



Forest Lake –2000 Metropolitan Council Aerial Photo

COMFORT LAKE FOREST LAKE WATERSHED DISTRICT WATER MONITORING REPORT

Prepared for:
Comfort Lake Forest Lake Watershed District

Prepared By:
Washington Conservation District

February 2004

Memorandum

To: Comfort Lake Forest Lake Watershed District Managers

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

Date: February 26, 2004

Re: CLFLWD 2003 Monitoring: Bone Lake Inlet, Bone Lake Inlet, Forest Lake Outlet, 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 four new stream monitoring stations (Bone Lake Inlet, Bone Lake Outlet, Forest Lake Outlet, Comfort Lake Outlet), monitored water quality and level on Sylvan/Halfbreed Lake, Shields Lake, Big Comfort Lake, and monitored water quality at Forest Lake and Bone 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, 2003. This report and the accompanying data will also be provided in an electronic format.

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

Continuous stage, velocity, and discharge measurements were taken every 15 minutes at Bone Lake Inlet from May 27-October 30, 2003, at Bone Lake Outlet from May 27-October 30, 2003, at Forest Lake Outlet from May 29-October 28, 2003 and at Comfort Lake Outlet from May 29-November 3, 2003. 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. 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 four 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 2003 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.

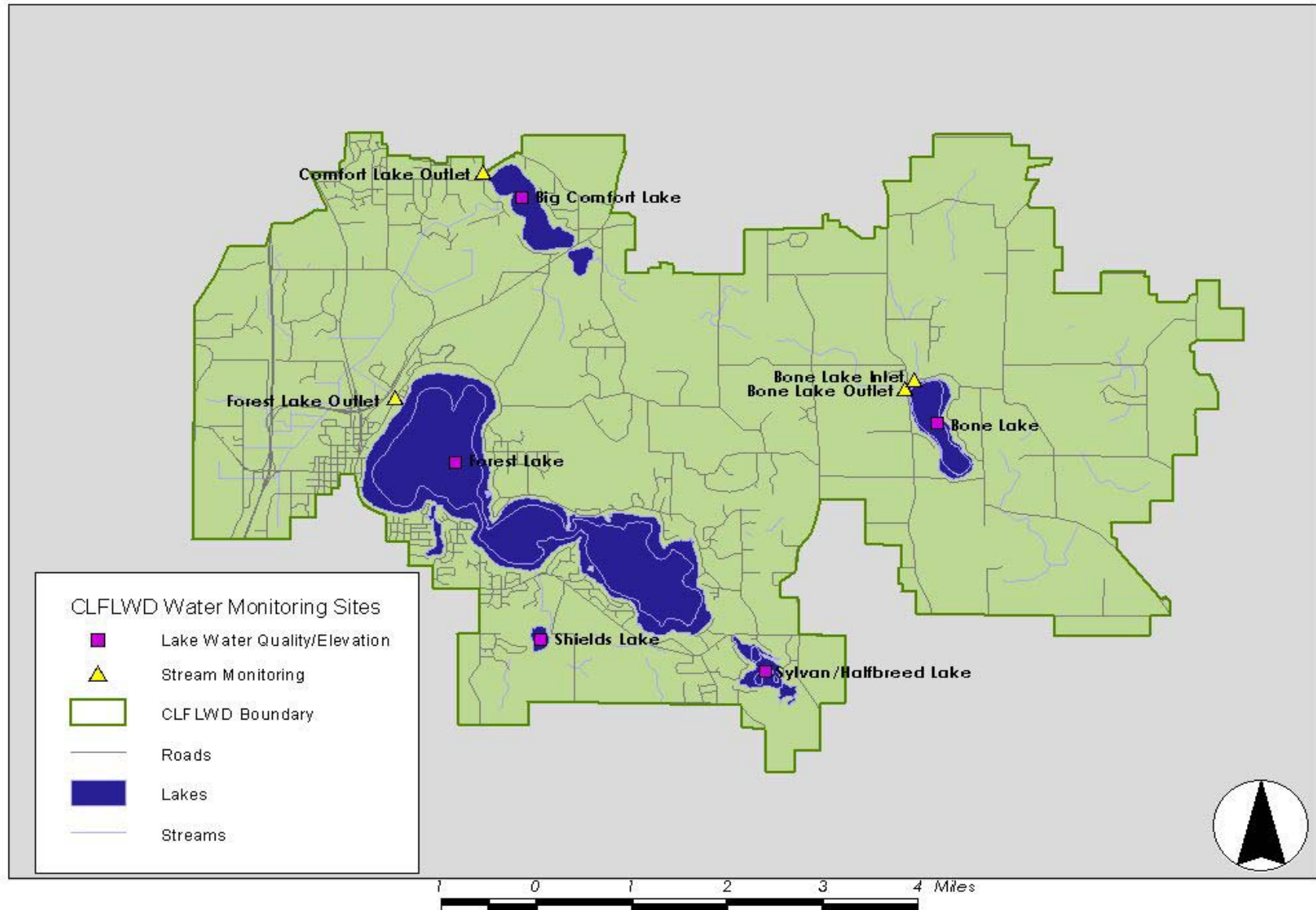


Figure 1. CLFLWD Monitoring Locations

Sections Within Report

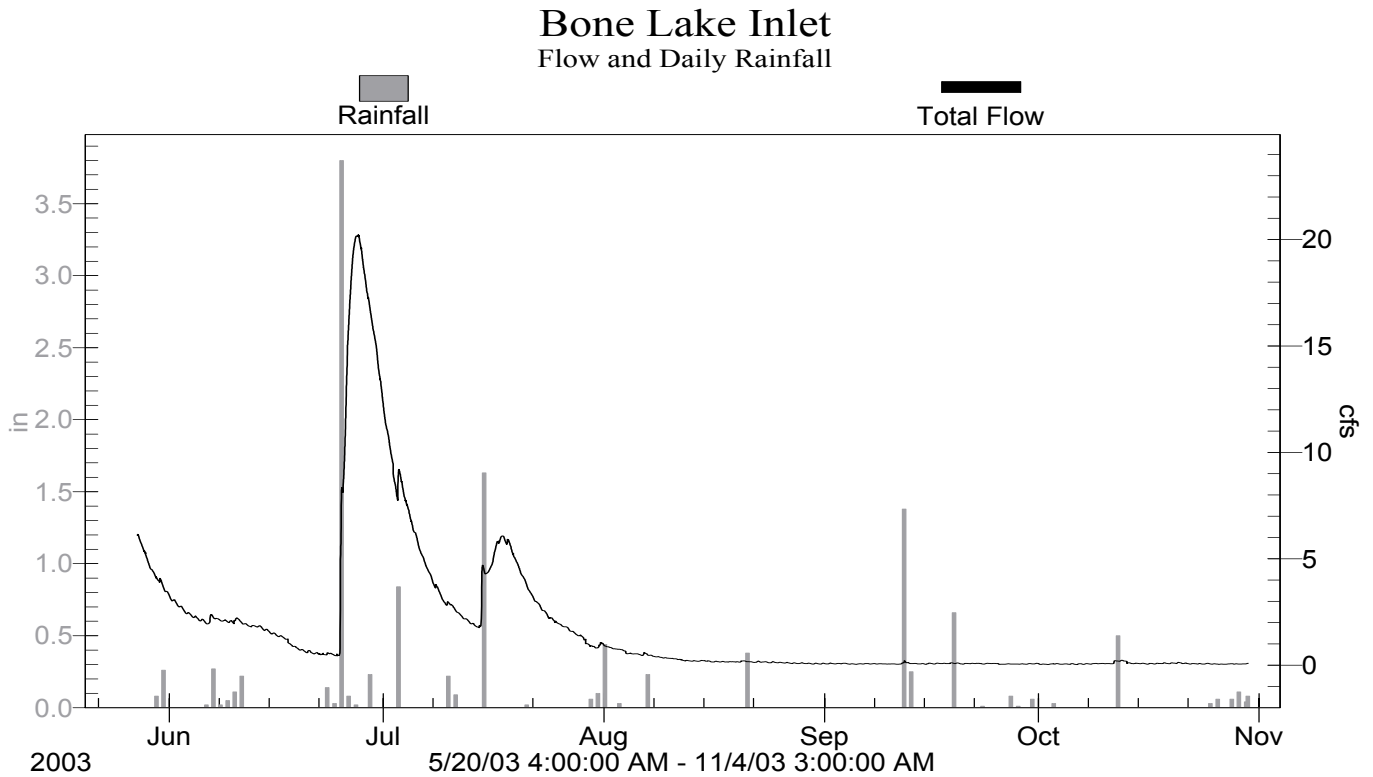
1. Stream Discharge and Water Quality
2. Lake Water Quality Summaries
3. Appendices

1. 2003 Stream Discharge and Water Quality

Bone Lake Inlet

The station at the Bone Lake Inlet site recorded stage, velocity, flow, and rainfall between May 27–October 30, 2003 (Figure 2). Total discharge during this period was 24,941,570 cf or 573 acre-ft. The peak discharge—20.17 cfs, was on June 27, 2003 from daily precipitation of 3.80 inches, which fell on June 25, 2003. This was also the highest daily precipitation total for the 2003 monitoring season. The hydrograph for the Bone Lake Inlet site is shown below.

Figure 2. Bone Lake Inlet Continuous Flow and Daily Rainfall



Grab and flow weighted composite samples were taken at the Bone Lake Inlet site to determine water quality. Samples were taken during storm runoff as well as during baseflow conditions. The total suspended solids (TSS), total Kjeldahl nitrogen (TKN), total phosphorus (TP), volatile suspended solids (VSS), Nitrate, Nitrite, Ammonia Nitrogen, Orthophosphate, and Fecal Coliform concentrations from all collected samples are listed in Table 1. The highest TSS and TKN concentrations (201 mg/L and 5.80 mg/L respectively) were collected in a storm composite sample on July 15, 2003. The highest TP concentration of 0.88 mg/L was collected in a base grab sample on September 11, 2003.

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)
Base Grab	6/20/03	9:40	6/20/03	9:40	14	10	2.30	0.62	0.03	0.05	0.76		
Storm Composite	6/24/03	22:37	6/25/03	12:14	124	86	4.90	0.61	0.03	0.40	0.39	0.160	
Storm Composite	6/26/03	17:01	6/28/03	2:14			1.60	0.36	0.14	0.35	0.11		
Storm Composite	7/14/03	20:06	7/15/03	9:11	201	146	5.80	0.58	0.23	0.13	0.22		
Storm Composite	7/15/03	10:30	7/18/03	9:29	65	51	3.10	0.44	0.03	0.05	0.02		
Fecal Grab	7/22/03	9:40	7/22/03	9:40									110
Base Grab	7/22/03	9:40	7/22/03	9:40	18	14	1.80	0.38	0.03	0.05	0.02	0.223	
Base Composite	7/29/03	10:39	7/30/03	22:02	44	25	2.10	0.60	0.03	0.05	0.21		
Base Composite	8/7/03	11:28	8/11/03	9:07	44	30	2.80	0.74	0.03	0.05	0.38		
Base Composite	8/26/03	13:49	8/27/03	2:43	65	43	4.30	0.71	0.03	0.08	0.99		
Base Grab	9/8/03	10:00	9/8/03	10:00	19	12	4.60	0.81	0.03	0.05	2.97		
Fecal Grab	9/11/03	8:45	9/11/03	8:45									2600
Base Grab	9/11/03	8:45	9/11/03	8:45	14	11	4.80	0.88	0.03	0.05	2.96	0.218	
Base Composite	9/12/03	3:06	9/12/03	15:57	116	82	5.50	0.61	0.04	0.33	2.05		
Base Composite	10/3/03	8:53	10/6/03	7:18	39	28	3.40	0.30	0.03	0.55	1.44		
Base Grab, Fecal Grab	10/7/03	10:15	10/7/03	10:15	9	6	2.30	0.25	0.03	0.45	1.36	0.065	70
Base Composite	10/11/03	15:15	10/13/03	10:16	20	14	2.10	0.30	0.03	0.14	0.81		
Base Grab, Fecal Grab	10/28/03	8:25	10/28/03	8:25	6	4	2.00	0.14	0.03	0.52	1.15	0.045	45
Average					53	37	3.34	0.52	0.05	0.21	0.99	0.142	706

Table 1. Bone Lake Inlet 2003 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			
Base Grab	6/20/03	9:40	6/20/03	9:40	0.62	14	5/27/03 12:15	6/24/03 22:00	5,085,819	196.53	4,445
Storm Composite	6/24/03	22:37	6/25/03	12:14	0.61	124	6/24/03 22:15	6/25/03 8:00	227,046	8.66	1,758
Storm Composite	6/26/03	17:01	6/28/03	2:14	0.36	130	6/25/03 8:15	7/3/03 1:15	9,802,049	219.06	79,548
<i>BASE</i>					<i>0.53</i>	<i>34</i>	<i>7/3/03 1:30</i>	<i>7/5/03 18:45</i>	<i>1,754,271</i>	<i>58.04</i>	<i>3,723</i>
<i>STORM</i>					<i>0.50</i>	<i>130</i>	<i>7/5/03 19:00</i>	<i>7/14/03 18:45</i>	<i>2,432,823</i>	<i>75.94</i>	<i>19,743</i>
Storm Composite	7/14/03	20:06	7/15/03	9:11	0.58	201	7/14/03 19:00	7/15/03 10:45	237,678	8.59	2,982
Storm Composite	7/15/03	10:30	7/18/03	9:29	0.44	65	7/15/03 11:00	7/20/03 6:30	2,196,278	60.60	8,912
Base Grab	7/22/03	9:40	7/22/03	9:40	0.38	18	7/20/03 6:45	7/27/03 3:30	1,581,090	37.11	1,777
Base Composite	7/29/03	10:39	7/30/03	22:02	0.60	44	7/27/03 3:45	8/4/03 8:45	705,299	26.29	1,937
Base Composite	8/7/03	11:28	8/11/03	9:07	0.74	44	8/4/03 9:00	8/15/03 2:00	325,401	15.01	894
Base Composite	8/26/03	13:49	8/27/03	2:43	0.71	65	8/15/03 2:15	8/31/03 18:15	189,699	8.40	770
Base Grab	9/8/03	10:00	9/8/03	10:00	0.81	19	8/31/03 18:30	9/9/03 10:30	47,479	2.40	56
Base Grab	9/11/03	8:45	9/11/03	8:45	0.88	14	9/9/03 10:45	9/11/03 12:45	8,762	0.48	8
Base Composite	9/12/03	3:06	9/12/03	15:57	0.61	116	9/11/03 13:00	9/26/03 12:45	98,667	3.77	714
Base Composite	10/3/03	8:53	10/6/03	7:18	0.30	39	9/26/03 13:00	10/6/03 13:00	44,343	0.82	108
Base Grab	10/7/03	10:15	10/7/03	10:15	0.25	9	10/6/03 13:15	10/11/03 14:15	28,292	0.44	16
Base Composite	10/11/03	15:15	10/13/03	10:16	0.30	20	10/11/03 14:30	10/20/03 2:45	78,040	1.44	97
Base Grab	10/28/03	8:25	10/28/03	8:25	0.14	6	10/20/03 3:00	10/30/03 10:00	56,284	0.49	21
<i>BASE</i>					<i>0.53</i>	<i>130</i>	<i>10/30/03 10:15</i>	<i>12/31/03 23:45</i>	<i>432,432</i>	<i>14.31</i>	<i>3,509</i>
Storm Average					0.50	130					
Base Average					0.53	34					
Snowmelt Average					0.00	0					
All Average					0.52	61					
Total									25,331,752	738.38	131,018
CLFLWD Major Subwatershed Total Acres									2,550		
Total TP/TSS (lb/ac/June-December)										0.29	51.38
Total TP/TSS (kg/ha/June-December)										0.32	57.59

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

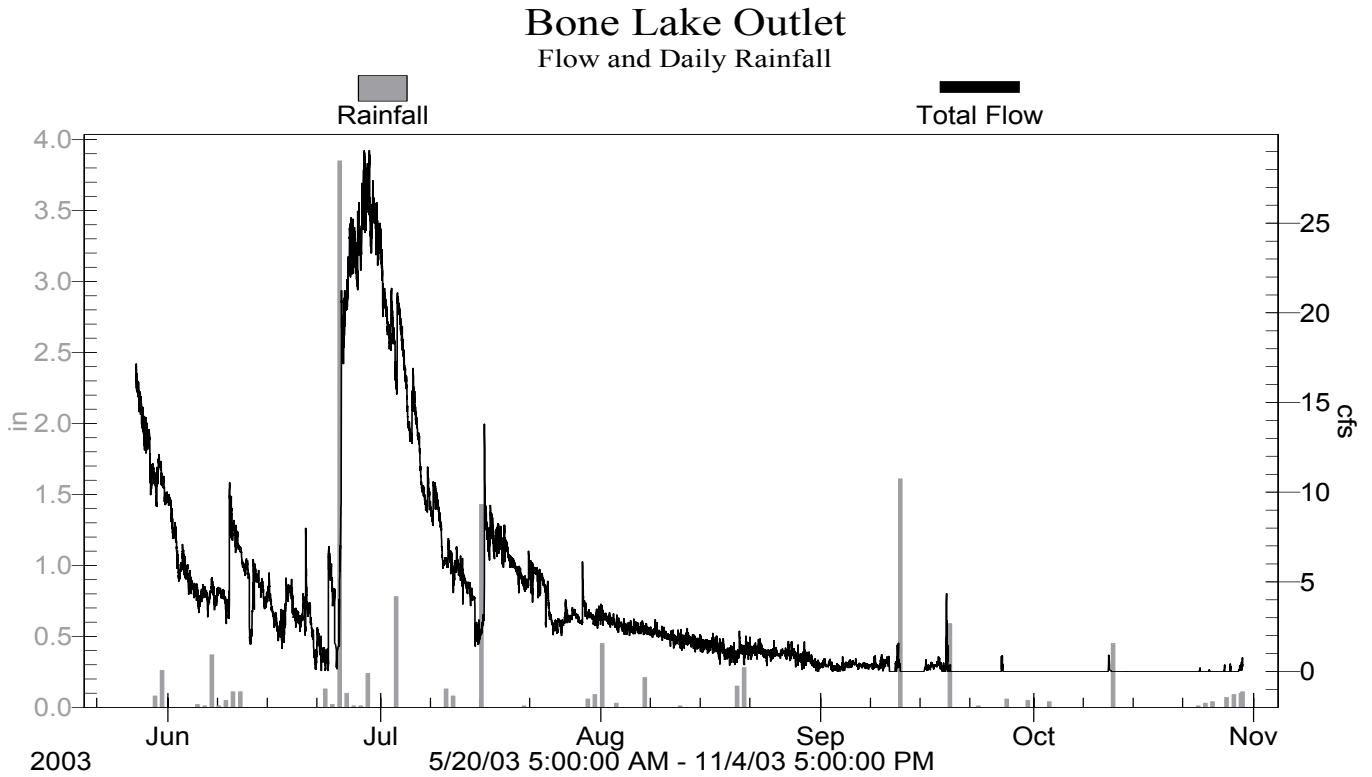
Table 2. Bone Lake Inlet 2003 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Bone Lake Inlet for the period June-December, 2003 was estimated at 0.32 kg/ha (738 lbs.) (Table 2). This loading amount is an underestimate of the total annual load since no flow data or samples were collected during the first part of the year. 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 2.

Bone Lake Outlet

The station for the Bone Lake Outlet site recorded stage, velocity, flow, and rainfall between May 27-October 30, 2003 (Figure 3). Total discharge during this period was 50,325,760 cf or 1,155 acre-ft. The highest flow—28.75 cfs occurred on June 28, 2003, from a total rainfall of 3.85 inches, which fell on June 25, 2003. This event was also the highest daily rainfall for the 2003 monitoring season. The hydrograph for the Bone Lake Outlet site is shown below.

Figure 3. Bone Lake Outlet 2003 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 3. The highest TSS concentration of 133 mg/L was from the August 11, 2003 base composite sample. The highest TKN and TP concentrations (4.00 and 0.38 mg/L respectively) were from an August 28, 2003 base 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)
Storm Composite	6/9/03	19:35	6/12/03	11:04	10	5	1.10	0.04	0.03	0.05	0.03		
Base Grab	6/20/03	10:10	6/20/03	10:10	7	9	1.60	0.06	0.03	0.05	0.18		
Storm Composite	6/25/03	3:40	6/26/03	7:00	13	7	1.40	0.10	0.03	0.06	0.13	0.005	
Storm Grab	7/16/03	8:55	7/16/03	8:55	18	16	1.70	0.08	0.03	0.05	0.02		
Base Grab Fecal Grab	7/22/03	9:20	7/22/03	9:20	14	12	1.50	0.09	0.03	0.05	0.02	0.005	1
Base Composite	7/29/03	10:45	7/30/03	21:57	31	20	2.40	0.12	0.03	0.29	0.09		
Base Composite	8/7/03	12:22	8/11/03	7:25	133	50	3.70	0.25	0.03	0.05	0.05		
Base Composite	8/26/03	10:36	8/28/03	9:28	112	51	4.00	0.38	0.03	0.05	0.02		
Base Composite	9/4/03	14:58	9/8/03	8:45	60	26	2.90	0.32	0.03	0.05	0.62		
Base Grab, Fecal Grab	9/11/03	8:55	9/11/03	8:55	36	20	2.30	0.12	0.03	0.05	0.02	0.005	420
Base Grab	9/15/03	8:15	9/15/03	8:15	9	8	1.50	0.05	0.03	0.05	0.13		
Average					40	20	2.19	0.15	0.03	0.07	0.12	0.005	211

Table 3. Bone Lake Outlet 2003 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			
<i>BASE</i>					<i>0.09</i>	<i>19</i>	<i>5/27/03 13:00</i>	<i>6/9/03 15:30</i>	<i>8,568,333.00</i>	<i>48.14</i>	<i>10,377</i>
Storm Composite	6/9/03	19:35	6/12/03	11:04	0.04	10	6/9/03 15:45	6/11/03 2:45	996,309	2.55	622
Base Grab	6/20/03	10:10	6/20/03	10:10	0.06	7	6/11/03 3:00	6/24/03 18:15	4,148,694	14.50	1,813
Storm Composite	6/25/03	3:40	6/26/03	7:00	0.10	13	6/24/03 18:30	7/2/03 3:30	13,778,430	87.73	11,182
<i>BASE</i>					<i>0.09</i>	<i>19</i>	<i>7/2/03 3:45</i>	<i>7/3/03 6:45</i>	<i>1,796,058</i>	<i>10.09</i>	<i>2,175</i>
<i>STORM</i>					<i>0.07</i>	<i>14</i>	<i>7/3/03 7:00</i>	<i>7/4/03 15:45</i>	<i>2,191,005</i>	<i>9.57</i>	<i>1,870</i>
<i>BASE</i>					<i>0.09</i>	<i>19</i>	<i>7/4/03 16:00</i>	<i>7/14/03 19:00</i>	<i>7,101,729</i>	<i>39.90</i>	<i>8,601</i>
Storm Grab	7/16/03	8:55	7/16/03	8:55	0.08	18	7/14/03 19:15	7/18/03 19:15	2,279,052	10.95	2,561
Base Grab	7/22/03	9:20	7/22/03	9:20	0.09	14	7/18/03 19:30	7/29/03 10:30	3,925,107	21.56	3,430
Base Composite	7/29/03	10:45	7/30/03	21:57	0.12	31	7/29/03 10:45	8/5/03 18:15	1,819,512	13.97	3,521
Base Composite	8/7/03	12:22	8/11/03	7:25	0.25	133	8/5/03 18:30	8/19/03 5:30	2,106,333	32.48	17,488
Base Composite	8/26/03	10:36	8/28/03	9:28	0.38	112	8/19/03 5:45	9/1/03 14:45	1,086,885	25.85	7,599
Base Composite	9/4/03	14:58	9/8/03	8:45	0.32	60	9/1/03 15:00	9/10/03 12:00	276,318	5.47	1,035
Base Grab	9/11/03	8:55	9/11/03	8:55	0.12	36	9/10/03 12:15	9/14/03 7:15	34,929	0.25	78
Base Grab	9/15/03	8:15	9/15/03	8:15	0.05	9	9/14/03 7:30	10/30/03 11:00	151,740	0.45	85
<i>BASE</i>					<i>0.09</i>	<i>19</i>	<i>10/30/03 11:15</i>	<i>12/31/03 23:45</i>	<i>0</i>	<i>0.00</i>	<i>0</i>
Storm Average					0.07	14					
Base Average					0.09	19					
Snowmelt Average					0.00	0					
All Average					0.13	33					
Total									41,692,101	275.34	62,061
CLFLWD Major Subwatershed Total Acres									5,370		
Total TP/TSS (lb/ac/June-December)										0.05	11.56
Total TP/TSS (kg/ha/June-December)										0.06	12.95

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

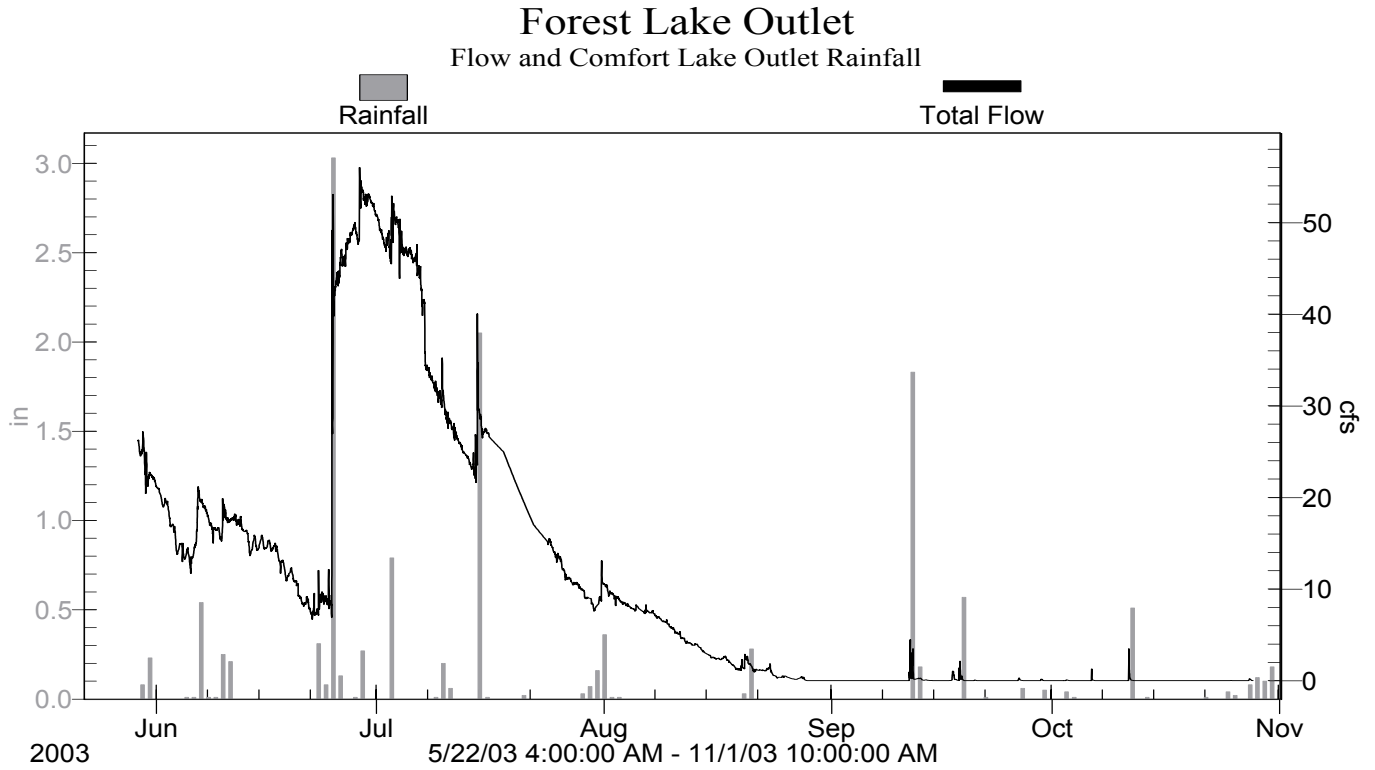
Table 4. Bone Lake Outlet 2003 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Bone Lake Outlet for the period June-December, 2003 was estimated at 0.06 kg/ha (275 lbs.) (Table 4). The loading amount is an underestimate of the total annual load since no flow data or samples were collected during the first part of the year. 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 4. Unlike the Bone Lake Inlet, the total loads for the outlet show how the lake acts as a settling basin for sediment and nutrients which is evident by lower total loads of TP and TSS leaving Bone Lake. This may indicate that nutrients from outside sources may be contributing to the overall poor water quality in Bone Lake.

Forest Lake Outlet

The station at the Forest Lake Outlet site recorded stage, velocity, and flow between May 29-October 28, 2003 (Figure 4). Total discharge during this period was 140,000,100 cf or 3,214 acre-ft. The highest flow--55.99 cfs occurred on June 28, 2003 from a rainfall of 3.55 inches which fell from June 23-June 26, 2003. This event was also the highest cumulative rainfall event for the 2003 monitoring season. The hydrograph for the Forest Lake Outlet site is shown below.

Figure 4. Forest Lake Outlet 2003 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 5. The highest TSS concentration of 256 mg/L was from the September 18, 2003 storm composite sample. The highest TKN concentration of 2.20 mg/L was collected from a September 12, 2003 storm composite sample. The highest TP concentrations were from an October 11, 2003 storm composite sample. One aspect of this site that should be noted is that this site stopped flowing over the weir at the outlet on August 28, 2003. Flow data and the associated samples collected after August 28, 2003 were from stormwater runoff from North Shore Drive, which drains into the stream via a storm drain.

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)
Storm Composite	6/10/03	1:11	6/10/03	11:16	13	5	0.82	0.03	0.03	0.05	0.02		
Base Grab	6/20/03	8:15	6/20/03	8:15	5	4	0.71	0.05	0.03	0.05	0.04		
Storm Composite	6/24/03	22:47	6/25/03	18:37	27	8	0.87	0.06	0.03	0.08	0.06	0.005	
Storm Composite	7/3/03	1:43	7/3/03	19:16	62	15	1.20	0.09	0.03	0.08	0.09		
Fecal Grab	7/22/03	10:25	7/22/03	10:25									20
Base Grab	7/22/03	10:25	7/22/03	10:25	6	5	0.76	0.04	0.03	0.05	0.02	0.005	
Base Grab	7/31/03	9:35	7/31/03	9:35	8	6	0.70	0.01					
Base Composite	8/7/03	9:34	8/11/03	8:50	29	13	1.10	0.05	0.03	0.05	0.07		
Storm Composite	8/19/03	20:10	8/20/03	13:07	111	62	1.50	0.36	0.05	0.12	0.04		
Base Composite	8/26/03	9:27	8/28/03	8:08	10	6	1.10	0.06	0.04	0.06	0.10		
Storm Composite	9/11/03	16:07	9/12/03	0:05	107	42	2.20	0.45	0.05	0.26	0.45		
Storm Composite	9/12/03	1:35	9/12/03	5:52	22	8	0.80	0.17	0.03	0.22	0.25		
Storm Composite	9/17/03	12:19	9/17/03	19:28	10	6	1.20	0.25	0.07	0.08	0.09		
Storm Composite	9/18/03	10:27	9/18/03	21:01	256	48	1.70	0.75	0.05	0.13	0.03		
Storm Composite	10/11/03	14:37	10/11/03	18:39	106	46	1.50	0.92	0.03	0.36	0.02		
Average					55	20	1.15	0.23	0.04	0.12	0.10	0.005	20

Table 5. Forest Lake Outlet 2003 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			
BASE					0.04	12	5/29/03 12:30	6/5/03 17:15	11,810,230	29.49	8,552
STORM					0.14	53	6/5/03 17:30	6/7/03 11:45	2,598,388	22.71	8,638
BASE					0.04	12	6/7/03 12:00	6/9/03 21:30	3,524,726	8.80	2,552
Storm Composite	6/10/03	1:11	6/10/03	11:16	0.03	13	6/9/03 21:45	6/10/03 21:45	1,531,590	2.77	1,243
Base Grab	6/20/03	8:15	6/20/03	8:15	0.05	5	6/10/03 22:00	6/24/03 22:00	15,181,010	50.23	4,738
Storm Composite	6/24/03	22:47	6/25/03	18:37	0.06	27	6/24/03 22:15	7/2/03 23:00	33,552,053	125.67	56,552
Storm Composite	7/3/03	1:43	7/3/03	19:16	0.09	62	7/2/03 23:15	7/5/03 14:15	10,965,720	64.35	42,442
BASE					0.04	12	7/5/03 14:30	7/14/03 4:30	24,044,530	60.04	17,412
STORM					0.14	53	7/14/03 4:45	7/19/03 8:45	11,560,410	101.03	38,429
Base Grab	7/22/03	10:25	7/22/03	10:25	0.04	6	7/19/03 9:00	7/25/03 15:00	9,524,811	25.57	3,568
BASE					0.04	12	7/25/03 15:15	7/30/03 21:00	4,765,253	11.90	3,451
Base Grab	7/31/03	9:35	7/31/03	9:35	0.01	8	7/30/03 21:15	7/31/03 9:45	370,550	0.23	185
STORM					0.14	53	7/31/03 10:00	8/2/03 10:00	1,712,442	14.97	5,692
Base Composite	8/7/03	9:34	8/11/03	8:50	0.05	29	8/2/03 10:15	8/15/03 22:15	7,127,161	22.25	12,903
Storm Composite	8/19/03	20:10	8/20/03	13:07	0.36	111	8/15/03 22:30	8/20/03 22:30	868,756	19.52	6,020
Base Composite	8/26/03	9:27	8/28/03	8:08	0.06	10	8/20/03 22:45	8/28/03 19:15	457,718	1.71	286
No Water Over Weir-All Road Runoff											
NO FLOW							8/28/03 19:30	9/11/03 15:30	0	0.00	0
Storm Composite	9/11/03	16:07	9/12/03	0:05	0.45	107	9/11/03 15:45	9/12/03 0:15	31,892	0.90	213
Storm Composite	9/12/03	1:35	9/12/03	5:52	0.17	22	9/12/03 0:30	9/12/03 6:15	28,045	0.29	39
NO FLOW							9/12/03 6:30	9/17/03 11:15	0	0.00	0
Storm Composite	9/17/03	12:19	9/17/03	19:28	0.25	10	9/17/03 11:30	9/17/03 21:30	20,724	0.32	13
NO FLOW							9/17/03 21:45	9/18/03 10:00	0	0.00	0
Storm Composite	9/18/03	10:27	9/18/03	21:01	0.75	256	9/18/03 10:15	9/18/03 21:15	15,697	0.74	251
NO FLOW							9/18/03 21:30	10/11/03 14:00	0	0.00	0
Storm Composite	10/11/03	14:37	10/11/03	18:39	0.92	106	10/11/03 14:15	10/11/03 21:15	21,731	1.24	144
							10/11/03 21:30	12/31/03 23:45	0	0.00	0
Storm Average					0.14	53					
Base Average					0.04	12					
Snowmelt Average					0.00	0					
All Average											
Load - 5/29/03--8/28/03	Total Flow Over Weir and Local Road Runoff								139,595,348	561.24	212,663
Load - 8/29/03--12/31/03	Local Road Runoff Only (Forest Lake Below Weir)								118,089	3.49	659
Total									139,713,437	564.73	213,322
CLFLWD Major Subwatershed Total Acres									6,536		
Total Load											
Total TP/TSS (lb/ac/June-December)										0.09	32.54
Total TP/TSS (kg/ha/June-December)										0.10	36.47
Local Road Runoff Load Only (8/29/03-12/31/03)											
Total TP/TSS (lb/ac/June-December)										0.001	0.10
Total TP/TSS (kg/ha/June-December)										0.001	0.11

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

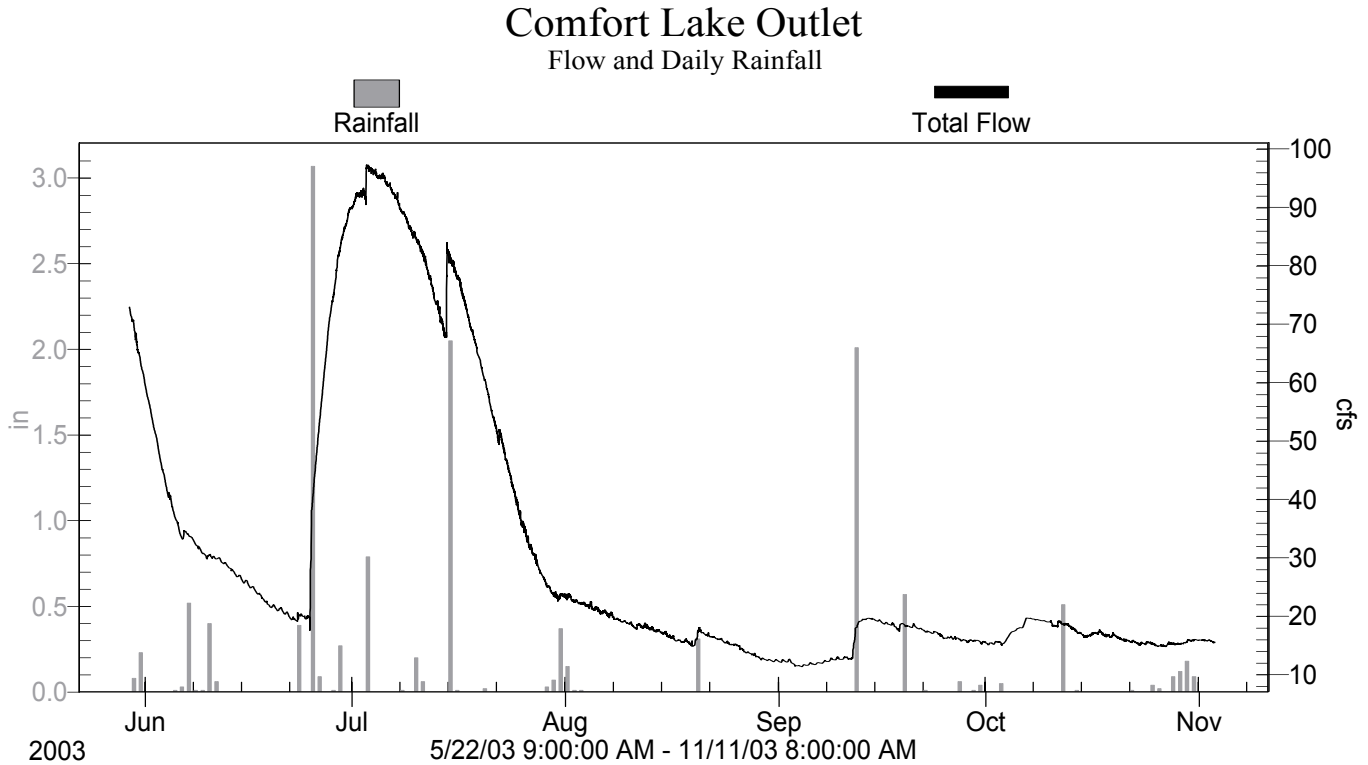
Table 6. Forest Lake Outlet 2003 Total Phosphorus and Total Suspended Solids Loading

Total phosphorus loading for Forest Lake Outlet for the period June-December, 2003 was estimated at 0.10 kg/ha (565 lbs.) (Table 6). This loading amount is an estimate of the total annual load since no flow data or samples were collected during the first part of the year. One other note that should be made is the fact that the outlet stopped flowing over the weir in August 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, 0.11 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 6. The total loads for the outlet show how the lake acts as a settling basin for sediment and nutrients. The large volume of Forest Lake, especially in reference to its relatively small watershed (watershed: lake area, ~2:1), may be contributing to the overall good water quality of the lake and low nutrient and sediment levels leaving the outlet.

Comfort Lake Outlet

The station for the Comfort Lake Outlet site recorded flow between May 29-November 3, 2003 (Figure 5). Total discharge during this period was 423,323,100 cf or 9,718 acre/ft. The highest discharge—96.87 occurred on July 3, 2003, from a total rainfall of 4.26 inches between June 23 and July 3, 2003. The rainfall on June 25, 2003 was the highest daily rainfall for the monitoring period, yielding 3.07 inches of rain. The hydrograph for the Comfort Lake Outlet is shown below.

Figure 5. Comfort Lake Outlet 2003 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, Orthophosphate, and Fecal Coliform results from all collected samples are listed in Table 7. The highest TSS, TKN, and TP concentrations of 24 mg/L, 1.50 mg/L, and 0.08 mg/L respectively were all collected in a June 26, 2003 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)
Base Grab	6/20/03	8:45	6/20/03	8:45	11	7	1.10	0.04	0.03	0.05	0.08		
Storm Composite	6/25/03	0:20	6/26/03	10:57	24	11	1.50	0.08	0.03	0.07	0.02	0.005	
Storm Grab	7/16/03	10:20	7/16/03	10:20	8	6	1.10	0.06	0.03	0.05	0.03		
Base Grab, Fecal Grab	7/22/03	10:00	7/22/03	10:00	9	5	1.40	0.07	0.03	0.05	0.02	0.005	4
Base Composite	7/29/03	10:10	7/30/03	19:27	10	6	1.30	0.05	0.03	0.05	0.12		
Base Composite	8/7/03	10:08	8/11/03	9:55	12	6	1.40	0.04	0.03	0.05	0.10		
Base Composite	8/26/03	9:42	8/28/03	8:26	9	5	1.20	0.06	0.04	0.05	0.03		
Base Composite	9/4/03	10:19	9/8/03	4:28	19	14	1.20	0.07	0.03	0.05	0.06		
Base Grab, Fecal Grab	9/11/03	8:25	9/11/03	8:25	3	2	0.99	0.04	0.03	0.05	0.02	0.005	54
Storm Composite	9/11/03	20:15	9/14/03	14:48	19	14	1.10	0.04	0.03	0.05	0.07		
Base Composite	10/3/03	8:51	10/6/03	8:14	4	4	1.20	0.04	0.04	0.48	0.26		
Base Grab, Fecal Grab	10/7/03	10:00	10/7/03	10:00	4	4	1.20	0.03	0.03	0.56	0.22	0.005	20
Base Grab, Fecal Grab	10/28/03	8:10	10/28/03	8:10	2	2	1.30	0.03	0.03	0.51	0.41	0.005	4
Average					10	7	1.23	0.05	0.03	0.16	0.11	0.005	21

Table 7. Comfort Lake Outlet 2003 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			
<i>BASE</i>					<i>0.05</i>	<i>8</i>	<i>5/29/03 17:00</i>	<i>6/14/03 19:00</i>	<i>56337410</i>	<i>175.85</i>	<i>29,190</i>
Base Grab	6/20/03	8:45	6/20/03	8:45	0.04	11	6/14/03 19:15	6/24/03 22:15	19,347,330	42.27	13,286
Storm Composite	6/25/03	0:20	6/26/03	10:57	0.08	24	6/24/03 22:30	7/3/03 1:15	52,201,960	267.22	78,210
<i>STORM</i>					<i>0.06</i>	<i>17</i>	<i>7/3/03 1:30</i>	<i>7/8/03 22:45</i>	<i>47,633,964</i>	<i>178.42</i>	<i>50,551</i>
<i>BASE</i>					<i>0.05</i>	<i>8</i>	<i>7/8/03 23:00</i>	<i>7/14/03 18:45</i>	<i>39,766,060</i>	<i>124.12</i>	<i>20,604</i>
Storm Grab	7/16/03	10:20	7/16/03	10:20	0.06	8	7/14/03 19:00	7/18/03 22:00	26,981,310	101.06	13,475
Base Grab	7/22/03	10:00	7/22/03	10:00	0.07	9	7/18/03 22:15	7/28/03 15:30	38,152,783	164.34	21,436
Base Composite	7/29/03	10:10	7/30/03	19:27	0.05	10	7/28/03 15:45	8/5/03 23:45	16,657,650	48.87	10,399
Base Composite	8/7/03	10:08	8/11/03	9:55	0.04	12	8/6/03 0:00	8/19/03 20:45	21,481,807	53.64	16,092
Base Composite	8/26/03	9:42	8/28/03	8:26	0.06	9	8/19/03 21:00	9/2/03 17:45	17,324,690	63.81	9,734
Base Composite	9/4/03	10:19	9/8/03	4:28	0.07	19	9/2/03 18:00	9/10/03 13:00	8,158,956	36.67	9,677
Base Grab	9/11/03	8:25	9/11/03	8:25	0.04	3	9/10/03 13:15	9/11/03 18:00	1,332,344	3.33	250
Storm Composite	9/11/03	20:15	9/14/03	14:48	0.04	19	9/11/03 18:15	9/15/03 6:15	5,700,273	15.66	6,761
<i>BASE</i>					<i>0.05</i>	<i>8</i>	<i>9/15/03 6:30</i>	<i>10/2/03 10:00</i>	<i>25,398,150</i>	<i>79.28</i>	<i>13,160</i>
Base Composite	10/3/03	8:51	10/6/03	8:14	0.04	4	10/2/03 10:15	10/7/03 8:15	7,271,795	19.97	1,816
Base Grab	10/7/03	10:00	10/7/03	10:00	0.03	4	10/7/03 8:30	10/19/03 22:15	19,570,150	36.65	4,887
Base Grab	10/28/03	8:10	10/28/03	8:10	0.03	2	10/19/03 22:30	11/3/03 10:15	19,513,900	34.11	2,436
<i>BASE</i>					<i>0.05</i>	<i>8</i>	<i>11/3/03 10:30</i>	<i>12/31/03 23:45</i>	<i>81,283,500</i>	<i>253.71</i>	<i>42,116</i>
Storm Average					0.06	17					
Base Average					0.05	8					
Snowmelt Average					0.00	0					
All Average					0.05	10					
Total									504,114,032	1,699	344,080
CLFLWD Major Subwatershed Total Acres									30,098		
Total TP/TSS (lb/ac/June-December)										0.06	11.43
Total TP/TSS (kg/ha/June-December)										0.06	12.81

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

Table 8. Comfort Lake Outlet 2003 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 June-December, 2003 was estimated at 0.06 kg/ha (1699 lbs.) (Table 8). This loading amount is an underestimate of the total annual load since no flow data or samples were collected during the first part of the year. Once again, it is evident from the table that the lake acts to settle out nutrients and sediment. Further studies of water coming into Comfort Lake versus the water leaving will give a good idea of how well Comfort Lake is functioning as a control for volume and nutrients/sediments leaving the watershed.

2. Lake Water Quality Summaries

2.1 Summary of 2003 Lake Water Quality

2.2 Historical Water Quality Trends

2.1 Summary of 2003 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 2003-study period, ranged from 4.6 feet in Bone Lake to 15.3 feet in Halfbreed Lake. The typical range for this ecoregion, is 4.9 - 10.5 feet (Figure 6). Of the average Secchi disk transparency values observed in 2003, two were less than (poorer than) the average for this ecoregion, one was greater than (better than) average and two were within the average range for this ecoregion. The average transparency for all lakes sampled in 2003 was 7.2 feet, which was more (better) than the transparency during the 2002 study period which was 6.8 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 7). Total phosphorous concentrations in sampled lakes in CLFLWD range 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. One lake had an average summer total phosphorous value less than (better than average) the range for this ecoregion, two lakes had values 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 2002 ranged from 0.018 mg/l in Halfbreed Lake to 0.113 mg/l in Shields Lake with a watershed average of 0.08 mg/l.

3. CHLOROPHYLL-*a*

Chlorophyll-*a* is a photosynthetic component found in algae and aquatic plants. It is also an indicator of algal productivity. The 2003 average chlorophyll-*a* concentrations for lakes in CLFLWD ranged from 3 µg/l in Halfbreed Lake to 38 µg/l in Bone Lake, with a watershed average of 22.2 µg/l. The ecoregion range for chlorophyll-*a* concentration is 5.0-22.0 µg/l (Figure 8). Of the lakes sampled in 2003, three 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 2002 ranged from 2.8 µg/l in Halfbreed Lake to 49.2 µg/l in Shields Lake, with a watershed average of 27.1 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 CMWD is phosphorous and not nitrogen. In 2003, average total Kjeldahl nitrogen (TKN) concentrations in CLFLWD lakes ranged from 0.538 mg/l in Halfbreed Lake to 2.079 mg/l in Shields Lake, with a watershed average of 1.269 mg/l. The ecoregion range for TKN is 0.60-1.20 mg/l (Figure 9). Of the lakes sampled in 2003, three exceeded (poorer than) the ecoregion range for Kjeldahl nitrogen concentration, one lake was within the ecoregion range and one lake was below (better than) the ecoregion range. For comparison, TKN concentrations in 2002 ranged from 0.67 mg/l in Halfbreed to 2.08 mg/l in Shields Lake, with a watershed average of 1.38 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. In 2002 and 2003, chloride was collected only on Bone Lake. The total chloride ion concentrations ranged from 9 mg/L to 12 mg/L in Bone Lake with a seasonal average of 10.2 mg/L. Bone Lake was above the ecoregion range of 4.0-10.0 mg/L for 2003 (Figure 10). For comparison, total chloride ion concentrations in 2002 ranged from 5 mg/L in Fish Lake to 12 mg/L with a seasonal average of 10.0 mg/L.

Figure 6. 2003 Average Secchi Transparencies and Ecoregion Range

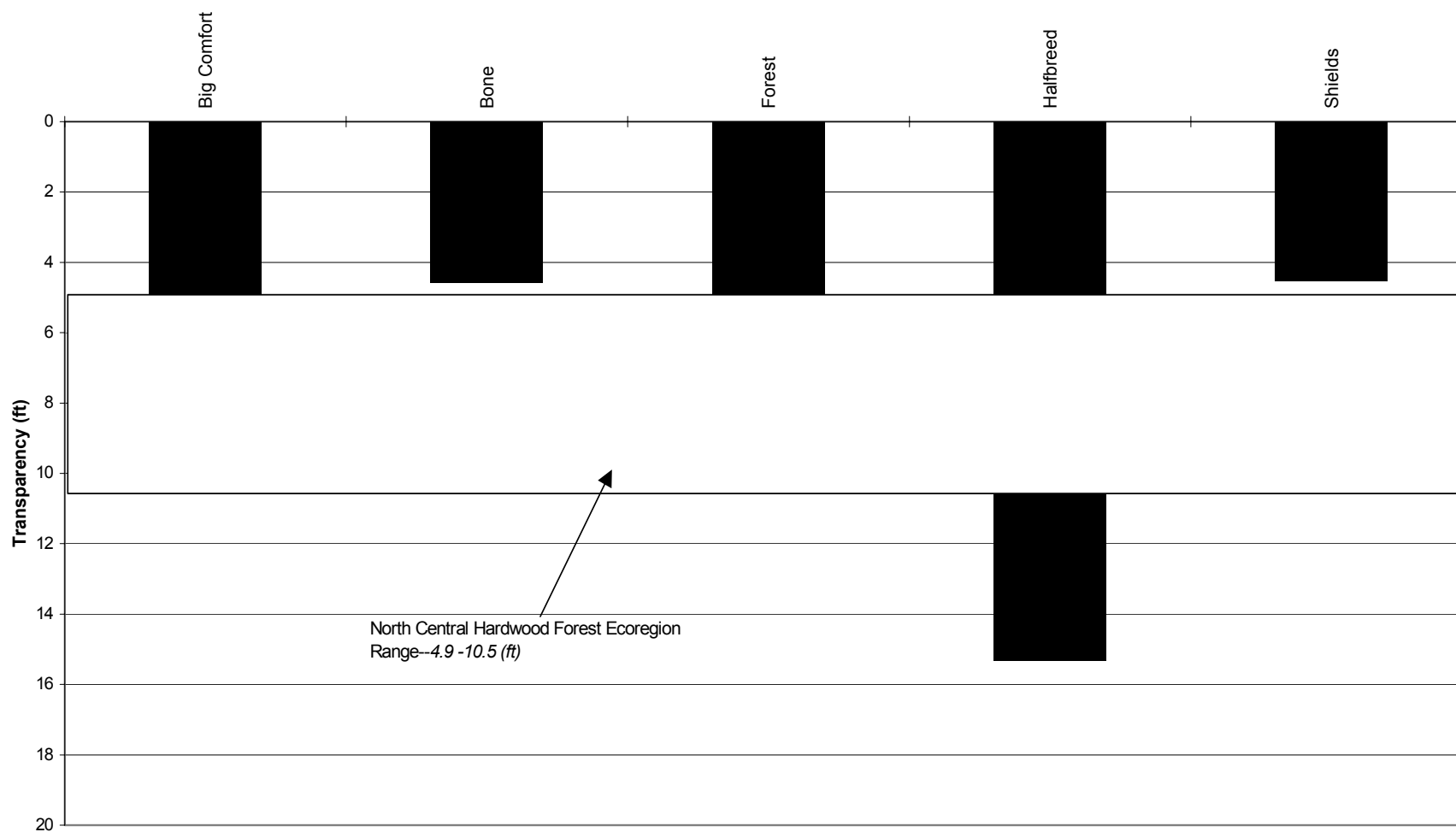


Figure 7. 2003 Average Total Phosphorus and Ecoregion Range

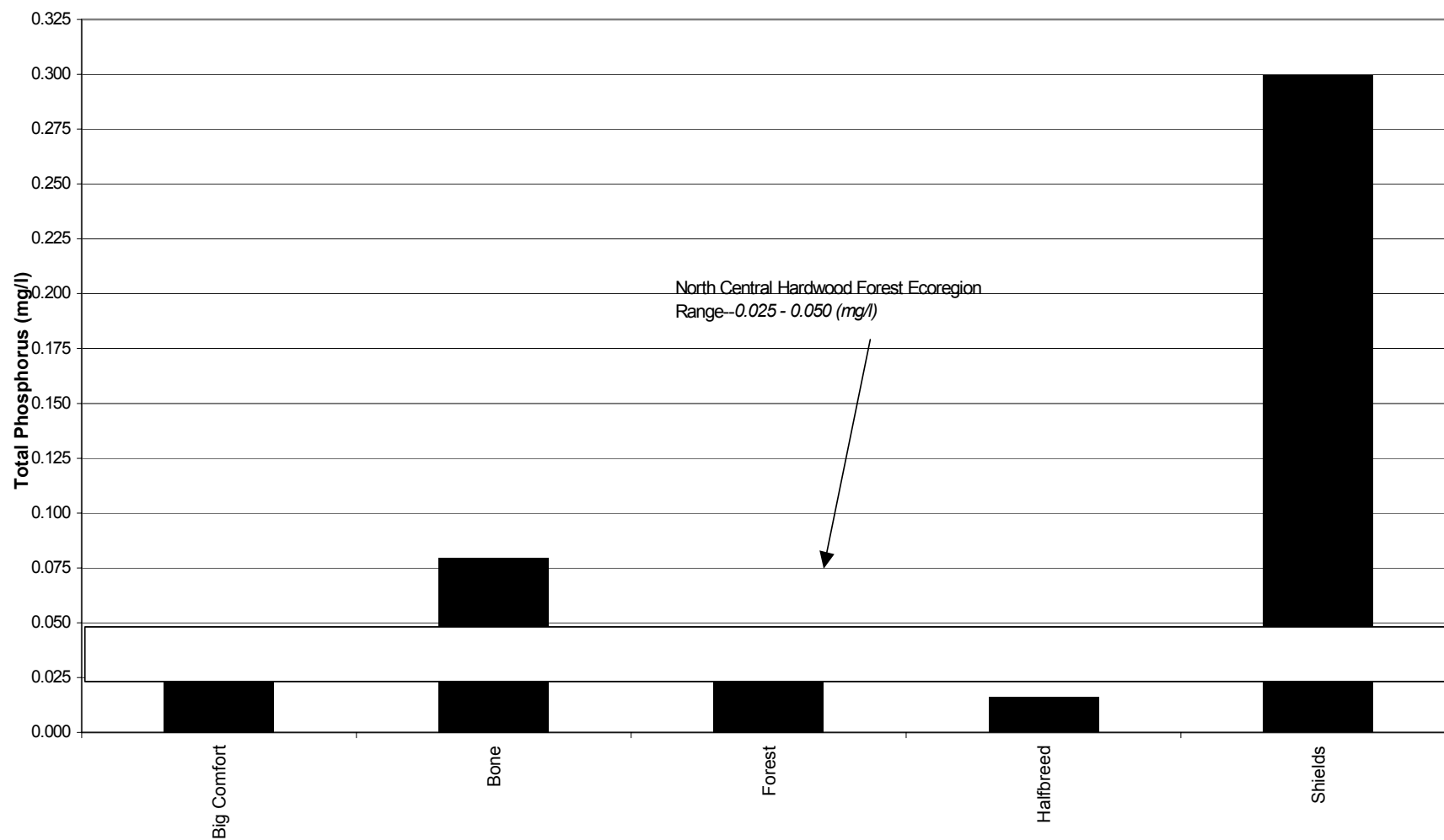


Figure 8. 2003 Average Chlorophyll-*a* and Ecoregion Range

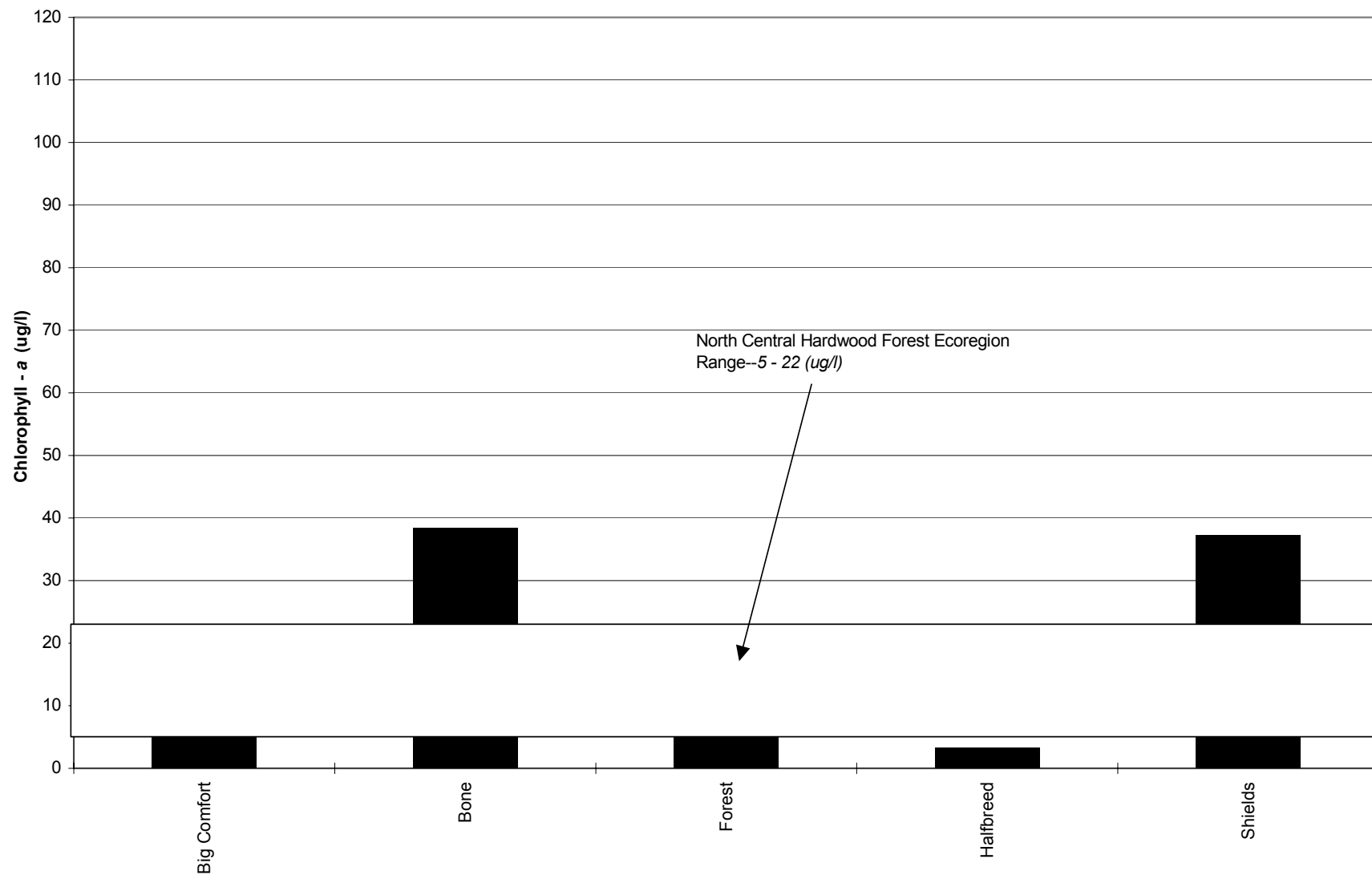


Figure 9. 2003 Average Total Kjeldahl Nitrogen and Ecoregion Range

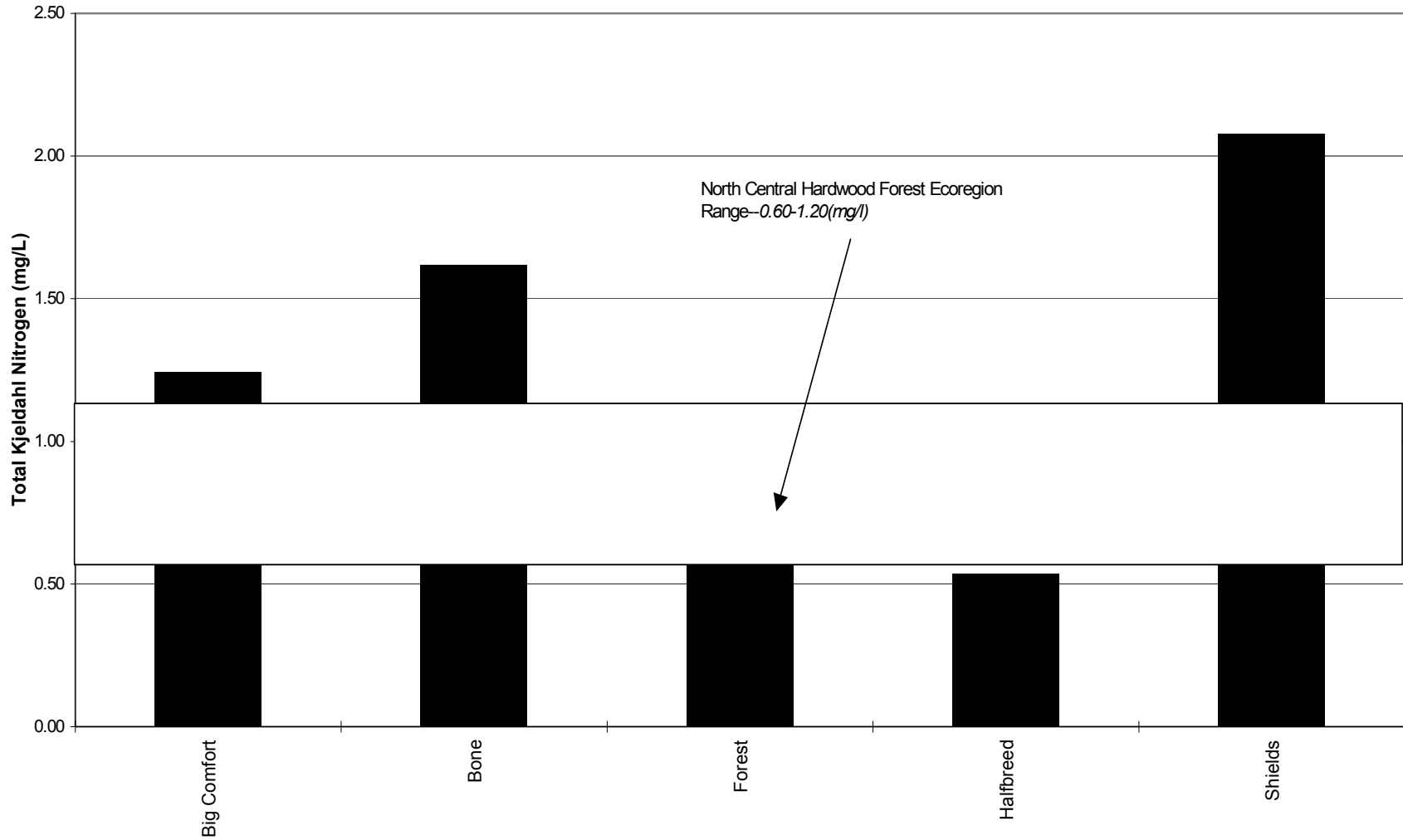
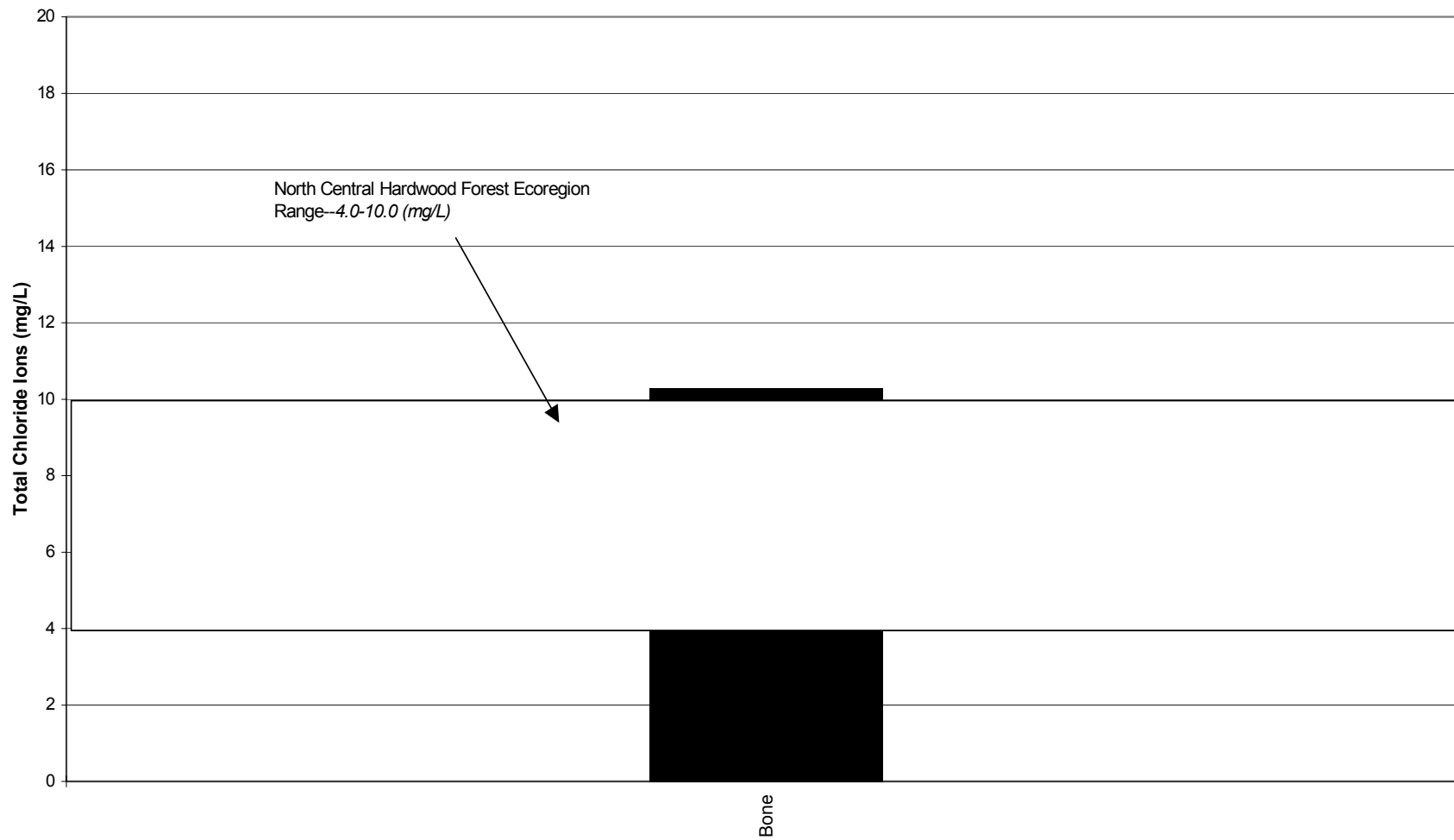


Figure 10. 2003 Average Total Chloride Ions and Ecoregion Range



CLFLWD

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	0.047	20	1.243		5.4	1.64
Bone	0.080	38	1.618	10.3	4.6	1.40
Forest	0.032	13	0.868		6.2	1.90
Halfbreed	0.016	3	0.536		15.3	4.67
Shields	0.299	37	2.079		4.5	1.38

Table 9. 2003 Average Water Quality Results and Ecoregion Ranges

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 15 to October 14, 2003, 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 10 gives the Big Comfort Lake 2003 high, low, and average lake levels. Individual lake level readings are shown in Figure 11.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
3/18/03- 12/1/03	60	885.45	887.35	1.90	886.19
		9/2/2003	5/23/2003		

Table 10. Big Comfort 2003 Lake Level

Figure 11. Big Comfort Lake Elevations 2002-03

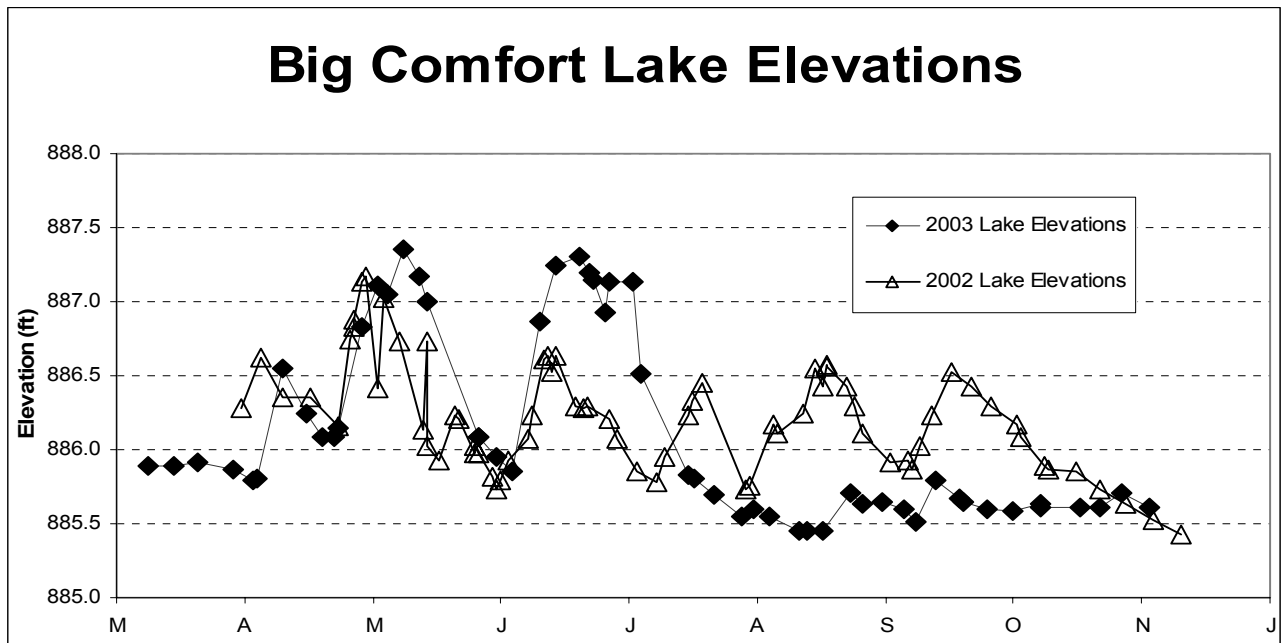


Table 11 gives the 2003 Big Comfort Lake monitoring chemistry results for the 2003 monitoring season. The total phosphorus concentration on May 6, 2003 was left out of the 2003 calculated average value because it is an extreme outlying value and may not be representative of TP for that day.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/15/03	0.044	1.10	11.0	9.01	9.0
5/6/03	0.198	1.10	15.0	8.01	12.4
5/16/03	0.046	1.10	7.1	5.40	16.2
5/29/03	0.042	1.10	10.0	4.91	20.3
6/11/03	0.045	1.10	15.0	NA	NA
6/27/03	0.056	1.10	25.0	7.82	22.3
7/11/03	0.057	1.20	14.0	6.01	21.8
7/23/03	0.071	1.20	32.0	4.23	24.5
8/6/03	0.038	1.30	39.0	9.03	23.7
8/21/03	0.022	1.40	22.0	5.60	26.2
9/4/03	0.040	1.10	31.0	6.37	21.9
9/17/03	0.054	1.50	21.0	6.32	20.3
10/2/03	0.049	1.60	28.0	6.90	12.6
10/14/03	0.048	1.50	14.0	8.22	13.6
2003 Averages	0.047	1.20	20.3	6.76	18.8

Table 11. Big Comfort Lake 2003 Monitoring Results

Table 12 shows the Big Comfort Lake Water Quality Summary. The lake received an average lake grade of a C for 2003.

	Trophic Status (2003 Average)	Lake Grade (2003 Average)
Total Phosphorus (mg/L)	Eutrophic	C
Chlorophyll- <i>a</i> (ug/L)	Eutrophic	C
Secchi disk (ft)	Eutrophic	C
Overall	Eutrophic	C

Table 12. Lake Grade and Trophic Status

Figure 12-14 compare the lake chemistry data and Secchi disk readings.

Figure 12. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

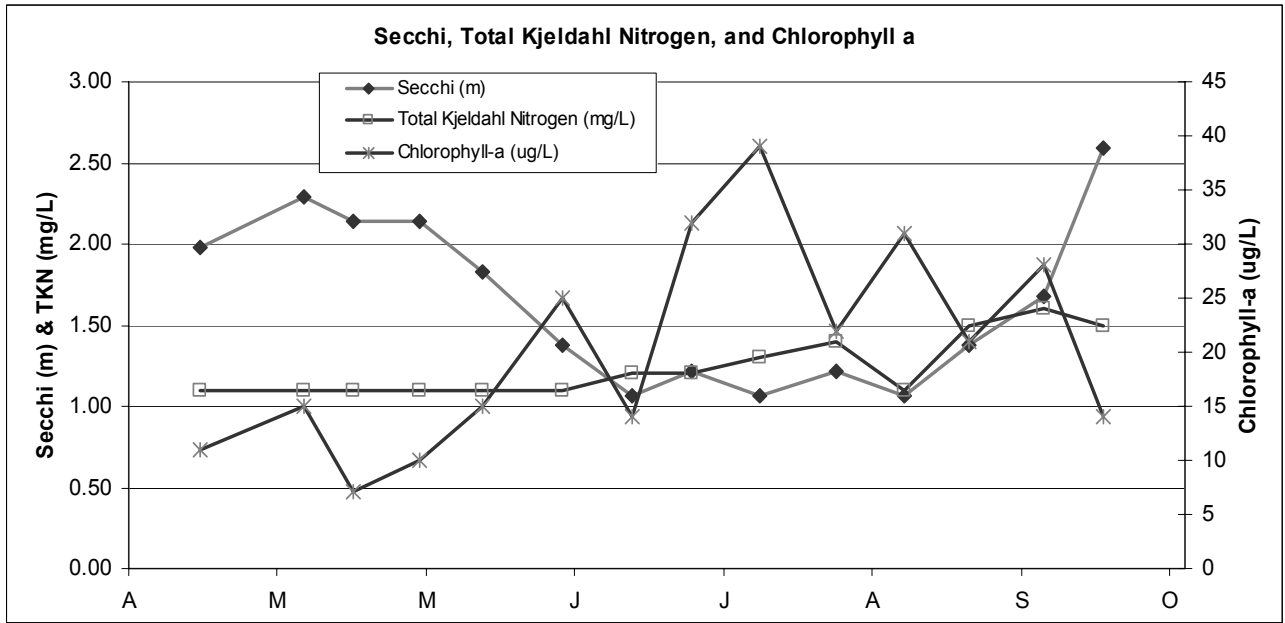


Figure 13. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

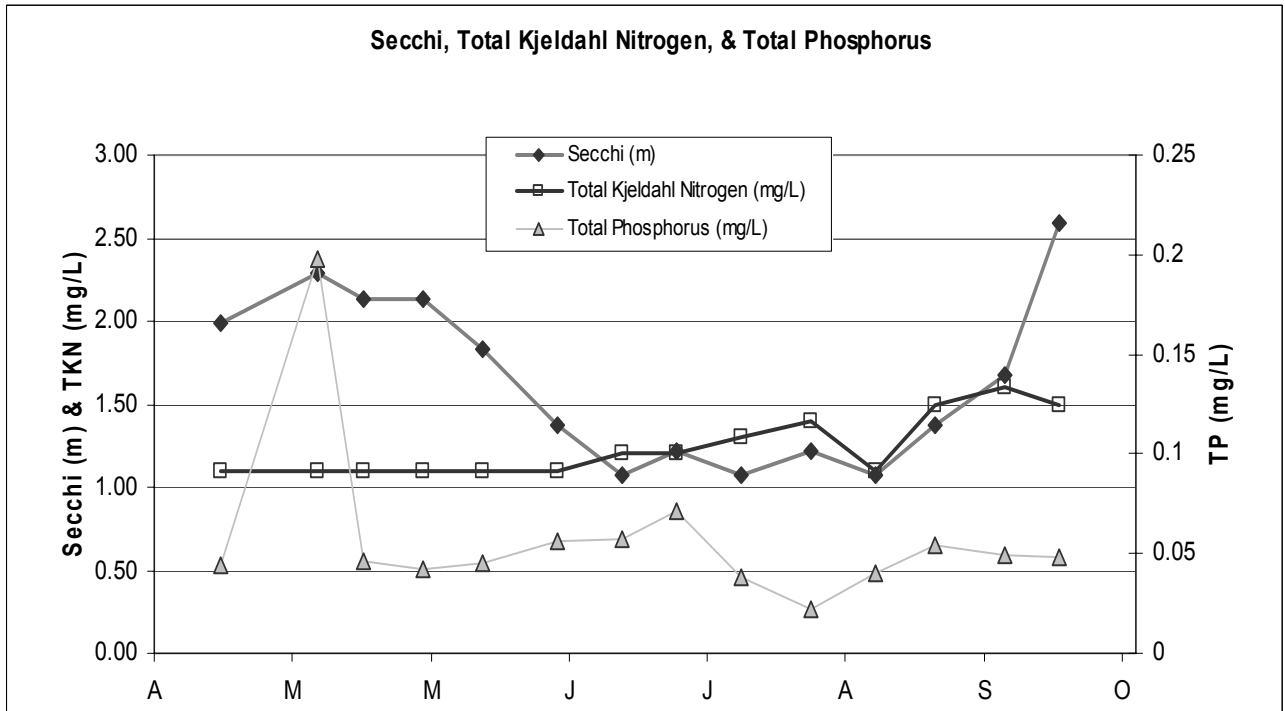
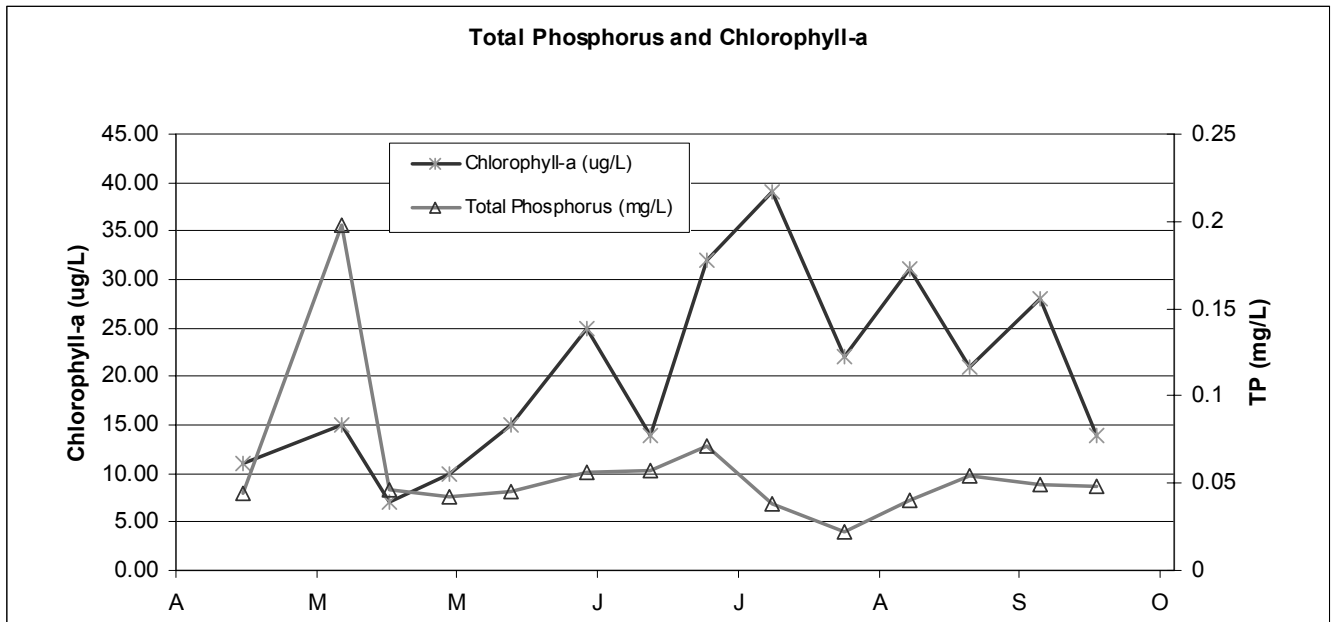
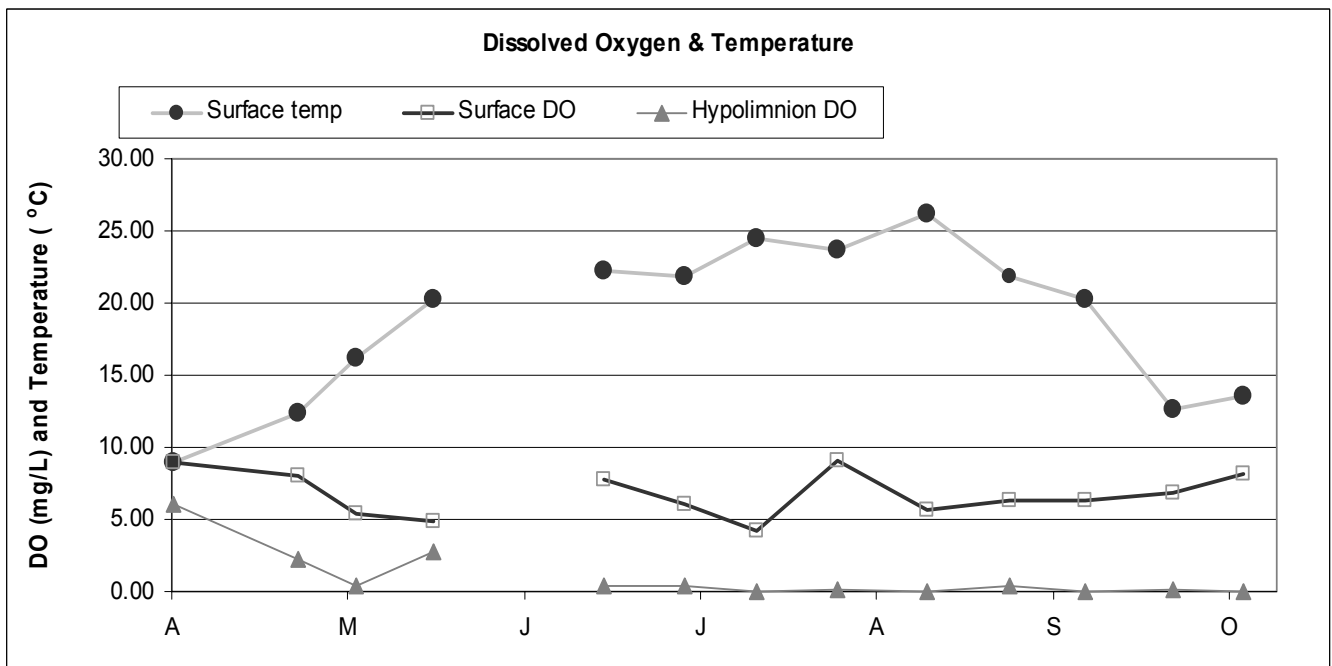


Figure 14. Total Phosphorous and Chlorophyll-a



Surface dissolved oxygen and surface temperature readings for 2003 are shown in Figure 15.

Figure 15. Surface Dissolved Oxygen and Surface Temperatures



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 15 to October 14, 2003, 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.

Only one elevation reading was recorded during the 2003 monitoring season. On 4/15/2003 the elevation was 908.65. Individual lake level readings are shown in Figure 16.

Figure 16. Bone Lake Elevations 2002-03

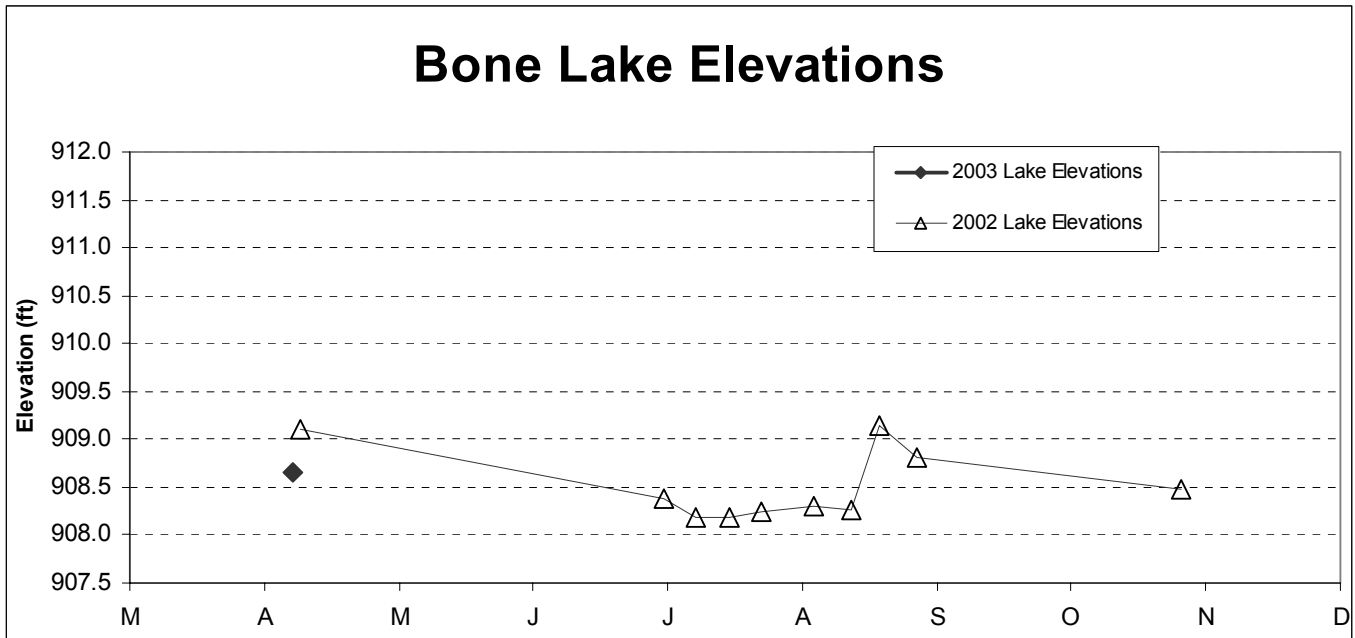


Table 13 gives the 2003 Bone Lake monitoring chemistry results for the 2003 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Chloride (mg/L)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/15/03	0.123	1.60	33.0	9	9.66	10.1
5/5/03	0.072	1.70	27.0	9	10.55	13.2
5/16/03	0.047	1.20	14.0	12	5.58	16.9
5/27/03	0.051	0.95	2.8	11	4.21	19.5
6/11/03	0.048	1.30	26.0	11	NA	NA
6/27/03	0.056	1.50	13.0	11	5.47	20.8
7/11/03	0.051	1.60	30.0	10	9.23	22.9
7/23/03	0.082	1.80	67.0	10	7.15	26.5
8/6/03	0.146	1.70	73.0	10	11.58	24.6
8/21/03	0.083	2.00	49.0	10	5.60	26.2
9/4/03	0.053	1.30	50.0	10	5.42	21.7
9/18/03	0.136	2.20	79.0	11	6.32	20.6
10/1/03	0.053	1.90	30.0	11	9.70	12.4
10/14/03	0.113	1.90	43.0	9	10.58	13.8
2003 Averages	0.080	1.62	38.34	10	7.77	19.2

Table 13. Bone Lake 2003 Monitoring Results

Table 14 shows the Bone Lake Water Quality Summary. The lake received an average lake grade of a C- for 2003.

	Trophic Status (2003 Average)	Lake Grade (2003 Average)
Total Phosphorus (mg/L)	Hypereutrophic	D
Chlorophyll- <i>a</i> (ug/L)	Hypereutrophic	C
Secchi disk (ft)	Eutrophic	C
Overall	Hypereutrophic	C-

Table 14. Lake Grade and Trophic Status.

Figure 17-21 compare the lake chemistry data and Secchi disk readings.

Figure 17. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

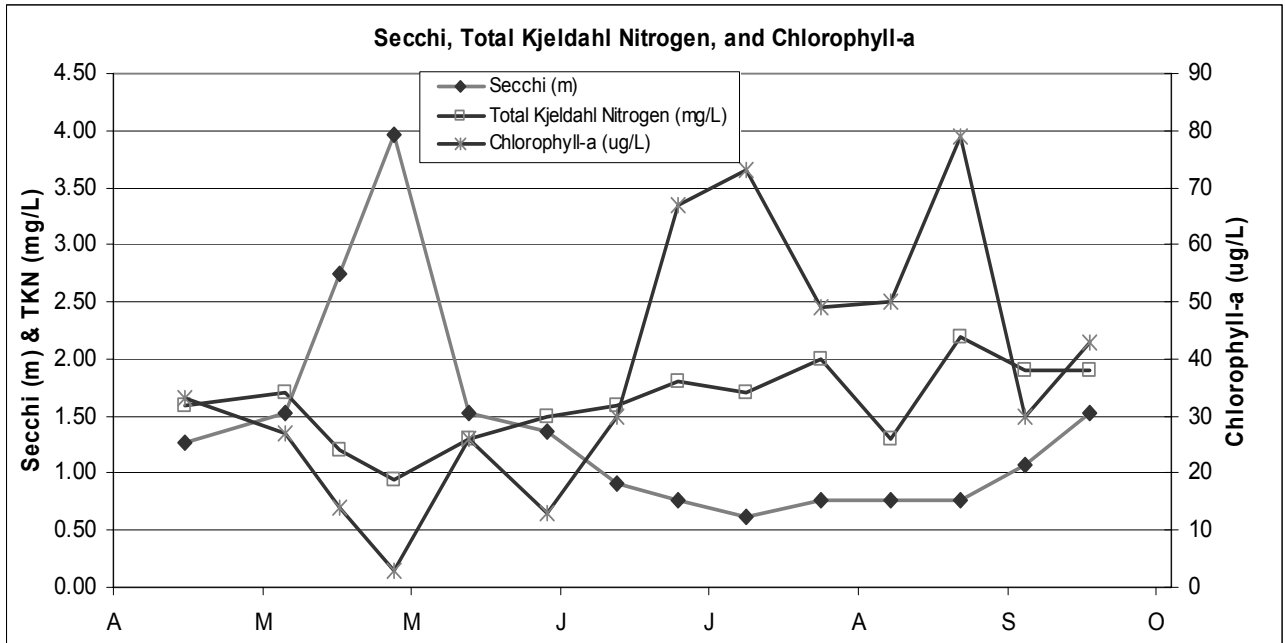


Figure 18. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

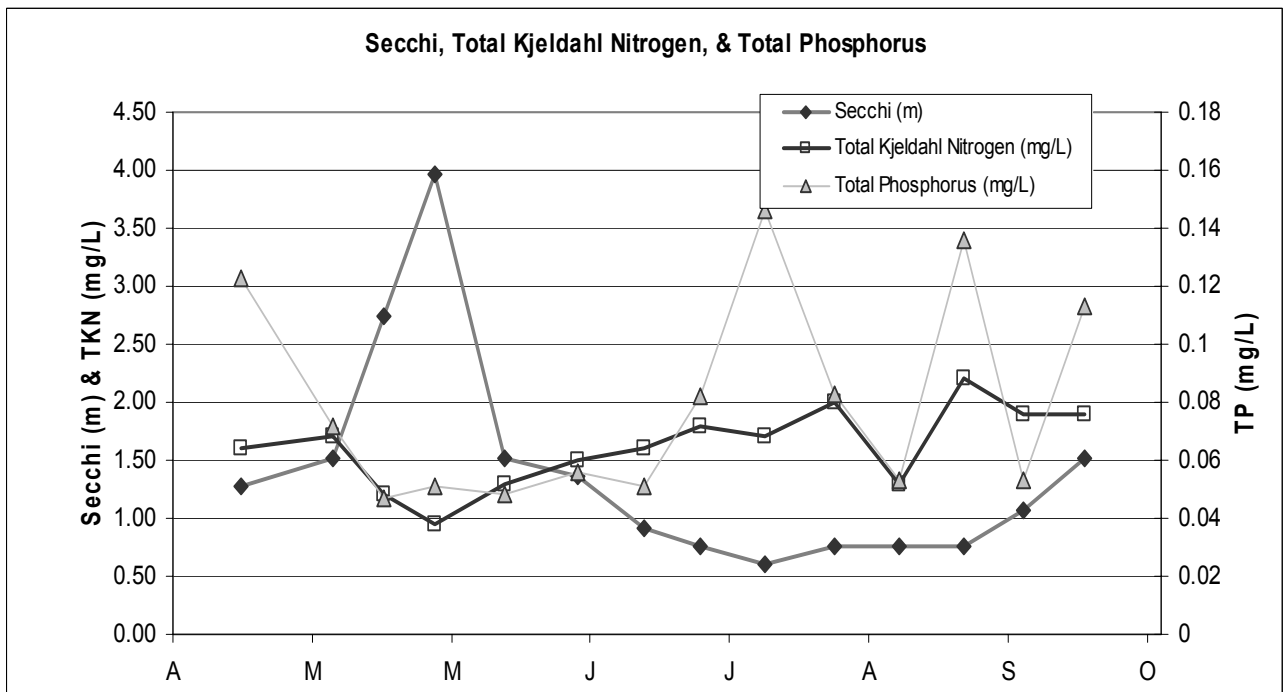


Figure 19. Secchi and Chloride ion

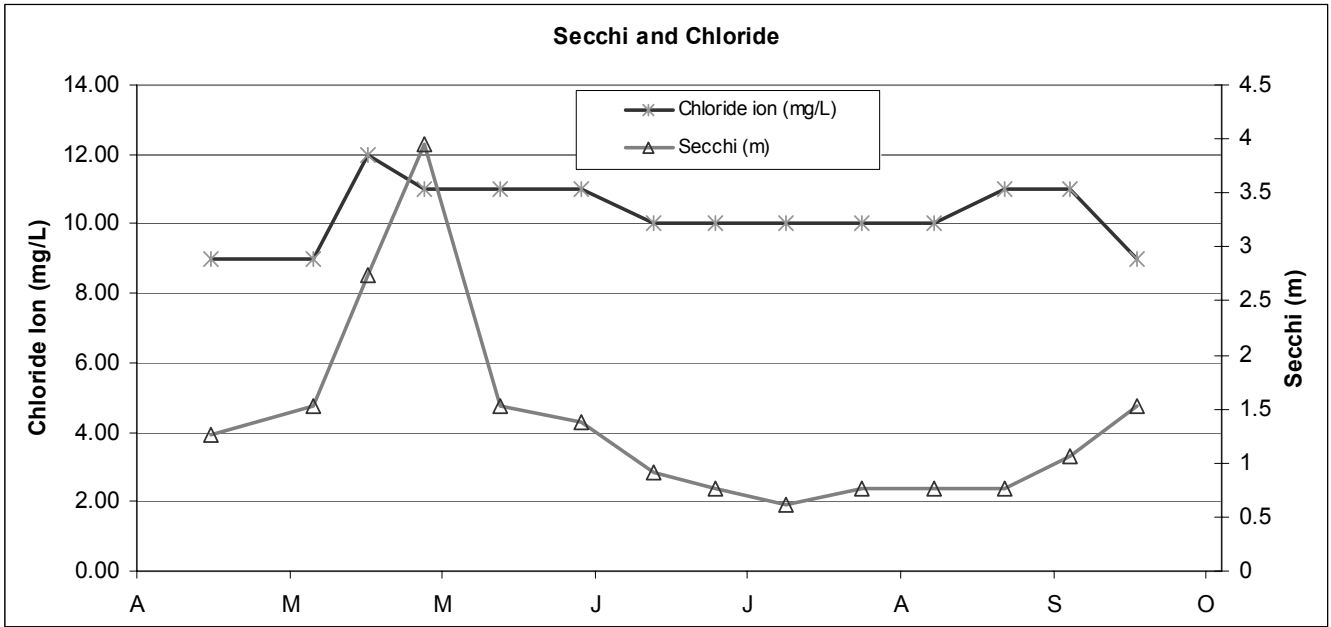


Figure 20. Total Phosphorous and Chlorophyll-a

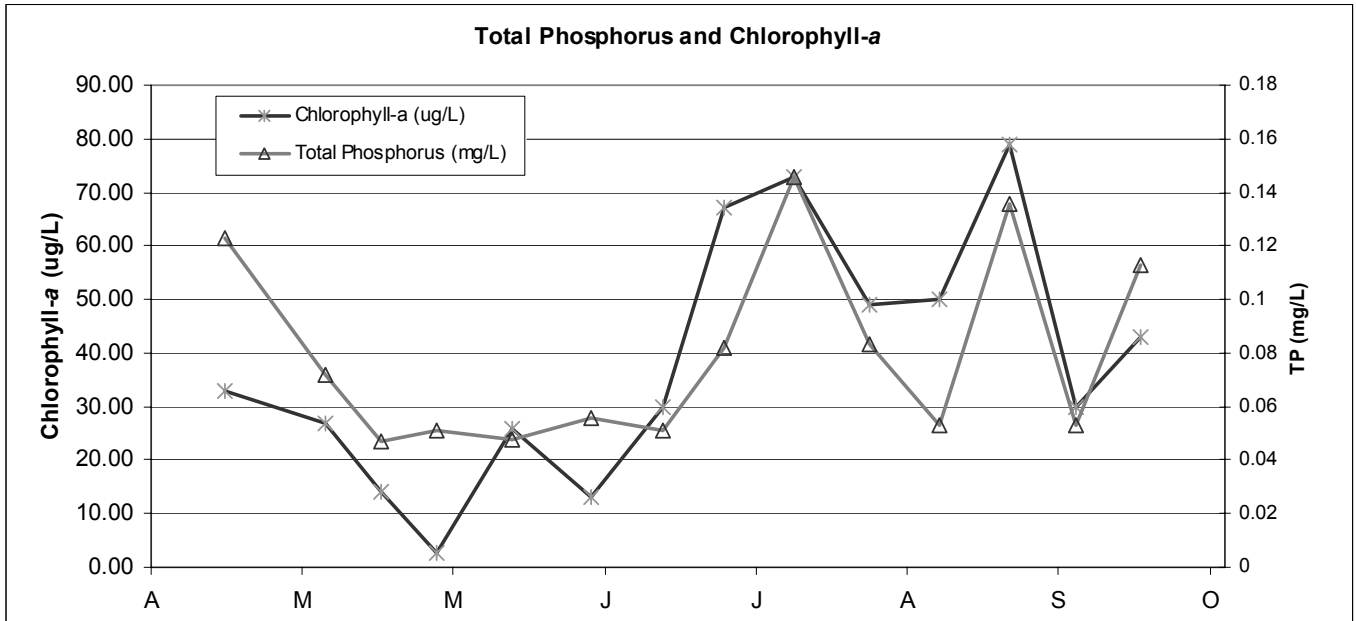
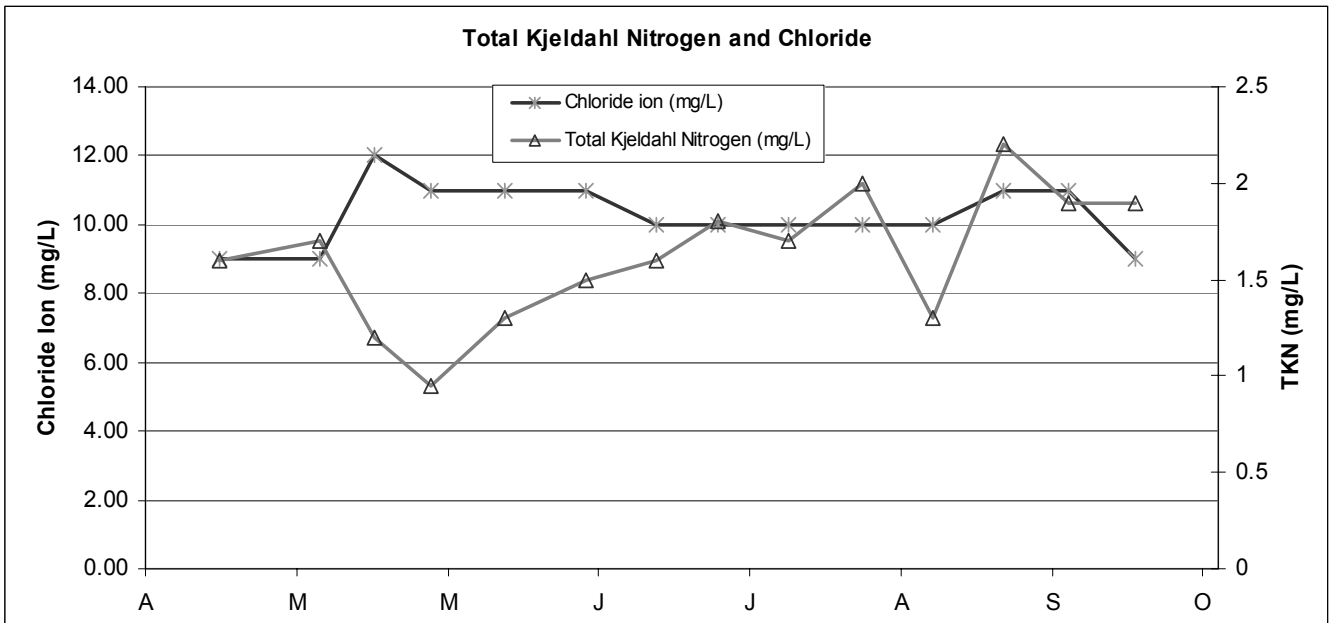
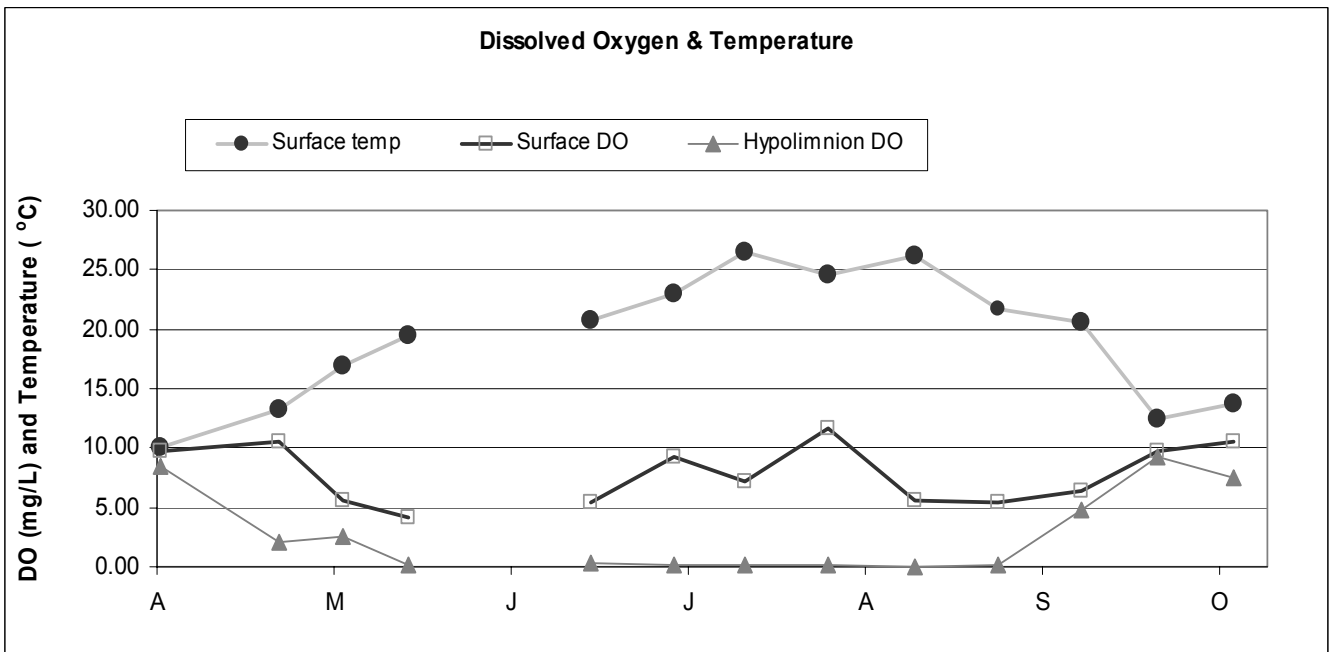


Figure 21. Total Kjeldahl Nitrogen and Chloride ion



Surface dissolved oxygen and surface temperature readings for 2003 are shown in Figure 22.

Figure 22. Surface Dissolved Oxygen and Surface Temperatures



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 15 to October 14, 2003, 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 15 gives the Forest Lake 2003 range, high, low, and average lake levels. Individual lake level readings are shown in Figure 23.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
3/18/03-12/1/03	20	901.02	902.08	1.06	901.69
		9/7/2003	6/29/2003		

Table 15. Forest Lake 2003 Lake Level

Figure 23. Forest Lake Elevations 2002-03

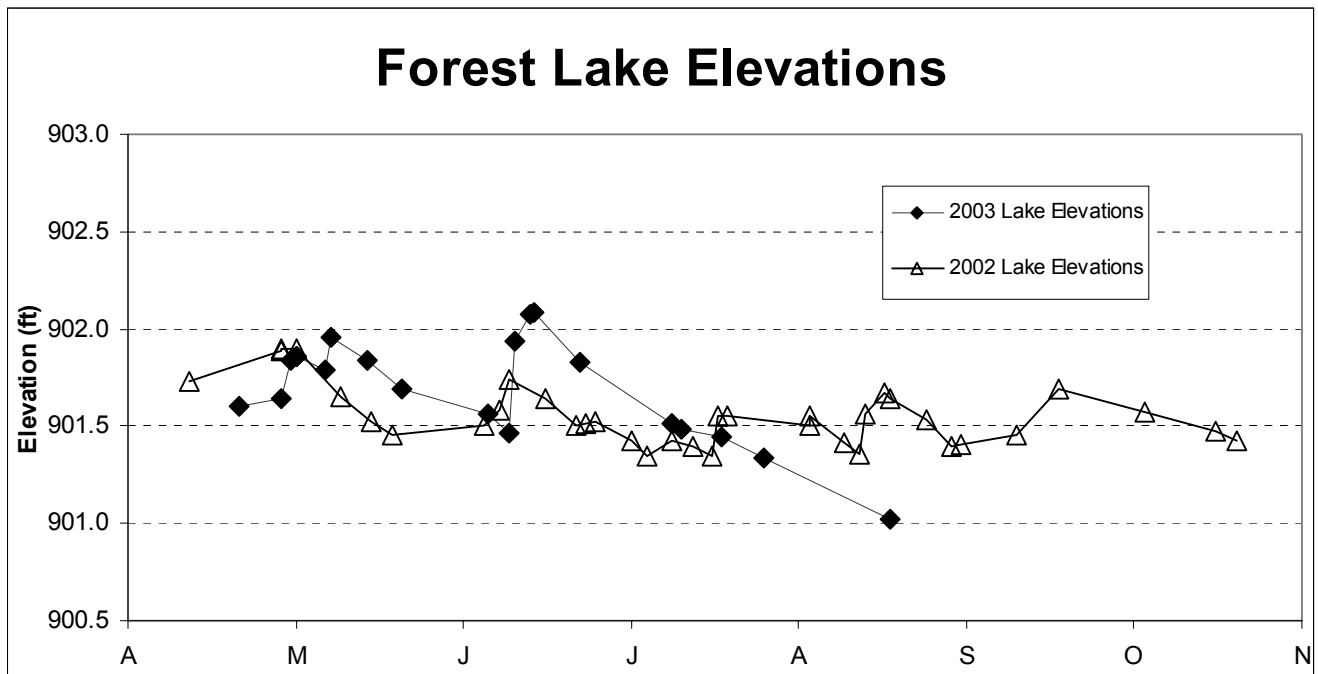


Table 16 gives the 2003 Forest Lake monitoring chemistry results for the 2003 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/15/03	0.022	0.66	2.1	9.38	10.0
5/6/03	0.022	0.72	5.2	7.30	13.0
5/16/03	0.033	0.84	5.4	5.85	15.9
5/29/03	0.023	0.73	4.7	4.77	20.2
6/11/03	0.020	0.64	7.2	NA	NA
6/27/03	0.028	0.85	12.0	7.87	21.2
7/11/03	0.031	0.92	8.9	7.16	22.0
7/23/03	0.043	0.84	18.0	4.44	24.4
8/6/03	0.035	0.90	20.0	9.33	24.1
8/21/03	0.024	1.20	19.0	5.70	25.9
9/4/03	0.052	0.92	25.0	7.73	22.5
9/18/03	0.058	1.30	23.0	7.42	20.0
10/2/03	0.025	0.87	19.0	10.18	10.7
10/14/03	0.028	0.76	8.1	8.82	13.4
2003 Averages	0.032	0.87	12.7	7.38	18.7

Table 16. Forest Lake 2003 Monitoring Results

Table 17 shows the Forest Lake Water Quality Summary. The lake received an average lake grade of a B- for 2003.

	Trophic Status (2003 Average)	Lake Grade (2003 Average)
Total Phosphorus (mg/L)	Eutrophic	B
Chlorophyll- <i>a</i> (ug/L)	Eutrophic	B
Secchi disk (ft)	Mesotrophic	C
Overall	Eutrophic	B-

Table 17. Lake Grade and Trophic Status.

Figure 24-26 compare the lake chemistry data and Secchi disk readings.

Figure 24. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

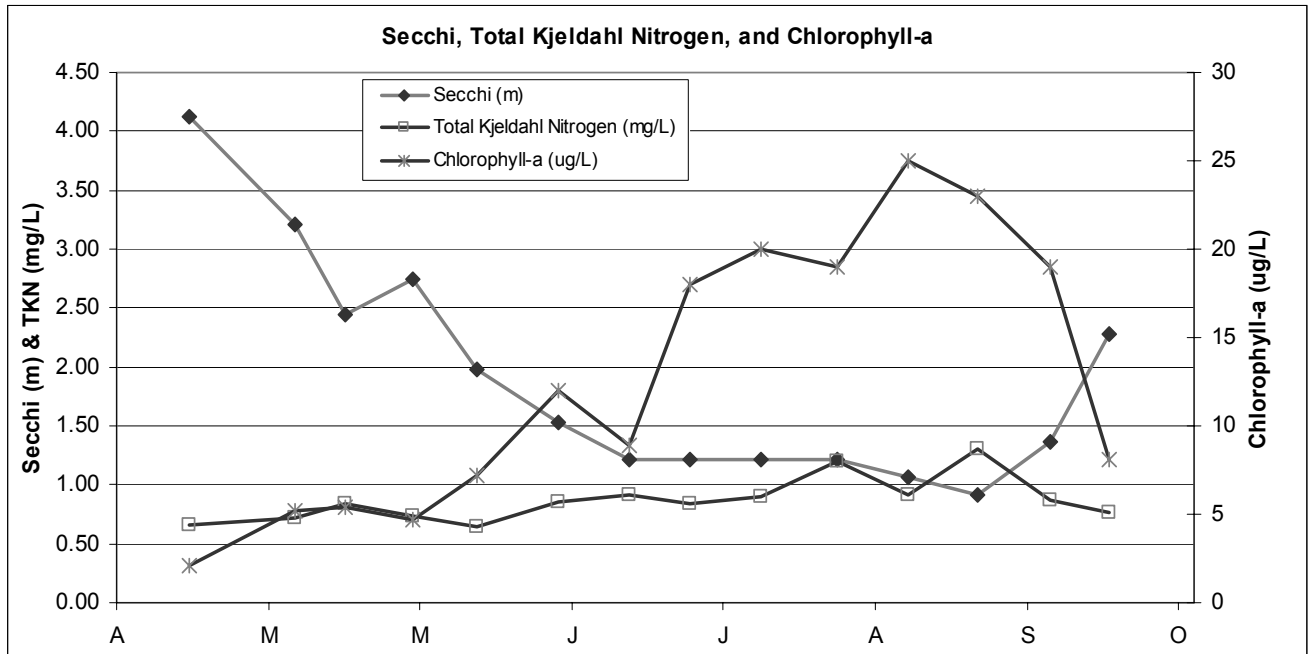


Figure 25. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

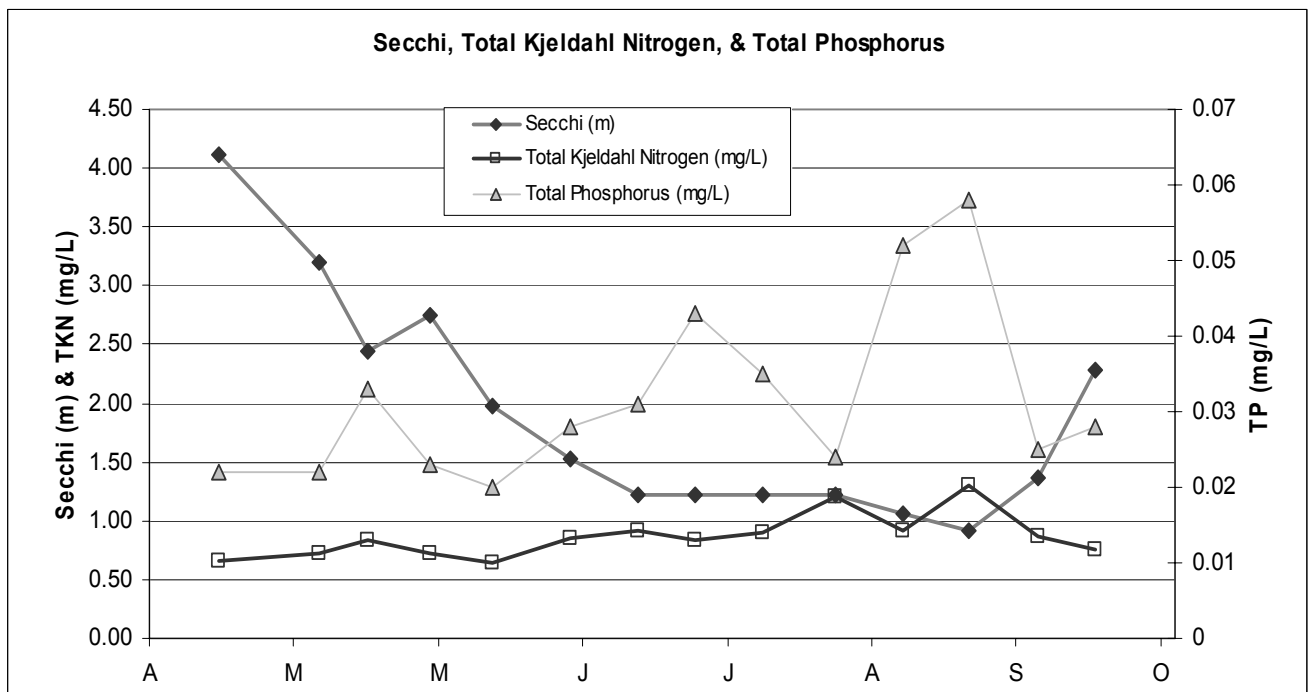
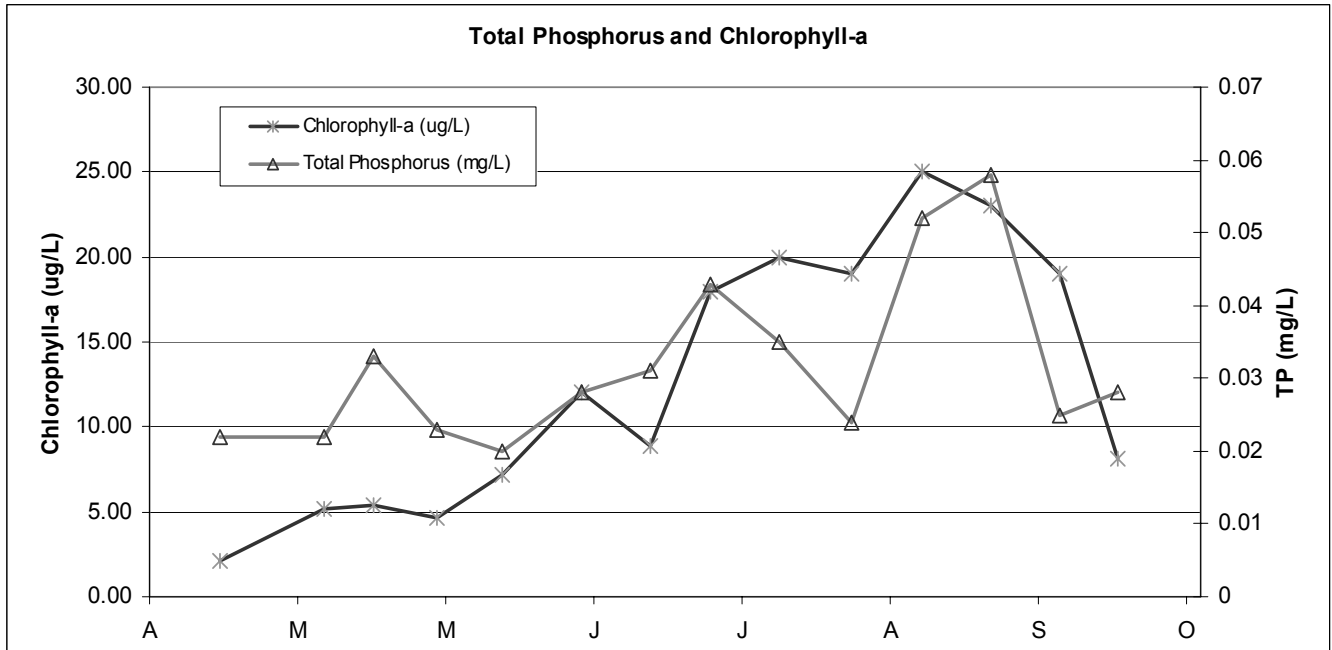
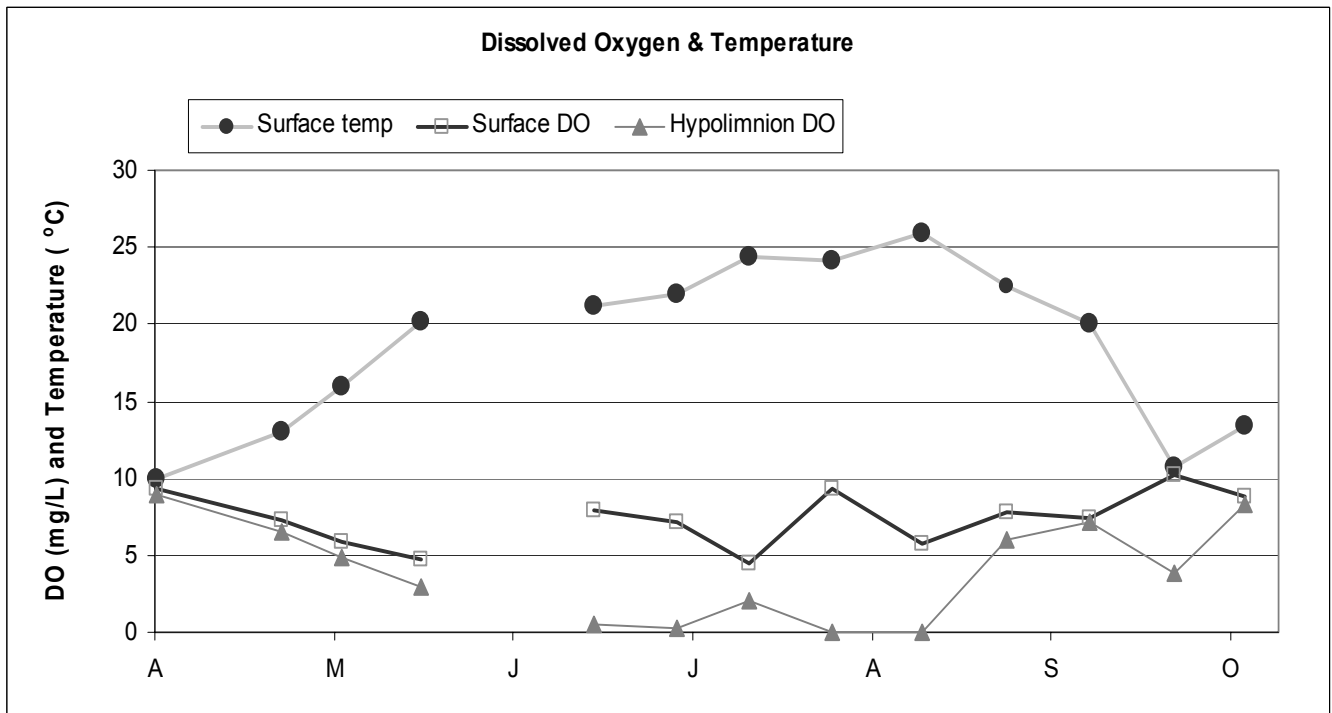


Figure 26. Total Phosphorous and Chlorophyll-a



Surface dissolved oxygen and surface temperature readings for 2003 are shown in Figure 27.

Figure 27. Surface Dissolved Oxygen and Surface Temperatures



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 15 to October 14, 2003, 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 18 gives the Halfbreed Lake 2003 high, low, and average lake levels. Individual lake level readings are shown in Figure 28.

Dates Monitored	# Readings	Lowest Reading (ft) Date	Highest Reading (ft) Date	Range (ft)	Average Elevation (ft)
3/18/03-12/1/03	26	936.92	938	1.08	937.47
		10/26/2003	7/3/2003		

Table 18. Halfbreed 2003 Lake Level

Figure 28. Halfbreed Lake Elevations 2002-03

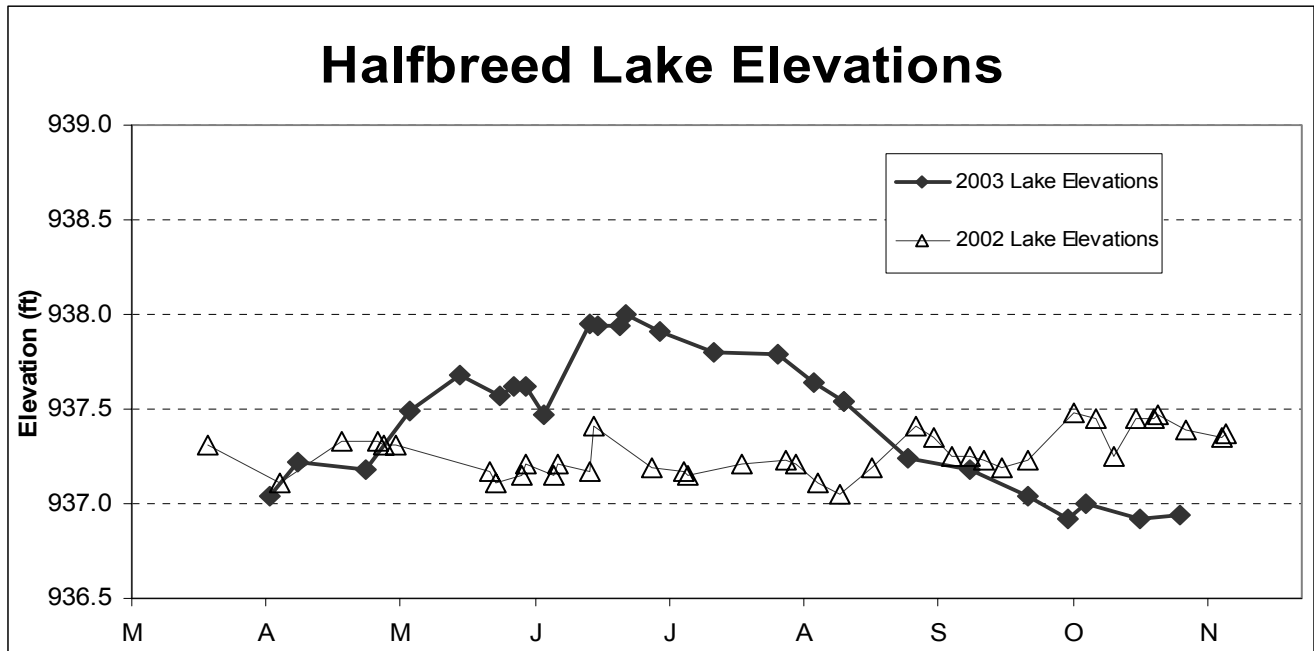


Table 19 gives the 2003 Halfbreed Lake monitoring chemistry results for the 2003 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/15/03	0.019	0.65	3.0	8.05	13.9
5/6/03	0.014	0.47	3.6	7.05	13.2
5/16/03	0.011	0.50	2.1	5.84	16.7
5/27/03	0.013	0.38	1.5	5.54	20.6
6/11/03	0.015	0.48	3.4	NA	NA
6/24/03	0.018	0.55	5.1	7.31	20.7
7/11/03	0.017	0.41	2.7	5.72	22.5
7/23/03	0.012	0.49	2.7	4.78	23.1
8/6/03	0.018	0.49	3.2	6.86	24.4
8/21/03	0.011	0.77	4.2	5.43	26.5
9/4/03	0.019	0.52	4.1	5.76	22.9
9/18/03	0.022	0.70	3.9	7.05	20.0
10/1/03	0.013	0.50	2.6	9.64	11.4
10/14/03	0.022	0.59	3.1	9.28	13.8
2003 Averages	0.016	0.54	3.2	6.79	19.2

Table 19. Halfbreed 2003 Monitoring Results

Table 20 shows the Halfbreed Lake Water Quality Summary. The lake received an average lake grade of an A for 2003.

	Trophic Status (2003 Average)	Lake Grade (2003 Average)
Total Phosphorus (mg/L)	Mesotrophic	A
Chlorophyll-a (ug/L)	Oligotrophic	A
Secchi disk (ft)	Mesotrophic	A
Overall	Mesotrophic	A

Table 20. Lake Grade and Trophic Status.

Figure 29-31 compare the lake chemistry data and Secchi disk readings.

Figure 29. Secchi, Total Kjeldahl Nitrogen and Chlorophyll-a

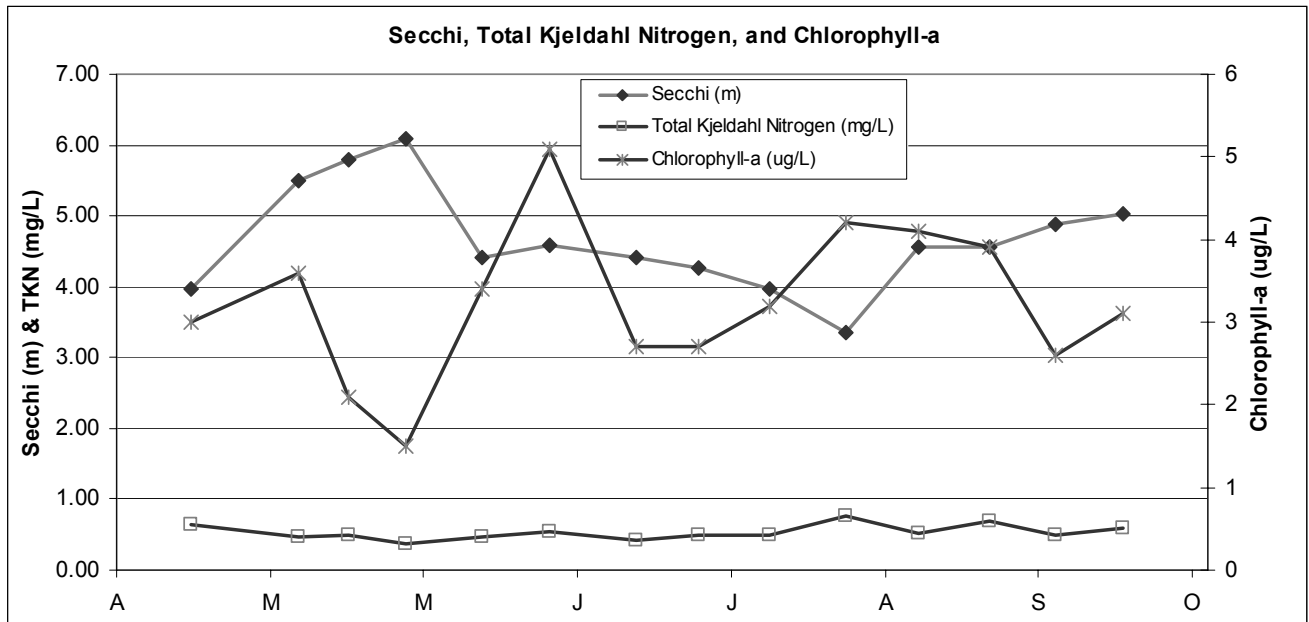


Figure 30. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

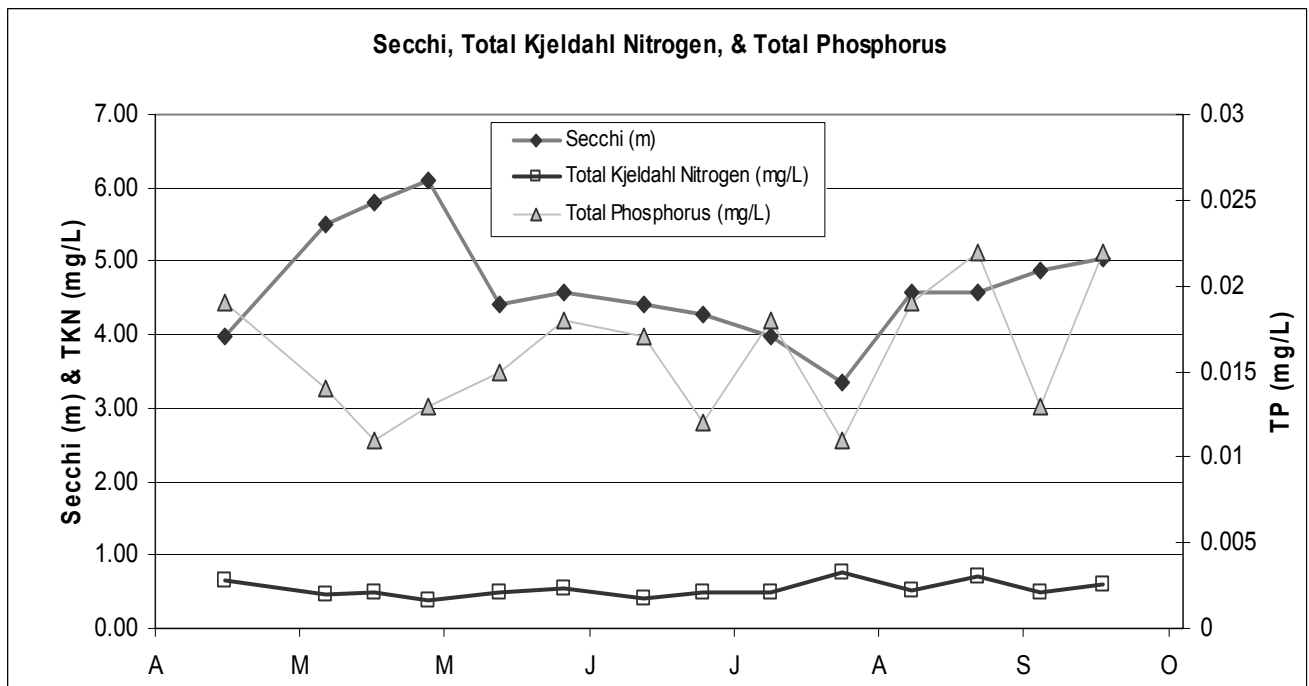
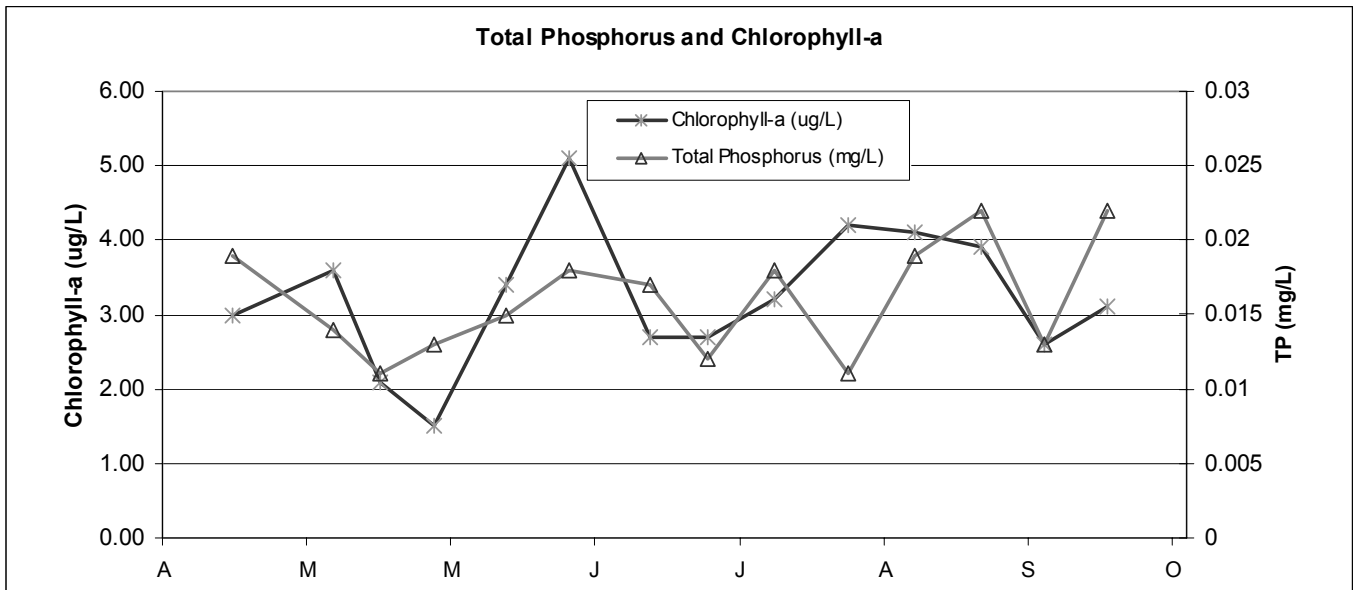
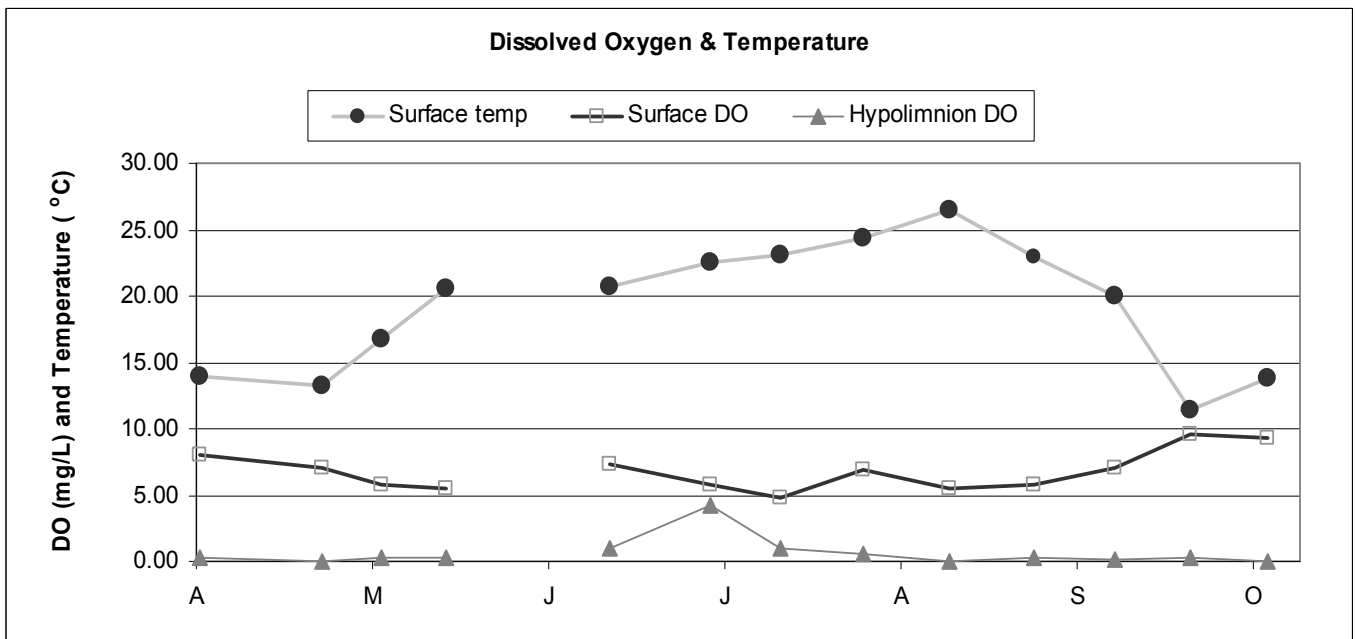


Figure 31. Total Phosphorous and Chlorophyll-a



Surface dissolved oxygen and surface temperature readings are shown in Figure 32.

Figure 32. 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 15 to October 14, 2003, 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 21 gives the Shields Lake 2003 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)
3/18/03-12/1/03	14	901.46	903.99	2.53	902.07
		9/4/2003	6/27/2003		

Table 21. Shields 2003 Lake Level

Figure 33. Shields Lake Elevations 2002-03

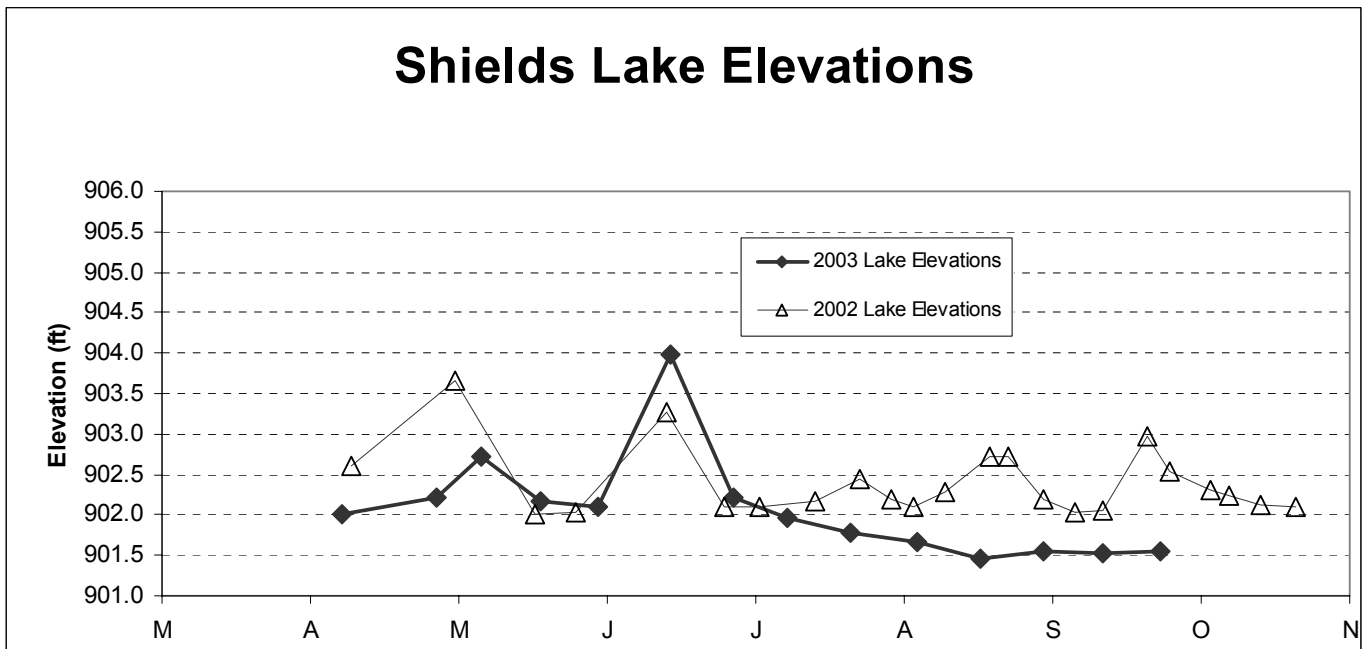


Table 22 gives the 2003 Shields Lake monitoring chemistry results for the 2003 monitoring season.

Date	Surface Total Phosphorus (mg/L)	Surface Total Kjeldahl Nitrogen (mg/L)	Chlorophyll <i>a</i> (ug/L)	Surface Dissolved Oxygen (mg/L)	Surface Temperature (C)
4/15/03	0.119	3.00	45.0	11.05	14.2
5/6/03	0.105	1.70	11.0	8.16	13.1
5/16/03	0.116	1.70	4.4	5.89	17.5
5/29/03	0.209	1.30	7.2	4.80	20.0
6/11/03	0.478	1.60	6.1	NA	NA
6/27/03	0.624	1.60	12.0	4.64	21.7
7/11/03	0.513	2.10	23.0	4.05	21.9
7/23/03	0.279	1.60	73.0	7.15	27.4
8/6/03	0.267	2.00	52.0	11.55	24.3
8/21/03	0.377	3.00	110.0	5.01	26.5
9/4/03	0.252	2.30	55.0	8.91	22.7
9/18/03	0.260	2.40	39.0	5.35	20.3
10/1/03	0.261	2.70	29.0	5.68	10.6
10/14/03	0.332	2.10	54.0	12.23	13.8
2003 Averages	0.299	2.08	37.2	7.27	19.2

Table 22. Shields 2003 Monitoring Results

Table 23 shows the Shields Lake Water Quality Summary. The lake received an average lake grade of a D+ for 2003.

	Trophic Status (2003 Average)	Lake Grade (2003 Average)
Total Phosphorus (mg/L)	Hypereutrophic	C
Chlorophyll-a (ug/L)	Hypereutrophic	C
Secchi disk (ft)	Eutrophic	F
Overall	Hypereutrophic	D+

Table 23. 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

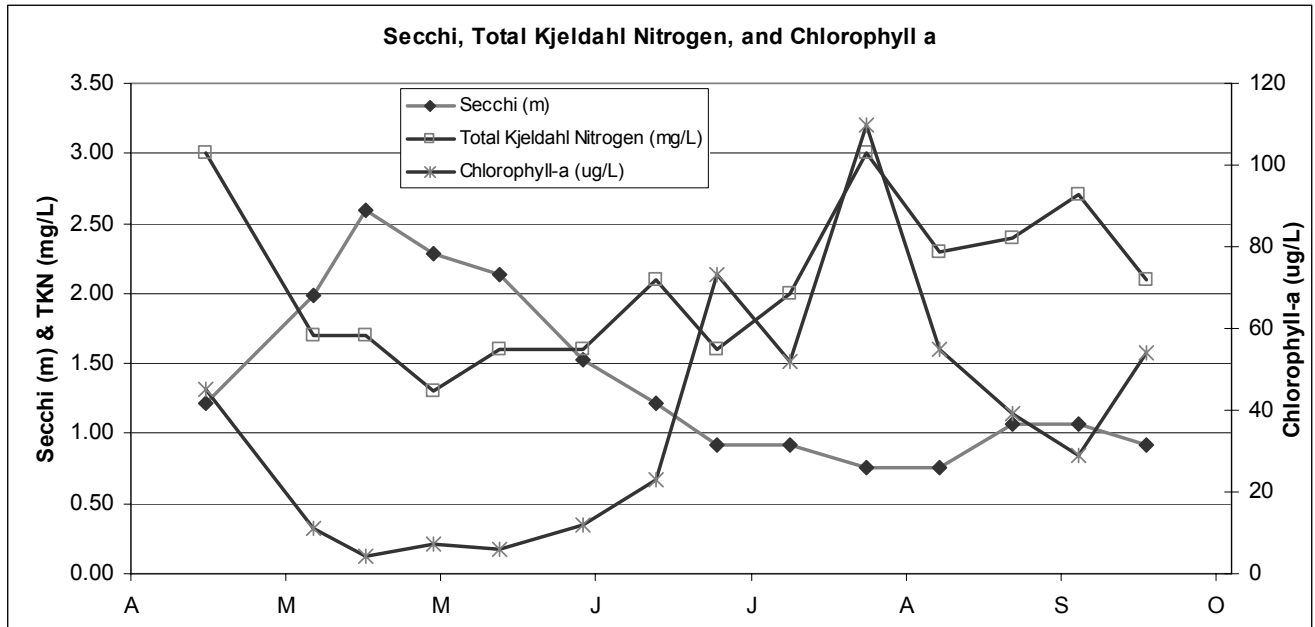


Figure 35. Secchi, Total Kjeldahl Nitrogen, and Total Phosphorus

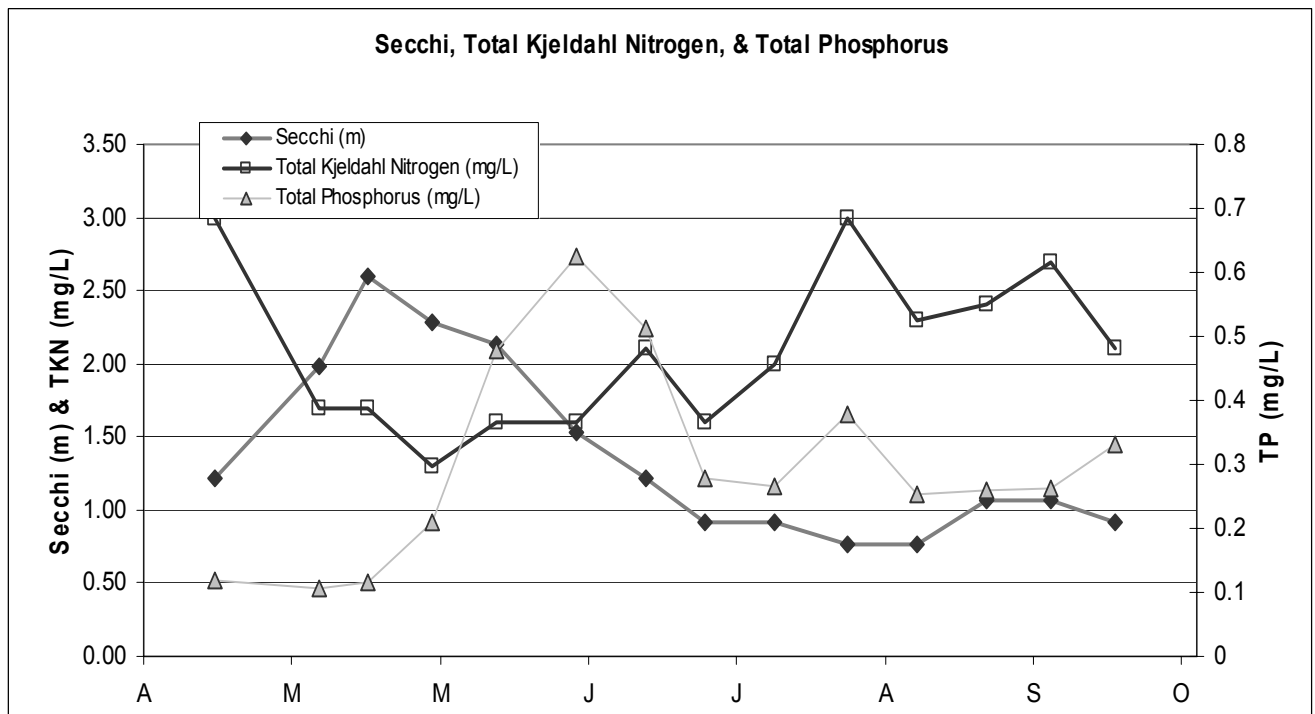
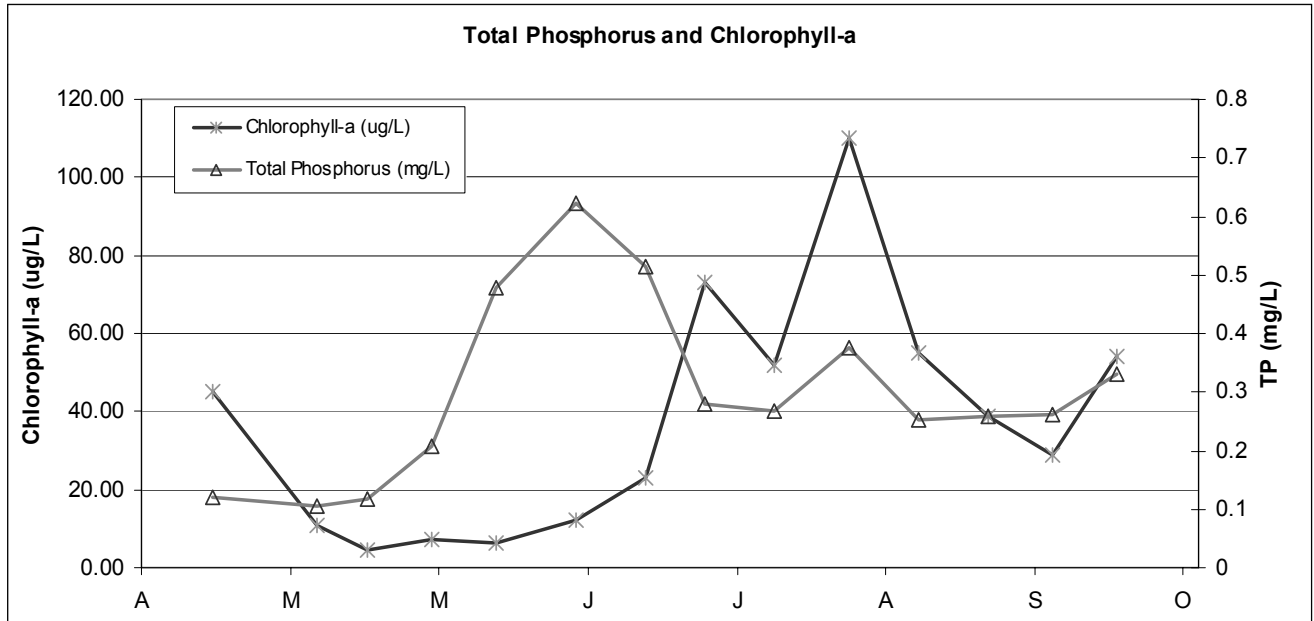
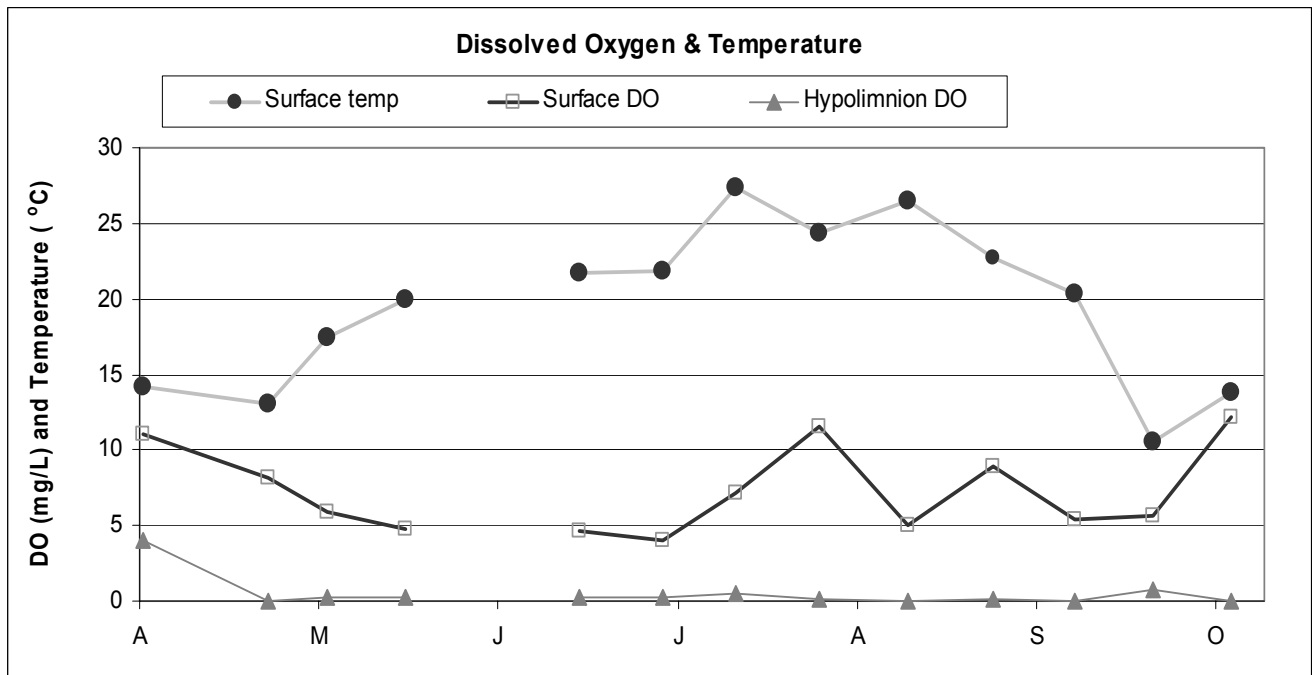


Figure 36. Total Phosphorous and Chlorophyll *a*



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

Figure 37. Surface Dissolved Oxygen and Surface Temperatures



2.2 Historical Lake Water Quality Trends

1993-2003 Summer Averages

Figure 38. Historical Average Summer TP

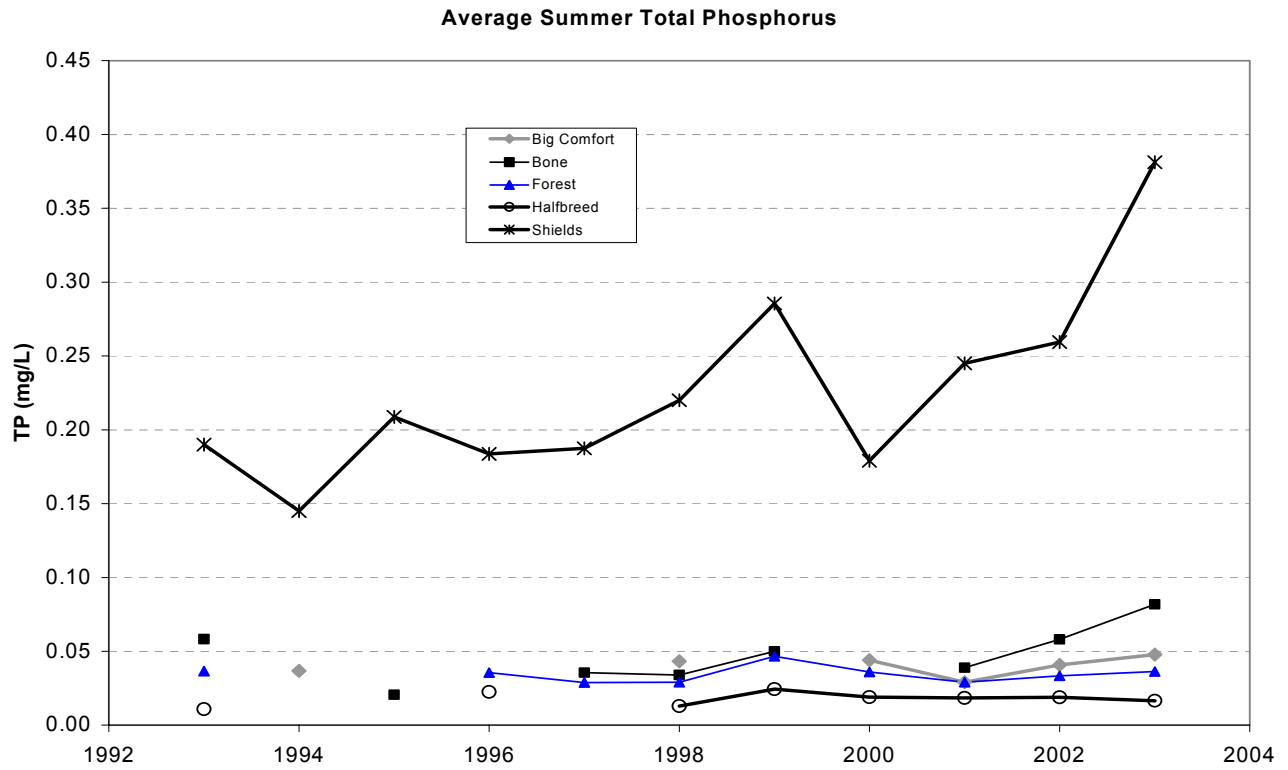


Figure 39. Historical Average Summer TKN

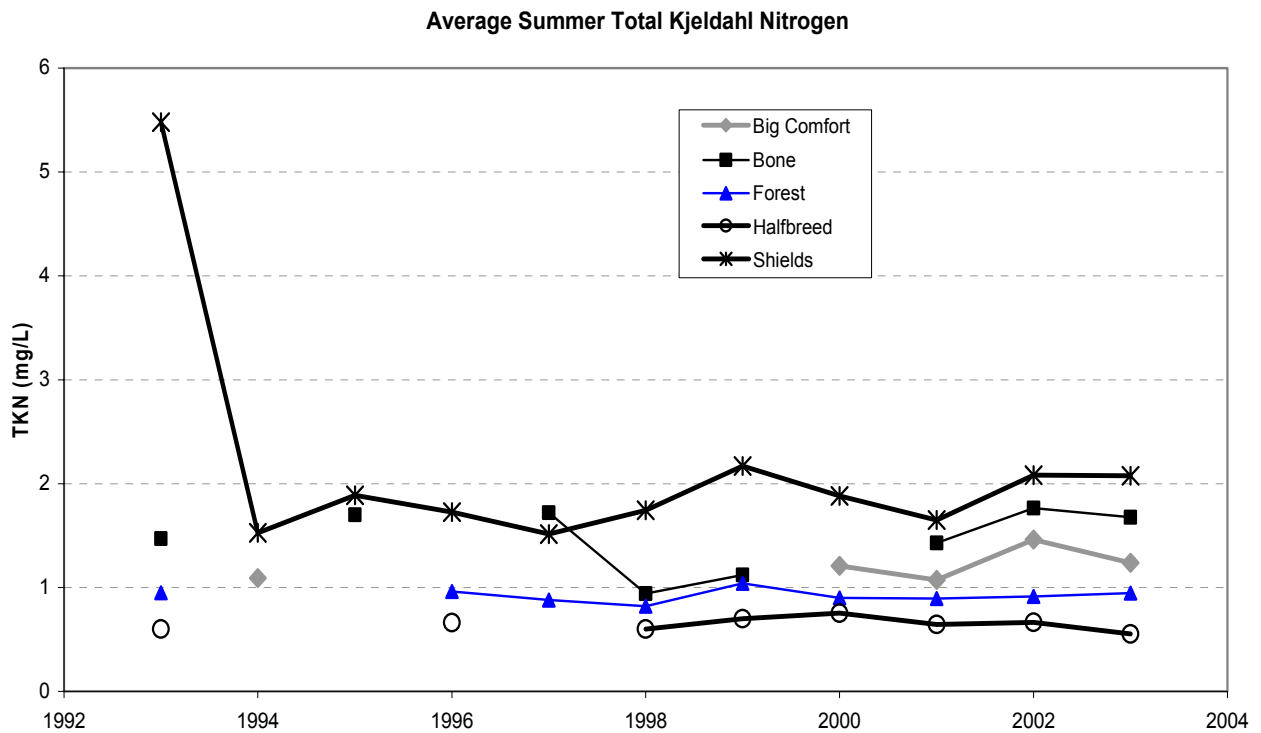


Figure 40. Historical Average Summer CLA

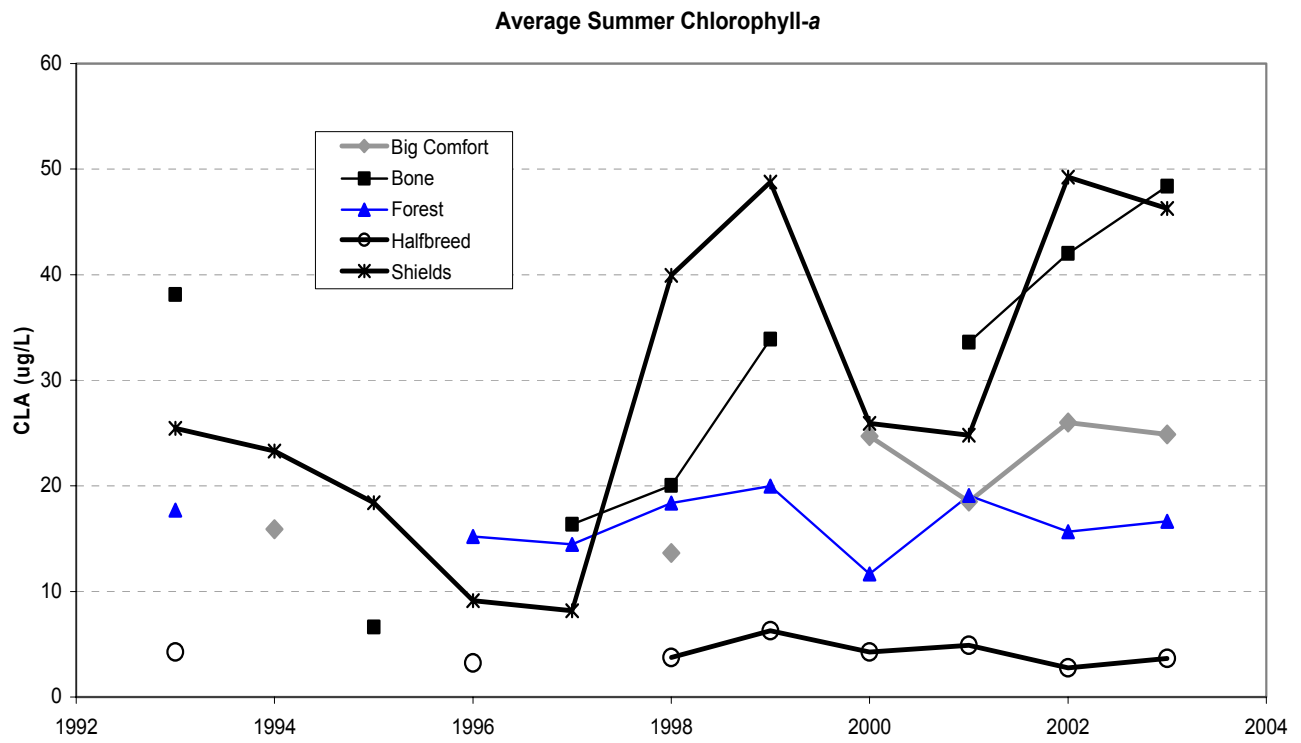
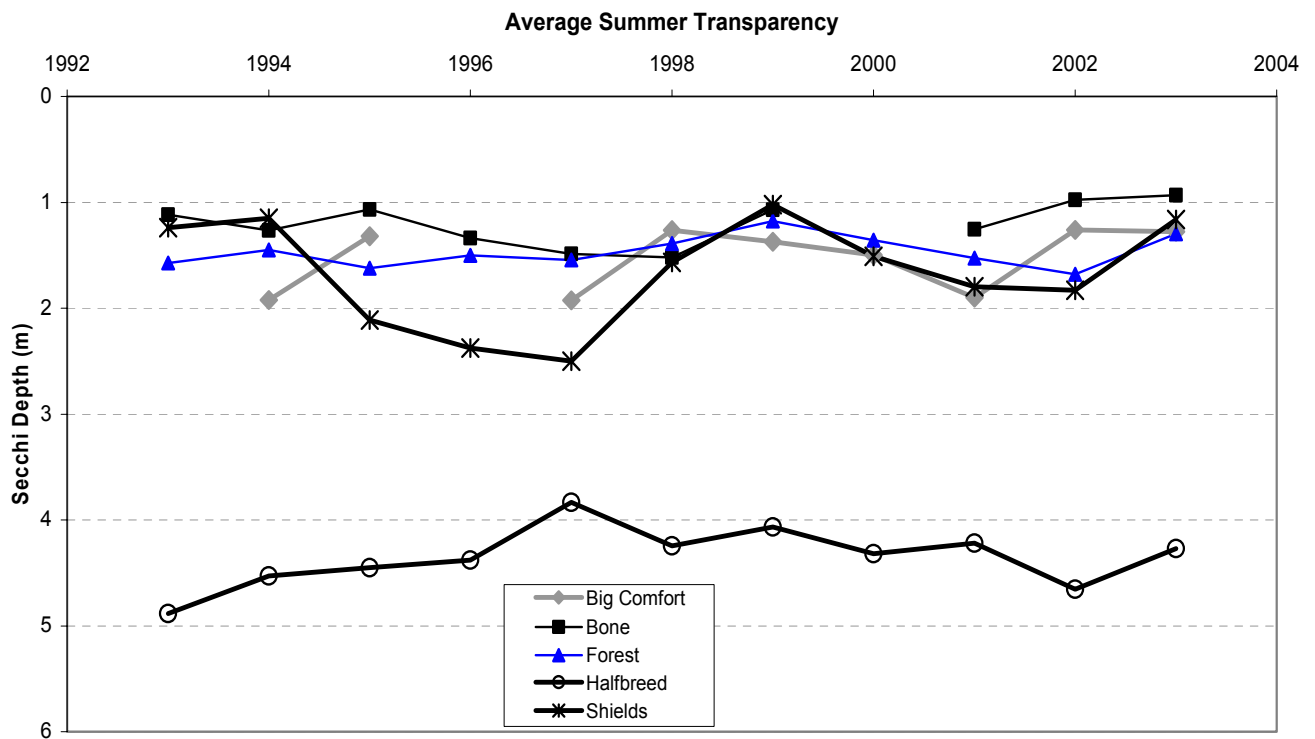


Figure 41. Historical Average Summer Transparencies



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
Summer Mean														
1986 Ave														
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

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)
2002 Ave			41	1463	26		1	3	3	88%		58	63	57
2003 Ave			48	1238	25		1	3	3	75%		60	62	56
Total Ave			40	1215	20.6		1.8	2.3	2.5	54%		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		
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
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
Grades														
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

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)
07/25/87							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
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

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)
09/01/89							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
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

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)
06/06/95							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
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

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)
09/10/96							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
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

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)
08/24/98							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
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

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)
08/24/99	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
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

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)
04/15/03	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

Summer Mean															
1986 Ave							1.0								60
1987 Ave							1.6	2.1	2.1	6%					53
1988 Ave							1.1	2.1	2.9	80%					59
1989 Ave			46	1291	28		1.3	2.1	2.0	0%		59	63		56
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
Total Ave			47	1457	29.7	10.0	1.2	3.0	3.0	61%		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												

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)
2001 Grade			C		C		B						C+	
2002 Grade			C		C		C						C	
2003 Grade			D		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
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

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)
05/13/89							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
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	60
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			57
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			55
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

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	7:55	19.0	50		31.0		0.9	3	4	78%	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		CAMP	61	60	55
04/23/97	12:45	10.0	20		7.9		2.0	3	2	33%	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
10/15/97	12:20	13.0	40		11.0		1.5	2	2		CAMP	57	54	54
04/17/98	9:00	9.5	50		5.6		2.6	2	2	30%	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	CAMP	53	46	57	
04/20/99	9:40	9.5	30		3.8		3.2	1	1	56%	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		CAMP	76	58	54
04/12/00	10:30	7.4	20	930	3.4		3.2	2	2		CAMP	47	43	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)
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
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

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)
08/06/03	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	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
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
Total Ave			35	923	17		1.6	2.4	2.2	35%		55	58	54
Grade														
1986 Grade							C					Average Annual Grade		
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-		
Letter Grade			C+		B		C					C+		

Halfbreed (Sylvan) Lake

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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DNR ID #82-80

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

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)
07/06/80							2.4				MPCA			47
07/13/80							2.4				MPCA			47
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

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)
08/05/84							3.8				MPCA			41
08/08/84							3.2				MPCA			43
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

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)
07/23/88							4.6	2	1		MPCA			38
07/29/88							4.7	1	1		MPCA			38
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

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)
08/10/93							6.1	1	1		MPCA			34
09/09/93							5.0	1	1		MPCA			37
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

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)
08/08/96	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
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

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)
08/19/98	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
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

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)
09/24/00							6.3	1	1		MPCA			34
10/11/00							4.1	2	2		MPCA			40
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

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)
06/17/02							4.0				MPCA			40
06/25/02							4.6				MPCA			38
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
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

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)
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
Total Ave			18	647	4.1		4.1	1.2	1.2	4%		46	45	40

Grade	Average Annual Grade														
1974 Grade															A
1975 Grade															
1976 Grade															
1977 Grade															
1978 Grade															B
1979 Grade															B
1980 Grade															A
1981 Grade															A
1982 Grade															A
1983 Grade															A
1984 Grade															A
1985 Grade															A
1986 Grade															A
1987 Grade															A
1988 Grade															A
1989 Grade															A
1990 Grade															A
1991 Grade															A
1992 Grade															A
1993 Grade				A		A									A
1994 Grade															A
1995 Grade															A
1996 Grade				B		A									A
1997 Grade															A
1998 Grade				A		A									A
1999 Grade				B		A									
2000 Grade				A		A									A
2001 Grade				A		A									A
2002 Grade				A		A									A
2003 Grade				A		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)
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
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		

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)
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
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

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)
06/08/95	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
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

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)
10/15/98	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
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

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)
07/09/02		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
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
Total Ave			206	2117	29.0		1.6	3.2	3.3	78%		81	64	53
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+		

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)
2001 Grade			F		C		C								D+
2002 Grade			F		D		C								D
2003 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 12/1/2003

of readings: 568

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

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

Recorded range: 3.52 ft

Average water level: 886.26 ft

Last reading: 885.61 ft (12/1/2003)

[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	885.62
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	886.64
1995	886.81
1996	886.43
1997	886.23
1998	
1999	886.62
2000	885.92
2001	885.92
2002	885.98

	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
2003	26.53

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
9/12/1974	885.54
9/27/1974	885.40

2003	886.19
Total Average	886.20
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

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

10/17/1974	885.40
11/25/1974	885.42
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

1/15/1981	885.54
2/17/1981	885.58
3/24/1981	885.74
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

9/24/1987	885.98
4/14/1988	886.24
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

7/16/1994	886.17
7/20/1994	886.67
7/22/1994	886.80
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

9/11/1995	886.44
9/13/1995	886.39
9/28/1995	886.25
10/4/1995	886.51
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

5/8/1997	886.44
5/9/1997	886.41
5/12/1997	886.37
5/13/1997	886.31
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

5/20/2000	885.77
5/24/2000	885.70
6/6/2000	885.97
6/6/2000	885.67
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

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

Period of record: 06/01/1965 to 04/15/2003
of readings: 303
Highest recorded: 910.97 ft (07/07/1975)
Lowest recorded: 906.7 ft(11/07/1966)
Recorded range: 4.27 ft
Average water level: 908.47
Last reading: 908.65 ft (04/15/2003)
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	909.37
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
Total Average	907.99

2003	26.53
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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
11/24/1976	907.58

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

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
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
7/2/1996	908.20

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

7/9/1996	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

4/13/1999	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

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

Period of record: 04/30/1965 to 9/7/2003
of readings: 546
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: 901.2 ft (9/7/2003)
[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
1996	901.36
1997	901.37

	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

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
10/4/1966	900.68
10/17/1966	900.80

1998	901.44
1999	901.49
2000	901.68
2001	901.64
2002	901.55
2003	901.69
Total Average	901.39

1998	30.56
1999	31.96
2000	26.70
2001	33.00
2002	41.50
2003	26.53

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
10/26/1978	901.33

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
4/29/1972	901.36

8/28/1972	901.15
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
7/22/1977	900.98

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
8/19/1990	901.49

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
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
5/13/1993	901.49
5/17/1993	901.38
5/25/1993	901.43
6/1/1993	901.48

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
7/19/1993	901.77
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
7/20/1994	901.34
7/29/1994	901.21
8/1/1994	901.16

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
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
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

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
7/15/1993	901.89
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
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

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
6/13/1995	901.62
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
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

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
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
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

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
7/13/1998	901.50
7/20/1998	901.44
7/29/1998	901.26

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
6/22/2001	901.75
6/25/2001	901.69
6/26/2001	901.67
6/28/2001	901.65

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

Halfbreed (Sylvan) Lake

DNR ID #82-80

Forest Lake Township/New Scandia Township, Washington County

Period of record: 09/17/1981 to 11/4/2003

of readings: 303

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: 936.82 ft

Last reading: 937.94 ft (11/4/2003)

[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	936.12
1993	937.08
1994	936.88
1995	937.08
1996	937.28
1997	936.82
1998	936.81
1999	936.97
2000	936.28
2001	937.00
2002	937.22
2003	937.47

	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

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
7/20/1991	936.52
8/10/1991	936.52
8/18/1991	936.52

Total Average	936.67
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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

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
8/31/1998	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
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

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
6/3/1995	937.07
6/17/1995	937.03
6/23/1995	936.89
7/7/1995	937.11

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
4/7/1998	937.44
4/28/1998	937.06
5/11/1998	937.04
5/26/1998	936.94

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
7/12/1996	937.04
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
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

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
8/19/1998	936.70
8/31/1998	936.72
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
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

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
7/9/2000	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

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
6/17/2002	937.15
6/18/2002	937.21
6/25/2002	937.17

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
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

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
1982	31.24
1983	30.29
1984	36.74
1985	32.11

Annual Averages	Elevation (ft)
1982	
1983	
1984	
1985	
1986	
1987	
1988	
1989	
1990	
1991	
1992	
1993	
1994	
1995	
1996	
1997	
1998	
1999	
2000	

Date	Elevation (ft)
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
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

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

2001	885.86
2002	886.18

6/29/2002	886.71
7/10/2002	886.37
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

Date	Elevation (ft)
1/9/1985	885.75
5/8/2001	887.81

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

Period of record: 06/04/1991 to 10/14/2003
of readings: 132
Highest recorded: 903.99 ft (6/27/2002)
Lowest recorded: 901.28 ft (10/07/1996)
Recorded range: 2.71 ft
Average water level: 902.01 ft
Last reading: 901.54 (10/14/2003)
OHW elevation: 902.5 ft
Datum: 1929 (ft)

Annual Averages	Elevation (ft)
1991	
1992	
1993	
1994	
1995	
1996	901.70
1997	901.90
1998	901.85
1999	902.13
2000	901.79
2001	902.18
2002	902.39
2003	902.07
Total Average	901.99

	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

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
9/25/1996	901.28
10/7/1996	901.28
10/21/1996	901.40
4/7/1997	902.29

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

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
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

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
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

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
7/25/2001	901.74
8/7/2001	901.67

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

Appendix C: Lake Temperature and Dissolved Oxygen Profiles

Big Comfort Lake

DNR ID #13-53

Wyoming Township, Chisago County

Dissolved Oxygen & Temperature Profiles

Date	8/27/1997 11:15		10/2/1997 12:45		10/15/1997 10:43	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	24.5	9.80	17.0	6.30	14.0	7.00
1	23.0	10.00	16.0	6.30	14.5	7.00
2	21.5	8.60	16.0	5.80	14.5	6.70
3	21.0	7.00	16.0	5.40	14.0	6.70
4	20.0	3.80	16.0	5.40	14.0	6.60
5	19.0	0.05	16.0	5.40	14.0	6.60
6	18.0	0.03	16.0	5.40	14.0	6.50
7	14.5	0.02	16.0	4.30	14.0	6.50
8	12.5	0.15	16.0	1.75	14.0	6.50
9	12.0	0.10	15.0	0.25	14.0	6.50
10	11.5	0.05	12.5	0.25	14.0	6.50
11	11.0	0.05	12.0	0.10	14.0	6.50
12	11.0	0.05	12.0	0.10	14.0	6.20
13	11.0	0.05	11.5	0.10	14.0	6.20
14	11.0	0.05	11.5	0.10	14.0	6.00
15						
16						
17						
18						
Top of Thermocline (m)	4		8			

4/30/1998 12:00		5/15/1998 12:00		5/31/1998 12:00		6/18/1998 12:00		6/29/1998 12:00		7/13/1998 12:00		7/30/1998 12:00		
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)	Temp (C)	D.O. (mg/L)	
19.0	10	21	8.6	22.0	9.30	23.2	10	25.5	8.40	30.0	11.00	25.0	7.00	
17.0	9	21	8.6	22.0	9.00	24	10.5	25.5	7.80	30.0	10.30	25.0	7.00	
16.5	8.6	20.5	8.6	22.0	8.60	24	11.20	25.0	7.80	27.5	9.00	24.8	6.50	
15.0	8.6	20	8.4	22.0	8.40	22	10.5	25.0	7.80	26.0	5.20	24.0	5.50	
14.0	8.2	20	8.3	20.5	7.00	19	9	23.0	4.80	24.0	1.20	24.0	4.40	
		17	6.8	18.0	5.00	18	6	20.0	0.30	21.0	0.20	25.0	0.20	
		11.0	6	13	4.6	16.0	2.40	16.5	2.2	6.0	0.20	18.0	0.20	
			11	3	14.0	0.60	15.5	0.2	16.5	0.20	15.0	0.20	15.5	0.00
Top of Thermocline (m)	6		6		7		8		7		5		6	

Date	7/30/1998 12:00		8/20/1998 12:00		8/31/1998 12:00		9/21/1998 12:00		9/30/1998 12:00		10/9/1998 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)
0	25.0	7.00	25.0	9.00	25.0	8.60	21.5	7.00	18.2	7.40	11.0	7.00
1	25.0	7.00	24.8	8.80	25.0	8.50	21.5	6.50	18.0	7.30		
2	24.8	6.50	24.0	8.00	25.0	8.20	21.5	6.30	18.0	7.20		
3	24.0	5.50	24.0	6.80	24.8	7.50	21.5	6.00	17.8	7.10	12.0	6.80
4	24.0	4.40	23.0	5.60	24.1	5.40	21.5	5.80	17.8	6.90	11.0	6.80
5	25.0	0.20	23.0	3.80	24.0	0.50	21.5	5.70	17.5	6.90	11.0	6.80
6	19.0	0.20	20.5	0.20	21.0	0.00	20.5	1.80	17.0	3.40	11.0	6.60
7	15.5	0.00	16.5	0.20	16.1	0.00	18.0	1.20	16.0	2.00	11.0	6.60
8	14.0	0.00	14.0	0.20	15.0	0.00	16.0	0.80	15.0	1.50	11.0	6.60
9	13.0	0.00	13.0	0.20	13.6	0.00	14.5	0.80	13.0	1.40	11.0	6.60
10	13.0	0.00	13.0	0.20	13.0	0.00	13.8	0.00	12.0	1.20	11.0	6.80
11			12.0	0.20	12.8	0.00	13.0	0.00			11.0	5.40
12					12.1	0.00	13.0	0.00				
13					12.0	0.00	13.0	0.00				
14												
15												
16												
17												
18												
Top of Thermocline (m)	6		6		7		7		6			

4/12/2000 11:30		5/24/2000 11:00		6/8/2000 9:50		6/22/2000 9:45		
Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	
7.7	12.64	18.3		20.9	9.64	20.3	8.04	
7.5	12.63	18.3		20.0	9.61	20.3	8.01	
7.4	12.55	18.3		19.1	9.82	20.3	8.00	
7.3	12.38	18.2		18.5	9.53	20.2	7.95	
7.3	12.31	16.8		17.3	8.85	19.6	7.03	
7.3	12.29	14.5		16.1	6.65	19.2	6.23	
7.3	12.26	13.3		13.7	3.35	15.3	0.89	
7.3	12.24	11.9		12.3	1.15	12.7	0.56	
7.2	12.21	9.1		10.9	0.55	11.7	0.48	
7.2	12.15	8.5		9.9	0.44	10.7	0.42	
7.1	12.08	8.5		9.6	0.38	10.3	0.36	
7.1	12.04	8.0		9.5	0.33	10.2	0.34	
7.1	12.03			9.1	0.30	10.1	0.32	
7.0	11.98			8.9	0.29	10.0	0.30	
7.0	2.34			8.8	0.25			
				8.8	0.23			
Top of Thermocline (m)	14		8		7		5	

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									
Top of Thermocline (m)	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			11.2	0.36			11.7	0.43			7.0	1.27
15							11.3	0.39			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	
Top of Thermocline (m)			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)				

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)		

Date	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			
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	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)			5		4					

Date	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	
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	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																					
10																					
Top of Thermocline (m)			6		5		5		4		4		6								

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	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	16.5	8.60	13.0	8.70
1	16.0	8.60	13.0	8.70
2	16.0	8.40	13.0	8.70
3	16.0	8.20	13.0	8.70
4	15.5	8.40	12.5	8.70
5	15.5	8.40	12.0	8.50
6			12.5	1.00
Top of Thermocline (m)				

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	
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)
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
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
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
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
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
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
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	
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	22.5	6.50	23.0	6.50	24.2	9.70	23.0	10.00	18.5	9.60
1	22.5	6.50	23.0	6.50	24.2	9.20	23.0	9.70	18.5	9.60
2	22.5	6.50	23.0	6.50	24.0	8.90	23.0	9.70	18.5	9.60
3	22.5	6.50	23.0	6.50	24.0	9.50	23.0	9.40	18.5	9.60
4	22.5	6.60	23.0	6.50	23.5	8.20	21.5	7.70	18.5	9.60
5	22.5	0.65	23.0	6.40	23.5	0.75	21.0	0.75	18.5	9.60
6			23.0	0.50					18.5	0.30
7										
Top of Thermocline (m)					4		4			

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	
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)
9.5	9.70	15.9	9.63	17.5	9.92	23.0	8.54	21.9	9.09
9.5	9.63	15.9	9.53	16.6	9.82	22.9	8.42	21.8	8.98
9.5	9.53	15.9	9.39	16.5	9.61	22.7	8.22	21.7	8.84
9.5	9.44	15.9	9.23	16.3	9.47	22.5	8.02	21.5	8.68
9.5	9.35	15.9	9.10	15.9	9.16	21.9	6.76	21.5	8.68
9.5	9.20	15.9	8.79	15.9	0.66	20.8	0.49	21.5	8.52
9.0	0.17	15.3	0.51			20.5	0.39	21.2	3.56
		15.2	0.41					20.9	0.64
Top of Thermocline (m)						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	
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	25.0	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
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
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
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
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
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
6	24.5	0.25	23.6	0.46			22.0	0.60								
7																

4/12/2000 10:30		5/25/2000 7:45	
Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
7.4	11.30	17.8	9.19
7.3	11.36	17.8	9.18
7.1	11.34	17.8	9.15
7.1	11.30	17.8	9.13
7.0	11.31	17.8	9.12
7.2	1.50	17.7	8.97
		17.6	8.40
		17.3	0.50

Top of Thermocline (m)				4				4		4									
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Date	6/8/2000 9:00		6/22/2000 8:34		7/6/2000 8:30		7/19/2000 8:12		7/31/2000 9:35		8/10/2000 9:00		8/23/2000 8:36		8/29/2000 11:04		9/13/2000 14:26		9/25/2000 14:05	
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)	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	20.4	9.57	20.1	8.15	24.9	8.09	23.7	7.25	26.4	8.89	25.6	8.12	23.1	9.86	23.9	7.91	21.6	8.49	14.6	8.92
1	19.6	9.64	20.1	8.11	24.7	8.06	23.7	7.22	25.9	8.90	25.6	8.12	23.1	9.85	23.1	7.24	21.0	8.58	14.5	8.83
2	19.3	9.66	20.1	8.11	24.9	8.00	23.7	7.18	25.8	8.81	25.5	7.99	23.0	9.12	23.0	7.23	20.2	8.65	14.5	8.79
3	18.9	9.42	20.1	8.08	24.9	7.95	23.7	7.22	24.5	7.82	25.5	8.00	22.8	7.95	22.8	6.75	20.0	8.30	14.4	8.81
4	18.2	8.76	20.1	8.10	24.4	6.35	23.6	7.61	23.9	5.11	24.5	3.98	22.7	7.61	22.7	6.61	19.8	8.34	14.2	8.82
5	17.3	1.94			23.2	0.44	23.4	0.45	23.5	1.35	24.3	2.75	22.6	0.55	22.7	6.57	19.4	5.74		
6													22.5	0.48			19.7	0.30		
Top of Thermocline (m)					4				4		4		3							

Date	10/3/2000 10:24		10/18/2000 10:18	
Depth	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)
0	16.4	8.45	12.7	9.66
1	16.3	8.43	12.6	9.66
2	16.3	8.44	12.5	9.63
3	16.2	8.44	12.5	9.59
4	16.2	8.42	12.4	9.45
5	16.2	0.85	12.6	1.78
6			12.6	1.20
7				
Top of Thermocline (m)				

Date	4/27/2001 11:15		5/15/2001 9:00		5/30/2001 10:30		6/7/2001 8:45		6/20/2001 8:45		6/28/2001 8:20		7/10/2001 9:45		7/25/2001 8:15	
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			18.0	10.96	17.2	10.44	16.7	9.08	21.6	6.09	26.2	8.79	25.8	9.87	25.9	8.80
1			17.9	10.94	17.1	10.42	16.5	8.98	21.5	6.09	26.2	8.82	25.9	9.89	25.9	8.72
2			17.7	11.05	16.8	10.46	16.5	8.90	21.5	6.10	25.4	8.95	25.8	9.90	25.9	8.70
3			17.7	11.01	16.6	10.21	16.5	8.75	21.5	6.08	23.8	8.49	24.4	8.51	25.9	8.66
4			17.6	10.95	15.2	8.71	16.4	8.70	21.4	6.07	23.2	7.76	22.7	4.09	25.9	8.72
5			17.1	10.13	14.7	6.73	16.2	6.11	20.9	4.62	22.4	0.50	22.3	2.29	24.6	0.28
6			16.1	0.25	14.6	0.20			20.7	0.56			22.2	0.36		
7																
Top of Thermocline (m)					4								4			

Date	8/7/2001 9:30		8/14/2001 8:45		8/28/2001 8:45		9/13/2001 8:30		9/28/2001 10:15		10/11/2001 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)	Temp (C)	D.O. (mg/L)
0	30.1	9.04	24.9	7.36	23.9	10.44	19.8	10.8	15.6	12.24	11.9	7.39
1	30.0	9.15	24.9	7.38	23.9	10.49	19.8	10.77	15.5	12.26	11.7	7.31
2	28.5	8.27	24.9	7.30	23.9	10.37	19.8	10.73	15.4	11.39	11.6	7.29
3	27.7	5.98	24.9	7.32	23.9	10.23		19.80	15.3	8.84	11.6	7.23
4	26.6	2.67	24.9	7.30	23.4	6.44		19.40	15.2	10.23	11.6	7.16
5	25.1	0.21	24.8	0.74	22.6	0.29			15.1	10.22	11.7	0.99
6												
7												
Top of Thermocline (m)												

Date	4/22/2002 12:38		5/10/2002 11:50		5/28/2002 11:05		6/6/2002 9:20	
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	10.4	10.30	9.5	11.60	17.0	9.81	18.2	7.60
1	10.0	10.30	9.4	11.60	17.0	9.82	18.2	7.57
2	9.9	10.20	9.0	11.60	16.9	9.80	18.1	7.57
3	9.9	10.30	8.9	11.60	16.7	9.78	18.0	7.55
4	9.7	10.40	8.9	11.70	15.4	9.50	17.3	6.63
5	9.8	5.30	8.9	11.70	15.1	6.52		
6	9.8	4.80	8.7	3.60				
7	9.8	4.50	8.7	2.90				
Top of Thermocline (m)	5		6					

Date	6/28/2002 11:20		7/9/2002 9:15		7/29/2002 9:15		8/8/2002 10:40		8/20/2002 8:50		9/9/2002 12:25		9/18/2002 8:15		10/1/2002 9:25		10/16/2002 11:30		10/29/2002 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	26.4	8.44	27.5	10.91	25.7	9.58	23.4	11.19	22.3	10.42	25.4	8.62	21.5	9.76	15.9	11.63	10.1	13.37	5.4	14.50
1	25.9	8.51	27.4	10.86	25.7	9.66	23.4	11.18	22.3	10.49	25.0	8.87	21.5	9.72	15.9	11.57	10.0	13.20	5.4	14.18
2	25.5	8.47	27.3	10.70	25.6	9.63	23.4	11.05	22.3	10.52	24.8	10.43	21.5	9.71	15.9	11.52	9.9	13.18	5.4	14.13
3	24.5	7.85	27.3	10.58	25.6	9.61	23.3	11.00	21.6	8.75	24.8	11.62	21.5	9.68	15.4	10.25	9.9	13.23	5.3	14.13
4	24.1	6.63	27.1	10.15	25.6	9.57	23.1	10.91	21.3	7.62	24.7	13.49	21.5	9.65	15.3	2.14	9.7	13.29	5.3	14.13
5	23.0	4.13	25.5	2.06	24.6	1.57	22.9	1.35	21.1	0.92	23.0	9.12	21.5	9.61			9.5	11.51	5.3	14.09
6									21.1	0.83	22.7	0.77								
7																				
Top of Thermocline (m)									3											

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)								

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			

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

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	
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)
		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
		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
		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
		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
		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
		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
		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
		7.1	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
		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
		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
		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
		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
		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
		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				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		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)	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	11.2	10.70	10.4	11.10	19.1	9.46	22.5	8.40	25.3	8.65
1	25.2	8.90	24.5	11.20	20.4	10.93	15.8	13.16	11.9	7.85	10.8	11.20	10.4	11.10	19.1	9.51	22.5	7.10	25.2	8.72
2	25.1	8.85	24.4	10.97	20.3	11.16	15.7	13.31	11.6	7.82	10.6	11.40	10.2	11.30	17.6	9.32	22.5	6.55	25.2	8.72
3	24.8	8.43	24.3	10.62	20.2	11.21	15.6	13.25	11.6	7.72	10.2	11.10	9.5	11.10	16.8	9.37	21.8	5.55	24.1	7.45
4	23.7	3.60	23.1	6.37	20.2	11.15	15.6	12.53	11.5	7.65	6.7	7.60	9.4	11.00	16.3	8.80	18.1	4.71	22.6	2.29
5	18.7	3.04	19.9	2.54	20.0	10.99	15.5	11.81	11.4	7.70	6.0	6.40	9.3	10.90	13.4	9.74	14.9	5.48	17.1	4.88
6	14.1	0.60	15.0	0.70	16.3	11.00	15.2	10.12	11.3	7.61	5.6	5.10	9.2	10.90	11.4	9.70	12.4	6.31	13.2	6.14
7	11.1	0.34	10.9	0.28	12.1	1.06	13.0	0.76	11.0	7.46	5.4	4.00	9.2	106.00	10.4	9.17	11.1	6.17	11.4	6.08
8	8.4	0.24	8.7	0.20	9.1	0.81	9.5	0.58	10.7	7.25	5.2	1.40	9.1	10.50	9.8	8.42	10.3	5.35	10.5	5.50
9	7.1	0.18	7.3	0.15	7.4	0.60	7.9	0.38	10.2	5.71	5.0	1.40	8.9	10.00	9.5	6.70	9.7	4.60	9.8	1.91
10	6.6	0.15	6.7	0.12	6.7	0.35	6.9	0.29	8.5	0.53	5.0	1.20	8.5	7.50	8.7	3.27	9.1	2.74	9.4	0.55
11	6.2	0.14	6.4	0.10	6.4	0.16	6.6	0.25	6.7	0.24	5.0	1.10	7.5	0.30	8.5	1.92	8.9	1.01	9.0	0.38
12	6.1	0.13	6.3	0.10	6.3	0.15	6.4	0.22	6.6	0.19	5.0	1.00	7.3	0.20	8.5	1.33	8.8	0.81	9.0	0.28
13	6.1	0.12	6.3	0.07					6.6	0.13	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)	5		5		6		6		10		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	

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	

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		
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)	
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	
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	
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	
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	
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	
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	
6.0	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	
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	
				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			

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

Date	7/25/2001 10:30		8/7/2001 11:30		8/14/2001 10:45		8/28/2001 10:20		9/13/2001 10:35		9/28/2001 12:10		10/17/2001 13:25	
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)
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								

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	2	2	2	3	4		2	7	4
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Date	6/6/2002 11:15		6/26/2002 10:45		7/9/2002 10:55		7/29/2002 11:00		8/8/2002 12:50		8/20/2002 10:45		9/6/2002 13:30		9/18/2002 9:50		10/1/2002 11:25		10/16/2002 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	18.5	7.09	24.4	5.01	28.5	10.16	26.6	13.01	24.3	17.21	22.6	3.00	24.7	8.94	21.5	11.63	16.3	9.31	10.5	11.78
1	18.0	6.91	24.6	4.18	27.5	6.53	25.7	4.64	24.0	16.64	22.5	2.87	23.3	8.62	21.4	11.08	16.2	9.32	9.8	10.59
2	17.1	5.23	22.2	0.74	22.1	0.61	22.9	0.78	22.4	6.45	22.4	2.23	22.4	3.73	20.8	5.57	15.2	5.74	9.7	10.43
3	13.3	4.76	20.8	0.52	16.4	0.56	17.7	0.69	18.4	1.04	19.6	0.79	21.0	1.05	19.5	1.17	14.4	2.49	9.6	10.31
4	10.7	0.39	13.0	0.43	11.8	0.50	12.6	0.67	13.8	0.93	13.3	0.66	15.6	0.69	14.6	0.82	14.1	0.82	9.5	10.08
5	8.9	0.32	10.3	0.37	10.0	0.46	10.3	0.62	10.4	0.87	10.7	0.59	11.9	0.62	11.8	0.66	12.5	0.64	9.3	9.81
6	8.4	0.27	9.0	0.32	8.9	0.39	9.4	0.57	9.7	0.81	9.9	0.57	10.4	0.58	10.5	0.58	10.6	0.54	9.2	9.76
7	8.2	0.25	8.6	0.31	8.6	0.37	9.1	0.51			9.7	0.52	10.1	0.51	10.1	0.51	10.1	0.50	9.2	9.78
8			8.5	0.16									9.9	0.48	9.9	0.44	10.0	0.45		
9																	9.9	0.44		
10																	9.9	0.35		
11																	9.9	0.29		
Top of Thermocline (m)	4		2		2		2		2		2		3		3		3			

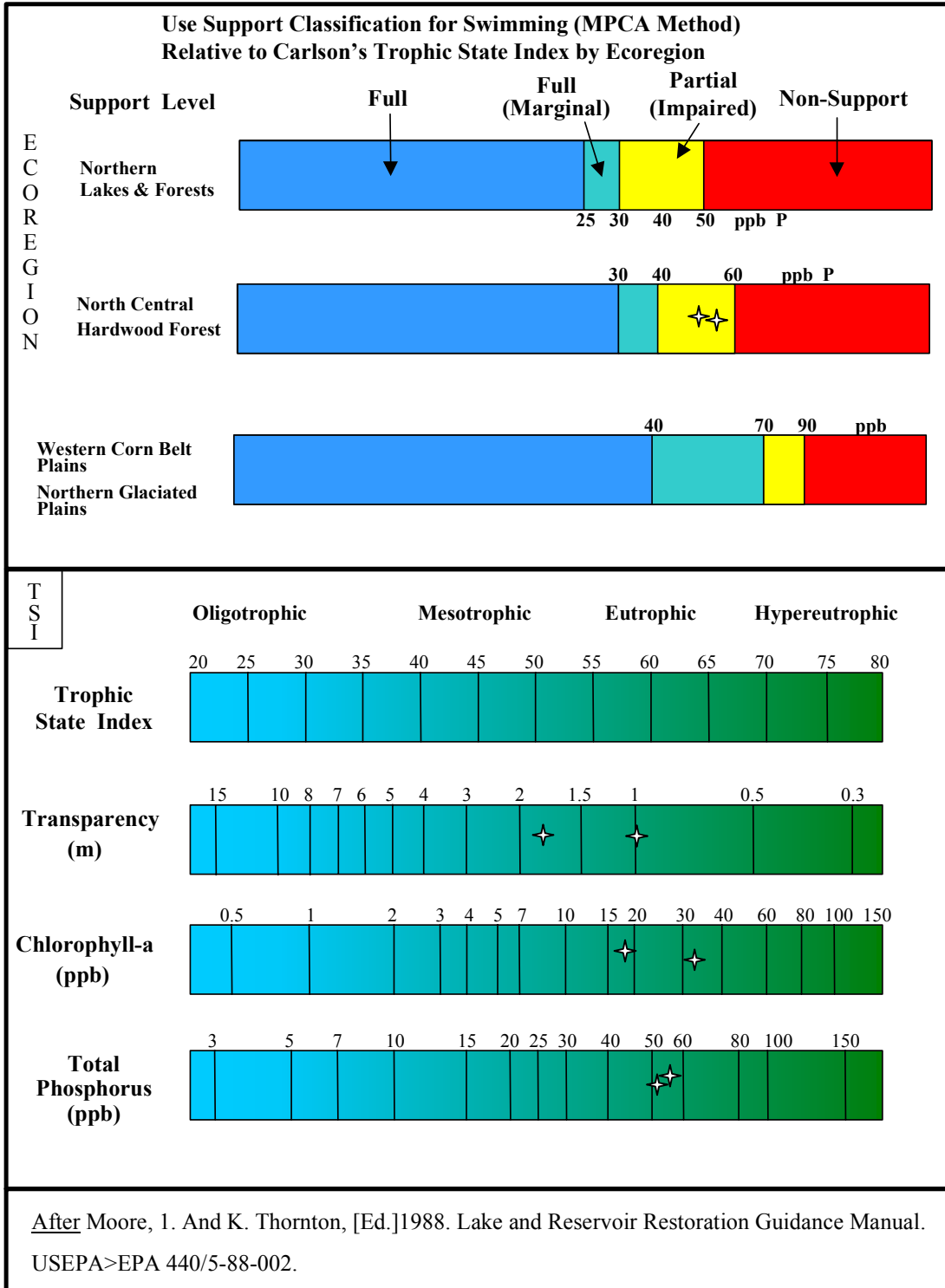
Date	10/29/2002 10:20	
Depth	Temp (C)	D.O. (mg/L)
0	5.1	14.55
1	5.1	13.85
2	5.0	13.68
3	5.0	13.6
4	5.0	13.52
5	5.0	13.51
6	5.0	13.47
7	5.0	13.42
8		
9		
10		
11		
Top of Thermocline (m)		

Date	4/15/2003 11:20		5/6/2003 10:25		5/16/2003 10:30		5/29/2003 12:30		6/11/2003 11:00		6/27/2003 12:54		7/11/2003 11:25		7/23/2003 12:45		8/6/2003 11:20	
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	11.05	14.2	8.16	13.1	5.89	17.5	4.8	20	NA	NA	4.64	21.7	4.05	21.9	7.15	27.4	11.55	24.3
1	11.56	14.1	7.91	12.7	6.48	15.4	4.6	18			4.59	20.2	3.25	21.1	5.96	24.1	6.9	23.4
2	11.37	12.6	7.75	12.5	4.89	13	3.38	16.8			3.37	19.6	2.1	20.8	0.46	22.8	1.86	22.6
3	9.81	9.5	6.46	10.1	3.88	11	2.35	11.8			0.35	18.6	0.26	16.3	0.03	16.5	0.11	17.1
4	9.35	7.1	3.92	7.9	2.1	9.2	0.24	9.4			0.21	13.6	0.14	12	0.02	11.7	0.05	12.4
5	8.54	6.2	3	7.2	0.39	7.5	0.2	7.8			0.16	10	0.11	9.6	0.01	9.3	0.05	9.7
6	6.5	5.7	0.22	6.5	0.31	6.7	0.19	6.8			0.14	7.9	0.08	8.2	0	8.3	0.03	8.6
7	4.05	5.2	0.1	6	0.3	6.3	0.16	6.7			0.17	7.2	0.06	7.5	0	7.9	0.02	8.2
8			0.05	5.7	0.29	6.1	0.16	6.3			0.13	7	0.05	7.4	0	7.6	0	8
9											0.1	6.9						
10																		
11																		
Top of Thermocline (m)			3		4		4		4		4		3		2		3	

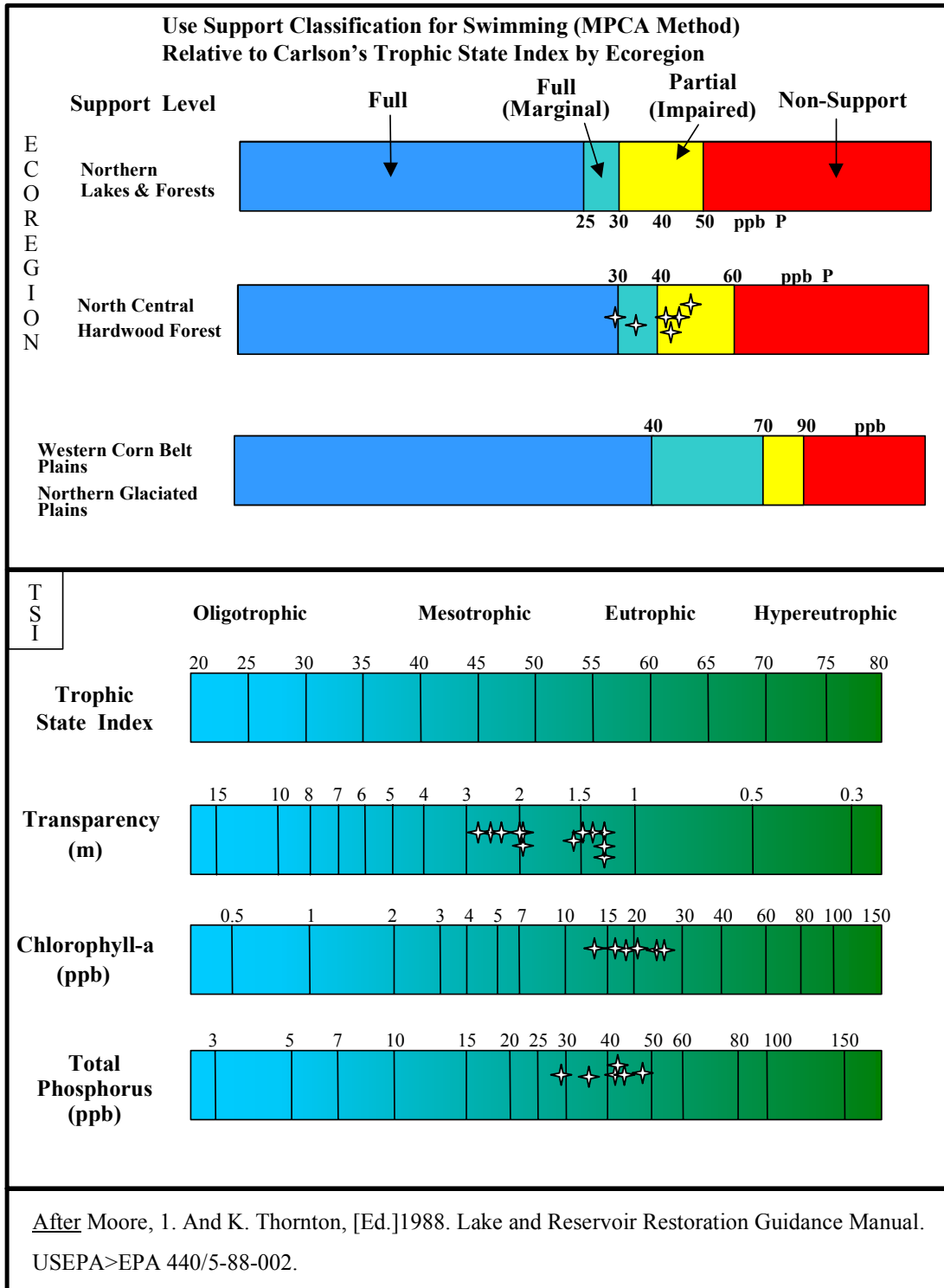
Date	8/21/2003 10:00		9/4/2003 13:50		9/18/2003 10:30		10/1/2003 10:30		10/14/2003 11:10	
Depth	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)	D.O. (mg/L)	Temp (C)
0	5.01	26.5	8.91	22.7	5.35	20.3	5.68	10.6	12.23	13.8
1	4.74	26.5	8.9	21.5	5.34	20.3	5.47	10.6	11.66	13.7
2	2.3	25.5	6.02	20.6	5	20.3	5.27	10.7	10.56	13.6
3	0.03	18.8	1.25	19.6	4.42	20.2	5.33	10.6	0.85	11.9
4	0.02	12.9	0.08	13.3	0.05	14.6	5.28	10.6	2.07	10.6
5	0.01	9.9	0.02	10.2	0.02	12.1	4.9	10.3	0.16	10.2
6	0.02	8.8	0.02	8.9	0.01	9.3	4.74	10	0.07	9.9
7	0.01	8.3	0.01	8.6	0.01	8.8	0.71	9.2	0.05	9.2
8	0.01	8.2								
9	0	8.1								
10										
11										
Top of Thermocline (m)	3		4		4		3			

Appendix D

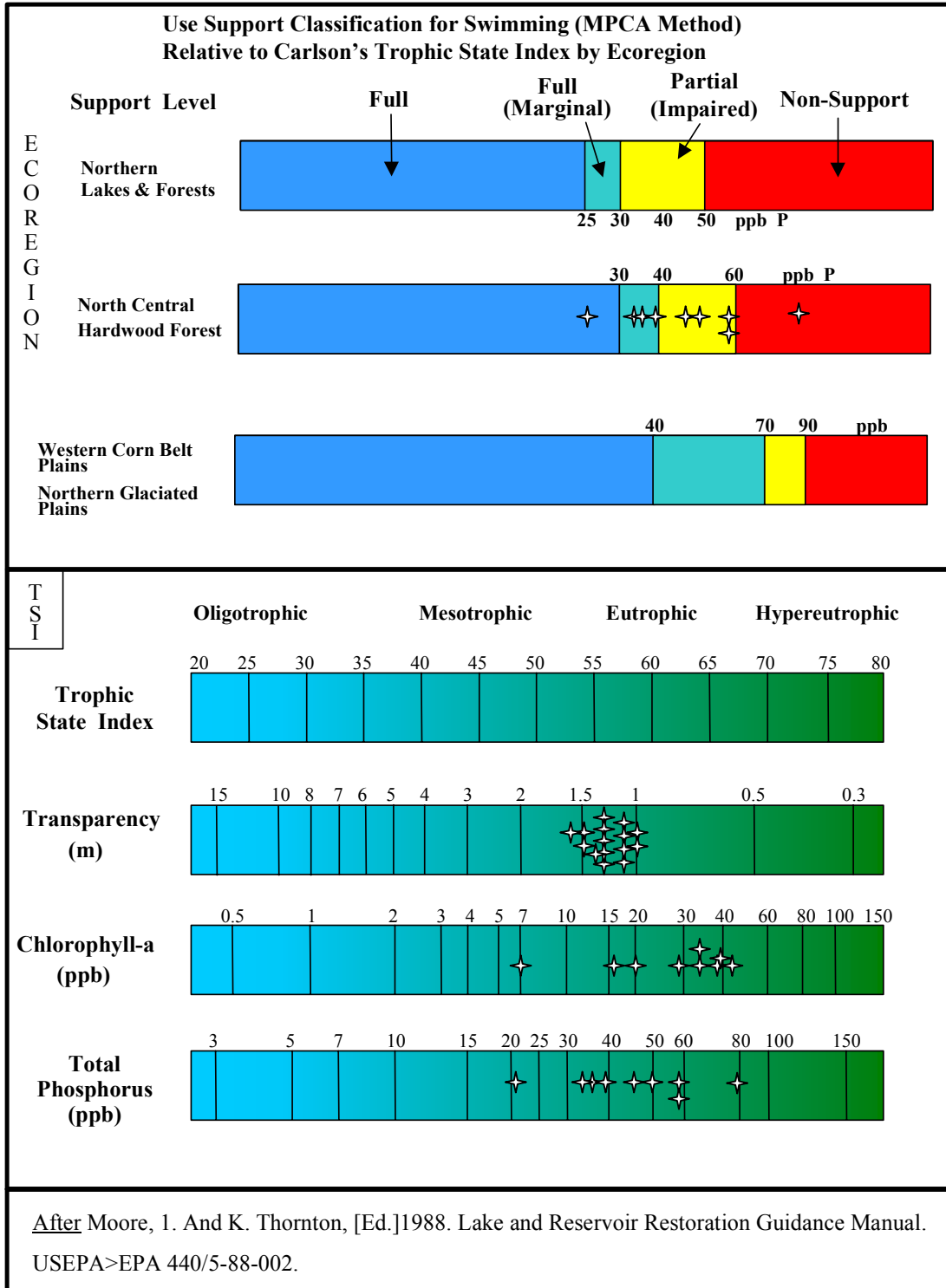
Little Comfort Lake. MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)



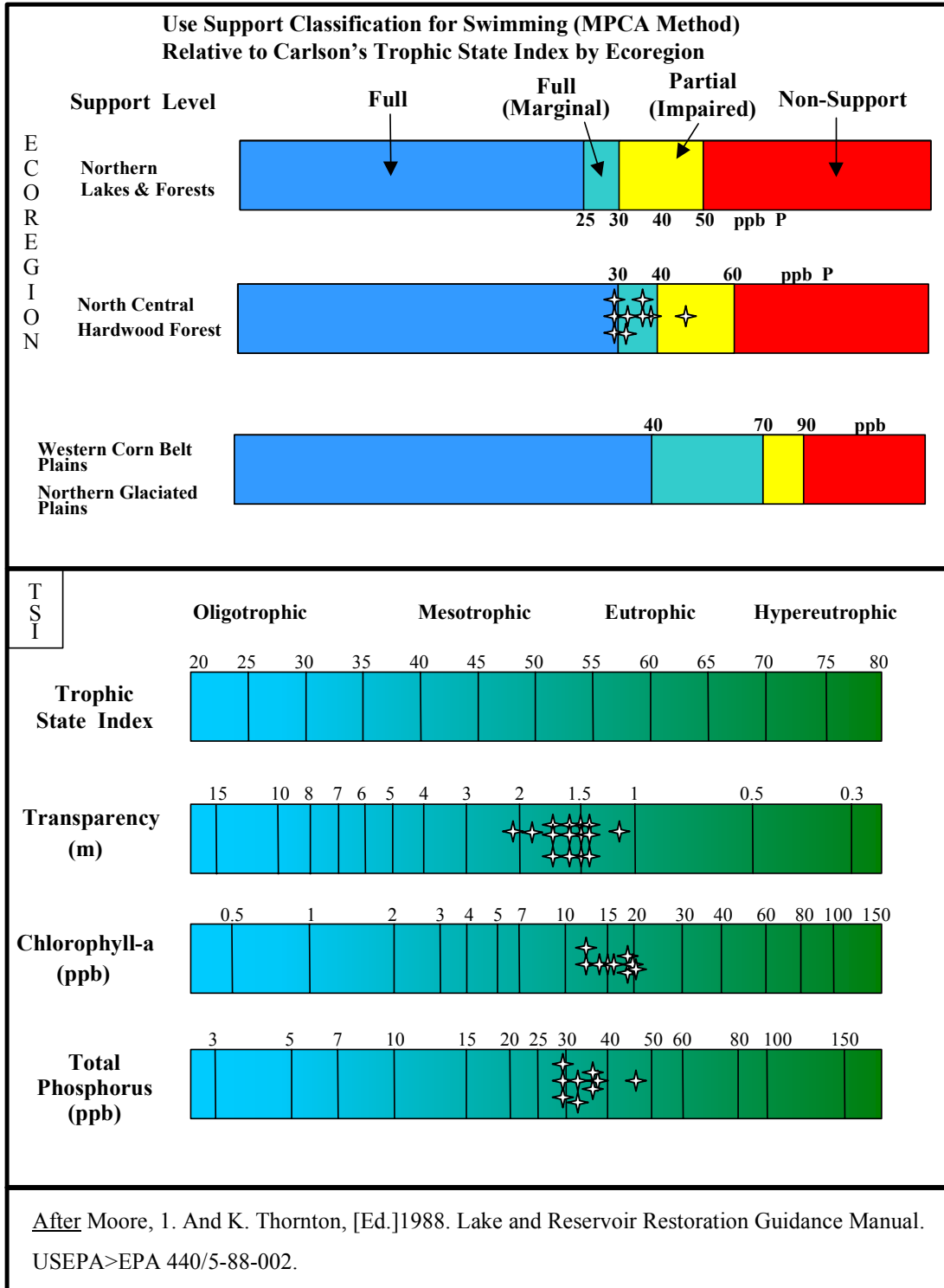
Big Comfort Lake. MPCA’s Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson’s Trophic State Index by Ecoregion. (Symbols are annual average values)



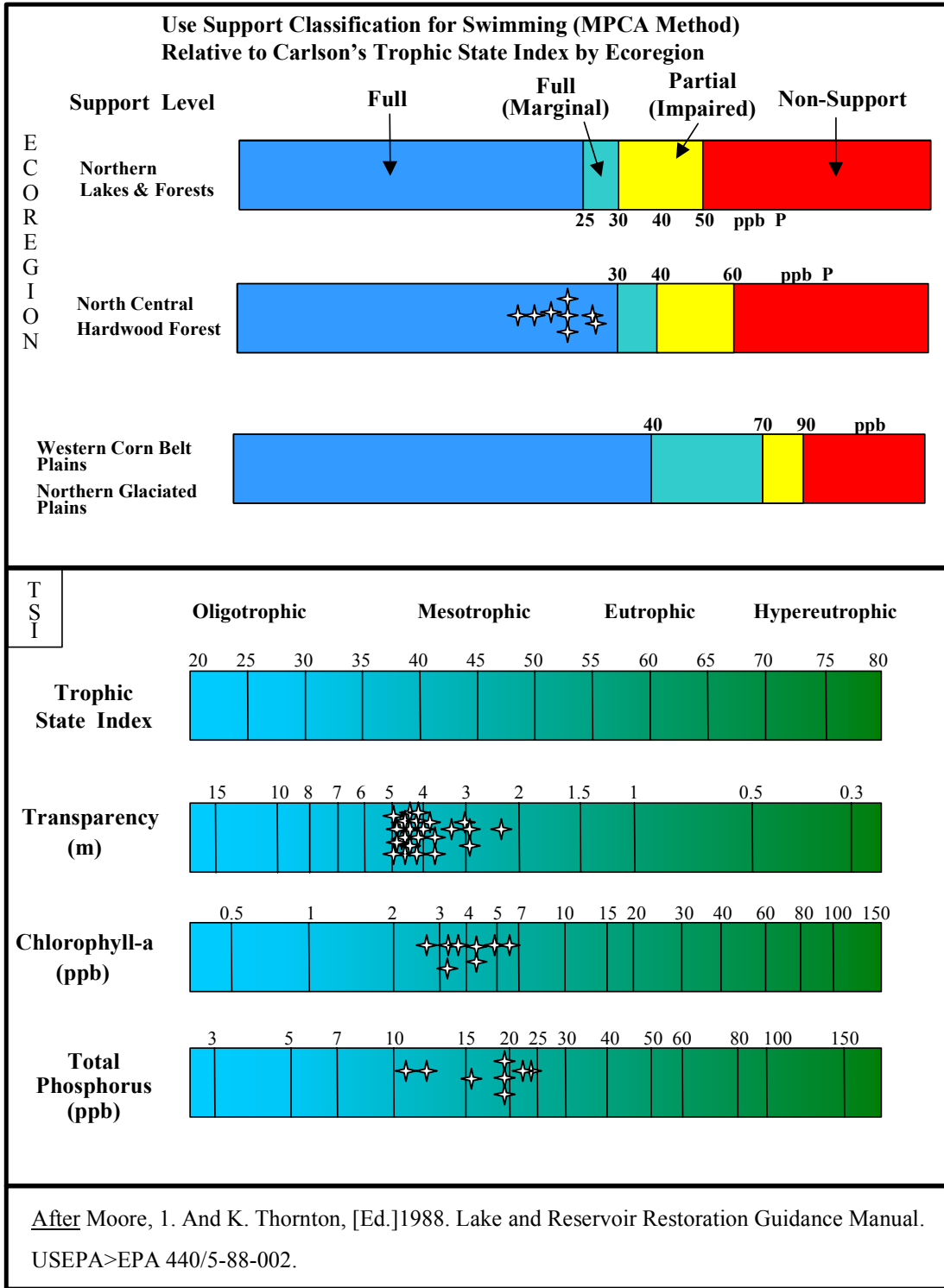
Bone Lake. MPCA's Swimmable Use Support Classification for 305(b) Assessments Relative to Carlson's Trophic State Index by Ecoregion. (Symbols are annual average values)



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)

