



COMFORT LAKE FOREST LAKE WATERSHED DISTRICT WATER MONITORING REPORT

Prepared for:

Comfort Lake Forest Lake Watershed District

Prepared By:

Washington Conservation District

April 2005

Memorandum

To: Comfort Lake Forest Lake Watershed District Managers

From: Wendy Griffin, Karen Kill, Travis Thiel, and Erik Anderson--Washington Conservation District

Date: April 28, 2005

Re: CLFLWD 2004 Monitoring: Bone Lake Outlet, Little Comfort Lake Inlet, Forest Lake Outlet, Comfort Lake Inlet, Comfort Lake Outlet, Bone Lake, Sylvan/Halfbreed Lake, Shields Lake, Forest Lake, Little Comfort Lake, Big Comfort Lake

At the request of the Comfort Lake Forest Lake Watershed District (CLFLWD), the Washington Conservation District (WCD) conducted stream monitoring at five stream monitoring stations (Bone Lake Outlet, Little Comfort Lake Inlet, Forest Lake Outlet, Comfort Lake Inlet, Comfort Lake Outlet), monitored water quality and level on Sylvan/Halfbreed Lake, Shields Lake, Big Comfort Lake, Bone Lake and monitored water quality at Forest Lake. The locations of the monitoring sites can be found in Figure 1. The following report summarizes our methods and results for monitoring conducted from January 1 - December 31, 2004. This report and the accompanying data will also be provided in an electronic format.

Stream Sites: Bone Lake Outlet, Little Comfort Lake Inlet, Forest Lake Outlet, Comfort Lake Inlet, Comfort Lake Outlet

Continuous stage, velocity, and discharge measurements were taken every 15 minutes at Bone Lake Outlet from March 24-November 2, 2004, at Little Comfort Lake Inlet from May 4-November 2, 2004, Forest Lake Outlet from March 31-November 2, 2004, at Comfort Lake Inlet from April 5-November 2, 2004, and at Comfort Lake Outlet from March 22-November 2, 2004. Precipitation data was also continuously collected at each of these sites except at the Forest Lake Outlet site.

Staff gages were installed and read at each site. Field stage measurements were taken in the stream channels. Temperature, dissolved oxygen, and transparency tube measurements were also taken. If feasible, stage to discharge relationships were developed at all stream sites. When the area-velocity probe was covered with debris, erroneous velocity readings were given and the stage to discharge relationships were used to calculate discharge. Flow weighted storm event samples, storm event grab samples, baseflow composite samples, and baseflow grab samples were collected at all stream sites. In addition to these samples, fecal grab samples were also taken at all five sites. The samples were analyzed at the Metropolitan Council Environmental Services Lab.

Lake Sites: Bone Lake, Sylvan/Halfbreed Lake, Shields Lake, Forest Lake, Comfort Lake

The work plan for 2004 included monitoring of 5 lakes. All lakes were monitored biweekly from April through October. All lakes were monitored by collecting Secchi transparencies, temperature, and dissolved oxygen profiles. Secchi transparencies are used for general comparisons of water quality across the watershed and for monitoring general water quality trends in a given lake from year to year. Temperature and dissolved oxygen profiles provide information on the in-lake dynamics and how each lake may be functioning each year. All 5 lakes had surface composite water quality samples taken for analysis of total phosphorus, total Kjeldahl nitrogen, and chlorophyll-a concentrations. Bone Lake was the only lake that had surface composite water quality samples taken that included the analysis of total chloride ions.

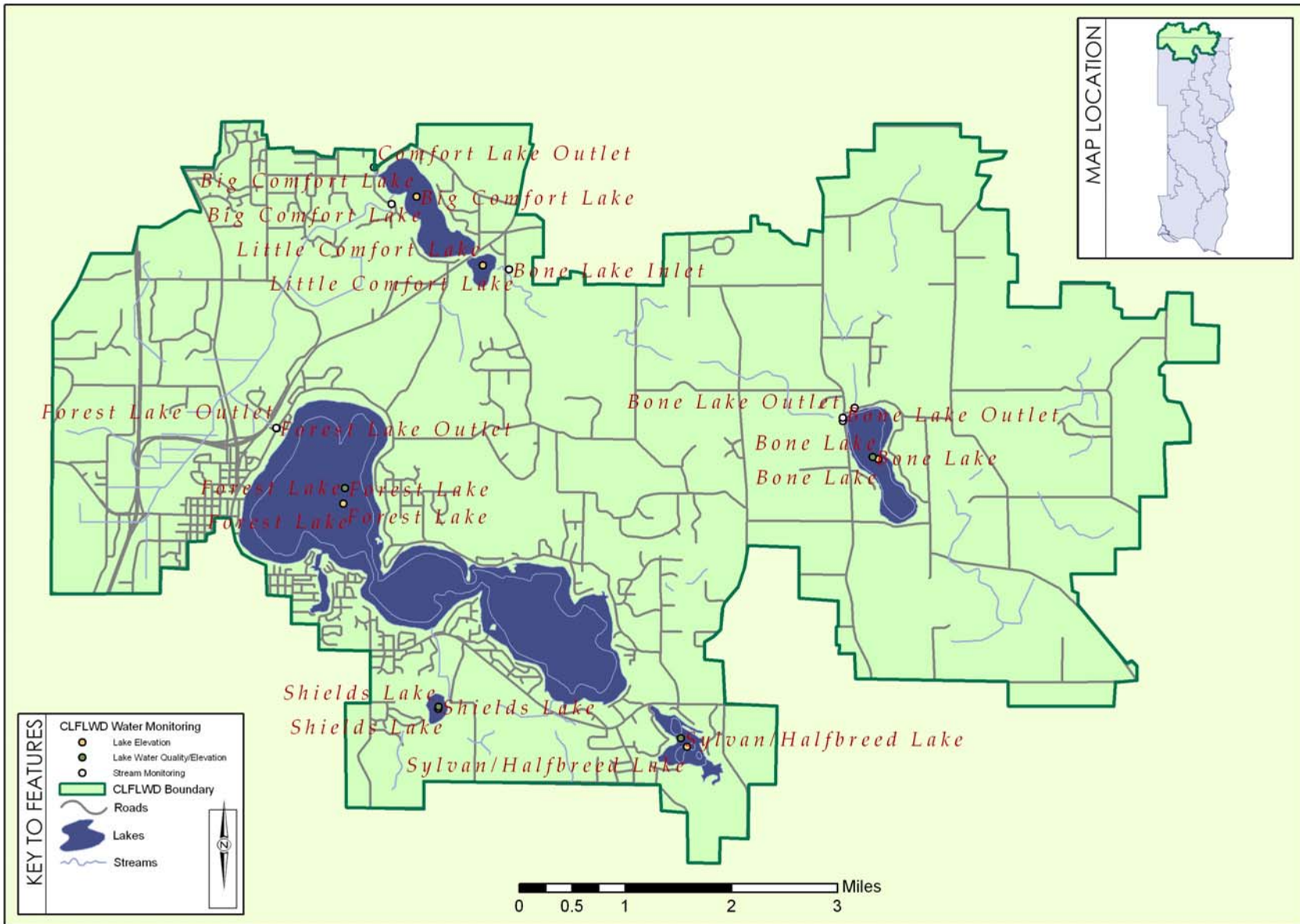


Figure 1. CLFLWD Monitoring Locations

Sections Within Report

Summary of 2004 Lake Water Quality

1) Bone Lake Subwatershed

- Stream Monitoring
 - a. Bone Lake Outlet
- Lake Monitoring
 - a. Bone Lake

2) Little Comfort Lake Subwatershed

- Stream Monitoring
 - a. Little Comfort Lake Inlet

3) Sylvan/Halfbreed Subwatershed

- Lake Monitoring
 - a. Halfbreed Lake

4) Forest Lake Subwatershed

- Stream Monitoring
 - a. Forest Lake Outlet
- Lake Monitoring
 - a. Forest Lake
 - b. Shields Lake

5) Comfort Lake Subwatershed

- Stream Monitoring
 - a. Comfort Lake Inlet
 - b. Comfort Lake Outlet
- Lake Monitoring
 - a. Big Comfort

6) Historical Lake Water Quality Trends

Summary of 2004 Lake Water Quality

1. TRANSPARENCY (SECCHI DISK)

The measurement of depth of light penetration using a Secchi disk gives a simple measure of water transparency, or clarity. It is a possible indication of turbidity in the water, as well as, an indication of the trophic state of the lake. A reduction in water transparency is usually the result of increased turbidity caused by suspended sediments, organic matter, and/or phytoplankton (algae). The average water transparency of lakes in CLFLWD, as measured by Secchi disk during the 2004-study period, ranged from 4.6 feet in Shields Lake to 16.1 feet in Halfbreed Lake. The typical range for this ecoregion, is 4.9 - 10.5 feet (Figure 2). Of the average Secchi disk transparency values observed in 2004, one was less than (poorer than) the average for this ecoregion, one was greater than (better than) average and three were within the average range for this ecoregion. The average transparency for all lakes sampled in 2004 was 8.0 feet, which was more (better) than the transparency during the 2003 study period which was 7.2 feet. Historical transparency data for selected lakes appears in Appendix A.

2. PHOSPHORUS

Phosphorus is a major nutrient involved in eutrophication and is generally associated with the growth of aquatic weeds and algae blooms. Common sources of phosphorus include runoff from agricultural fields, livestock areas, urban areas, lakeshore lawns, and improperly operating septic systems. In most lakes in the Northern Hardwood ecoregion, phosphorous is the least available nutrient; therefore, the concentration of phosphorous controls the extent of algal growth. Algal growth in turn affects the clarity of the water and light penetration. The typical range for total phosphorous concentrations in the ecoregion is 0.025 - 0.050 mg/l (Figure 3). Total phosphorous concentrations in sampled lakes in CLFLWD range from 0.020 mg/l in Halfbreed Lake to 0.214 mg/l in Shields Lake with a watershed average of 0.072 mg/l. One lake had an average summer total phosphorous value less than (better than average) the range for this ecoregion, two lakes had an average summer total phosphorous value greater than (poorer than average) the ecoregion range and two lakes were within the ecoregion range for average total phosphorous. For comparison, phosphorous concentrations in 2003 ranged from 0.016 mg/l in Halfbreed Lake to 0.299 mg/l in Shields Lake with a watershed average of 0.095 mg/l. High concentrations of phosphorus were seen again in 2004 as well as historically in Shields Lake, when compared to the rest of the watershed. A project that would address the sources of phosphorus either in or

entering Shields Lake should be implemented by the CLFLWD in order to better manage the internal and external loads within this subwatershed.

3. CHLOROPHYLL-*a*

Chlorophyll-*a* is a photosynthetic component found in algae and aquatic plants. It is also an indicator of algal productivity. The 2004 average chlorophyll-*a* concentrations for lakes in CLFLWD ranged from 3.4 µg/l in Halfbreed Lake to 38.6 µg/l in Shields Lake, with a watershed average of 20.1 µg/l. The ecoregion range for chlorophyll-*a* concentration is 5.0-22.0 µg/l (Figure 4). Of the lakes sampled in 2004, two exceeded (poorer than) the ecoregion range for chlorophyll-*a*, two lakes were within the ecoregion values and one lake was less than (better than) the ecoregion range. For comparison, chlorophyll-*a* concentrations in 2003 ranged from 3.0 µg/l in Halfbreed Lake to 38 µg/l in Bone Lake, with a watershed average of 22.2 µg/l.

4. NITROGEN

Nitrogen, much like phosphorus, is a nutrient found naturally in lakes and streams. Several forms of nitrogen are responsible for health problems in young children and pregnant women and increase the rate of lake eutrophication. The concentration of nitrogen (along with phosphorus) can control primary production (the rate of algal growth) and subsequently water quality. Phosphorus is usually thought to become limiting where the total nitrogen to total phosphorus (TN/TP) ratio is 10:1 (Carlson 1992). Therefore, the nutrient controlling water quality in the lakes of the CLFLWD is phosphorous and not nitrogen. In 2004, average total Kjeldahl nitrogen (TKN) concentrations in CLFLWD lakes ranged from 0.547 mg/l in Halfbreed Lake to 1.986 mg/l in Shields Lake, with a watershed average of 1.172 mg/l. The ecoregion range for TKN is 0.60-1.20 mg/l (Figure 5). Of the lakes sampled in 2004, two exceeded (poorer than) the ecoregion range for Kjeldahl nitrogen concentration, two lakes were within the ecoregion range and one lake was below (better than) the ecoregion range. For comparison, TKN concentrations in 2003 ranged from 0.538 mg/l in Halfbreed to 2.079 mg/l in Shields Lake, with a watershed average of 1.269 mg/l.

5. TEMPERATURE AND DISSOLVED OXYGEN

Temperature and dissolved oxygen profiles were measured when samples were taken. In addition to surface water measurements, temperature and dissolved oxygen was measured at one-meter intervals from the surface to the lake bottom. This data is contained in Appendix C. The data collected enables temperature and dissolved oxygen profiles to be developed. These profiles show the extent of summer stratification and are useful in identifying the thermocline (the layer of water in which the temperature rapidly declines). The thermocline is an important thermal barrier for chemical and biological activity. In lakes with no thermocline present or little stratification, the lake may mix throughout the summer making bottom nutrients available throughout the water column for use by organisms like algae.

6. TOTAL CHLORIDE ION

Chloride ions are naturally present in very small amounts in surface water. The presence of larger amounts of chloride ions in surface water could indicate a point-source location where the chloride is originating. These point sources could include road runoff from spring snowmelts where salts were used to keep roads clear of ice or from septic systems where a water softener has been used. It is important to note that the presence of chloride does not indicate malfunctioning septic systems, as septic systems are not intended to remove chlorides. It can, however, indicate where possible human impact is contributing to higher chloride levels and may need further study to understand the sources completely. Chloride was collected only on Bone Lake from 2002-2004. The 2004 total chloride ion concentrations ranged from 3.0 mg/L to 18.0 mg/L in Bone Lake with a seasonal average of 9.1 mg/L. Bone Lake was slightly below the ecoregion range of 4.0-10.0 mg/L for 2004 (Figure 6). One note to make with the highest concentration at Bone Lake of 18.0 mg/L is that this sample was collected in August. Bone Lake had highly variable concentrations of chloride for the entire monitoring season, but the mid-summer sampling showed many high concentrations of chlorides, which is strange for this portion on the year. Most high chloride concentrations occur during early spring monitoring because of recent snowmelt and runoff events, which does not match this trend. The source of these higher than normal concentrations in mid-summer may be due to higher water use and release of more chlorides from septic systems or from chloride in surficial groundwater or local

water tables seeping into the lake, For comparison, total chloride ion concentrations in 2003 ranged from 9 mg/L to 12 mg/L with a seasonal average of 10.29 mg/L.

Figure 2. 2004 Average Secchi Transparencies and Ecoregion Range

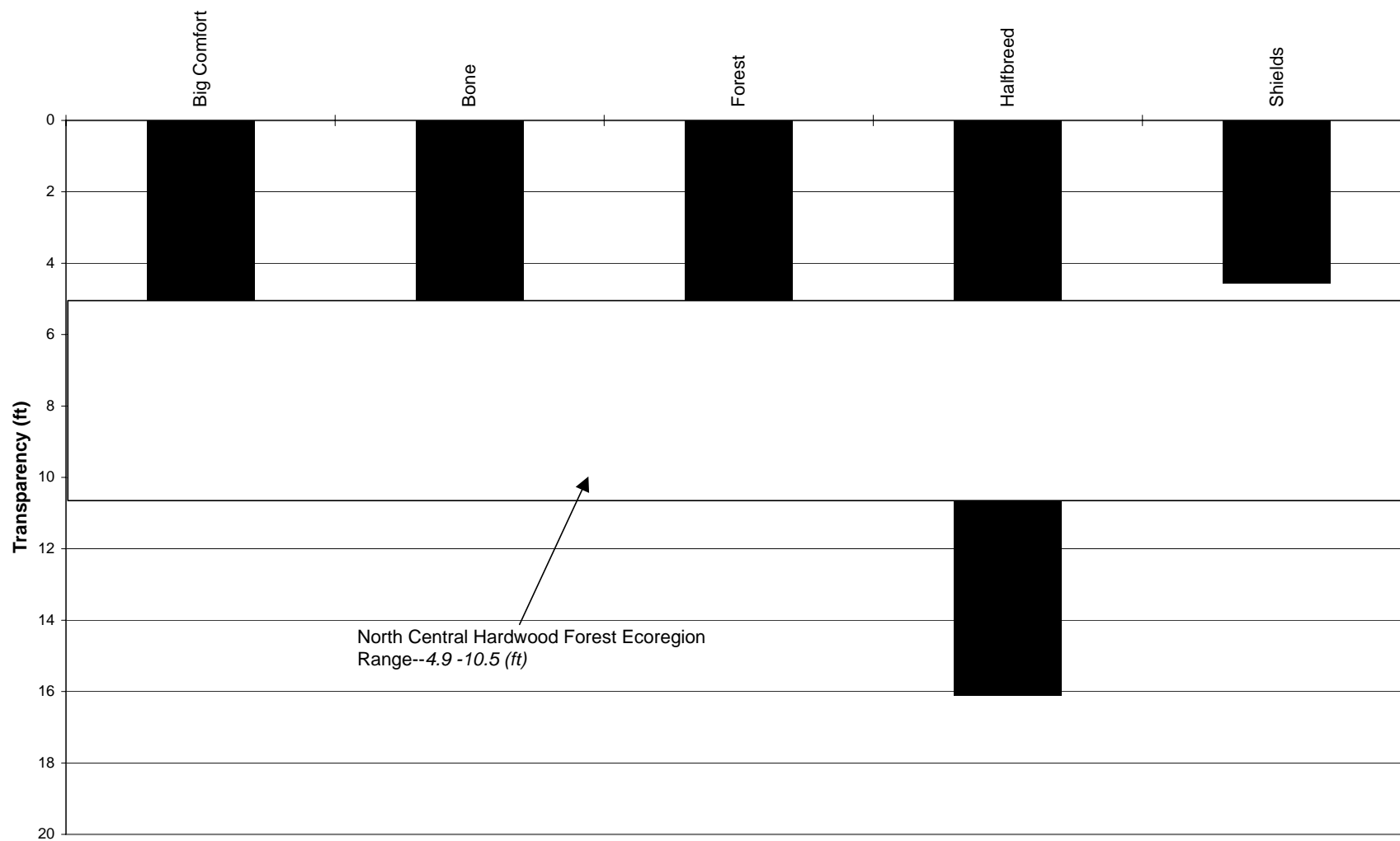


Figure 3. 2004 Average Total Phosphorus and Ecoregion Range

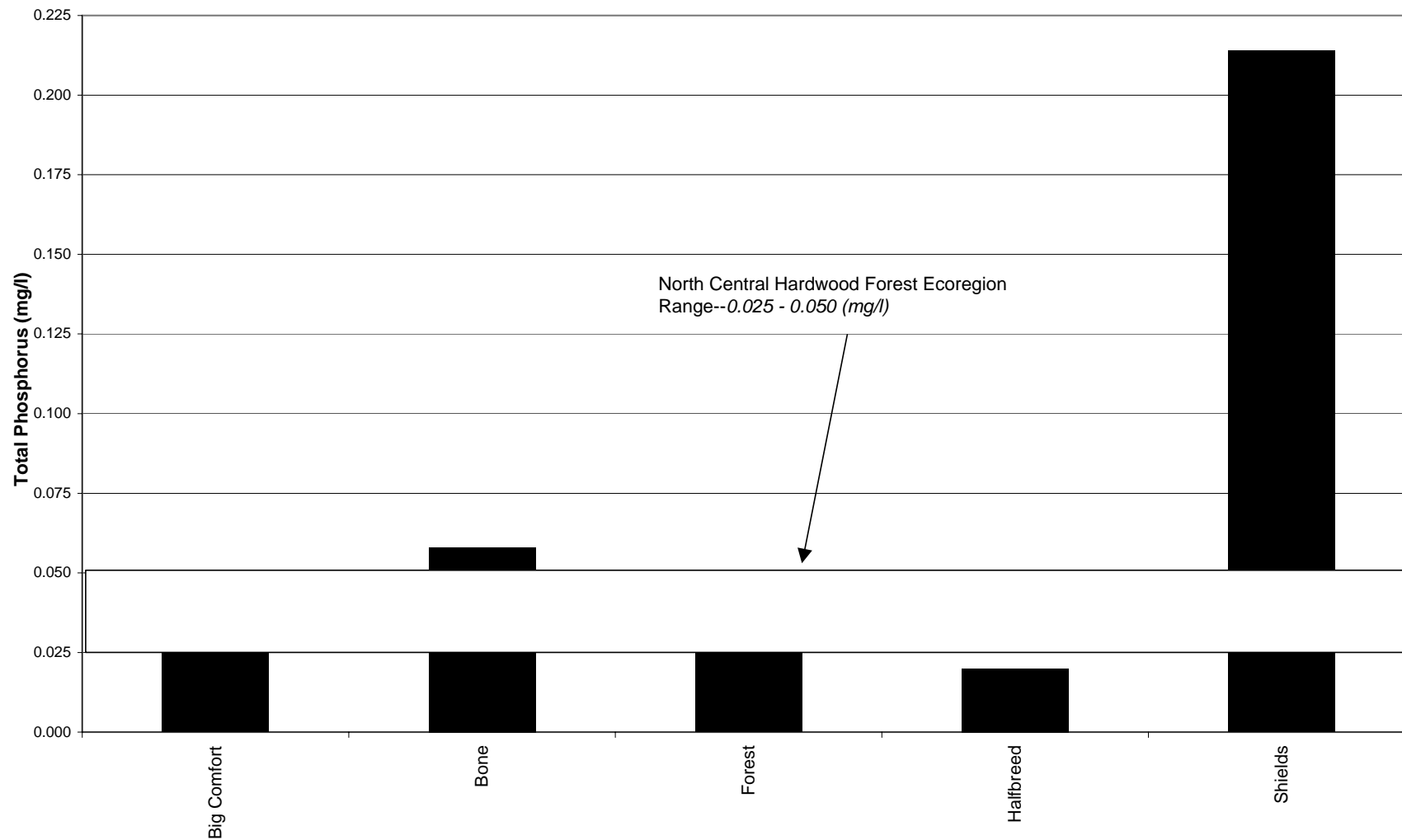


Figure 4. 2004 Average Chlorophyll-*a* and Ecoregion Range

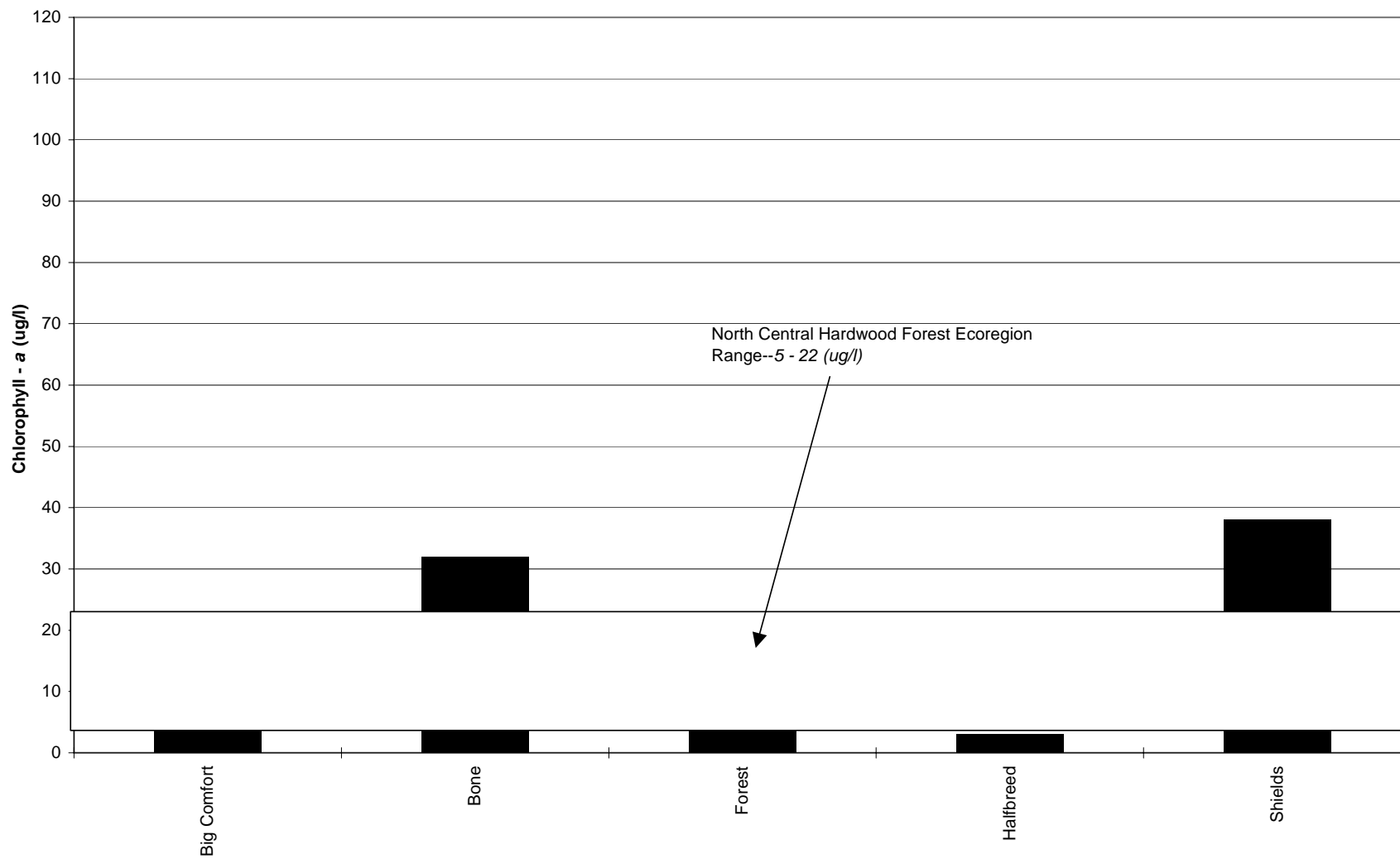


Figure 5. 2004 Average Total Kjeldahl Nitrogen and Ecoregion Range

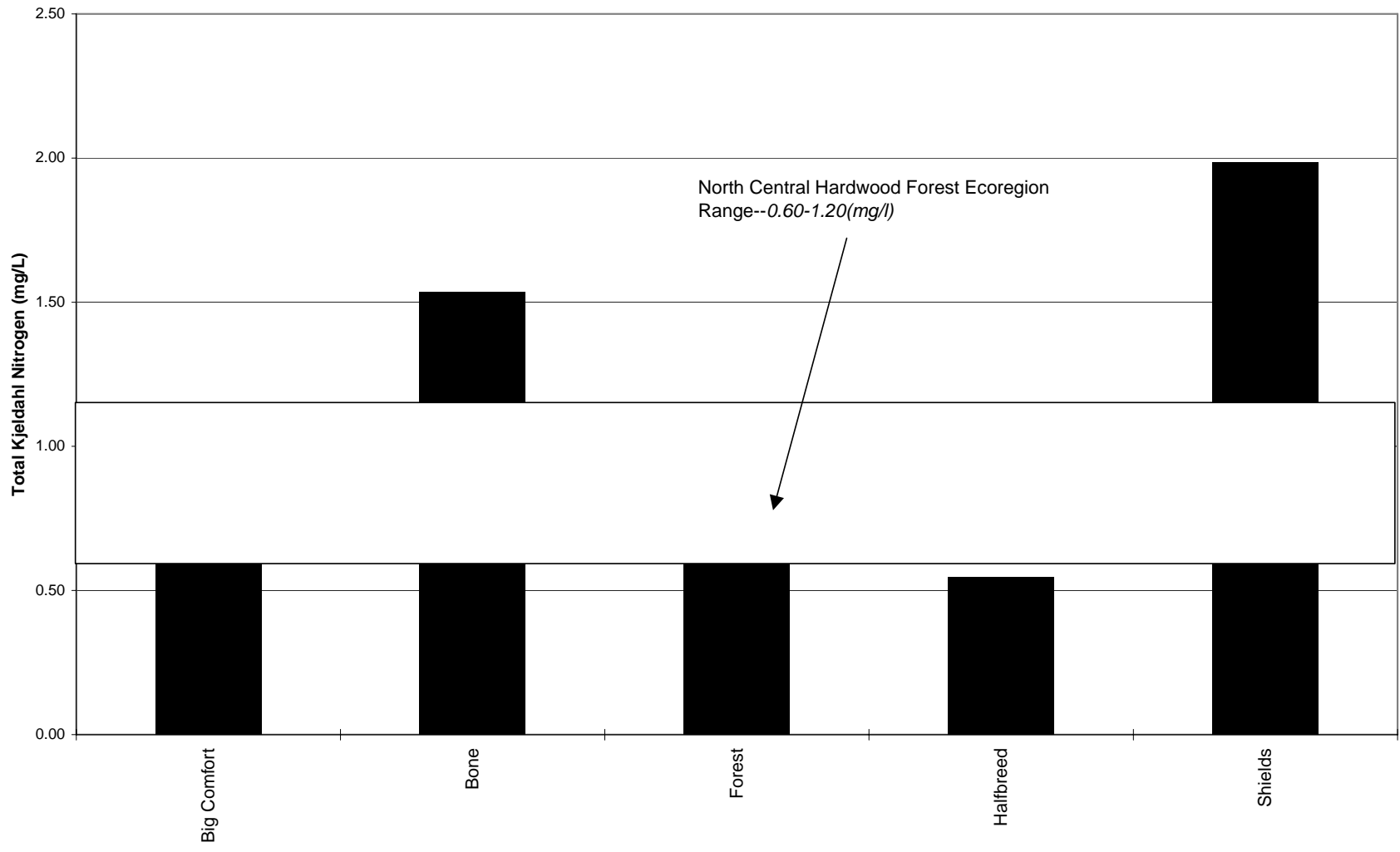
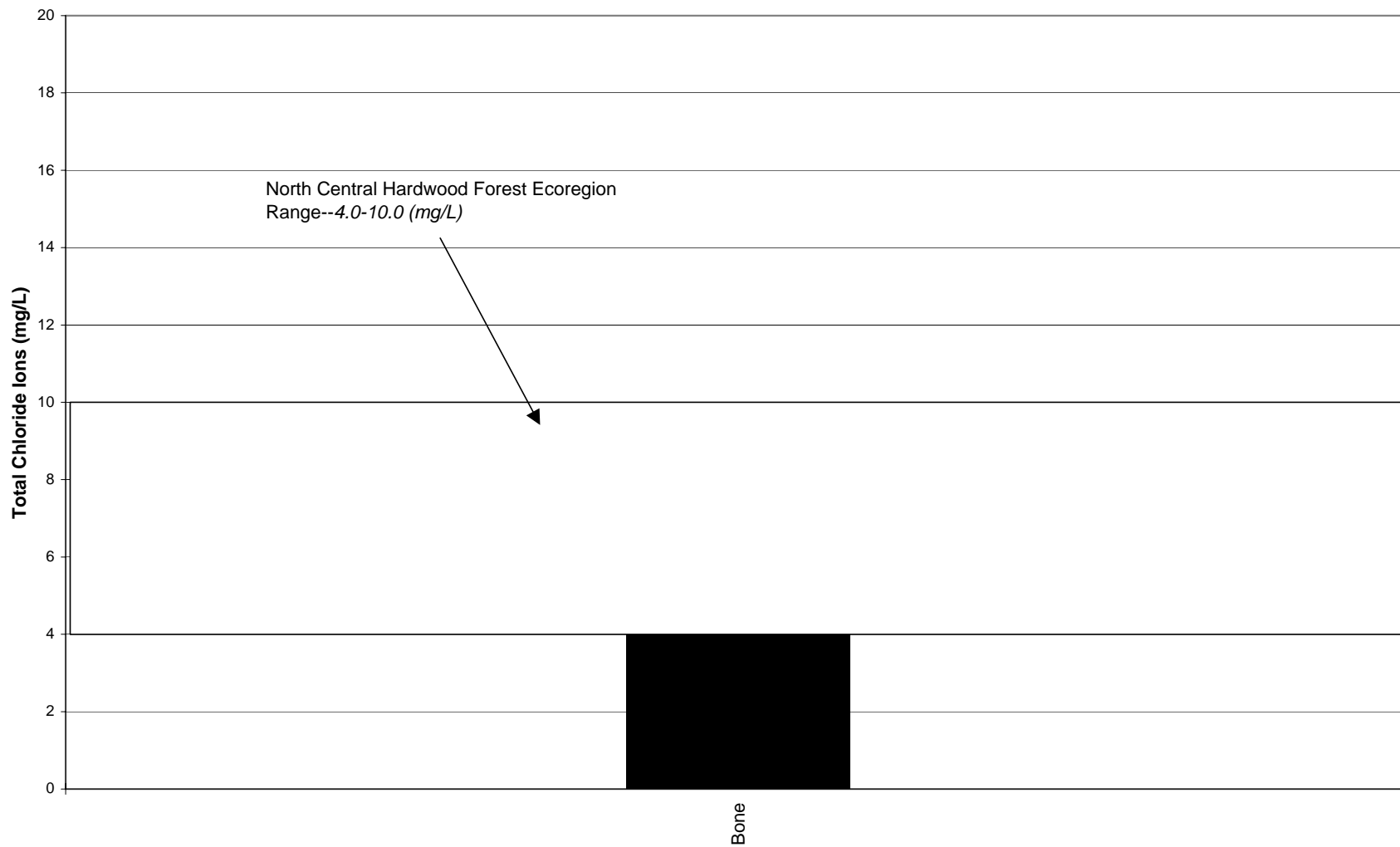


Figure 6. 2004 Average Total Chloride Ions and Ecoregion Range



Lake	Total Phosphorus (mg/l)	Chlorophyll-a (ug/l)	Total Kjeldahl Nitrogen (mg/l)	Total Chloride Ions (mg/L)	Secchi Disk (feet)	Secchi Disk (meters)
<i>Eco-Region Value</i>	<i>0.025-0.050</i>	<i>5-22</i>	<i>0.600-1.200</i>	<i>4.0-10.0</i>	<i>4.9-10.5</i>	<i>1.50-3.20</i>
Big Comfort	0.039	17	1.072		6.2	1.88
Bone	0.058	32	1.536	9.1	5.5	1.67
Forest	0.031	9	0.719		7.5	2.30
Halfbreed	0.020	3	0.547		16.1	4.91
Shields	0.214	39	1.986		4.6	1.39

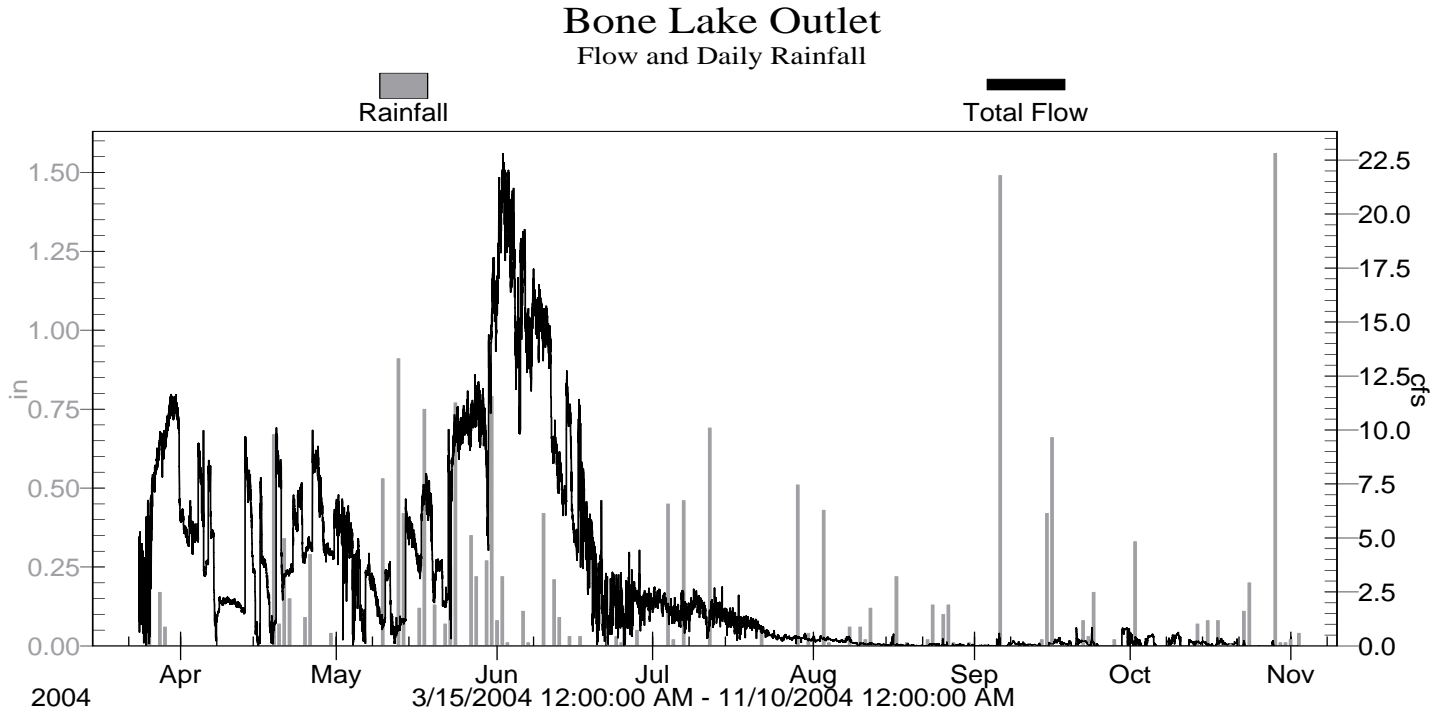
Table 1. 2004 Average Water Quality Results and Ecoregion Ranges

1) Bone Lake Subwatershed

Bone Lake Outlet

The station for the Bone Lake Outlet site recorded stage, velocity, flow, and rainfall between March 24-November 2, 2004 (Figure 7). Total discharge during this period was 57,500,590 cf or 1320 acre-ft. Total rainfall for the monitoring season was 18.03 inches. The highest flow—22.81 cfs occurred on June 2, 200, from a total rainfall of 1.93 inches, which fell from May 27-June 2, 2004.

Figure 7. Bone Lake Outlet 2004 Continuous Flow and Daily Rainfall



Grab samples and flow weighted composite samples were taken at the Bone Lake Outlet site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Ammonia Nitrogen, Orthophosphate, and Fecal Coliform results from all collected samples are listed in Table 2. The highest TSS concentrations of 36 mg/L were from the July 22, 2004 base composite sample. The highest TKN concentrations of 2.10 mg/L were from the March 1, 2004 snowmelt grab sample, the May 4, 2004 base composite sample, and the July 22, 2004 base composite sample. The highest TP concentration of 0.15 mg/L were also from the July 22, 2004 base composite sample. Many of the high concentrations seen here are during baseflow conditions which may indicate that because this is a simple pipe originating from the lake which normally has a large amount of debris moving in, around, or through it, that the settled debris is getting resuspended as water moves through the pipe and the results are that the additional material may be getting sampled.

Table 2. Bone Lake Outlet 2004 Sample Chemistry Results

Sample Type	Start Date	Start Time	End Date	End Time	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	Ortho P (mg/L)	Fecal Coliform (#/100ml)
Snow Grab	3/1/04	8:40	3/1/04	8:40	~2	~2	2.10	~0.04	<0.03	0.48	0.62		
Snow Grab	3/11/04	14:10	3/11/04	14:10	<2	~2	2.00	~0.04	<0.03	0.47	0.70		
Storm Composite	4/16/04	17:03	4/20/04	8:56	8	~4	1.80	0.11	<0.03	0.37	0.56		
Base Composite	5/4/04	15:28	5/5/04	14:54	22	9	2.10	0.10	0.03	0.18	0.52		
Storm Composite	5/16/04	22:08	5/18/04	6:54	11	~4	1.80	0.07	<0.03	0.21	0.39		
Storm Composite	6/1/04	8:51	6/3/04	9:54	9	~5	1.50	0.07	<0.03	0.23	0.10		
Fecal and Base Grab	6/8/04	10:00	6/8/04	10:00	~8	~9	1.80	0.10	<0.03	<0.05	<0.02		5
Fecal and Base Grab	7/15/04	10:00	7/15/04	10:00	~2	~1	1.10	~0.03	<0.03	0.08	<0.02	<0.005	3
Base Composite	7/22/04	11:50	7/26/04	12:21	36	22	2.10	0.15	<0.03	0.47	<0.02		
Fecal and Base Grab	8/12/04	9:15	8/12/04	9:15	15	~14	1.90	0.08	<0.03	0.10	<0.02	<0.005	220

Sample Type	Sample Collection Time				TP (mg/L)	TSS (mg/L)	Loading Interval		Interval Volume (cf)	Interval TP (lb)	Interval TSS (lb)
	Start Date	Start Time	End Date	End Time			Start	End			
<i>BASE</i>					0.08	7	1/1/2004 0:00	2/20/2004 0:00	4,320,000	20.80	1,965
Snow Grab	3/1/04	8:40	3/1/04	8:40	0.04	2	2/20/2004 0:15	3/6/2004 0:15	1,296,000	3.24	162
Snow Grab	3/11/04	14:10	3/11/04	14:10	0.04	2	3/6/2004 0:30	3/24/2004 0:15	1,554,300	3.88	194
<i>STORM</i>					0.08	9	3/24/2004 0:30	3/31/2004 17:30	8,972,907	46.68	5,228
<i>BASE</i>					0.08	7	3/31/2004 17:45	4/16/2004 17:00	3,414,133	16.44	1,553
Storm Composite	4/16/04	17:03	4/20/04	8:56	0.11	8	4/16/2004 17:15	4/21/2004 11:00	1,510,377	10.37	754
<i>BASE</i>					0.08	7	4/21/2004 11:15	5/1/2004 11:15	4,725,849	22.76	2,149
Base Composite	5/4/04	15:28	5/5/04	14:54	0.10	22	5/1/2004 11:30	5/9/2004 17:30	2,396,415	14.96	3,291
<i>STORM</i>					0.08	9	5/9/2004 17:45	5/11/04 10:45	348,077	1.81	203
<i>BASE</i>					0.08	7	5/11/2004 11:00	5/12/2004 12:30	75,238	0.36	34
<i>STORM</i>					0.08	9	5/12/2004 12:45	5/14/2004 23:00	452,127	2.35	263
<i>BASE</i>					0.08	7	5/14/2004 23:15	5/16/2004 21:45	792,331	3.82	360
Storm Composite	5/16/04	22:08	5/18/04	6:54	0.07	11	5/16/2004 22:00	5/19/2004 14:00	1,385,178	6.05	951
<i>BASE</i>					0.08	7	5/19/2004 14:15	5/23/2004 3:15	1,063,787	5.12	484
<i>STORM</i>					0.08	9	5/23/2004 3:30	5/26/2004 16:45	3,028,388	15.75	1,764
<i>BASE</i>					0.08	7	5/26/2004 17:00	5/30/2004 19:00	3,641,620	17.54	1,656
Storm Composite	6/1/04	8:51	6/3/04	9:54	0.07	9	5/30/2004 19:15	6/3/2004 11:15	5,884,126	25.71	3,306
Base Grab	6/8/04	10:00	6/8/04	10:00	0.10	8	6/3/2004 11:30	6/17/2004 11:30	14,694,400	91.73	7,339
<i>BASE</i>					0.08	7	6/17/2004 11:45	7/5/2004 11:45	3,648,756	17.57	1,660
Base Grab	7/15/04	10:00	7/15/04	10:00	0.03	2	7/5/2004 12:00	7/20/2004 12:00	1,847,387	3.46	231
Base Composite	7/22/04	11:50	7/26/04	12:21	0.15	36	7/20/2004 12:15	8/5/2004 12:15	597,075	5.59	1,342
Base Grab	8/12/04	9:15	8/12/04	9:15	0.08	15	8/5/2004 12:30	9/1/2004 12:30	157,382	0.79	147
<i>BASE</i>					0.08	7	9/1/2004 12:45	9/29/2004 10:00	172,560	0.83	78
<i>STORM</i>					0.08	9	9/29/2004 10:15	10/3/2004 4:30	112,493	0.59	66
<i>BASE</i>					0.08	7	10/3/2004 4:45	11/2/2004 14:15	225,605	1.09	103
NO FLOW							11/2/2004 14:30	12/31/2004 23:45	0	0.00	0
Storm Average					0.08	9					
Base Average					0.08	7					
Snowmelt Average					0.04	2					
All Average					0.08	9					
Total									66,316,511	339	35,283
CLFLWD Major Subwatershed Total Acres									5,971		
Total TP/TSS (lb/ac/June-December)										0.06	5.91
Total TP/TSS (kg/ha/June-December)										0.06	6.62

*Italics indicate estimated concentrations based on average base and storm flow concentrations

Table 3. Bone Lake Outlet 2004 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Bone Lake Outlet for 2004 was estimated at 0.06 kg/ha (339 lbs.) (Table 3). As expected, the portions of the year where storms occurred have equal or higher amounts of total water discharge and higher loads of TP and TSS per unit time as shown by the loading intervals in Table 4. One unique item to note is that the storm average and base average are very similar in concentrations for both TP and TSS. This may be due to a couple different reasons. The first is the problem of debris covering the grate on the outlet of the lake during many periods of the monitoring season. When possible, the WCD, with the help of others, removed debris many times during the season to maintain this outlet. Many times, the removal would send large flushes of water through the pipe and downstream to other portions of the watershed. Even in baseflow conditions, removal of debris can still send a large rush of water through the pipe. This large flush of water may have contained higher concentrations of nutrients than a true baseflow scenario. The second item relates to part of the first problem. With debris on the grate, the lake has the ability to allow further loading and eutrophication without sending this water downstream. When the debris is removed, even in a baseflow period, higher nutrient concentrations may be leaving the lake because of further eutrophication than what a true baseflow would reflect. In 2004, much of the floodplain modeling had been completed and a much more accurate determination of total subwatershed drainage was achieved and applied to the 2004 loadings. The Minnesota Pollution Control Agency has placed Bone Lake on the 303(d) Impaired Waters List and the data collected at the locations within this subwatershed will provide a baseline of data with which to implement Total Maximum Daily Load studies/projects.

Bone Lake

Vital Statistics:

DNR ID #: 82-0054

LOCATION: E^{1/2} Section 5 T32N-R20W

MUNICIPALITY: New Scandia Township

LAKE SIZE: 210 acres

ORDINARY HIGH WATER MARK: 909.1 ft

Bone Lake was monitored from April 22 to October 20, 2004, in accordance with the Metropolitan Council Citizen-Assisted Monitoring Program (CAMP). Monitoring consisted of 14 biweekly samplings of Secchi disk, surface total phosphorus, surface total Kjeldahl nitrogen, surface chlorophyll-*a*, and surface total chloride ion. In addition, a temperature and dissolved oxygen profile was taken during each sampling round. The Metropolitan Council Lab analyzed the samples.

Table 4 gives the Bone Lake 2004 high, low, and average lake levels. Individual lake level readings are shown in Figure 8.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
4/21/04- 11/29/04	48	885.65 10/4/04 & 10/11/2004	887.11 6/7/2004	1.46	886.06

Table 4. Bone 2004 Lake Levels

Figure 8. Bone Lake Elevations 2003-04

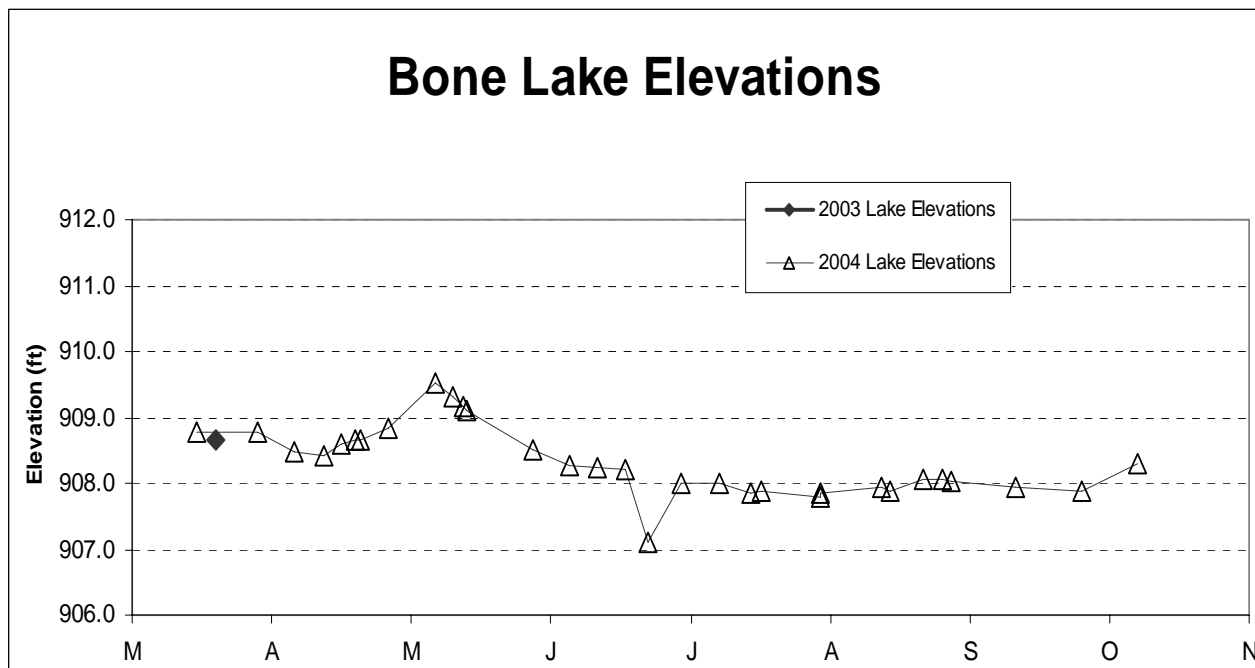


Table 5 gives the 2004 Bone Lake monitoring chemistry results and transparencies for the 2004 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Chloride (mg/L)	Secchi (m)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/22/04	0.047	1.90	7.4	6	2.74	9.51	10.6
5/4/04	0.057	1.80	6.3	12	3.05	9.64	12.3
5/18/04	0.054	1.70	9.8	11	2.74	7.87	18.3
6/2/04	0.055	1.70	32.0	5	1.52	10.76	16.3
6/16/04	0.047	1.60	44.0	8	1.22	9.21	22.3
6/29/04	0.043	1.40	40.0	11	1.07	8.52	20.4
7/14/04	0.037	1.30	24.0	3	1.52	8.23	24.3
7/26/04	0.057	1.30	21.0	11	1.52	7.59	26.0
8/12/04	0.056	1.20	20.0	18	1.22	4.11	19.7
8/25/04	0.061	1.30	67.0	11	0.91	9.52	21.3
9/9/04	0.132	1.70	52.0	4	0.91	6.17	20.8
9/22/04	0.050	1.10	38.0	7	1.37	5.42	20.1
10/6/04	0.056	1.70	49.0	10	1.83	7.20	14.4
10/20/04	0.058	1.80	35.0	11	1.68	6.89	10.3
2004 Averages	0.058	1.54	31.82	9.1	1.67	7.90	18.4

Table 5. Bone Lake 2004 Monitoring Results

Table 6 shows the Bone Lake Water Quality Summary. The lake received an average lake grade of a C for 2004.

	Trophic Status (2004 Average)	Lake Grade (2004 Average)
Total Phosphorus (mg/L)	Eutrophic	C
Chlorophyll-a (ug/L)	Hypereutrophic	C
Secchi disk (ft)	Eutrophic	C
Overall	Hypereutrophic	C

Table 6. Lake Grade and Trophic Status.

Figure 9-13 compare the lake chemistry data and Secchi disk readings.

Figure 9. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

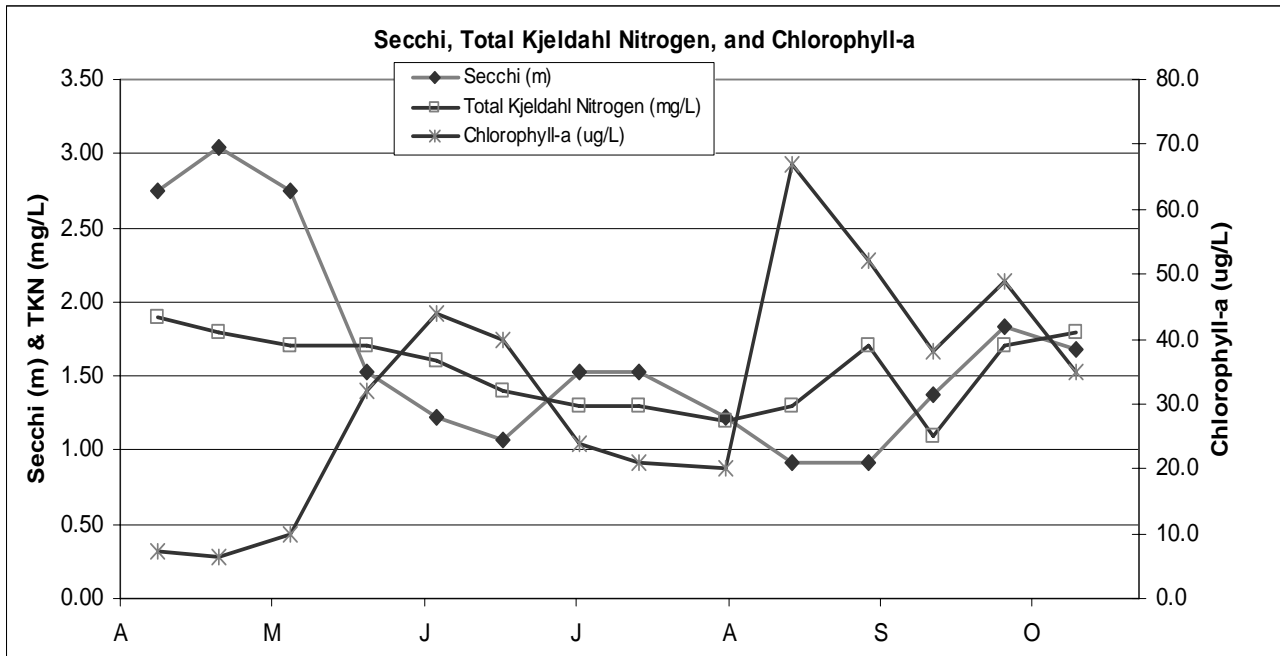


Figure 10. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

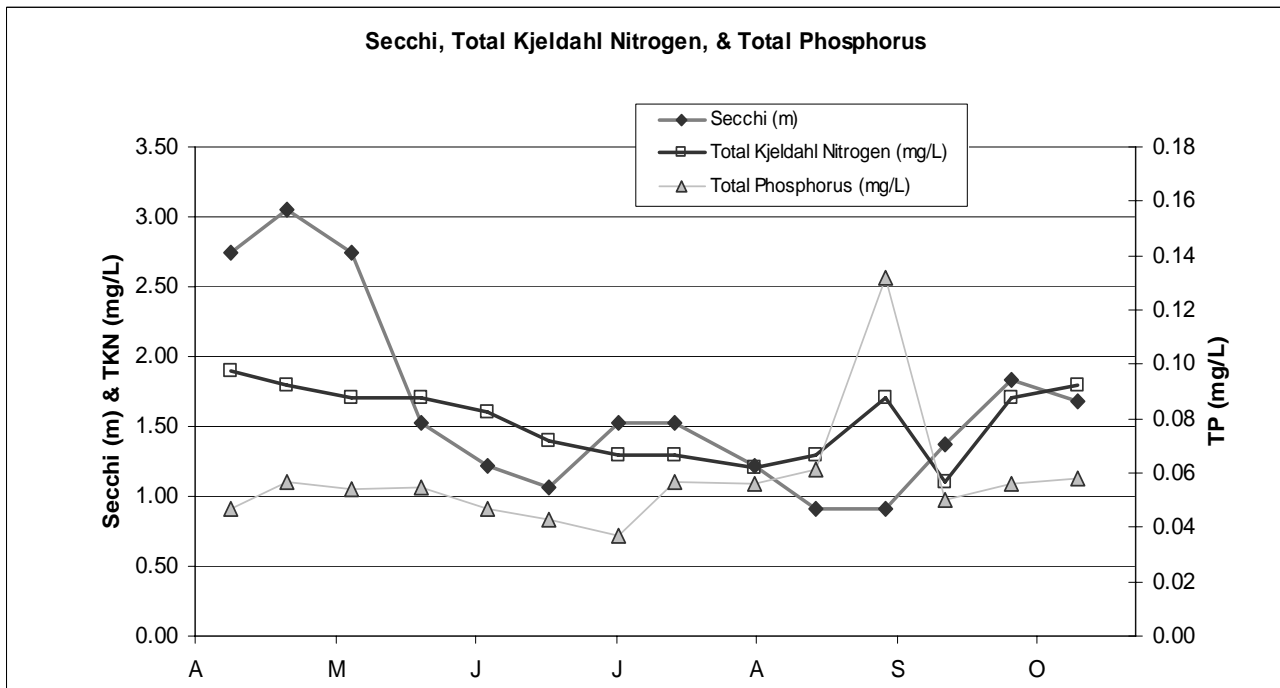


Figure 11. Secchi and Chloride ion

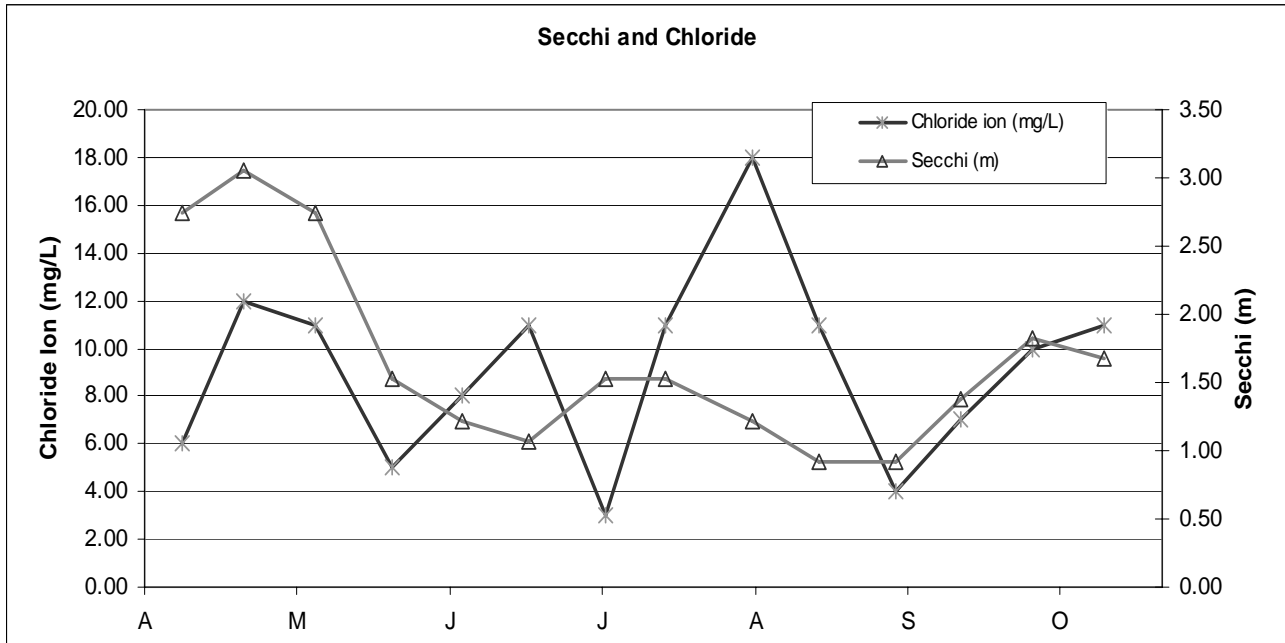


Figure 12. Total Phosphorous and Chlorophyll-a

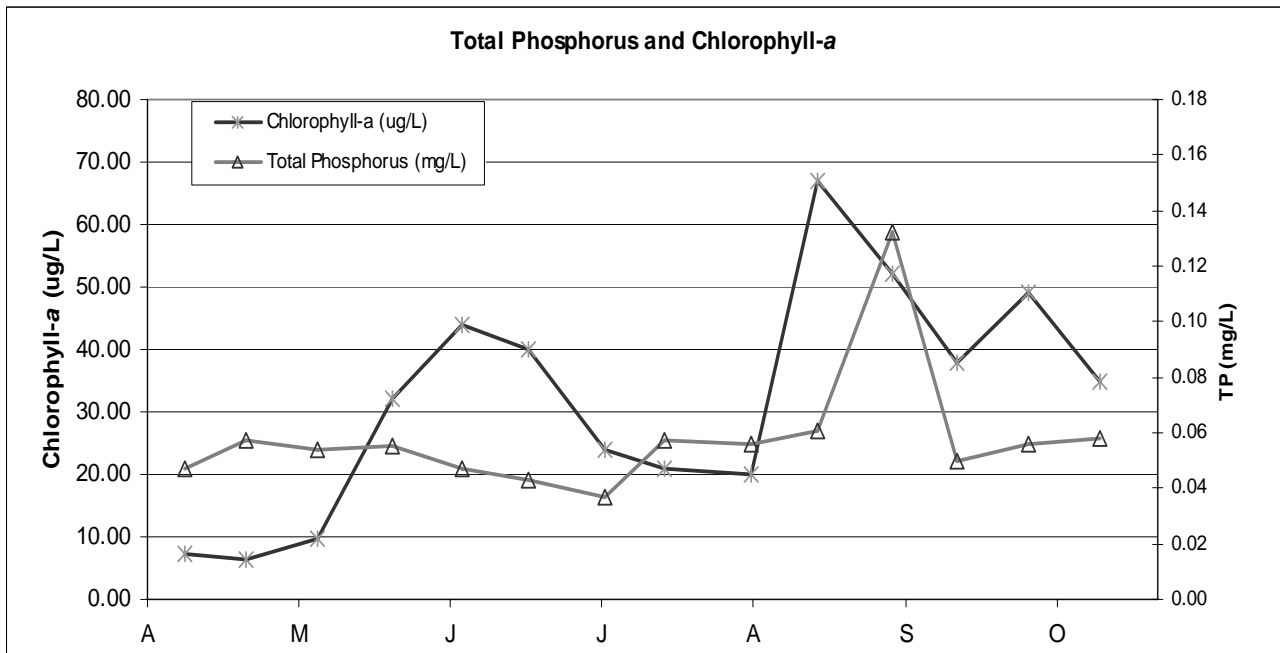
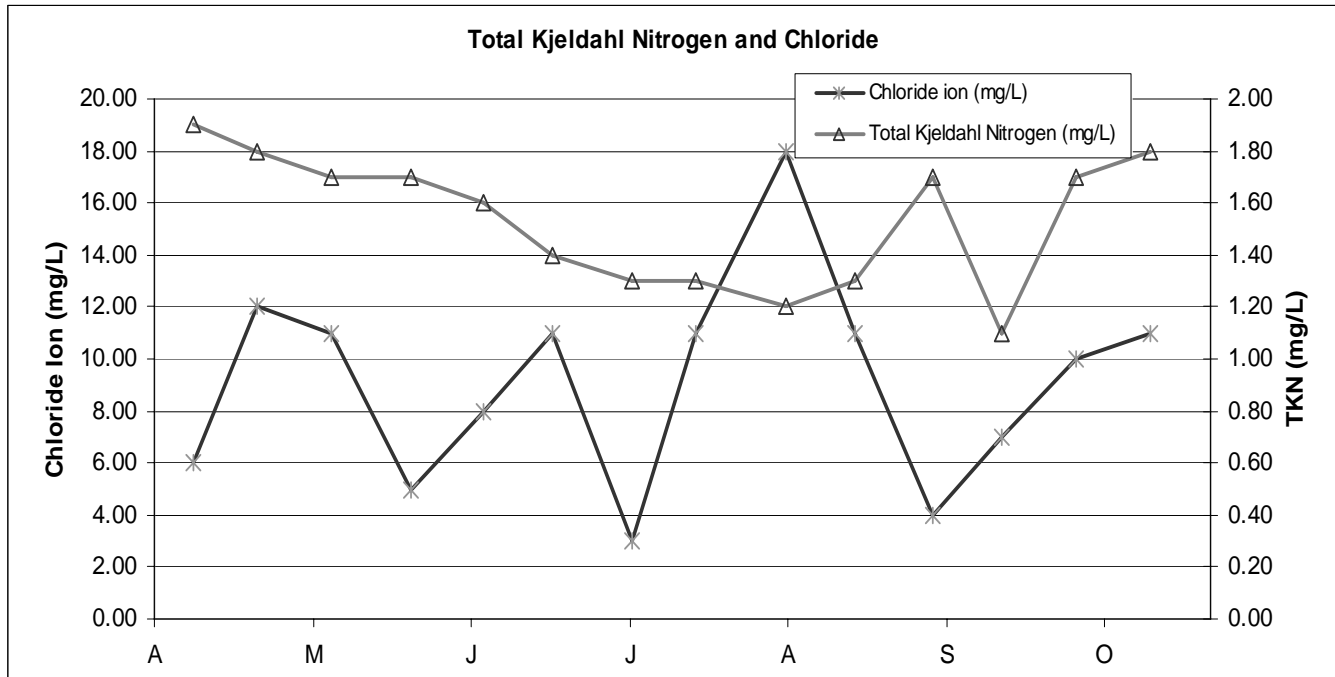
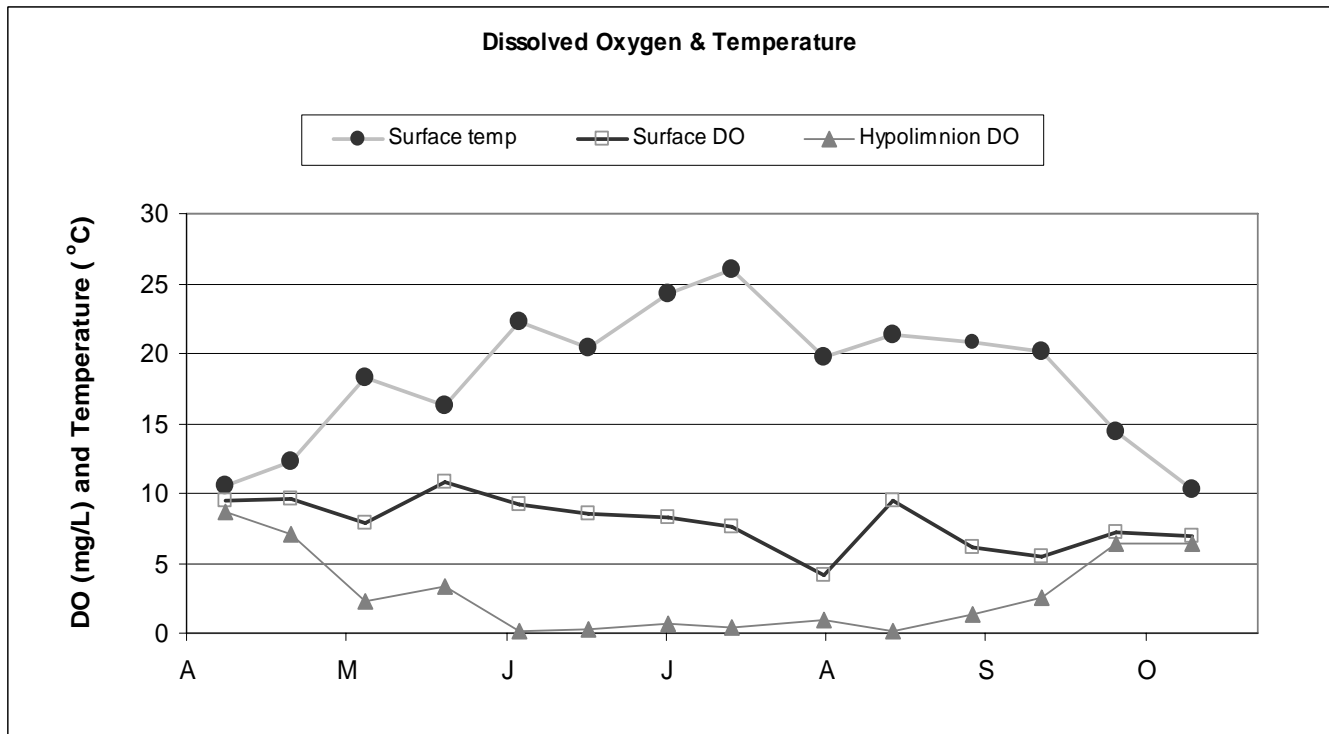


Figure 13. Total Kjeldahl Nitrogen and Chloride ion



Surface dissolved oxygen and surface temperature readings for 2004 are shown in Figure 14.

Figure 14. Surface Dissolved Oxygen and Surface Temperatures

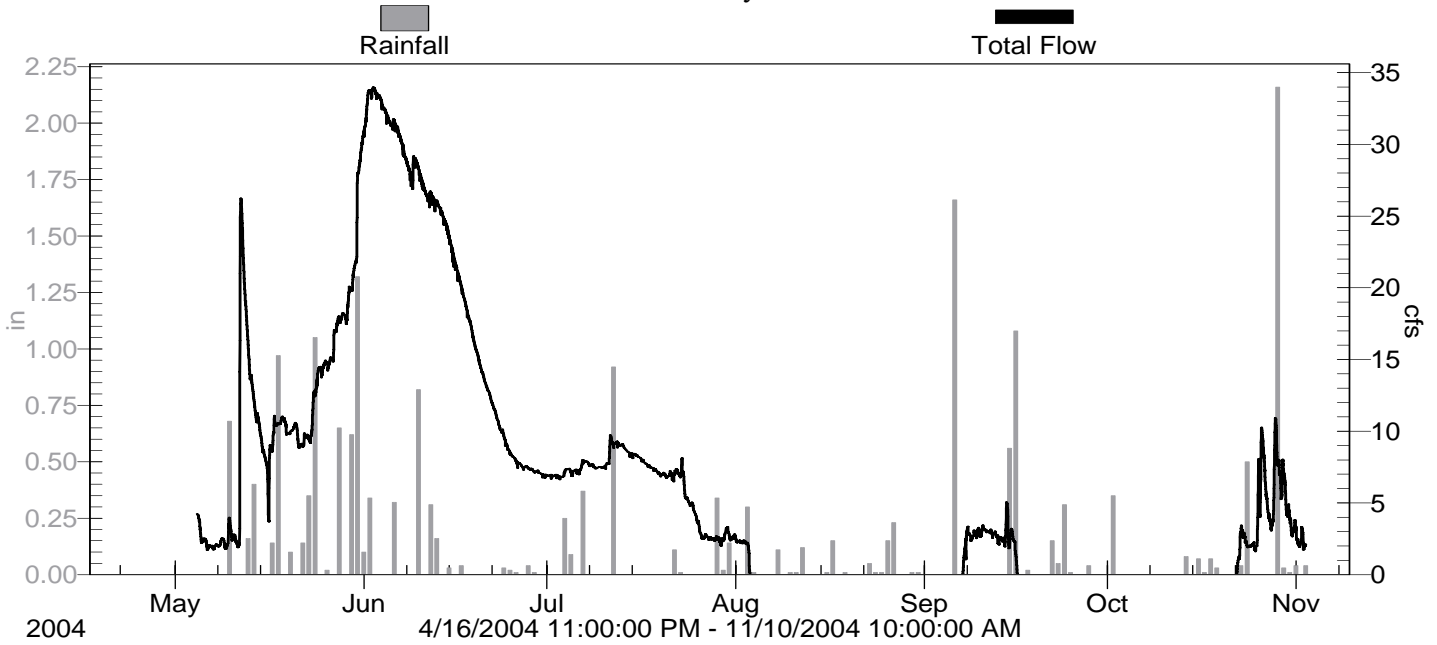


2) Little Comfort Lake Subwatershed

Little Comfort Lake Inlet

The station for the Little Comfort Lake Inlet site recorded flow between May 5-November 2, 2004 (Figure 14). Total discharge during this period was 102,870,700 cf or 2,362 acre/ft. Total rainfall for the monitoring season was 19.59 inches. The highest discharge—34.00 occurred on June 2, 2004, from a total rainfall of 3.03 inches between May 27 and June 2, 2003. The rainfall on October 28, 2004 was the highest daily rainfall for the monitoring period, yielding 2.16 inches of rain. The hydrograph for the Little Comfort Lake Inlet is shown below.

Figure 14. Little Comfort Lake Inlet 2004 Flow and Daily Rainfall
Little Comfort Lake Inlet
 Flow and Daily Rainfall



Grab samples and flow weighted composite samples were taken at the Little Comfort Lake Inlet site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Orthophosphate, and Fecal Coliform results from all collected samples are listed in Table 7. The highest TSS, TKN, and TP concentrations of 504 mg/L, >4.0 mg/L, and 0.70 mg/L respectively were all collected in an October 28, 2004 storm composite sample.

Sample Type	Start Date	Start Time	End Date	End Time	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	Ortho P (mg/L)	Fecal Coliform (#/100ml)
Snow Grab	3/1/04	8:50	3/1/04	8:50	~3	<2	1.80	0.08	<0.03	0.46	0.79		
Snow Grab	3/11/04	14:20	3/11/04	14:20	13	7	1.40	0.12	<0.03	0.28	0.65		
Storm Grab	4/19/04	15:30	4/19/04	15:30	7	~4	0.94	0.08	<0.03	0.11	0.15		
Base Grab	5/6/04	14:45	5/6/04	14:45	~4	~2	0.27	0.07					
Storm Composite	5/11/04	14:09	5/12/04	5:15	~2	~2	0.95	0.07	<0.03	<0.05	~0.04		
Storm Grab	5/17/04	10:03	5/17/04	10:30	130	32	2.00	0.18	<0.03	<0.05	0.07		
Storm Composite	5/23/04	17:00	5/25/04	9:01	10	~5	0.94	~0.03	<0.03	<0.05	<0.02		
Storm Composite	5/30/04	23:32	6/3/04	6:33	34	13	1.50	0.10	<0.03	0.07	~0.04		
Fecal and Base Grab	6/8/04	9:45	6/8/04	9:45	7	~4	1.00	0.09	<0.03	<0.05	<0.02	0.022	26
Base Composite	6/24/04	11:26	6/28/04	8:39	20	~10	1.50	0.11	<0.03	0.15	0.10		
Storm Composite	7/11/04	9:06	7/12/04	9:57	138	60	3.00	0.28	0.04	0.44	~0.05		
Fecal and Base Grab	7/15/04	9:45	7/15/04	9:45	~5	~5	1.20	0.09	<0.03	0.13	~0.03	~0.007	26
Base Composite	7/22/04	11:35	7/26/04	11:47	55	24	1.70	0.18	<0.03	0.48	~0.04		
Storm Composite	7/28/04	15:34	7/30/04	2:43	28	13	1.30	0.13	0.08	0.38	~0.03		
Storm Composite	8/1/04	6:08	8/2/04	12:56	20	~10	1.20	0.09	0.05	0.27	~0.04		
Fecal and Base Grab	8/12/04	9:00	8/12/04	9:00	32	15	1.20	0.10	0.04	0.28	~0.04	0.014	310
Storm Composite	8/13/04	23:26	8/17/04	17:02	12	6	0.91	0.05	0.05	0.31	~0.04		
Storm Composite	9/5/04	7:55	9/6/04	18:31	93	41	2.10	0.19	0.06	0.38	~0.03		
Storm Grab	9/16/04	8:45	9/16/04	8:45	~1	<1	0.90	~0.05	0.06	0.23	0.17		
Fecal and Base Grab	9/27/04	10:00	9/27/04	10:00	4	~2	0.69	0.07	0.08	0.38	0.07	0.021	200
Storm Composite	10/23/04	0:50	10/25/04	4:37	45	~17	1.70	0.14	<0.03	0.28	0.36		
Storm Composite	10/28/04	10:05	10/28/04	16:46	504	260	>4.00	0.70	<0.03	0.54	0.21		

Table 7. Little Comfort Lake Inlet 2004 Sample Chemistry Results

Sample Type	Sample Collection Time				TP (mg/L)	TSS (mg/L)	Loading Interval		Interval Volume (cf)	Interval TP (lb)	Interval TSS (lb)
	Start Date	Start Time	End Date	End Time			Start	End			
Snow Grab	3/1/04	8:50	3/1/04	8:50	0.08	3	1/1/2004 0:00	3/5/2004 23:45	8,422,650	41.01	21,564
Snow Grab	3/11/04	14:20	3/11/04	14:20	0.12	13	3/6/04 0:00	3/20/2004 0:00	36,279,000	274.04	620,625
<i>SNOWMELT</i>					<i>0.10</i>	<i>8</i>	<i>3/20/04 0:15</i>	<i>4/16/2004 0:15</i>	<i>11,664,000</i>	<i>72.45</i>	<i>52,753</i>
Storm Grab	4/19/04	15:30	4/19/04	15:30	0.08	7	4/16/04 0:30	4/25/2004 23:45	3,883,500	19.39	4,702
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>4/26/04 0:00</i>	<i>5/4/2004 14:30</i>	<i>3,717,000</i>	<i>24.76</i>	<i>5,746</i>
Base Grab	5/6/04	14:45	5/6/04	14:45	0.07	4	5/4/04 14:45	5/9/2004 17:30	1,017,648	4.13	262
Storm Composite	5/11/04	14:09	5/12/04	5:15	0.07	2	5/9/04 17:45	5/14/2004 5:00	4,343,013	18.16	4,925
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>5/14/04 5:15</i>	<i>5/16/2004 9:30</i>	<i>1,669,788</i>	<i>11.12</i>	<i>1,160</i>
Storm Grab	5/17/04	10:03	5/17/04	10:30	0.18	130	5/16/04 9:45	5/18/2004 22:45	2,217,771	24.23	3,354
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>5/18/04 23:00</i>	<i>5/22/2004 2:30</i>	<i>2,657,916</i>	<i>17.71</i>	<i>2,938</i>
<i>STORM</i>					<i>0.18</i>	<i>97</i>	<i>5/22/04 2:45</i>	<i>5/23/2004 4:15</i>	<i>884,925</i>	<i>9.94</i>	<i>549</i>
Storm Composite	5/23/04	17:00	5/25/04	9:01	0.03	10	5/23/04 4:30	5/24/2004 19:30	1,766,061	3.31	365
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>5/24/04 19:45</i>	<i>5/26/2004 23:00</i>	<i>2,709,936</i>	<i>18.05</i>	<i>3,054</i>
<i>STORM</i>					<i>0.18</i>	<i>97</i>	<i>5/26/04 23:15</i>	<i>5/28/2004 2:15</i>	<i>1,680,552</i>	<i>18.88</i>	<i>1,981</i>
Storm Composite	5/30/04	23:32	6/3/04	6:33	0.10	34	5/28/04 2:30	6/4/2004 2:30	16,417,380	105.56	108,188
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>6/4/04 2:45</i>	<i>6/5/2004 17:30</i>	<i>4,444,785</i>	<i>29.61</i>	<i>8,216</i>
Base Grab	6/8/04	9:45	6/8/04	9:45	0.09	7	6/5/04 17:45	6/8/2004 23:45	8,341,182	45.82	23,860
<i>STORM</i>					<i>0.18</i>	<i>97</i>	<i>6/9/04 0:00</i>	<i>6/10/2004 1:00</i>	<i>2,582,037</i>	<i>29.01</i>	<i>4,677</i>
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>6/10/04 1:15</i>	<i>6/11/2004 18:30</i>	<i>4,000,779</i>	<i>26.65</i>	<i>6,656</i>
<i>STORM</i>					<i>0.18</i>	<i>97</i>	<i>6/11/04 18:45</i>	<i>6/13/2004 14:30</i>	<i>4,101,201</i>	<i>46.08</i>	<i>11,799</i>
Base Composite	6/24/04	11:26	6/28/04	8:39	0.11	20	6/13/04 14:45	7/11/2004 5:30	26,463,751	175.12	289,296
Storm Composite	7/11/04	9:06	7/12/04	9:57	0.28	138	7/11/04 5:45	7/13/2004 18:45	2,005,002	35.55	4,449
Base Grab	7/15/04	9:45	7/15/04	9:45	0.09	5	7/13/04 19:00	7/19/2004 1:00	3,636,216	19.29	4,380
Storm Composite	7/22/04	11:35	7/26/04	11:47	0.18	55	7/19/04 1:15	7/28/2004 4:15	4,215,654	46.84	12,328
Storm Composite	7/28/04	15:34	7/30/04	2:43	0.13	28	7/28/04 4:30	7/31/2004 0:00	630,801	5.16	203
Base Composite	8/1/04	6:08	8/2/04	12:56	0.09	20	7/31/04 0:15	8/3/2004 9:45	649,764	3.81	155
NO FLOW							8/3/04 10:00	9/7/2004 6:45	0	0.00	0
<i>STORM</i>					<i>0.18</i>	<i>97</i>	<i>9/7/04 7:00</i>	<i>9/10/2004 15:15</i>	<i>756,171</i>	<i>8.50</i>	<i>401</i>
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>9/10/04 15:30</i>	<i>9/14/2004 5:00</i>	<i>849,285</i>	<i>5.66</i>	<i>300</i>
Storm Grab	9/16/04	8:45	9/16/04	8:45	0.05	1	9/14/04 5:15	9/16/2004 8:45	455,508	1.42	40
NO FLOW							9/16/04 9:00	10/22/2004 5:30	0	0.00	0
Storm Composite	10/23/04	0:50	10/25/04	4:37	0.14	45	10/22/04 5:45	10/23/2004 22:00	317,151	2.69	53
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>10/23/04 22:15</i>	<i>10/28/2004 5:15</i>	<i>1,601,496</i>	<i>10.67</i>	<i>1,067</i>
Storm Composite	10/28/04	10:05	10/28/04	16:46	0.70	504	10/28/04 5:30	10/30/2004 6:00	1,302,183	56.50	4,593
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>10/30/04 6:15</i>	<i>11/22/2004 0:00</i>	<i>2,947,050</i>	<i>19.63</i>	<i>3,612</i>
<i>STORM</i>					<i>0.18</i>	<i>97</i>	<i>11/22/04 0:15</i>	<i>11/24/2004 0:00</i>	<i>1,719,000</i>	<i>19.32</i>	<i>2,073</i>
<i>BASE</i>					<i>0.11</i>	<i>20</i>	<i>11/24/04 0:15</i>	<i>12/31/2004 23:45</i>	<i>4,922,100</i>	<i>32.79</i>	<i>10,075</i>
Storm Average					0.18	97					
Base Average					0.11	20					
Snowmelt Average					0.10	8					
All Average					0.14	52					
Total									175,272,256	1,283	1,220,397
CLFLWD Major Subwatershed Total Acres											
Total Load									9,565		
Total TP/TSS (lb/ac/June-December)										0.13	127.59
Total TP/TSS (kg/ha/June-December)										0.15	143.01

*Italics indicate estimated concentrations based on average base and storm flow concentrations

Table 8. Little Comfort Lake Inlet 2004 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Little Comfort Lake Inlet for 2004 was estimated at 0.15 kg/ha (1,283 lbs.) (Table 8). In 2004, much of the floodplain modeling had been completed and a much more accurate determination of total subwatershed drainage was achieved and applied to the 2004 loadings. Monitoring upstream (any road crossing between this location and Bone Lake) of this location would be advised because of the loading differences compared to the Bone Lake Outlet. There is slightly more than double the total phosphorus/acre/yr at this site than at the Bone Lake Outlet indicating some direct source(s) of TP as well as TSS between the two sites.

3) Sylvan/Halfbreed Subwatershed

Halfbreed Lake

Vital Statistics:

DNR ID #: 82-0080

LOCATION: NE^{1/4} Section 24 T32N-R21W

MUNICIPALITY: Forest Lake Township

LAKE SIZE: 74.5 acres

ORDINARY HIGH WATER MARK: 937.1 ft

Halfbreed Lake was monitored from April 22 to October 20, 2004, in accordance with the Metropolitan Council Citizen-Assisted Monitoring Program (CAMP). Monitoring consisted of 14 biweekly lake gage readings and samplings of Secchi disk, surface total phosphorus, surface total Kjeldahl nitrogen, and surface chlorophyll-*a*. In addition, a temperature and dissolved oxygen profile was taken during each sampling round. The Metropolitan Council Lab analyzed the samples.

Table 9 gives the Halfbreed Lake 2004 high, low, and average lake levels. Individual lake level readings are shown in Figure 15.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
4/13/04-11/1/04	16	936.65	937.49	0.84	936.99
		8/25/04 & 10/20/04	6/2/2004		

Table 9. Halfbreed 2004 Lake Level

Figure 15. Halfbreed Lake Elevations 2003-04

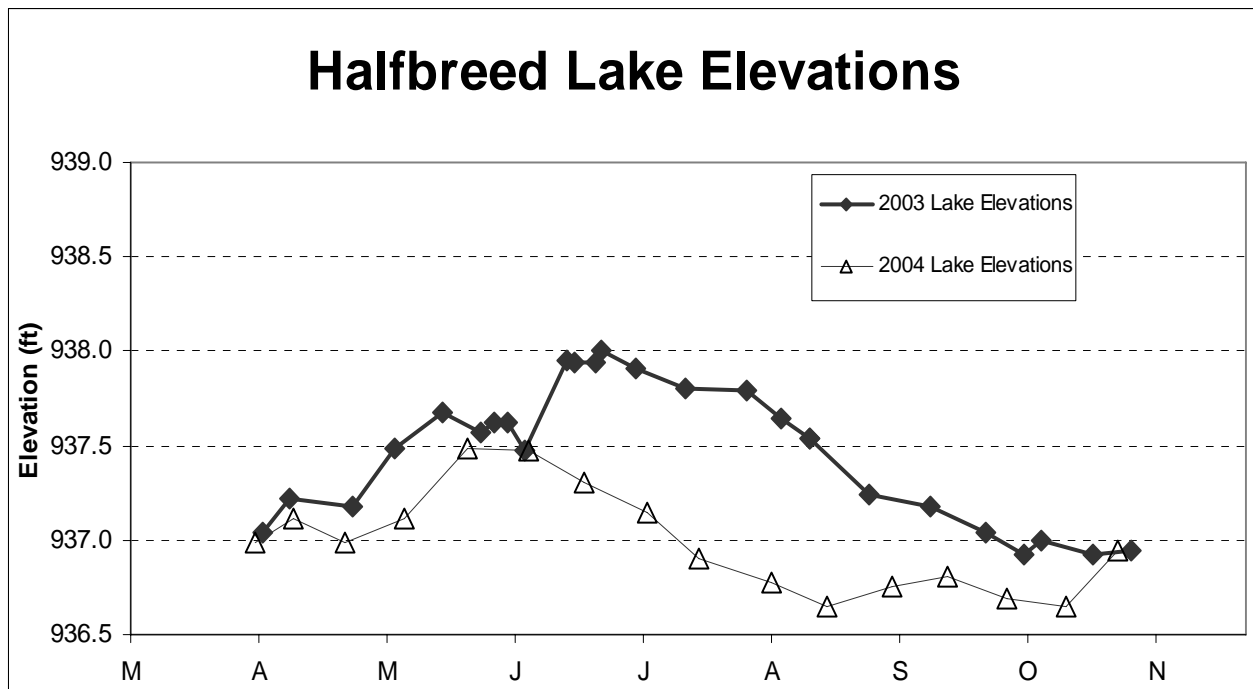


Table 10 gives the 2004 Halfbreed Lake monitoring chemistry results and transparencies for the 2004 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Secchi (m)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/22/2004	0.024	0.62	3.9	3.66	9.46	11.2
5/4/2004	0.019	0.46	2.6	4.88	9.77	12.6
5/18/2004	0.019	0.65	3.3	5.18	7.84	15.0
6/2/2004	0.020	0.86	2.6	5.18	8.79	15.6
6/16/2004	0.025	0.61	4.1	4.42	8.23	21.8
6/29/2004	0.019	0.52	3.0	5.03	7.76	19.7
7/14/2004	0.016	0.57	3.8	4.72	7.93	23.7
7/26/2004	0.015	0.38	3.1	5.03	7.37	25.2
8/12/2004	0.012	0.48	4.1	5.03	7.62	18.9
8/25/2004	0.018	0.55	3.9	5.18	7.17	20.0
9/9/2004	0.029	0.37	2.3	4.88	7.23	20.5
9/22/2004	0.027	0.50	3.8	6.40	5.94	19.6
10/6/2004	0.022	0.55	3.2	6.25	7.4	12.7
10/20/2004	0.019	0.54	4.2	2.90	7.32	9.0
2004 Averages	0.020	0.55	3.4	4.91	7.85	17.53

Table 10. Halfbreed 2004 Monitoring Results

Table 11 shows the Halfbreed Lake Water Quality Summary. The lake received an average lake grade of an A for 2004.

	Trophic Status (2004 Average)	Lake Grade (2004 Average)
Total Phosphorus (mg/L)	Mesotrophic	A
Chlorophyll-a (ug/L)	Oligotrophic	A
Secchi disk (ft)	Oligotrophic	A
Overall	Oligotrophic	A

Table 11. Lake Grade and Trophic Status.

Figure 16-18 compare the lake chemistry data and Secchi disk readings.

Figure 16. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

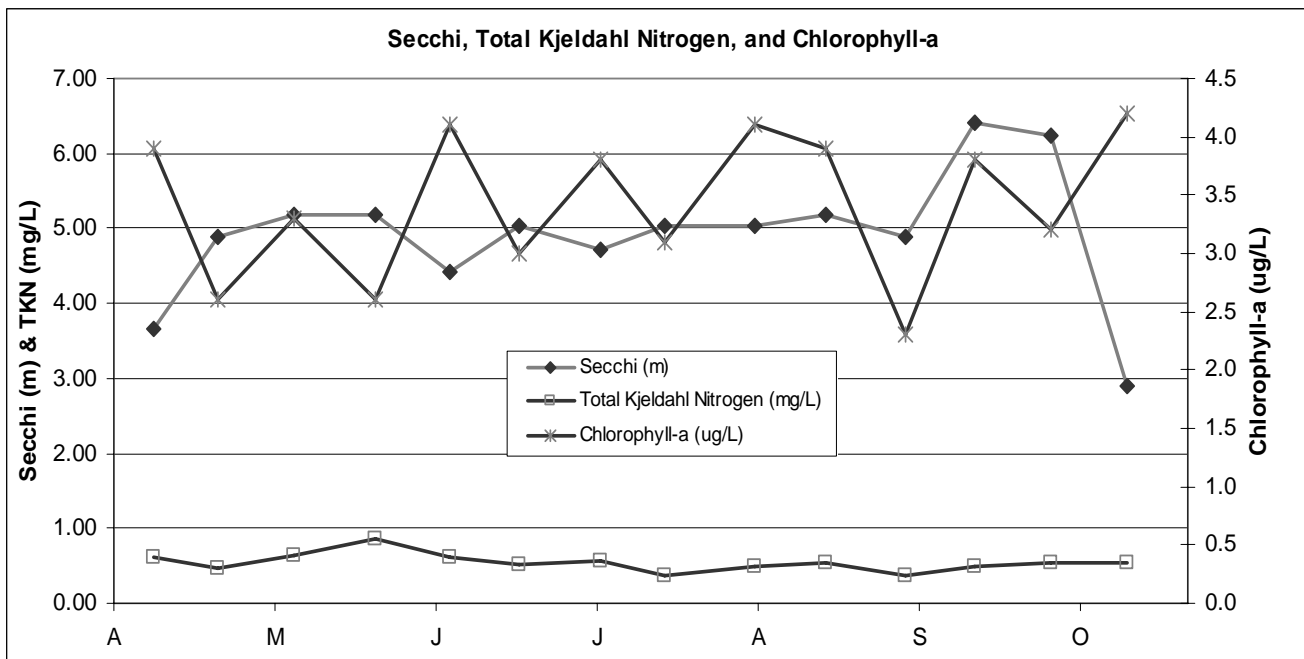


Figure 17. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

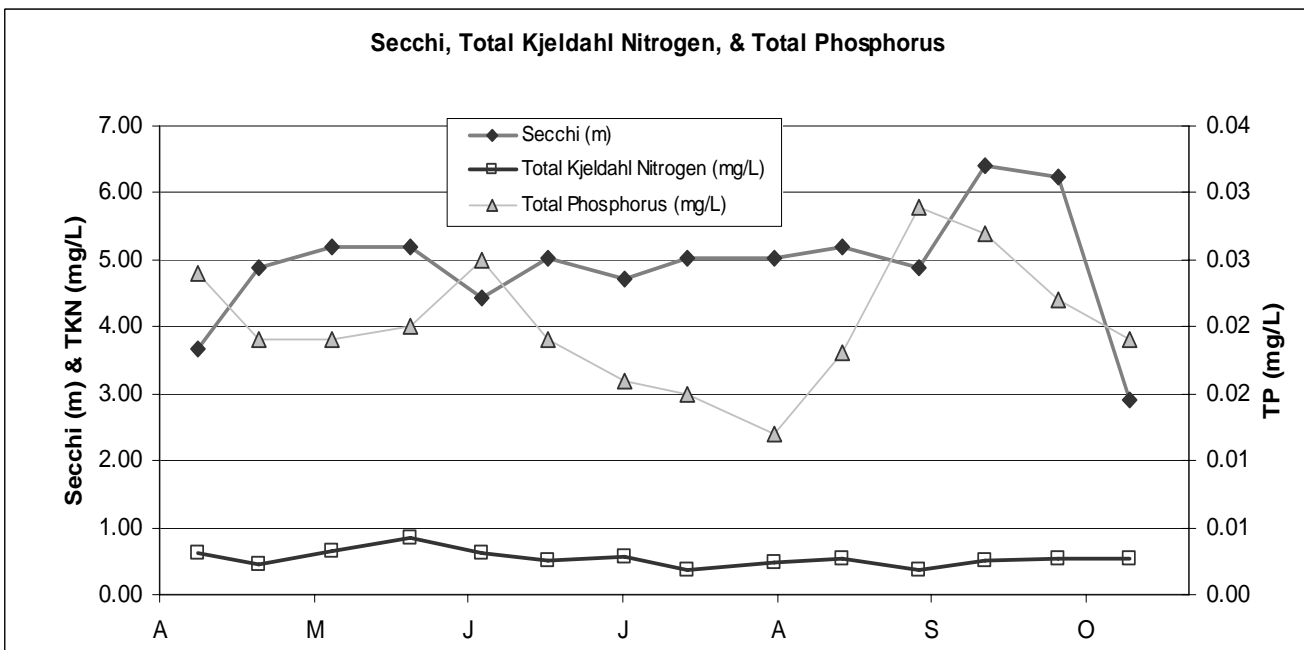
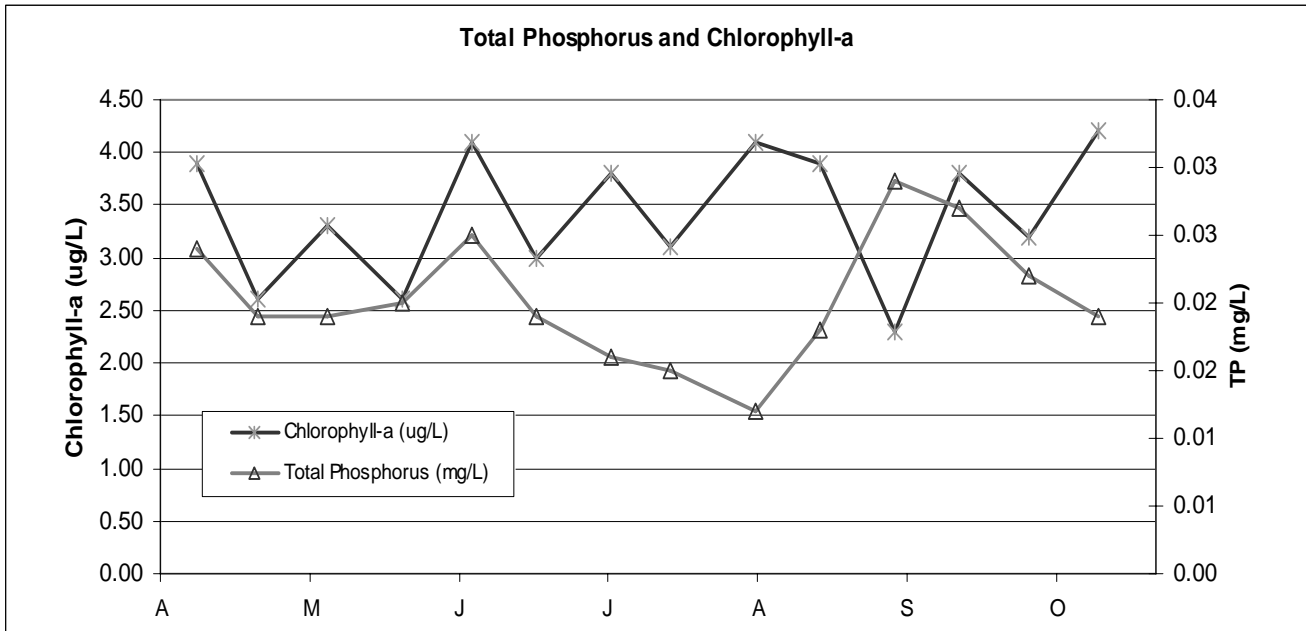
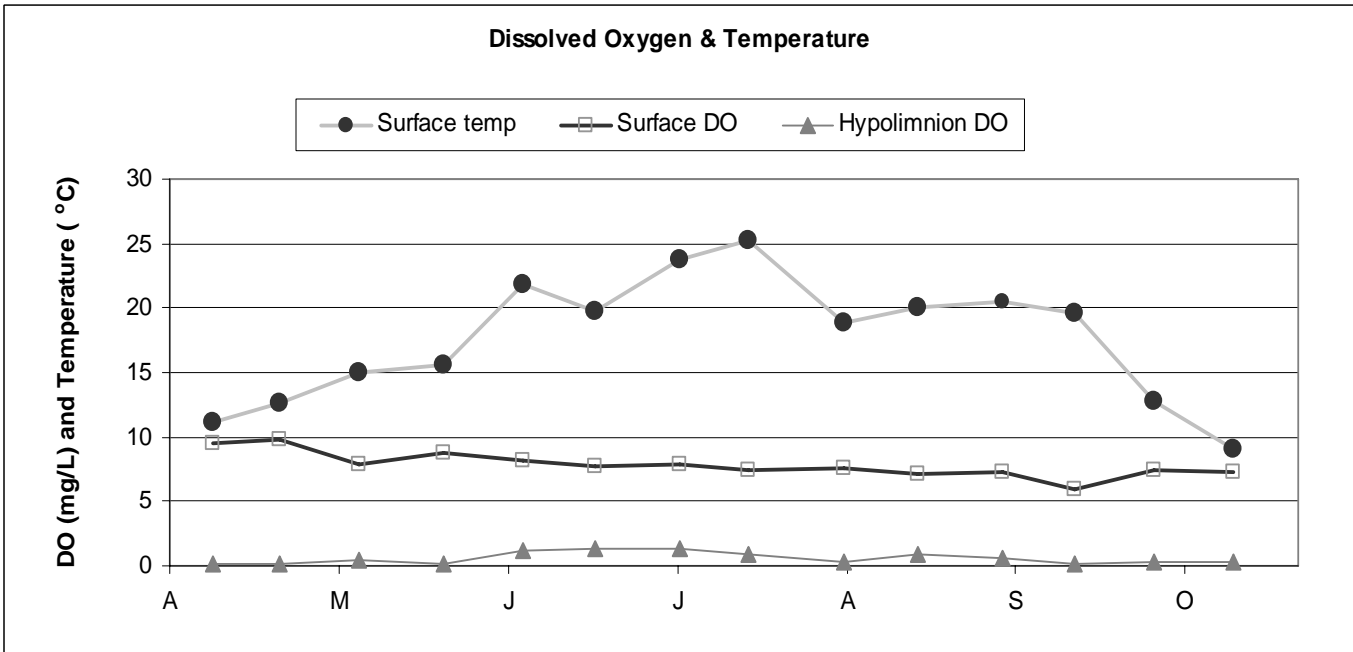


Figure 18. Total Phosphorous and Chlorophyll-a



Surface dissolved oxygen and surface temperature readings are shown in Figure 19.

Figure 19. Surface Dissolved Oxygen and Surface Temperatures

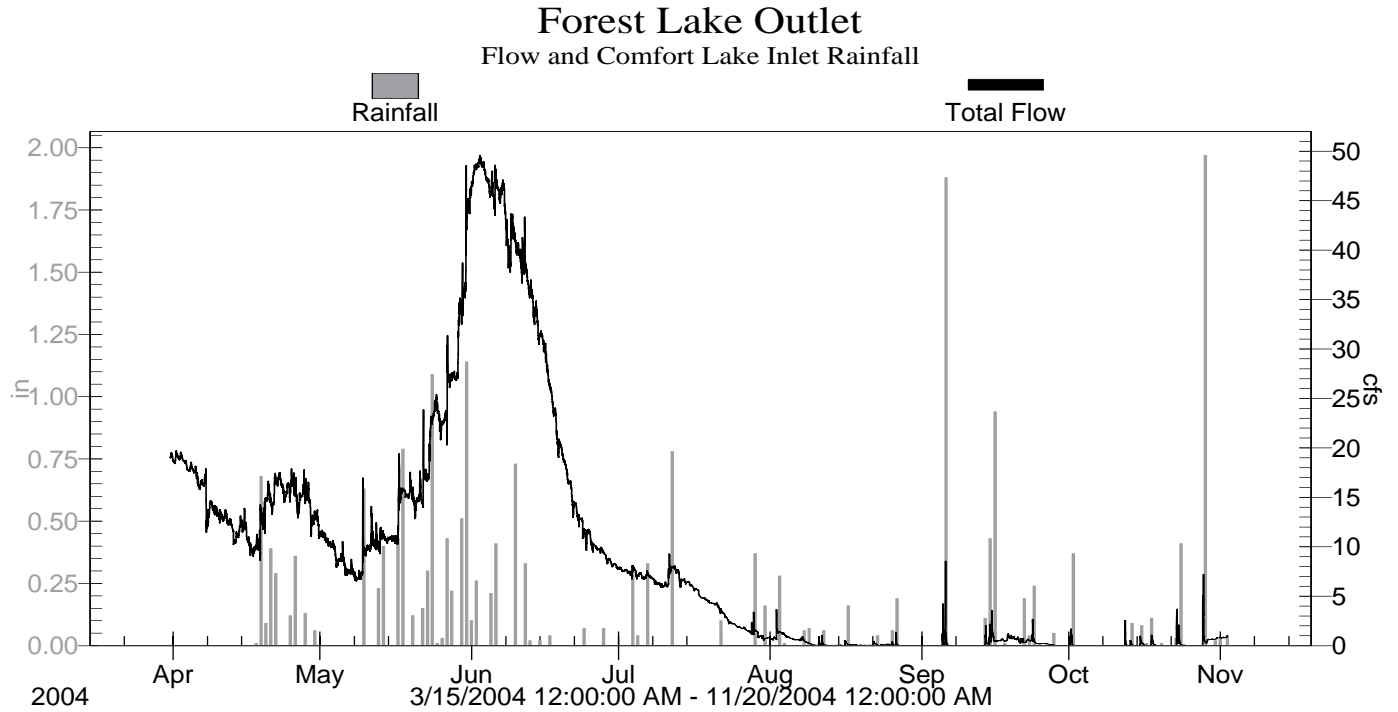


4) Forest Lake Subwatershed

Forest Lake Outlet

The station at the Forest Lake Outlet site recorded stage, velocity, and flow between March 31-November 2, 2004 (Figure 20). Total discharge during this period was 169,999,100 cf or 3,903 acre-ft. No automated rain gage was installed at this site to determine total seasonal rainfall. The highest flow—49.60 cfs occurred on June 2, 2004 from heavy rainfall events during the previous week. The hydrograph for the Forest Lake Outlet site is shown below.

Figure 20. Forest Lake Outlet 2004 Flow and Daily Rainfall



Grab samples and flow weighted composite samples were taken at the Forest Lake Outlet site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Ammonia Nitrogen, Orthophosphate, and Fecal Coliform results from all collected samples are listed in Table 12. The highest TSS, TP, and TKN concentration of 488 mg/L, 0.57 mg/L, and 3.10 mg/L, respectively, were from the September 5, 2004 storm composite sample. One note that should be made is the fact that the outlet stopped flowing over the weir during a couple periods of the monitoring season and the storm events that occurred during these periods were direct road runoff. Samples collected during these periods were from stormwater runoff from North Shore Drive, which drains into the stream via a storm drain. This particular known source of runoff may need to be looked at in the future to implement stormwater control projects in order to lower amounts of discharge and pollutants from entering the stream.

Sample Type	Start Date	Start Time	End Date	End Time	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	Ortho P (mg/L)	Fecal Coliform (#/100ml)
Snow Grab	3/1/04	9:45	3/1/04	9:45	<1	<1	0.63	~0.04	<0.03	0.39	0.09		
Snow Grab	3/11/04	15:05	3/11/04	15:05	<1	<1	0.50	<0.01	<0.03	0.18	~0.05		
Storm Grab	4/19/04	13:45	4/19/04	13:45	~3	~2	0.52	~0.03	<0.03	0.12	<0.02		
Storm Composite	5/4/04	14:37	5/6/04	13:19	4	~2	0.23	0.26	<0.03	<0.05	<0.02		
Storm Composite	5/17/04	1:05	5/18/04	10:00	4	~2	0.58	~0.04	<0.03	<0.05	~0.03		
Storm Composite	5/22/04	3:29	5/25/04	6:17	3	~2	0.79	~0.03	<0.03	<0.05	<0.02		
Storm Composite	5/30/04	19:36	6/2/04	0:01	30	4	6.20	0.15	<0.03	<0.05	<0.02		
Fecal and Base Grab	6/8/04	8:45	6/8/04	8:45	~2	~2	0.55	~0.04	<0.03	<0.05	<0.02	<0.005	5
Base Composite	6/24/04	10:27	6/28/04	6:39	7	4	0.66	~0.05	<0.03	0.10	<0.02		
Storm Grab	7/12/04	11:00	7/12/04	11:00	4	~2	0.59	~0.02	<0.03	0.06	<0.02		
Fecal and Base Grab	7/15/04	8:45	7/15/04	8:45	8	5	0.59	~0.02	<0.03	0.05	<0.02	<0.005	29
Base Composite	7/22/04	9:56	7/26/04	9:41	9	~5	0.63	~0.05	<0.03	0.43	<0.02		
Storm Composite	8/2/04	7:28	8/2/04	10:00	218	96	1.90	0.26	<0.03	0.21	<0.02		
Storm Composite	9/5/04	7:12	9/5/04	20:22	488	138	3.10	0.57	<0.03	<0.05	<0.02		
Storm Composite	9/14/04	2:01	9/15/04	9:16	142	~28	1.10	0.21	<0.03	0.05	<0.02		
Storm Composite	10/28/04	10:03	10/28/04	13:59	126	~29	1.10	0.40	<0.03	0.10	<0.02		

Table 12. Forest Lake Outlet 2004 Sample Chemistry Results

Sample Type	Sample Collection Time				TP (mg/L)	TSS (mg/L)	Loading Interval		Interval Volume (cf)	Interval TP (lb)	Interval TSS (lb)
	Start Date	Start Time	End Date	End Time			Start	End			
Snow Grab	3/1/04	9:45	3/1/04	9:45	0.04	1	1/1/2004 0:00	3/5/2004 0:00	27,648,000	69.03832237	1726
Snow Grab	3/11/04	15:05	3/11/04	15:05	0.01	1	3/5/2004 0:15	3/25/2004 0:15	13,824,000	8.629790296	863
SNOWMELT					0.08	6	3/25/2004 0:30	4/19/2004 13:30	33,102,000	173.5801414	12399
Storm Grab	4/19/04	13:45	4/19/04	13:45	0.03	3	4/19/2004 13:45	4/23/2004 3:45	4,806,132	9.000848805	900
BASE					0.08	6	4/23/2004 4:00	5/4/2004 14:30	13,221,390	69.33027447	4952
Base Composite	5/4/04	14:37	5/6/04	13:19	0.26	4	5/4/2004 14:45	5/9/2004 17:45	3,422,417	55.54855804	855
STORM					0.19	51	5/9/2004 18:00	5/10/2004 7:00	465,304	5.518955652	1467
BASE					0.08	6	5/10/2004 7:15	5/17/2004 0:45	6,185,042	32.43309966	2317
Storm Composite	5/17/04	1:05	5/18/04	10:00	0.04	4	5/17/2004 1:00	5/18/2004 15:45	2,165,141	5.406456248	541
BASE					0.08	6	5/18/2004 16:00	5/22/2004 3:15	4,511,357	23.65663663	1690
Storm Composite	5/22/04	3:29	5/25/04	6:17	0.03	3	5/22/2004 3:30	5/25/2004 9:45	5,921,278	11.08927678	1109
BASE					0.08	6	5/25/2004 10:00	5/26/04 23:00	3,013,361	15.80145092	1129
STORM					0.19	51	5/26/2004 23:15	5/27/2004 12:15	1,281,577	15.20074323	4040
BASE					0.08	6	5/27/2004 12:30	5/29/2004 4:15	3,888,235	20.38911187	1456
STORM					0.19	51	5/29/2004 4:30	5/30/2004 2:45	5,311,863	63.00383476	16746
Storm Composite	5/30/04	19:36	6/2/04	0:01	0.15	30	5/30/2004 3:00	6/3/2004 23:15	19,108,755	178.9328868	35787
Base Grab	6/8/04	8:45	6/8/04	8:45	0.04	2	6/3/2004 23:30	6/5/2004 18:00	7,073,730	17.66342781	883
STORM					0.19	51	6/5/2004 18:15	6/7/2004 17:30	7,862,663	93.25879082	24787
BASE					0.08	6	6/7/2004 17:45	6/8/2004 21:15	4,070,929	21.34712197	1525
STORM					0.19	51	6/8/2004 21:30	6/9/2004 20:00	3,367,327	39.93975633	10616
BASE					0.08	6	6/9/2004 20:15	6/11/2004 18:30	6,571,785	34.46110112	2462
STORM					0.19	51	6/11/2004 18:45	6/12/2004 12:45	2,479,487	29.40911489	7817
BASE					0.08	6	6/12/2004 13:00	6/24/2004 10:15	23,451,550	122.9751485	8784
Base Composite	6/24/04	10:27	6/28/04	6:39	0.05	7	6/24/2004 10:30	7/1/2004 5:15	11,511,420	35.93067875	5030
Storm Grab	7/12/04	11:00	7/12/04	11:00	0.02	4	7/1/2004 5:30	7/13/2004 10:30	1,471,749	1.837512332	368
Base Grab	7/15/04	8:45	7/15/04	8:45	0.02	8	7/13/2004 10:45	7/22/2004 9:45	3,987,658	4.978682337	1991
Base Composite	7/22/04	9:56	7/26/04	9:41	0.05	9	7/22/2004 10:00	8/2/2004 7:15	1,463,649	4.568498241	822
Storm Composite	8/2/04	7:28	8/2/04	10:00	0.26	218	8/2/2004 7:30	8/3/2004 3:30	106,209	1.723856795	1445
BASE					0.08	6	8/3/2004 3:45	8/10/2004 16:00	380,059	1.992951935	142
BASE/INTERMITTENT FLOW					0.08	6	8/10/2004 16:15	9/5/2004 4:30	119,701	0.627687647	45
No Flow Over Weir-Local Road Runoff Only 8/10/04-9/14/04											
Storm Composite	9/5/04	7:12	9/5/04	20:22	0.57	488	9/5/2004 4:45	9/6/2004 17:30	75,306	2.67960607	2294
NO FLOW							9/6/2004 17:45	9/13/2004 23:15	0	0	0
Flow Over Weir 9/14/04-9/28/04											
Storm Composite	9/14/04	2:01	9/15/04	9:16	0.21	142	9/13/2004 23:30	9/19/2004 9:30	321,936	4.220416923	2854
BASE					0.08	6	9/19/04 9:45	9/28/2004 18:15	292,936	1.53609668	110
NO FLOW							9/28/2004 18:30	10/1/2004 6:30	0	0	0
No Flow Over Weir-Local Road Runoff Only 10/1/04-10/28/04											
STORM					0.19	307	10/12/2004 13:45	10/12/2004 23:30	11,422	0.135475972	219
NO FLOW							10/12/2004 23:45	10/13/2004 8:45	0	0	0
STORM					0.19	307	10/13/2004 9:00	10/14/2004 9:15	12,797	0.151784802	245
NO FLOW							10/14/2004 9:30	10/15/2004 13:45	0	0	0
STORM					0.19	307	10/15/2004 14:00	10/16/2004 19:45	27,577	0.327089903	529
NO FLOW							10/16/2004 20:00	10/17/2004 21:00	0	0	0
STORM					0.19	307	10/17/2004 21:15	10/19/2004 6:15	29,974	0.355520642	574
NO FLOW							10/19/2004 6:30	10/22/2004 22:30	0	0	0
STORM					0.19	307	10/22/2004 22:45	10/25/2004 3:00	66,228	0.78552816	1269
NO FLOW							10/25/2004 3:15	10/28/2004 8:45	0	0	0
Flow Over Weir 10/28/04-12/31/04											
Storm Composite	10/28/04	10:03	10/28/04	13:59	0.40	126	10/28/2004 9:00	10/29/2004 16:15	110,322	2.754790871	868
BASE					0.08	6	10/29/2004 16:30	11/2/2004 10:45	242,701	1.272674578	97
BASE					0.08	6	11/2/2004 11:00	12/31/2004 0:00	10,116,000	53.04624223	3789
Storm Average					0.19	51					
Base Average					0.08	6					
Snowmelt Average					0.03	1					
Local Runoff Storm Average					0.49	307					
All Average					0.13	72					
Load - 5/29/03--8/28/03									232,877,663	1,230.10	162,403
Load - 8/29/03--12/31/03									223,304	4.44	5,130
Total									233,100,967	1,234.54	167,533
CLFLWD Major Subwatershed Total Acres									8,829		
Total Load											
Total TP/TSS (lb/ac/yr)										0.14	18.39
Total TP/TSS (kg/ha/yr)										0.16	20.62
Local Road Runoff Load Only											
Total TP/TSS (lb/ac/yr)										0.001	0.58
Total TP/TSS (kg/ha/yr)										0.001	0.65

*Italics indicate estimated concentrations based on average base and storm flow concentrations

Table 13. Forest Lake Outlet 2004 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Forest Lake Outlet for 2004 was estimated at 0.16 kg/ha (1,235 lbs.) (Table 13). In 2004, much of the floodplain modeling had been completed and a much more accurate determination of total subwatershed drainage was achieved and applied to the 2004 loadings. One note that should be made is the fact that the outlet stopped flowing over the weir during a couple periods of the monitoring season and the storm events that occurred were direct road runoff. Total amounts and loading rates of sediment and nutrients from the road runoff were an insignificant amount (0.001 kg/ha TP, 0.65 kg/ha TSS). Analysis of heavy metals and other toxic chemicals would be something to further analyze in the future, which may show other interesting results. As expected, the portions of the year

where storms occurred have higher amounts of total water discharge and higher loads of TP and TSS per unit time as shown by the loading intervals in Table 13.

Forest Lake

Vital Statistics:

DNR ID #: 82-0159
 LOCATION: NE^{1/4} Section 9 T32N-R21W
 MUNICIPALITY: City of Forest Lake
 LAKE SIZE: 2,251 acres
 ORDINARY HIGH WATER MARK: 901.8 ft

Forest Lake was monitored from April 22 to October 20, 2004, in accordance with the Metropolitan Council Citizen-Assisted Monitoring Program (CAMP). Monitoring consisted of 14 biweekly samplings of Secchi disk, surface total phosphorus, surface total Kjeldahl nitrogen, and surface chlorophyll-*a*. In addition, a temperature and dissolved oxygen profile was taken during each sampling round. The Metropolitan Council Lab analyzed the samples.

Table 14 gives the Forest Lake 2004 range, high, low, and average lake levels. Individual lake level readings are shown in Figure 21.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
4/21/04-8/30/04	20	900.97 8/30/2004	902.04 6/2/2004	1.07	901.56

Table 14. Forest Lake 2004 Lake Level

Figure 21. Forest Lake Elevations 2003-04

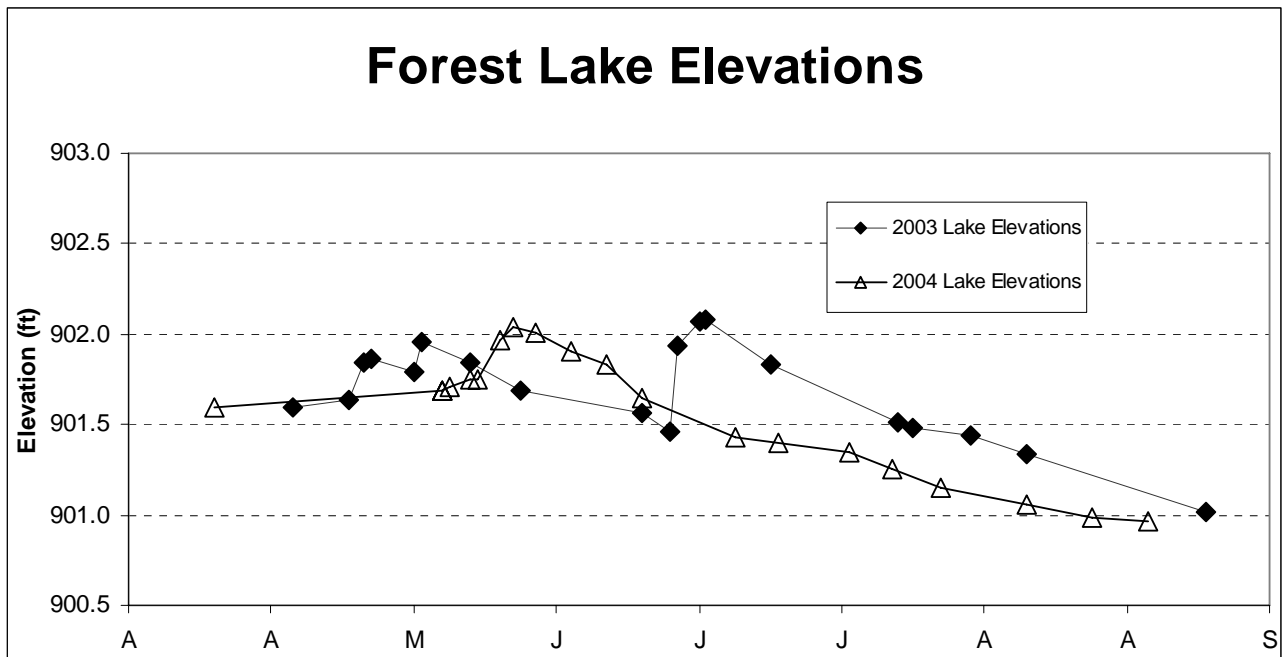


Table 15 gives the 2004 Forest Lake monitoring chemistry results and transparencies for the 2004 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Secchi (m)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/22/2004	0.020	0.60	4.1	3.2	9.46	11.2
5/5/2004	0.022	0.72	2.5	3.81	9.77	12.6
5/18/2004	0.017	0.61	5.2	3.81	7.84	15.0
6/2/2004	0.032	0.50	6.1	3.048	8.79	15.6
6/16/2004	0.030	0.72	8.5	2.134	8.23	21.8
6/29/2004	0.025	0.71	6.0	2.286	7.76	19.7
7/14/2004	0.025	0.79	8.3	1.829	7.93	23.7
7/26/2004	0.025	0.76	7.1	1.981	7.37	25.2
8/12/2004	0.034	0.70	16.0	1.372	7.62	18.9
8/25/2004	0.035	0.72	13.0	1.372	7.17	20.0
9/9/2004	0.034	0.66	13.0	1.524	7.23	20.5
9/22/2004	0.055	0.89	16.0	1.372	5.94	19.6
10/6/2004	0.054	1.10	14.0	1.83	7.40	12.7
10/20/2004	0.031	0.59	9.6	2.591	7.32	9.0
2004 Averages	0.031	0.72	9.2	2.30	7.85	17.5

Table 15. Forest Lake 2004 Monitoring Results

Table 16 shows the Forest Lake Water Quality Summary. The lake received an average lake grade of a B for 2004.

	Trophic Status (2004 Average)	Lake Grade (2004 Average)
Total Phosphorus (mg/L)	Eutrophic	C+
Chlorophyll- <i>a</i> (ug/L)	Mesotrophic	A-
Secchi disk (ft)	Mesotrophic	B
Overall	Mesotrophic	B

Table 16. Lake Grade and Trophic Status.

Figure 22-24 compare the lake chemistry data and Secchi disk readings.

Figure 22. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

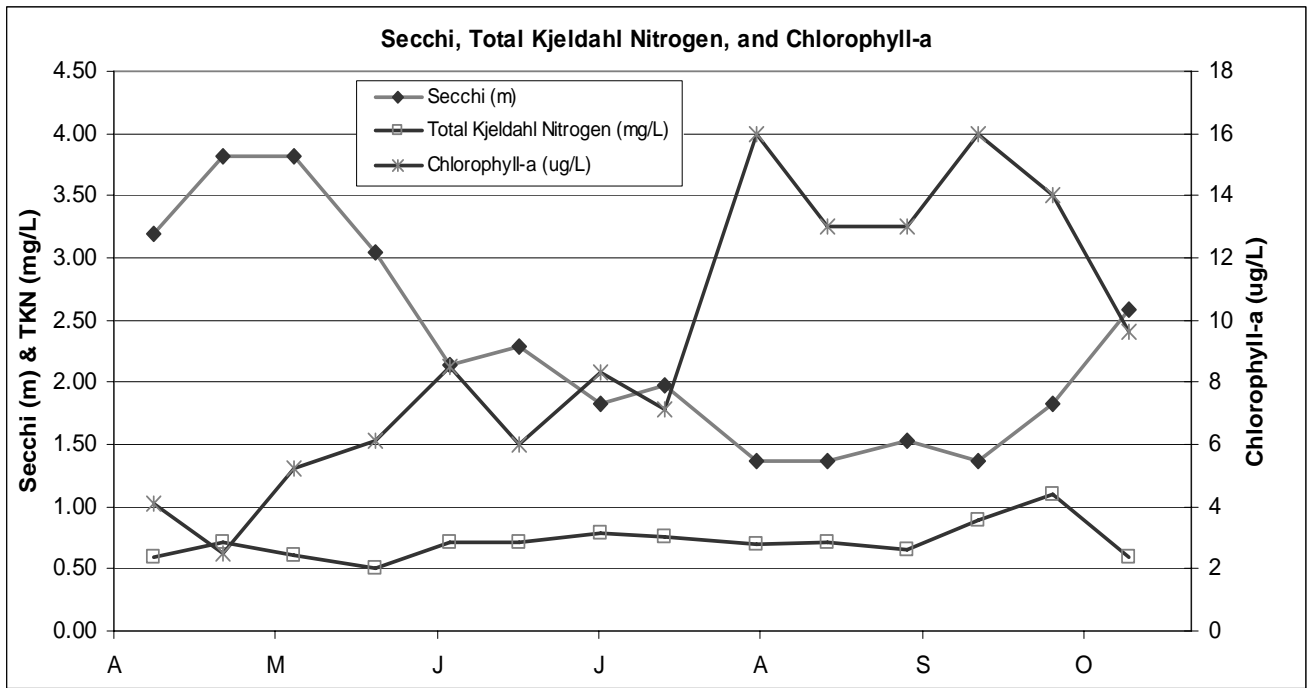


Figure 23. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

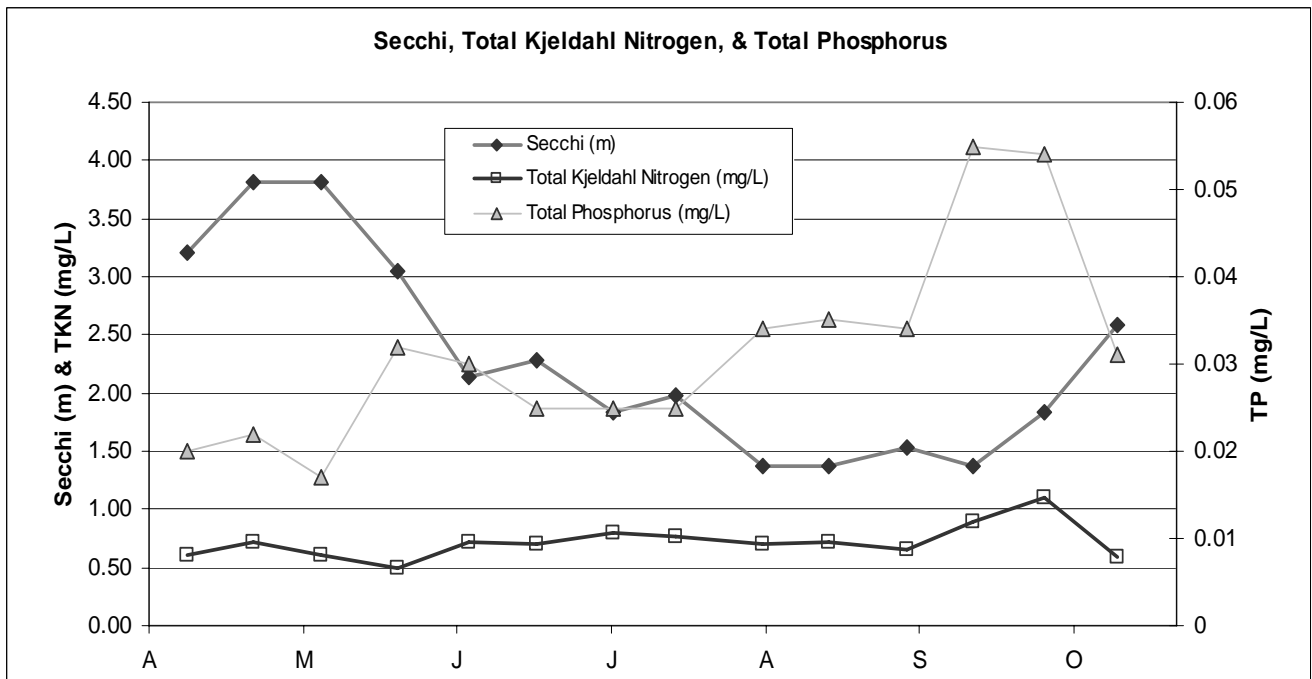
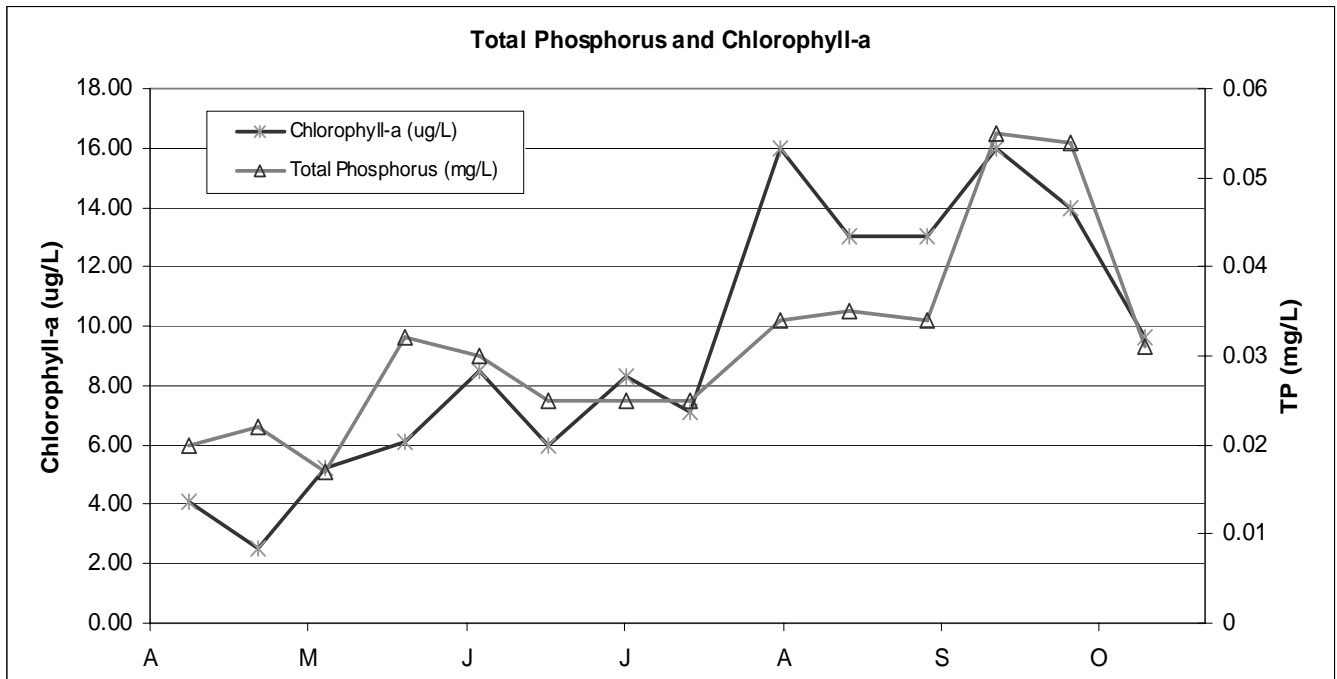
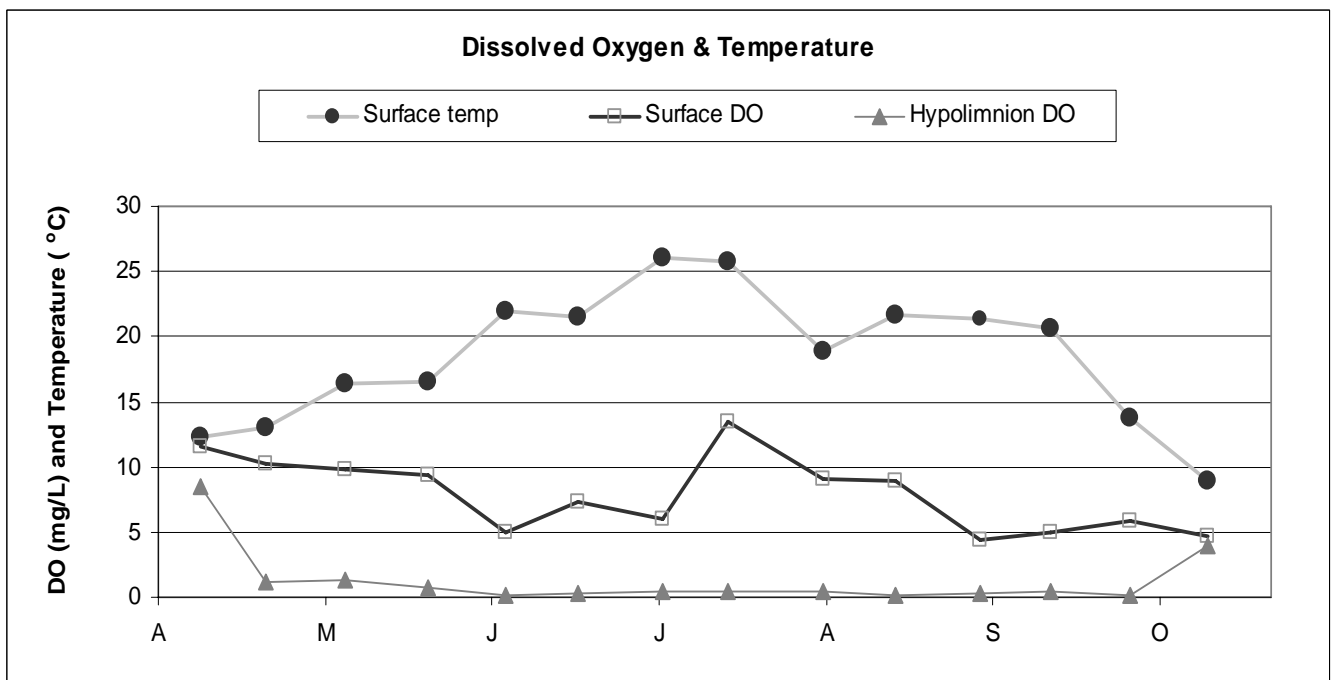


Figure 24. Total Phosphorous and Chlorophyll-a



Surface dissolved oxygen and surface temperature readings for 2004 are shown in Figure 25.

Figure 25. Surface Dissolved Oxygen and Surface Temperatures



Shields Lake

Vital Statistics:

DNR ID #: 82-0162
 LOCATION: NE^{1/4} Section 22 T32N-R21W
 MUNICIPALITY: Forest Lake Township
 LAKE SIZE: 26 acres
 ORDINARY HIGH WATER MARK: 902.5 ft

Shields Lake was monitored from April 22 to October 20, 2004, in accordance with the Metropolitan Council Citizen-Assisted Monitoring Program (CAMP). Monitoring consisted of 14 biweekly lake gage readings and samplings of Secchi disk, surface total phosphorus, surface total Kjeldahl nitrogen, and surface chlorophyll-*a*. In addition, a temperature and dissolved oxygen profile was taken during each sampling round. The Metropolitan Council Lab analyzed the samples.

Table 17 gives the Shields Lake 2004 high, low, and average lake levels. Individual lake level readings are shown in Figure 26.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
4/13/04-10/20/04	14	901.55 8/25/04	902.25 4/22/04	0.70	901.85

Table 17. Shields 2004 Lake Level

Figure 26. Shields Lake Elevations 2003-04

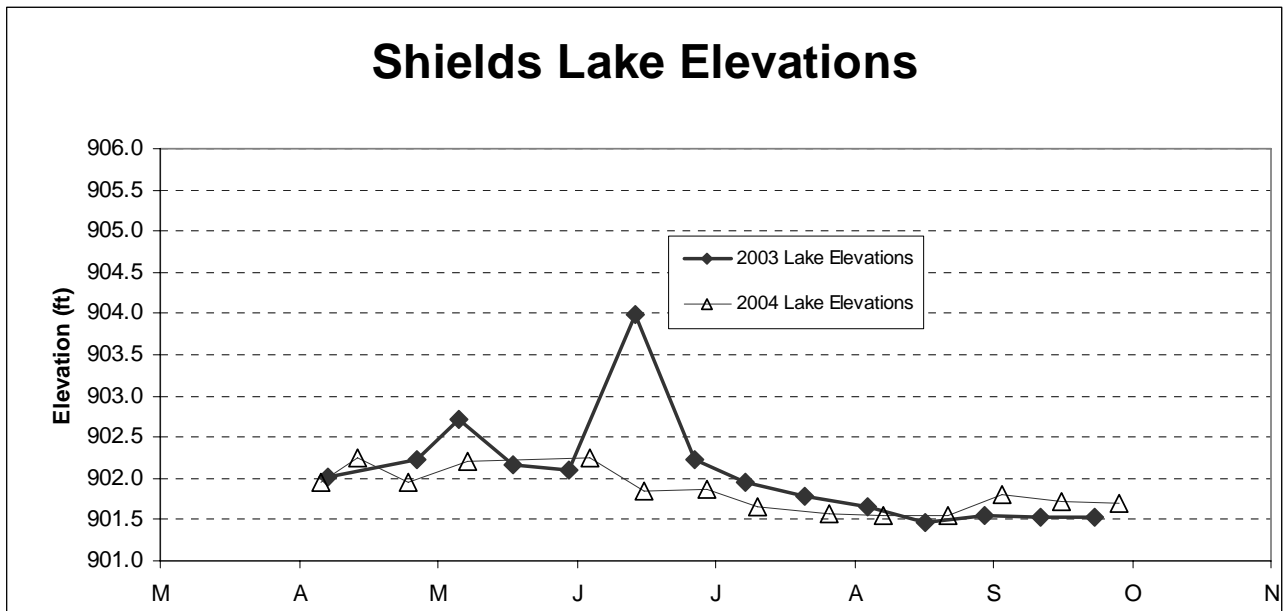


Table 18 gives the 2004 Shields Lake monitoring chemistry results and transparencies for the 2004 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Secchi (m)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/22/2004	0.110	1.90	29.0	1.37	11.6	12.3
5/4/2004	0.072	1.40	3.9	2.896	10.3	13.0
5/18/2004	0.064	1.20	12.0	3.533	9.80	16.4
6/2/2004	0.181	1.80	26.0	1.372	9.36	16.5
6/16/2004	0.145	1.70	11.0	1.219	5.02	21.9
6/29/2004	0.362	2.50	25.0	1.372	7.29	21.5
7/14/2004	0.303	1.80	27.0	1.524	5.93	26.0
7/26/2004	0.202	2.40	60.0	0.457	13.5	25.8
8/12/2004	0.230	2.30	29.0	0.762	9.04	18.9
8/25/2004	0.227	2.60	130.0	0.762	8.90	21.6
9/9/2004	0.215	1.90	53.0	0.914	4.45	21.3
9/22/2004	0.194	1.80	74.0	0.914	4.92	20.7
10/6/2004	0.314	2.10	40.0	1.219	5.89	13.7
10/20/2004	0.374	2.40	21.0	1.372	4.65	9.0
2004 Averages	0.214	1.99	38.6	1.41	7.90	18.5

Table 18. Shields 2004 Monitoring Results

Table 19 shows the Shields Lake Water Quality Summary. The lake received an average lake grade of a D+ for 2004.

	Trophic Status (2004 Average)	Lake Grade (2004 Average)
Total Phosphorus (mg/L)	Hypereutrophic	C
Chlorophyll-<i>a</i> (ug/L)	Hypereutrophic	C
Secchi disk (ft)	Eutrophic	F
Overall	Hypereutrophic	D+

Table 19. Lake Grade and Trophic Status.

Figure 27-29 compare the lake chemistry data and Secchi disk readings.

Figure 27. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

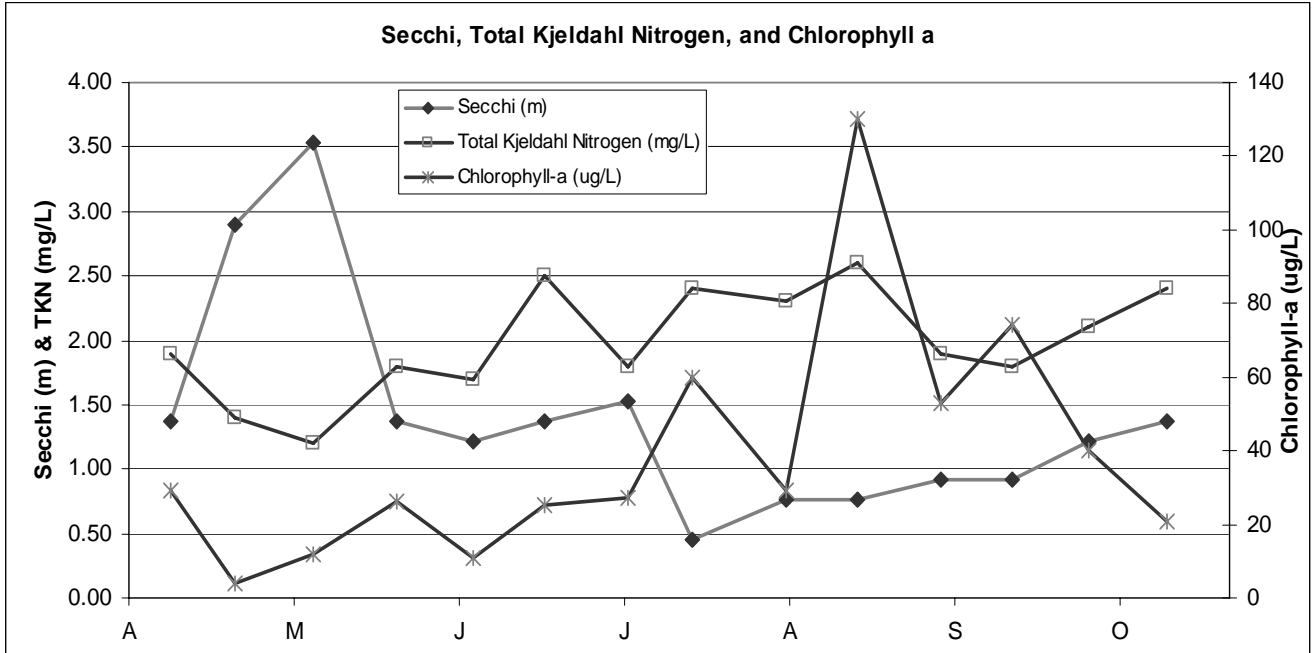


Figure 28. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

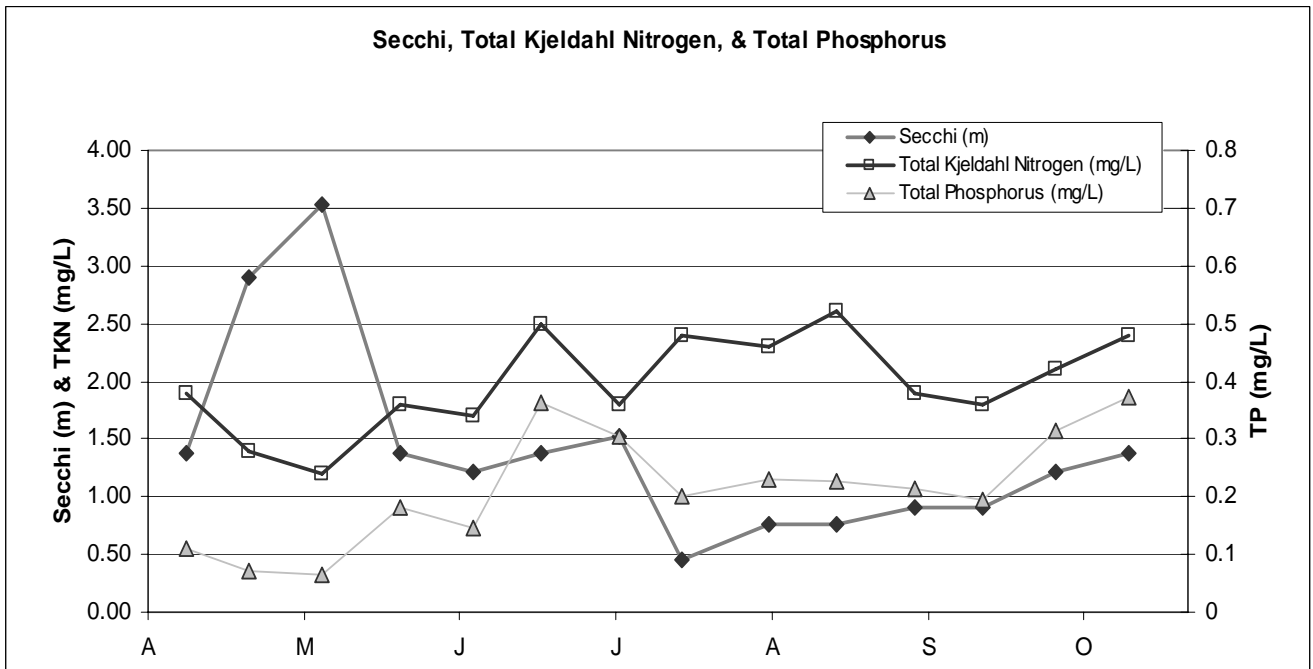
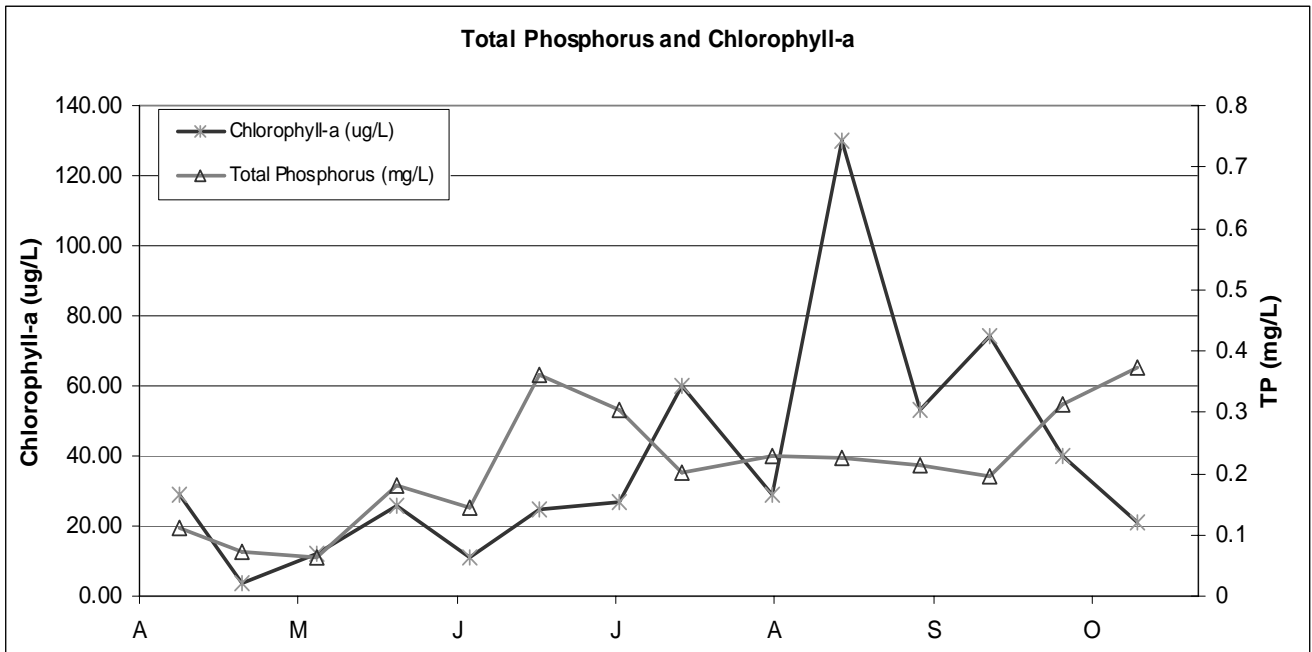
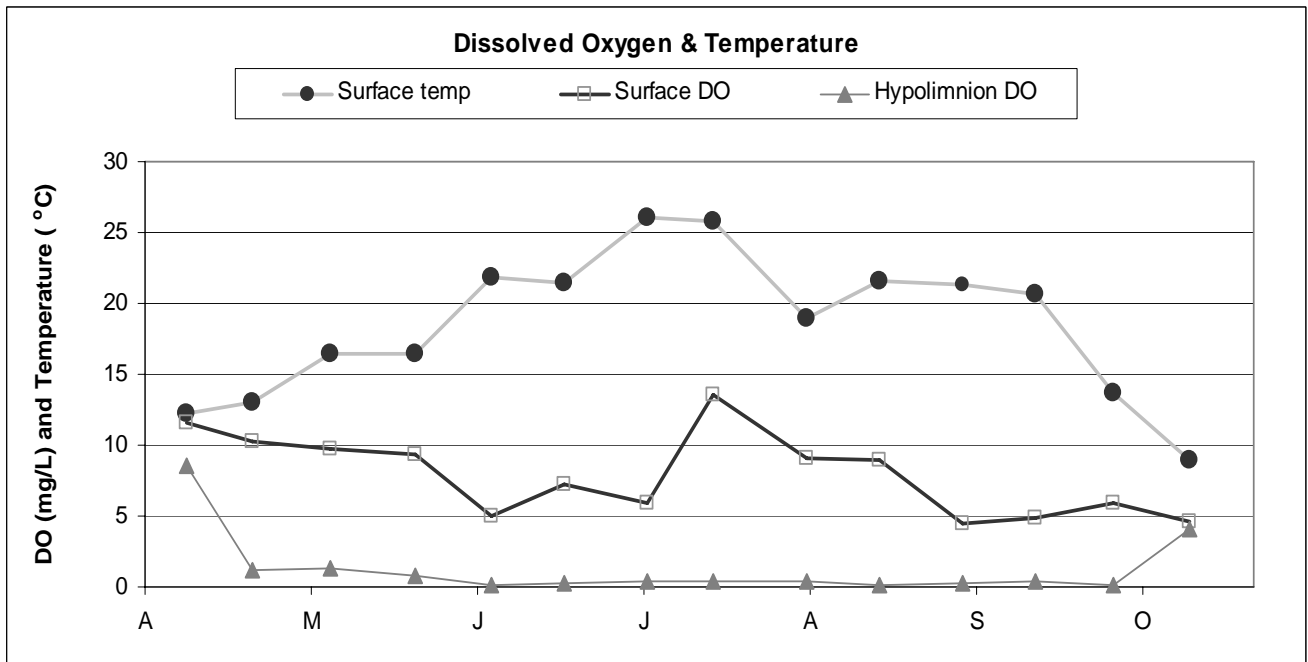


Figure 29. Total Phosphorous and Chlorophyll a



Surface dissolved oxygen and surface temperature readings are shown in Figure 30.

Figure 30. Surface Dissolved Oxygen and Surface Temperatures

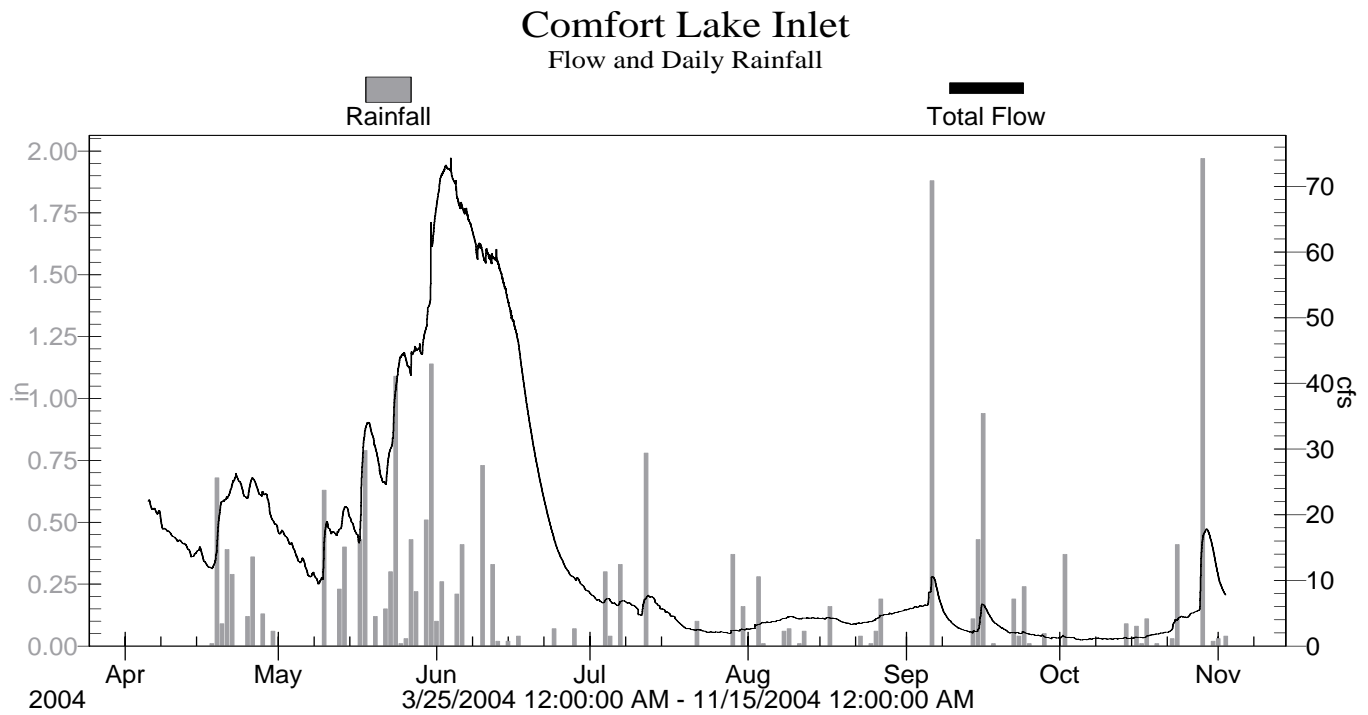


5) Comfort Lake Subwatershed

Comfort Lake Inlet

The station for the Comfort Lake Inlet site recorded flow between April 5-November 2, 2004 (Figure 31). Total discharge during this period was 267,918,200 cf or 6,151 acre/ft. Total rainfall for the monitoring season was 20.97 inches. The highest discharge—74.31 occurred on June 3, 2004, from a total rainfall of 2.66 inches between May 27 and June 3, 2004. The rainfall on October 28, 2004 was the highest daily rainfall for the monitoring period, yielding 1.97 inches of rain. The hydrograph for the Comfort Lake Inlet is shown below.

Figure 31. Comfort Lake Inlet 2004 Flow and Daily Rainfall



Grab samples and flow weighted composite samples were taken at the Comfort Lake Inlet site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Orthophosphate, and Fecal Coliform results from all collected samples are listed in Table 20. The highest TSS concentration of 684 mg/L was collected in a base grab sample on July 15, 2004. Since base samples typically have very low TSS concentrations compared to storm samples, this result should be used with caution. The result may have been from solid material that entered the sample inadvertently or because of an error at the laboratory and was left out of the calculated average. The next highest TSS concentration of 38 mg/L was collected in a May 30, 2004 storm composite sample. The highest TKN concentration of 2.70 mg/L was collected in a August 12, 2004 base grab sample. The highest TP concentration of 0.20 mg/L was collected in an October 28, 2004 storm composite sample.

Sample Type	Start Date	Start Time	End Date	End Time	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	Ortho P (mg/L)	Fecal Coliform (#/100ml)
Snow Grab	3/1/04	9:30	3/1/04	9:30	-3	<2	1.20	0.06	<0.03	0.56	0.26		
Snow Grab	3/11/04	14:50	3/11/04	14:50	-4	-2	1.30	0.05	<0.03	0.46	0.29		
Storm Composite	4/19/04	12:06	4/20/04	9:20	33	10	1.60	0.12	<0.03	0.76	0.13		
Base Composite	5/4/04	15:12	5/6/04	13:18	15	-5	1.00	-0.04	<0.03	0.17	0.08		
Storm Composite	5/10/04	2:49	5/11/04	9:41	26	11	1.90	0.13	<0.03	1.11	0.09		
Storm Composite	5/13/04	15:21	5/14/04	10:06	13	-4	1.30	0.07	<0.03	0.21	0.07		
Storm Composite	5/17/04	9:30	5/17/04	9:30	12	-5	1.20	0.09	<0.03	0.38	0.09		
Storm Grab	5/17/04	14:58	5/18/04	9:11	24	-8	1.40	0.10	<0.03	0.33	0.08		
Storm Composite	5/24/04	3:08	5/25/04	9:41	18	-6	1.30	-0.05	<0.03	0.18	<0.02		
Storm Composite	5/30/04	21:46	6/2/04	3:54	38	-11	1.60	0.06	<0.03	0.07	<0.02		
Fecal and Base Grab	6/8/04	9:00	6/8/04	9:00	13	-5	1.10	0.12	<0.03	0.06	<0.02	0.015	30
Base Composite	6/24/04	11:24	6/28/04	9:58	9	-5	1.00	0.06	<0.03	0.18	-0.02		
Storm Grab	7/12/04	11:30	7/12/04	11:30	-3	-1	0.71	-0.05	<0.03	0.35	-0.03		
Fecal and Base Grab	7/15/04	9:15	7/15/04	9:15	684	-52	0.76	-0.04	<0.03	0.41	-0.03	0.017	80
Base Composite	7/22/04	10:17	7/25/04	20:04	5	-3	0.73	0.07	<0.03	0.90	-0.03		
Fecal and Base Grab	8/12/04	8:30	8/12/04	8:30	<1	<1	2.70	0.05	0.05	2.27	-0.03	-0.009	280
Storm Composite	8/30/04	14:56	9/1/04	8:59	7	-4	0.52	-0.02	0.06	2.38	<0.02		
Storm Grab	9/16/04	9:30	9/16/04	9:30	6	-3	1.20	0.11	0.04	0.22	0.15		
Fecal and Base Grab	9/27/04	9:30	9/27/04	9:30	-2	<1	1.10	0.07	0.15	0.96	0.15	0.013	35
Base Grab	10/14/04	9:30	10/14/04	9:30	-1	<1	0.62	-0.03	0.06	1.47	<0.02		
Storm Composite	10/24/04	14:48	10/24/04	23:51	-5	-2	1.20	0.06	0.03	0.67	-0.05		
Storm Composite	10/28/04	12:35	10/28/04	20:21	7	-3	0.88	0.20	<0.03	0.77	<0.02		

Table 20. Comfort Lake Inlet 2004 Sample Chemistry Results

Sample Type	Sample Collection Time				TP (mg/L)	TSS (mg/L)	Loading Interval		Interval Volume (cf)	Interval TP (lb)	Interval TSS (lb)
	Start Date	Start Time	End Date	End Time			Start	End			
Snow Grab	3/1/04	9:30	3/1/04	9:30	0.06	3	1/1/2004 0:00	3/5/2004 0:00	44,236,800	168.45	8,285
Snow Grab	3/11/04	14:50	3/11/04	14:50	0.05	4	3/5/2004 0:15	3/20/2004 0:15	19,440,000	63.11	4,854
<i>BASE</i>					0.06	6	3/20/2004 0:30	4/5/2004 13:30	50,184,000	174.50	20,189
<i>SNOWMELT</i>					0.06	4	4/5/2004 13:45	4/18/2004 17:00	18,259,668	64.40	3,990
Storm Composite	4/19/04	12:06	4/20/04	9:20	0.12	33	4/18/2004 17:15	4/23/2004 5:45	8,718,237	64.22	17,960
Base Composite	5/4/04	15:12	5/6/04	13:18	0.04	15	4/23/2004 6:00	5/9/2004 17:30	25,218,400	62.97	23,614
Storm Composite	5/10/04	2:49	5/11/04	9:41	0.13	26	5/9/2004 17:45	5/11/2004 9:45	2,465,244	20.01	4,001
<i>BASE</i>					0.06	6	5/11/2004 10:00	5/13/2004 15:15	3,373,290	11.73	1,357
Storm Composite	5/13/04	15:21	5/14/04	10:06	0.07	13	5/13/2004 15:30	5/15/2004 1:30	2,531,808	11.54	2,055
<i>BASE</i>					0.06	6	5/15/2004 1:45	5/16/2004 19:45	2,689,245	9.35	1,082
Storm Composite	5/17/04	14:58	5/18/04	9:11	0.10	24	5/16/2004 20:00	5/19/2004 3:00	5,842,647	36.47	8,754
<i>BASE</i>					0.06	6	5/19/2004 3:15	5/22/2004 2:15	7,191,945	25.01	2,893
Storm Composite	5/24/04	3:08	5/25/04	9:41	0.05	18	5/22/2004 2:30	5/25/2004 14:15	11,002,606	34.34	12,363
<i>BASE</i>					0.06	6	5/25/2004 14:30	5/26/2004 23:15	5,068,269	17.62	2,039
<i>STORM</i>					0.10	19	5/26/2004 23:30	5/27/04 20:00	3,290,589	20.15	3,834
<i>BASE</i>					0.06	6	5/27/2004 20:15	5/29/2004 4:30	5,152,887	17.92	2,073
<i>STORM</i>					0.10	19	5/29/2004 4:45	5/30/2004 21:30	7,287,183	44.63	8,492
Storm Composite	5/30/04	21:46	6/2/04	3:54	0.06	38	5/30/2004 21:45	6/2/2004 4:00	13,094,447	45.78	31,063
Base Grab	6/8/04	9:00	6/8/04	9:00	0.12	13	6/2/2004 4:15	6/24/2004 11:00	96,944,035	720.17	78,674
Base Composite	6/24/04	11:24	6/28/04	9:58	0.06	9	6/24/2004 11:15	7/11/2004 4:45	11,959,178	42.55	6,719
Storm Grab	7/12/04	11:30	7/12/04	11:30	0.05	3	7/11/2004 5:00	7/13/2004 15:00	1,500,066	4.68	281
Base Grab	7/15/04	9:15	7/15/04	9:15	0.04	684	7/13/2004 15:15	7/22/2004 10:00	3,089,349	7.71	131,914
Base Composite	7/22/04	10:17	7/25/04	20:04	0.07	5	7/22/2004 10:15	8/12/2004 8:15	5,555,745	22.89	1,734
Base Grab	8/12/04	8:30	8/12/04	8:30	0.05	1	8/12/2004 8:30	8/30/2004 14:30	6,477,390	21.84	404
Base Composite	8/30/04	14:56	9/1/04	8:59	0.02	7	8/30/2004 14:45	9/5/2004 4:30	2,791,332	3.49	1,220
<i>STORM</i>					0.10	19	9/5/2004 4:45	9/7/2004 0:45	1,468,143	8.99	1,711
<i>BASE</i>					0.06	6	9/7/2004 1:00	9/15/2004 4:45	2,455,326	8.54	988
Storm Grab	9/16/04	9:30	9/16/04	9:30	0.11	6	9/15/2004 5:00	9/17/2004 7:15	977,994	6.72	366
<i>BASE</i>					0.06	6	9/17/2004 7:30	9/22/2004 19:30	1,307,664	4.55	526
Base Grab	9/27/04	9:30	9/27/04	9:30	0.07	2	9/22/2004 19:45	10/10/2004 23:15	2,104,623	8.93	263
Base Grab	10/14/04	9:30	10/14/04	9:30	0.03	1	10/10/2004 23:30	10/18/2004 1:30	741,177	1.39	46
<i>BASE</i>					0.06	6	10/18/2004 1:45	10/23/2004 10:00	935,532	3.25	376
Base Composite	10/24/04	14:48	10/24/04	23:51	0.06	5	10/23/2004 10:15	10/28/2004 7:45	1,961,361	7.71	612
Storm Composite	10/28/04	12:35	10/28/04	20:21	0.20	7	10/28/2004 8:00	10/31/2004 6:00	3,914,712	47.90	1,711
<i>BASE</i>					0.06	6	10/31/2004 6:15	11/2/2004 12:00	1,929,933	6.71	776
<i>BASE</i>					0.06	6	11/2/2004 12:15	12/31/2004 23:45	41,112,000	142.95	16,539
Storm Average					0.10	19					
Base Average					0.06	6					
Snowmelt Average					0.06	4					
All Average					0.07	29					
Total									422,272,825	1,963	403,759
CLFLWD Major Subwatershed Total Acres									5,303		
Total TP/TSS (lb/ac/June-December)										0.37	76.13
Total TP/TSS (kg/ha/June-December)										0.41	85.33

*Italics indicate estimated concentrations based on average base and storm flow concentrations

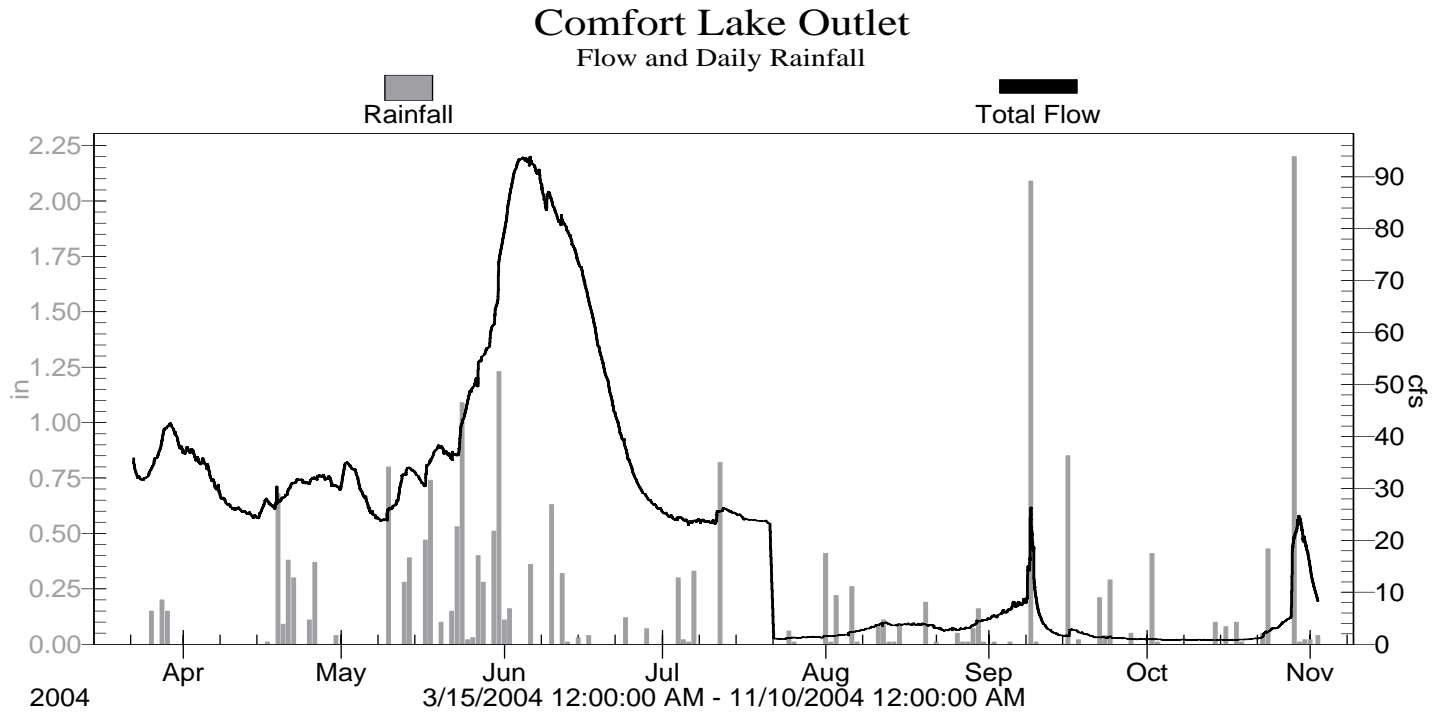
Table 21. Comfort Lake Inlet 2004 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Comfort Lake Inlet for 2004 was estimated at 0.41 kg/ha (1,963 lbs.) (Table 21). In 2004, much of the floodplain modeling had been completed and more a much more accurate determination of total subwatershed drainage was achieved and applied to the 2004 loadings. With the annual load from this monitoring station as well as the Forest Lake Outlet's annual load, a comparison of total loads can be performed and a total external load can be determined from outside sources between the two sites. In 2004, it was estimated that approximately 730 lbs. of phosphorus and 236,226 lbs. of suspended solids were externally loaded into the subwatershed between the two monitoring locations. Future projects for the watershed should include nutrient modeling using tools such as SLAM or P8 to determine whether the total external load between the Forest Lake Outlet site and the Comfort Lake Inlet site is from the City of Forest Lake draining through the ditch which connects to the river between these two sites or if the ditched wetlands between the two sites are allowing phosphorus to leach into the river. When compared to other rivers and streams in the County, the total loads for these two sites are about average, but the landscape and drainage systems are completely different and it is difficult to compare the dynamics of this watershed to others to determine whether this is a normally functioning system or if there is an excessive amount of external load.

Comfort Lake Outlet

The station for the Comfort Lake Outlet site recorded flow between March 22-November 2, 2004 (Figure 32). Total discharge during this period was 423,323,100 cf or 9,718 acre/ft. Total rainfall for the monitoring season was 21.68 inches. The highest discharge—93.93 occurred on June 5, 2004, from a total rainfall of 2.69 inches between May 27 and June 3, 2004. The rainfall on October 28, 2004 was the highest daily rainfall for the monitoring period, yielding 2.20 inches of rain. The hydrograph for the Comfort Lake Outlet is shown below.

Figure 32. Comfort Lake Outlet 2004 Flow and Daily Rainfall



Grab samples and flow weighted composite samples were taken at the Comfort Lake Outlet site. The TSS, TKN, TP, VSS, Nitrate, Nitrite, Ammonia Nitrogen, Orthophosphate, and Fecal Coliform results from all collected samples are listed in Table 22. The highest TSS concentrations of 51 mg/L were from the June 24, 2004 base composite sample and the September 5, 2004 storm composite sample. The highest TKN concentration of 1.80 mg/L was from the June 24, 2004 base composite sample. The highest TP concentration of 0.12 mg/L was from a May 30, 2004 storm composite sample.

Table 22. Comfort Lake Outlet 2004 Sample Chemistry Results

Sample Type	Start Date	Start Time	End Date	End Time	TSS (mg/L)	VSS (mg/L)	TKN (mg/L)	TP (mg/L)	Nitrite N (mg/L)	Nitrate N (mg/L)	Ammonia Nitrogen (mg/L)	Ortho P (mg/L)	Fecal Coliform (#/100ml)
Snow Grab	3/1/04	9:15	3/1/04	9:15	<1	<1	1.30	-0.02	<0.03	0.53	0.49		
Snow Grab	3/11/04	14:40	3/11/04	14:40	~1	~1	1.40	-0.02	<0.03	0.29	0.55		
Storm Grab	4/19/04	15:15	4/19/04	15:15	~5	~3	1.20	-0.05	<0.03	0.50	0.33		
Base Composite	5/4/04	15:31	5/6/04	13:30	17	8	0.23	0.08	0.03	0.22	0.09		
Storm Composite	5/12/04	5:05	5/14/04	9:36	15	8	1.20	0.07	<0.03	0.18	0.08		
Storm Composite	5/24/04	12:50	5/25/04	9:40	9	~5	1.00	-0.04	<0.03	0.14	-0.02		
Storm Composite	5/30/04	20:30	5/31/04	5:36	39	12	1.40	0.12	<0.03	0.17	<0.02		
Storm Composite	6/1/04	10:19	6/2/04	18:13	6	~3	0.97	-0.03	<0.03	0.14	<0.02		
Fecal Grab and Base Grab	6/8/04	9:15	6/8/04	9:15	~6	~3	0.96	0.05	<0.03	<0.05	<0.02	<0.005	10
Base Composite	6/24/04	11:07	6/28/04	8:44	51	24	1.80	0.10	<0.03	0.07	-0.03		
Fecal Grab and Base Grab	7/15/04	9:30	7/15/04	9:30	8	~5	1.10	-0.04	<0.03	0.29	<0.02	<0.005	10
Base Composite	7/22/04	10:12	7/26/04	0:54	10	6	1.00	0.06	<0.03	0.42	-0.03		
Fecal Grab and Base Grab	8/12/04	8:45	8/12/04	8:45	6	4	1.00	0.06	<0.03	0.09	<0.02	<0.005	51
Base Grab	9/1/04	11:00	9/1/04	11:00	~3	~4	0.97	-0.04	<0.03	0.08	<0.02		
Storm Composite	9/5/04	2:50	9/6/04	12:12	51	32	1.50	0.05	<0.03	0.07	-0.02		
Storm Grab	9/16/04	9:00	9/16/04	9:00	~2	~2	0.86	-0.03	<0.03	<0.05	-0.02		
Fecal Grab and Base Grab	9/27/04	9:45	9/27/04	9:45	~4	~3	0.92	<0.01	<0.03	<0.05	-0.04	<0.005	22
Base Composite	10/12/04	12:49	10/14/04	8:43	8	~2	0.95	-0.03	<0.03	0.12	0.11		
Storm Composite	10/24/04	15:32	10/25/04	9:35	7	~3	1.40	0.05	<0.03	0.13	0.44		
Storm Composite	10/28/04	8:52	10/29/04	8:35	7	3	1.50	0.05	<0.03	0.09	0.44		

Sample Type	Sample Collection Time				TP (mg/L)	TSS (mg/L)	Loading Interval		Interval Volume (cf)	Interval TP (lb)	Interval TSS (lb)
	Start Date	Start Time	End Date	End Time			Start	End			
Snow Grab	3/1/04	9:15	3/1/04	9:15	0.02	1	1/1/04 0:00	3/5/04 0:00	138,240,000	172.60	8,630
Snow Grab	3/11/04	14:40	3/11/04	14:40	0.02	1	3/5/04 0:15	3/22/04 14:15	60,768,000	75.87	3,794
BASE					0.05	11	3/22/04 14:30	3/24/04 10:30	5,145,336	16.06	3,562
SNOWMELT					0.02	1	3/24/04 10:45	3/31/04 3:45	21,841,310	27.27	1,363
BASE					0.05	11	3/31/04 4:00	4/18/04 19:00	48,004,400	149.84	33,236
Storm Grab	4/19/04	15:15	4/19/04	15:15	0.05	5	4/18/04 19:15	4/24/04 9:30	14,498,083	45.25	4,525
Base Composite	5/4/04	15:31	5/6/04	13:30	0.08	17	4/24/04 9:45	5/9/04 18:15	39,776,760	198.65	42,213
Storm Composite	5/12/04	5:05	5/14/04	9:36	0.07	15	5/9/04 18:30	5/14/04 10:00	11,982,908	52.36	11,221
BASE					0.05	11	5/14/04 10:15	5/16/04 20:30	6,744,761	21.05	4,670
STORM					0.06	19	5/16/04 20:45	5/19/04 4:30	7,080,007	25.89	8,334
BASE					0.05	11	5/19/04 4:45	5/23/04 4:15	12,709,104	39.67	8,799
Storm Composite	5/24/04	12:50	5/25/04	9:40	0.04	9	5/23/04 4:30	5/28/04 4:30	20,830,720	52.02	11,703
Storm Composite	5/30/04	20:30	5/31/04	5:36	0.12	39	5/28/04 4:45	6/1/04 10:00	24,367,610	182.54	59,326
Storm Composite	6/1/04	10:19	6/2/04	18:13	0.03	6	6/1/04 10:15	6/6/04 10:45	39,586,108	74.14	14,827
Base Grab	6/8/04	9:15	6/8/04	9:15	0.05	6	6/6/04 11:00	6/8/04 23:15	19,317,438	60.30	7,235
STORM					0.06	19	6/8/04 23:30	6/10/04 11:00	10,954,972	40.06	12,896
Base Composite	6/24/04	11:07	6/28/04	8:44	0.10	51	6/10/04 11:15	6/25/04 20:45	79,775,672	498.01	253,984
BASE					0.05	11	6/25/04 21:00	7/11/04 5:45	33,715,237	105.24	23,343
Base Grab	7/15/04	9:30	7/15/04	9:30	0.04	8	7/11/04 6:00	7/22/04 10:00	22,362,740	55.84	11,168
Base Composite	7/22/04	10:12	7/26/04	0:54	0.06	10	7/22/04 10:15	8/5/04 21:30	1,785,079	6.69	1,114
Base Grab	8/12/04	8:45	8/12/04	8:45	0.06	6	8/5/04 21:45	8/24/04 15:45	5,531,493	20.72	2,072
Base Grab	9/1/04	11:00	9/1/04	11:00	0.04	3	8/24/04 16:00	9/5/04 2:45	4,342,999	10.84	813
Storm Composite	9/5/04	2:50	9/6/04	12:12	0.05	51	9/5/04 3:00	9/9/04 13:00	4,112,489	12.84	13,093
BASE					0.05	11	9/9/04 13:15	9/16/04 8:45	2,030,749	6.34	1,406
Base Grab	9/16/04	9:00	9/16/04	9:00	0.03	2	9/16/04 9:00	9/24/04 13:30	1,278,583	2.39	160
Base Grab	9/27/04	9:45	9/27/04	9:45	0.01	4	9/24/04 13:45	10/5/04 14:30	937,172	0.59	234
Base Composite	10/12/04	12:49	10/14/04	8:43	0.03	8	10/5/04 14:45	10/18/04 11:30	930,434	1.74	465
Base Composite	10/24/04	15:32	10/25/04	9:35	0.05	7	10/18/04 11:45	10/28/04 8:45	1,978,570	6.18	865
Storm Composite	10/28/04	8:52	10/29/04	8:35	0.05	7	10/28/04 9:00	11/2/04 11:15	7,647,777	23.87	3,342
BASE					0.05	11	11/2/04 11:30	12/31/04 23:45	25,708,500	80.24	17,800
Storm Average					0.06	19					
Base Average					0.05	11					
Snowmelt Average					0.02	1					
All Average					0.05	12					
Total									673,985,011	2,065	566,195
CLFLWD Major Subwatershed Total Acres									24,518		
Total TP/TSS (lb/ac/June-December)										0.08	23.09
Total TP/TSS (kg/ha/June-December)										0.09	25.88

*Italics indicate estimated concentrations based on average base and storm flow concentrations

Table 23. Comfort Lake Outlet 2004 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Comfort Lake Outlet and the Entire Comfort Lake Forest Lake Watershed for the period of 2004 was estimated at 0.09 kg/ha (2,065 lbs.) (Table 23). In 2004, much of the floodplain modeling had been completed and a much more accurate determination of total subwatershed drainage was achieved and applied to the 2004 loadings. With the additional data from the Little Comfort Lake Inlet and the Comfort Lake Inlet, a much better determination can be made of approximately how much TP and TSS gets settled out in Comfort Lake and Little Comfort Lake before leaving the watershed outlet. The Minnesota Pollution Control Agency has placed Comfort Lake on the 303(d) Impaired Waters List and the data collected at the locations within this subwatershed will provide a baseline of data with which to implement Total Maximum Daily Load studies/projects.

Big Comfort

Vital Statistics:

DNR ID #: 13-0053
 LOCATION: Section 27 T33N-R21W
 MUNICIPALITY: Wyoming Township
 LAKE SIZE: 219 acres
 ORDINARY HIGH WATER MARK: 887.2 ft

Big Comfort Lake was monitored from April 22 to October 20, 2004, in accordance with the Metropolitan Council Citizen-Assisted Monitoring Program (CAMP). Monitoring consisted of 14 biweekly lake gage readings and samplings of Secchi disk, surface total phosphorus, surface total Kjeldahl nitrogen, and surface chlorophyll-*a*. In addition, a temperature and dissolved oxygen profile was taken during each sampling round. The Metropolitan Council Lab analyzed the samples.

Table 24 gives the Big Comfort Lake 2004 high, low, and average lake levels. Individual lake level readings are shown in Figure 33.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
4/21/04-11/29/04	48	885.65 10/4/04 &	887.11 6/7/2004	1.46	886.06

Table 24. Big Comfort 2004 Lake Level

Figure 33. Big Comfort Lake Elevations 2003-04

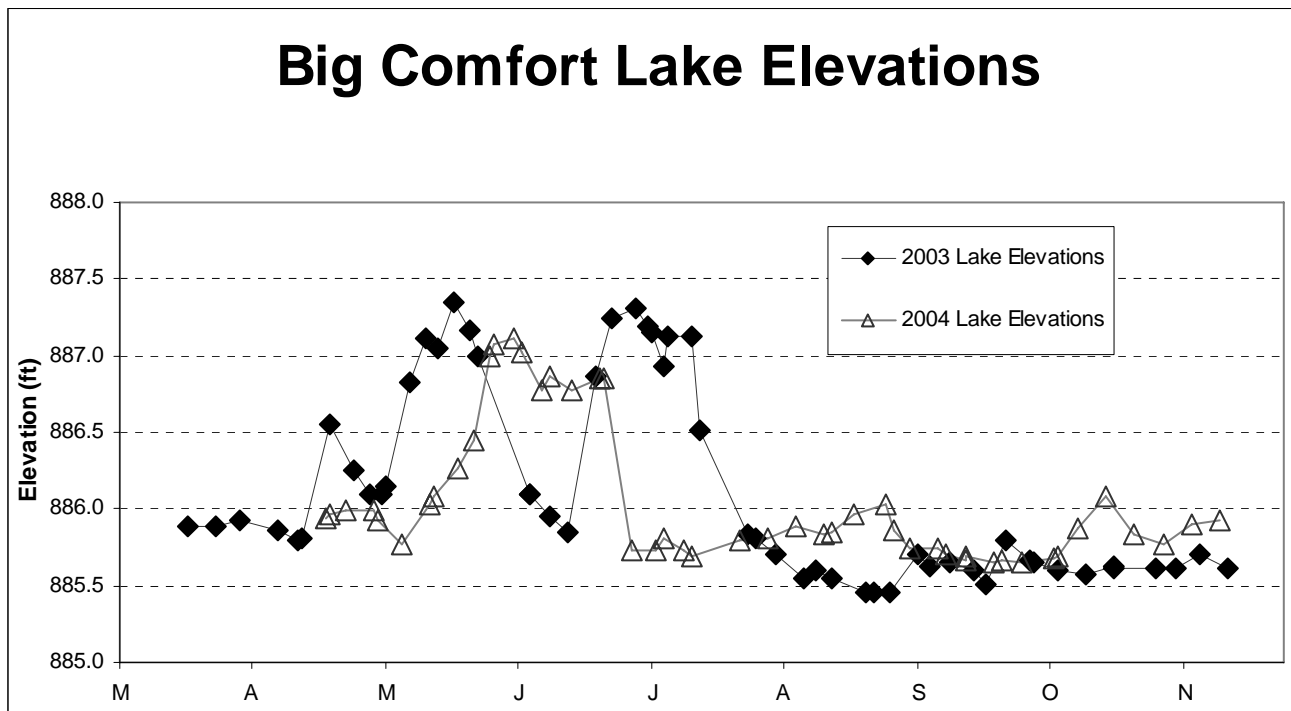


Table 25 gives the 2004 Big Comfort Lake monitoring chemistry results and transparencies for the 2004 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Secchi (m)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/22/2004	0.037	1.40	19.0	1.3716	10.50	9.7
5/4/2004	0.047	1.60	21.0	1.8288	12.52	12.0
5/18/2004	0.030	1.10	15.0	2.7432	4.60	10.8
6/2/2004	0.048	0.99	6.5	2.5908	0.05	8.2
6/16/2004	0.041	1.10	22.0	1.524	8.50	22.7
6/29/2004	0.034	0.90	19.0	1.6764	9.21	20.4
7/14/2004	0.032	1.00	15.0	1.6764	6.97	24.0
7/26/2004	0.026	0.94	15.0	1.9812	7.43	25.5
8/12/2004	0.028	0.97	14.0	1.8288	6.12	19.6
8/25/2004	0.039	1.20	21.0	1.524	7.45	20.5
9/9/2004	0.052	0.79	16.0	1.9812	6.24	20.7
9/22/2004	0.056	1.00	20.0	1.6764	4.88	19.8
10/6/2004	0.034	1.10	20.0	1.8288	3.97	15.0
10/20/2004	0.037	0.92	18.0	2.1336	5.46	11.3
2004 Averages	0.039	1.07	17.3	1.88	6.70	17.2

Table 25. Big Comfort Lake 2004 Monitoring Results

Table 26 shows the Big Comfort Lake Water Quality Summary. The lake received an average lake grade of a C+ for 2004.

	Trophic Status (2004 Average)	Lake Grade (2004 Average)
Total Phosphorus (mg/L)	Eutrophic	B
Chlorophyll- <i>a</i> (ug/L)	Eutrophic	C
Secchi disk (ft)	Mesotrophic	C
Overall	Eutrophic	C+

Table 26. Lake Grade and Trophic Status

Figure 34-36 compare the lake chemistry data and Secchi disk readings.

Figure 34. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

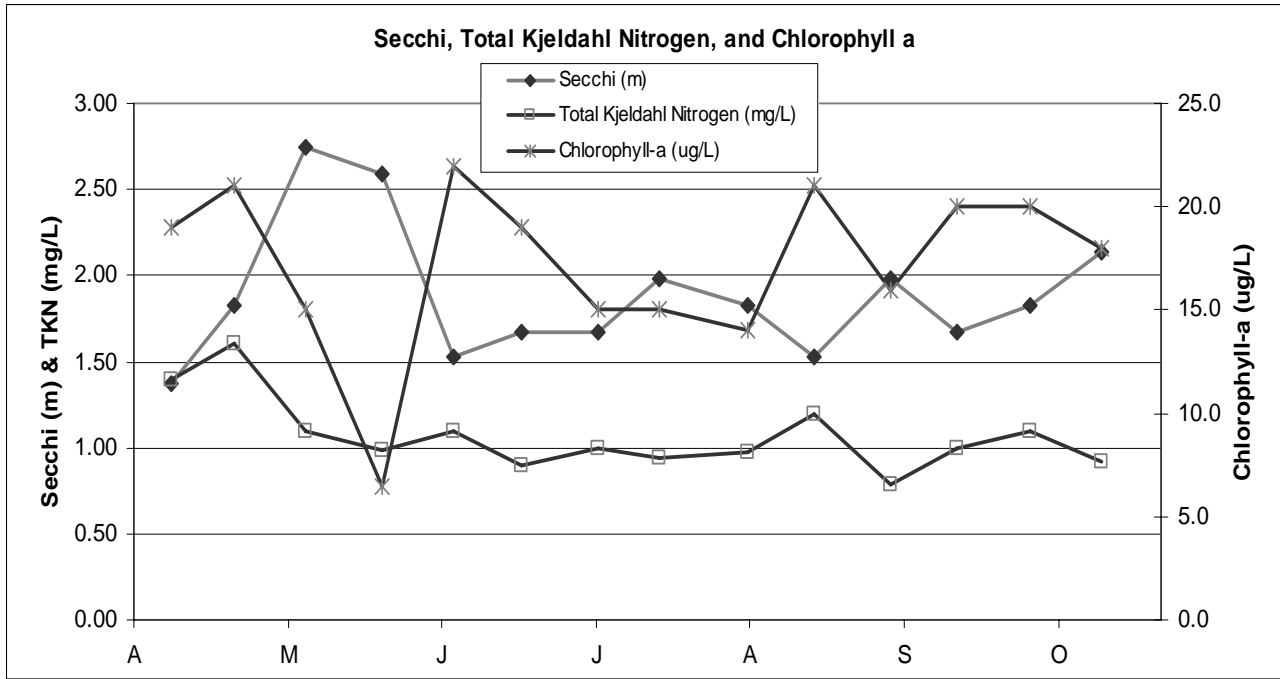


Figure 35. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

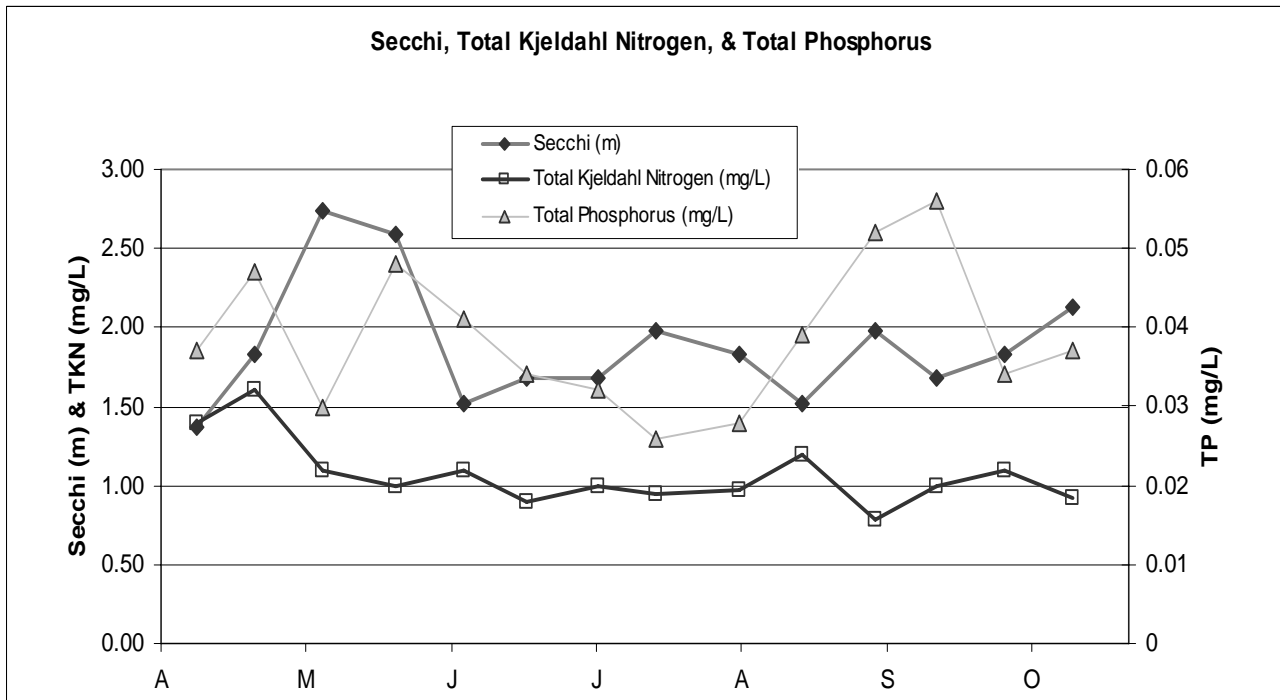
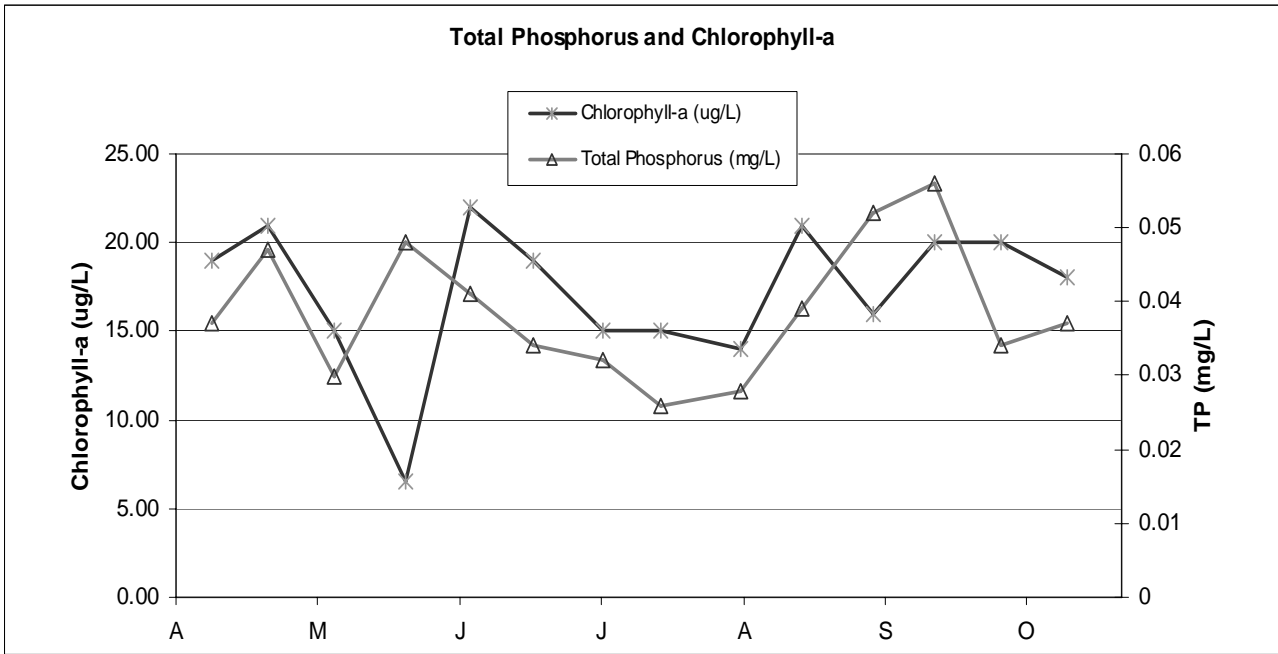
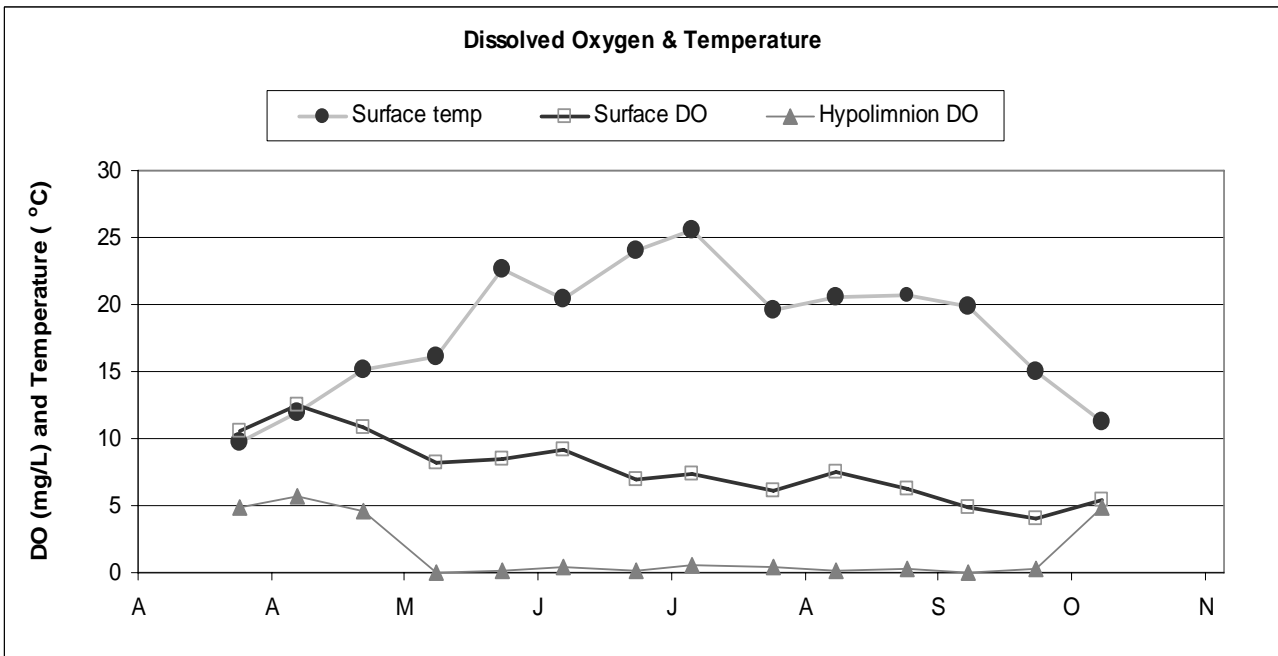


Figure 36. Total Phosphorous and Chlorophyll-a



Surface dissolved oxygen and surface temperature readings for 2004 are shown in Figure 37.

Figure 37. Surface Dissolved Oxygen and Surface Temperatures



6) Historical Lake Water Quality Trends

1993-2004 Summer Averages

Figure 38. Historical Average Summer TP

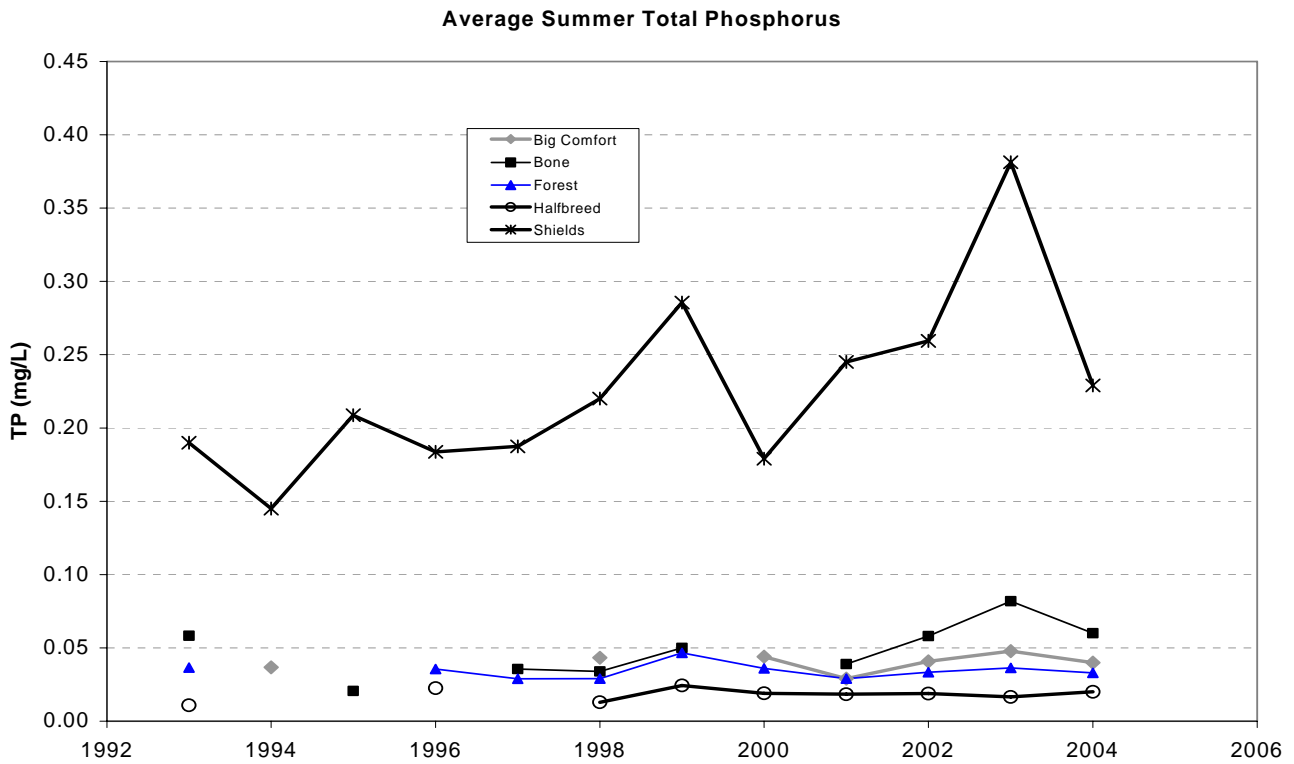


Figure 39. Historical Average Summer TKN

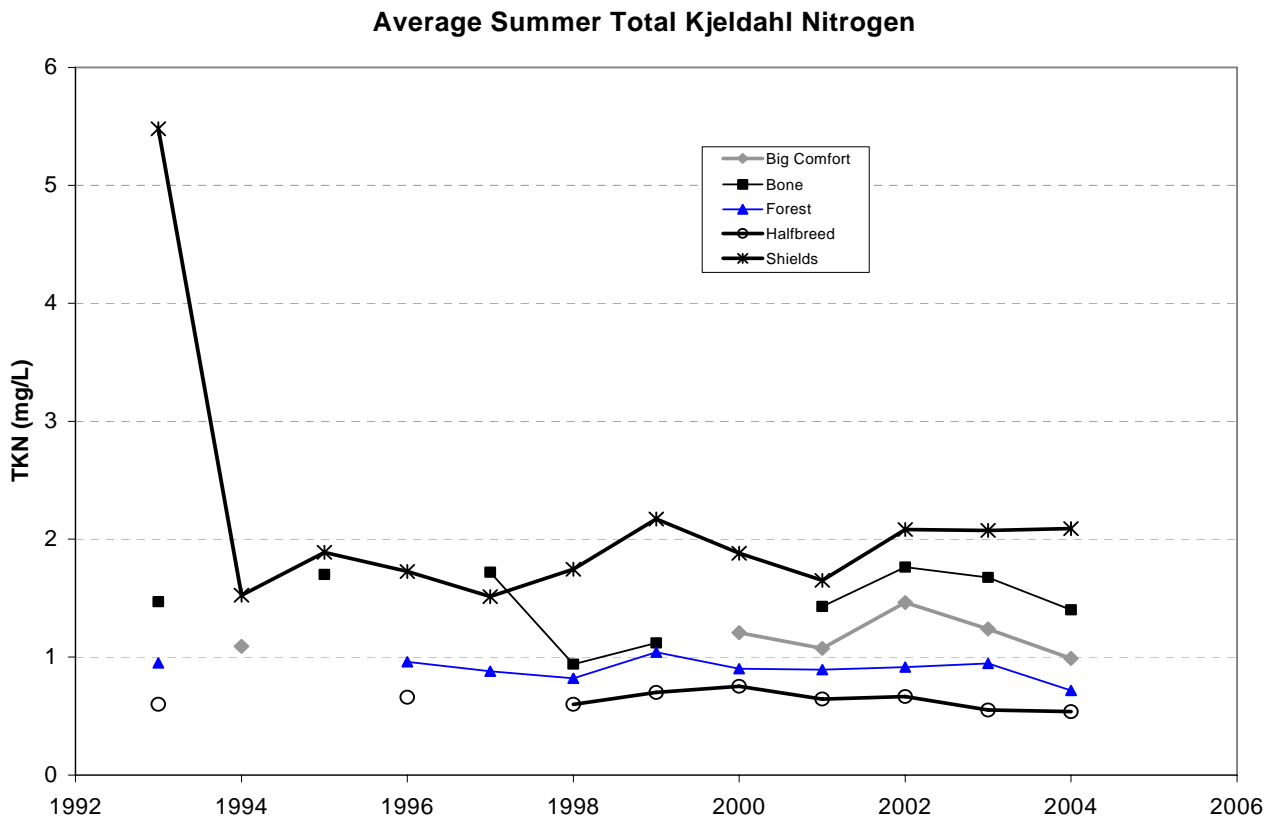


Figure 40. Historical Average Summer CLA

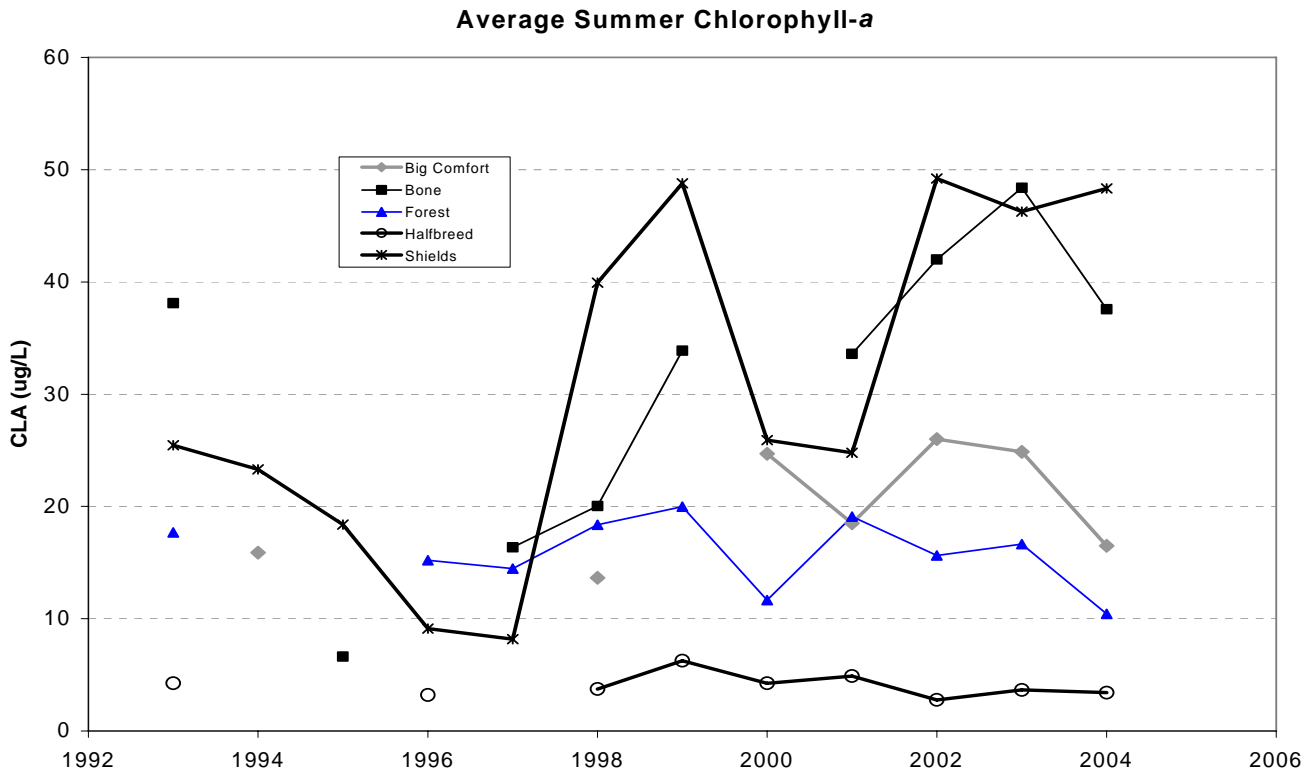
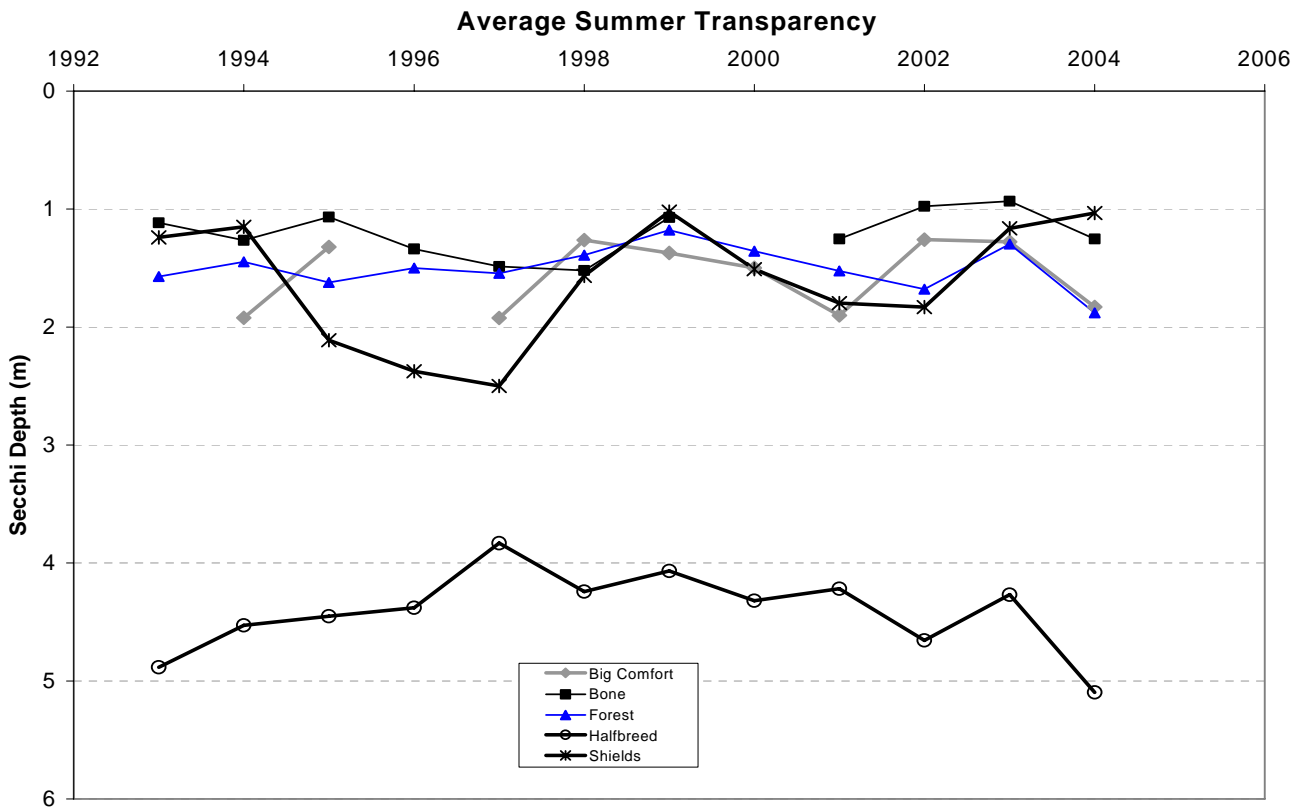


Figure 41. Historical Average Summer Transparencies



3. Appendices

Appendix A

Appendix B

Appendix C

Appendix D

Appendix A

Appendix Glossary (In Order Found in Appendix)

DNR ID #	Minnesota Department of Natural Resources Identification Number
Date	Date Sample Taken
Time	Time Sample Taken
Surface Temp (C)	Surface Temperature in Degrees Celcius
TP (ug/L)	Total Phosphorus Two-Meter Composite Concentrations in ug/L or ppb
TKN (ug/L)	Total Kjeldahl Nitrogen Two-Meter Composite Concentrations in ug/L or ppb
CLA (ug/L)	Chlorophyll- <i>a</i> Two-Meter Composite Concentrations in ug/L or ppb
Total Chloride (mg/L)	Total Chloride Two-Meter Composite Concentrations in mg/L or ppm
Secchi (m)	Secchi Disk Transparency in Meters
Phys Cond	Physical Condition-Subjective Observation
	<u>Physical Condition</u>
	Crystal Clear (1)
	Some Algae Present (2)
	Definite Algae Present (3)
	High Algal Color (4)
	Severe Bloom (Odor, Scum) (5)
Rec Suit	Recreational Suitability-Subjective Observation
	<u>Suitability for Recreation</u>
	Beautiful (1)
	Minor Aesthetic Problem (2)
	Swimming...Slightly Impaired (3)
	No Swim...Boating OK (4)
	No Aesthetics Possible (5)
Swimming Impaired	Recreational Suitability >2
% Swimming Impaired	Frequency of Summer (June-September) Samples with Swimming Impaired Condition
Source	Program Through Which the Sample was Taken
	CAMP- Metropolitan Council Environmental Service's "Citizen Assisted Monitoring Program"
	CWP-Minnesota Pollution Control Agency's Clean Water Partnership Study
	MPCA- Minnesota Pollution Control Agency's "Citizen Lake Monitoring Program"
TSI (TP)	Carlson's Trophic State Index for Total Phosphorus in ug/L or ppb
	$= (14.42 * \text{LN}(\text{TP})) + 4.15$
TSI (CLA)	Carlson's Trophic State Index for Chlorophyll- <i>a</i> in ug/L or ppb
	$= (9.81 * \text{LN}(\text{CLA})) + 30.6$
TSI (SD)	Carlson's Trophic State Index for Secchi Disk Transparency in meters
	$= 60 - (14.41 * (\text{LN}(\text{SD})))$
Summer Mean	Average of all samples taken June 1 through September 30 of any given year
Lake Grade	Lake Grading System Developed by the Metropolitan Council in 1989
	Grade Percentile TP (ug/l) CLA (ug/l) SD (m)
	A <10 <23 <10 >3.0
	B 10 - 30 23-32 10-20 2.2-3.0
	C 30-70 32-68 20-48 1.2-2.2
	D 70-90 68-152 48-77 0.7-1.2
	F >90 >152 >77 <0.7

Big Comfort Lake

DNR ID #13-53

Wyoming Township, Chisago County

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/07/87							2.9	2	1		MPCA			
07/14/87							2.7	2	1		MPCA			45
07/21/87							2.6	2	2		MPCA			46
07/28/87							2.1	3	3		MPCA			49
08/04/87							2.4	2	2	20%	MPCA			47
06/03/88							1.8	3	3		MPCA			51
06/30/88							1.8	3	3		MPCA			51
07/14/88							2.7	2	2		MPCA			45
07/23/88							2.7	2	2		MPCA			45
07/31/88							2.9	2	2	40%	MPCA			45
05/13/89							2.3	4	4		MPCA			48
05/20/89							2.6	3	4		MPCA			46
05/30/89							2.1	3	4		MPCA			49
06/04/89							3.7	3	4		MPCA			41
06/10/89							3.8	3	4		MPCA			41
06/25/89							2.7	3	4		MPCA			45
07/02/89							3.2	3	4		MPCA			43
07/08/89							2.3	3	5		MPCA			48
07/16/89							2.0	3	3		MPCA			50
07/20/89							2.6	2	2		MPCA			46
07/25/89							2.9	1	2		MPCA			45
07/31/89							2.9	1	2		MPCA			45
08/05/89							3.2	1	2		MPCA			43
08/12/89							2.7	1	2		MPCA			45
08/20/89							2.4	1	2		MPCA			47
08/27/89							2.4	2	3		MPCA			47
09/02/89							2.7	1	2		MPCA			45
09/09/89							2.7	1	2		MPCA			45
09/18/89							2.9	1	2	44%	MPCA			45
05/05/94	12:10	11.5	29	1100	13.8	21	1.8	2	1		MPCA	53		52
05/14/94	19:01						2.1	2	2		MPCA			49
05/22/94							2.3	2	2		MPCA			48
06/06/94							2.3	2	2		MPCA			48
06/11/94							2.1	2	2		MPCA			49
06/16/94	14:45	23.7	46	990	12.8	19	1.8	2	2		MPCA	59	56	52
06/18/94	15:25						2.3	2	2		MPCA			48
06/24/94							1.8	2	2		MPCA			51
06/29/94							1.7	2	2		MPCA			53
07/14/94	14:50	25	24	920	6.41	19	1.9	2	1		MPCA	50	49	51
07/20/94							2.1	2	2		MPCA			49
07/24/94							2.4	2	2		MPCA			47
07/31/94							2.1	2	2		MPCA			49
08/12/94	20:01						1.7	2	2		MPCA			53

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
08/25/94	14:40	25	27	1280	25.6	19	1.4	2	2		MPCA	52	62	55
08/27/94							1.5	2	2		MPCA			54
09/14/94	14:45	21.9	50	1170	20.8	19	1.7	3	3	83%	MPCA	61	60	52
05/17/95							2.3		1		MPCA			48
05/28/95							2.1		1		MPCA			49
06/11/95							2.1		1		MPCA			49
07/16/95							1.1		4		MPCA			59
07/20/95							1.2		4		MPCA			57
08/05/95							1.1		4		MPCA			59
09/17/95							1.2		4		MPCA			57
09/20/95							1.2		4		MPCA			57
05/21/97							1.7	2	2		MPCA			53
05/31/97							2.9	2	2		MPCA			45
06/07/97							2.9	2	2		MPCA			45
06/21/97							2.1	2	2		MPCA			49
07/05/97							1.7	2	2		MPCA			53
07/12/97							2.0	2	2		MPCA			50
07/19/97							1.5	2	2		MPCA			54
08/06/97							1.7	2	2		MPCA			53
08/16/97							1.8	2	2		MPCA			51
9/21/1997							1.7	2	2		MPCA			53
11/28/1997			25		3		2.4				CWP	51	41	47
12/13/1997			48		11		1.6		2	0%	CWP	60	54	53
1/21/1998			29		1		1.6				CWP	53	31	53
2/21/1998			17		1		4.2				CWP	45	31	39
3/25/1998			38								CWP	57		
4/26/1998							2.3				MPCA			48
4/30/1998			10		2		2.8				CWP	37	37	45
5/2/1998							2.4				MPCA			47
5/15/1998			24		6		2.2				CWP	50	48	48
5/31/1998			33		8		1.7				CWP	55	51	52
6/7/1998							2.0				MPCA			50
6/17/1998			37		4		1.3				CWP	56	44	56
6/21/1998							2.0				MPCA			50
6/29/1998			73		4		1.5				CWP	66	44	54
7/13/1998			47		24		0.7				CWP	60	62	64
7/18/1998							0.8				MPCA			64
7/30/1998			39		19		0.9				CWP	57	59	62
8/20/1998			42		18		1.1				CWP	58	59	59
8/31/1998			59		24		1.0				CWP	63	62	60
9/5/1998							1.2				MPCA			57
9/21/1998			14		3		1.2				CWP	42	41	57
9/30/1998			37				1.4				CWP	56		55
10/9/1998			37				1.4				CWP	56		55
10/9/1998							1.4				MPCA			55
11/2/1998			38				2.0				CWP	57		50
05/28/99							1.7	2	1		MPCA			53
06/10/99							1.7	2	2		MPCA			53

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/01/99							1.5	3	3		MPCA			54
07/18/99							1.4	3	3		MPCA			55
08/03/99							1.1	3	2		MPCA			59
09/30/99							1.2	2	2	40%	MPCA			57
05/03/00							2.4				MPCA			47
05/09/00							3.4				MPCA			42
05/14/00							2.5				MPCA			47
05/20/00							2.5				MPCA			47
06/12/00							1.8				MPCA			51
06/20/00							1.6				MPCA			53
06/28/00							1.7				MPCA			53
07/08/00							1.1				MPCA			59
08/11/00							0.8				MPCA			64
08/21/00							1.1				MPCA			59
09/06/00							1.3				MPCA			56
09/22/00							1.7				MPCA			52
10/15/00							1.8				MPCA			51
04/12/00	11:30	7.7	40	1200	20		1.7	2	2		CAMP	57	60	53
05/24/00	11:00	18.3	30	920	13		1.8	2	1		CAMP	53	56	51
06/08/00	9:50	20.9	30	1000	13		2.1	2	2		CAMP	53	56	49
06/22/00	9:45	20.3	20	1000	13		2.0	2	1		CAMP	47	56	50
07/06/00	9:15	24.8	30	900	12		1.7	2	2		CAMP	53	55	53
07/19/00	8:54	8.1	30	980	28		1.2	3	2		CAMP	53	63	57
07/31/00	10:15	26.9	50	1700	53		1.1	3	3		CAMP	61	70	59
08/10/00	9:45	25.6	30	1400	36		1.1	3	3		CAMP	53	66	59
08/23/00	9:21	23.5	30	1200	22		1.4	3	4		CAMP	53	61	55
08/29/00	11:56	23.9	30	1400	29		1.4	4	3		CAMP	53	64	55
09/13/00	15:27	21.1	140	1200	23		1.5	2	3		CAMP	75	61	54
09/25/00	14:47	17.5	50	1300	18		2.4	2	3		CAMP	61	59	47
10/03/00	11:08	16.6	40	1600	32		1.7	3	4		CAMP	57	65	53
10/18/00		15.6	50	1600	44			3	4	60%	CAMP	61	68	
06/13/01							1.5				MPCA			54
06/19/01							2.0				MPCA			50
07/15/01							1.7				MPCA			53
08/15/01							2.1				MPCA			49
09/03/01							1.8				MPCA			51
10/15/01							1.5				MPCA			54
11/05/01							1.4				MPCA			55
04/27/01	10:15		60	1500	23		1.7	3	2		CAMP	63	61	53
05/15/01	9:50	18.8	40	1200	23		2.0	2	1		CAMP	57	61	50
05/30/01	11:15	18.5	30	1000	13		2.0		2		CAMP	53	56	50
06/07/01	9:30	17.2	30	970	17		2.0	2	2		CAMP	53	58	50
06/20/01	9:30	21.9	40	1000	14		2.1	2	2		CAMP	57	56	49
06/28/01	9:00	26.9	30	1000	20		2.6	2	1		CAMP	53	60	46
07/10/01	10:30	25.9	20	1100	10		2.4	2	2		CAMP	47	53	47
07/25/01	9:20	26.2	20	860	16		2.1	2	3		CAMP	47	58	49
08/07/01	10:25	30.3	20	1100	21		1.8	2	3		CAMP	47	60	51
08/14/01	9:25	25.1	20	1300	23		1.4	3	3		CAMP	47	61	55

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
08/28/01	9:30	24.1	40	1100	23		1.7	3	4		CAMP	57	61	53
09/13/01	9:15	20.3	30	1200	18		1.5	3	3		CAMP	53	59	54
09/28/01		16.8	40	1100	23		1.7	2	3		CAMP	57	61	53
10/11/01	12:05	13.4			15		1.7	3	4	60%	CAMP		57	53
04/22/02		9.2	37	1200	17		1.5	2	2		CAMP	56	58	54
05/10/02	10:50	9.3	28	1100	16		1.7	3	3		CAMP	52	58	53
05/28/02	12:10	18.4	38	1100	9		2.0	2	2		CAMP	57	52	50
06/06/02	10:10	19.1	22	1000	11		2.1	2	2		CAMP	49	54	49
06/28/02		27.0	52	1600	23		1.4	2	3		CAMP	61	61	55
07/09/02		28.4	47	1600	43		0.9	3	3		CAMP	60	67	61
07/29/02	9:55	25.8	27	1200	27		1.1	3	3		CAMP	52	63	59
08/08/02	11:25	23.8	31	1400	30		1.1	3	3		CAMP	54	64	59
08/20/02		22.2	53	1400	23		1.2	3	4		CAMP	61	61	57
09/09/02		26.2	54	2100	28		1.2	3	3		CAMP	62	63	57
09/18/02		21.6	41	1400	23		1.1	2	3		CAMP	58	61	59
10/01/02		16.7	43	1200	32		1.4	3	4		CAMP	58	65	55
10/16/02		11.4	52	1700	22		1.4	2	3		CAMP	61	61	55
10/29/02	9:45	6.9	44	1300	21		1.8	2	2	88%	CAMP	59	60	51
04/15/03	10:30	9.0	44	1100	11		2.0	3	3		CAMP	59	54	50
05/06/03	9:40	12.4	198	1100	15		2.3	2	2		CAMP	80	57	48
05/16/03	8:45	16.2	46	1100	7		2.1	2	2		CAMP	59	50	49
05/29/03	11:40	20.3	42	1100	10		2.1	2	2		CAMP	58	53	49
06/11/03	10:00	Na	45	1100	15		1.8	2	1		CAMP	59	57	51
06/27/03	12:00	22.3	56	1100	25		1.4	3	3		CAMP	62	62	55
07/11/03	8:40	21.8	57	1200	14		1.1	3	3		CAMP	62	56	59
07/23/03	10:30	24.5	71	1200	32		1.2	3	3		CAMP	66	65	57
08/06/03	9:15	23.7	38	1300	39		1.1	3	3		CAMP	57	67	59
08/21/03	12:30	26.2	22	1400	22		1.2	3	3		CAMP	49	61	57
09/04/03	11:55	21.9	40	1100	31		1.1	3	3		CAMP	57	64	59
09/17/03	8:30	20.3	54	1500	21		1.4	2	2		CAMP	62	60	55
10/02/03	11:45	12.6	49	1600	28		1.7	2	3		CAMP	60	63	53
10/14/03	9:15	13.6	48	1500	14		2.6	2	2	75%	CAMP	60	56	46
04/22/04	10:00	9.7	37	1400	19		1.4	2	2		CAMP	56	59	55
05/04/04	9:25	12.0	47	1600	21		1.8	2	2		CAMP	60	60	51
05/18/04	9:10	15.1	30	1100	15		2.7	2	2		CAMP	53	57	45
06/02/04	11:30	16.1	48	990	7		2.6	2	2		CAMP	60	49	46
06/16/04	9:45	22.7	41	1100	22		1.5	2	2		CAMP	58	61	54
06/29/04	9:30	20.4	34	900	19		1.7	3	3		CAMP	55	59	53
07/14/04	10:15	24.0	32	1000	15		1.7	2	2		CAMP	54	57	53
07/26/04	10:00	25.5	26	940	15		2.0	2	2		CAMP	51	57	50
08/12/04	9:45	19.6	28	970	14		1.8	3	2		CAMP	52	56	51
08/25/04	11:00	20.5	39	1200	21		1.5	2	2		CAMP	57	60	54
09/09/04	11:00	20.7	52	790	16		2.0	2	2		CAMP	61	58	50
09/22/04	9:30	19.8	56	1000	20		1.7	5	2		CAMP	62	60	53
10/06/04	10:00	15.0	34	1100	20		1.8	2	2		CAMP	55	60	51
10/20/04	11:15	11.3	37	920	18		2.1	2	2	11%	CAMP	56	59	49
Summer Mean														
1986 Ave														

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
1987 Ave							2.6	2.2	1.8	20%				46
1988 Ave							2.4	2.4	2.4	40%				47
1989 Ave							2.8	1.9	2.8	44%				45
1990 Ave														
1991 Ave														
1992 Ave														
1993 Ave														
1994 Ave			37	1092	16	19	1.9	2.1	1.9	83%		56	58	51
1995 Ave							1.3		3.5	83%				56
1996 Ave														
1997 Ave							1.9	2.0	2.0	0%				51
1998 Ave			43		14		1.3					59	56	57
1999 Ave							1.4	2.6	2.4	40%				55
2000 Ave			44	1208	25		1.5	2.6	2.6	60%		59	62	54
2001 Ave			29	1073	19		1.9	2.3	2.6	60%		53	59	51
2002 Ave			41	1463	26		1	3	3	88%		58	63	57
2003 Ave			48	1238	25		1	3	3	75%		60	62	56
2004 Ave			40	988	17		2	3	2	11%		57	58	51
Total Ave			40	1177	20		2	2	2	50%		57	60	52
Grades												Average Annual Grade		
1987 Grade							B							B
1988 Grade							B							B
1989 Grade							B							B
1990 Grade														
1991 Grade														
1992 Grade														
1993 Grade														
1994 Grade							C							C
1995 Grade							C							C
1996 Grade														
1997 Grade							C							C
1998 Grade			C		B		C							C+
1999 Grade							C							C
2000 Grade			C		C		C							C
2001 Grade			B		B		C							B-
2002 Grade			C		C		C							C
2003 Grade			C		C		C							C
2004 Grade			C		B		C							C+
Ave Letter Grade			C		C+		C							C+

Bone Lake

DNR ID #82-54

New Scandia Township, Washington County

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/24/86							1.5				MPCA			54
07/02/86							1.7				MPCA			52
07/09/86							1.5				MPCA			55

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/16/86							1.5				MPCA			55
07/22/86							0.9				MPCA			62
07/29/86							0.9				MPCA			62
08/06/86							0.8				MPCA			64
08/14/86							0.6				MPCA			67
08/23/86							0.5				MPCA			69
08/27/86							0.5				MPCA			69
09/04/86							1.0				MPCA			60
09/12/86							1.0				MPCA			60
06/06/87							2.3	2	2		MPCA			48
06/13/87							2.3	2	2		MPCA			48
06/24/87							1.5	4	4		MPCA			54
06/28/87							1.7	2	2		MPCA			53
07/05/87							1.7	2	2		MPCA			53
07/11/87							1.7	2	2		MPCA			53
07/18/87							1.7	2	2		MPCA			53
07/25/87							1.7	2	2		MPCA			53
08/01/87							1.7	2	2		MPCA			53
08/08/87							1.5	2	2		MPCA			54
08/15/87							1.5	2	2		MPCA			54
08/22/87							1.5	2	2		MPCA			54
08/29/87							1.4	2	2		MPCA			55
09/05/87							1.4	2	2		MPCA			55
09/12/87							1.4	2	2		MPCA			55
09/19/87							1.4	2	2		MPCA			55
09/26/87							1.4	2	2	6%	MPCA			55
06/02/88							1.5	2	2		MPCA			54
06/09/88							1.4	2	2		MPCA			55
06/16/88							1.4	2	2		MPCA			55
06/21/88							1.1	2	3		MPCA			59
06/27/88							1.1	2	3		MPCA			59
07/04/88							1.1	2	3		MPCA			59
07/12/88							1.1	2	3		MPCA			59
07/22/88							0.9	2	3		MPCA			61
07/29/88							0.9	2	3		MPCA			61
08/05/88							0.9	2	3		MPCA			61
08/12/88							0.9	2	3		MPCA			61
08/18/88							0.9	2	3		MPCA			61
08/24/88							0.9	2	3		MPCA			61
08/30/88							0.9	3	4		MPCA			61
09/06/88							0.9	3	4	80%	MPCA			61
04/21/89	8:30	7.8	60	1320	32		1.3				CAMP	63	65	56
05/08/89	8:45	11.0	35	1120	5		3.9				CAMP	55	46	40
05/22/89	9:25	19.1	20	1180	3		5.1				CAMP	47	41	37
06/02/89	8:35	17.3	65	1580	9		4.1				CAMP	64	52	40
06/19/89	9:25	21.8	35	1060	10		2.4				CAMP	55	53	47
07/05/89	8:00	26.3	50	1200	35		1.1				CAMP	61	65	59
07/14/89	8:10	25.8	55	1180	30		0.9				CAMP	62	64	62
07/31/89	8:40	24.5	30	1200	14		1.2				CAMP	53	56	58

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
08/11/89	8:30	23.8	40	1460	40		1.0				CAMP	57	67	61
08/25/89	8:40	22.4	40	1220	35		1.0				CAMP	57	65	60
09/11/89	8:50	19.6	40	1280	34		1.5				CAMP	57	65	54
09/22/89	9:15	19.0	55	1440	47		1.2				CAMP	62	68	57
10/13/89	8:50	11.2	50	1440	31		1.7				CAMP	61	64	52
06/13/89							1.7	2	2		MPCA			53
06/23/89							1.7	2	2		MPCA			53
06/29/89							1.2	2	2		MPCA			57
07/05/89							1.1	2	2		MPCA			59
07/12/89							1.1	3	2		MPCA			59
07/19/89							1.1	2	2		MPCA			59
07/26/89							1.1	2	2		MPCA			59
08/02/89							1.2	2	2		MPCA			57
08/16/89							1.1	2	2		MPCA			59
08/24/89							0.9	2	2		MPCA			61
08/30/89							0.9	2	2		MPCA			61
09/01/89							1.1	2	2		MPCA			59
09/12/89							1.1	2	2		MPCA			59
09/19/89							1.1	2	2		MPCA			59
09/27/89							1.1	2	2		MPCA			59
10/04/89							1.1	2	2	0%	MPCA			59
06/09/90							1.8	2	2		MPCA			51
06/15/90							2.0	2	2		MPCA			50
06/23/90							1.5	2	2		MPCA			54
07/14/90							1.4	2	2		MPCA			55
07/26/90							1.1	2	2		MPCA			59
08/02/90							1.1	2	2		MPCA			59
08/17/90							1.1	2	2		MPCA			59
09/01/90							0.9	2	2		MPCA			61
09/20/90							0.8	2	2	0%	MPCA			64
05/14/93	11:20	8.5	40		1		5.0	1	1		CAMP	57	32	37
06/10/93	9:35	18.5	30		9		1.3	3	2		CAMP	53	52	56
07/15/93	9:45	23.0	50		37		1.4	4	2		CAMP	61	66	55
07/22/93	10:15	24.1	50		38		1.0	4	2		CAMP	61	66	60
08/10/93	9:45	25.0	80		67		0.8	4	3		CAMP	67	72	63
09/09/93	10:00	19.0	70		42		1.0	3	2		CAMP	65	67	60
09/29/93	10:10	13.0	70		36		1.2	2	2	17%	CAMP	65	66	57
05/09/94							2.7	2	2		MPCA			45
05/16/94							2.7	2	2		MPCA			45
05/22/94							2.7	3	2		MPCA			45
05/31/94							1.5	3	2		MPCA			54
06/06/94							1.2	4	3		MPCA			57
06/13/94							1.4	4	3		MPCA			55
06/20/94							0.9	4	3		MPCA			61
06/27/94							0.9	4	3		MPCA			61
07/04/94							0.8	4	3		MPCA			64
07/11/94							0.9	4	3		MPCA			61
07/18/94							1.1	4	3		MPCA			59

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/25/94							0.9	4	3		MPCA			61
08/01/94							0.9	4	3		MPCA			61
08/07/94							0.9	4	3		MPCA			61
08/16/94							0.8	4	3		MPCA			64
08/23/94							0.8	4	4		MPCA			64
08/29/94							0.9	4	4		MPCA			61
09/05/94							1.1	4	4		MPCA			59
09/12/94							0.9	4	4		MPCA			61
09/19/94							1.2	4	4	100%	MPCA			57
04/24/95							1.2	1	1		MPCA			57
05/02/95							2.3	1	1		MPCA			48
05/10/95							4.0	1	1		MPCA			40
05/15/95							4.0	1	2		MPCA			40
05/22/95							2.7	2	2		MPCA			45
05/29/95							2.4	3	3		MPCA			47
06/01/95							1.2	4	4		MPCA			57
06/06/95							1.2	4	4		MPCA			57
06/12/95							1.1	5	5		MPCA			59
06/21/95							2.1	3	3		MPCA			49
06/26/95							2.0	3	3		MPCA			50
07/04/95							1.4	3	3		MPCA			55
07/10/95							1.1	3	3		MPCA			59
07/18/95							0.8	3	3		MPCA			64
07/25/95							0.5	4	4		MPCA			71
08/02/95							0.6	4	4		MPCA			67
08/08/95							0.6	4	4		MPCA			67
08/15/95							0.8	4	5		MPCA			64
08/22/95							0.6	5	5		MPCA			67
08/29/95							0.8	5	5		MPCA			64
09/05/95							1.2	5	5		MPCA			57
09/12/95							0.9	3	5		MPCA			61
09/19/95							0.9	3	3		MPCA			61
09/26/95							1.5	3	3		MPCA			54
10/02/95							1.1	3	3		MPCA			59
04/14/95	10:50	7.0	130		6.8			1	1		CAMP	74	49	
04/25/95	11:40	11.0	140		11.0			1	1		CAMP	75	54	
05/11/95	12:00	17.0	340		6.0			2	2		CAMP	88	48	
05/23/95	10:55	14.0	290		8.0			2	3		CAMP	86	51	
06/08/95	10:10	12.5	200		2.9			2	2		CAMP	81	41	
06/21/95	11:40	27.0	250		5.4			3	2		CAMP	84	47	
07/06/95	14:15	17.5	300		9.7			2	2		CAMP	86	53	
07/20/95	10:00	21.0	580		1.9			3	2		CAMP	96	37	
08/03/95	13:45	24.5	500		11.0			3	2		CAMP	94	54	
08/15/95	10:45	22.5	410		11.0			2	2		CAMP	91	54	
08/30/95	10:00	22.0	340		2.3			2	2		CAMP	88	39	
09/13/95	10:15	18.0	260		8.8			2	2		CAMP	84	52	
10/02/95	11:30	13.0	90		4.3			2	2		CAMP	69	45	
10/19/95	15:30	10.0	120		2.3			2	3	69%	CAMP	73	39	
05/07/96							1.2	2	2		MPCA			57

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
05/14/96							2.4	2	2		MPCA			47
05/21/96							4.3	1	1		MPCA			39
05/28/96							3.7	1	1		MPCA			41
06/04/96							2.7	1	1		MPCA			45
06/11/96							2.7	2	2		MPCA			45
06/18/96							2.0	2	2		MPCA			50
06/25/96							1.8	3	4		MPCA			51
07/02/96							1.5	3	4		MPCA			54
07/09/96							1.2	3	4		MPCA			57
07/16/96							0.9	3	4		MPCA			61
07/23/96							0.9	3	4		MPCA			61
07/30/96							0.9	3	4		MPCA			62
08/06/96							0.9	4	4		MPCA			62
08/13/96							0.9	4	4		MPCA			62
08/20/96							0.8	5	4		MPCA			64
08/27/96							0.9	5	4		MPCA			62
09/03/96							0.9	5	4		MPCA			62
09/10/96							1.1	4	4	80%	MPCA			59
05/27/97							2.4	2	3		MPCA			47
06/03/97							2.1	2	3		MPCA			49
06/10/97							1.7	3	3		MPCA			53
06/17/97							1.5	3	3		MPCA			54
06/24/97							1.7	3	3		MPCA			53
07/01/97							1.5	3	4		MPCA			54
07/09/97							1.2	4	5		MPCA			57
07/15/97							1.2	4	5		MPCA			57
07/22/97							1.1	4	5		MPCA			59
07/24/97							1.2	4	4		MPCA			57
08/05/97							1.2	4	4		MPCA			57
08/12/97							1.1	4	4		MPCA			59
08/19/97							1.2	4	4		MPCA			57
08/25/97							1.4	4	4		MPCA			55
09/04/97							1.5	4	4		MPCA			54
09/17/97							1.5	4	4		MPCA			54
04/23/97	11:45	10.0	70		17.0		1.4	3	3		CAMP	65	58	55
05/08/97	10:15	11.0	50		24.0		1.5	2	2		CAMP	61	62	54
05/30/97	12:00	16.0	30		12.0		2.9	3	3		CAMP	53	55	45
06/05/97	13:00	22.5	30		9.7		2.3	2	2		CAMP	53	53	48
06/23/97	11:10	24.0	30		6.5		1.5	3	3		CAMP	53	49	54
07/07/97	11:20	21.0	30		17.0		1.5	2	3		CAMP	53	58	54
07/16/97	13:00	27.0	50		15.0		1.7	2	3		CAMP	61	57	52
07/31/97	10:05	26.0	30		11.0		1.4	3	3		CAMP	53	54	55
08/13/97	10:45	22.5	30		28.0		1.4	3	3		CAMP	53	63	55
08/27/97	14:15	25.0	30		32.0		1.5	3	3		CAMP	53	65	54
09/17/97	14:00	20.0	50		15.0		1.5	3	3		CAMP	61	57	54
09/18/97		23.4	40		13.0		1.7	2	3		CAMP	57	56	52
10/01/97	12:40	17.0	70		20.0		1.2	2	3		CAMP	65	60	57
10/16/97	14:30	15.0	50		25.0		2.0	3	3	67%	CAMP	61	62	50
04/21/98							1.2	3	2		MPCA			57

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
04/28/98							1.4	3	3		MPCA			55
05/04/98							2.9	1	2		MPCA			45
05/13/98							2.3	1	2		MPCA			48
05/19/98							1.9	2	2		MPCA			51
05/26/98							1.8	2	2		MPCA			51
06/02/98							1.7	3	3		MPCA			53
06/09/98							1.4	3	3		MPCA			55
06/16/98							1.7	3	3		MPCA			53
06/23/98							1.4	3	3		MPCA			55
06/30/98							1.5	3	3		MPCA			54
07/07/98							1.8	2	2		MPCA			51
07/14/98							1.9	4	4		MPCA			51
07/21/98							1.1	4	4		MPCA			59
07/28/98							1.2	4	4		MPCA			57
08/04/98							1.5	4	4		MPCA			54
08/11/98							1.2	4	5		MPCA			57
08/19/98							1.4	4	5		MPCA			55
08/24/98							1.4	4	5		MPCA			55
09/07/98							1.5	4	5		MPCA			54
09/15/98							1.4	4	5		MPCA			55
09/26/98							1.4	4	5		MPCA			55
10/08/98							1.5	3	4		MPCA			54
04/15/98	13:30	10.0	50		27.0		1.5	1	2		CAMP	61	63	54
04/28/98	11:45	15.5	40		17.0		1.5	3	2		CAMP	57	58	54
05/26/98	11:35	22.0	30		10.0		2.4	2	2		CAMP	53	53	47
06/08/98	12:30	19.0	40		15.0		1.4	2	2		CAMP	57	57	55
06/22/98	12:15	23.0	30		8.4		1.7	2	3		CAMP	53	51	52
07/07/98	12:15	25.0	40		14.0		2.0	3	2		CAMP	57	56	50
07/10/98		24.0	30		18.0		2.1	2	2		CAMP	53	59	49
07/20/98	12:00	27.5	30		15.0		1.2	2	2		CAMP	53	57	57
08/05/98	10:45	23.5	40		20.0		1.2	3	2		CAMP	57	60	57
08/19/98	10:45	23.0	30		30.0		1.5	2	2		CAMP	53	64	54
08/31/98	12:45	25.5	20		30.0		1.8	2	3		CAMP	47	64	52
09/14/98	10:50	24.0	40		35.0		1.7	2	2		CAMP	57	65	52
09/28/98	11:30	19.0	40		15.0		1.5	3	3		CAMP	57	57	54
10/15/98	11:10	12.5	40		13.0		1.8	2	2	69%	CAMP	57	56	52
04/27/99							2.0	2	2		MPCA			50
05/05/99							1.7	2	2		MPCA			53
05/11/99							1.8	2	2		MPCA			52
05/18/99							1.2	2	2		MPCA			57
05/25/99							1.4	2	2		MPCA			55
06/01/99							2.0	2	2		MPCA			50
06/13/99							1.4	2	2		MPCA			55
06/22/99							1.4	3	3		MPCA			55
06/29/99							1.4	3	3		MPCA			55
07/06/99							0.9	4	4		MPCA			61
07/14/99							1.1	4	4		MPCA			59
07/21/99							0.9	4	4		MPCA			61
07/27/99							0.9	4	4		MPCA			61
08/03/99							0.8	4	4		MPCA			64

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
08/17/99							1.1	4	4		MPCA			59
08/26/99							0.9	4	4		MPCA			61
08/31/99							0.9	4	4		MPCA			61
09/05/99							0.9	4	4		MPCA			61
09/15/99							0.9	5	5		MPCA			61
09/21/99							0.8	5	5		MPCA			64
09/28/99							0.9	5	4		MPCA			61
04/20/99	13:00	9.2	40		15.0		2.0	2	2		CAMP	57	57	50
05/11/99	14:50	15.9	50		25.0		1.5	3	2		CAMP	61	62	54
05/26/99	13:15	19.9	60		20.0		1.4	3	2		CAMP	63	60	55
06/10/99	15:00	23.8	40		24.0		1.5	3	2		CAMP	57	62	54
06/22/99	14:35	22.4	60		18.0		1.4	3	2		CAMP	63	59	55
07/06/99	13:36	25.7	50		21.0		1.4	4	3		CAMP	61	60	55
07/20/99	10:00	25.7	70		20.0		1.1	4	4		CAMP	65	60	59
08/04/99	15:10	25.9	40		38.0		0.9	3	3		CAMP	57	66	62
08/09/99		24.0	50		41.0		0.8	3	4		CAMP	61	67	63
08/24/99	14:15	22.9	70		36.0		0.8	3	3		CAMP	65	66	63
09/08/99	14:00	22.2	50		43.0		0.9	3	3		CAMP	61	67	62
09/23/99	12:40	17.8	20		64.0		0.9	3	3		CAMP	47	71	62
10/04/99	14:45	14.1	20		48.0		0.9	2	2		CAMP	47	69	62
10/20/99	15:30	11.0	20		13.0		1.2	2	2	84%	CAMP	47	56	57
07/03/01							2.6	1	2		MPCA			46
07/10/01							2.4	3	3		MPCA			47
07/17/01							1.5	3	3		MPCA			54
07/24/01							1.2	3	3		MPCA			57
08/01/01							1.1	3	3		MPCA			59
08/08/01							0.9	3	3		MPCA			61
08/15/01							0.9	3	3		MPCA			61
08/22/01							0.9	3	4		MPCA			61
08/29/01							0.9	3	4		MPCA			61
09/05/01							0.8	3	4		MPCA			64
09/11/01							0.8	3	4		MPCA			64
09/19/01							0.8	4	4		MPCA			64
09/26/01							0.8	4	4		MPCA			64
10/02/01							0.8	4	4		MPCA			64
10/08/01							0.8	4	4		MPCA			64
04/27/01	14:00		60	1600	25.0		1.1	3	3		CAMP	63	62	59
05/15/01	13:10	19.4	50	1300	30.0		1.4	2	1		CAMP	61	64	55
05/30/01	13:40	19.2	40	1200	4.7		3.7	2	2		CAMP	57	46	41
06/07/01	12:15	17.4	40	1300	8.0		3.1	3	2		CAMP	57	51	44
06/21/01	12:30	23.1	40	1200	31.0		1.5	3	3		CAMP	57	64	54
06/28/01	11:27	27.3	30	1300	28.0		1.5	3	2		CAMP	53	63	54
07/11/01	13:00	26.7	30	1300	27.0		0.9	4	4		CAMP	53	63	61
07/25/01	12:02	26.5	30	1200	35.0		1.2	3	3		CAMP	53	65	57
08/07/01	13:00	30.8	40	1500	46.0		0.9	3	3		CAMP	57	68	61
08/14/01	12:15	25.0	50	1700	53.0		0.8	3	4		CAMP	61	70	64
08/28/01	11:35	25.8	40	1400	43.0		0.8	3	4		CAMP	57	67	64
09/13/01	12:35	20.9	50	1800	37.0		1.1	3	3		CAMP	61	66	59
09/28/01		17.4	40	1600	28.0		1.5	3	3		CAMP	57	63	54

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
10/17/01	14:10	11.0			36.0		1.4	4	4	87%	CAMP		66	55
04/23/02		9.6	63	2500	31.0	11	1.1	3	3		CAMP	64	64	59
05/13/02	10:45	10.2	70	1300	20.0	11	1.5	3	2		CAMP	65	60	54
05/28/02	14:40	18.9	122	2000	39.0	12	1.2	3	3		CAMP	73	67	57
06/11/02	10:45	21.4	61	1400	18.0	11	1.7	3	3		CAMP	63	59	53
06/26/02	11:09	24.0	49	1600	26.0	7	1.7	3	3		CAMP	60	63	53
07/09/02		30.1	43	1800	55.0	11	0.8	3	4		CAMP	58	70	64
07/26/02	12:10	26.3	52	1900	72.0	11	0.5	4	4		CAMP	61	73	71
08/08/02	14:00	24.2	49	2000	42.0	10	0.5	3	4		CAMP	60	67	71
08/20/02		22.7	75	1800	34.0	11	0.9				CAMP	66	65	61
09/09/02		26.8	68	1700	38.0	5	1.1	4	4		CAMP	65	66	59
09/18/02		21.9	68	1900	51.0	11	0.8	3	3		CAMP	65	69	64
10/01/02		17.3	70	1900	83.0	9	1.2	3	4		CAMP	65	74	57
10/16/02		11.7	81	1800	42.0	9	1.4	3	4		CAMP	68	67	55
10/29/02	11:45	6.7	51	1700	47.0	11	1.1	3	3	100%	CAMP	61	68	59
04/15/03	12:30	10.1	123	1600	33.0	9	1.3	3	3		CAMP	74	65	57
05/05/03	14:10	13.2	72	1700	27.0	9	1.5	3	4		CAMP	66	63	54
05/16/03	11:00	16.9	47	1200	14.0	12	2.7	3	3		CAMP	60	56	45
05/27/03	12:05	19.5	51	950	2.8	11	4.0	3	3		CAMP	61	41	40
06/11/03	12:15	NA	48	1300	26.0	11	1.5	3	3		CAMP	60	63	54
06/27/03	10:28	20.8	56	1500	13.0	11	1.4	3	4		CAMP	62	56	55
07/11/03	12:00	22.9	51	1600	30.0	10	0.9	3	4		CAMP	61	64	61
07/23/03	13:30	26.5	82	1800	67.0	10	0.8	3	4		CAMP	68	72	64
08/06/03	12:00	24.6	146	1700	73.0	10	0.6	5	4		CAMP	76	73	67
08/21/03	11:00	26.2	83	2000	49.0	10	0.8	3	3		CAMP	68	69	64
09/04/03	11:00	21.7	53	1300	50.0	10	0.8	4	4		CAMP	61	69	64
09/18/03	9:20	20.6	136	2200	79.0	11	0.8	4	3		CAMP	75	73	64
10/01/03	9:15	12.4	53	1900	30.0	11	1.1	3	3		CAMP	61	64	59
10/14/03	10:00	13.8	113	1900	43.0	9	1.5	4	3	100%	CAMP	72	67	54
04/22/04	11:00	10.6	47	1900	7.4	6	2.7	2	2		CAMP	60	50	45
05/04/04	11:35	12.3	57	1800	6.3	12	3.0	3	2		CAMP	62	49	44
05/18/04	12:50	18.3	54	1700	9.8	11	2.7	2	2		CAMP	62	53	45
06/02/04	12:30	16.3	55	1700	32.0	5	1.5	3	3		CAMP	62	65	54
06/16/04	10:45	22.3	47	1600	44.0	8	1.2	2	2		CAMP	60	68	57
06/29/04	10:30	20.4	43	1400	40.0	11	1.1	4	4		CAMP	58	67	59
07/14/04	11:00	24.3	37	1300	24.0	3	1.5	4	3		CAMP	56	62	54
07/26/04	11:00	26.0	57	1300	21.0	11	1.5	4	2		CAMP	62	60	54
08/12/04	10:45	19.7	56	1200	20.0	18	1.2	3	2		CAMP	62	60	57
08/25/04	13:00	21.2	61	1300	67.0	11	0.9	5	2		CAMP	63	72	61
09/09/04	12:00	20.8	132	1700	52.0	4	0.9	4	2		CAMP	75	69	61
09/22/04	10:15	20.0	50	1100	38.0	7	1.4	5	2		CAMP	61	66	55
10/06/04	10:45	14.4	56	1700	49.0	10	1.8	4	2		CAMP	62	69	51
10/20/04	13:45	10.4	58	1800	35.0	11	1.7	3	2	33%	CAMP	63	65	53
Summer Mean														
1986 Ave														60
1987 Ave														53
1988 Ave														59
1989 Ave												59	63	56

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
1990 Ave							1.3	2.0	2.0	0%				56
1991 Ave														
1992 Ave														
1993 Ave			58	1470	38		1.1	3.3	2.2	17%		63	66	58
1994 Ave							1.3	3.7	3.1	100%				57
1995 Ave			21	1700	7		1.1	3.3	3.3	69%		48	49	59
1996 Ave							1.3	3.3	3.5	80%				56
1997 Ave			36	1720	16		1.5	3.2	3.5	67%		56	58	54
1998 Ave			34	940	20		1.5	3.1	3.3	69%		55	60	54
1999 Ave			50	1120	34		1.1	3.6	3.5	84%		61	65	59
2000 Ave														
2001 Ave			39	1430	34		1.3	3.0	3.3	87%		57	65	57
2002 Ave			58	1763	42	10	1.0	3.3	3.6	100%		63	67	60
2003 Ave			82	1675	48	10	0.9	3.5	3.6	100%		68	69	61
2004 Ave			60	1400	38	9	1.3	3.8	2.4	33%		63	66	57
Total Ave			48	1451	30	10	1.2	3.0	3.0	59%		60	64	57

Grades												Ave Annual Grade
1986 Grade							C					C
1987 Grade							B					B
1988 Grade							C					C
1989 Grade							B					B
1990 Grade							B					B
1991 Grade												
1992 Grade												
1993 Grade			C		C		C					C
1994 Grade							B					B
1995 Grade			A		A		C					B+
1996 Grade							B					B
1997 Grade			C		B		B					B-
1998 Grade			C		C		B					C+
1999 Grade			C		C		C					C
2000 Grade												
2001 Grade			C		C		B					C+
2002 Grade			C		C		C					C
2003 Grade			D		C		C					C-
2004 Grade			C		C		C					C
Ave Letter Grade			C		C+		B-					C+

Forest Lake (West)
DNR ID #82-159
Forest Lake Township, Washington County

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
05/12/86							2.3				MPCA			48
05/12/86							2.1				MPCA			49
05/12/86							2.3				MPCA			48
06/07/86							0.6				MPCA			67
06/20/86							2.3				MPCA			48

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/29/86							2.1				MPCA			49
07/07/86							1.8				MPCA			51
07/19/86							1.8				MPCA			51
08/15/86							1.5				MPCA			54
04/26/87							3.4				MPCA			43
05/04/87							3.0				MPCA			44
05/15/87							3.0				MPCA			44
05/25/87							2.7				MPCA			45
06/05/87							2.0				MPCA			50
06/10/87							2.0				MPCA			50
06/19/87							1.8				MPCA			51
06/29/87							1.6				MPCA			53
07/02/87							1.8				MPCA			51
07/06/87							1.4				MPCA			55
07/15/87							1.5				MPCA			54
07/29/87							1.7				MPCA			53
08/03/87							1.7				MPCA			53
08/13/87							1.5				MPCA			54
08/21/87							1.4				MPCA			55
08/31/87							1.4				MPCA			55
09/12/87							1.2				MPCA			57
05/21/88							2.7	2	2		MPCA			45
05/28/88							2.9	2	2		MPCA			45
06/04/88							3.0	2	2		MPCA			44
06/11/88							2.4	2	2		MPCA			47
06/18/88							2.3	2	2		MPCA			48
06/25/88							1.8	3	2		MPCA			51
07/02/88							1.7	3	2		MPCA			53
07/09/88							1.5	3	2		MPCA			54
07/16/88							1.2	3	3		MPCA			57
07/23/88							0.9	3	3		MPCA			61
07/30/88							0.8	3	3	33%	MPCA			64
05/13/89							2.3	1	1		MPCA			48
06/01/89							2.3	1	1		MPCA			48
06/19/89							2.1	1	1		MPCA			49
07/07/89							2.0	1	1		MPCA			50
07/21/89							2.1	1	1		MPCA			49
08/02/89							2.0	1	1	0%	MPCA			50
05/08/93							2.3	1	1		MPCA			48
05/29/93							2.1	1	1		MPCA			49
06/04/93							2.1	1	1		MPCA			49
06/21/93							2.0	1	1		MPCA			50
07/03/93							1.4	2	1		MPCA			55
08/01/93							0.9	2	2		MPCA			61
08/29/93							2.0	1	1		MPCA			50
05/19/93	9:45	16.0	10		1.9		2.5	1	1		CAMP	37	37	47
06/10/93	13:30	19.0	20		3.2		2.0	2	1		CAMP	47	42	50

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/15/93	13:30	23.5	40		10.0		2.0	2	1		CAMP	57	53	50
07/22/93	9:45	23.7	20		15.0		1.7	2	2		CAMP	47	57	52
08/10/93	13:25	26.0	40		17.0		1.2	2	2		CAMP	57	58	57
09/09/93	13:30	18.0	60		39.0		1.0	3	2		CAMP	63	67	60
09/29/93	14:00	12.0	40		22.0		1.0	3	2		0%	CAMP	57	61
06/02/94							2.1	1	1		MPCA			49
06/17/94							2.0	1	1		MPCA			50
06/28/94							2.0	1	1		MPCA			50
07/06/94							0.9	3	2		MPCA			61
07/27/94							1.2	2	2		MPCA			57
08/10/94							1.2	2	2		MPCA			57
08/26/94							0.9	3	2		MPCA			61
09/15/94							1.2	2	2		0%	MPCA		
06/14/95							2.0	2	2		MPCA			50
06/16/95							2.1	2	1		MPCA			49
06/30/95							2.1	2	1		MPCA			49
07/06/95							1.4	3	3		MPCA			55
07/15/95							1.8	3	2		MPCA			51
07/24/95							1.7	2	2		MPCA			53
08/04/95							1.5	2	2		MPCA			54
08/14/95							1.2	2	2		MPCA			57
08/21/95							0.9	3	3		MPCA			61
09/01/95							1.4	2	2		20%	MPCA		
05/23/96	10:00	18.0	30		9.2		2.0	2	2		CAMP	53	52	50
06/04/96	9:00	16.5	20		5.8		3.2	2	2		CAMP	47	48	43
06/18/96	15:00	20.0	40		9.0		1.8	3	2		CAMP	57	52	52
07/11/96	15:00	23.0	10		10.0		1.5	2	3		CAMP	37	53	54
07/23/96	14:30	25.0	40		11.0		1.2	2	3		CAMP	57	54	57
08/08/96	14:30	25.0	20		11.0		1.2	3	3		CAMP	47	54	57
08/17/96		26.0	40		17.0		1.4	3	3		CAMP	57	58	55
08/28/96	10:55	23.0	50		22.0		0.9	3	3		CAMP	61	61	62
09/13/96	7:55	19.0	50		31.0		0.9	3	4		CAMP	61	64	62
09/25/96	9:30	16.0	50		20.0		1.1	3	3		CAMP	61	60	59
10/07/96	10:20	13.0	40		17.0		1.4	3	3		CAMP	57	58	55
10/24/96	10:40	8.0	50		20.0		1.4	3	4	78%	CAMP	61	60	55
04/23/97	12:45	10.0	20		7.9		2.0	3	2		CAMP	47	51	50
05/08/97	8:45	11.0	20		12.0			2	2		CAMP	47	55	
05/22/97	9:10	13.5	5		7.8		1.5	2	2		CAMP	27	51	54
06/05/97	11:50	20.5	20		2.5		2.3	2	2		CAMP	47	40	48
06/18/97	8:30	21.0	20		4.4		2.0	2	2		CAMP	47	45	50
07/07/97	9:00	20.5	20		11.0		1.5	2	2		CAMP	47	54	54
07/16/97	11:40	26.0	20		6.4		1.5	2	2		CAMP	47	49	54
08/01/97	9:15	24.5	20		5.9		1.5	2	3		CAMP	47	48	54
08/13/97	8:30	22.0	40		57.0		0.9	3	3		CAMP	57	70	62
08/27/97	9:00	23.5	30		10.0		1.7	2	3		CAMP	53	53	52
09/16/97	9:00	20.0	50		18.0		1.2	3	2		CAMP	61	59	57
09/18/97		21.2	40		15.0		1.3	2	2		CAMP	57	57	56
10/02/97	10:40	16.5	40		15.0		1.4	2	3		CAMP	57	57	55

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
10/15/97	12:20	13.0	40		11.0		1.5	2	2	33%	CAMP	57	54	54
04/17/98	9:00	9.5	50		5.6		2.6	2	2		CAMP	61	48	46
04/28/98	9:20	14.0	30		5.3		3.5	2	2		CAMP	53	47	42
05/11/98	9:30	18.1	30		3.7		3.4	2	1		CAMP	53	43	42
05/26/98	9:30	20.5	20		4.7		2.6	2	2		CAMP	47	46	46
06/08/98	10:05	18.0	20		8.1		1.8	2	2		CAMP	47	51	52
06/22/98	9:50	22.0	20		6.8		2.0	2	2		CAMP	47	49	50
07/07/98	8:25	24.2	20		7.2		1.5	2	2		CAMP	47	50	54
07/10/98		23.0	20		6.9		1.6	2	2		CAMP	47	50	53
07/20/98	9:15	27.0	20		9.8		1.8	2	2		CAMP	47	53	52
08/05/98	8:30	22.5	40		17.0		1.2	3	2		CAMP	57	58	57
08/19/98	8:30	23.0	40		34.0		1.2	3	2		CAMP	57	65	57
08/31/98	10:10	24.2	30		41.0		1.1	4	3		CAMP	53	67	59
09/14/98	8:45	23.0	40		26.0		0.9	3	3		CAMP	57	63	62
09/28/98	9:00	18.5	40		27.0		0.8	3	3		CAMP	57	63	63
10/15/98	8:40	11.0	30		4.7		1.2	3	2	30%	CAMP	53	46	57
04/20/99	9:40	9.5	30		3.8		3.2	1	1		CAMP	53	44	43
05/11/99	11:30	15.9	30		3.4		2.0	2	2		CAMP	53	43	50
05/26/99	10:30	17.5	30		4.9		2.0	2	2		CAMP	53	46	50
06/09/99	12:20	23.0	20		7.9		1.5	2	2		CAMP	47	51	54
06/22/99	12:00	21.9	50		14.0		1.4	3	2		CAMP	61	56	55
07/07/99	11:00	25.0	50		18.0		1.1	3	2		CAMP	61	59	59
07/19/99	13:05	25.9	40		13.0		1.2	3	2		CAMP	57	56	57
08/04/99	12:30	25.8	40		19.0		1.2	4	3		CAMP	57	59	57
08/09/99		24.0	40		24.0		1.1	3	3		CAMP	57	62	59
08/24/99	12:00	22.4	30		30.0		1.1	3	3		CAMP	53	64	59
09/10/99	9:45	19.2	50		30.0		0.9	3	3		CAMP	61	64	62
09/23/99	10:20	16.6	100		24.0		1.1	3	3		CAMP	71	62	59
10/04/99	11:40	12.7	130		11.0		1.2	3	3		CAMP	74	54	57
10/20/99	12:30	9.4	150		17.0		1.5	2	2	56%	CAMP	76	58	54
04/12/00	10:30	7.4	20	930	3.4		3.2	2	2		CAMP	47	43	43
05/25/00	7:45	17.8	40	880	6.9		1.8	2	2		CAMP	57	50	51
06/08/00	9:00	20.4	30	740	8.1		2.3	3	2		CAMP	53	51	48
06/22/00	8:34	20.1	40	630	14		1.4	3	2		CAMP	57	56	55
07/06/00	8:30	24.9	30	730	4.2		1.4		2		CAMP	53	45	55
07/19/00	8:12	26.4	40	860	8.6		1.2	4	2		CAMP	57	52	57
07/31/00	9:35	25.6	20	940			1.4	3	4		CAMP	47		55
08/10/00	9:00	23.1	20	850	12		1.2	4	4		CAMP	47	55	57
08/22/00	8:36	23.9	40	900	17		1.2	4	4		CAMP	57	58	57
08/29/00	11:04	21.6	40	1100	16		1.1	3	3		CAMP	57	58	59
09/13/00	14:26	14.6	60	1300	13		1.2	3	3		CAMP	63	56	57
09/25/00	14:05	14.6	40	960	12		1.2	3	4		CAMP	57	55	57
10/03/00	10:24	16.4	40	960	13		1.4	3	4		CAMP	57	56	55
10/18/00		12.7	30	870	7.4			3	3	60%	CAMP	53	50	
04/27/01	11:15		20	720	10		2.3	2	2		CAMP	47	53	48
05/15/01	9:00	18	10	730	4.7		3.2	2	1		CAMP	37	46	43
05/30/01	10:30	17.2	20	600	5.1		2.3	2	2		CAMP	47	47	48
06/07/01	8:45	16.7	30	680	6.6		2.3		2		CAMP	53	49	48

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/20/01	8:45	21.6	30	780	11		1.7				CAMP	53	54	53
06/28/01	8:22	26.2	20	740	7.3		2.4	3	1		CAMP	47	50	47
07/10/01	9:45	25.8	20	810	11		1.7	2	3		CAMP	47	54	53
07/25/01	8:15	25.9	20	710	18		1.5	3	3		CAMP	47	59	54
08/07/01	9:30	30.1	30	950	24		1.4	3	3		CAMP	53	62	55
08/14/01	8:45	24.9	40	1100	33		0.9	3	3		CAMP	57	65	61
08/28/01	8:45	23.9	30	1100	33		1.1	3	4		CAMP	53	65	59
09/13/01	8:30	19.8	30	1100	29		1.1	4	4		CAMP	53	64	59
09/28/01		15.6	40	970	18		1.2	2	2		CAMP	57	59	57
10/11/01	11:20	11.9			14		1.8	4	1	67%	CAMP		56	51
04/22/02		10.4	16	640	3.2		2.8	2	2		CAMP	44	42	45
05/10/02	11:50	9.5	25	550	2.6		2.8	2	2		CAMP	51	40	45
05/28/02	11:05	17	52	1300	1.9		3.5	2	2		CAMP	61	37	42
06/06/02	9:20	18.2	15	570	3.6		3.4	2	2		CAMP	43	43	43
06/28/02		26.4	21	740	6.6		2.4	2	3		CAMP	48	49	47
07/09/02		27.5	24	780	3		1.8	2	3		CAMP	50	41	51
07/29/02	9:15	25.7	35	930	15		1.4	3	3		CAMP	55	57	55
08/08/02	10:40	23.4	37	1100	27		1.2	3	3		CAMP	56	63	57
08/20/02		22.3	36	1000	29		1.1	3	4		CAMP	56	64	59
09/09/02		25.4	68	1200	24		1.2	2	2		CAMP	65	62	57
09/18/02		21.5	31	1000	17		0.9	2	2		CAMP	54	58	61
10/01/02		15.9	38	870	13		0.9	3	4		CAMP	57	56	61
10/16/02		10.1	28	880	14		1.7	3	3		CAMP	52	56	53
10/29/02	9:00	5.4	12	600	6.4		3.6	2	2	38%	CAMP	40	49	42
04/15/03	9:40	10	22	660	2.1		4.1	2	2		CAMP	49	38	40
05/06/03	9:05	13	22	720	5.2		3.2	2	2		CAMP	49	47	43
05/16/03	8:00	15.9	33	840	5.4		2.4	2	2		CAMP	55	47	47
05/29/03	10:20	20.2	23	730	4.7		2.7	2	2		CAMP	49	46	45
06/11/03	9:20	NA	20	640	7.2		2.0	2	1		CAMP	47	50	50
06/27/03	11:12	21.2	28	850	12		1.5	3	3		CAMP	52	55	54
07/11/03	9:40	22	31	920	8.9		1.2	3	3		CAMP	54	52	57
07/23/03	11:30	24.4	43	840	18		1.2	3	2		CAMP	58	59	57
08/06/03	10:05	24.1	35	900	20		1.2	2	2		CAMP	55	60	57
08/21/03	9:15	25.9	24	1200	19		1.2	2	2		CAMP	50	59	57
09/04/03	12:40	22.5	52	920	25		1.1	3	3		CAMP	61	62	59
09/18/03	7:50	20.0	58	1300	23		0.9	3	2		CAMP	63	61	61
10/02/03	11:00	10.7	25	870	19		1.4	2	2		CAMP	51	59	55
10/14/03	8:30	13.4	28	760	8.1		2.3	2	2	38%	CAMP	52	51	48
4/22/2004	8:50	11.2	20	600	4.1		3.2	2	2		CAMP	47	44	43
5/5/2004	8:00	12.6	22	720	2.5		3.8	2	2		CAMP	49	40	41
5/18/2004	8:30	15.0	17	610	5.2		3.8	2	1		CAMP	45	47	41
6/2/2004	10:20	15.6	32	500	6.1		3.0	2	2		CAMP	54	48	44
6/16/2004	8:30	21.8	30	720	8.5		2.1	2	2		CAMP	53	52	49
6/29/2004	8:45	19.7	25	710	6.0		2.3	3	2		CAMP	51	48	48
7/14/2004	9:00	23.7	25	790	8.3		1.8	2	2		CAMP	51	51	51
7/26/2004	9:00	25.1	25	760	7.1		2.0	2	2		CAMP	51	50	50
8/12/2004	9:00	18.9	34	700	16.0		1.4	3	2		CAMP	55	58	55
8/25/2004	10:15	20.0	35	720	13.0		1.4	2	2		CAMP	55	56	55
9/9/2004	10:00	20.5	34	660	13.0		1.5	2	2		CAMP	55	56	54

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
9/22/2004	8:45	19.6	55	890	16.0		1.4	3	2		CAMP	62	58	55
10/6/2004	9:30	12.7	54	1100	14.0		1.8	3	2		CAMP	62	56	51
10/20/2004	10:45	9.1	31	590	9.6		2.6	2	2	0%	CAMP	54	53	46
Summer Mean														
1986 Ave							1.7							52
1987 Ave							1.6							53
1988 Ave							1.7	2.7	2.3	33%				52
1989 Ave							2.1	1.0	1.0	0%				49
1990 Ave														
1991 Ave														
1992 Ave														
1993 Ave			37	950	17.7		1.6	1.9	1.5	0%		56	59	53
1994 Ave							1.4	1.9	1.6	0%				55
1995 Ave							1.6	2.3	2.0	20%				53
1996 Ave			36	960	15.2		1.5	2.7	2.9	78%		56	57	54
1997 Ave			29	880	14		1.5	2.2	2.3	33%		53	57	54
1998 Ave			29	820	18		1.4	2.6	2.3	30%		53	59	55
1999 Ave			47	1040	20		1.2	3.0	2.4	56%		60	60	58
2000 Ave			36	901	12		1.4	3.3	3.0	60%		56	55	56
2001 Ave			29	894	19		1.5	2.9	2.8	67%		53	60	54
2002 Ave			33	915	16		1.7	2.4	2.8	38%		55	58	53
2003 Ave			36	946	17		1.3	2.6	2.3	38%		56	58	56
2004 Ave			33	717	10		1.9	2.3	2.0	0%		54	54	51
Total Ave			34	902	16		1.6	2.4	2.2	32%		55	58	53
Grade												Average Annual Grade		
1986 Grade							C					C		
1987 Grade							C					C		
1988 Grade							C					C		
1989 Grade							C					C		
1990 Grade														
1991 Grade														
1992 Grade														
1993 Grade			C		B		C					C+		
1994 Grade							C					C		
1995 Grade							C					C		
1996 Grade			C		B		C					C+		
1997 Grade			B		B		C					B-		
1998 Grade			B		B		C					B-		
1999 Grade			C		B		C					C+		
2000 Grade			C		B		C					C+		
2001 Grade			B		B		C					B-		
2002 Grade			C		B							B-		
2003 Grade			B		B		C					B-		
2004 Grade			C+		A-		B					B		
Letter Grade			C+		B		C					C+		

Halfbreed (Sylvan) Lake

DNR ID #82-80

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
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Forest Lake Township/New Scandia Township, Washington County

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/30/74							5.3				MPCA			36
07/06/74							4.9				MPCA			37
07/13/74							3.7				MPCA			41
07/20/74							4.3				MPCA			39
07/27/74							4.4				MPCA			39
08/07/74							4.7				MPCA			38
08/14/74							4.9				MPCA			37
08/21/74							4.9				MPCA			37
08/28/74							4.6				MPCA			38
09/11/74							5.0				MPCA			37
09/18/74							5.0				MPCA			37
06/26/78							2.6				MPCA			46
07/03/78							2.6				MPCA			46
07/10/78							2.1				MPCA			49
07/17/78							2.3				MPCA			48
07/31/78							2.3				MPCA			48
08/07/78							2.3				MPCA			48
08/21/78							2.4				MPCA			47
08/28/78							2.3				MPCA			48
09/04/78							2.3				MPCA			48
09/11/78							2.3				MPCA			48
09/18/78							2.4				MPCA			47
09/25/78							2.6				MPCA			46
06/02/79							2.3				MPCA			48
06/16/79							2.1				MPCA			49
06/23/79							2.6				MPCA			46
06/30/79							3.4				MPCA			43
07/07/79							3.0				MPCA			44
07/14/79							2.9				MPCA			45
07/21/79							2.3				MPCA			48
08/04/79							2.9				MPCA			45
08/11/79							2.9				MPCA			45
08/18/79							4.6				MPCA			38
08/21/79							3.4				MPCA			43
09/02/79							2.7				MPCA			45
09/08/79							3.0				MPCA			44
09/16/79							3.2				MPCA			43
09/23/79							3.4				MPCA			43
05/31/80							2.1				MPCA			49
06/08/80							2.7				MPCA			45
06/29/80							2.4				MPCA			47
07/06/80							2.4				MPCA			47
07/13/80							2.4				MPCA			47

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/19/80							2.7				MPCA			45
07/26/80							4.0				MPCA			40
08/02/80							4.0				MPCA			40
08/24/80							3.4				MPCA			43
09/01/80							3.4				MPCA			43
09/07/80							4.0				MPCA			40
06/03/81							4.0				MPCA			40
06/07/81							4.0				MPCA			40
06/21/81							2.6				MPCA			46
06/28/81							2.6				MPCA			46
07/12/81							2.7				MPCA			45
07/19/81							2.4				MPCA			47
08/01/81							2.3				MPCA			48
08/08/81							2.6				MPCA			46
08/23/81							4.0				MPCA			40
08/29/81							3.5				MPCA			42
09/13/81							3.2				MPCA			43
09/27/81							3.5				MPCA			42
06/05/82							5.3				MPCA			36
06/13/82							5.2				MPCA			36
06/27/82							4.0				MPCA			40
07/04/82							3.4				MPCA			43
07/18/82							3.2				MPCA			43
08/01/82							3.2				MPCA			43
08/09/82							3.7				MPCA			41
08/17/82							3.5				MPCA			42
06/04/83							6.1				MPCA			34
06/12/83							6.1				MPCA			34
06/18/83							7.3				MPCA			31
07/03/83							5.3				MPCA			36
07/13/83							4.7				MPCA			38
07/19/83							3.8				MPCA			41
08/06/83							4.0				MPCA			40
08/14/83							3.8				MPCA			41
08/27/83							3.7				MPCA			41
09/04/83							3.8				MPCA			41
09/17/83							4.7				MPCA			38
10/01/83							5.0				MPCA			37
06/02/84							6.3				MPCA			34
06/12/84							3.2				MPCA			43
06/19/84							3.0				MPCA			44
06/27/84							4.0				MPCA			40
07/15/84							5.8				MPCA			35
07/23/84							5.0				MPCA			37
07/26/84							4.4				MPCA			39
07/28/84							4.1				MPCA			40
08/05/84							3.8				MPCA			41
08/08/84							3.2				MPCA			43

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
08/24/84							4.0				MPCA			40
09/01/84							4.9				MPCA			37
09/15/84							5.2				MPCA			36
09/28/84							5.3				MPCA			36
06/09/85							5.5				MPCA			35
06/17/85							3.7				MPCA			41
06/24/85							4.1				MPCA			40
07/01/85							3.5				MPCA			42
07/07/85							4.0				MPCA			40
07/20/85							3.8				MPCA			41
07/27/85							3.2				MPCA			43
08/10/85							3.4				MPCA			43
08/17/85							3.2				MPCA			43
08/25/85							3.8				MPCA			41
09/05/85							5.5				MPCA			35
04/25/86							3.2				MPCA			43
05/03/86							2.7				MPCA			45
05/11/86							2.9				MPCA			45
05/24/86							4.0				MPCA			40
05/31/86							6.1				MPCA			34
06/14/86							2.4				MPCA			47
06/28/86							3.2				MPCA			43
07/11/86							2.9				MPCA			45
07/20/86							2.6				MPCA			46
07/27/86							2.7				MPCA			45
08/09/86							3.4				MPCA			43
08/22/86							3.7				MPCA			41
08/30/86							4.3				MPCA			39
09/07/86							4.0				MPCA			40
05/30/87							5.3	1	1		MPCA			36
06/11/87							4.7	1	1		MPCA			38
06/18/87							3.2	2	1		MPCA			43
07/02/87							3.8	2	2		MPCA			41
07/11/87							3.7	2	2		MPCA			41
07/22/87							4.1	2	2		MPCA			40
07/29/87							3.8	2	2		MPCA			41
08/22/87							4.4	2	2		MPCA			39
08/29/87							4.7	1	2		MPCA			38
09/12/87							5.3	1	2		MPCA			36
09/30/87							5.8	1	1	0%	MPCA			35
05/21/88							5.3	2	1		MPCA			36
05/28/88							4.1	2	1		MPCA			40
06/11/88							4.0	2	1		MPCA			40
06/17/88							4.0	2	1		MPCA			40
06/25/88							3.5	2	1		MPCA			42
07/09/88							4.1	2	1		MPCA			40
07/23/88							4.6	2	1		MPCA			38
07/29/88							4.7	1	1		MPCA			38

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
08/07/88							5.3	1	1		MPCA			36
09/03/88							5.3	1	1		MPCA			36
09/09/88							5.2	1	1	0%	MPCA			36
06/02/89							3.5	1	1		MPCA			42
06/09/89							4.6	1	1		MPCA			38
06/16/89							4.4	1	1		MPCA			39
06/25/89							4.1	1	1		MPCA			40
07/05/89							3.5	1	1		MPCA			42
07/28/89							4.0	1	1		MPCA			40
08/05/89							4.6	1	1		MPCA			38
08/07/89							4.0	1	1		MPCA			40
08/26/89							4.3	1	1		MPCA			39
09/04/89							4.4	1	1	0%	MPCA			39
06/10/90							4.3	2	1		MPCA			39
06/19/90							4.6	1	1		MPCA			38
06/22/90							4.6	1	1		MPCA			38
07/08/90							3.4	2	1		MPCA			43
07/13/90							3.0	1	1		MPCA			44
07/28/90							2.7	1	1		MPCA			45
08/11/90							3.4	1	1		MPCA			43
08/24/90							4.3	1	1	0%	MPCA			39
05/19/91							4.9	1	1		MPCA			37
05/27/91							4.0	1	1		MPCA			40
05/31/91							3.4	1	1		MPCA			43
06/08/91							4.3	1	1		MPCA			39
06/15/91							4.3	1	1		MPCA			39
07/12/91							4.3	1	1		MPCA			39
07/20/91							4.3	1	1		MPCA			39
08/10/91							5.5	1	1		MPCA			35
08/18/91							4.9	1	1		MPCA			37
09/14/91							6.4	1	1	0%	MPCA			33
05/30/92							5.0	1	1		MPCA			37
06/06/92							4.9	1	1		MPCA			37
06/21/92							3.7	1	1		MPCA			41
07/05/92							4.0	1	1		MPCA			40
07/12/92							5.2	1	1		MPCA			36
08/02/92							5.2	1	1		MPCA			36
09/13/92							6.1	1	1	0%	MPCA			34
05/14/93							4.0	1	1		MPCA			40
06/10/93							4.0	1	1		MPCA			40
06/20/93							3.5	1	1		MPCA			42
06/27/93							6.4	1	1		MPCA			33
07/04/93							5.3	1	1		MPCA			36
07/15/93							4.6	1	1		MPCA			38
07/17/93							5.2	1	1		MPCA			36
08/10/93							6.1	1	1		MPCA			34
09/09/93							5.0	1	1		MPCA			37

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
09/29/93							4.0	1	1		MPCA			40
05/14/93	12:25	20.0	5		1.5		4.0	1	1		CAMP	27	35	40
06/10/93	10:50	19.5	10		4.5		4.0	1	1		CAMP	37	45	40
07/15/93	12:15	23.0	10		2.3		4.5	1	1		CAMP	37	39	38
08/06/93	9:00	25.3	10				5.7	1	1		CAMP	37		35
08/10/93	11:55	25.0	5		2.4		6.0	1	1		CAMP	27	39	34
09/09/93	11:05	19.0	20		4.1		5.0	1	1		CAMP	47	44	37
09/29/93	11:15	12.0	10		8.0		4.0	1	1	0%	CAMP	37	51	40
06/06/94							5.6	1	1		MPCA			35
06/20/94							4.3	1	1		MPCA			39
07/05/94							4.6	1	1		MPCA			38
07/09/94							4.6	1	1		MPCA			38
07/18/94							4.3	1	1		MPCA			39
07/26/94							4.4	1	1		MPCA			39
08/07/94							4.0	1	1		MPCA			40
08/15/94							4.4	1	1		MPCA			39
08/22/94							4.6	1	1		MPCA			38
09/10/94							4.6	1	1	0%	MPCA			38
06/03/95							6.4	1	1		MPCA			33
06/17/95							5.8	1	1		MPCA			35
06/23/95							3.8	1	1		MPCA			41
07/07/95							3.4	1	1		MPCA			43
07/14/95							3.5	1	1		MPCA			42
07/26/95							3.4	1	1		MPCA			43
08/08/95							3.7	1	1		MPCA			41
08/18/95							4.1	1	1		MPCA			40
09/04/95							4.4	1	1		MPCA			39
09/16/95							6.1	1	1	0%	MPCA			34
05/23/96							6.4	1	1		MPCA			33
06/02/96							5.2	1	1		MPCA			36
06/15/96							4.7	1	1		MPCA			38
06/20/96							4.1	1	1		MPCA			40
06/29/96							3.5	1	1		MPCA			42
07/12/96							3.8	1	1		MPCA			41
07/19/96							3.8	1	1		MPCA			41
07/31/96							3.8	1	1		MPCA			41
08/20/96							4.3	1	1		MPCA			39
08/29/96							5.0	1	1		MPCA			37
04/29/96	15:30	10.0	10		3.4		2.7	2	2		CAMP	37	43	46
05/08/96	16:00	14.0	10		2.4		3.4	2	2		CAMP	37	39	42
05/23/96	13:15	19.5	20		2.0		6.4	1	1		CAMP	47	37	33
06/04/96	11:30	17.0	10		2.4		5.5	1	1		CAMP	37	39	35
06/20/96	15:00	24.0	10		2.6		4.9	1	1		CAMP	37	40	37
07/11/96	13:40	23.0	20		3.6		3.8	2	2		CAMP	47	43	41
07/23/96	13:15	25.0	10		3.8		4.1	1	1		CAMP	37	44	40
08/08/96	13:15	25.0	10		2.6		4.6	1	1		CAMP	37	40	38
08/28/96	13:30	25.0	80		4.7		4.9	1	1		CAMP	67	46	37

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
09/13/96	14:30	19.0	20		3.8		3.8	2	3		CAMP	47	44	41
09/25/96	11:30	16.0	20		2.2		4.6	2	2		CAMP	47	38	38
10/07/96	12:15	13.0	20		2.1		5.2	1	1		CAMP	47	38	36
10/21/96	14:30	10.0	20		5.2		2.0	3	4	6%	CAMP	47	47	50
06/04/97							2.9	1	1		MPCA			45
06/20/97							4.0	1	1		MPCA			40
07/09/97							3.7	1	1		MPCA			41
07/16/97							3.4	1	1		MPCA			43
07/30/97							3.8	1	1		MPCA			41
08/14/97							3.7	1	1		MPCA			41
08/24/97							5.5	1	1	0%	MPCA			35
04/15/98							3.5	1	1		MPCA			42
04/28/98							5.8	1	1		MPCA			35
05/11/98							4.7	1	1		MPCA			38
05/26/98							4.6	1	1		MPCA			38
05/28/98							4.3	1	1		MPCA			39
06/06/98							3.8	1	1		MPCA			41
06/08/98							4.3	1	1		MPCA			39
06/22/98							4.6	1	1		MPCA			38
06/28/98							4.4	1	1		MPCA			39
07/07/98							4.9	1	1		MPCA			37
07/12/98							4.3	1	1		MPCA			39
07/19/98							4.3	1	1		MPCA			39
07/20/98							3.5	1	1		MPCA			42
08/01/98							4.6	1	1		MPCA			38
08/05/98							4.1	1	1		MPCA			40
08/08/98							4.6	1	1		MPCA			38
08/15/98							4.7	1	1		MPCA			38
08/31/98							3.4	1	1		MPCA			43
09/02/98							3.7	2	2		MPCA			41
09/05/98							3.7	2	2		MPCA			41
09/14/98							4.0	1	1		MPCA			40
09/19/98							4.1	1	1		MPCA			40
09/26/98							4.6	1	2		MPCA			38
09/28/98							5.0	1	1		MPCA			37
10/03/98							4.9	1	1		MPCA			37
10/16/98							4.9	1	1		MPCA			37
04/15/98	12:00	11.5	30		2.5		3.1	1	2		CAMP	53	40	44
04/28/98	10:45	15.5	20		1.0		5.8	1	1		CAMP	47	31	35
05/11/98	11:30	19.8	20		0.5		4.7	1	1		CAMP	47	24	38
05/26/98	11:50	21.5	20		1.3		4.6	2	2		CAMP	47	33	38
06/08/98	11:35	19.0	10		3.0		4.3	2	2		CAMP	37	41	39
06/22/98	11:30	23.5	10		1.4		4.6	2	1		CAMP	37	34	38
07/07/98	10:50	25.0	10		2.5		4.9	1	1		CAMP	37	40	37
07/10/98		24.0	10		4.2		4.8	1	1		CAMP	37	45	37
07/20/98	11:00	28.0	10		3.0		3.5	2	1		CAMP	37	41	42
08/05/98	10:10	23.0	10		2.7		4.1	2	1		CAMP	37	40	40
08/19/98	10:00	23.0	20		5.1		4.1	2	1		CAMP	47	47	40
08/31/98	12:00	25.0	20		6.9		3.4	1	1		CAMP	47	50	42

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
09/14/98	10:15	23.5	10		4.9		4.0	2	1		CAMP	37	46	40
09/28/98	10:40	19.0	20		3.7		5.0	1	1		CAMP	47	43	37
10/15/98	10:20	11.5	10		1.8		3.4	1	1	0%	CAMP	37	36	42
04/03/99							5.2	1	1		MPCA			36
05/30/99							4.6	1	1		MPCA			38
06/16/99							4.4	1	1		MPCA			39
06/30/99							4.7	1	1		MPCA			38
07/01/99							4.6	1	1		MPCA			38
07/04/99							4.7	1	1		MPCA			38
07/10/99							3.4	1	1		MPCA			43
07/23/99							4.7	1	1		MPCA			38
08/12/99							3.8	2	2		MPCA			41
08/14/99							3.8	1	1		MPCA			41
08/15/99							4.0	2	2		MPCA			40
08/26/99							3.7	2	1		MPCA			41
09/01/99							4.4	1	1		MPCA			39
09/11/99							4.6	1	1		MPCA			38
10/10/99							3.7	2	2		MPCA			41
10/31/99							3.8	2	2		MPCA			41
04/20/99	12:00	10.2	20		3.2		4.6	2	1		CAMP	47	42	38
05/11/99	14:15	16.4	20		5.0		4.3	2	2		CAMP	47	46	39
05/26/99	12:00	18.4	10		4.8		4.1	2	1		CAMP	37	46	40
06/10/99	14:00	24.2	20		3.0		4.3	1	1		CAMP	47	41	39
06/22/99	13:40	22.9	40		1.8		4.0	2	1		CAMP	57	36	40
07/06/99	12:20	26.5	20		3.0		4.6	1	1		CAMP	47	41	38
07/20/99	9:50	25.7	30		4.6		3.5	1	1		CAMP	53	46	42
08/04/99	14:32	26.6	20		5.0		3.5	2	2		CAMP	47	46	42
08/09/99		24.2	20		14.0		3.2	2	2		CAMP	47	56	43
08/24/99	13:10	23.4	20		18.0		2.7	2	1		CAMP	47	59	46
09/08/99	14:40	22.2	20		4.0		3.5	2	1		CAMP	47	44	42
09/23/99	11:45	17.2	30		3.0		5.3	1	1		CAMP	53	41	36
10/04/99	13:45	13.3	20		2.1		5.2	1	1		CAMP	47	38	36
10/20/99	14:30	10.6	30		5.6		2.6	2	2	0%	CAMP	53	48	46
04/23/00							6.3	1	1		MPCA			34
05/26/00							4.9	1	1		MPCA			37
06/14/00							3.7	1	1		MPCA			41
06/17/00							3.5	1	1		MPCA			42
06/30/00							5.1	1	1		MPCA			37
07/08/00							5.0	1	1		MPCA			37
07/09/00							4.7	1	1		MPCA			38
07/15/00							5.0	1	1		MPCA			37
07/20/00							4.1				MPCA			40
08/06/00							3.0	1			MPCA			44
08/09/00							4.0	2	2		MPCA			40
08/18/00							4.0	2	2		MPCA			40
08/25/00							4.6				MPCA			38
09/02/00							4.4				MPCA			39
09/24/00							6.3	1	1		MPCA			34
10/11/00							4.1	2	2		MPCA			40

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
10/18/00							5.2	1	1		MPCA			36
04/12/00	13:52	8.4	20	660	3.1		4.3	1	1		CAMP	47	42	39
05/24/00	12:30	19.7	10	580	1.6		3.1	2			CAMP	37	35	44
06/08/00	11:15	9.9	20	520	2.7		5.2	1	1		CAMP	47	40	36
06/22/00	11:00	20.9	20	570	3.3		3.8	1	1		CAMP	47	42	41
07/06/00	11:00	25.7	10	620	2.3		4.4	2			CAMP	37	39	39
07/19/00	10:30	24.1	10	560	5.6		4.3	1	1		CAMP	37	48	39
07/31/00	12:00	26.7	10	710	4		3.5	1	1		CAMP	37	44	42
08/10/00	11:15	26.7	20	650	4.9		3.4	1	1		CAMP	47	46	43
08/23/00	11:15	23.3	20	890	7		3.5	2	1		CAMP	47	50	42
08/29/00	13:46	24.2	20	960	6.4		3.5		1		CAMP	47	49	42
09/14/00	8:51	20.5	40	1400	4.4		3.8	2	1		CAMP	57	45	41
09/28/00	11:17	15.1	20	650	2		6.6	1	2		CAMP	47	37	33
10/09/00		11.2	20	990	2.7		3.1	2			CAMP	47	40	44
10/18/00		13.5	10	430	2.1		5.2	1		0%	CAMP	37	38	36
07/12/01							4.0	1	1		MPCA			40
07/13/01							4.0	1	1		MPCA			40
07/22/01							4.5	1	1		MPCA			38
07/27/01							4.6	1	1		MPCA			38
08/11/01							3.0	2	1		MPCA			44
08/14/01							3.8	1	1		MPCA			41
08/18/01							3.5	1	1		MPCA			42
08/21/01							4.0	1	1		MPCA			40
08/27/01							3.8	1	1		MPCA			41
08/28/01							4.1	1	1		MPCA			40
09/07/01							5.5	1	1		MPCA			35
09/08/01							4.1	1	1		MPCA			40
09/14/01							3.4	2	1		MPCA			43
09/22/01							4.9	1	1		MPCA			37
09/25/01							5.3	1	1		MPCA			36
10/01/01							5.3	1	1		MPCA			36
04/27/01	13:00		30	550	6.7		2.7	2	1		CAMP	53	49	45
05/15/01	12:20	21.1	20	500	3.8		4.3	1	1		CAMP	47	44	39
05/30/01	12:55	18.7	20	610	5.6		4.6	1	1		CAMP	47	48	38
06/07/01	11:30	17.8	20	680	11		2.9	1	1		CAMP	47	54	45
06/20/01	11:30	23.1	20	610	4.7		3.5	1	1		CAMP	47	46	42
06/28/01	10:50	27.4	20	660	4.3		5.2	1	1		CAMP	47	45	36
07/10/01	12:10	26.6	20	650	4.8		3.2	2	2		CAMP	47	46	43
07/25/01	11:15	26.9	5	470	6.6		3.7	2	2		CAMP	27	49	41
08/07/01	12:31	30.2	20	760	3.8		4.6	1	2		CAMP	47	44	38
08/14/01	11:20	25.2	20	790	5.6		3.4	1	1		CAMP	47	48	43
08/28/01	11:02	24.9	30	570	2.9		4.9	1	1		CAMP	53	41	37
09/13/01	11:20	20.5	10	670	3.6		5.3	1	1		CAMP	37	43	36
09/28/01		16	20	580	1.7		6.4	2	2		CAMP	47	36	33
10/11/01	13:05	12			2.4		3.7	1	1	0%	CAMP		39	41
06/11/02							4.9				MPCA			37
06/17/02							4.0				MPCA			40
06/25/02							4.6				MPCA			38

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
07/02/02							5.3				MPCA			36
07/16/02							5.2				MPCA			36
07/26/02							5.0				MPCA			37
08/01/02							5.2				MPCA			36
08/15/02							5.2				MPCA			36
08/24/02							5.0				MPCA			37
04/22/02		11.2	10	430	1.9		4.9	1	1		CAMP	37	37	37
05/10/02	13:50	10.4	21	400	1.5		5.8	1	1		CAMP	48	35	35
05/28/02	14:00	19.1	26	670	1.1		5.6	1	1		CAMP	51	32	35
06/11/02	10:10	22.5	19	620	4.3		4.3	1	1		CAMP	47	45	39
06/26/02		25.3	16	720	2		4.1	1	1		CAMP	44	37	40
07/09/02		28.7	14	660	2.1		3.8	1	1		CAMP	42	38	41
07/29/02		26.2	10	770	1.9		5.2	1	1		CAMP	37	37	36
08/08/02	11:30	23.9	14	580	2.6		4.9	1	1		CAMP	42	40	37
08/20/02	13:25	22.4	49	520	3		4.6	1	1		CAMP	60	41	38
09/06/02		23.8	15	720	3.3		4.3	1	3		CAMP	43	42	39
09/18/02		21.5	14	730	2.9		3.7	1	2		CAMP	42	41	41
10/01/02		16.7	10	650	1.7		6.6	1	1		CAMP	37	36	33
10/16/02		10.9	12	470	2.5		3.5	1	1		CAMP	40	40	42
10/29/02	11:00	6.0	15	520	3.6		5.0	1	1	13%	CAMP	43	43	37
04/15/03	11:50	13.9	19	650	3		4.0	2	2		CAMP	47	41	40
05/06/03	10:55	13.2	14	470	3.6		5.5	1	1		CAMP	42	43	35
05/16/03	9:40	16.7	11	500	2.1		5.8	2	2		CAMP	39	38	35
05/27/03	12:40	20.6	13	380	1.5		6.1	1	1		CAMP	41	35	34
06/11/03	11:30	NA	15	480	3.4		4.4	1	1		CAMP	43	43	39
06/24/03	13:25	20.7	18	550	5.1		4.6	1	1		CAMP	46	47	38
07/11/03	10:40	22.5	17	410	2.7		4.4	1	1		CAMP	45	40	39
07/23/03	12:10	23.1	12	490	2.7		4.3	2	3		CAMP	40	40	39
08/06/03	10:45	24.4	18	490	3.2		4.0	2	3		CAMP	46	42	40
08/21/03	10:30	26.5	11	770	4.2		3.4	3	3		CAMP	39	45	43
09/04/03	14:25	22.9	19	520	4.1		4.6	1	1		CAMP	47	44	38
09/18/03	10:00	20.0	22	700	3.9		4.6	1	1		CAMP	49	44	38
10/01/03	10:00	11.4	13	500	2.6		4.9	2	1		CAMP	41	40	37
10/14/03	10:40	13.8	22	590	3.1		5.0	1	1	38%	CAMP	49	42	37
04/22/04	12:20	12.2	24	620	3.9		3.7	2	2		CAMP	50	44	41
05/04/04	10:50	13.0	19	460	2.6		4.9	2	2		CAMP	47	40	37
05/18/04	11:30	17.0	19	650	3.3		5.2	2	1		CAMP	47	42	36
06/02/04	13:45	17.0	20	860	2.6		5.2	2	2		CAMP	47	40	36
06/16/04	11:30	22.7	25	610	4.1		4.4	2	2		CAMP	51	44	39
06/29/04	11:10	20.8	19	520	3.0		5.0	3	2		CAMP	47	41	37
07/14/04	12:30	25.1	16	570	3.8		4.7	2	2		CAMP	44	44	38
07/26/04	11:45	25.7	15	380	3.1		5.0	2	2		CAMP	43	42	37
08/12/04	11:30	19.5	12	480	4.1		5.0	3	2		CAMP	40	44	37
08/25/04	12:00	20.4	18	550	3.9		5.2	2	2		CAMP	46	44	36
09/09/04	12:45	20.6	29	370	2.3		4.9	2	2		CAMP	53	39	37
09/22/04	11:00	19.9	27	500	3.8		6.4	3	2		CAMP	52	44	33
10/06/04	12:30	13.9	22	550	3.2		6.2	3	2		CAMP	49	42	34
10/20/04	13:15	9.3	19	540	4.2		2.9	2	2	0%	CAMP	47	45	45

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
Summer Mean														
1974 Ave							4.7							38
1975 Ave														
1976 Ave														
1977 Ave														
1978 Ave							2.4							48
1979 Ave							3.0							44
1980 Ave							3.1							44
1981 Ave							3.1							44
1982 Ave							3.9							40
1983 Ave							4.9							37
1984 Ave							4.4							39
1985 Ave							4.0							40
1986 Ave							3.2							43
1987 Ave							4.4	1.6	1.7	0%				39
1988 Ave							4.5	1.6	1.0	0%				38
1989 Ave							4.1	1.0	1.0	0%				40
1990 Ave							3.8	1.3	1.0	0%				41
1991 Ave							4.8	1.0	1.0	0%				37
1992 Ave							4.8	1.0	1.0	0%				37
1993 Ave			11	600	4.3		4.9	1.0	1.0	0%		39	45	37
1994 Ave							4.5	1.0	1.0	0%				38
1995 Ave							4.5	1.0	1.0	0%				38
1996 Ave			23	660	3.2		4.4	1.2	1.2	13%		49	42	39
1997 Ave							3.8	1.0	1.0	0%				41
1998 Ave			13	600	3.7		4.2	1.3	1.1	0%		41	44	39
1999 Ave			24	700	6.3		4.1	1.4	1.2	0%		50	49	40
2000 Ave			19	753	4.3		4.3	1.3	1.2	0%		47	45	39
2001 Ave			19	644	4.9		4.2	1.2	1.2	0%		46	46	39
2002 Ave			19	665	2.8		4.7	1.0	1.4	13%		47	41	38
2003 Ave			17	551	3.7		4.3	1.5	1.8	38%		45	43	39
2004 Ave			20	538	3.4		5.1	2.3	2.0	0%		47	43	37
Total Ave			18	635	4.1		4.1	1.3	1.2	4%		46	44	40
Grade												Average Annual Grade		
1974 Grade							A					A		
1975 Grade														
1976 Grade														
1977 Grade														
1978 Grade							B					B		
1979 Grade							B					B		
1980 Grade							A					A		
1981 Grade							A					A		
1982 Grade							A					A		
1983 Grade							A					A		
1984 Grade							A					A		
1985 Grade							A					A		
1986 Grade							A					A		
1987 Grade							A					A		
1988 Grade							A					A		
1989 Grade							A					A		

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
1990 Grade							A						A	
1991 Grade							A						A	
1992 Grade							A						A	
1993 Grade			A		A		A						A	
1994 Grade							A						A	
1995 Grade							A						A	
1996 Grade			B		A		A						A	
1997 Grade							A						A	
1998 Grade			A		A		A						A	
1999 Grade			B		A		A							
2000 Grade			A		A		A						A	
2001 Grade			A		A		A						A	
2002 Grade			A		A		A						A	
2003 Grade			A		A		A						A	
2004 Grade			A		A		A						A	
Letter Grade			A		A		A						A	

Little Comfort Lake
DNR ID #13-54
Wyoming Township, Chisago County

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
05/29/94	16:00						2.1	2	3		MPCA			49
06/02/94	16:15						2.1	3	2		MPCA			49
06/12/94	16:00						2.0	3	2		MPCA			50
06/16/94	16:15	23.6	63	1370	17		2.0	2	2		MPCA	64	58	50
07/05/94	15:50						2.0	3	2		MPCA			50
07/14/94	16:20	24.1	59	1390	39.4		1.8	2	1		MPCA	63	67	52
08/15/94	16:00						1.4	2	2		MPCA			55
08/25/94	15:45	26.2	35	1060	15.4		1.8	3	2		MPCA	55	57	52
09/14/94	15:50	22.2	46	1200	56.7		1.4	2	2	0%	MPCA	59	70	55
11/28/1997			31								CWP	54		
12/13/1997			48		10		2.3				CWP	60	53	48
1/21/1998			28		1		2.3				CWP	52	37	48
2/21/1998			67		2		2.9				CWP	65		45
3/25/1998			46								CWP	59	48	
4/30/1998			20		6						CWP	47	41	
5/15/1998			29		3		2.4				CWP	53	44	47
5/31/1998			40		4		1.4				CWP	57	44	55
6/17/1998			37		4		1.2				CWP	56	48	57
6/29/1998			56		6		1.2				CWP	62	61	57
7/13/1998			79		22		0.8				CWP	67	66	63
7/30/1998			69		36		0.6				CWP	65	66	66
8/20/1998			64		37		0.7				CWP	64	65	65

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
8/31/1998			86		32		0.9				CWP	68	41	61
9/21/1998			15		3		0.9				CWP	43		61
9/30/1998			62				1.5				CWP	64		54
10/9/1998			40				1.3				CWP	57		56
11/2/1998			46				1.8				CWP	59		52
Summer Mean														
1994 Ave		24.0	50.8	1255	32.1		1.8	2.5	1.9	0%		60	63	52
1998 Ave			55.8		18.0		1.0					61	58	61
Total Ave			53.3	1255	25.1		1.4	2.5	1.9	0%		61	60	56
Grade												Average Annual Grade		
1994 Grade			C		C		C					C		
1998 Grade			C		B		D					C		
Letter Grade			C		B+		C-					C		

Shields Lake
DNR ID #82-162
Forest Lake Township, Washington County

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/12/89	13:00						0.43				MPCA			72
06/15/90	15:45		300	2800			0.46				MPCA	86		71
06/22/90	18:55							4	5		MPCA			
07/13/90	11:00		350	2700			0.11	5	5		MPCA	89		92
08/24/90	9:08		280	2800			1.07	1	2	67%	MPCA	85		59
05/31/91	12:35		240	2000			1.52				MPCA	83		54
07/12/91	10:15		110	1900			1.22				MPCA	72		57
08/15/91	11:00		90	1600			1.68				MPCA	69		53
06/02/92	11:45		40	2000			1.70				MPCA	57		52
07/09/92	9:35		100	1800			0.90				MPCA	71		62
08/12/92	9:30		130	2300			0.60				MPCA	74		67
05/14/93	13:45	21.0	90.0	1490	27.0		1.5	3	2		CAMP	69	63	54
06/10/93	12:00	20.0	120.0	20000	11.0		2.1	2	2		CAMP	73	54	49
07/15/93	11:15	24.0	130.0	1400	15.0		0.6	4	2		CAMP	74	57	67
08/10/93	10:50	24.5	140.0	1300	6.3		1.5	3	2		CAMP	75	49	54
09/09/93	12:20	18.5	260.0	2300	33.0		1.0	3	2		CAMP	84	65	60
09/29/93	12:15	12.0	300.0	2400	62.0		1.0	3	1	0%	CAMP	86	71	60
04/20/94	13:55	11.0	120.0	1900	26.0		1.0	2	1		CAMP	73	63	60
05/05/94	13:00	13.0	120.0	1500	3.4		2.0	1	1		CAMP	73	43	50
05/19/94	9:50	20.0	110.0	900	7.0		3.0	2	1		CAMP	72	50	44
05/31/94	10:45	22.0	170.0	2000	68.0		1.0	4	3		CAMP	78	72	60

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/16/94	10:45	24.0	170.0	1800	6.4		2.4	2	2		CAMP	78	49	47
06/27/94	11:20	25.5	170.0	1500	43.0		1.0	3	2		CAMP	78	67	60
07/15/94	9:45	24.0	120.0	1200	20.0		1.0	4	3		CAMP	73	60	60
07/28/94	10:00	23.5	140.0	1100	24.0		0.8	3	4		CAMP	75	62	63
08/11/94	12:15	19.5	190.0	1600	17.0		1.2	3	2		CAMP	80	58	57
08/25/94	11:00	25.0	110.0	1600	20.0		0.8	4	3		CAMP	72	60	63
09/13/94	10:45	22.0	90.0	1400	20.0		0.6	4	4		CAMP	69	60	67
09/20/94	11:05	21.0	170.0	2000	36.0		1.4	3	2		CAMP	78	66	55
10/05/94	11:20	13.5	290.0	2230	47.0		1.4	3	2		CAMP	86	68	55
10/20/94	11:25	13.5	230.0	2000	11.0		2.3	2	1	50%	CAMP	83	54	48
04/14/95	10:00	5.0	160.0	2300	23.0		1.7	1	1		CAMP	77	61	52
04/25/95	10:55	10.0	140.0	2100	34.0		1.2	2	1		CAMP	75	65	57
05/11/95	11:50	13.0	150.0	2000	2.0		3.5	1	1		CAMP	76	37	42
05/23/95	10:30	17.0	100.0	1900	4.0		3.1	3	3		CAMP	71	44	44
06/08/95	11:00	17.0	90.0	1800	2.3		2.4	2	2		CAMP	69	39	47
06/21/95	12:20	29.0	100.0	1800	10.0		2.1	5	4		CAMP	71	53	49
07/06/95	13:30	20.0	160.0	2200	75.0		1.4	4	3		CAMP	77	73	55
07/20/95	9:30	24.5	340.0	2300	3.0		2.8	4	3		CAMP	88	41	45
08/03/95	13:10	25.0	230.0	1100	2.6		1.5	3	3		CAMP	83	40	54
08/15/95	10:15	24.5	380.0	1800	3.3		2.3	2	2		CAMP	90	42	48
08/30/95	9:35	23.5	210.0	2100	33.0		2.7	2	2		CAMP	81	65	46
09/13/95	9:30	20.0	160.0	2000	18.0		1.7	4	4		CAMP	77	59	52
10/02/95	10:30	15.5	230.0	1800	62.0		1.7	2	2		CAMP	83	71	52
10/18/95	9:40	11.0	260.0	1500	4.9		2.3	2	3	63%	CAMP	84	46	48
04/29/96	14:45	10.0	220.0	1700	24.0		1.5	3	2		CAMP	82	62	54
05/08/96	15:15	11.0	200.0	2400	28.0		1.5	2	3		CAMP	81	63	54
05/23/96	12:30	19.0	200.0	870	2.1		4.4	2	2		CAMP	81	38	39
06/04/96	10:45	16.5	130.0	1100	3.9		3.5	3	3		CAMP	74	44	42
06/20/96	14:00	23.0	150.0	1500	9.7		3.4	3	3		CAMP	76	53	42
07/11/96	14:20	24.0	200.0	2000	40.0		1.4	3	4		CAMP	81	67	55
07/23/96	13:30	25.5	170.0	1500	9.1		0.6	4	4		CAMP	78	52	67
08/08/96	14:00	26.0	200.0	1900	2.7		1.1	5	5		CAMP	81	40	59
08/28/96	13:00	24.5	240.0	910	2.9		0.9	3	4		CAMP	83	41	62
09/13/96	13:40	19.0	210.0	2700	2.5		4.3	2	3		CAMP	81	40	39
09/25/96	10:45	16.0	170.0	2200	2.2		3.8	2	3		CAMP	78	38	41
10/07/96	11:30	13.0	190.0	2400	1.7		4.1	2	2		CAMP	80	36	40
10/21/96	14:00	10.0	80.0	2100	4.2		4.4	3	4	100%	CAMP	67	45	39
04/24/97	9:20	11.5	110.0	2600	90.0		1.8	3	3		CAMP	72	75	52
05/05/97	11:00	14.0	40.0	1300	0.5		4.3	2	2		CAMP	57	24	39
05/22/97	10:25	15.0	50.0	1700	3.7		3.7	2	3		CAMP	61	43	41
06/05/97	11:00	21.5	30.0	1400	2.5		3.5	3	3		CAMP	53	40	42
06/20/97	14:15	23.0	120.0	1500	0.5		3.0	4	4		CAMP	73	24	44
07/07/97	10:15	20.0	200.0	1100	17.0		2.1	4	4		CAMP	81	58	49
07/16/97	10:25	27.5	210.0	1300	11.0		1.2	5	4		CAMP	81	54	57
07/31/97	9:10	24.0	280.0	1800	7.1		2.1	3	3		CAMP	85	50	49
08/13/97	9:45	21.5	240.0	1600	3.7		3.1	4	4		CAMP	83	43	44
08/27/97	13:30	24.0	180.0	1900	16.0		2.4	3	4		CAMP	79	58	47
09/17/97	15:00	20.0	240.0	1500	7.6		2.6	2	3		CAMP	83	50	46
10/01/97	11:27	16.0	240.0	1200	23.0		3.7	2	2		CAMP	83	61	41

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
10/17/97	11:45	13.0	270.0	1600	1.2		3.7	2	2	100%	CAMP	85	32	41
04/15/98	11:15	11.5	160.0	1800	3.0		2.7	2	2		CAMP	77	41	46
04/28/98	10:10	15.5	110.0	1200	2.1		4.9	2	3		CAMP	72	38	37
05/11/98	10:30	19.4	180.0	1300	1.5		3.7	3	4		CAMP	79	35	41
05/26/98	10:15	21.0	350.0	1500	3.6		3.5	2	2		CAMP	89	43	42
06/08/98	10:55	18.5	250.0	1400	2.2		3.1	2	2		CAMP	84	38	44
06/22/98	10:40	23.0	250.0	1100	5.3		3.2	2	3		CAMP	84	47	43
07/07/98	9:30	24.5	320.0	1500	42.0		1.2	3	3		CAMP	87	67	57
07/20/98	10:15	27.0	280.0	2100	76.0		0.5	3	3		CAMP	85	73	70
08/05/98	9:30	22.0	170.0	1600	40.0		0.9	3	3		CAMP	78	67	62
08/19/98	9:30	22.5	180.0	2400	107.0		0.8	3	3		CAMP	79	76	63
08/31/98	11:00	24.0	190.0	2200	29.0		1.5	2	3		CAMP	80	64	54
09/14/98	9:40	23.0	140.0	1700	40.0		0.9	3	3		CAMP	75	67	62
09/28/98	10:00	18.0	200.0	1700	18.0		2.0	2	2		CAMP	81	59	50
10/15/98	9:30	11.5	450.0	2900	6.2		2.1	2	2	78%	CAMP	92	48	49
04/20/99	10:45	10.0	220.0		18.0		1.5	2	2		CAMP	82	59	54
05/11/99	13:00	16.5	90.0		5.6		2.4	2	2		CAMP	69	48	47
05/26/99	11:30	17.5	170.0		13.0		1.8	2	3		CAMP	78	56	52
06/10/99	13:14	23.3	230.0		11.0		2.0	2	2		CAMP	83	54	50
06/22/99	13:00	23.4	360.0		18.0		1.4	3	3		CAMP	89	59	55
07/06/99	11:36	26.3	240.0		78.0		1.1	4	3		CAMP	83	73	59
07/19/99	14:00	28.0	240.0		35.0		0.9	4	3		CAMP	83	65	62
08/04/99	13:30	26.1	380.0		30.0		0.6	5	5		CAMP	90	64	67
08/09/99		24.5	390.0		48.0		0.7	3	4		CAMP	90	69	65
08/24/99	12:40	23.1	390.0		83.0		0.8	3	3		CAMP	90	74	63
09/08/99	15:20	22.0	300.0		86.0		0.8	4	4		CAMP	86	74	63
09/23/99	11:15	16.8	40.0		50.0		0.9	3	4		CAMP	57	69	62
10/04/99	13:10	12.9	30.0		46.0		0.9	3	3		CAMP	53	68	62
10/20/99	14:00	10.2	40.0		35.0		1.4	2	2	89%	CAMP	57	65	55
04/12/00	13:15	8.7	80.0	1500	22		1.4	2	2		CAMP	67	61	55
05/23/00	12:00	19	180.0	1600	9.1		2.4	2	3		CAMP	79	52	47
06/08/00	10:45	21.5	320.0	1600	26		2.9	2	2		CAMP	87	63	45
06/22/00	10:30	20.6	190.0	1900	9.9		2.1		4		CAMP	80	53	49
07/06/00	10:21	25.7	170.0	1600	67		1.8	2	3		CAMP	78	72	51
07/19/00	10:00	23.4	250.0	1500	50		0.9	3	4		CAMP	84	69	61
07/31/00	11:30	28.2	190.0	2000	59		0.6	4			CAMP	80	71	67
08/10/00	10:45	27	130.0	2000	7.5		0.8	4	4		CAMP	74	50	64
08/23/00	10:40	24.1	140.0	1600	8.1		0.8	5	5		CAMP	75	51	64
08/29/00	13:02	24.4	120.0	2300	23		0.6	5	4		CAMP	73	61	67
09/14/00	9:30	20.3	90.0	1700	3.3		1.2	4	5		CAMP	69	42	57
09/28/00	10:33	14.9	190.0	2600	5.3		3.4	3	4		CAMP	80	47	43
10/09/00		10.6	200.0	6700	18			2	4		CAMP	81	59	
10/18/00		14.3	180.0	2300	69			3	3	89%	CAMP	79	72	
04/27/01	12:30		150	1800	59.0		1.1	3	3		CAMP	76	71	59
05/15/01	11:27	21.3	60	1100	4.3		4.6	1	1		CAMP	63	45	38
05/30/01	12:15	19.1	70	990	9.2		3.2	2	2		CAMP	65	52	43
06/07/01	10:50	17.6	60	1100	5.5		2.3	3	2		CAMP	63	47	48
06/20/01	10:50	22.7	270	1700	6.4		2.4	3			CAMP	85	49	47

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
06/28/01	10:19	27.4	220	1400	15.0		2.1	3	3		CAMP	82	57	49
07/10/01	11:45	26.9	210	1700	22.0		1.4	2	4		CAMP	81	61	55
07/25/01	10:30	25.9	320	1600	22.0		1.8	3	4		CAMP	87	61	51
08/07/01	11:30	30.9	310	1900	36.0		2.1	3	3		CAMP	87	66	49
08/14/01	10:45	26.3	270	2000	50.0		1.2	3	4		CAMP	85	69	57
08/28/01	10:20	24.7	220	1900	29.0		1.3	3	4		CAMP	82	64	56
09/13/01	10:35	20.0	360	1700	32.0		1.2	5	4		CAMP	89	65	57
09/28/01		16.3	210	1500	30.0		2.0	4	4		CAMP	81	64	50
10/17/01	13:25	10.3			13.0		2.4	3	3	89%	CAMP		56	47
04/22/02		10.7	93	1900	57		1.07	3	3		CAMP	70	70	59
05/10/02	13:20	10.8	92	1100	16		1.07	3	3		CAMP	69	58	59
05/28/02	13:25	20.1	167	2300	4.5		2.44				CAMP	78	45	47
06/06/02	11:15	18.5	91	1400	9.8		2.44	3	4		CAMP	69	53	47
06/26/02		24.4	348	1900	18		1.68	3	4		CAMP	89	59	53
07/09/02		28.5	356	2000	38		0.92	3	5		CAMP	89	66	61
07/29/02	11:00	26.6	158	260	68		0.76	3	4		CAMP	77	72	64
08/08/02	12:55	24.3	230	2400	98		0.61	3	4		CAMP	83	76	67
08/20/02		22.6	400	3600	12		1.53	4	5		CAMP	91	55	54
09/06/02		24.7	227	2600	74		0.61	3	3		CAMP	82	73	67
09/18/02		21.5	265	2500	76		6.1	4	4		CAMP	85	73	34
10/01/02		16.3	355	2400	41		1.07	3	4		CAMP	89	67	59
10/16/02		10.5	413	2800	29		1.22	3	3		CAMP	91	64	57
10/29/02	10:20	5.1	312	2100	13		1.98	2	2	100%	CAMP	87	56	50
04/15/03	11:20	14.2	119	3000	45		1.22	3	3		CAMP	73	68	57
05/06/03	10:25	13.1	105	1700	11		1.983	3	4		CAMP	71	54	50
05/16/03	10:30	17.5	116	1700	4.4		2.593	3	3		CAMP	73	45	46
05/29/03	12:30	20	209	1300	7.2		2.288	3	4		CAMP	81	50	48
06/11/03	11:00	NA	478	1600	6.1		2.135	3	4		CAMP	93	48	49
06/27/03	12:54	21.7	624	1600	12		1.525	3	4		CAMP	97	55	54
07/11/03	11:25	21.9	513	2100	23		1.22	3	3		CAMP	94	61	57
07/23/03	12:45	27.4	279	1600	73		0.915	3	4		CAMP	85	73	61
08/06/03	11:20	24.3	267	2000	52		0.915	5	5		CAMP	85	69	61
08/21/03	10:00	26.5	377	3000	110		0.763	4	4		CAMP	90	77	64
09/04/03	13:50	22.7	252	2300	55		0.763	4	4		CAMP	84	70	64
09/18/03	10:30	20.3	260	2400	39		1.067	3	4		CAMP	84	67	59
10/01/03	10:30	10.6	261	2700	29		1.067	4	4		CAMP	84	64	59
10/14/03	11:10	13.8	332	2100	54		0.914	3	4	100%	CAMP	88	70	61
04/22/04	11:35	12.3	110	1900	29.0		1.370	2	2		CAMP	72	64	55
05/04/04	10:20	13.0	72	1400	3.9		2.896	2	4		CAMP	66	44	45
05/18/04	11:00	16.4	64	1200	12.0		3.533	3	5		CAMP	64	55	42
06/02/04	14:30	16.5	181	1800	26.0		1.372	4	4		CAMP	79	63	55
06/16/04	12:15	21.9	145	1700	11.0		1.219	5	5		CAMP	76	54	57
06/29/04	11:45	21.5	362	2500	25.0		1.372	4	4		CAMP	89	62	55
07/14/04	13:00	26.0	303	1800	27.0		1.524	3	3		CAMP	87	63	54
07/26/04	12:30	25.8	202	2400	60.0		0.457	5	5		CAMP	81	71	71
08/12/04	12:00	18.9	230	2300	29.0		0.762	5	4		CAMP	83	64	64
08/25/04	12:30	21.6	227	2600	130.0		0.762	3	3		CAMP	82	78	64
09/09/04	13:15	21.3	215	1900	53.0		0.914	4	4		CAMP	82	70	61
09/22/04	11:30	20.7	194	1800	74.0		0.914	3	2		CAMP	80	73	61

Date	Time	Surface Temp (C)	TP (ug/L)	TKN (ug/L)	CLA (ug/L)	Total Chloride (mg/L)	Secchi (m)	Phys Cond	Rec Suit	% Swimming Impaired	Source	TSI (TP)	TSI (CLA)	TSI (SD)
10/06/04	13:00	13.7	314	2100	40.0		1.219	3	2		CAMP	87	67	57
10/20/04	12:45	9.0	374	2400	21.0		1.372	2	2	89%	CAMP	90	60	55
Summer Mean														
1991 Ave			100	1750			1.4							
1992 Ave			90	2033			1.1							
1993 Ave			190	5480	25.5		1.2	3.0	1.8	0%		80	62	57
1994 Ave			145	1525	23.3		1.2	3.3	2.8	50%		76	61	58
1995 Ave			209	1888	18.4		2.1	3.3	2.9	63%		81	59	49
1996 Ave			184	1726	9.1		2.4	3.1	3.6	100%		79	52	48
1997 Ave			188	1513	8.2		2.5	3.5	3.6	100%		80	51	47
1998 Ave			220	1744	39.9		1.6	2.6	2.8	78%		82	67	54
1999 Ave			286	2170	48.8		1.0	3.4	3.4	89%		86	69	60
2000 Ave			179	1880	25.9		1.5	3.6	3.9	89%		79	63	54
2001 Ave			245	1650	24.8		1.8	3.2	3.6	89%		83	62	52
2002 Ave			259	2083	49.2		1.8	3.3	4.1	100%		84	69	51
2003 Ave			381	2075	46.3		1.2	3.5	4.0	100%		90	68	58
2004 Ave			229	2089	48.3		1.0	4.0	3.8	89%		82	69	60
Total Ave			207	2115	30.6		1.6	3.3	3.4	79%		81	64	54
Grade												Average Annual Grade		
1991 Grade			D				C					C-		
1992 Grade			D				D					D		
1993 Grade			F		C		C					D+		
1994 Grade			D		C		C					C-		
1995 Grade			F		B		C					C-		
1996 Grade			F		A		B					C+		
1997 Grade			F		A		B					C+		
1998 Grade			F		C		C					D+		
1999 Grade			F		D		D					D-		
2000 Grade			F		C		C					D+		
2001 Grade			F		C		C					D+		
2002 Grade			F		D		C					D		
2003 Grade			F		C		C					D+		
2004 Grade			F		C		C					D+		
Total Grade			F		C+		C					D+		

Appendix B: Lake Elevations and Precipitation

Big Comfort Lake

DNR ID #13-53

Wyoming Township, Chisago County

Period of record: 06/11/1952 to 11/29/04

of readings: 615

Highest recorded: 888.32 ft (07/02/1975)

Lowest recorded: 884.8 ft (10/08/1969)

Recorded range: 3.52 ft

Average water level: 886.24 ft

Last reading: 885.93 ft (11/29/2004)

[OHW elevation: 887.2 ft](#)

Datum: 1929 (ft)

Annual Averages	Elevation (ft)
1952	
1965	885.60
1966	
1967	
1968	
1969	884.99
1970	
1971	885.90
1972	886.04
1973	885.93
1974	885.60
1975	886.74
1976	886.01
1977	885.56
1978	886.31
1979	886.16
1980	885.98
1981	885.89
1982	885.96
1983	886.32
1984	887.02
1985	886.23
1986	886.69
1987	886.15
1988	885.99
1989	886.23
1990	886.63
1991	886.95
1992	886.45
1993	886.90
1994	886.45
1995	886.81
1996	886.43
1997	886.49
1998	
1999	886.62
2000	885.92
2001	885.92
2002	886.23

2003	886.19
2004	886.06
Total Average	886.21

	Total Precip (in)
1965	
1966	
1967	
1968	
1969	
1970	
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	30.39
1981	31.26
1982	31.24
1983	30.29
1984	36.74
1985	32.11
1986	35.72
1987	21.92
1988	25.62
1989	23.28
1990	34.72
1991	39.41
1992	25.61
1993	38.00
1994	34.65
1995	42.41
1996	31.87
1997	27.08
1998	30.56
1999	31.96
2000	26.70

2002	41.50
2003	26.53
2004	30.69

Date	Elevation (ft)
6/11/1952	885.76
8/6/1965	885.81
8/20/1965	885.54
8/27/1965	885.44
7/24/1969	885.22
8/6/1969	885.24
8/13/1969	885.04
8/19/1969	885.02
8/26/1969	884.98
9/8/1969	884.88
9/16/1969	884.84
10/8/1969	884.80
10/18/1969	884.92
10/25/1969	884.96
4/29/1970	885.76
5/7/1971	886.13
8/13/1971	885.53
8/31/1971	885.77
11/24/1971	886.17
5/15/1972	886.08
6/12/1972	885.62
7/28/1972	886.54
8/15/1972	886.00
8/31/1972	885.97
5/10/1973	886.11
11/20/1973	885.74
5/23/1974	886.12
7/23/1974	885.70
8/28/1974	885.61

2001	33.00
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9/12/1974	885.54
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9/27/1974	885.40
10/17/1974	885.40
11/25/1974	885.42
2/18/1975	885.68
5/9/1975	887.04
5/21/1975	886.76
6/20/1975	886.93
6/30/1975	888.28
7/2/1975	888.32
8/4/1975	886.33
8/28/1975	886.56
9/10/1975	886.40
10/22/1975	885.68
11/25/1975	886.18
2/10/1976	885.88
3/25/1976	886.81
3/30/1976	887.19
4/21/1976	886.39
4/27/1976	886.13
5/19/1976	885.73
6/21/1976	885.43
7/19/1976	885.33
8/4/1976	885.24
5/16/1977	885.42
6/10/1977	885.65
7/28/1977	885.87
8/23/1977	885.28
3/16/1978	885.79
4/19/1978	886.59
5/16/1978	886.09
6/19/1978	886.89
7/17/1978	886.89
8/15/1978	886.17
8/23/1978	886.22
9/14/1978	886.71
10/16/1978	885.99
11/15/1978	885.79
5/15/1979	886.29
6/14/1979	886.01
7/12/1979	886.41
8/17/1979	885.86
9/18/1979	886.35
11/15/1979	886.03
1/31/1980	885.82
3/21/1980	886.16
4/17/1980	886.32
5/8/1980	885.68
5/13/1980	885.66
6/25/1980	885.64
7/15/1980	885.54
8/13/1980	886.52
9/9/1980	886.78
10/27/1980	886.08
12/29/1980	885.59

1/15/1981	885.54
2/17/1981	885.58
3/24/1981	885.74
4/10/1981	886.52
4/20/1981	886.20
5/19/1981	886.08
6/15/1981	886.39
7/29/1981	886.00
8/24/1981	885.52
9/22/1981	885.56
10/28/1981	885.74
12/9/1981	885.77
4/1/1982	886.80
5/13/1982	886.42
6/17/1982	885.53
7/1/1982	885.53
8/25/1982	885.33
11/18/1982	886.15
4/28/1983	886.63
8/11/1983	885.90
12/12/1983	886.42
5/11/1984	886.83
6/15/1984	887.66
8/30/1984	886.57
1/9/1985	885.75
4/25/1985	886.81
6/18/1985	885.21
7/11/1985	885.05
7/22/1985	885.30
7/29/1985	885.40
7/31/1985	885.44
8/12/1985	886.08
8/19/1985	886.08
8/28/1985	886.18
9/5/1985	886.83
9/16/1985	886.58
9/26/1985	886.78
10/10/1985	886.93
10/18/1985	887.03
10/27/1985	886.98
11/4/1985	886.83
11/10/1985	886.58
11/18/1985	886.48
4/11/1986	887.23
6/4/1986	886.81
6/17/1986	886.47
7/15/1986	886.57
8/13/1986	886.37
4/6/1987	886.10
4/13/1987	886.15
4/24/1987	886.14
6/17/1987	886.05
7/6/1987	886.23
8/21/1987	886.33
8/31/1987	886.23

4/14/1988	886.24
4/21/1988	886.32
7/6/1988	885.72
7/11/1988	885.64
8/4/1988	885.76
9/7/1988	885.82
10/17/1988	886.20
10/26/1988	886.19
5/4/1989	886.59
5/10/1989	886.59
5/16/1989	886.46
5/25/1989	886.45
6/8/1989	886.31
6/15/1989	886.27
6/29/1989	886.16
7/6/1989	886.11
7/12/1989	886.01
8/10/1989	885.83
8/22/1989	885.99
9/20/1989	886.21
10/4/1989	886.11
10/26/1989	886.11
4/16/1990	886.36
4/26/1990	886.49
6/4/1990	887.13
8/10/1990	886.55
4/29/1991	886.84
4/29/1991	886.84
4/29/1991	886.84
6/6/1991	887.17
9/18/1991	887.07
11/20/1991	886.93
4/21/1992	886.84
7/23/1992	886.06
5/4/1993	886.78
5/18/1993	886.53
6/24/1993	888.10
7/15/1993	887.34
8/5/1993	886.55
10/28/1993	886.08
4/18/1994	886.70
4/29/1994	887.48
5/12/1994	887.22
5/19/1994	886.72
6/13/1994	886.14
6/18/1994	886.10
6/21/1994	886.12
6/26/1994	886.12
6/28/1994	886.08
7/2/1994	886.01
7/5/1994	886.29
7/6/1994	886.32
7/9/1994	886.39
7/16/1994	886.17
7/20/1994	886.67

9/24/1987	885.98
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7/22/1994	886.80
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7/22/1994	887.10
7/26/1994	886.61
7/29/1994	886.42
7/31/1994	886.27
8/3/1994	886.37
8/11/1994	886.49
8/14/1994	886.44
8/16/1994	886.39
8/21/1994	886.29
8/24/1994	886.22
8/27/1994	886.27
9/4/1994	886.22
9/22/1994	886.27
10/2/1994	886.22
10/5/1994	886.44
10/6/1994	886.20
10/7/1994	886.87
10/8/1994	886.62
10/12/1994	886.27
10/17/1994	886.62
10/20/1994	886.52
10/23/1994	886.72
10/28/1994	886.52
11/1/1994	886.47
11/5/1994	886.42
11/9/1994	886.37
11/12/1994	886.27
3/22/1995	886.84
3/27/1995	887.06
4/11/1995	886.70
4/19/1995	886.88
4/21/1995	886.94
4/29/1995	886.72
5/2/1995	886.64
5/15/1995	886.52
5/26/1995	886.28
5/28/1995	886.54
6/3/1995	886.66
6/10/1995	886.68
7/1/1995	886.66
7/5/1995	886.82
7/5/1995	886.80
7/12/1995	887.02
7/13/1995	887.04
7/16/1995	887.08
7/23/1995	887.00
7/24/1995	886.94
8/7/1995	886.62
8/14/1995	887.22
8/15/1995	887.33
8/17/1995	887.41
8/24/1995	887.08
8/26/1995	887.09
8/28/1995	887.03
9/4/1995	886.73
9/6/1995	886.66
9/11/1995	886.44

11/1/1995	886.93
11/9/1995	886.85
3/22/1996	886.71
4/12/1996	886.99
4/25/1996	886.85
4/30/1996	886.73
5/8/1996	886.69
5/12/1996	886.63
5/21/1996	887.13
5/30/1996	886.65
6/18/1996	886.43
7/18/1996	886.15
8/26/1996	885.91
8/28/1996	885.75
9/30/1996	885.97
9/30/1996	885.69
10/18/1996	886.17
10/21/1996	886.15
10/23/1996	886.29
10/23/1996	886.27
10/24/1996	886.39
10/30/1996	886.31
11/17/1996	886.73
11/19/1996	886.87
3/19/1997	886.29
3/22/1997	886.39
3/23/1997	886.45
3/25/1997	886.61
3/27/1997	886.89
3/28/1997	887.39
3/29/1997	887.49
3/30/1997	887.59
3/31/1997	887.49
4/2/1997	887.21
4/3/1997	887.20
4/4/1997	887.21
4/6/1997	887.23
4/7/1997	887.21
4/9/1997	887.15
4/10/1997	887.10
4/11/1997	887.04
4/14/1997	886.93
4/14/1997	886.95
4/15/1997	886.87
4/20/1997	886.79
4/22/1997	886.75
4/23/1997	886.71
4/24/1997	886.84
4/25/1997	886.61
4/26/1997	886.59
4/28/1997	886.71
5/4/1997	886.51
5/5/1997	886.51
5/5/1997	886.41
5/7/1997	886.46
5/8/1997	886.44

5/17/1997	886.21
5/19/1997	886.33
5/20/1997	886.11
5/25/1997	886.09
5/28/1997	886.31
6/4/1997	885.91
6/9/1997	886.11
6/16/1997	886.01
6/19/1997	886.01
6/23/1997	885.97
7/3/1997	886.47
7/4/1997	886.55
7/5/1997	886.65
7/7/1997	886.77
7/7/1997	886.71
7/14/1997	886.71
7/18/1997	886.57
7/21/1997	886.69
7/22/1997	886.51
7/25/1997	886.51
8/1/1997	886.35
8/3/1997	886.41
8/11/1997	886.39
8/16/1997	886.01
8/25/1997	886.35
9/1/1997	886.39
9/4/1997	886.16
9/8/1997	886.29
9/15/1997	886.23
9/18/1997	885.87
9/22/1997	886.25
9/27/1997	885.91
9/29/1997	886.01
9/30/1997	886.19
10/2/1997	885.96
10/6/1997	886.13
10/8/1997	885.86
10/11/1997	886.11
10/16/1997	886.11
10/18/1997	886.11
10/20/1997	886.11
10/24/1997	886.03
10/27/1997	886.07
10/29/1997	885.96
10/31/1997	886.01
11/4/1997	886.07
11/12/1997	886.13
4/9/1998	887.06
4/7/1999	886.62
4/7/1999	886.62
4/7/1999	886.62
3/31/2000	886.05
3/31/2000	886.05
5/13/2000	885.97
5/20/2000	885.77

9/13/1995	886.39
9/28/1995	886.25
10/4/1995	886.51

5/9/1997	886.41
5/12/1997	886.37
5/13/1997	886.31

5/24/2000	885.70
6/6/2000	885.97
6/6/2000	885.67

6/8/2000	885.93
6/13/2000	885.67
6/20/2000	885.67
6/22/2000	885.97
6/24/2000	885.97
6/25/2000	886.37
6/30/2000	885.67
7/7/2000	885.67
7/8/2000	885.97
7/9/2000	886.37
7/10/2000	886.57
7/12/2000	886.67
7/18/2000	886.20
7/19/2000	886.13
7/31/2000	885.72
8/10/2000	885.54
8/22/2000	885.51
8/29/2000	885.65
9/13/2000	885.80
9/25/2000	885.85
9/25/2000	885.83
10/3/2000	885.89
10/26/2000	885.76
5/8/2001	887.58
5/15/2001	886.84
5/21/2001	886.28
5/30/2001	886.12
6/7/2001	885.90
6/13/2001	886.18
6/13/2001	886.10
6/18/2001	886.28
6/20/2001	886.71
6/25/2001	885.94
6/28/2001	885.92
7/2/2001	885.83
7/9/2001	885.68
7/10/2001	885.64
7/25/2001	885.97
8/6/2001	885.80
8/7/2001	885.80
8/13/2001	885.68
8/14/2001	885.66
8/20/2001	885.74
8/27/2001	885.72
8/28/2001	885.74
9/3/2001	885.72
9/10/2001	885.82
9/13/2001	885.76
9/17/2001	885.70
9/24/2001	885.76
9/28/2001	885.70
10/1/2001	885.68
10/8/2001	885.68
10/10/2001	885.70
10/22/2001	885.71

4/11/2002	886.28
4/16/2002	886.62
4/22/2002	886.35
4/29/2002	886.35
5/6/2002	886.16
5/9/2002	886.74
5/10/2002	886.83
5/10/2002	886.83
5/10/2002	886.88
5/12/2002	887.13
5/13/2002	887.17
5/16/2002	886.41
5/18/2002	887.03
5/22/2002	886.73
5/28/2002	886.13
5/29/2002	886.73
5/29/2002	886.03
6/1/2002	885.93
6/5/2002	886.23
6/6/2002	886.21
6/10/2002	885.97
6/10/2002	886.03
6/11/2002	885.98
6/15/2002	885.82
6/16/2002	885.73
6/17/2002	885.79
6/19/2002	885.93
6/24/2002	886.07
6/25/2002	886.23
6/28/2002	886.61
6/29/2002	886.63
6/30/2002	886.53
7/1/2002	886.63
7/6/2002	886.29
7/8/2002	886.28
7/9/2002	886.29
7/15/2002	886.21
7/17/2002	886.07
7/22/2002	885.85
7/27/2002	885.78
7/29/2002	885.95
7/29/2002	885.95
8/4/2002	886.23
8/5/2002	886.33
8/8/2002	886.45
8/19/2002	885.73
8/20/2002	885.76
8/26/2002	886.17
8/27/2002	886.11
9/3/2002	886.25
9/6/2002	886.55
9/8/2002	886.43
9/9/2002	886.57
9/9/2002	886.56
9/14/2002	886.43

10/3/2002	886.03
10/6/2002	886.23
10/11/2002	886.53
10/16/2002	886.43
10/21/2002	886.29
10/28/2002	886.17
10/29/2002	886.09
11/4/2002	885.89
11/5/2002	885.87
11/12/2002	885.85
11/18/2002	885.73
11/25/2002	885.63
12/2/2002	885.53
12/9/2002	885.43
3/18/2003	885.89
3/25/2003	885.89
3/31/2003	885.92
4/9/2003	885.86
4/14/2003	885.79
4/15/2003	885.81
4/22/2003	886.55
4/28/2003	886.25
5/2/2003	886.09
5/2/2003	886.09
5/5/2003	886.09
5/6/2003	886.15
5/6/2003	886.15
5/12/2003	886.83
5/16/2003	887.11
5/16/2003	887.11
5/19/2003	887.05
5/23/2003	887.35
5/27/2003	887.17
5/29/2003	887
5/29/2003	887
6/11/2003	886.09
6/16/2003	885.95
6/20/2003	885.85
6/27/2003	886.87
6/27/2003	886.97
7/1/2003	887.24
7/7/2003	887.31
7/10/2003	887.19
7/11/2003	887.15
7/14/2003	886.93
7/15/2003	887.13
7/21/2003	887.13
7/21/2003	887.13
7/23/2003	886.51
8/4/2003	885.83
8/6/2003	885.81
8/11/2003	885.7
8/18/2003	885.55
8/21/2003	885.6
8/25/2003	885.55

10/29/2001	885.69
11/5/2001	885.69
11/12/2001	885.69
11/18/2001	885.69
12/10/2001	885.76

9/16/2002	886.29
9/18/2002	886.11
9/25/2002	885.92
9/30/2002	885.93
10/1/2002	885.87

9/2/2003	885.45
9/4/2003	885.45
9/8/2003	885.45
9/15/2003	885.71
9/18/2003	885.63

9/23/2003	885.65
9/29/2003	885.60
10/2/2003	885.51
10/7/2003	885.79
10/13/2003	885.67
10/14/2003	885.65
10/20/2003	885.60
10/27/2003	885.58
11/3/2003	885.63
11/3/2003	885.61
11/13/2003	885.61
11/18/2003	885.61
11/24/2003	885.71
12/1/2003	885.61
4/21/2004	885.94
4/22/2004	885.97
4/26/2004	885.99
5/3/2004	885.99
5/4/2004	885.93
5/10/2004	885.77
5/17/2004	886.03
5/18/2004	886.08
5/24/2004	886.27
5/28/2004	886.45
6/1/2004	886.99
6/2/2004	887.07
6/7/2004	887.11
6/9/2004	887.02
6/14/2004	886.77

6/16/2004	886.87
6/21/2004	886.77
6/28/2004	886.85
6/29/2004	886.85
7/6/2004	885.73
7/12/2004	885.73
7/14/2004	885.81
7/19/2004	885.73
7/21/2004	885.69
8/2/2004	885.79
8/9/2004	885.81
8/16/2004	885.89
8/23/2004	885.83
8/25/2004	885.85
8/30/2004	885.96
9/7/2004	886.03
9/9/2004	885.86
9/13/2004	885.74
9/20/2004	885.75
9/22/2004	885.71
9/27/2004	885.67
9/27/2004	885.69
10/4/2004	885.65
10/6/2004	885.67
10/11/2004	885.65
10/19/2004	885.68
10/20/2004	885.69
10/25/2004	885.87
11/01/2004	886.08
11/08/2004	885.83
11/15/2004	885.77
11/22/2004	885.9
11/29/2004	885.93

Bone Lake
DNR ID #82-54
New Scandia Township, Washington County

Period of record: 06/01/1965 to 11/1/2004
of readings: 334
Highest recorded: 910.97 ft (07/07/1975)
Lowest recorded: 906.7 ft(11/07/1966)
Recorded range: 4.27 ft
Average water level: 908.46
Last reading: 908.29 ft (11/1/2004)
[OHW elevation: 909.1 ft](#)
Datum: 1929 (ft)

Annual Averages	Elevation (ft)
1965	909.86
1966	907.38
1967	908.55
1968	908.44
1969	
1970	908.00
1971	908.56
1972	909.29
1973	908.36
1974	908.25
1975	909.19
1976	909.39
1977	907.88
1978	908.75
1979	908.26
1980	908.68
1981	908.52
1982	907.95
1983	
1984	
1985	
1986	
1987	
1988	
1989	
1990	907.83
1991	
1992	
1993	
1994	907.99
1995	908.62
1996	908.13
1997	908.20
1998	908.58
1999	909.08
2000	908.39
2001	

	Total Precip (in)
1965	
1966	
1967	
1968	
1969	
1970	
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	30.39
1981	31.26
1982	31.24
1983	30.29
1984	36.74
1985	32.11
1986	35.72
1987	21.92
1988	25.62
1989	23.28
1990	34.72
1991	39.41
1992	25.61
1993	38.00
1994	34.65
1995	42.41
1996	31.87
1997	27.08
1998	30.56
1999	31.96
2000	26.70
2001	33.00
2002	41.50

Date	Elevation (ft)
6/1/1965	910.55
11/24/1965	909.16
5/6/1966	908.06
11/7/1966	906.70
5/15/1967	909.32
9/27/1967	907.78
6/21/1968	909.48
8/23/1968	907.40
4/23/1970	907.82
5/8/1970	907.92
5/25/1970	908.02
6/9/1970	907.92
6/30/1970	907.97
7/7/1970	907.87
7/17/1970	907.98
8/7/1970	907.96
9/1/1970	907.75
9/21/1970	907.68
10/8/1970	907.72
10/23/1970	907.94
11/9/1970	908.58
11/23/1970	908.82
4/21/1971	909.06
5/24/1971	908.85
6/8/1971	909.13
7/12/1971	908.44
8/31/1971	907.74
9/15/1971	907.93
9/27/1971	907.87
10/27/1971	908.09
11/8/1971	909.15
11/16/1971	909.37

2002	908.51
2003	NA
2004	908.33
Total Average	908.48

2003	26.53
2004	30.69

4/29/1972	910.27
5/16/1972	910.03
5/25/1972	909.78
5/30/1972	909.84
6/12/1972	909.47
6/22/1972	909.50
6/29/1972	909.22
7/7/1972	909.14

7/18/1972	909.34
7/21/1972	909.37
7/24/1972	909.56
8/3/1972	909.42
8/9/1972	909.39
8/14/1972	909.34
8/28/1972	909.39
9/15/1972	909.24
9/26/1972	909.31
10/25/1972	909.31
4/16/1973	910.00
5/23/1973	909.80
6/6/1973	910.00
7/2/1973	908.07
7/25/1973	907.86
8/8/1973	907.81
8/22/1973	907.88
9/14/1973	907.74
9/26/1973	907.84
9/28/1973	907.74
10/10/1973	907.84
10/11/1973	908.04
11/9/1973	908.04
4/26/1974	908.94
5/17/1974	908.48
6/10/1974	908.83
7/9/1974	908.26
7/26/1974	908.13
8/16/1974	908.18
10/25/1974	907.62
11/26/1974	907.56
5/8/1975	910.02
6/13/1975	909.12
6/30/1975	910.52
7/7/1975	910.97
7/16/1975	909.62
7/30/1975	908.42
8/18/1975	908.12
8/28/1975	908.80
8/29/1975	908.74
10/28/1975	908.24
11/14/1975	908.52
4/21/1976	910.31
5/11/1976	909.45
5/26/1976	909.27
5/26/1976	910.72
7/6/1976	908.99

4/21/1978	909.01
5/19/1978	908.62
6/22/1978	908.73
8/3/1978	908.95
12/4/1978	908.45
5/21/1979	908.56
6/18/1979	908.64
7/2/1979	908.28
8/3/1979	908.26
9/13/1979	908.14
10/11/1979	908.06
10/26/1979	907.88
6/6/1980	908.42
8/19/1980	908.54
9/12/1980	909.09
9/25/1980	909.00
11/13/1980	908.33
4/15/1981	908.47
4/30/1981	908.52
5/5/1981	908.70
6/5/1981	908.31
6/19/1981	909.02
7/6/1981	908.86
8/27/1981	908.17
11/12/1981	908.09
4/26/1982	908.57
6/18/1982	907.97
7/16/1982	907.76
8/6/1982	907.77
9/14/1982	907.79
10/7/1982	907.88
11/10/1982	907.93
6/20/1989	908.10
8/10/1990	907.83
8/17/1990	907.73
8/18/1990	907.91
8/23/1990	907.93
8/27/1990	908.03
9/1/1990	907.95
9/12/1990	907.87
9/19/1990	907.77
9/23/1990	907.77
10/1/1990	907.69
11/9/1990	907.68

6/27/1994	907.90
7/4/1994	907.78
7/5/1994	907.96
7/11/1994	907.94
7/18/1994	907.94
7/25/1994	908.04
8/1/1994	907.98
8/7/1994	908.00
8/16/1994	908.02
8/23/1994	907.94
8/29/1994	907.96
9/5/1994	907.96
9/12/1994	907.92
9/19/1994	907.94
4/14/1995	908.69
4/24/1995	908.67
5/2/1995	908.37
5/10/1995	908.29
5/15/1995	908.17
5/22/1995	908.07
5/29/1995	908.41
6/6/1995	909.55
6/12/1995	908.75
6/19/1995	908.33
6/21/1995	908.33
6/26/1995	908.23
7/4/1995	908.13
7/10/1995	908.73
7/18/1995	909.03
7/25/1995	908.73
8/2/1995	908.45
8/8/1995	908.37
8/15/1995	909.53
8/22/1995	909.31
8/29/1995	908.93
9/5/1995	908.63
9/12/1995	908.43
9/26/1995	908.25
10/3/1995	908.53
10/31/1995	909.19
4/25/1996	908.72
5/7/1996	908.38
5/14/1996	908.28
5/21/1996	908.92
5/28/1996	908.58
6/4/1996	908.40
6/11/1996	908.24
6/18/1996	908.20
6/25/1996	908.20

11/24/1976	907.58
4/11/1977	907.75
4/28/1977	907.93
5/16/1977	907.83
6/6/1977	907.83
6/24/1977	907.74
7/22/1977	907.61
9/13/1977	907.88
11/8/1977	908.44

4/29/1991	908.35
11/6/1992	907.87
4/18/1994	908.42
6/1/1994	908.14
6/6/1994	908.08
6/13/1994	907.98
6/20/1994	907.96

7/2/1996	908.20
7/9/1996	908.06
7/16/1996	907.92
7/23/1996	907.94
7/30/1996	907.86
8/6/1996	907.82
8/13/1996	907.75
8/20/1996	907.68
8/27/1996	907.68
9/18/1996	907.70

4/16/1997	908.72
4/23/1997	908.38
5/6/1997	908.14
5/27/1997	908.12
6/3/1997	908.08
6/5/1997	908.12
6/10/1997	908.02
6/17/1997	907.92
6/23/1997	907.94
6/24/1997	907.98
7/1/1997	908.06
7/7/1997	908.42
7/9/1997	908.54
7/15/1997	908.58
7/22/1997	908.46
7/29/1997	908.42
8/5/1997	908.24
8/12/1997	908.10
8/19/1997	908.02
8/25/1997	908.10
9/4/1997	908.04
9/17/1997	908.06
4/7/1998	909.30
4/7/1998	909.30
4/21/1998	908.80
4/28/1998	908.50
5/4/1998	908.40
5/13/1998	908.46
5/19/1998	908.56
5/26/1998	908.50
6/2/1998	908.48
6/9/1998	908.46
6/16/1998	908.49
6/23/1998	908.50
6/30/1998	909.28
7/7/1998	908.82
7/14/1998	908.58
7/21/1998	908.47
7/28/1998	908.46
8/4/1998	908.50
8/11/1998	908.48
8/19/1998	908.44
8/31/1998	908.50
9/9/1998	908.38
9/26/1998	908.26
10/8/1998	908.24
10/20/1998	908.40
10/22/1998	908.42

6/22/1999	908.57
7/6/1999	908.49
7/14/1999	908.37
7/21/1999	908.21
7/27/1999	908.65
8/3/1999	908.63
8/11/1999	908.47
8/24/1999	909.41
8/26/1999	909.23
8/31/1999	908.91
9/5/1999	908.75
9/21/1999	908.59
9/28/1999	908.47
4/7/2000	908.45
5/29/2000	908.23
6/2/2000	908.33
6/17/2000	908.33
7/1/2000	908.35
7/9/2000	908.77
7/12/2000	908.95
7/19/2000	908.63
7/26/2000	908.57
8/3/2000	908.51
8/11/2000	908.27
8/20/2000	908.21
9/1/2000	908.17
9/10/2000	908.17
10/1/2000	908.17
10/17/2000	908.15
4/18/2001	909.35
4/17/2002	909.10
7/15/2002	908.38
7/23/2002	908.18
7/31/2002	908.18
8/8/2002	908.24
8/21/2002	908.30
8/30/2002	908.26
9/6/2002	909.14
9/15/2002	908.82
11/19/2002	908.48
4/15/2003	908.65
4/13/2004	908.79
4/26/2004	908.79
5/4/2004	908.48

6/10/2004	909.09
6/24/2004	908.51
7/2/2004	908.27
7/8/2004	908.25
7/14/2004	908.21
7/19/2004	907.09
7/26/2004	908.01
8/3/2004	907.99
8/10/2004	907.85
8/12/2004	907.87
8/25/2004	907.79
8/25/2004	907.85
9/7/2004	907.93
9/9/2004	907.89
9/16/2004	908.05
9/20/2004	908.05
9/22/2004	908.04
10/6/2004	907.95
10/20/2004	907.89
11/1/2004	908.29

4/13/1999	909.27
4/27/1999	909.09
5/5/1999	909.05
5/11/1999	909.21
5/18/1999	909.37
5/25/1999	909.09
6/1/1999	908.63
6/13/1999	908.89

5/10/2004	908.41
5/14/2004	908.59
5/17/2004	908.65
5/18/2004	908.66
5/24/2004	908.85
6/3/2004	909.53
6/7/2004	909.31
6/9/2004	909.17

Forest Lake (West)
DNR ID #82-159
Forest Lake Township, Washington County

Period of record: 04/30/1965 to 8/30/2004
of readings: 566
Highest recorded: 902.23 ft (06/25/1993)
[Highest known: 902.6 ft \(1975\)](#)
Lowest recorded: 899.45 ft (10/07/1969)
Recorded range: 2.78 ft
Average water level: 901.43 ft
Last reading: 900.97 ft (8/30/2004)
[OHW elevation: 901.8 ft](#)
Datum: 1929 (ft)

Annual Averages	Elevation (ft)
1965	901.39
1966	901.03
1967	901.11
1968	901.24
1969	900.71
1970	901.07
1971	901.28
1972	901.17
1973	901.29
1974	901.34
1975	901.45
1976	900.99
1977	
1978	901.84
1979	901.71
1980	901.72
1981	
1982	
1983	
1984	
1985	
1986	
1987	
1988	
1989	
1990	901.46
1991	901.45
1992	901.24
1993	901.58
1994	901.39
1995	901.61

	Total Precip (in)
1965	
1966	
1967	
1968	
1969	
1970	
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	30.39
1981	31.26
1982	31.24
1983	30.29
1984	36.74
1985	32.11
1986	35.72
1987	21.92
1988	25.62
1989	23.28
1990	34.72
1991	39.41
1992	25.61
1993	38.00
1994	34.65
1995	42.41

Date	Elevation (ft)
4/30/1965	901.54
5/5/1965	901.54
5/16/1965	901.66
5/30/1965	901.47
6/1/1965	901.89
6/13/1965	901.85
6/28/1965	901.53
7/12/1965	901.55
7/25/1965	901.39
8/9/1965	901.27
8/22/1965	901.11
9/5/1965	901.11
9/17/1965	901.14
10/2/1965	901.21
10/16/1965	901.23
10/30/1965	901.16
11/12/1965	901.11
11/24/1965	901.17
4/26/1966	901.37
5/6/1966	901.26
5/23/1966	901.25
6/4/1966	901.20
6/13/1966	901.20
6/21/1966	901.20
6/29/1966	901.18
7/19/1966	901.12
7/27/1966	901.00
8/8/1966	900.88
8/27/1966	900.88
9/20/1966	900.74

1996	901.36
1997	901.37
1998	901.44
1999	901.49
2000	901.68
2001	901.64
2002	901.55
2003	901.69
2004	901.56
Total Average	901.39

1996	31.87
1997	27.08
1998	30.56
1999	31.96
2000	26.70
2001	33.00
2002	41.50
2003	26.53
2004	30.69

10/4/1966	900.68
10/17/1966	900.80
11/7/1966	900.69
6/2/1967	901.19
6/17/1967	901.37
6/21/1967	901.37
7/14/1967	901.20
7/28/1967	901.11
8/11/1967	900.99
8/27/1967	901.05
9/10/1967	900.94
9/27/1967	900.80

5/6/1968	901.15
5/24/1968	901.10
6/10/1968	901.33
6/21/1968	901.51
6/26/1968	901.53
8/6/1968	901.17
9/6/1968	900.95
9/18/1968	901.05
9/23/1968	901.13
10/8/1968	901.11
10/18/1968	901.43
11/6/1968	901.33
11/20/1968	901.29
5/1/1969	901.35
6/2/1969	900.99
6/19/1969	900.95
7/24/1969	900.92
8/29/1969	900.60
10/7/1969	899.45
4/23/1970	901.10
5/8/1970	901.10
5/25/1970	901.10
6/9/1970	901.14
6/30/1970	901.18
7/7/1970	901.08
7/17/1970	901.06
8/7/1970	900.99
9/1/1970	900.96
9/21/1970	900.90
10/8/1970	900.95
10/23/1970	900.94
11/9/1970	901.24
11/23/1970	901.30
4/21/1971	901.41
5/24/1971	901.31
6/8/1971	901.29
7/7/1971	901.21
7/12/1971	901.30
8/31/1971	901.42
9/24/1971	901.11
10/26/1971	901.16
10/29/1971	901.21
11/5/1971	901.35

9/15/1972	901.07
9/26/1972	901.10
10/25/1972	901.08
4/16/1973	901.35
5/23/1973	901.38
6/6/1973	901.51
7/2/1973	901.43
7/25/1973	901.23
8/8/1973	901.17
8/8/1973	901.33
8/22/1973	901.17
9/14/1973	901.15
9/26/1973	901.13
10/11/1973	901.30
11/9/1973	901.27
4/26/1974	901.56
5/17/1974	901.46
6/10/1974	901.62
6/25/1974	901.48
7/9/1974	901.32
7/26/1974	901.22
8/16/1974	901.28
10/25/1974	901.04
11/26/1974	901.12
5/8/1975	901.73
6/13/1975	901.69
6/23/1975	902.03
6/24/1975	901.92
6/30/1975	901.95
7/7/1975	901.97
7/16/1975	901.67
7/30/1975	901.42
8/18/1975	900.76
8/29/1975	900.97
10/28/1975	900.69
11/14/1975	900.63
4/21/1976	901.78
5/11/1976	901.38
5/26/1976	901.24
7/6/1976	900.98
8/11/1976	900.62
11/24/1976	899.94

5/21/1979	901.74
6/12/1979	901.74
6/19/1979	901.84
7/2/1979	901.92
8/3/1979	901.60
8/7/1979	901.54
9/4/1979	901.89
9/13/1979	901.81
9/25/1979	901.64
10/11/1979	901.54
10/26/1979	901.58
5/5/1980	901.51
5/20/1980	901.41
6/3/1980	901.51
6/9/1980	901.60
8/2/1980	902.00
8/19/1980	901.65
9/12/1980	902.21
9/25/1980	902.09
10/30/1980	901.67
11/13/1980	901.58
7/13/1981	901.73
5/4/1989	901.49
10/27/1989	900.64
4/16/1990	901.21
4/26/1990	901.35
4/29/1990	901.43
5/4/1990	901.43
5/11/1990	901.35
5/19/1990	901.56
5/25/1990	901.59
6/4/1990	901.76
6/12/1990	901.71
6/16/1990	901.81
6/29/1990	901.71
7/4/1990	901.59
7/16/1990	901.41
7/26/1990	901.53
7/31/1990	901.59
8/2/1990	901.51
8/6/1990	901.43
8/14/1990	901.31

4/29/1972	901.36
5/25/1972	901.22
5/30/1972	901.22
6/12/1972	901.34
6/22/1972	901.16
6/29/1972	901.15
7/7/1972	901.12
7/18/1972	901.11
7/21/1972	901.22
7/24/1972	901.20
8/3/1972	901.14
8/9/1972	901.14
8/14/1972	901.12
8/28/1972	901.15

7/22/1977	900.98
11/8/1977	901.64
4/21/1978	901.87
5/19/1978	901.57
6/22/1978	901.83
6/28/1978	902.02
7/6/1978	902.13
7/15/1978	902.03
7/17/1978	901.94
8/2/1978	901.82
8/28/1978	901.89
9/5/1978	901.82
10/26/1978	901.33

8/19/1990	901.49
8/30/1990	901.51
9/5/1990	901.46
9/11/1990	901.41
9/17/1990	901.31
9/25/1990	901.23
10/5/1990	901.23
10/16/1990	901.16
10/22/1990	901.23
4/29/1991	901.59
5/10/1991	901.60
6/8/1991	901.50

7/25/1991	901.40
8/22/1991	901.24
10/14/1991	901.22
11/20/1991	901.59
4/1/1992	901.45
4/18/1992	901.53
4/28/1992	901.59
5/1/1992	901.57
5/5/1992	901.49
5/8/1992	901.43
5/13/1992	901.39
5/20/1992	901.31
5/26/1992	901.29
5/30/1992	901.26
6/2/1992	901.16
6/6/1992	901.17
6/11/1992	901.15
6/16/1992	901.11
6/25/1992	901.17
7/2/1992	901.33
7/6/1992	901.29
7/12/1992	901.33
7/15/1992	901.31
7/22/1992	901.25
7/29/1992	901.19
8/5/1992	901.15
8/14/1992	901.13
8/18/1992	901.09
8/23/1992	901.03
8/26/1992	901.13
9/1/1992	901.05
9/16/1992	901.13
9/23/1992	901.07
10/4/1992	900.96
10/14/1992	901.05
10/25/1992	901.05
5/4/1993	901.54
5/6/1993	901.48
5/12/1993	901.50

7/15/1993	901.89
7/21/1993	901.69
7/29/1993	901.60
7/30/1993	901.51
8/3/1993	901.39
8/8/1993	901.38
8/9/1993	901.53
8/10/1993	901.53
8/16/1993	901.49
8/19/1993	901.55
8/23/1993	901.47
8/30/1993	901.38
9/7/1993	901.23
9/11/1993	901.15
9/15/1993	901.23
9/21/1993	901.28
9/30/1993	901.23
10/9/1993	901.18
10/21/1993	901.23
10/24/1993	901.23
4/18/1994	901.51
4/30/1994	902.02
5/2/1994	902.00
5/3/1994	901.96
5/9/1994	901.76
5/13/1994	901.64
5/19/1994	901.52
5/23/1994	901.46
5/26/1994	901.36
5/30/1994	901.31
6/1/1994	901.26
6/2/1994	901.23
6/6/1994	901.24
6/13/1994	901.16
6/20/1994	901.16
6/24/1994	901.16
6/29/1994	901.11
7/4/1994	901.06
7/5/1994	901.26
7/16/1994	901.18

6/13/1995	901.62
6/24/1995	901.40
7/4/1995	901.36
7/6/1995	901.58
7/12/1995	901.58
7/13/1995	901.74
7/25/1995	901.65
8/5/1995	901.42
8/9/1995	901.53
8/10/1995	901.51
8/12/1995	901.64
8/13/1995	901.84
8/13/1995	901.95
8/13/1995	901.93
8/21/1995	901.86
8/28/1995	901.80
9/5/1995	901.64
9/11/1995	901.50
9/14/1995	901.45
9/22/1995	901.38
9/29/1995	901.50
10/9/1995	901.64
10/22/1995	901.50
5/4/1996	901.58
5/6/1996	901.62
5/6/1996	901.62
5/13/1996	901.58
5/21/1996	901.74
5/27/1996	901.64
6/4/1996	901.50
6/4/1996	901.48
6/5/1996	901.62
6/14/1996	901.38
6/17/1996	901.54
6/25/1996	901.48
6/25/1996	901.46
6/26/1996	901.58
7/6/1996	901.40
7/18/1996	901.44
7/23/1996	901.38

5/13/1993	901.49
5/17/1993	901.38
5/25/1993	901.43
6/1/1993	901.48
6/7/1993	901.41
6/13/1993	901.48
6/17/1993	901.73
6/19/1993	901.87
6/21/1993	901.91
6/23/1993	902.13
6/24/1993	902.23
6/25/1993	902.23
6/26/1993	902.17
6/28/1993	902.09
7/2/1993	902.03

7/20/1994	901.34
7/29/1994	901.21
8/1/1994	901.16
4/19/1995	901.80
4/30/1995	901.68
5/3/1995	901.60
5/7/1995	901.57
5/12/1995	901.51
5/26/1995	901.36
5/28/1995	901.58
5/30/1995	901.58
6/6/1995	901.64
6/7/1995	901.68
6/8/1995	901.64

7/25/1996	901.40
8/7/1996	901.36
8/12/1996	901.30
8/15/1996	901.24
8/20/1996	901.20
8/22/1996	901.26
8/28/1996	901.18
8/28/1996	901.18
9/10/1996	901.10
9/18/1996	900.96
9/25/1996	900.98
10/5/1996	900.94
10/18/1996	900.98
10/25/1996	901.10

4/22/1997	901.59
5/4/1997	901.47
5/6/1997	901.45
5/7/1997	901.47
5/13/1997	901.39
5/20/1997	901.31
5/20/1997	901.36
5/22/1997	901.33
5/28/1997	901.29
6/2/1997	901.27
6/4/1997	901.29
6/5/1997	901.29
6/12/1997	901.21
6/18/1997	901.11
6/19/1997	901.11
6/27/1997	901.10
6/29/1997	901.27
7/2/1997	901.47
7/3/1997	901.39
7/7/1997	901.55
7/7/1997	901.43
7/8/1997	901.51
7/11/1997	901.51
7/13/1997	901.59
7/14/1997	901.65
7/16/1997	901.60
7/27/1997	901.57
8/1/1997	901.41
8/1/1997	901.45
8/2/1997	901.53
8/13/1997	901.29
8/16/1997	901.27
8/27/1997	901.33
8/28/1997	901.31
9/4/1997	901.36
10/2/1997	901.26
10/6/1997	901.23
10/11/1997	901.21

7/13/1998	901.50
7/20/1998	901.44
7/29/1998	901.26
8/14/1998	901.22
9/10/1998	901.12
4/7/1999	901.59
4/24/1999	901.50
5/1/1999	901.41
5/9/1999	901.46
5/12/1999	901.60
5/25/1999	901.56
5/28/1999	901.52
6/2/1999	901.40
6/6/1999	901.58
6/12/1999	901.66
6/18/1999	901.51
6/19/1999	901.46
6/27/1999	901.42
6/30/1999	901.40
7/6/1999	901.46
7/12/1999	901.36
7/18/1999	901.28
7/26/1999	901.58
7/27/1999	901.58
7/29/1999	901.56
8/2/1999	901.51
8/15/1999	901.31
3/31/2000	901.45
6/11/2000	901.77
6/15/2000	901.75
6/19/2000	901.75
6/26/2000	901.75
7/5/2000	901.70
7/7/2000	901.90
7/9/2000	902.07
7/29/2000	901.75
8/13/2000	901.65

6/22/2001	901.75
6/25/2001	901.69
6/26/2001	901.67
6/28/2001	901.65
7/4/2001	901.53
7/5/2001	901.48
7/7/2001	901.43
7/9/2001	901.43
7/15/2001	901.34
7/23/2001	901.43
8/17/2001	901.19
8/19/2001	901.29
9/16/2001	901.15
4/22/2002	901.73
5/10/2002	901.89
5/10/2002	901.90
5/13/2002	901.90
5/22/2002	901.65
5/28/2002	901.52
6/1/2002	901.45
6/19/2002	901.50
6/22/2002	901.58
6/24/2002	901.74
7/1/2002	901.64
7/7/2002	901.50
7/9/2002	901.51
7/11/2002	901.52
7/18/2002	901.43
7/21/2002	901.35
7/26/2002	901.43
7/30/2002	901.40
8/3/2002	901.35
8/4/2002	901.55
8/6/2002	901.55
8/22/2002	901.50
8/22/2002	901.55
8/29/2002	901.42
9/1/2002	901.36

4/9/1998	901.76
4/11/1998	901.74
4/23/1998	901.54
4/27/1998	901.44
4/29/1998	901.40
5/11/1998	901.38
5/18/1998	901.32
5/19/1998	901.38
5/22/1998	901.32
5/26/1998	901.28
6/5/1998	901.30
6/19/1998	901.40
6/22/1998	901.38
6/24/1998	901.52
6/25/1998	901.70
6/27/1998	901.76

8/19/2000	901.65
9/9/2000	901.50
9/10/2000	901.57
10/12/2000	901.25
5/7/2001	902.15
5/8/2001	901.83
5/8/2001	902.08
5/15/2001	901.93
5/16/2001	901.88
5/25/2001	901.83
5/29/2001	901.78
6/3/2001	901.73
6/4/2001	901.65
6/10/2001	901.77
6/18/2001	901.79

9/2/2002	901.56
9/6/2002	901.67
9/7/2002	901.64
9/14/2002	901.53
9/19/2002	901.40
9/21/2002	901.41
10/2/2002	901.45
10/10/2002	901.69
10/27/2002	901.57
11/10/2002	901.47
11/14/2002	901.43

5/2/2003	901.6
5/10/2003	901.64
5/12/2003	901.84
5/13/2003	901.86
5/13/2003	901.86
5/19/2003	901.79
5/20/2003	901.96
5/27/2003	901.84
6/3/2003	901.69
6/20/2003	901.56
6/24/2003	901.46
6/25/2003	901.94
6/28/2003	902.07
6/29/2003	902.08
7/8/2003	901.83
7/26/2003	901.51
7/28/2003	901.48
8/5/2003	901.44
8/13/2003	901.34
9/7/2003	901.02
4/21/2004	901.59
5/23/2004	901.69
5/23/2004	901.69
5/24/2004	901.71
5/27/2004	901.75
5/28/2004	901.75
5/31/2004	901.97
6/2/2004	902.04
6/5/2004	902.01
6/10/2004	901.9
6/15/2004	901.83
6/20/2004	901.65
7/3/2004	901.43
7/9/2004	901.4
7/19/2004	901.35
7/25/2004	901.25
8/1/2004	901.15

8/13/2004	901.06
8/22/2004	900.99
8/30/2004	900.97

Halfbreed (Sylvan) Lake

DNR ID #82-80

Forest Lake Township/New Scandia Township, Washington County

Period of record: 09/17/1981 to 11/1/2004

of readings: 319

Highest recorded: 938 ft (7/3/2003)

[Highest known: 938 ft \(7/3/2003\)](#)

Lowest recorded: 934.52 ft (11/22/1990)

Recorded range: 3.48 ft

Average water level: 936.83 ft

Last reading: 936.94 ft (11/1/2004)

[OHW elevation: 937.1 ft](#)

Datum: 1929 (ft)

Annual Averages	Elevation (ft)
1981	936.85
1982	
1983	
1984	
1985	
1986	
1987	
1988	
1989	
1990	934.71
1991	936.28
1992	936.29
1993	937.08
1994	936.88
1995	937.08
1996	937.07
1997	936.82
1998	936.81
1999	936.97
2000	936.50

	Total Precip (in)
1965	
1966	
1967	
1968	
1969	
1970	
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	30.39
1981	31.26
1982	31.24
1983	30.29
1984	36.74
1985	32.11

Date	Elevation (ft)
9/17/1981	936.93
9/24/1981	936.77
8/10/1990	934.74
8/20/1990	934.91
8/24/1990	934.79
8/29/1990	934.90
9/6/1990	934.84
9/9/1990	934.84
9/19/1990	934.72
9/28/1990	934.59
10/15/1990	934.62
10/20/1990	934.64
10/28/1990	934.59
11/12/1990	934.54
11/22/1990	934.52
4/29/1991	934.97
6/8/1991	935.07
6/12/1991	936.31
6/15/1991	936.38

2001	937.00
2002	937.27
2003	937.47
2004	936.99
Total Average	936.75

1986	35.72
1987	21.92
1988	25.62
1989	23.28
1990	34.72
1991	39.41
1992	25.61
1993	38.00
1994	34.65
1995	42.41
1996	31.87
1997	27.08
1998	30.56
1999	31.96
2000	26.70
2001	33.00
2002	41.50
2003	26.53
2004	30.69

7/20/1991	936.52
8/10/1991	936.52
8/18/1991	936.52
9/14/1991	936.76
9/24/1991	936.51
10/24/1991	936.56
11/20/1991	936.91
4/21/1992	936.67
4/26/1992	936.61
5/11/1992	936.51
5/21/1992	936.41
5/30/1992	936.33
6/6/1992	936.21
6/13/1992	936.13
6/21/1992	936.19
7/5/1992	936.19
7/10/1992	936.21
7/12/1992	936.31

8/2/1992	936.09
9/13/1992	936.19
11/4/1992	936.07
5/4/1993	936.76
6/18/1993	937.11
6/21/1993	937.18
6/24/1993	937.22
7/4/1993	937.20
7/17/1993	937.20
7/29/1993	937.09
8/9/1993	937.16
9/1/1993	937.18
10/28/1993	936.68
4/18/1994	936.87
4/26/1994	937.21
5/19/1994	937.17
6/1/1994	936.99
6/8/1994	936.93
6/16/1994	936.85
6/20/1994	936.85
7/5/1994	936.85
7/9/1994	936.81
7/16/1994	936.81
7/26/1994	936.73
8/7/1994	936.77
8/15/1994	936.77
8/22/1994	936.69
9/10/1994	936.69
9/20/1994	936.79
10/20/1994	937.01
11/2/1994	936.99
4/19/1995	937.16

7/12/1996	937.04
7/19/1996	937.04
7/23/1996	937.04
7/31/1996	937.00
8/8/1996	936.94
8/20/1996	936.80
8/29/1996	936.72
9/13/1996	936.58
10/10/1996	936.70
10/28/1996	936.69
11/6/1996	936.92
11/20/1996	937.34
4/16/1997	937.20
6/4/1997	936.66
6/10/1997	936.83
6/16/1997	936.72
6/20/1997	936.26
7/8/1997	936.95
7/9/1997	936.96
7/13/1997	936.86
7/16/1997	936.98
7/21/1997	936.96
7/30/1997	936.86
7/31/1997	936.94
8/13/1997	936.74
8/14/1997	936.66
8/24/1997	936.80
8/27/1997	936.78
9/15/1997	936.86
9/16/1997	936.76
10/1/1997	936.74
10/17/1997	936.83
10/29/1997	936.76
11/6/1997	936.84

8/19/1998	936.70
8/31/1998	936.72
8/31/1998	936.71
9/14/1998	936.50
9/19/1998	936.46
9/26/1998	936.44
9/28/1998	936.42
10/21/1998	936.32
10/23/1998	936.46
4/15/1999	936.95
4/20/1999	936.99
5/10/1999	936.99
5/11/1999	936.96
5/16/1999	937.09
5/20/1999	937.09
5/26/1999	937.06
6/10/1999	937.13
6/16/1999	937.05
6/23/1999	937.05
7/1/1999	936.99
7/6/1999	936.99
7/10/1999	936.95
7/19/1999	936.84
7/23/1999	936.85
8/4/1999	937.01
8/17/1999	936.89
8/23/1999	937.18
8/24/1999	937.17
9/8/1999	936.99
9/23/1999	936.89
9/24/1999	936.89
10/4/1999	936.80
10/20/1999	936.73
10/25/1999	936.69

6/3/1995	937.07
6/17/1995	937.03
6/23/1995	936.89
7/7/1995	937.11
7/14/1995	937.21
7/26/1995	937.07
8/8/1995	936.92
8/18/1995	937.17
9/4/1995	937.15
9/16/1995	937.13
4/25/1996	937.42
5/23/1996	937.34
6/2/1996	937.34
6/4/1996	937.34
6/15/1996	937.32
6/20/1996	937.30
6/25/1996	937.30
6/29/1996	937.29
7/11/1996	937.06

4/7/1998	937.44
4/28/1998	937.06
5/11/1998	937.04
5/26/1998	936.94
5/28/1998	936.98
6/4/1998	936.94
6/6/1998	936.92
6/8/1998	936.90
6/22/1998	936.90
6/28/1998	937.18
7/7/1998	937.03
7/12/1998	937.04
7/19/1998	936.94
7/20/1998	936.94
7/25/1998	936.80
8/1/1998	936.70
8/5/1998	936.72
8/8/1998	936.76
8/15/1998	936.68

4/7/2000	936.80
4/12/2000	936.76
4/24/2000	936.72
5/4/2000	936.70
5/10/2000	936.68
5/26/2000	936.68
5/26/2000	936.68
6/8/2000	936.74
6/14/2000	936.66
6/14/2000	936.66
6/17/2000	936.64
6/22/2000	936.62
6/30/2000	936.66
6/30/2000	936.66
7/6/2000	936.57
7/9/2000	936.90
7/19/2000	936.74
7/20/2000	936.64
7/20/2000	936.64

7/31/2000	936.58
8/6/2000	936.46
8/6/2000	936.46
8/10/2000	936.48
8/22/2000	936.36
8/25/2000	936.36
8/25/2000	936.36
8/29/2000	936.44
9/2/2000	936.30
9/2/2000	936.30
9/14/2000	936.36
9/21/2000	936.26
9/21/2000	936.26
9/25/2000	936.20
9/26/2000	936.20
9/28/2000	936.18
10/3/2000	936.14
10/9/2000	936.04
10/26/2000	936.02
4/18/2001	937.11
4/21/2001	937.21
4/22/2001	937.19
4/23/2001	937.45
4/27/2001	937.43
5/15/2001	937.39
5/30/2001	937.41
6/7/2001	937.43
6/20/2001	937.57
6/28/2001	937.41
7/10/2001	937.06
7/24/2001	936.89
7/27/2001	936.77
7/27/2001	936.85

6/17/2002	937.15
6/18/2002	937.21
6/25/2002	937.17
6/26/2002	937.41
7/9/2002	937.19
7/16/2002	937.17
7/17/2002	937.15
7/29/2002	937.21
8/8/2002	937.23
8/10/2002	937.21
8/15/2002	937.11
8/20/2002	937.05
8/27/2002	937.19
9/6/2002	937.41
9/10/2002	937.35
9/14/2002	937.25
9/18/2002	937.25
9/21/2002	937.23
9/25/2002	937.19
10/1/2002	937.23
10/11/2002	937.48
10/16/2002	937.45
10/20/2002	937.25
10/25/2002	937.45
10/29/2002	937.45
10/30/2002	937.47
11/5/2002	937.39
11/13/2002	937.35
11/14/2002	937.37
4/15/2003	937.04
4/21/2003	937.22
5/6/2003	937.18
5/16/2003	937.49

9/18/2003	937.18
10/1/2003	937.04
10/10/2003	936.92
10/14/2003	937
10/26/2003	936.92
11/4/2003	936.94
4/13/2004	936.99
4/22/2004	937.11
5/4/2004	936.99
5/18/2004	937.11
6/2/2004	937.49
6/16/2004	937.47
6/29/2004	937.31
7/14/2004	937.15
7/26/2004	936.9
8/12/2004	936.78
8/25/2004	936.65
9/9/2004	936.75
9/22/2004	936.81
10/6/2004	936.69
10/20/2004	936.65
11/1/2004	936.94

8/7/2001	936.77
8/8/2001	936.75
8/14/2001	936.61
8/14/2001	936.65
8/22/2001	936.55
8/28/2001	936.61
9/15/2001	936.65
10/10/2001	936.73
12/1/2001	936.75
12/22/2001	936.69
4/1/2002	937.31
4/17/2002	937.11
5/1/2002	937.33
5/9/2002	937.33
5/10/2002	937.31
5/13/2002	937.31
6/3/2002	937.17
6/4/2002	937.11
6/10/2002	937.15
6/11/2002	937.21

5/27/2003	937.68
6/5/2003	937.57
6/8/2003	937.62
6/11/2003	937.62
6/15/2003	937.47
6/25/2003	937.95
6/27/2003	937.94
7/2/2003	937.94
7/3/2003	938
7/11/2003	937.91
7/23/2003	937.8
8/6/2003	937.79
8/14/2003	937.64
8/21/2003	937.54
8/21/2003	937.54
9/4/2003	937.24

Little Comfort Lake
DNR ID #13-54
Wyoming Township, Chisago County

Period of record: 01/09/1985 to 05/23/2003
of readings: 43
Highest recorded: 887.81 ft (05/08/2001)
Lowest recorded: 885.55 ft (07/16/2001)
Recorded range: 2.26 ft
Average water level: 886.24 ft
Last reading: 887.6 ft (05/23/2003)
[OHW elevation: 887.2 ft](#)
Datum: 1929 (ft)

	Total Precip (in)
1965	
1966	
1967	
1968	
1969	
1970	
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	
1980	30.39
1981	31.26

Annual Averages	Elevation (ft)
1982	
1983	
1984	
1985	
1986	
1987	
1988	
1989	
1990	
1991	
1992	
1993	
1994	
1995	
1996	

Date	Elevation (ft)
8/3/2001	885.81
8/16/2001	885.61
8/28/2001	885.72
9/8/2001	885.81
9/21/2001	885.67
10/12/2001	885.59
10/24/2001	885.75
5/10/2002	886.97
5/12/2002	887.29
5/21/2002	886.87
6/5/2002	886.19
6/10/2002	885.97
6/16/2002	885.81
6/24/2002	886.13
6/29/2002	886.71
7/10/2002	886.37

1982	31.24
1983	30.29
1984	36.74
1985	32.11
1986	35.72
1987	21.92
1988	25.62
1989	23.28
1990	34.72
1991	39.41
1992	25.61
1993	38.00
1994	34.65
1995	42.41
1996	31.87
1997	27.08
1998	30.56
1999	31.96
2000	26.70
2001	33.00
2002	41.50

1997	
1998	
1999	
2000	
2001	885.98
2002	886.35

Date	Elevation (ft)
1/9/1985	885.75
5/8/2001	887.81
6/13/2001	886.21
6/16/2001	886.33
6/21/2001	886.25
6/28/2001	885.89
7/10/2001	885.65
7/16/2001	885.55

7/24/2002	885.77
7/31/2002	885.93
8/4/2002	886.31
8/9/2002	886.43
8/16/2002	885.89
8/20/2002	885.75
8/22/2002	886.11
9/5/2002	886.35
9/7/2002	886.63
9/11/2002	886.59
9/19/2002	886.05
10/9/2002	886.51
10/14/2002	886.59
10/16/2002	886.57
10/18/2002	886.51
10/20/2002	886.43
10/21/2002	886.36
10/23/2002	886.29

Shields Lake
DNR ID #82-162
Forest Lake Township, Washington County

Period of record: 06/04/1991 to 10/20/2004
 # of readings: 136
 Highest recorded: 903.99 ft (6/27/2002)
 Lowest recorded: 901.28 ft (10/07/1996)
 Recorded range: 2.71 ft
 Average water level: 902.00 ft
 Last reading: 901.69 (10/20/2004)
[OHW elevation: 902.5 ft](#)
 Datum: 1929 (ft)

Annual Averages	Elevation (ft)
1991	
1992	
1993	
1994	
1995	
1996	901.70
1997	901.90
1998	901.91
1999	902.13
2000	901.79
2001	901.98
2002	902.39
2003	902.07
2004	901.85

	Total Precip (in)
1965	
1966	
1967	
1968	
1969	
1970	
1971	
1972	
1973	
1974	
1975	
1976	
1977	
1978	
1979	

Date	Elevation (ft)
6/4/1991	902.57
1/13/1992	901.93
6/10/1992	901.33
4/30/1996	901.96
5/8/1996	902.04
5/23/1996	902.44
6/4/1996	901.86
6/20/1996	901.86
7/11/1996	901.70
7/23/1996	901.75
8/8/1996	901.68
8/28/1996	901.50
9/13/1996	901.32

Total Average	901.97
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1980	30.39
1981	31.26
1982	31.24
1983	30.29
1984	36.74
1985	32.11
1986	35.72
1987	21.92
1988	25.62
1989	23.28
1990	34.72
1991	39.41
1992	25.61
1993	38.00
1994	34.65
1995	42.41
1996	31.87
1997	27.08
1998	30.56
1999	31.96
2000	26.70
2001	33.00
2002	41.50
2003	26.53
2004	30.69

9/25/1996	901.28
10/7/1996	901.28
10/21/1996	901.40
4/7/1997	902.29
4/16/1997	901.99
4/24/1997	901.85
5/5/1997	901.93
5/22/1997	901.85
6/5/1997	901.72
6/20/1997	901.55
7/7/1997	902.14
7/16/1997	902.43
7/31/1997	902.13
8/13/1997	901.73
8/27/1997	901.75
9/16/1997	901.69
10/17/1997	901.83
10/29/1997	901.75
11/6/1997	901.82
4/7/1998	902.59
4/17/1998	902.16
4/28/1998	901.87
5/11/1998	901.83

5/26/1998	901.79
6/8/1998	901.92
6/22/1998	902.07
7/7/1998	902.30
7/8/1998	902.27
7/13/1998	902.05
8/5/1998	901.77
8/19/1998	901.71
8/31/1998	901.75
9/14/1998	901.57
9/28/1998	901.54
10/21/1998	901.50
10/23/1998	901.71
4/15/1999	902.39
4/20/1999	902.47
5/11/1999	902.26
5/26/1999	902.33
6/10/1999	902.32
6/23/1999	902.27
7/6/1999	902.19
7/19/1999	901.89
8/4/1999	902.29
8/24/1999	902.43
9/8/1999	902.07
9/23/1999	901.87
10/4/1999	901.75
10/20/1999	901.71
10/25/1999	901.69

7/25/2001	901.74
8/7/2001	901.67
8/14/2001	901.53
8/28/2001	901.59
9/13/2001	901.54
9/28/2001	901.56
10/17/2001	901.62
4/17/2002	902.61
5/10/2002	903.67
5/28/2002	902.01
6/6/2002	902.03
6/26/2002	903.27
7/9/2002	902.09
7/17/2002	902.09
7/29/2002	902.17
8/8/2002	902.45
8/15/2002	902.19
8/20/2002	902.09
8/27/2002	902.29
9/6/2002	902.73
9/10/2002	902.73
9/18/2002	902.19
9/25/2002	902.03
10/1/2002	902.05
10/11/2002	902.97
10/16/2002	902.53
10/25/2002	902.31
10/29/2002	902.25

6/16/2004	902.25
6/29/2004	901.85
7/14/2004	901.86
7/26/2004	901.65
8/12/2004	901.58
8/25/2004	901.55
9/9/2004	901.55
9/22/2004	901.81
10/6/2004	901.73
10/20/2004	901.69

4/7/2000	901.97
4/12/2000	901.91
5/23/2000	901.81
6/8/2000	902.11
6/22/2000	901.91
7/6/2000	901.79
7/19/2000	902.15
7/31/2000	901.85
8/10/2000	901.69
8/22/2000	901.67
8/29/2000	901.74
9/14/2000	901.75
9/25/2000	901.64
9/28/2000	901.61
10/9/2000	901.53
10/26/2000	901.57
4/18/2001	902.70
4/27/2001	903.34
5/15/2001	902.09
5/30/2001	902.08
6/7/2001	901.88
6/20/2001	902.44
6/28/2001	902.12
7/10/2001	901.74

11/5/2002	902.13
11/13/2002	902.09
4/15/2003	902.02
5/6/2003	902.22
5/16/2003	902.72
5/29/2003	902.16
4/15/2003	902.02
5/6/2003	902.22
5/16/2003	902.72
5/29/2003	902.16
6/11/2003	902.10
6/27/2003	903.99
7/11/2003	902.22
7/23/2003	901.96
8/6/2003	901.78
8/21/2003	901.66
9/4/2003	901.46
9/18/2003	901.56
10/1/2003	901.52
10/14/2003	901.54
4/13/2004	901.95
4/22/2004	902.25
5/4/2004	901.95
5/18/2004	902.21

Date	7/6/2000 9:15		7/19/2000 8:54		7/31/2000 10:15		8/10/2000 9:45		8/23/2000 9:21		8/29/2000 11:56		9/13/2000 15:27		9/25/2000 14:47		10/3/2000 11:08		10/18/2000 15:12		
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
0	24.8	8.56	23.5	8.10	26.9	10.20	25.6	9.05	23.5	8.87	23.9	7.54	21.1	8.51	17.5	6.07	16.6	8.14	15.6	10.56	
1	24.8	8.55	23.6	7.93	26.2	11.02	25.4	8.44	23.3	8.91	23.3	7.27	21.1	8.41	17.1	6.01	16.6	7.93	13.4	10.91	
2	24.8	8.50	23.6	7.86	24.8	8.20	25.3	8.05	22.9	6.77	23.2	6.84	20.7	7.81	16.3	6.01	16.6	7.61	13.2	10.73	
3	24.3	7.91	23.6	7.80	23.6	3.58	24.6	4.93	22.7	6.25	23.1	6.72	20.3	7.01	16.1	5.39	16.6	6.96	13.1	10.58	
4	21.6	4.90	22.8	1.04	22.7	1.33	23.3	0.92	22.6	5.40	22.9	6.24	20.2	6.04	16.0	4.70	16.5	6.34	12.9	9.21	
5	19.5	1.50	20.5	0.45	20.7	0.60	20.6	0.57	22.0	2.25	21.4	0.37	20.1	5.20	16.0	4.52	16.4	5.77	12.7	7.40	
6	15.9	0.50	16.3	0.40	16.4	0.45	17.2	0.38	17.9	0.43	19.2	0.34	19.1	1.28	15.9	4.52	16.4	5.72	12.6	6.51	
7	13.3	0.43	13.5	0.33	13.9	0.40	14.3	0.34	14.1	0.36	14.4	0.30	17.8	0.45	15.9	4.39	16.2	3.94	12.5	5.62	
8	12.0	0.36	12.3	0.27	12.6	0.37	12.8	0.30	13.1	0.33	13.6	0.27	15.0	0.35	15.7	4.04	15.8	1.72	12.5	5.26	
9	11.2	0.31	11.6	0.24	11.8	0.35	11.8	0.28	12.2	0.31	12.3	0.26	12.6	0.29	15.5	2.79	15.5	0.92	12.4	4.78	
10	10.9	0.27	11.2	0.22	11.1	0.33	11.5	0.27	11.8	0.30	11.8	0.24	12.1	0.26	12.4	0.55	14.8	0.71	12.4	4.46	
11	10.7	0.25	11.0	0.21	11.0	0.31	11.3	0.28	11.5	0.28	11.6	0.23	11.9	0.24	12.0	0.43	12.5	0.63	12.4	4.02	
12	10.7	0.24	10.9	0.20	10.9	0.30	11.2	0.24	11.3	0.27	11.6	0.22	11.8	0.20	11.8	0.37	11.8	0.56	12.3	3.60	
13	10.5	0.20	10.8	0.20	10.7	0.28	11.1	0.20	11.3	0.26	11.4	0.21			11.7	0.36	11.7	0.53	12.3	3.04	
14			10.7	0.18							11.3	0.20			11.5	0.35	11.6	0.50	12.2	1.76	
15			10.6	0.18													11.6	0.47			
16																					
17																					
18																					
Top of Thermocline (m)	5		4		4		3		5		4		5		9		8		5		

Date	4/27/2001 10:15		5/15/2001 9:50		5/30/2001 11:15		6/7/2001 9:30		6/20/2001 9:30		6/28/2001 9:00		7/10/2001 10:30		7/25/2001 9:20		8/7/2001 10:25		8/14/2001 9:25		
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
0			18.8	12.26	18.5	10.79	17.1	9.47	21.9	6.41	26.9	8.82	25.9	10.43	26.2	10.39	30.3	8.36	25.1	7.67	
1			18.2	12.54	17.8	10.88	16.8	9.50	21.5	6.41	26.9	8.91	25.9	10.49	26.2	10.4	29.8	8.39	25.1	7.63	
2			17.5	12.41	17.5	10.84	16.7	9.43	21.2	6.25	25.3	9.72	25.7	10.54	26.1	10.35	29.1	8.55	25.1	7.50	
3			16.7	11.81	15.7	9.96	16.2	8.43	21.2	6.20	23.2	8.15	23.1	8.11	26.0	10.39	27.6	7.69	25.0	6.79	
4			15.9	11.49	14.6	8.59	15.7	7.06	19.5	4.84	20.3	4.03	21.1	4.05	23.4	0.84	24.7	2.17	24.7	3.55	
5			14.9	10.21	14.2	7.66	14.1	4.38	14.7	1.34	16.3	0.51	18.5	0.53	19.8	0.30	20.5	0.21	21.8	0.23	
6			13.2	7.15	13.0	5.32	13.0	2.53	13.0	0.64	12.9	0.26	13.5	0.34	15.2	0.20	15.6	0.20	16.6	0.21	
7			11.7	5.61	11.4	0.33	11.5	0.37	11.6	0.53	11.6	0.21	11.9	0.29	12.6	0.15	13.1	0.18	13.2	0.12	
8			9.6	3.60	10.1	0.33	10.0	0.31	11.0	0.47	11.3	0.05	11.2	0.24	12.1	0.13	11.9	0.16	12.0	0.12	
9			8.7	2.27	9.4	0.29	9.5	0.28	10.8	0.37	10.8	0.15	10.8	0.23	11.3	0.10	11.4	0.16	11.4	0.11	
10			8.4	1.50	9.0	0.23	9.2	0.24	10.7	0.37	10.6	0.15	10.6	0.19	11.0	0.09	11.1	0.16	11.1	0.10	
11			8.2	1.03	8.7	0.23	8.9	0.20	10.5	0.33	10.5	0.05	10.5	0.19	10.9	0.07	11.0	0.16	11.0	0.10	
12			8.1	0.49			8.9	0.20	10.4	0.36	10.4	0.05	10.4	0.19	10.8	0.06	10.9	0.16	10.9	0.10	
13			8.1	0.36			8.8	0.18	10.4	0.31	10.3	0.15	10.3	0.19	10.7	0.06	10.8	0.16	10.9	0.10	
14			7.9	0.11			8.6	0.16	10.2	0.29	10.2	0.11	10.2	0.17			10.7	0.16	10.7	0.09	
15			7.9	0.10			8.6	0.15	10.2	0.27			10.2	0.14			10.7	0.15			
16																					
17																					
18																					
Top of Thermocline (m)			6		6		6		5		4		4		4		4		4		

Date	8/28/2001 9:30		9/13/2001 9:15		9/28/2001 11:00		10/11/2001 12:05	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	24.1	9.81	20.3	8.60	16.8	10.37	13.4	6.02
1	24.0	9.93	20.4	8.55	16.5	10.56	13.2	5.29
2	23.9	9.53	20.4	8.53	16.4	9.63	12.9	4.90
3	23.7	8.61	20.4	8.52	16.3	9.49	12.9	4.81
4	22.8	4.24	20.4	8.38	16.2	7.14	12.9	4.76
5	21.1	0.35	20.3	7.15	16.1	6.80	12.9	4.75
6	18.4	0.21	19.7	1.09	16.1	5.34	12.8	4.75
7	13.5	0.18	15.2	0.33	15.8	1.14	12.8	4.71
8	12.4	0.17	12.9	0.19	14.4	0.35	12.8	4.64
9	11.6	0.16	11.9	0.20	12.2	0.22	12.8	4.60
10	11.2	0.14	11.5	0.20	11.6	0.21	12.8	4.62
11	11.1	0.14	11.3	0.16	11.2	0.19	12.7	4.65
12	11.0	0.14	11.2	0.15	11.1	0.18	12.7	4.41
13	11.0	0.13	11.1	0.16	11.1	0.14		
14	10.9	0.13	11.0	0.11	11.0	0.11		
15								
16								
17								
18								
Top of Thermocline (m)	4		6		6			

4/22/2002 10:50		5/10/2002 10:50		5/28/2002 12:10		6/6/2002 10:10		6/28/2002 12:10		7/9/2002 10:00		
Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
9.2	11.60	9.3	11.40	18.4	10.02	19.1	8.44	27.0	8.84	28.4	12.90	
9.0	11.40	9.0	11.30	18.0	10.11	19.0	8.46	25.6	8.58	27.5	12.07	
8.9	11.50	8.9	11.20	17.6	10.17	17.7	8.41	24.7	8.83	27.4	11.31	
8.9	11.10	8.9	11.20	15.5	9.78	16.9	7.74	24.0	6.60	26.9	7.84	
8.8	10.90	8.9	11.10	14.5	9.14	15.6	6.86	22.7	5.65	23.0	0.97	
7.8	8.90	8.9	11.10	14.1	8.51	13.7	5.75	19.4	2.65	19.1	0.60	
7.3	8.40	8.9	11.10	13.0	7.46	12.5	4.80	14.4	0.37	14.6	0.52	
6.6	6.50	8.9	11.20	10.8	5.52	11.1	2.97	12.0	0.30	12.4	0.45	
6.3	6.50	8.9	11.20	10.2	4.94	10.2	1.56	11.2	0.26	11.5	0.40	
5.9	5.60	8.9	11.20	9.8	4.05	10.0	0.70	10.9	0.27	11.0	0.41	
5.8	5.10	8.8	11.20	9.7	3.16	9.9	0.26	10.6	0.23	10.7	0.34	
5.7	4.70	8.8	11.10	9.6	2.99	9.8	0.21	10.6	0.23	10.6	0.32	
5.6	4.10	8.8	11.10	9.6	2.57	9.8	0.20	10.5	0.20	10.5	0.30	
5.6	0.30	8.8	11.10	9.5	1.56	9.8	0.20	10.4	0.18	10.4	0.29	
5.7	0.20	8.7	11.00			9.7	0.20					
5.7	0.20	8.7	11.00									
		8.8	3.60									
		8.8	0.10									
	5				6		8		6		4	

Date	7/29/2002 9:55		8/8/2002 11:25		8/20/2002 9:40		9/9/2002 13:10		9/18/2002 9:00		10/1/2002 10:10		10/16/2002 12:00		10/29/2002 9:45	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	25.8	10.44	23.8	11.17	22.2	8.63	26.2	8.27	21.6	8.34	16.7	10.20	11.4	11.64	6.9	13.74
1	25.5	10.29	23.3	10.96	22.2	8.54	25.5	8.38	21.6	8.21	16.6	9.70	11.2	11.03	6.8	13.10
2	25.3	10.01	23.2	10.06	22.2	8.32	24.6	8.23	21.6	8.07	16.3	8.06	11.2	10.63	6.8	12.94
3	25.0	8.88	23.0	10.22	21.6	6.39	23.5	6.55	21.5	7.65	16.1	7.08	11.2	10.57	6.8	12.87
4	22.8	2.62	22.7	7.85	21.5	5.80	22.4	5.77	21.3	6.44	16.0	6.73	11.1	10.32	6.8	12.79
5	18.6	0.78	21.9	5.12	20.5	2.42	21.3	0.73	21.0	4.96	15.8	6.13	11.1	10.25	6.8	12.74
6	15.1	0.72	16.0	1.10	17.3	0.81	18.6	0.57	19.5	0.96	15.6	2.91	11.0	10.17	6.8	12.71
7	12.7	0.71	13.0	1.06	13.2	0.68	15.0	0.38	15.1	0.87	15.2	0.67	11.0	10.04	6.8	12.69
8	11.7	0.63	12.0	0.98	12.1	0.60	13.2	0.39	13.3	0.48	14.6	0.59	11.0	10.01	6.8	12.67
9	11.2	0.62	11.5	0.94	11.5	0.55	12.3	0.39	12.6	0.46	12.7	0.56	11.0	9.99	6.8	12.68
10	11.0	0.55	11.2	0.90	11.3	0.53	11.8	0.39	12.3	0.44	12.1	0.54	11.0	9.95	6.8	12.68
11	10.9	0.54	11.0	0.86	11.1	0.52	11.6	0.39	12.0	0.43	11.9	0.53	11.0	9.90	6.8	12.69
12	10.8	0.51	10.9	0.85	11.1	0.51	11.5	0.40	11.7	0.40	11.8	0.50	11.0	9.87	6.8	12.69
13	10.7	0.50	10.8	0.85	11.0	0.51	11.4	0.39	11.8	0.37	11.7	0.46			6.8	12.80
14			10.7	0.85							11.7	0.43			7.0	1.27
15											11.7	0.41				
16											11.7	0.40				
17											11.6	0.39				
18											11.6	0.39				
Top of Thermocline (m)	3		5		5		5		5		6					

4/15/2003 10:30		5/6/2003 9:40	
D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
9.01	9	8.01	12.4
8.67	9	7.76	12.3
8.54	9	7.68	12.2
8.6	8.9	7.11	12
8.69	8.8	7.26	11.9
8.67	8.4	6.67	11.5
7.9	7.5	6.29	11.4
7.78	7.2	4.46	9.8
7.86	7	3.57	8.1
6.99	6.7	3	7.9
6.42	6.2	3.1	7.8
6.26	6.1	2.84	7.7
6.06	6	2.41	7.7
		2.21	7.6
		2.29	7.6
	7		

Date	5/16/2003 8:45		5/29/2003 11:40		6/11/2003 10:00		6/27/2003 12:00		7/11/2003 8:40		7/23/2003 10:30		8/6/2003 9:15		8/21/2003 12:30		9/4/2003 11:55		9/17/2003 8:30	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	5.4	16.2	4.91	20.3	NA	NA	7.82	22.3	6.01	21.8	4.23	24.5	9.03	23.7	5.6	26.2	6.37	21.9	6.32	20.3
1	5.18	15.7	4.69	18.6			7.6	21.1	5.85	21.9	3.56	23.5	7.75	23.6	5.4	26.3	6.38	21.9	6.1	20.3
2	5.86	14.7	4.49	18.1			6.97	20.8	6.46	21.8	3.46	23.2	1.87	23.2	5.32	26.3	5.55	21.6	6.13	20.3
3	5.1	13.5	3.62	17.3			6.41	20.7	5.42	21.8	0.92	22.8	0.09	21.9	4.31	26.1	5	21.5	6.26	20.3
4	4.27	12.8	4.11	16.6			5.49	20.3	5.42	21.7	0.05	21.5	0.06	18.8	0.02	23.2	4.9	21.4	6.07	20.2
5	3.95	12.6	4.12	16.6			3.16	19.3	0.46	19.4	0	19.7	0.06	15.4	0.03	18.7	0.43	20.4	5.82	20.2
6	4.1	12.1	2.73	13.2			0.38	15.2	0.24	15.7	0.01	16.1	0.04	13.1	0.02	15.2	0.03	16	5.83	20.1
7	3.85	11.8	1.7	11.4			0.27	13.1	0.17	13.3	0.01	13.3	0.05	11.9	0.01	13.1	0.02	13.4	0.05	15.5
8	2.9	10.9	1.07	10.6			0.21	11.7	0.13	12.2	0.01	11.8	0.02	11.3	0.02	12.2	0.01	12.1	0.02	14.2
9	2.64	10	0.41	10.2			0.17	11.2	0.11	11.5	0.01	11.2	0.02	11	0.01	11.5	0.01	11.5	0.01	12
10	1.55	9.1	0.21	10			0.16	10.8	0.09	11.1	0	11	0.02	10.8	0.01	11	0.01	11.1	0.02	11.4
11	1.1	8.7	0.05	9.6			0.15	10.6	0.09	10.9	0	10.8	0.02	10.7			0.01	11	0.01	11.2
12	0.54	8.3	0.04	9.4			0.13	10.5	0.08	10.7	0	10.7	0.01	10.6			0.01	10.8	0.01	11
13	0.33	8.1	0.15	9.1			0.13	10.4	0.07	10.6	0	10.6	0.01	10.5			0.01	10.8	0.01	10.9
14			0.14	9.1					0.06	10.5	0	10.5	0.01	10.3						
15																				
16																				
17																				
18																				
Top of Thermocline (m)			6				6		5		4		3		4		5		7	

Date	10/2/2003 11:45		10/14/2003 9:15	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	6.9	12.6	8.22	13.6
1	6.55	12.6	8.35	13.6
2	5.99	12.5	8.35	13.6
3	5.32	12.4	8.11	13.6
4	5.37	12.4	8.14	13.6
5	5.19	12.4	7.66	13.6
6	5.2	12.4	8.08	13.6
7	5.11	12.4	5.01	13.3
8	5.5	12.4	1.7	12.9
9	5.26	12.3	0.56	12.6
10	5.25	12.3	0.17	12.4
11	4.65	12.2	0.09	12.3
12	3.68	12.1	0.06	12.3
13	0.08	10.9	0.04	12.3
14				
15				
16				
17				
18				
Top of Thermocline (m)				

Date	4/22/2004 10:00		5/4/2004 9:25		5/18/2004 9:10		6/2/2004 11:30		6/16/2004 9:45		6/29/2004 9:30		7/14/2004 10:15	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	10.5	9.7	12.52	12	10.77	15.1	8.18	16.1	8.5	22.7	9.21	20.4	6.97	24
1	9.98	9.6	12.42	12	10.16	14.8	7.44	15.8	7.66	22.7	8.87	20.3	7.07	23.8
2	9.78	9.5	12.05	12	10.42	14.7	7.85	15.5	7.74	22.5	9.08	20.2	6.7	23.9
3	10.04	9.4	12.31	12	10.53	14.6	7.88	15.4	6.46	18.5	8.61	19.6	5.5	23.1
4	9.71	9.2	12.03	11.9	8.8	14.4	7.44	15.1	5.12	17.7	6.22	18.9	1.54	20.4
5	9.2	9	11.86	11.8	8.89	14.2	6.54	15	4.65	16.7	3.41	17.7	0.11	17.3
6	8.83	8.8	11.6	11.7	7.56	13.9	7.11	14.9	3.91	15	0.44	15.5	0.11	15.8
7	8.64	8.7	8.44	10.6	6.48	13.3	5.8	14.6	1.84	14.1	0.25	14	0.12	14.1
8	8.65	7.9	8.46	10.4	4.6	12.6	4.8	14.1	0.16	13.4	0.21	13.4	0.11	13.6
9	7.26	7.5	8.26	10.4	3.63	12.1	2.56	13.2	0.11	13	0.2	12.9	0.11	13
10	7.19	7.4	6.91	10.2	3.23	11.7	0.05	12.6	0.11	12.6	0.2	12.7	0.12	12.7
11	6.2	7.3	6.29	10.1	2.6	11.5	0.04	12.2	0.1	12.4	0.2	12.5	0.18	12.9
12	6.25	7.1	5.65	9.9	1.3	11.2	0.04	12	0.1	12.2	0.21	12.3	0.14	12.9
13	5.88	6.8	0.01	9.7	0.29	11.1	0.04	11.6	0.1	12.1	0.21	12.2	0.13	12.4
14	4.9	6.7			0.09	11	0.04	11.5	0.1	12	0.2	12.1	0.14	12.2
15									0.1	11.8				
16														
17														
18														
Top of Thermocline (m)			7		8		9		8		6		5	

Date	7/26/2004 10:00		8/12/2004 9:45		8/25/2004 11:00		9/9/2004 11:00		9/22/2004 9:30		10/6/2004 10:00		10/20/2004 11:15	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	7.43	25.5	6.12	19.7	7.45	20.5	6.24	20.7	4.88	19.8	3.97	14.9	5.46	11.3
1	7.01	25.2	6.09	19.6	6.77	20.3	5.9	20.7	4.6	19.8	3.54	14.9	5.2	11.2
2	6.23	24.8	5.96	19.5	6.41	20.2	5.68	20.7	4.81	19.7	3.63	14.8	5.1	11.1
3	4.86	24.4	5.56	19.5	6.14	20	5.6	20.6	4.4	19.7	3.63	14.8	5.22	11.1
4	0.5	22.3	6.07	19.5	5.52	19.9	5.01	20.5	3.71	19.7	3.61	14.8	5.16	11.1
5	0.36	18.6	5.62	19.4	4.61	19.4	3.83	20.3	3.13	19.6	3.55	14.8	5.13	11
6	0.38	15.9	0.41	17.2	1.91	18.5	0.22	19.1	2.38	19.4	3.49	14.8	5.08	11
7	0.39	14.2	0.35	14.3	0.09	17.3	0.18	18	1.01	19.1	3.61	14.8	5.01	11
8	0.39	13.3	0.34	13.6	0.06	14.1	0.17	14.9	0.06	18.2	3.6	14.8	5.11	11
9	0.4	12.8	0.35	13	0.07	13.5	0.17	14	0.04	15.6	3.3	14.8	4.8	11
10	0.4	12.6	0.34	12.7	0.06	12.9	0.17	13.3	0.04	13.8	3.01	14.7	4.9	11
11	0.41	12.4	0.36	12.5	0.06	12.7	0.17	13	0.04	13.2	2.55	14.7	4.96	11
12	0.41	12.2	0.34	12.4	0.06	12.6	0.17	12.8	0.04	13	2.16	14.6	5.09	11
13	0.4	12.2	0.34	12.3	0.05	12.5	0.16	12.7	0.04	12.9	0.24	13.9	4.93	11
14	0.4	12.1	0.34	12.2	0.06	12.4	0.16	12.6			0.1	12.6		
15					0.05	12.3								
16														
17														
18														
Top of Thermocline (m)	4		6		6		6		8		12			

Bone Lake
DNR ID #82-54
New Scandia Township, Washington County

Dissolved Oxygen & Temperature Profiles

Date	4/23/1997 11:45		5/30/1997 12:00		6/5/1997 13:00		6/23/1997 11:10		7/7/1997 11:20		7/16/1997 13:00		7/31/1997 10:05		8/13/1997 10:45		8/27/1997 14:15		10/1/1997 12:40	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	10.0	15.00	16.0	11.20	22.5	12.10	24.0	11.00	21.0	10.10	27.0	11.20	26.0	11.00	22.5	8.50	25.0	11.40	17.0	8.00
1	10.0	15.00	15.5	11.20	22.0	12.20	24.0	11.00	21.0	10.10	27.0	11.20	26.0	11.00	22.5	8.50	25.0	12.00	17.0	8.00
2	10.0	15.50	15.0	11.30	21.0	13.20	23.5	10.50	20.5	10.10	25.5	11.20	25.5	11.00	22.5	8.50	22.0	11.30	17.0	8.00
3	9.0	15.50	15.0	11.30	16.0	12.10	20.0	7.50	20.5	10.10	24.0	11.00	24.5	7.50	22.0	8.00	21.5	8.00	16.5	7.70
4	7.5	15.00	15.0	11.20	15.0	9.50	17.0	1.75	20.0	7.90	22.0	5.50	22.5	0.50	22.0	6.80	20.5	4.25	16.5	7.70
5	7.0	14.00	15.0	10.20	14.5	8.00	15.0	0.50	18.5	1.30	19.0	0.75	19.0	0.30	21.0	0.75	19.5	0.25	16.5	7.70
6	6.0	12.50	14.0	7.60	14.0	4.60	13.0	0.50	16.0	0.30	17.0	0.60	17.0	0.30	16.5	0.25	18.0	0.10	16.5	7.70
7	6.0	12.00	13.0	2.50	13.0	0.50	12.5	0.25	13.5	0.25	14.0	0.50	15.0	0.30	14.5	0.25	15.0	0.10	16.0	7.50
8	6.0	11.00	12.5	0.75	12.5	0.60	12.0	0.15	13.0	0.25	13.5	0.40	14.0	0.30	14.0	0.25	14.0	0.05	16.0	5.00
9	5.5	8.50	12.0	0.30	12.5	0.30	12.0	0.05	12.5	0.25					14.0	0.25				
10	5.5	1.00																		
Top of Thermocline (m)			6		6		3		4		4		3		4		4			

Date	10/16/1997 14:30	
Depth	Temp (C)	D.O. (mg/L)
0	14.5	8.00
1	14.5	8.00
2	14.0	8.00
3	14.0	8.00
4	13.5	7.70
5	13.5	7.30
6	13.5	7.00
7	13.5	6.40
8		
9		
10		
Top of Thermocline (m)		

4/15/1998 13:30		4/28/1998 11:45		5/11/1998 12:30		5/26/1998 11:35		6/8/1998 12:30		6/22/1998 12:15		7/7/1998 12:15		7/20/1998 12:00		8/5/1998 10:45		
Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
0	10.0	12.00	15.5	9.80	19.4	8.60	22.0	9.10	19.0	9.20	23.0	9.90	25.0	7.70	27.5	8.10	23.5	6.70
1	10.0	12.10	14.5	9.80	19.2	8.20	21.0	9.50	19.0	9.20	23.0	10.00	25.0	8.00	27.5	8.20	23.5	6.70
2	10.0	12.10	14.0	9.80	19.0	7.90	21.0	9.50	18.5	9.20	23.0	9.90	24.5	7.70	27.5	8.20	23.5	6.70
3	10.0	12.10	13.5	9.60	18.1	7.50	20.0	9.50	18.5	9.30	22.0	9.50	24.5	7.50	27.5	8.20	23.5	6.80
4	10.0	12.10	13.0	8.50	17.2	6.90	20.0	7.70	18.5	9.30	19.5	4.10	23.5	2.30	26.0	3.90	23.5	6.70
5	10.0	12.10	11.5	7.50	15.5	5.10	19.0	3.75	18.0	8.80	18.0	1.00	18.5	0.75	22.0	1.25	22.5	1.25
6	10.0	12.00	11.0	6.00	12.2	2.15	15.0	0.50	17.5	4.75	17.0	0.75	17.0	0.50	17.5	0.80	19.0	0.60
7	10.0	11.00	10.0	4.30	10.8	0.55	12.5	0.25	16.0	0.50	15.5	0.50	15.5	0.50	16.5	0.75	16.0	0.50
8	10.0	11.00	10.0	2.50	10.2	0.35	11.0	0.25	12.5	0.25	14.0	0.50	14.5	0.50	15.5	0.75	15.0	0.50
9	10.0	4.50	10.0	0.75	10.2	0.20							14.0	0.30				
10																		
Top of Thermocline (m)			5		6		5		6		4		4		4		4	

Date	8/19/1998 10:45		8/31/1998 12:45		9/14/1998 10:50		9/28/1998 11:30		10/15/1998 11:10	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	23.0	7.10	25.5	8.50	24.0	10.10	19.0	7.00	12.5	9.80
1	23.0	7.10	24.9	8.50	24.0	9.70	19.0	7.00	12.5	9.80
2	23.0	7.10	24.5	8.50	23.5	9.50	19.0	6.60	12.5	10.00
3	23.0	7.10	24.5	8.50	23.0	9.00	19.0	6.60	12.5	10.00
4	23.0	7.10	24.0	7.00	22.0	6.40	19.0	6.60	12.5	10.00
5	23.0	7.10	23.5	1.50	21.5	5.30	18.8	6.60	12.5	10.00
6	23.0	7.10	21.5	1.00	21.0	2.00	18.5	6.50	12.5	10.00
7	20.0	0.75	18.0	0.75	19.0	0.30	18.5	6.00	12.5	0.50
8			16.0	0.50	17.0	0.25	18.5	0.25		
9										
10										
Top of Thermocline (m)	7		5		4					

4/20/1999 1:00		5/11/1999 14:50		5/26/1999 13:15		6/10/1999 14:56		6/22/1999 14:35		
Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
0	9.2	10.64	15.9	11.07	19.9	9.81	23.8	10.31	22.4	9.39
1	9.1	10.55	15.9	10.87	16.7	9.88	23.5	10.23	22.3	9.24
2	9.1	10.48	15.9	10.64	16.2	9.27	23.1	9.45	22.3	9.07
3	9.1	10.34	15.9	10.64	16.0	8.95	21.7	8.53	22.3	8.95
4	9.1	10.28	15.8	10.09	16.0	8.77	19.9	6.63	22.3	8.82
5	9.1	10.22	15.3	9.58	16.0	8.67	18.4	5.40	22.3	8.73
6	9.0	10.14	13.5	7.39	15.6	8.08	15.9	1.16	15.9	0.73
7	8.7	9.67	10.3	3.98	14.0	3.65	13.8	0.54	14.1	0.58
8	8.6	9.35	9.4	2.34	12.8	0.74	13.8	0.43	13.6	0.43
9	8.3	0.30	9.2	0.45	12.7	0.52	13.0	0.29		
10										
Top of Thermocline (m)			6		7		5		5	

Date	8/20/2002 11:55		9/9/2002 14:25		9/18/2002 11:00		10/1/2002 13:00		10/16/2002 14:40		10/29/2002 11:45	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	22.7	8.51	26.8	9.93	21.9	8.03	17.3	9.22	11.7	13.66	6.7	16.14
1	22.6	8.22	25.6	9.08	21.8	7.96	17.3	9.15	11.0	13.21	6.7	16.33
2	22.4	7.24	24.8	10.86	21.8	7.83	17.2	9.15	11.0	12.83	6.7	16.34
3	22.0	5.75	23.8	6.90	21.8	7.58	17.1	9.15	10.9	12.56	6.6	16.18
4	21.9	4.55	22.8	4.37	21.7	7.24	17.00	8.06	10.9	12.42	6.6	16.14
5	21.6	2.21	22.3	1.35	21.5	5.54	16.6	6.8	10.8	12.41	6.6	16.09
6	21.3	0.71	21.3	0.61	21.0	0.65	16.2	5.75	10.7	10.05	6.6	16.07
7	20.0	0.63	19.8	0.52	20.5	0.57	16.2	5.43	10.2	12.10	6.6	15.99
8	16.2	0.57	17.6	0.46	18.3	0.52	16.1	0.57	10.5	1.15		
9			17.6	0.46								
10												
Top of Thermocline (m)	4		5		5		5		6			

4/15/2003 12:30		5/5/2003 14:10		5/16/2003 11:00		5/27/2003 12:05		
D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	
9.66	10.1	10.55	13.2	5.58	16.9	4.21	19.5	
9.54	10.1	9.85	13.1	5.22	16.2	4.08	18.5	
9.55	10.1	9	13.1	4.89	15.6	4.03	18.1	
9.62	9.9	8.97	13.1	4.61	14.4	3.62	16	
9.46	9.8	8.65	12.8	4.35	13.7	3.24	15.2	
9.32	9.3	8.23	12.5	4.26	13.4	2.99	14.8	
9.11	8.4	6.19	11	3.96	13.1	1.89	13.8	
8.9	7.8	3.83	9.2	3.64	12.6	0.7	13	
8.47	7.6	2.07	8.8	2.63	11.9	0.15	12.2	
	6		7					

Date	6/11/2003 12:15		6/27/2003 10:28		7/11/2003 12:00		7/23/2003 13:30		8/6/2003 12:00		8/21/2003 11:00		9/4/2003 11:00		9/18/2003 9:20		10/1/2003 9:15		10/14/2003 10:00		
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	
0	NA	NA	5.47	20.8	9.23	22.9	7.15	26.5	11.58	24.6	5.6	26.2	5.42	21.7	6.32	20.6	9.7	12.4	10.58	13.8	
1			5.29	20.8	7.61	22.3	6.27	23.9	9.7	23.9	5.45	26.2	4.88	21.6	6.17	20.6	9.29	12.6	10.22	13.8	
2			4.95	20.8	7.03	22.2	5.42	23.5	9.1	23.8	5.11	26.2	4.31	21.4	6.17	20.6	9.36	12.6	10.1	13.9	
3			4.68	20.8	6.94	22.1	5.04	23.3	2.05	23.5	4.96	26.2	4.11	21.4	6.03	20.6	9.33	12.6	10.34	13.9	
4			4.01	20.7	2.64	21.9	1.34	22.7	0.1	22.2	0.04	23	4.03	21.3	6.08	20.6	9.3	12.5	10.36	13.8	
5			2.54	20.4	0.23	19.7	0.1	21.1	0.04	20.7	0.01	20.4	3.86	21.3	6	20.6	9.41	12.5	10.27	13.8	
6			0.32	17.9	0.13	18.1	0.01	18.4	0.02	18.5	0.01	18.6	0.15	20.6	5.62	20.5	9.2	12.4	8.29	13.7	
7			0.29	16	0.09	16.1	0	16.1	0.03	16.7	0.02	16.5	0.02	17	4.83	20.4	9.3	12.2	7.49	13.5	
8			0.24	14.6	0.07	15	0	15	0.01	14.8	0	15.3	0.01	15.4							
9							0	14.6													
10																					
Top of Thermocline (m)			6		5		5		4		4		6								

Date	4/22/2004 11:00		5/4/2004 11:35		5/18/2004 12:50		6/2/2004 12:30		6/16/2004 10:45		6/29/2004 10:30		7/14/2004 11:00		7/26/2004 11:00		8/12/2004 10:45		8/12/2004 10:45		
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	
0	9.51	10.6	9.64	12.3	7.87	18.3	10.76	16.3	9.21	22.3	8.52	20.4	8.23	24.3	7.59	26	4.11	19.7	9.52	21.3	
1	8.63	10.4	9.17	12.3	8.85	15.8	10.35	16.1	8.89	22	8.12	20.2	7.99	23.9	7.8	25.2	3.71	19.6	7.03	20.6	
2	9.1	10.3	9.5	12.3	8.14	15.2	10.4	16.1	4.24	18.5	7.66	20	7.85	23.8	6.59	24.9	3.11	19.4	6.47	20.3	
3	9.22	10.2	9.1	12.2	7.83	15	10.03	15.9	5.26	18.6	8.25	19.9	5.09	23.4	4.23	24.1	3.55	19.4	5.82	20.2	
4	9.03	10.1	9.55	12.2	7.88	14.9	8.96	15.5	3.72	18	5.87	19.3	0.7	20.8	0.38	22.4	3.2	19.4	4.46	19.7	
5	8.28	10.1	9.45	12.1	7.02	14.7	8.7	15.5	3.2	17.7	3.31	18.8	0.16	19.1	0.34	19.6	1.55	19.2	2.56	19.4	
6	8.7	10.1	9.25	12.1	6.85	14.5	8.63	15.5	1.59	16.2	0.24	17.1	0.16	17.6	0.34	17.3	0.9	18.9	0.16	18.9	
7	8.98	10	8.94	11.8	6.44	14.2	6.75	15.2	0.18	15.3	0.18	15.8	0.16	16.5	0.36	15.9	0.3	16.3	0.09	18.7	
8	8.65	9.8	7.02	11.2	2.23	14.1	3.3	14.7	0.1	14.8			0.16	15.1	0.35	15.2	0.25	15.5	0.06	17.4	
9	0.1	9.4	0.02	11.1			0.05	14.5													
10																					
Top of Thermocline (m)			8		7		8		6		6		4		4		6		6		

Date	8/25/2004 13:00		9/22/2004 10:15		10/6/2004 10:45		10/20/2004 13:45	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	6.17	20.8	5.42	20.1	7.2	14.4	6.89	10.3
1	5.78	20.7	4.9	20	6.83	14.2	6.92	10.3
2	5.96	20.7	4.66	19.9	6.93	14.2	6.82	10.1
3	5.83	20.6	4.37	19.9	7.03	14.1	6.5	10.1
4	5.38	20.5	4.88	19.8	6.71	14.1	6.41	10.1
5	3.33	20.3	3.98	19.8	6.85	14.1	6.36	10.1
6	1.29	20	3.45	19.7	6.71	14	6.22	10
7	0.17	19.7	2.5	19.6	6.38	13.9	6.41	10
8	0.15	18.5	0.11	19.3	0.1	13.9		
9								
10								
Top of Thermocline (m)	7							

Forest Lake (West)
DNR ID #82-159
Forest Lake Township, Washington County

Dissolved Oxygen & Temperature Profiles

Date	4/23/1997 12:50		5/22/1997 9:10		6/5/1997 11:50		6/18/1997 8:30		7/7/1997 9:00		7/16/1997 11:40		8/1/1997 9:15		8/13/1997 8:30		8/27/1997 9:00		9/16/1997 9:00	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	10.0	13.00	13.5	12.10	20.5	9.70	21.0	9.40	20.5	10.10	26.0	21.50	24.5	9.20	22.0	8.50	23.5	9.50	20.0	7.20
1	10.0	13.00	13.5	12.10	20.5	9.70	21.0	9.20	20.5	10.10	26.0	21.50	24.5	9.20	22.0	8.50	22.5	9.80	19.5	7.20
2	10.0	13.00	13.5	12.10	20.5	9.70	21.0	9.20	20.5	10.10	25.5	22.00	24.5	9.20	22.0	8.50	22.0	9.30	20.0	7.20
3			13.5	12.10	20.0	10.00	21.0	9.20	20.5	10.00	25.0	21.00	24.5	9.10	22.0	8.30	21.0	8.60	20.0	7.20
4			13.5	12.10	16.0	8.50	21.0	9.20	20.5	9.40	23.0	7.50	24.0	8.60	22.0	8.50	21.0	8.50	19.0	7.20
5			13.0	10.40	15.0	8.00	17.5	2.80	20.0	9.70	22.0	4.25	24.0	7.70	22.0	8.30	20.0	4.75	20.0	6.50
6			12.5	0.25	14.5	3.75			20.0	9.70	22.0	0.50	23.0	0.75	22.0	0.50				
Top of Thermocline (m)											4		4							

Date	10/2/1997 10:40		10/15/1997 12:20		4/17/1998 9:20		4/28/1998 9:20		5/11/1998 9:30		5/26/1998 9:30		6/8/2000 10:05		6/22/1998 9:50		7/7/1998 8:25		7/20/1998 9:15	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	16.5	8.60	13.0	8.70	9.5	8.00	14.0	7.60	18.1	8.00	20.5	8.50	18.0	9.10	22.0	8.70	24.2	7.50	27.0	7.20
1	16.0	8.60	13.0	8.70	9.5	8.00	14.0	7.60	18.2	8.00	20.5	8.00	18.5	9.20	22.0	8.70	24.2	7.50	27.0	7.20
2	16.0	8.40	13.0	8.70	9.5	8.00	14.0	7.50	18.2	7.80	20.5	8.00	17.5	8.50	22.0	8.80	24.2	7.30	27.0	7.50
3	16.0	8.20	13.0	8.70	9.5	8.00	13.5	7.50	17.9	7.80	20.0	7.90	17.5	8.20	22.0	8.80	24.2	7.50	26.5	5.70
4	15.5	8.40	12.5	8.70	9.5	8.00	13.5	7.50	16.9	7.50	19.5	7.90	17.5	7.80	22.0	8.80	24.2	7.40	26.0	4.25
5	15.5	8.40	12.0	8.50	9.5	8.00	13.0	7.30	16.3	5.00	19.0	7.40	17.0	7.50	21.5	8.80	24.0	4.00	26.0	0.75
6			12.5	1.00	9.5	7.60	13.0	7.30	16.0	3.70	19.0	0.50	17.0	0.50	21.5	1.25	23.5	0.50	25.5	0.50
Top of Thermocline (m)									5		5		4						3	

Date	8/5/1998 8:30		8/19/1998 8:30		8/31/1998 10:15		9/14/1998 8:45		9/28/1998 9:00		4/20/1999 9:39		5/11/1999 11:30		5/26/1999 10:30		6/9/1999 12:20		6/22/1999 12:00	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	22.5	6.50	23.0	6.50	24.2	9.70	23.0	10.00	18.5	9.60	9.5	9.70	15.9	9.63	17.5	9.92	23.0	8.54	21.9	9.09
1	22.5	6.50	23.0	6.50	24.2	9.20	23.0	9.70	18.5	9.60	9.5	9.63	15.9	9.53	16.6	9.82	22.9	8.42	21.8	8.98
2	22.5	6.50	23.0	6.50	24.0	8.90	23.0	9.70	18.5	9.60	9.5	9.53	15.9	9.39	16.5	9.61	22.7	8.22	21.7	8.84
3	22.5	6.50	23.0	6.50	24.0	9.50	23.0	9.40	18.5	9.60	9.5	9.44	15.9	9.23	16.3	9.47	22.5	8.02	21.5	8.68
4	22.5	6.60	23.0	6.50	23.5	8.20	21.5	7.70	18.5	9.60	9.5	9.35	15.9	9.10	15.9	9.16	21.9	6.76	21.5	8.68
5	22.5	0.65	23.0	6.40	23.5	0.75	21.0	0.75	18.5	9.60	9.5	9.20	15.9	8.79	15.9	0.66	20.8	0.49	21.5	8.52
6			23.0	0.50					18.5	0.30							20.5	0.39	21.2	3.56
7													15.2	0.41					20.9	0.64
Top of Thermocline (m)					4		4											4		

Date	7/7/99 11:000		7/19/99 13:05		8/4/1999 12:30		8/24/1999 12:00		9/10/1999 9:45		9/23/1999 10:20		10/4/1999 11:40		10/20/1999 12:30		4/12/2000 10:30		5/25/2000 7:45	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	25.0	8.20	25.9	7.43	25.8	7.61	2.4	8.56	19.2	8.41	16.6	9.53	12.7	9.73	9.4	10.58	7.4	11.30	17.8	9.19
1	25.0	8.30	25.0	7.13	25.8	7.52	22.3	8.36	19.2	8.28	16.5	9.51	12.7	9.72	9.3	10.51	7.3	11.36	17.8	9.18
2	25.0	8.20	24.7	6.77	25.8	7.42	22.3	8.14	19.2	8.13	16.5	9.41	12.6	9.71	9.2	10.50	7.1	11.34	17.8	9.15
3	25.0	8.20	24.6	6.62	25.8	7.30	22.2	7.98	19.2	8.03	16.4	9.25	12.5	9.70	9.2	10.51	7.1	11.30	17.8	9.13
4	25.0	8.20	24.3	6.20	25.7	4.05	22.2	7.85	19.0	7.96	16.1	8.15	12.5	8.39	9.3	10.50	7.0	11.31	17.8	9.12
5	24.5	8.30	24.3	5.80			22.1	7.64	19.4	0.60	16.2	0.45	12.6	4.80	9.2	3.29	7.2	1.50	17.7	8.97
6	24.5	0.25	23.6	0.46			22.0	0.60											17.6	8.40
7																			17.3	0.50
Top of Thermocline (m)					4						4		4							

Date	4/15/2003 9:40		5/6/2003 9:05		5/16/2003 8:00		5/29/2003 10:20		6/11/2003 9:20		6/27/2003 11:12		7/11/2003 9:40		7/23/2003 11:30		8/6/2003 10:05		8/21/2003 9:15	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	9.38	10	7.3	13	5.85	15.9	4.77	20.2	NA	NA	7.87	21.2	7.16	22	4.44	24.4	9.33	24.1	5.7	25.9
1	9.06	10	6.92	12.9	5.77	15.9	4.88	19.1			7.65	21	7.36	22	4.5	23.6	9.36	24.1	5.63	25.9
2	9.04	10	7.11	12.9	5.5	15.6	5.2	18.9			6.6	20.9	6.57	22	4.2	23.5	9.05	24	5.65	25.9
3	8.9	10	6.94	12.8	5.28	15	4.79	18.6			5.92	20.9	7.2	22	4.15	23.5	8.92	24	5.75	25.9
4	9.06	9.8	6.41	12.8	5	14.5	4.68	18.2			6.61	20.6	7.02	22	3.82	23.3	8.5	23.7	5.8	25.9
5	8.91	9.6	6.5	12.8	4.84	14	2.89	16.3			5.34	20.3	7.03	21.7	2.94	23.2	0.11	23.4	0.02	25.7
6											0.54	20.3	0.23	21.6	2.96	23	0.02	23		
7															1.99	23				
Top of Thermocline (m)																				

Date	9/4/2003 12:40		9/18/2003 7:50		10/2/2003 11:00		10/14/2003 8:30	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	7.73	22.5	7.42	20	10.18	10.7	8.82	13.4
1	7.55	22	7.37	20	9.97	10.7	8.63	13.5
2	6.98	21.4	7.41	20	9.94	10.7	8.74	13.5
3	6.45	21.2	7.28	20	9.94	10.6	8.54	13.5
4	6.4	20.9	7.29	20	10.3	10.4	8.44	13.5
5	6.01	20.5	7.16	20	3.88	10.4	8.29	13.5
6								
7								
Top of Thermocline (m)								

4/22/2004 8:50		5/5/2004 8:00		5/18/2004 8:30		6/2/2004 10:20		6/16/2004 8:30		6/29/2004 8:45	
D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
9.46	11.2	9.77	12.6	7.84	15	8.79	15.6	8.23	21.8	7.76	19.7
9.32	11.1	9.5	12.5	7.55	14.9	8.7	15.6	7.71	21.8	7.8	19.7
9.35	11.1	9.62	12.5	7.43	14.8	8.93	15.6	7.85	21.8	7.88	19.7
8.88	11.1	9.72	12.5	6.98	14.8	8.55	15.5	7.64	21.6	7.9	19.7
9.1	11.1	9.69	12.5	6.7	14.8	8.66	15.5	6.53	20.6	7.51	19.6
8.9	11.1	9.79	12.5	6.6	14.8	7.96	15.1	4.96	19.7	7.25	19.5
0.5	11.1	0.1	12.5	0.1	14.7	0.12	15.3	0.09	19.1		
								5			

Date	7/14/2004 9:00		7/26/2004 9:00		8/12/2004 9:00		8/25/2004 10:15		9/9/2004 10:00		9/22/2004 8:45		10/6/2004 9:30		10/20/2004 10:45	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	7.93	23.7	7.37	25.2	7.62	18.9	7.17	20	7.23	20.5	5.94	19.6	7.44	12.7	7.32	9
1	7.34	23.7	6.68	25.1	7.2	18.9	6.62	19.9	7.01	20.5	5.37	19.6	7.32	12.7	7.22	8.9
2	7.55	23.7	6.35	25.1	7.34	18.8	6.48	19.8	7.12	20.3	5.14	19.5	7.36	12.7	7.16	8.9
3	7.47	23.7	6.95	24.7	7.53	18.8	6.34	19.8	7.22	20.3	5	19.5	7.32	12.7	7.42	8.9
4	7.4	23.6	4.54	24.1	7.17	18.7	6.02	19.8	7.23	20.2	5.14	19.5	7.35	12.7	7.14	8.9
5	7.66	23.6	0.4	23.1	6.44	18.4	0.08	19.7	0.54	20.1	5.11	19.4	0.25	12.7	7.48	8.9
6	0.21	22.8			0.35	18.7	0.08	19.7							0.09	9.1
7																
Top of Thermocline (m)	6		4		5		5		5							

Halfbreed (Sylvan) Lake

DNR ID #82-80

Forest Lake Township/New Scandia Township, Washington County

Dissolved Oxygen & Temperature Profiles

Date	4/15/1998 12:00		4/28/1998 10:45		5/11/1998 11:30		5/26/1998 11:50		6/8/1998 11:35		6/22/1998 11:30		7/7/1998 10:45		7/20/1998 11:00		8/5/1998 10:10		8/19/1998 10:00	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	11.5	10.40	15.5	8.10	19.8	8.50	21.5	8.20	19.0	10.40	23.5	9.20	25.0	8.20	28.0	8.00	23.0	7.00	23.0	6.75
1	11.5	10.40	15.5	8.10	19.8	8.20	21.0	8.30	19.0	10.40	23.5	9.10	25.0	8.20	28.0	7.90	23.0	7.10	23.0	6.75
2	11.5	10.40	15.0	8.00	19.8	8.00	21.0	8.50	19.0	10.40	23.5	9.30	25.0	8.00	27.5	7.90	23.0	7.10	23.0	6.75
3	11.5	10.40	15.0	7.90	18.7	7.90	20.5	7.50	19.0	10.40	23.0	8.20	25.0	7.70	27.0	6.50	23.0	7.00	23.0	6.75
4	11.5	10.40	14.0	8.00	17.0	7.90	20.0	7.20	18.5	10.00	20.0	9.30	23.0	5.70	25.5	4.75	23.0	6.60	23.0	6.75
5	11.5	10.40	12.0	8.10	14.1	8.90	16.5	8.50	18.0	9.20	18.5	7.50	19.0	5.60	21.0	4.75	21.5	3.50	21.5	2.25
6	11.0	10.10	10.5	7.50	11.8	8.10	12.5	7.50	14.0	8.10	15.0	6.30	16.0	6.20	17.0	3.25	16.5	1.00	17.5	0.80
7	6.0	6.50	7.5	4.00	9.2	5.60	10.0	4.90	10.5	5.70	11.0	4.50	12.5	2.50	12.5	1.30	13.0	0.75	14.0	0.50
8	5.5	0.75	6.0	0.80	7.2	1.30	8.0	0.80	8.5	1.25	9.0	1.75	9.0	1.25	10.5	1.00	11.0	0.60	11.5	0.50
9	5.0	0.50	5.0	0.60	5.9	0.70	6.5	0.50	6.5	0.50	7.0	1.25	7.5	0.75	8.0	0.75	8.5	0.60	9.0	0.50
10	5.0	0.25	5.0	0.30	5.1	0.45	6.0	0.50	6.0	0.40	6.5	1.00	6.5	0.60	7.0	0.75	7.5	0.60	7.0	0.30
11	5.0	0.25	5.0	0.25	5.0	0.35	5.5	0.25	6.0	0.40	6.0	0.75	6.0	0.60	6.5	0.75	6.5	0.60	6.5	0.25
12	5.0	0.25	5.0	0.25	5.0	0.33	5.5	0.25	5.5	0.40	6.0	0.60	6.0	0.60	6.5	0.60	6.0	0.50	6.5	0.25
13					5.0	0.20														
14					5.0	0.15														
Top of Thermocline (m)			7		7		7		7		7		6		6		5		5	

Date	8/31/1998 12:00		9/14/1998 10:15		9/28/1998 10:40		10/15/1998 10:20	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	25.0	9.00	23.5	9.70	18.8	9.60	11.5	9.30
1	24.9	8.70	23.5	9.70	18.8	9.60	11.5	9.30
2	24.5	8.50	22.5	9.70	18.8	9.10	11.5	9.30
3	24.5	7.70	22.0	9.40	18.5	8.50	11.5	9.30
4	24.0	5.90	21.5	8.30	18.0	8.00	11.5	9.30
5	22.2	2.50	19.0	6.80	18.0	7.50	11.5	9.30
6	18.5	1.25	18.0	0.75	17.5	5.70	11.5	9.30
7	14.5	1.00	15.0	0.60	15.5	0.75	11.5	8.70
8	12.0	0.75	11.5	0.60	11.5	0.30	11.5	8.70
9	9.0	0.50	9.5	0.60	9.0	0.25	11.5	8.70
10	7.5	0.30	8.0	0.50	8.0	0.25	11.5	0.60
11	7.0	0.30	7.0	0.50	7.0	0.25		
12	6.5	0.25	6.5	0.50	7.0	0.15		
13								
14								
Top of Thermocline (m)	5		5		6			

Date	4/20/1999 12:00		5/11/1999 14:15		5/26/1999 12:00		6/10/1999 14:05		6/22/1999 13:40		7/6/1999 12:20	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	10.2	10.42	16.4	9.53	18.4	10.54	24.2	8.82	22.9	9.57	26.5	5.27
1	10.1	10.36	16.4	9.34	17.7	10.47	24.2	8.72	22.8	9.43	26.4	5.22
2	10.1	10.27	16.4	9.19	17.4	10.40	24.1	8.59	22.7	9.31	26.4	5.14
3	10.1	10.19	16.4	9.07	17.2	9.85	22.0	8.30	22.6	9.23	24.4	4.70
4	9.6	9.80	16.3	8.96	16.9	9.66	19.9	6.60	21.0	7.45	22.4	2.34
5	9.1	9.48	15.7	8.60	16.1	8.70	17.4	6.83	18.7	8.56	19.1	3.27
6	8.9	9.10	10.6	9.80	13.2	8.45	13.7	5.54	15.6	5.90	15.9	3.66
7	8.7	8.82	9.9	9.80	10.4	7.65	11.2	5.05	11.4	2.85	12.3	0.50
8	8.5	8.43	9.2	7.17	9.5	5.17	9.7	2.77	10.5	0.83	10.2	22.00
9	8.3	7.95	8.3	3.54	8.7	3.30	8.9	1.13	10.5	0.59	8.9	0.17
10	7.3	4.46	7.6	0.63	7.8	0.74	8.0	0.70	10.5	0.47	8.0	0.14
11	5.7	0.36	6.9	0.40	7.2	0.57	7.5	0.52	10.4	0.41	7.7	0.14
12	5.6	0.20	6.6	0.27	7.1	0.45	7.4	0.43	10.4	0.90	7.5	0.13
13	5.5	0.17	6.6	0.24	7.1	0.40	7.3	0.34			7.6	0.12
14					7.0	0.34	7.3	0.31				
Top of Thermocline (m)	10		8		8		8		7		6	

Date	7/20/1999 9:50		8/4/1999 11:32		8/24/1999 13:10		9/8/1999 14:40		9/23/1999 11:45		10/4/1999 13:45		10/20/1999 14:30	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	25.7	8.19	26.6	7.66	23.4	8.46	22.2	7.62	17.2	9.50	13.3	8.88	10.6	9.89
1	25.8	8.00	26.6	7.53	22.8	8.42	22.2	7.50	17.1	9.76	13.3	8.88	10.6	9.84
2	25.8	7.90	26.5	7.39	22.7	8.38	22.2	7.40	17.0	9.83	13.3	8.88	10.6	9.82
3	25.8	7.59	25.9	7.65	22.6	7.85	22.1	7.26	16.5	9.26	13.2	8.91	10.5	9.84
4	23.6	3.06	25.21	2.21	22.4	6.80	21.7	6.66	16.4	9.00	13.2	8.91	10.2	9.70
5	19.8	3.07	20.9	1.54	21.6	5.52	21.4	5.84	16.3	9.05	13.0	9.10	10.1	9.42
6	15.8	1.85	17.0	0.68	17.8	0.50	19.0	1.55	16.1	8.32	12.9	8.85	10.1	9.33
7	12.9	0.90	13.6	0.51	14.3	0.40	14.6	0.85	15.4	3.15	12.8	8.74	10.1	9.17
8	10.9	0.66	11.7	0.46	11.9	0.36	12.0	0.70	12.3	0.64	12.7	8.02	10.0	9.16
9	9.4	0.50	9.7	0.31	9.9	0.28	9.9	0.56	10.2	0.48	10.8	0.40	10.0	9.16
10	8.1	0.38	9.1	0.23	8.7	0.25	9.0	0.51	9.0	0.31	9.3	0.31	9.9	9.15
11	7.7	0.35	9.1	0.22	8.5	0.23	8.2	0.45	8.6	0.25	8.5	0.26	9.9	8.68
12	7.6	0.33			8.6	0.21	8.0	0.34	8.1	0.23	8.3	0.20	9.3	1.90
13	7.6	0.29			8.6	0.20			8.0	0.23			9.2	0.79
Top of Thermocline (m)	6		5		5		5		7		8			

Date	4/12/2000 13:52		5/24/2000 12:30		6/8/2000 11:15	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	8.4	11.31	19.7	9.22	21.6	9.90
1	8.4	11.28	19.7	9.22	21.4	10.00
2	8.4	11.27	19.7	9.23	20.2	9.90
3	8.4	11.25	19.3	9.22	18.8	8.65
4	8.2	11.28	15.5	8.33	16.9	8.02
5	8.0	11.15	11.6	10.08	12.9	9.95
6	7.9	11.18	9.4	9.28	10.4	9.81
7	7.8	11.14	8.8	9.43	9.1	7.22
8	7.7	11.01	8.1	8.50	8.4	5.12
9	7.6	10.83	7.7	7.29	7.9	4.00
10	7.6	10.31	7.4	5.15	7.6	1.50
11	7.5	2.30	7.5	1.34	7.6	0.80
12			7.4	0.81	7.6	0.54
13					7.6	0.40
Top of Thermocline (m)			9		9	

Date	6/22/2000 11:00		7/6/2000 11:00		7/19/2000 10:30		7/31/2000 12:00		8/10/2000 11:15		8/23/2000 11:15		8/29/2000 13:46		9/14/2000 8:51		9/28/2000 11:17		10/9/2000 11:35	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	20.9	8.31	25.7	7.80	24.1	7.95	26.7	8.61	26.7	7.87	23.3	8.20	24.2	7.36	20.5	7.74	15.1	8.77	11.2	9.38
1	20.9	8.25	25.6	7.79	24.1	7.92	26.3	8.84	26.0	8.01	22.9	8.27	23.4	7.42	20.5	7.72	15.0	8.75	10.9	9.20
2	20.9	8.23	25.5	7.75	24.0	7.67	25.6	8.61	25.9	6.87	22.8	8.45	23.3	7.11	20.5	7.69	15.0	8.74	10.9	9.15
3	20.9	8.21	24.1	6.51	23.7	7.35	24.8	7.11	24.8	6.26	22.5	7.36	23.0	6.59	20.5	7.68	15.0	8.73	10.9	9.11
4	19.9	7.15	20.5	5.30	22.4	4.91	23.1	5.56	22.9	3.57	22.2	6.50	22.7	5.53	20.4	7.01	14.9	8.73	10.8	8.95
5	14.7	8.86	17.1	6.37	17.4	5.83	18.3	4.35	18.7	3.88	19.7	1.54	20.4	1.38	20.1	6.30	14.9	8.73	10.8	8.76
6	11.5	9.01	13.1	9.80	13.2	7.46	13.8	3.64	13.9	2.57	15.5	0.95	15.8	0.70	17.8	1.15	14.8	8.69	10.8	8.58
7	9.9	7.01	10.5	5.30	10.9	3.98	12.0	3.17	11.6	0.93	12.2	0.58	12.8	0.55	13.6	0.63	14.3	6.08	10.6	8.40
8	9.0	5.35	9.4	2.60	9.8	1.58	10.2	1.58	10.1	0.85	10.3	0.68	10.6	0.45	11.1	0.62	11.9	0.79	10.5	8.07
9	8.4	1.17	8.8	1.41	8.9	0.66	9.9	1.08	9.0	0.61	9.4	0.43	9.3	0.34	9.8	0.45	9.9	0.64	10.5	7.71
10	7.9	0.67	8.3	0.78	8.4	0.49	9.0	0.91	8.6	0.43	8.6	0.40	8.7	0.30	9.0	0.33	9.3	0.55	10.0	5.35
11	7.7	0.51	8.1	0.50	8.1	0.40	8.2	0.66	8.2	0.39	8.4	0.37	8.3	0.27	8.7	0.28	8.9	0.46	8.8	1.43
12			8.0	0.43	8.0	0.34					8.2	0.36	8.2	0.26	8.6	0.26	8.7	0.43		
14													8.3	0.23						
Top of Thermocline (m)	8		7		7		7		6		5		4		5		7		8	

Date	10/18/2000 13:19	
Depth	Temp (C)	D.O. (mg/L)
0	13.5	10.97
1	13.0	10.93
2	12.9	10.93
3	12.7	10.73
4	11.8	10.34
5	11.2	10.11
6	10.8	9.10
7	10.5	8.89
8	10.4	7.94
9	10.2	4.52
10	9.9	2.32
11	9.3	2.06
12	9.2	1.63
13	9.2	1.44
Top of Thermocline (m)	9	

Date	4/27/2001 13:00		5/15/2001 12:20		5/30/2001 12:55		6/7/2001 11:30		6/20/2001 11:30		6/28/2001 10:50		7/10/2001 12:10		7/25/2001 11:15		8/7/2001 12:30	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0			21.1	12.61	18.7	11.23	17.8	10.07	23.1	6.47	27.4	9.49	26.6	12.22	26.9	11.12	30.2	8.88
1			20.2	12.83	18.5	11.26	17.3	10.20	22.6	6.46	27.1	9.63	26.6	12.34	26.9	11.15	30.0	9.00
2			19.3	12.78	17.9	11.45	17.3	10.07	22.4	6.35	25.8	10.72	26.6	12.39	26.8	11.1	29.6	8.91
3			18.5	12.96	16.2	10.77	17.1	9.77	22.1	6.11	24.6	9.95	24.4	12.14	26.5	10.08	27.8	5.51
4			17.1	12.35	15.3	9.67	16.4	8.52	19.2	7.00	20.9	9.24	22.6	9.46	22.4	6.75	23.6	3.84
5			13.2	11.09	14.5	8.24	14.1	6.33	15.2	7.67	15.6	11.28	16.8	11.76	17.5	11.97	18.0	4.17
6			8.5	14.37	10.5	8.25	10.8	6.87	11.6	2.68	11.7	4.03	13.0	5.40	12.9	5.00	13.6	0.97
7			7.1	11.00	8.4	8.22	8.3	6.10	8.7	3.62	9.2	3.89	10.2	2.46	9.6	0.93	10.3	0.38
8			6.2	5.96	7.4	3.59	6.8	3.08	7.3	1.29	7.2	0.33	7.6	0.53	7.7	0.46	8.0	0.24
9			5.5	4.00	6.2	0.74	6.2	0.66	6.4	0.80	6.4	0.22	6.7	0.41	6.8	0.28	6.9	0.20
10			5.2	1.32	5.5	0.57	5.6	0.47	6.0	0.72	6.0	0.17	6.1	0.34	6.4	0.21	6.5	0.18
11			5.0	0.44	5.3	0.48	5.4	0.38	5.8	0.66	5.8	0.14	5.9	0.31	6.1	0.19	6.2	0.17
12			5.0	0.29	5.3	0.34	5.4	0.33	5.7	0.63	5.8	0.12	5.9	0.29	6.0	0.18	6.1	0.15
13			5.0	0.22	5.3	0.36	5.4	0.30	5.7	0.56			5.9	0.26	6.0	0.16	6.2	0.14
Top of Thermocline (m)			9		8		7		5		5		5		5		5	

Date	8/14/2001 11:20		8/28/2001 11:00		9/13/2001 11:20		9/28/2001 12:40		10/11/2001 13:05	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	25.2	8.85	24.9	11.25	20.5	10.93	16.0	13.09	12.0	7.87
1	25.2	8.90	24.5	11.20	20.4	10.93	15.8	13.16	11.9	7.85
2	25.1	8.85	24.4	10.97	20.3	11.16	15.7	13.31	11.6	7.82
3	24.8	8.43	24.3	10.62	20.2	11.21	15.6	13.25	11.6	7.72
4	23.7	3.60	23.1	6.37	20.2	11.15	15.6	12.53	11.5	7.65
5	18.7	3.04	19.9	2.54	20.0	10.99	15.5	11.81	11.4	7.70
6	14.1	0.60	15.0	0.70	16.3	11.00	15.2	10.12	11.3	7.61
7	11.1	0.34	10.9	0.28	12.1	1.06	13.0	0.76	11.0	7.46
8	8.4	0.24	8.7	0.20	9.1	0.81	9.5	0.58	10.7	7.25
9	7.1	0.18	7.3	0.15	7.4	0.60	7.9	0.38	10.2	5.71
10	6.6	0.15	6.7	0.12	6.7	0.35	6.9	0.29	8.5	0.53
11	6.2	0.14	6.4	0.10	6.4	0.16	6.6	0.25	6.7	0.24
12	6.1	0.13	6.3	0.10	6.3	0.15	6.4	0.22	6.6	0.19
13	6.1	0.12	6.3	0.07					6.6	0.13
14										
Top of Thermocline (m)	5		5		6		6		10	

Date	4/22/2002 14:15		5/10/2002 13:50		5/28/2002 14:00		6/11/2002 10:10		6/26/2002 11:20	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	11.2	10.70	10.4	11.10	19.1	9.46	22.5	8.40	25.3	8.65
1	10.8	11.20	10.4	11.10	19.1	9.51	22.5	7.10	25.2	8.72
2	10.6	11.40	10.2	11.30	17.6	9.32	22.5	6.55	25.2	8.72
3	10.2	11.10	9.5	11.10	16.8	9.37	21.8	5.55	24.1	7.45
4	6.7	7.60	9.4	11.00	16.3	8.80	18.1	4.71	22.6	2.29
5	6.0	6.40	9.3	10.90	13.4	9.74	14.9	5.48	17.1	4.88
6	5.6	5.10	9.2	10.90	11.4	9.70	12.4	6.31	13.2	6.14
7	5.4	4.00	9.2	10.60	10.4	9.17	11.1	6.17	11.4	6.08
8	5.2	1.40	9.1	10.50	9.8	8.42	10.3	5.35	10.5	5.50
9	5.0	1.40	8.9	10.00	9.5	6.70	9.7	4.60	9.8	1.91
10	5.0	1.20	8.5	7.50	8.7	3.27	9.1	2.74	9.4	0.55
11	5.0	1.10	7.5	0.30	8.5	1.92	8.9	1.01	9.0	0.38
12	5.0	1.00	7.3	0.20	8.5	1.33	8.8	0.81	9.0	0.28
13	5.0	0.90	7.2	0.20			8.6	0.70		
14	5.0	0.50	7.2	0.20						
Top of Thermocline (m)	8		10		9		9		8	

Date	7/9/2002 11:30		7/29/2002 11:30		8/8/2002 13:25		8/20/2002 11:15		9/6/2002 14:05		9/18/2002 10:20		10/1/2002 12:00		10/16/2002 14:00		10/29/2002 11:00	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	28.7	12.80	26.2	11.51	23.9	11.74	22.4	10.71	23.8	7.75	21.5	8.98	16.7	10.40	10.9	11.56	6.0	15.00
1	28.4	13.44	26.2	11.57	23.8	11.62	22.5	10.27	23.6	7.32	21.5	8.96	16.6	10.32	10.6	11.52	5.9	14.60
2	28.3	13.46	26.2	11.53	23.5	11.30	22.4	10.14	23.3	8.08	21.5	8.96	16.5	10.33	10.5	11.48	5.9	14.50
3	27.1	3.22	24.8	5.70	23.3	11.21	22.4	10.04	23.1	9.23	21.5	8.94	15.6	9.69	10.4	11.31	5.9	14.46
4	23.0	1.64	24.0	2.63	23.2	10.16	21.9	8.34	23.0	10.8	21.3	7.64	15.4	9.29	10.3	11.13	5.9	14.44
5	17.1	10.58	19.4	3.90	21.2	6.17	21.4	7.03	21.6	4.35	20.8	5.38	15.3	8.94	10.3	11.12	5.8	14.44
6	14.1	9.52	15.4	3.95	17.5	4.85	16.5	2.10	18.4	2.51	18.3	0.88	15.2	8.12	10.3	11.12	5.8	14.43
7	11.8	7.60	12.5	1.12	13.6	1.60	14.0	1.00	15.0	0.78	16.9	0.70	14.9	6.44	10.2	11.05	5.8	14.42
8	10.5	1.24	11.5	0.71	11.8	1.38	11.9	0.74	12.5	0.61	12.6	0.60	12.7	0.79	10.1	11.05	5.8	14.41
9	9.9	0.69	10.0	0.39	10.7	1.21	10.6	0.67	11.0	0.53	11.1	0.43	10.9	0.68	10.1	11.24	5.8	14.41
10	9.4	0.52	9.3	0.30	9.7	1.02	9.5	0.59	10.1	0.50	10.1	0.39	10.2	0.63	10.1	11.31	5.8	14.42
11	9.2	0.42	8.9	0.24	9.2	0.91	9.1	0.56	9.4	0.49	9.4	0.38	9.3	0.59	10.0	11.31	5.8	14.40
12	8.8	0.38	8.8	0.23	8.9	0.89	9.0	0.53	9.3	0.46	9.2	0.37	9.2	0.56			5.8	14.40
13	8.7	0.38							9.2	0.44	9.3	0.36	9.0	0.54				
14													9.0	0.52				
Top of Thermocline (m)	7		6		5		5		4		5		7					

Date	4/15/2003 11:50		5/6/2003 10:55		5/16/2003 9:40		5/27/2003 12:40		6/11/2003 11:30		6/24/2003 13:25		7/11/2003 10:40		7/23/2003 12:10		8/6/2003 10:45		8/21/2003 10:30	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	8.05	13.9	7.05	13.2	5.84	16.7	5.54	20.6	NA	NA	7.31	20.7	5.72	22.5	4.78	23.1	6.86	24.4	5.43	26.5
1	7.85	13.8	6.84	13	5.76	16.6	5.65	19.3			6.77	22.2	5.87	22.5	4.04	24.5	6.59	24.2	5.52	26.5
2	8.59	11.7	6.56	12.9	5.57	16.6	5.46	18.9			6.42	21.8	5.74	22.5	4.22	24.3	6.59	24.1	5.6	26.5
3	8.59	10.5	6.73	12.9	5.12	15.7	4.71	17.5			6.53	21.5	5.79	22.5	4.86	24.1	6.63	24.1	5.51	26.5
4	8.24	10.1	6.33	12.7	4.99	15.3	4.47	16.7			5.46	18.4	4.99	22.3	0.28	23.4	0.62	23.6	0.06	24.4
5	7.87	9.2	7.21	12.5	5.11	13.9	4.62	15.2			5.2	14.8	4.22	19.4	0.99	19.7	0.15	20.5	0.25	20.2
6	7.14	6.9	7.45	9.3	4.68	11.6	4.35	12.7			5.25	12.3	3.36	15.7	0.8	16.1	0.07	17.1	0.05	17.5
7	2.46	5.4	6.41	8.1	4.98	9.4	4.81	10.4			5.38	9.5	2.69	12.9	0.21	13.2	0.06	14.1	0.04	13.7
8	1.85	4.9	2.45	6.8	2.56	7.3	2.29	7.7			0.95	8.2	0.26	10.5	0.07	11	0.04	11.1	0.01	11.2
9	0.99	4.7	0.19	5.7	0.5	6.1	0.34	6.7			0.55	7	0.16	8.7	0.04	9.1	0.03	9.8	0.01	9.1
10	0.53	4.7	0.06	5.2	0.34	5.5	0.28	6.1			0.33	6.4	0.12	7.6	0.02	7.5	0.02	0.7	0.01	7.8
11	0.39	4.6	0.03	5	0.32	5.2	0.19	5.7			0.27	6.1	0.11	6.7	0	6.9	0.01	7	0.02	6.9
12	0.34	4.6	0.02	5	0.31	5.2	0.15	5.3			0.23		0.09	6.4	0	6.5	0.01	6.6	0	6.6
13			0.02	5			0.15	5.3					0.08	6.2	0	6.4	0	6.4	0	6.4
14															0	6.4			0	6.5
Top of Thermocline (m)	6		8		8		9				8		6		5		4		4	

Date	9/4/2003 14:25		9/18/2003 10:00		10/1/2003 10:00		10/14/2003 10:40	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	5.76	22.9	7.05	20	9.64	11.4	9.28	13.8
1	6.05	22.3	6.9	20	9.37	11.5	8.72	13.8
2	6.1	21.9	9.82	20	9.3	11.5	9.1	13.8
3	5.54	21.5	6.91	20	9.82	11.5	9.74	13.8
4	5.47	21.3	6.55	20	9.74	11.5	9.18	13.8
5	2.16	20.8	6.68	20	9.7	11.5	9.23	11.7
6	0.29	17.4	2.26	19.4	9.31	11.4	9.83	11.3
7	0.14	14.2	0.17	14.5	9.29	11.4	9.26	11.1
8	0.04	11.6	0.006	11.9	9.11	11.3	9.21	10.9
9	0.01	9.1	0.03	9.8	5.35	10.8	0.46	10
10	0.01	7.7	0.02	8.4	0.31	7.9	0.14	8.5
11	0	7.1	0.01	7.3	0.13	7.1	0.09	7.3
12	0	6.7	0.01	6.9	0.1	6.9	0.07	6.9
13								
14								
Top of Thermocline (m)	6		7		10		9	

Date	4/22/2004 12:20		5/4/2004 10:50		5/18/2004 11:30		6/2/2004 13:45		6/16/2004 11:30		6/29/2004 11:10	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	9.17	12.2	9.92	13	7.8	17	8.5	17	8.91	22.7	8.57	20.8
1	9.52	12	9.4	13	8.22	15.9	8.37	16.9	8.98	22.6	8.12	20.7
2	8.88	11.7	9.55	13	8.44	15.7	8	16.6	8.11	22.6	8.37	20.7
3	8.83	11.6	9.5	13	7.03	15.5	9.18	16.1	7.61	20.3	7.82	19.9
4	8.4	11.5	9.56	13	7.53	15.1	7.77	15.8	7.72	18.9	7.55	19.5
5	8.02	11.3	9.22	12.8	7.16	14.5	7.54	15.7	6.95	16.6	6.65	19
6	7.84	8	8.61	11.2	6.01	13.2	7.14	15.3	4.33	15	6.36	15.9
7	0.21	5.9	2.86	8	3.59	10.3	2.42	10.6	1.12	11.9	1.36	12.9
8	0.07	5.1	0.22	5.8	0.42	7.4	0.22	8.7	0.21	9.5	0.45	9.7
9	0.06	4.8	0.05	5.1	0.11	6	0.1	6.5	0.14	7.5	0.34	7.7
10	0.03	4.7	0.03	4.8	0.05	5.5	0.06	5.6	0.13	6.1	0.24	6.3
11	0.03	4.7	0.03	4.8	0.03	5.2	0.04	5.3	0.13	5.6	0.22	5.8
12	0.02	4.7	0.02	4.8	0.03	5.1	0.03	5.3	0.12	5.4	0.23	5.5
13									0.11	5.4		
14												
Top of Thermocline (m)	7		6		6		7		6		6	

Date	7/14/2004 12:30		7/26/2004 11:45		8/12/2004 11:30		8/25/2004 12:00		9/9/2004 12:45		9/22/2004 11:00		10/6/2004 12:30		10/20/2004 13:15	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	8.81	25.1	7.8	25.8	6.75	19.5	7.13	20.4	6.11	20.6	6.12	19.9	7.09	13.8	6.68	9.3
1	8.74	24.9	7.65	25.3	6.88	19.4	7.32	20.3	5.83	20.6	5.85	19.8	7.03	13.4	6.55	9.2
2	8.34	24.7	8.12	25.1	6.43	19.4	7.15	20.2	6.06	20.5	5.5	19.8	6.95	13.3	6.38	9.2
3	6.22	23.6	5.45	24.6	6.6	19.2	7.13	20.1	5.65	20.4	5.55	19.7	7.04	13.2	6.39	9.1
4	4.39	21.4	6.42	22.7	6.76	19	6.52	19.9	5.05	20.1	5.35	19.6	6.65	13.2	6.35	9.1
5	4.61	18.8	4.43	19.2	5.23	18.7	4.55	19.3	3.18	19.6	4.76	19.6	6.93	13.1	6.1	9.1
6	1.38	15.8	0.88	16.4	0.34	17.4	0.72	17.4	0.6	18.1	3.04	19.1	6.56	13	6.01	9.1
7	0.47	13.3	0.44	13.4	0.31	13.6	0.95	14.6	0.42	15.1	0.15	15.5	6.6	13	6.33	9
8	0.41	10.3	0.42	11	0.27	10.8	0.13	11.3	0.36	11.9	0.08	12.4	3.46	12.5	6.28	9
9	0.36	7.8	0.39	8.5	0.29	8.7	0.08	8.8	0.33	9.6	0.06	9.8	0.25	10.1	6.09	9
10	0.19	6.9	0.38	7	0.3	6.8	0.07	7.2	0.33	7.2	0.06	7.8	0.09	7.7	6.14	8.9
11	0.15	5.9	0.38	6.2	0.3	6.2	0.06	6.3	0.37	6.6	0.05	7	0.06	6.9	5.55	8.9
12	0.15	5.6	0.38	5.8	0.3	6	0.06	6.1	0.38	6.5	0.04	6.5	0.08	6.5	0.32	6.8
13	0.14	5.6	0.38	5.7	0.3	5.9	0.06	6			0.05	6.4			0.11	6.5
14			0	6.4			0	6.5								
Top of Thermocline (m)	4		5		5		6		6		7		9		12	

Shields Lake
DNR ID #82-162
Forest Lake Township, Washington County

Dissolved Oxygen & Temperature Profiles

Date	4/27/1997 9:20		5/5/1997 11:30		5/22/1997 10:25		6/5/1997 11:00		6/20/1997 14:15		7/7/1997 10:15		7/16/1997 10:25		7/31/1997 9:09		8/13/1997 9:45		8/27/1997 13:30	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	11.5	16.00	14.0	11.20	15.0	13.40	21.5	12.20	22.0	8.70	20.0	11.20	27.5	14.3	24.0	6.10	21.5	4.25	24.0	7.30
1	11.5	16.00	13.0	11.40	15.0	13.40	21.1	12.10	21.0	8.00	20.0	11.30	25.5	4.00	24.0	6.30	21.5	4.10	22.5	6.60
2	11.0	16.00	13.0	11.40	14.0	14.00	18.0	11.40	20.0	7.00	20.0	11.00	20.0	6.25	22.0	1.50	21.5	3.50	21.0	3.75
3	8.0	14.00	9.0	11.00	13.5	14.00	16.0	11.20	18.0	8.20	19.0	5.50	18.5	2.00	18.5	0.50	21.0	0.25	19.5	0.75
4	6.5	13.50	6.0	5.20	12.0	11.00	14.0	9.00	15.0	5.00	16.0	0.50	17.0	0.60	16.0	0.25	16.0	0.25	16.5	0.20
5	6.0	12.50	5.5	2.70	10.5	7.50	11.5	0.75	12.5	0.90	13.0	0.30	14.0	0.50	13.0	0.25	12.5	0.25	14.0	0.15
6	6.0	12.00	5.5	1.50	8.5	0.75	9.0	0.40	10.0	0.40	11.0	0.25	11.5	0.30	11.5	0.25	11.0	0.15	11.5	0.05
7	5.0	1.00	4.0	1.00			8.0	0.40			10.0	0.25			11.0	0.25	10.0	0.10	11.0	0.05
8	5.0	1.00																		
Top of Thermocline (m)	6		4		4		4		4		3		3		2		2		2	

Date	10/1/1997 11:27		10/17/1997 11:45	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	16.0	5.20	13.0	5.80
1	17.0	5.20	13.0	5.80
2	17.0	5.20	13.0	5.80
3	17.0	5.30	13.0	5.80
4	17.0	5.20	13.0	5.80
5	16.5	4.30	13.0	2.80
6	14.0	0.20	13.0	5.80
7	12.5	0.15	12.5	5.10
8			12.0	0.50
Top of Thermocline (m)	5		5	

Date	4/15/1998 11:15		4/28/1998 10:13		5/11/1998 10:30		5/26/1998 10:15		6/8/1998 10:55		6/22/1998 10:40		7/7/1998 9:30		7/20/1998 10:15	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	11.5	10.10	15.5	8.30	19.4	7.70	21.0	6.10	18.5	7.00	23.0	7.40	24.5	5.80	27.0	13.00
1	11.5	10.10	15.0	8.30	19.2	7.20	20.0	4.40	18.5	7.00	23.0	6.70	24.5	5.10	28.0	13.20
2	11.5	10.10	15.0	8.20	17.9	5.40	19.5	2.80	17.5	5.90	22.0	2.75	23.5	0.75	24.5	1.50
3	11.5	9.40	13.0	5.80	15.9	3.70	18.5	1.50	17.5	4.50	18.5	0.75	24.0	0.50	20.0	1.25
4	11.0	9.10	11.0	3.10	13.0	1.00	14.0	0.30	15.5	0.25	16.0	0.50	16.0	0.50	16.0	1.25
5	10.0	8.20	10.0	0.25	10.8	0.60	11.0	0.25	11.5	0.25	13.0	0.30	13.0	0.50	13.0	1.25
6	6.0	2.00	8.5	0.15	9.0	0.40	10.0	0.25	10.0	0.25	10.0	0.30	11.0	0.50	11.0	1.30
7	5.5	0.25	7.0	0.15	8.0	0.35	9.0	0.25	9.5	0.25	10.0	0.30	10.0	0.50	11.0	1.25
8					7.8	0.37	8.5	0.25					10.0	0.50	11.0	1.00
Top of Thermocline (m)	5		4		4		4		4		3		2		2	

Date	8/5/1998 9:30		8/19/1998 9:30		8/31/1998 11:00		9/14/1998 9:30		9/28/1998 10:00		10/15/1998 9:30	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	22.0	3.25	22.5	4.30	24.0	6.00	23.0	7.70	18.0	7.40	11.5	7.00
1	22.0	3.15	22.5	4.00	23.5	5.00	23.0	7.50	18.0	7.60	11.5	6.70
2	22.0	2.50	22.5	3.80	23.0	1.25	21.0	3.75	18.0	3.75	11.5	6.70
3	19.0	0.75	19.5	0.50	20.0	0.50	20.0	0.50	17.0	1.00	11.5	6.70
4	16.0	0.50	16.0	0.50	16.5	0.40	16.0	0.30	16.5	0.25	11.5	6.70
5	13.0	0.30	13.0	0.30	16.5	0.40	13.0	0.30	14.0	0.25	11.5	6.70
6	11.5	0.30	11.5	0.30	13.5	0.50	12.0	0.30	12.0	0.25	11.5	6.70
7	11.0	0.30	11.0	0.25	12.0	0.50	11.5	0.30	11.5	0.25		
8					11.5	0.50	11.0	0.30	11.5	0.15		
Top of Thermocline (m)	2		2		2		2		2			

Date	4/20/1999 10:45		5/11/1999 13:00		5/26/1999 11:30		6/10/1999 13:14	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	10.0	10.48	16.5	10.32	17.5	10.23	23.3	7.13
1	10.0	10.37	16.5	10.17	16.4	10.08	22.4	4.01
2	9.9	10.2	16.4	9.78	16.1	9.50	17.4	6.24
3	9.4	8.41	12.6	8.51	13.0	3.60	14.0	0.53
4	8.6	7.11	9.9	5.09	10.2	0.80	11.2	0.44
5	8.5	6.82	8.8	0.49	9.1	0.63	9.4	0.39
6	8.4	5.81	8.6	0.38	8.7	0.52	9.1	0.34
7	7.9	0.21	8.3	0.28	8.4	0.47	8.7	0.31
8			8.3	0.25	8.4	0.35	8.7	0.25
Top of Thermocline (m)	4		4		3		3	

Date	6/22/1999 13:00		7/6/1999 11:36		7/19/1999 14:00		8/4/1999 13:30		8/21/1999 12:40		9/8/1999 15:21		9/23/1999 11:15		10/4/1999 13:10		10/20/1999 14:00		4/12/2000 13:15	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	23.4	8.63	26.2	5.70	28.0	12.33	26.1	9.66	23.1	9.86	22.0	8.10	16.8	10.67	12.9	4.88	10.2	8.55	8.7	12.74
1	23.2	8.47	25.9	5.09	25.0	5.52	25.6	7.81	22.3	6.83	22.0	7.88	16.7	10.60	12.8	4.68	10.2	8.41	8.6	13.00
2	18.8	2.17	20.2	0.24	21.2	0.21	22.6	0.57	22.0	2.48	21.8	6.86	15.6	6.24	12.8	4.55	10.1	8.17	8.6	13.00
3	14.2	0.75	15.2	0.20	14.9	0.21	17.4	0.43	19.3	0.50	19.7	2.18	15.3	3.43	12.8	4.51	10.1	8.13	7.9	13.00
4	11.4	0.65	11.2	0.16	11.4	0.20	12.8	0.34	14.2	0.40	13.5	0.73	15.0	0.45	12.8	4.50	10.1	7.95	7.8	12.78
5	9.8	0.53	9.9	0.14	9.8	0.21	10.7	0.29	11.4	0.35	12.0	0.65	12.0	0.32	12.7	4.18	10.1	7.86	7.5	12.13
6	9.0	0.45	9.2	0.13	9.2	0.21	10.1	0.27	10.5	0.32	10.9	0.50	11.0	0.26	11.5	0.33	9.7	7.62	7.4	11.50
7	9.0	0.27	9.0	0.13	9.2	0.21	9.8	0.22	10.4	0.30	10.5	0.53	10.5	0.24			10.1	0.92	7.4	2.15
8			8.9	0.12					10.2	0.26	10.4	0.42	10.3	0.22			10.1	0.90		
Top of Thermocline (m)	3		2		2		2		2		2		3							

Date	5/23/2000 12:00		6/8/2000 10:45		6/22/2000 10:30		7/6/2000 10:21		7/19/2000 10:00		7/31/2000 11:30		8/10/2000 10:45		8/23/2000 10:40		8/29/2000 13:02		9/14/2000 9:30	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	19.0	7.97	21.5	8.28	20.6	3.88	25.7	5.40	23.4	4.40	28.2	20.83	27.0	14.28	24.1	13.03	24.4	10.74	20.3	5.55
1	18.8	7.83	20.1	7.40	20.5	3.60	25.7	5.22	23.2	3.76	24.9	8.15	25.4	2.87	23.0	6.01	23.1	6.50	20.4	5.35
2	16.0	8.12	17.4	4.30	20.4	3.55	23.0	0.54	23.0	1.82	23.7	0.73	23.5	0.45	22.6	3.71	22.7	5.01	20.2	2.03
3	14.3	6.50	15.2	3.04	15.9	0.71	16.5	0.42	18.1	0.41	18.4	0.62	18.2	0.41	19.2	0.64	19.0	0.46	19.7	0.90
4	8.8	1.50	10.8	0.42	10.8	0.50	12.2	0.32	13.0	0.35	13.6	0.55	13.5	0.36	13.8	0.51	14.5	0.36	16.1	0.40
5	7.3	0.41	8.4	0.36	9.4	0.40	9.3	0.26	10.0	0.25	10.5	0.49	10.6	0.35	10.7	0.44	10.8	0.32	12.2	0.38
6	6.9	0.30	7.5	0.32	8.6	0.35	8.7	0.24	9.1	0.22	9.1	0.45	9.4	0.32	10.0	0.39	10.0	0.31	10.4	0.33
7	6.9	0.27	7.3	0.29	8.0	0.31	8.5	0.23	8.5	0.20	8.8	0.42			9.6	0.36	9.6	0.29	10.2	0.27
8			7.2	0.23			8.3	0.21	8.5	0.17							9.4	0.27		
Top of Thermocline (m)	4		3		2		2		2		2		2		3		3		3	

Date	9/29/2000 10:33		10/9/2000 10:52		10/18/2000 14:08	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	14.9	3.77	10.6	6.33	14.3	9.83
1	14.9	3.66	10.4	5.97	12.9	11.03
2	14.9	3.62	10.3	5.55	12.6	10.66
3	14.8	3.50	10.3	5.19	11.7	5.42
4	14.0	1.16	10.2	5.18	10.7	4.02
5	13.1	0.55	10.1	5.05	10.3	2.82
6			9.9	4.92	10.0	2.02
7			9.8	4.73	10.0	1.50
8					9.8	1.25
Top of Thermocline (m)					3	

Date	4/27/2001 12:30		5/15/2001 11:30		5/30/2001 12:15		6/7/2001 10:50		6/20/2001 10:50		6/28/2001 10:20		7/10/2001 11:45		
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
0			21.3	11.39	19.1	13.65	17.6	9.60	22.7	5.57	27.4	11.58	26.9	15.51	
1			21.2	11.3	18.1	13.27	16.9	9.64	22.1	5.52	27.1	10.54	26.8	15.27	
2			21.3	11.27	15.4	10.72	16.8	7.77	20.5	2.57	22.6	1.10	22.9	0.90	
3				12.6	0.66	14.0	7.49	14.5	3.34	15.8	0.72	16.4	0.38	17.6	0.41
4				7.3	1.29	10.2	0.67	10.0	0.46	11.6	0.51	11.4	0.21	11.6	0.33
5				6.7	0.13	7.8	0.43	7.5	0.34	8.8	0.43	8.8	0.19	9.1	0.27
6				6.3	0.11	6.6	0.36	6.8	0.30	7.7	0.40	8.0	0.09	8.0	0.25
7				6.2	0.08	6.5	0.35	6.6	0.27	7.4	0.41	7.6	0.07	7.7	0.23
8						6.4	0.21	6.5	0.22	7.2	0.34			7.6	0.20
Top of Thermocline (m)			2		3		3		2		2		2		

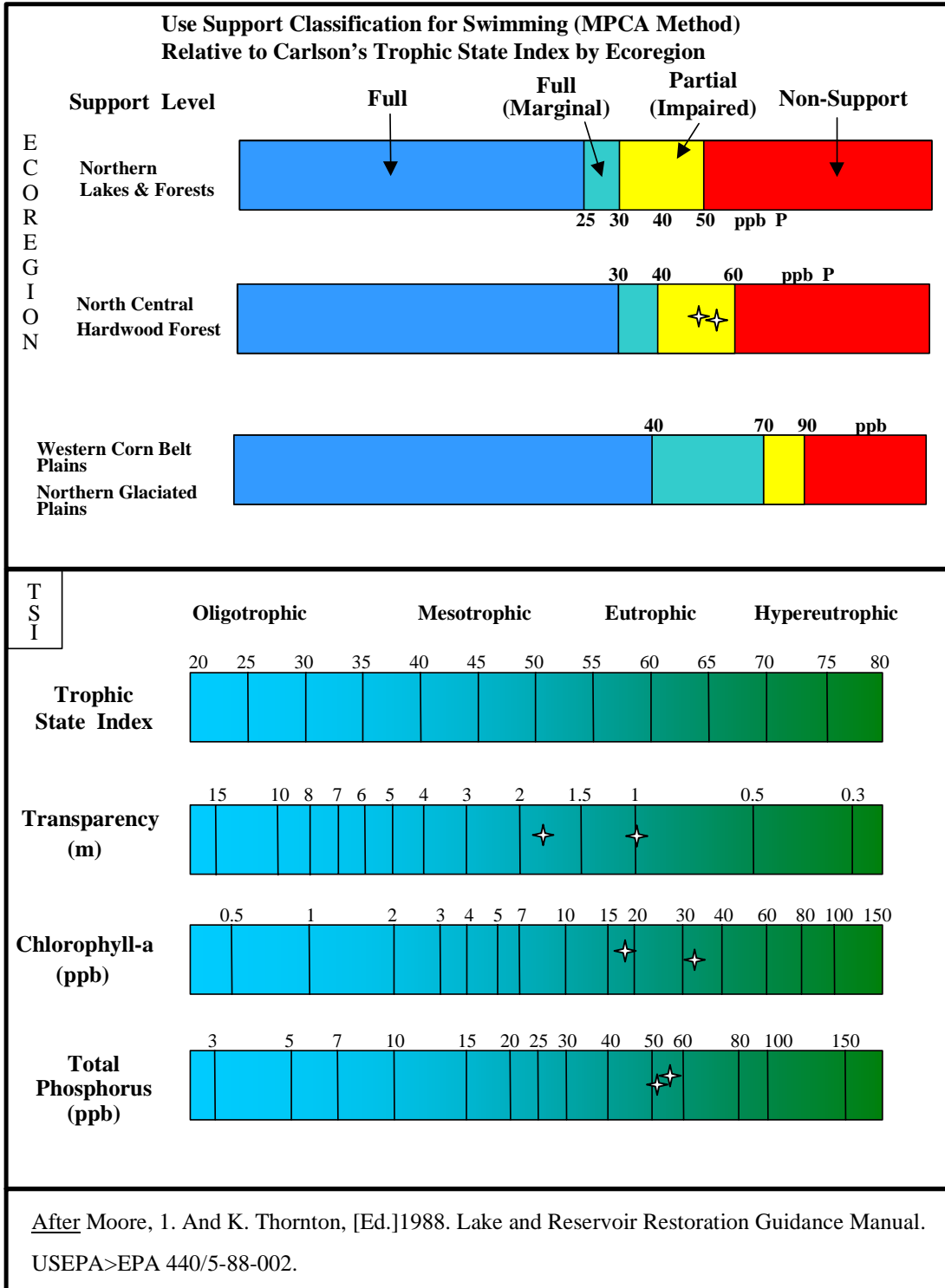
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Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	25.9	8.30	30.9	6.48	26.3	7.87	24.7	8.92	20.0	9.81	16.3	16.75	10.3	7.71
1	25.8	7.59	30.0	5.47	24.4	7.30	23.9	6.88	19.9	9.54	15.5	16.02	10.2	7.55
2	25.4	4.44	26.7	1.17	24.3	7.24	23.5	4.92	19.8	8.77	15.2	14.28	10.1	7.34
3	18.1	0.38	21.1	0.22	20.8	0.24	20.5	0.40	19.5	6.20	14.9	7.02	10.0	7.19
4	12.7	0.20	13.2	0.20	13.5	0.18	14.7	0.21	15.8	0.60	14.5	1.72	10.0	7.45
5	9.7	0.12	10.2	0.17	10.3	0.14	11.1	0.13	11.6	0.28	13.1	0.40	9.9	7.39
6	8.8	0.11	9.0	0.17	9.0	0.12	9.3	0.12	9.7	0.20	9.8	0.34	9.5	6.15
7	8.4	0.11	8.7	0.15	8.6	0.12	9.0	0.08	9.1	0.15	9.5	0.35		
8	8.2	0.08	8.5	0.14	8.5	0.12								
Top of Thermocline (m)	2		2		2		2		3		4			

Date	4/22/2002 13:30		5/10/2002 13:20		5/28/2002 13:25	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	10.7	13.40	10.8	10.90	20.1	9.54
1	10.1	13.20	10.3	10.70	20	9.57
2	9.1	7.20	9.2	10.10	16.4	6.48
3	5.3	3.20	8.8	9.60	14.2	7.99
4	4.7	0.70	8.7	9.40	9.5	1.87
5	4.7	0.80	8.4	9.40	8.5	0.33
6	4.7	0.60	8.2	9.20	8.2	0.27
7	4.8	0.60	8.1	0.30		
8	4.8	0.50	8.2	0.20		
Top of Thermocline (m)	2		7		4	

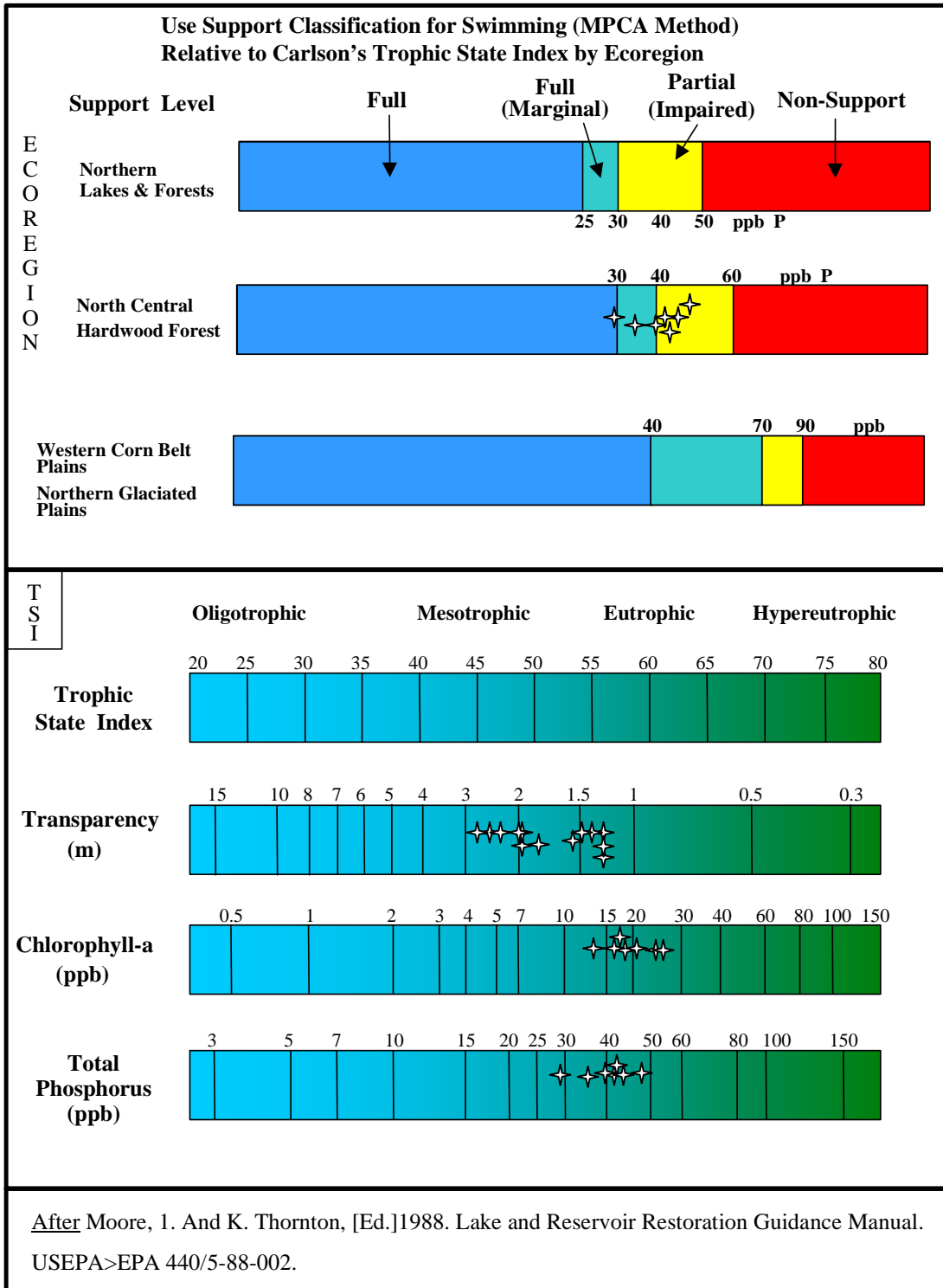
Date	6/29/2004 11:45		7/14/2004 13:00		7/26/2004 12:30		8/12/2004 12:00		8/25/2004 12:30		9/9/2004 13:15		9/22/2004 11:30		10/6/2004 13:00		10/20/2004 12:45	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	7.29	21.5	5.93	26	13.5	25.8	9.04	18.9	8.9	21.6	4.45	21.3	4.92	20.8	5.89	13.6	4.65	9
1	6.94	21.1	4.83	25.2	4.56	24.1	8.54	18.8	5.3	20.7	4.14	21	4.93	20.4	5.56	13.4	4.53	8.7
2	2.86	19	0.39	21.7	0.38	23.1	5.95	18.2	1.73	20	4.04	20.8	3.48	20	4.98	13.2	4.55	8.7
3	0.25	15.6	0.26	15.7	0.31	15.9	4.06	17.7	0.14	17.8	0.29	18.3	0.41	19.6	4.58	13	4.11	8.7
4	0.2	12.1	0.23	11.8	0.31	12.5	0.38	12.1	0.1	13.4	0.21	14.6	0.08	15.8	3.11	12.7	3.78	8.6
5	0.21	9.5	0.19	9.5	0.31	9.4	0.28	9.8	0.08	10.3	0.23	10.9	0.06	11.5	1.64	12.3	3.85	8.5
6	0.21	8	0.2	8.5	0.31	8.8	0.28	8.6	0.09	9.2	0.24	9.6	0.06	9.9	0.18	10.1	3.86	8.5
7	0.22	7.3	0.2	8			0.28	8.3	0.08	8.7	0.23	9.1	0.05	9.2	0.07	9.2	4.02	8.4
8							0.26	8.1	0.06	8.6			0.04	8.9				
9																		
10																		
11																		
Top of Thermocline (m)	3		3		3		3		3		3		3		5			

Appendix D

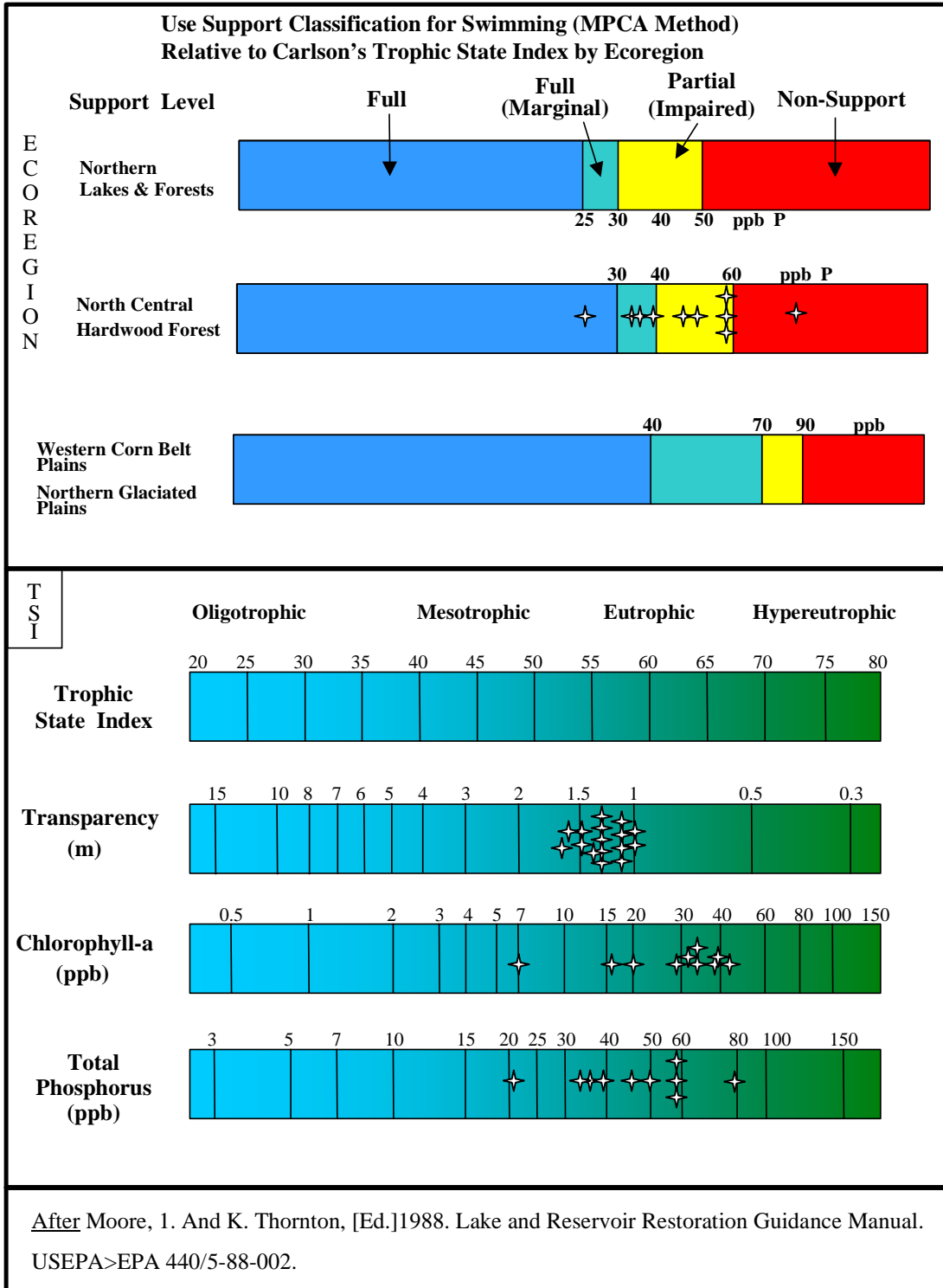
Little Comfort Lake. MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)



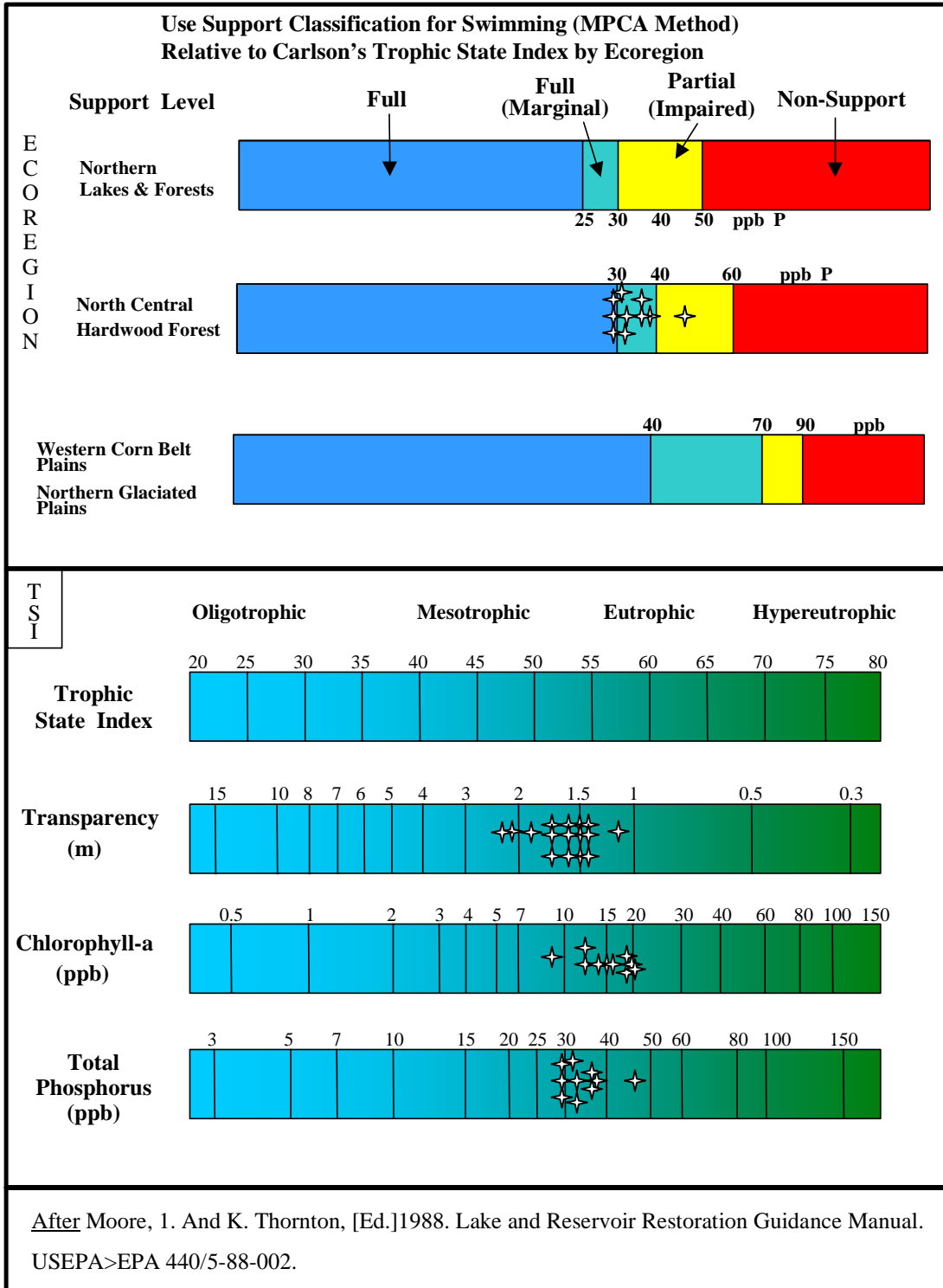
Big Comfort Lake. MPCA’s Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson’s Trophic State Index by Ecoregion. (Symbols are annual average values)



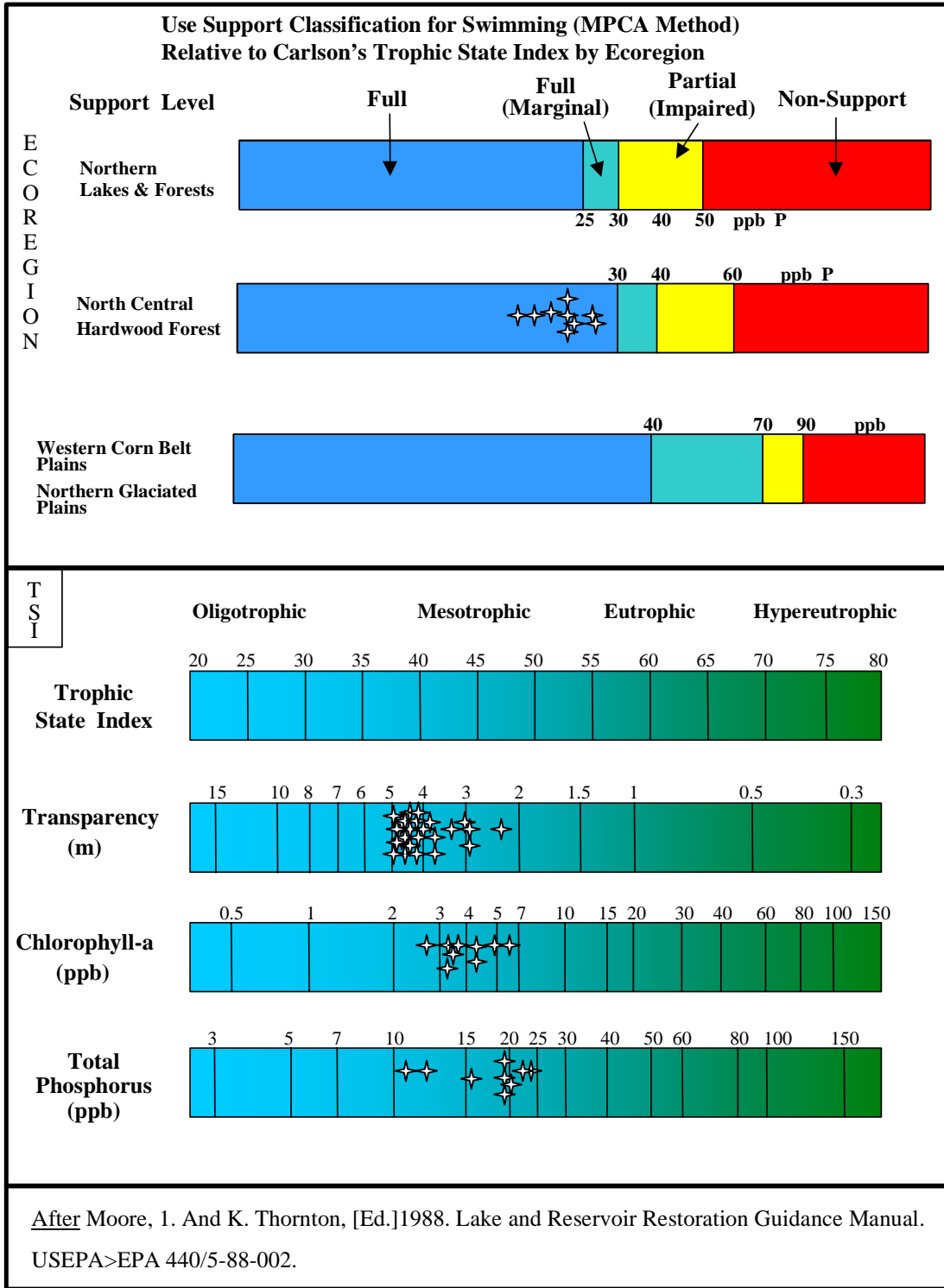
Bone Lake. MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)



Forest Lake (West). MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)



Halfbreed Lake (Sylvan). MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)



Shields Lake. MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)

