Appendix B

Water Quality Monitoring

2006 Lake Water Quality Study

Medicine Lake

Prepared by
Bassett Creek Watershed Management Commission

February 15, 2007

Bassett Creek Watershed Management Commission

www.bassettcreekwmo.org

1.0 Executive Summary

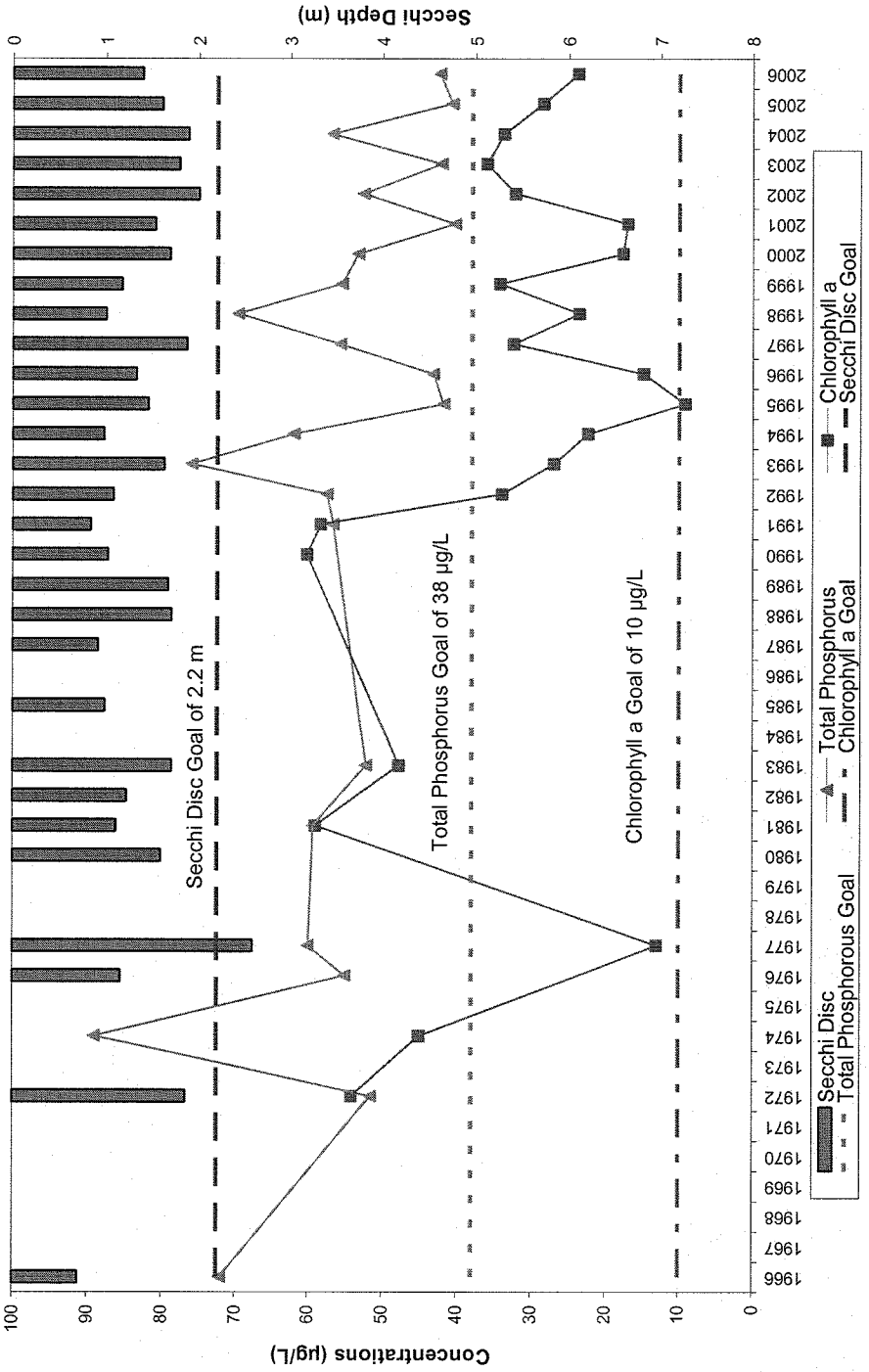
Since 1970, when the Bassett Creek Watershed Management Commission (Commission) and its predecessor, the Bassett Creek Flood Control Commission, were formed, water quality conditions in the ten major lakes have been periodically monitored. The objective of the lake monitoring program is to detect changes or trends in water quality over time, thereby determining the effect of changing land use patterns in the watershed and the effectiveness of the Commission's efforts to prevent water quality degradation in the lakes. Also, monitoring serves another function as Medicine Lake has been listed as "impaired" (i.e., not meeting water quality standards and not supporting assigned beneficial uses) for mercury and excess nutrients by the MPCA.

This report evaluates the historic and current water quality of Medicine Lake. In 2006, the lake was monitored for water quality (Appendix A) and biota, specifically zooplankton (Appendix B). Monitoring results for 2006 and past monitoring seasons were analyzed as summer averages (June through August) and are summarized in this report. The Commission's Medicine Lake goals for Total phosphorus (TP), chlorophyll *a*, and Secchi disc depth are 38 µg/L, 10 µg/L, and 2.2 meters, respectively.

The conclusions that can be reached from the water quality monitoring data are as follows:

- The water quality in Medicine Lake appears to have improved over the previous decade (1997 through 2006) but has been variable, making clear trends difficult to ascertain. Average summer (TP) levels peaked in 1998 at 69.7 µg/L and reached a low level of 40.3 µg/L in 2001.
- Average summer chlorophyll *a* was lowest in 2001 at 17.0 µg/L and reached a peak of 36.0 µg/L in 2003. In 2006, total phosphorus and chlorophyll *a* were 42.3 µg/L and 23.7 µg/L (June through August average), respectively. Both TP and chlorophyll *a* did not meet targets set for these parameters (38 µg/L for TP and 10 µg/L for chlorophyll *a*).
- Average summer Secchi disc levels have not noticeably improved in recent years, ranging from 1.0 meters in 1998 to 2.0 meters in 2002. The summer average in 2006 was 1.4 meters at both sampling locations (Main Basin and Medicine Bay) and did not meet the target of 2.2 meters.
- Total phosphorus concentrations increased substantially in the bottom waters of Medicine Lake during the summer of 2006, indicating the presence of internal phosphorus loading in the lake. From April through August 2006, TP increased from 37.5 µg/L to 1,151 µg/L at the Main Basin sampling station. From April through September 2006, TP increased from 425.5 µg/L to 2,248.1 µg/L at the Medicine Bay monitoring station.

- Total phosphorus, chlorophyll *a,* and Secchi depth measurement all indicate that Medicine Lake is eutrophic.



Medicine Lake Historical Trends 1966-2006

Summer Average: June - August

Figure 1

A Biotic Index Evaluation of Bassett Creek and Plymouth Creek: 2006

Prepared by
Bassett Creek Watershed Management Commission

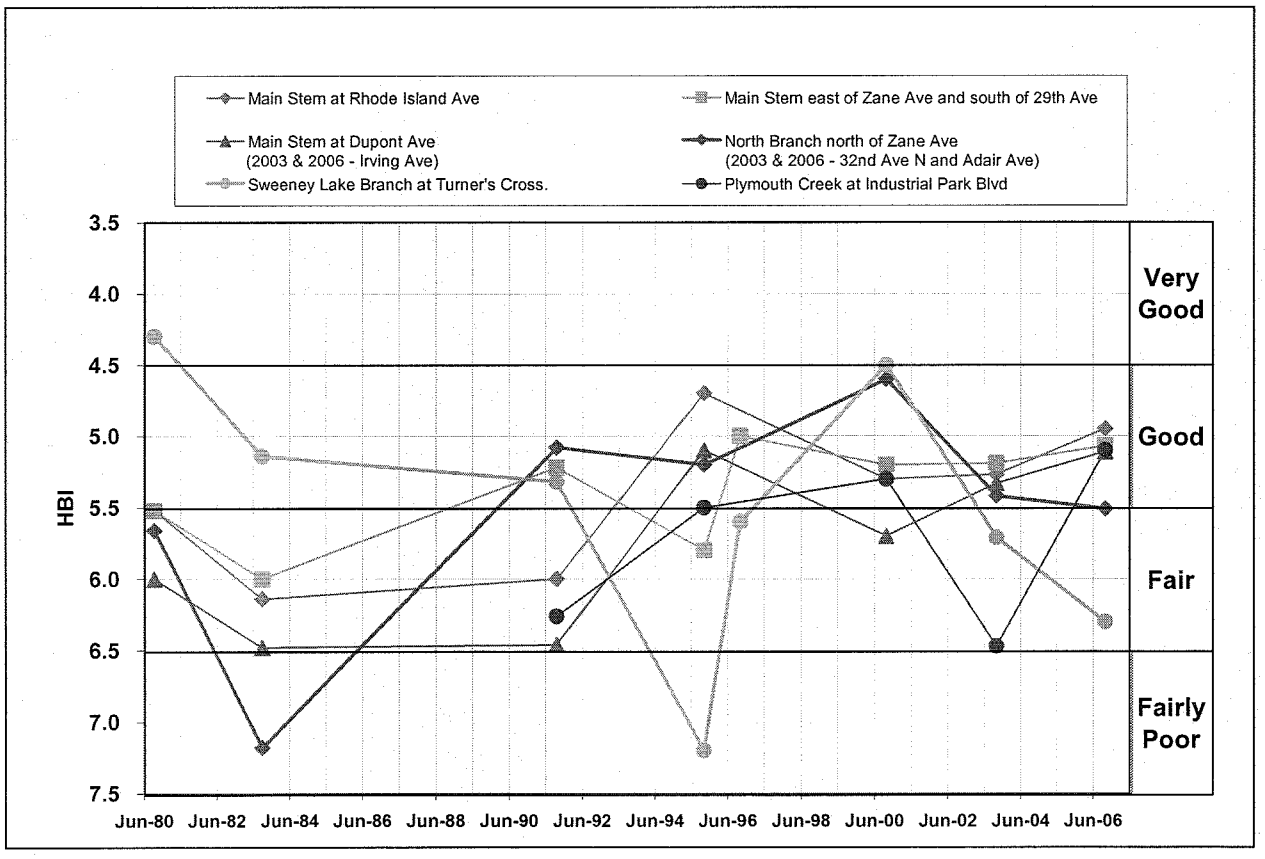
February 2007

Bassett Creek Watershed Management Commission
www.bassettcreekwmo.org

1.0 Executive Summary

Biological monitoring was conducted for Plymouth Creek and Bassett Creek (North Branch, Main Stem and Sweeney Lake Branch) to evaluate water quality of the streams. The Plymouth Creek location showed a significant improvement in water quality from fair to good during the 2003 through 2006 period. The water quality index in the North Branch and Main Stem locations indicated that good water quality was maintained between the 2003 and 2006 studies. The bioindicator data from the Sweeney Lake Branch location indicated a continuing decline in water quality during the 2003 through 2006 period. The 2003 monitoring year was very dry. Annual precipitation totals from in 2004 and 2005 were generally near or above normal. The 2006 monitoring year precipitation was slightly below normal.

Bassett Creek has been evaluated with the Hilsenhoff Biotic Index (HBI) since 1980. The HBI results for 1980-2006 are summarized in the following figure:



A second index, the Invertebrate Community Index (ICI), was applied to the 1995 through 2006 data, as a second opinion. Both biotic indices (HBI and ICI) generally show similar water quality classifications for 2006 at all monitoring locations. Results of the HBI evaluation of Plymouth Creek and Bassett Creek (North Branch, Main Stem and Sweeney Lake Branch) are described as follows:

Plymouth Creek, an intermittent stream, contains organisms that are sensitive to both high and low flows. The 1980 low flow and 1983 high flow severely limited the number of organisms colonizing the stream. Since very low numbers of organisms were collected, the HBI evaluation during 1980 and 1983 was not possible. A significant improvement in water quality occurred during the 1991 through 2000 period (from fair to good). Low flows in 2003 changed the population structure of the stream so that there were fewer individuals which were more tolerant organisms. This change in population resulted in decreased water quality (from good to fair). However, with more normal precipitation, the total number of individuals in the stream increased with more sensitive organisms present. Therefore, the water quality score increased from fair in 2003 to good in 2006.

The **North Branch of Bassett Creek** water quality has remained relatively stable during 1991 through 2006. Although the 2006 HBI values decreased slightly from 2003, the water quality score remained in the good range.

The **Main Stem of Bassett Creek** water quality has remained relatively stable during 1980 through 2006. There was a significant improvement in water quality at the Rhode Island and Dupont Avenue sample locations in 1995, which was likely due to climatic changes since 1991 was a very wet year and 1995 was a relatively average precipitation year. The reduced quantities of stormwater runoff and lower pollutant loads in 1995 resulted in improved water quality. The Main Stem water quality has ranged from good to fair during the period of record. The 2006 water quality score was consistent for each main stem site and remained in the good range.

The **Sweeney Lake Branch of Bassett Creek** observed significant water quality degradation in 1983, 1995 and 2003. Higher loads of pollutants washed into the stream during 1983, a very wet year, and changed the water quality from very good to good. The water quality remained good in 1991, another very wet year. In 1995, sediment and silt from an upstream construction project washed into the stream and degraded the water quality to fairly poor. The stream recovered from construction impacts during the 1996 through 2000 period, and the stream observed a borderline good/very good water quality during 2000. Low flows in 2003, a very dry year, changed the colonization of the stream to more tolerant organisms resulting in significantly decreased water quality (from good to fair). This decline continued in 2006, however, the water quality remained fair.

Bassett Creek has been listed as "impaired" for fish based on a third index, *Index of Biological Integrity* (IBI) by the MPCA. The HBI and ICI provide better assessments of water quality for small streams such as Bassett Creek.

Based on the results of the 2006 monitoring program, the following recommendations should be considered:

- The Commission should continue its management efforts of Bassett Creek and Plymouth Creek, including installation of BMPs to protect and, if possible, to improve the water quality of the stream, as opportunities become available.
- The results of the biotic indices demonstrate they are useful in assessing the water quality of Bassett Creek and Plymouth Creek. Therefore, the Commission should continue to use the two biotic indices.
- To maintain the long-term monitoring record and assess stream water quality changes, the Commission should continue to sample all stations again in 3 to 5 years.
- The Commission should continue to obtain the flow and water quality data from the Watershed Outlet Monitoring Point (WOMP) sample stations located on the Main Stem at Irving Avenue.
- The Sweeny Lake Branch location should be resampled in 2007 if there is near normal precipitation in the six months prior to the October sample date. If the precipitation remains below normal during these months and the site scores decrease, there should be a discussion about relocation the site to a more representative location downstream.

In general, the Bassett Creek Watershed Management Commission should continue management practices that preserve or improve the current water quality of Bassett Creek and Plymouth Creek.

A 2005 STUDY OF THE WATER QUALITY OF 172 METROPOLITAN AREA LAKES

June 2006

Randall J. Anhorn

Metropolitan Council

Mears Park Centre, 230 East Fifth Street, Saint Paul, Minnesota 55101
651/602-8743 TDD 651/291-0904
Publication No. 32-04-015

Northwood Lake (27-0627) *Bassett Creek Watershed Management Organization*

Northwood Lake is a 15-acre lake located within the City of New Hope (Hennepin County). The mean and maximum depths of the lake are 0.8 m (roughly 2.5 feet) and 1.5 m (roughly five feet), respectively. The lake's size and mean depth results in an approximate lake volume of 41 ac-ft. Because of the shallowness of the lake, the entire area is considered littoral zone (area of aquatic plant dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column). The lake's 1,341-acre immediate watershed translates to a small watershed-to-lake size ratio of 89:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the sixth year that Northwood Lake has been involved in CAMP. The lake was also enrolled in the program in 2000-2004. Other than the 2000-2004 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty. Thus, 2000-2005 are the only years of available data.

The lake was monitored 13 times from mid-April to early-October, 2005. On each sampling day the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

2005 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	131.7	41.0	195.0	D
CLA (µg/l)	18.5	7.3	54.0	B
Secchi (m)	1.1	0.7	1.3	D
TKN (mg/l)	1.39	0.47	2.60	
			Overall Grade	C

The lake's 2005 overall grade is similar to those recorded in 2002 and 2004, and better than those of 2000-2001 and 2003 (D).

Similar to past years, the Secchi transparency in 2005 would have been greater except for the shallowness of the lake. On numerous monitoring events, The Secchi disk was clearly noticeable while resting on the lake's bottom. Therefore, the lake's 2005 water clarity was actually better than that represented by the summer mean and resulting grade.

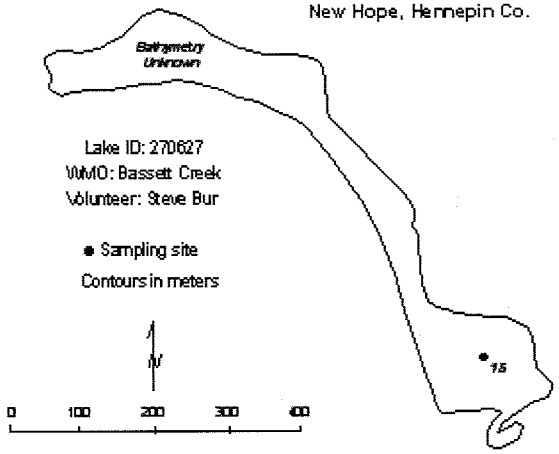
No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's quality seems well represented by an overall grade of D/C. To better understand the quality of the lake and what direction it may be heading, continued monitoring is suggested.

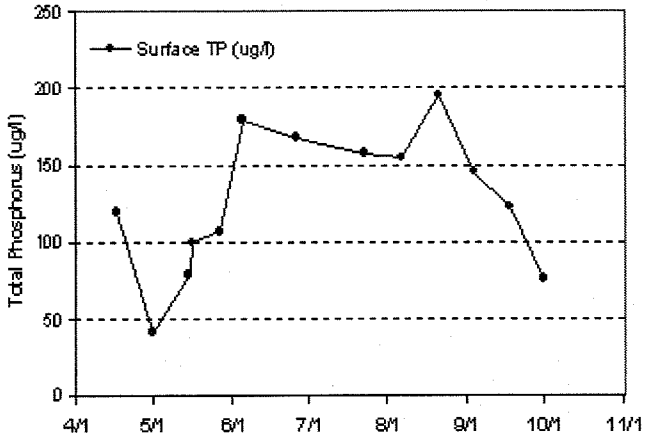
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 4.2 for physical condition (between 4- "high algal color" and 5- "severe bloom"), and 4.3 for recreational suitability (between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

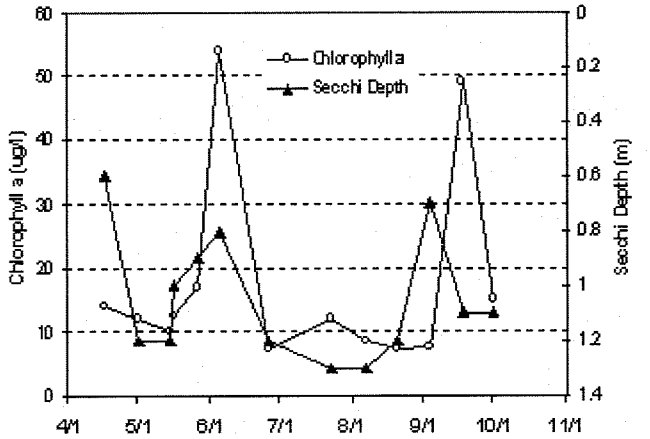
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

Northwood Pond

New Hope, Hennepin Co.

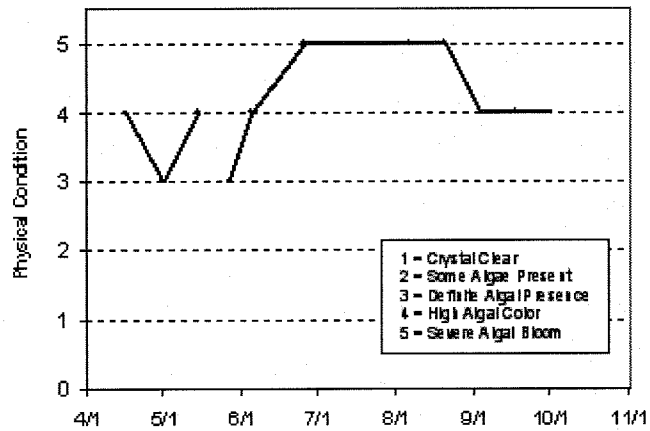






2005 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
4/17/05	13.1				14	119		0.6	4	4
5/1/05	9.3				12	41		1.2	3	4
5/15/05	12.3				9.9	79		1.2	4	4
5/16/05	14				12.5	100		1		
5/27/05	18				17	107		0.9	3	4
6/5/05	22.2				54	179		0.8	4	4
6/26/05	25				7.3	168		1.2	5	4
7/23/05	26.4				12	158		1.3	5	5
8/7/05	28.5				8.5	155		1.3	5	5
8/21/05	22.9				7.3	195		1.2	5	5
9/4/05	21.1				7.5	145		0.7	4	4
9/18/05	22.6				49	122		1.1	4	4
10/1/05	18.6				15	76		1.1	4	4

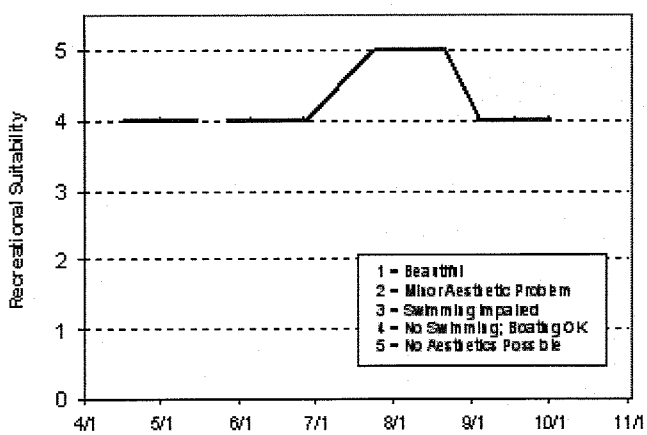


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus													
Chlorophylla													
Secchi Depth													
Overall													

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Phosphorus								F	F	D	F	D	D
Chlorophylla								B	C	B	C	B	B
Secchi Depth								D	D	D	D	D	D
Overall								D	D	C	D	C	C

Source : Metropolitan Council and STORET data



Parkers Lake (27-0107) *Bassett Creek Watershed Management Organization*

This was the fifth year that Parkers Lake has been involved in CAMP (it was first enrolled in 2000). The 97-acre lake, located within the City of Plymouth (Hennepin County), has a public access located within a city park on the lake's north end. One problem that may possibly hinder future recreational activity on the lake, however, is Eurasian Water Milfoil (*Myriophyllum spicatum*), which has been reported in the lake.

The mean and maximum depths of the lake are 3.7 m (roughly 12 feet) and 11.3 m (roughly 37 feet), respectively. The lake's size and mean depth result in an approximate lake volume of 1,164 ac-ft. Approximately 70 percent of the lake's surface area is considered littoral zone (area of aquatic plant dominance). The lake's 950-acre immediate watershed translates to a moderate watershed-to-lake size ratio of 10:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

The lake was monitored 15 times from mid-April to mid-October, 2005. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

2005 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	37.6	18.0	64.0	C
CLA (µg/l)	12.1	2.4	39.0	B
Secchi (m)	2.6	0.8	4.9	B
TKN (mg/l)	1.03	0.52	1.80	
			Overall Grade	B

While the lake's 2005 overall grade (identical to those recorded in 2003-2004) is better than the C's recorded in 1980, 1995, and 1999, it is worse than the recent A'a recorded in 2000 and 2002,

A search through the STORET nationwide water quality database for data on the lake resulted in nutrient and Secchi transparency information for 1980, 1990, 1995, and 1999. The 2000 and 2002-2005 water quality years represent the lake's best-monitored water quality. The lake's water quality shows a markable improvement in water quality from 2000 to 2002, before slipping a little in 2003-2005. To better understand the lake's water quality and where it truly may be heading, continued monitoring is suggested.

The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 2.5 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 2.5 for recreational suitability (between 2- "minor aesthetic problem" and 3- swimming slightly impaired").

The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

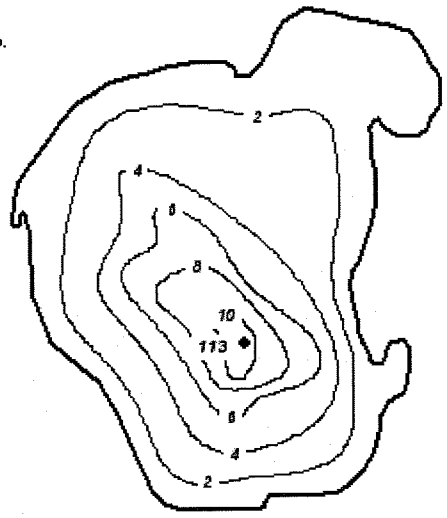
Parkers Lake

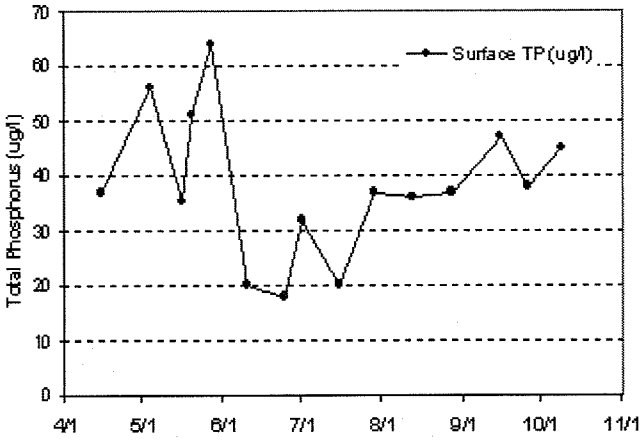
Plymouth, Hennepin Co.

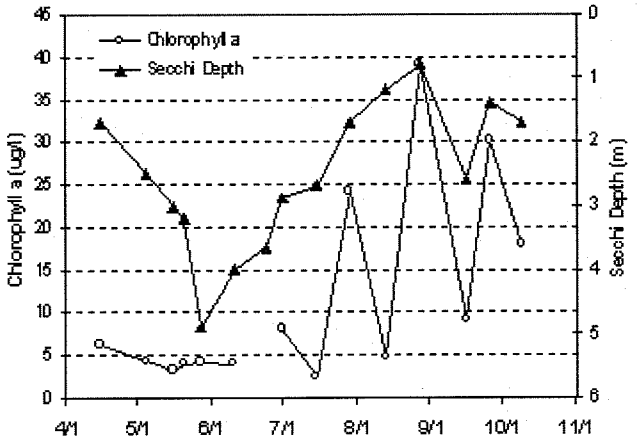
Lake ID: 270107
WMO: Bassett Creek
Volunteer: Bob Wideen

+ Sampling site

Contours in meters

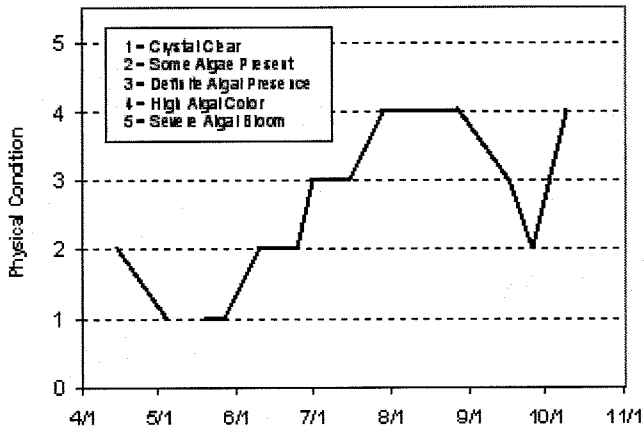






2005 Data

Date	Surf. Tmp C	Bot. Tmp C	Surf. DO mg/L	Bot. DO mg/L	CLA ug/L	Surf. TP ug/L	Bot. TP ug/L	Secchi M	PC 1 thru 5	RS 1 thru 5
4/15/05	14				6.2	37		1.7	2	3
5/4/05	11				4.3	56		2.5	1	1
5/16/05	13.8				3.2	35.5		3.0		
5/20/05	14.5				3.9	51		3.2	1	1
5/27/05	19				4.1	64		4.9	1	1
6/10/05	24				4	20		4.0	2	2
6/24/05	26.9					18		3.7	2	2
7/1/05	23				8	32		2.9	3	3
7/15/05	29				2.4	20		2.7	3	3
7/29/05	26				24	37		1.7	4	3
8/13/05	25.6				4.7	36		1.2	4	4
8/28/05	23.3				39	37		0.8	4	4
9/16/05	21.7				9.2	47		2.6	3	3
9/26/05	20.5				30	38		1.4	2	3
10/9/05	15				18	45		1.7	4	4

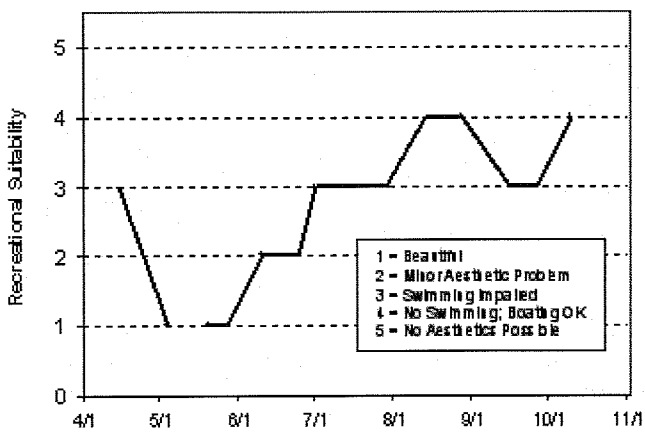


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus	C												
Chlorophyll a	C										B		
Secchi Depth	C										B		
Overall	C												

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Phosphorus			C				C	A		A	B	B	C
Chlorophyll a			B				B	A		A	B	A	B
Secchi Depth			C				C	B		A	B	C	B
Overall			C				C	A		A	B	B	B

Source: Metropolitan Council and STORET data



South Rice Lake (27-0645) *Bassett Creek Watershed Management Organization*

South Rice Lake is a 3.2-acre lake located within the City of Golden Valley (Hennepin County). The maximum and mean depths of the lake are 2.5 m (roughly 8 feet) and 0.5 m (one-and-a-half feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 5.4 ac-ft. Because of the shallowness of the lake, the entire area is considered littoral zone (area of aquatic plant dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

The lake's 63-acre immediate watershed and surface area translates to a watershed-to-lake size ratio of 20:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). When including the lake's whole contributing watershed (including flow from Grimes Pond and North Rice Lake), however, the size increases to 514 acres (160:1) (Barr 1997).

This was the sixth year that South Rice Lake has been involved in CAMP (it was also involved in 2000-2004). Other than the 2000-2005 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty. The lake was monitored 15 times between mid-April and mid-October, 2005. The resulting data and graphs appear on the next page.

2005 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	132.8	51.0	304.0	D
CLA (µg/l)	22.6	5.3	50.0	C
Secchi (m)	0.7	0.3	1.1	D
TKN (mg/l)	1.57	0.52	3.8	
			Overall Grade	C

Of the six years of monitoring data available for the lake, it is apparent that the lake experienced its best water quality in 2004 and its the worst water quality was recorded in 2000. The lake received overall grades of F in 2000, D in 2001-2003 and 2005, and C in 2004.

A recent in-lake alum treatment (applied at ice-off in mid-April, 2002) was meant to lower phosphorus levels, control algal growth and improve water clarity. It was reported in the 2002 Lake Report that the alum treatment was successful in the reducting of in-lake TP and CLA (indicating a reduction in algal biomass) in 2002. While, the lake's 2002, and 2004-2005 water quality concitions were better than pre-alum treatment, the 2003 water quality was not. In fact, the 2003 summer mean TP concentration was more than double those recorded in 2002 and 2004-2005. Additional years of monitoring are needed to truly determine the effectiveness and long-term efficiency of the alum treatment.

The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 3.8 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 4.4 for recreational suitability (between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

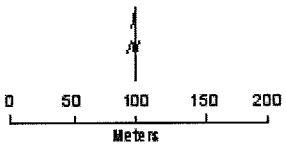
South Rice Pond

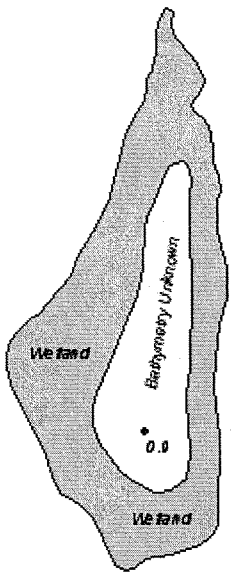
Golden Valley, Robbinsdale, Hennepin Co.

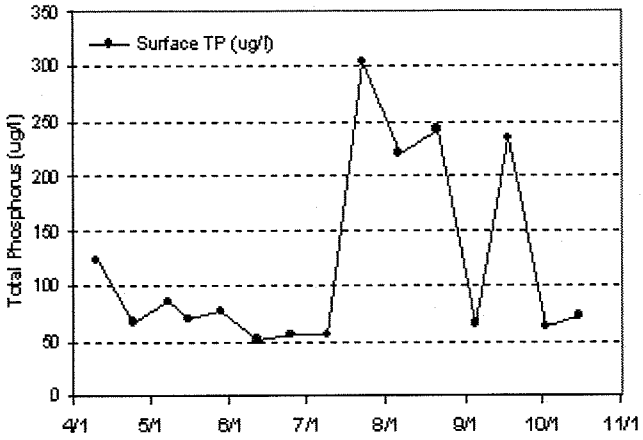
Lake ID: 270645
WMO: Bassett Creek
Volunteer: Steve Streff

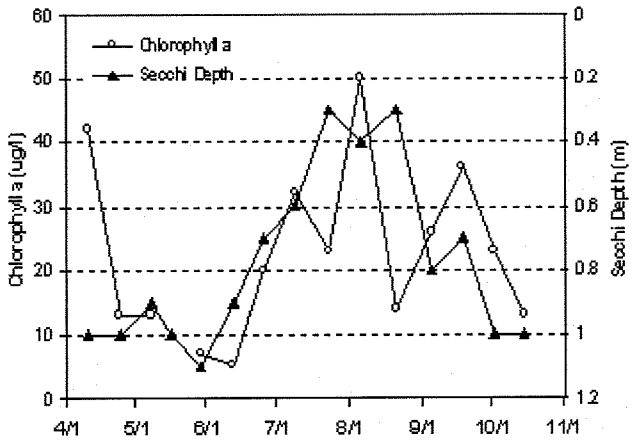
• Sampling site

Contours in meters



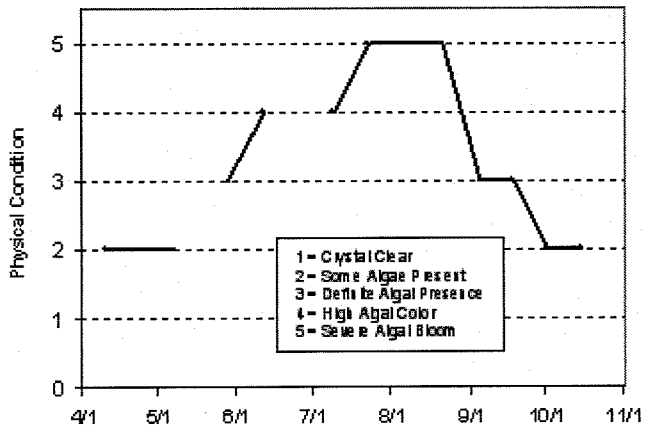






2005 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
4/10/05	14.3				42	124		1	2	4
4/24/05	12.3				13	67		1	2	4
5/6/05	16.8				13	85		0.9	2	4
5/16/05						70		1		
5/29/05	18.5				7	77		1.1	3	4
6/12/05	26.3				5.3	51		0.9	4	4
6/25/05	25.2				20	55		0.7		
7/9/05	25.2				32	55		0.6	4	5
7/23/05	25.8				23	304		0.3	5	5
8/6/05	25.2				50	221		0.4	5	5
8/21/05	20.2				14	243		0.3	5	5
9/6/05	20.2				26	66		0.8	3	4
9/18/05	23.5				36	234		0.7	3	4
10/2/05	17.9				23	53		1	2	4
10/15/05	13.4				13	72		1	2	4

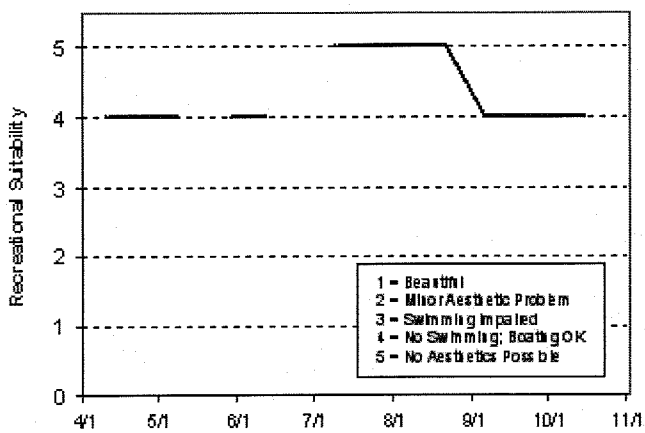


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus													
Chlorophyll a													
Secchi Depth													
Overall													

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Phosphorus								F	F	D	F	D	D
Chlorophyll a								F	B	B	C	A	C
Secchi Depth								F	F	F	F	D	D
Overall								F	D	D	D	C	D

Source: Metropolitan Council and STORET data



Sweeney Lake (27-0035) *Bassett Creek Watershed Management Organization*

The 66-acre lake has a mean and maximum depth of 3.6 m (11.8 feet) and 8.0 m (26.0 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 790 ac-ft. Because of the shallowness of the lake, and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column) it is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation),

This was the sixth year of CAMP monitoring in Sweeney Lake, which is located in the City of Golden Valley (Henepin County). The lake has two seperate depressions each reaching a maximum depth of approximately 8 meters (26 feet). Roughly 52 percent of the lake's area is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation). Additionally, the lake's surface area and 2,400-acre watershed translates to a rather large 36:1 watershed-to-lake size ratio. The greater the ratio, the greater the potential stress on the lake from surface runoff.

The Sweeney Lake branch of the Bassett Creek flows into the lake on the south and outlets at the north over a dam. Sweeny Lake is connected to Twin Lake during periods of high lake levels by a meandering channel through a cattail marsh between the northeast shore of Sweeny and the north shore of Twin Lake. The surface elevations of the two lakes are about the same, indicating a minimal flow between the two lakes except during periods of heavy runoff when transfer of water between the two lakes increases. The west and south shoreline of Sweeny Lake consists of privately owned single family homes. The east shore is bordered by the Glenwood Hills Hospital and park consisting of a lawn, a golf course, and a wooded area (Barr, 1994).

While the lake has been monitored at two separate sites (north end and south end) in the past, only one site (the southern site) was monitored in 2005. The lake was monitored 11 times between mid-April and mid-October, 2005. Results are presented on graphs and data tables on the following page. During each monitoring event, the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as the perceived physical condition and recreational suitability.

2005 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	49.5	30.0	81.0	C
CLA (µg/l)	21.2	3.3	60.0	C
Secchi (m)	1.5	1.1	2.0	C
TKN (mg/l)	1.08	0.70	1.50	
			Overall Grade	C

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's quality seems well represented by an overall grade of C (recorded in 2000-2005). To better understand the quality of the lake and what direction it may be heading, continued monitoring is suggested.

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The 2004 mean perceived physical condition of the lake was 1.4 (between 1- "crystal clear" and 2- "some algae present"), while the mean recreational suitability was 1.0 (1- "beautiful").

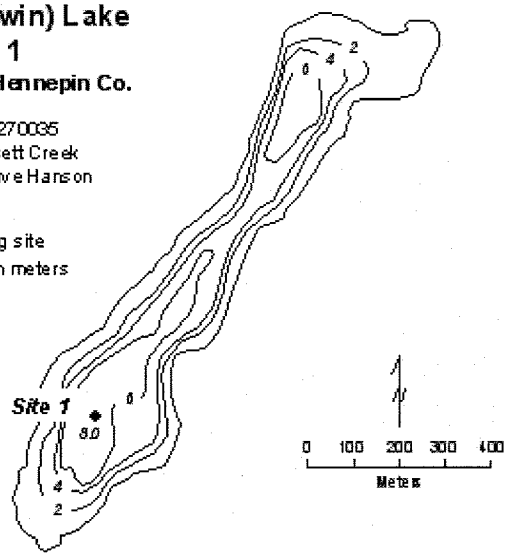
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

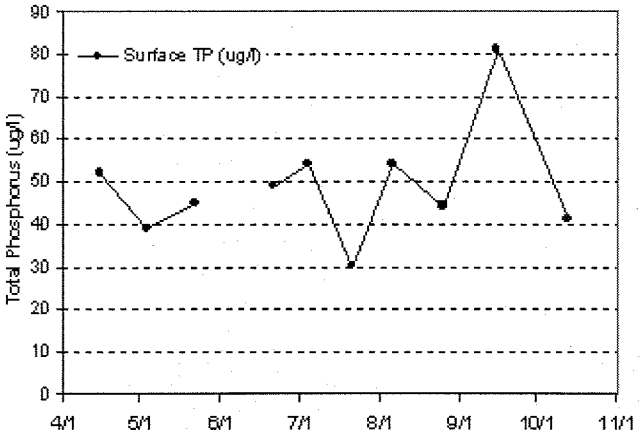
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

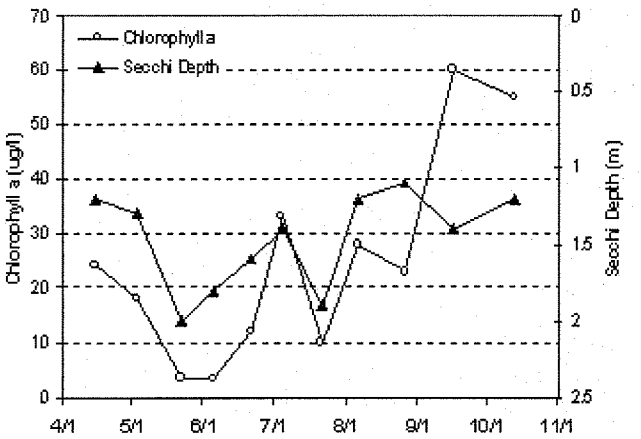
Sweeney (Twin) Lake
Site 1
Golden Valley, Hennepin Co.

Lake ID: 27003S
WMO: Bassett Creek
Volunteer: Dave Hanson

* Sampling site
Contours in meters

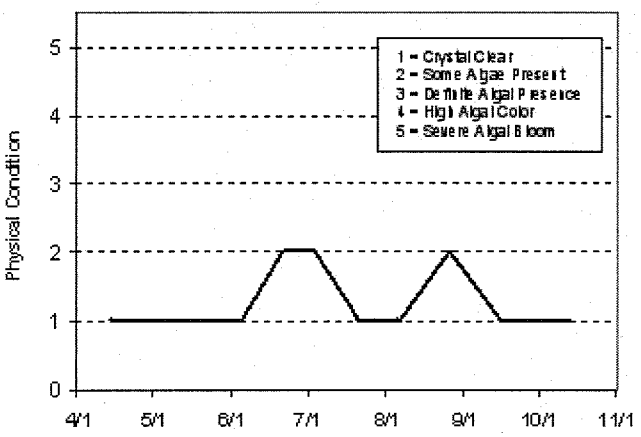






2005 Data

Date	Surf. Tmp C	Bot. Tmp C	Surf. DO mg/L	Bot. DO mg/L	CLA ug/L	Surf. TP ug/L	Bot. TP ug/L	Secchi M	PC 1 thru 5	RS 1 thru 5
4/15/05	11.9		11.9		24	52		1.2	1	1
5/3/05	11.5		12.9		18	39		1.3	1	1
5/22/05	15.6		9.9		3.4	45		2	1	1
6/6/05	20		9.1		3.3			1.8	1	1
6/21/05	23.7		5.6		12	49		1.6	2	1
7/4/05	24.2		7.8		33	54		1.4	2	1
7/21/05	29.5		8.1		10	30		1.9	1	1
8/6/05	26.7		6.1		28	54		1.2	1	1
8/26/05	24.3		6.7		23	44		1.1	2	1
9/16/05	22.4		6.4		60	81		1.4	1	1
10/13/05	15.2		8.15		55	41		1.2	1	1

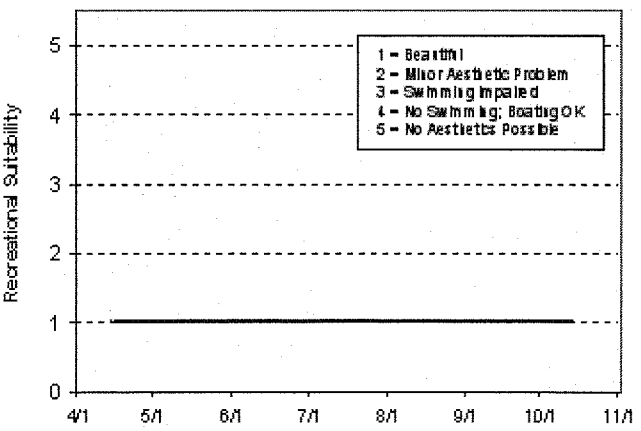


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus													
Chlorophylla													
Secchi Depth													
Overall													

Year	1993	1994	1995	1996	1997	1998	1999	2000 Site 1	2000 Site 2	2001 Site 1	2001 Site 2	2002 Site 1	2002 Site 2
Total Phosphorus								C	C	C	C	C	
Chlorophylla								C	C	B	C	B	
Secchi Depth								D	D	C	C	C	
Overall								C	C	C	C	C	

Year	2003 Site 1	2003 Site 2	2004 Site 1	2004 Site 2	2005 Site 1	2005 Site 2
Total Phosphorus	C		C		C	
Chlorophylla	B		B		C	
Secchi Depth	C		C		C	
Overall	C		C		C	



Source: Metropolitan Council and STORET data

Westwood Lake (27-0711) *Bassett Creek Watershed Management Organization*

This was the seventh year of CAMP monitoring in Westwood Lake (1993 and 2000-2004 being the others), which is located in the City of St. Louis Park (Washington County). The 41-acre lake has a maximum depth of 2.0 m (six-and-a half feet). Because of the shallowness of the lake, it is entirely considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation), and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

Westwood Lake was monitored seven times between mid-May and late-September, 2005. Results from the monitoring are presented on the information sheet on the next page.

2005 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	100.0	28.0	321.0	D
CLA (µg/l)	44.3	9.7	100.0	C
Secchi (m)	1.4	1.1	1.7	C
TKN (mg/l)	1.75	0.94	3.0	
			Overall Grade	C

Because there is a limited amount of historic data available for Westwood Lake, it is not possible to determine any long-term trends. In the short-term however, the lake's water quality shows a wide range of fluctuation (overall grade of D in 1982, C in 1993, 2001-2002, and 2005, and B in 2000 and 2003-2004). To better understand the lake's water quality and where it may be heading, continued monitoring is suggested.

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The average user perception rankings, on a 1-to-5 scale, were 2.8 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 3.6 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

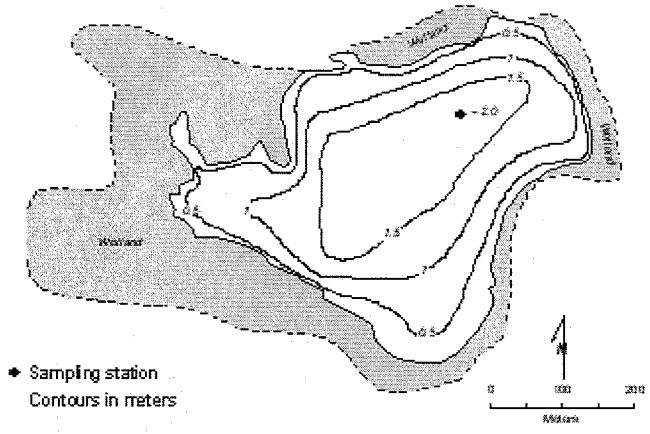
If you know of any errors in the lake's data or physical information, or are aware of any additional information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

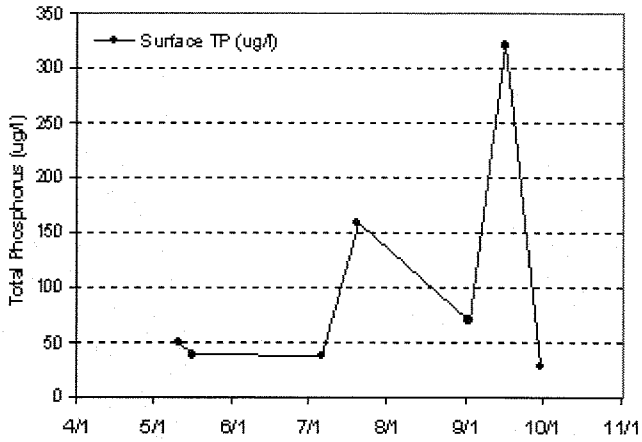
Lake ID: 27071
WMO: Bassett Creek

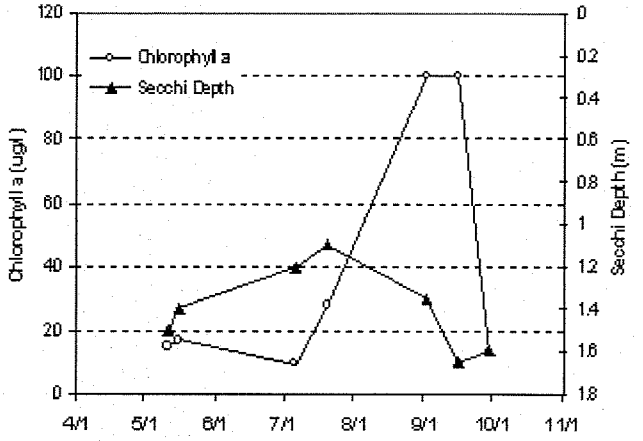
Volunteers: The Carlson Family

Westwood Lake,

St. Louis Park, Hennepin Co.

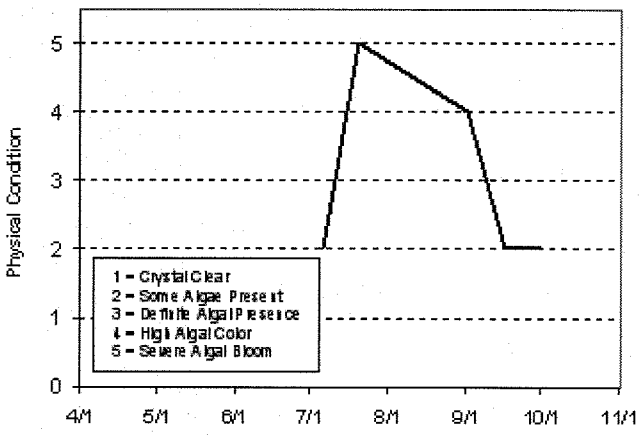






2005 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
5/11/05	16.8				15	49		1.5	2	3
5/16/05	18.2				17	38		1.4		
7/6/05	27.8				9.7	37		1.2	2	2
7/20/05	31.5				28	158		1.1	5	4
9/2/05	22				100	69		1.4	4	5
9/16/05	26.3				100	321		1.7	2	4
9/30/05	16.8				13	28		1.6	2	

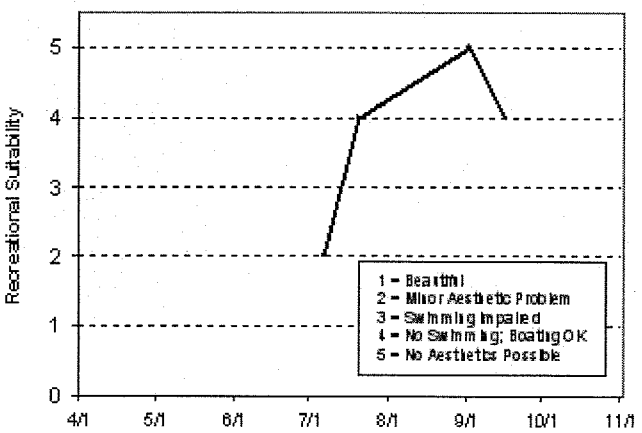


Lake Water Quality Grades Based on Summertime Averages

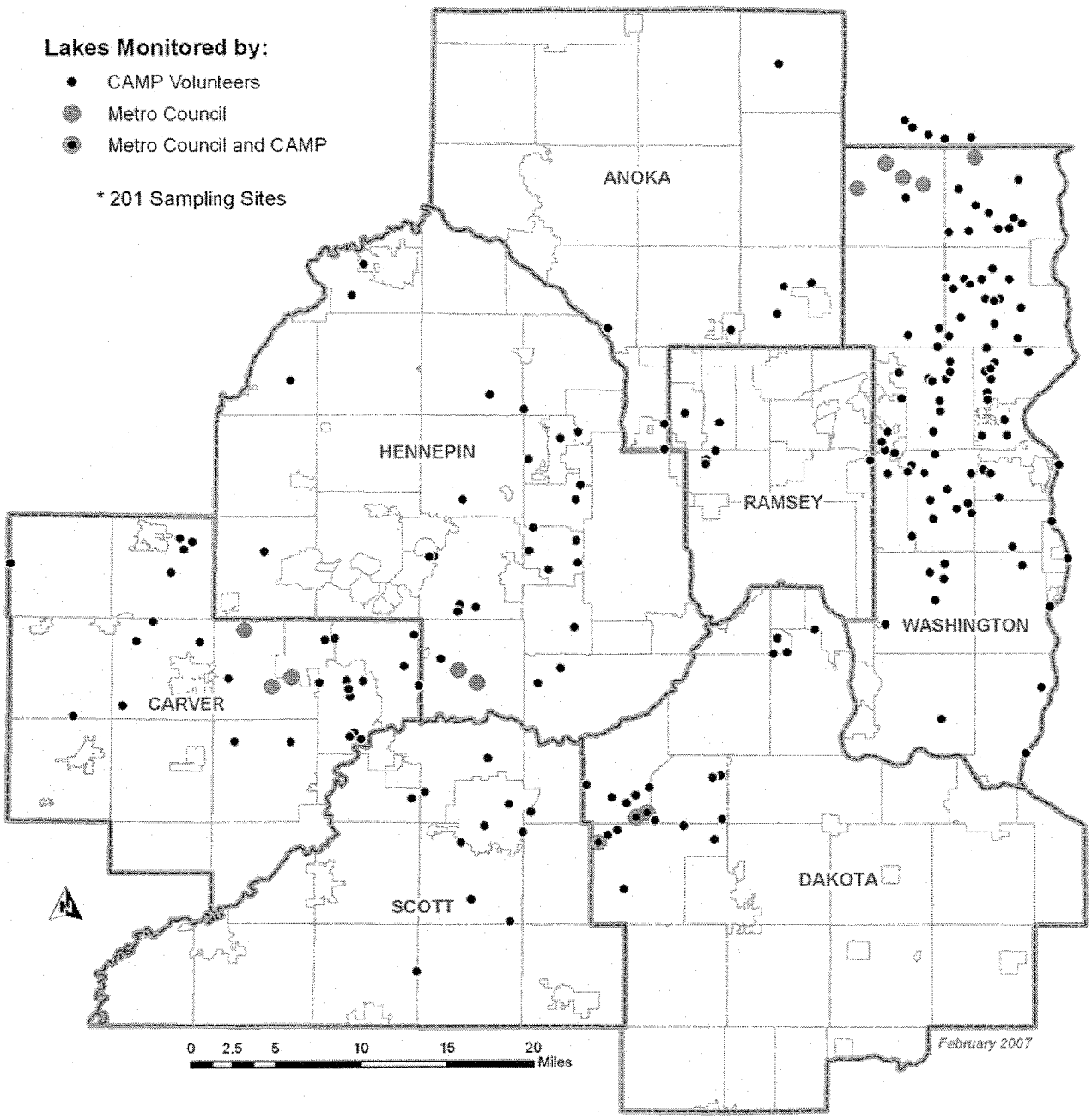
Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus			F										
Chlorophyll a			C										
Secchi Depth			D										
Overall			D										

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Phosphorus	C							B	B	C	C	C	D
Chlorophyll a	C							B	C	B	A	A	C
Secchi Depth	C							C	C	C	C	C	C
Overall	C							B	C	C	B	B	C

Source: Metropolitan Council and STORET data



2006 Study of the Water Quality of 186 Metropolitan Area Lakes *



By
Randall Anhorn and
Judith Sventek

Northwood Lake (27-0627) *Bassett Creek Watershed Management Organization*

Northwood Lake is a 15-acre lake located within the City of New Hope (Hennepin County). The mean and maximum depths of the lake are 0.8 m (roughly 2.5 feet) and 1.5 m (roughly five feet), respectively. The lake's size and mean depth results in an approximate lake volume of 41 ac-ft. Because of the shallowness of the lake, the entire area is considered littoral zone (area of aquatic plant dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column). The lake's 1,341-acre immediate watershed translates to a small watershed-to-lake size ratio of 89:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the seventh year that Northwood Lake has been involved in CAMP. The lake was also enrolled in the program in 2000-2005. Other than the 2000-2006 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty. Thus, 2000-2006 are the only years of available data.

The lake was monitored 10 times from mid-April to mid-October, 2006. On each sampling day the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

2006 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	175.0	66.0	244.0	F
CLA (µg/l)	16.2	4.4	36.0	B
Secchi (m)	1.1	1.0	1.2	D
TKN (mg/l)	1.50	1.20	2.00	
			Overall Grade	D

The lake's 2006 overall grade is similar to those recorded in 2000-2001 and 2003 (D) and worse than the C's recorded in 2002, and 2004-2005.

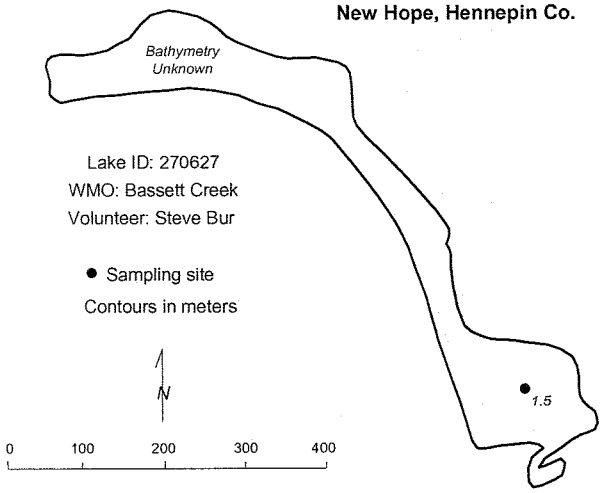
Similar to past years, the Secchi transparency in 2006 would have been greater except for the shallowness of the lake. On numerous monitoring events, the Secchi disk was clearly noticeable while resting on the lake's bottom. Therefore, the lake's 2006 water clarity was actually better than that represented by the summer mean and resulting grade.

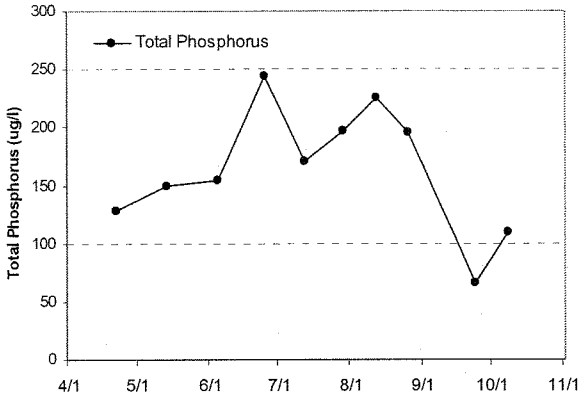
No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's quality seems well represented by an overall grade of D/C. To better understand the quality of the lake and what direction it may be heading, continued monitoring is suggested.

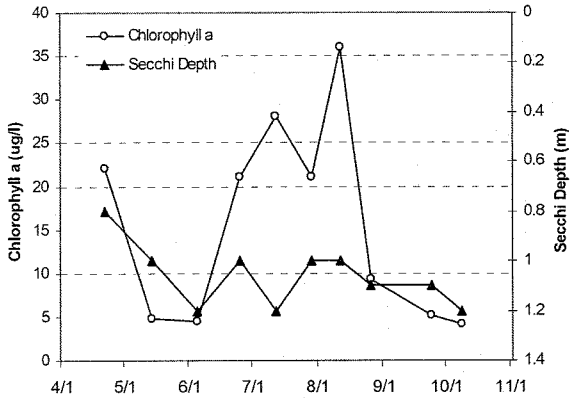
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 4.3 for physical condition (between 4- "high algal color" and 5- "severe bloom"), and 4.4 for recreational suitability (between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Kent Johnson of the Metropolitan Council at (651) 602-8117 or kent.johnson@metc.state.mn.us.

Northwood Pond
New Hope, Hennepin Co.

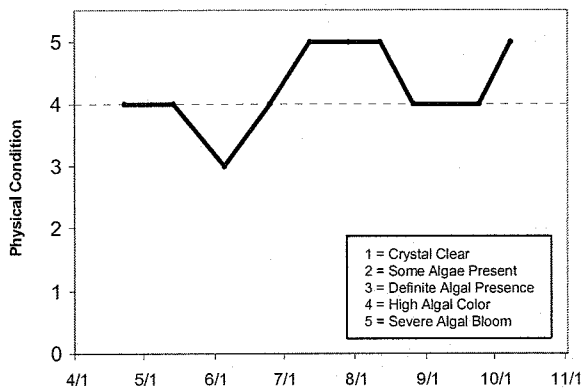






2006 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
4/22/06	18.8				22	128		0.8	4	4
5/14/06	10.4				4.8	149		1	4	4
6/5/06	26.6				4.4	154		1.2	3	4
6/25/06	25.2				21	244		1	4	4
7/12/06	27.3				28	170		1.2	5	5
7/29/06	29				21	197		1	5	5
8/12/06	25				36	225		1	5	5
8/26/06	24.1				9.3	195		1.1	4	5
9/24/06	12.5				5.1	66		1.1	4	4
10/8/06	14.8				4.2	109		1.2	5	4

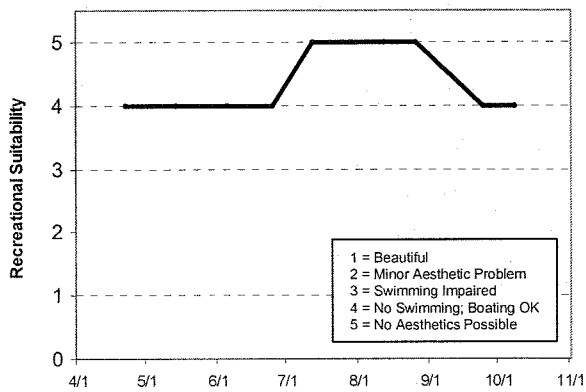


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus													
Chlorophyll a													
Secchi Depth													
Overall													

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total Phosphorus								F	F	D	F	D	D	F
Chlorophyll a								B	C	B	C	B	B	B
Secchi Depth								D	D	D	D	D	D	D
Overall								**D**	**D**	**C**	**D**	**C**	**C**	**D**

Source: Metropolitan Council and STORET data



Parkers Lake (27-0107) *Bassett Creek Watershed Management Organization*

This was the sixth year that Parkers Lake has been involved in CAMP (it was first enrolled in 2000). The 97-acre lake, located within the City of Plymouth (Hennepin County), has a public access located within a city park on the lake's north end. One problem that may possibly hinder future recreational activity on the lake, however, is Eurasian Water Milfoil (*Myriophyllum spicatum*), which has been reported in the lake.

The mean and maximum depths of the lake are 3.7 m (roughly 12 feet) and 11.3 m (roughly 37 feet), respectively. The lake's size and mean depth result in an approximate lake volume of 1,164 ac-ft. Approximately 70 percent of the lake's surface area is considered littoral zone (area of aquatic plant dominance). The lake's 950-acre immediate watershed translates to a moderate watershed-to-lake size ratio of 10:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

The lake was monitored 14 times from early-May to mid-October, 2006. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

2006 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	38.0	15.0	74.0	C
CLA (µg/l)	4.8	1.0	13.0	A
Secchi (m)	3.3	1.6	5.3	A
TKN (mg/l)	1.07	0.73	1.50	
			Overall Grade	B

While the lake's 2006 overall grade (identical to those recorded in 2003-2005) is better than the C's recorded in 1980, 1995, and 1999, it is worse than the recent A's recorded in 2000 and 2002.

A search through the STORET nationwide water quality database for data on the lake resulted in nutrient and Secchi transparency information for 1980, 1990, 1995, and 1999. The 2000 and 2002-2006 water quality years represent the lake's best-monitored water quality. The lake's water quality shows a markable improvement in water quality from 2000 to 2002, before slipping a little in 2003-2006. To better understand the lake's water quality and where it truly may be heading, continued monitoring is suggested.

The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 2.1 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 2.1 for recreational suitability (between 2- "minor aesthetic problem" and 3- swimming slightly impaired").

The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Kent Johnson of the Metropolitan Council at (651) 602-8117 or kent.johnson@metc.state.mn.us.

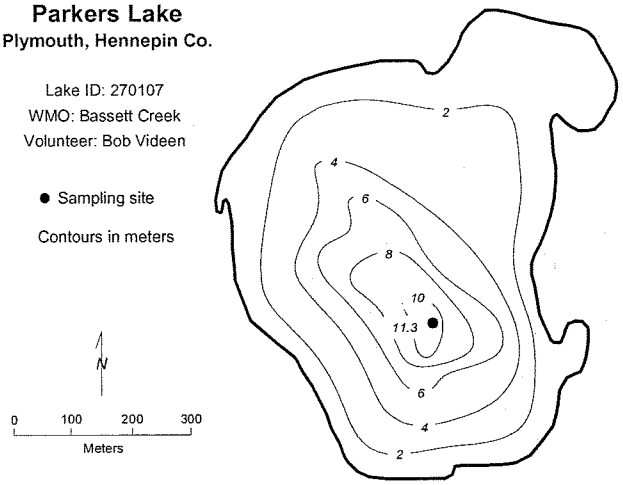
Parkers Lake

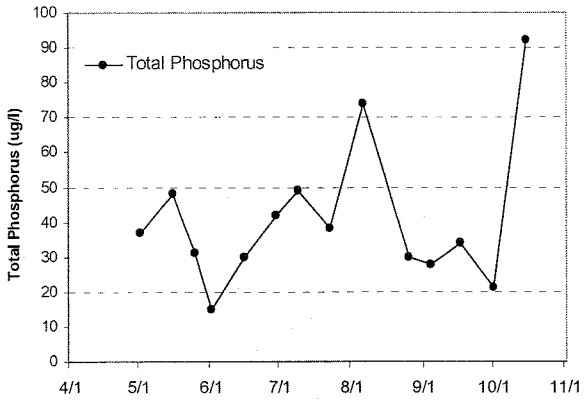
Plymouth, Hennepin Co.

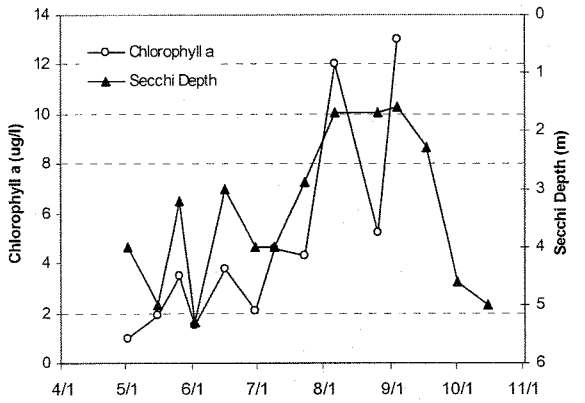
Lake ID: 270107
WMO: Bassett Creek
Volunteer: Bob Videen

● Sampling site

Contours in meters

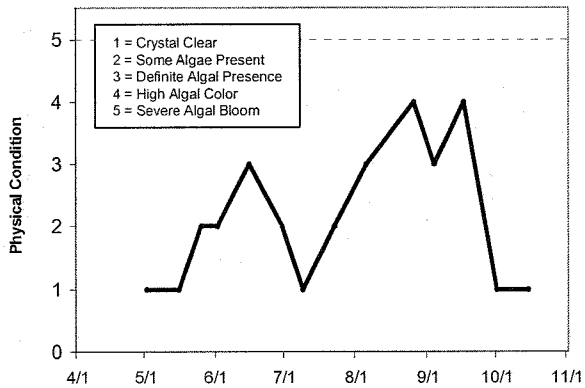






2006 Data

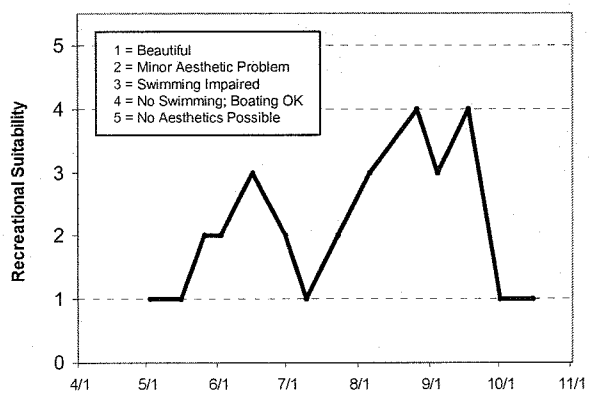
	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
5/2/06	16				1	37		4	1	1
5/16/06	16				1.9	48		5	1	1
5/26/06	22				3.5	31		3.2	2	2
6/2/06	26				1.5	15		5.3	2	2
6/16/06	26				3.8	30		3	3	3
6/30/06	24				2.1	42		4	2	2
7/9/06	26				4.6	49		4	1	1
7/23/06	27				4.3	38		2.9	2	2
8/6/06	29				12	74		1.7	3	3
8/26/06	24				5.2	30		1.7	4	4
9/4/06	24.5				13	28		1.6	3	3
9/17/06	20					34		2.3	4	4
10/1/06	16					21		4.6	1	1
10/15/06	10					92		5	1	1



Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus	C												
Chlorophyll a	C										B		
Secchi Depth	C										B		
Overall	**C**												

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total Phosphorus			C				C	A		A	B	B	C	C
Chlorophyll a			B				B	A		A	B	A	B	A
Secchi Depth			C				C	B		A	B	C	B	A
Overall			**C**				**C**	**A**		**A**	**B**	**B**	**B**	**B**



Source: Metropolitan Council and STORET data

South Rice Lake (27-0645) *Bassett Creek Watershed Management Organization*

South Rice Lake is a 3.2-acre lake located within the City of Golden Valley (Hennepin County). The maximum and mean depths of the lake are 2.5 m (roughly 8 feet) and 0.5 m (one-and-a-half feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 5.4 ac-ft. Because of the shallowness of the lake, the entire area is considered littoral zone (area of aquatic plant dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

The lake's 63-acre immediate watershed and surface area translates to a watershed-to-lake size ratio of 20:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). When including the lake's whole contributing watershed (including flow from Grimes Pond and North Rice Lake), however, the size increases to 514 acres (160:1) (Barr 1997).

This was the seventh year that South Rice Lake has been involved in CAMP (it was also involved in 2000-2005). Other than the 2000-2006 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty. The lake was monitored 14 times between mid-April and mid-October, 2006. The resulting data and graphs appear on the next page.

2006 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	177.1	73.0	423.0	F
CLA (µg/l)	21.1	1.9	59.0	C
Secchi (m)	0.7	0.3	1.0	D
TKN (mg/l)	1.17	0.51	3.4	
			Overall Grade	D

Of the seven years of monitoring data available for the lake, it is apparent that the lake experienced its best water quality in 2004 and its worst water quality was recorded in 2000. The lake received overall grades of F in 2000, D in 2001-2003 and 2005-2006, and C in 2004.

A recent in-lake alum treatment (applied at ice-off in mid-April, 2002) was meant to lower phosphorus levels, control algal growth and improve water clarity. It was reported in the 2002 Lake Report that the alum treatment was successful in reducing in-lake TP and CLA (indicating a reduction in algal biomass) in 2002. While, the lake's 2002, and 2004-2005 water quality conditions were better than pre-alum treatment, the 2003 and 2006 water quality was not. Additional years of monitoring are needed to truly determine the effectiveness and long-term efficiency of the alum treatment.

The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 3.3 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 4.4 for recreational suitability (between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

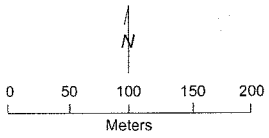
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Kent Johnson of the Metropolitan Council at (651) 602-8117 or kent.johnson@metc.state.mn.us.

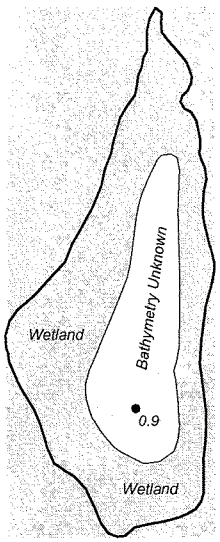
South Rice Pond

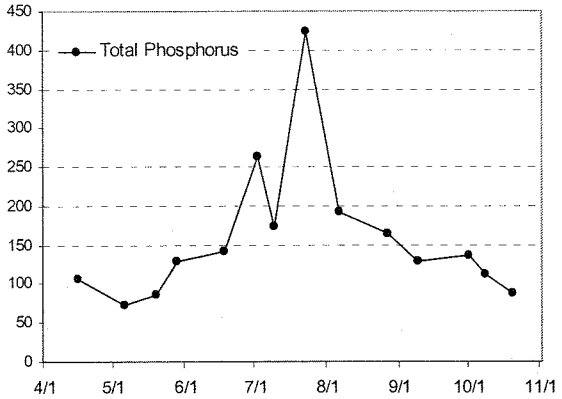
Golden Valley, Robbinsdale, Hennepin Co.

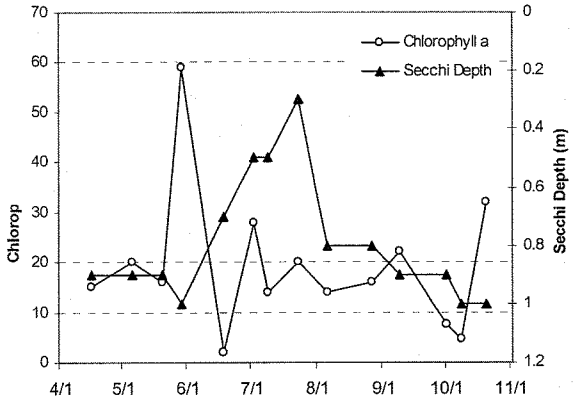
Lake ID: 270645
WMO: Bassett Creek
Volunteer: Steve Streff

• Sampling site
Contours in meters



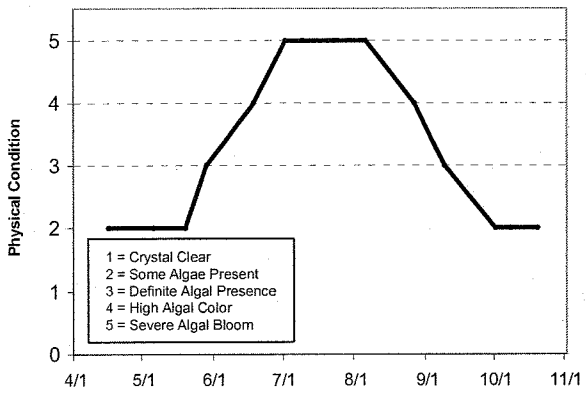






2006 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
4/16/06	18.5				15	107		0.9	2	4
5/6/06	16.8				20	73		0.9	2	4
5/20/06	18.5				16	85		0.9	2	4
5/29/06					59	128		1	3	4
6/18/06					1.9	141		0.7	4	5
7/2/06					28	263		0.5	5	5
7/9/06					14	173		0.5	5	5
7/23/06					20	423		0.3	5	5
8/6/06					14	192		0.8	5	5
8/27/06	22.4				16	165		0.8	4	4
9/9/06	17.9				22	128		0.9	3	4
10/1/06	15.1				7.6	137		0.9	2	4
10/8/06	15.7				4.6	112		1	2	4
10/20/06	6.7				32	88		1	2	4

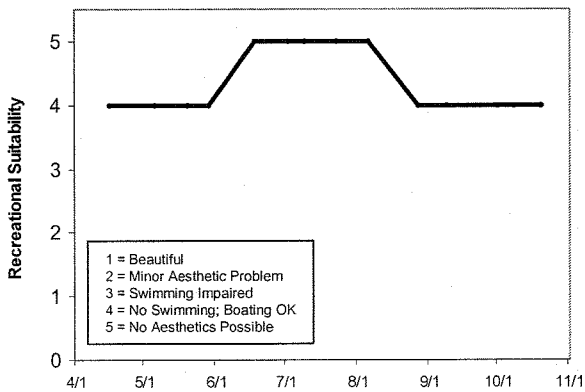


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus													
Chlorophyll a													
Secchi Depth													
Overall													

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total Phosphorus								F	F	D	F	D	D	F
Chlorophyll a								F	B	B	C	A	C	C
Secchi Depth								F	F	F	F	D	D	D
Overall								**F**	**D**	**D**	**D**	**C**	**D**	**D**

Source: Metropolitan Council and STORET data



Sweeney Lake (27-0035) *Bassett Creek Watershed Management Organization*

This was the seventh year of CAMP monitoring in Sweeney Lake, which is located in the City of Golden Valley (Hennepin County). The 66-acre lake has a mean and maximum depth of 3.6 m (11.8 feet) and 8.0 m (26.0 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 790 ac-ft. The lake has two separate depressions each reaching a maximum depth of approximately 8 meters (26 feet). Roughly 52 percent of the lake's area is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation). Additionally, the lake's surface area and 2,400-acre watershed translates to a rather large 36:1 watershed-to-lake size ratio. The greater the ratio, the greater the potential stress on the lake from surface runoff.

The Sweeney Lake branch of Bassett Creek flows into the lake on the south and outlets at the north over a dam. Sweeny Lake is connected to Twin Lake during periods of high lake levels by a meandering channel through a cattail marsh between the northeast shore of Sweeny and the north shore of Twin Lake. The surface elevations of the two lakes are about the same, indicating a minimal flow between the two lakes except during periods of heavy runoff when transfer of water between the two lakes increases. The west and south shoreline of Sweeny Lake consists of privately owned single family homes. The east shore is bordered by the Glenwood Hills Hospital and park consisting of a lawn, a golf course, and a wooded area (Barr, 1994).

While the lake has been monitored at two separate sites (north end and south end) in the past, only one site (the southern site) was monitored in 2006. The lake was monitored 10 times between mid-May and mid-October, 2006. Results are presented on graphs and data tables on the following page. During each monitoring event, the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as the perceived physical condition and recreational suitability.

2006 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	95.9	39.0	188.0	D
CLA (µg/l)	23.7	11.0	37.0	C
Secchi (m)	1.0	0.9	1.2	D
TKN (mg/l)	1.96	1.20	6.60	
			Overall Grade	D

The lake's 2006 overall grade (D) is the worst recorded to date. The lake's overall grade in 2000-2005 was a C. No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's quality seems well represented by an overall grade of C-/D+. To better understand the quality of the lake and what direction it may be heading, continued monitoring is suggested.

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The 2004 mean perceived physical condition of the lake was 1.1 (between 1- "crystal clear" and 2- "some algae present"), while the mean recreational suitability was 1.0 (1- "beautiful").

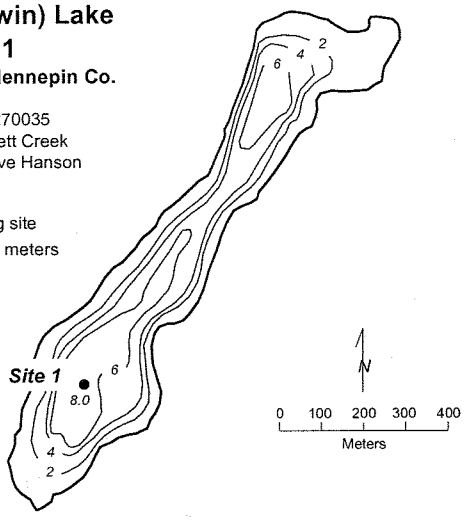
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

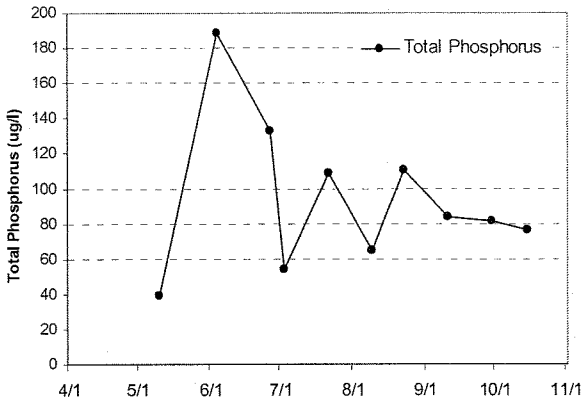
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Kent Johnson of the Metropolitan Council at (651) 602-8117 or kent.johnson@metc.state.mn.us.

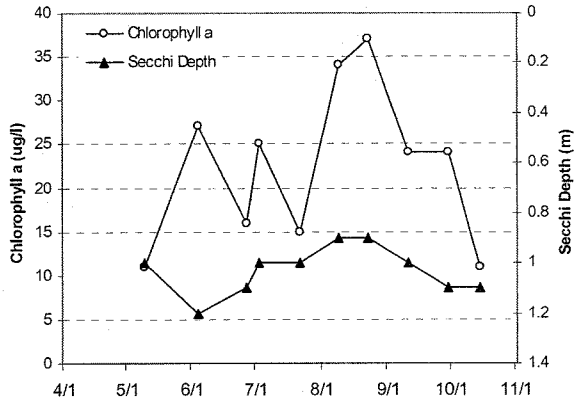
Sweeney (Twin) Lake
Site 1
Golden Valley, Hennepin Co.

Lake ID: 270035
WMO: Bassett Creek
Volunteer: Dave Hanson

● Sampling site
Contours in meters

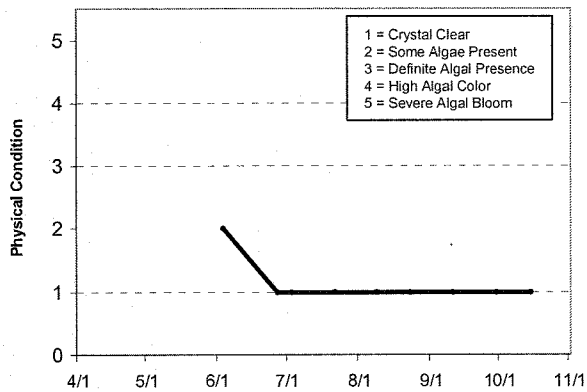






2006 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
5/10/06	15.9		10.8		11	39		1		
6/4/06	24.2		9.5		27	188		1.2	2	1
6/27/06	25.2		8.4		16	133		1.1	1	1
7/3/06	25.6		6.8		25	54		1	1	1
7/22/06	27.3		7.9		15	109		1	1	1
8/9/06	27		8.3		34	65		0.9	1	1
8/23/06	25.5		9.1		37	110		0.9	1	1
9/11/06	20		8.1		24	84		1	1	1
9/30/06	15.8		10.2		24	81		1.1	1	1
10/15/06	11.1		10.3		11	76		1.1	1	1

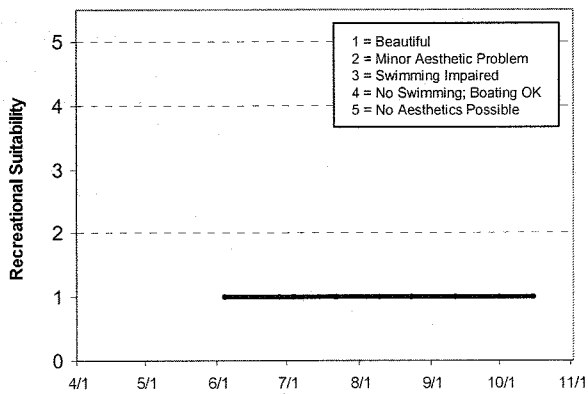


Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus													
Chlorophyll a													
Secchi Depth													
Overall													

Year	1993	1994	1995	1996	1997	1998	1999	2000 Site 1	2000 Site 2	2001 Site 1	2001 Site 2	2002 Site 1	2002 Site 2
Total Phosphorus								C	C	C	C	C	
Chlorophyll a								C	C	B	C	B	
Secchi Depth								D	D	C	C	C	
Overall								C	C	C	C	C	

Year	2003 Site 1	2003 Site 2	2004 Site 1	2004 Site 2	2005 Site 1	2005 Site 2	2006 Site 1	2006 Site 2
Total Phosphorus	C		C		C		D	
Chlorophyll a	B		B		C		C	
Secchi Depth	C		C		C		D	
Overall	C		C		C		D	



Source: Metropolitan Council and STORET data

Westwood Lake (27-0711) *Bassett Creek Watershed Management Organization*

This was the eighth year of CAMP monitoring in Westwood Lake (1993 and 2000-2005 being the others), which is located in the City of St. Louis Park (Washington County). The 41-acre lake has a maximum depth of 2.0 m (six-and-a half feet). Because of the shallowness of the lake, it is entirely considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation), and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

Westwood Lake was monitored eight times between mid-April and mid-September, 2006. Results from the monitoring are presented on the information sheet on the next page.

2005 summer (May-September) data summary

Parameter	*Mean*	*Minimum*	*Maximum*	*Grade*
TP (µg/l)	148.0	30.0	374.0	D
CLA (µg/l)	13.6	5.9	35.0	B
Secchi (m)	1.3	0.7	1.5	C
TKN (mg/l)	1.70	1.20	2.20	
			Overall Grade	C

Because there is a limited amount of historic data available for Westwood Lake, it is not possible to determine any long-term trends. In the short-term however, the lake's water quality shows a wide range of fluctuation (overall grade of D in 1982, C in 1993, 2001-2002, 2005 and 2006, and B in 2000 and 2003-2004). To better understand the lake's water quality and where it may be heading, continued monitoring is suggested.

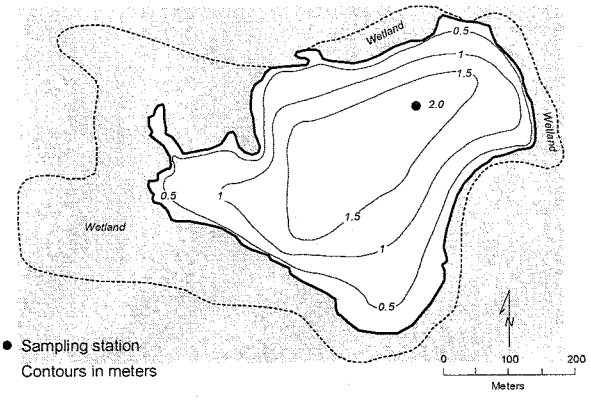
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The average user perception rankings, on a 1-to-5 scale, were 2.0 for physical condition (2- "some algae present"), and 3.6 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Kent Johnson of the Metropolitan Council at (651) 602-8117 or kent.johnson@metc.state.mn.us.

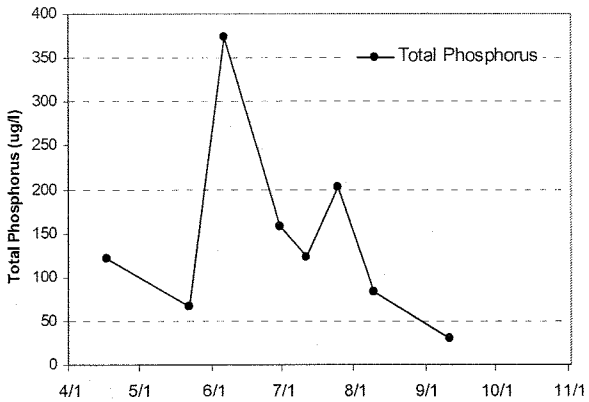
Lake ID: 270711
WMO: Bassett Creek

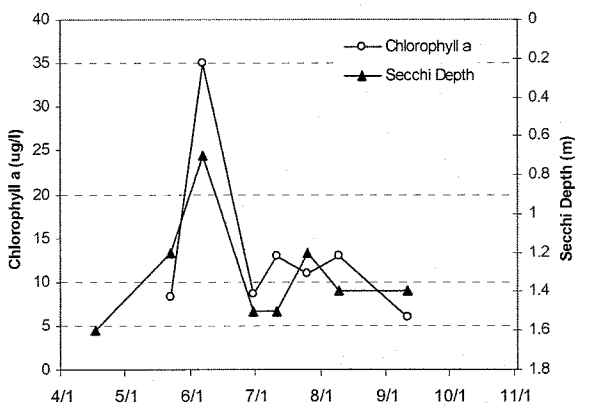
Westwood Lake,
St. Louis Park, Hennepin Co.

Volunteers: The Westwood Nature Center



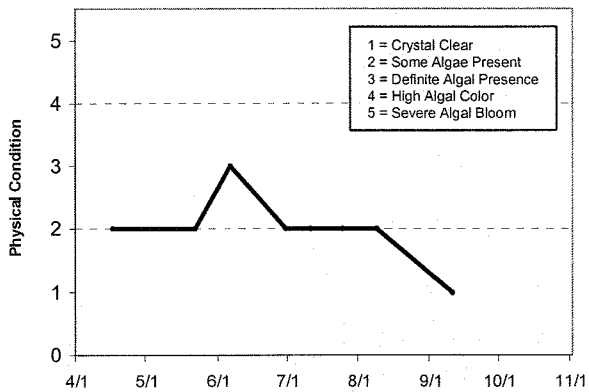
● Sampling station
Contours in meters





2006 Data

	Surf. Tmp	Bot. Tmp	Surf. DO	Bot. DO	CLA	Surf. TP	Bot. TP	Secchi	PC	RS
Date	C	C	mg/L	mg/L	ug/L	ug/L	ug/L	M	1 thru 5	1 thru 5
4/17/06	16					121		1.6	2	1
5/22/06	19				8.3	66		1.2	2	4
6/6/06	25				35	374		0.7	3	4
6/30/06	28				8.7	158		1.5	2	4
7/11/06	25.9				13	122		1.5	2	4
7/25/06	27.8				11	203		1.2	2	4
8/9/06	25.7				13	83		1.4	2	4
9/11/06	16.6				5.9	30		1.4	1	4

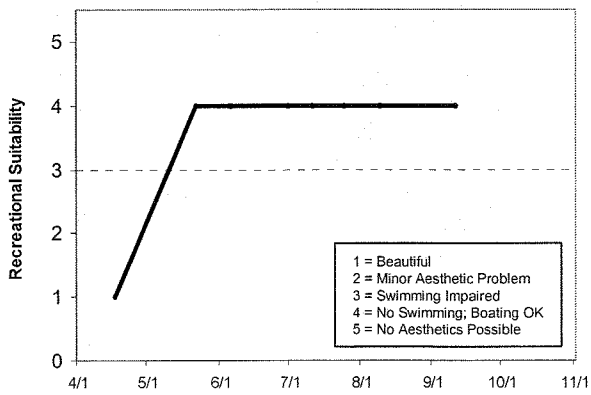


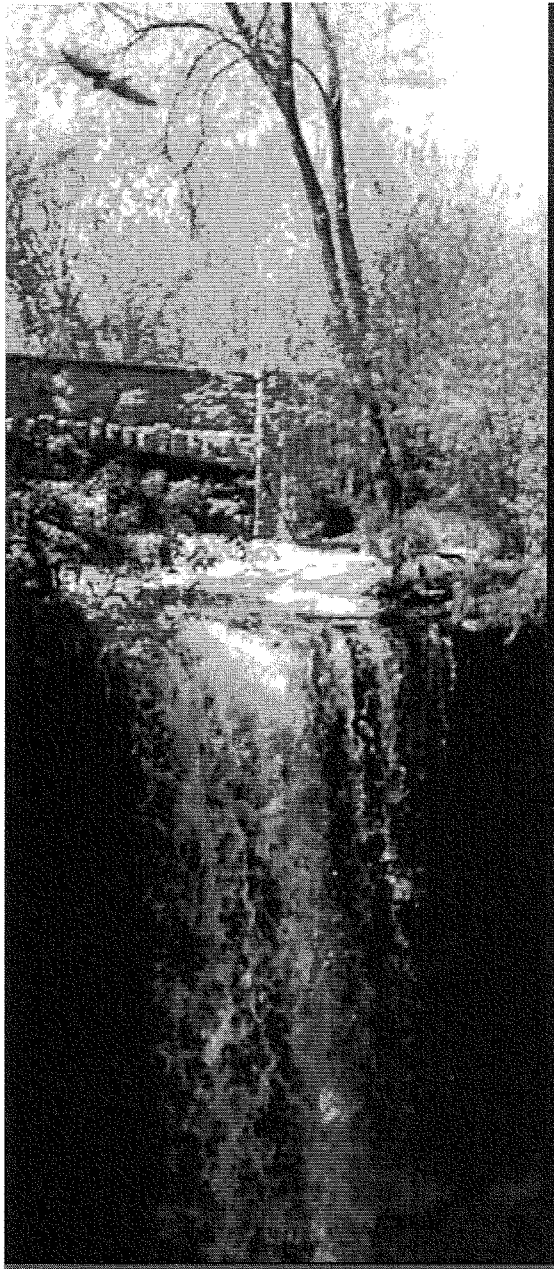
Lake Water Quality Grades Based on Summertime Averages

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Total Phosphorus			F										
Chlorophyll a			C										
Secchi Depth			D										
Overall			**D**										

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total Phosphorus	C							B	B	C	C	C	D	D
Chlorophyll a	C							B	C	B	A	A	C	B
Secchi Depth	C							C	C	C	C	C	C	C
Overall	**C**							**B**	**C**	**C**	**B**	**B**	**C**	**C**

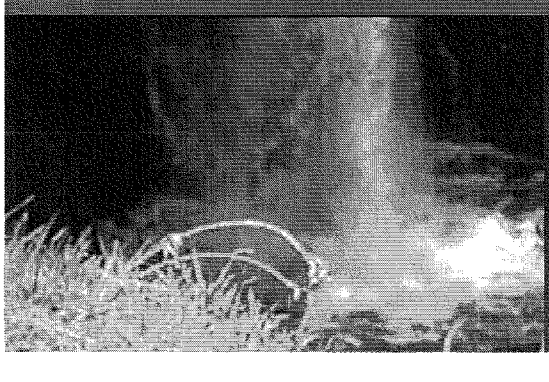
Source: Metropolitan Council and STORET data





Minneapolis Park & Recreation Board

2005 Water Resources Report



Operations Division

Environmental Operations Section

October 2006

www.minneapolisparks.org

2005 Water Resources Report

Prepared by:
Sara Aplikowski
Melissa Baker
Amanda Janet
Michael Perniel
MaryLynn Pulscher

Minneapolis Park & Recreation Board
Environmental Operations
3800 Bryant Avenue South
Minneapolis, MN 55409-1029
612.370.4900
www.minneapolisparks.org

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Minneapolis Park & Recreation Board

City of Minneapolis
Public Works

Bassett Creek Watershed Management Commission

Minnesota Department of Transportation
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EXECUTIVE SUMMARY

An overview of the results for the 2005 monitoring season as collected by the Minneapolis Park and Recreation Board (MPRB) Environmental Operations Section are presented. Details and analyses are presented within the report.

The MPRB monitors the water quality of Brownie, Calhoun, Cedar, Diamond, Grass, Harriet, Hiawatha, Isles, Loring, Nokomis, Powderhorn, Spring, Webber and Wirth lakes. Historical data from 1991 – 2005 are used to calculate trophic state index (TSI) trends and estimate fertility for each lake. Based on the trophic state report for 2005, the following can be concluded:

Lakes with Decreasing TSI trends and Decreasing Fertility	Lakes with Stable TSI Trends	Lakes with Increasing TSI Trends and Increasing Fertility
➢ Lake Calhoun ➢ Cedar Lake ➢ Lake Harriet ➢ Wirth Lake	➢ Brownie Lake ➢ Lake Hiawatha ➢ Lake of the Isles ➢ Loring Pond ➢ Lake Nokomis ➢ Powderhorn Lake ➢ Webber Pond	➢ Spring Lake

The water quality of Lake Calhoun and Lake Harriet has improved to pre-European settlement conditions. Rehabilitation efforts have helped these urban lakes tremendously. The other noteworthy lake was Wirth Lake which continues to show a steadily decreasing TSI. Powderhorn Lake received its second year of barley straw in an effort to improve water clarity.

In early summer of 2005, a fish kill occurred on Lake Harriet. It is believed to have been caused by the naturally occurring *Columnaris* bacteria. The fish kill on Lake Nokomis in August 2005 was likely due to low dissolved oxygen levels at night.

The MPRB monitored 10 public beaches for *Escherichia coli* (*E. coli*, as recommended by the Environmental Protection Agency). These bacteria are used as indicators of pathogens in the water. Using the EPA's single sample maximum guideline for *E. coli* (235 per 100 mL), the MPRB had a total of eight beach closures. The following beaches were closed:

Beach Name	Date Closed	*E. coli* (cfu/100 mL)
Calhoun 32nd Street	6/27/2005	855
Calhoun 32nd Street	6/28/2005	340
Calhoun 32nd Street	6/29/2005	280
Calhoun 32nd Street	6/30/2005	467
Calhoun 32nd Street	7/20/2005	635
Calhoun 32nd Street	8/8/2005	485
Calhoun Main	8/1/2005	264
Harriet Southeast	6/27/2005	559

A new assessment of the lakes began in 2004 and was further refined in 2005. The Lake Aesthetic and User Recreation Index (LAURI) grades the lakes on aesthetics, aquatic plants (as they interfere with recreation), water clarity and public health.

Exotic aquatic plants out-compete native species and reduce the available habitat for fish and other organisms. They also reduce the overall aesthetic appeal of area lakes. Eurasian watermilfoil harvesting was completed on Calhoun, Cedar, Harriet, Isles, Nokomis and Wirth in 2005. In 2005, a Point Intercept aquatic plant survey was conducted on Isles, Nokomis, Powderhorn, Webber and Wirth.

MPRB monitored storm sewers within Minneapolis to comply with the federal National Pollutant Discharge Elimination System (NPDES) permit. Four new sites were selected for 2005. The purpose of monitoring is to characterize the impacts of stormwater discharges. The results of the 2005 data were typical for stormwater as compared to reports from other cities.

The City of Minneapolis has many Best Management Practices (BMPs) throughout the city. BMPs include procedures and structures designed to help reduce water pollution. The MPRB monitored one stormwater pond in North Minneapolis to evaluate its effectiveness, known as Logan Pond. Logan Pond provided over 50 percent removal of many stormwater pollutants. Further monitoring will help better determine how effective Logan Pond is at improving water quality.

The MPRB also monitored a permeable paver lot at the City of Minneapolis' Animal Shelter. Permeable pavers are a BMP designed to increase infiltration. The MPRB monitors the system to assess the effectiveness on water quality improvements. Many rainfall events were treated by the permeable paver lot but some events showed larger volumes than possible for the calculated drainage area. This generally occurred for large rain events. Further monitoring is necessary to assess whether the drainage area is accurately accounted for in flow volume calculations.

The MPRB presents the precipitation and temperature data collected by the National Weather Service each year from the rain gage located at the Twin Cities airport. In general, most 2005 average monthly temperatures were warmer than normal. The average annual temperature for 2005 was 48.2° F, 2.9° F above normal. Spring through mid summer had below normal precipitation while August through October was an inch or more above normal. An unusually large rainfall event occurred on 10/4/05-10/5/05 resulting in 4.89 inches at the Twin Cities airport. The annual recorded rainfall total for 2005 was 33.41 inches, 3.96 inches above normal.

15 SPRING LAKE

HISTORY

Spring Lake is a small, meromictic lake. Meromictic lakes do not mix completely; the deeper layers of the lake remain stratified. It is located to the west of Loring Pond, adjacent to Kenwood Parkway in central Minneapolis. Highway 394 borders the northwest portion of the riparian zone. The lake is surrounded by parkland. Spring Lake's subwatershed is 195 acres. It is in the Bassett's Creek watershed. Table 15A shows the morphometric data on Spring Lake.

Table 15A. Spring Lake morphometric data.

Surface Area (acres)	Mean Depth (m)	Maximum Depth (m)	Volume (m^3)	Watershed Area (acres)	Watershed: Lake Area (ratio)
3	3.0	8.5	$3.65x10^4$	45	15.0

WATER QUALITY TRENDS (TSI)

Figure 15A shows the Spring Lake linear regression to be roughly increasing as the TSI scores decrease. A detailed explanation of TSI can be found in Section 1.

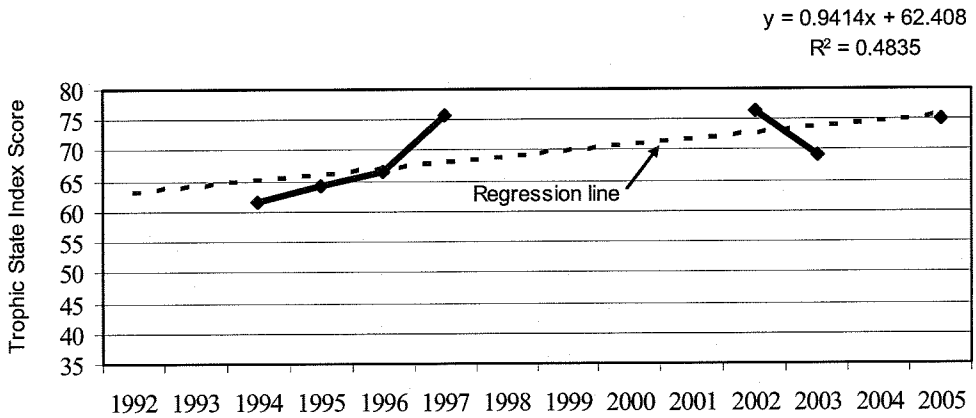

Figure 15A. Spring Lake TSI scores and regression analysis.

These scores must be viewed with caution as they are based on a limited number of samples. Spring Lake was not monitored in 1998. From 1999 – 2001 samples were collected quarterly. Only one of those samples a year was during the growing season. In 2002 and 2003, Spring Lake was sampled monthly to collect enough data to calculate a TSI score. Water quality improvements were seen in 2003 compared to 2002, but the overall trend analysis (1994 – 2005) indicates degradation.

BOX AND WHISKER PLOTS

The box and whisker plots show the scatter within the years data set for the Secchi, chlorophyll-*a* and total phosphorus in more detail. Long-term lake monitoring is necessary to evaluate the seasonal and year-to-year variations seen in each lake and predict trends. The current sampling schedule is to monitor Spring Lake every other year. A detailed explanation of box and whisker

plots can be found in Section 1. Figure 15B shows the box and whisker plots of TSI data.

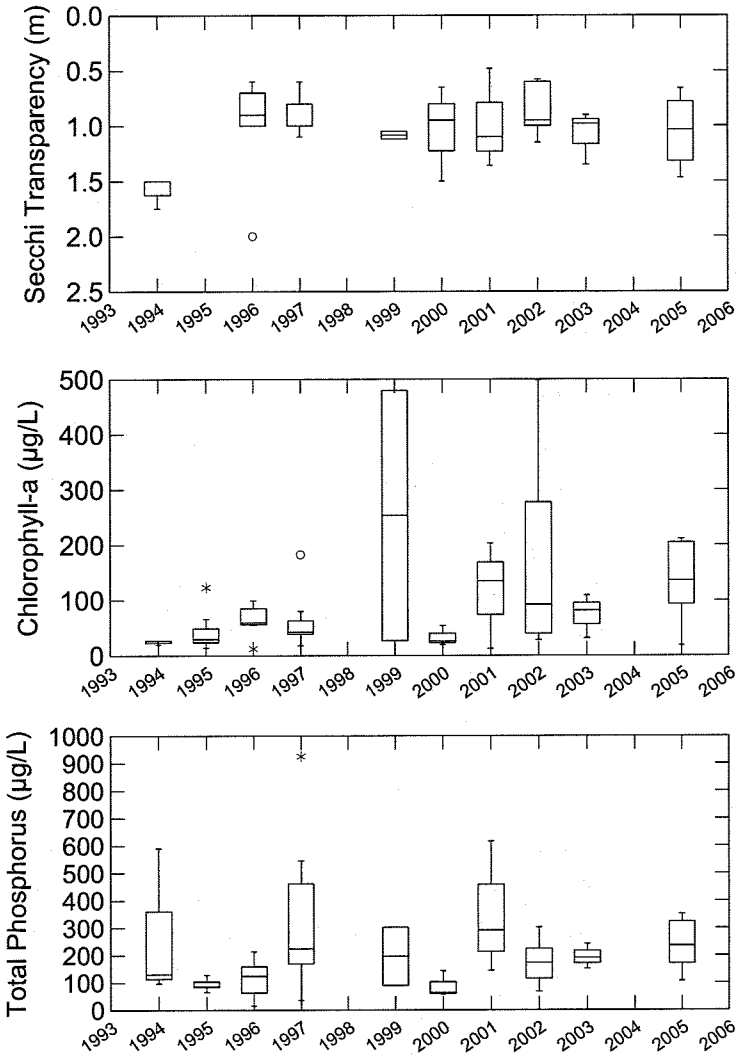

Figure 15B. Box and whisker plots of Spring Lake TSI data.

Spring Lake is eutrophic with considerable amounts of algae. The Spring Lake box plot is made composed of only three data points for most years because of a limited sampling schedule. Analysis is difficult with so few historical data points. The limited number of samples are best viewed as snapshots of the lake's water quality with the understanding that lakes vary within the year, as well as from year to year. It is difficult to compare meromictic lakes with dimictic or even polymictic lakes.

WINTER ICE COVER

The ice came off Spring Lake on April 4, 2005 which is three days later than the average for this lake. Ice covered Spring Lake on November 30, 2005 which is one day later than average. See Section 1 for details on winter ice cover records and Section 18 for a comparison with other lakes.

PHYTOPLANKTON AND ZOOPLANKTON

Phytoplankton and zooplankton are the microscopic plant and animal life that form the basic food web of lake ecology. The greenness of a lake is measured by chlorophyll-*a* (chl-*a*) as an expression of the phytoplankton present. In 2005, due to laboratory problems, complete phytoplankton and zooplankton analysis were not available for the entire sampling season. Tables 15B and 15C show the phytoplankton and zooplankton data, respectively. Table 15B shows the 2005 dominant phytoplankton for the specific sampling trip. The percent (%) dominant are in reference to the total (division) community. Figure 15C shows the chlorophyll-*a* data throughout 2005. The chlorophyll-*a* appears high at around 200 µg/L throughout most of the spring and summer. Table 15C shows the zooplankton distribution for the data available in 2005. Spring Lake zooplankton appears to be dominated by Rotifera. It should be noted the Protozoa were undetected.

Table 15B. Spring Lake 2005 sampling trips and the corresponding dominant phytoplankton division.

Lake	Date	Dominant Division	% Dominant
Spring	7/8/2005	Pyrrhophyta	41
Spring	8/15/2005	Pyrrhophyta	30
Spring	9/15/2005	Chrysophyta	48
Spring	10/14/2005	Chrysophyta	58

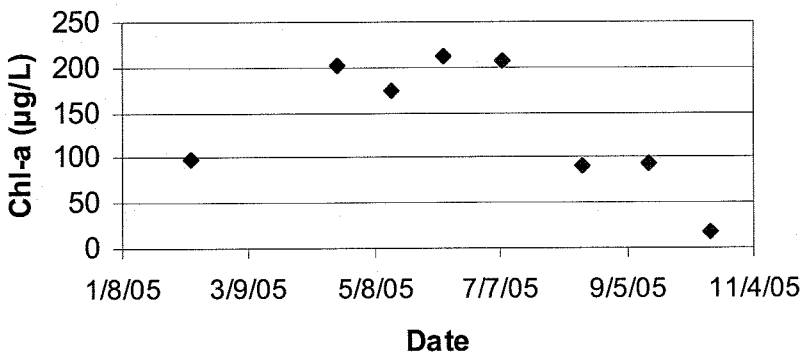

Figure 15C. Spring Lake 2005 chlorophyll-*a* data.

Table 15C. Spring Lake 2005 zooplankton tow data distribution. ND = not detected.

Vertical Tow Depth (m)	Date	Lake	Arthropoda units/L	Protozoa units/L	Rotifera units/L	Total Zooplankton units/L	% Arthropoda	% Protozoa	% Rotifera
7	7/8/2005	Spring	20	ND	174	194	10%	ND	90%
7	8/15/2005	Spring	38	ND	92	130	29%	ND	71%
6	9/15/2005	Spring	96	ND	170	266	36%	ND	64%
5	10/14/2005	Spring	51	ND	478	529	10%	ND	90%

EVENTS REPORT

Recent vegetation restoration projects have occurred in the park. Activities have included buckthorn removal and applying wood chips to the trails.

17 WIRTH LAKE

HISTORY

Wirth Lake was historically known as Keegan's Lake and renamed Glenwood Lake in 1890. It was acquired by the Minneapolis Park and Recreation Board (MPRB) in 1909 and named after Theodore Wirth in 1938 at the end of his tenure as park superintendent. This 38-acre purchase enlarged the previously owned area of 64 acres that were purchased in 1889. A MPRB nursery was established in 1910 on the west side of the lake and provided the system with plantings through 1980. As with most other lakes in the MPRB system, thousands of cubic yards of sediment from Wirth were dredged. The spoils were used to create a beach on the east side of the lake. Figure 17A shows a photograph of Wirth Lake.

Wirth Lake is generally dimictic but may mix during extreme events during the summer. Historically, the lake was considered infertile to moderately fertile. Early restoration projects included rotenone in 1977 to remove the rough fish and subsequent stocking of channel catfish, largemouth bass, walleye and blue gills. A summer aerator was in operation beginning in the early 1980s but was no longer in use by 1991. A portable winter aerator was used for a few years before a permanent hypolimnetic aeration system was put in place in 2002. This was done in cooperation with the Minnesota Department of Natural Resources (MDNR). Figure 17B shows a bathymetric map of Wirth Lake. The stage and bleachers described on the map were used for the Aquafollies from 1941-1964 but are no longer present. Table 17A shows the Wirth Lake morphometric data.

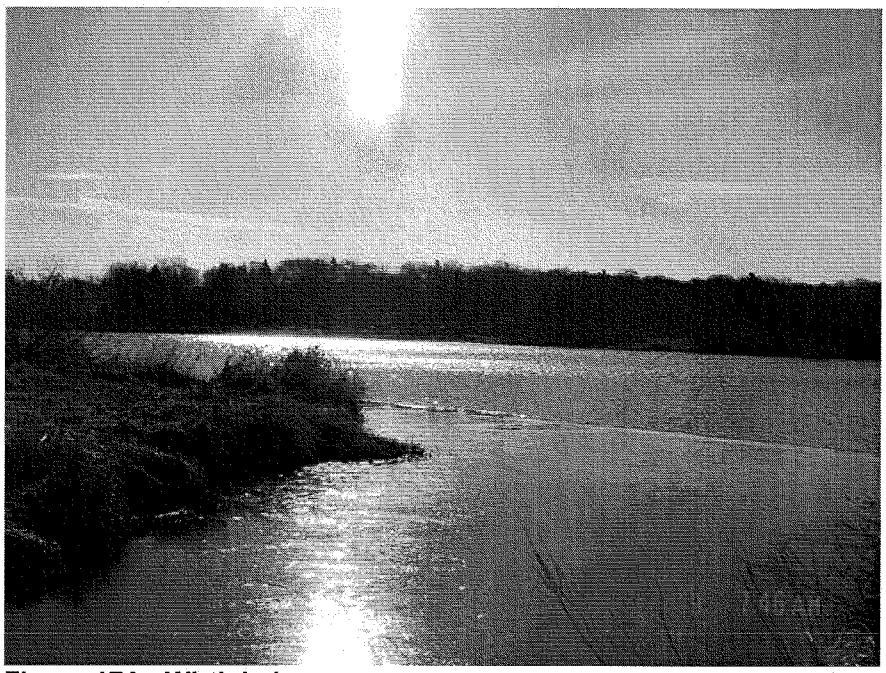

Figure 17A. Wirth Lake.

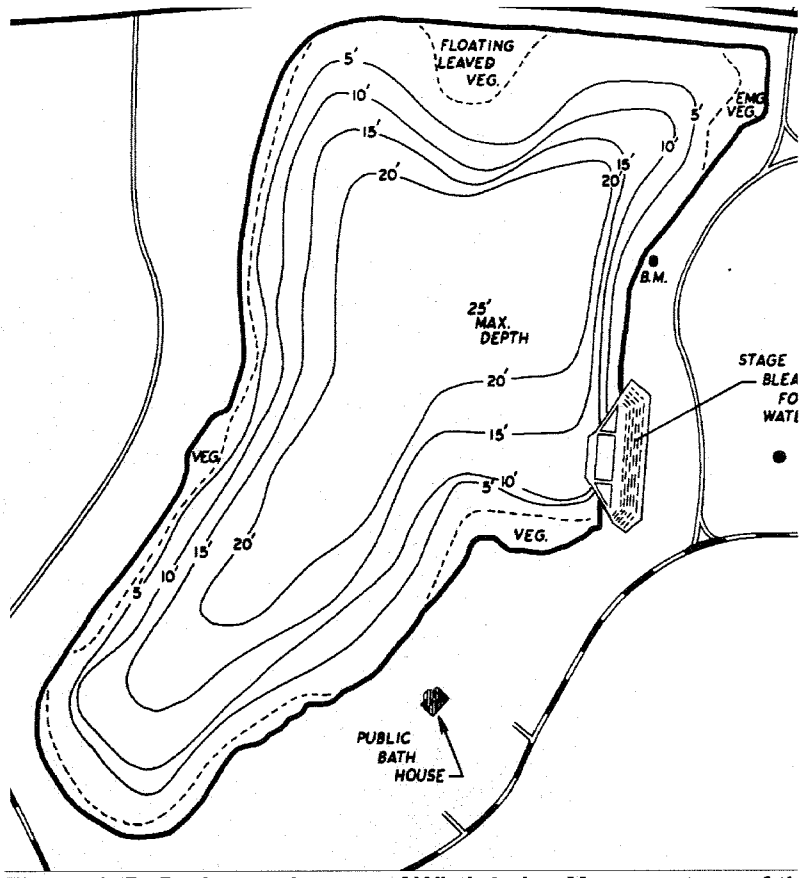

Figure 17B. Bathymetric map of Wirth Lake. Map courtesy of the MDNR.

Table 17A. Wirth Lake morphometric data. * Littoral area defined as less than 15 feet deep

Surface Area (acres)	Mean Depth (m)	Maximum Depth (m)	% Littoral Area*	Volume (m^3)	Watershed Area (acres)	Watershed: Lake Area (ratio)
39	4.3	7.9	61%	$6.70x10^5$	348	9.4

LAKE LEVEL

Wirth Lake levels are recorded weekly during ice free conditions. The historical lake levels for Wirth Lake are shown in Figure 17C for the entire period of record. Mean sea level elevation can be calculated by adding the city datum (710.3 feet) to the elevations shown in Figure 17C.

See Section 18 for a comparison between other MPRB lake levels.

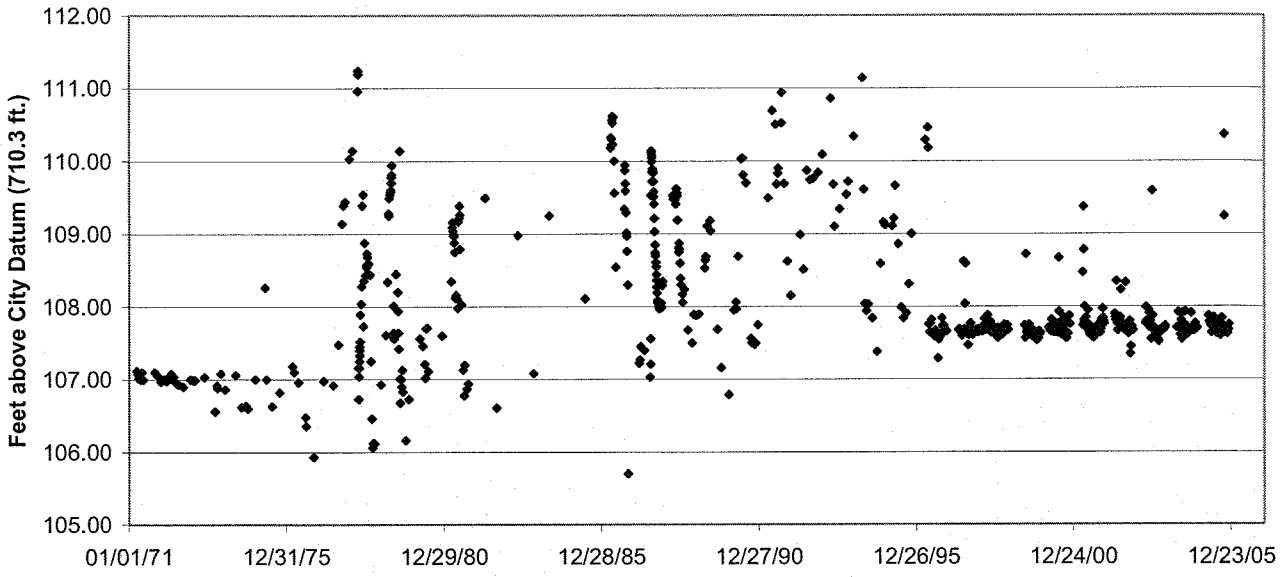

Figure 17C. Historical lake levels for Wirth Lake.

WATER QUALITY TRENDS (TSI)

Figure 17D shows the Wirth Lake linear regression to be decreasing as the TSI scores fall. A detailed explanation of TSI can be found in Section 1.

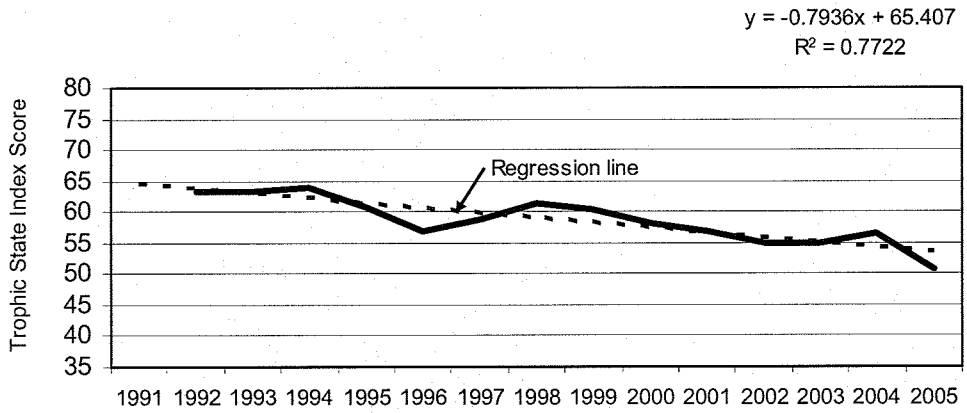

Figure 17D. Wirth Lake TSI scores and regression line.

Water quality is generally improving at Wirth Lake. The regression correlation is strong with an R^2 of 0.77. Wirth Lake has a TSI score that is average for this ecoregion. It falls slightly above the 50th percentile category for lakes in this ecoregion (based on calculations from the Minnesota Pollution Control Agency, using the Minnesota Lake Water Quality Data Base Summary, 1998).

BOX AND WHISKER PLOTS

The box and whisker plots show in more detail the scatter within the years data set for the Secchi, chlorophyll-*a* and total phosphorus. Long-term lake monitoring is necessary to evaluate the seasonal and year-to-year variations seen in each lake and predict trends. Figure 17E shows

box and whisker plot data from 1992-2005. The median for chlorophyll-*a*, in 2005, was low. A detailed explanation of box and whisker plots can be found in Section 1.

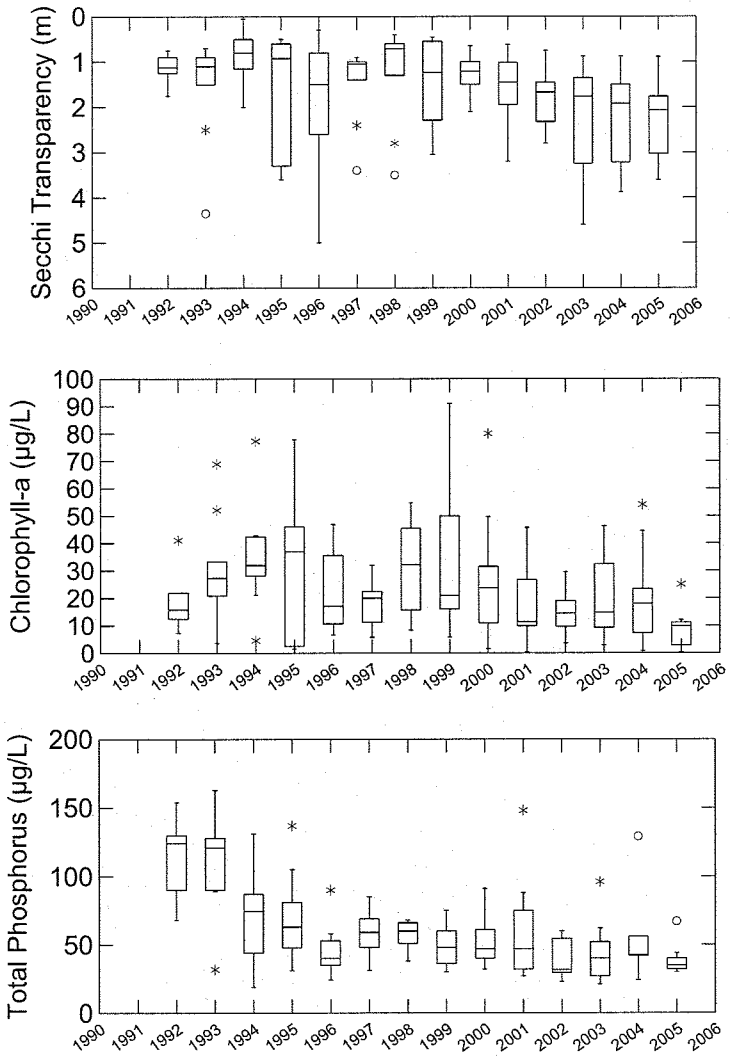

Figure 17E. Box and whisker plots of Wirth Lake.

Since the early 1990's, the median phosphorus levels appear to be decreasing and the Secchi readings appear to be increasing, pointing to improved water quality.

BEACH MONITORING

Bacteria levels were monitored at one location on Wirth Lake at Wirth Beach. As can be seen from Table 17B, the season long geometric mean for *E. coli* was extremely low. Wirth Beach was amongst the lowest of season long geometric mean of all MPRB beaches and was open for the entire season. Figure 17F illustrates the box and whisker plot of *E. coli* sampling results (per 100 mL) for 2003-2005. The box and whisker plot shows in more detail the scatter, within the years, of the data set.

Table 17B. Summary of *E. coli* results (per 100 mL) for Wirth Beach in 2005.

Statistical Calculation	Wirth
Minimum Value	2
Maximum Value	102
Median Value	13
Geometric Mean	7
Standard Deviation	19
Number of Samples Taken	45

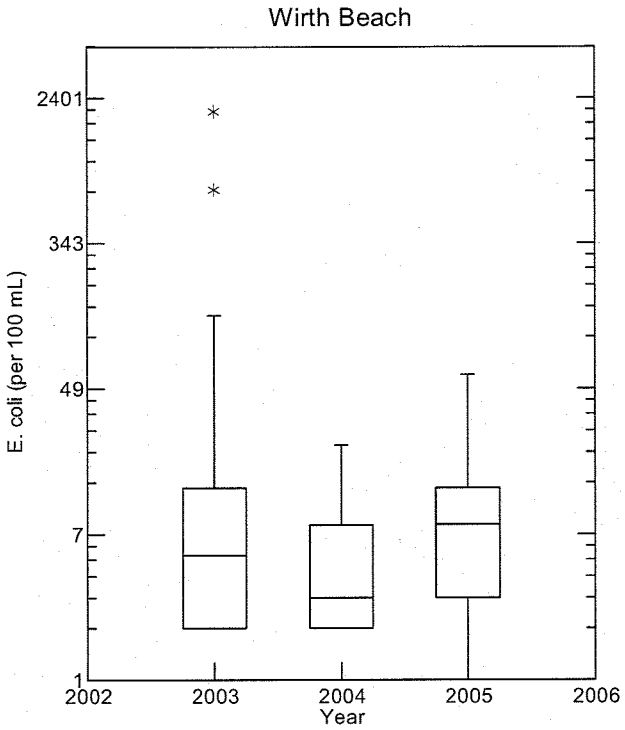

Figure 17F. Box and whisker plot of Wirth Beach *E. coli* results (per 100 mL), 2003-2005. Note the log scale on the Y-axis,

Table 17C gives the parameters that correlated best with the *E. coli* at Wirth beach. Very strong positive correlations existed between *E. coli* and lake elevation and rain and very strong negative correlations existed with air and water temperature and specific conductivity. There was also a strong negative correlation with beach attendance.

Table 17C. Selected correlations (r) between *E. coli* and select variables at Wirth Beach in 2005.

Variables	Wirth
Air Temperature	-0.537
Beach Attendance from Previous Day	-0.353
Lake Elevation	0.703
Rainfall Amount from Previous 24 Hours	0.598
Specific Conductivity	-0.741
Water Temperature	-0.657

According to 2004 and 2005 MPRB beach attendance reports, Wirth Beach was opened for a total of 440 and 430 hours, respectively, during the beach season and had a patron count of 2,000 and 5,100 consecutively. A 157% increase in beach attendance occurred from 2004 to 2005 and there was a 2% decrease in the amount of hours opened. The increase in beach attendance from 2004 to 2005 may be partially attributed to the renovation of the beach house and completion of a new retaining wall during the 2005 beach season. The decrease in the amount of hours opened from 2004 to 2005 may be partially attributed to inclement weather. Further details on MPRB beach monitoring can be found in Section 19.

Lake Aesthetic and User Recreation Index (LAURI)

The LAURI for Wirth Lake is shown in Figure 17G. Wirth Lake scored "excellent" for aesthetics, "good" for clarity, and "poor" for aquatic plant interferences. The lake also scored "excellent" for public health due to the extremely low *E. coli* values at the beach. Details on the LAURI can be found in Section 1.

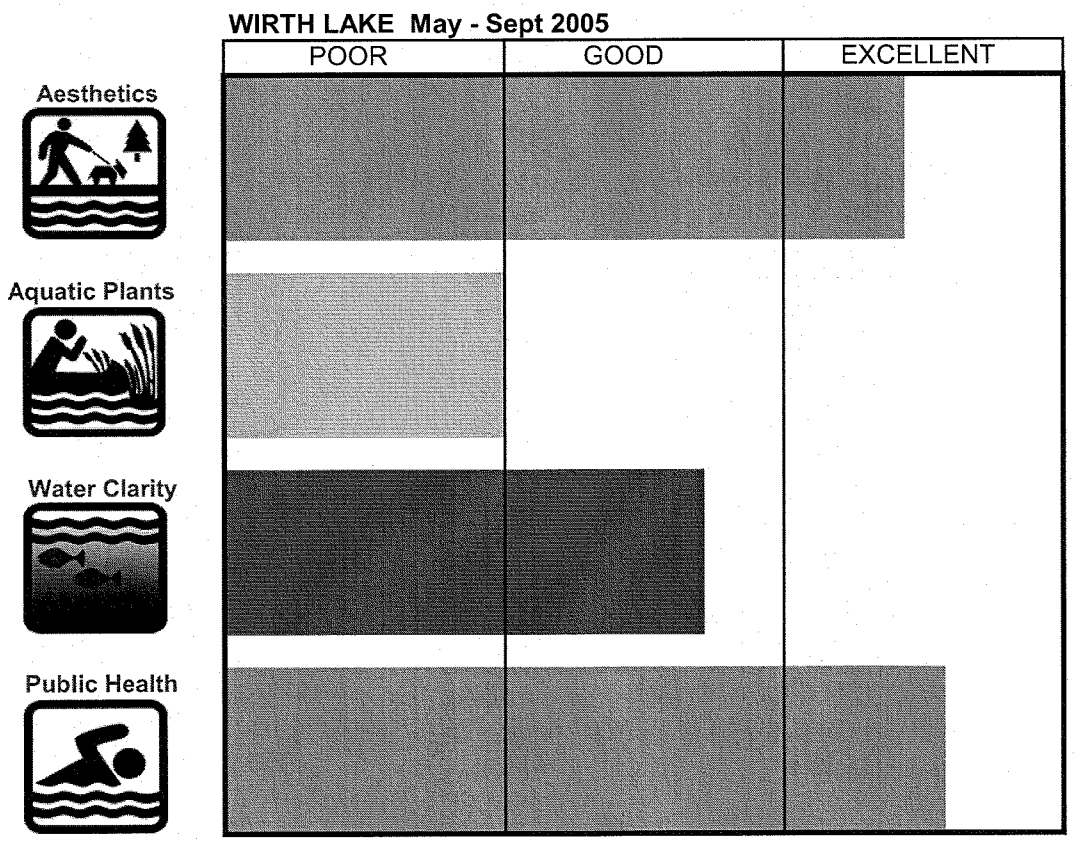

Figure 17G. Wirth Lake LAURI for 2005.

Winter Ice Cover

Ice came off Wirth Lake on April 5, 2005, which is four days later than average ice off. Ice came on to the lake for the winter on December 5, 2005, which is one week later than average. Details on winter ice cover records can be found in Section 1, and a comparison with other lakes

can be found in Section 18.

EXOTIC AQUATIC PLANT MANAGEMENT

The MDNR requires a permit to remove or control Eurasian watermilfoil. These permits limit the area from which milfoil can be harvested to protect fish habitat. The permits issued to the MPRB allowed for harvesting primarily in swimming areas, boat launches and in shallow areas where dense growth occurred. Wirth Lake was harvested for Eurasian watermilfoil in early June of 2005 due to nuisance milfoil growth near the beach. See Section 1 for details on aquatic plants.

PHYTOPLANKTON AND ZOOPLANKTON

Phytoplankton and zooplankton are the microscopic plant and animal life that form the basic food web of lake ecology. The greenness of a lake is measured by chlorophyll-*a* (chl-*a*) as an expression of the phytoplankton present. In 2005, due to laboratory problems, complete phytoplankton and zooplankton analysis were not available for the entire sampling season. Tables 17D and 17E show the phytoplankton and zooplankton data, respectively. Table 17D shows the 2005 dominant phytoplankton for the specific sampling trip. The percent (%) dominant are in reference to the total (division) community. The limited data set shows the dominant division appears to be blue-green algae (Cyanophyta), but green algae (Chlorophyta) were present earlier in the sampling period. The 2005 phytoplankton dominant division profile is similar to Cedar Lake. Figure 17H shows the chlorophyll-*a* data throughout 2005. The peak chlorophyll-*a* value was in the mid-twenties and was early in the spring. Table 17E shows the zooplankton distribution for the data available in 2005. The dominant zooplankton community appears to change through the sampling period where it changes from Arthropoda to Protozoa/Rotifera to Rotifera.

Table 17D. Wirth Lake 2005 sampling trips and the corresponding dominant phytoplankton division.

Lake	Date	Dominant Division	% Dominant
Wirth	6/20/2005	Chlorophyta	79
Wirth	7/5/2005	Chlorophyta	44
Wirth	7/18/2005	Cyanophyta	42
Wirth	8/9/2005	Cyanophyta	46
Wirth	8/23/2005	Pyrrhophyta	71
Wirth	9/13/2005	Cyanophyta	56
Wirth	9/27/2005	Cyanophyta	76
Wirth	10/18/2005	Cyanophyta	64

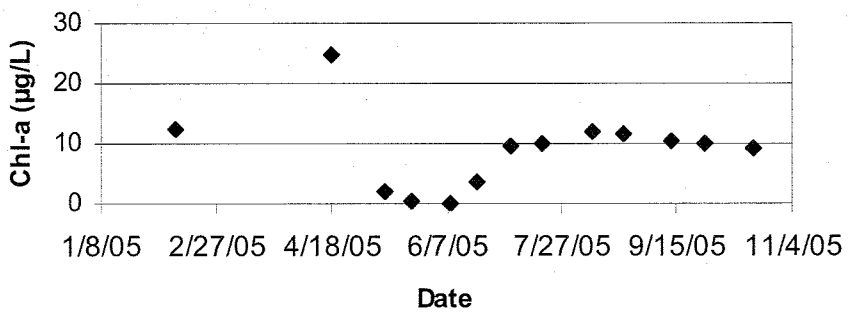

Figure 17H. Wirth Lake 2005 chlorophyll-*a* data.

Table 17E. Wirth Lake 2005 zooplankton tow data distribution. ND = not detected.

Vertical Tow Depth (m)	Date	Lake	Arthropoda units/L	Protozoa units/L	Rotifera units/L	Total Zooplankton units/L	% Arthropoda	% Protozoa	% Rotifera
7	7/5/2005	Wirth	87	ND	48	136	64%	ND	36%
7	8/9/2005	Wirth	300	811	811	1921	16%	42%	42%
7	9/13/2005	Wirth	92	6	157	255	36%	2%	61%
7	10/18/2005	Wirth	59	ND	115	174	34%	ND	66%

MACROPHYTE SURVEY

In fall of 2005, a point survey method of macrophytes was conducted using GIS mapping, GPS coordinates and rake methodology. The findings are presented in Table 17F. The two most common species were Coontail (*Ceratophyllum demrsum*) and Eurasian watermilfoil (*Myriophyllum spicatum*). Figure 17I shows the aquatic plant densities found on Wirth Lake during the August 2005 point intercept survey. The maximum depth plants were encountered was 9 feet. The frequency is the percentage of time the species was encountered at all of the sampling points.

Table 17F. Wirth Lake macrophyte survey.

Common Name	Species	Number of points w/ species present	Total points	Points <10ft	Frequency
Coontail	*Ceratophyllum demersum*	26	71	35	0.37
Eurasian watermilfoil	*Myriophyllum spicatum*	31	71	35	0.44
Northern watermilfoil	*Myriophyllum sibiricum*	4	71	35	0.06
Yellow Waterlilly	*Nuphar variegata*	3	71	35	0.04
White Waterlily	*Nymphaea odorata*	4	71	35	0.06
Algal leaved pondweed	*Potamogeton confervoides*	1	71	35	0.01
Flat-stemed pondweed	*Potamogeton sp.*	1	71	35	0.01

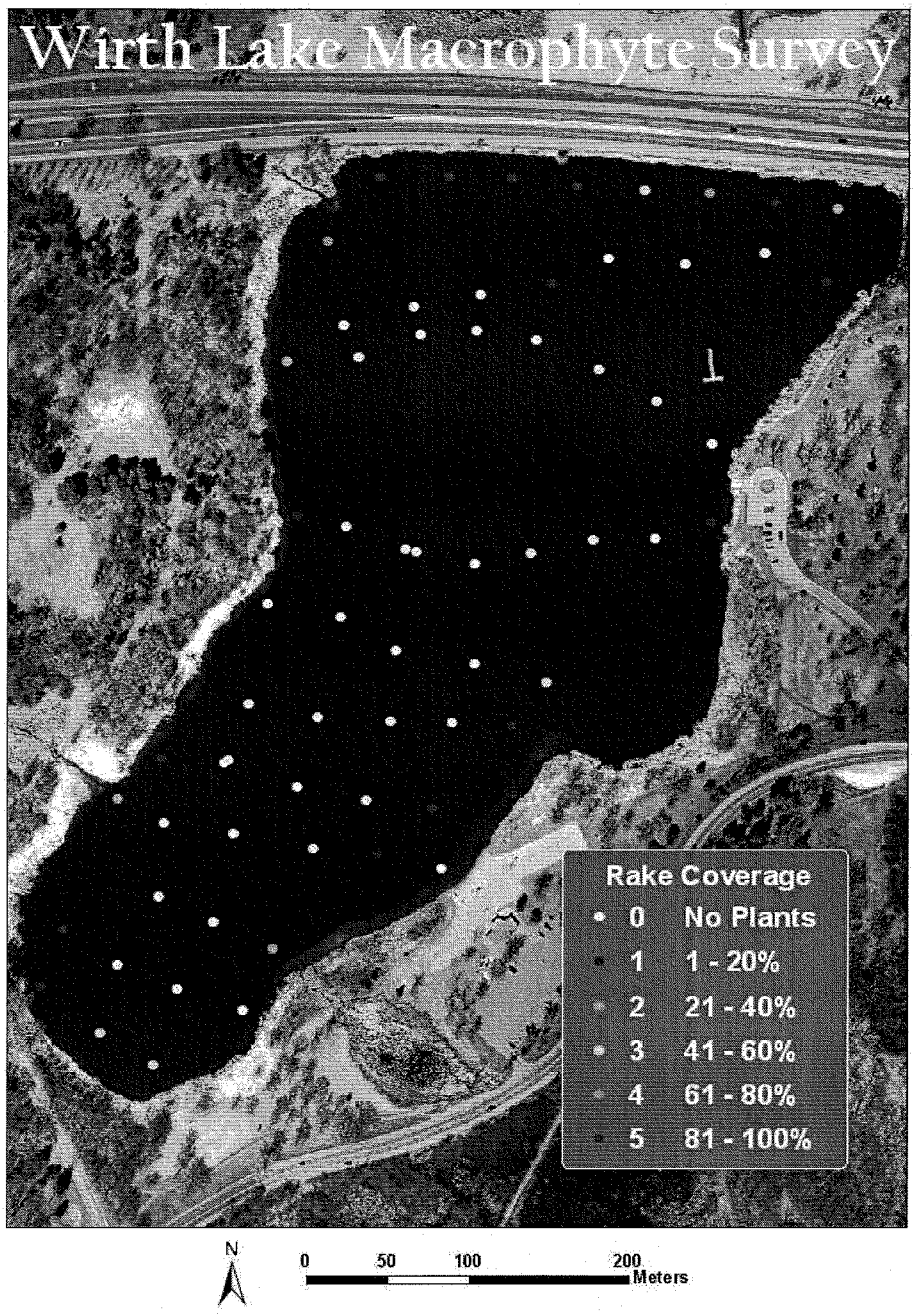

Figure 17l. Wirth Lake 2005 point intercept macrophyte survey.

FISH STOCKING

Additional information and a definition of fry, fingerling, yearling, and adult fish sizes can be found in Section 1.

Wirth Lake was stocked by MDNR in:
1998 with 290 adult Black Crappie 258 adult Bluegill Sunfish
1999 with 1,900 fingerling Channel Catfish
2000 with 1,900 fingerling Channel Catfish
2001 with 2,304 yearling Channel Catfish

2003 with 600 adult Walleye

WATER QUALITY PROJECTS

The Wirth Beach bathhouse underwent an extensive rehabilitation in 2004 – 2005. The new bathhouse used the footings from the 1957 bathhouse. A bench wall around the beach was also constructed. This is part of a larger renovation project for the Wirth Beach area with different phases being implemented at different times due to installment funding from the legislature and the Metropolitan Council.

More details on the project can be found at:
http://www.minneapolisparks.org/default.asp?PageID=738

18 Comparison Among Lakes

Morphometric Data

Table 18A compares the morphometric data among the Minneapolis lakes. The largest and deepest lake is Calhoun and the smallest and shallowest lake is Webber Pond.

Table 18A. Minneapolis lakes morphometric data. NA= No Data Available, *Littoral area defined as less than 15 feet deep.

Lake	Surface Area (acres)	Mean Depth (m)	Maximum Depth (m)	% Littoral Area*	Volume (m^3)	Watershed Area (acres)	Watershed: Lake Area (ratio)	Residence Time (years)
Birch	5.8	NA	NA	NA	NA	NA	NA	NA
Brownie	18	6.8	15.2	67%	$4.98x10^5$	369	20.5	2.0
Calhoun	421	10.6	27.4	31%	$1.80x10^7$	2,992	7.1	4.2
Cedar	170	6.1	15.5	37%	$4.26x10^6$	1,956	11.5	2.7
Diamond	41	0.9	2.1	100%	$7.15x10^4$	669	16.3	NA
Grass	27	0.6	1.5	NA	NA	386	14.3	NA
Harriet	353	8.7	25.0	25%	$1.25x10^7$	1,139	3.2	3.4
Hiawatha	54	4.1	7.0	26%	$8.95x10^5$	115,840	2,145	0.03
Isles	103	2.7	9.4	89%	$1.11x10^6$	735	7.1	0.6
Loring	8	1.5	5.3	NA	$4.88x10^4$	24	3.0	NA
Nokomis	204	4.3	10.1	51%	$3.54x10^6$	869	4.3	4.0
Powderhorn	11	1.2	6.1	99%	$5.43x10^4$	286	26.0	0.2
Ryan	18	NA	10.7	50%	NA	5,510	306	NA
Spring	3	3.0	8.5	NA	$3.65x10^4$	45	15.0	NA
Webber	3	0.9	2.0	NA	$1.10x10^4$	2	0.7	NA
Wirth	39	4.3	7.9	61%	$6.70x10^5$	348	9.4	NA

Largest Lake: Lake Calhoun is 412 acres.
Smallest Lake: Webber Pond is 3 acres.
Deepest Lake: Lake Calhoun at 89 feet 11 inches.

Water Quality Trends (TSI)

Changes in lake water quality can be tracked by analyzing long-term trends in Trophic State Index (TSI) scores. The Minneapolis Park and Recreation Board (MPRB) uses TSI scores to assess changes in water quality and evaluate the effectiveness of restoration and management activities on the trophic state of the lakes. Detailed information on TSI scores can be found in

Section 1.

Lakes in the North Central Hardwood Forest (NCHF) ecoregion frequently fall into the eutrophic category and the lowest trophic status lakes typically fall into the mesotrophic category. All the sampled lakes in Minneapolis are either eutrophic or mesotrophic with one lake, Calhoun, bordering on oligotrophic due to restoration activities. TSI scores dating back to 1991 are presented in Table 18B. Trend lines were calculated using a linear regression for all lakes and the fit was assessed with R^2. For more detailed information on TSI scores and nutrient related water quality parameters, see the individual lake sections (2-17).

Table 18B. Average Carlson TSI scores for Minneapolis lakes.
ID = insufficient data, NS = not sampled.

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Brownie	NS	NS	55	55	55	56	58	ID	ID	ID	ID	58	NS	58	NS
Calhoun	54	59	50	46	48	47	43	48	47	46	46	43	43	40	37
Cedar	54	54	62	52	58	51	45	43	45	47	48	48	49	47	48
Diamond	NS	67	59	66	71	60	68	73	67	71	68	60	71	73	79
Grass	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	77	80	61	NS
Harriet	47	50	45	47	51	52	43	47	49	48	45	44	45	43	40
Hiawatha	NS	58	58	57	59	59	58	58	59	65	58	59	58	60	56
Isles	55	64	65	58	59	55	52	56	56	53	58	59	62	58	54
Loring	NS	60	59	61	65	65	NS	63	71	73	71	70	69	65	63
Nokomis	NS	65	57	60	58	61	60	58	60	61	60	57	57	64	57
Powderhorn	NS	66	68	66	68	69	75	73	73	75	72	70	63	68	61
Spring	NS	NS	NS	62	64	67	76	ID	ID	ID	ID	76	69	NS	75
Webber	NS	58	57	58	58	59	49	51	46	56	61	62	67	67	52
Wirth	NS	63	63	64	61	57	59	61	60	58	57	55	55	57	51

In 2005, MPRB water quality scientists monitored 12 of the city's most heavily used lakes. The data collected were used to estimate the fertility or TSI of the lakes. Changes in lake water quality can be tracked by looking for trends in TSI scores over time. These values are especially important for monitoring long-term trends (5-10 years). Historical trends in TSI scores are used by lake managers to assess improvement or degradation in water quality.

Table 18C shows the slope and R^2 values for the trend lines which are shown in each individual lake section. A negative slope is seen as decreasing fertility and positive slope as increasing fertility. R^2 shows how well the trend fits the data (with 1.00 being a perfect fit). Details on TSI scores and linear regression analysis can be found in Section 1.

TSI scores can have scatter in the data, the scatter changes from year to year. This scatter in the data can make assessment difficult. With enough data points over time (approximately 5 years) a linear regression can be done and a trend ascertained.

Lakes with decreasing TSI trends and decreasing fertility

- Lake Calhoun
- Cedar Lake (stable last 6 years)
- Lake Harriet
- Wirth Lake

Lakes with stable TSI trends

- Brownie Lake
- Lake Hiawatha
- Lake of the Isles
- Loring Pond (improvement since 2001)
- Lake Nokomis
- Powderhorn Lake
- Webber Pond

Lakes with increasing TSI trends and increasing fertility

- Spring Lake (limited data points)

Table 18C. 2005 slope and R^2 values for trend lines (see individual lake sections), calculated from average growing season TSI scores.

Lake	Slope of Regression	R^2
Calhoun	-1.001	0.711
Cedar	-0.716	0.381
Diamond	0.695	0.264
Harriet	-0.452	0.371
Hiawatha	0.012	0.0008
Isles	-0.208	0.060
Loring	0.569	0.291
Nokomis	-0.124	0.043
Powderhorn	-0.144	0.020
Spring	0.941	0.484
Webber	0.376	0.063
Wirth	-0.794	0.772

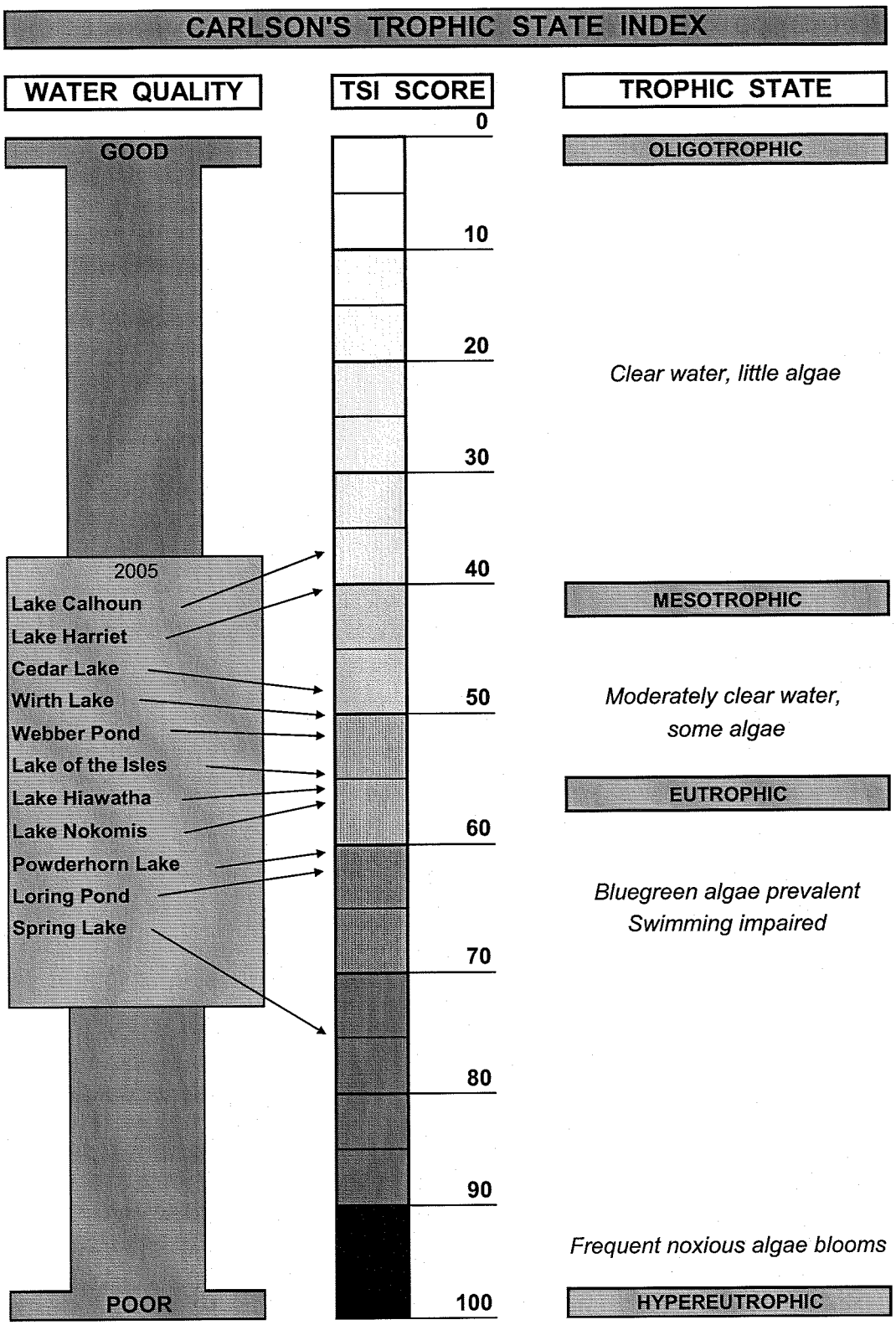

Figure 18A. 2005 Lake trophic state comparison.

GROUNDWATER WELLS

Generally, the shallower piezometric wells in 2005 show the influence of a dry July and very wet September and October as they fall and rise with lags respectively. Peaks tend to lag wet periods by a few weeks. The deeper piezometric wells appear to be less affected by annual climate and those groundwater levels fluctuate very little.

LAKE LEVELS

Lake levels are recorded weekly for Calhoun, Isles, Cedar, Brownie, Harriet, Hiawatha, Nokomis, Loring, Powderhorn and Wirth lakes from ice out to ice on. The lake level for the Upper Chain of Lakes (Brownie, Calhoun, Cedar and Isles) was taken at Lake Calhoun. Channels connect the lakes which makes the level representative of all four lakes. The monitoring locations are shown in Figure 18B. The Chain of Lakes (Upper Chain and Lake Harriet) are graphed in Figure 18C. The remaining lakes are shown in Figure 18D. Mean sea level elevation can be calculated by adding the city datum (710.3 feet) to the elevations shown on the figures. Fixed staff gauges are used at all locations.

Lake levels vary annually based on precipitation and other inputs including creeks and stormwater. The 2005 average lake levels were comparable to 2004 (Table 18D). Late summer and fall of 2005 were predominantly wet which is shown in the peak lake levels of Figures 18B and 18C. Powderhorn and Loring lake levels are subject to augmentation wells that pump groundwater into the lakes periodically throughout the year to maintain a consistent level. Lake Hiawatha levels are also influenced by the inflow of Minnehaha Creek which can fluctuate by the maintenance of the Lake Minnetonka outlet dam. The average lake level at Wirth Lake was very consistent over the years of record. It is important to track lake level trends for lake management purposes. High water can cause shoreline erosion and habitat loss while low levels can impede recreation.

Historical lake levels for the entire period of record can be found in the individual lake chapters (2-17).

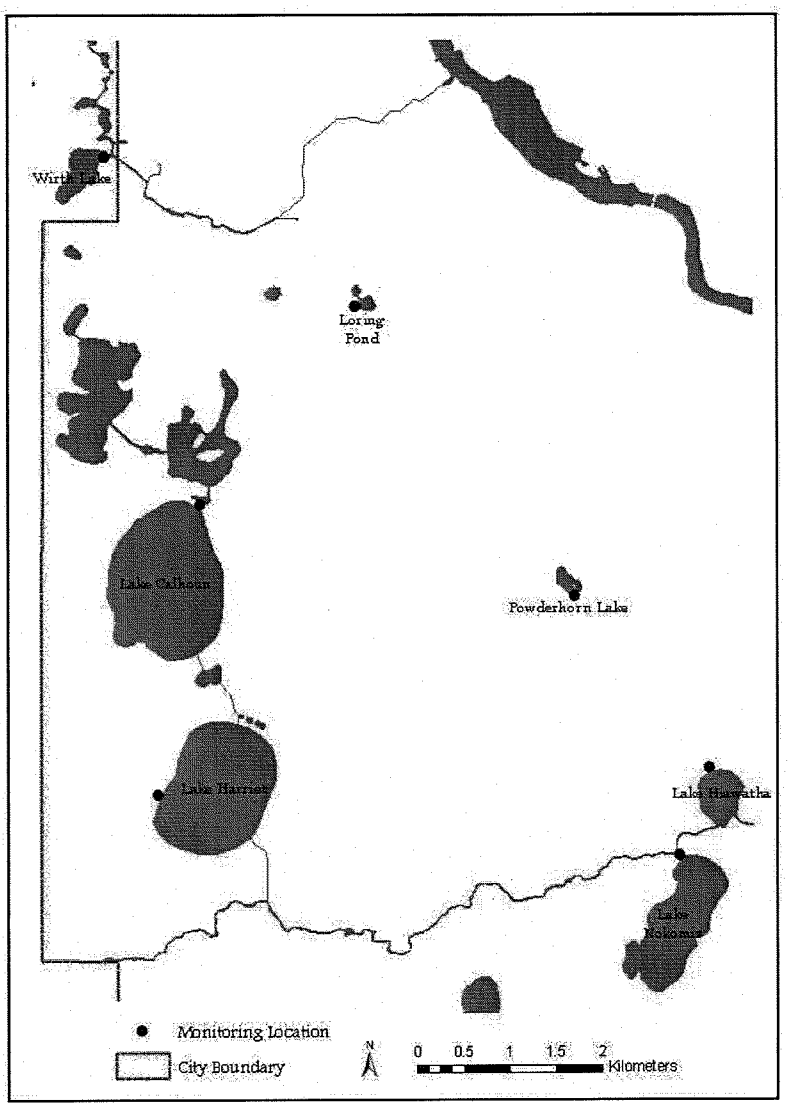

Figure 18B. Minneapolis lake level monitoring locations.

Table 18D. Average lake level in feet above city datum (710.3 ft) by year. NA = no data available, * Some Loring records were below recordable stage therefore the minimum recorded value was used in calculating averages.

Lake	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Calhoun, Cedar, Isles, Brownie	142.07	141.77	141.63	142.93	143.09	142.39	142.05	142.60
Harriet	136.87	136.86	136.74	137.23	137.33	137.51	137.13	137.01
Hiawatha	102.18	102.18	101.46	102.44	103.29	102.23	102.28	102.62
Loring	107.78	108.13	108.36	108.23	108.29	107.91	107.71*	107.93
Nokomis	NA	106.30	103.92	104.27	104.54	104.12	102.98	102.59
Powderhorn	NA	107.53	108.01	108.05	106.98	107.79	108.18	108.05
Wirth	107.68	107.67	107.72	107.81	107.78	107.76	107.71	107.83

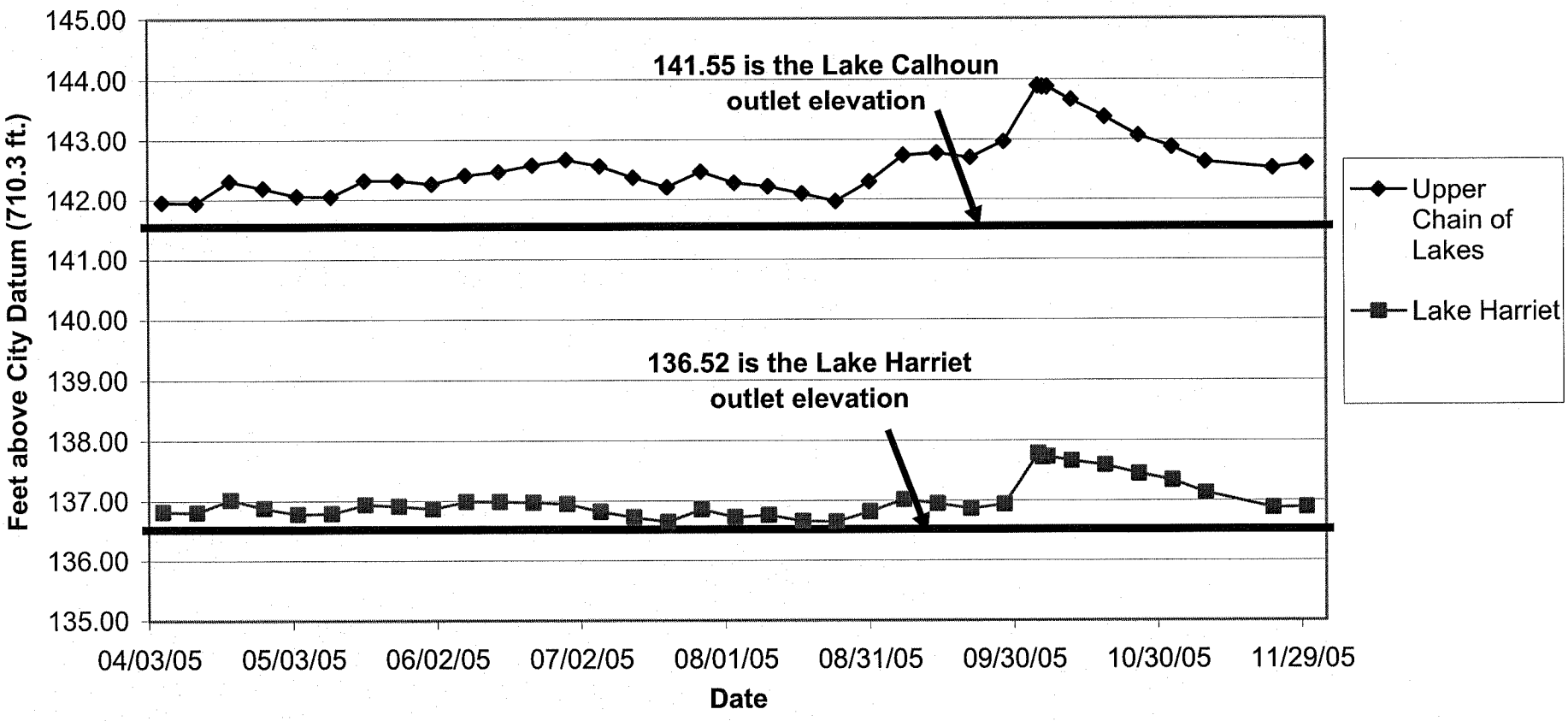

Figure 18C. 2005 Lake levels for the Minneapolis Upper Chain of Lakes (Brownie, Cedar, Isles and Calhoun) and Lake Harriet.

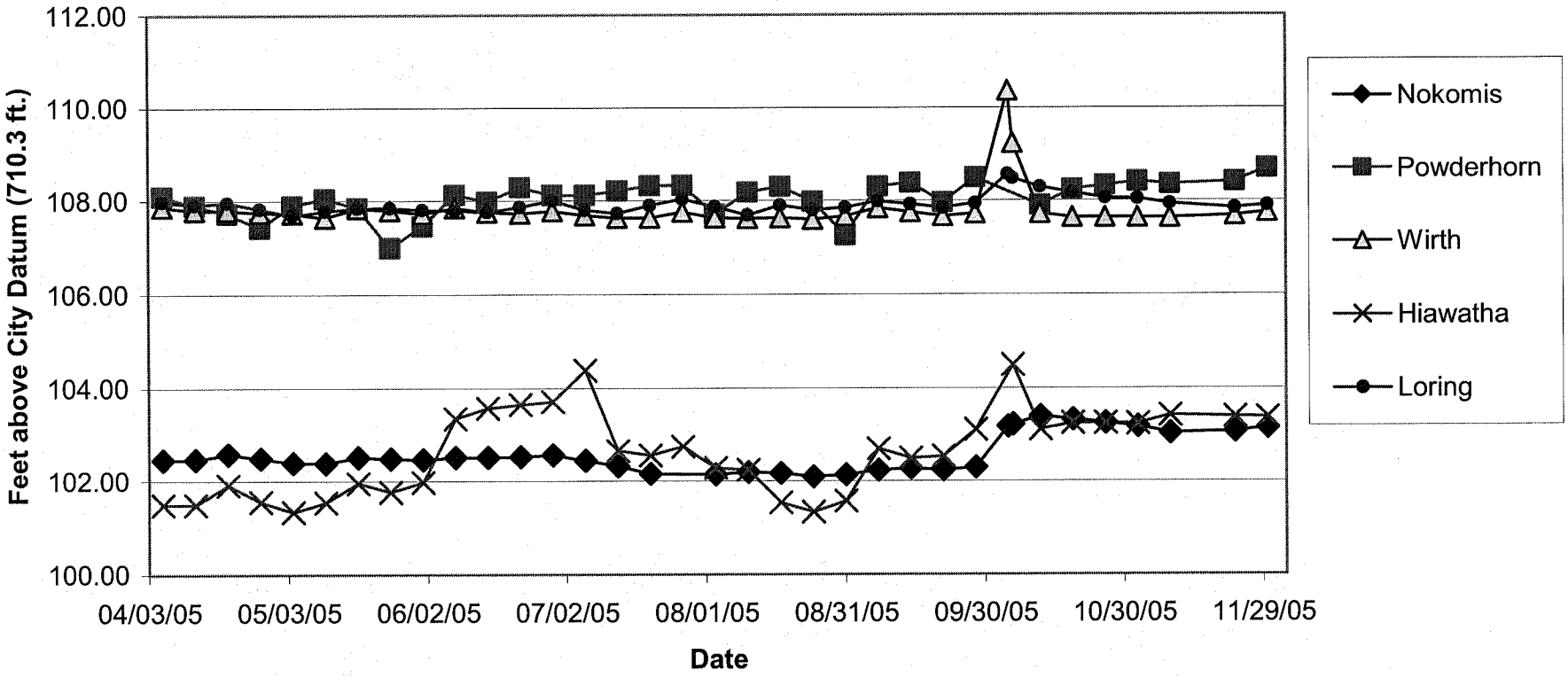

Figure 18D. 2005 Lake levels for Nokomis, Powderhorn, Wirth, Hiawatha, and Loring Lakes.

LAKE AESTHETIC AND USER RECREATION INDEX (LAURI)

The LAURI was developed to provide recreational users with an additional source of information about the health of MPRB lakes. Previously, TSI scores were used, which indicate the environmental health of a lake and not its suitability for recreation. The LAURI provides lake users with an easily understandable recreational suitability indicator for MPRB lakes. Background information on the LAURI can be found in Section 1. Table 18E shows the LAURI scores of each lake for 2005. Scores for Aesthetics, Aquatic Plant Interferences, and Public Health are on a scale of 0 to 10, with 0 being the best possible and 10 being the worst possible score. Water clarity scores are the growing season (May – Sept) mean Secchi depth in feet.

Table 18E. 2005 average scores and classifications for each LAURI category. NB = no swimming beach. *Denotes shallow lake, at least 85% or more littoral.

Excellent | Good | Poor

Lake	Aesthetics	Aquatic Plant Interferences	Public Health	Water Clarity
Calhoun	2.1	7.0	2.0	6.05
Cedar	1.5	6.5	1.0	2.78
Harriet	1.8	6.5	1.0	5.28
Hiawatha	2.7	5.5	NB	1.78
Isles	1.9	6.1	NB	2.54*
Loring	2.5	2.8	NB	1.18*
Nokomis	2.6	3.6	1.0	1.65
Powderhorn	3.0	2.4	NB	1.26*
Wirth	2.3	7.3	1.0	2.49

In general, lakes with "excellent" clarity have recreational interferences from aquatic plants (e.g. Lake Calhoun). Lakes with poorer clarity have less aquatic plants growing in them (e.g. Lake Nokomis) and therefore less recreational interferences from aquatic plants. Hiawatha, Loring, and Powderhorn were not rated for the public health category because these lakes do not have swimming beaches. All the lakes with beaches scored "excellent" for public health, as rated for swimming by bacteria levels.

WINTER ICE COVER

Ice off dates were fairly typical for 2005 (Table 18F). Ice on dates were generally a few days to a week later than usual in 2005 (Table 18G) except for Calhoun, Cedar, Harriet, and Loring which had dates roughly two weeks sooner than average. For further information on winter ice cover records see Section 1 or the individual lake's section.

Table 18F. Statistics related to ice off dates.

Lake	Earliest Ice Off	Year Occurred	Latest Ice Off	Year Occurred	Mean	Median	Years of Record
Birch	3/8	2000	4/15	1996	4/3	4/4	20
Brownie	3/9	2000	4/18	1996	4/3	4/3	24
Calhoun	3/9	2000	4/28	1965	4/9	4/10	54
Cedar	3/9	2000	4/26	1975	4/7	4/6	32
Diamond	3/6	2000	4/13	1963	3/31	3/31	13
Harriet	3/9	2000	4/28	1965	4/7	4/7	38
Hiawatha	3/8	2000	4/25	1965	4/4	4/4	31
Isles	3/8	2000	4/26	1965	4/5	4/5	36
Loring	3/6	2000	4/19	1996	4/2	4/3	25
Nokomis	3/8	2000	4/25	1965	4/4	4/4	34
Powderhorn	3/8	2000	4/27	1965	4/4	4/3	26
Spring	3/6	2000	4/15	1996	4/1	4/3	15
Webber	3/6	2000	4/18	1996	3/31	4/2	16
Wirth	3/7	2000	4/18	1996	4/1	4/3	29

Table 18G. Statistics related to ice on dates.

Lake	Earliest Ice On	Year Occurred	Latest Ice On	Year Occurred	Mean	Median	Years of Record
Birch	11/1	1991	12/16	1998	11/25	11/27	20
Brownie	11/5	1991	12/20	2001	11/28	12/1	24
Calhoun	11/25	1996	12/31	2001	12/21	12/11	36
Cedar	11/18	1989	12/21	1998, 1999, 2001	12/19	12/3	24
Diamond	11/20	2000	12/20	2001	12/4	12/4	11
Harriet	11/25	1996	12/31	2001	12/22	12/11	33
Hiawatha	11/1	1991	12/21	2001	11/29	11/30	25
Isles	11/5	1991	12/21	1999	11/29	11/30	31
Loring	11/1	1991	12/21	1999, 2001	12/18	12/2	21
Nokomis	11/1	1991	12/20	2001	11/29	11/30	26
Powderhorn	11/1	1991	12/20	2001	11/28	11/30	21
Spring	11/10	1995	12/20	2001	11/29	11/30	15
Webber	11/10	1995	12/20	2001	11/29	11/30	16
Wirth	11/5	1991	12/21	2001	11/28	11/30	25

21 BASSETT'S CREEK

WATERSHED OUTLET MONITORING PROGRAM (WOMP) STATION

Background

Stormwater runoff, in urban areas, carries non-point source pollutants from diverse and widely scattered sources to Twin Cities Metropolitan Area (TCMA) streams and rivers. Monitoring is necessary to determine the extent of non-point source pollutant loading from tributaries to the Mississippi River. It also provides information for the development of target pollutant loads for the watershed and helps evaluate the effectiveness of best management practices; all in an effort to improve water quality in streams and rivers.

In 1997, the Minnesota Legislature provided $575,000 to the Metropolitan Council Environmental Services (MCES), via the *Interagency Water Monitoring Initiative* (IWMI), for expansion of MCES water quality monitoring efforts. With this funding, the Metropolitan Area Watershed Outlet Monitoring Program (WOMP) 2 was implemented in early 1998. The new WOMP2 program expanded the existing WOMP MCES stream-monitoring network in the metro area. The Metropolitan Council is mandated by state law (MN Statute 473.157) to establish target pollutant loads for TCMA watersheds. Long-term stream monitoring data are critical for understanding non-point source pollutant impacts on water quality and for documenting water quality improvements as non-point source best management practices are implemented. The Minneapolis Park and Recreation Board (MPRB) operates the Bassett's Creek station in cooperation with the Metropolitan Council. The Bassett's Creek Watershed Management Commission (BCWMC) provided additional funding assistance to operate the station in 2004 and 2005. The Bassett's Creek station is located at 100 Irving Avenue North, near the Minneapolis Impound Lot (Figure 21A).

The Bassett Creek Watershed exceeds 40 square miles and is divided into four major subwatersheds:

Main Stem: The Main Stem of Bassett Creek originates in Medicine Lake and generally flows east through parts of Plymouth, Golden Valley and Minneapolis to the Mississippi River.
Medicine Lake Branch: The Medicine Lake Branch drains portions of Plymouth that discharge to Plymouth Creek. Plymouth Creek originates in western Plymouth and generally flows southeast through Plymouth to Medicine Lake.
North Branch: The North Branch of Bassett Creek drains portions of northern Plymouth, southern New Hope, and Crystal and joins the Main Stem immediately upstream of Highway 100.
Sweeney Lake Branch: The Sweeney Lake Branch drains portions of northern St. Louis Park and southern Golden Valley and joins the Main Stem in Theodore Wirth Park, near Golden Valley Road.

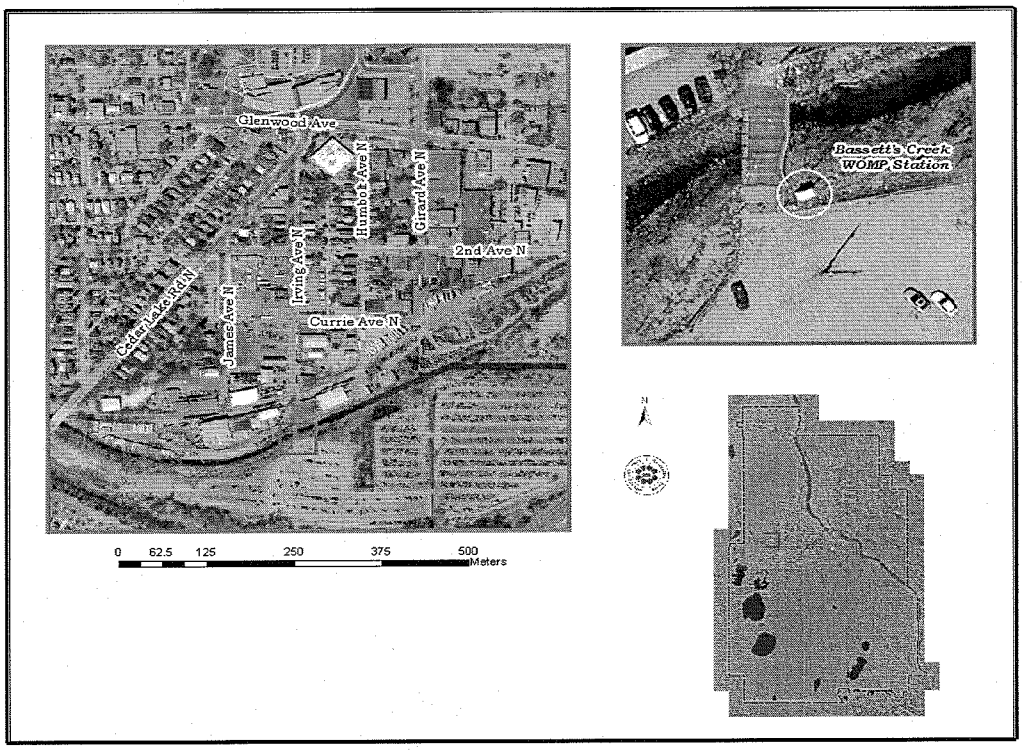

Figure 21A. Map of the Bassett's Creek WOMP2 station, Minneapolis, MN.

Methods

The Bassett's Creek WOMP2 station is located approximately ¼ mile upstream of where the creek enters the City of Minneapolis storm sewer system. The creek eventually empties into the Mississippi River.

In July 2001, the MPRB began monitoring the WOMP2 station at Bassett's Creek. The WOMP2 station previously began operation under the MCES in early 2000. The Bassett's Creek station is operated in cooperation with the BCWMC and MCES.

Barr Engineering is the consulting engineering firm for the BCWMC. The BCWMC gathers data to build the rating curve for the station and participates with the MPRB for support and operation of the Bassett's Creek station. The MCES laboratory analyzes all the samples that are collected and maintains, repairs, and coordinates larger aspects of the station.

The Bassett's Creek station shelter is equipped with electricity, heat and telephone modem. The station measures stage using a bubbler, which is connected to a Campbell datalogger. The datalogger records and calculates the conversion of stage (ft) readings into discharge (cfs) using a rating curve polynomial. The data are averaged over 15-minute intervals and are downloaded via modem. The Bassett's Creek station also uses an ultrasonic transducer, mounted under a bridge, to measure stage and is equipped with a tipping bucket rain gauge. An automatic Sigma™ sampler, equipped with 24 one-liter sample bottles, is also housed at the

station. When stream stage increases to the trigger depth, the datalogger controls and activates flow pacing to the sampler. For example, a sample can be taken every 100,000 cubic feet once the stream stage reaches a pre-determined trigger depth. The sampler pre-purges, rinses the line and collects the sample. The sampler multiplexes (four - 200 mL samples per bottle) to collect up to 96 flow-weighted samples per storm. A Campbell Scientific 247 conductivity/temperature probe was installed in the stream and continually records data. The Campbell conductivity probes are cleaned and calibrated monthly or when a new program is downloaded. An Oakton Con 100 series conductivity probe and Oakton TDS 1413 single calibration standards are used.

The individual flow paced samples, collected by the automatic sampler, for runoff events were composited into one large sample. Grab samples were taken monthly during baseflow conditions. These samples were taken to the MCES laboratory for analysis. To comply with holding times, water quality parameters were selected for analysis based on the elapsed time since the end of sample collection.

Remote access to the site, via modem, allowed MPRB Environmental Operations staff to manage and check many aspects of the site without having to physically travel there. Staff used a desktop computer and modem to download data, reprogram the datalogger in anticipation of storm events, and trouble shoot. Data were downloaded and imported into spreadsheets for analysis and reporting. The MCES automatically downloaded the data daily from each station as a backup of the data.

Since the sampler creates flow paced composites, it is important to have accurate rating curves at Bassett's Creek. Stream gauging is conducted by Barr Engineering. The stream gauge information is used to develop a scatter plot and multiple regression equation through the points. The resulting polynomial equation is programmed into the datalogger at the station. This allows for accurate flow pacing of the sampler and for total discharge volumes to be summed, which result in accurate load calculations.

When samples were collected from the station, a tape down was measured from a fixed point on the bridge (surveyed at 814.86 feet on 7-29-02) to the water surface. Stage plus the tape down must equal a fixed number. This provides a quick check as to the bubbler stage accuracy at the station.

Results

Discharge and level were monitored when the creek is ice free, year round. Table 21A shows the months of the year and the corresponding Julian Day used in the hydrograph. The Bassett's Creek 2005 hydrograph is shown in Figure 21B. The gaps in Figure 21B stage data were due to the probe being out of the water, equipment failure or ice conditions.

The hydrograph (Figure 21C) used monthly averages, which attenuates storm peaks, to show the differences in stream stage over the last three years. The fall of 2005 was wetter than normal.

Table 21A. The first of the month and its corresponding Julian Day.

Month	Julian Day
January 1	1
February 1	32
March 1	61
April 1	92
May 1	122
June 1	153
July 1	183
August 1	214
September 1	245
October 1	275
November 1	306
December 1	336

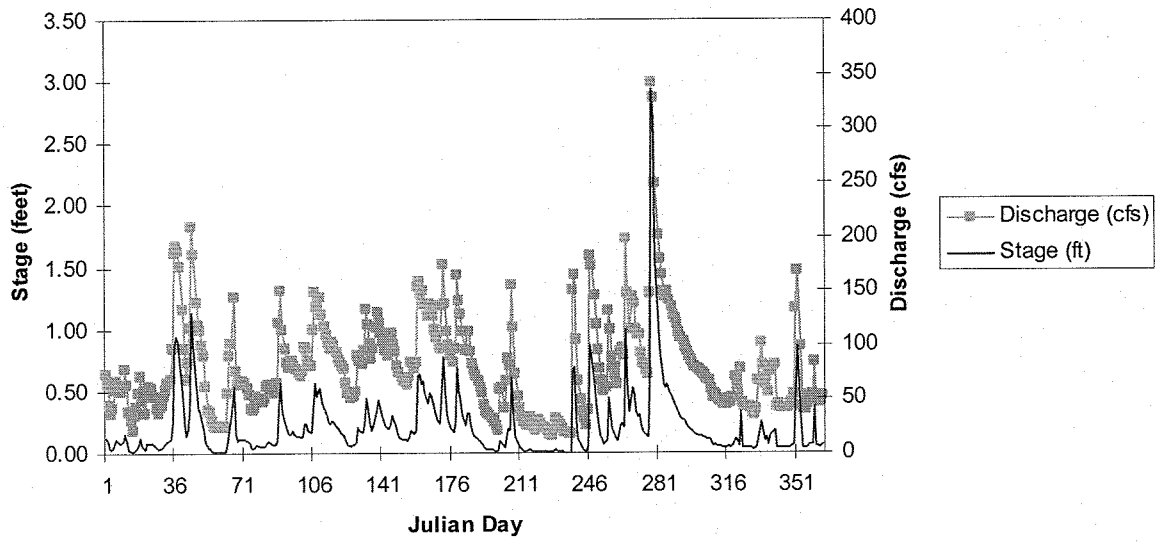

Figure 21B. Bassett's Creek 2005 stage and discharge in 15-minute average intervals.

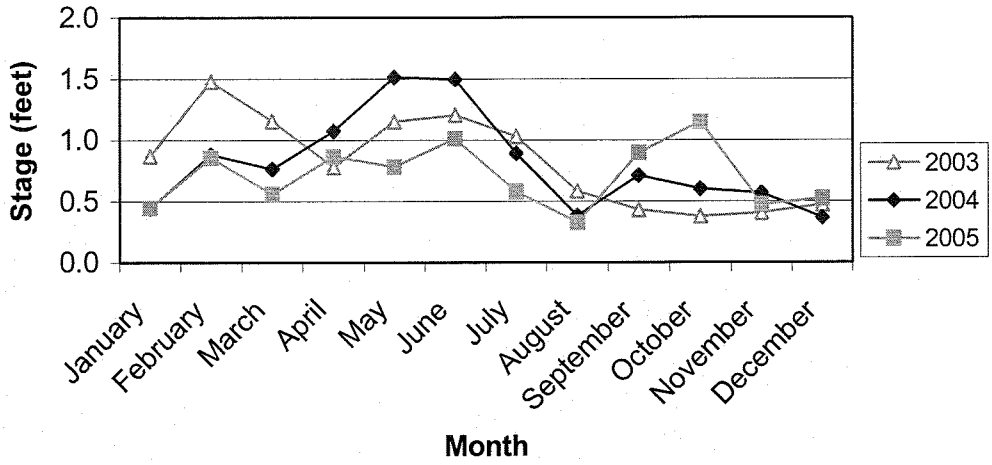

Figure 21C. Bassett's Creek average monthly stage, 2003-2005.

The Bassett's Creek WOMP2 station was used to continually monitor the discharge level and water chemistry of the creek. These data can be used to assess the effects of stormwater runoff from the surrounding watershed. MCES used the FLUX watershed model to calculate flow-weighted mean concentrations for the Bassett's Creek station. The station will allow natural resource managers to track changes in the creek through long-term data collection as well as document differences between creeks in the metro area with varying watershed characteristics. Table 21B shows the 2005 Bassett's Creek monthly average stage, discharge, temperature and conductivity. The peak monthly discharge in 2005 occurred in October for both Minnehaha Creek and Bassett's Creek WOMP2 stations. Bassett's Creek (storm and baseflow) 2005 water chemistry data can be found in Table 21C including the minimum, maximum, median and mean concentrations. Definitions for the chemical abbreviations in Table 21C can be found in Section 28, Table 28B.

Table 21B. Bassett's Creek monthly average data for 2005.
NA = No Data Available.

Month	Average Stage (ft)	Average Discharge (cfs)	Average Conductivity (µmhos)/cm	Average Water Temp (°C)
January	0.45	7.7	NA	-1.1
February	0.86	37.9	1524	0.1
March	0.56	14.4	1083	1.4
April	0.87	29.4	838	12.3
May	0.78	24.1	862	14.8
June	1.01	41.7	721	23.5
July	0.58	15.5	559	24.9
August	0.33	7.9	329	21.3
September	0.89	35.2	591	19.9
October	1.15	62.9	632	13.0
November	0.47	9.3	841	4.5
December	0.52	13.7	1005	0.2

Table 21C. Bassett's Creek 2005 storm and baseflow laboratory data. Blank cells are where the analysis was not requested.

Storm Event Samples

Bassett's Creek Event Date	Sample Type	Alk mg/L	Total BOD5 mg/L	Total COD mg/L	Total Cd mg/L	Cl mg/L	Chl-a µg/L (pheo. corrected)	Total Cr mg/L	Cond µmho/cm	Total Cu mg/L	Fecal Coliform #/100 mL	Hard mg/L	Total Pb mg/L	Total Ni mg/L	NH3 mg/L	TKN mg/L	NO3 mg/L	NO2 mg/L	OTP mg/L	TP mg/L	Diss Phos mg/L	TSS mg/L	VSS mg/L	Total Sulfate mg/L	TOC mg/L	Turb NTU	Total Zn mg/L
3/25/2005	COMP	195	6	30		197			1079			254			0.23	1.7	0.41	0.03	0.047	0.233	0.088	32	10	28	6.9	5.6	
3/30/2005	COMP	102	8	58		161			773			140			0.40	2.0	0.42	0.04	0.036	0.309	0.067	73	19	18	7.5	23	
4/17/2005	COMP	147	6	66		128			784			190			0.09	1.9	0.35	0.03	0.025	0.341	0.034	119	36	24	6.1	22	
5/9/2005	COMP	166	6	155		129						242			0.14	4.2	0.52	0.03	0.037	0.978	0.042	462	88	31	8.1	50	
5/13/2005	COMP	146		50		125			763			200			0.08	1.5	0.33	0.04		0.241	0.045	87	21	25	5.9		
5/18/2005	COMP	149	5	59		109			730			200			0.35	1.8	0.37	0.04	0.021	0.317	0.046	100	22	25	6.0	22	
6/8/2005	COMP	135	5	47		103						186			0.06	1.6	0.27	0.03	0.033	0.267	0.050	86	20	23	6.4	19	
6/9/2005	COMP	104	4	40		91			561			144			0.16	1.4	0.29	0.05	0.046	0.240	0.067	74	17	17	5.9	18	
6/21/2005	COMP	105	3	44	0.00004	81		0.0018	524	0.0054		132	0.0081	0.0032	0.12	1.3	0.42	0.09	0.050	0.224	0.077	72	16	16	5.7	17	0.0196
8/27/2005	COMP	93	4	52		77						138			0.12	1.9	0.57	0.04	0.059	0.348	0.078	118	33	23	5.1	23	
9/4/2005	COMP	87	3	45	0.00010	47		0.0023		0.0072		106	0.0112	0.0035	0.13	1.3	0.55	0.07	0.047	0.243	0.049	103	31	16	4.5	20	0.0280
9/8/2005	COMP	140		33		6						198			0.02	1.0	0.42	0.03		0.176	0.087	48	8	27	5.6		
9/13/2005	COMP	112	4	33		70						150			0.02	1.0	0.36	0.03	0.043	0.163	0.060	33	13	18	5.3	10	
10/5/2005	COMP	56	4	38		25						78			0.02	1.2	0.36	0.03	0.068	0.324	0.067	112	22	4	3.4	27	
10/8/2005	COMP	122	2	25		80						158			0.02	1.4	0.50	0.04	0.034	0.176	0.048	17	6	18	6.0	3.8	
	Min	56	2.4	25	0.00004	6	0	0.0018	524	0.0054	0	78	0.0081	0.0032	0.02	1.0	0.27	0.03	0.021	0.163	0.034	17	6	4	3.4	3.8	0.0196
	Max	195	7.7	155	0.00010	197	0	0.0023	1079	0.0072	0	254	0.0112	0.0035	0.40	4.2	0.57	0.09	0.068	0.978	0.088	462	88	31	8.1	50	0.0280
	Mean	123.9	4.5	52	0.00007	95	0	0.0021	745	0.0063	0	168	0.0097	0.0034	0.13	1.7	0.41	0.04	0.042	0.305	0.060	102	24	21	5.9	20	0.0238
	Median	122	4.2	45	0.00007	91	0	0.0021	763	0.0063	0	158	0.0097	0.0034	0.12	1.5	0.41	0.04	0.043	0.243	0.060	86	20	23	5.9	20	0.0238

Baseflow Samples

1/11/2005	GRAB	298	1	20	0.00004	188	8.1	0.0003		0.0015	10	372	0.0002	0.005	0.19	0.8	0.43	0.03	0.008	0.027	0.012	2	1	53	4.4	3.4	0.0034
2/8/2005	GRAB	209	4	33		285	8.2				180	300			0.66	1.9	0.42	0.03	0.087	0.183	0.090	10	4	36	6.8	5.8	
3/8/2005	GRAB	171	8	39		198	14				160	224			0.86	2.5	0.67	0.03	0.170	0.293	0.232	8	4	24	11.1	5.4	
4/8/2005	GRAB	187	4	31		156	16				3	244			0.02	1.2	0.12	0.03	0.005	0.095	0.047	8	4	31	6.8	3.8	
5/3/2005	GRAB	198	2	28		136	8.3		905		33	260			0.07	0.8	0.10	0.03	0.010	0.064	0.021	3	1	34	6.2	4.2	
6/2/2005	GRAB	177	3	30	0.00004	126	24	0.0008	851	0.0032	48	248	0.0022	0.0035	0.12	1.0	0.16	0.12	0.022	0.119	0.080	17	7	29	6.6	6.8	0.0087
7/12/2005	GRAB	165	3	29		121	18				56	222			0.08	1.0	0.23	0.03	0.035	0.097	0.043	5	3	25	6.7	3.1	
8/23/2005	GRAB	191	2	27		137	15				150	286			0.12	0.7	0.21	0.03	0.026	0.065	0.034	8	3	40	5.7	3.6	
9/21/2005	GRAB	137	2	23		89	49				290	180			0.03	0.9	0.26	0.03	0.022	0.093	0.036	10	4	21	5.7	6.0	
10/11/2005	GRAB	127	2	23		92	18				350	166			0.07	1.2	0.24	0.04	0.029	0.079	0.038	6	3	16	6.7	3.2	
11/4/2005	GRAB	198	2	26		96	8.8				60	274			0.10	1.4	0.32	0.03	0.010	0.068	0.022	3	2	34	5.9	3.5	
12/9/2005	GRAB	246	2	20		142	19				41	337			0.25	1.1	0.43	0.03	0.012	0.057	0.017	2	2	47		5.0	
	Min	127	1	20	0.00004	89	8	0.0003	851	0.0015	3	166	0.0002	0.0035	0.02	0.67	0.1	0.03	0.005	0.027	0.012	2	1	16	4.4	3.1	0.0034
	Max	298	8	39	0.00004	285	49	0.0008	905	0.0032	350	372	0.0022	0.0050	0.86	2.5	0.67	0.12	0.170	0.293	0.232	17	7	53	11.1	6.8	0.0087
	Mean	192	3	27	0.00004	147	17	0.0006	878	0.0024	115	259	0.0012	0.0043	0.21	1.20	0.30	0.04	0.0363	0.103	0.056	7	3	33	6.6	4.5	0.00605
	Median	189	2	28	0.00004	137	16	0.0006	878	0.0024	58	254	0.0012	0.0043	0.11	1.05	0.25	0.03	0.022	0.086	0.037	7	3	33	6.6	4.0	0.00605

Fifteen runoff events and 12 baseflows were collected in 2005 at Bassett's Creek. Section 26 provides a summary for 2005 weather.

The MCES will continue to use the FLUX computer model to develop flow-weighted mean concentrations for both Minnehaha Creek and Bassett's Creek. These data will likely be important in creating future Total Maximum Daily Loads (TMDL's) for each watershed. See the MCES Stream Monitoring Report for further information.

Stream Erosion Assessment

In October 2005, a stream erosion assessment was done on Bassett's Creek. Site inventory forms were obtained from the BCWMC, and 28 sites were evaluated using these forms. Sites were identified based on severity of stream bank erosion. Those sites were evaluated based on hydraulic structures, threatened resources, size and extent of erosion, type of erosion (bank scour, bank failure, or hill slope), bank soil conditions, and flow levels. Each site was also photographed and mapped using GPS. Results of the assessment can be seen in Figure 21D. The assessment can be a useful tool for future management efforts of Bassett's Creek and prioritizing stream bank restoration projects.

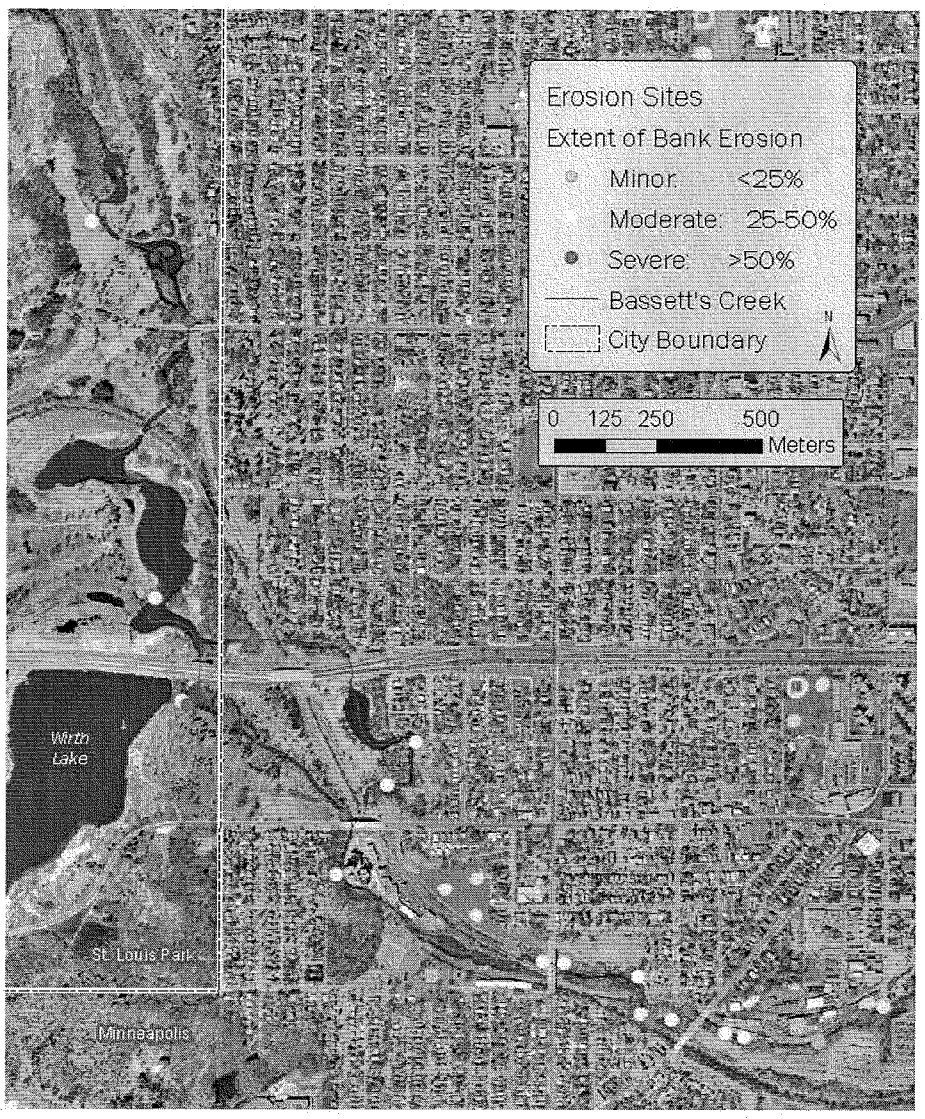

Figure 21D. Map of Bassett's Creek 2005 stream erosion assessment.