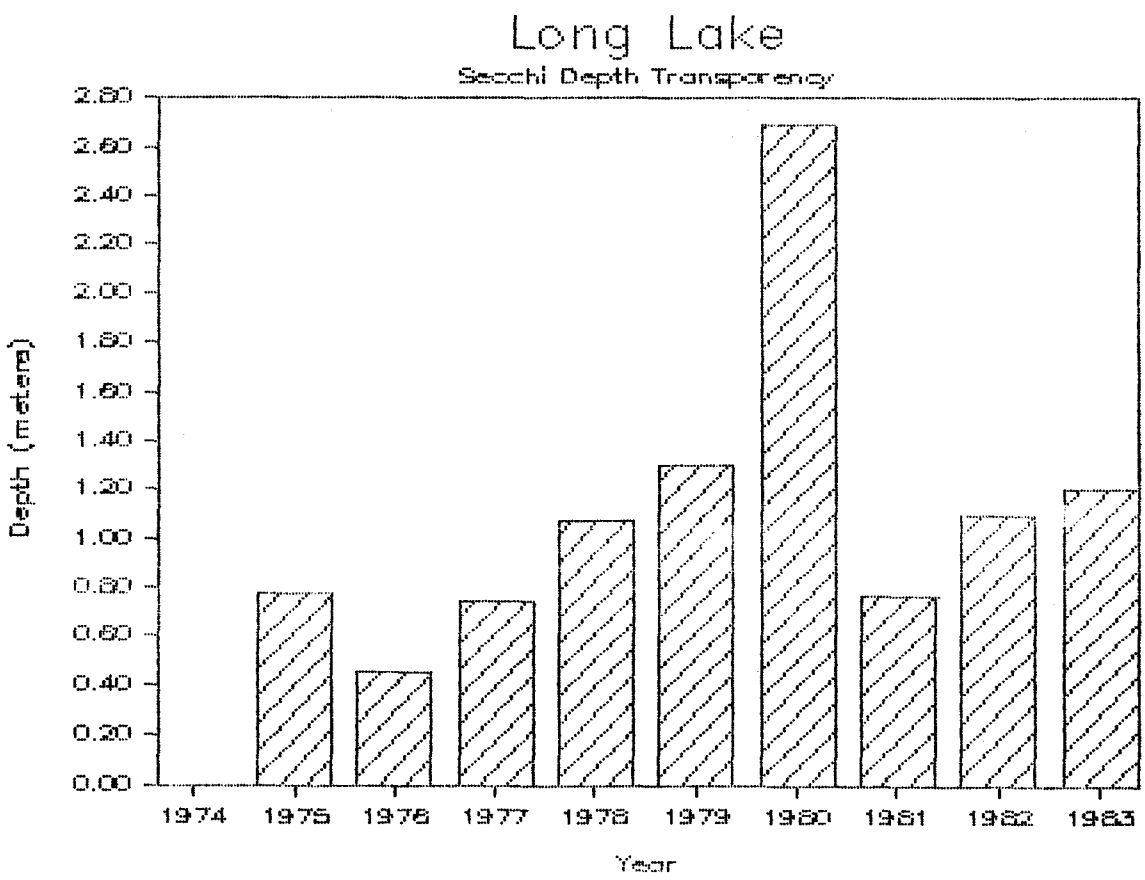
No storage areas modeled.

WATER QUALITY DATA

LONG LAKE

		1974-1976	1977-1980	1981-1983
Ortho Phosphorus (mg/l)	Number	10	128	585
	Maximum	0.316	0.719	0.910
	Minimum	0.001	0.001	0.010
	Mean	0.044	0.048	0.057
Total Phosphorus (mg/l)	Number	10	125	586
	Maximum	0.33	1.02	8.00
	Minimum	0.04	0.03	0.01
	Mean	0.14	0.12	0.12
Chlorophyll-a (ug/l)	Number	10	123	137
	Maximum	77.0	100.0	137.0
	Minimum	14.0	1.0	0.1
	Mean	39.5	17.2	26.3
Conductivity at 25° C (micromho)	Number	10	0	0
	Maximum	700.0	--	--
	Minimum	260.0	--	--
	Mean	453.0	--	--
Secchi Depth Transparency (meters)	Number	10	85	96
	Maximum	1.00	4.60	4.00
	Minimum	0.20	0.30	0.30
	Mean	0.65	1.12	1.06
Total Alkalinity $CaCO_3$ (mg/l)	Number	0	128	580
	Maximum	--	266.0	294.0
	Minimum	--	93.0	76.0
	Mean	--	138.8	141.9
Total Kjeldahl Nitrogen (mg/l)	Number	0	128	572
	Maximum	--	4.10	11.00
	Minimum	--	1.10	0.50
	Mean	--	2.05	1.98
Dissolved Oxygen (mg/l)	Number	2.7	701	802
	Maximum	14.9	15.6	25.5
	Minimum	0.3	0.1	0.01
	Mean	6.0	6.3	6.2
Temperature (°C)	Number	27	702	804
	Maximum	27.0	27.0	29.0
	Minimum	16.0	0.0	0.1
	Mean	21.5	11.7	14.3
pH	Number	10	128	585
	Maximum	8.8	9.3	8.7
	Minimum	6.8	7.1	6.0
	Mean	8.1	7.9	7.8

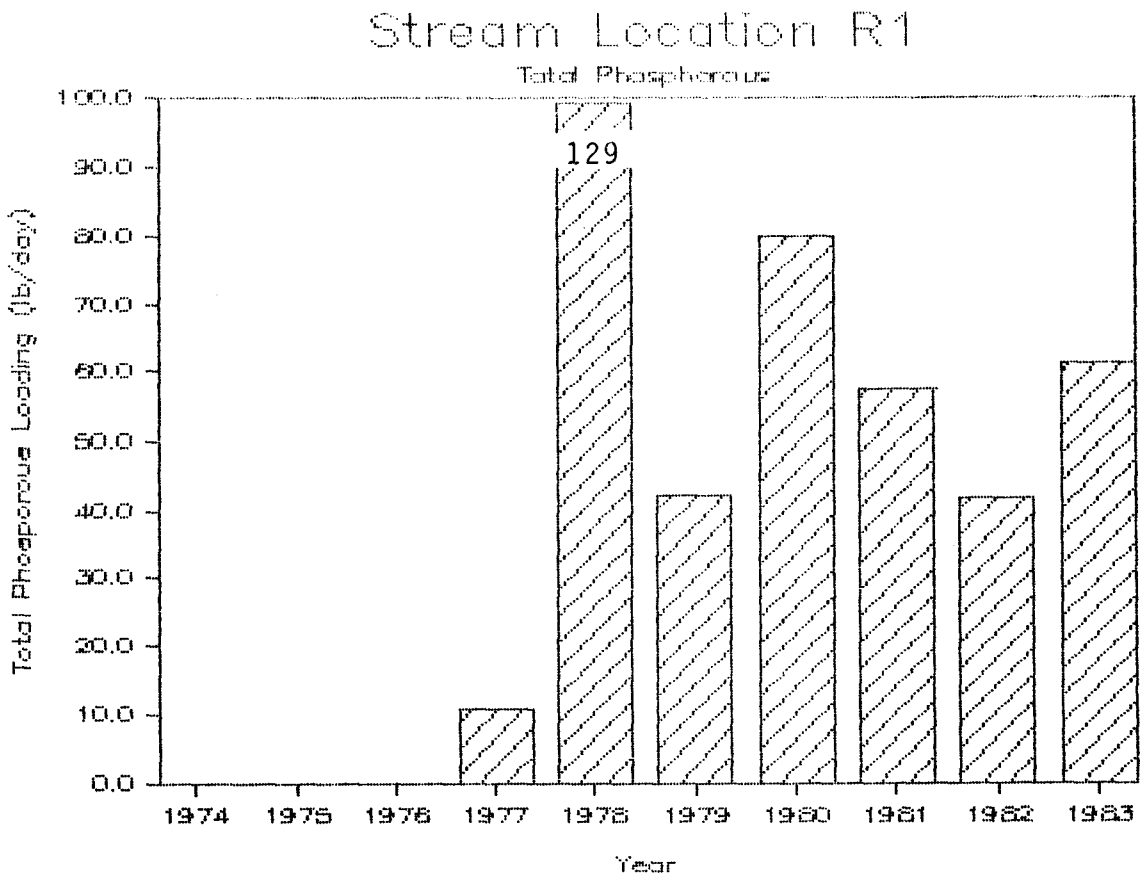

Long Lake
Total Phosphorous
Total Phosphorous Concentration mg/l
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

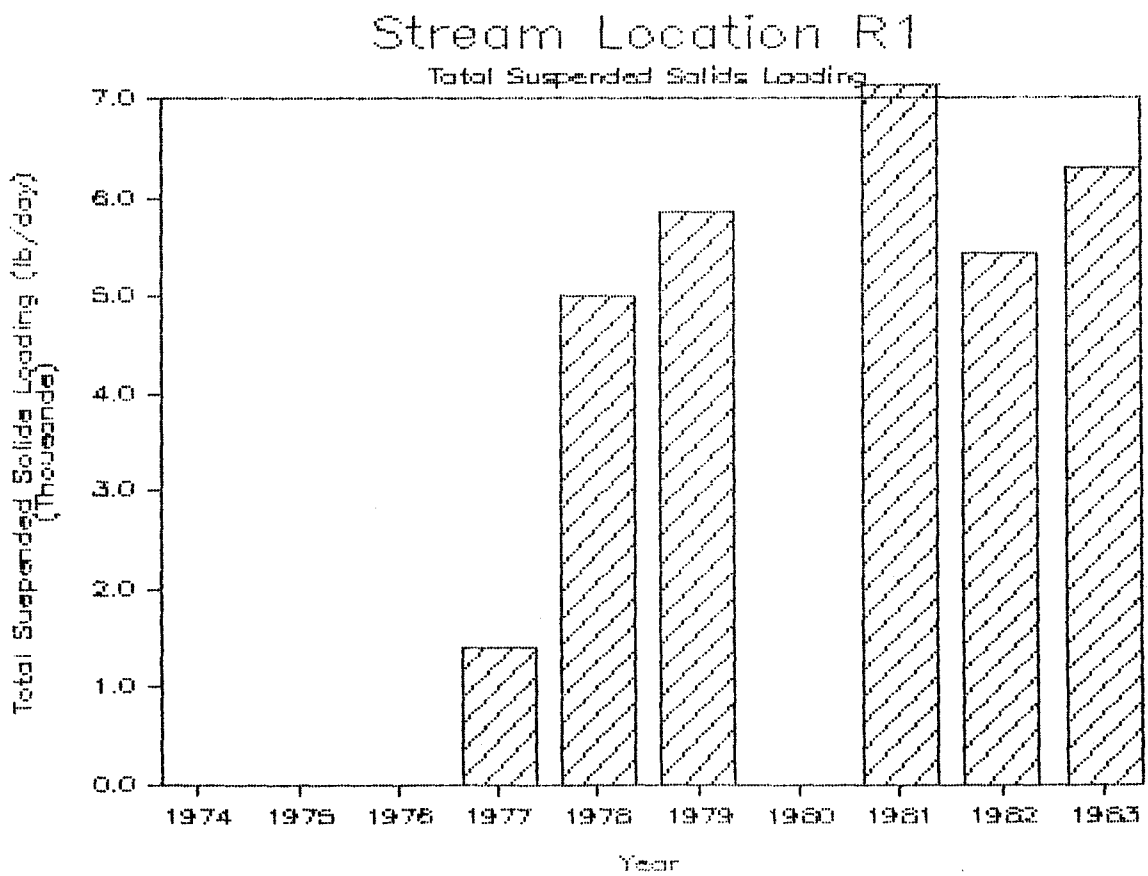

Long Lake
Secchi Depth Transparency
Depth (meters)
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY DATA

STREAM LOCATION R1

		1974-1976	1977-1980	1981-1983
Stream Flow (cfs)	Number	0	28	28
	Maximum	--	236.0	248.0
	Minimum	--	3.0	3.4
	Mean	--	67.9	81.1
Dissolved Oxygen (mg/l)	Number	1	12	27
	Maximum	10.8	14.2	14.2
	Minimum	10.8	7.8	4.0
	Mean	10.8	9.7	9.5
Water Temperature (°C)	Number	0	12	27
	Maximum	--	26.0	29.0
	Minimum	--	3.0	2.0
	Mean	--	16.5	15.5
Total Kjeldahl Nitrogen (lb/D)	Number	0	15	15
	Maximum	--	3055.0	1287.5
	Minimum	--	24.3	349.5
	Mean	--	795.1	746.0
Ortho-Phosphorus (lb/D)	Number	0	19	15
	Maximum	--	150.4	82.8
	Minimum	--	0.6	2.6
	Mean	--	24.2	20.5
Total Phosphorus (lb/D)	Number	0	19	15
	Maximum	--	243.6	84.1
	Minimum	--	3.6	23.7
	Mean	--	63.7	54.8
pH	Number	12	20	15
	Maximum	8.5	8.5	8.2
	Minimum	7.0	7.4	7.7
	Mean	7.7	8.0	7.9
Turbidity Turbidity Meter Hach (FTU)	Number	9	0	0
	Maximum	21.0	--	--
	Minimum	7.0	--	--
	Mean	11.8	--	--
Total Non-Filterable Residue (lb/D)	Number	0	17	13
	Maximum	--	17,017.9	13,609.0
	Minimum	--	129.5	263.8
	Mean	--	3992.5	6277.5
Total Chloride (lb/D)	Number	0	6	15
	Maximum	--	23,878.2	26,278.4
	Minimum	--	4780.0	2427.2
	Mean	--	15,137.3	12,535.4


Stream Location R1
Total Phosphorous
129
Total Phosphorous Loading (lb/day)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year


Stream Location R1
Total Suspended Solids Loading
Total Suspended Solids Loading (lb/day)
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
Year

WATER QUALITY RANKING OF LAKES
MONITORED BY THE RICE CREEK WATERSHED DISTRICT
BASED ON TROPHIC STATE INDEX

Ranking	Lake Name	Trophic State Index
1	Turtle	47
2	White Bear	50
3	Island	52
4	Rondeau	57
5	Clear	61
6	Oneka	63
7	Josephine	63
8	Johanna	63
9	Bald Eagle	67
10	Silver	67
11	Reshanau	69
12	Sunset	70
13	Golden	70
14	Pike	70
15	Long	70
16	Valentine	72
17	Moore Lake	74
18	Centerville	75
19	Forsham	85
20	Peltier	86
21	Tamarac (Crossways)	87
22	George Watch	87
23	Rice	88
24	Baldwin	92

LAKE NAME: Baldwin Lake

LOCATION: Circle Pines

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.45

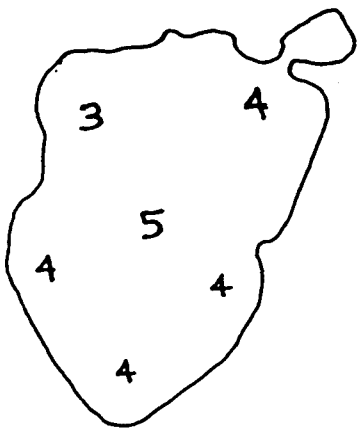
Chlorophyll-a (ug/l) 86

Secchi Depth (m) 0.7

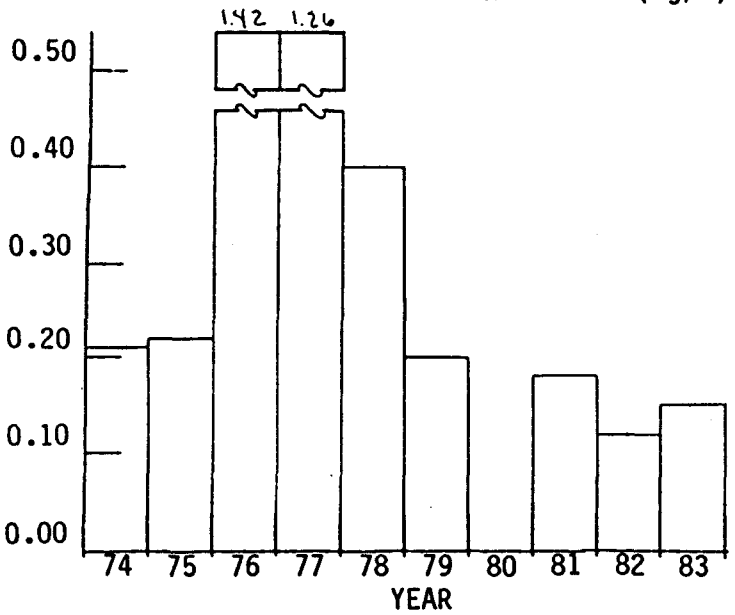
Conductivity (mg/l) 349

pH 8.5 TSI 92

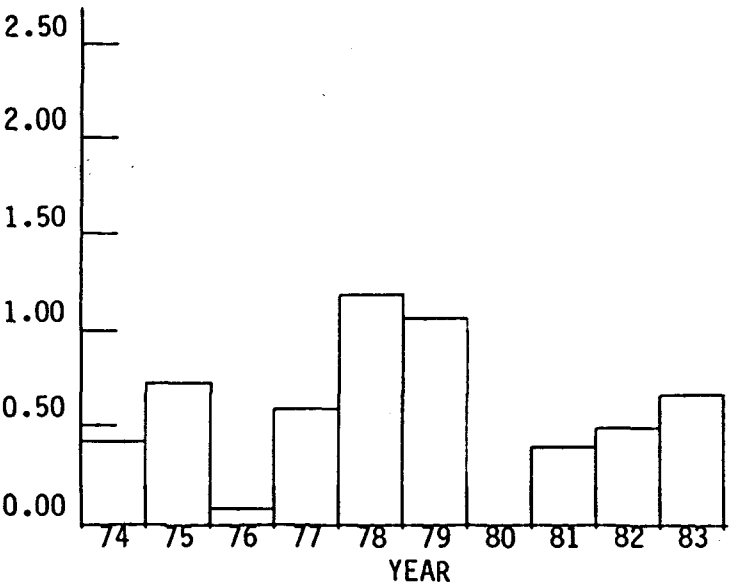
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1974 to 1983, except for 1980.
- The lake is shallow, does not appear to stratify.
- The nitrogen to phosphorus ratio ranges from 10-20, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Rice

LOCATION: Lino Lakes

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.33

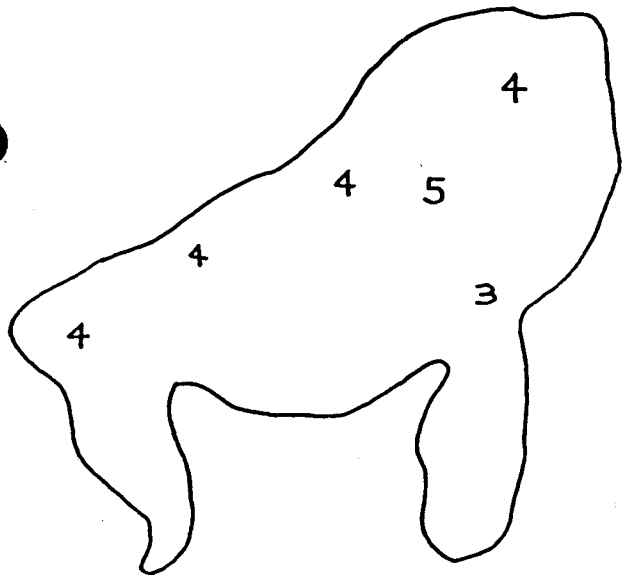
Chlorophyll-a (ug/l) 126

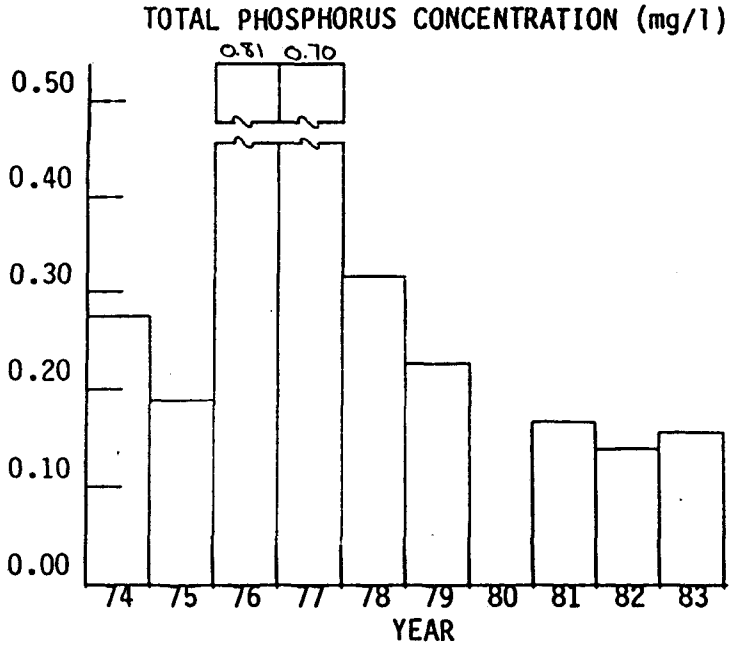
Secchi Depth (m) 0.6

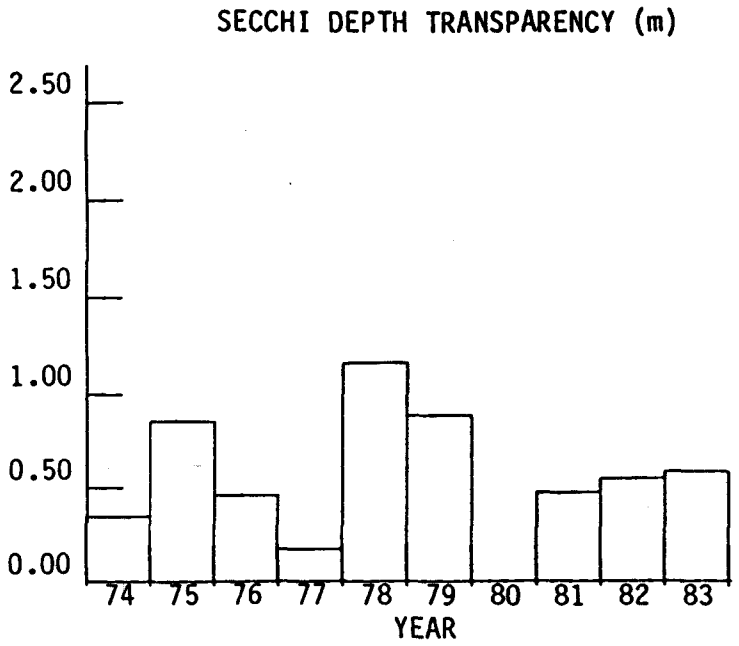
Conductivity (mg/l) 350

pH 8.6 TSI 88

LAKE MAP







COMMENTS:

- Lake water quality was monitored from 1973 to 1983, except for 1980.
- The lake is shallow and does not appear to stratify.
- The nitrogen to phosphorus ratio ranges from 10-20, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: George Watch

LOCATION: Centerville

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.32

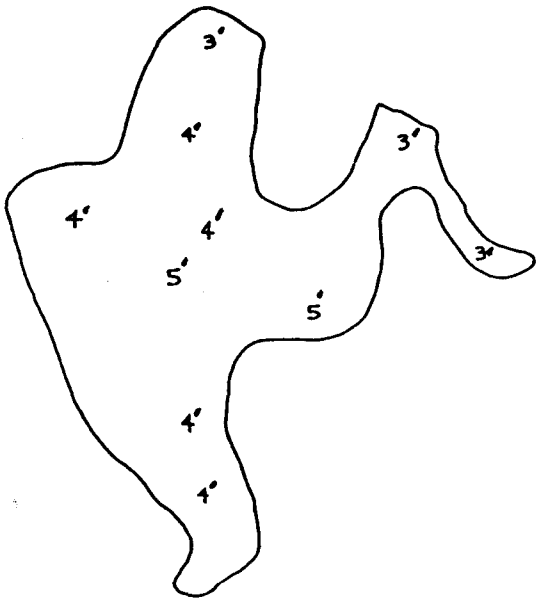
Chlorophyll-a (ug/l) 95

Secchi Depth (m) 0.6

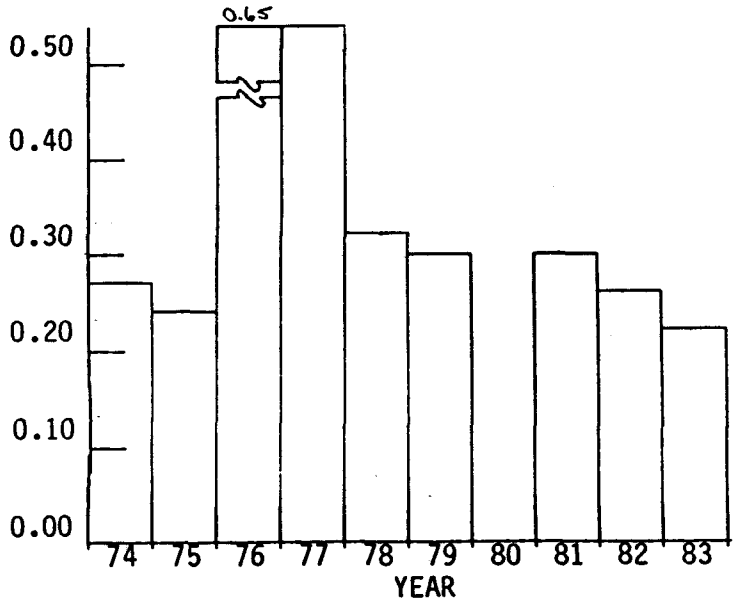
Conductivity (mg/l) 328

pH 8.6 TSI 87

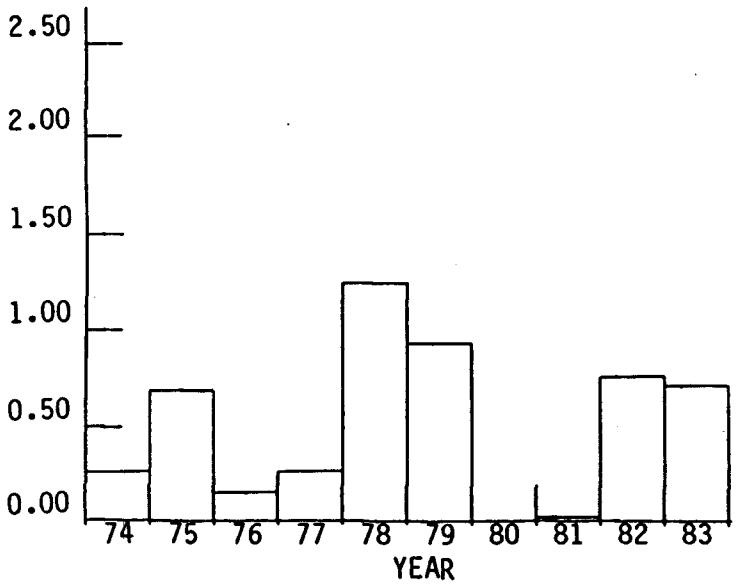
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Water quality was monitored from 1974 to 1983, excluding 1980.
- The lake is shallow with no stratification observed.
- The lake is of poor water quality as indicated by the TSI and chlorophyll-a concentrations.
- Elevated pH readings could be the result of intense algal blooms.
- Low nitrogen to phosphorus ratios indicate nitrogen may limit plant growth at some times of the year.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Tamarac (Crossways)

LOCATION: Columbus Township

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) .32

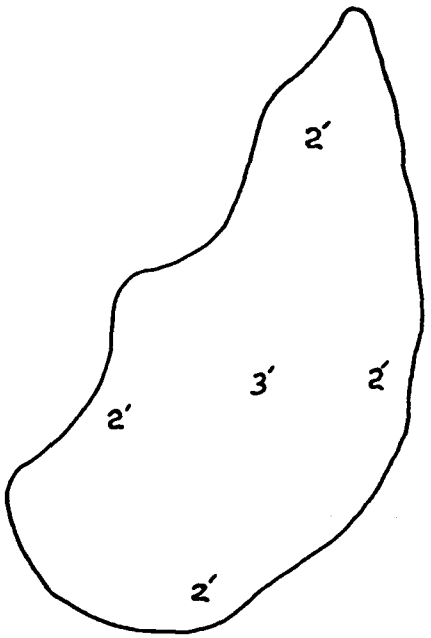
Chlorophyll-a (ug/l) 11

Secchi Depth (m) 0.4

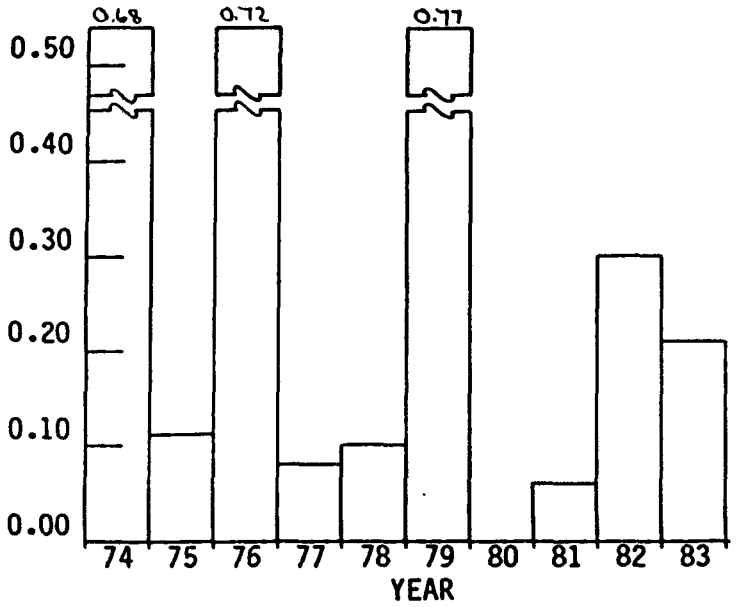
Conductivity (mg/l) 300

pH 7.7 TSI 87

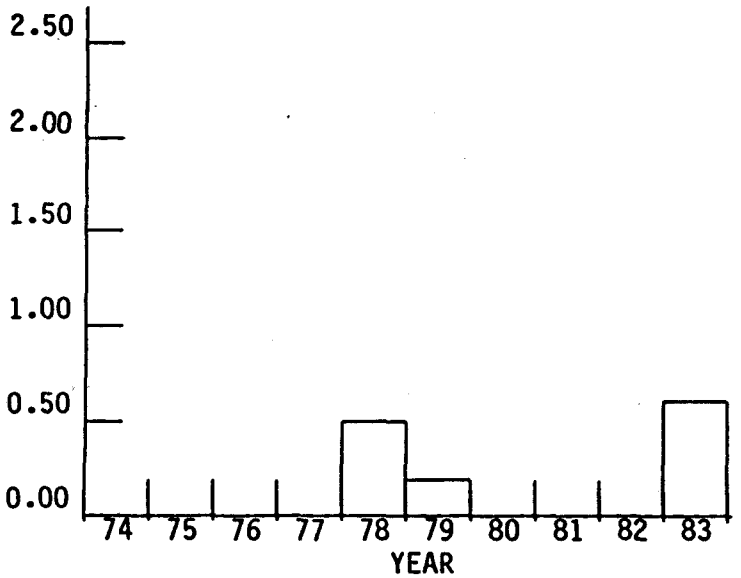
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- The lake was sampled two times per year from 1974 to 1983, excluding 1980.
- The lake is shallow with no stratification observed.
- The nitrogen to phosphorus ratio ranges from 20-30, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Peltier

LOCATION: Centerville

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.29

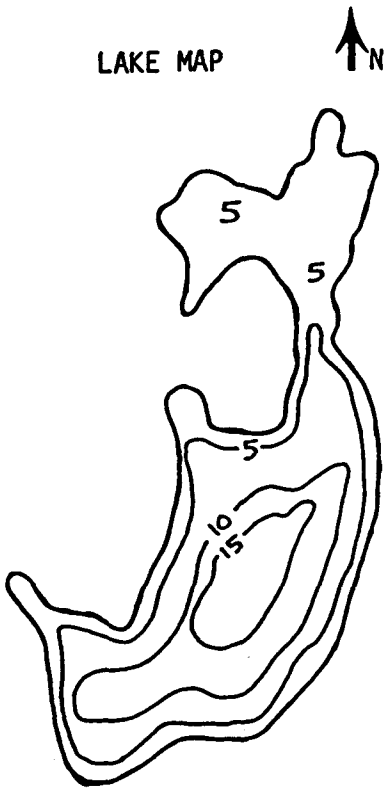
Chlorophyll-a (ug/l) 34

Secchi Depth (m) 0.9

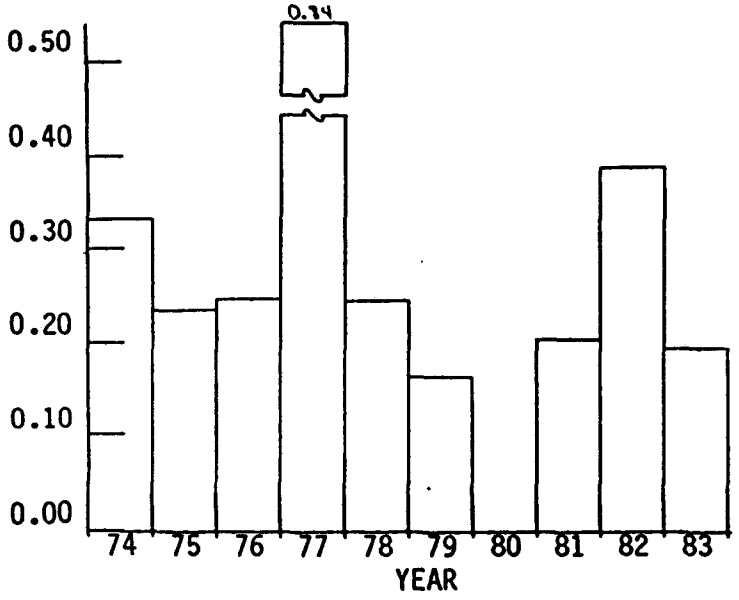
Conductivity (mg/l) 365

pH 7.7 TSI 86

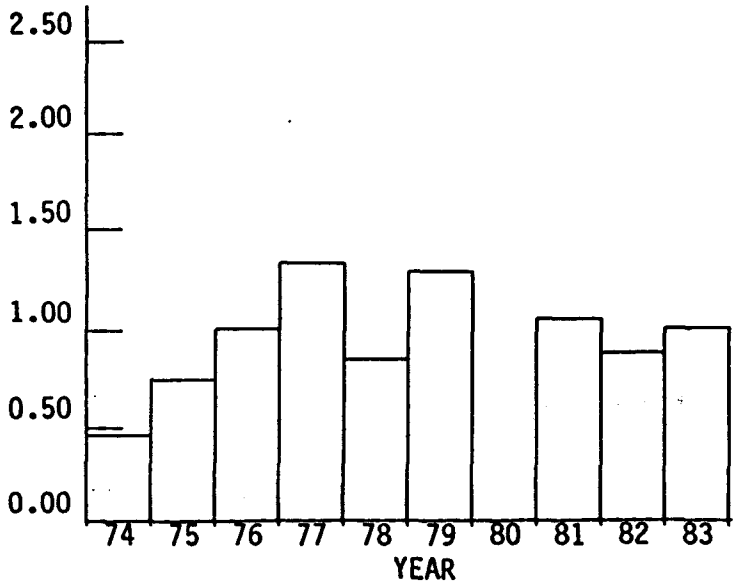
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Water quality was monitored from 1974 to 1983 except for 1980.
- The lake does not continually stratify during the summer months; however, oxygen depletion occurs near the bottom.
- The nitrogen to phosphorus ratio ranges from 10-15, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Forsham

LOCATION: Lino Lakes

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.27

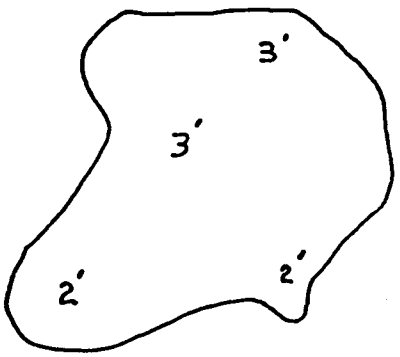
Chlorophyll-a (ug/l) 55

Secchi Depth (m) 0.9

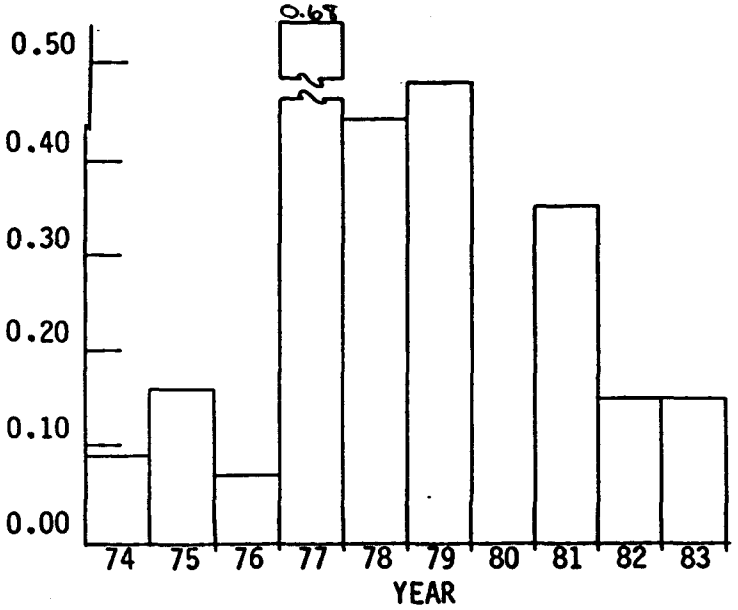
Conductivity (mg/l) 335

pH 8.2 TSI 85

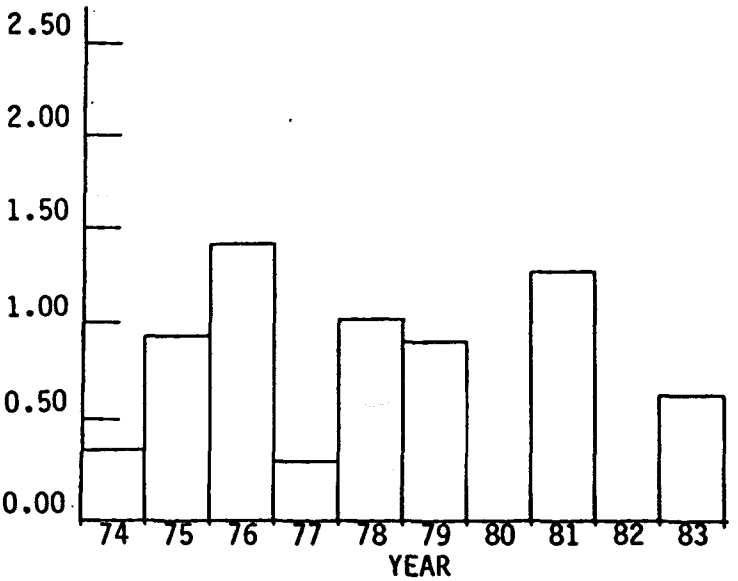
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1974 to 1983, except for 1980.
- The lake is shallow and does not appear to stratify.
- The nitrogen to phosphorus ratio ranges from 5 to 15, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Centerville

LOCATION: Centerville,
Lino Lakes

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.14

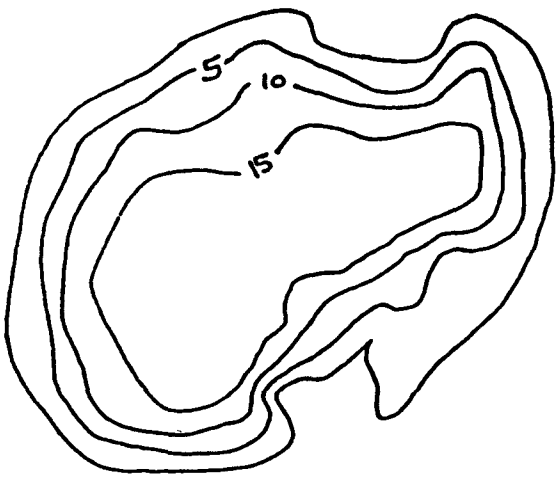
Chlorophyll-a (ug/l) 76

Secchi Depth (m) 1.4

Conductivity (mg/l) 332

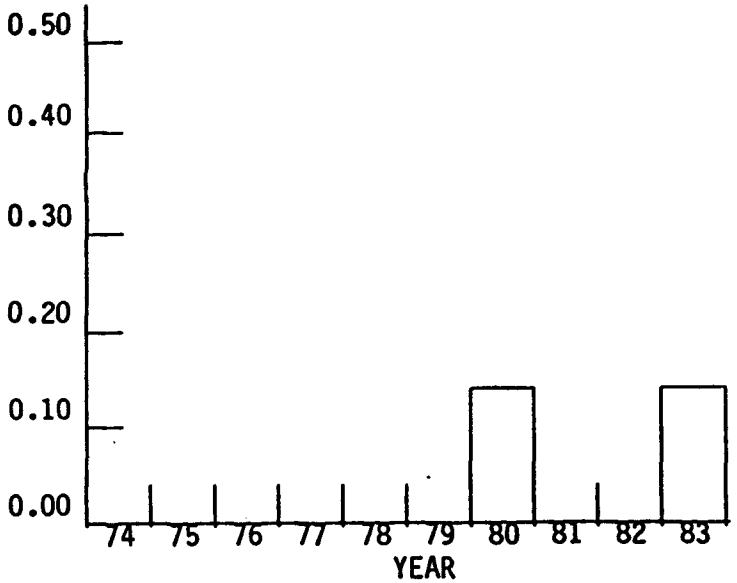
pH NIA TSI 75

LAKE MAP

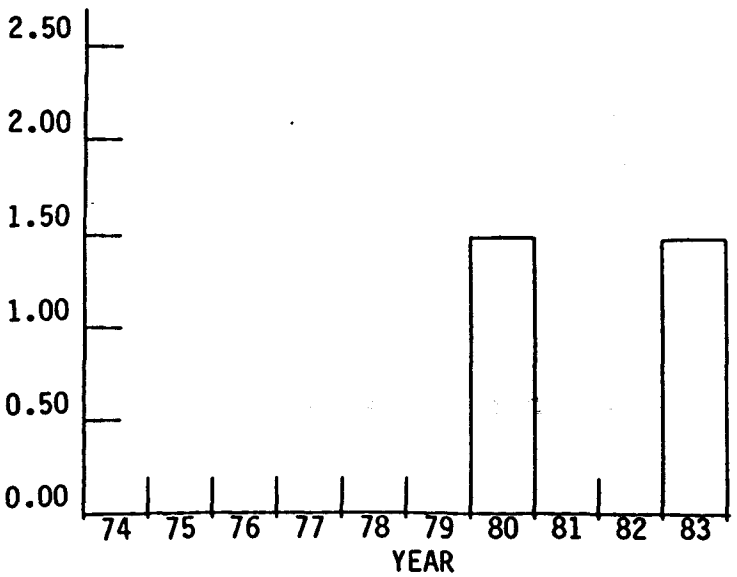


N

TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored in 1980 and 1983 only.
- The lake does not appear to continually stratify, but there is evidence of oxygen depletion near the bottom during some times of the year.
- The nitrogen to phosphorus ratio ranges from 10-20, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Moore - East Basin

LOCATION: Fridley

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.10

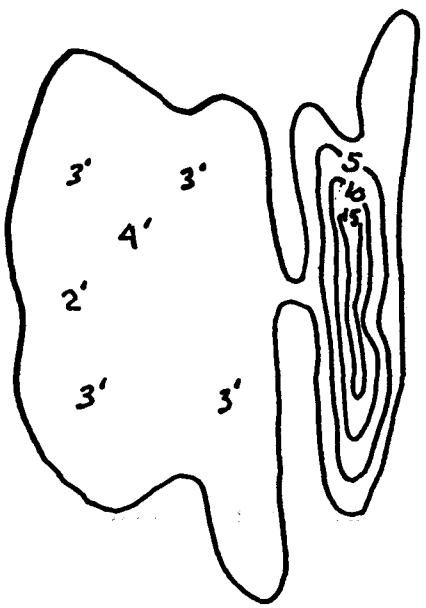
Chlorophyll-a (ug/l) 13

Secchi Depth (m) 1.4

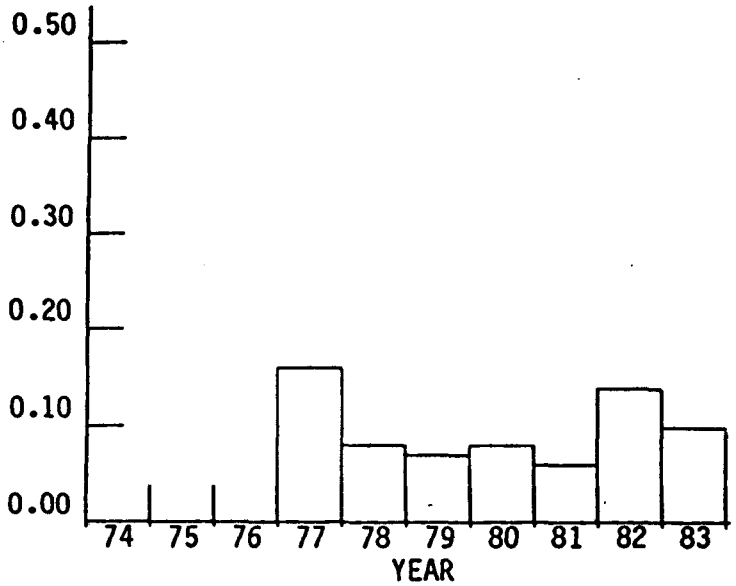
Conductivity (mg/l) 372

pH 7.8 TSI 74

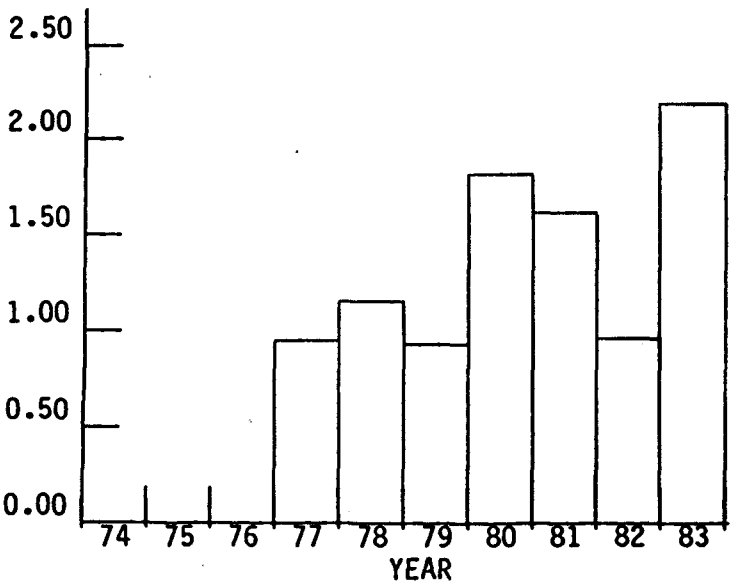
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1977-1983.
- The lake stratifies and dissolved oxygen concentrations drop below 1 mg/l during the summer and winter months unless aeration system is operating.
- Hypolimnetic phosphorus concentrations were observed to be elevated, indicating internal loading of nutrients from sediments is occurring.
- The nitrogen to phosphorus ratio ranges from 10-20, indicating that the nutrients are close to being balanced, but phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Valentine

LOCATION: Arden Hills

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.11

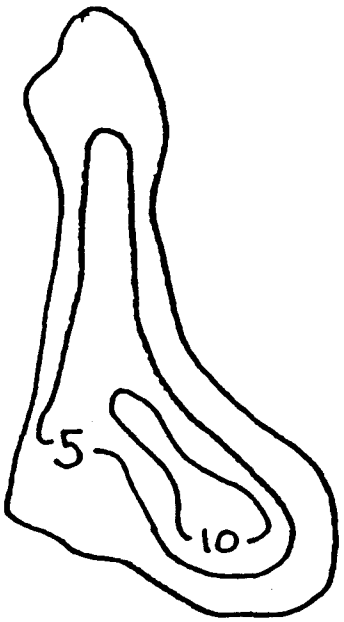
Chlorophyll-a (ug/l) 27

Secchi Depth (m) 0.7

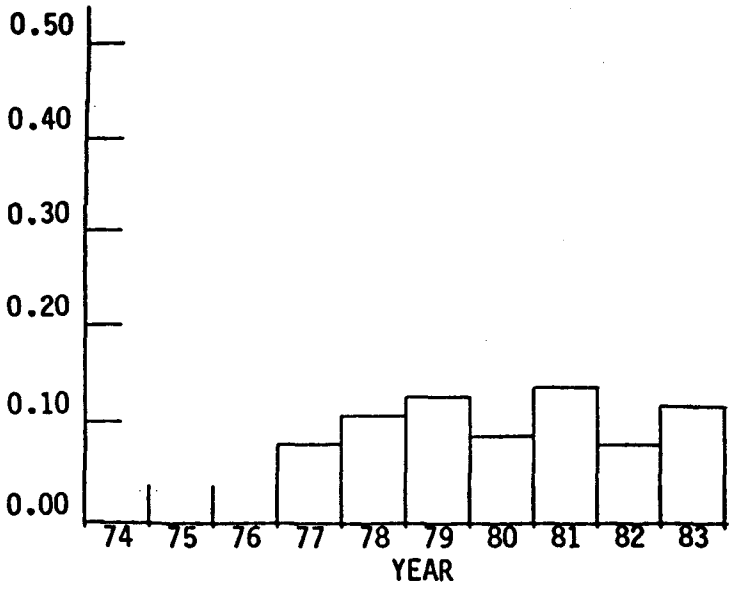
Conductivity (mg/l) NIA

pH 8.1 TSI 72

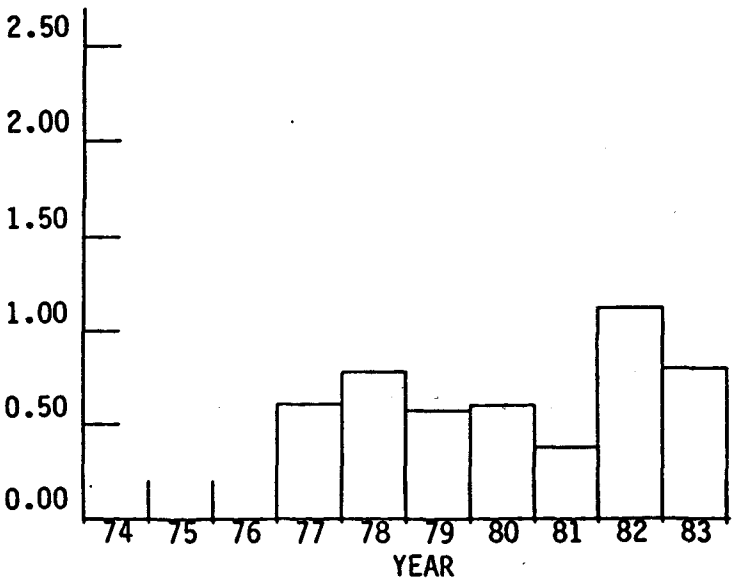
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1977-1983.
- The lake stratifies during the summer and winter, with dissolved oxygen concentrations dropping below 1 mg/l.
- Elevated phosphorus concentrations were observed in the hypolimnion and suggest nutrient release from bottom sediments is occurring.
- The nitrogen to phosphorus ratio ranges from 10-20, indicating that the nutrients are close to being balanced, but phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Long

LOCATION: New Brighton

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.10

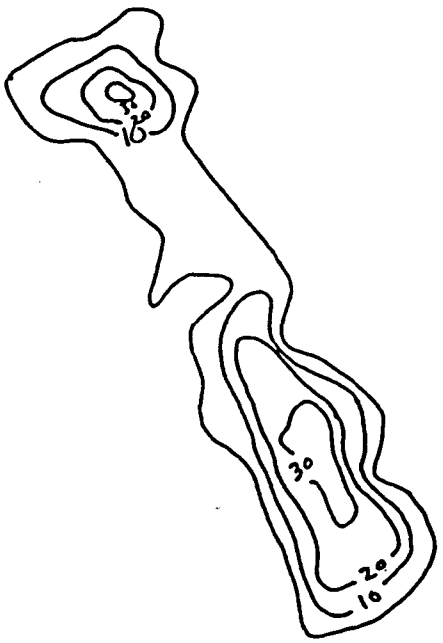
Chlorophyll-a (ug/l) 29

Secchi Depth (m) 1.1

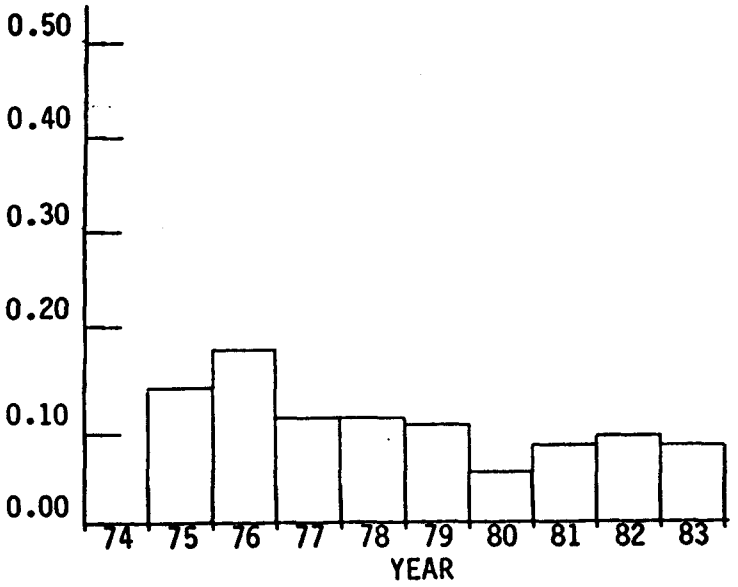
Conductivity (mg/l) 472

pH 7.9 TSI 70

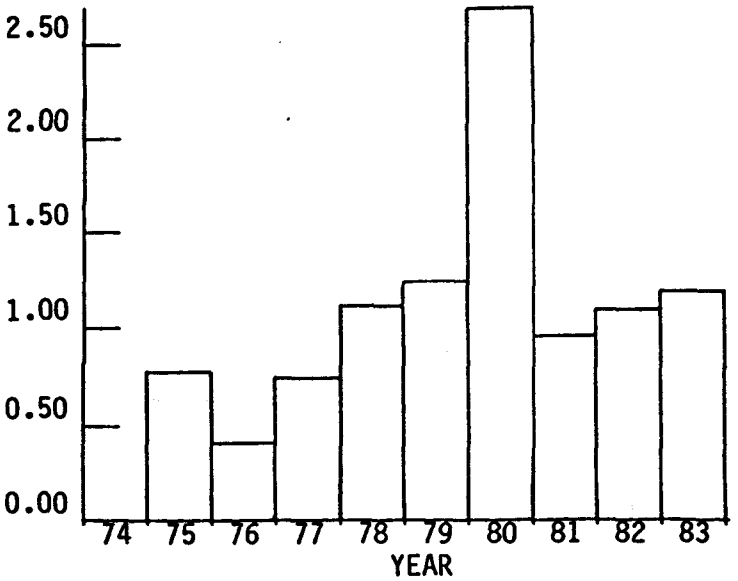
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1975-1983.
- The lake stratifies during the summer and winter, with dissolved oxygen concentrations in the hypolimnion dropping below 1 mg/l.
- Internal nutrient loading is evident from elevated phosphorus values in hypolimnion during stratified periods.
- The nitrogen to phosphorus ratio ranges from 20-30, indicating that phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Pike

LOCATION: New Brighton

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.10

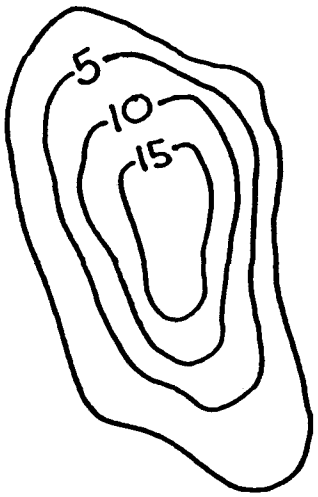
Chlorophyll-a (ug/l) 29

Secchi Depth (m) 0.8

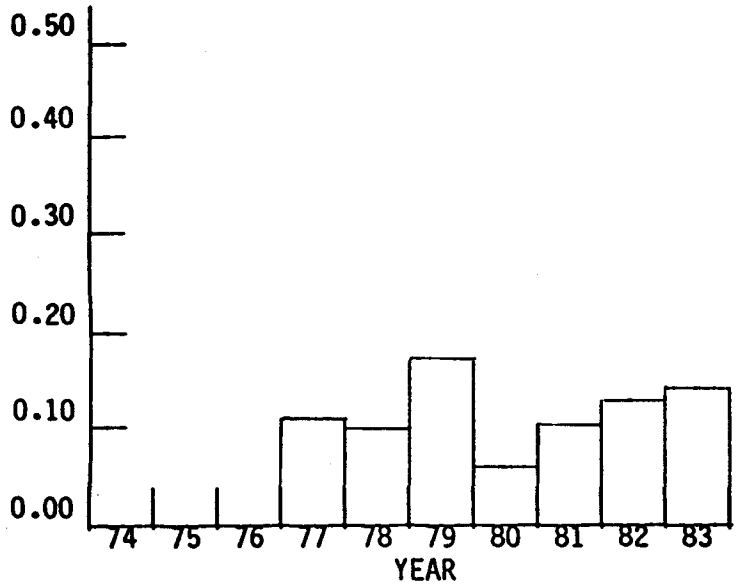
Conductivity (mg/l) NIA

pH 8.0 TSI 70

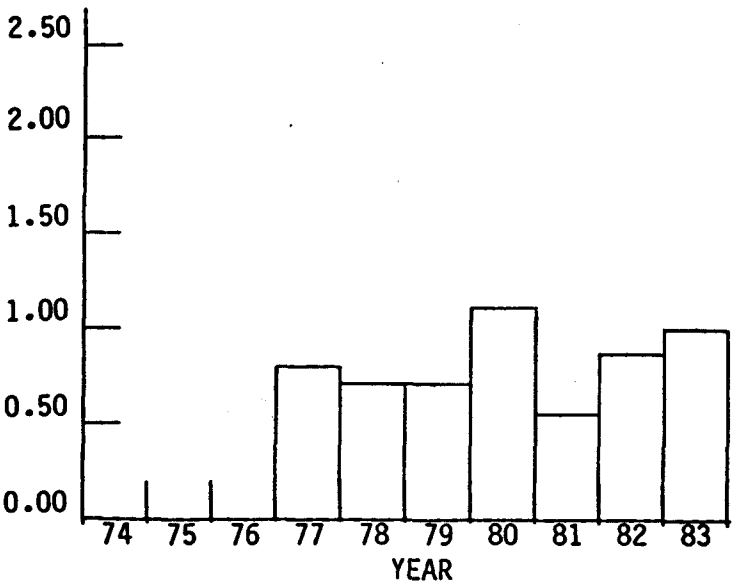
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1977-1983.
- The lake stratifies during the summer and winter and hypolimnetic dissolved oxygen concentrations drop below 1 mg/l.
- Hypolimnetic phosphorus values are observed to be elevated during periods of stratification, indicating internal nutrient loading from sediments is occurring.
- The nitrogen to phosphorus ratio ranges from 10-30, indicating that the nutrients are close to being balanced, but phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Golden

LOCATION: Circle Pines

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.10

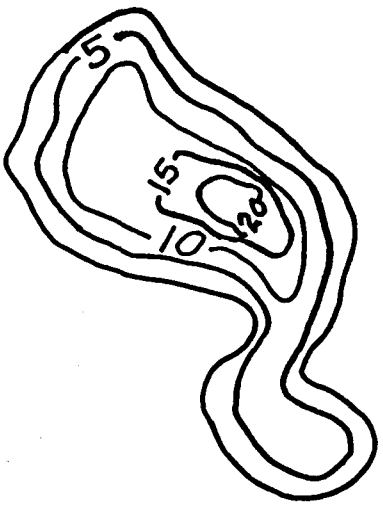
Chlorophyll-a (ug/l) 26

Secchi Depth (m) 0.9

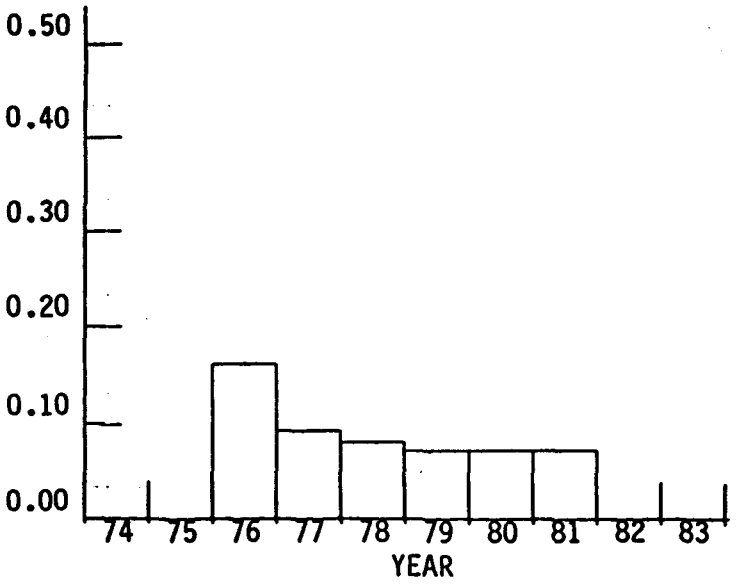
Conductivity (mg/l) 383

pH 8.0 TSI 70

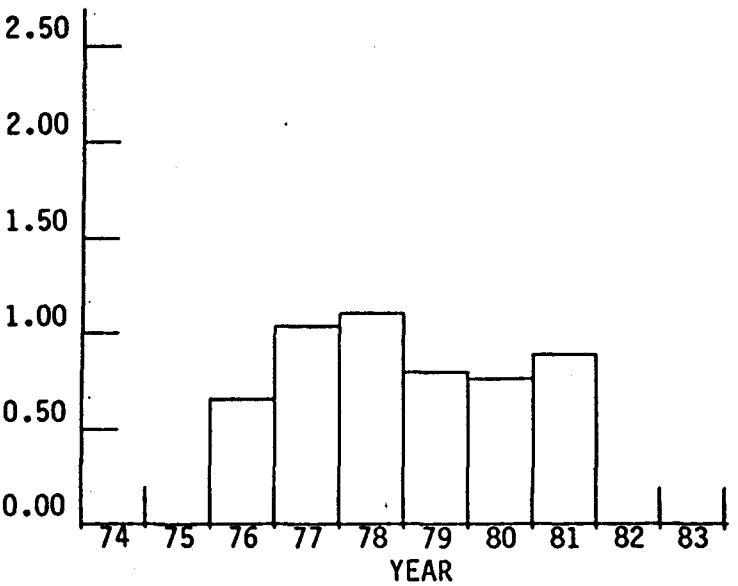
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- The lake's water quality was monitored from 1976 to 1982.
- The lake stratifies and experiences dissolved oxygen concentrations less than 1 mg/l during summer and winter months.
- Elevated phosphorus concentrations in hypolimnetic waters indicate that some internal nutrient loading from sediments is present.
- The nitrogen to phosphorus ratio ranges from 25-40, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Sunset

LOCATION: Hugo

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.10

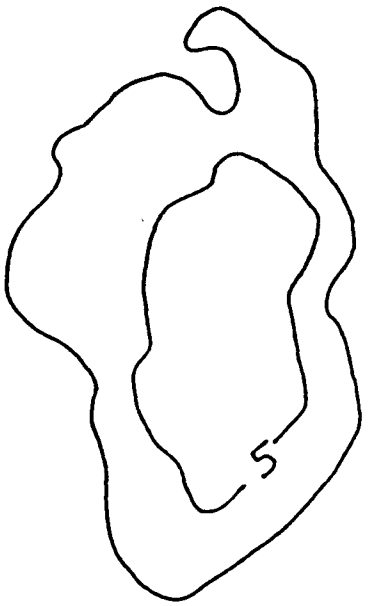
Chlorophyll-a (ug/l) 42

Secchi Depth (m) 0.8

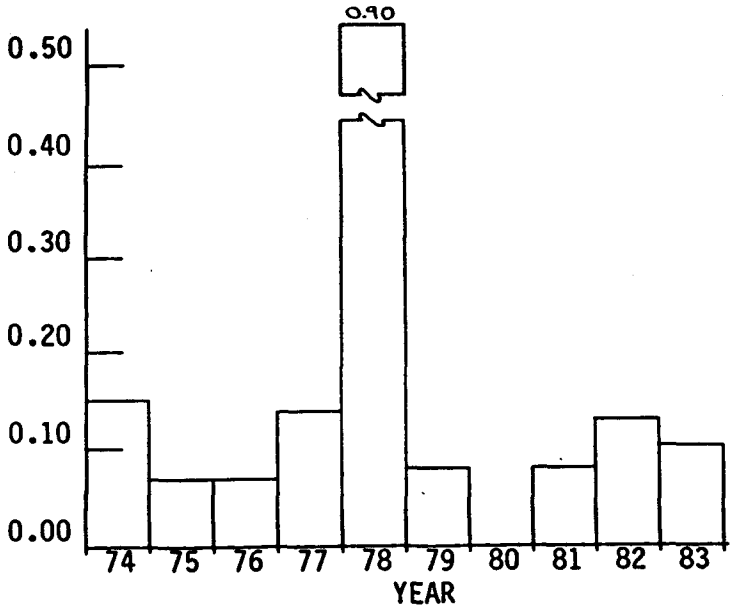
Conductivity (mg/l) 152

pH 8.6 TSI 70

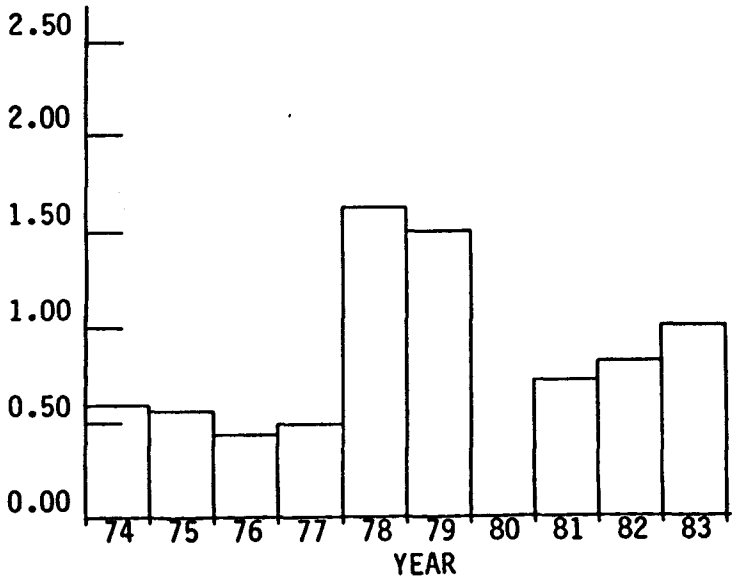
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- The lake was sampled two times per year from 1974 to 1983, excluding 1980. The lake does not thermally stratify during the year, but oxygen depletion is evident near bottom.
- The nitrogen to phosphorus ratio ranges from 20-30, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Reshanau Lake

LOCATION: Lino Lakes

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.09

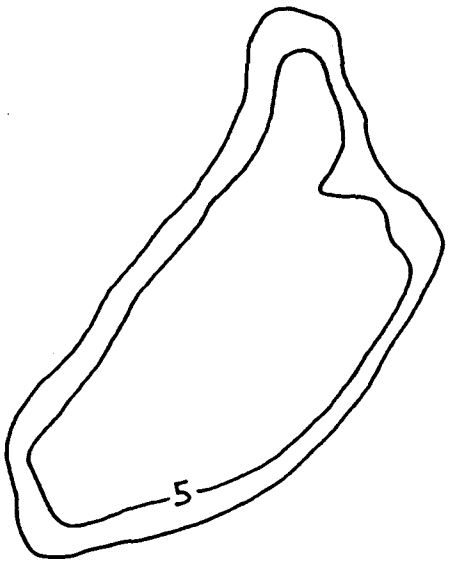
Chlorophyll-a (ug/l) 30

Secchi Depth (m) 0.8

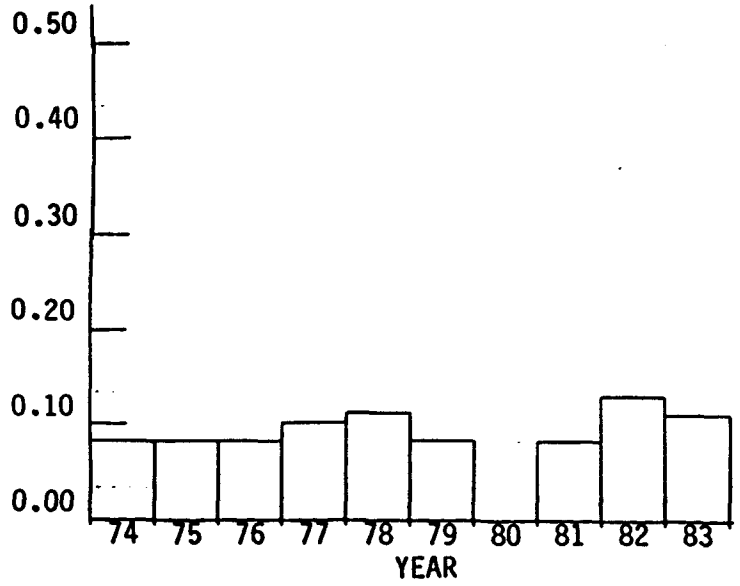
Conductivity (mg/l) 291

pH 8.6 TSI 69

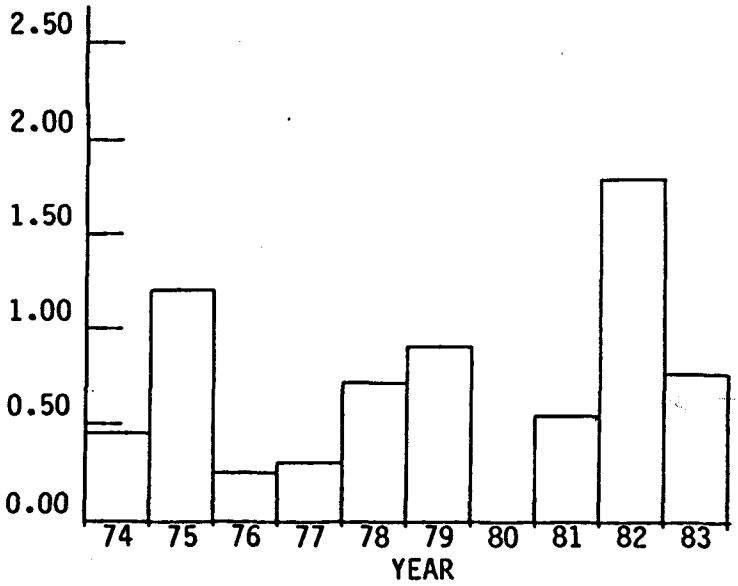
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1974 to 1983, except for 1980.
- The lake is shallow, does not appear to stratify, and no oxygen depletion is evident near the bottom.
- The nitrogen to phosphorus ratio ranges from 20-60, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Silver

LOCATION: New Brighton

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.08

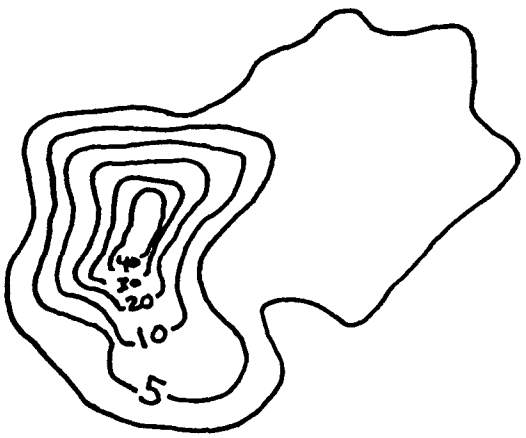
Chlorophyll-a (ug/l) 26

Secchi Depth (m) 0.9

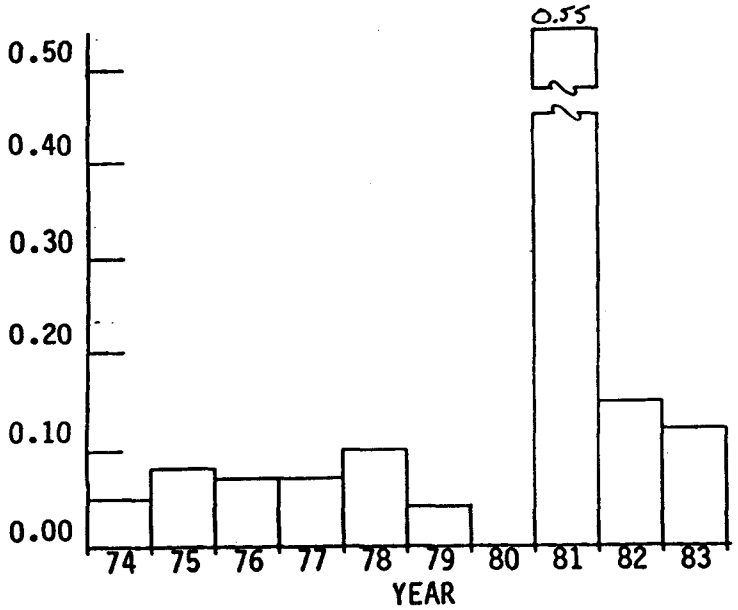
Conductivity (mg/l) 337

pH 8.3 TSI 67

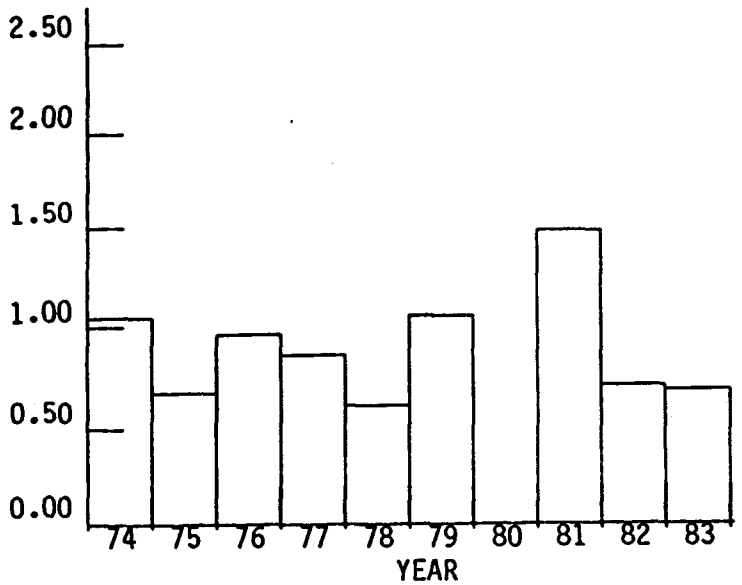
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1974-1979 and 1981-1983.
- The lake stratifies and dissolved oxygen concentrations drop below 1 mg/l at the bottom.
- The nitrogen to phosphorus ratio ranges from 15-20, indicating that phosphorus is typically the nutrient limiting growth.
- Lake water quality has been declining in recent years.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Bald Eagle

LOCATION: White Bear Township,
Lino Lakes, Hugo

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.08

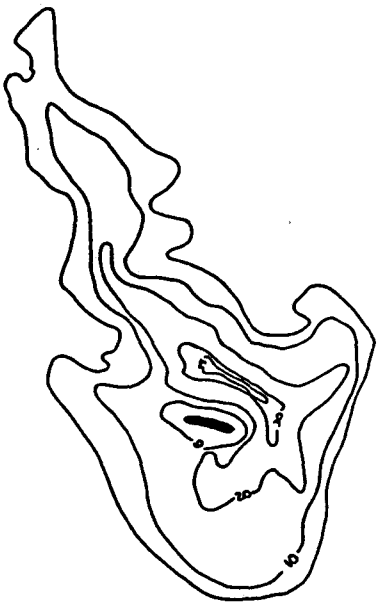
Chlorophyll-a (ug/l) 36

Secchi Depth (m) 1.0

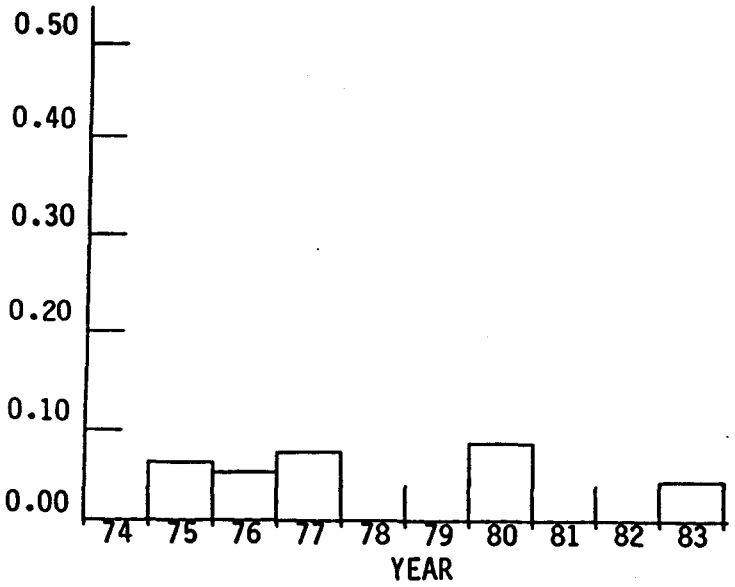
Conductivity (mg/l) 330

pH 8.4 TSI 67

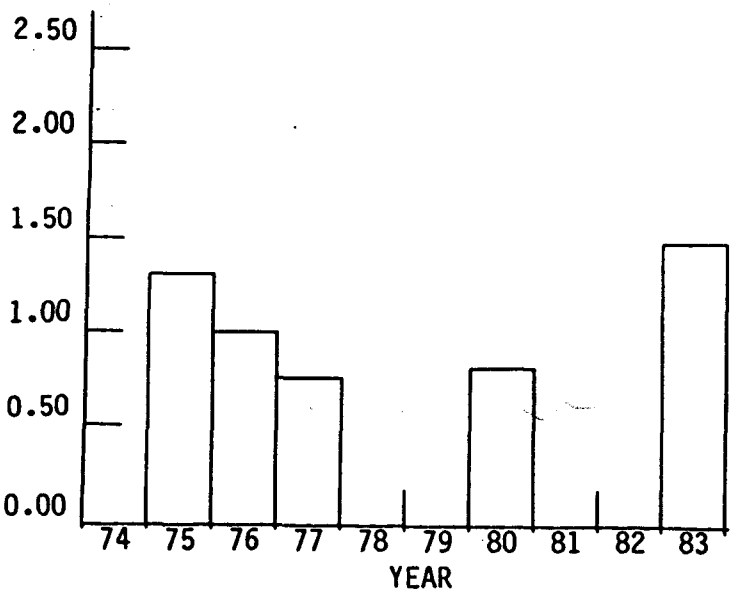
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- The lake stratifies with dissolved oxygen concentrations dropping below 1.0 mg/l near the bottom.
- Elevated phosphorus concentrations in the hypolimnion indicate the sediments exert a nutrient loading on the water column.
- The nitrogen to phosphorus ratio ranges from 20-30, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Johanna

LOCATION: Arden Hills

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.06

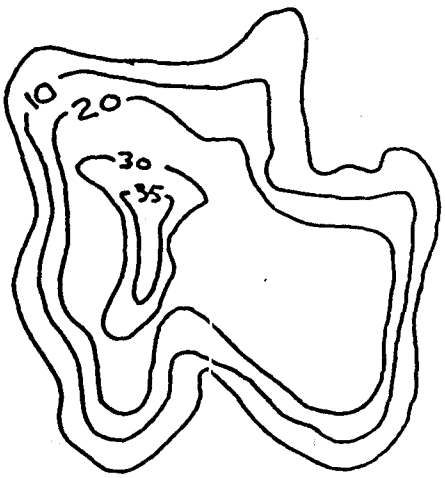
Chlorophyll-a (ug/l) 15

Secchi Depth (m) 1.7

Conductivity (mg/l) 445

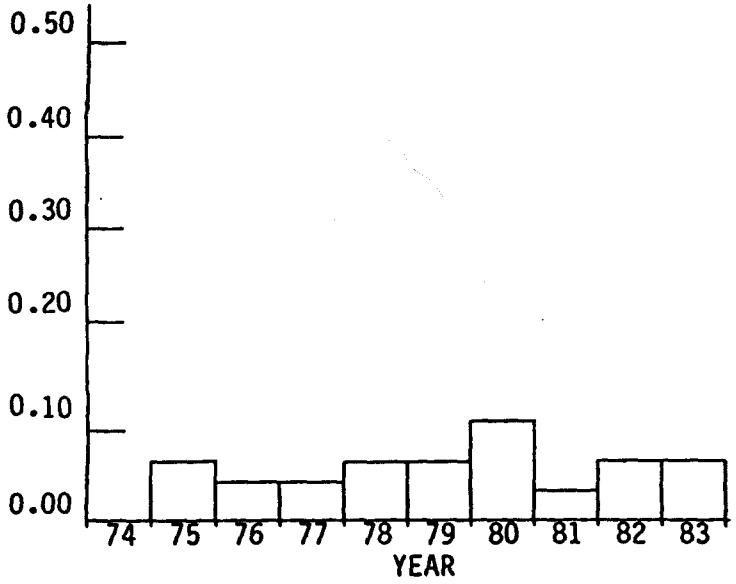
pH 8.2 TSI 63

LAKE MAP

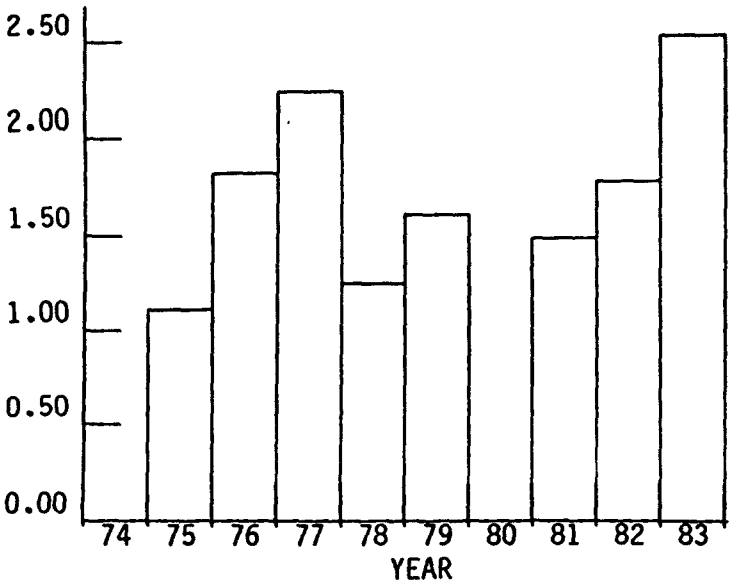


N

TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1975 to 1983.
- The lake stratifies and dissolved oxygen concentrations in bottom waters drop to less than 1 mg/l.
- The hypolimnetic waters become enriched with phosphorus during stratification, indicating nutrient release from sediments is occurring.
- The nitrogen to phosphorus ratio ranges from 20-40, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Josephine

LOCATION: Roseville

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.06

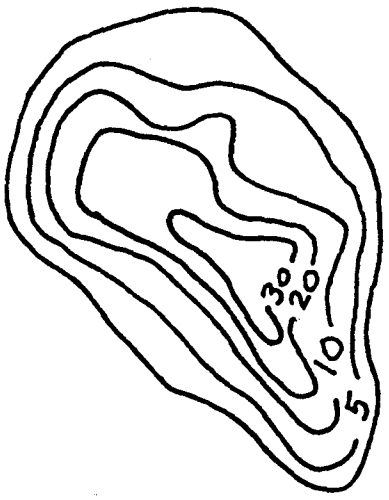
Chlorophyll-a (ug/l) 14

Secchi Depth (m) 1.3

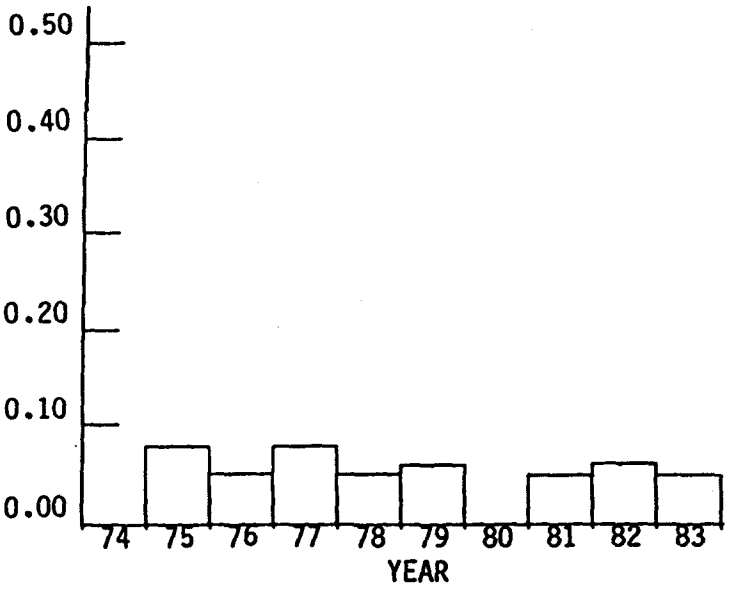
Conductivity (mg/l) 450

pH 8.1 TSI 63

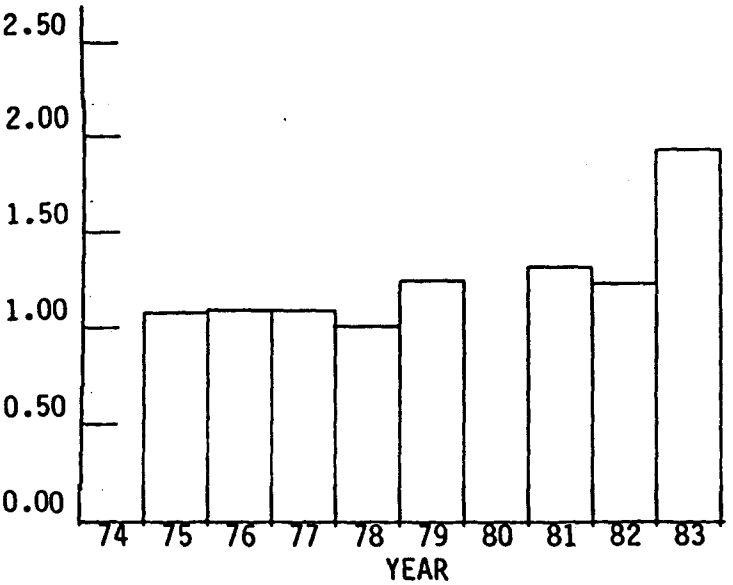
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1975 to 1979 and 1981 to 1983.
- The lake stratifies during summer and winter months and dissolved oxygen concentrations drop below 1 mg/l.
- Elevated phosphorus concentrations within the hypolimnion suggest possible internal loading of nutrients from sediments.
- The nitrogen to phosphorus ratio ranges from 20-30, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Oneka

LOCATION: Hugo

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.06

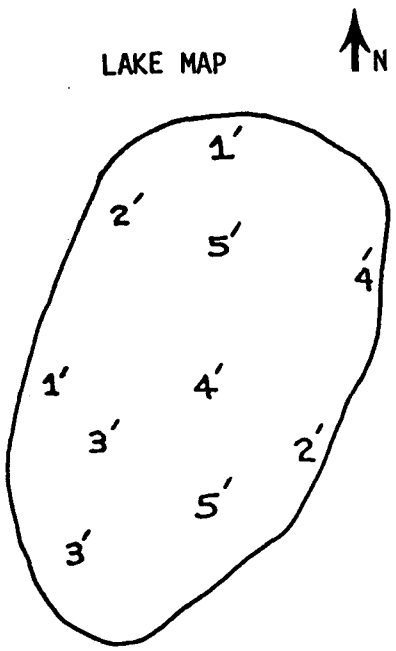
Chlorophyll-a (ug/l) 10

Secchi Depth (m) 1.6

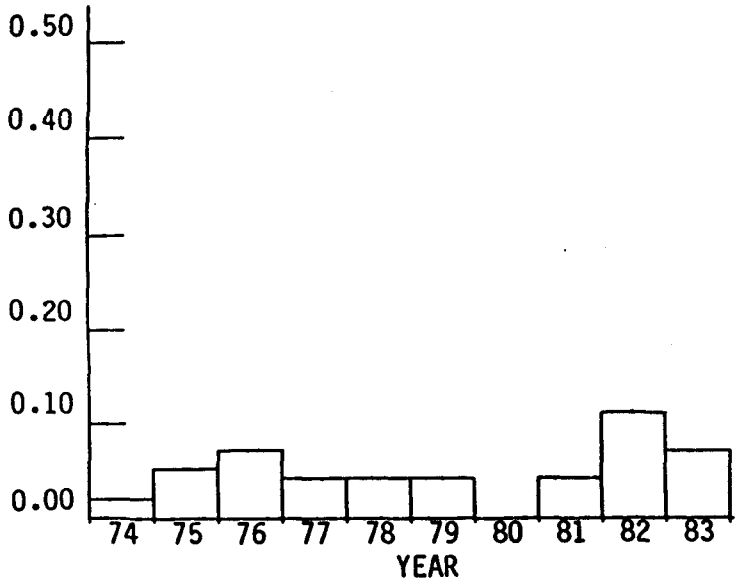
Conductivity (mg/l) 100

pH 8.4 TSI 63

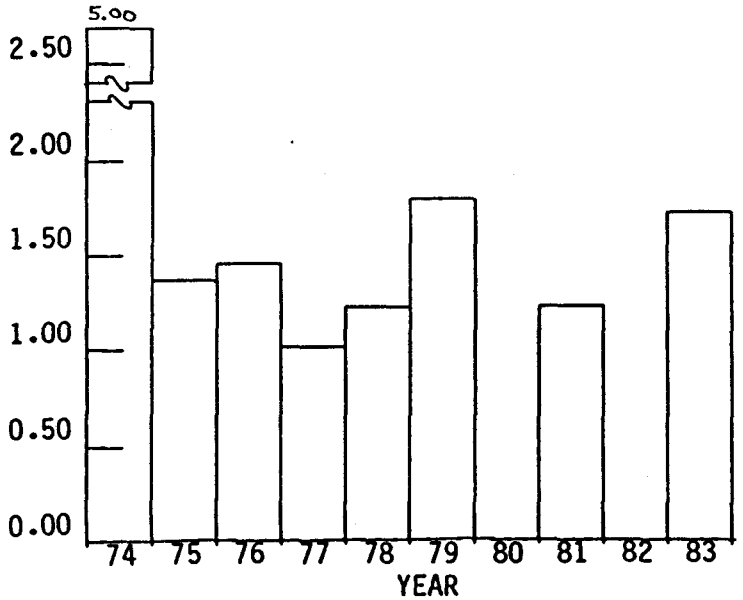
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Water quality was monitored from 1974 to 1983, excluding 1980.
- The lake is shallow and does not stratify.
- The nitrogen to phosphorus ratio ranges from 30-40, indicating phosphorus is typically the nutrient limiting growth.
- The water quality is generally good and is probably the result of the lake level being maintained by groundwater inflow and the lake having a small tributary watershed.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Clear

LOCATION: Forest Lake Township

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) .05

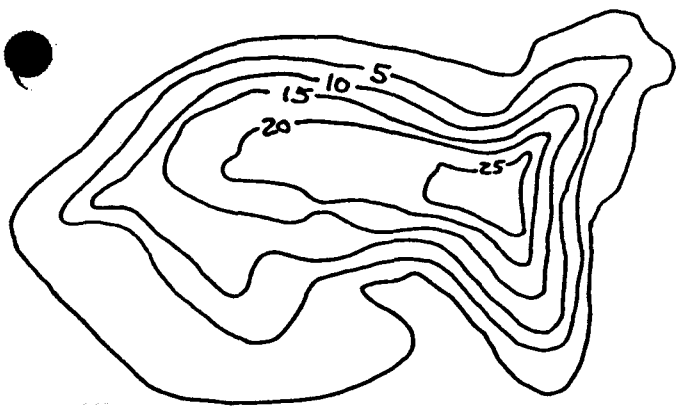
Chlorophyll-a (ug/l) 40

Secchi Depth (m) 1.3

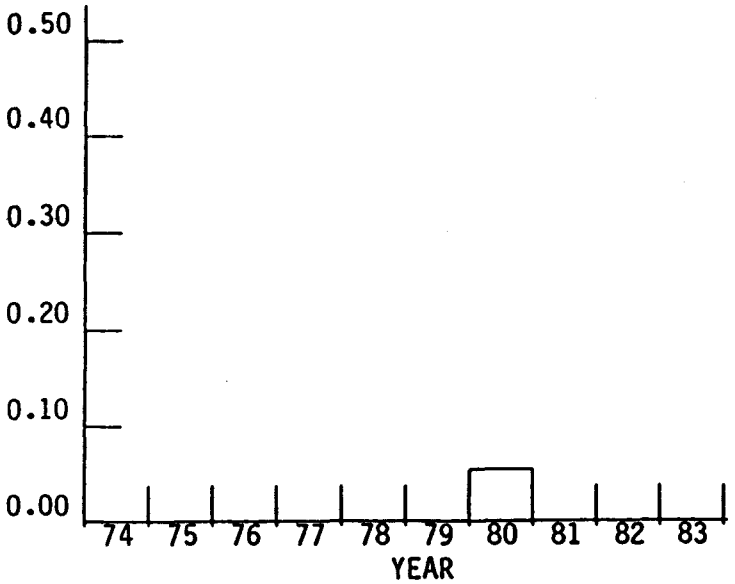
Conductivity (mg/l) 335

pH NIA TSI 61

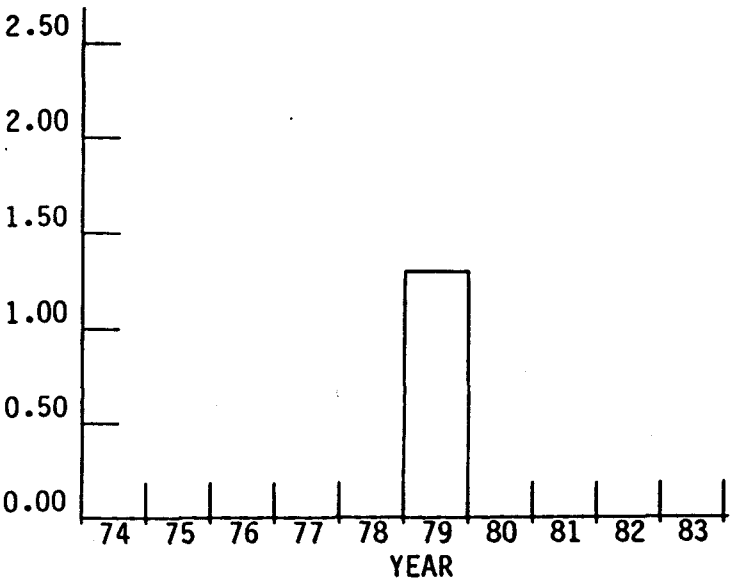
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- The lake's water quality was monitored from June to September 1980 only.
- The data shows that the lake stratifies during the summer months and the dissolved oxygen is depleted to less than 1 mg/l in the hypolimnion. For this reason, the internal nutrient loading may be significant in this lake, but detailed profile sampling is not available to confirm this suspicion.
- The nitrogen to phosphorus ratio ranges from 25-35, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Rondeau

LOCATION: Lino Lakes

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) .04

Chlorophyll-a (ug/l) 27

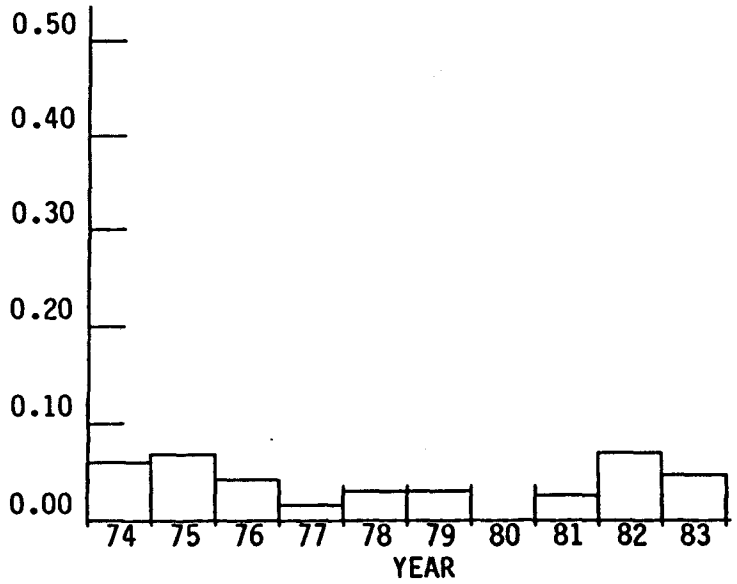
Secchi Depth (m) 0.5

Conductivity (mg/l) 289

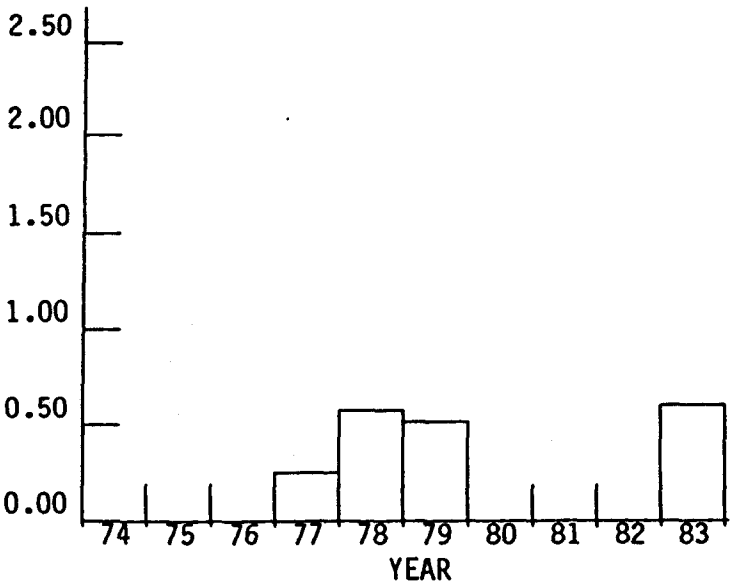
pH 7.7 TSI 57

LAKE MAP

TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Water quality sampling was conducted two times per year from 1974 to 1983, excluding 1980.
- The lake does not stratify during the summer as the lake is very shallow.
- The nitrogen to phosphorus ratio exceeds 50, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Island

LOCATION: Shoreview

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.03

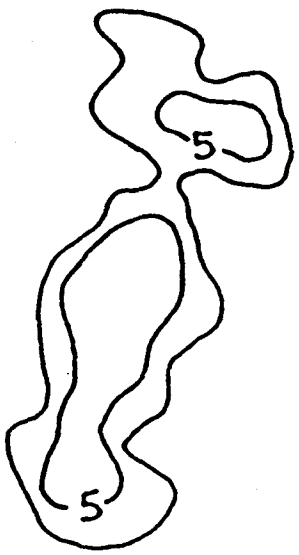
Chlorophyll-a (ug/l) NIA

Secchi Depth (m) 2.5

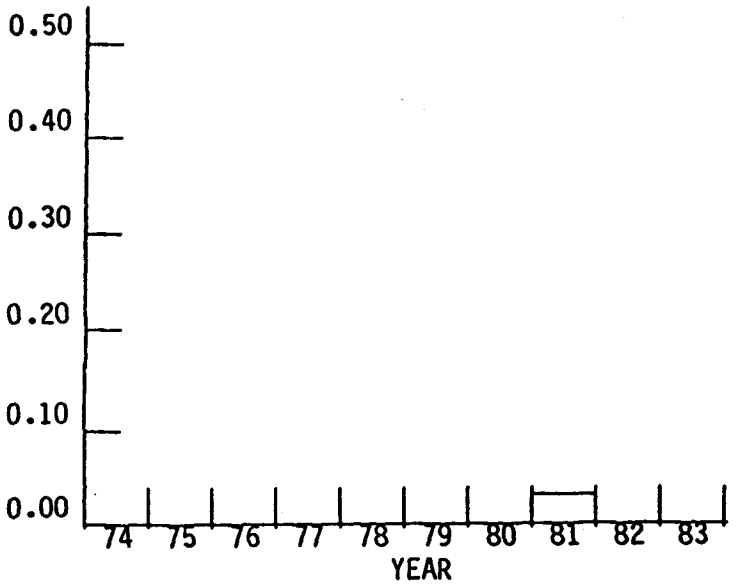
Conductivity (mg/l) 321

pH 7.5 TSI 52

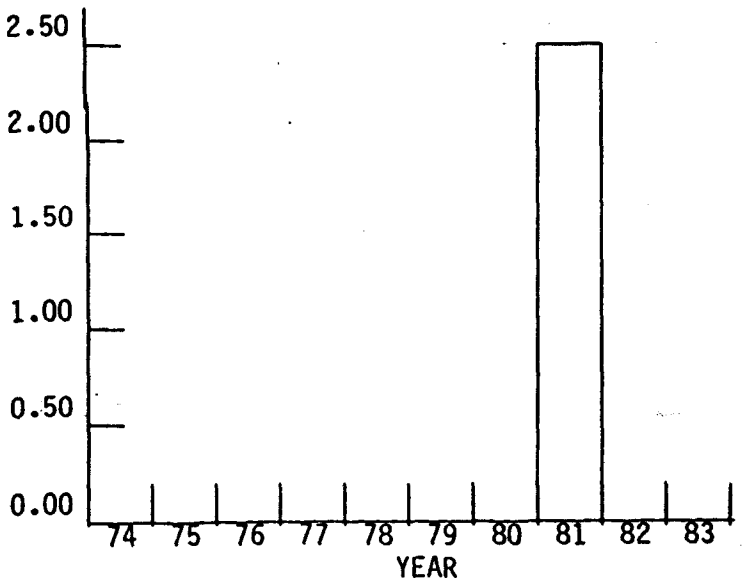
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored in 1981 only.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: White Bear

LOCATION: White Bear Lake, Birchwood, Mahtomedi, Dellwood

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) .025

Chlorophyll-a (ug/l) 4

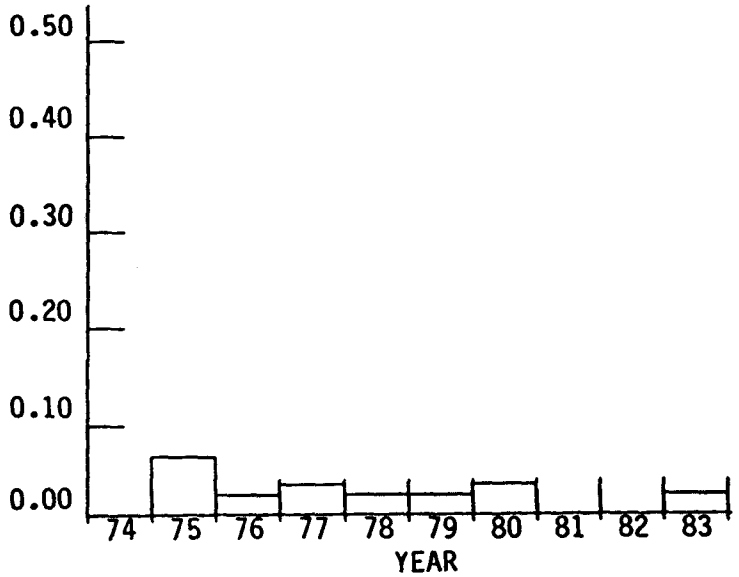
Secchi Depth (m) 2.6

Conductivity (mg/l) 260

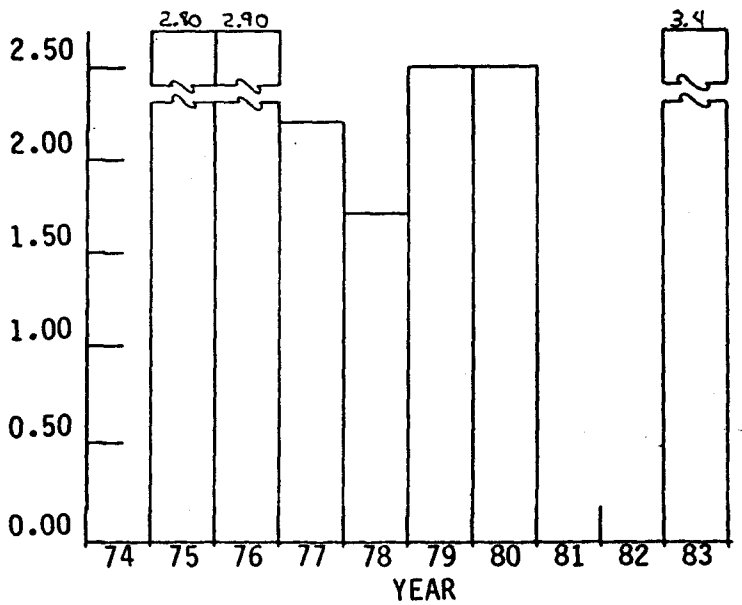
pH 8.2 TSI 50

LAKE MAP

TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Water quality was monitored two times per year from 1975 to 1983.
- The lake exhibits a strong stratification during the summer and winter months with the dissolved oxygen in the hypolimnetic waters dropping to less than 0.1 mg/l during these times.
- Water quality of this lake is very good and may be improving slightly in the last 9 years.
- The nitrogen to phosphorus ratio exceeds 40, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.

LAKE NAME: Turtle

LOCATION: Shoreview

TYPICAL WATER QUALITY*

Total Phosphorus (mg/l) 0.02

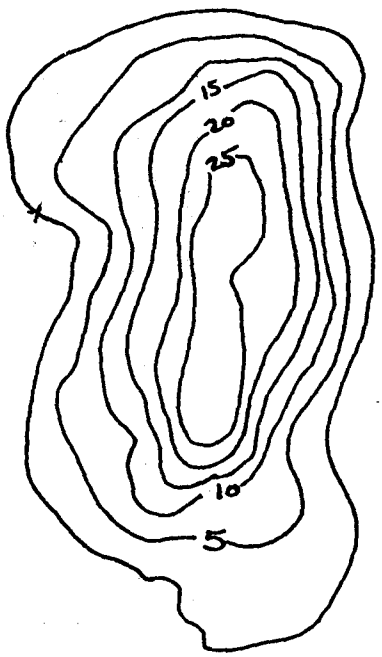
Chlorophyll-a (ug/l) 11

Secchi Depth (m) 2.5

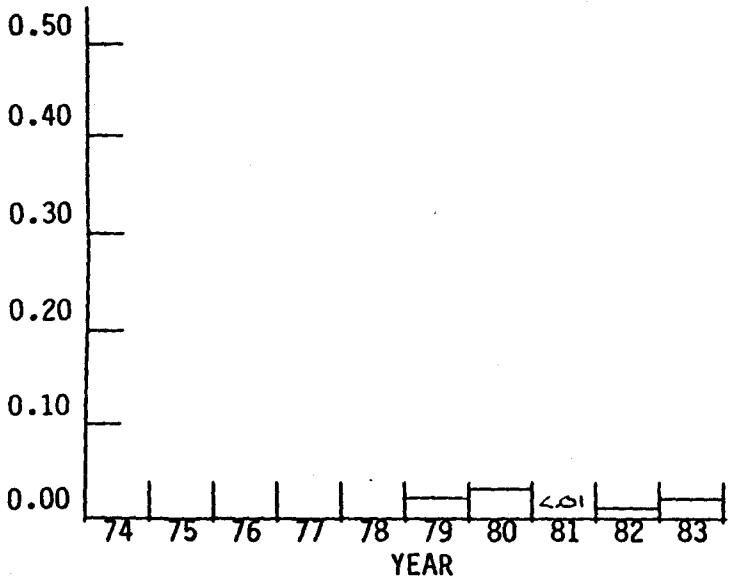
Conductivity (mg/l) 451

pH 8.0 TSI 47

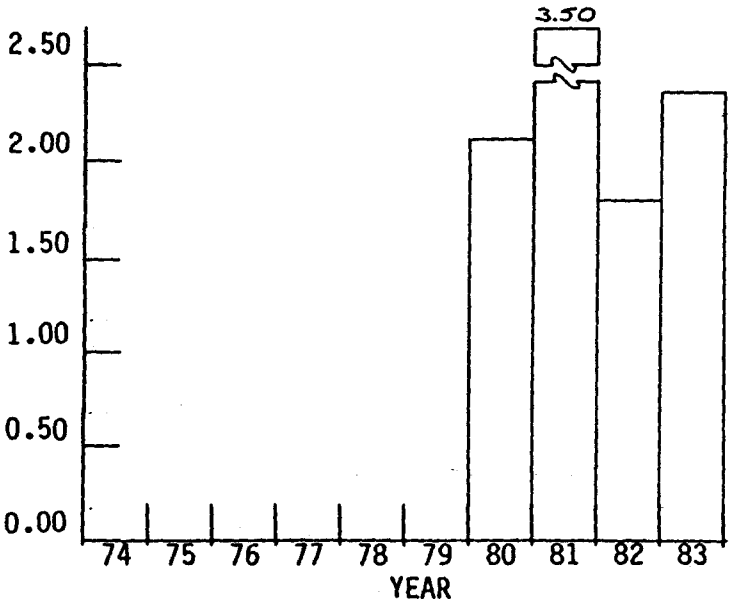
LAKE MAP



TOTAL PHOSPHORUS CONCENTRATION (mg/l)



SECCHI DEPTH TRANSPARENCY (m)



COMMENTS:

- Lake water quality was monitored from 1979 to 1983.
- The lake stratifies and dissolved oxygen concentrations within the hypolimnion drop to less than 1 mg/l.
- Slightly elevated phosphorus concentrations in bottom waters indicate some internal loading from the sediments is occurring.
- The nitrogen to phosphorus ratio ranges from 30-60, indicating phosphorus is typically the nutrient limiting growth.

*Definition of typical water quality and descriptions of parameters listed are included in Procedures and Methods Used section of this report.

NIA: No information available.