# A 2003 STUDY OF THE WATER QUALITY OF 140 METROPOLITAN AREA LAKES

June 2004

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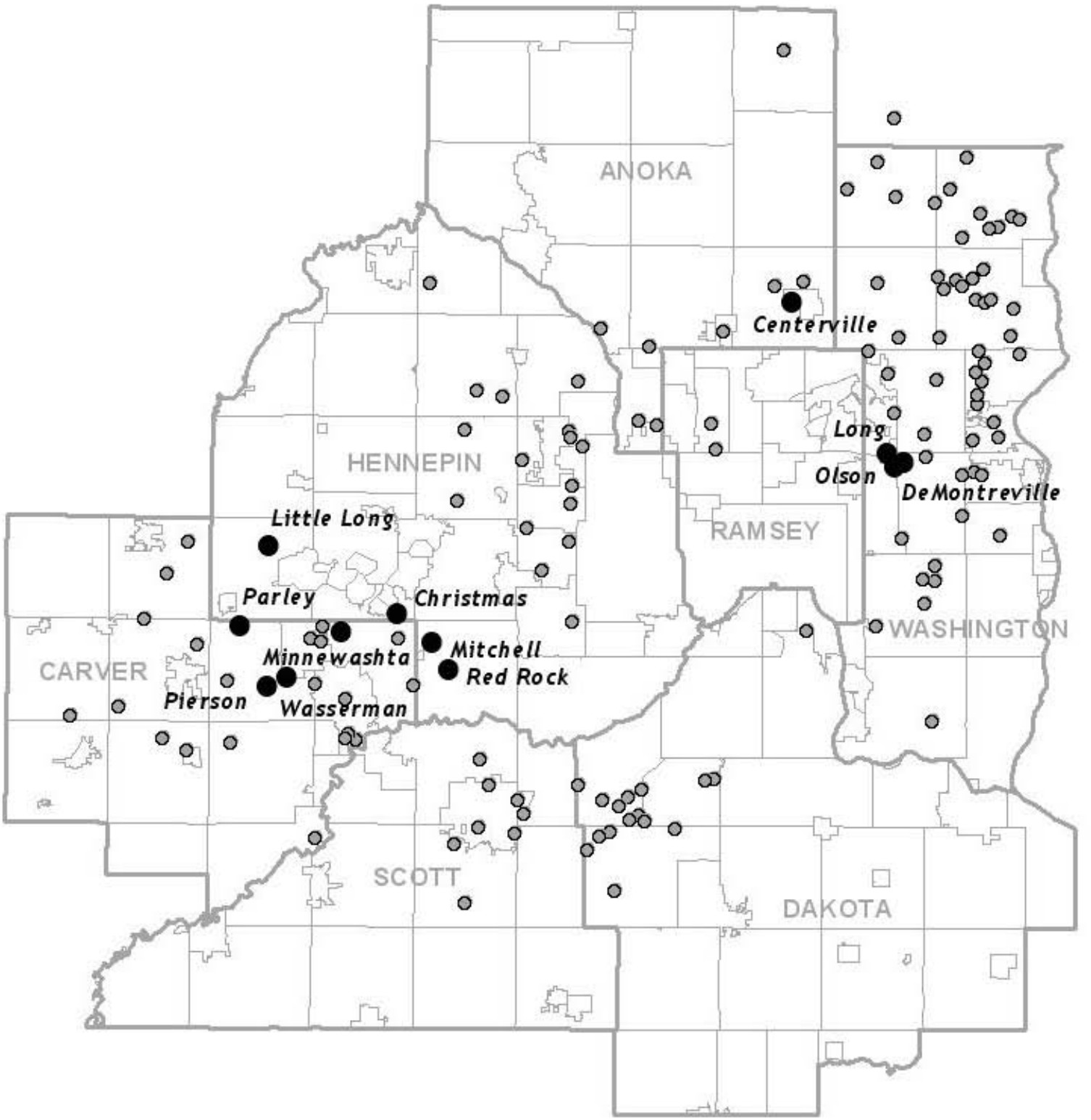



By
Randall J. Anhorn

March 2004

# EXECUTIVE SUMMARY

To date, the Council's lake monitoring programs (including the staff- and volunteer- monitoring programs) and have provided an important tool for making informed lake management decisions. Data from our regional lake monitoring programs are frequently used to determine possible trends in in-lake water quality, estimate expected ranges in water quality of unmonitored lakes, examine intra-and inter-regional differences, determine potential impairments due to water quality, and investigate the relationships between landscape and water quality.

This report is the latest in a continuing series of reports summarizing results of the Metropolitan Council's (Council) annual lake monitoring program. The Council has collected water quality data on area lakes since 1980. This report contains data from 140 lake sites sampled in 2003, including 12 lakes monitored by the Council and 128 lakes monitored by volunteers.

The objectives of this study were to:

1. Provide lake water quality data to lake, watershed and water resource managers.
2. Advise managers of known or suspected threats to lake water quality.
3. Continue to compile a water quality database on the six area lakes that support a trout fishery.
4. Collect in-lake water quality data on Jellum's Bay, Lee, Northwood, Twin [Burnsville], and Valley lakes to determine the results of in-lake barley straw treatments on the lakes' algal population and resulting water clarity.

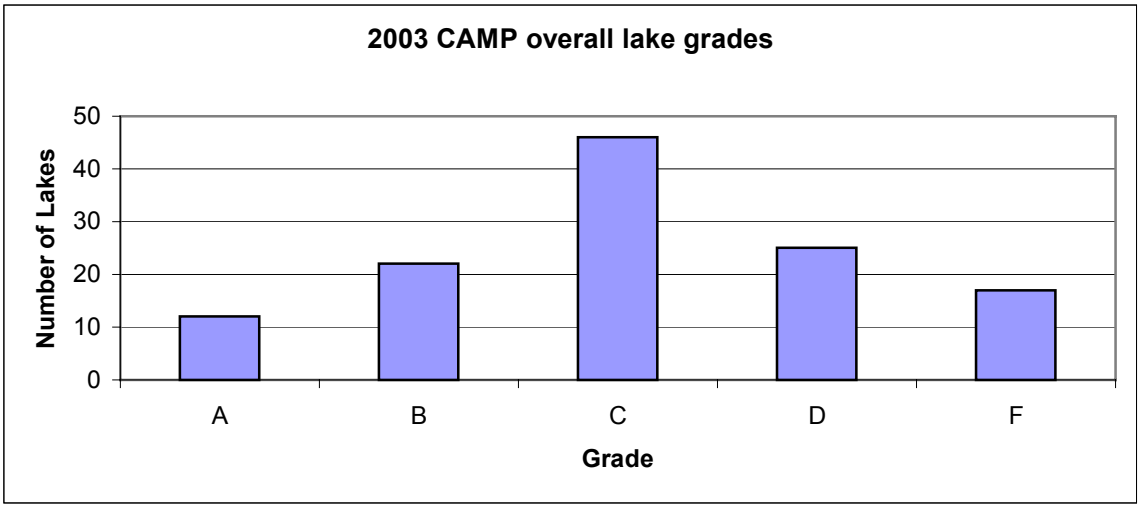
The year 2003 marked the eleventh year that the Council-sponsored volunteer monitoring program, entitled "The Citizen-Assisted Monitoring Program" (CAMP), was used to increase our knowledge of the water quality of area lakes. Once again volunteers measured surface water temperature and transparency, and collected surface water samples that were analyzed for total phosphorus, total Kjeldahl nitrogen, and chlorophyll-a on a biweekly basis from mid-April to mid-October (approximately 14 sampling events).

This year's volunteer monitoring program included two lakes never before monitored by the Council, and 108 lake sites returning from 2002 (six of which just included Secchi transparency readings). The 2003 program included lake data from 23 of the 26 watersheds/municipalities/counties represented in the 2002 program. Additionally, the 2003 CAMP program added two new citizen-based entities (Conservation League of Edina and Seidl Lake Association), and one new watershed district (Minnehaha Creek Watershed District) to its growing list of monitoring partners.

Of the 128 lake sites involved in CAMP in 2003, two lake sites (Cornelia and Long [Mahtomedi] lakes) had never been monitored by the Council prior to 2003. No pre-2003 water quality data could be found for either of the lakes. Thirteen of the 125 lake sites (Brickyard, Cate, Dean, Fish [Grant Township], German, Goetschel, Grace, Island [Linwood], Klawitter, Mergen's, South Oak, Success, and Twin [St. Louis Park]), had only one year of Council-collected data prior to 2003. The greatest percentage of the lakes monitored through CAMP in 2003 received an overall water quality grade of "C" (37.7 percent). The water quality of these lakes is considered average as compared to others in the seven-county metropoitan area.

When comparing the percentage of above-average lakes (those receiving grades of "A" or "B") to below-average lakes (those receiving "D" or "F"), more lakes were below average (34.4 percent to 27.9 percent).

The complete 2003 CAMP lake report card grade tally assigned "A's" to 12 lakes (9.9 percent) and "B's" to 22 lakes (18.0 percent). Forty-six lakes acquired "C's" (37.7 percent), 25 received "D's" (20.5 percent), and 17 obtained an "F" (13.9 percent).




Of the 108 repeat CAMP lakes from 2002, 22 had a better overall water quality grade in 2003 (Big Marine, Courthouse, Dean, Downs, Eagle [Carver County], Fish [Scott County], Fish [Grant Township], Goggins, Hydes, Kismet, Long [May Township], Louise, Oneka, Peltier, Lower Prior, Upper Prior, Seidl, Silver, Spring [Scott County], Sullivan, Westwood, and Wilmes lakes), and 18 had worse overall water quality grades in 2003 (Bass [Washington County], Colby, Fish [Washington County], Goose [Waconia], Keller [Burnsville], Kingsley, Klawitter, Long [Washington County], Loon, Miller, Maple Marsh, Oak, Parkers, Schutz, Staples, Swede, Tamarack, and Waconia lakes), and 68 had the same overall water quality grade for both years. By further breaking down the 68 lakes that had identical overall grades in 2002 and 2003, 40 had similar summertime mean conditions in both 2002 and 2003 (mean TP, CLA and Secchi transparency), 13 had better means in 2003, and 15 had worse or somewhat worse means in 2002.

Water quality data from the 108 repeat CAMP lakes seem to indicate that the Metro Area lakes experienced similar to slightly better water quality conditions in 2003 as compared to 2002. Furthermore recently conducted trend analysis by MPCA on lakes with extensive Secchi transparency databases, revealed that while the majority of statistically assessed lakes showed no trends in water clarity (either negative or improving), more lakes showed an improving trend than a negative trend (MPCA 2003). Of the CAMP 2003 lakes assessed (those with sufficinet data), 11 showed an improving trend in water clarity (Big Marine, Halfbreed/Sylvan, Little Carnelian, Lotus, Marion, Parkers, Sand, Silver, Sunset, Valentine, and Waconia lakes) and four showed a negative trend (Farquhar, Markgrafs, Square, and Sullivan lakes) (MPCA 2003).

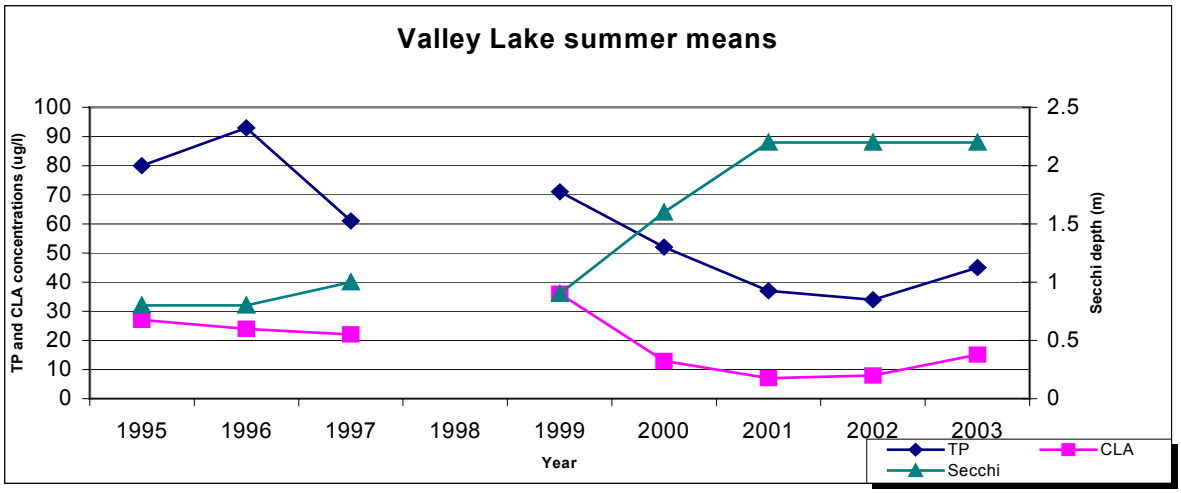
As for the 12 Council staff-monitored lakes, a review of each lakes' summertime TP, CLA and Secchi means and water quality grades reveal that the majority seem to have water quality levels that fall within their normal fluctuation ranges of seasonal water quality. While a few of the 12 lakes may show a slight degradation in one of the individual parameters, the other parameters either showed no real difference or a slight improvement. An example would be Lake Wasserman, which recorded significantly worse TP and CLA conditions in 2003 (as compared to those of 2002), yet had a slighlty improved water clarity. Statistical analysis on each of the lakes' databases failed to reveal any "statistically significant" water

quality trends (either improving or decreasing) on 10 of the lakes and an improving trend on two (DeMontreville and Olson lakes).

Four of the 12 Council-staff monitored lakes monitored in 2003 were also monitored in 2002. Three of the four lakes which were monitored by the Council in 2003 and 2003, received identical overall water quality grades in both years, while one, Lake Minnewashta had a better overall grade in 2003. Lake Minnewashta's 2003 overall grade ("A") is an improvemenat over the "B" the lake received in 2002. The lake's 2003 overall grade is identical to those recorded in each of the previous six years of monitoring (1984, 1990, 1993, and 1997-1999), prior to the poorer grade of 2002.

Similar to 2002, five lakes monitored through CAMP 2003 used barley straw in order to inhibit algal growth and improve water clarity (Jellum's Bay, Lee, Northwood, Twin [Burnsville], and Valley lakes). Barley straw has been used for algae control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes. In an attempt to identify the mechanism behind the decaying barley straw actually reducing in-lake phosphorus concentrations and reducing algal biomass, research has been underway on Valley Lake (and its associated sedimentation basin), since 2001.

Valley Lake was monitored through CAMP in 1995-1997 when barley straw treatments were not used in the lake and 1999-2003 when barley straw was used. This has provided an opportunity to compare the five years where barley straw has been used in the lake, to the three years where it was not. The Valley Lake data indicate that the barley straw not only inhibit algal growth on Valley Lake in 1999-2003, but has also reduced total phosphorus in the lake's surface waters. While the 2003 summer mean TP, CLA and Secchi transparency were similar to or slightly worse than those recorded in 2001 and 2002, they were quite a bit better than those recorded prior to the use of barley straw.




As part of the barley straw research on Valley Lake and its associated sedimentation basin (viewed as a control), past sampling centered on trying to identify the chemical compound released by the decaying barley straw. Samples within the lake and sedimentation basin were analyzed for a break down of phenol concentrations (one of the theories behind the barley straw inhibitor) as a part of 57 base neutral acids organic compounds (BNAs). Because the breakdown of BNA compounds for each of the collected

samples came back below detection limit (< 2.0 µg/l), it is not thought that chemical compounds (such as phenols) released from the decomposing straw is the mechanism inhibiting the algal growth.

Since the release of a chemical compund such as a phenol is not thought to be the algal inhibitor (as a result of our research), recent Valley Lake research monitoring has centered on the decaying straw actually acting as a carbon source for carbon-limited microbial growth. With the carbon availability secure, the microbial community production soars and phosphorus uptake is shunted through the microbial loop ecosystem (McComas 2003). Therefore, the presence of decaying barley straw results in the lake's algal biomass actually being phosphorus-limited not inhibited by a released chemical compound. Initial analysis of the 2003 carbon and chlorophyll data seem s to indicate that this is the case. Continued monitoring and analysis of carbon (as well as additional analyses), will continue on Valley Lake and its associated sedimentation basin throughout the upcoming 2004-monitoring season.

Since 1980, 273 area lakes have been monitored through the Council's Lake Program (including Council-staff monitoring and CAMP). Some of the lakes have multiple monitoring sites [288 sites]. The list of lakes in the Council's monitoring database is shown in Appendix C. The resulting data from the Council's lake monitoring program are permanently stored in the U.S. EPA's national water quality data bank, STORET (stands for STOrage and RETrievel). The majority of the 288 lake sites have been revisited on a rotating schedule throughout the past 24 years to develop a working baseline to help determine possible trends and to aid lake and watershed managers in their decision making. While the Council has done its best to enhance and expand the region's lake water quality database, it is apparent that one of the most economical and efficient method to expand knowledge of our lakes has been with the assistance of volunteers and cooperation and financial support of watershed management organizations, counties, and cities. So while the first 11 years of CAMP have been very successful, our future goal is to continue to expand the coverage of our lake monitoring program in order to better understand and manage the areas water resources.

A comprehensive regional lake-monitoring program should ensure adequate representation across both space and time. However, due to cost and logistical problems, ground-based monitoring programs usually sacrifice spatial coverage (fewer lakes) in favor of more frequent sampling. In order to economically expand the spatial coverage of our lakes program, and provide a more complete picture of the annual water quality of lakes in the TCMA, the Council, through a MetroEnvironment Partnership grant, will add a satellite imagery component to our lakes program in 2004.

If you have questions pertaining to the lake data or descriptions contained in this report, inquiries about CAMP, or suggestions of lakes the Council should consider monitoring in the future, please contact Randy Anhorn at the Metropolitan Council (651) 602-8743 or randy.anhorn@metc.state.mn.us.

## ACKNOWLEDGMENTS

This report represents the coordinated efforts of many individuals. I would like to acknowledge the following people for their technical and supportive contributions to the preparation of this report:

- The various watershed management organizations (WMOs), participating agencies, and volunteers involved in the citizen-assisted monitoring program (CAMP), for without their enthusiastic participation, CAMP would not be successful. A list of involved WMOs, agencies, and volunteer lake monitors is shown in Appendix B. The following of this years volunteers should be given added thanks for their multiple years of service:

**11 years of service**
Diane and Bob Coderre - Sunset Lake

**10 years of service**
City of Columbia Heights- SullivanLake
Washington Co. SWCD- Multiple

**9 years of service**
Bill Aamadt- Wilmes Lake
Janet and Harvey Bartz- Seidl Lake
Wayne LeBlanc- Lake Peltier
Cindy and Wes Rogers- Marcott Lake
Carver Co. Env. Services- Multiple

**8 years of service**
City of Circle Pines- Golden Lake
Mahle Family- La Lake
Arlene Peterson- Simley Lake
John Ritter - Lake Alimagnet
Wargo Nature Center- George Watch

**7 years of service**
City of Blaine-Laddie Lake
City of Prior Lake- Markley Lake
Charles Robin- Fish Lake
Anoka Co.- Multiple
PL-SL WD- Multiple

**6 years of service**
Wally Shaver- Lac Lavon Lake
Glen Gramse- Keller Lake
Mona and David Hanson- Pike Lake
Cottage Grove- Regional Park Lake

**5 years of service**
Joel Buys- Clear Lake
City of Lakeville- Valley lake
Philip Goodrich- Pike Lake
Cindy and Beth Hvass- Colby Lake
John Ryski- Bavaria Lake
Westwood Nature Center- Westwood Lake

**4 years of service**
Steve Bur- Northwood Lake
Cooper Family- Lee Lake
Carolyn Dindorf- Magda Lake
Dan Engstrom- Pomerleau Lake
Dave Hanson-Sweeney Lake
Henzler Family- Sunset Pond
Renay Leone-Virginia Lake

**3 years of service**
Arnett Family- Crystal Lake
Gene Berwald- Pine Tree Lake
Kevin Bjork- Cloverdale Lake
Madison Groves- Upper Prior Lake
Tom/Dorothy Goodwin- Orchard Lake
Green Family- Kingsley Lake
Candice Kraemer- Sunnybrook Lake
Steve Lane- Cedar Island Lake
Wally Potter- Marion Lake
Terry Riley- Markgrafs Lake
Ryan Opdahl- Little Johanna
Mike Shouldrice- Tamarack and Schutz lakes
Phillip Solseng- Long Lake
Sly Family- Downs Lake
Bob Videen- Parkers Lake

- The Metropolitan Council Environmental Services - Environmental Planning and Evaluation department (MCES-EPE) for laboratory analysis of the lake samples.

- And, the members of the Metropolitan Council and its environmental staff, Jeffrey Jax, and Craig Skone for support with lake monitoring, data management, and report preparation. Craig Skone deserves additional recognition for developing all the graphics for this report.

# CONTENTS

*This report is divided into two parts: Part I describes the lake water quality of the 12 lakes monitored by the Metropolitan Council-staff, while Part II details the water quality of the 128 lakes monitored by volunteers as part of the Citizen-Assisted Monitoring Program.*

**Physical/chemical lake data and copies of the volunteer monitoring methods pilot study can be obtained upon request by contacting Randy Anhorn at (651) 602-8743 or** randy.anhorn@metc.state.mn.us**.**

# PART I - METROPOLITAN COUNCIL 2003 LAKE MONITORING PROGRAM

## INTRODUCTION

The Metropolitan Council-staff sampled 12 lakes in 2003 as part of its continuing effort to manage lakes in the Twin Cities Metropolitan Area (TCMA) (Figure 1). This report follows a series of lake studies (Appendix C):

| YEAR | NUMBER OF LAKES | REFERENCE |
|---|---|---|
| 1980 | 60 | Osgood (1981) |
| 1981 | 30 | Osgood (1982a) |
| 1982 | 7 | Osgood (1983) |
| 1983 | 28 | Osgood (1984a) |
| 1984 | 43 | Osgood (1984b) |
| 1985 | 32 | Osgood (1985) |
| 1986/87 | 10 | Osgood (1988a) |
| 1988 | 6 | Osgood (1989a) |
| 1989 | 20 | Osgood (1989b) |
| 1990 | 21 | Osgood (1990) |
| 1991 | 17 | Hartsoe and Osgood (1991) |
| 1993 | 12 (+ 31 CAMP lakes) | Anhorn (1994) |
| 1994 | 13 (+ 38 CAMP lakes) | Anhorn (1995) |
| 1995 | 13 (+ 46 CAMP lakes) | Anhorn (1996) |
| 1996 | 13 (+ 53 CAMP lakes) | Anhorn (1997) |
| 1997 | 12 (+ 59 CAMP lakes) | Anhorn (1998) |
| 1998 | 13 (+ 57 CAMP lakes) | Anhorn (1999) |
| 1999 | 14 (+ 99 CAMP lakes) | Anhorn (2000) |
| 2000 | 14 (+110 CAMP lakes) | Anhorn (2001) |
| 2001 | 12 (+120 CAMP lakes) | Anhorn (2002) |
| 2002 | 12 (+125 CAMP lakes) | Anhorn (2003) |
| 2003 | 12 (+128 CAMP lakes) | Anhorn (This Study) |

The long-term goal of the Council's lake studies has been to provide a comprehensive database to enable cities, counties and watershed management organizations (WMOs) to better manage area lakes. The Council believes that without such comprehensive lake data, the foundation of lake and watershed management plans is weakened. While the Council has provided a commendable lake data collection program, the data collection of others, specifically WMOs, is encouraged (Osgood 1989c). Several agencies and cities have taken initiative (for example, Ramsey County, Eagan, Maple Grove, and Minneapolis), but for the most part the WMOs are not collecting adequate data.

To date, the Council's lake monitoring programs have provided an important tool for making informed lake management decisions. Data from our regional lake monitoring programs are frequently used to determine possible trends in in-lake water quality, estimate expected ranges in water quality of unmonitored lakes, examine intra-and inter-regional differences, and investigate the relationships between landscape and water quality. A comprehensive regional lake monitoring program should ensure adequate representation across both space and time. However, due to cost and logistical problems, ground-based monitoring programs usually sacrifice spatial coverage (fewer lakes) in favor of more frequent sampling.

The Council addressed this lack of adequate data collection problem by initiating a citizen-assisted lake monitoring program (CAMP) in 1993. CAMP is funded in part by watershed districts (WDs), WMOs, counties, and cities that are participating in the program. Through this program, citizens collect

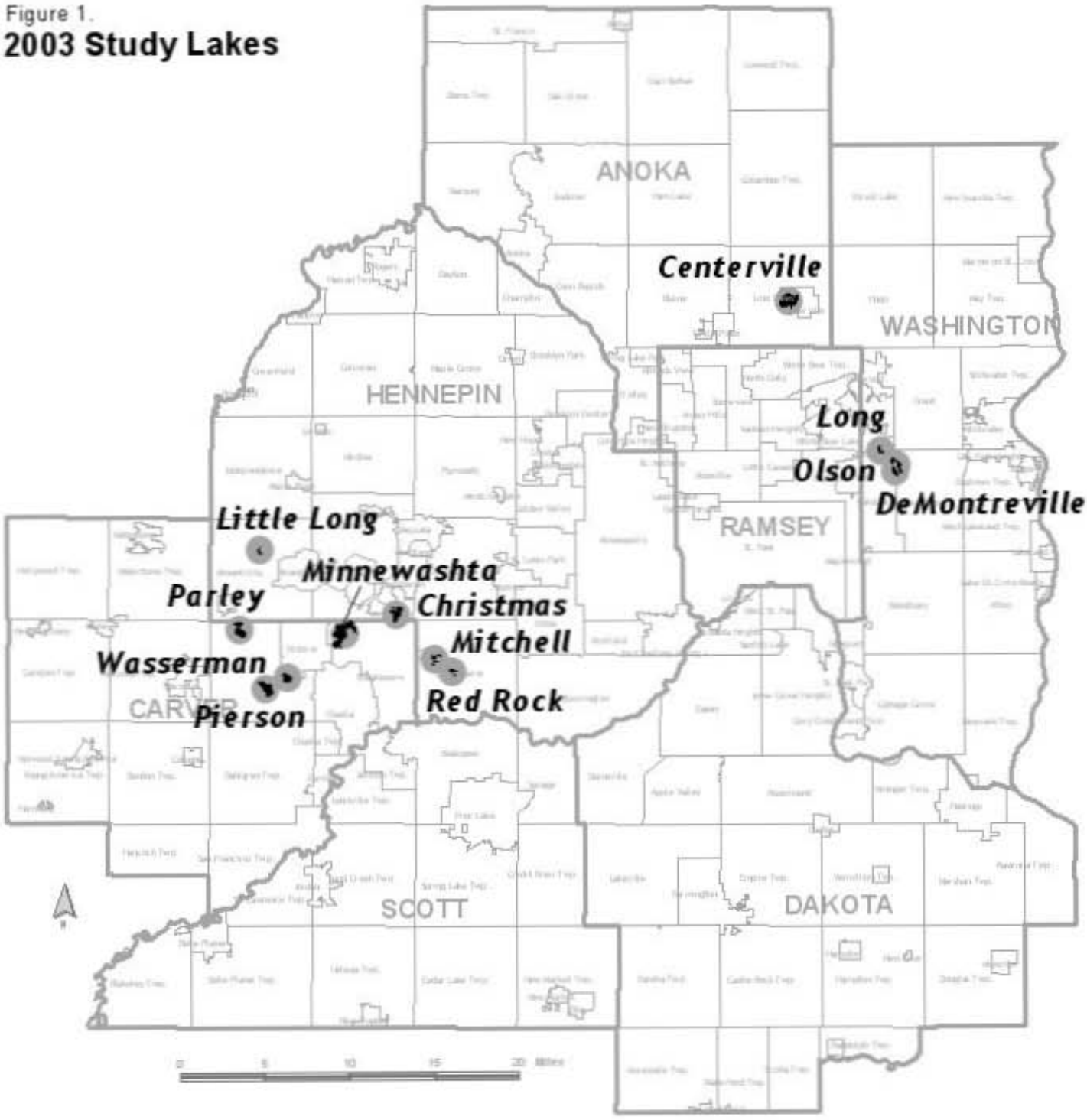
comprehensive data. To assure that the data collection methods used by citizen volunteers are credible; the Council conducted a pilot study along with its routine monitoring in 1991 (Hartsoe and Osgood 1991). The pilot study and its results are included in the 1993 lake report, and can be obtained by contacting Randy Anhorn at (651) 602-8743 or randy.anhorn@metc.state.mn.us. The methods and results of the CAMP for 2003 are described in Part II of this report.

In addition to using volunteers to expand the data collection process, satellite technology has potential to supplement existing (ground-based) monitoring and assessment programs. A study undertaken by the University of Minnesota in 2000 (funded through a Metropolitan Council --Twin Cities Water Quality Initiative [TCQI] grant) looked at this potential use of satellite remote sensing and GIS-based modeling tools to enhance the assessment of lake water quality in the TCMA. This study was successful in developing techniques and procedures for using Landsat imagery on a regional scale to assess trophic status of lakes in the TCMA. It developed a detailed set of procedures describing the satellite-based methods. And, applied the satellite–based procedures to a series of images of the TCMA that span several decades in order to evaluate how lake trophic conditions (especially water clarity) have changed over time and space in relation to changes in land-use and land-cover conditions.

In order to economically expand the spatial coverage of our lakes program, and provide a more complete picture of the annual water quality of lakes in the TCMA, the Council, through a MetroEnvironment Partnership grant, will add a satellite imagery component to our lakes program in 2004.

Figure 1.

**2003 Study Lakes**



## METHODS

Twelve area lakes were sampled by Council-staff at two-week intervals from mid-April through mid-October, 2003. The lakes were normally visited between 8:00 a.m. and noon on the sampling days. Samples were collected from one station located over the deepest spot near the center of the lakes (the sampling location(s), as well as graphs of the seasonal data are shown on lake information sheets located in alphabetical order at the end of Part I of this report).

A hand-held Global Positioning System (GPS) was used to lock in sampling location coordinates (shown as latitude and longitude on the lake information sheets), and to aid in relocating sampling locations during each ensuing monitoring event. Time, surf and weather conditions, and station depth were recorded upon anchoring at the site. Temperature, dissolved oxygen, pH, specific conductivity, turbidity, chloride, and oxidation reduction potential were measured at one-meter intervals (additional readings are captured at half-meter intervals near the thermocline) using a Yellow Springs, Inc. (model 610-DM) multiparameter field monitoring system. The YSI was calibrated in the morning, prior to the daily monitoring, and again after the last lake was monitored on that day. Water transparency was measured using a 20 cm black-and-white Secchi disk.

Water was collected from the lakes' surface (0-2 m) using a two-meter PVC pipe that held two liters of water. Two or three such samples were mixed in an 8-liter plastic jug. Subsurface samples (middle and near bottom) are drawn uing a 2-liter Van Dorn. All water samples were transported on ice in a dark cooler and processed and preserved within six hours of collection. Water from the surface jug was withdrawn for the following chemical analyses (depending on the lake): total phosphorus (TP), total dissolved phosphorus (TDP), total Kjeldahl nitrogen (TKN), chlorophyll-a (CLA), and chloride (Cl). Subsurface water samples were also drawn using a 2-liter Van Dorn. Subsurface samples were taken for TP and Cl analysis on all lakes deeper than 2.5 meters, and for TDP on Centerville Lake, Christmas Lake, Lake Minnewashta, and Lake Wasserman.

The routine chemical analyses were performed at the Metropolitan Council Environmental Services - Environmental Planning and Evaluation department (MCES-EPE) laboratory following U.S. EPA approved methods. Surface and subsurface water samples that were analyzed for TDP were filtered through a 0.45 μm membrane filter and analyzed for TP. Water samples tested for phosphorus and TKN were digested with the sulfates of hydrogen, potassium and mercury ($H_2SO4$, $K_2SO_4$ and $HgSO_4$). Following digestion, phosphorus was analyzed using a modified ascorbic acid reduction method (APHA 1980). Samples tested for TKN were chemically reduced the same way as the total phosphorus samples, then were color-intensified with sodium nitroprusside and assayed for ammonia colorimetrically. TKN and TP from the surface were periodically analyzed in duplicate to determine accuracy, at which time their average values were reported.

Water samples to be analyzed for CLA were filtered onto a 0.45 μm glass-fiber-filter, saturated with magnesium carbonate, and stored frozen in the dark until analyzed (within 30 days). Chlorophyll was extracted from the filters by homogenization in 90 percent aqueous acetone. The optical density of the extract was measured spectrophotometrically at 630, 647, 664 and 750 nm. CLA was calculated from a trichromatic equation that corrects for turbidity (APHA 1980).

## RESULTS/ANALYSES

Tables 1, 2, and 3 show summertime average phosphorus concentration in micrograms per liter (µg/l), chlorophyll-a concentration in µg/l, and Secchi transparency in meters (m), for the 12 lakes monitored by the Council-staff. Raw data will be input into the STORET database, or it can be obtained upon request by contacting Randy Anhorn at (651) 602-8743 or randy.anhorn@metc.state.mn.us. Tables 1, 2, and 3, also document summertime means (May through September) for any prior years the lake was monitored by the Council. Seasonal data is graphed for each lake at the end of Part I of this report.

Due to normal seasonal variability, insufficient data collection intensity for each lake, and changing climatological conditions, determining long-range water quality trends in area lakes is generally not statistically reliable. Accurate conclusions are difficult because one year's data may represent only one monitoring date or parameter, water quality may fluctuate greatly from year to year, and/or the lake may only be monitored once every ten years. Therefore, to fully determine if there truly is a change in the water quality of a lake, either additional years of data collection are needed in the future to accurately determine the present condition of the lake, and/or a broader, more complete historical baseline database is needed.

While an extensive database of a lake's present water quality is obtainable; a more extensive historical database is not. In other words, without a complete and accurate historical database, which is rare, it is difficult to determine if a lake's quality has changed because it is not known what its quality used to be. Therefore, an extensive baseline database needs to be constructed now so lake quality trends can be determined in the future. Many of 12 lakes monitored by Council staff in 2003 have databases that are insufficient in size and quality to determine "statistically significant" long-range trends. Statistical trend analysis on the few lake databases which did contain sufficient data revealed improving water clarity trends in two of the lakes (DeMontreville and Olson) (MPCA 2003).

After comparing the 2003 data to pre-2003 data on the remaining 10 lakes, a few general comments and observations can be made. A review of each lakes' summertime TP, CLA and Secchi means and water quality grades reveal that they seem to have water quality levels that fall within their normal fluctuation ranges of seasonal water quality. While a few of the 10 lakes may show a slight degradation in one of the individual parameters, the other parameters either showed no real difference or a slight improvement. An example would be Lake Wasserman, which recorded significantly worse TP and CLA conditions in 2003 (as compared to those of 2002), yet had a slighlty improved water clarity.

Overall, four of the 12 Council-staff monitored lakes monitored in 2003 were also monitored in 2002. Three of the four lakes which were monitored by the Council in 2003 and 2003, received identical overall water quality grades in both years, while one, Lake Minnewashta had a better overall grade in 2003. Lake Minnewashta's 2003 overall grade ("A") is an improvemenat over the "B" the lake received in 2002. The lake's 2003 overall grade is identical to those recorded in each of the previous six years of monitoring (1984, 1990, 1993, and 1997-1999), prior to the poorer grade of 2002.

## Table 1
## Trends in May - September average surface total phosphorus concentration (μg/l)

| Lake | '80 | '81 | 82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Centerville | 137 | 111 | -- | 136 | -- | -- | -- | -- | 133 | -- | -- | 106 | -- | -- | -- | -- | -- | -- | -- | 49 | 50 | 45 | -- | 59 |
| Christmas | 25 | 17 | -- | -- | -- | 22 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 13 | 11 | 15 | -- | -- | 12 | 12 |
| DeMontreville | 40 | -- | -- | -- | 43 | -- | -- | -- | -- | -- | -- | 30 | -- | 25 | -- | 33 | -- | -- | -- | -- | 20 | -- | -- | 18 |
| Little Long | 20 | -- | -- | -- | 23 | -- | -- | -- | -- | -- | NA | -- | -- | -- | -- | -- | -- | -- | 10 | -- | -- | 9 | -- | 10 |
| Long (Pine Springs) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 30 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 62 |
| Minnewashta | -- | -- | -- | -- | 19 | -- | -- | -- | -- | -- | NA | -- | -- | 21 | -- | -- | -- | 17 | 15 | 22 | -- | -- | 21 | 17 |
| Mitchell | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 80 | -- | -- | -- | 50 | -- | -- | -- | 119 | 90 | -- | -- | 76 |
| Olson | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 27 | -- | 24 | -- | 36 | -- | -- | -- | -- | 20 | -- | -- | 18 |
| Parley | -- | -- | -- | -- | 91 | -- | 207 | 133 | -- | -- | -- | 104 | -- | -- | -- | -- | 94 | -- | -- | 79 | -- | 90 | -- | 75 |
| Pierson | 25* | 24 | -- | 18 | -- | -- | -- | -- | -- | 20 | -- | -- | -- | -- | -- | 21 | -- | -- | -- | -- | -- | 18 | 21 | 19 |
| Red Rock | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 70 | -- | -- | -- | -- | -- | -- | -- | 74 | 80 | -- | -- | 70 |
| Wasserman | -- | -- | -- | 78 | -- | -- | 44 | 48 | -- | -- | -- | -- | -- | -- | 64 | -- | -- | 63 | 65 | 85 | -- | -- | 51 | 72 |

* Sampled only twice in 1980

## Table 2
## Trends in May - September average surface chlorophyll-a concentration (µg/l)

| Lake | '80 | '81 | 82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Centerville | 61 | 43 | -- | 48 | -- | -- | -- | -- | 38 | -- | -- | 30 | -- | -- | -- | -- | -- | -- | -- | 10 | 22 | 30 | -- | 47 |
| Christmas | 3 | 3 | -- | -- | -- | 2 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 3 | -- | -- | 4 | 3 |
| DeMontreville | 29 | -- | -- | -- | 24 | -- | -- | -- | -- | -- | -- | 25 | -- | 9 | -- | 17 | -- | -- | -- | -- | 7 | -- | -- | 14 |
| Little Long | 3 | -- | -- | -- | 3 | -- | -- | -- | -- | -- | 3 | -- | -- | -- | -- | -- | -- | -- | 5 | -- | -- | 4 | -- | 4 |
| Long (Pine Springs) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 20 |
| Minnewashta | -- | -- | -- | -- | 6 | -- | -- | -- | -- | -- | 6 | -- | -- | 8 | -- | -- | -- | 5 | 6 | 9 | -- | -- | 10 | 8 |
| Mitchell | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 37 | -- | -- | -- | 40 | -- | -- | -- | 53 | 59 | -- | -- | 76 |
| Olson | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 17 | -- | 9 | -- | 15 | -- | -- | -- | -- | 8 | -- | -- | 10 |
| Parley | -- | -- | -- | -- | 70 | -- | 86 | 66 | -- | -- | -- | 76 | -- | -- | -- | -- | 55 | -- | -- | 57 | -- | 78 | -- | 65 |
| Pierson | 12* | 8 | -- | 14 | -- | -- | -- | -- | -- | 10 | -- | -- | -- | -- | -- | 11 | -- | -- | -- | -- | -- | 18 | 12 | 13 |
| Red Rock | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 50 | -- | -- | -- | -- | -- | -- | -- | 62 | 41 | -- | -- | 51 |
| Wasserman | -- | -- | -- | 65 | -- | -- | 42 | 40 | -- | -- | -- | -- | -- | -- | 47 | -- | -- | 44 | 64 | 50 | -- | -- | 19 | 30 |

* Sampled only twice in 1980

## Table 3
## Trends in May - September average Secchi disk transparency (m)

| Lake | '80 | '81 | 82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Centerville | 1.5 | 1.6 | -- | 1.4 | -- | -- | -- | -- | 0.8 | -- | -- | 1.4 | -- | -- | -- | -- | -- | -- | -- | 1.0 | 1.8 | 1.3 | -- | 1.5 |
| Christmas | 6.1 | 6.3 | -- | -- | -- | 7.4 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 5.7 | 6.0 | 6.2 | -- | -- | 5.6 | 4.7 |
| DeMontreville | 2.0 | -- | -- | -- | 1.8 | -- | -- | -- | -- | -- | -- | 2.2 | -- | 2.7 | -- | 2.3 | -- | -- | -- | -- | 3.7 | -- | -- | 3.3 |
| Little Long | 5.3 | -- | -- | -- | 5.2 | -- | -- | -- | -- | -- | 6.0 | -- | -- | -- | -- | -- | -- | -- | 4.8 | -- | -- | 4.8 | -- | 4.5 |
| Long (Pine Springs) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.9 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.6 |
| Minnewashta | -- | -- | -- | -- | 3.1 | -- | -- | -- | -- | -- | 3.6 | -- | -- | 3.2 | -- | -- | -- | 3.4 | 2.8 | 2.7 | -- | -- | 2.8 | 3.0 |
| Mitchell | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1.3 | -- | -- | -- | 1.3 | -- | -- | -- | 1.2 | 1.4 | -- | -- | 1.2 |
| Olson | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2.4 | -- | 2.9 | -- | 2.3 | -- | -- | -- | -- | 3.4 | -- | -- | 3.1 |
| Parley | -- | -- | -- | -- | 0.8 | -- | 1.8 | 1.1 | -- | -- | -- | 1.0 | -- | -- | -- | -- | 1.3 | -- | -- | 1.2 | -- | 1.4 | -- | 1.5 |
| Pierson | 2.4* | 3.3 | -- | 2.4 | -- | -- | -- | -- | -- | 2.7 | -- | -- | -- | -- | -- | 2.2 | -- | -- | -- | -- | -- | 2.0 | 2.0 | 2.7 |
| Red Rock | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.7 | -- | -- | -- | -- | -- | -- | -- | 1.2 | 1.5 | -- | -- | 1.6 |
| Wasserman | -- | -- | -- | 1.3 | -- | -- | 2.4 | 2.2 | -- | -- | -- | -- | -- | -- | 0.9 | -- | -- | 1.2 | 0.9 | 0.9 | -- | -- | 1.1 | 1.3 |

* Sampled only twice in 1980

## LAKE QUALITY REPORT CARD

The Metropolitan Council following its 1989 lake survey (Osgood 1989b) developed the lake quality report card. The idea is simply that lake water quality characteristics can be ranked by comparing measured values to those of other Metro Area lakes. In this way, technical information, which in the past had required professional analysis, can more easily be used by a less technical audience to visualize the water quality of their lake relative to other area lakes. The grading curve represents percentile ranges for three water quality indicators - the summertime (May - September) average values for total phosphorus, chlorophyll-a, and Secchi disk. These percentiles use ranked data from 120 lakes sampled from 1980 - 1988:

| GRADE | PERCENTILE | TP(µg/l) | CLA(µg/l) | Secchi(m) |
|---|---|---|---|---|
| A | <10 | <23 | <10 | >3.0 |
| B | 10-30 | 23-32 | 10-20 | 2.2-3.0 |
| C | 30-70 | 32-68 | 20-48 | 1.2-2.2 |
| D | 70-90 | 68-152 | 48-77 | 0.7-1.2 |
| F | >90 | >152 | >77 | <0.7 |

In 2000, the percentiles determined from the 1980-1988 water quality database of 120 lakes were compared to calculated percentiles from a more current and expanded 1980-1999 water quality database of 230 lakes. It was found that the percentiles from the expanded database were very similar to those determined from the 1980-1988 database. For this reason, and in an attempt to maintain commonality, the original 1980-1988 percentiles are continued to be used for lake quality grading purposes.

The three variables used in the grading system strongly relate to open-water nuisance-aspects of a lake (i.e. algal blooms), which can indicate accelerated aging (cultural eutrophication). For example, lake phosphorus concentration has been related to increased algal abundance, increased frequency of algal blooms, and to the increased abundance of blue-green algae (Osgood 1988b). Chlorophyll-a, which is a pigment in plants (including algae) essential in the photosynthesis process, is used to estimate the algal abundance of a lake. And finally, Secchi transparency relates to the appearance of a lake (generally the fewer algae, the better the transparency of a lake). TKN concentration was not included in the grading process because most lake nuisances in the area are related to the phosphorus concentration of the lake (Osgood 1988b).

These water quality grades, however, only characterize the open-water quality of lakes. Other nuisances, such as the abundance of aquatic macrophytes, are not indicated with these grades.

The percentile curve can be used to assign individual TP, CLA and Secchi grades to the monitored lakes. Therefore, a lake having a mean summertime Secchi transparency of 1.7 m would receive a “C” grade, or is considered average compared to other area lakes. Overall lake water quality grades were determined by averaging the individual grades. Grades will generally correspond to descriptive rankings and recreational-use impairments of lakes. Lakes receiving an “A” (<10-percentile) can be deemed exceptional as compared to other area lakes and as having no recreational use impairments. A “B” grade lake is considered to have very good water quality and some recreational use impairment, while lakes receiving a “C” are considered to have average water quality and are recreationally impaired. A “D” grade lake translates to a very poor ranking (severely impaired), and a lake receiving a grade of “F” would mean extremely poor quality compared to other area lakes and indicates no possible recreational use.

The report card for lakes sampled by Metropolitan Council-staff in 2003 is presented below. Grades for CAMP-monitored lakes will be addressed later in this report. The grades are based on all data from past studies, so that the grade represents an overall characterization. Pluses and minuses are assigned to indicate apparent trends, either improvement (+) (e.g., DeMontreville and Olson) or degradation (-) in the quality of the lake. In the case of Lake DeMontreville and Lake Olson, the lakes received overall grades of "C" in the 1980's, "B's" in the 1990's and "A's" in 2000 and 2003.

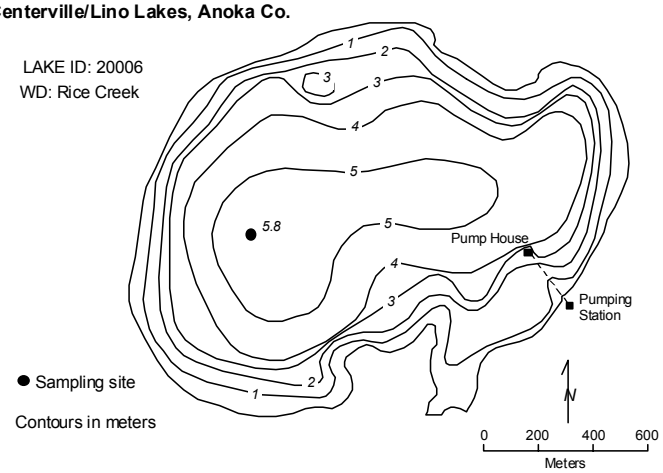
2003 LAKE QUALITY REPORT CARD

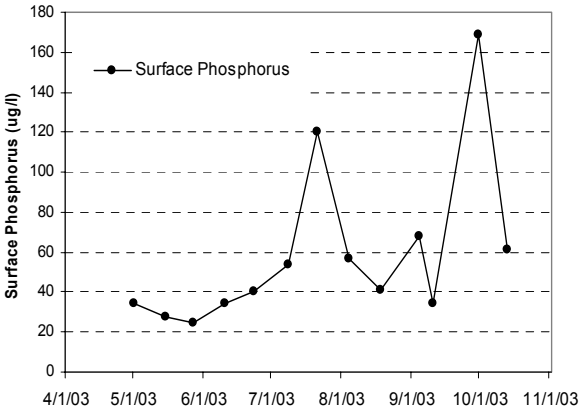
| | | | |
|---|---|---|---|
| Centerville | C | Mitchell | D |
| Christmas | A | Olson | A+ |
| DeMontreville | A+ | Parley | D |
| Little Long | A | Pierson | B |
| Long (Pine Springs) | C | Red Rock | D |
| Minnewastha | A | Wasserman | C |

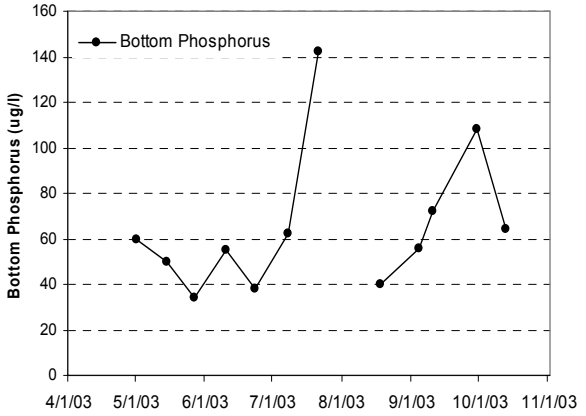
# Centerville Lake

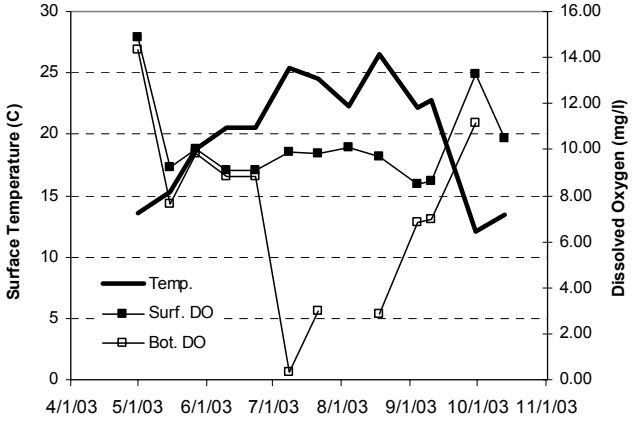
**Centerville/Lino Lakes, Anoka Co.**

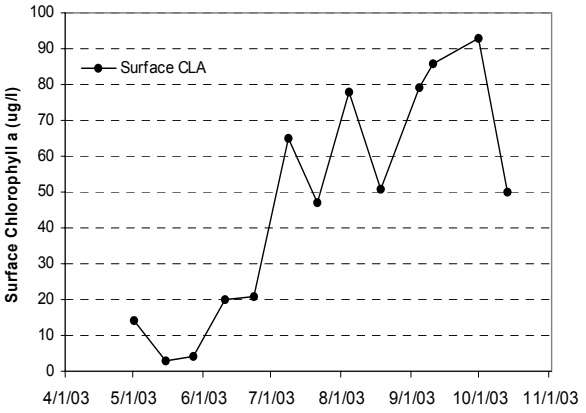
LAKE ID: 20006
WD: Rice Creek

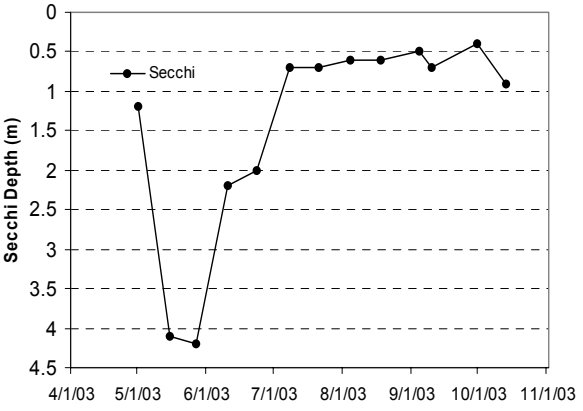



**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | C | C | | C |
| Chlorophyll a | | | | | | | | | C | C | | C |
| Secchi Depth | D | D | C | | | | | | C | C | | C |
| **Overall** | | | | | | | | | **C** | **C** | | **C** |

Source: Metropolitan Council and STORET data

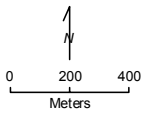
# Christmas Lake

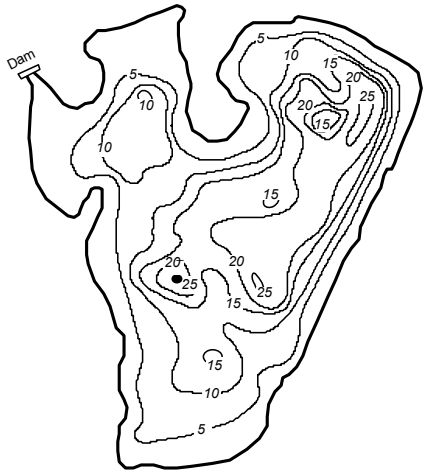
**Chanhassen, Carver Co./**
**Shorewood, Hennepin Co.**

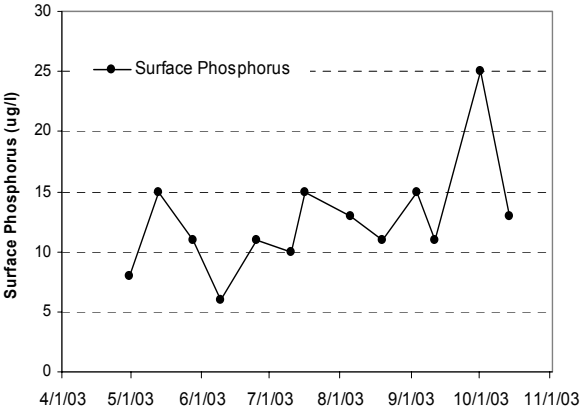
Lake ID: 270137
WD: Minnehaha Creek

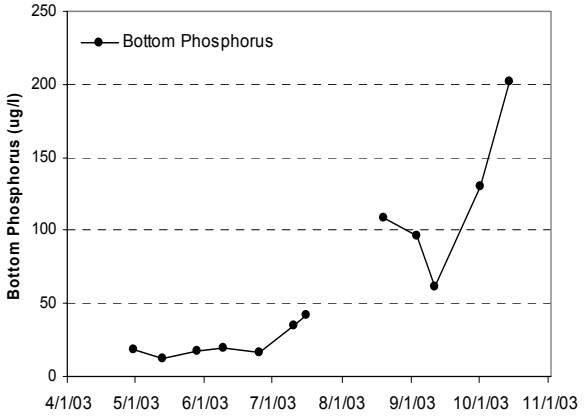
● Sampling site

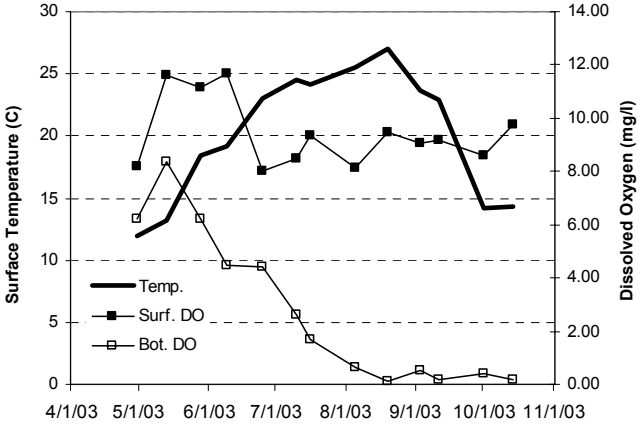
Contours in meters

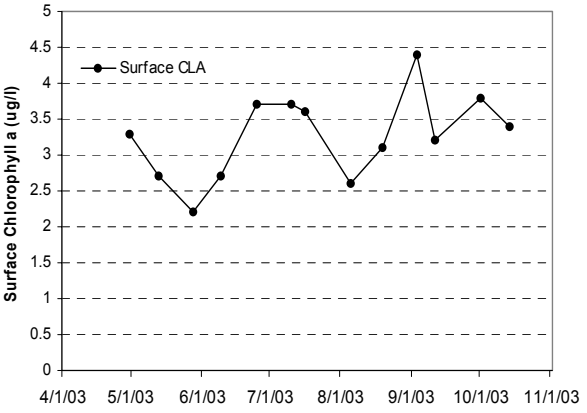


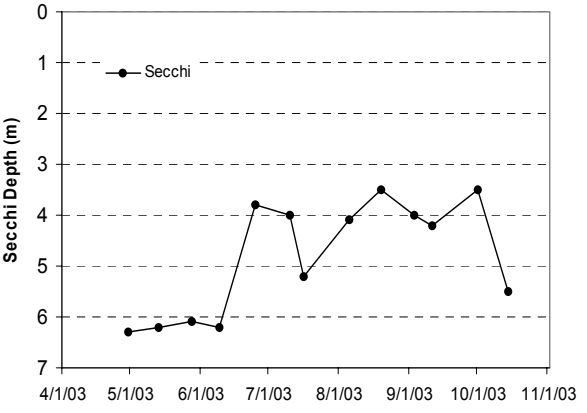




**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | A | A | A | | | A | A |
| Chlorophyll a | | | | | | A | A | A | | | A | A |
| Secchi Depth | | | | | | A | A | A | | | A | A |
| **Overall** | | | | | | **A** | **A** | **A** | | | **A** | **A** |

Source: Metropolitan Council and STORET data

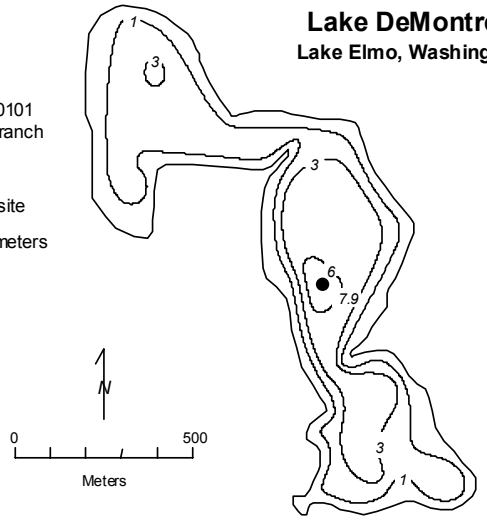
# Lake DeMontreville

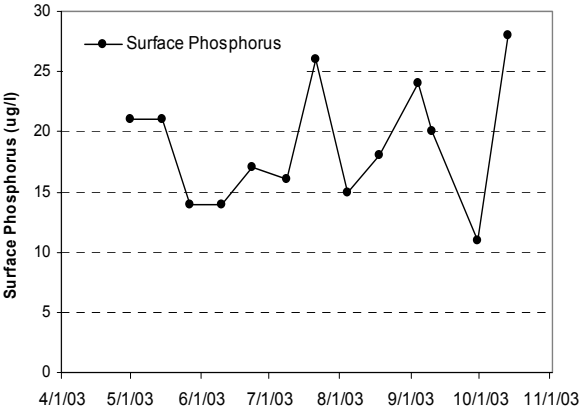
**Lake Elmo, Washington Co.**

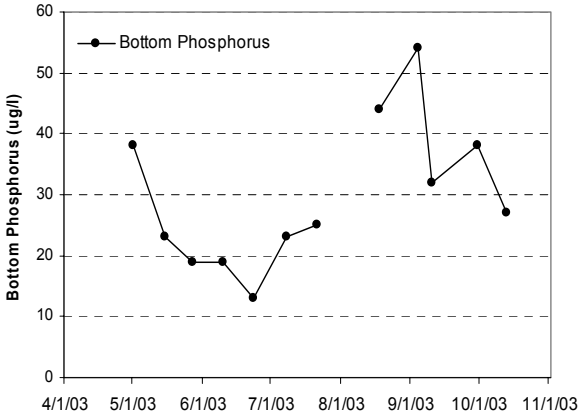
Lake ID: 820101
WD: Valley Branch

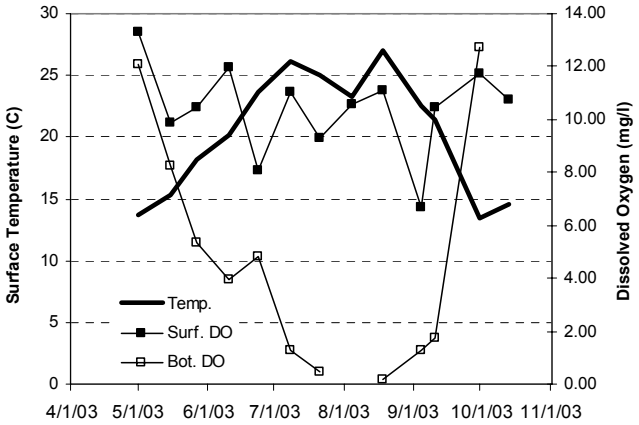
● Sampling site

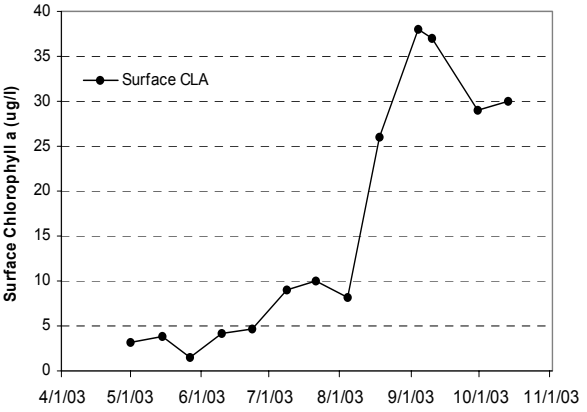
Contours in meters

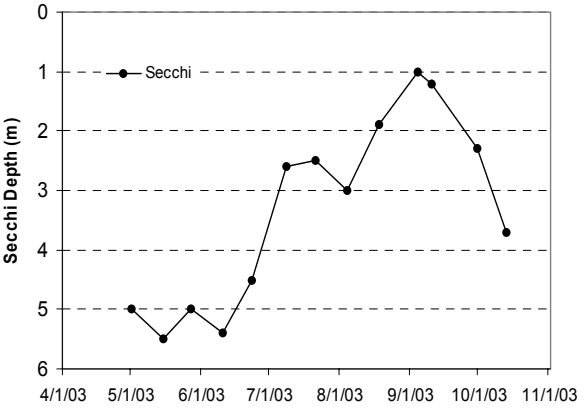



**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | B | | C | | | | | A | | | A |
| Chlorophyll a | | A | | B | | | | | A | | | B |
| Secchi Depth | | B | | B | | | | | A | | | A |
| **Overall** | | **B** | | **B** | | | | | **A** | | | **A** |

Source: Metropolitan Council and STORET data

# Long Lake

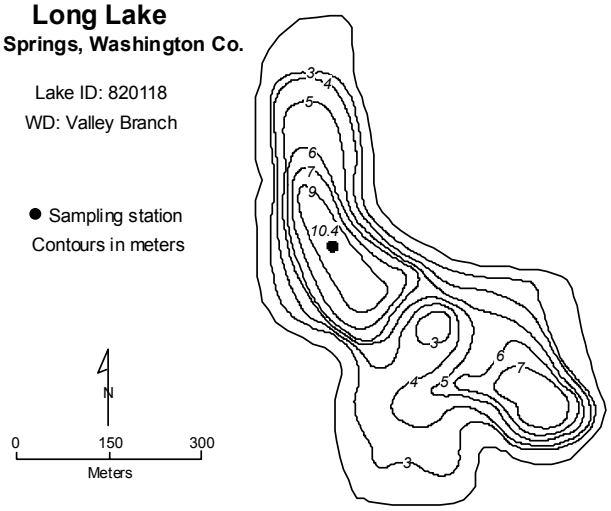
**Pine Springs, Washington Co.**

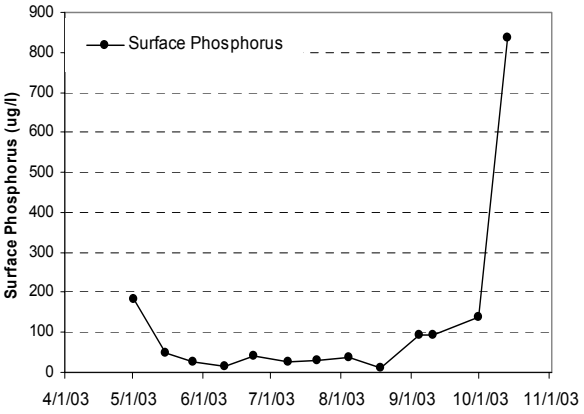
Lake ID: 820118

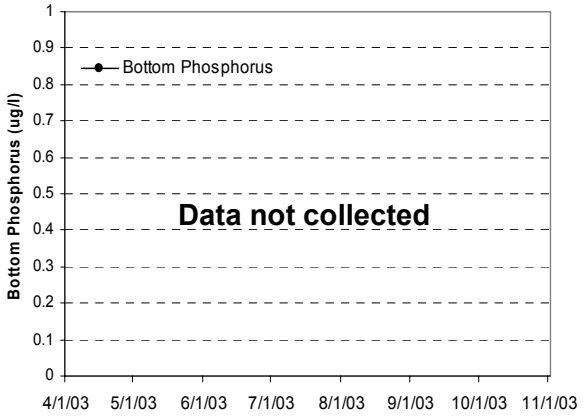
WD: Valley Branch

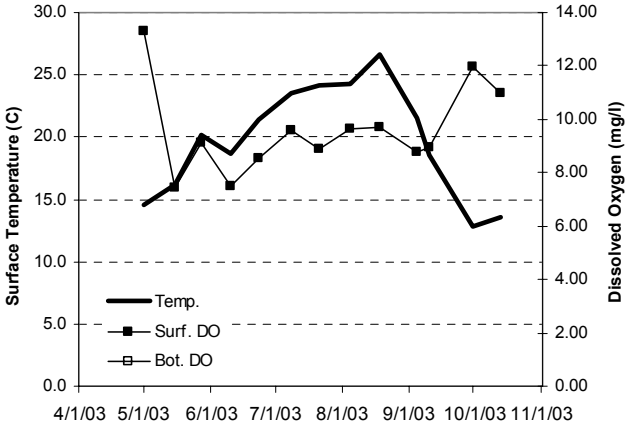
● Sampling station

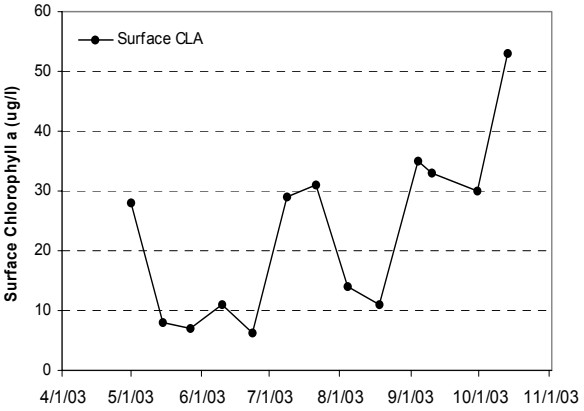
Contours in meters

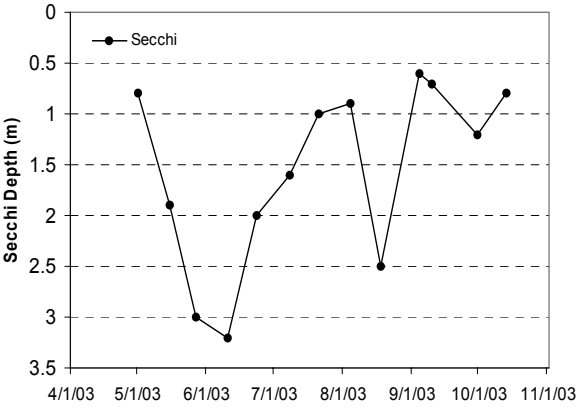



**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | B | | | | | | | | | | C |
| Chlorophyll a | | B | | | | | | | | | | C |
| Secchi Depth | | C | | | | | | | | | | C |
| **Overall** | | **B** | | | | | | | | | | **C** |

Source: Metropolitan Council and STORET data

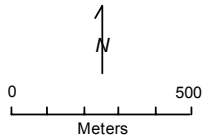
# Little Long Lake

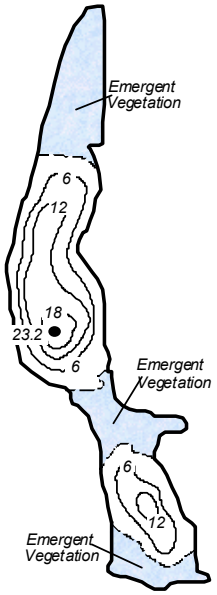
**Minnetrista, Hennepin Co.**

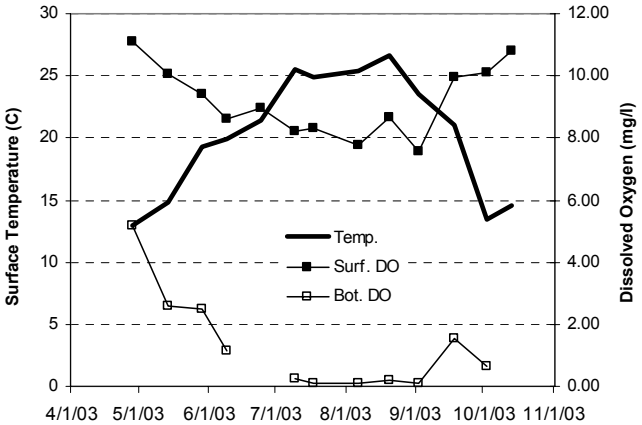
Lake ID: 270179-02
WMO: Pioneer-Sarah Creek

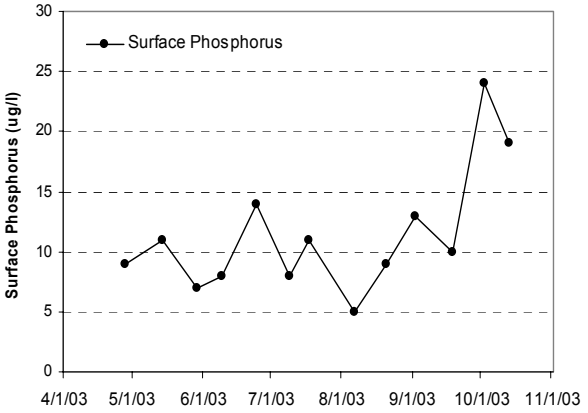
● Sampling site

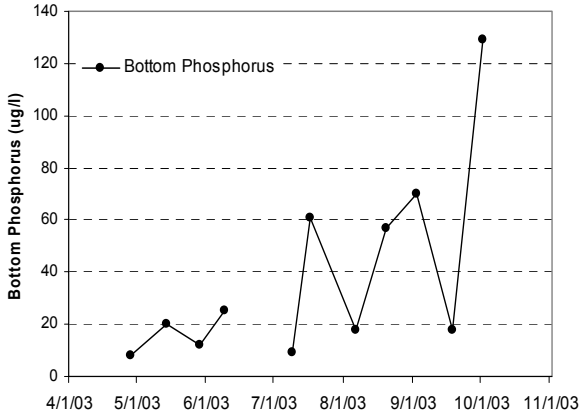
Contours in meters

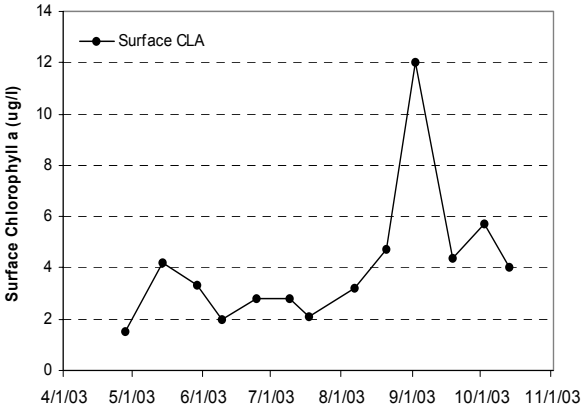


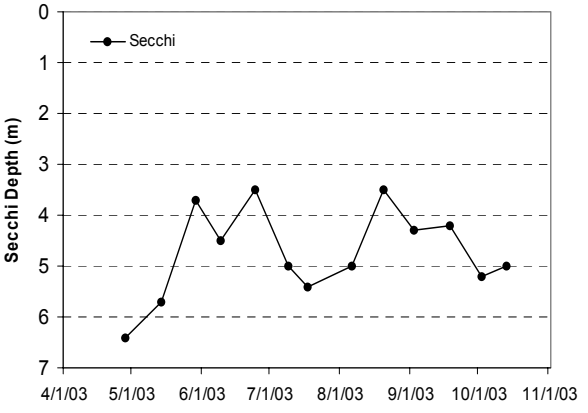




**Lake Water Quality Grades Based on Summertime Averages**

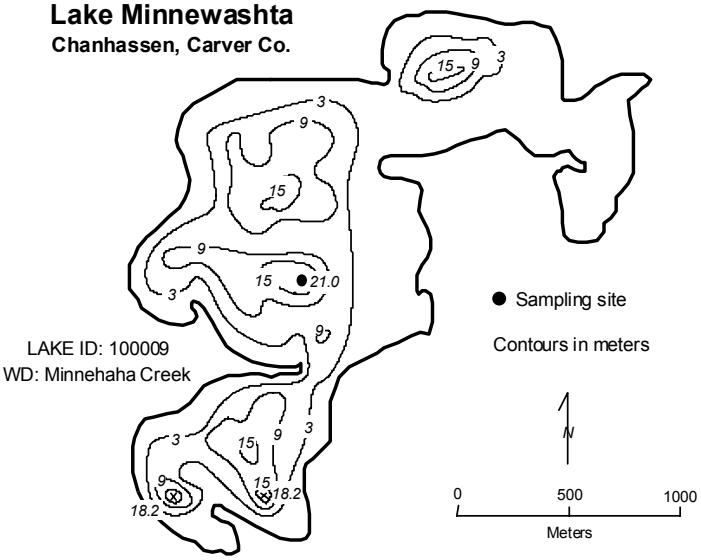
| Year | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | A | | | | A | | | | | | | |
| Chlorophyll a | A | | | | A | | | | | | A | |
| Secchi Depth | A | | | | A | | | | | | A | |
| **Overall**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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | A | | | A | | A |
| Chlorophyll a | | | | | | | A | | | A | | A |
| Secchi Depth | | | | | | | A | | | A | | A |
| **Overall** | | | | | | | **A** | | | **A** | | **A** |

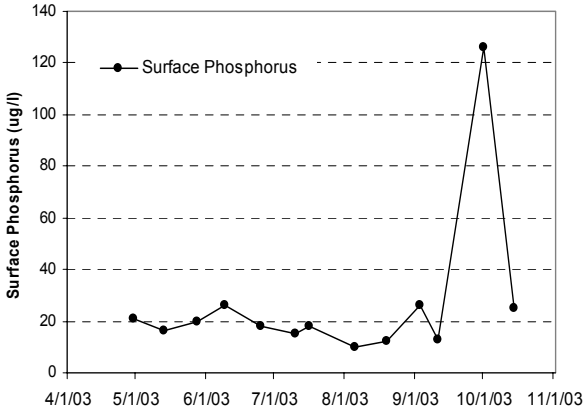
Source: Metropolitan Council and STORET data

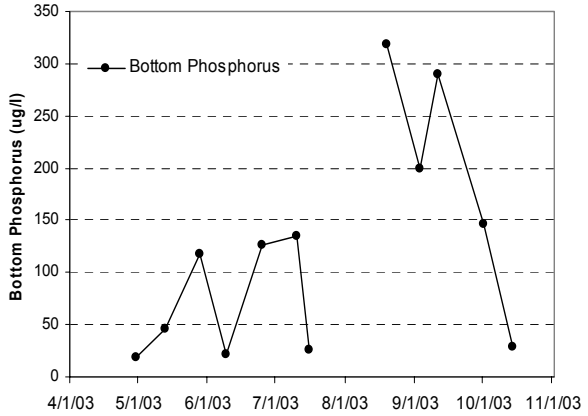
## Lake Minnewashta

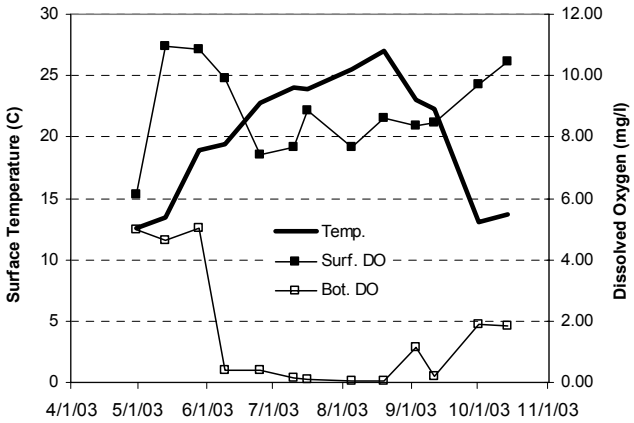
**Chanhassen, Carver Co.**

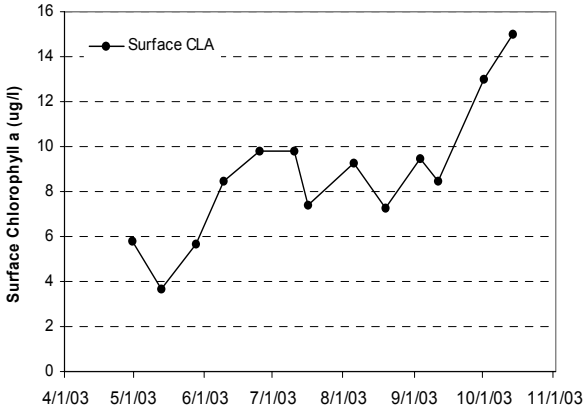


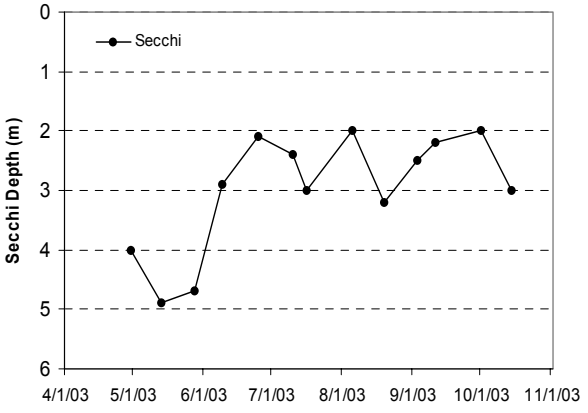

LAKE ID: 100009
WD: Minnehaha Creek




**Lake Water Quality Grades Based on Summertime Averages**

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

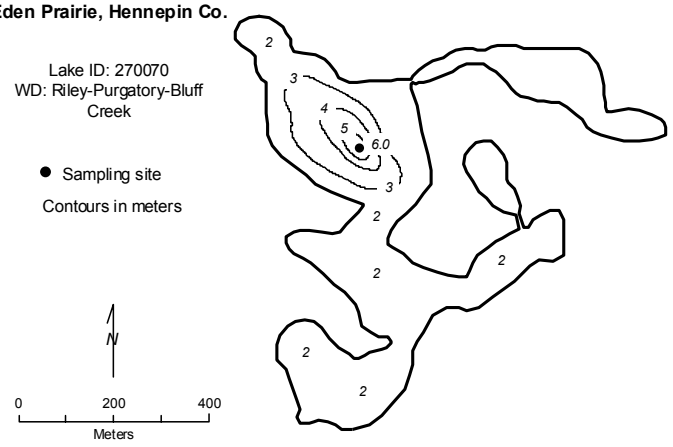
| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | A | | | | A | A | A | | | A | A |
| Chlorophyll a | | A | | | | A | A | A | | | B | A |
| Secchi Depth | | A | | | | A | A | B | | | B | B |
| **Overall** | | **A** | | | | **A** | **A** | **A** | | | **B** | **A** |

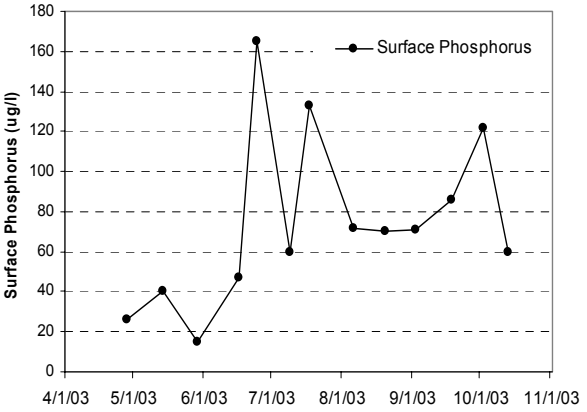
Source: Metropolitan Council and STORET data

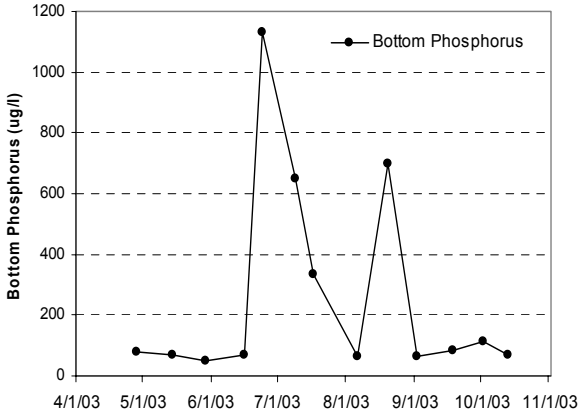
## Lake Mitchell

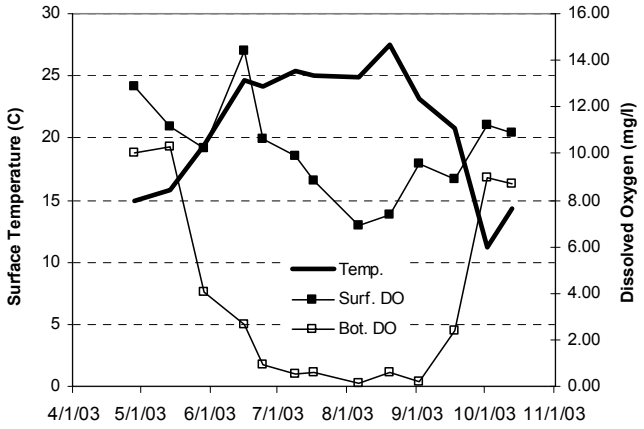
**Eden Prairie, Hennepin Co.**

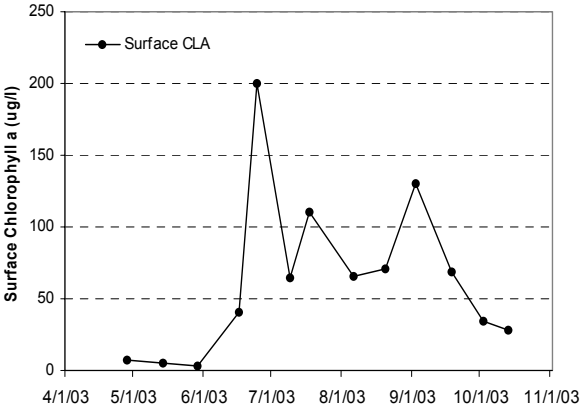
Lake ID: 270070
WD: Riley-Purgatory-Bluff Creek

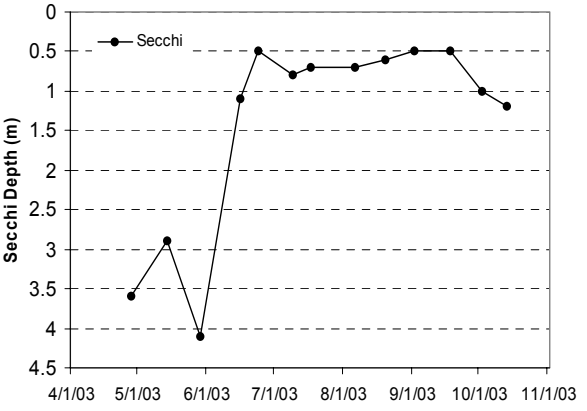



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | C | | | | D | D | | | D |
| Chlorophyll a | | | | C | | | | D | D | | | D |
| Secchi Depth | | | | C | | | | D | C | | | C |
| **Overall** | | | | **C** | | | | **D** | **D** | | | **D** |

Source: Metropolitan Council and STORET data

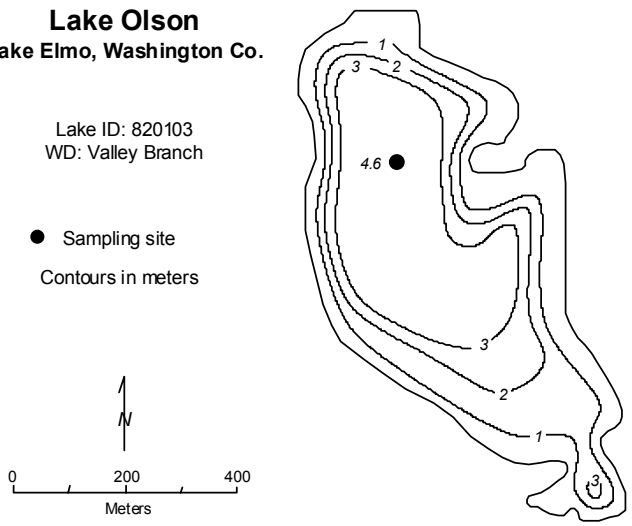
# Lake Olson

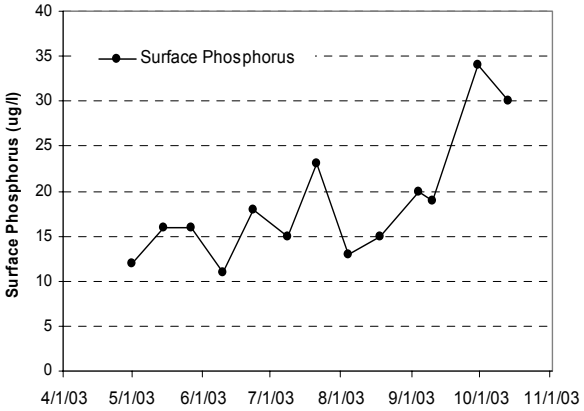
**Lake Elmo, Washington Co.**

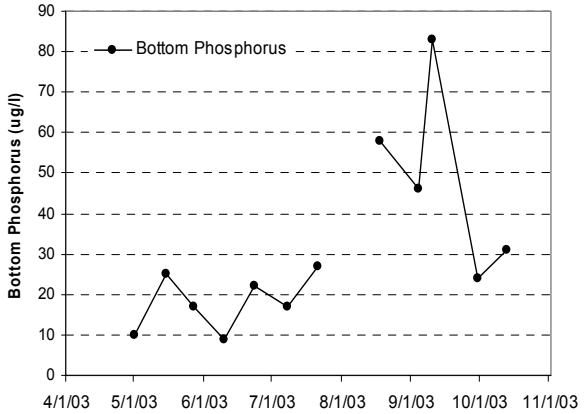
Lake ID: 820103
WD: Valley Branch

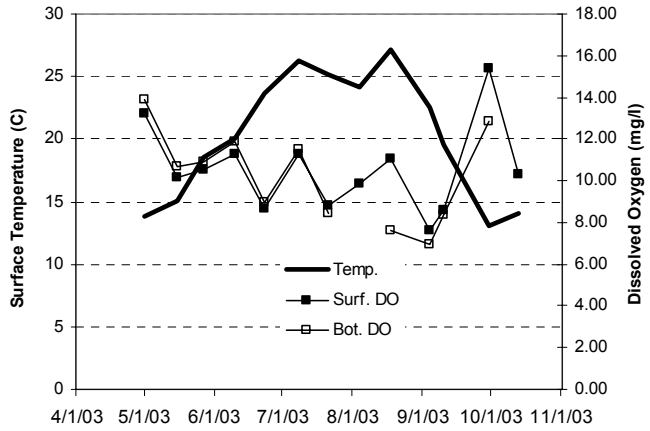
● Sampling site

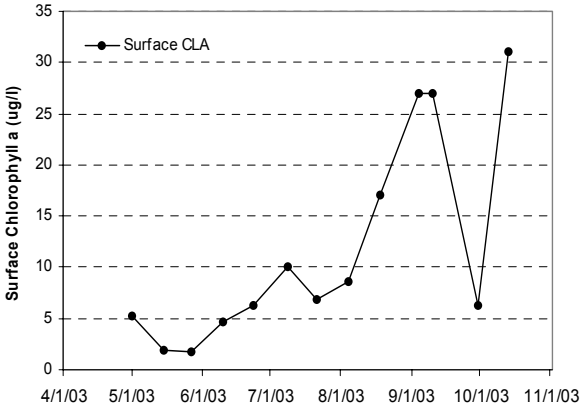
Contours in meters

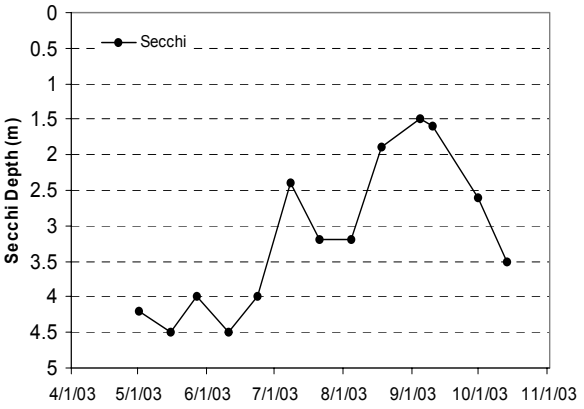


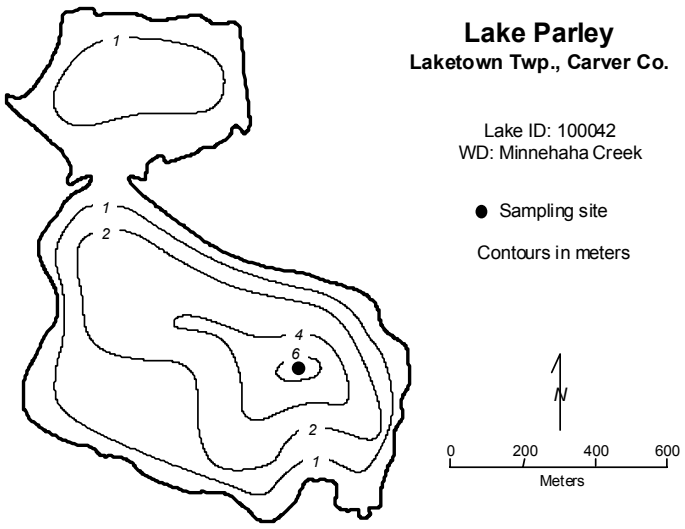




**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | B | | C | | | | | A | | | A |
| Chlorophyll a | | A | | B | | | | | A | | | B |
| Secchi Depth | | B | | B | | | | | A | | | A |
| **Overall** | | **B** | | **B** | | | | | **A** | | | **A** |

Source: Metropolitan Council and STORET data



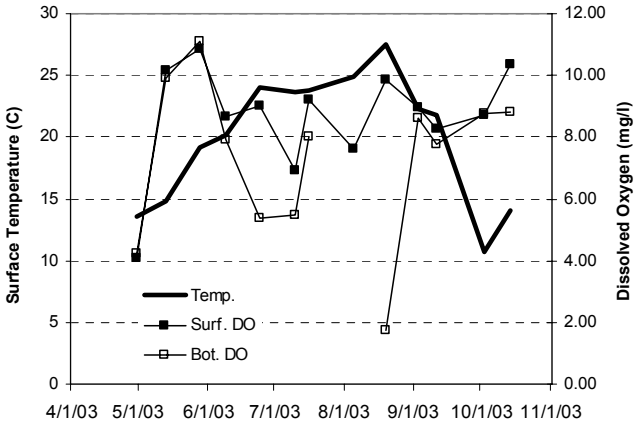

# Lake Parley

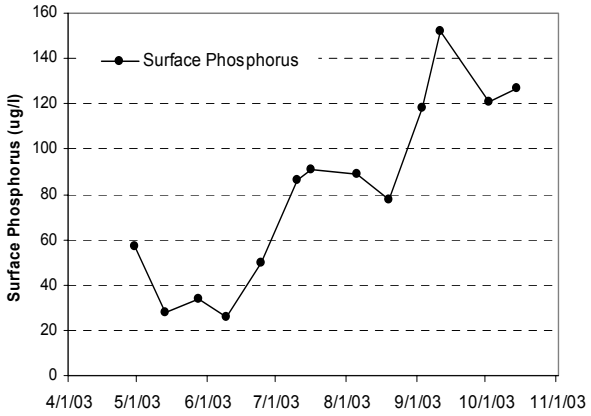
**Laketown Twp., Carver Co.**

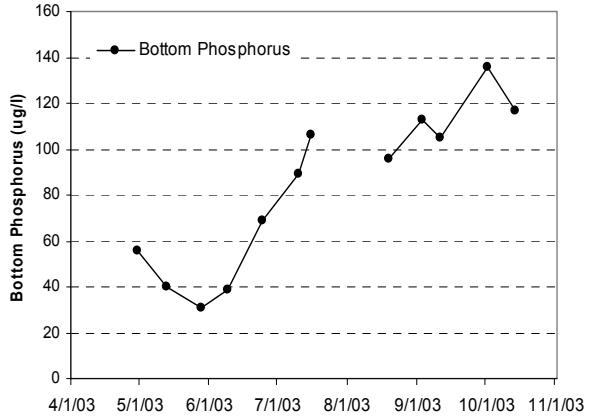
Lake ID: 100042
WD: Minnehaha Creek

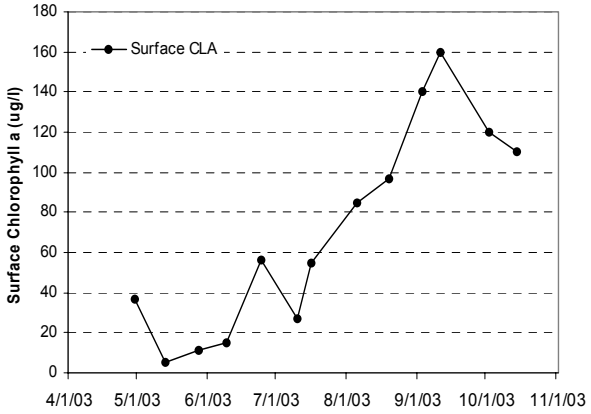
● Sampling site

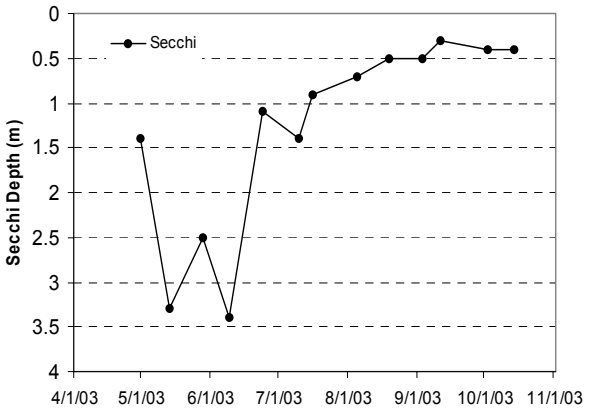
Contours in meters




**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | D | | | D | | | | D |
| Chlorophyll a | | | | | D | | | D | | | | D |
| Secchi Depth | | | | | C | | | D | | | | C |
| **Overall** | | | | | **D** | | | **D** | | | | **D** |

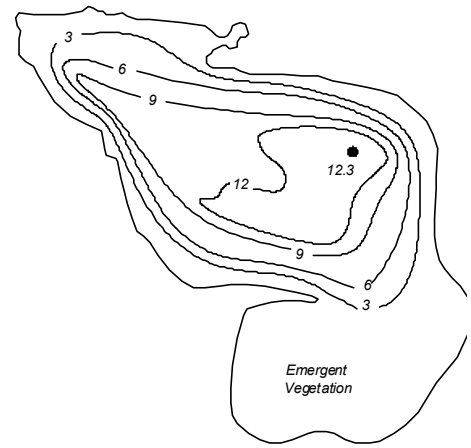
Source: Metropolitan Council and STORET data

# Lake Pierson

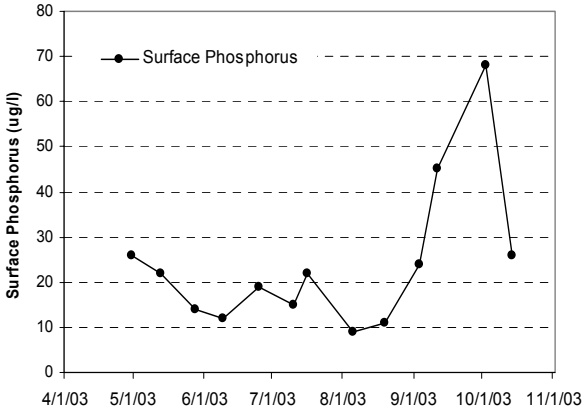
**Laketown Twp., Carver Co.**

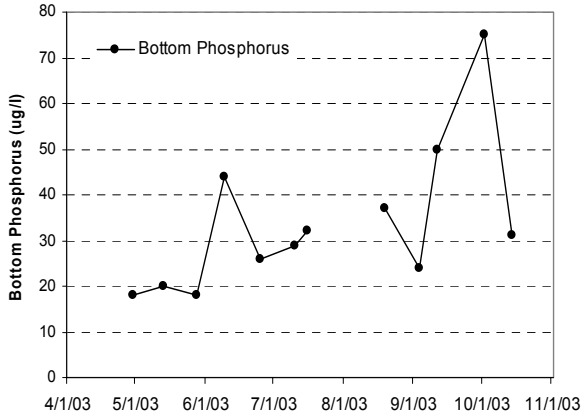
Lake ID: 100053
WD: Minnehaha Creek

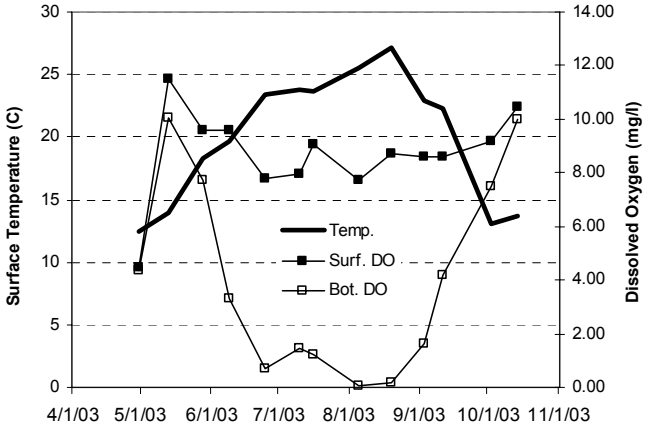
● Sampling site
Contours in meters

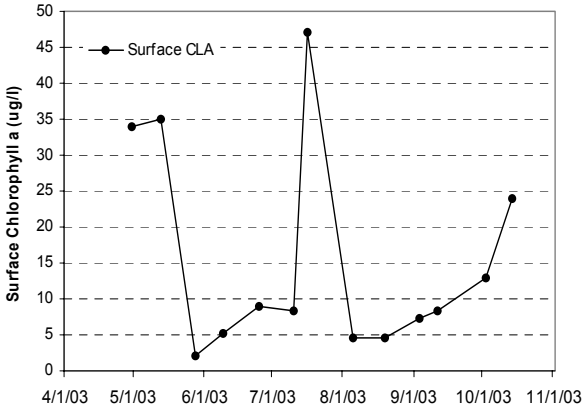


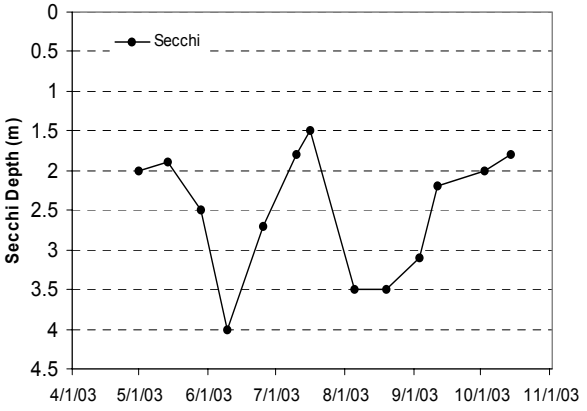

0 600 1,200
Meters



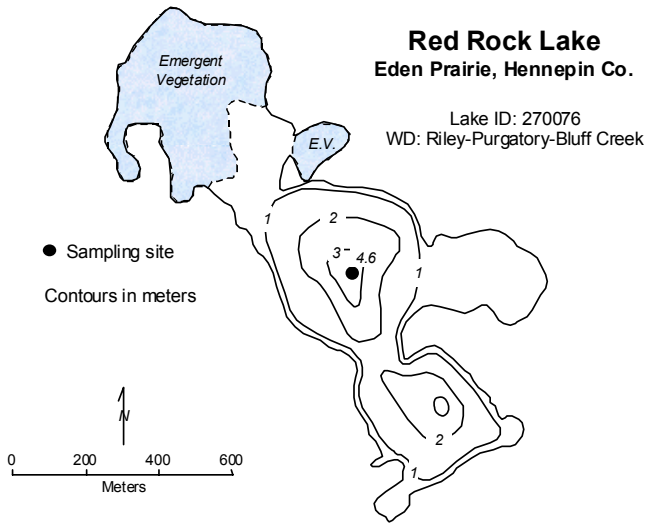



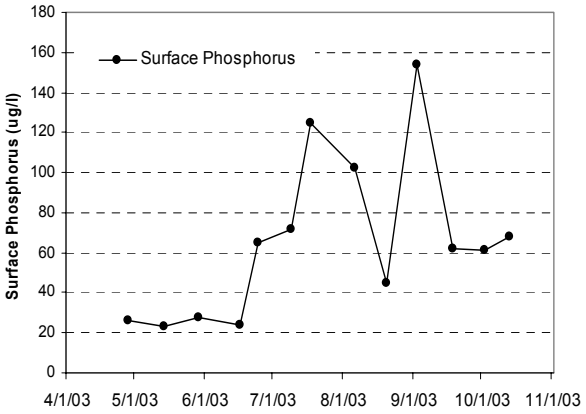

**Lake Water Quality Grades Based on Summertime Averages**

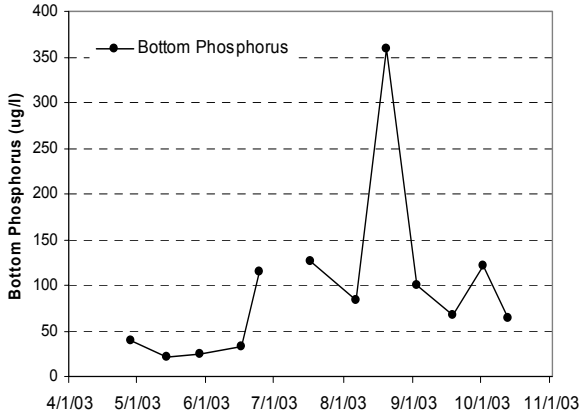
| Year | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | B | A | A | | | | | | | A | | |
| Chlorophyll a | B | A | B | | | | | | | A | | |
| Secchi Depth | B | A | B | | | | | | | B | | |
|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

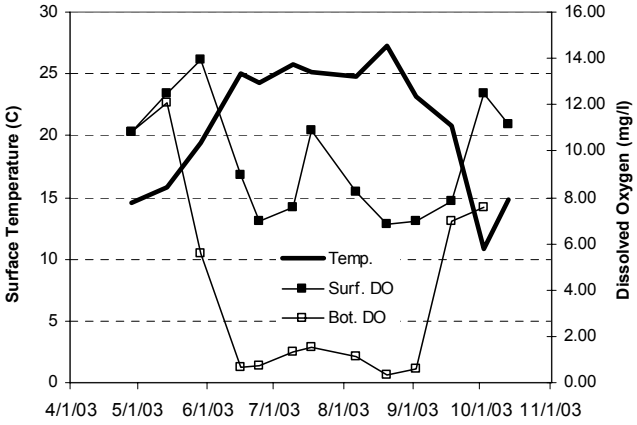
| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | A | | | | | | B | A | A |
| Chlorophyll a | | | | B | | | | | | B | B | B |
| Secchi Depth | | | | B | | | | | | C | C | B |
| **Overall** | | | | **B** | | | | | | **B** | **B** | **B** |

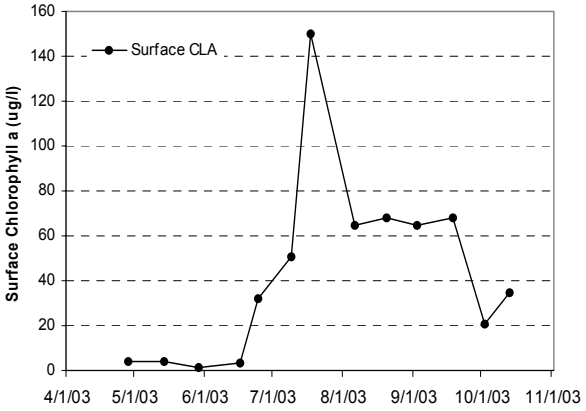
Source: Metropolitan Council and STORET data

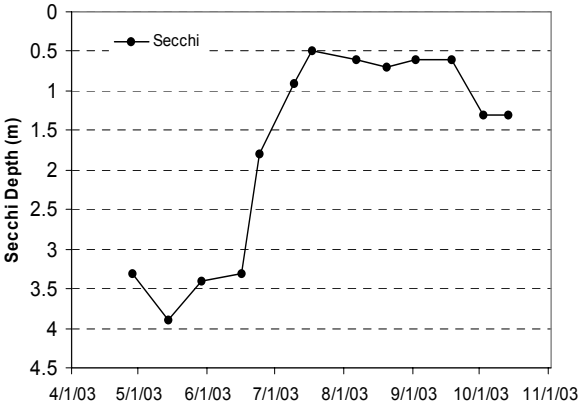



**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | D | | | D |
| Chlorophyll a | | | | | | | | D | C | | | D |
| Secchi Depth | | | | | | | | C | C | | | C |
| **Overall** | | | | | | | | **C** | **C** | | | **D** |

Source: Metropolitan Council and STORET data

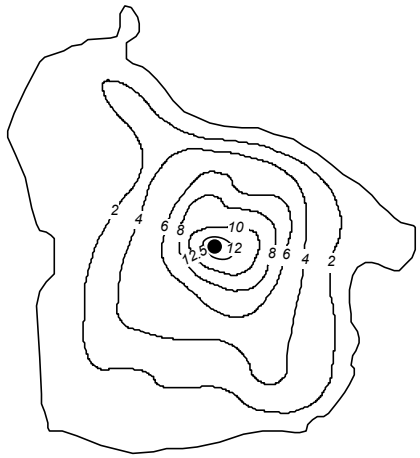
## Wasserman Lake

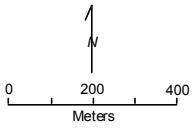
**Laketown Twp., Carver Co.**

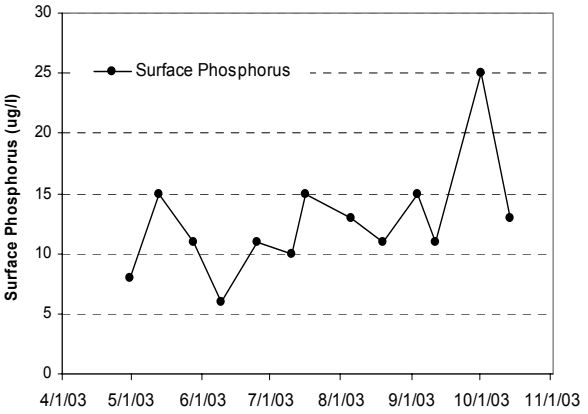
LAKE ID: 100048
WD: Minnehaha Creek

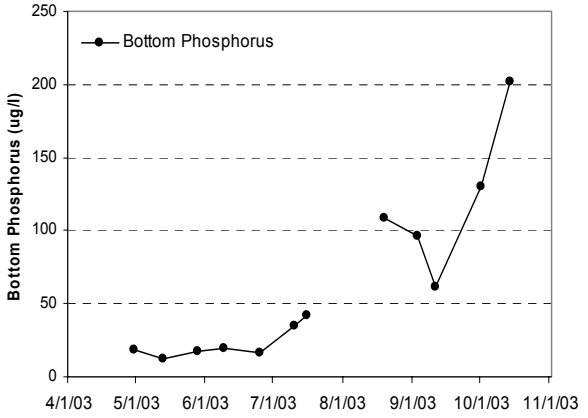
● Sampling site

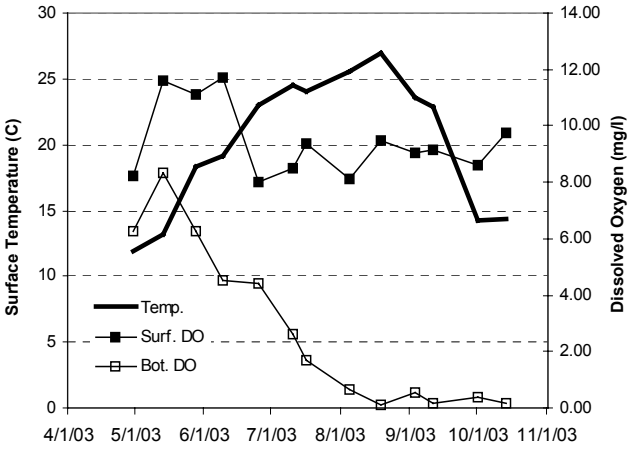
Contours in meters

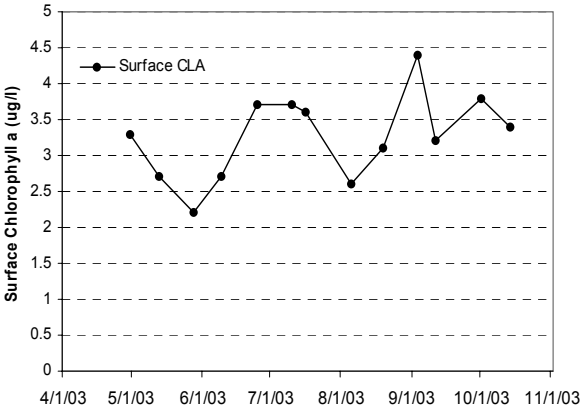


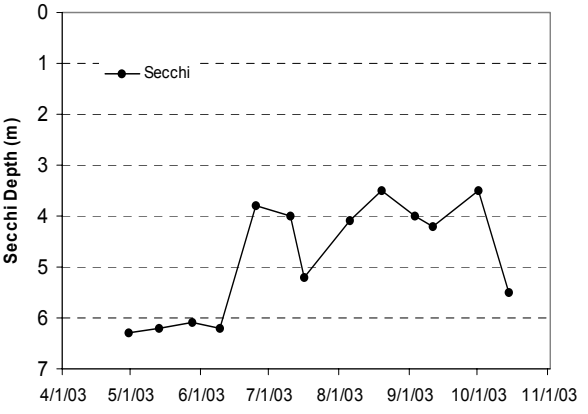




**Lake Water Quality Grades Based on Summertime Averages**

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | | | C | C | D | | | C | D |
| Chlorophyll a | | | C | | | C | D | D | | | B | C |
| Secchi Depth | | | D | | | C | D | D | | | D | C |
| **Overall** | | | **C** | | | **C** | **D** | **D** | | | **C** | **C** |

Source: Metropolitan Council and STORET data

# PART II - CITIZEN-ASSISTED LAKE MONITORING

## ACKNOWLEDGMENTS

The success of the 2003 volunteer lake monitoring program would not have been possible without the greatly appreciated work done by volunteer monitors, and the support of the organizations that enrolled lakes in the program.

The enrolling organizations, which included 15 watershed management organizations/watershed districts (WMO/WD), eight cities, two counties and two individual lake groups were involved in volunteer recruitment, training, and occasional follow up on the progress of their volunteer lake monitors. Without this help, the program would not have been as successful as it was.

However, those deserving the greatest appreciation, are the volunteers themselves. Their help has made this program successful. The list of the volunteers involved in the 2003 Citizen-Assisted Monitoring Program (CAMP) is shown in Appendix B. The Metropolitan Council and local WMO/WDs thank them for the sustained efforts contributed over six months and the quality of their work.

## INTRODUCTION

Volunteer monitoring is a growing endeavor around the country. Citizens are finding that good information on the status of local water quality and the causes of water quality degradation is often not available from scientific research projects or government surveys. Therefore, the citizens themselves are collecting this information.

As is the case throughout the United States, the majority of lakes in the Twin Cities Metropolitan Area (TCMA) suffer from this lack of water quality data. Area lakes and watershed managers need a broad, comprehensive water quality database for regulatory and decision-making purposes. Because of the lack of public funding and the large ratio of area lakes to monitoring staff, very little data exist for the majority of the lakes in the area, and local decision-makers are forced to make management decisions lacking adequate information.

CAMP was initiated by the Metropolitan Council in 1993 to help bridge the data gaps for area lakes, provide a more complete and improved Metro database, give local decision makers a better idea of the water quality in the area, and assist them in decision making on water quality issues. The Council's goal for CAMP is to provide a means to gather as much information on area lakes, as is economically possible.

Previous volunteer programs conducted throughout the United States have shown that with proper equipment and instructions, volunteers can be trained to produce credible water quality data. Because most of the volunteers live near the lakes they are monitoring, they are very interested in determining any trends and/or changes in local water quality (Nichols 1992).

Not only does volunteer involvement in the lake monitoring process substantially reduce the cost of obtaining data, but it enhances the grass-root understanding of how lakes work and how certain lake conditions relate to the surrounding watershed.

## PURPOSE OF THE VOLUNTEER PROGRAM

The main purpose of CAMP is to provide lake and watershed managers with water quality data that will not only support them in properly managing the resources, but also provide much needed historic baseline data to help document water quality impacts. As noted earlier, an additional function of the monitoring program is the volunteer's increased awareness of their lake's condition and workings throughout the summer, which may foster grass-roots initiatives to protect lakes and promote support for lake management.

CAMP involved the collection of in-lake samples by volunteers. Monitoring procedures and sample handling methods were determined through a pilot study during the summer of 1991. The pilot study was designed to evaluate the validity of data collected using several possible citizen monitoring and sample handling methods by comparing them to routine methods (Hartsoe and Osgood 1991). The pilot study and results are presented in Appendix D of the Council's 1993 lake monitoring report (Anhorn 1994) and can be obtained by contacting Randy Anhorn at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

Volunteers collected surface water samples that were analyzed for total phosphorus (TP), total Kjeldahl nitrogen (TKN), and chlorophyll-a (CLA) [a select few of the lakes collected samples to be analyzed for chloride as well]. In addition, they measured surface water temperature, water transparency, and recorded user perceptions. Most lakes were visited biweekly from April through October (fourteen sampling dates) and were sampled at the lake's deepest open-water location. Quite a few of the lakes, however, were not monitored each of the desired 14 sampling weeks. The reasons for the missed sampling dates varied. However, the majority of the lakes, even with the missed sampling dates, were sampled adequately and often enough to provide an annual overview of the water quality of each lake. Samples were submitted to Council-staff and then forwarded to the MCES-EPE laboratory.

## CAMP METHODS

### OBTAINING VOLUNTEERS

Active recruitment for lakes and interested volunteers for the 2003 volunteer monitoring program began in the winter months of 2002. Letters and registration forms were sent to various WMOs, counties, and cities to determine their interest in enrolling lakes within their jurisdiction in the program. The organizations were then encouraged to obtain volunteers for each lake they enrolled in the program. If there were problems finding willing volunteers the Council assisted in the search; however, the belief was that the supervising organization would benefit in the long run by having direct contact in recruiting its volunteers. This contact would hopefully open a two-way communication line between concerned citizens and the WMOs.

The year 2003 marked the eleventh year of the Council's volunteer program. Fifteen watershed management organizations/watershed districts (WMO/WD), eight cities, two counties, and two individual lake groups participated in CAMP in 2003, enrolling a total of 128 lakes. This year's volunteer-monitoring program included two lake sites never before monitored by the Council and 108 lake sites returning from 2002. A map indicating the 2003 CAMP lakes and their affiliated WMO/WD is shown in Figure 2, while a list of the volunteer monitors for each lake is provided in Appendix B.

### TRAINING VOLUNTEERS

Volunteer training was conducted by Council-staff at various locations throughout the seven- county metropolitan area. Volunteer training was scheduled between late-February and early-April 2002. At each training session, volunteers were given a handbook describing the program, outlining basics in the biology and ecology of lake systems, and containing detailed written instructions for the lake monitoring and data form completion procedures.

At each training session, volunteers received the necessary equipment for the lake monitoring. This equipment was purchased by the enrolling agency through the Council and loaned to the volunteers. At the end of the year's monitoring season, equipment was returned to the enrolling agency to be used in future years. Each lake's volunteer received:

- Chlorophyll hand pump, flask, and filters
- Dial thermometer
- Map of lake with sampling site(s)
- Sampling observation forms
- Sample jug
- Sample vials and labels
- Secchi disk
- Aluminum foil
- Tweezers (forceps)

During the training session, volunteers were given a brief description of the inner working of a lake system as described in their handbook, instructed on proper lake monitoring procedures, and shown how each piece of sampling equipment worked. After this discussion, the volunteers received a package containing the equipment, and the proper use of each piece of equipment was again described and practiced. Finally, each volunteer was asked to sign a waiver of liability stating that they were not an employee of either the Council or the agency enrolling the lake in the program (i.e. the watershed management organization), and that they would use proper safety equipment and observe boat operating methods specified by the State of Minnesota.

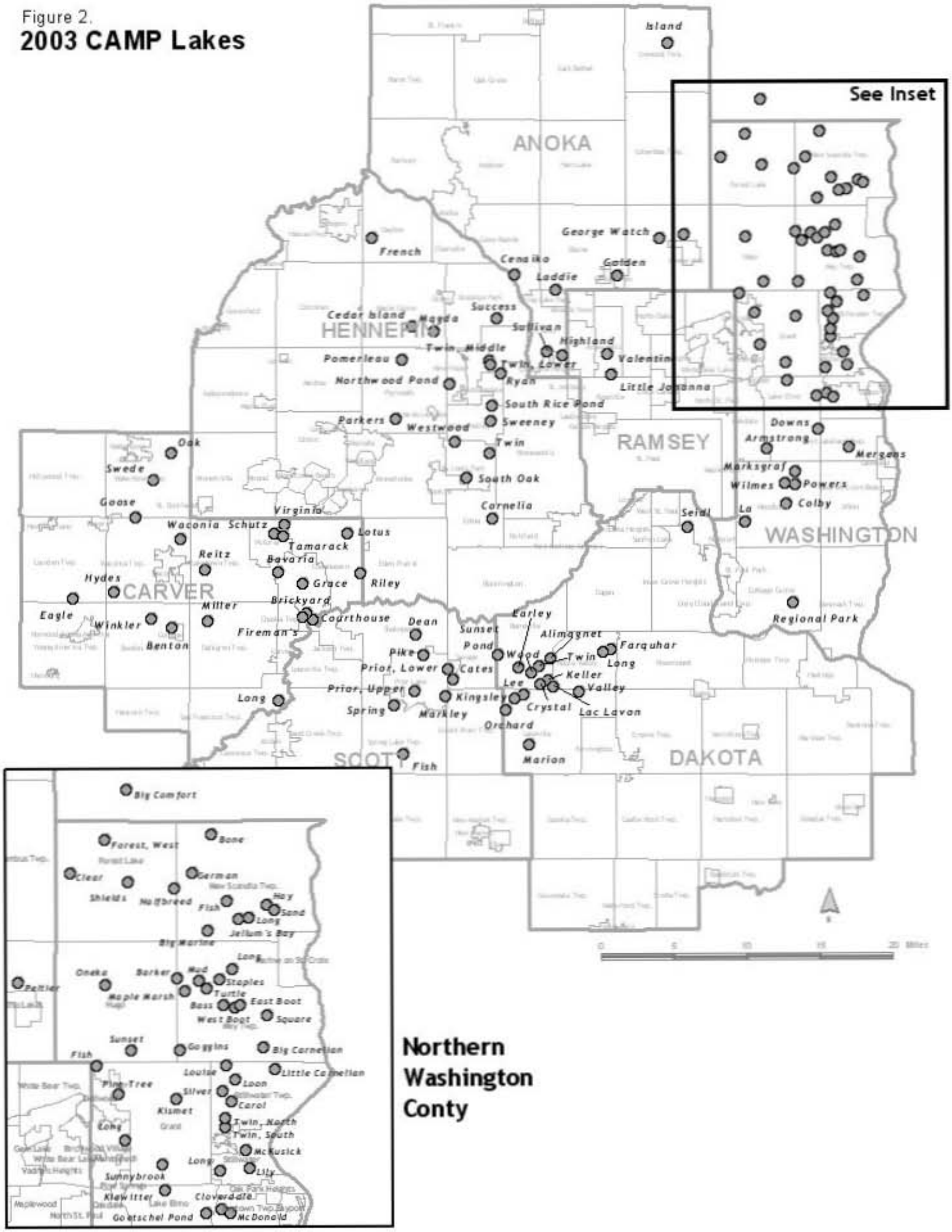
**MONITORING METHODS**

Volunteers were instructed to monitor their designated lake site(s) on a biweekly basis from mid-April to mid-October. Thus, there were 14 possible sampling periods. The methods they used were determined through a pilot study in 1991 that tested simplified methods for using volunteers to obtain credible water quality data (Anhorn 1994). The monitoring methods are detailed in the following paragraphs.

First, during pre-arranged sampling weeks, volunteers located and anchored their boat at pre-determined monitoring locations (the deep open-water area of the lake). Once at the monitoring location, an observation form for lake and meteorological conditions was completed. The form, shown in Figure 3, provided space to mention natural and cultural observations which may have influenced what was happening in the lake (i.e., heavy rains two days before monitoring), and an area to relate general perceptions of the lake's condition and suitability for recreation.

Figure 2.

## 2003 CAMP Lakes




**Northern Washington Conty**

Next, the volunteers took a water transparency reading by lowering a Secchi disk on the shaded side of the boat to the point at which it disappeared. The point where the disk reappears is the Secchi transparency depth that was recorded on the observation form. The next lake monitoring step involved the collection of the surface water sample.

**Collecting a surface water sample**. A surface water sample was collected in a clean one-gallon plastic milk jug. To begin, the volunteer pre-rinsed the jug three times with lake water. After rinsing, the jug was filled by submersing it upside down to forearm depth and turning it upright while still submersed. After filling the sample jug, volunteers tested and prepared it for the following parameters:

- **Temperature**. Surface water temperature was measured from the volunteer's sampling jug using a dial thermometer that is readable to 0.5°C. The temperature was measured immediately following sample collection. Special care was taken to keep the sample out of direct sunlight in order to minimize temperature change.

- **Total Phosphorus (TP) and Total Kjeldahl Nitrogen (TKN)**. Two samples, one each for TP and TKN, were decanted from the volunteer's jug in the field into their respective triple pre-rinsed, pre-labeled (including lake name, date, time, and parameter) 50-milliliter (ml) vials. These samples were then placed in the cooler, taken home, and stored in the freezer until they were picked up and delivered to the laboratory for analysis.

- **Chlorophyll-a (CLA)**. CLA samples from the volunteer's jug were filtered in the field *(out of direct sunlight)* onto a 0.45 micrometer (μm) glass-fiber filter using a field filtration apparatus and a hand pump. Water from the sampling jug was measured and poured into the pump reservoir using a graduated cylinder. The pump reservoir holds approximately 250 ml. By squeezing the handle of the pump, the sample water was forced through the filter and the suspended planktonic algae became attached to the filter. The filtered water was then dumped back into the lake. If possible, this was repeated until a total of 1000 ml of sample water was allowed to pass through the filter. However, if the water sample was too green and the filter became clogged without allowing more water to pass through, the amount of water that did pass through the filter was calculated and recorded on the observation form. The filters were then removed from the filter holder with tweezers, and placed in a petri dish. The sample container was then labeled using the same methods used on the TP and TN sample vials (except the amount of water pumped through the filter was also included on the label), wrapped in tin foil, and frozen until pick-up and delivery to the lab.

The frozen samples were picked up within approximately 30-60 days by Council-staff and delivered to the MCES-EPE's laboratory for chemical analysis. Results from the 1991 pilot study reveal that the volunteer monitoring and handling methods chosen for use in the CAMP program yield results comparable to routine methods used by the Council (Hartsoe and Osgood 1991).

In addition, a few WMO/WDs had their volunteer(s) record dissolved oxygen (DO) and temperature profiles, as well as collect surface chloride and subsurface TP and CLA samples. Chloride samples were prepared in the field identical to the TP/TKN samples. The WMO/WDs provided their volunteers with supplementary equipment and training to use this equipment, as well as paying for the additional cost of laboratory analysis for the TP samples. The additional profiles, and subsurface samples were picked up by the Council along with the routine samples. Profiles obtained by the volunteers were then mailed to the WMO/WD, and the samples were delivered to the lab for analysis.

**Figure 3. Example of Sampling Form**

Lake Name and ID #:_____ Site #:_____

Sampling Date:_____ Time:_____

Name(s) of Volunteer(s): Sample #s:

_____ TP:_____
TKN:_____

_____ CLA:_____

SECCHI DISK DEPTH:_____meters

SURFACE TEMPERATURE:_____°C

VOLUME OF FILTERED LAKE WATER (CLA) _____ml

## GENERAL OBSERVATIONS

(Circle)

***** Water Color

Clear Yellow
Green Gray
Brown Blue-Green
Comment:

***** Odor of Water

None Rotten Egg-like
Fishy Septic-like
Musty _____
Comment:

***** Wind Conditions

Calm Strong
Breezy
Direction:____

***** Water Surface

Calm Moderate Waves
Ripple Whitecaps
Small Waves
Comment:

***** Cloud Cover

0% 75%
25% 100%
50%

***** Lake Level

Above Normal
Normal
Below Normal
Staff Gage Reading _____

***** Amount of Aquatic Plants

None Moderate
Minimal Substantial
Slight

***** Air Temperature (F)

< 40 81-90
41-60 > 90
61-80

***** Unusual Conditions in the past week (storms, high winds, temp. extremes):

***** Physical Condition

Crystal Clear(1)
Some Algae Present(2)
Definite Algae Present(3)
High Algal Color(4)
Severe Bloom (Odor, Scum)(5)

***** Suitability For Recreation

Beautiful(1)
Minor Aesthetic Problem(2)
Swimming..Slightly Impaired(3)
No Swim..Boating OK(4)
No Aesthetics Possible(5)

## DATA HANDLING AND ANALYSIS

Once each lake's sampling forms and lab analyses were delivered to the Council, the data were entered into a data management and statistical analysis program called Statistical Analysis System (SAS). This data handling system served three purposes:

1. Check-in of forms and tracking of volunteer participation;

2. Entry of nutrient, Secchi, and user perception data into a database for statistical, graphical, and tabular outputs; and

3. Entry into the U.S. Environmental Protection Agency's (U.S. EPA) national water quality data bank called STORET.

If there were questions concerning the data and/or lake observations, the volunteer was called by the Council-staff. The Council maintained contact with most volunteers throughout the season by telephone or in person during sample pick-up. Statistical analyses were performed, and tables and plots of the data were prepared.

## PROGRAM QUALITY ASSURANCE/QUALITY CONTROL

The quality assurance/quality control (QA/QC) objective for CAMP is to prevent erroneous data from being produced and used. If by chance errors did occur, they were identified and corrected. Additionally, all suspect data were excluded in lake databases or conclusions.

The MCES-EPE's laboratory follows its own internal QA/QC program. The MCES-EPE lab uses an extensive internal and external check and balance system to ensure credible data. Documentation of the lab's QA/QC procedures can be obtained through the MCES-EPE.

To ensure that CAMP volunteer monitors were using proper sampling techniques and producing credible data, two QA/QC methods were used. Either Council-staff accompanied a volunteer on a sampling event to oversee their collection and preparation procedures, or staff monitored a CAMP lake site during the same week (although not necessarily the same day) that volunteers were to sample the lake site. The first method was used to simply observe the monitor's methods to determine if there were any problems that needed to be addressed. This procedure was usually undertaken when Council-staff was in a volunteer's area on a known sampling day, or when it seemed necessary.

The most common quality check method, however, involved monitoring of the lake by the Council during a scheduled monitoring week. For these sampling events, Council-staff used the same type of equipment and same methods as the volunteers. The Council-collected QA/QC samples were then treated just as the volunteer samples were so that the nutrient concentrations and Secchi transparencies of both sampling events could be compared to determine if any procedural problems existed. If there seemed to be discrepancies, Council-staff would accompany the volunteer on their next sampling event to observe their methods and, if necessary, re-train them. Data determined to be erroneous were thrown out of the database.

During the 2003-monitoring season, roughly 35 percent of the CAMP lake sites monitored more than three times throughout the summer were monitored by Council staff during scheduled monitoring weeks to determine the credibility of the volunteer data. Many of the lakes that were 'checked' by Council-staff

in 2003 were monitored by volunteers (and 'checked') as part of past CAMP monitoring years. Council-sampled QA/QC measurements are presented along with volunteer samples in each lake's descriptive section. A regression analysis was performed on the QA/QC dataset to determine if a statistically significant difference was found between the volunteer and professionally collected data. The resulting statistical analysis of the quality check data revealed excellent agreement between volunteer and professionally-collected samples.

**Regression analysis.** The 2003 and 1993-2003 QA/QC volunteer- and professional-collected TP, CLA and Secchi data were plotted on a scatterplot graph (Figures 4-9). A linear regression (shown on the graph as a solid line) was run on the resulting data. If the professional- (y) and volunteer-collected (x) data were identical, the data points would fall along the dashed line shown on the following graphs (x=y).

The graphs show that while the majority of the data points do not fall exactly on the x=y-line, they do, for the most part, fit the x=y-line well. The graphs also show that while the regression-lines for each parameter are nearly identical to the x=y-lines when the tested parameters are low, the regression-line begins to fall away from the x=y-line as the parameter levels increase. Because of the close fit of the regression-line to the x=y-line and because of the strong linear relationships of each parameters data (shown as a large $R^2$), it is determined that there is no statistically significant difference found between samples collected by volunteers and those collected by Council staff.

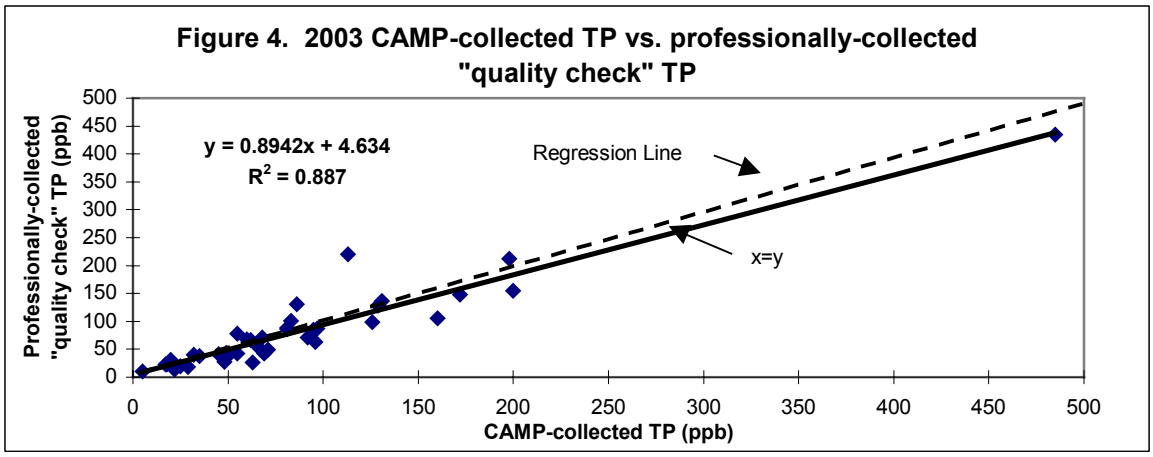


Figure 4. 2003 CAMP-collected TP vs. professionally-collected "quality check" TP
y = 0.8942x + 4.634
R2 = 0.887
Regression Line
x=y
Professionally-collected "quality check" TP (ppb)
CAMP-collected TP (ppb)
0
50
100
150
200
250
300
350
400
450
500

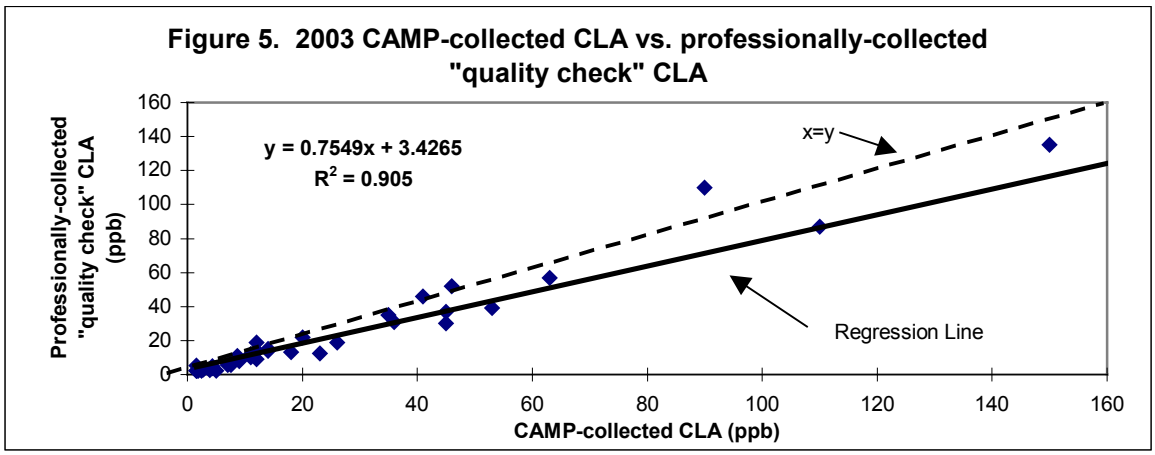


Figure 5. 2003 CAMP-collected CLA vs. professionally-collected "quality check" CLA
y = 0.7549x + 3.4265
R2 = 0.905
x=y
Regression Line
Professionally-collected "quality check" CLA (ppb)
CAMP-collected CLA (ppb)
0
20
40
60
80
100
120
140
160

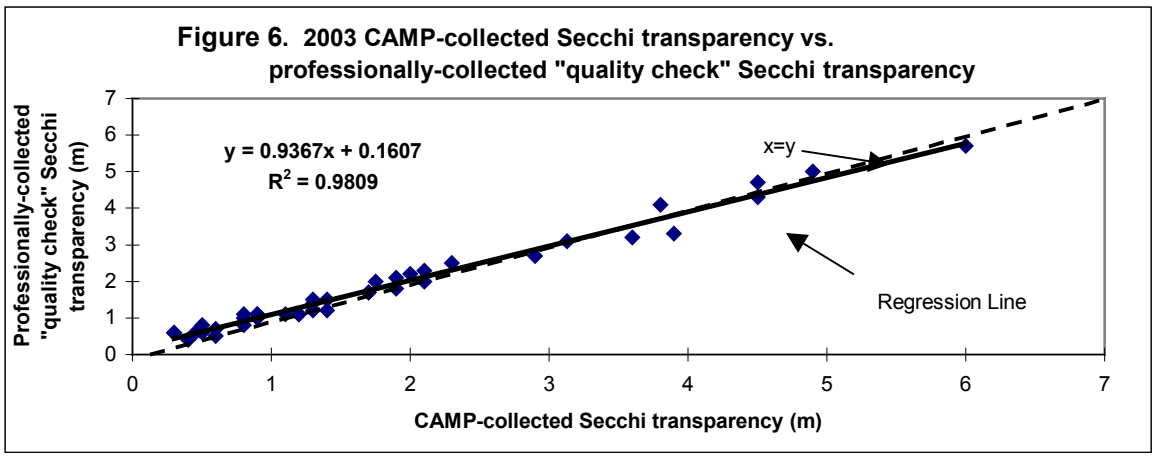


Figure 6. 2003 CAMP-collected Secchi transparency vs. professionally-collected "quality check" Secchi transparency
y = 0.9367x + 0.1607
R2 = 0.9809
x=y
Regression Line
Professionally-collected "quality check" Secchi transparency (m)
CAMP-collected Secchi transparency (m)
0
1
2
3
4
5
6
7

**Figure 7. 1993-2003 CAMP-collected TP vs. professionally-collected "quality check" TP**

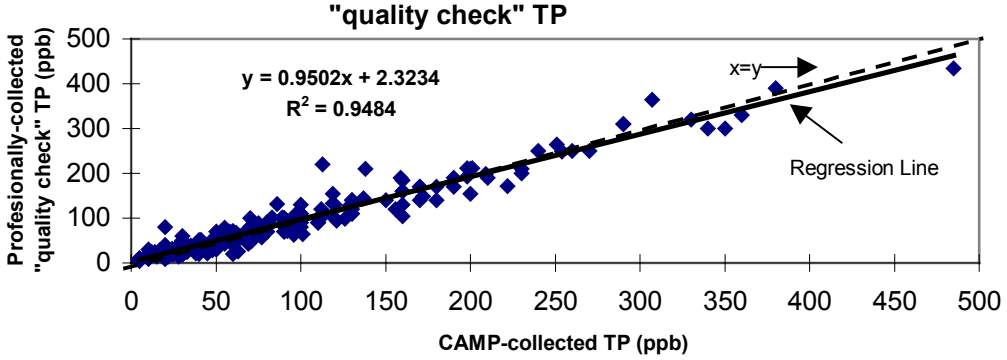



**Figure 8. 1993-2003 CAMP-collected CLA vs. professionally-collected "quality check" CLA**

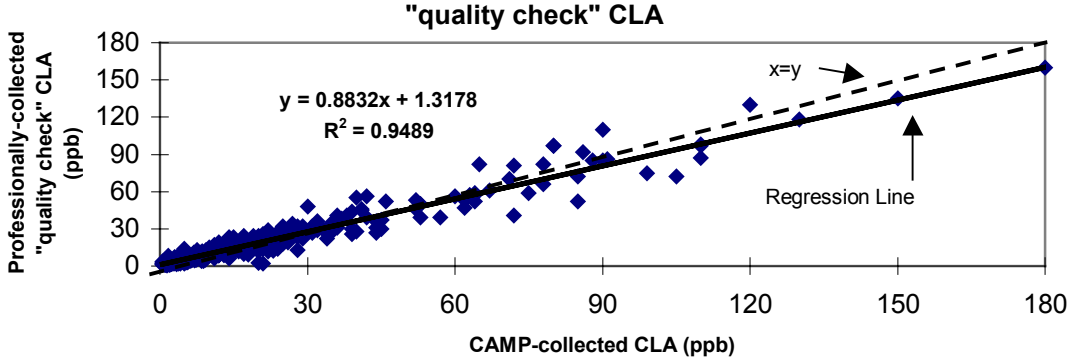
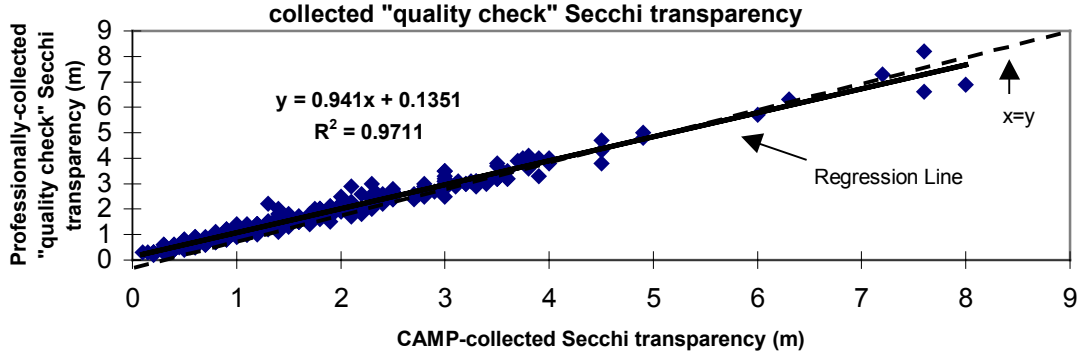



**Figure 9. 1993-2003 CAMP-collected Secchi transparency vs. professionally-collected "quality check" Secchi transparency**



## RESULTS AND ANALYSIS

The water quality of the CAMP lakes will be discussed on a lake-by-lake basis in the following pages. *The Handbook for the Citizen-Assisted Lake Monitoring Program* (Anhorn 93), handed out at the volunteer training sessions, overviews the basic inner workings of lakes.

The results and subsequent analysis of the water quality of each lake includes a written section describing the lake's current condition as determined through the 2003 CAMP monitoring and a separate lake information sheet. Each information sheet includes current 2003 water quality data, shown in both tabular and graphic form, and all 1980-to-the-present lake water quality grades (the methodology and percentile ranges of the grading system were discussed in Part I of this report). To determine any water quality trends (i.e., whether the lake quality is improving, degrading, staying the same, or has no trend) each lake's 1980-to-the-present database was used.

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.

## Alimagnet Lake (19-0021) *City of Apple Valley*

Approximately half of Lake Alimagnet's 109-acre surface area is located within the City of Apple Valley, the other half in the City of Burnsville (Dakota County). The lake's shoreline is 3.2 miles. The lake has maximum and mean depths of 3.0 and 1.5 m (10 and five feet), respectively. Because the lake is relatively shallow, it does not develop and maintain a thermocline (a density gradient owed to changing water temperatures throughout the water column), and the entire lake is considered littoral, (the shallow [0-15 feet] area dominated by aquatic plants). The approximate lake volume is 545 acre-feet (ac-ft). The lake has a 1,288-acre watershed and a watershed-to-lake area ratio of 11.8:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

There are 12 inlets into the lake. A 1990 Clean Water Partnership Diagnostic-Feasibility Study on the lake estimated land use for the watershed at: 29 percent single-family residential, eight percent multi-family residential, three percent commercial/industrial, 19 percent wooded, 10 percent open waters/wetlands, and 31 percent open/undeveloped (Montgomery Watson 1990). Land use percentages have no doubt continued to shift from open/undeveloped to urban uses (single-family residential, multi-family residential, and commercial/industrial) since that study.

The lake, which has been monitored through CAMP since 1995, was sampled 12 times between late-April and mid-October, 2003. Summertime (May through September) means for the monitored variables were: surface TP= 112.7 µg/l (minimum concentration of 57.0 µg/l and a maximum value of 207.0 µg/l); surface chlorophyll-a= 45.1 µg/l (minimum of 13.0 µg/l and maximum of 130.0 µg/l); Secchi transparency= 0.6 m (minimum of 0.3 m and a maximum of 1.0 m); and TKN= 1.58 mg/l (minimum of 1.00 mg/l and maximum of 3.00 mg/l). Lake quality grades associated with the 2003 means were as follows: TP= D; CLA= C; and Secchi= F. The overall 2003 water quality grade calculated from the TP, CLA, and Secchi grades was D. The 2003 overall grade is similar to that of 1990, 1996, and 1999-2002 and worse than those recorded in 1995, 1997 and 1998.

While annual Secchi transparency data are recorded from 1980 to 2003, a lesser amount of nutrient and chlorophyll data exist. The only years other than 1995-2003 (as a part of CAMP) for which other nutrient data were found were 1980 and 1981 (surface phosphorus), and 1990 (phosphorus and chlorophyll). The lake's overall water quality grades indicate that the lake fluctuates between a C and D. The lake's water quality was at its best in 1995, 1997, and 1998 (overall grade of C) as compared to that of 1990, 1996, and 1999-2003 (overall grade of D). The lake's 2003 summertime TP, CLA, and Secchi means were similar to those recorded in 1999-2002 (which represent some of the lake's worst water quality).

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 summertime mean physical condition was 3.4 on a 1-to-5 scale shown on the lake information sheet (between 3- "definite algae present" and 4-"high algal color"). The mean suitability for recreation ranking, also on a 1-to-5 scale, was 3.0 (3-"swimming slightly impared").

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.

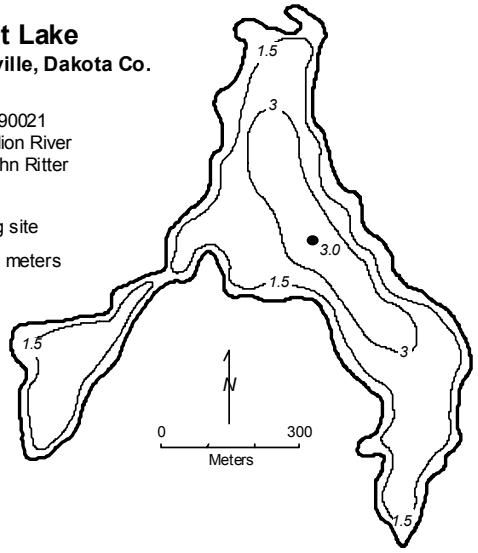
# Alimagnet Lake

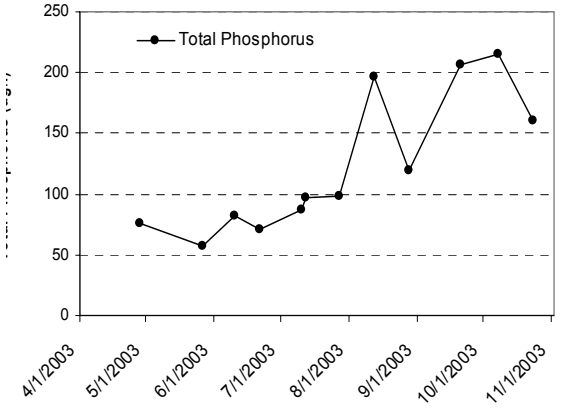
**Apple Valley/Burnsville, Dakota Co.**

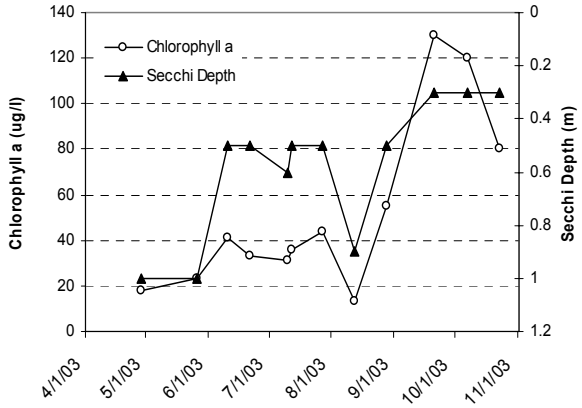
Lake ID: 190021
WMO: Vermillion River
Volunteer: John Ritter

● Sampling site

Contours in meters

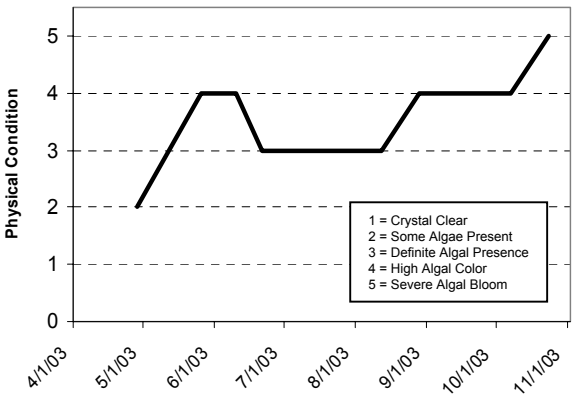



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/28/03 | 15.1 | | | | 18 | 76 | | 1 | 2 | 2 |
| 05/26/03 | 20.2 | | | | 23 | 57 | | 1 | 4 | 3 |
| 06/10/03 | 19.6 | | | | 41 | 82 | | 0.5 | 4 | 3 |
| 06/21/03 | 24.1 | | | | 33 | 71 | | 0.5 | 3 | 3 |
| 07/10/03 | 24.1 | | | | 31 | 87 | | 0.6 | 3 | 3 |
| 07/12/03 | 23.5 | | | | 36 | 97 | | 0.5 | 3 | 3 |
| 07/27/03 | 25.2 | | | | 44 | 98 | | 0.5 | 3 | 3 |
| 08/12/03 | 28 | | | | 13 | 196 | | 0.9 | 3 | 3 |
| 08/28/03 | 23.5 | | | | 55 | 119 | | 0.5 | 4 | 3 |
| 09/20/03 | 19 | | | | 130 | 207 | | 0.3 | 4 | 3 |
| 10/07/03 | 14.6 | | | | 120 | 215 | | 0.3 | 4 | 3 |
| 10/23/03 | 11.8 | | | | 80 | 161 | | 0.3 | 5 | 3 |

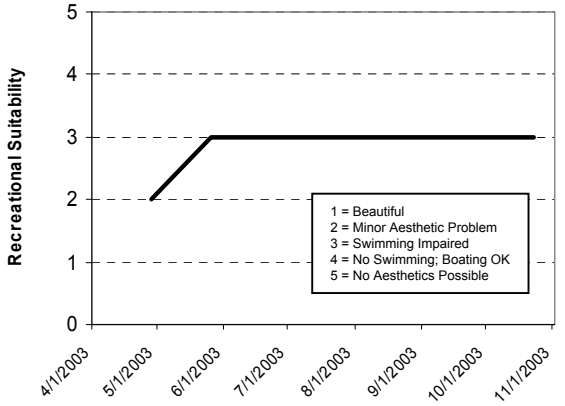



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | D | D | C | D | F | D | D | D | D |
| Chlorophyll a | | | | B | C | C | C | D | D | C | C | C |
| Secchi Depth | D | C | C | C | D | C | C | D | F | D | F | F |
| **Overall** | | | | **C** | **D** | **C** | **C** | **D** | **D** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Armstrong Lake (82-0116-02) *South Washington Watershed District*

Armstrong Lake has been annually monitored through CAMP since 1998 (six years). There is very little physical information available on the lake or the lake's watershed. Located partially within the cities of Lake Elmo and Oakdale (Washington County), the 39-acre lake has a mean and maximum depth of 1.0 m (3.2 feet) and 1.5 m (roughly 5 feet), respectively. Because of the shallowness of the lake, its entire area is considered littoral (the shallow [0-15 foot depth] area dominated by aquatic vegetation), and it never maintains a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column) through the summer months. The lake's surface area and mean depth translate to a volume of roughly 128 ac-ft. There is no public access to the lake.

Armstrong Lake was monitored 14 times between mid-April and mid-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page. Armstrong Lake received an overall grade of C for 2003. The overall grade was determined from the individual parameter grades. The summertime May through September) mean TP concentration of 84.6 µg/l (minimum of 42.0 µg/l and maximum of 235.0 µg/l) fell within the lake water quality D grade range. Similarly, the lake's Secchi transparency mean of 0.8 m (minimum of 0.6 m and maximum of 1.1 m) also resulted in a grade of D.

The lake's 2003 CLA mean of 15.1 µg/l (minimum and maximum of 4.7 and 31.0 µg/l) on the otherhand, resulted in a grade of B. The lake's mean TKN concentration was 1.16 mg/l (minimum of 0.67 mg/l and maximum of 1.50 mg/l). The lake's 2003 overall water quality grade was better than that recorded in 1998-1999 and 2001 (D), and similar to that of 2000 and 2002 (C). The main reason for the lake's improvement was the reduction in mean chlorophyll concentration as compared to previous years.

By comparing the lake's historic database TP (nutrient), CLA (algal biomass estimator), and Secchi (water clarity) grades, it is apparent that the TP and Secchi grades are quite a bit worse than the CLA grade. In a most cases, the three should be fairly comparable. One possible explanation for the lake's recent findings may be that the majority of the lake's TP comes from either in-lake suspended sediments (re-suspension), or the intrusion of sediment-laden runoff to the lake, which in turn lessens the clarity of the water and inhibits algal growth.

Because 2003 is only the sixth year of available data for Armstrong Lake, it is not possible to determine any statistically significant long-term trends. To better understand the lake's current water quality condition, and which direction its quality may be heading, additional years of data collection are needed. In the short-tern, however, the lake's quality seems best described by a high D/low C grade.

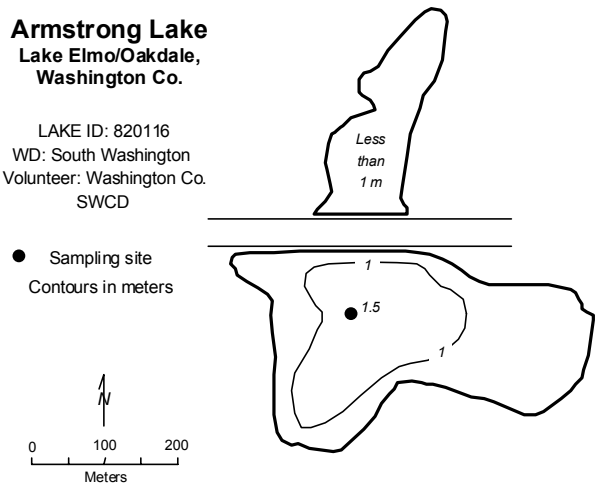
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The mean physical condition ranking was 3.4 (ranking between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability ranking was 4.5 (between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

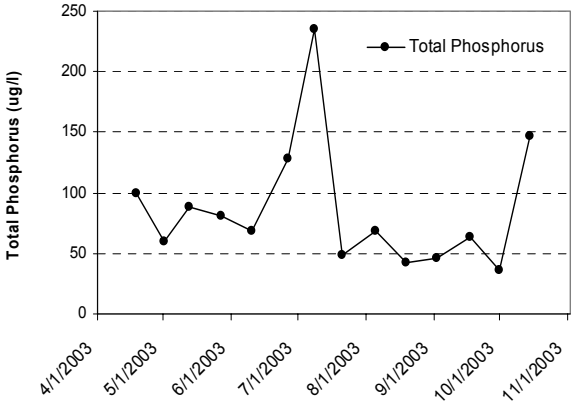
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

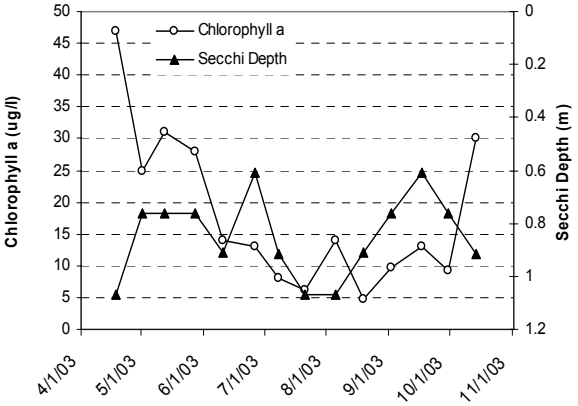
# Armstrong Lake

**Lake Elmo/Oakdale, Washington Co.**

LAKE ID: 820116
WD: South Washington
Volunteer: Washington Co. SWCD

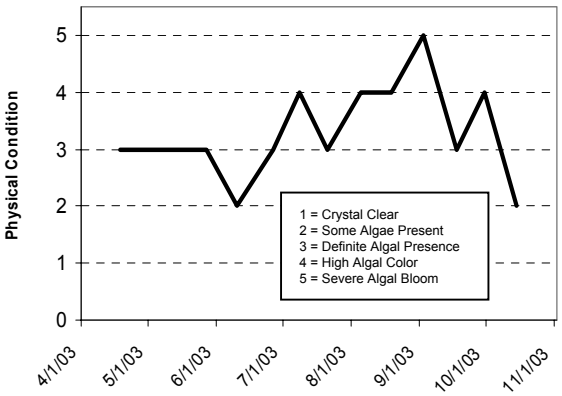



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 6.2 | | | | 47 | 99 | | 1.07 | 3 | 4 |
| 05/01/03 | 16.5 | | | | 25 | 60 | | 0.76 | 3 | 4 |
| 05/12/03 | 11.3 | | | | 31 | 88 | | 0.76 | 3 | 4 |
| 05/27/03 | 19.5 | | | | 28 | 81 | | 0.76 | 3 | 4 |
| 06/10/03 | 20.4 | | 2.81 | | 14 | 69 | | 0.91 | 2 | 4 |
| 06/26/03 | 19.5 | | | | 13 | 128 | | 0.61 | 3 | 4 |
| 07/08/03 | 23.6 | | | | 8 | 235 | | 0.918 | 4 | 5 |
| 07/21/03 | 22.2 | | | | 6.1 | 49 | | 1.068 | 3 | 5 |
| 08/05/03 | 21.6 | | 3.5 | | 14 | 68 | | 1.07 | 4 | 5 |
| 08/19/03 | 27.3 | | 8.8 | | 4.7 | 42 | | 0.91 | 4 | 5 |
| 09/02/03 | 19.8 | | | | 9.7 | 46 | | 0.762 | 5 | 5 |
| 09/17/03 | 19.4 | | 4.31 | | 13 | 64 | | 0.61 | 3 | 4 |
| 09/30/03 | 9.5 | | 13.27 | | 9.3 | 36 | | 0.762 | 4 | 4 |
| 10/14/03 | 12.5 | | | | 30 | 147 | | 0.914 | 2 | 4 |

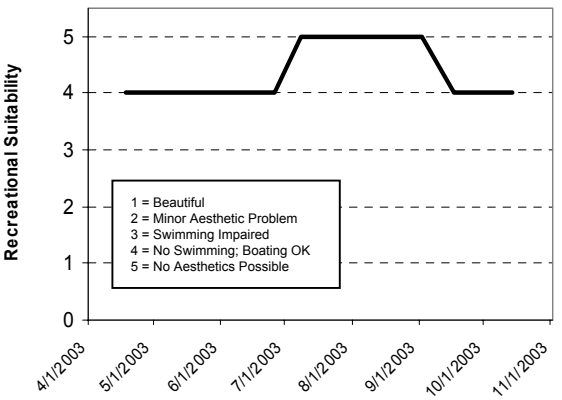



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | D | F | C | D | D | D |
| Chlorophyll a | | | | | | | D | C | C | C | B | B |
| Secchi Depth | | | | | | | D | F | D | D | D | D |
| **Overall** | | | | | | | **D** | **D** | **C** | **D** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Barker Lake (82-0076) *Carnelian - Marine Watershed District*

Barker Lake is a 45-acre lake located within May Township (Washington County). The mean and maximum depth of the lake is 4.4 m (14 feet) and 9.0 m (roughly 29 feet), respectively. 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). Additionally, the surface area and mean depth of the lake result in a calculated volume of 648 ac-ft.). The lake has an 823-acre watershed and a rather large watershed-to-lake area ratio of 19:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

Two thousand and three marks the fourth year in which Barker Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake revealed a limited amount of data (1997-2002) collected over the past twenty years.

The lake's Secchi transparency was monitored seven times from late-April to early-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 1.2 m (minimum of 0.8 m and a maximum of 2.1 m). This translates to a grade of C for water clarity. While the lake's 2003 water clarity grade is similar to past years, the actual mean in 2003 is worse than those recorded in 1999-2002, and similar to those recorded 1997-1998

As mentioned earlier, because there is little water quality data available for Barker Lake, it is not possible to determine any statistically significant long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

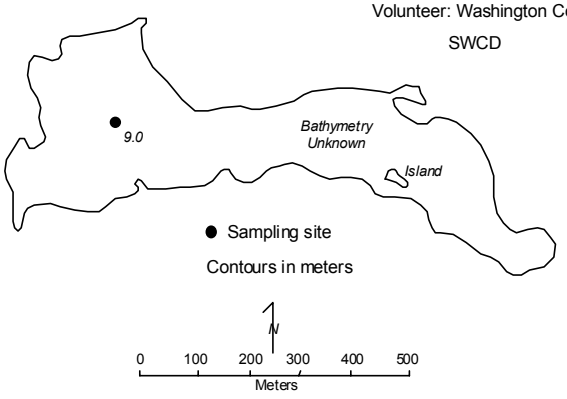
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 2.8 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 3.4 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

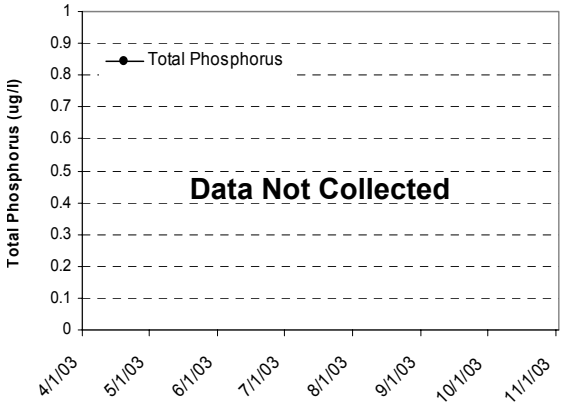
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

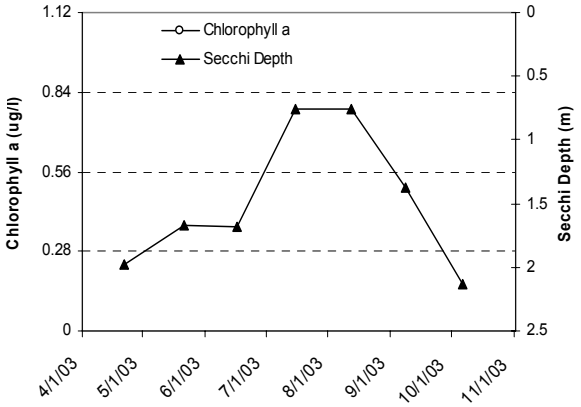
# Barker Lake

**Hugo, May Twp., Washington Co.**

LAKE ID: 820076
WD: Carnelian-Marine
Volunteer: Washington Co. SWCD

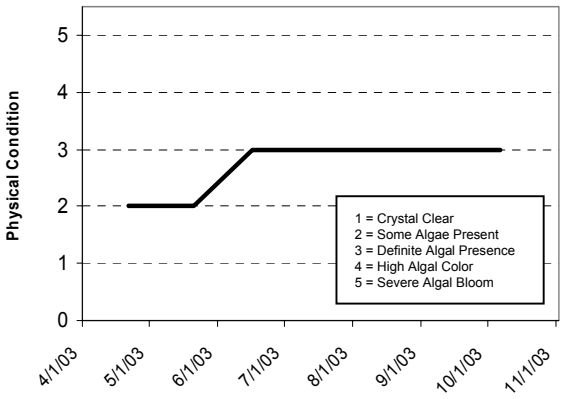



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 9.1 | | 7.86 | | | | | 1.983 | 2 | 2 |
| 05/21/03 | 16.5 | | 4.63 | | | | | 1.673 | 2 | 3 |
| 06/16/03 | 26.5 | | 8.09 | | | | | 1.678 | 3 | 3 |
| 07/15/03 | 23.1 | | 8.29 | | | | | 0.763 | 3 | 4 |
| 08/12/03 | 27.2 | | 11.45 | | | | | 0.763 | 3 | 4 |
| 09/08/03 | 25.3 | | 10.51 | | | | | 1.372 | 3 | 3 |
| 10/06/03 | 12.2 | | 7.41 | | | | | 2.134 | 3 | 3 |

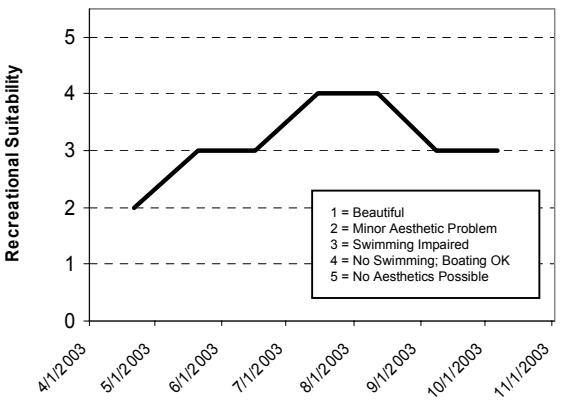



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | C | D | D | C | D | | |
| Chlorophyll a | | | | | | C | C | D | B | C | | |
| Secchi Depth | | | | | | D | C | C | C | C | C | C |
| **Overall** | | | | | | **C** | **C** | **D** | **C** | **C** | | |

Source: Metropolitan Council and STORET data



## Bass Lake (27-0098) *Shingle Creek Watershed Management Commission*

Bass Lake is located within the City of Plymouth (Hennepin County). The lake covers an area of 194 acres and has a maximum and mean depth of 9.4 m (roughly 31 feet) and 2.9 m (9.5 feet). About 82 percent of the lake's area is considered littoral, the shallow (0-15 foot depth) area dominated by aquatic vegetation. The approximate volume of the lake is 1,640 acre-feet (ac-ft) and its approximate residence time (the amount of time required to completely replace the lake's current volume of water with an equal volume of "new" water) is 0.7 years. The lake's watershed of 3,100 acres translates to a rather large watershed-to-lake size ratio of 16:1. The larger the ratio the greater the potential stress put on the lake from surface runoff. 1990 land use estimates indicate that approximately 23.1 % of the watershed is single family residential, 1.2 % is commercial/retail, 0.4 % is industrial/manufacturing, 13.0 % is public waters/wetlands, and 62.3 % is available for potential growth (Montgomery Watson 1994).

Additionally, the lake is considered a "Priority Lake" by the Metropolitan Council, due to its multi-recreational uses. Primary management concerns in the past have revolved around the lake's sizable aquatic macrophyte population and periods of low oxygen levels.

Bass Lake, which was also monitored through CAMP in 1994, 1997, 1999, and 2001, was monitored nine times from early-April to mid-October, 2003. Summertime (May through September) means for the monitored variables were: surface TP= 96.3 µg/l (minimum concentration of 15.0 µg/l and a maximum value of 257.0 µg/l); surface chlorophyll-a= 39.3 µg/l (minimum of 4.5 µg/l and maximum of 84.0 µg/l); Secchi transparency= 1.4 m (minimum of 0.8 m and a maximum of 2.9 m); and TKN= 1.14 mg/l (minimum of 0.67 mg/l and maximum of 1.70 mg/l). The summer means for TP and CLA were the worst recorded to date (worse than the 2001 summer means which at the time were the worst recorded).

The water quality database for Bass Lake is limited to four years of CAMP data collection (1994, 1997, 1999, 2001, and 2001). Lake quality grades associated with the 2003 summertime means are as follows: TP= D; CLA= C; and Secchi= C. Similarly to past years, the lake's overall water quality grade, calculated from the TP, CLA, and Secchi grades, was C. While the lake has received identical overall grades in all four years of CAMP monitoring, 2003 represents the lakes worst monitored water quality year. The best-monitored water quality for the lake was recorded in 1997.

While the limited nature of the lake's water quality database makes any statistically significant long-term trend detection impossible, on the short-term the lake seems to consistently have water quality that is representative of a lake grade of C. The last two years of data (2001 and 2003), however, have shown a slight decrease in water quality over that in recorded the 1990's. This is especially shown in the increase in summer mean total phosphorus and chloropyhll-a concentrations.

The summertime mean physical condition was ranked 2.8 on a 1-to-5 scale shown on the lake information sheet (between 2- "some algae present" and 3- "definite algae present"). The mean suitability for recreation ranking, also on a 1-to-5 scale, was 2.7 (between 2- "minor aesthetic problem" and 3- " swimming slightly impaired").

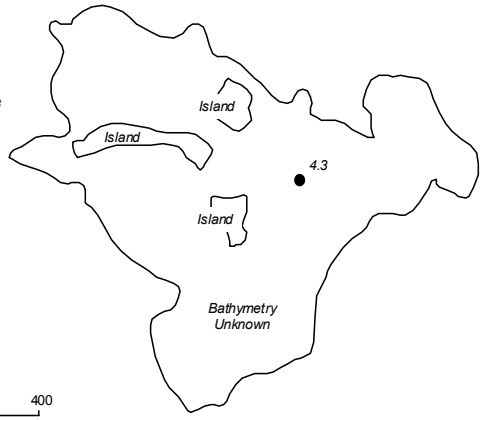
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) conducted a fisheries survey on the lake in 1991. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

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.

# Bass Lake

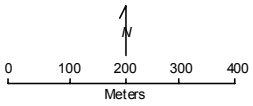
**May Twp., Washington Co.**

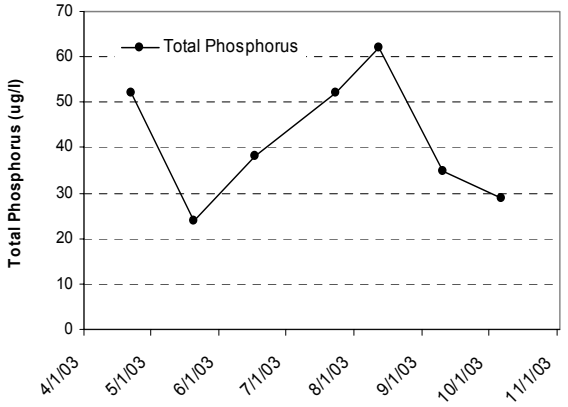
LAKE ID: 820035
WD: Carnelian-Marine
Volunteer:
Washington Co.
SWCD

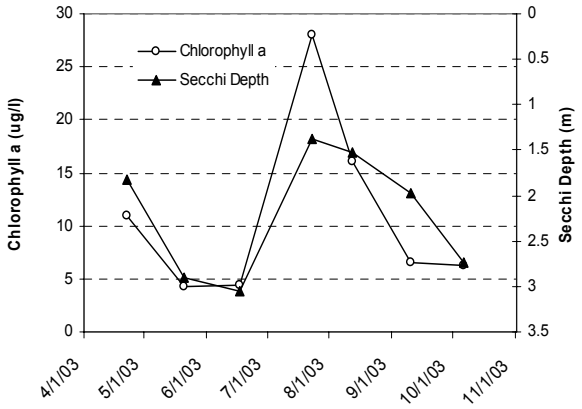



● Sampling site

Contours in meters

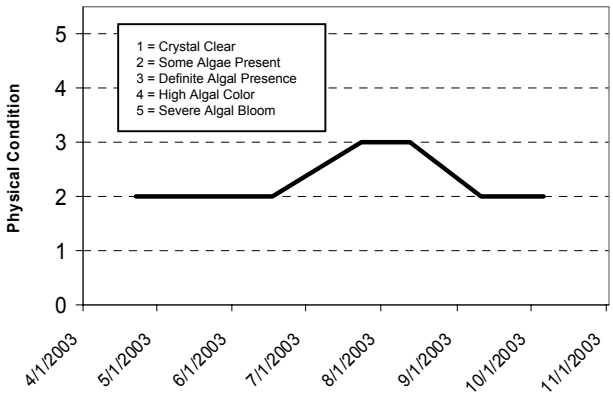



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 11.3 | | | | 11 | 52 | | 1.83 | 2 | 2 |
| 05/20/03 | 17.6 | | 4.86 | | 4.2 | 24 | | 2.9 | 2 | 2 |
| 06/17/03 | 24.6 | | | | 4.4 | 38 | | 3.05 | 2 | 2 |
| 07/23/03 | 26.7 | | 4.4 | | 28 | 52 | | 1.37 | 3 | 3 |
| 08/12/03 | 27.1 | | 7.4 | | 16 | 62 | | 1.525 | 3 | 3 |
| 09/10/03 | 22.2 | | 5.67 | | 6.6 | 35 | | 1.981 | 2 | 3 |
| 10/06/03 | 11.9 | | 9.33 | | 6.3 | 29 | | 2.743 | 2 | 2 |

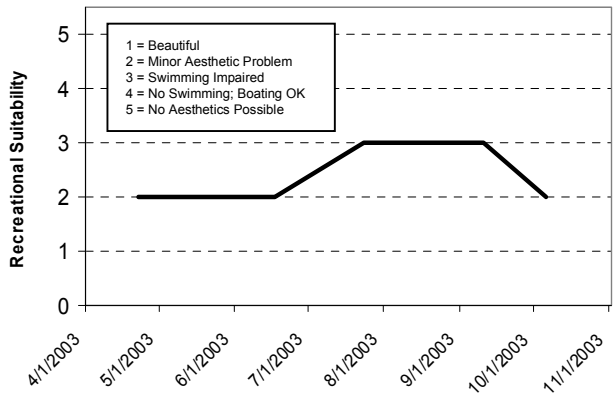



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | B | | | | C | C | C | C | C | C | | C |
| Chlorophyll a | B | | | | C | C | B | B | B | B | | B |
| Secchi Depth | C | C | C | C | C | C | C | C | C | C | B | C |
| **Overall** | **B** | | | | | **C** | **C** | **C** | **C** | **C** | | **C** |

Source: Metropolitan Council and STORET data



## Bass Lake (82-0035) *Carnelian - Marine Watershed District*

Bass Lake is an 81-acre lake located within May Township (Washington County). The maximum depth of the lake is 4.3 m (roughly 14 feet). 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).

This was the fourth year that Bass Lake was monitored through CAMP. A search through the STORET nationwide water quality database provided a moderate amount of historic data including Secchi data from 1991-2002 and nutrient and CLA data in 1991-1992 and 1996-2001.

The lake was monitored seven times between mid-April and early-October, 2003. The resulting data and graphs appear on the next page. 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.

The lake's overall 2003 lake quality grade of C was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 42.2 µg/l (minimum of 24.0 µg/l, maximum of 62.0 µg/l) corresponds to a lake water quality grade of C, as did the mean Secchi transparency of 2.2 m (minimum of 1.4 m, maximum of 3.1 m). The lake's the mean CLA concentration of 11.8 µg/l (minimum of 4.2 µg/l and maximum of 28.0 µg/l) resulted in a grade of B. The mean TKN concentration over the same time period was 0.94 mg/l.

The 2003 grade of C is similar to that of past years 1991, and 1997-2001), and slightly worse than the B recorded in 1992. The 2003 summer means were slightly better than those recorded from 1996-2002.

Because of the limited nature of the lake's water quality database the determination of statistically significant trends are not possible. The lake's water quality seems to be well represened by an overall grade of C. To better understand the lake's water quality and where it may be heading, more data are needed.

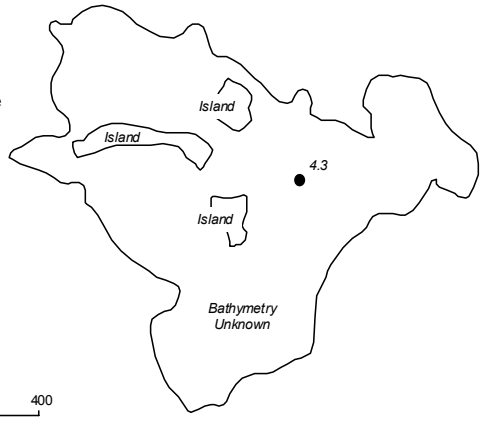
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-5-scale. The user perception rankings are shown on the lake's associated information sheet on the following page. The summertime mean physical condition was ranked 2.9 on a (between 2- "some algae present" and 3- "definite algae present"). The mean suitability for recreation ranking, also on a 1-to-5 scale, was 2.7 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

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.

# Bass Lake

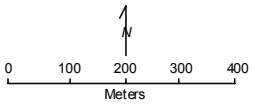
**May Twp., Washington Co.**

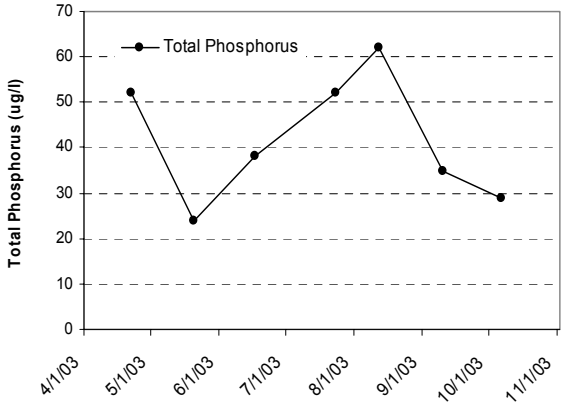
LAKE ID: 820035
WD: Carnelian-Marine
Volunteer:
Washington Co.
SWCD

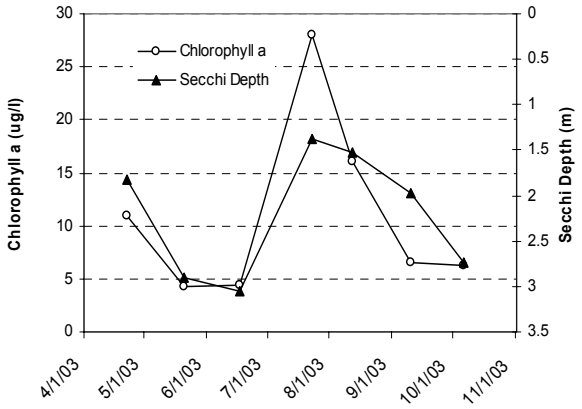



● Sampling site

Contours in meters

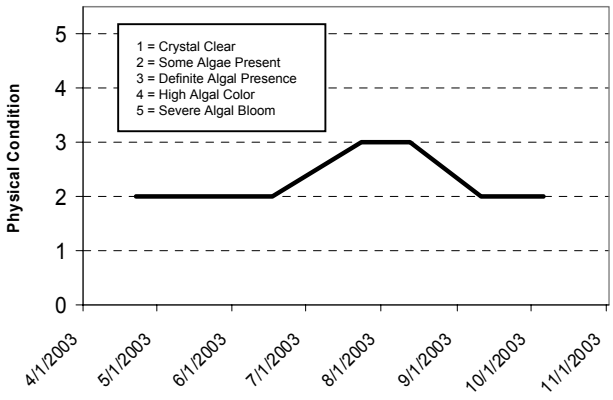



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 11.3 | | | | 11 | 52 | | 1.83 | 2 | 2 |
| 05/20/03 | 17.6 | | 4.86 | | 4.2 | 24 | | 2.9 | 2 | 2 |
| 06/17/03 | 24.6 | | | | 4.4 | 38 | | 3.05 | 2 | 2 |
| 07/23/03 | 26.7 | | 4.4 | | 28 | 52 | | 1.37 | 3 | 3 |
| 08/12/03 | 27.1 | | 7.4 | | 16 | 62 | | 1.525 | 3 | 3 |
| 09/10/03 | 22.2 | | 5.67 | | 6.6 | 35 | | 1.981 | 2 | 3 |
| 10/06/03 | 11.9 | | 9.33 | | 6.3 | 29 | | 2.743 | 2 | 2 |

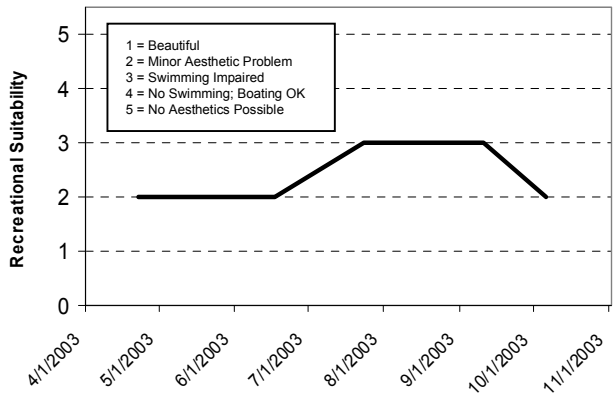



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | B | | | | C | C | C | C | C | C | | C |
| Chlorophyll a | B | | | | C | C | B | B | B | B | | B |
| Secchi Depth | C | C | C | C | C | C | C | C | C | C | B | C |
| **Overall** | **B** | | | | | **C** | **C** | **C** | **C** | **C** | | **C** |

Source: Metropolitan Council and STORET data



## Bavaria Lake (10-0019) *City of Chaska*

This marked the eighth year that Lake Bavaria has been involved in CAMP (1996-2003). Located in the City of Chaska (Carver County), the 200-acre lake has a mean and maximum depth of 5.6 m (18.4 feet) and 18.3 m (60 feet), respectively. Roughly 65 percent of the lake is considered littoral, the shallow (0-15 foot depth) area dominated by aquatic vegetation. Eurasian Water Milfoil (*Myriophyllum spicatum*) [EWM] has been reported on the lake.

The lake's surface area and mean depth translates to an approximate lake volume of 3,674 ac-ft. The lake has a 711-acre immediate watershed, which translates to a watershed-to-lake area ratio of 3.5:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: 17.5 percent residential, 52.7 percent agricultural, 29.7 percent commercial/industrial, and 0.2 percent open/undeveloped (Carver County Planning 1999). A public access is located on the lake's western edge and because of its multi-recreational uses, it is considered a "Priority Lake" in the Metropolitan Area.

Lake Bavaria was monitored 19 times between mid-April and mid-October, 2003. The mean summertime (May through September) TP concentration for the lake was 37.1 µg/l (minimum of 20.0 µg/l and maximum of 63.0 µg/l). The summertime mean CLA concentrations was 8.7 µg/l (minimum of 2.1 µg/l and maximum of 17.0 µg/l). The summertime mean Secchi transparency for the lake in 2003 was 2.3 m (minimum of 1.5 m and a maximum of 6.0 m). Additionally, the lake's summertime mean surface TKN concentration was 0.94 mg/l (minimum of 0.63 mg/l and maximum of 1.30 mg/l). The resulting water quality grades for Lake Bavaria in 2003 were: C for TP, A for CLA, and B for Secchi transparency, which translate to a 2003 overall water quality grade of B.

The lake's 2003 overall grade, although similar to that recorded in 1994, 1996, and 1999-2002, had a slightly worse TP mean than those recorded in the 1990's. The 2003 CLA mean, however, compared to those recorded in 1997 and 1998 (the years in which the lake experienced its best recorded water quality [overall grades of A]). The lakes worst recorded water quality years were 1983, 1986, and 1987 (C).

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's associated information sheet on the following page. The mean physical condition ranking was 2.3 (between 2- "some algae present" and 3- "definite algae present), while the mean recreational suitability ranking for the lake was 2.1 (roughly 2- "minor aesthetics problem").

While 2003 was the eighth year that Bavaria has been involved in CAMP, the lake has been monitored by Council staff in the past and has recently been involved in the MPCA's volunteer Secchi transparency program (included in the lake's report card grading system on the following page). Additionally, Lake Bavaria was included within the MPCA's Lake Assessment Program (LAP) in 2001. Through this program additional data, besides in-lake data through CAMP, will be collected to help complete a more comprehensive study on the lake.

Available data for Bavaria Lake reveal that the lake water quality remained constant through the 1980's and improved slightly in the mid-1990s before declining slightly in 1999-2003. The lake's water quality report card shown on the information sheet indicates that the lake has received an overall grade of C during the 1980's, A and B grades throughout the 1990's and early-2000's. The best water quality year to date for the lake was 1997.

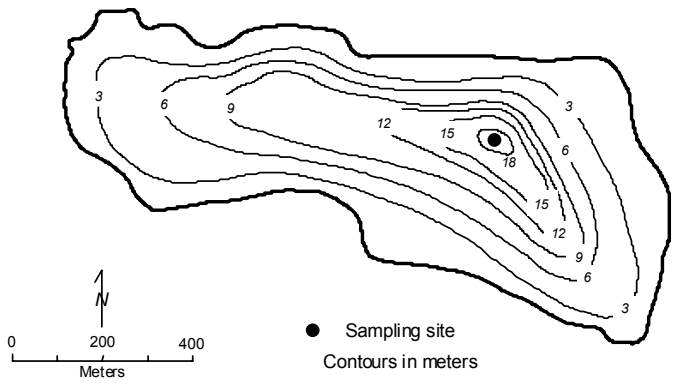
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

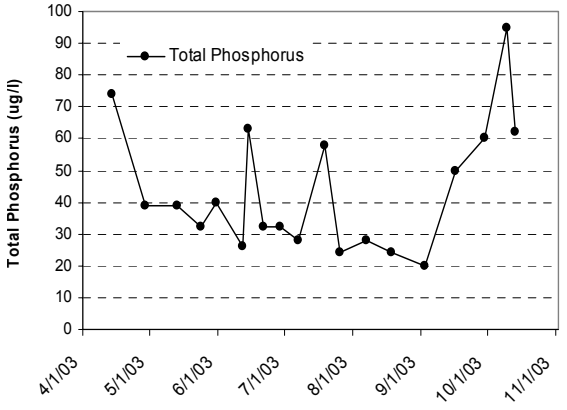
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

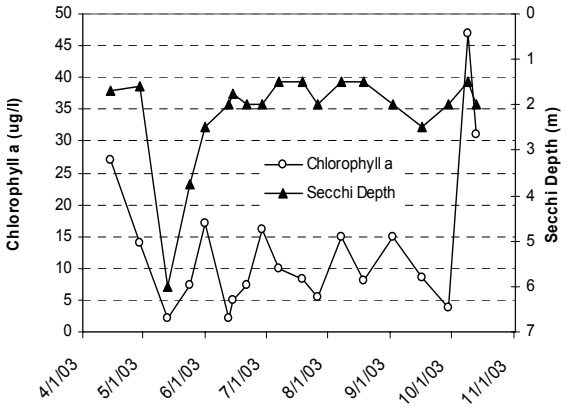
# Lake Bavaria

**Chaska/Laketown Twp., Carver Co.**

LAKE ID: 100019
WMO: Carver County
Volunteer: John Ryski

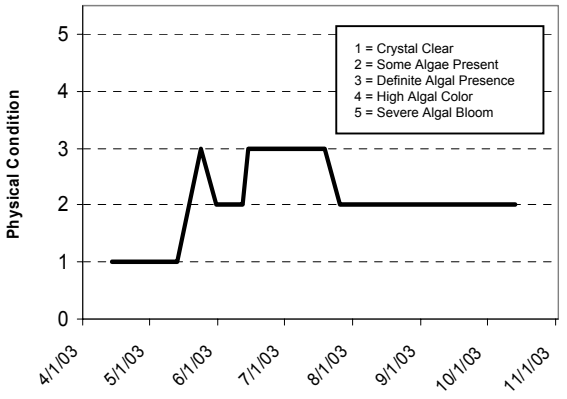



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 10.1 | | 14.95 | | 27 | 74 | | 1.7 | 1 | 1 |
| 04/29/03 | 12.6 | | 15.23 | | 14 | 39 | | 1.6 | 1 | 1 |
| 05/13/03 | 13 | | | | 2.1 | 39 | | 6 | 1 | 1 |
| 05/24/03 | 18 | | | | 7.3 | 32 | | 3.75 | 3 | 2 |
| 05/31/03 | 15 | | | | 17 | 40 | | 2.5 | 2 | 2 |
| 06/12/03 | 21 | | | | 2.1 | 26 | | 2 | 2 | 2 |
| 06/14/03 | 22 | | | | 5 | 63 | | 1.75 | 3 | 2 |
| 06/21/03 | 22 | | | | 7.3 | 32 | | 2 | 3 | 3 |
| 06/29/03 | 20 | | | | 16 | 32 | | 2 | 3 | 3 |
| 07/07/03 | 25 | | | | 10 | 28 | | 1.5 | 3 | 2 |
| 07/19/03 | 24 | | | | 8.3 | 58 | | 1.5 | 3 | 2 |
| 07/26/03 | 25 | | | | 5.5 | 24 | | 2 | 2 | 2 |
| 08/07/03 | 25 | | | | 15 | 28 | | 1.5 | 2 | 2 |
| 08/18/03 | 25 | | | | 8 | 24 | | 1.5 | 2 | 2 |
| 09/02/03 | 24 | | | | 15 | 20 | | 2 | 2 | 2 |
| 09/16/03 | 19 | | | | 8.5 | 50 | | 2.5 | 2 | 2 |
| 09/29/03 | 12 | | | | 3.7 | 60 | | 2 | 2 | 2 |
| 10/09/03 | 14 | | | | 47 | 95 | | 1.5 | 2 | 2 |
| 10/13/03 | 13 | | | | 31 | 62 | | 2 | 2 | 2 |

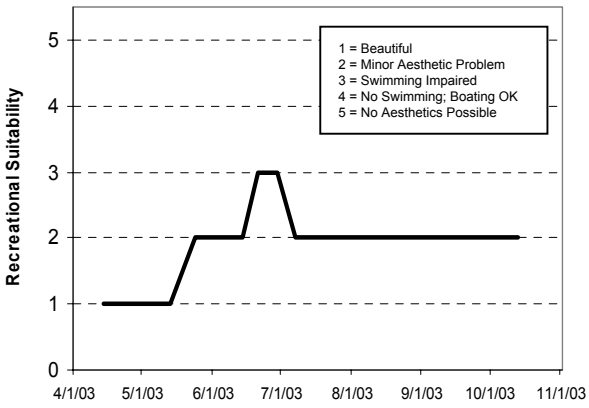



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | B | | C | A | B | B | C | B | B | C |
| Chlorophyll a | | | A | | A | A | A | B | B | B | B | A |
| Secchi Depth | | | B | B | C | A | A | B | B | B | C | B |
| **Overall** | | | **B** | | **B** | **A** | **A** | **B** | **B** | **B** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Benton Lake (10-0069) *Carver County Environmental Services*

Benton Lake is a 115-acre lake located within Benton Township (Carver County). The maximum depth of the lake is 2.0 m (roughly 6.5 feet). 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 has a 322-acre immediate watershed, which translates to a watershed-to-lake area ratio of 2.8:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: 19 percent residential, 55 percent agricultural, 16 percent commercial/industrial, and 10 percent open/undeveloped (Carver County Planning 1999).

This was the fourth year that Benton Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake provided only three years of prior data (collected through CAMP in 1999-2001). The lake was monitored 15 times between mid-April and mid-October, 2003. During each monitoring event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as its perceived physical condition and recreational suitability. The resulting data and graphs appear on the next page.

The lake's 2003 summertime (May through September) mean TP concentration of 247.8 µg/l (minimum of 130.0 µg/l and maximum of 401.0 µg/l) fell within the lake water quality F grade range. The lake's Secchi transparency mean of 0.3 m (minimum of 0.1 m (worst recorded Secchi reading in CAMP 2003) and maximum of 0.5 m) resulted in a grade of F. The CLA mean of 261.6 µg/l (minimum and maximum of 89.0 and 550.0 µg/l) fell within the F grading percentile range. The lake's mean TKN concentration was 4.64 mg/l (minimum of 2.10 mg/l and maximum of 7.20 mg/l). Similar to that recorded from 1999-2001, the resulting overall grade for the lake's 2003 water quality was F.

As mentioned earlier, there are no water quality data available for Benton Lake other than the 1999-2001 and 2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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's associated information sheet on the following page. 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 3.8 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

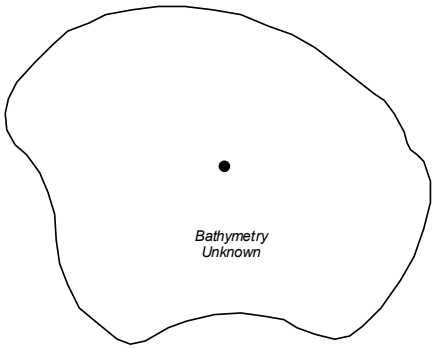
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

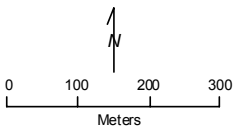
# Lake Benton

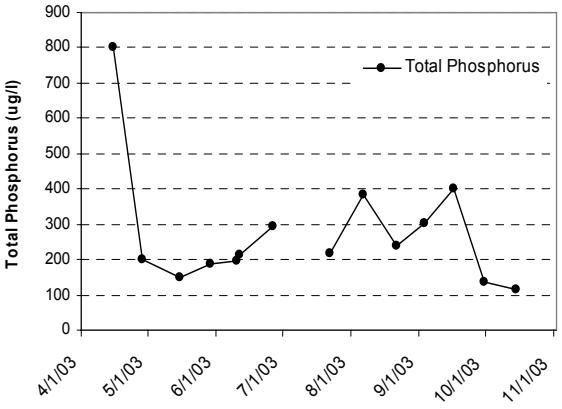
**Cologne, Carver Co.**

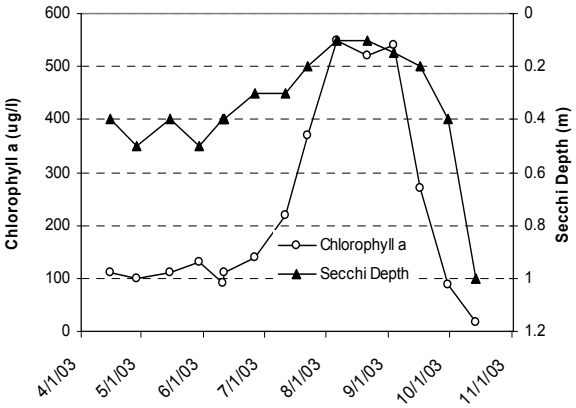
Lake ID: 100069
WMO: Carver County
Volunteer: Carver Co. Env. Services

● Sampling site
Contours in meters



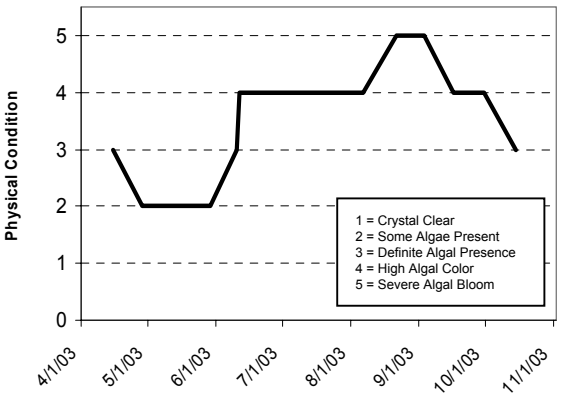




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 16.1 | | 12.21 | | 110 | 802 | | 0.4 | 3 | 4 |
| 04/28/03 | 14.9 | | 10.9 | | 100 | 199 | | 0.5 | 2 | 5 |
| 05/15/03 | 15.5 | | 12.1 | | 110 | 150 | | 0.4 | 2 | 2 |
| 05/29/03 | 20.4 | | 10.68 | | 130 | 188 | | 0.5 | 2 | 3 |
| 06/10/03 | 20.5 | | 13.43 | | 90 | 198 | | 0.4 | 3 | 3 |
| 06/11/03 | 21 | | | | 110 | 212 | | 0.4 | 4 | 4 |
| 06/26/03 | 20.4 | | 8.7 | | 140 | 296 | | 0.3 | 4 | 4 |
| 07/11/03 | 22.3 | | | | 220 | | | 0.3 | 4 | 4 |
| 07/22/03 | 23 | | 9.08 | | 370 | 217 | | 0.2 | 4 | 4 |
| 08/06/03 | 23.8 | | 11.3 | | 550 | 384 | | 0.1 | 4 | 4 |
| 08/21/03 | 25.9 | | 11.1 | | 520 | 240 | | 0.1 | 5 | 5 |
| 09/03/03 | 21.2 | | 9.77 | | 540 | 302 | | 0.15 | 5 | 5 |
| 09/16/03 | 19.3 | | 5.99 | | 270 | 401 | | 0.2 | 4 | 4 |
| 09/30/03 | 10.2 | | | | 89 | 138 | | 0.4 | 4 | 4 |
| 10/14/03 | 12.5 | | 5.5 | | 16 | 114 | | 1 | 3 | 3 |

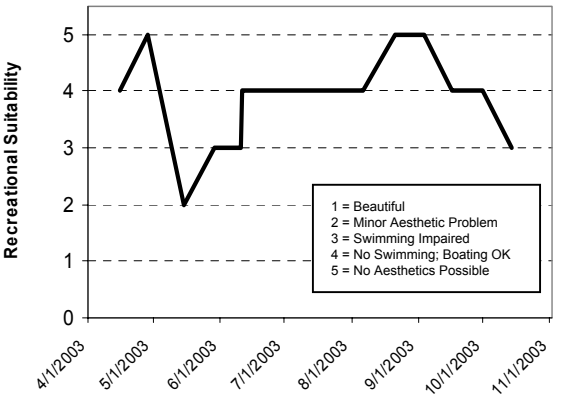



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | F | F | F | | F |
| Chlorophyll a | | | | | | | | F | F | F | | F |
| Secchi Depth | | | C | | | | | F | F | F | | F |
| **Overall** | | | | | | | | **F** | **F** | **F** | | **F** |

Source: Metropolitan Council and STORET data



## Big Carnelian Lake (82-0049) *Carnelian - Marine Watershed District*

Big Carnelian Lake, located within May Township (Washington County), has a public access on its southwestern side, and is considered a "Priority Lake" due to its multi-recreational uses. The lake covers an area of 455 acres and has a maximum and mean depth of 20 m (roughly 66 feet) and 9.8 m (32 feet). Roughly 28 percent of the lake's area is considered littoral, the shallow (0-15 foot depth) area dominated by aquatic vegetation. The approximate volume of the lake is 14,560 acre-feet (ac-ft). The lake's watershed of 1,900 acres translates to a rather small watershed-to-lake size ratio of 4:1. The larger the ratio the greater the potential stress put on the lake from surface.

Big Carnelian Lake was monitored 14 times between late-April and late-October, 2003. The data and related graphs are presented on the information sheet on the following page.

The lake's summertime (May - September) mean TP concentration of 17.6 µg/l (minimum of 11.0 µg/l and maximum of 27.0 µg/l) corresponded to a lake water quality grade of A, as does the mean CLA concentration of 8.1 µg/l (minimum and maximum of 4.4 and 17.0 µg/l). The Secchi transparency mean of 2.7 m (minimum of 2.1 m and maximum of 3.5 m), however, resulted in a grade of B. The lake's mean TKN concentration was 0.54 mg/l (minimum of 0.45 mg/l and maximum of 0.70 mg/l). The 2003 summermeans were similar to those recorded in 2002, but worse than those previously recorded in the 2000-2001.

The overall lake quality grade for Big Carnelian Lake in 2003, determined from the three individual grades, was A. The lake received overall grades of A in 1980, 1989, 1991, 1994, 1996-1998, 2000-2002, and a grade of B in 1984 and 1999.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The resulting user perception rankings are shown on the information sheet. The mean physical condition ranking was 2.0 (2- "some algae present"), while the mean recreational suitability ranking was 2.0 (2- "minor aesthetic problem").

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 A.

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.

# Big Carnelian Lake

**May Twp., Washington Co.**

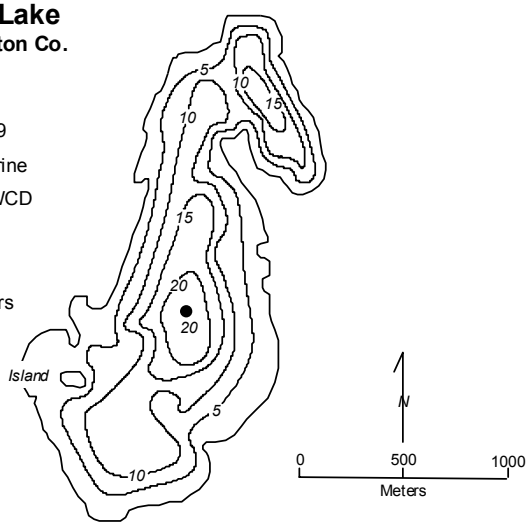
LAKE ID: 820049

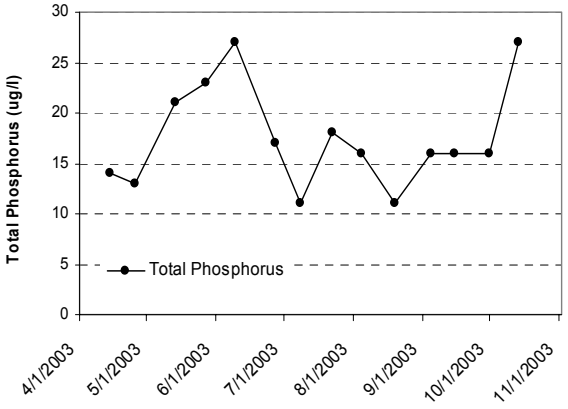
WD: Carnelian-Marine

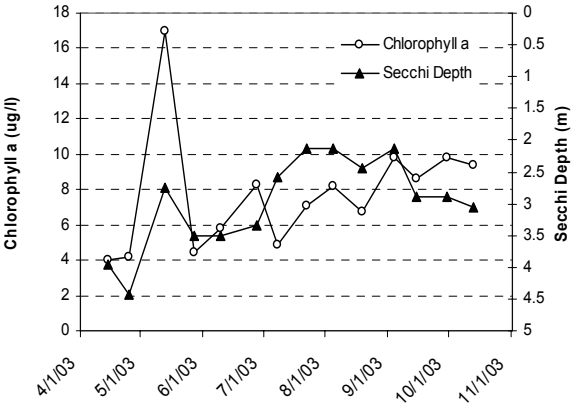
Washington Co. SWCD

● Sampling site

Contours in meters

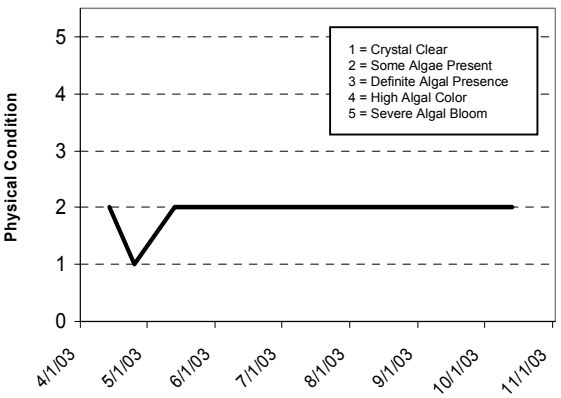



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 7.1 | | 9.51 | | 4 | 14 | | 3.96 | 2 | 2 |
| 04/25/03 | 10.1 | | 4.1 | | 4.2 | 13 | | 4.42 | 1 | 1 |
| 05/13/03 | 13 | | 8.89 | | 17 | 21 | | 2.74 | 2 | 2 |
| 05/27/03 | 18.7 | | 5.55 | | 4.4 | 23 | | 3.51 | 2 | 2 |
| 06/09/03 | 19 | | 7.07 | | 5.8 | 27 | | 3.51 | 2 | 1 |
| 06/27/03 | 21.6 | | 8.4 | | 8.3 | 17 | | 3.35 | 2 | 3 |
| 07/08/03 | 25.6 | | 10.16 | | 4.9 | 11 | | 2.59 | 2 | 2 |
| 07/22/03 | 24.2 | | 4.48 | | 7.1 | 18 | | 2.14 | 2 | 2 |
| 08/04/03 | 22.8 | | 9.69 | | 8.2 | 16 | | 2.135 | 2 | 2 |
| 08/19/03 | 26.6 | | 9.63 | | 6.7 | 11 | | 2.438 | 2 | 3 |
| 09/04/03 | 22.1 | | 7.11 | | 9.8 | 16 | | 2.134 | 2 | 2 |
| 09/15/03 | 21.2 | | 7.06 | | 8.6 | 16 | | 2.896 | 2 | 1 |
| 09/30/03 | 14.1 | | 9.66 | | 9.8 | 16 | | 2.896 | 2 | 2 |
| 10/13/03 | 14.2 | | 9.72 | | 9.4 | 27 | | 3.048 | 2 | 1 |

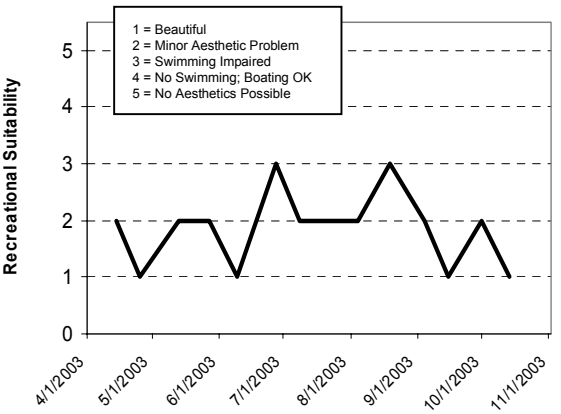



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | A | | A | A | A | A | A | A | B | A |
| Chlorophyll a | | | A | | A | A | A | B | A | A | A | A |
| Secchi Depth | B | B | B | B | B | A | A | B | A | A | A | B |
| **Overall** | | | **A** | | **A** | **A** | **A** | **B** | **A** | **A** | **A** | **B** |

Source: Metropolitan Council and STORET data



## Big Comfort Lake (13-0053) *Comfort Lake-Forest Lake Watershed District*

Big Comfort Lake is located just north east of the City of Forest Lake, in Isanti County. This year marked the fifth year that the 219-acre lake has been enrolled in CAMP (1998 [it was, however, only monitored a two times in October] and 2000-2002). The lake has a maximum depth of 14.3 m (47 feet). Roughly 41 percent of the lake's area is considered littoral, the shallow (0-15 foot) depth area dominated by aquatic vegetation.

An indepth lake assessment was undertaken on the lake by the MPCA in 1994.

Big Comfort Lake was monitored 14 times between late-April and late-October, 2003. The data and related graphs are presented on the information sheet on the following page.

The summertime (May - September) mean TP concentration of 47.1 µg/l (minimum of 22.0 µg/l and maximum of 71.0 µg/l) corresponded to a lake water quality grade of C mean as did the CLA mean of 21.0 µg/l (minimum and maximum of 7.1 and 39.0 µg/l). The lake's 2003 Secchi transparency mean of 1.5 m (minimum of 1.1 m and maximum of 2.3 m) also falls within the C grading range. The lake's mean TKN concentration was 1.20 mg/l (minimum of 1.10 mg/l and maximum of 1.50 mg/l). The overall lake quality grade for Big Comfort Lake, determined from the three individual grades, was C. The overall grade is similar to that recorded in 2000 and 2002, and worse than that of 2001.

The lake's TP mean does not include a point deemed an outlier (198.0 µg/l) on one sampling date (May 6). The point is roughly four-to-five times greater than the expected value and a reason for the erroneous number is not known (in-lab processes and QA/QC runs within the batch where the questionable sample was analyzed, were checked and okayed).

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The resulting user perception rankings are shown on the information sheet. The mean physical condition ranking was 2.6 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.5 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

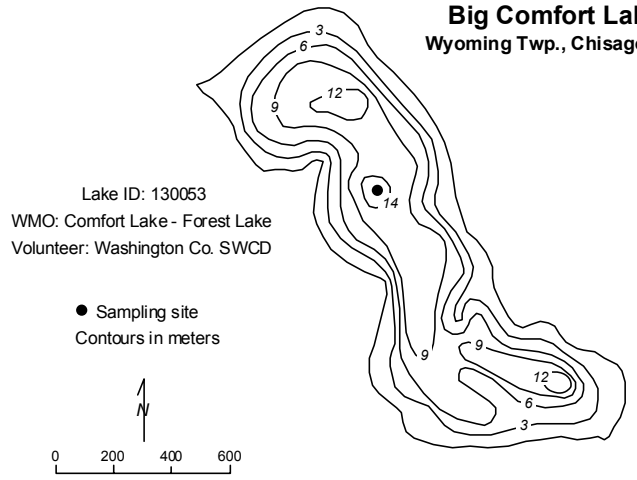
Because of the limited size of the lake's water quality database, no long- or short-term trends can be determined. To better understand the quality of the lake and what direction it may be heading, more years of data collection are needed.

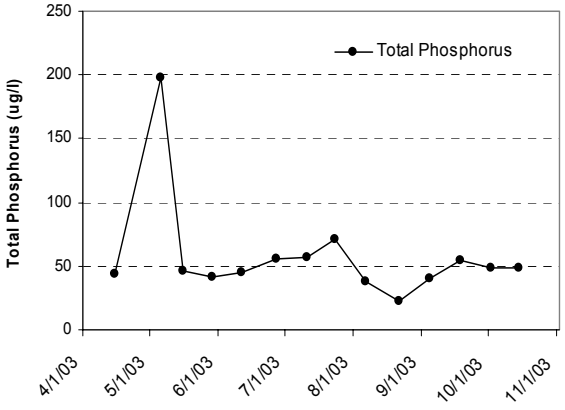
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

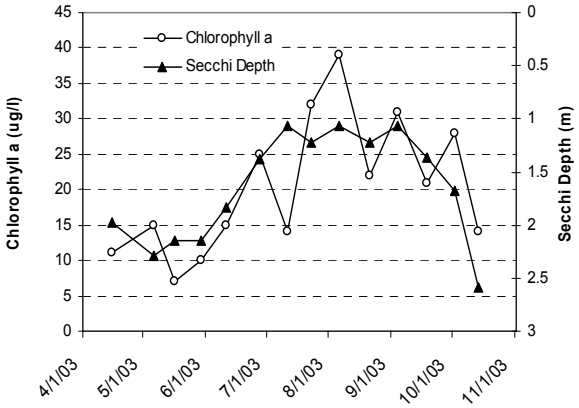
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Big Comfort Lake

**Wyoming Twp., Chisago Co.**

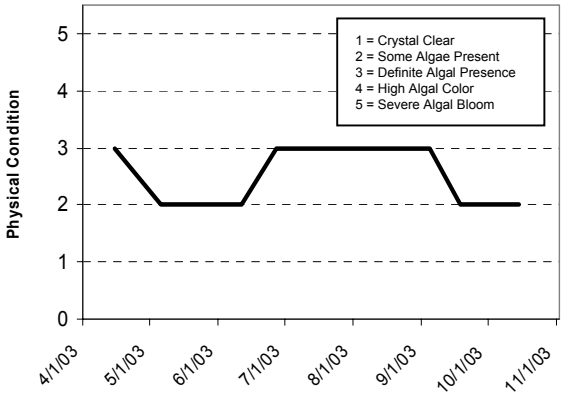



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 9 | | 9.01 | | 11 | 44 | | 1.98 | 3 | 3 |
| 05/06/03 | 12.4 | | 8.01 | | 15 | 198 | | 2.29 | 2 | 2 |
| 05/16/03 | 16.2 | | 5.4 | | 7.1 | 46 | | 2.14 | 2 | 2 |
| 05/29/03 | 20.3 | | 4.91 | | 10 | 42 | | 2.14 | 2 | 2 |
| 06/11/03 | 18.7 | | 2.91 | | 15 | 45 | | 1.83 | 2 | 1 |
| 06/27/03 | 22.3 | | | | 25 | 56 | | 1.373 | 3 | 3 |
| 07/11/03 | 21.8 | | | | 14 | 57 | | 1.068 | 3 | 3 |
| 07/23/03 | 24.5 | | 4.2 | | 32 | 71 | | 1.22 | 3 | 3 |
| 08/06/03 | 23.7 | | 9 | | 39 | 38 | | 1.07 | 3 | 3 |
| 08/21/03 | 26.2 | | 5.6 | | 22 | 22 | | 1.22 | 3 | 3 |
| 09/04/03 | 21.9 | | 6.37 | | 31 | 40 | | 1.067 | 3 | 3 |
| 09/18/03 | 20.3 | | 6.32 | | 21 | 54 | | 1.372 | 2 | 2 |
| 10/02/03 | 12.6 | | 6.9 | | 28 | 49 | | 1.676 | 2 | 3 |
| 10/14/03 | 13.6 | | 8.22 | | 14 | 48 | | 2.591 | 2 | 2 |

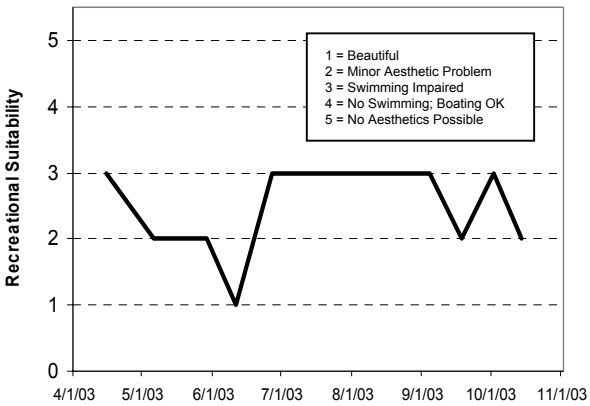



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | D | | | | | | C | B | C | C |
| Chlorophyll a | | | B | | | | | | C | B | C | C |
| Secchi Depth | | | C | C | | C | C | | C | C | C | C |
| **Overall** | | | **C** | | | | | | **C** | **B** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Big Marine Lake (82-0052) *Carnelian - Marine Watershed District*

Big Marine Lake, located within New Scandia Township (Washington County), has two public accesses, and is considered a "Priority Lake" due to its multi-recreational uses. The lake covers an area of 1,706 acres and has a maximum and mean depth of 15.2 m (roughly 50 feet) and 7.6 m (25 feet). Roughly 67 percent of the lake's area is considered littoral, the shallow (0-15 foot depth) area dominated by aquatic vegetation. The approximate volume of the lake is 42,527 acre-feet (ac-ft). The lake's watershed of 2,659 acres translates to a small watershed-to-lake size ratio of 1.5:1. The larger the ratio the greater the potential stress put on the lake from surface runoff.

Big Marine Lake was monitored 14 times between mid-April and mid-October, 2003. The data and related graphs are presented on the information sheet on the following page.

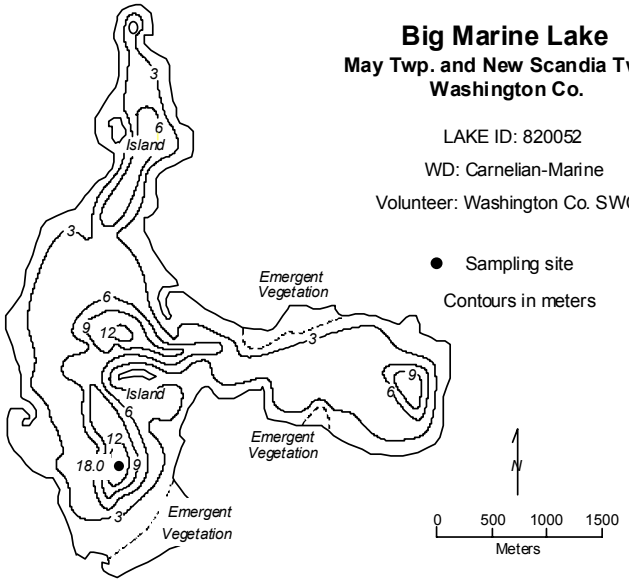
The summertime (May - September) mean TP concentration of 22.5 µg/l (minimum of 12.0 µg/l and maximum of 66.0 µg/l) corresponded to a lake water quality grade of A, as did the CLA mean concentration of 6.9 µg/l (minimum and maximum of 3.0 and 9.6 µg/l). The lake's Secchi transparency mean of 2.96 m (minimum of 1.98 m and maximum of 5.64 m) translates to a grade of B. The lake's mean TKN concentration was 0.53 mg/l (minimum of 0.37 mg/l and maximum of 0.63 mg/l). The overall lake quality grade for Big Marine Lake, determined from the three individual grades, was A. The lake received overall grades of A in 1989, 1994, 1996-1998, 2000-2001, and 2003 and a grades of B in 1980, 1981, 1984, 1991, 1999, and 2002.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The resulting user perception rankings are shown on the information sheet. The mean physical condition ranking was 2.0 (2- "some algae present"), while the mean recreational suitability ranking was 1.9 (roughly equal to 2- "minor aesthetic problem").

While no statistically significant long-term trend is evident from the lake's whole water quality database (including TP, CLA and Sechi data), a recent MPCA conducted trend analysis using just the lake's Secchi transparency data, revealed a statistically significant improvement in recent water clarity. In the short-term, the lake's quality seems well represented by an overall grade of B+/A.

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.




# Big Marine Lake

**May Twp. and New Scandia Twp., Washington Co.**

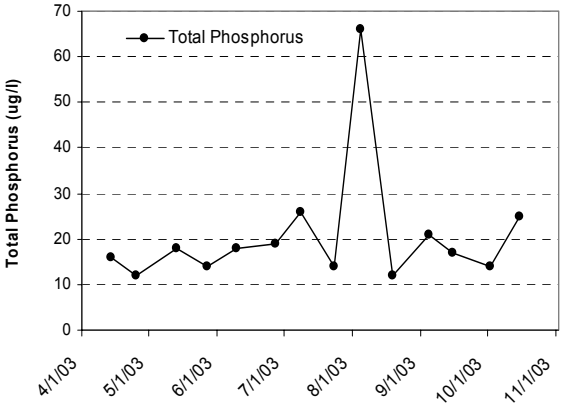
LAKE ID: 820052

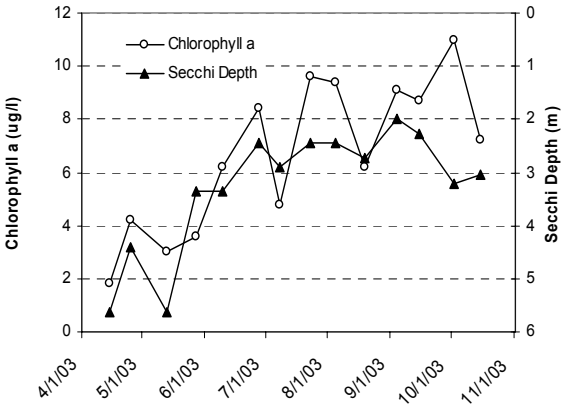
WD: Carnelian-Marine

Volunteer: Washington Co. SWCD

● Sampling site

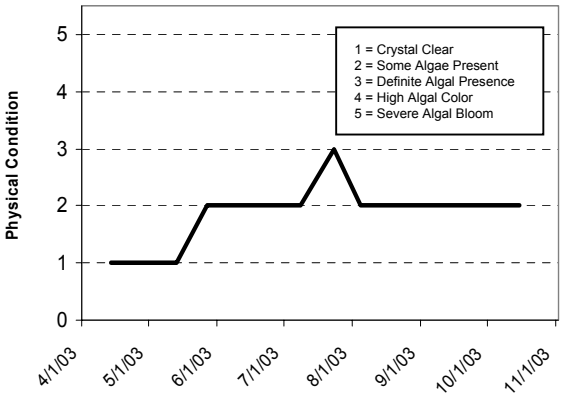
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 7.8 | | 10.64 | | 1.8 | 16 | | 5.64 | 1 | 1 |
| 04/25/03 | 10.2 | | 4.93 | | 4.2 | 12 | | 4.42 | 1 | 1 |
| 05/13/03 | 14.5 | | 8.24 | | 3 | 18 | | 5.64 | 1 | 1 |
| 05/27/03 | 18.3 | | 5.41 | | 3.6 | 14 | | 3.35 | 2 | 2 |
| 06/09/03 | 20.1 | | 6 | | 6.2 | 18 | | 3.35 | 2 | 2 |
| 06/27/03 | 21.2 | | 7.27 | | 8.4 | 19 | | 2.44 | 2 | 2 |
| 07/08/03 | 26.3 | | 8.95 | | 4.8 | 26 | | 2.9 | 2 | 2 |
| 07/23/03 | 23.7 | | 4.52 | | 9.6 | 14 | | 2.44 | 3 | 2 |
| 08/04/03 | 24.4 | | 8 | | 9.4 | 66 | | 2.44 | 2 | 2 |
| 08/19/03 | 26.4 | | 5.6 | | 6.2 | 12 | | 2.743 | 2 | 2 |
| 09/04/03 | 21.8 | | 5.93 | | 9.1 | 21 | | 1.981 | 2 | 2 |
| 09/15/03 | 21.3 | | 6.21 | | 8.7 | 17 | | 2.286 | 2 | 2 |
| 10/02/03 | 12.3 | | 10.8 | | 11 | 14 | | 3.2 | 2 | 2 |
| 10/15/03 | 13.1 | | 9.22 | | 7.2 | 25 | | 3.048 | 2 | 2 |

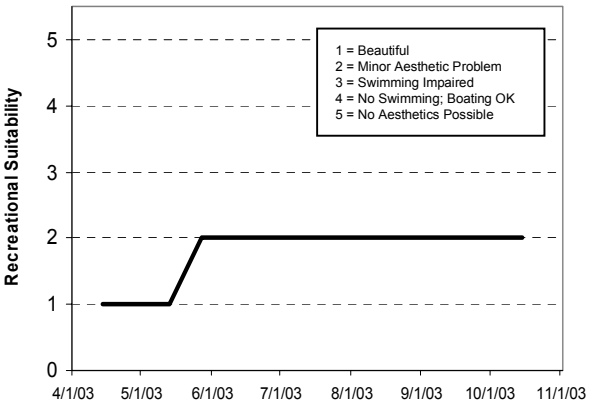



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | A | | B | A | A | A | A | A | B | A |
| Chlorophyll a | | | A | | A | A | A | B | A | A | B | A |
| Secchi Depth | A | A | B | | A | B | A | B | A | A | B | B |
| **Overall** | | | **A** | | **A** | **A** | **A** | **B** | **A** | **A** | **B** | **A** |

Source: Metropolitan Council and STORET data



## Bone Lake (82-0054) *Comfort Lake-Forest Lake Watershed District*

Bone Lake was previously monitored as a part of CAMP in 1993, 1995, 1997-1999, and 2001-2002. In 2003, the lake was monitored 14 times between mid-April and mid-October. Results are presented on the information sheet on the following page.

The 212-acre lake is located within New Scandia Township (Washington County). It receives flow through three inlets. The lake has a public access on its northwestern side and has a maximum and mean depth of 9.8 m and 3.7 m (32 and 12 feet), respectively. The approximate lake volume of Bone Lake, which has been stocked with walleye by the MDNR in the 1990's, is 2,820 ac-ft. The lake's 5,177-acre watershed translates to a rather large watershed-to-lake size ratio of 24:1. The greater the ratio, the greater the potential stress on the lake from surface runoff. Roughly 59 percent of the lake is considered littoral zone, that is, the area of aquatic plant dominance. The lake is considered a Metropolitan Council "Priority Lake" due to its multi-recreational uses.

The summertime (May - September) mean TP concentration of 75.0 µg/l (minimum of 47.0 µg/l and maximum of 146.0 µg/l), corresponded to a lake water quality grade of D. The lake's Secchi transparency mean of 1.4 m (minimum of 0.6 m and maximum of 4.0 m) also resulted in a grade of C as did the CLA mean of 39.1 µg/l (minimum and maximum of 2.8 and 79.0 µg/l). The lake's mean TKN concentration was 1.57 mg/l (minimum of 0.95 mg/l and maximum of 2.20 mg/l).

The overall lake quality grade for Bone Lake in 2003, determined from the three individual grades, was C. Based on the lake water quality grade, shown on the facing information page, the lake's quality throughout the mid-1980's, 1990's, and early-2000's seems to be consistently represented by an overall grade of C. The lake's recent TP conditions (shown as summer means) however, have worsened.

Throughout the summer, the volunteer(s) ranked the lake's perceived physical and recreational conditions on a 1-to-5 scale (see lake information sheet). The mean rankings were 3.4 for physical condition (between 3- "definite algae present" and 4- high algal color"), and 3.6 for recreational suitability (between 3- " swimming slightly impaired" and 4- "no swimming – boating ok").

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 know of any erroneous lake 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.

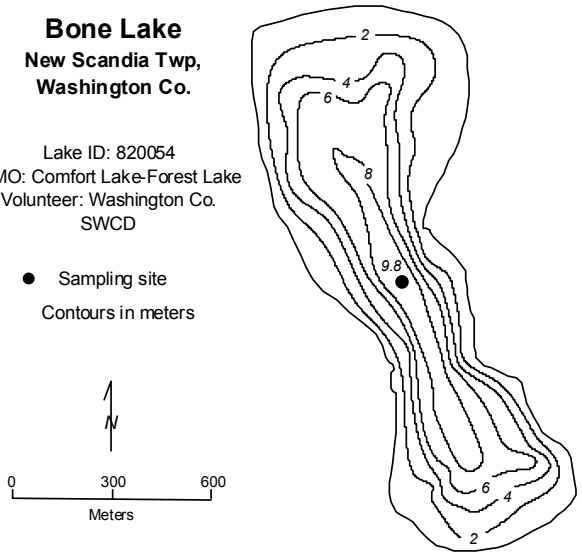
# Bone Lake

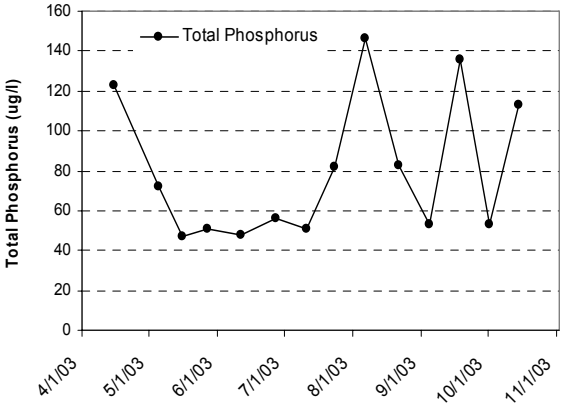
**New Scandia Twp,**
**Washington Co.**

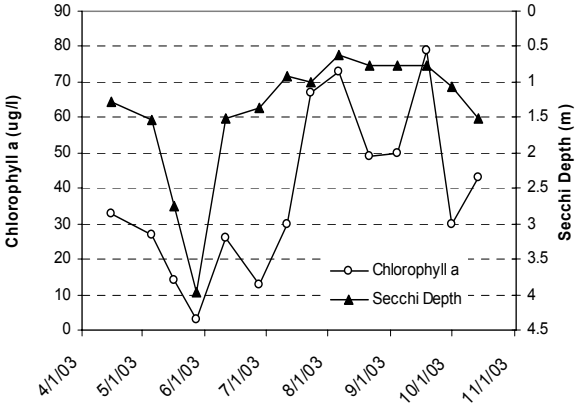
Lake ID: 820054
WMO: Comfort Lake-Forest Lake
Volunteer: Washington Co. SWCD

● Sampling site

Contours in meters

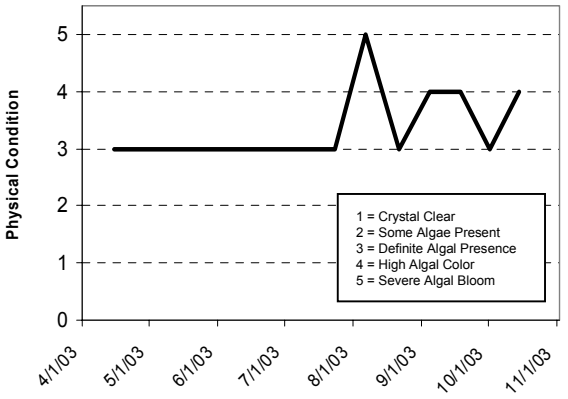



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 10.1 | | 9.66 | | 33 | 123 | | 1.27 | 3 | 3 |
| 05/05/03 | 13.2 | | 10.55 | | 27 | 72 | | 1.525 | 3 | 4 |
| 05/16/03 | 16.9 | | 5.58 | | 14 | 47 | | 2.75 | 3 | 3 |
| 05/27/03 | 19.5 | | 4.21 | | 2.8 | 51 | | 3.96 | 3 | 4 |
| 06/11/03 | 19.3 | | 2.21 | | 26 | 48 | | 1.52 | 3 | 3 |
| 06/27/03 | 20.8 | | 5.49 | | 13 | 56 | | 1.37 | 3 | 4 |
| 07/11/03 | 22.9 | | 9.23 | | 30 | 51 | | 0.915 | 3 | 4 |
| 07/23/03 | 26.5 | | 7.15 | | 67 | 82 | | 1 | 3 | 4 |
| 08/06/03 | 24.6 | | 11.58 | | 73 | 146 | | 0.61 | 5 | 4 |
| 08/21/03 | 26.2 | | 5.6 | | 49 | 83 | | 0.763 | 3 | 3 |
| 09/04/03 | 21.7 | | 5.42 | | 50 | 53 | | 0.762 | 4 | 4 |
| 09/18/03 | 20.6 | | 6.32 | | 79 | 136 | | 0.762 | 4 | 3 |
| 10/01/03 | 12.4 | | 9.7 | | 30 | 53 | | 1.067 | 3 | 3 |
| 10/14/03 | 13.8 | | 10.58 | | 43 | 113 | | 1.524 | 4 | 3 |

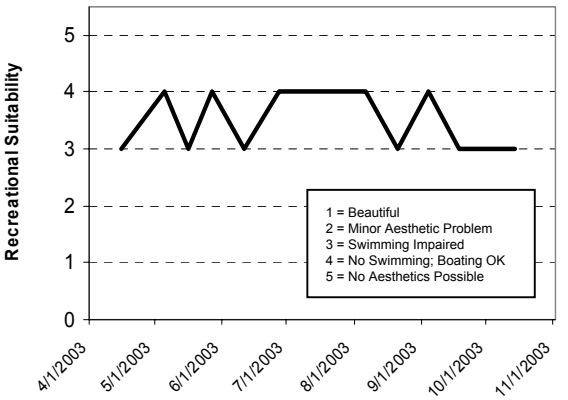



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | | | | C | C | C | | C | C | D |
| Chlorophyll a | | C | | | | B | B | C | | C | C | C |
| Secchi Depth | | C | D | C | | C | C | D | | C | D | C |
| **Overall** | | **C** | | | | **C** | **C** | **C** | | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Brickyard Lake (10-0225) *Carver County Environmental Services*

Brickyard Lake is a 17-acre lake located near the City of Chaska (Carver County). The maximum depth of the lake is 13.1 m (roughly 43 feet). Thirty-five percent of the lake's surface area is considered littoral zone (area of aquatic plant dominance).

This was the second year that Brickyard Lake has been involved in CAMP (2002 being the first). The lake was monitored 13 times between mid-April and mid-October, 2003. During each monitoring event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as its perceived physical condition and recreational suitability. The resulting data and graphs appear on the next page.

Summertime (May through September) means for the monitored variables were: surface TP= 15.0 µg/l (minimum concentration of 8.0 µg/l and a maximum value of 22.0 µg/l); surface chlorophyll-a= 1.9 µg/l (minimum of 1.1 µg/l and maximum of 2.8 µg/l); Secchi transparency= 4.2 m (minimum of 2.5 m and a maximum of 6.1 m); and TKN= 0.35 mg/l (minimum of 0.23 mg/l and maximum of 0.64 mg/l). The lake quality grades associated with the 2003 summertime means are as follows: TP= A; CLA= A; and Secchi= A. Similar to that recorded in 2002, the lake's resulting overall 2003 water quality grade, calculated from the TP, CLA, and Secchi grades, was A. The lakes's 2003 summer means, however, were better than those of 2002.

To the best of our knowledge, there are no water quality data available for Brickyard Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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 1.1 for physical condition (between 1- "crystal clear" and 2- "some algae problem" ), and 1.3 for recreational suitability (between 1- "beautiful" and 2- "minor aesthetic problems").

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.

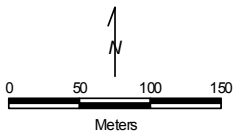
# Brickyard Lake

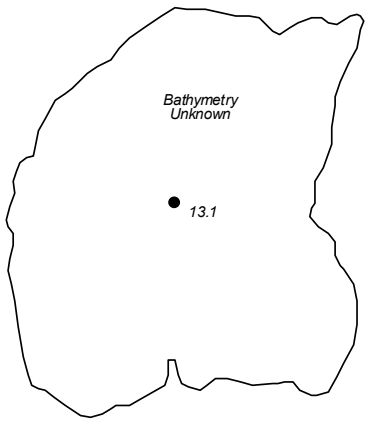
**Chaska, Carver Co.**

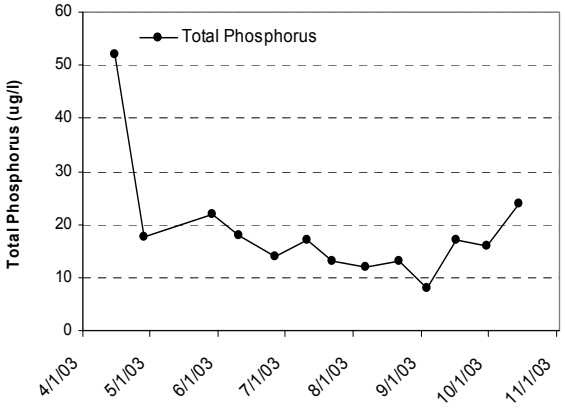
Lake ID: 100225
WMO: Carver County
Volunteer: Carver Co. Env. Services

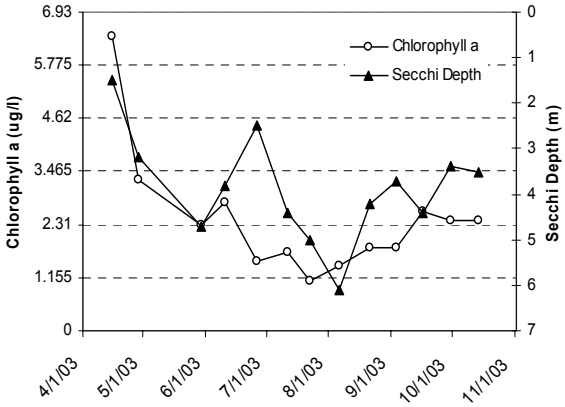
● Sampling site

Contours in meters



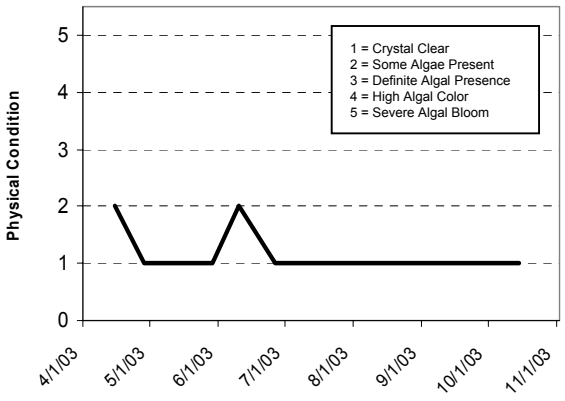




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 13.7 | | 11.05 | | 6.4 | 52 | | 1.5 | 2 | 2 |
| 04/28/03 | 15.6 | | 10.28 | | 3.3 | 17.5 | | 3.2 | 1 | 1 |
| 05/29/03 | 20 | | 11.18 | | 2.3 | 22 | | 4.7 | 1 | 1 |
| 06/10/03 | 21.5 | | 9.4 | | 2.8 | 18 | | 3.8 | 2 | 3 |
| 06/26/03 | 22.4 | | 7.4 | | 1.5 | 14 | | 2.5 | 1 | 1 |
| 07/11/03 | 23.6 | | 6.65 | | 1.7 | 17 | | 4.4 | 1 | 1 |
| 07/22/03 | 24.7 | | 8.34 | | 1.1 | 13 | | 5 | 1 | 2 |
| 08/06/03 | 25.8 | | 8.29 | | 1.4 | 12 | | 6.1 | 1 | 1 |
| 08/21/03 | 27 | | 15.7 | | 1.8 | 13 | | 4.2 | 1 | 1 |
| 09/03/03 | 23.3 | | 8.72 | | 1.8 | 8 | | 3.7 | 1 | 1 |
| 09/16/03 | 21.9 | | 5.29 | | 2.6 | 17 | | 4.4 | 1 | 1 |
| 09/30/03 | 14.9 | | | | 2.4 | 16 | | 3.4 | 1 | 1 |
| 10/14/03 | 15 | | 9.05 | | 2.4 | 24 | | 3.5 | 1 | 1 |

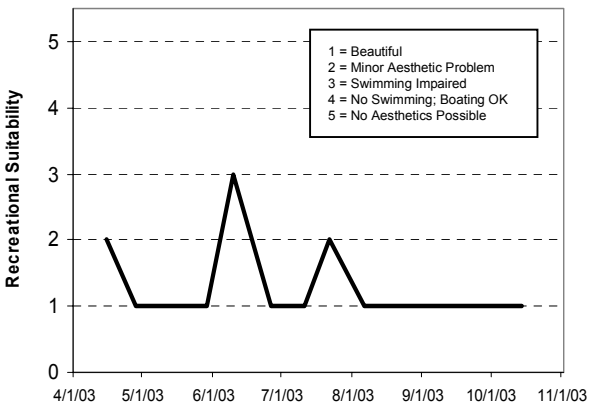



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | A | A |
| Chlorophyll a | | | | | | | | | | | A | A |
| Secchi Depth | | | | | | | | | | | A | A |
| **Overall** | | | | | | | | | | | **A** | **A** |

Source: Metropolitan Council and STORET data



## Carol Lake (82-0017) *Carnelian - Marine Watershed District*

Carol Lake is located within Stillwater Township (Washington County). The lake covers an area of 63 acres and has a maximum and mean depth of 1.8 m (roughly 6 feet) and 0.9 m (3 feet). Because of the shallowness of the lake, the entire lake is considered littoral, the shallow (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). The approximate volume of the lake is 186 acre-feet (ac-ft). The lake's watershed of 375 acres translates to a watershed-to-lake size ratio of 6:1. The larger the ratio the greater the potential stress put on the lake from surface runoff.

This was the fourth year that Carol Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake revealed a limited amount of historic data (1996-2002).

The lake was monitored seven times from late-April to early-October, 2003. The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

The 2003 mean concentrations were as follows; TP= 35.4 µg/l (minimum of 23.0 µg/l and a maximum of 56.0 µg/l), CLA= 15.2 µg/l (minimum of 4.2 µg/l and maximum of 20.0 µg/l), Secchi transparency= 1.1 m (minimum of 0.8 m and maximum of 1.4 m), and TKN= 0.72 mg/l (minimum and maximum of 0.45 and 0.91 mg/l, respectively). The means resulted in grades of C for TP and B for CLA and D for Secchi transparency. The resulting 2003 overall water quality grade for the lake was C.

Although no "statistically significant" trend can be determined from the lake's water quality database, the 2003 overall grade is the lake's worst to date. The lake had received overall grades of B in the previous years of monitoring (1996-2001). In fact, the lake's Secchi transparency grade has steadily fallen from B's in 1996-1999, to C's in 200-2001, to D's in 2002-2003. This decrease in the lake's short-term water quality should cause some concern and a watchful eye should be kept on the lake's future quality. To better understand the lake's overall water quality and where it may truly be heading, more data are needed.

As mentioned in past reports, the lake's overall grade may be skewed due to the shallowness of the lake. When looking at the lake's 2000 and 2001 mean TP and CLA readings, it seems that the associated Secchi readings could have been limited by the shallowness of the lake rather than excessive nutrients and algal growth. So, while the lake only received an overall grade of B, the actual water quality may have been more representative of an A. This, however, does not explain the drop in mean clarity form grades of B in the late-1990's, to C in 2000-2001, and D in 2002-2003.

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 2.4 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 4.2 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.

# Carol Lake

**Stillwater Twp.,**
**Washington Co.**

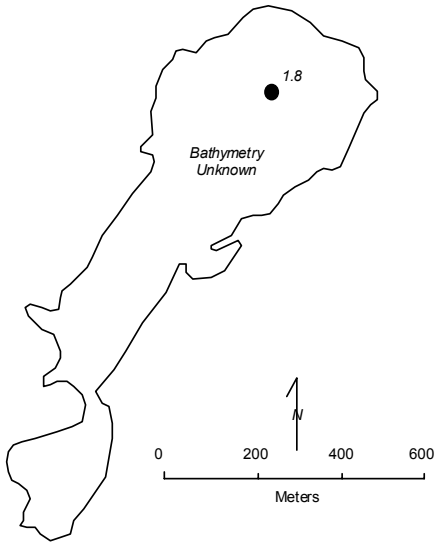
LAKE ID: 820017

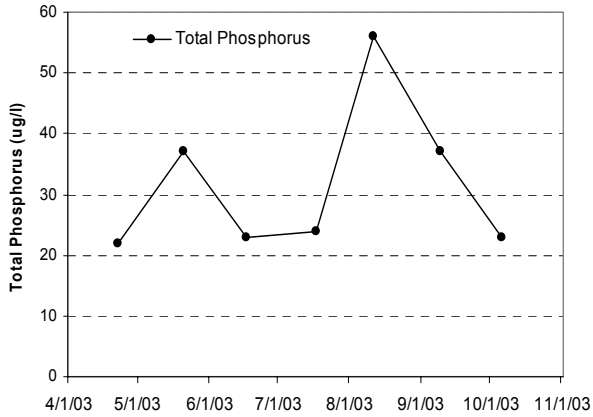
WD: Carnelian-Marine

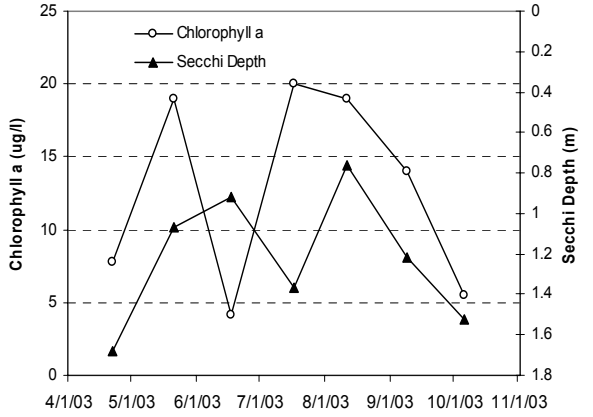
Volunteer: Washington Co. SWCD

● Sampling site

Contours in meters

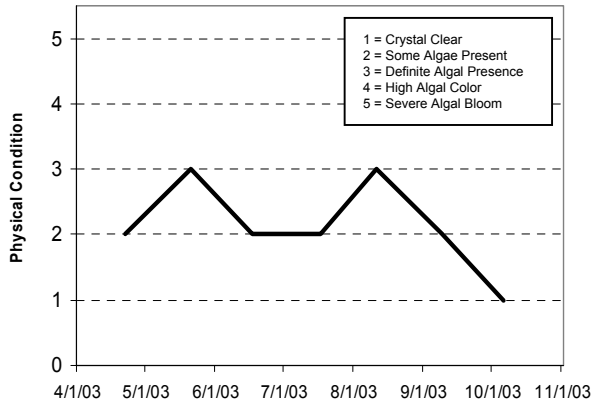



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/22/03 | 12.6 | | 7.18 | | 7.8 | 22 | | 1.678 | 2 | 2 |
| 05/21/03 | 16 | | 3.99 | | 19 | 37 | | 1.07 | 3 | 4 |
| 06/17/03 | 23.8 | | 8.67 | | 4.2 | 23 | | 0.915 | 2 | 4 |
| 07/17/03 | 24.8 | | 6.9 | | 20 | 24 | | 1.37 | 2 | 4 |
| 08/11/03 | 26.1 | | 7.8 | | 19 | 56 | | 0.763 | 3 | 5 |
| 09/09/03 | 21.1 | | 4.66 | | 14 | 37 | | 1.219 | 2 | 4 |
| 10/06/03 | 13.3 | | 10.29 | | 5.5 | 23 | | 1.524 | 1 | 2 |

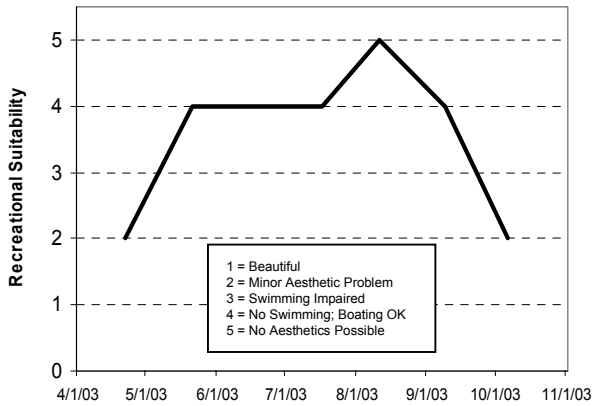



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | B | A | A | A | A | B | | C |
| Chlorophyll a | | | | | B | C | C | C | A | A | | B |
| Secchi Depth | | | | | B | B | B | B | C | C | D | D |
| **Overall** | | | | | **B** | **B** | **B** | **B** | **B** | **B** | | **C** |

Source: Metropolitan Council and STORET data



## Cates Lake (70-0018) *Prior Lake – Spring Lake Watershed District*

Cates Lake is a 27-acre lake located in the City of Savage (Scott County). The maximum depth of the lake is 4.0 m (roughly 13 feet). Because of the shallowness of the lake, its entire area is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation), and the lake does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lak0+e's water column). The lake has no public access.

This was the second year that Cates Lake has been involved in CAMP (2002 being the first). The lake was monitored 13 times between mid-April and mid-October, 2003. During each monitoring event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as its perceived physical condition and recreational suitability. The resulting data and graphs appear on the next page.

The 2003 summertime (May through September) mean concentrations in Cates Lake were: TP= 29.1 µg/l (minimum of 18.0 µg/l, maximum of 57.0 µg/l), CLA= 4.8 µg/l (minimum of 2.3 µg/l, maximum of 8.3 µg/l), Secchi transparency= 1.8 m (minimum of 1.4 m, maximum of 2.1 m), and TKN= 0.53 mg/l (minimum and maximum of 0.39 and 0.76 mg/l, respectively). The summertime means resulted in a TP grade of B, CLA grade of A, and Secchi transparency grade of C, resulting an overall grade of B.

To the best of our knowledge, there are no water quality data available for Cates Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

During each monitoring event, the volunteers' opinion of the lake condition was ranked on a 1-to-5 scale as shown on the lake information sheet. The average score for physical condition was 2.8 (between 2- " some algae present" and 3- "definite algae present"), and 3.7 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

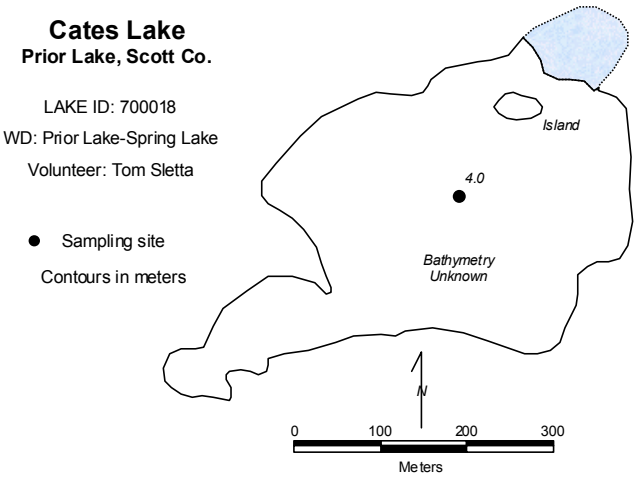
# Cates Lake

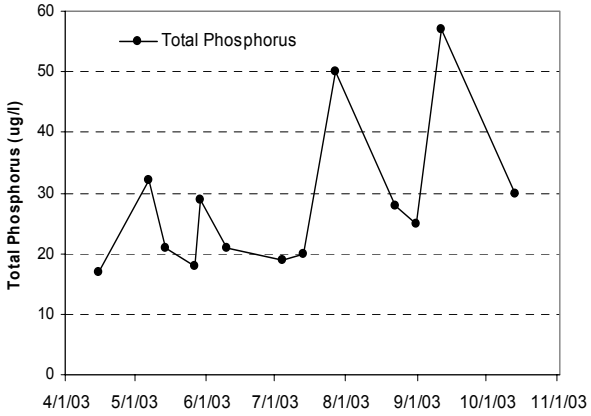
**Prior Lake, Scott Co.**

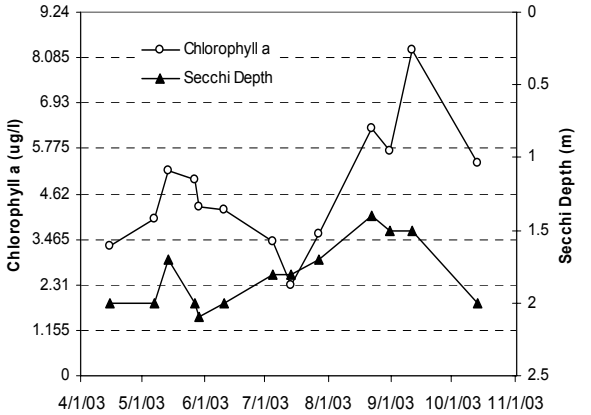
LAKE ID: 700018

WD: Prior Lake-Spring Lake

Volunteer: Tom Sletta

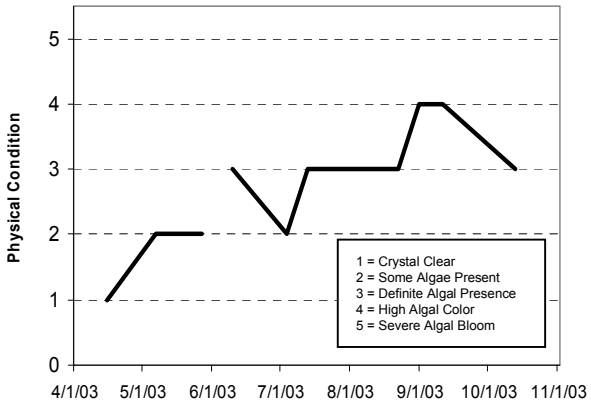



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 17.3 | | | | 3.3 | 17 | | 2 | 1 | 4 |
| 05/07/03 | 15.7 | | | | 4 | 32 | | 2 | 2 | 2 |
| 05/14/03 | 16.2 | | | | 5.2 | 21 | | 1.7 | 2 | |
| 05/27/03 | 19.7 | | | | 5 | 18 | | 2 | 2 | 3 |
| 05/29/03 | 20.7 | | | | 4.3 | 29 | | 2.1 | | |
| 06/10/03 | 21.5 | | | | 4.2 | 21 | | 2 | 3 | 4 |
| 07/04/03 | 26.3 | | | | 3.4 | 19 | | 1.8 | 2 | 4 |
| 07/13/03 | 26.8 | | | | 2.3 | 20 | | 1.8 | 3 | 4 |
| 07/27/03 | 26.3 | | | | 3.6 | 50 | | 1.7 | 3 | 4 |
| 08/22/03 | 25.8 | | | | 6.3 | 28 | | 1.4 | 3 | 4 |
| 08/31/03 | 24.1 | | | | 5.7 | 25 | | 1.5 | 4 | 4 |
| 09/11/03 | 22.9 | | | | 8.3 | 57 | | 1.5 | 4 | 4 |
| 10/13/03 | 14.6 | | | | 5.4 | 30 | | 2 | 3 | 4 |

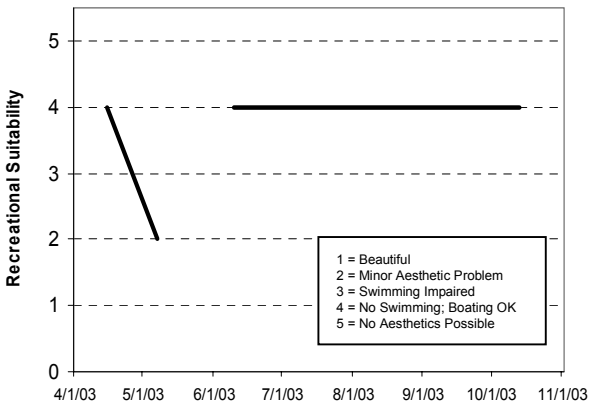



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | A | B |
| Chlorophyll a | | | | | | | | | | | A | A |
| Secchi Depth | | | | | | | | | | | C | C |
| **Overall** | | | | | | | | | | | **B** | **B** |

Source: Metropolitan Council and STORET data



## Cedar Island Lake (27-0119) *Shingle Creek Watershed Management Commission*

This was the third year that Cedar Island Lake has been enrolled in CAMP (the lake was involved in CAMP in 1995 and 2001). The 80-acre lake is located within the City of Maple Grove (Hennepin County). It has an 800-acre immediate watershed. The lake and watershed areas translate to a watershed-to-lake area ratio of 8:1. The larger the ratio the greater the potential stress put on the lake from surface runoff.

The maximum and mean depths of the lake are 2.1 and 1.4 m (seven and 4.5 feet), respectively. The mean depth and surface translates to an approximate lake volume of 360 ac-ft and it would take approximately 0.5 years to replenish itself. Because of the shallowness of the lake, 100 percent of the lake's area is considered littoral (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).

Cedar Island Lake was monitored 11 times from mid-April to mid-September, 2001. The data and resulting graphs showing seasonal variability in TP and CLA concentrations, Secchi transparency, and user perceptions are presented on the information sheet following these written comments.

The 2003 summertime (May through September) mean concentrations in Cedar Island Lake were: TP= 248.6 µg/l (minimum of 74.0 µg/l, maximum of 788.0 µg/l [the worst recorded TP concentration in CAMP 2003]), CLA= 103.6 µg/l (minimum of 17.0 µg/l, maximum of 360.0 µg/l), Secchi transparency= 0.5 m (minimum of 0.3 m, maximum of 0.6 m), and TKN= 3.28 mg/l (minimum and maximum of 1.60 and 5.30 mg/l, respectively). The summertime means resulted in a TP grade of F, CLA grade of F, and Secchi transparency grade of F, culminating in an overall grade of F.

The lake's 2003 overall water quality grade is identical to that recorded in 1995, and worse than that of 2001 (D). The 2003 summer means are the worst recorded to date. The dramatic increase in in-lake TP concentrations in 2003 (a 128-175 percent increase over those recorded in either 1995 or 2001) resulted in a 25-100 percent increase in CLA. This in turn resulted in a 40-50 percent decrease in transparency.

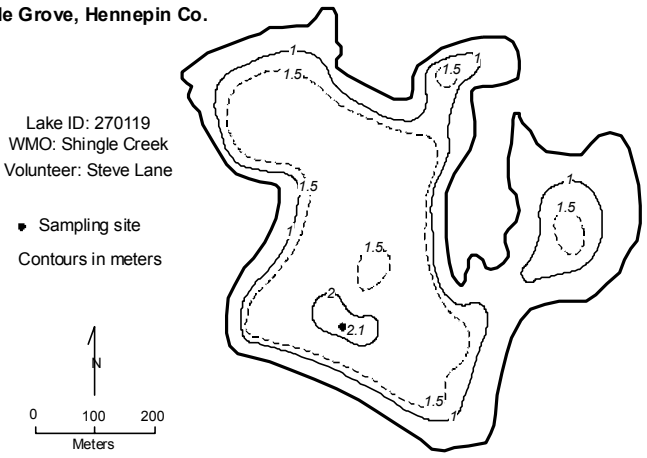
A search for water quality data through Council, MPCA, and STORET files resulted in a minimal amount of data. 1984, 1995, 2001and now 2003 are the only years for which nutrient data are available. Using Secchi transparency data collected through the MPCA's Citizen-Lake monitoring Program to supplement the four years of nutrient data it becomes apparent that the lake's water quality through the 1990's has remained somewhat constant. The recently poor water quality (especially shown as a dramatic decrease in 2003 as compared to 1995 and 2001), however, should be a reason for concern. To better understand the lake's water quality and where it may be heading (if the decline in water quality revealed in 2003 is a potential trend or if it is a result of climitalogical conditions), additional years of data collection are needed.

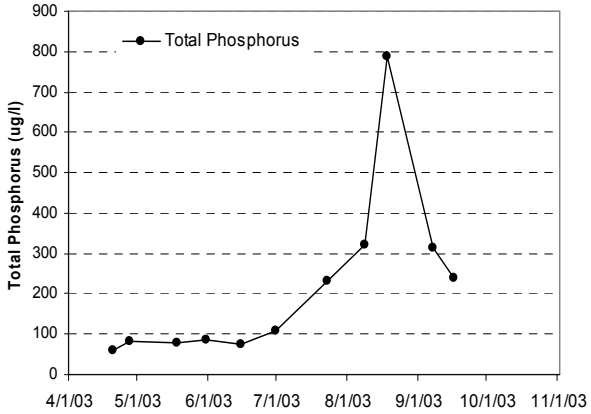
During each monitoring event, the volunteers' opinion of the lake condition was ranked on a 1-to-5 scale as shown on the lake information sheet. The average score for physical condition was 2.5 (between 2- "some algae present" and 3- "definite algae present"), and 3.0 for recreational suitability (3- "swimming slightly impaired").

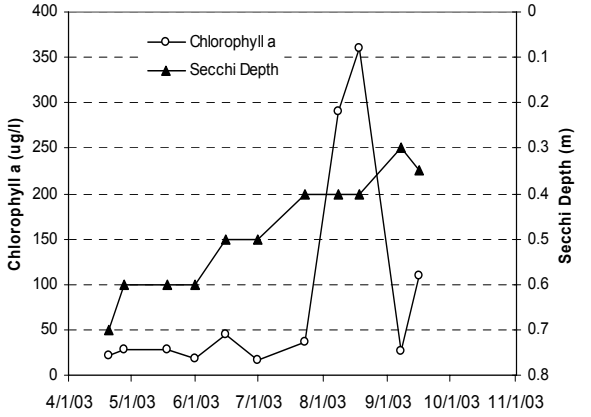
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Cedar Island Lake

**Maple Grove, Hennepin Co.**

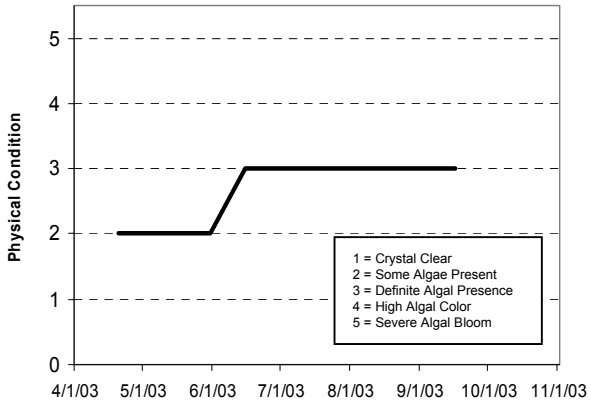



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/20/03 | 8 | | | | 22 | 60 | | 0.7 | 2 | 2 |
| 04/27/03 | 17 | | | | 29 | 82 | | 0.6 | 2 | 2 |
| 05/18/03 | 21 | | | | 29 | 77 | | 0.6 | 2 | 2 |
| 05/31/03 | 19 | | | | 19 | 86 | | 0.6 | 2 | 2 |
| 06/15/03 | 25 | | | | 44 | 74 | | 0.5 | 3 | 3 |
| 06/30/03 | 26 | | | | 17 | 110 | | 0.5 | 3 | 3 |
| 07/23/03 | 24 | | | | 37 | 230 | | 0.4 | 3 | 3 |
| 08/08/03 | 28 | | | | 290 | 320 | | 0.4 | 3 | 3 |
| 08/18/03 | 29 | | | | 360 | 788 | | 0.4 | 3 | 3 |
| 09/07/03 | 22 | | | | 26 | 312 | | 0.3 | 3 | 3 |
| 09/16/03 | 22 | | | | 110 | 240 | | 0.35 | 3 | 3 |

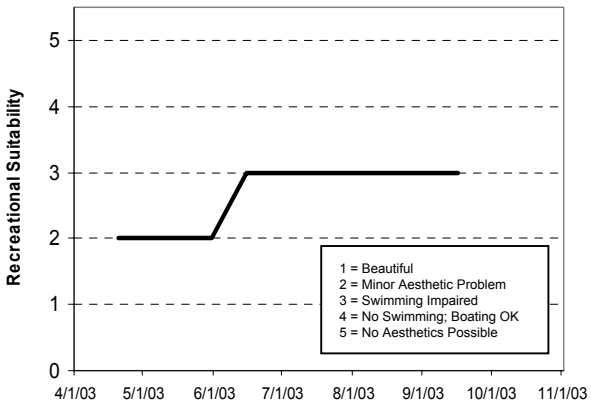



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | D | | | | | | D | | F |
| Chlorophyll a | | | | F | | | | | | D | | F |
| Secchi Depth | F | F | F | F | F | F | F | F | F | D | F | F |
| **Overall** | | | | **F** | | | | | | **D** | | **F** |

Source: Metropolitan Council and STORET data



## Cenaiko Lake (2-0654) *Anoka County Parks*

This was the seventh year in which Cenaiko Lake, located within Coon Rapids Dam Regional Park in the City of Coon Rapids in Anoka County, has been monitored through CAMP. Other than for the seven years of CAMP data, a search through the STORET nationwide water quality database for historic data on the lake came up empty.

The lake is maintained by groundwater and has a very small watershed that is completely publicly owned (MDNR 1996). No boats, canoes, or floatables are allowed on the 29-acre man-made lake that is one of only six lakes in the seven-county metropolitan area that are stocked with trout (brook and rainbows). The only fishing access to the lake is two fishing docks and the lake's shoreline. The lake, which is 0.6 miles in circumference, has a maximum depth of 9.1 m (30 ft). Only 12 percent of the lake is considered littoral zone (the 0-15 foot depth zone of the lakeominated by aquatic vegetation). Eurasian Water Milfoil (*Myriophyllum spicatum*) [EWM] has been reported on the lake.

Cenaiko Lake was monitored 12 times between mid-April and mid-October, 2003. The data and resulting graphs showing seasonal variability in TP and CLA concentrations, Secchi transparency, and user perceptions are presented on the information sheet following these written comments.

The lake's 2003 summertime (May through September) mean TP concentration of 17.0 µg/l (minimum of 7.0 µg/l and maximum of 46.0 µg/l) fell within the lake water quality A grade range as did the lake's 2003 Secchi transparency mean of 3.0 m (minimum of 2.1 m and maximum of 3.9 m). The CLA mean of 2.0 µg/l (minimum and maximum of 1.4 and 2.5 µg/l) also fell within the A grading percentile range. The lake's mean TKN concentration was 0.37 mg/l (minimum of 0.30 mg/l and maximum of 0.47 mg/l). The idividual parameter grades result in an overall grade of A for the lake in 2003. Cenaiko Lake, has received an overall grades of B in 1997and 2001, A from 1998-2002 and 2003.

No statistically significant trends are evident from the lake's water quality database. To better understand the quality of the lake and what direction it may be heading, continued monitoring is recommended.

At each monitoring event, the volunteers' opinion of the lake condition was ranked on a 1-to-5 scale as shown on the lake information sheet. The average score for physical condition was 2.0 (2- "some algae present" and 3- "definite algae present").

Cenaiko Lake was one of eight lakes in Minnesota and one in Wisconsin that where a part of a research project supported by the MDNR and conducted by researchers at the University of Minnesota has examined the possibilities of an aquatic weevil *Euryhchiopsis lecontei* as a biological control agent for EWM (U.S.EPA 1997). The following is an excerpt from a U.S.EPA document detailing research in weevils as a biological control:

> Of the nine sites, the most pronounced weevil infestation was found in Cenaiko Lake in Anoka County, Minnesota. Weevils caused severe damage to the EWM plants in Cenaiko Lake, most likely resulting in the plants' decreased abundance. EWM biomass (wet weight) at Cenaiko decline from 974 $g/m^2$ in July 1996, to 239 $g/m^2$ in September 1996 (Newman et al. 1996). Researchers estimate that the biomass in June 1996 (before sampling) was close to 2,000 $g/m^2$ (Newman we al. 1996). In July 1996, EWM was approximately 50 percent of the total plant biomass in the lake; by September 1996, this value had decreased to 14 percent.
>
> Monitoring of Cenaiko Lake did not begin until June 1996 when a dense population of weevils was discovered during reconnaissance studies for introduction sites (Newman et al. 1996).

> Cenaiko Lake was then added to the list of regular sampling sites. Plant samples collected at Cenaiko Lake, as well as at other sites, were processed for invertebrates, plant biomass, and stem damage.
>
> Because monitoring is still ongoing, sampling and data are limited for this study. However, the preliminary results indicate the weevils in Cenaiko Lake may be responsible for the natural decline of EWM.

Since that report however, the lake's biological make-up has changed slightly. The lake's Sunfish population has dramically increased, which has resulted in a reduced aquatic weevil population (the Sunfish feed on the weevils). The reduction in the aquatic weevil population has reulted in increase in abundance of EWM within the lake.

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/.

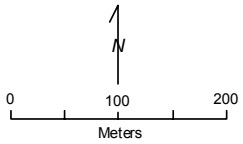
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

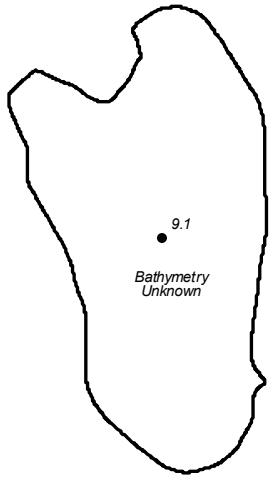
# Lake Cenaiko

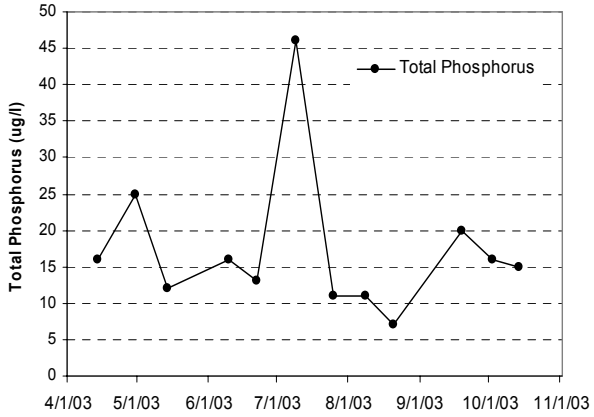
**Coon Rapids, Anoka Co.**

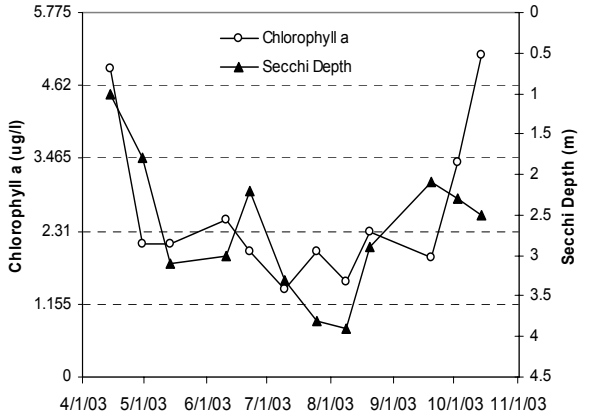
Lake ID: 20654
WD: Coon Creek
Volunteer: Anoka Co. Parks

● Sampling site
Contours in meters



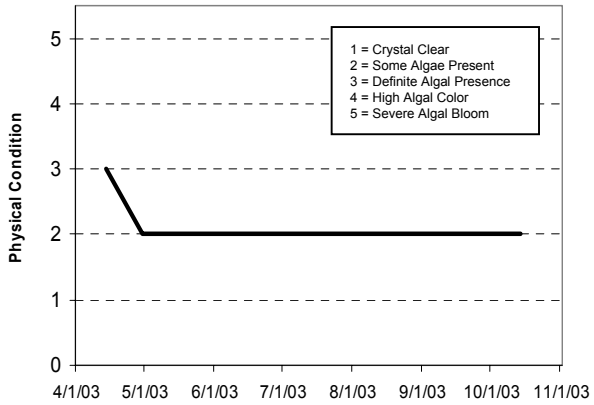




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 12 | | | | 4.9 | 16 | | 1 | 3 | |
| 04/30/03 | 13 | | | | 2.1 | 25 | | 1.8 | 2 | |
| 05/14/03 | 14 | | | | 2.1 | 12 | | 3.1 | 2 | |
| 06/10/03 | 19 | | | | 2.5 | 16 | | 3 | 2 | |
| 06/22/03 | 22 | | | | 2 | 13 | | 2.2 | 2 | |
| 07/09/03 | 24 | | | | 1.4 | 46 | | 3.3 | 2 | |
| 07/25/03 | 23 | | | | 2 | 11 | | 3.8 | 2 | |
| 08/08/03 | 25 | | | | 1.5 | 11 | | 3.9 | 2 | |
| 08/20/03 | 27 | | | | 2.3 | 7 | | 2.9 | 2 | |
| 09/19/03 | 18 | | | | 1.9 | 20 | | 2.1 | 2 | |
| 10/02/03 | 10 | | | | 3.4 | 16 | | 2.3 | 2 | |
| 10/14/03 | 13 | | | | 5.1 | 15 | | 2.5 | 2 | 5 |

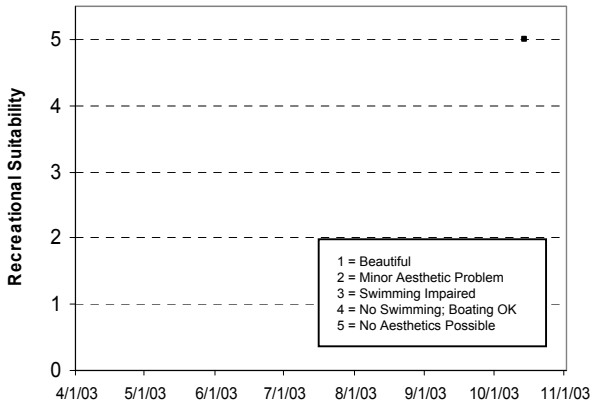



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | A | A | A | A | A | A | A |
| Chlorophyll a | | | | | | A | A | A | A | A | A | A |
| Secchi Depth | | | | | | C | A | A | B | C | A | A |
| **Overall** | | | | | | **B** | **A** | **A** | **A** | **B** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Clear Lake (82-0163) *Rice Creek Watershed District*

Clear Lake, located in Forest Lake Township (Washington County), has public access on its western side, and is considered a "Priority Lake" due to its multi-recreational uses. The approximate maximum and mean depths of the lake are 8.5 and 3.7 m (28 and 12 feet), respectively. The lake has a 400-acre surface area (a circumference of 3.9 miles) which, along with its mean depth, represents a volume of 4,800 ac-ft. Approximately 67 percent of the lake is considered littoral zone (the area of aquatic vegetation dominance).

In 2003, the lake was monitored 12 times between early-May and mid-October. During each monitoring event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as its perceived physical condition and recreational suitability.

The summertime (May - September) mean surface TP concentration for the lake was 38.1 µg/l (minimum of 12.0 µg/l, maximum of 68.0 µg/l). The mean CLA and Secchi transparency readings were 8.3 µg/l (minimum of 2.7 µg/l, maximum of 17.0 µg/l), and 1.8 m (minimum of 1.6 m, maximum of 2.1 m), respectively. Additionally, the lake's mean surface TKN concentration was 0.87 mg/l (minimum of 0.67 mg/l and a maximum of 1.40 mg/l). The resulting individual water quality grades for 2003 were C for TP, A for CLA, and C for Secchi transparency, translating to an overall water quality grade of B. The lake's 2003 water quality grade is similar to thise recorded from 1994-1999 and 2002, and better than those recorded in 2000-2001 (overall grade of C). The lake's 2003 summer means were better than those recorded in the majority of past years. In fact the 2003 Secchi mean (1.8 m) is the best recorded on the lake since it first was enrolled in CAMP in 1993.

The volunteers' perceived conditions of the lake (both physical and recreational) were ranked on a 1-to-5 scale. The mean physical condition was 1.8 (between 1- " crystal clear" and 2- "some algae present"), while the mean recreational suitability was 1.5 (between 1- "beautiful" and 2- "minor aesthetics problem").

Clear Lake has a fairly large database with varying degrees of water quality data available for 19 of the last 23 years. Six of those years contain just Secchi transparency data, but the last 11 (1993-2003) contain TP, CLA and transparency data collected through CAMP.

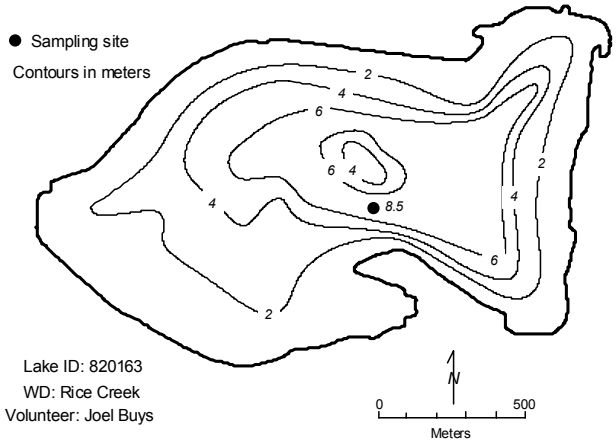
Available data show that Clear Lake's water quality has remained fairly constant over the past 20+ years. While there is some variability in its water quality grades from year to year, they seem to portray the lake's normal range of water quality conditions rather than any noticeable trend. The lake received an overall grade of B for 1994-1999, 2002 and 2003, as compared to receiving overall C grades during the 1993, 2000, and 2001 monitoring season as well as two years in the 1980's (1980 and 1984). The 1993-2003 Secchi transparency grades of C (with means ranging from 1.2 m to 1.8 m), however, remained consistent with the C or D grades recorded in 1980-1992.

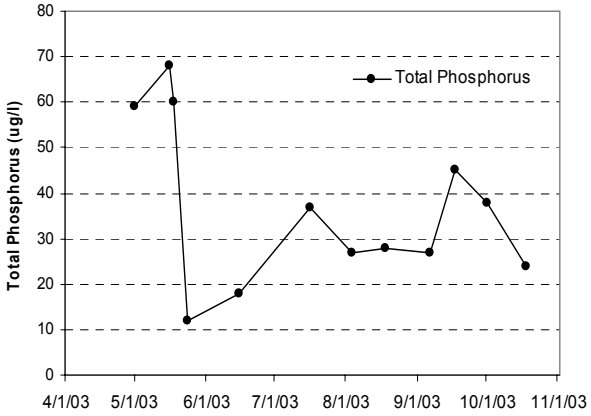
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

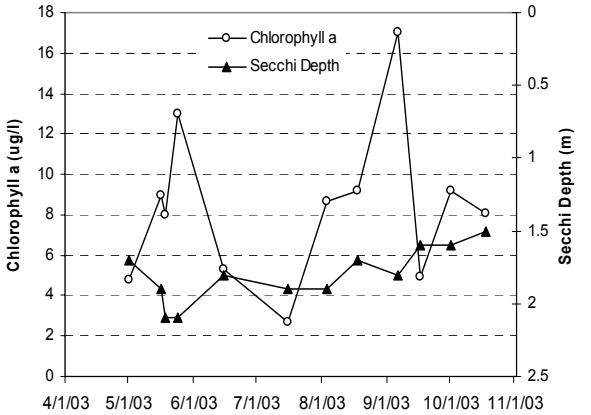
If you know of any errors in the lake's data or physical information, or are aware of additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Clear Lake

**Columbus Twp., Anoka Co.**

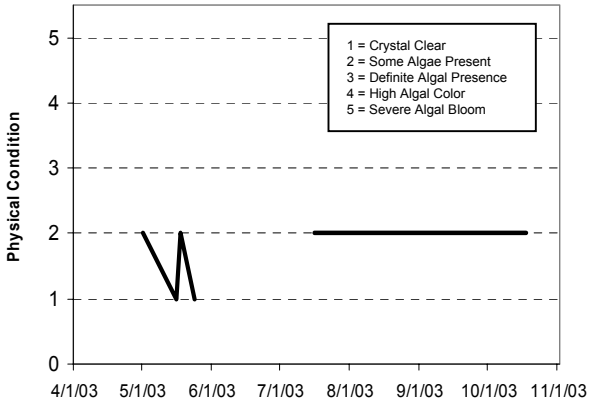



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/01/03 | 11 | | | | 4.8 | 59 | | 1.7 | 2 | 2 |
| 05/16/03 | 14 | | | | 9 | 68 | | 1.9 | 1 | |
| 05/18/03 | 16 | | | | 8 | 60 | | 2.1 | 2 | 2 |
| 05/24/03 | 18 | | | | 13 | 12 | | 2.1 | 1 | 1 |
| 06/15/03 | 22 | | | | 5.3 | 18 | | 1.8 | | |
| 07/16/03 | 22 | | | | 2.7 | 37 | | 1.9 | 2 | 1 |
| 08/03/03 | 24 | | | | 8.7 | 27 | | 1.9 | 2 | 1 |
| 08/18/03 | 26 | | | | 9.2 | 28 | | 1.7 | 2 | 1 |
| 09/06/03 | 24 | | | | 17 | 27 | | 1.8 | 2 | 2 |
| 09/17/03 | 14 | | | | 4.9 | 45 | | 1.6 | 2 | 2 |
| 10/01/03 | 13 | | | | 9.2 | 38 | | 1.6 | 2 | 2 |
| 10/18/03 | 13 | | | | 8.1 | 24 | | 1.5 | 2 | 1 |

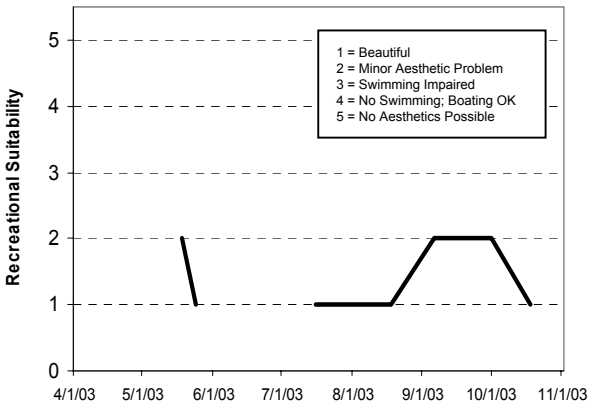



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | B | B | B | A | B | B | D | C | C | C |
| Chlorophyll a | | B | A | A | A | A | B | B | B | B | A | A |
| Secchi Depth | D | C | C | C | C | C | C | C | C | C | C | C |
| **Overall** | | **C** | **B** | **B** | **B** | **B** | **B** | **B** | **C** | **C** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Cloverdale Lake (82-0009) *Valley Branch Watershed District*

Cloverdale Lake is a 37-acre landlocked lake located within Baytown Township (Washington County). The maximum depth of the lake is 8.5 m (almost 30 feet). The lake's surface area and watershed size (671 acres) translates to an 18:1 watershed-to-lake size ratio. Generally the larger the ratio, the greater the potential stress on the lake from surface runoff.

This was the third year that Cloverdale Lake has been involved in CAMP. A search through the STORET nationwide water quality database for historic data on the lake came up empty. Thus, 2001-2003 are the only years of available nutrient data. 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.

The lake was monitored 11 times between late-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of B (identical to that recorded in 2002 and better than the C in 2001) was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 38.7 µg/l (minimum of 12.0 µg/l, maximum of 82.0 µg/l) corresponds to a lake water quality grade of C. The lake's the mean CLA concentration of 10.1 µg/l (minimum of 1.0 µg/l and maximum of 33.0 µg/l) resulted in a grade of B, as did the mean Secchi transparency of 2.7 m (minimum of 1.2 m, maximum of 5.1 m). The mean TKN concentration over the same time period was 0.74 mg/l (minimum of 0.50 mg/l and maximum of 1.10 mg/l).

As mentioned earlier, there are no nutrient data available for Cloverdale Lake other than the 2001-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

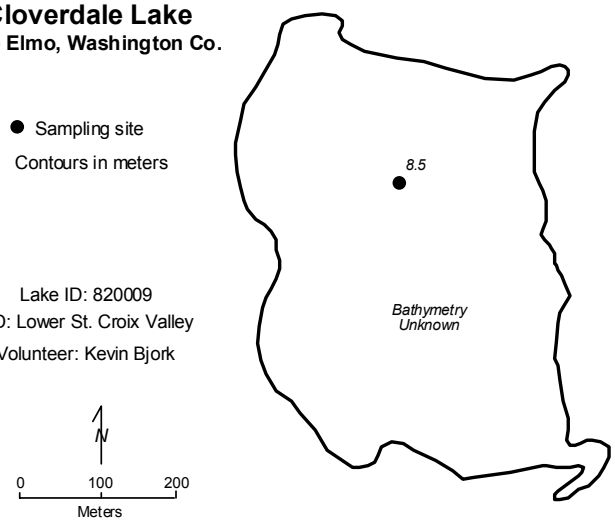
The perceived physical and recreational conditions (ranked on a 1-to-5 scale) are shown on the lake's information sheet on the next page. The average user perception rankings, were 1.9 for physical condition (between 1- "crystal clear" and 2- "some algae present"), and 1.8 for recreational suitability (between 1- "beautiful" and 2- "minor asthetic problem").

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/.

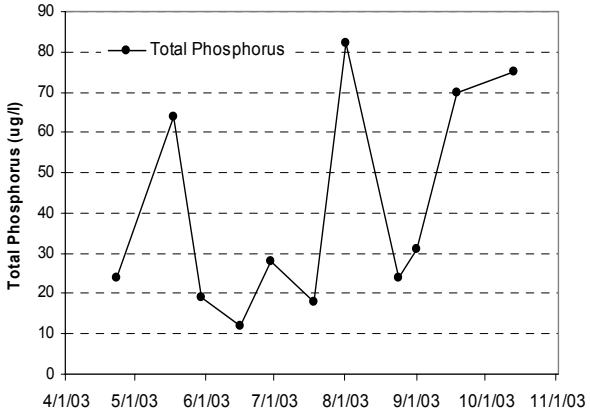
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

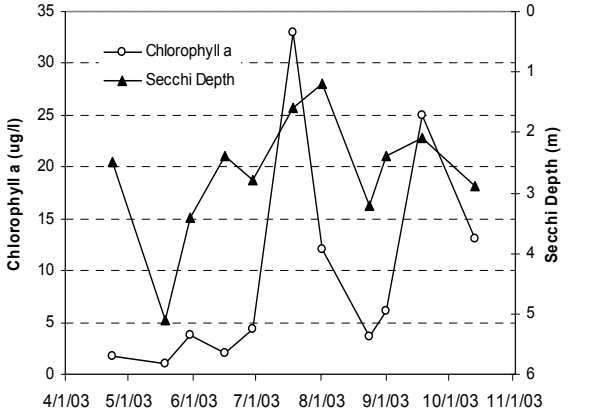
# Cloverdale Lake

**Lake Elmo, Washington Co.**



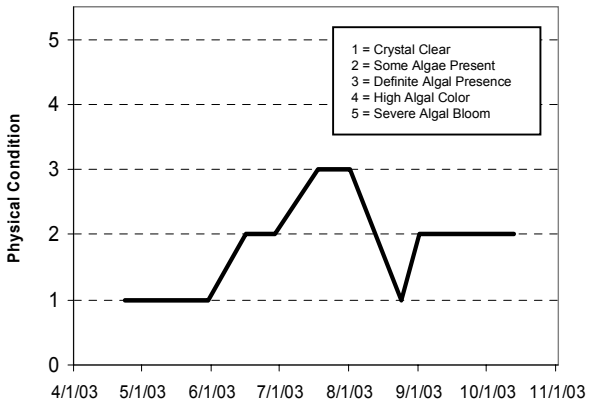

Lake ID: 820009
WD: Lower St. Croix Valley
Volunteer: Kevin Bjork




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/23/03 | 13 | | | | 1.7 | 24 | | 2.5 | 1 | 1 |
| 05/18/03 | 16 | | | | 1 | 64 | | 5.1 | 1 | 1 |
| 05/30/03 | 20 | | | | 3.8 | 19 | | 3.4 | 1 | |
| 06/16/03 | 24 | | | | 2 | 12 | | 2.4 | 2 | 2 |
| 06/29/03 | 24 | | | | 4.3 | 28 | | 2.8 | 2 | 2 |
| 07/18/03 | 24.6 | | | | 33 | 18 | | 1.6 | 3 | 2 |
| 08/01/03 | 26 | | | | 12 | 82 | | 1.2 | 3 | 2 |
| 08/24/03 | 26.9 | | | | 3.6 | 24 | | 3.2 | 1 | 1 |
| 09/01/03 | 25.8 | | | | 6.1 | 31 | | 2.4 | 2 | 2 |
| 09/18/03 | 17 | | | | 25 | 70 | | 2.1 | 2 | 2 |
| 10/13/03 | 13 | | | | 13 | 75 | | 2.9 | 2 | 2 |

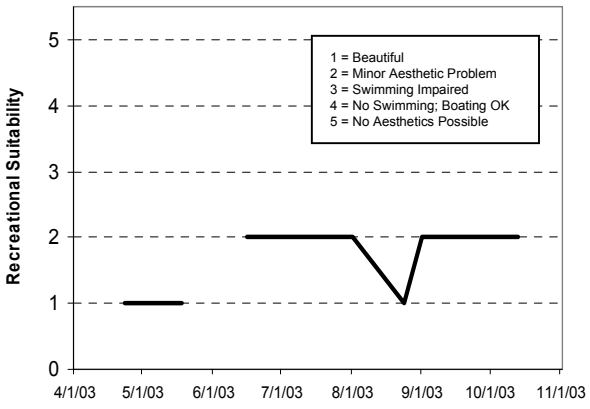



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | C | C | C |
| Chlorophyll a | | | | | | | | | | B | B | B |
| Secchi Depth | | | | | | | | | | C | B | B |
| **Overall** | | | | | | | | | | **C** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Colby Lake (82-0094) *City of Woodbury*

Colby Lake is located in the City of Woodbury in Washington County. A mid-1990's search for water quality data revealed no data prior to that collected as part of CAMP in 1994. Colby Lake's database now includes 10 data years (1994-2003). Analysis on the lake' water quality database reveals no statistically significant trend in its water quality (either improving or degrading). The lake's water quality seems well represented by an overall water quality grade of D/F.

Information from the City of Woodbury revealed that the lake has a surface area of 71 acres and a maximum depth of just 3.4 m (11 feet). The lake's large 8,088-acre contributing watershed results in a large 114:1 watershed-to-lake size ratio. The larger the ratio the greater the potential for stress on the lake from surface runoff. Because of the shallowness of the lake, its entire area is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation), and the lake does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column). The lake has no public access.

As part of the city's involvement in CAMP in 2003, the lake was monitored 10 times between late-April and mid-October. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration was 162.1 µg/l (minimum of 66.0 µg/l, maximum of 308.0 µg/l). The mean CLA and Secchi transparency readings were 58.7 µg/l (minimum of 12.0 µg/l, maximum of 100.0 µg/l), and 0.6 m (minimum of 0.3 m, maximum of 0.8 m), respectively. The lake's mean surface TKN concentration was 1.97 mg/l (minimum of 1.10 mg/l and a maximum of 2.10 mg/l). The summertime means resulted in a TP grade of F, CLA grade of D, and a Secchi transparency grade of F. The overall grade determined through the calculation of all three parameters was F.

The lake's 2003 overall grade was similar to that of 1995, 1996, 1998 and 2001, and worse than that of 1994, 1997, and 1999-2000 (D's).

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 following page. The mean physical condition ranking was 2.5 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 4.3 (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.

# Colby Lake

**Woodbury, Washington Co.**

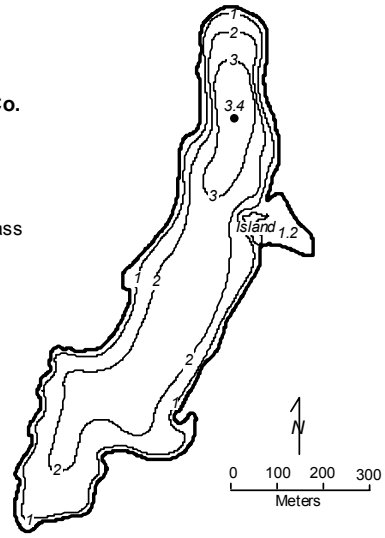
Lake ID: 820094

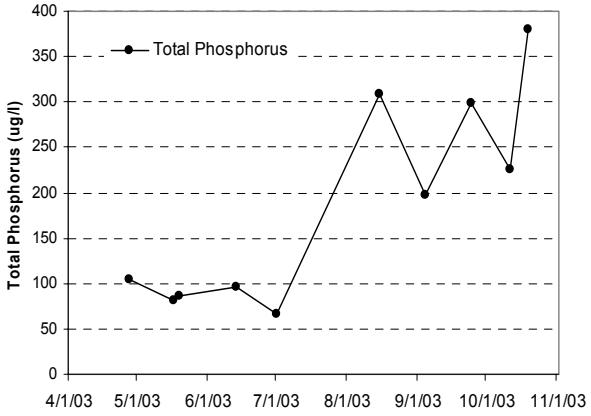
WD: South Washington

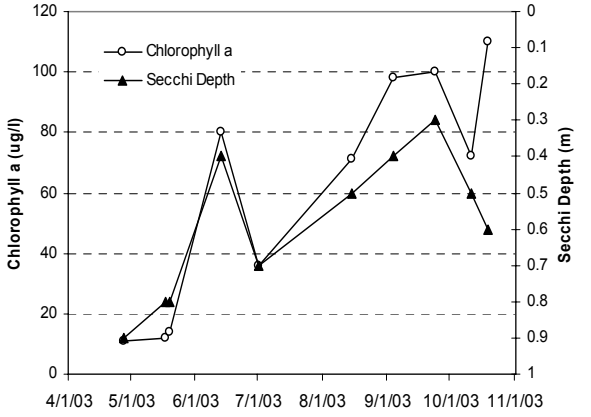
Volunteers: Beth and Claire Hvass

● Sampling site

Contours in meters

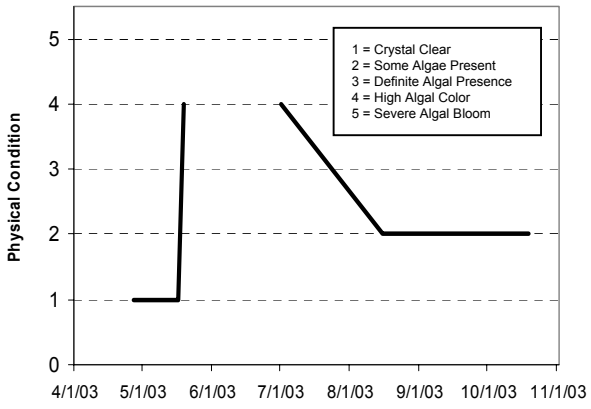



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/27/03 | 14.5 | | | | 11 | 105 | | 0.9 | 1 | 4 |
| 05/17/03 | 21.8 | | | | 12 | 81 | | 0.8 | 1 | 4 |
| 05/19/03 | 22.2 | | | | 14 | 86 | | 0.8 | 4 | 4 |
| 06/13/03 | 24.1 | | | | 80 | 97 | | 0.4 | | 4 |
| 07/01/03 | 25.2 | | | | 36 | 66 | | 0.7 | 4 | 4 |
| 08/15/03 | 29.7 | | | | 71 | 308 | | 0.5 | 2 | 5 |
| 09/04/03 | 22.4 | | | | 98 | 198 | | 0.4 | 2 | 4 |
| 09/24/03 | 16.2 | | | | 100 | 299 | | 0.3 | 2 | 5 |
| 10/11/03 | 17.4 | | | | 72 | 226 | | 0.5 | 2 | 5 |
| 10/19/03 | 15.7 | | | | 110 | 380 | | 0.6 | 2 | 4 |

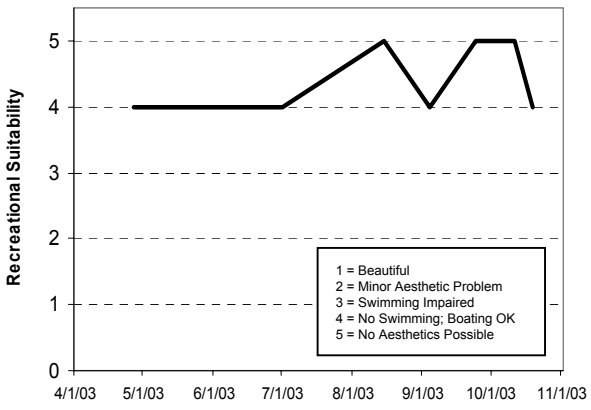



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | D | D | F | F | F | D | D | F | F | F |
| Chlorophyll a | | | D | F | F | C | F | F | D | F | C | D |
| Secchi Depth | | | F | F | F | F | F | D | D | D | F | F |
| **Overall** | | | **D** | **F** | **F** | **D** | **F** | **D** | **D** | **F** | **D** | **F** |

Source: Metropolitan Council and STORET data



## Cornelia Lake (27-0028) *Conservation League of Edina*

Lake Cornelia is a small shallow lake located within Edina (Hennepin County). There is very little known morphological data available for the lake.

Two thousand and three marks the first year in which Lake Cornelia has been involved in CAMP. A search through the STORET nationwide water quality database for historic data on the lake was unsuccessful. Thus, 2002 is the only complete, year of available data. 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.

The lake was monitored seven times between late-May and late-August, 2003. The resulting data and graphs appear on the next page.

The lake summertime (May through September) mean TP concentration of 224.3 µg/l (minimum of 55.0 µg/l, maximum of 407.0 µg/l) corresponds to a lake water quality grade of F, as did the mean Secchi transparency of 0.6 m (minimum of 0.2 m, maximum of 1.0 m). The lake's the mean CLA concentration of 130.1 µg/l (minimum of 14.0 µg/l and maximum of 290.0 µg/l) also resulted in a grade of F. The mean TKN concentration over the same time period was 2.42 mg/l. The lake's overall 2003 lake quality grade of F was determined from the individual parameter grades.

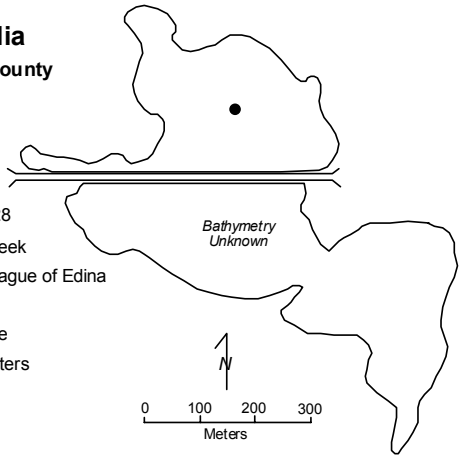
As mentioned earlier, there are no water quality data available for Lake Cornelia other than the 2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 3.6 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 4.1 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

# Lake Cornelia

**Edina, Hennepin County**



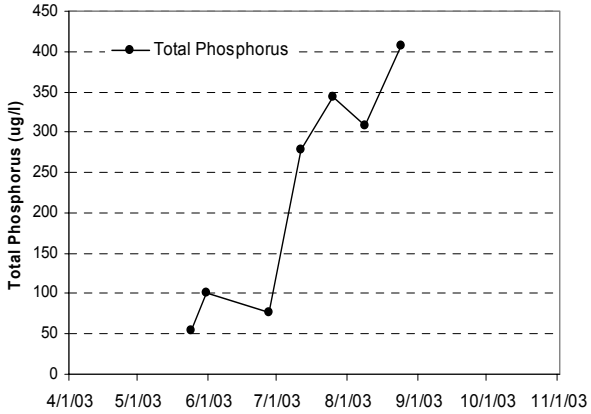

Lake ID: 270028

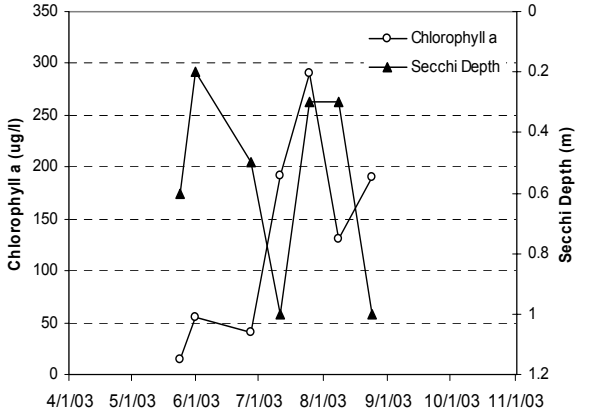
WD: Nine Mile Creek

Volunteer: Conservation League of Edina

● Sampling site

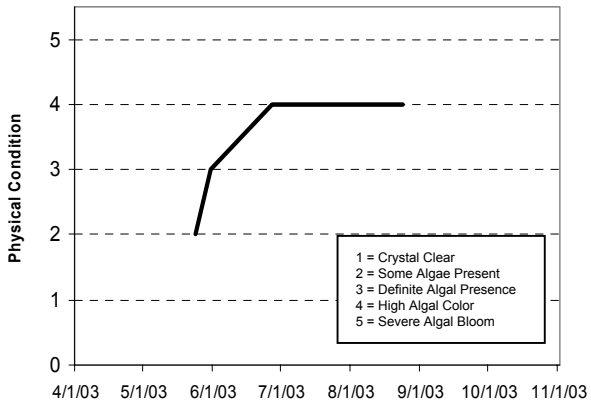
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/24/03 | 16.8 | | | | 14 | 55 | | 0.6 | 2 | 4 |
| 05/31/03 | 18 | | | | 55 | 101 | | 0.2 | 3 | 4 |
| 06/27/03 | 24.3 | | | | 41 | 76 | | 0.5 | 4 | 4 |
| 07/11/03 | 23.2 | | | | 191 | 279 | | 1 | 4 | 5 |
| 07/25/03 | 25.3 | | | | 290 | 344 | | 0.3 | 4 | 4 |
| 08/08/03 | 30.1 | | | | 130 | 308 | | 0.3 | 4 | 4 |
| 08/24/03 | 23.5 | | | | 190 | 407 | | 1 | 4 | 4 |

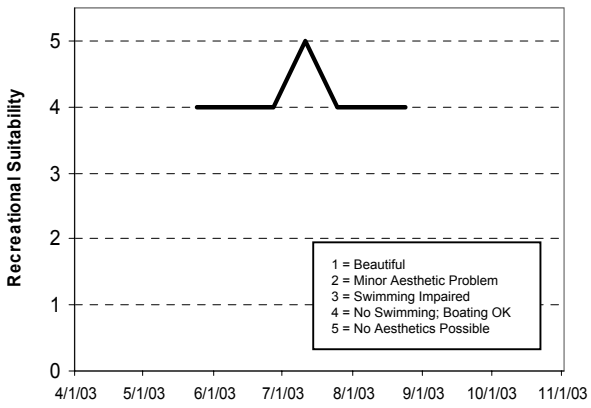



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | | F |
| Chlorophyll a | | | | | | | | | | | | F |
| Secchi Depth | | | | | | | | | | | | F |
| **Overall** | | | | | | | | | | | | **F** |

Source: Metropolitan Council and STORET data



## Courthouse Lake (10-0005) *Carver County Environmental Services*

Courthouse Lake, located in the City of Chaska (Carver County) is a unique resource in the Twin Cities Metropolitan Area. The lake is only one of six lakes in the seven-county metropolitan area stocked with trout (rainbows). Very little lake data (or physical information) are available for Courthouse Lake. The 10-acre lake (0.6 miles in circumference) has a maximum depth of 17.4 m (57 feet) and only three percent of the lake is considered littoral zone (the 0-15 foot depth zone of the lake dominated by aquatic vegetation). The lake's level is maintained by groundwater. It has a very small watershed that is completely publicly owned (MDNR 1996).

The only data available for Courthouse Lake are a result of CAMP monitoring from 1996-2003.

Courthouse Lake was monitored biweekly from mid-April to mid-October 2003, for a total of 14 monitoring events. The data collected by volunteers showed seasonal variability in TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability). Results are presented on the lake's information sheet.

The 2003 summertime (May through September) mean concentrations were as follows: TP= 17.3 µg/l (minimum of 8.0 µg/l, maximum of 23.0 µg/l); CLA= 2.4 µg/l (minimum of 1.2 µg/l, maximum of 3.4 µg/l); Secchi transparency= 4.4 m (minimum of 3.1 m, maximum of 6.3 m); and TKN= 0.55 mg/l (minimum and maximum of 0.32 and 0.72 mg/l). The summertime means resulted in a TP grade of A, CLA grade of A, and Secchi transparency grade of A. The individual lake water quality grades translate to an overall grade of A for the lake in 2003.

The lake's 2003 overall grade was similar to that of 1996, and 1998-2001, and better than 1997 and 2002 (overall grades of B). When comparing the lake's historical summer means, it is apparent that 1998 was the lake's best overall water quality year (although the best Secchi transparency was recorded in 2003) and 1997 was the worst.

Analysis on the lake' water quality database reveals no statistically significant trend in its water quality (either improving or degrading). The lake's water quality seems well represented by an overall water quality grade of A/B+.

The average user perception rankings, on a 1-to-5 scale, were 1.0 for physical condition ("crystal clear"), and 1.1 for recreational suitability (between 1- "beautiful" and 2- "minor aesthic problem").

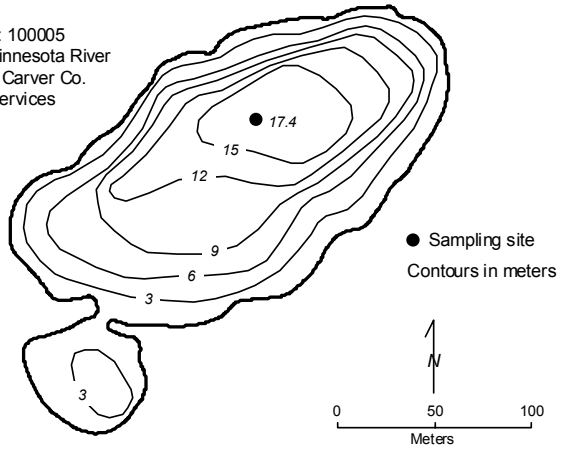
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

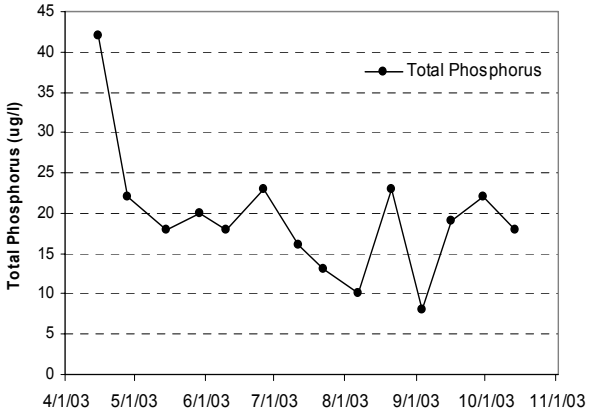
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

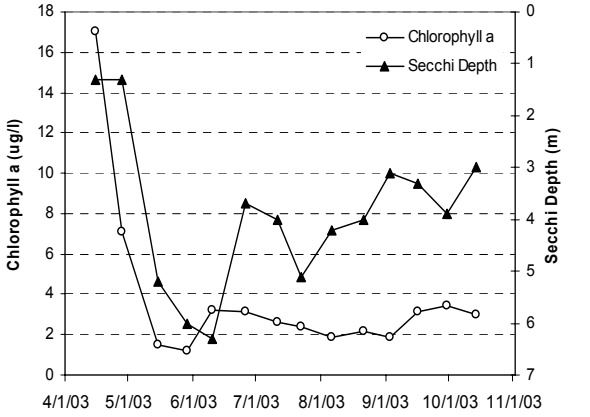
# Courthouse Lake

**Chaska, Carver Co.**

Lake ID: 100005
WD: Lower Minnesota River
Volunteer: Carver Co. Env. Services

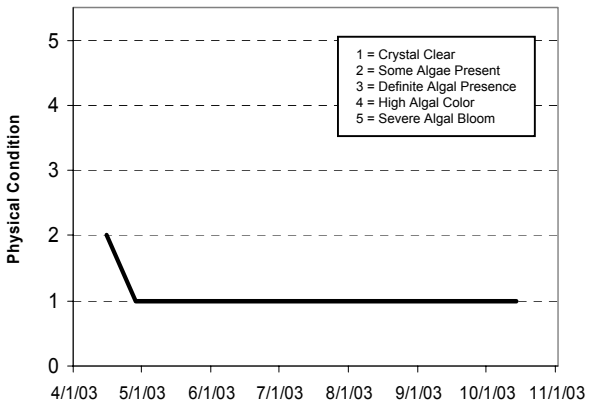



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 13.8 | | | | 17 | 42 | | 1.3 | 2 | 2 |
| 04/28/03 | 15.9 | | 11.48 | | 7.1 | 22 | | 1.3 | 1 | 1 |
| 05/15/03 | 18.6 | | 8.11 | | 1.5 | 18 | | 5.2 | 1 | 1 |
| 05/29/03 | 20 | | 8.62 | | 1.2 | 20 | | 6 | 1 | 2 |
| 06/10/03 | 21.9 | | 8.93 | | 3.2 | 18 | | 6.3 | 1 | 1 |
| 06/26/03 | 23.1 | | 7.9 | | 3.1 | 23 | | 3.7 | 1 | 1 |
| 07/11/03 | 24.2 | | 6.7 | | 2.6 | 16 | | 4 | 1 | 1 |
| 07/22/03 | 24.6 | | 7.9 | | 2.4 | 13 | | 5.1 | 1 | 1 |
| 08/06/03 | 26.7 | | 7.92 | | 1.9 | 10 | | 4.2 | 1 | 1 |
| 08/21/03 | 25.5 | | | | 2.2 | 23 | | 4 | 1 | 1 |
| 09/03/03 | 24.1 | | 8.49 | | 1.9 | 8 | | 3.1 | 1 | 1 |
| 09/16/03 | 22.8 | | 6.32 | | 3.1 | 19 | | 3.3 | 1 | 1 |
| 09/30/03 | 15.7 | | | | 3.4 | 22 | | 3.9 | 1 | 1 |
| 10/14/03 | 15.5 | | 9 | | 3 | 18 | | 3 | 1 | 1 |

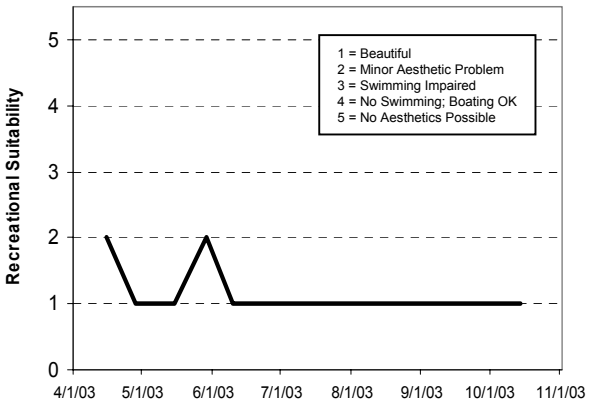



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | A | A | A | A | A | A | B | A |
| Chlorophyll a | | | | | A | A | A | A | A | A | A | A |
| Secchi Depth | | | | | A | C | A | B | A | A | B | A |
| **Overall** | | | | | **A** | **B** | **A** | **A** | **A** | **A** | **B** | **A** |

Source: Metropolitan Council and STORET data



## Crystal Lake [Burnsville] (19-0027) *Black Dog Watershed Management Commission*

Crystal Lake is located mainly in the City of Burnsville (Dakota County) covers an area of 292 acres, with 5.3 miles of shoreline. The maximum and mean depths of the lake are 11.3 m (37 feet) and 3.1 m (10 feet), respectively. The lake's surface area and mean depth translate to an approximate lake volume of 2,920 acre-feet. The lake's watershed covers approximately 2,001 acres of which roughly two-thirds is urban/developed. The watershed and lake surface areas translate to a moderate watershed-to-lake size ratio of 7:1 (the smaller the ratio the less stress on the lake from surface runoff).

Roughly 72 percent of the lake's area in considered littoral (the 0-15 foot depth area of aquatic vegetation dominance). Because of its multi-recreational uses, the lake is considered a "Priority Lake" in the Metropolitan Area. The lake, managed by the MDNR as a panfish lake and stocked with tiger muskellunge, has a public access and fishing pier on its north side and a public swimming beach on its eastern shore. 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.

This was the fifth year that Crystal Lake has been involved in CAMP (1999-2003). The lake was monitored during each of the five years prior to 1999 by Council staff. A search of the STORET nationwide water quality database for data on the lake revealed an extensive database throughout the 1980's and 1990's with nutrient data available in 1980, 1983, 1989, and 1994-2003. Additionally, Secchi transparency data are available for all years between 1980 and 1999 except 1993.

The lake was monitored 15 times between mid-April and mid-October, 2003. Results are presented on graphs and data tables on the following page. During each monitoring event, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as its perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration for the lake was 52.3 µg/l (minimum of 28.0 µg/l, maximum of 82.0 µg/l). The mean CLA and Secchi transparency readings were 27.3 µg/l (minimum of 4.1 µg/l, maximum of 52.0 µg/l) and 1.5 m (minimum of 1.0 m, maximum of 2.7 m), respectively. The lake's mean surface TKN concentration was 0.83 mg/l. The lake quality grades assigned to the 2001 summertime means are TP= C; CLA= C; and Secchi= C, resulting in an overall grade of C.

The 2003 grade is similar to those recorded from 1994-2000, and 2002, and worse than 1983, 1989, and 2001. The 2003 summer mean, worse than those recorded in 2001-2002, were very similar to those of 2000.

Analysis on the lake's water quality database reveals no statistically significant trend in its water quality (either improving or degrading). The lake's water quality seems well represented by an overall water quality grade of C/B-.

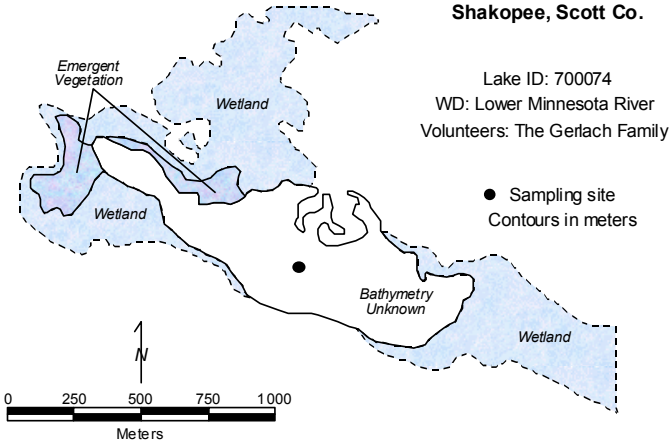
Throughout the monitoring period, the volunteer's opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The average user perception rankings, were 2.4 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 1.8 for recreational suitability (between 1- "beautiful" and 2- "minor aesthetic problem").

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.

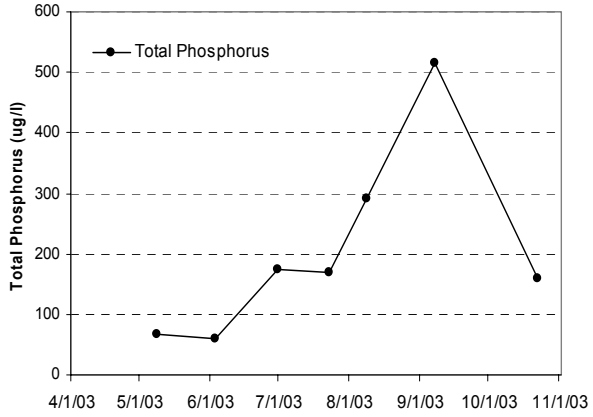
# Dean Lake,

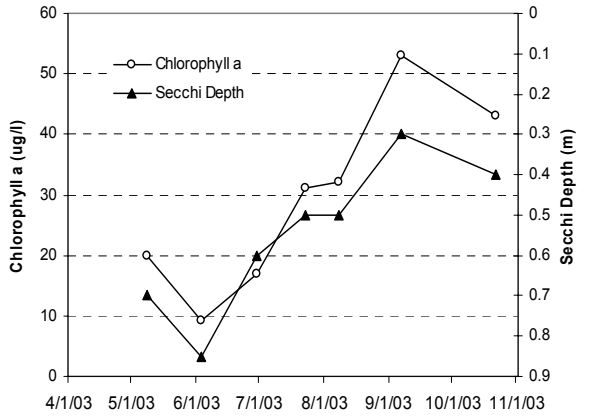
**Shakopee, Scott Co.**




Lake ID: 700074
WD: Lower Minnesota River
Volunteers: The Gerlach Family

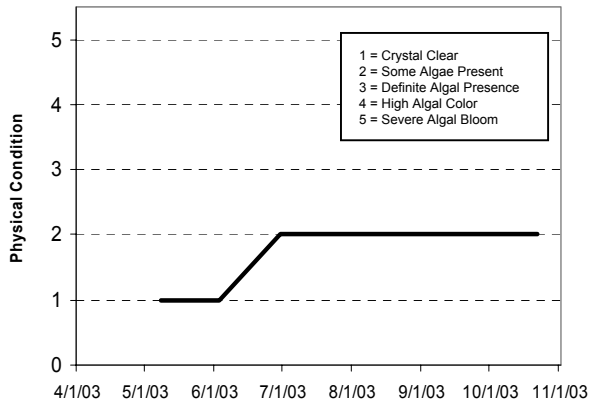
● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 05/08/03 | 17.1 | | | | 20 | 66 | | 0.7 | 1 | 1 |
| 06/03/03 | 21.6 | | | | 9.1 | 59 | | 0.85 | 1 | 2 |
| 06/30/03 | 23.5 | | | | 17 | 174 | | 0.6 | 2 | 4 |
| 07/23/03 | 29.1 | | | | 31 | 169 | | 0.5 | 2 | 4 |
| 08/08/03 | 30.4 | | | | 32 | 292 | | 0.5 | 2 | 4 |
| 09/07/03 | 29.7 | | | | 53 | 515 | | 0.3 | 2 | 4 |
| 10/22/03 | 15.3 | | | | 43 | 160 | | 0.4 | 2 | 4 |

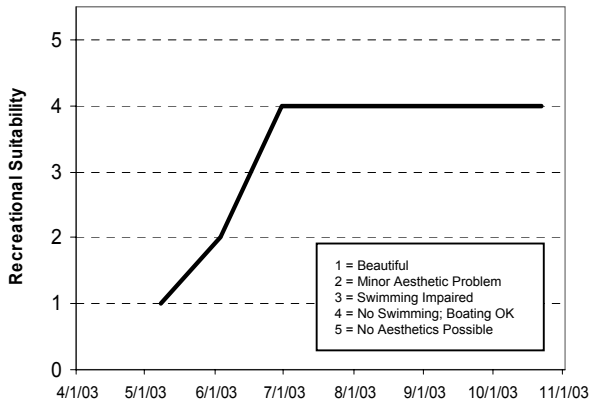



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | F | F |
| Chlorophyll a | | | | | | | | | | | D | C |
| Secchi Depth | | | | | | | | | | | F | F |
| **Overall** | | | | | | | | | | | **F** | **D** |

Source: Metropolitan Council and STORET data



## Dean Lake (70-0074) *City of Shakopee*

Dean Lake is a small shallow lake located within City of Shakopee (Scott County). There is very little known morphological data available for the lake. ). Because of the shallowness of the lake, its entire area is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation), and the lake does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

Two thousand and three marks the second year in which Dean Lake has been involved in CAMP. A search through the STORET nationwide water quality database for historic data on the lake was unsuccessful. Thus, 2002-2003 are the only years of available data. 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.

The lake was monitored seven times between early-May and late-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of F (identical to that of 2002) was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 212.5 µg/l (minimum of 59.0 µg/l, maximum of 515.0 µg/l) corresponds to a lake water quality grade of F, as did the mean Secchi transparency of 0.6 m (minimum of 0.3 m, maximum of 0.9 m). The lake's the mean CLA concentration of 27.0 µg/l (minimum of 9.1 µg/l and maximum of 53.0 µg/l) resulted in a grade of C. The mean TKN concentration over the same time period was 1.50 mg/l.

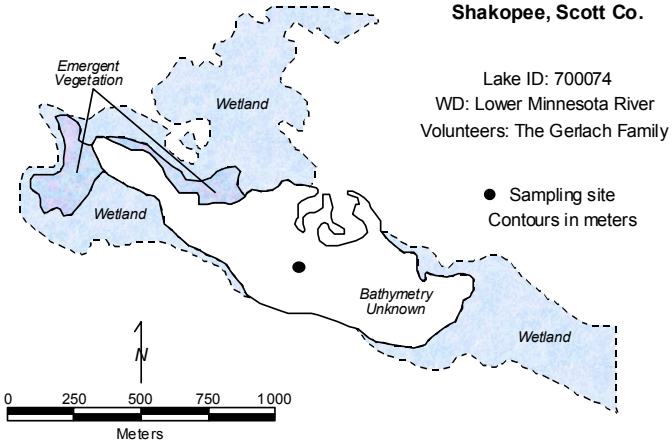
As mentioned earlier, there are no water quality data available for Dean Lake other than the 2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 1.7 for physical condition (between 1- "crystal clear" and 2- "some algae present"), and 3.2 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us

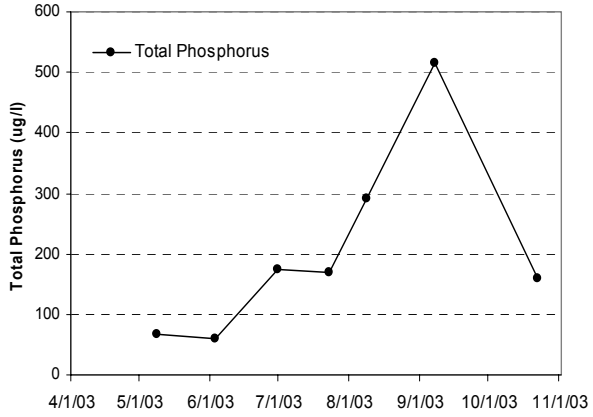
# Dean Lake,

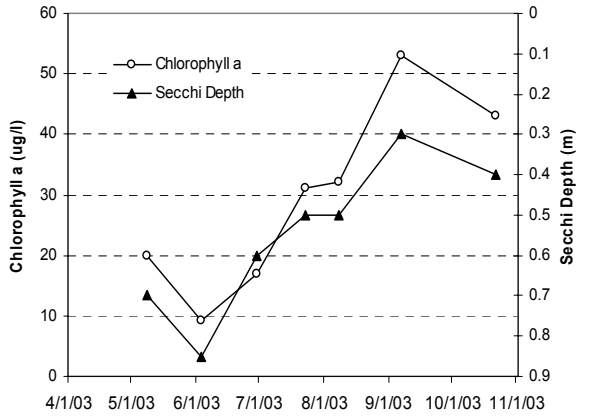
**Shakopee, Scott Co.**




Lake ID: 700074
WD: Lower Minnesota River
Volunteers: The Gerlach Family

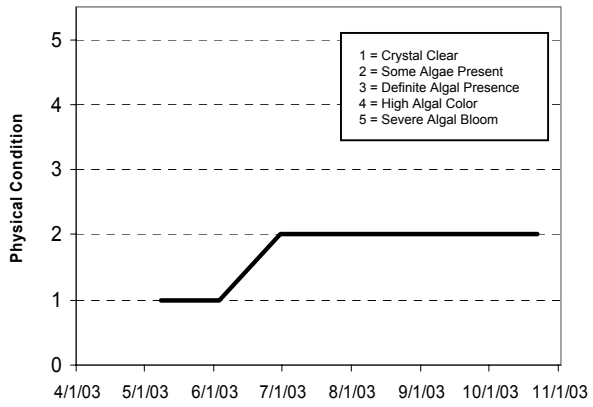
● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 05/08/03 | 17.1 | | | | 20 | 66 | | 0.7 | 1 | 1 |
| 06/03/03 | 21.6 | | | | 9.1 | 59 | | 0.85 | 1 | 2 |
| 06/30/03 | 23.5 | | | | 17 | 174 | | 0.6 | 2 | 4 |
| 07/23/03 | 29.1 | | | | 31 | 169 | | 0.5 | 2 | 4 |
| 08/08/03 | 30.4 | | | | 32 | 292 | | 0.5 | 2 | 4 |
| 09/07/03 | 29.7 | | | | 53 | 515 | | 0.3 | 2 | 4 |
| 10/22/03 | 15.3 | | | | 43 | 160 | | 0.4 | 2 | 4 |

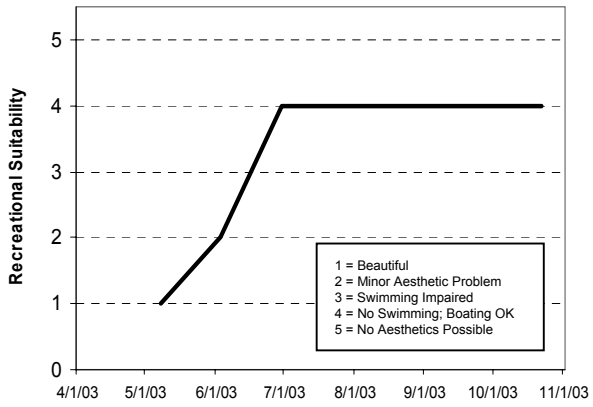



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | F | F |
| Chlorophyll a | | | | | | | | | | | D | C |
| Secchi Depth | | | | | | | | | | | F | F |
| **Overall** | | | | | | | | | | | **F** | **D** |

Source: Metropolitan Council and STORET data



## Downs Lake (82-0110) *Valley Branch Watershed District*

Downs Lake, located in Lake Elmo (Washington County), was monitored six times between mid-May and early-October, 2003. The mean and maximum depths of the 35-acre lake are 1.5 m (5 feet) and 2.1 m (7 feet), respectively. The lake's size and mean depth results in an approximate lake volume of 175 ac-ft. Because of the shallowness of the lake, the entire lake 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 2,400-acre watershed translates to a large watershed-to-lake size ratio of 69:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the fourth year in which Downs Lake has been involved in CAMP (1999 and 2001-2002 being the others). A search through the STORET nationwide water quality database for data on the lake resulted in no data other than that collected through CAMP. Thus, 1999 and 2001-2003 are the only years where data are available. The resulting data and graphs appear on the next page.

On each sampling date, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as perceived physical condition and recreational suitability. The mean summertime (May through September) surface TP concentration for the lake was 110.0 µg/l (minimum of 64.0 µg/l, maximum of 167.0 µg/l). The mean CLA and Secchi transparency readings were 43.0 µg/l (minimum of 16.0 µg/l, maximum of 70.0 µg/l) and 0.5 m (minimum of 0.4 m, maximum of 0.8 m), respectively. The lake's mean surface TKN concentration was 1.92 mg/l (minimum of 1.60 mg/l, maximum of 2.40 mg/l).

The summertime means resulted in a TP grade of D, CLA grade of C, and Secchi transparency grade of F. The overall grade, calculated from all three parameters was D. The lake's 2003 overall water quality grade is similar to that recorded in 1999, and better than those of 2001-2002 (overall grade of F). The TP and CLA means for the lake in 2003, are the best recorded to date.

As mentioned earlier, there are no water quality data available for Downs Lake other than the 1999 and 2001-2003 CAMP data. Therefore it is not possible to determine any long-term. In th eshort-term, the lake seems to flucuate between overall grades of D/F. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer's 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, were 2.8 for physical condition (between 2- "some algae present" and 3- "defnite algae presenct"), and 4.0 for recreational suitability (4- "no swimming - boating ok").

If you notice any errors in the lake 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.

# Downs Lake

**Lake Elmo, Washington Co.**

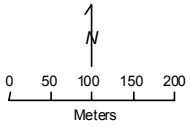
Lake ID: 820110

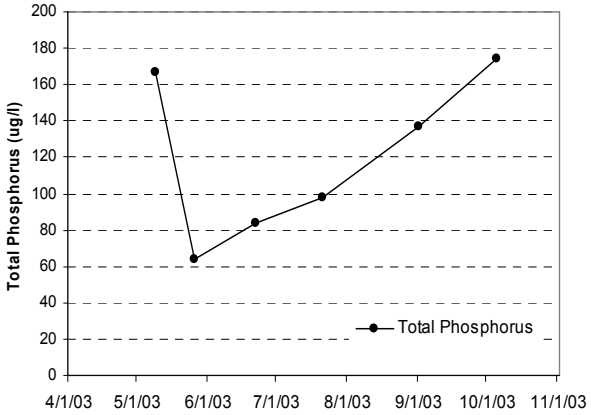
WD: Valley Branch

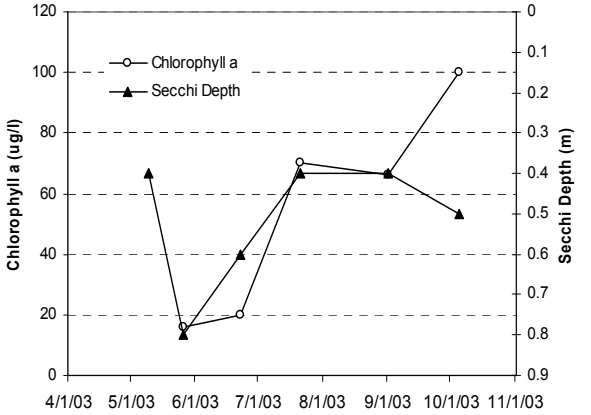
Volunteers: The Wesley Sly Family

● Sampling site

Contours in meters

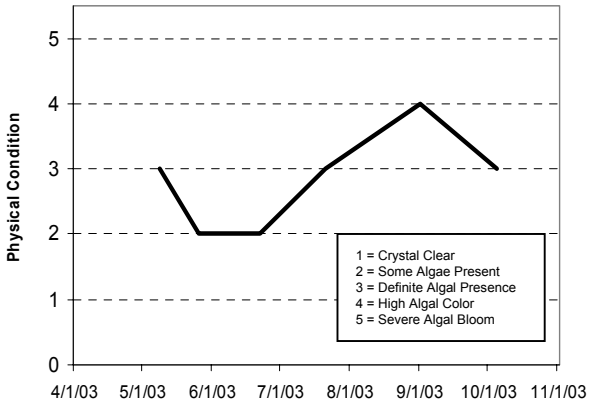




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/09/03 | | | | | | 167 | | 0.4 | 3 | 4 |
| 05/26/03 | 21.2 | | | | 16 | 64 | | 0.8 | 2 | 4 |
| 06/22/03 | 25 | | | | 20 | 84 | | 0.6 | 2 | 4 |
| 07/21/03 | 25.9 | | | | 70 | 98 | | 0.4 | 3 | 4 |
| 09/01/03 | 27.4 | | | | 66 | 137 | | 0.4 | 4 | 4 |
| 10/05/03 | 16.8 | | | | 100 | 174 | | 0.5 | 3 | 4 |

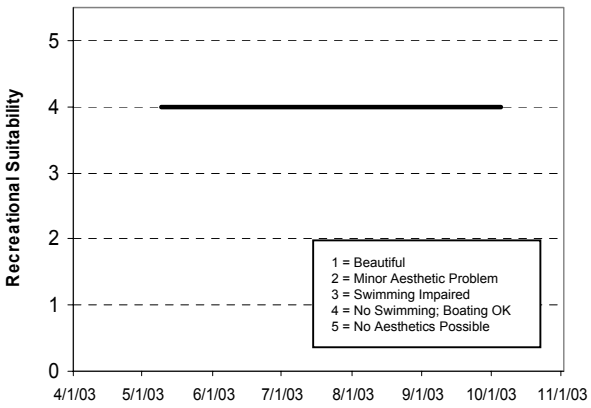



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | | D | F | D |
| Chlorophyll a | | | | | | | | D | | F | F | C |
| Secchi Depth | | | | | | | | D | | F | F | F |
| **Overall** | | | | | | | | **D** | | **F** | **F** | **D** |

Source: Metropolitan Council and STORET data



## Eagle Lake [Carver County] (10-0121) *Carver County Environmental Services*

Eagle Lake is located in Young America Township in Carver County. The lake has a surface area of 233 acres, and a maximum and mean depth of 7.9 m (26 feet) and 1.2 m (4 feet), respectively. Because of the shallowness of the lake, the entire area is considered littoral, (the shallow [0-15 foot depth] area dominated by aquatic vegetation) and does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

The lake has a 1,050-acre immediate watershed, which translates to a watershed-to-lake area ratio of 4.5:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: two percent residential, 63 percent agricultural, and 35 percent open/undeveloped (Carver County Planning 1999).

This was the sixth year that Eagle Lake has been involved in CAMP (previously enrolled in 1998-2002), although it has been previously monitored by Council staff. The lake was monitored 14 times between mid-April and mid-October, 2003. 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. The mean summertime (May through September) surface TP concentration was 215.3 µg/l (minimum of 152.0 µg/l, maximum of 315.0 µg/l). The mean CLA and Secchi transparency readings were 47.4 µg/l (minimum of 17.0 µg/l, maximum of 94.0 µg/l) and 0.8 m (minimum of 0.5 m, maximum of 1.2 m), respectively. The lake's mean surface TKN concentration was 2.09 mg/l (minimum of 1.40 mg/l, maximum of 3.20 mg/l). Results are presented on graphs and data tables on the following page.

The lake quality grades determined from each parameter's summertime mean are TP= F, CLA= C, and Secchi transparency= D, resulted in a 2003 overall grade of D. The lake's 2003 overall water quality grade similar to those recorded in 1980-1981, 1996, 1998-2001, and better than that of 2002 (F). Although the lake's overall grade has improved over that of 2002, the 2003 Secchi grade remains low. The lake's 2001 (D), 2002 (F), and 2003 (D) Secchi transparency grades reveal a continual decline since receiving B's in 1996 and 1999.

The perceived physical and recreational conditions of the lake, recorded by the volunteers, were ranked on a 1-to-5 scale. The rankings are shown in both tabular and graphical form on the lake's associated information sheet. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 3.2 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

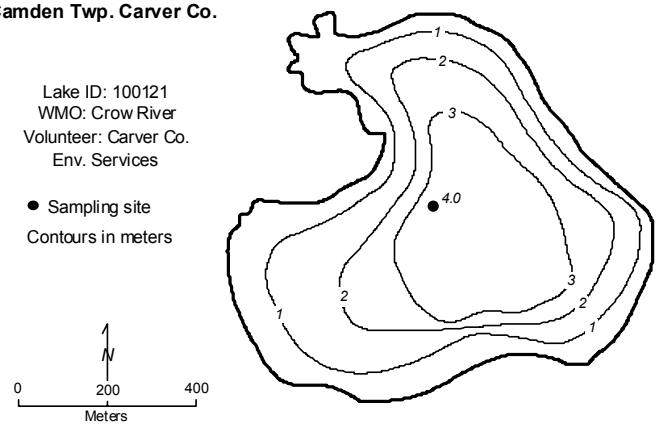
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

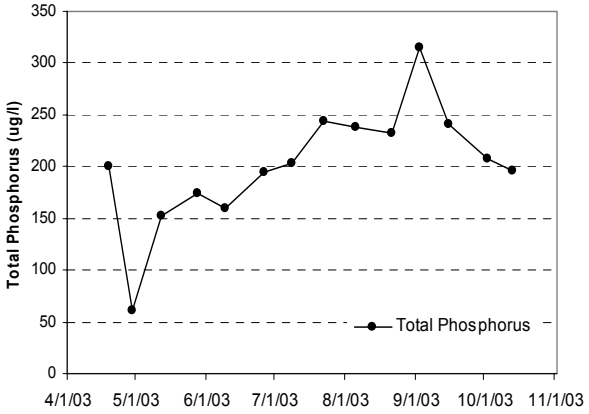
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

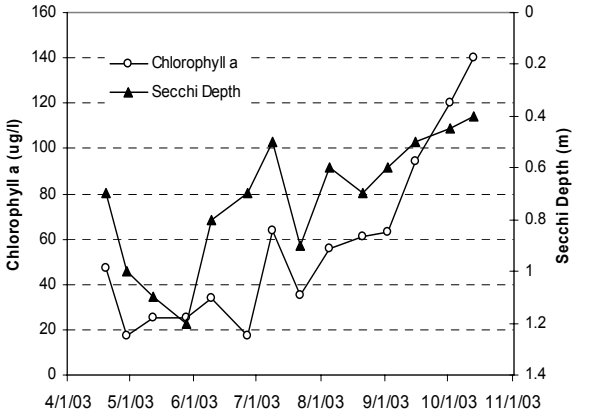
# Eagle Lake,
**Camden Twp. Carver Co.**

Lake ID: 100121
WMO: Crow River
Volunteer: Carver Co. Env. Services

● Sampling site
Contours in meters

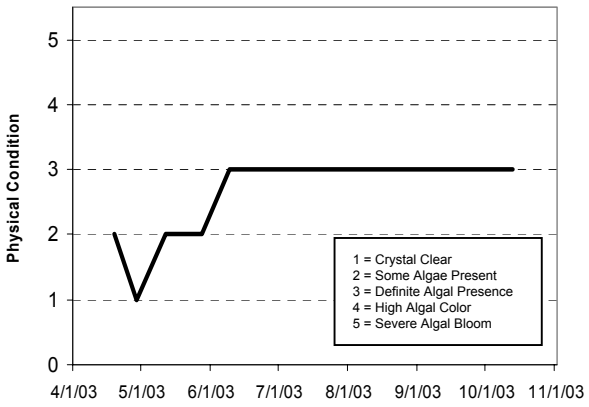



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/19/03 | 10.7 | | 13.66 | | 47 | 200 | | 0.7 | 2 | 3 |
| 04/29/03 | 13.9 | | 11.52 | | 17 | 61 | | 1 | 1 | 3 |
| 05/12/03 | 12.7 | | 9.62 | | 25 | 152 | | 1.1 | 2 | 2 |
| 05/28/03 | 18.7 | | 12.84 | | 25 | 174 | | 1.2 | 2 | 3 |
| 06/09/03 | 20.3 | | 10.13 | | 34 | 160 | | 0.8 | 3 | 4 |
| 06/26/03 | 19.4 | | 2.7 | | 17 | 194 | | 0.7 | 3 | 3 |
| 07/08/03 | 25.1 | | 6.8 | | 64 | 203 | | 0.5 | 3 | 4 |
| 07/22/03 | 25.1 | | 3.9 | | 35 | 244 | | 0.9 | 3 | 4 |
| 08/05/03 | 25.4 | | | | 56 | 238 | | 0.6 | 3 | 3 |
| 08/21/03 | 26.2 | | 6.53 | | 61 | 232 | | 0.7 | 3 | 3 |
| 09/02/03 | 23.2 | | 7.51 | | 63 | 315 | | 0.6 | 3 | 3 |
| 09/15/03 | 20.4 | | 6.21 | | 94 | 241 | | 0.5 | 3 | 3 |
| 10/02/03 | 10.6 | | 11.63 | | 120 | 208 | | 0.45 | 3 | 3 |
| 10/13/03 | 14.3 | | 9.05 | | 140 | 196 | | 0.4 | 3 | 3 |

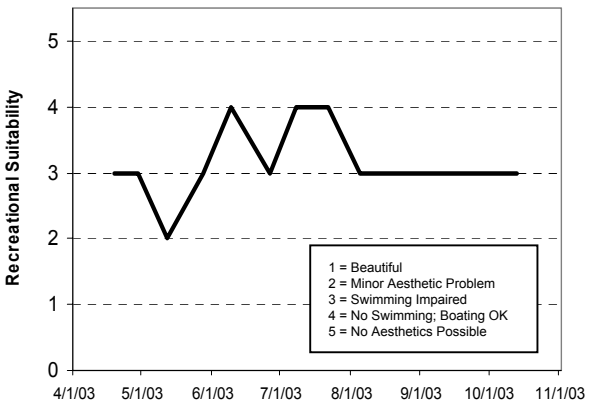



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | F | | F | F | F | F | F | F |
| Chlorophyll a | | | | | C | | C | C | C | D | D | C |
| Secchi Depth | | | | | B | | C | B | C | D | F | D |
| **Overall** | | | | | **D** | | **D** | **D** | **D** | **D** | **F** | **D** |

Source: Metropolitan Council and STORET data



## Earley Lake (19-0033) *Black Dog Watershed Management Commission*

Earley Lake is located within the City of Burnsville in Dakota County. The 29-acre lake receives flow from Crystal Lake (Burnsville) and the Earley Lake watershed. Most of its 1,629-acre watershed is either parkland or open space. The watershed-to-lake size ratio is a rather large 56:1. Generally, the larger the ratio the greater the potential stress on the lake from surface runoff. Earley Lake outlets at its west end to Sunset Pond.

Earley Lake has been enrolled in CAMP since 1994. The lake was monitored nine times between late-May and mid-October in 2003. On each sampling date the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration for the lake was 38.7 µg/l (minimum of 26.0 µg/l, maximum of 74.0 µg/l). The mean CLA and Secchi transparency readings were 13.0 µg/l (minimum of 3.4 µg/l, maximum of 49.0 µg/l), and 1.7 m (minimum of 1.2 m, maximum of 2.0 m), respectively. The lake's mean surface TKN concentration was 0.97 mg/l (minimum of 0.43 mg/l, maximum of 2.9 mg/l).

Associated lake quality grades for the 2003 summertime means were TP= C, CLA= B, and Secchi= C, resulting in an overall quality grade of C. Individual and overall grades for 2003 are identical to those found in 1994-2002. While there has been slight variability in individual summer means from year to year, the lake's quality has remained fairly consistent. The lake's mean TP seems to generally fall within the 50.0-60.0 µg/l range, while the CLA and Secchi means generally range between 11.0-18.0 µg/l and 1.2-1.6 m, respectively.

Overall, the mean TP and Secchi numbers for 2003 were the best recorded to date. The 2003 CLA mean was at it's near best historically.

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean physical condition ranking was 4.0 (4- "high algal color"), while the mean recreational suitability ranking was 4.0 (4- "no swimming – boating ok").

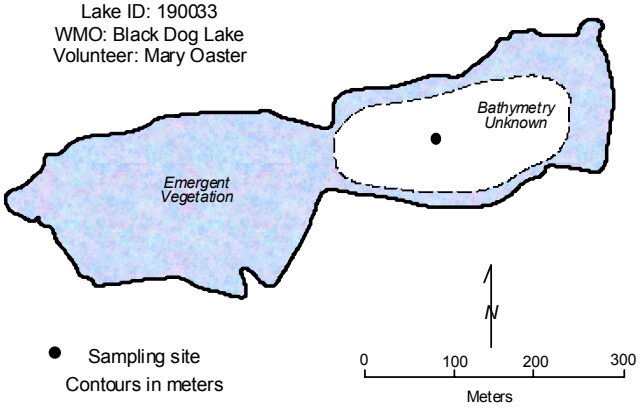
No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake seems to be very well represented by an overall water quality grade of C.

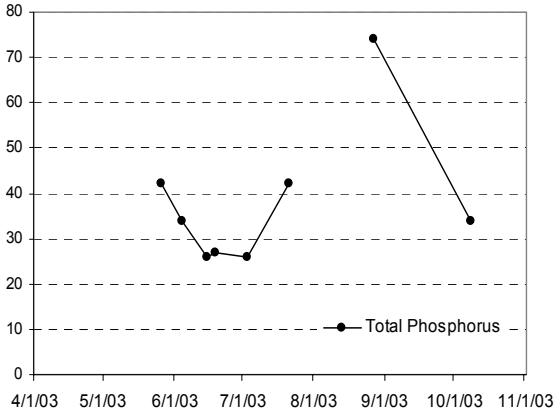
If you know of errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

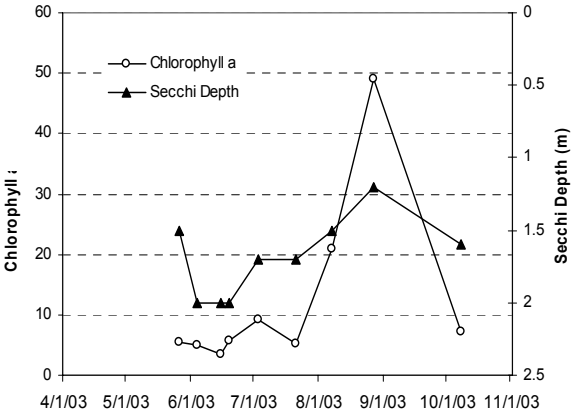
# Earley Lake

**Burnsville, Dakota Co.**

Lake ID: 190033
WMO: Black Dog Lake
Volunteer: Mary Oaster

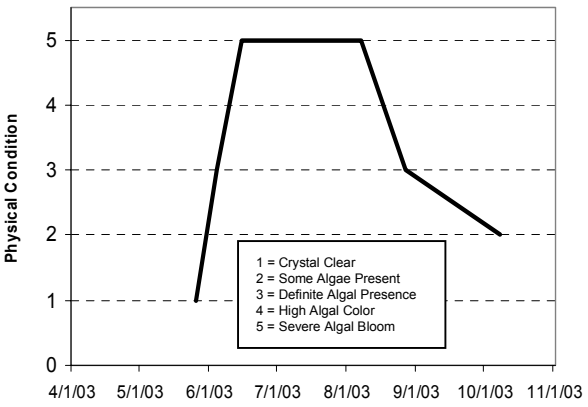



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/26/03 | 19 | | | | 5.6 | 42 | | 1.5 | 1 | 4 |
| 06/04/03 | 23 | | | | 4.9 | 34 | | 2 | 3 | 4 |
| 06/15/03 | 30 | | | | 3.4 | 26 | | 2 | 5 | 4 |
| 06/19/03 | 29 | | | | 5.8 | 27 | | 2 | 5 | 4 |
| 07/03/03 | 33 | | | | 9.1 | 26 | | 1.7 | 5 | 4 |
| 07/21/03 | 25 | | | | 5.2 | 42 | | 1.7 | 5 | 4 |
| 08/07/03 | 29 | | | | 21 | | | 1.5 | 5 | 4 |
| 08/27/03 | 30 | | | | 49 | 74 | | 1.2 | 3 | 4 |
| 10/08/03 | 16.8 | | | | 7.1 | 34 | | 1.6 | 2 | 4 |

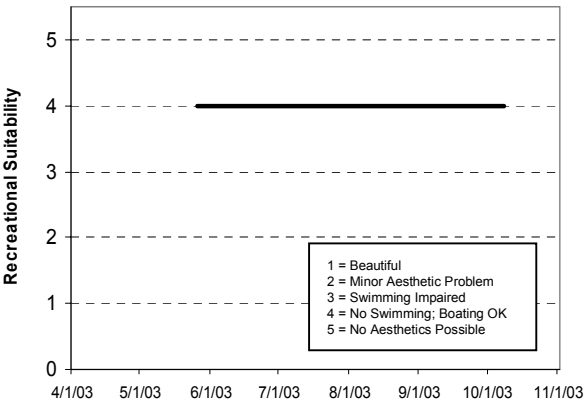



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | C | C | C | C | C | C | C | C | C |
| Chlorophyll a | | | B | B | B | B | B | B | B | B | B | B |
| Secchi Depth | | | C | C | C | C | C | C | C | C | C | C |
| **Overall** | | | **C** | **C** | **C** | **C** | **C** | **C** | **C** | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## East Boot Lake (82-0034) *Carnelian - Marine Watershed district*

East Boot Lake, located in May Township (Washington County), was monitored 14 times between mid-April and mid-October, 2003. The mean and maximum depths of the 47-acre lake are 8.2 m (27 feet) and 0.9 m (3 feet), respectively. The lake's size and mean depth results in an approximate lake volume of 282 ac-ft. Because of the overall shallowness of the lake, roughly 82 percent of the lake's surface 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 small 93-acre immediate watershed translates to a small watershed-to-lake size ratio of 2:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the fourth year that East Boot Lake Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake revealed a limited amount of data (1996-2002).

On each sampling date, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as perceived physical condition and recreational suitability. The 2003 mean summertime (May through September) surface TP concentration for the lake was 42.1 µg/l (minimum of 20.0 µg/l, maximum of 79.0 µg/l). The mean CLA and Secchi transparency readings were 29.1 µg/l (minimum of 3.2 µg/l, maximum of 64.0 µg/l) and 2.5 m (minimum of 0.8 m, maximum of 5.5 m) [the widest range in CAMP 2003], respectively. The lake's mean surface TKN concentration was 1.19 mg/l (minimum of 0.65 mg/l, maximum of 1.70 mg/l).

The summertime means resulted in a TP grade of C, CLA grade of C, and Secchi transparency grade of B. The overall grade calculated from all three parameters was C. While the lake's 2003 overall grade is identical to those recorded through CAMP in 1999-2002, they are worse than those recorded in 1996-1998.

No statistically significant trends are evident from the lake's water quality database. With this in mind however, the lake's recent water quality seems to be well represented by an overall grade of C+/B-. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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 2.9 for physical condition (between 2- "some algae prensent" and 3- "definite algae present"), and 3.4 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

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.

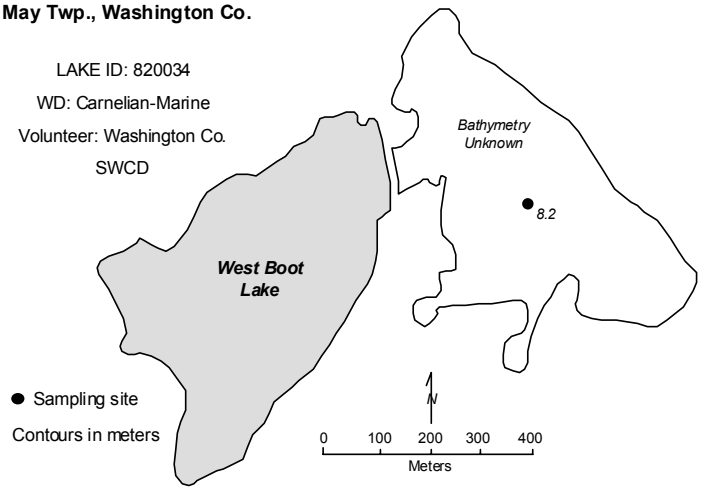
# East Boot Lake

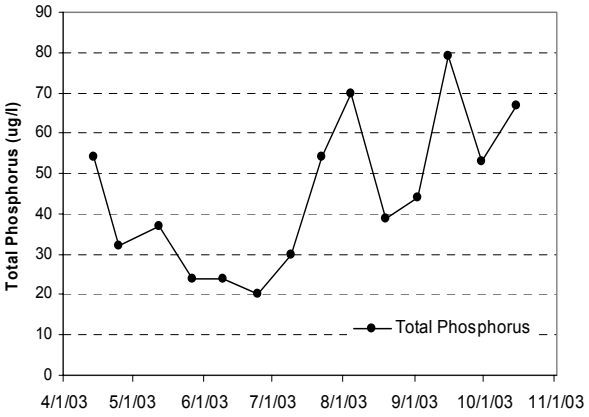
**May Twp., Washington Co.**

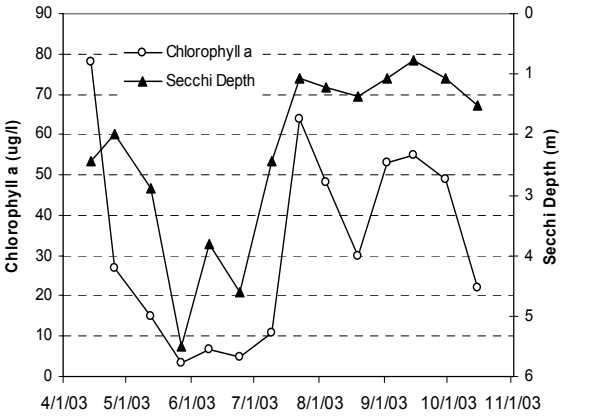
LAKE ID: 820034

WD: Carnelian-Marine

Volunteer: Washington Co. SWCD

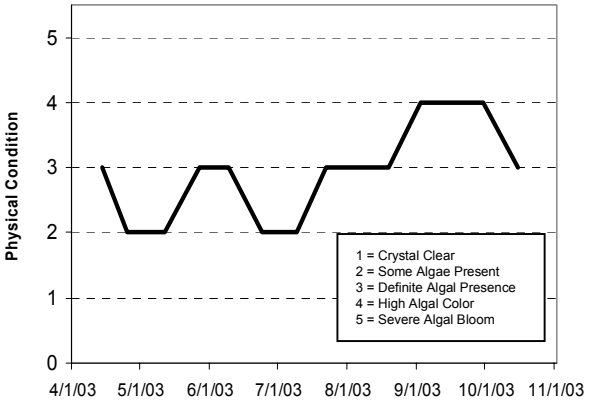



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 10.5 | | 11.34 | | 78 | 54 | | 2.44 | 3 | 3 |
| 04/25/03 | 12.2 | | 3.61 | | 27 | 32 | | 1.98 | 2 | 2 |
| 05/12/03 | 13.5 | | 8.35 | | 15 | 37 | | 2.9 | 2 | 3 |
| 05/27/03 | 22.8 | | 5.53 | | 3.2 | 24 | | 5.49 | 3 | 3 |
| 06/09/03 | 22.5 | | 3.74 | | 6.9 | 24 | | 3.81 | 3 | 3 |
| 06/24/03 | 25.1 | | 6.31 | | 4.8 | 20 | | 4.6 | 2 | 2 |
| 07/09/03 | 25.4 | | 8.83 | | 11 | 30 | | 2.44 | 2 | 3 |
| 07/22/03 | 25.7 | | 7.12 | | 64 | 54 | | 1.068 | 3 | 4 |
| 08/04/03 | 25.8 | | 8.1 | | 48 | 70 | | 1.22 | 3 | 4 |
| 08/19/03 | 27.7 | | 10.6 | | 30 | 39 | | 1.372 | 3 | 4 |
| 09/02/03 | 23.2 | | 6.02 | | 53 | 44 | | 1.07 | 4 | 4 |
| 09/15/03 | 22.2 | | 6.69 | | 55 | 79 | | 0.762 | 4 | 4 |
| 09/30/03 | 12.9 | | 7.82 | | 49 | 53 | | 1.067 | 4 | 3 |
| 10/15/03 | 13 | | 7.53 | | 22 | 67 | | 1.524 | 3 | 3 |

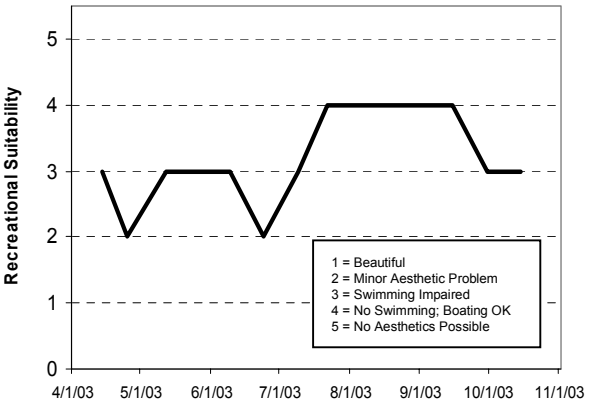



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | B | B | B | C | C | C | C | C |
| Chlorophyll a | | | | | B | C | C | C | C | C | C | C |
| Secchi Depth | | | | | B | A | B | C | C | C | B | B |
| **Overall** | | | | | **B** | **B** | **B** | **C** | **C** | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



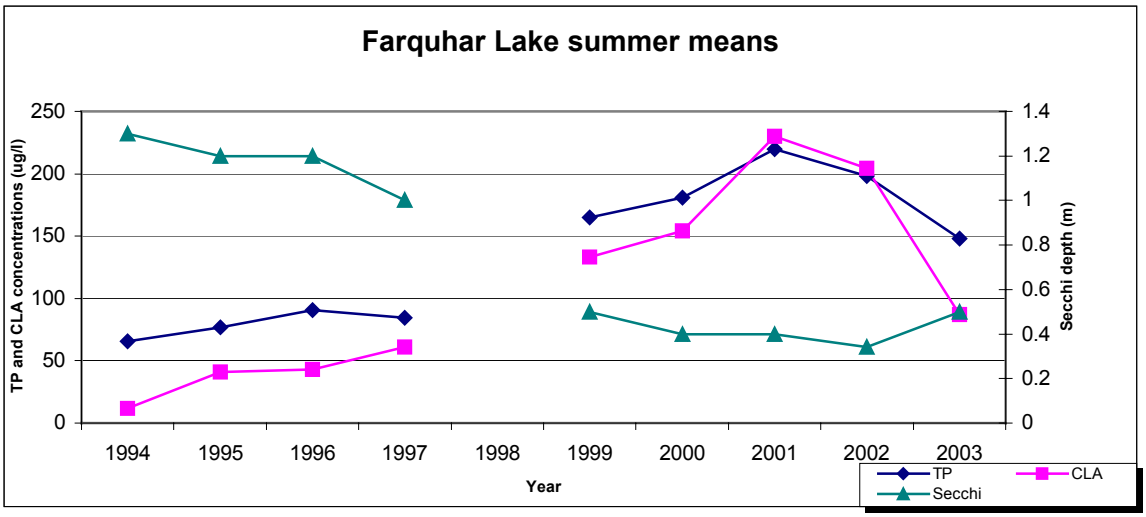
## Farquhar Lake (19-0023) *City of Apple Valley*

Farquhar Lake, located in the City of Apple Valley (Dakota County), covers an area of 63 acres and has a maximum depth of 3.0 m (10 feet). The lake's mean depth of 1.4 m (4.6 feet) and surface area translates to an approximate lake volume of 290 ac-ft (the lake volume may have changed over the past couple years due to the lake level rising 1.5 to 2.0 feet above normal). Because the maximum depth is only 3.0 m, the entire lake area is considered littoral (the 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 land uses within the 353-acre contributing watershed to the lake are approximately split between agricultural uses and urban/residential. The watershed-to-lake size ratio is 6:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff).

This was the ninth year that Farquhar Lake has been enrolled in CAMP. The lake was monitored 14 times between mid-April and mid-October, 2003.

The summertime (May through September) mean TP concentration was 148.3 µg/l (minimum of 49.0 µg/l, maximum of 243.0 µg/l), while the CLA mean was 87.2 µg/l (minimum and maximum of 3.6 and 230.0 µg/l). The lake's 2003 mean Secchi transparency was 0.5 m (minimum of 0.1 m [the worst recorded in CAMP 2003] and maximum of 1.2 m). The mean TKN concentration over the same time period was 2.54 mg/l (minimum of 1.20 mg/l, maximum of 4.10 mg/l). The lake's 2003 means are similar to those of 1999 and worse than those of 1994-1997. The 2003 means are, however better than the more recent monitoring time period of 2000-2002 (this scenerio is shown on the graph below).




The graph clearly depicts the lakes recent (mid-1990s to present) degradation. In fact, a recent MPCA conducted trend analysis on the lake's Secchi transparency data, revealed a statistically significant decrease in recent water clarity. The reason for the degradation in the lake's water quality is not entirely known. A more in-depth study combining watershed as well as in-lake monitoring may help determine the areas contributing the most to the lake's degradation.

The lake quality grades determined from each parameter's 2003 summertime mean are TP= F, CLA= F and Secchi transparency= F, resulted in an overall grade of F (as it did in 1999-2002). For comparison, the lake had overall grades of D in 1995 and 1997 and C in 1994 and 1996.

Throughout the 2003 season, the volunteer monitor ranked their perceptions of the lake's physical and recreational condition on a 1-to-5 scale. The mean perceived physical condition was 3.6 (falling between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 3.1 (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

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/.

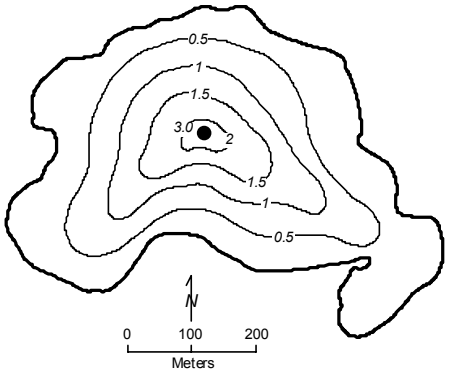
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

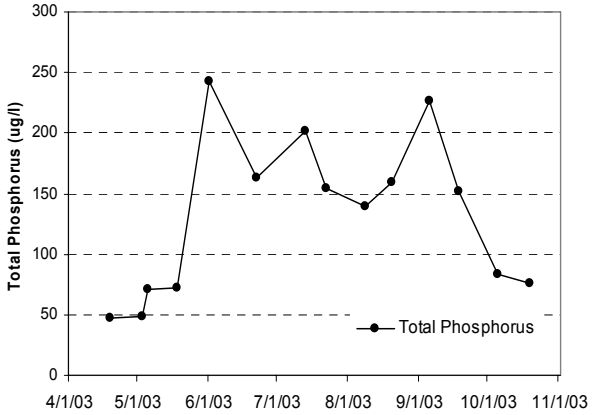
# Farquhar Lake

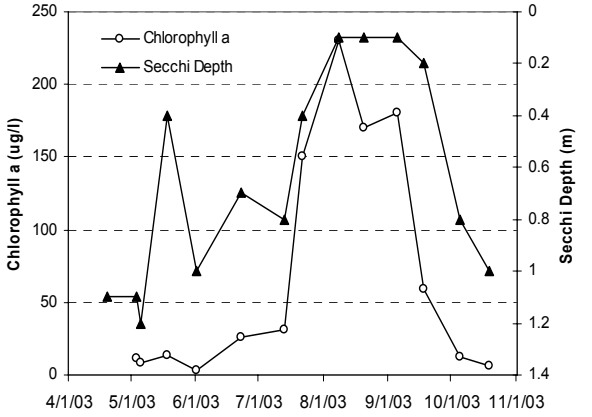
**Apple Valley, Dakota Co.**

Lake ID: 190023
WMO: Dakota County
Volunteer: Rick Bruneau

● Sampling site
Contours in meters

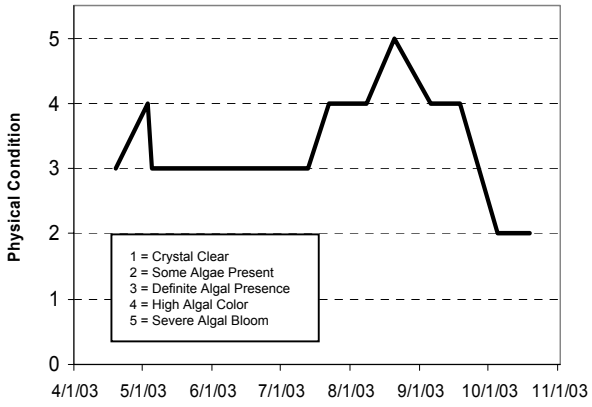



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/19/03 | 9 | | | | | 47 | | 1.1 | 3 | 2 |
| 05/03/03 | 16.5 | | | | 11 | 49 | | 1.1 | 4 | 4 |
| 05/05/03 | 15.7 | | | | 8.7 | 71 | | 1.2 | 3 | 2 |
| 05/18/03 | 17.9 | | | | 14 | 72 | | 0.4 | 3 | |
| 06/01/03 | 25 | | | | 3.6 | 243 | | 1 | 3 | 2 |
| 06/22/03 | 29 | | | | 26 | 163 | | 0.7 | 3 | 3 |
| 07/13/03 | 30 | | | | 31 | 202 | | 0.8 | 3 | |
| 07/22/03 | 30 | | | | 150 | 154 | | 0.4 | 4 | 3 |
| 08/08/03 | 26.9 | | | | 230 | 140 | | 0.1 | 4 | 4 |
| 08/20/03 | 26.9 | | | | 170 | 159 | | 0.1 | 5 | 4 |
| 09/05/03 | 26.9 | | | | 180 | 226 | | 0.1 | 4 | 4 |
| 09/18/03 | 21.3 | | | | 59 | 152 | | 0.2 | 4 | 4 |
| 10/05/03 | 15.7 | | | | 12 | 83 | | 0.8 | 2 | 3 |
| 10/19/03 | 21.3 | | | | 6.6 | 76 | | 1 | 2 | |

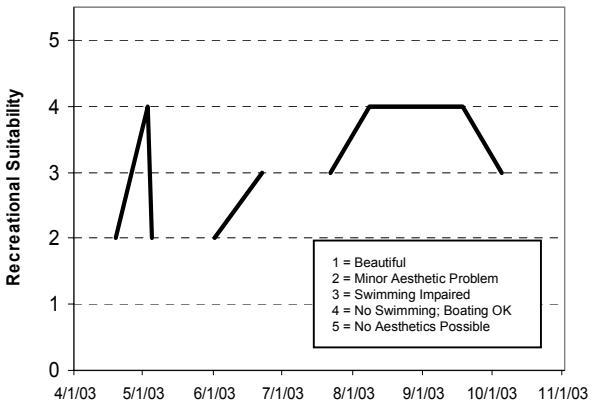



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | D | D | D | | F | F | F | F | D |
| Chlorophyll a | | | B | C | C | D | | F | F | F | F | F |
| Secchi Depth | | | C | D | C | D | | F | F | F | F | F |
| **Overall** | | | **C** | **D** | **C** | **D** | | **F** | **F** | **F** | **F** | **F** |

Source: Metropolitan Council and STORET data



## Fireman's Lake (10-0266) *Carver County Environmental Services*

This was the third year that Fireman's Lake (located within the City of Chaska [Carver County]), has been involved in CAMP (the lake was first enrolled in 2001). The 8-acre lake has a maximum depth of 7.0 m (23 feet). Roughly 88 percent of the lake's surface 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).

A search through the STORET nationwide water quality database for data on the lake provided no data. Therefore, 2001-2003 are the only years of available water quality data for the lake.

The lake was monitored 14 times from mid-April to mid-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 28.6 µg/l (minimum concentration of 15.0 µg/l and a maximum value of 56.0 µg/l); surface chlorophyll-a= 3.5 µg/l (minimum of 1.0 µg/l and maximum of 10.0 µg/l); Secchi transparency= 3.3 m (minimum of 1.8 m and a maximum of 4.7 m); and TKN= 0.40 mg/l (minimum of 0.20 mg/l and maximum of 0.50 mg/l). The lake's summer means translate to water quality grades of B for TP, A, for CLA, and A for Secchi transparency. These grades result in an overall water quality grade of A for Fireman's Lake in 2003. While the lake's 2003 overall grade is identical to that of 2001-2002, the 2003 TP mean was higher than that recorded in past years.

As mentioned earlier, there are no water quality data available for Fireman's Lake other than the limited 2001-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

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 1.3 for physical condition (between 1- "crystal clear" and 2- "some algae present"), and 1.6 for recreational suitability (between 1- "beautiful" and 2- "minor aesthetic problem").

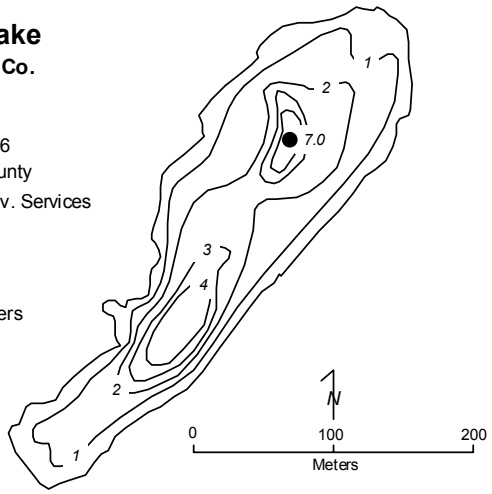
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

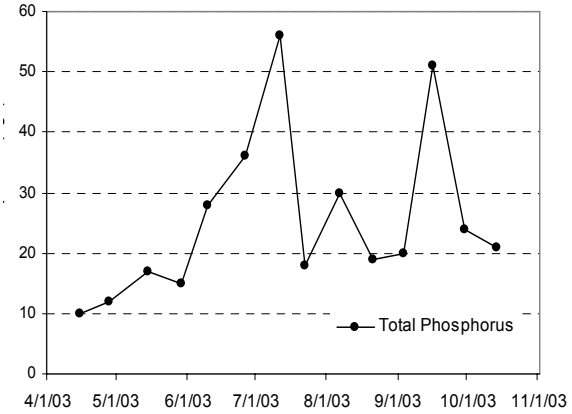
# Fireman's Lake

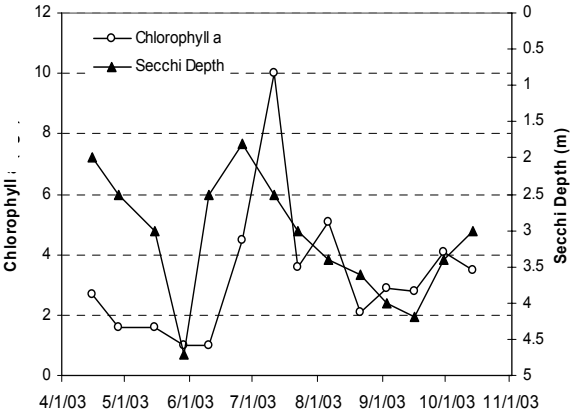
**Chaska, Carver Co.**

Lake ID: 100226
WMO: Carver County
Volunteer: Carver Co. Env. Services

● Sampling site
Contours in meters

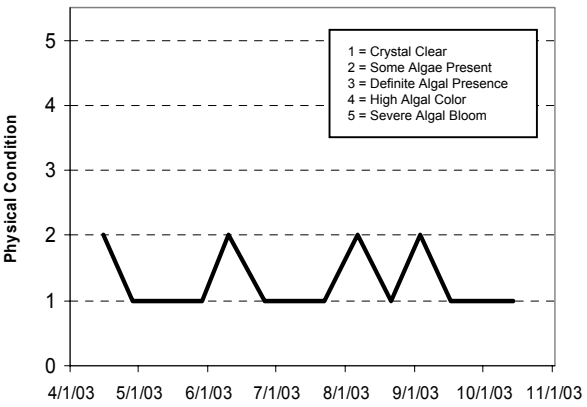



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 14.2 | | 11.42 | | 2.7 | 10 | | 2 | 2 | 2 |
| 04/28/03 | 15.8 | | 9.92 | | 1.6 | 12 | | 2.5 | 1 | 1 |
| 05/15/03 | 18.2 | | 9.4 | | 1.6 | 17 | | 3 | 1 | 1 |
| 05/29/03 | 21.3 | | 11.09 | | 1 | 15 | | 4.7 | 1 | 1 |
| 06/10/03 | 22 | | 5.66 | | 1 | 28 | | 2.5 | 2 | 2 |
| 06/26/03 | 22.5 | | 5.8 | | 4.5 | 36 | | 1.8 | 1 | 2 |
| 07/11/03 | 24.3 | | 6 | | 10 | 56 | | 2.5 | 1 | 2 |
| 07/22/03 | 25.2 | | 10.8 | | 3.6 | 18 | | 3 | 1 | 2 |
| 08/06/03 | 26.6 | | 8.24 | | 5.1 | 30 | | 3.4 | 2 | 1 |
| 08/21/03 | 28 | | | | 2.1 | 19 | | 3.6 | 1 | 2 |
| 09/03/03 | 23.2 | | 8.89 | | 2.9 | 20 | | 4 | 2 | 2 |
| 09/16/03 | 22.5 | | 6 | | 2.8 | 51 | | 4.2 | 1 | 2 |
| 09/30/03 | 14.3 | | | | 4.1 | 24 | | 3.4 | 1 | 1 |
| 10/14/03 | 14.9 | | 10.28 | | 3.5 | 21 | | 3 | 1 | 1 |

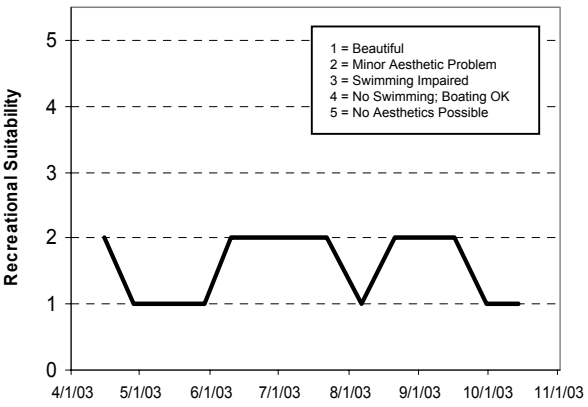



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | A | A | B |
| Chlorophyll a | | | | | | | | | | A | A | A |
| Secchi Depth | | | | | | | | | | B | A | A |
| **Overall** | | | | | | | | | | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Fish Lake [Grant Township] (82-0137) *Rice Creek Watershed District*

Fish Lake is a 21-acre lake located within the Grant Township (Washington County). The maximum depth of the lake is 10.4 m (roughly 34 feet). Roughly 67 percent of the lake's surface 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).

This was the second year that Fish Lake has been involved in CAMP (2002 being the first). A search through the STORET nationwide water quality database for data on the lake provided no historical data. Therefore 2002-2003 are the only years of available water quality data for the lake.

As part of the watershed's involvement in CAMP in 2003, the lake was monitored five times between early-May and early-September. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The 2003 mean summertime (May through September) surface TP concentration was 45.4 µg/l (minimum of 29.0 µg/l, maximum of 57.0 µg/l). The mean CLA and Secchi transparency readings were 20.1 µg/l (minimum of 8.3 µg/l, maximum of 51.0 µg/l), and 1.8 m (minimum of 1.0 m, maximum of 3.0 m), respectively. The lake's mean surface TKN concentration was 0.87 mg/l (minimum of 0.77 mg/l and a maximum of 0.95 mg/l). The summertime means in 2003 resulted in a TP grade of C, CLA of C, and a Secchi transparency grade of C. The overall grade determined through the calculation of all three parameters was C.

The lake's 2003 parameter means were dramatically better than those recorded in 2002. Th 2003 TP summer mean was roughly 25 % of that recorded in 2002, while the 2003 CLA mean was 50 % of the 2002 mean. This resulted in the 2003 mean Secchi transparency doubling that of 2002. The reason for this dramatic improvement is not known. Continued monitoring is recommended in order to determine the true quality of the lake.

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 following page. The mean physical condition ranking was 2.6 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.2 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

As mentioned earlier, there are no water quality data available for Fish Lake other than the 2002-2003 CAMP data (and the two years of data vary dramatically). Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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.

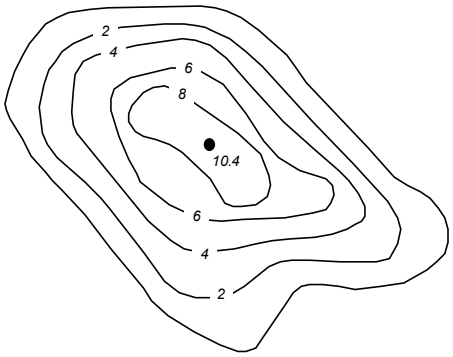
# Fish Lake

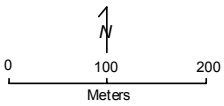
**Grant, Washington Co.**

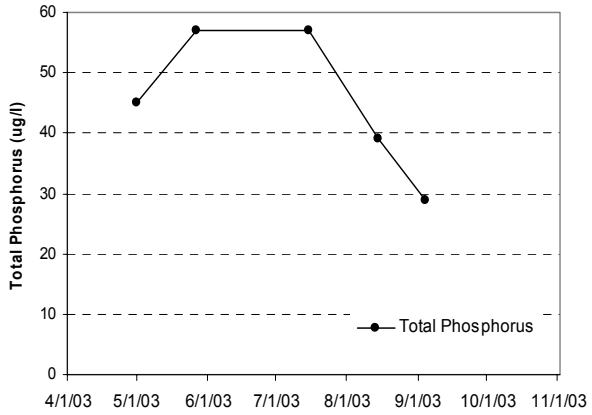
Lake ID: 820137
WD: Rice Creek

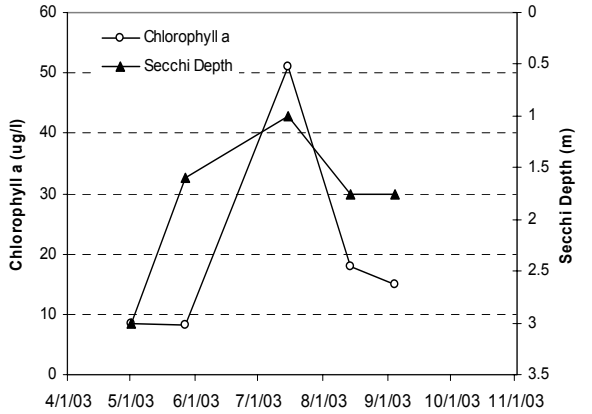
Volunteer: Rice Creek Watershed District

● Sampling site
Contours in meters



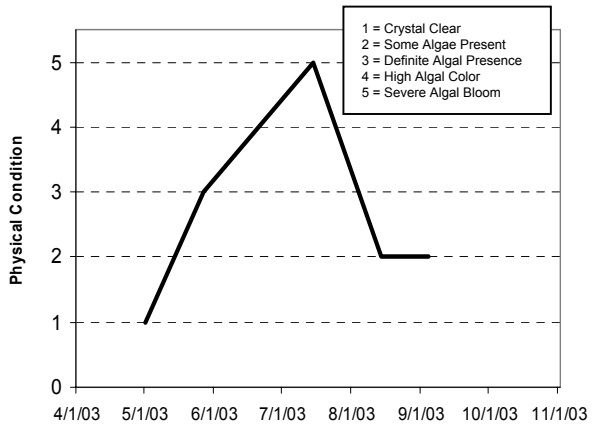




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 05/01/03 | 14.3 | | 11 | | 8.4 | 45 | | 3 | 1 | 1 |
| 05/27/03 | 19.4 | | 11 | | 8.3 | 57 | | 1.6 | 3 | 2 |
| 07/15/03 | 13 | | | | 51 | 57 | | 1 | 5 | 4 |
| 08/14/03 | 21.3 | | | | 18 | 39 | | 1.75 | 2 | 2 |
| 09/04/03 | 22.5 | | | | 15 | 29 | | 1.75 | 2 | 2 |

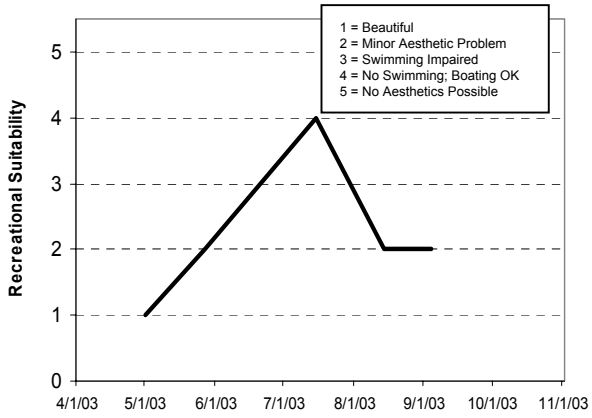



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | F | C |
| Chlorophyll a | | | | | | | | | | | C | C |
| Secchi Depth | | | | | | | | | | | D | C |
| **Overall** | | | | | | | | | | | **D** | **C** |

Source: Metropolitan Council and STORET data



## Fish Lake [Scott County] (70-0069) *Prior Lake - Spring Lake Watershed District*

Fish Lake is located in Spring Lake Township (Scott County). This was the sixth year that the 171-acre lake has been a part of CAMP. The lake's mean and maximum depth of 4.4 m (14 feet) and 8.5 m (28 feet) translates to an approximate volume of 2,468 ac-ft. Roughly 43 percent of the lake's surface area is considered littoral, that is, the 0-15 foot depth area of the lake dominated by aquatic vegetation. The lake has a 434-acre watershed that, when divided by the surface area of the lake results in a rather small watershed-to-lake size ratio of 2.5:1 (the larger the ratio the greater the potential stress on the lake from surface runoff). The lake is considered a Metropolitan Council "Priority Lake" due to its multi-recreational uses. The lake can be accessed on the northwestern end.

The lake was monitored 13 times between early-May and mid-October, 2003. A search for historic water quality data through Council, MPCA, and STORET files resulted in a few years of data (1980, 1984, 1990, 1995, 1997 [only two monitoring events], and 1998-2003).

The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

The 2003 mean concentrations were as follows; TP= 53.5 µg/l (minimum of 32.0 µg/l and a maximum of 107.0 µg/l), CLA= 25.0 µg/l (minimum of 1.5 µg/l and maximum of 54.0 µg/l), Secchi transparency= 2.4 m (minimum of 0.9 m and maximum of 6.0 m), and TKN= 1.25 mg/l (minimum and maximum of 0.90 and 2.20 mg/l, respectively). The means resulted in grades of C for TP and C for CLA and B for Secchi transparency. The resulting 2003 overall water quality grade for the lake was C.

The 2003 overall grade represents a rebound from the lake's poor water quality recorded in 2002 (D). The lakes has received overall grades of C in 1980, 1995, 1997-2000 and 2003, overall grade of B in 2001 and D's in 1984 and 2002.

During each visit, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean physical condition ranking was 2.2 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.3 (between 2- "minor aesthtic problem" and 3- "swimming slightly impaired").

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake seems to be very well represented by an overall lake water quality grade of C/C+. To better determine if this indicates a possible trend or is simply a flucuation within the lake's normal range, more data are needed.

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/.

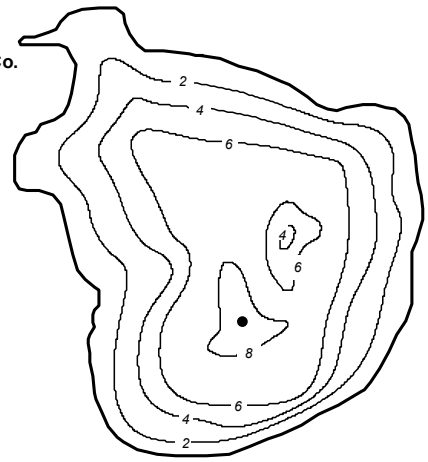
If you know of any erroneous lake data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

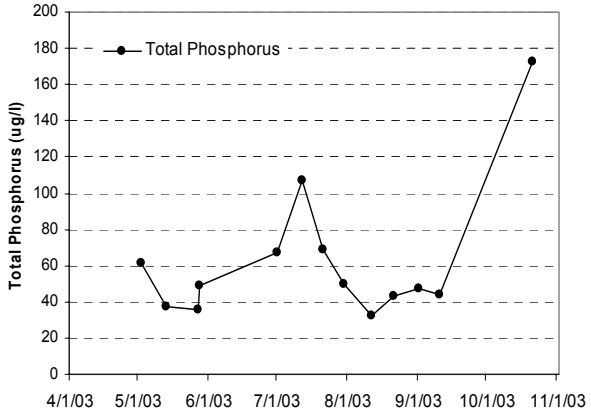
## Fish Lake

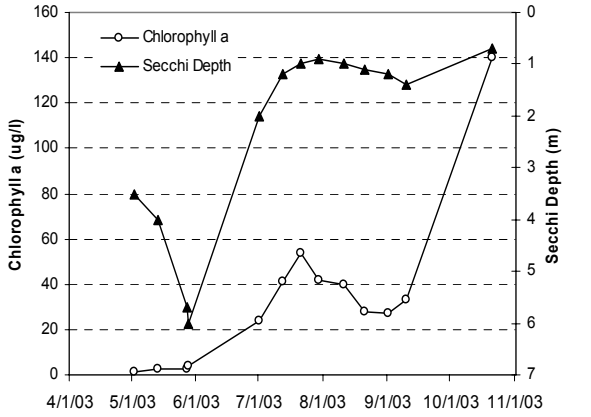
**Spring Lake Twp., Scott Co.**

Lake ID: 700069
WD: Prior Lake-Spring Lake
Volunteers: Charlie and Camille Robin

● Sampling site
Contours in meters

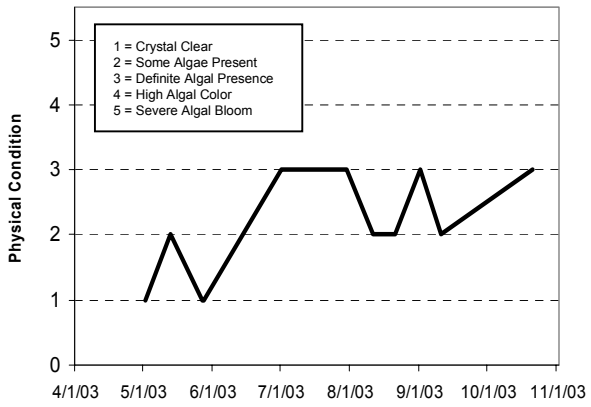



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/02/03 | 14 | | | | 1.5 | 61 | | 3.5 | 1 | 1 |
| 05/13/03 | 17 | | | | 2.8 | 37 | | 4 | 2 | 2 |
| 05/27/03 | 17 | | | | 2.5 | 36 | | 5.7 | 1 | 1 |
| 05/28/03 | 19 | | | | 3.9 | 49 | | 6 | 1 | 2 |
| 07/01/03 | 24.6 | | | | 24 | 67 | | 2 | 3 | 3 |
| 07/12/03 | 25.8 | | | | 41 | 107 | | 1.2 | 3 | 3 |
| 07/21/03 | 25.8 | | | | 54 | 69 | | 1 | 3 | 3 |
| 07/30/03 | 27.4 | | | | 42 | 50 | | 0.9 | 3 | 3 |
| 08/11/03 | 26.9 | | | | 40 | 32 | | 1 | 2 | 3 |
| 08/21/03 | 26.9 | | | | 28 | 43 | | 1.1 | 2 | 3 |
| 09/01/03 | 25.2 | | | | 27 | 47 | | 1.2 | 3 | 2 |
| 09/10/03 | 23.5 | | | | 33 | 44 | | 1.4 | 2 | 2 |
| 10/21/03 | 12.9 | | | | 140 | 173 | | 0.7 | 3 | 3 |

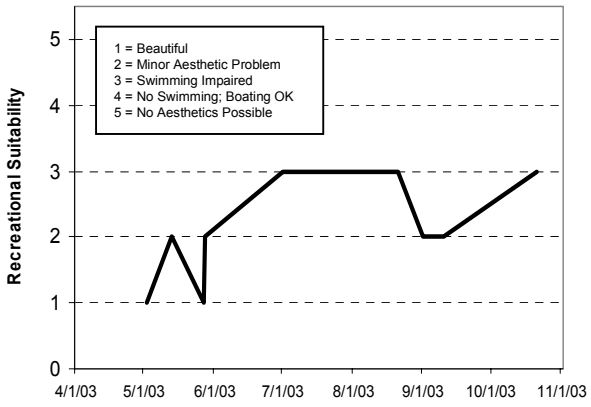



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | C | | C | C | C | C | C | D | C |
| Chlorophyll a | | | | C | | C | C | C | C | B | C | C |
| Secchi Depth | | | | D | | C | C | C | B | B | D | B |
| **Overall** | | | | **C** | | **C** | **C** | **C** | **C** | **B** | **D** | **C** |

Source: Metropolitan Council and STORET data



## Fish Lake [Washington County] (82-0064) *Carnelian - Marine Watershed District*

Fish Lake is located in New Scandia Township in Washington County. The lake has a surface area of 72 acres, and a maximum and mean depth of 3.0 m (10 feet) and 1.5 m (5 feet), respectively. Because of the shallowness of the lake, its entire surface area is considered littoral, the shallow (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). The mean depth and surface area of the lake translates to an approximate volume of 360 ac-ft.

The lake's watershed area of 683 acres translates to a watershed-to-lake size ratio of 9.5:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff).

This was the third year that Fish Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake revealed a limited amount of data collected. Water quality data were found for 1998-2002.

The lake was monitored seven times between mid-April and early-October, 2003. 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. The mean summertime (May through September) surface TP concentration was 95.6 µg/l (minimum of 71.0 µg/l, maximum of 143.0 µg/l). The mean CLA and Secchi transparency readings were 81.6 µg/l (minimum of 22.0 µg/l, maximum of 110.0 µg/l) and 0.6 m (minimum of 0.5 m, maximum of 0.9 m), respectively. The lake's mean surface TKN concentration was 2.24 mg/l (minimum of 1.90 mg/l, maximum of 2.90 mg/l).

The lake's 2003 quality grades determined from each parameter's summertime mean are TP= D, CLA= F, and Secchi transparency= F. The resulting overall grade for 2003 is F, which is identical to the F's the lake received from 1998-2001 and worse than the D of 2002. The lake's 2003 nutrient concentrations and Secchi transparencies are graphed on the following page.

Because of the limitedness of the lake's water quality database, the determination of any long-term trends is not possible to determine. In the short-term, the lake seems well represent by the overall grade of F. To better understand the lake's water quality and what direction it may be heading, more years of data collection are needed.

The perceived physical and recreational conditions of the lake, recorded by the volunteers, were ranked on a 1-to-5 scale. The rankings are shown in both tabular and graphical form on the lake's associated information sheet. The mean physical condition ranking was 3.0 (3- "definite algae present"), while the mean recreational suitability ranking was 3.6 (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

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.

## Forest Lake [West Basin] (82-0159) *Comfort Lake-Forest Lake Watershed District*

Forest Lake is divided into three distinct basins; however, only the west basin was monitored through CAMP in 2003. Because of the lake's multi-recreational uses it is considered a "Priority Lake" in the Metropolitan Area.

The entire 2,249-acre lake is located within the City of Forest Lake (Washington County). The acreage of each basin is as follows: west basin= 1,109 acres, middle basin= 360 acres, and the east basin= 780 acres. While the lake as a whole has a maximum and mean depths of 11.5 and 3.4 m (38 and 11 feet), the western basin itself has a mean and maximum depth of 3.0 m and 6.7 m (10 and 22 feet). The total volume of the whole lake is 24,986 ac-ft, and depending on hydrologic conditions has an 8-12 year residence time. Roughly 68 percent of the lake's surface area is considered littoral, (the shallow [0-15 feet] area dominated by aquatic plants). The 4,285-acre watershed translates to a rather small watershed-to-lake area ratio of 2:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). The lake has nine public accesses, 14 inlets and one outlet.

This was the ninth year that the west basin of Forest Lake has been involved in CAMP (the previous being 1993, and 1996-2002). In 2003, the west basin of Forest Lake was monitored 14 times between mid-April and mid-October. Results are presented on graphs and data tables on the following page.

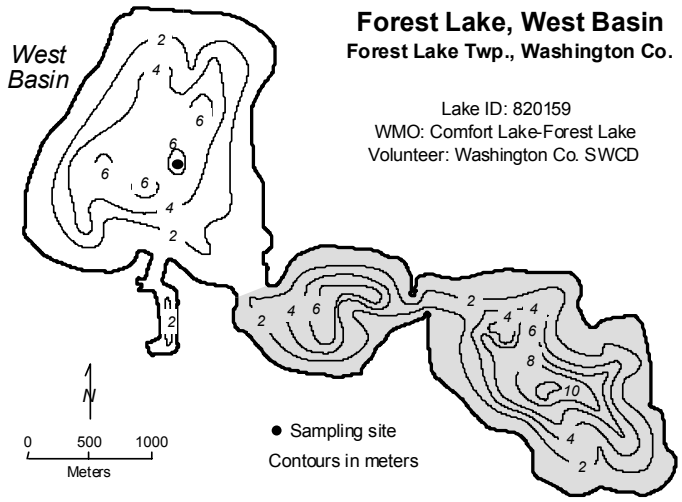
The overall lake quality grade for the west basin of Forest Lake in 2003 was C. This was determined from the individual parameter grades. The lake's 2003 summertime (May through September) mean TP concentration of 33.6 µg/l (minimum of 20.0 µg/l and maximum of 58.0 µg/l) corresponds to a lake water quality grade of C for the basin, as did the basin's mean Secchi transparency of 1.7 m (minimum of 0.9 m and maximum of 3.2 m). The 2003 CLA mean of 13.5 µg/l (minimum and maximum of 4.7 and 25.0 µg/l) results in a grade of C. The mean TKN concentration over the same time period was 0.90 mg/l (minimum of 0.64 mg/l, maximum of 1.30 mg/l).

Given the volatility of the lake's annual water quality (the lake received overall water quality grades of C in 1984, 1986, 1988, 1991, 1992, 1999-2000, and 2002-2003 and B in 1989, 1997-1998, and 2001), no definitive long-trends can be determined at this time. The lake's water quality fluctuates beween and B and C, depending on annual climatological conditions.

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean perceived physical condition of the west basin of Forest Lake was 2.5 (ranking between 2- " some algae present" and 3- "algae present"), while the mean recreational suitability was 2.3 (falling between 2- "minor aesthetics 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/.

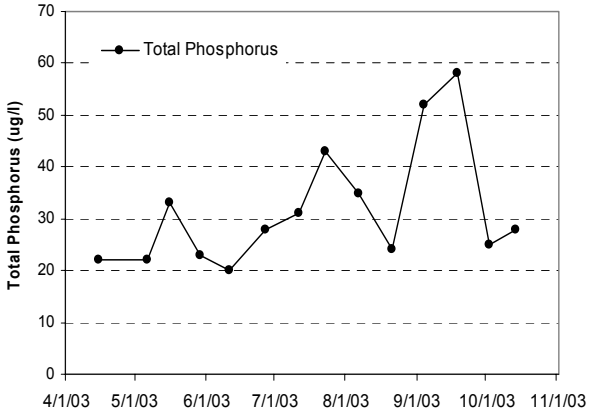
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

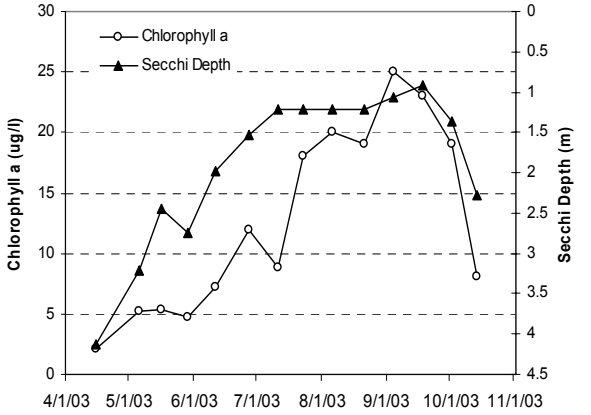



# Forest Lake, West Basin

**Forest Lake Twp., Washington Co.**

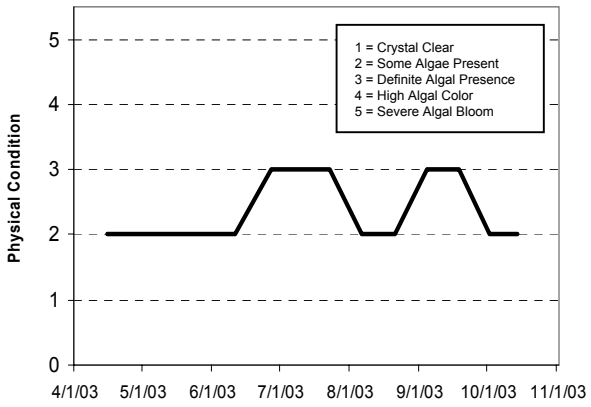
Lake ID: 820159
WMO: Comfort Lake-Forest Lake
Volunteer: Washington Co. SWCD




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 10 | | 9.38 | | 2.1 | 22 | | 4.118 | 2 | 2 |
| 05/06/03 | 13 | | 7.3 | | 5.2 | 22 | | 3.203 | 2 | 2 |
| 05/16/03 | 15.9 | | 5.85 | | 5.4 | 33 | | 2.44 | 2 | 2 |
| 05/29/03 | 20.2 | | 4.77 | | 4.7 | 23 | | 2.745 | 2 | 2 |
| 06/11/03 | 18.5 | | 3.09 | | 7.2 | 20 | | 1.98 | 2 | 1 |
| 06/27/03 | 21.2 | | 7.87 | | 12 | 28 | | 1.525 | 3 | 3 |
| 07/11/03 | 22 | | 7.16 | | 8.9 | 31 | | 1.22 | 3 | 3 |
| 07/23/03 | 24.4 | | 4.44 | | 18 | 43 | | 1.22 | 3 | 2 |
| 08/06/03 | 24.1 | | 9.35 | | 20 | 35 | | 1.22 | 2 | 2 |
| 08/21/03 | 25.9 | | 5.7 | | 19 | 24 | | 1.22 | 2 | 2 |
| 09/04/03 | 22.5 | | 7.73 | | 25 | 52 | | 1.068 | 3 | 3 |
| 09/18/03 | 20 | | 7.42 | | 23 | 58 | | 0.914 | 3 | 3 |
| 10/02/03 | 10.7 | | 10.18 | | 19 | 25 | | 1.372 | 2 | 2 |
| 10/14/03 | 13.4 | | 8.82 | | 8.1 | 28 | | 2.286 | 2 | 2 |

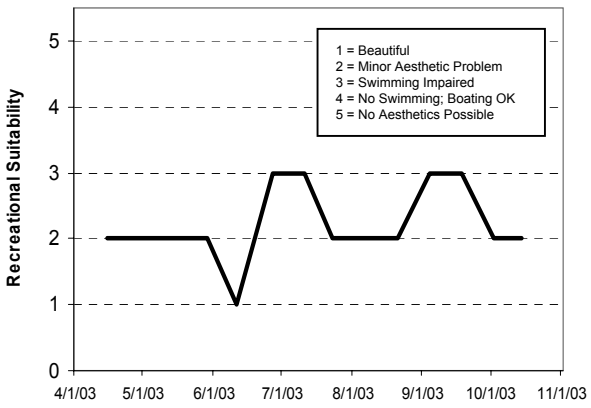



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | | | C | B | B | C | C | B | C | C |
| Chlorophyll a | | B | | | B | B | B | B | B | B | B | B |
| Secchi Depth | | C | | | C | C | C | C | C | C | C | C |
| **Overall** | | **C** | | | **C** | **B** | **B** | **C** | **C** | **B** | **C** | **C** |

Source: Metropolitan Council and STORET data



## French Lake (27-0127) *Elm Creek Watershed Management Commission*

This was the third year that the French Lake, located within the boundaries of Dayton (Hennepin County), has been involved in CAMP. The 352-acre lake has a maximum depth of 1.0 m (roughly 3 feet). A search through the STORET nationwide water quality database for data on the lake provided limited data (just Secchi data in 1985). Therefore, the 2001- 2003 CAMP data are the only known available nutrient water quality data for the lake.

The lake was monitored seven times from early-May to early-August, 2003. The dry mid- to late-summer conditions resulted in the lake becoming un-navigable. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 283.7 µg/l (minimum concentration of 136.0 µg/l and a maximum value of 489.0 µg/l); surface chlorophyll-a= 92.1 µg/l (minimum of 27.0 µg/l and maximum of 230.0 µg/l); Secchi transparency= 0.3 m (minimum of 0.20 m and a maximum of 0.55 m); and TKN= 2.74 mg/l (minimum of 1.70 mg/l and maximum of 4.80 mg/l). The lake's summer means translate to water quality grades of F for TP, F, for CLA, and F for Secchi transparency. These grades result in an overall water quality grade of F for French Lake in 2003 (similar to the overall frade recorded in 2002 and worse than that of 2001 [D]).

As mentioned earlier, there was little water quality data found for French Lake prior to the 2001 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

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 3.7 for physical condition (between 3- "denfinite algae present" and 4- "high algal color"), and 4.3 for recreational suitability (between 4- "no swimming - boating ok" and 5- "no aesthics 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.

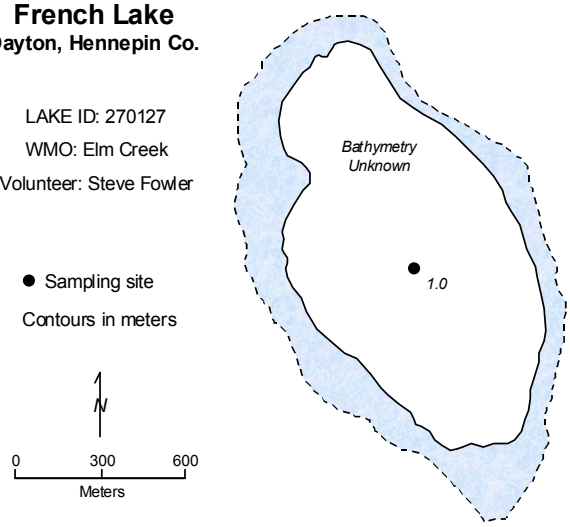
# French Lake

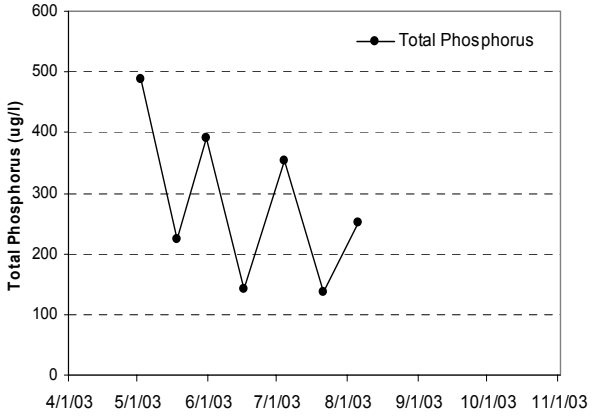
**Dayton, Hennepin Co.**

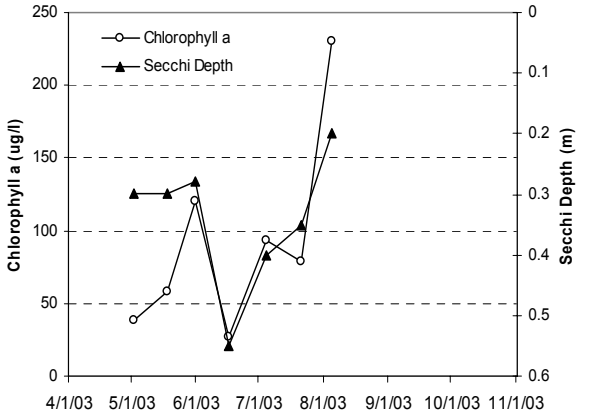
LAKE ID: 270127

WMO: Elm Creek

Volunteer: Steve Fowler

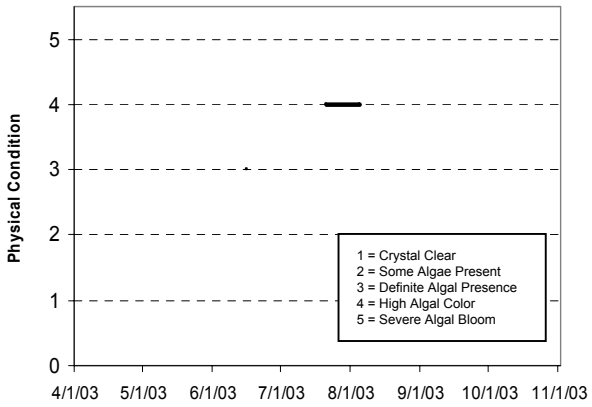



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/02/03 | 16.6 | | | | 38 | 489 | | 0.3 | | 4 |
| 05/18/03 | 21.4 | | | | 58 | 224 | | 0.3 | | 4 |
| 05/31/03 | 17.8 | | | | 120 | 390 | | 0.28 | | 4 |
| 06/16/03 | 29.1 | | | | 27 | 142 | | 0.55 | 3 | 4 |
| 07/04/03 | 27.6 | | | | 93 | 354 | | 0.4 | | 4 |
| 07/21/03 | 24.3 | | | | 79 | 136 | | 0.35 | 4 | 5 |
| 08/05/03 | 24.7 | | | | 230 | 251 | | 0.2 | 4 | 5 |

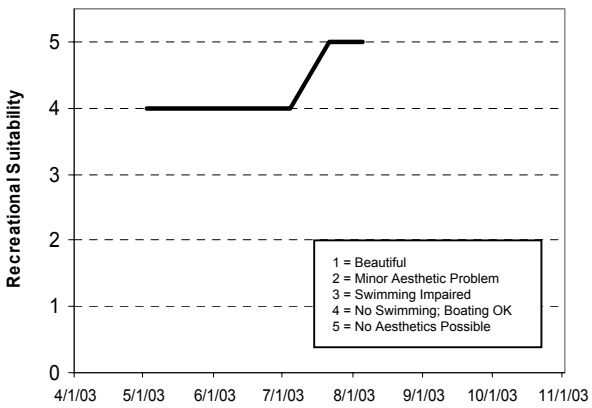



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | F | F | F |
| Chlorophyll a | | | | | | | | | | C | F | F |
| Secchi Depth | | | | | | | | | | F | F | F |
| **Overall** | | | | | | | | | | **D** | **F** | **F** |

Source: Metropolitan Council and STORET data



## George Watch Lake (2-0005) *Rice Creek Watershed District*

This was the eighth year that George Watch Lake, located in the City of Lino Lakes (Anoka County), has been enrolled in CAMP. The lake was monitored nine times from mid-April to early-October, 2003. The 528-acre lake, which has a canoe access on its eastern side, has a mean and maximum depth of 1.5 m (5 feet) and 2.0 m (6.5 feet). The lake's approximate volume is 2,587 ac-ft and because of the shallowness of the lake, it is entirely littoral zone (the area of aquatic plant dominance) and never develops and maintains a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column) through the summer months. The major land use within the lake's immediate watershed is undeveloped/park.

Summertime (May through September) means for the variables monitored were: surface TP= 155.9 µg/l (minimum concentration of 80.0 µg/l, maximum value of 335.0 µg/l); surface chlorophyll-a= 36.7 µg/l (minimum of 11.0 µg/l, maximum of 130.0 µg/l); Secchi transparency= 0.9 m (minimum of 0.5 m, and maximum of 1.4 m); and TKN= 1.61 mg/l. The associated lake quality grades for the 2003 means (TP= F, CLA= C, and Secchi= D) translated to an overall water quality grade of D for the lake in 2003.

The lake's data reveal overall grades of D in 1982-1983, 1985, 1987-1988, 1990, 1997, 1999-2000 and 2003, and F in 1981, 1989, 1991, 1996, 1998, and 2001-2002.

A search through the STORET database for historic data on George Watch showed that the lake has been monitored several times in the past. There are nutrient data available for 1981-1983, 1985-1991, and 1996-2002. The lake's overall lake water quality grades seem to indicate that the lake water quality has remained fairly constant fluctuating between an F and D grade throughout the 20+ years of data. The TP and Secchi data has remained fairly consistent throughout the monitoring years, but the CLA seems to fluctuate greatly. A reason for the fluctuating CLA means while the Secchi and TP numbers remain fairly constant could be the amount of sedimentation that could at times be limiting the amount of light available for algal growth thus keeping CLA low and vice versa

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The summertime mean physical condition was 2.5 (between 2- "some algae present" and 3- "definite algae present"). The mean suitability for recreation ranking was 4.0 (4- "no swimming - boating ok").

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/.

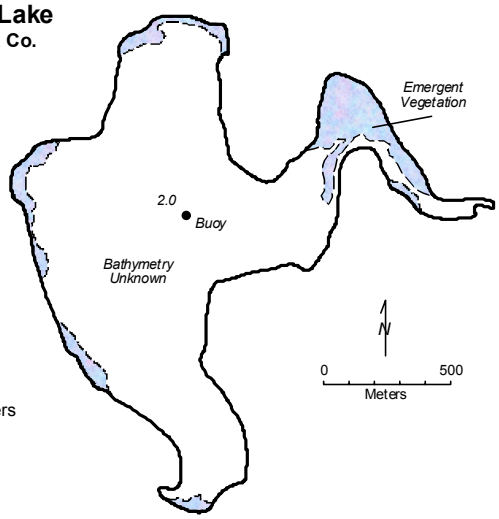
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# George Watch Lake

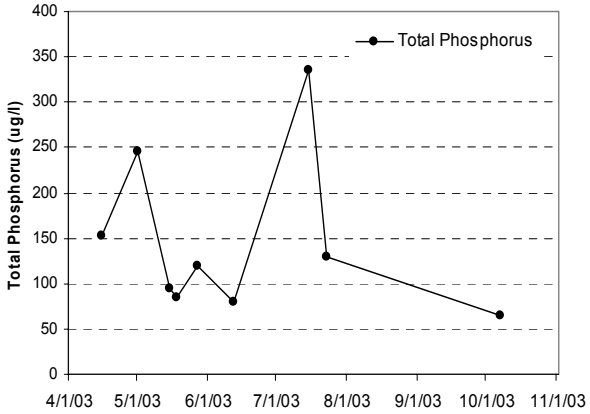
**Lino Lakes, Anoka Co.**

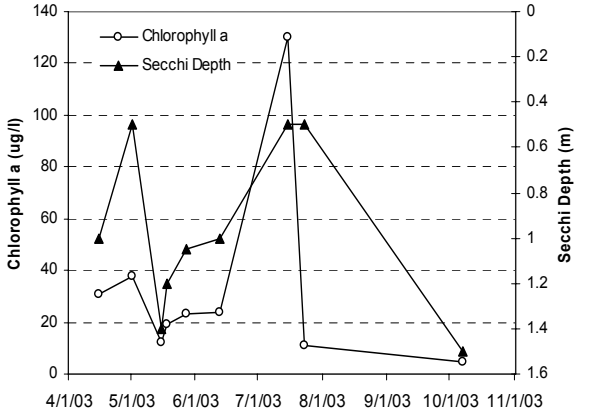
Lake ID: 20005
WD: Rice Creek

Volunteer:
Wargo Nature
Center



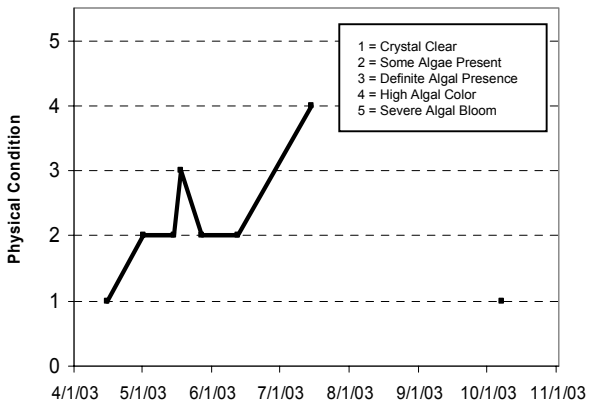

● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 13 | | | | 31 | 152 | | 1 | 1 | 4 |
| 05/01/03 | 15 | | | | 38 | 246 | | 0.5 | 2 | 4 |
| 05/15/03 | 22 | | | | 12 | 95 | | 1.4 | 2 | 4 |
| 05/18/03 | 23 | | | | 19 | 85 | | 1.2 | 3 | 4 |
| 05/27/03 | 22 | | | | 23 | 120 | | 1.05 | 2 | 4 |
| 06/12/03 | 22 | | | | 24 | 80 | | 1 | 2 | 4 |
| 07/15/03 | 26 | | | | 130 | 335 | | 0.5 | 4 | 4 |
| 07/23/03 | 30 | | | | 11 | 130 | | 0.5 | | |
| 10/07/03 | 18 | | | | 4.9 | 64 | | 1.5 | 1 | 2 |

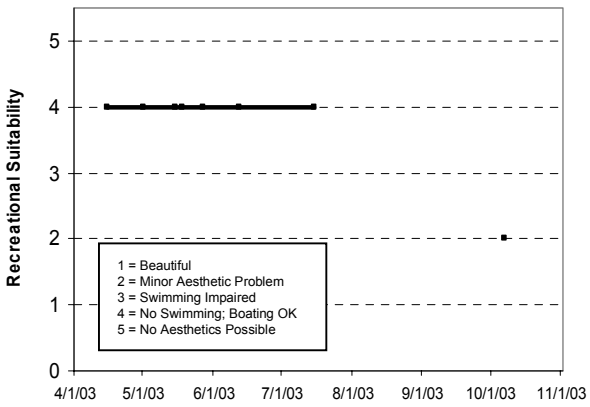



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | F | D | F | D | D | F | D | F |
| Chlorophyll a | | | | | D | C | D | C | C | F | D | C |
| Secchi Depth | | | | | F | F | F | D | F | D | F | D |
| **Overall** | | | | | **F** | **D** | **F** | **D** | **D** | **F** | **D** | **D** |

Source: Metropolitan Council and STORET data



## German Lake (82-0056) *Carnelian – Marine Watershed District*

German Lake is a 109-acre lake located in New Scandia Township (Washington County). There is very little known morphological data available for the lake.

This was the second year that German Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake provided no data, therefore 2002-2003 are the only years of available water quality data for the lake.

As part of the watershed's involvement in CAMP in 2003, the lake was monitored seven times between late-April and early-October. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The 2003 mean summertime (May through September) surface TP concentration was 26.2 µg/l (minimum of 18.0 µg/l, maximum of 34.0 µg/l). The mean CLA and Secchi transparency readings were 4.8 µg/l (minimum of 2.8 µg/l, maximum of 7.3.0 µg/l), and 2.3 m (minimum of 1.5 m, maximum of 2.7 m), respectively. The lake's mean surface TKN concentration was 0.60 mg/l (minimum of 0.47 mg/l and a maximum of 0.84 mg/l). The summertime means in 2003 resulted in a TP grade of B, CLA of A, and a Secchi transparency grade of B. The overall grade determined through the calculation of all three parameters was B (similar to 2002).

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 following page. The mean physical condition ranking was 1.6 (between 1- "crystal clear" and 2- "some algae present"), while the mean recreational suitability ranking was 2.0 (2- "minor aesthetic problems").

As mentioned earlier, there are no water quality data available for German Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

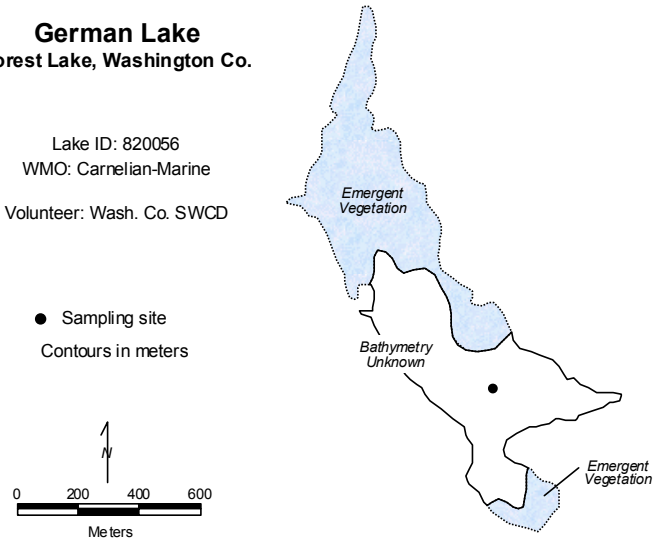
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

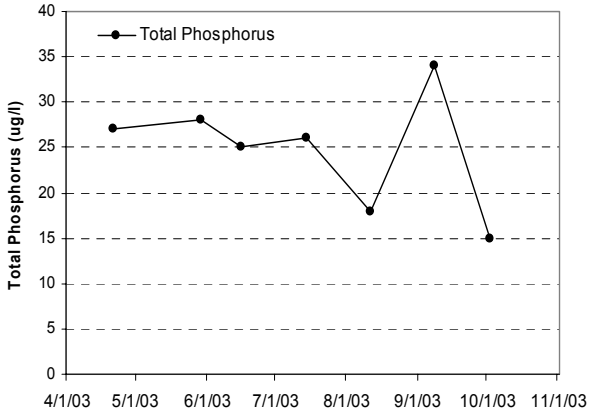
# German Lake

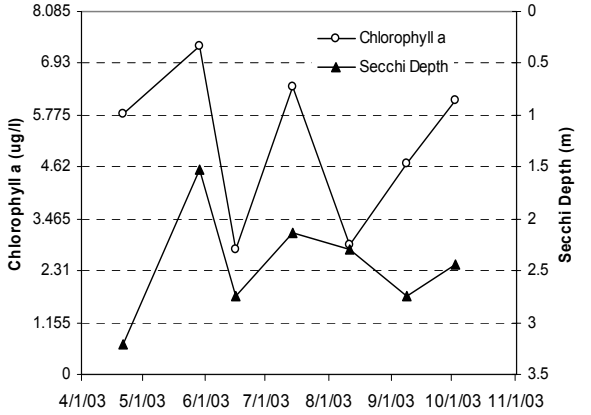
**Forest Lake, Washington Co.**

Lake ID: 820056
WMO: Carnelian-Marine

Volunteer: Wash. Co. SWCD

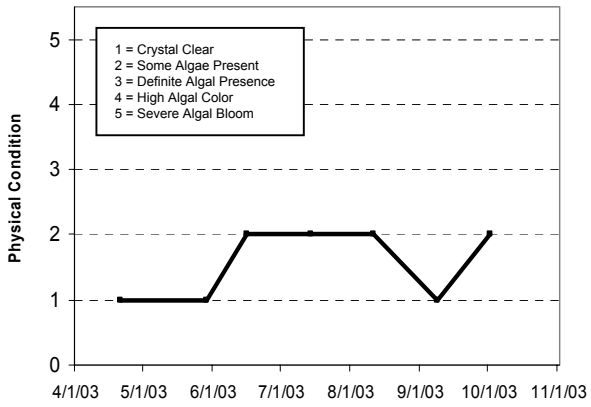



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 8.5 | | 7.36 | | 5.8 | 27 | | 3.203 | 1 | 1 |
| 05/29/03 | 20.4 | | 5.59 | | 7.3 | 28 | | 1.525 | 1 | 2 |
| 06/16/03 | 23.3 | | 7.7 | | 2.8 | 25 | | 2.745 | 2 | 2 |
| 07/14/03 | 23.8 | | 5.91 | | 6.4 | 26 | | 2.135 | 2 | 2 |
| 08/11/03 | 25.1 | | 7.6 | | 2.9 | 18 | | 2.288 | 2 | 2 |
| 09/08/03 | 23.9 | | 6.74 | | 4.7 | 34 | | 2.743 | 1 | 2 |
| 10/02/03 | 10.1 | | 11.29 | | 6.1 | 15 | | 2.438 | 2 | 3 |

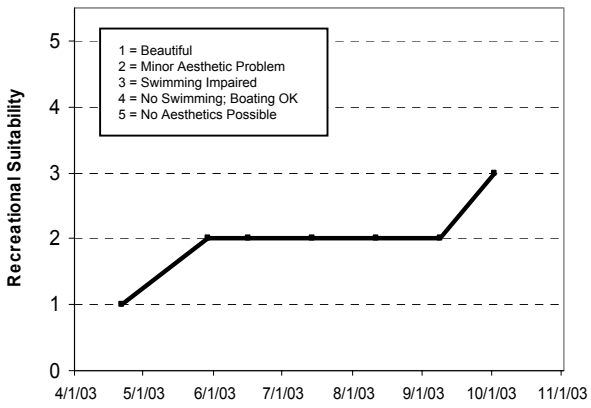



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | B | B |
| Chlorophyll a | | | | | | | | | | | A | A |
| Secchi Depth | | | | | | | | | | | C | B |
| **Overall** | | | | | | | | | | | **B** | **B** |

Source: Metropolitan Council and STORET data



## Goetschel Lake (82-0313) *Valley Branch Watershed District*

Goetschel Lake is located in Grant Township (Washington County). This was the second year that the 23-acre lake has been a part of CAMP. The lake's mean and maximum depth of 1.2 m (4 feet) and 4.2 m (14 feet) translates to an approximate volume of 92 ac-ft. Because of the shallowness of the lake, its entire surface area is considered littoral, that is, the 0-15 foot depth area of the lake dominated by aquatic vegetation. The lake has a 4,317-acre watershed that, when divided by the surface area of the lake results in a large watershed-to-lake size ratio of 188:1 (the larger the ratio the greater the potential stress on the lake from surface runoff).

A search through the STORET nationwide water quality database for data on the lake provided no data, therefore 2002-2003 are the only years of available water quality data for the lake.

As part of the watershed's involvement in CAMP in 2003, the lake was monitored nine times between late-April and early-September. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The 2003 mean summertime (May through September) surface TP concentration was 33.5 µg/l (minimum of 16.0 µg/l, maximum of 59.0 µg/l). The mean CLA and Secchi transparency readings were 5.3 µg/l (minimum of 1.3 µg/l, maximum of 23.0 µg/l), and 2.2 m (minimum of 1.0 m, maximum of 3.6 m), respectively. The lake's mean surface TKN concentration was 0.69 mg/l (minimum of 0.54 mg/l and a maximum of 0.93 mg/l). The summertime means in 2003 resulted in a TP grade of C, CLA of A, and a Secchi transparency grade of B. The overall grade determined through the calculation of all three parameters was B (similar to that of 2002).

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 following page. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 3.3 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

As mentioned earlier, there are no water quality data available for Goetschel Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

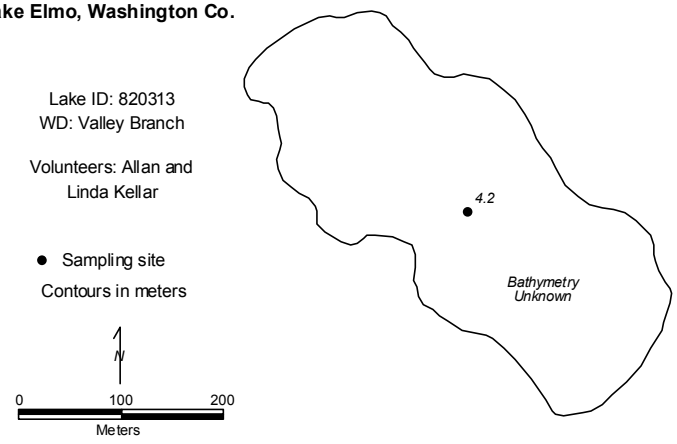
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

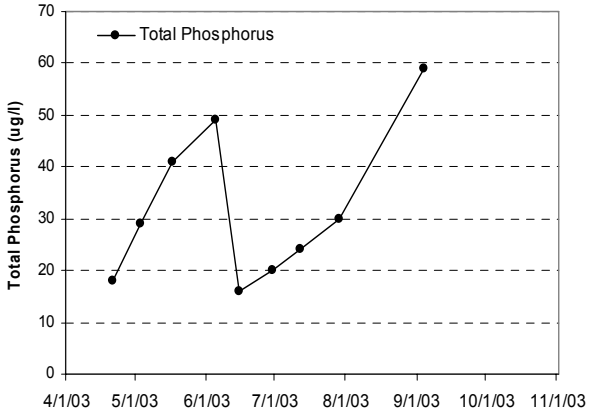
# Goetschel Pond

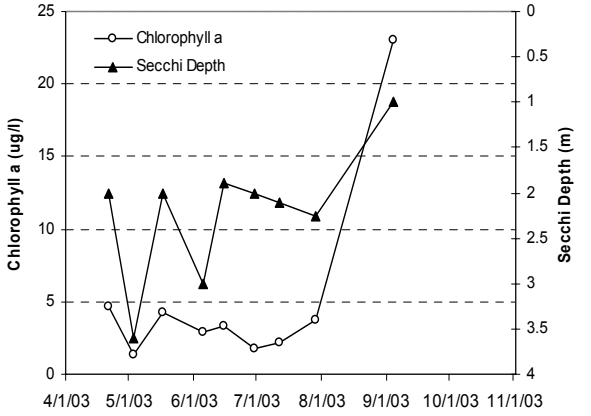
**Lake Elmo, Washington Co.**

Lake ID: 820313
WD: Valley Branch

Volunteers: Allan and Linda Kellar

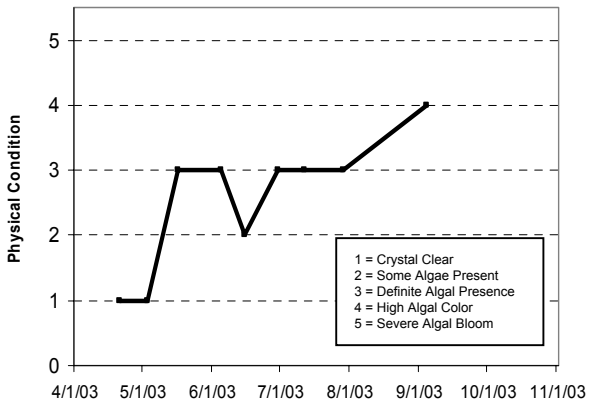



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 9.5 | | | | 4.7 | 18 | | 2 | 1 | 1 |
| 05/03/03 | 17.8 | | | | 1.3 | 29 | | 3.6 | 1 | 1 |
| 05/17/03 | 20.4 | | | | 4.3 | 41 | | 2 | 3 | 4 |
| 06/05/03 | 23.8 | | | | 2.9 | 49 | | 3 | 3 | 1 |
| 06/15/03 | 28 | | | | 3.3 | 16 | | 1.9 | 2 | 4 |
| 06/30/03 | 25 | | | | 1.8 | 20 | | 2 | 3 | 4 |
| 07/12/03 | | | | | 2.2 | 24 | | 2.1 | 3 | 4 |
| 07/29/03 | 27.4 | | | | 3.7 | 30 | | 2.25 | 3 | 4 |
| 09/04/03 | 21.3 | | | | 23 | 59 | | 1 | 4 | 4 |

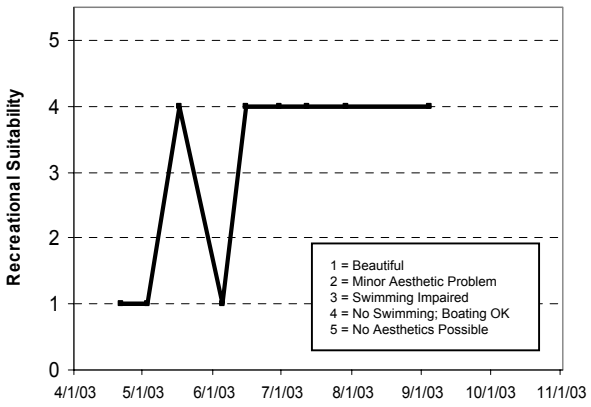



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | C | C |
| Chlorophyll a | | | | | | | | | | | A | A |
| Secchi Depth | | | | | | | | | | | C | B |
| **Overall** | | | | | | | | | | | **B** | **B** |

Source: Metropolitan Council and STORET data



## Goggins Lake (82-0077) *Browns Creek Watershed District*

Goggins Lake is an 11-acre lake located within May Township (Washington County). 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).

This was the fifth year that Goggins Lake has been involved in CAMP (1999 -2002 being the other CAMP years). Other than the CAMP data, a search through the STORET nationwide water quality database for historical water quality data for the lake came up empty. The lake was monitored 14 times between mid-April and mid-October, 2003. 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. The mean summertime (May through September) surface TP concentration was 67.1 µg/l (minimum of 26.0 µg/l, maximum of 109.0 µg/l). The mean CLA and Secchi transparency readings were 31.2 µg/l (minimum of 5.2 µg/l, maximum of 74.0 µg/l) and 1.3 m (minimum of 0.6 m, maximum of 3.1 m), respectively. The lake's mean surface TKN concentration was 1.42 mg/l (minimum of 0.84 mg/l, maximum of 1.90 mg/l).

The lake quality grades determined from each parameter's summertime mean are TP= C, CLA= C, and Secchi transparency= C, resulted in a 2003 overall grade of C. The 2003 overall grade is identical to that recorded 1999 and better that the C's recorded in 2000-2002. Results are presented on graphs and data tables on the following page.

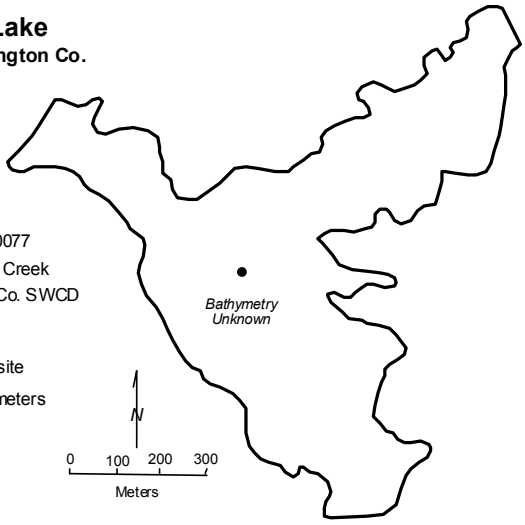
Because 2003 is just the fifth year that data are available for the lake, long- or short-term trends are not possible to determine. To better understand the lake's water quality and what direction it may be heading, more years of data collection are needed.

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 3.1 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 3.1 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

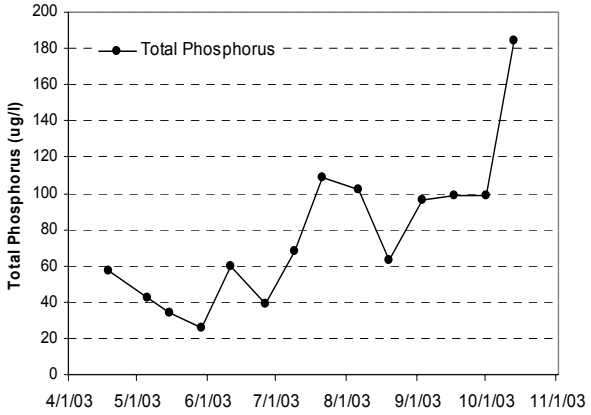
# Goggins Lake

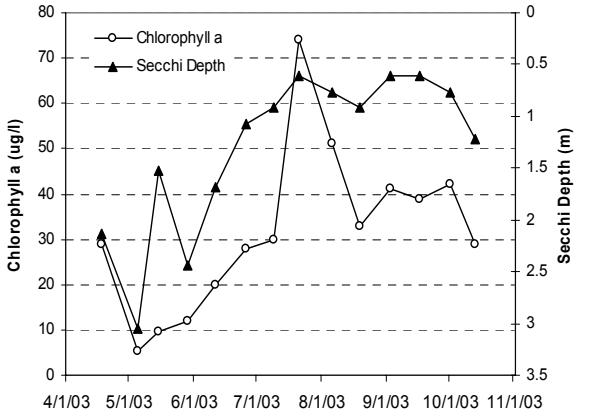
**May Twp., Washington Co.**




Lake ID: 820077
WMO: Browns Creek
Volunteer: Wash. Co. SWCD

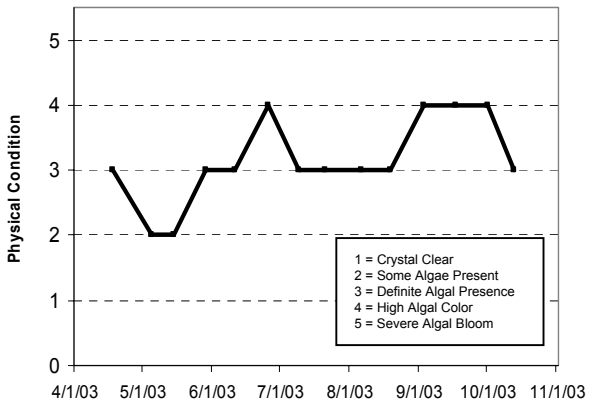
● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 8.9 | | 6.48 | | 29 | 57 | | 2.135 | 3 | 3 |
| 05/05/03 | 12.7 | | 7.55 | | 5.2 | 42 | | 3.05 | 2 | 2 |
| 05/15/03 | 17.4 | | 5.8 | | 9.5 | 34 | | 1.525 | 2 | 3 |
| 05/29/03 | 20 | | 5.7 | | 12 | 26 | | 2.44 | 3 | 3 |
| 06/11/03 | 19.1 | | 2.38 | | 20 | 60 | | 1.678 | 3 | 3 |
| 06/26/03 | 22.2 | | 7.78 | | 28 | 39 | | 1.068 | 4 | 4 |
| 07/09/03 | 24.5 | | 8.6 | | 30 | 68 | | 0.915 | 3 | 4 |
| 07/21/03 | 25.4 | | 6.98 | | 74 | 109 | | 0.61 | 3 | 3 |
| 08/06/03 | 24.9 | | 11.2 | | 51 | 102 | | 0.763 | 3 | 3 |
| 08/19/03 | 27.8 | | 10.3 | | 33 | 63 | | 0.915 | 3 | 3 |
| 09/03/03 | 21.9 | | 5.33 | | 41 | 96 | | 0.61 | 4 | 3 |
| 09/17/03 | 20.1 | | 6.96 | | 39 | 99 | | 0.61 | 4 | 3 |
| 10/01/03 | 11.2 | | 11.08 | | 42 | 99 | | 0.763 | 4 | 3 |
| 10/13/03 | 14.2 | | 10.37 | | 29 | 184 | | 1.219 | 3 | 3 |

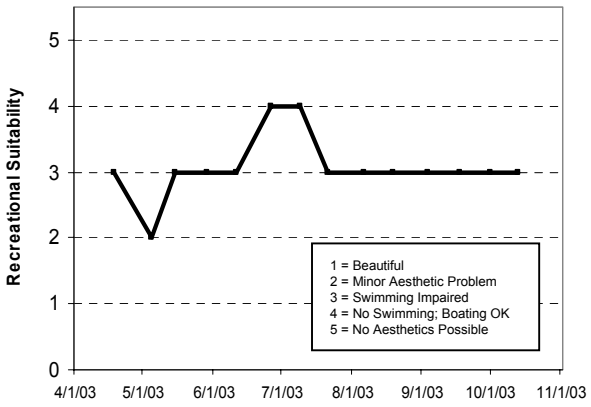



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | D | D | D | C |
| Chlorophyll a | | | | | | | | C | C | C | C | C |
| Secchi Depth | | | | | | | | C | D | D | D | C |
| **Overall** | | | | | | | | **C** | **D** | **D** | **D** | **C** |

Source: Metropolitan Council and STORET data



## Golden Lake (2-0045) *Rice Creek Watershed District*

Golden Lake, located in the City of Circle Pines (Anoka County), was monitored 11 times between mid-April and late-October, 2003. Public access to the 57-acre lake (1.5 miles in circumference) is possible for non-motorized boats through Golden Lake County Park. The mean and maximum depths of the lake are 2.5 m (8 feet) and 7.3 m (24 feet), respectively. The lake's size and mean depth results in an approximate lake volume of 460 ac-ft. Roughly 42 percent of the lake is considered littoral zone, that is, an area of aquatic plant dominance.

The lake's 7,680-acre watershed translates to a large watershed-to-lake size ratio of 135:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

On each sampling date, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as perceived physical condition and recreational suitability. The 2003 mean summertime (May through September) surface TP concentration for the lake was 85.0 µg/l (minimum of 32.0 µg/l, maximum of 134.0 µg/l). The mean CLA and Secchi transparency readings were 38.4 µg/l (minimum of 19.0 µg/l, maximum of 95.0 µg/l), and 1.1 m (minimum of 0.6 m, maximum of 1.6 m), respectively. The lake's mean surface TKN concentration was 2.48 mg/l (minimum of 1.60 mg/l, maximum of 3.20 mg/l). The lake's 2002 summertime means resulted in a TP grade of D, CLA grade of C, and Secchi transparency grade of D. The 2003 overall grade calculated from all three parameters is D.

The physical and recreational conditions of Golden Lake as perceived by the volunteer(s) were ranked on a 1-to-5 scale. These rankings are shown on the lake's information sheet on the next page. The summertime mean physical condition was 1.9 (between 1- " crystal clear" and 2- "some algae present"). The mean suitability for recreation ranking, was 1.5 (between 1- "beautiful" and 2- "minor aesthetic problem").

Golden Lake has a fairly extensive water quality database with Secchi and nutrient data for 1980-1981, 1984-1991, and 1993-2002. Because the lake's water quality grade has fluctuated between C, D, and F (a C in 1985-1987, 1996, and 1998-2000, D in 1980-1981, 1993, 1997 and 2001-2003, and an F in 1988-1991) throughout these 20+ years of monitoring data, no long-trends can be determined. It seems that the lake has a very wide fluctuation range in its water quality. In order to detect any possible long-term trends, more years of data collection are needed.

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/.

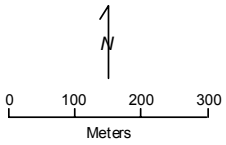
If you recognize any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

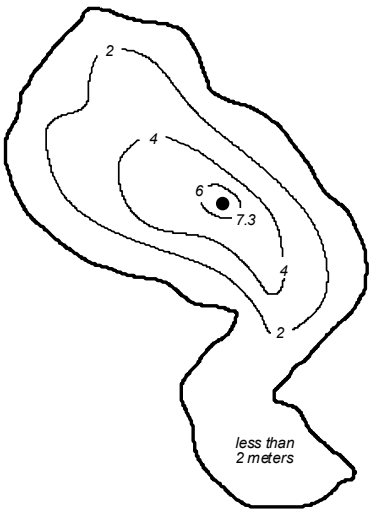
# Golden Lake

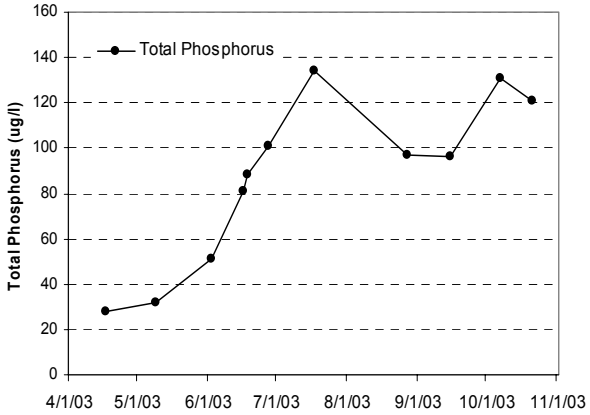
**Circle Pines, Anoka Co.**

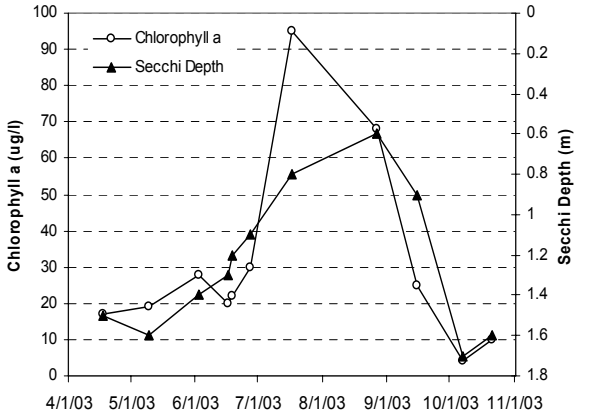
Lake ID: 20045
WD: Rice Creek
Volunteer: City of Circle Pines

● Sampling site
Contours in meters



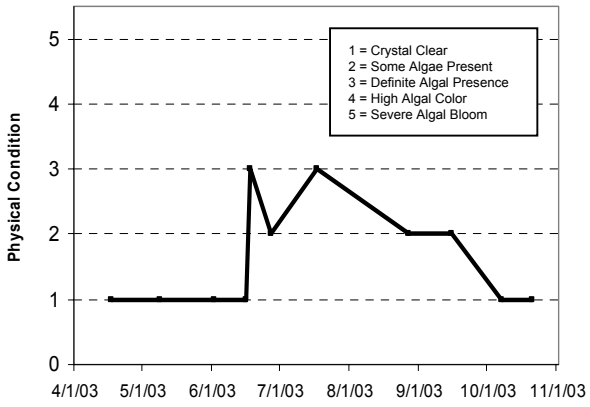




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/17/03 | 9.5 | | | | 17 | 28 | | 1.5 | 1 | 1 |
| 05/09/03 | 14 | | | | 19 | 32 | | 1.6 | 1 | 1 |
| 06/02/03 | 18.5 | | | | 28 | 51 | | 1.4 | 1 | 1 |
| 06/16/03 | 24.6 | | | | 20 | 81 | | 1.3 | 1 | 1 |
| 06/18/03 | 23.2 | | | | 22 | 88 | | 1.2 | 3 | 3 |
| 06/27/03 | 20.7 | | | | 30 | 101 | | 1.1 | 2 | 1 |
| 07/17/03 | 25.2 | | | | 95 | 134 | | 0.8 | 3 | 2 |
| 08/27/03 | 24.6 | | | | 68 | 97 | | 0.6 | 2 | 2 |
| 09/15/03 | 21.3 | | | | 25 | 96 | | 0.9 | 2 | 1 |
| 10/07/03 | 12.9 | | | | 4.1 | 131 | | 1.7 | 1 | 1 |
| 10/21/03 | 13.4 | | | | 10 | 121 | | 1.6 | 1 | 1 |

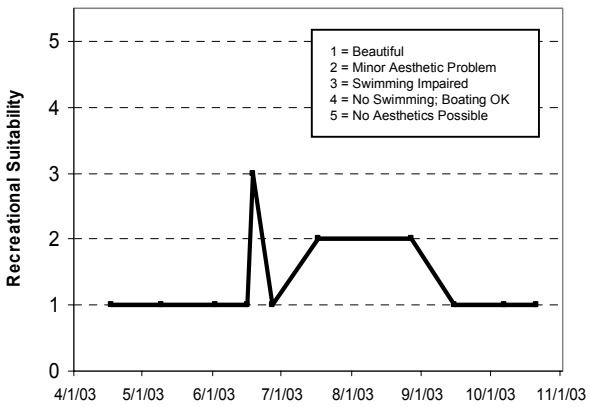



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | D | | | C | D | C | C | C | D | D | D |
| Chlorophyll a | | D | | | C | C | C | C | C | D | D | C |
| Secchi Depth | | D | | | D | D | D | D | C | D | D | D |
| **Overall** | | **D** | | | **C** | **D** | **C** | **C** | **C** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Goose Lake [Waconia] (10-0089) *Carver County Environmental Services*

Goose Lake, located in Waconia Township in Carver County, was monitored 14 times between mid-April and mid-October, 2003. The lake has been involved in CAMP since 1995. Because the maximum depth of the 407-acre lake is only 3.0 m (10 feet), the entire lake area is considered littoral zone (the 0-15 foot depth area of the lake dominated by aquatic vegetation). Additionally, because of the lake's shallowness it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column). The lake's mean depth of 1.5 m (roughly 5 feet) and its surface area translate to an approximate lake volume of 2,035 ac-ft.

The lake has a 1,100-acre immediate watershed, which translates to a watershed-to-lake area ratio of 27:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: four percent residential, 61.0 percent agricultural, and 35.0 percent open/undeveloped (Carver County Planning 1999).

On each sampling date, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The mean summertime (May through September) surface TP concentration for the lake was 170.2 µg/l (minimum of 127.0 µg/l, maximum of 213.0 µg/l). The mean CLA and Secchi transparency readings were 88.3 µg/l (minimum of 23.0 µg/l, maximum of 220.0 µg/l), and 0.4 m (minimum of 0.2 m, maximum of 0.8 m), respectively. The lake's mean surface TKN concentration was 2.64 mg/l (minimum of 1.80 mg/l, maximum of 4.00 mg/l). The summertime means resulted in a TP grade of F, CLA grade of F, and Secchi transparency grade of F. An overall grade of F was calculated from the grades of all three parameters.

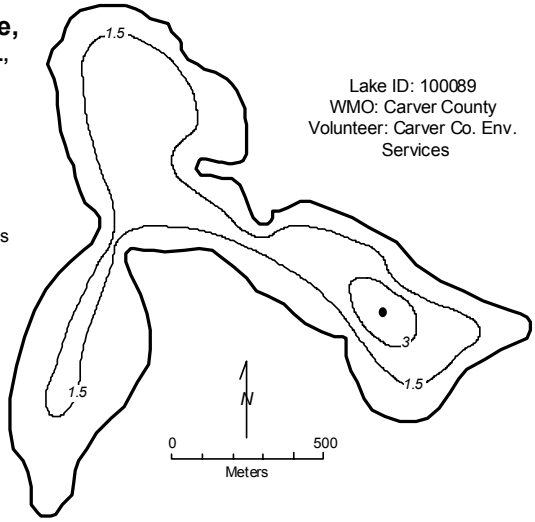
The physical and recreational conditions of Goose Lake as perceived by the volunteer were ranked on a 1-to-5 scale. These rankings are shown on the lake's information sheet on the next page. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.5, (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

Because of the variability among the nine years of data (grades ranging from C to F), no long-term trends can be determined. In the short-term however, the lake flucuates greatly, with an overall grade of C in 1996 and 1998, D in 1995, 1999, and 2001-2002, and an overall grade of F in 1997, 2000 and 2003. To better understand the lake's current water quality condition, and to help detect any possible long-term trends, more years of data collection are needed.

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 know of 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.

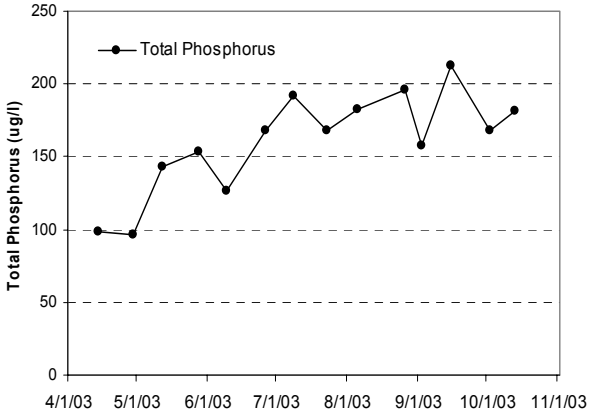
## Goose Lake,
**Waconia Twp.,**
**Carver Co.**

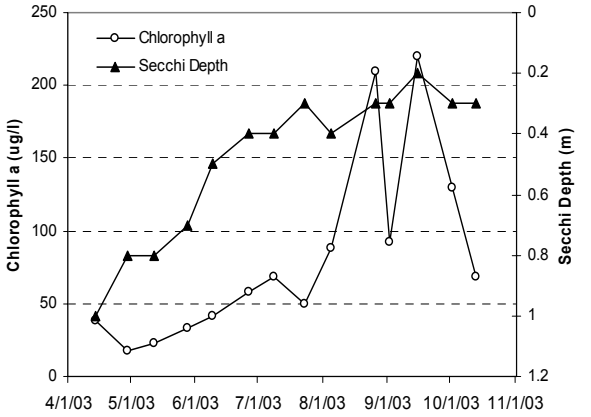



Lake ID: 100089
WMO: Carver County
Volunteer: Carver Co. Env. Services

- Sampling site

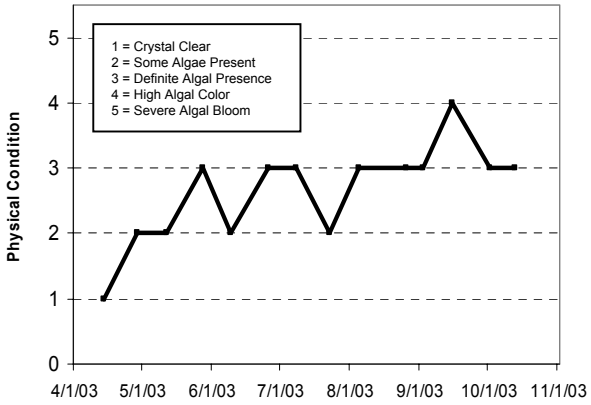
Contours in meters




### 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/14/03 | 11.7 | | 11.16 | | 38 | 99 | | 1 | 1 | 1 |
| 04/29/03 | 14.3 | | 11.01 | | 18 | 96 | | 0.8 | 2 | 2 |
| 05/12/03 | 13 | | 9.44 | | 23 | 143 | | 0.8 | 2 | 1 |
| 05/28/03 | 20.1 | | 12.9 | | 33 | 154 | | 0.7 | 3 | 2 |
| 06/09/03 | 21.7 | | 10.09 | | 41 | 127 | | 0.5 | 2 | 3 |
| 06/26/03 | 23.6 | | 7.38 | | 58 | 168 | | 0.4 | 3 | 2 |
| 07/08/03 | 24.7 | | 5.09 | | 68 | 192 | | 0.4 | 3 | 3 |
| 07/23/03 | 24.5 | | 9.07 | | 50 | 168 | | 0.3 | 2 | 2 |
| 08/05/03 | 24.7 | | | | 88 | 183 | | 0.4 | 3 | 3 |
| 08/26/03 | 26.2 | | | | 210 | 196 | | 0.3 | 3 | 3 |
| 09/02/03 | 25.5 | | 8.44 | | 92 | 158 | | 0.3 | 3 | 3 |
| 09/15/03 | 19.4 | | 6.69 | | 220 | 213 | | 0.2 | 4 | 3 |
| 10/02/03 | 9.6 | | 12.02 | | 130 | 168 | | 0.3 | 3 | 3 |
| 10/13/03 | 14.4 | | 8.55 | | 68 | 182 | | 0.3 | 3 | 3 |

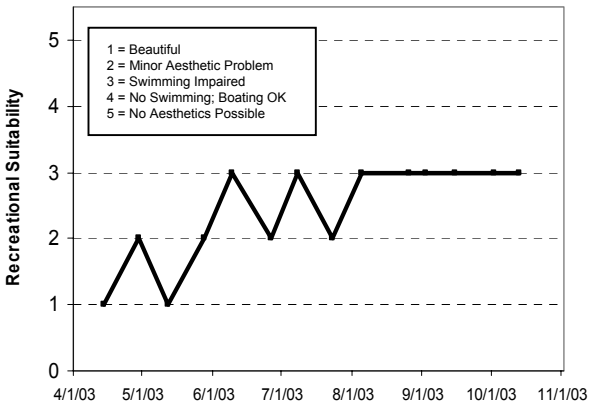



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | D | C | F | D | D | F | D | D | F |
| Chlorophyll a | | | | C | C | D | C | D | F | C | C | F |
| Secchi Depth | | | | F | C | F | C | F | F | D | F | F |
| **Overall** | | | | **D** | **C** | **F** | **C** | **D** | **F** | **D** | **D** | **F** |

Source: Metropolitan Council and STORET data



## Grace Lake (10-0218) *Carver County Environmental Services*

Grace Lake is a 22-acre lake located near the City of Chaska (Washington County). The lake has a maximum depth of 6.7 m (22 feet). Roughly 79 percent of the lake's surface 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).

This was the second year that Grace Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake provided no data, therefore 2002-2003 are the only years of available water quality data for the lake.

As part of the county's involvement in CAMP in 2003, the lake was monitored 14 times between mid-April and mid-October. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The 2003 mean summertime (May through September) surface TP concentration was 116.2 µg/l (minimum of 66.0 µg/l, maximum of 261.0 µg/l). The mean CLA and Secchi transparency readings were 23.3 µg/l (minimum of 1.9 µg/l, maximum of 68.0 µg/l), and 1.1 m (minimum of 0.5 m, maximum of 2.1 m), respectively. The lake's mean surface TKN concentration was 1.47 mg/l (minimum of 0.99 mg/l and a maximum of 2.00 mg/l). The summertime means in 2002 resulted in a TP grade of D, CLA of C, and a Secchi transparency grade of D. The overall grade determined through the calculation of all three parameters was D (Identical to that recorded in 2002).

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 following page. The mean physical condition ranking was 2.9 (between 2- "some algae present" and 3- "high algal color"), while the mean recreational suitability ranking was 2.7 (between 2- "minor aesthetic problems" and 3- "swimming slightly impaired").

As mentioned earlier, there are no water quality data available for Grace Lake other than the limited 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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/.

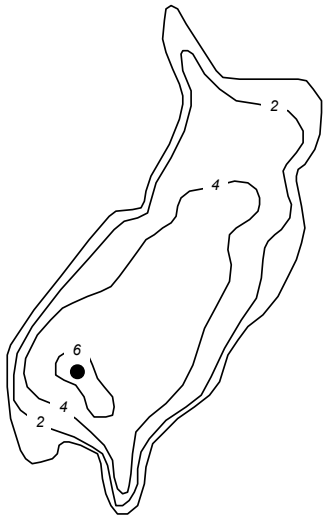
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

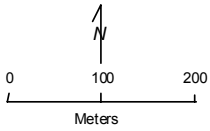
# Grace Lake

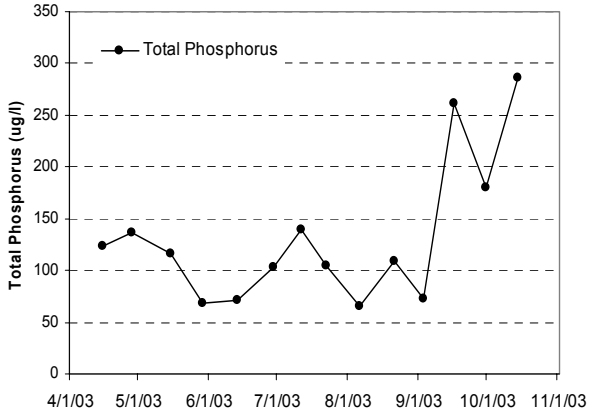
**Chaska, Carver Co.**

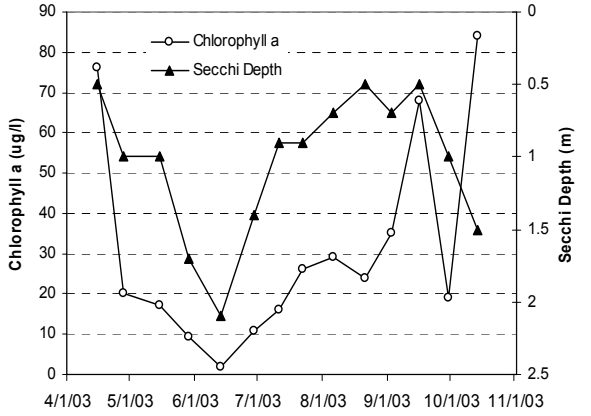
LAKE ID: 100218
WMO: Carver County
Volunteer: Carver Co. Env. Services

● Sampling station
Contours in meters



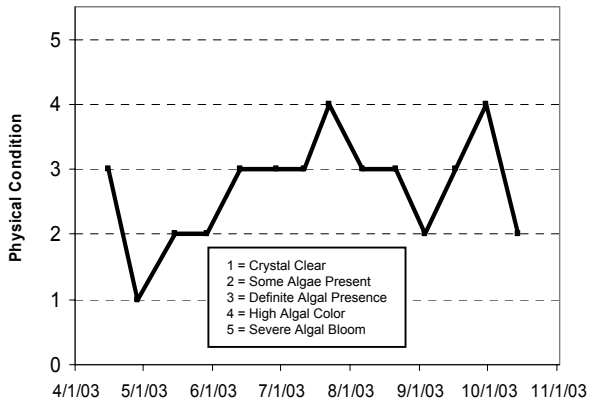




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 13.1 | | 17.83 | | 76 | 123 | | 0.5 | 3 | 3 |
| 04/28/03 | 16.4 | | 11.12 | | 20 | 137 | | 1 | 1 | 1 |
| 05/15/03 | 16.9 | | 9.5 | | 17 | 116 | | 1 | 2 | 2 |
| 05/29/03 | 20.7 | | 9.89 | | 9.5 | 68 | | 1.7 | 2 | 1 |
| 06/13/03 | 21.5 | | 7.12 | | 1.9 | 71 | | 2.1 | 3 | 2 |
| 06/29/03 | 26 | | | | 11 | 103.5 | | 1.4 | 3 | 3 |
| 07/11/03 | 23.5 | | 5.49 | | 16 | 139 | | 0.9 | 3 | 3 |
| 07/22/03 | 24 | | 8.46 | | 26 | 104 | | 0.9 | 4 | 4 |
| 08/06/03 | 24.5 | | 9.21 | | 29 | 66 | | 0.7 | 3 | 3 |
| 08/21/03 | 26.7 | | | | 24 | 109 | | 0.5 | 3 | 3 |
| 09/03/03 | 22.2 | | 7.7 | | 35 | 73 | | 0.7 | 2 | 3 |
| 09/16/03 | 21.4 | | 6.81 | | 68 | 261 | | 0.5 | 3 | 3 |
| 09/30/03 | 13.5 | | | | 19 | 180 | | 1 | 4 | 3 |
| 10/14/03 | 14.5 | | 7.55 | | 84 | 286 | | 1.5 | 2 | 2 |

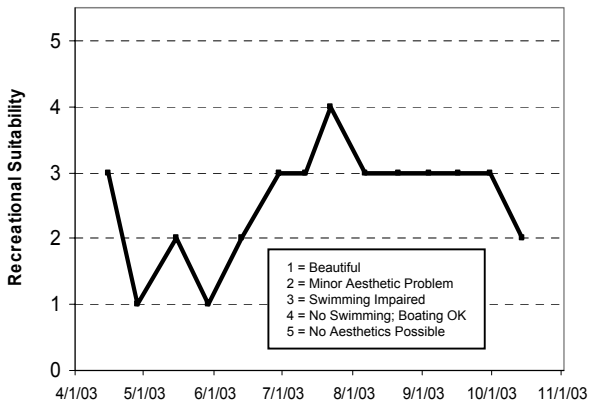



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | F | D |
| Chlorophyll a | | | | | | | | | | | C | C |
| Secchi Depth | | | | | | | | | | | D | D |
| **Overall** | | | | | | | | | | | **D** | **D** |

Source: Metropolitan Council and STORET data



## Half Breed Lake [Sylvan] (82-0080) *Comfort Lake-Forest Lake Watershed District*

Half Breed Lake (also known as Sylvan Lake) is located in Forest Lake Township (Washington County). The lake, which has been a part of CAMP in six out of the programs nine years, has a surface area of 75 acres. The lake's mean and maximum depth of 1.7 m (5.6 feet) and 10.3 m (34 feet) translates to an approximate volume of 420 ac-ft. Roughly 67 percent of the lake's surface area is considered littoral, that is, the area dominated by aquatic vegetation. The lake has a 303-acre watershed which, when divided by the surface area of the lake results in a rather small watershed-to-lake size ratio of 4:1 (the larger the ratio the greater the potential stress on the lake from surface runoff). The lake has no inlets and no public access to the lake.

Half Breed Lake was monitored 14 times from mid-April to mid-October, 2003. The collected data and resulting graphs showing the seasonal variability in TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

Similar to prior years, the lake's data and graphs reveal that the water quality of Half Breed Lake rates in the top 10 percent of lakes again in the area in 2003. The 2003 summertime (May through September) mean concentrations were as follows; TP= 15.5 µg/l (minimum of 11.0 µg/l and a maximum of 22.0 µg/l), CLA= 3.3 µg/l (minimum of 1.5 µg/l and maximum of 5.1 µg/l), Secchi transparency= 4.7 m (minimum of 3.4 m and maximum of 6.1 m), and TKN= 0.52 mg/l (minimum and maximum of 0.38 and 0.77 mg/l, respectively). The summertime means resulted in grades of A for TP, CLA, Secchi transparency. The individual grades translate to an overall water quality grade of A.

The lake's 2003 overall grade is identical to those recorded in 1987-1989, 1991, 1993, 1996, and 1998-2002, and better than the overall grade of B recorded in 1986. The lake's best recorded water quality was in 1993 with a summer mean TP of 10.0 µg/l, CLA mean of 3.8 µg/l, and Secchi mean of 4.7 m. Historic water quality data and resulting lake quality grades indicate that the lake has maintained its high quality over the past 20+ years. Additionally, the MPCA recently conducted a trend analysis on the lake's Secchi transparency data, which revealed a statistically significant improvement in recent water clarity.

Throughout the monitoring period, the volunteer's opinion of the lake's physica.l and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The mean physical condition ranking was 1.5 (between 1- "crystal clear" and 2- "some algae present"), while the mean recreational suitability ranking was 1.6 (between 1- "beautiful" and 2- "minor aesthetic problem").

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 know of 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.stat.mn.us.

# Half Breed Lake

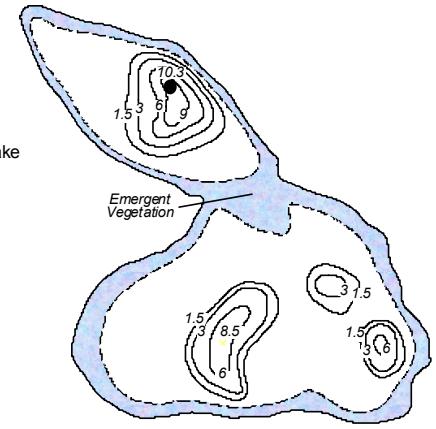
***(Sylvan Lake)***

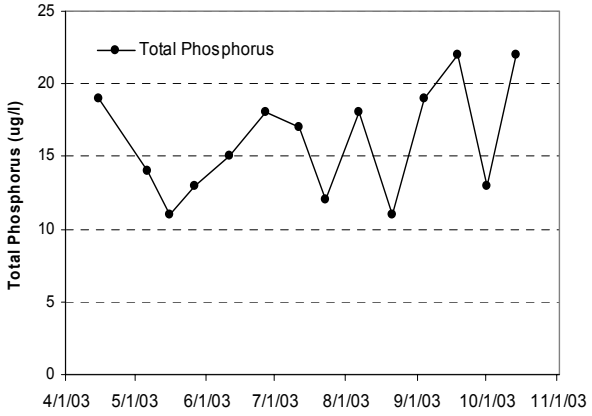
**Forest Lake Twp./ New Scandia Twp., Washington Co.**

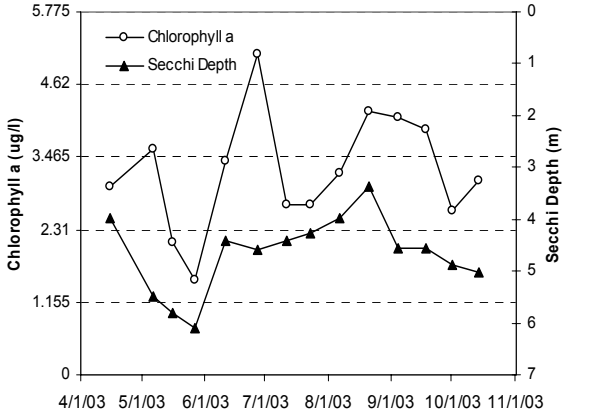
LAKE ID: 820080
WMO: Comfort Lake - Forest Lake
Volunteer: Washington Co. SWCD

● Sampling station

Contours in meters

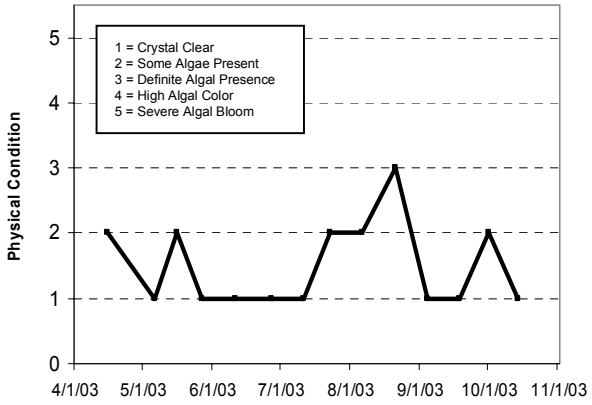



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 13.9 | | 8.05 | | 3 | 19 | | 3.965 | 2 | 2 |
| 05/06/03 | 13.2 | | 7.05 | | 3.6 | 14 | | 5.49 | 1 | 1 |
| 05/16/03 | 16.7 | | 5.84 | | 2.1 | 11 | | 5.795 | 2 | 2 |
| 05/27/03 | 20.6 | | 5.54 | | 1.5 | 13 | | 6.1 | 1 | 1 |
| 06/11/03 | 19.7 | | | | 3.4 | 15 | | 4.423 | 1 | 1 |
| 06/27/03 | 20.7 | | 7.3 | | 5.1 | 18 | | 4.575 | 1 | 1 |
| 07/11/03 | 22.5 | | 5.72 | | 2.7 | 17 | | 4.423 | 1 | 1 |
| 07/23/03 | 23.1 | | 4.7 | | 2.7 | 12 | | 4.27 | 2 | 3 |
| 08/06/03 | 24.4 | | 6.8 | | 3.2 | 18 | | 3.965 | 2 | 3 |
| 08/21/03 | 26.5 | | 5.4 | | 4.2 | 11 | | 3.355 | 3 | 3 |
| 09/04/03 | 22.9 | | 5.76 | | 4.1 | 19 | | 4.572 | 1 | 1 |
| 09/18/03 | 20 | | 7.05 | | 3.9 | 22 | | 4.572 | 1 | 1 |
| 10/01/03 | 11.4 | | 9.64 | | 2.6 | 13 | | 4.877 | 2 | 1 |
| 10/14/03 | 13.8 | | 9.28 | | 3.1 | 22 | | 5.029 | 1 | 1 |

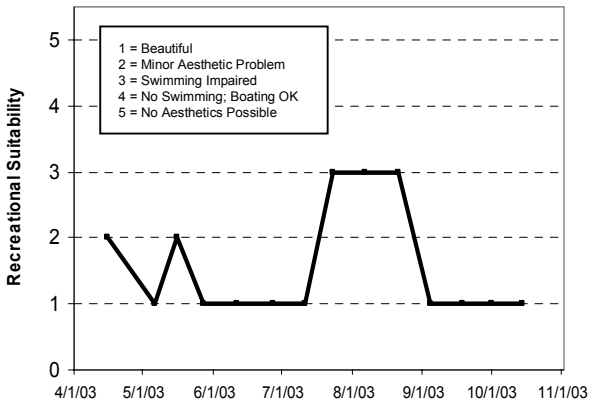



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | A | | | A | | A | A | A | A | A | A |
| Chlorophyll a | | A | | | A | | A | A | A | A | A | A |
| Secchi Depth | A | A | | | A | | A | A | A | A | A | A |
| **Overall** | | **A** | | | **A** | | **A** | **A** | **A** | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Hay Lake (82-0065) *Marine on St. Croix Watershed Management Organization*

This was the fiftth year of CAMP monitoring on Hay Lake, located in New Scandia Township (Washington County). The lake was monitored seven times between mid-April and early-October, 2003. The only known morphological data available for the 33-acre lake is its maximum depth (6.1 m [20 feet]). Other than the 1998-2001 CAMP data for the lake, a search for historical water quality data and any physical information came up empty.

During each monitoring event, 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 on graphs and data tables on the following page.

The lake's overall 2003 lake quality grade of C was better than those recorded in 1998-2001 (D). The summertime (May through September) mean TP concentration of 83.3 µg/l (minimum of 52.0 µg/l, maximum of 152.0 µg/l) corresponds to a lake water quality grade of D. The lake's mean CLA concentration of 33.0 µg/l (minimum of 12.0 µg/l and maximum of 53.0 µg/l) resulted in a grade of C, as did the mean Secchi transparency of 1.4 m (minimum of 1.4 m, maximum of 1.5 m). The mean TKN concentration over the same time period was 1.30 mg/l (minimum of 1.10 mg/l and maximum of 1.70 mg/l). The lake's 2003 overall grade, and individual lake means were the best recorded through CAMP to date.

Because 2003 is only the fifth year of available data, no long- or short-term trends can be determined. On the short-term however, the lake seems well represented with an overall water quality grade of D/C. To better understand the quality of the lake and what direction it may be heading, more years of data collection are needed.

Throughout the monitoring period, the volunteer(s) ranked the perceived physical condition of the lake on a 1-to-5 scale. The mean perceived physical condition of Hay Lake was 2.4 (between 2- "some algae present" and 3- "definite algal presence"), while the mean recreational suitability was 2.8 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

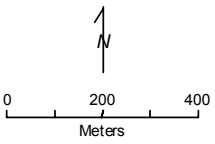
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

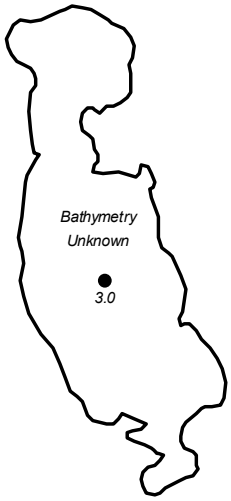
# Hay Lake

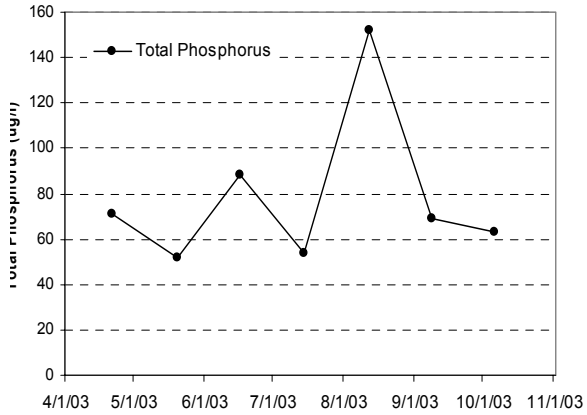
**New Scandia Twp.,**
**Washington Co.**

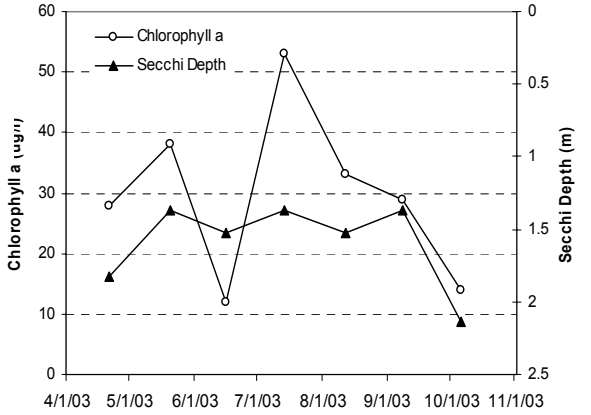
LAKE ID: 820065
WMO: Marine-on-St. Croix
Volunteer: Washington Co. SWCD

● Sampling site
Contours in meters



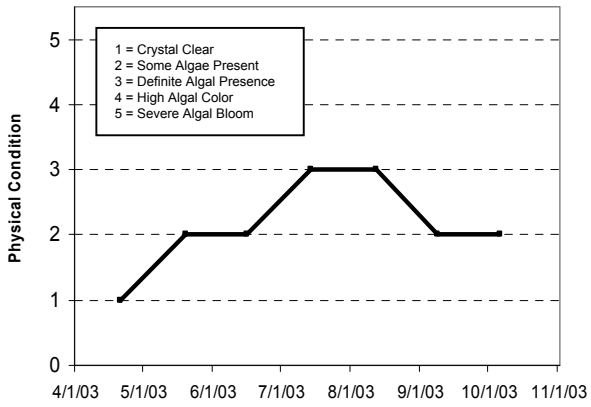




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 8.8 | | 7.53 | | 28 | 71 | | 1.83 | 1 | 1 |
| 05/20/03 | 16.6 | | 4.8 | | 38 | 52 | | 1.37 | 2 | 2 |
| 06/16/03 | 24.2 | | 6.34 | | 12 | 88 | | 1.525 | 2 | 2 |
| 07/14/03 | 23.7 | | 8.77 | | 53 | 54 | | 1.373 | 3 | 4 |
| 08/12/03 | 25 | | 5.8 | | 33 | 152 | | 1.525 | 3 | 3 |
| 09/08/03 | 22.9 | | 7.34 | | 29 | 69 | | 1.372 | 2 | 3 |
| 10/06/03 | 10.9 | | 9.27 | | 14 | 63 | | 2.134 | 2 | 2 |

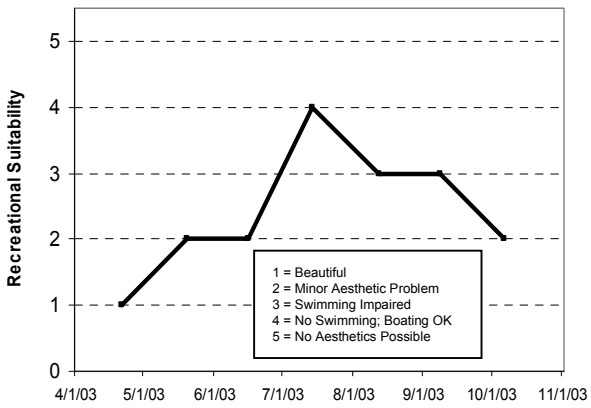



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | D | D | D | D | | D |
| Chlorophyll a | | | | | | | F | F | F | F | | C |
| Secchi Depth | | | | | | | D | D | D | D | | C |
| **Overall** | | | | | | | **D** | **D** | **D** | **D** | | **C** |

Source: Metropolitan Council and STORET data



## Highland Lake (2-0079) *Anoka County Parks*

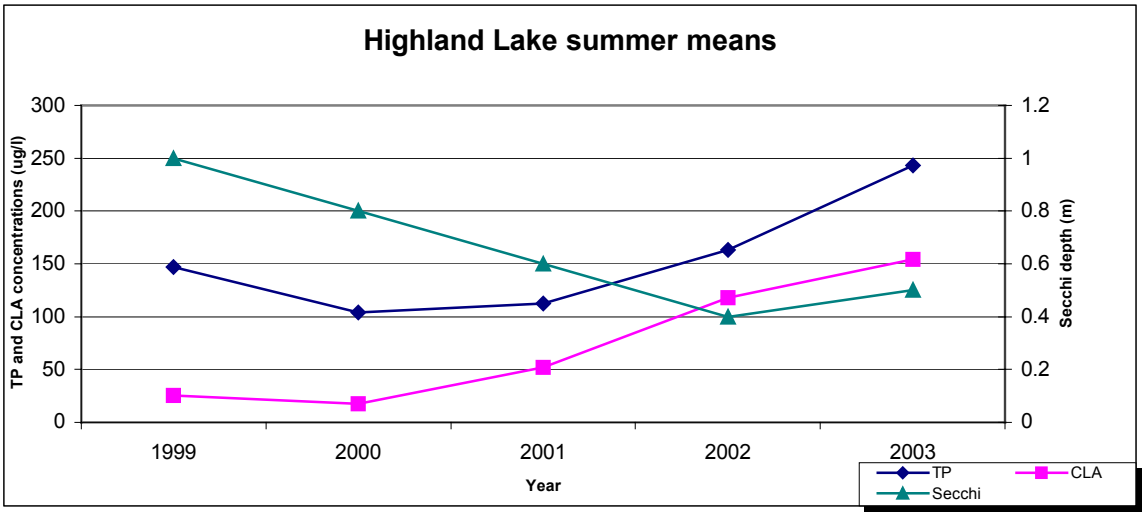
Highland Lake is a 22-acre lake located within the City of Columbia Heights (Anoka County). The maximum depth of the lake is approximately only 1.0 m (roughly 3 feet). Because of the shallowness of the lake, the entire area is considered littoral zone (area of aquatic plant dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

This was the fifth year that Highland Lake has been involved in CAMP (the lake was initially enrolled in 1999). Other than the past CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty.

The lake was monitored 12 times between mid-April and mid-October, 2003. During each monitoring event, 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 on graphs and data tables on the following page.

The lake's overall 2003 lake quality grade of F was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 243.1 µg/l (minimum of 117.0 µg/l, maximum of 356.0 µg/l) corresponds to a lake water quality grade of F, as did the mean mean CLA concentration of 154.0 µg/l (minimum of 59.0 µg/l and maximum of 300.0 µg/l). The lake's Secchi transparency of 0.5 m (minimum of 0.2 m, maximum of 0.9 m) also resulted in a grade of F. The mean TKN concentration over the same time period was 2.50 mg/l (minimum of 1.30 mg/l and maximum of 3.70 mg/l). The lake's 2003 water quality was again quite a bit worse than that of the previous year (2002), which in turn was worse than that of 1999-2001.

As mentioned earlier, there are no water quality data available for Highland Lake other than the 1999-2003 CAMP data. Therefore it is not possible to determine any long-term trends. In the short-term, however, the lake's water quality seems to be degrading. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.



The graph clearly depicts the lakes recent degradation. The reason for the degradation in the lake's water quality is not entirely known. A more in-depth study combining watershed as well as in-lake monitoring may help determine the areas contributing the most to the lake's degradation.

The last two graphs on the information sheet show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, was 2.6 for physical condition (between 2- "some algae present" and 3- "definite algae present"). There were no data collected for the lake's recreational suitability in 2003.

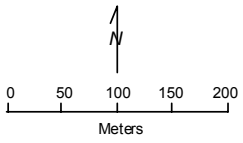
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

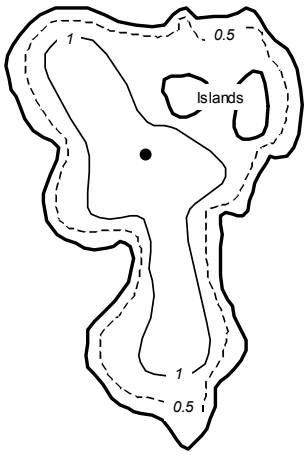
# Highland Lake

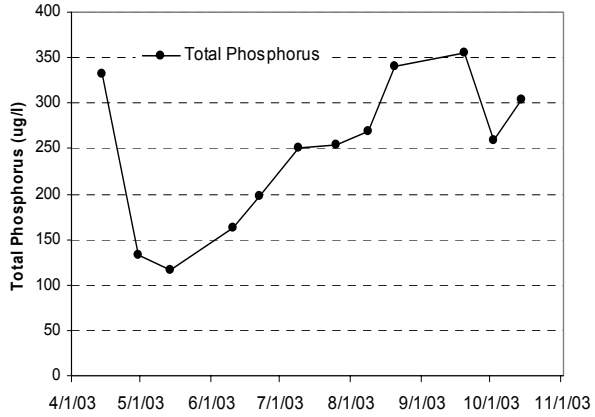
**Columbia Heights, Anoka Co.**

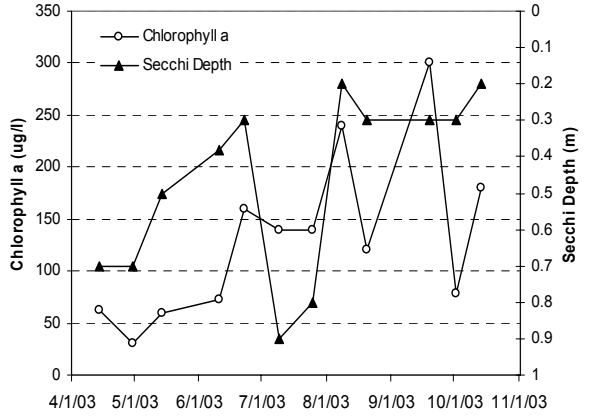
Lake ID: 20079
WMO: Six Cities
Volunteer: Anoka Co. Parks

● Sampling site
Contours in meters



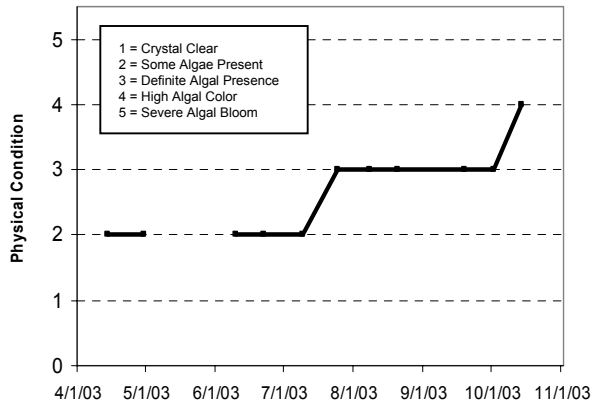




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 17 | | | | 63 | 332 | | 0.7 | 2 | |
| 04/30/03 | 14 | | | | 30 | 133 | | 0.7 | 2 | |
| 05/14/03 | 15 | | | | 59 | 117 | | 0.5 | | |
| 06/10/03 | 18 | | | | 73 | 162 | | 0.38 | 2 | |
| 06/22/03 | 22 | | | | 160 | 197 | | 0.3 | 2 | |
| 07/09/03 | 21 | | | | 140 | 250 | | 0.9 | 2 | |
| 07/25/03 | 22.5 | | | | 140 | 254 | | 0.8 | 3 | |
| 08/08/03 | 24 | | | | 240 | 269 | | 0.2 | 3 | |
| 08/20/03 | 27 | | | | 120 | 340 | | 0.3 | 3 | |
| 09/19/03 | 14 | | | | 300 | 356 | | 0.3 | 3 | |
| 10/02/03 | 6 | | | | 78 | 259 | | 0.3 | 3 | |
| 10/14/03 | 12 | | | | 180 | 304 | | 0.2 | 4 | 5 |

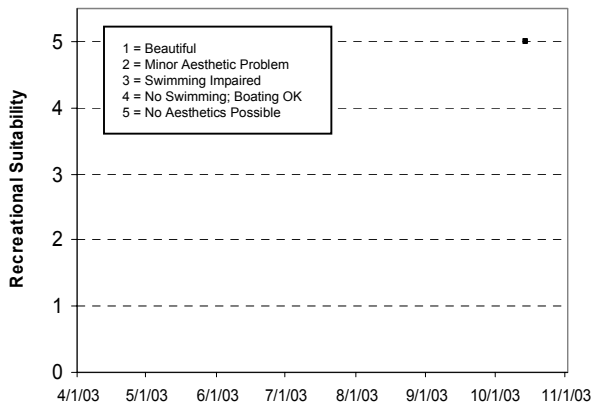



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | D | D | F | F |
| Chlorophyll a | | | | | | | | C | B | D | F | F |
| Secchi Depth | | | | | | | | D | D | F | F | F |
| **Overall** | | | | | | | | **D** | **C** | **D** | **F** | **F** |

Source: Metropolitan Council and STORET data



## Hydes Lake (10-0088) *Carver County Environmental Services*

Hydes Lake, a 215-acre lake located within Waconia Township (Carver County) is considered a Metropolitan Area "Priority Lake" because of its multi-recreational uses. A public access is located on the lake's northeastern shore. The mean and maximum depth of the lake is 3.0 (roughly 10 feet) and 5.5 m (18 feet). Because of the shallowness of the lake, 88 percent of the total lake 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 surface area and mean depth result in an approximate lake volume of 2,150 ac-ft.

The lake has a 430-acre immediate watershed, which translates to a watershed-to-lake area ratio of 2:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: seven percent residential, 76 percent agricultural, and 17 percent open/undeveloped (Carver County Planning 1999).

This was the fifth year that Hydes Lake has been involved in CAMP (the lake was initially enrolled in 1999). The lake has been monitored by Council staff in the past (the last year being 1996). A search of the STORET nationwide water quality database for data on the lake revealed a moderate database throughout the 1990's with nutrient data available in 1985, 1991, 1993, 1996 and now 1999-2003.

The lake was monitored 15 times between early-April and mid-October, 2003. 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. The mean summertime (May through September) surface TP concentration was 77.4 µg/l (minimum of 26.0 µg/l, maximum of 221.0 µg/l). The mean CLA and Secchi transparency readings were 37.3 µg/l (minimum of 4.2 µg/l, maximum of 100.0 µg/l) and 1.2 m (minimum of 0.4 m, maximum of 3.8 m), respectively. The lake's mean surface TKN concentration was 1.68 mg/l (minimum of 1.00 mg/l, maximum of 3.90 mg/l). The lake quality grades determined from each parameter's summertime mean are TP= D, CLA= C, and Secchi transparency= C. This results in an overall grade of C. The lake's 2003 overall grade is identical to that of 2001 and better than those of worse recorded in 1985, 1991, 1993, 1996, 1999-2000, and 2002 (D

As mentioned earlier, there is a moderate amount of water quality data available for Hydes Lake. It is not, however, extensive enough to determine any long-term statistically significant trends. In the short-term however, the lake's water quality seems to be well represented by an overall grade of D. In order to detect any possible long-term trends, additional years of data collection are needed.

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 2.9 for physical condition (between 2– "some algae present" and 3- "definite algae present") and 2.8 for recreational suitability (between 2- "minor aesthetic problems" and 3- "swimming slightly impaired").

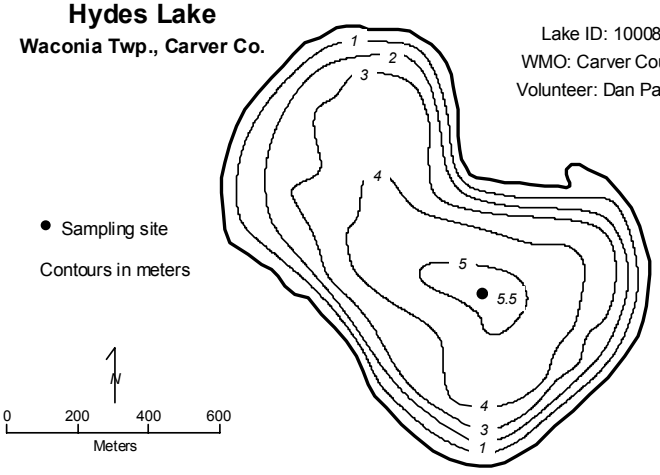
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

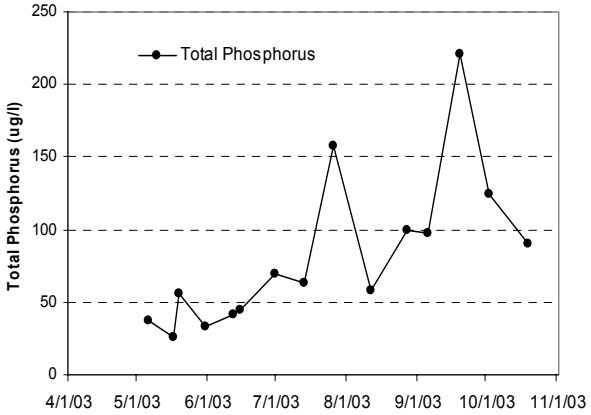
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

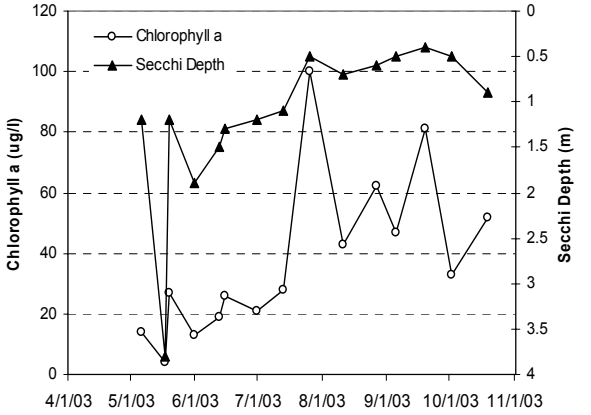
# Hydes Lake

**Waconia Twp., Carver Co.**

Lake ID: 100088
WMO: Carver County
Volunteer: Dan Palmer

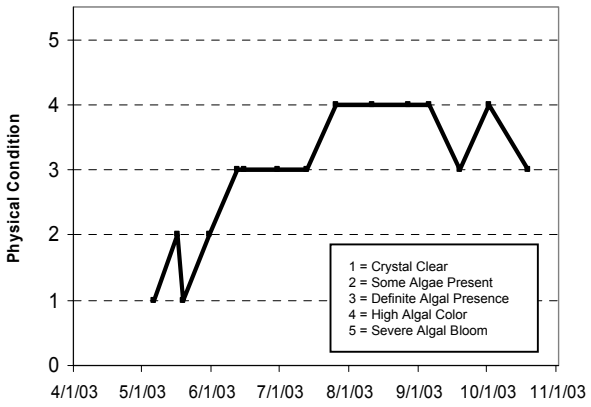



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/06/03 | 14 | | | | 14 | 37 | | 1.2 | 1 | 2 |
| 05/17/03 | 18 | | | | 4.2 | 26 | | 3.8 | 2 | 2 |
| 05/19/03 | 18 | | | | 27 | 56 | | 1.2 | 1 | 2 |
| 05/31/03 | 18 | | | | 13 | 33 | | 1.9 | 2 | 2 |
| 06/12/03 | 23.5 | | | | 19 | 41 | | 1.5 | 3 | 3 |
| 06/15/03 | 25.7 | | | | 26 | 45 | | 1.3 | 3 | 3 |
| 06/30/03 | 24.1 | | | | 21 | 70 | | 1.2 | 3 | 2 |
| 07/13/03 | 23.8 | | | | 28 | 63 | | 1.1 | 3 | 2 |
| 07/26/03 | 29.2 | | | | 100 | 158 | | 0.5 | 4 | 3 |
| 08/11/03 | 27.1 | | | | 43 | 58 | | 0.7 | 4 | 4 |
| 08/27/03 | 26.1 | | | | 62 | 100 | | 0.6 | 4 | 4 |
| 09/05/03 | 21.1 | | | | 47 | 98 | | 0.5 | 4 | 4 |
| 09/19/03 | 18.7 | | | | 81 | 221 | | 0.4 | 3 | 3 |
| 10/02/03 | 11.2 | | | | 33 | 125 | | 0.5 | 4 | 3 |
| 10/19/03 | 13.2 | | | | 52 | 90 | | 0.9 | 3 | 3 |

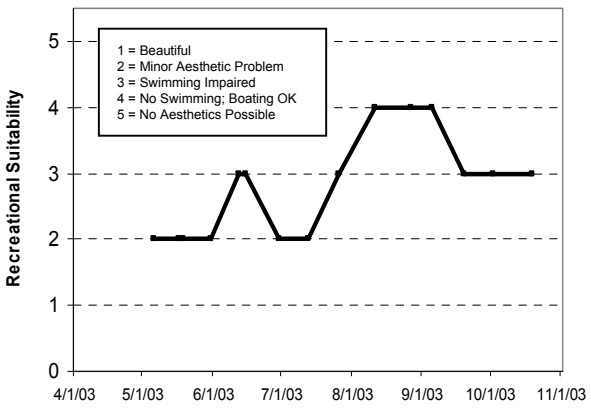



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | F | | | F | | | F | F | D | D | D |
| Chlorophyll a | | C | | | C | | | C | C | C | C | C |
| Secchi Depth | | C | | | C | | | C | C | A | F | C |
| **Overall** | | **D** | | | **D** | | | **D** | **D** | **C** | **D** | **C** |

Source: Metropolitan Council and STORET data



## Island Lake (2-0022) *Anoka County Parks*

This was the first year of CAMP monitoring on Island Lake, which is located in Linwood Township (Anoka County). The lake has a surface area of 67 acres and a maximum depth of 6.7 m (22 feet). Roughly 87 percent of the lake's surface 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).

A search through the STORET nationwide water quality database for data on the lake provided only one prior year of water quality data for the lake (1983).

The lake's overall 2003 lake quality grade of B is better than the C calculateded from the 1983 data. The lake's 2003 summertime (May through September) mean TP concentration of 30.6 µg/l (minimum of 24.0 µg/l, maximum of 37.0 µg/l) corresponds to a lake water quality grade of B, as did the CLA mean of 11.8 µg/l (minimum and maximum of 2.3 and 26.0 µg/l). The Secchi transparency mean of 1.5 m (minimum of 1.1 m, maximum of 1.9 m) translates to a grade of C. The mean TKN concentration over the same time period was 0.88 mg/l (minimum of 0.81 mg/l, maximum of 0.93).

Because 2003 is only the second year of available data, no long- or short-term trends can be determined. To better understand the quality of the lake and what direction it may be heading, more years of data collection are needed.

Throughout the monitoring period, the volunteers ranked the perceived physical condition of the lake on a 1-to-5 scale. The mean perceived physical condition of Island Lake was 2.0 (2- "some algae present"). There were no recreational suitability data collected in 2003.

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 know of any errors in the lake's data/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.

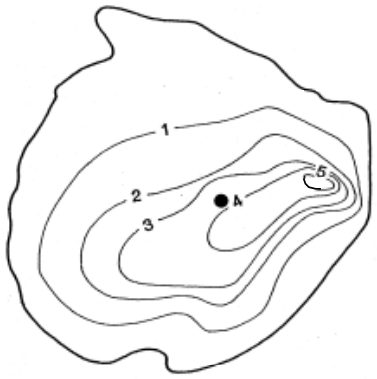
# Island Lake

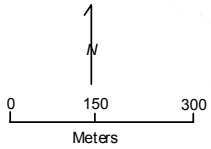
**Linwood Twp., Anoka Co.**

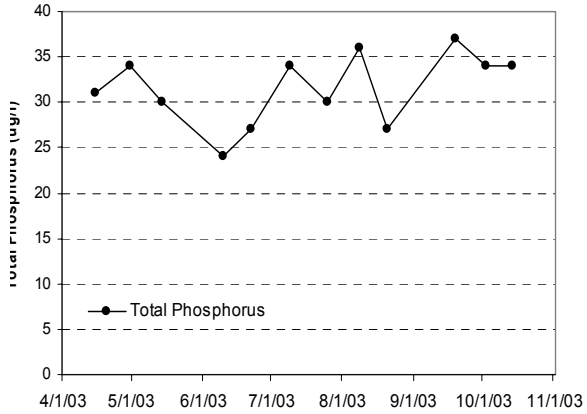
Lake ID: 20022
WMO: Sunrise River
Volunteer: Anoka Co. Parks

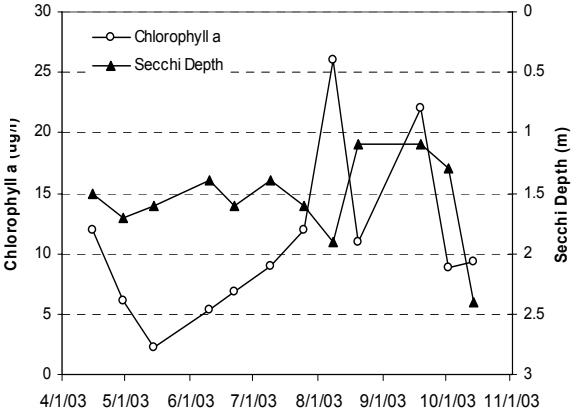
● Sampling site

Contours in meters



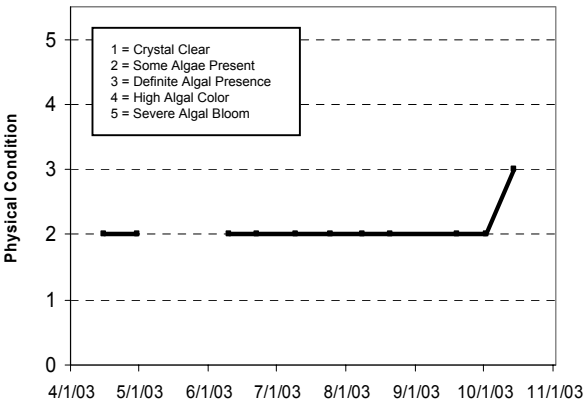




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 14 | | | | 12 | 31 | | 1.5 | 2 | |
| 04/30/03 | 15 | | | | 6.1 | 34 | | 1.7 | 2 | |
| 05/14/03 | 14 | | | | 2.3 | 30 | | 1.6 | | |
| 06/10/03 | 19 | | | | 5.4 | 24 | | 1.4 | 2 | |
| 06/22/03 | 23 | | | | 6.8 | 27 | | 1.6 | 2 | |
| 07/09/03 | 23 | | | | 9 | 34 | | 1.4 | 2 | |
| 07/25/03 | 23 | | | | 12 | 30 | | 1.6 | 2 | |
| 08/08/03 | 25 | | | | 26 | 36 | | 1.9 | 2 | |
| 08/20/03 | 26 | | | | 11 | 27 | | 1.1 | 2 | |
| 09/19/03 | 16 | | | | 22 | 37 | | 1.1 | 2 | |
| 10/02/03 | 8 | | | | 8.8 | 34 | | 1.3 | 2 | |
| 10/14/03 | 13 | | | | 9.3 | 34 | | 2.4 | 3 | 5 |

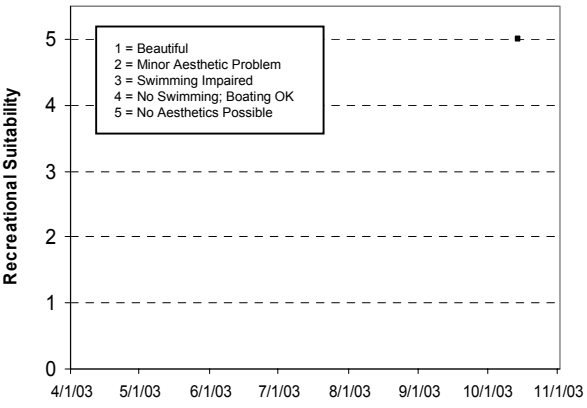



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | | B |
| Chlorophyll a | | | | | | | | | | | | B |
| Secchi Depth | | | | | | | | | | | | C |
| **Overall** | | | | | | | | | | | | **B** |

Source: Metropolitan Council and STORET data



## Jellum's Bay - Site-1 (82-0052-02) *Carnelian - Marine Watershed District*

Jellum's Bay, located in New Scandia Township in Washington County. This was the second year the lake has been involved in CAMP. Because the maximum depth of the 72-acre lake is only 4.9 m (16 feet), the majority of the lake's area is considered littoral zone (the 0-15 foot depth area of the lake dominated by aquatic vegetation). Additionally, because of the lake's shallowness it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column). The lake's mean depth of 2.4 m (roughly 8 feet) and its surface area translate to an approximate lake volume of 569 ac-ft. The lake has a 333-acre immediate watershed, which translates to a watershed-to-lake area ratio of 4.6:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff).

A search through the STORET nationwide water quality database for data on the lake provided historical water quality data on the lake for years 1996-2002.

In an attempt to inhibit algal populations within the lake, barley straw (similar to 2002) has been added to a portion of the lake in May 2003. Barley straw has been used for algal control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes.

The resulting data and graphs appear on the next page.

The lake was monitored 14 times between mid-April and mid-October, 2003. 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.

Summertime (May through September) means for the monitored variables were: surface TP= 111.5 µg/l (minimum concentration of 68.0 µg/l and a maximum value of 193.0 µg/l), surface chlorophyll-a= 88.6 µg/l (minimum of 43.0 µg/l and maximum of 190.0 µg/l), Secchi transparency= 0.7 m (minimum of 0.6 m and a maximum of 0.9 m), and TKN= 2.14 mg/l (minimum of 1.60 mg/l and maximum of 2.80 mg/l). Associated lake quality grades for the 2003 summertime means were TP= D, CLA= F, Secchi= D. The lake's 2003 overall grade of D (calculated from the three idividual grades) is identical to those recorded in 1996-1999, and 2001-2002, and better than that of 2000 (F).

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean perceived physical condition of Jellum's Bay was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability was 3.9 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

As mentioned earlier, there is little historic water quality data available for Jellum's Lake (1996-2003). Because of the limitedness of the lake's database, it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

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.

# Jellum's Bay, Site 1

**New Scandia Twp.,**
**Washington Co.**

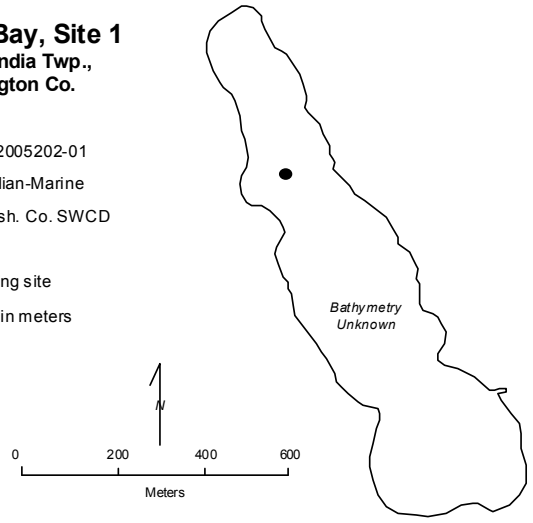
LAKE ID: 82005202-01

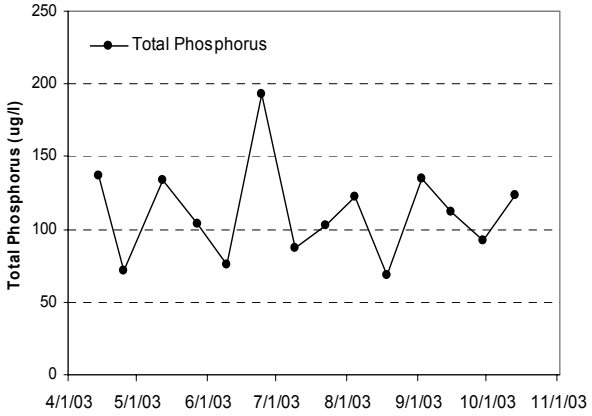
WD: Carnelian-Marine

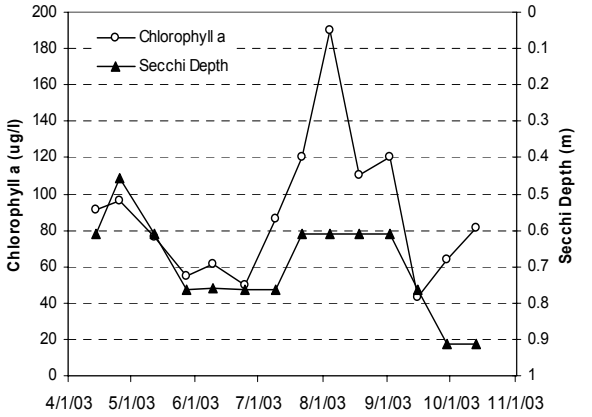
Volunteer: Wash. Co. SWCD

● Sampling site

Contours in meters

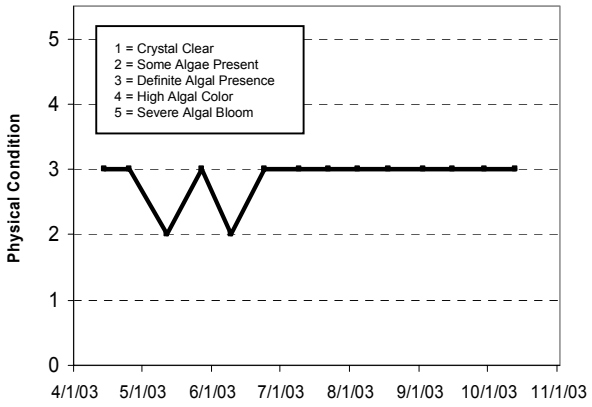



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 11.7 | | 10.11 | | 91 | 137 | | 0.61 | 3 | 3 |
| 04/25/03 | 12.4 | | 4.6 | | 96 | 72 | | 0.458 | 3 | 4 |
| 05/12/03 | 13.7 | | 8.24 | | 76 | 134 | | 0.61 | 2 | 4 |
| 05/27/03 | 20.1 | | 6.03 | | 55 | 104 | | 0.763 | 3 | 4 |
| 06/09/03 | 21.3 | | 4.95 | | 61 | 76 | | 0.76 | 2 | 3 |
| 06/24/03 | 24.2 | | 6.58 | | 50 | 193 | | 0.763 | 3 | 4 |
| 07/09/03 | 24.3 | | 6.89 | | 86 | 87 | | 0.763 | 3 | 4 |
| 07/22/03 | 24.2 | | 4.24 | | 120 | 103 | | 0.61 | 3 | 4 |
| 08/04/03 | 22.9 | | 7.5 | | 190 | 122 | | 0.61 | 3 | 4 |
| 08/18/03 | 26.4 | | 9.6 | | 110 | 68 | | 0.61 | 3 | 4 |
| 09/02/03 | 22.5 | | 6.02 | | 120 | 135 | | 0.61 | 3 | 4 |
| 09/15/03 | 21.3 | | | | 43 | 112 | | 0.762 | 3 | 4 |
| 09/29/03 | 12.8 | | 6.9 | | 64 | 92 | | 0.914 | 3 | 4 |
| 10/13/03 | 14.8 | | 10.62 | | 81 | 123 | | 0.914 | 3 | 2 |

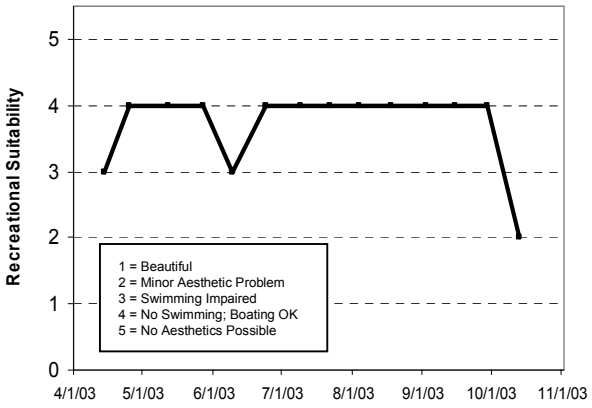



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | F | D | D | D | D | D | C | D |
| Chlorophyll a | | | | | D | D | D | D | F | D | D | F |
| Secchi Depth | | | | | D | D | F | F | F | D | D | D |
| **Overall** | | | | | **D** | **D** | **D** | **D** | **F** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Keller Lake [Burnsville] (19-0025) *Black Dog Watershed Management Commission*

Keller Lake, located in both the cities of Apple Valley and Burnsville (Dakota County), covers an area of 63 acres and has a maximum depth of 3.0 m (10 feet). The lake's mean depth of 1.4 m (4.6 feet) and surface area translates to an approximate lake volume of 290 ac-ft (the lake volume may have changed over the past couple years due to the lake level rising 1.5 to 2.0 feet above normal). Because the maximum depth is only 3.0 m, the entire lake area is considered littoral (the 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 land uses within the 353-acre contributing watershed to the lake are approximately split between agricultural uses and urban/residential. The watershed-to-lake size ratio is 6:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff).

This was the sixth year that Keller Lake has been enrolled in CAMP. The lake had been monitored by Council-staff in the past as part of a study on Crystal Lake (which Keller flows into). In 2003, the lake was monitored 15 times between mid-April and mid-October. The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

The lake's 2003 overall lake quality grade of D was calculated from the individual parameter grades. The summertime (May through September) mean TP concentration of 108.9 µg/l (minimum of 37.0 µg/l, maximum of 198.0 µg/l) corresponds to a grade of D as did the Secchi transparency mean of 0.7 m (minimum of 0.4 m and maximum of 1.4 m). The lake's summertime mean CLA concentration of 41.8 µg/l (minimum and maximum of 8.8 and 76.0 µg/l) resulted in a grade C. The mean TKN concentration over the same time period was 1.54 mg/l (minimum of 0.75 mg/l, maximum of 2.20 mg/l).

The lake's overall grade in 2003 (D) is similar to those recorded in 1996-1997 and 1999-2001, and worse than those recorded in 1998 (B) and 2002 (C). Because of the variability of the lake's gradwes, no statistically significant long-term trend is evident from the lake's water quality database.

Throughout the 2003 season, the volunteer monitor ranked their perceptions of the lake's physical and recreational condition on a 1-to-5 scale. The mean perceived physical condition was 3.3 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 4.0 (4- "no swimming - boating ok").

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.

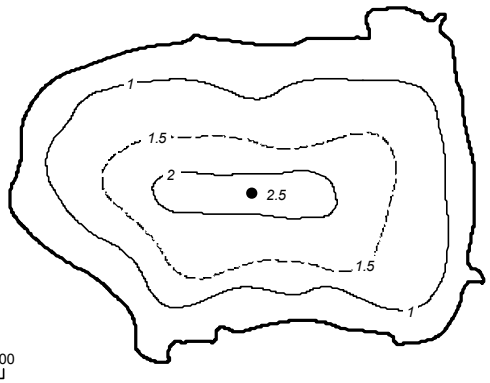
# Keller Lake

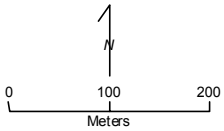
**Burnsville, Dakota Co.**

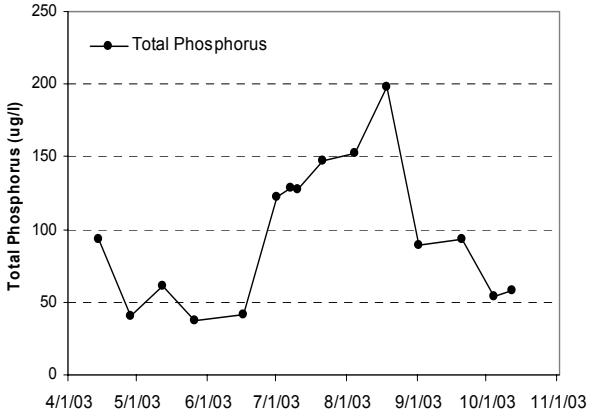
Lake ID: 190025
WMO: Black Dog
Volunteer: Glen Gramse

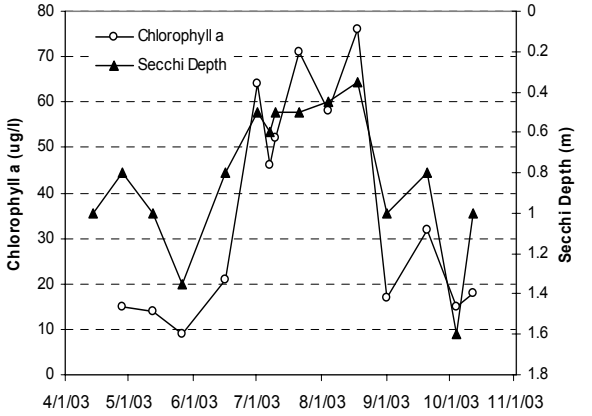
● Sampling site

Contours in meters



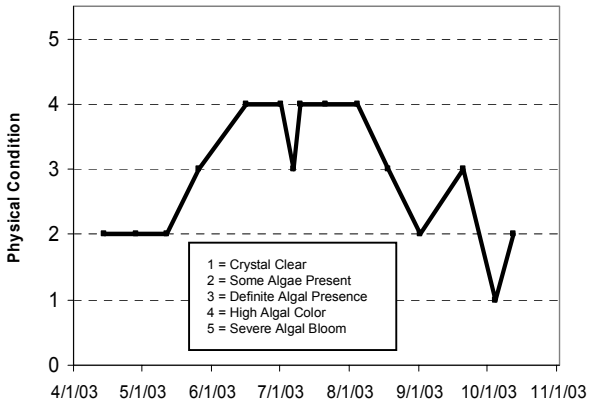




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 14 | | | | | 93 | | 1 | 2 | 2 |
| 04/28/03 | 17 | | | | 15 | 40 | | 0.8 | 2 | 2 |
| 05/12/03 | 14 | | | | 14 | 61 | | 1 | 2 | 4 |
| 05/26/03 | 21 | | | | 8.8 | 37 | | 1.35 | 3 | 4 |
| 06/16/03 | 30 | | | | 21 | 42 | | 0.8 | 4 | 4 |
| 07/01/03 | 26 | | | | 64 | 122 | | 0.5 | 4 | 4 |
| 07/07/03 | 29 | | | | 46 | 129 | | 0.6 | 3 | 4 |
| 07/10/03 | 27 | | | | 52 | 128 | | 0.5 | 4 | 4 |
| 07/21/03 | 26 | | | | 71 | 147 | | 0.5 | 4 | 4 |
| 08/04/03 | 29 | | | | 58 | 152 | | 0.45 | 4 | 4 |
| 08/18/03 | 30 | | | | 76 | 198 | | 0.35 | 3 | 4 |
| 09/01/03 | 25 | | | | 17 | 89 | | 1 | 2 | 4 |
| 09/20/03 | 18 | | | | 32 | 93 | | 0.8 | 3 | 4 |
| 10/04/03 | 10 | | | | 15 | 54 | | 1.6 | 1 | 2 |
| 10/12/03 | 15 | | | | 18 | 58 | | 1 | 2 | 4 |

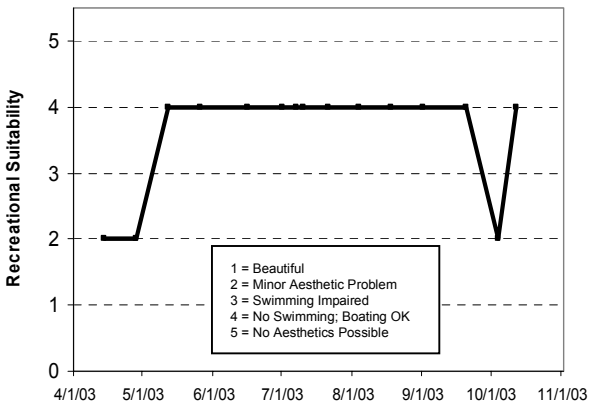



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | D | D | C | D | D | D | C | D |
| Chlorophyll a | | | | | F | C | A | C | C | C | B | C |
| Secchi Depth | | | | | D | D | C | D | D | D | D | D |
| **Overall** | | | | | **D** | **D** | **B** | **D** | **D** | **D** | **C** | **D** |

Source: Metropolitan Council and STORET data



## Kingsley Lake (19-0030) *Black Dog Watershed Management Commission*

This was the seventh year that Kingsley Lake has been monitored as part of CAMP (1995-1997 and 2000-2003). Additionally, the lake was monitored by Council-staff in 1993. The lake is located in the northwestern corner of the City of Lakeville in Dakota County. The lake has a surface area of 44 acres (shoreline length of 1.7 miles), a maximum depth of 4.0 m (13 feet), and a contributing watershed of 193 acres. The resulting watershed-to-lake size ratio is a rather small 4:1, that no doubt contributes to the good water quality of the lake. Because of the shallowness of the lake, the entire lake is considered littoral (area of aquatic vegetation dominance), and never develops and maintains a thermocline.

Kingsley Lake was monitored 14 times between mid-April and mid-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

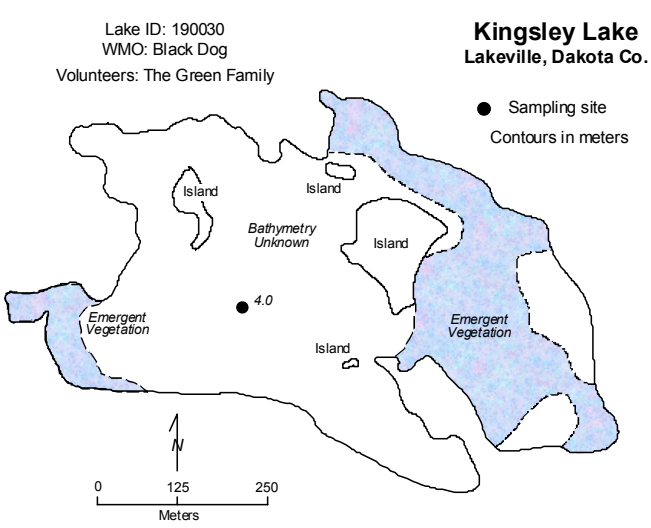
The overall 2003 lake quality grade of B for Kingsley Lake was determined from the grades assigned to the individual parameters. The summertime (May through September) mean TP concentration of 25.0 µg/l (minimum of 16.0 µg/l, maximum of 44.0 µg/l), fell within the B range, as did the Secchi transparency mean of 2.5 m (minimum of 1.9 m, maximum of 3.0 m). The lake's CLA mean of 3.2 µg/l (minimum and maximum of 1.9 and 5.6 µg/l) translates to a grade of A. The lake's mean TKN concentration was 0.49 mg/l (minimum of 0.35 mg/l, maximum of 0.57 mg/l).

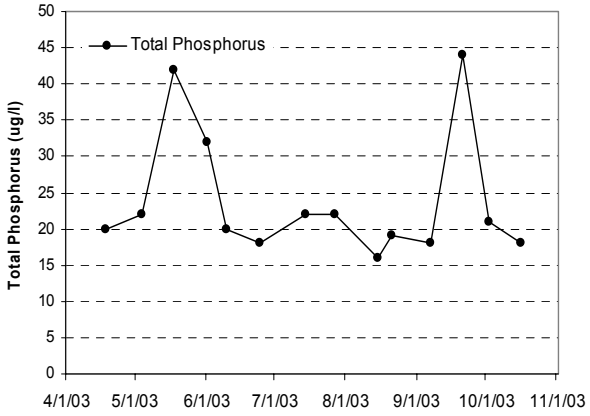
Similarly to past years, the Secchi transparency in 2003 would have been greater except on many monitoring events the lake's excessive submergent macrophyte growth got in the way. For this reason, if it weren't for the macrophyte interference, the water clarity conditions may have actually been that of an A grade--which in turn would have resulted in an overall grade of A for the lake in 2003.

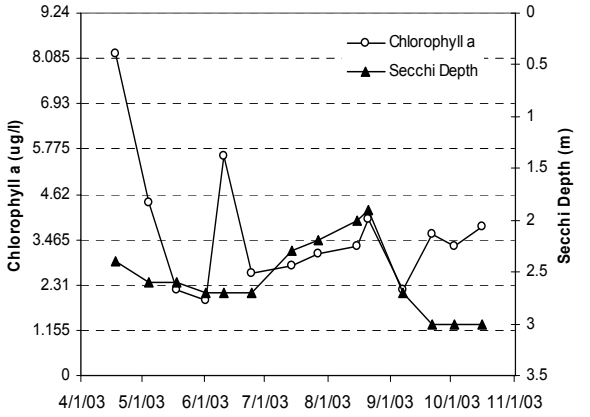
The physical and recreational conditions of Kingsley Lake as perceived by the volunteer(s) were ranked on a 1-to-5 scale. The mean physical condition ranking was 1.9 (roughly equal to 2- "some algae present"), while the mean recreational suitability ranking was 2.6 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's water quality seems to be represented by a water quality grade of A/high B.

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.

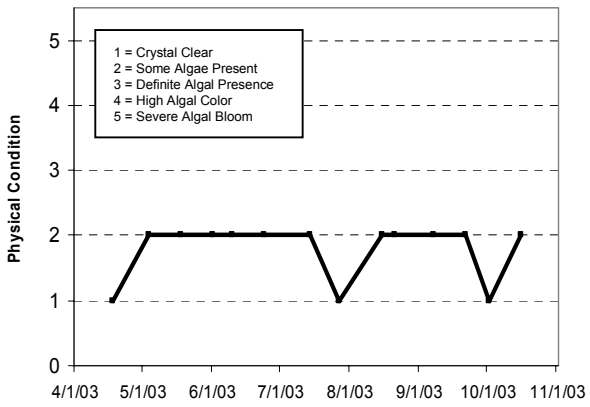



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 8 | | | | 8.2 | 20 | | 2.4 | 1 | 1 |
| 05/04/03 | 14 | | | | 4.4 | 22 | | 2.6 | 2 | 1 |
| 05/18/03 | 19 | | | | 2.2 | 42 | | 2.6 | 2 | 1 |
| 06/01/03 | 20 | | | | 1.9 | 32 | | 2.7 | 2 | 3 |
| 06/10/03 | 20 | | | | 5.6 | 20 | | 2.7 | 2 | 3 |
| 06/24/03 | 24 | | | | 2.6 | 18 | | 2.7 | 2 | 3 |
| 07/14/03 | 23 | | | | 2.8 | 22 | | 2.3 | 2 | 2 |
| 07/27/03 | 29 | | | | 3.1 | 22 | | 2.2 | 1 | 3 |
| 08/15/03 | 25 | | | | 3.3 | 16 | | 2 | 2 | 3 |
| 08/21/03 | 25 | | | | 4 | 19 | | 1.9 | 2 | 3 |
| 09/07/03 | 22 | | | | 2.2 | 18 | | 2.7 | 2 | 3 |
| 09/21/03 | 15 | | | | 3.6 | 44 | | 3 | 2 | 3 |
| 10/02/03 | 10 | | | | 3.3 | 21 | | 3 | 1 | 3 |
| 10/16/03 | 12 | | | | 3.8 | 18 | | 3 | 2 | 2 |

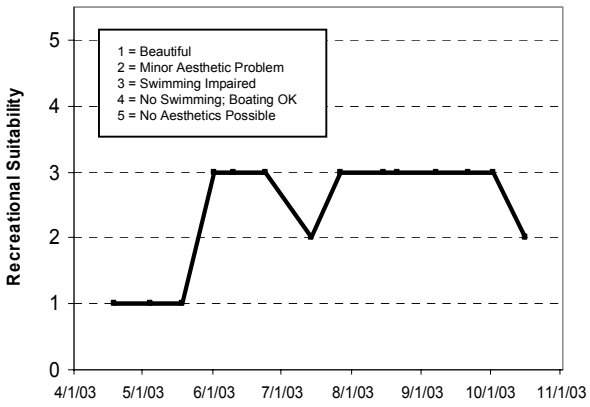



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | B | | B | A | A | | | A | A | A | B |
| Chlorophyll a | | A | | A | A | A | | | A | A | A | A |
| Secchi Depth | | A | | B | B | B | | | B | C | B | B |
| **Overall** | | **A** | | **B** | **A** | **A** | | | **A** | **B** | **A** | **B** |

Source: Metropolitan Council and STORET data



## Kismet Lake (82-0333) *Browns Creek Watershed District*

Kismet Lake is located in Washington County. The relatively small lake has a maximum depth of approximately 3.7 m (12 feet). Because of the shallowness of the lake the whole lake is considered littoral, the shallow (0-15 foot depth) area dominated by aquatic vegetation.

This was the sixth year that Kismet Lake has been involved in CAMP (in was initially enrolled in 1998). The only available lake data found through a search for historical water quality was the 1998-2002 CAMP data. The lake was monitored 14 times between mid-April and mid-October, 2003. 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. The 2003 mean summertime (May through September) surface TP concentration of 30.2 µg/l (minimum of 21.0 µg/l, maximum of 45.0 µg/l). The mean CLA and Secchi transparency readings in 2002 were 14.5 µg/l (minimum of 3.4 µg/l, maximum of 38.0 µg/l) and 2.2 m (minimum of 1.7 m, maximum of 3.1 m), respectively. The lake's mean surface TKN concentration was 0.79 mg/l (minimum of 0.62 mg/l, maximum of 0.92 mg/l).

Results are presented on graphs and data tables on the following page.

The lake quality grades determined from each parameter's summertime mean wer; TP= B, CLA= B, and Secchi transparency= B. The combined individual grades resulted in a 2003 overall grade of B, which represents the lake's best monitored water quality to date.

Because 2003 is the only the sixth year that data are available for the lake, long- trends are not possible to determine. In the short-term however, the lake seems well represented by an overall grade of C/C+. To better understand the lake's water quality and what direction it may be heading, more years of data collection are needed.

The perceived physical and recreational conditions of the lake, recorded by the volunteers, were ranked on a 1-to-5 scale. The rankings are shown in both tabular and graphical form on the lake's associated information sheet. The mean physical condition ranking was 2.2 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.7 (2- "minor aesthetic problem" and 3- "swimming slightly impaired").

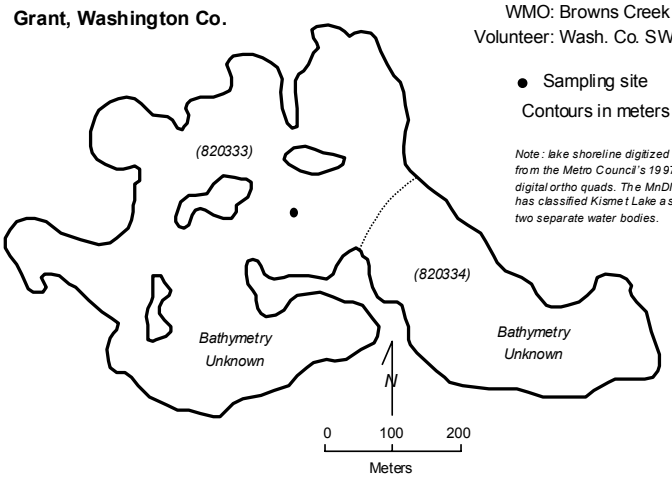
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

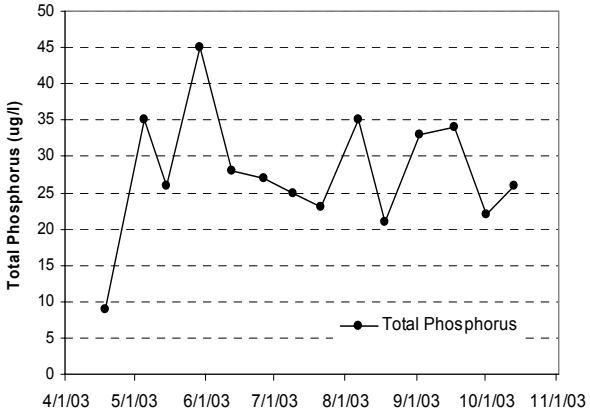
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

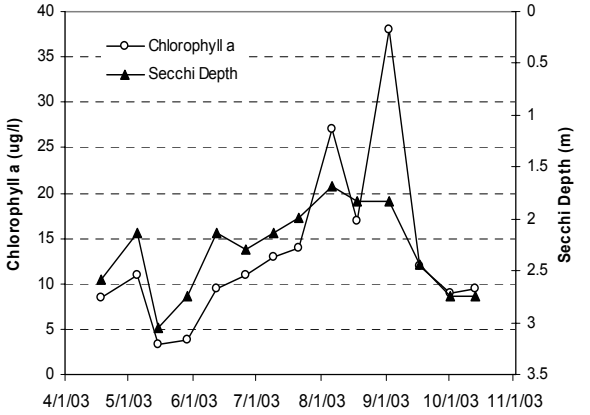
# Kismet Lake

**Grant, Washington Co.**

Lake IDs: 820333 and 820334
WMO: Browns Creek
Volunteer: Wash. Co. SWCD

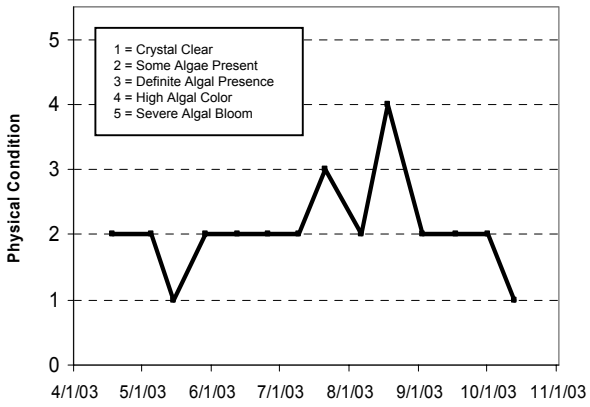



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 9.4 | | 7.53 | | 8.5 | 9 | | 2.59 | 2 | 2 |
| 05/05/03 | 14.1 | | 6.97 | | 11 | 35 | | 2.13 | 2 | 3 |
| 05/15/03 | 18 | | 5.2 | | 3.4 | 26 | | 3.05 | 1 | 2 |
| 05/29/03 | 22.6 | | 4.26 | | 3.9 | 45 | | 2.74 | 2 | 2 |
| 06/12/03 | 19.5 | | | | 9.4 | 28 | | 2.13 | 2 | 2 |
| 06/26/03 | 22.7 | | 5.86 | | 11 | 27 | | 2.288 | 2 | 2 |
| 07/09/03 | 25.1 | | 6 | | 13 | 25 | | 2.13 | 2 | 3 |
| 07/21/03 | 25.8 | | | | 14 | 23 | | 1.983 | 3 | 4 |
| 08/06/03 | 25.4 | | 7.2 | | 27 | 35 | | 1.678 | 2 | 4 |
| 08/18/03 | 28.6 | | 9.62 | | 17 | 21 | | 1.829 | 4 | 4 |
| 09/02/03 | 22.9 | | 5.52 | | 38 | 33 | | 1.83 | 2 | 3 |
| 09/17/03 | 20.6 | | 7.36 | | 12 | 34 | | 2.438 | 2 | 1 |
| 10/01/03 | 10.6 | | 10.4 | | 8.9 | 22 | | 2.743 | 2 | 2 |
| 10/13/03 | 13.8 | | 9.14 | | 9.5 | 26 | | 2.743 | 1 | 1 |

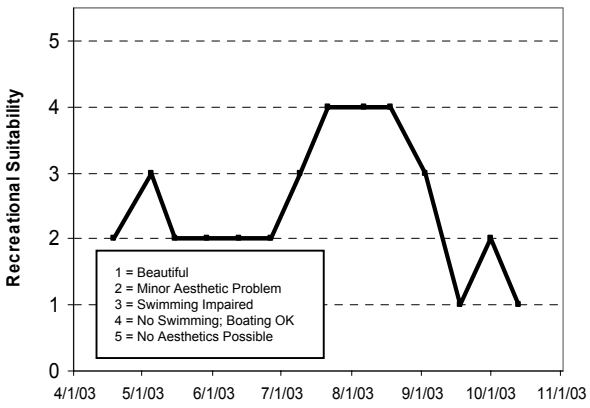



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | C | C | D | C | C | B |
| Chlorophyll a | | | | | | | C | C | C | B | B | B |
| Secchi Depth | | | | | | | C | C | C | C | C | B |
| **Overall** | | | | | | | **C** | **C** | **C** | **C** | **C** | **B** |

Source: Metropolitan Council and STORET data



## Klawitter Lake (82-0368) *Valley Branch Watershed District*

Klawitter Lake is a small lake located within the boundaries of Lake Elmo (Washington County). There is very little known morphological data available for the lake.

This was the second year that Klawitter Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake came up empty, therefore 2002-2003 are the only years of available water quality data for the lake.

As part of the watershed's involvement in CAMP in 2003, the lake was monitored 13 times between mid-April and mid-October. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The 2003 mean summertime (May through September) surface TP concentration was 122.9 µg/l (minimum of 46.0 µg/l, maximum of 316.0 µg/l). The mean CLA and Secchi transparency readings were 28.7 µg/l (minimum of 1.0 µg/l, maximum of 81.0 µg/l), and 0.69 m (minimum of 0.50 m, maximum of 1.00 m), respectively. The lake's mean surface TKN concentration was 1.63 mg/l (minimum of 1.20 mg/l and a maximum of 2.1 mg/l). The summertime means in 2003 resulted in a TP grade of D, CLA of C, and a Secchi transparency grade of F. The 2003 overall grade determined through the calculation of all three parameters was D (worse than the overall grade of C in 2002) .

By comparing the lakes TP (nutrient), CLA (algal biomass estimator), and Secchi (water clarity) grades, it is apparent that the TP and Secchi grades (and summer means) are quite a bit worse than the CLA grade. In a most cases, the three should be fairly comparable. One possible explanation for the lake's 2002 findings may be that the majority of the lake's TP comes from either in-lake suspended sediments (re-suspension), or the intrusion of sediment-laden runoff to the lake, which in turn lessens the clarity of the water and inhibits algal growth.

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 following page. The mean physical condition ranking was 3.0 (3- "definite algae present"), while the mean recreational suitability ranking was 2.5 (between 2- "minor aesthetic problems" and 3- "swimming slightly impaired").

As mentioned earlier, there are no water quality data available for Klawitter Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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.

# Klawitter Pond

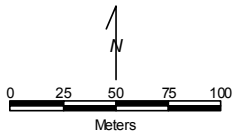
**Lake Elmo, Washington Co.**

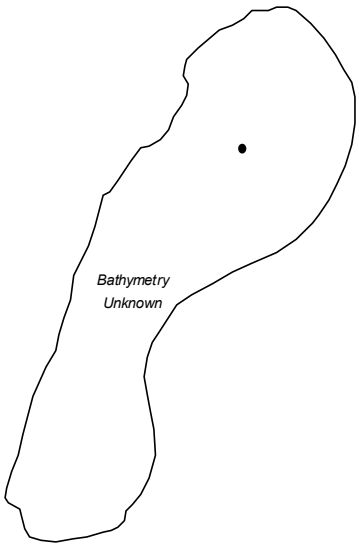
Lake ID: 820368
WD: Valley Branch

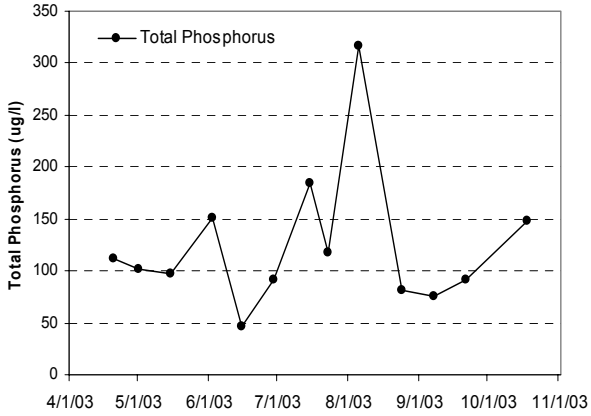
Volunteer: Bonnie Jurand

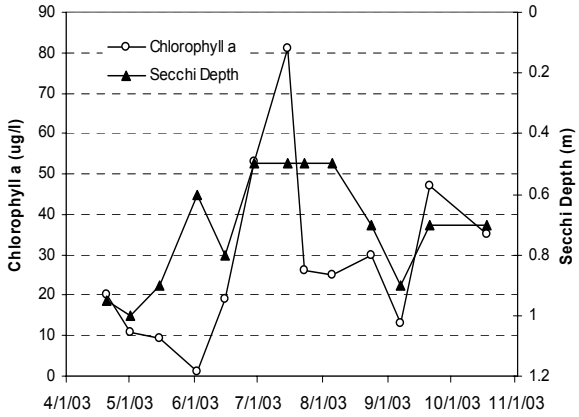
- Sampling site

Contours in meters



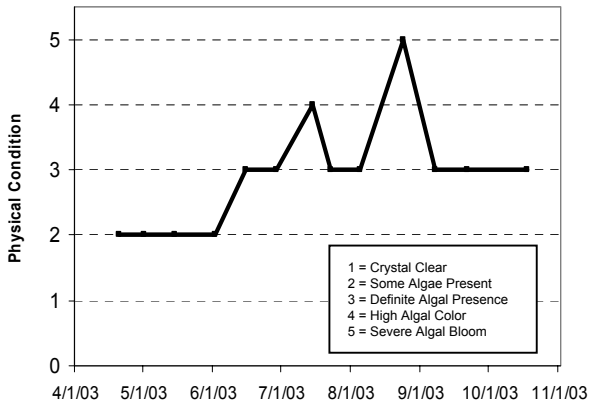




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/20/03 | 12.8 | | | | 20 | 112 | | 0.95 | 2 | 1 |
| 05/01/03 | 18.6 | | | | 11 | 101 | | 1 | 2 | 1 |
| 05/15/03 | 20 | | | | 9.3 | 98 | | 0.9 | 2 | 2 |
| 06/02/03 | 22.7 | | | | 1 | 151 | | 0.6 | 2 | 2 |
| 06/15/03 | 26.7 | | | | 19 | 46 | | 0.8 | 3 | 2 |
| 06/29/03 | 26.3 | | | | 53 | 91 | | 0.5 | 3 | 2 |
| 07/15/03 | 26.4 | | | | 81 | 184 | | 0.5 | 4 | 3 |
| 07/23/03 | 25.4 | | | | 26 | 117 | | 0.5 | 3 | 2 |
| 08/05/03 | 23.8 | | | | 25 | 316 | | 0.5 | 3 | 4 |
| 08/24/03 | 26.5 | | | | 30 | 82 | | 0.7 | 5 | 3 |
| 09/07/03 | 23.6 | | | | 13 | 75 | | 0.9 | 3 | 3 |
| 09/21/03 | 18.8 | | | | 47 | 91 | | 0.7 | 3 | 3 |
| 10/18/03 | 14.9 | | | | 35 | 148 | | 0.7 | 3 | 4 |

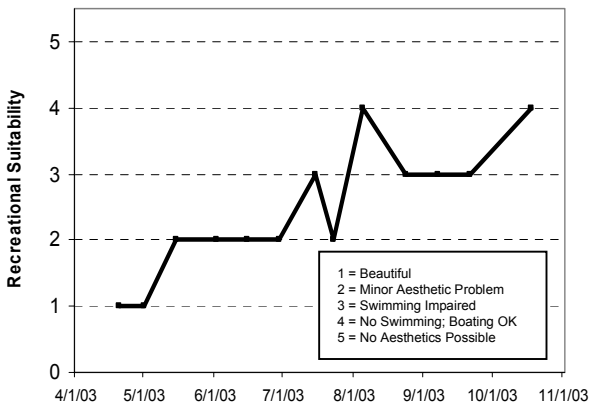



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | D | D |
| Chlorophyll a | | | | | | | | | | | B | C |
| Secchi Depth | | | | | | | | | | | D | F |
| **Overall** | | | | | | | | | | | **C** | **D** |

Source: Metropolitan Council and STORET data



## La Lake (82-0097) *City of Woodbury*

La Lake, located in the City of Woodbury (Washington County), has been monitored through CAMP since 1994. The lake has a surface area of approximately 35 acres (1.3 miles around) and a maximum depth of 3.5 m (11 feet). Because of the shallowness of the lake, it is considered entirely littoral (the 0-15 foot depth zone of a lake dominated by aquatic vegetation), and does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

Between mid-May and late-August, 2003, the lake was monitored six times. During each sampling event, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as perceived physical condition and recreational suitability. The 2003 summertime (May - September) mean TP concentration of 60.0 µg/l (minimum and maximum of 53.0 and 67.0 µg/l) results in grade of C, as did the summer mean CLA concentration of 24.9 µg/l (minimum of 2.2 µg/l, maximum of 89.0 µg/l). The mean Secchi transparency of 2.3 m (minimum of 1.1 m, maximum of 3.2 m), corresponds to a lake water quality grades of B. Additionally, the mean TKN concentration was 0.97 mg/l (minimum of 0.44 mg/l, maximum of 1.60 mg/l).

The lake's individual parameter grades result in an overall lake quality report card grade of C for the lake in 2003. This grade is similar to that recorded in 1994, 1996, 1997, 1999-2002 and worse than that of 1995 and 1998 (B). The individual grades for the lake in 2003 however, are better than those more recently monitored (1999-2002).

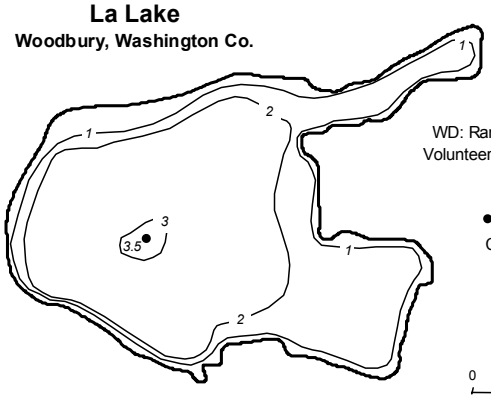
The perceived physical and recreational conditions, ranked on a 1-to-5 scale, were documented during each monitoring event. The mean physical condition ranking in 2002 was 2.0 (2- "some algae present"), while the mean recreational suitability ranking was 2.0 (2- "minor aesthetic problem").

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's overall water quality seems to be well represented by a water quality grade of high-C/low-B. With this in mind, however, some concern should be given to the recent (late-1990's and early-2000's) poor water quality years.

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.

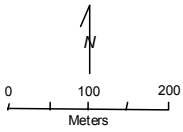
## La Lake

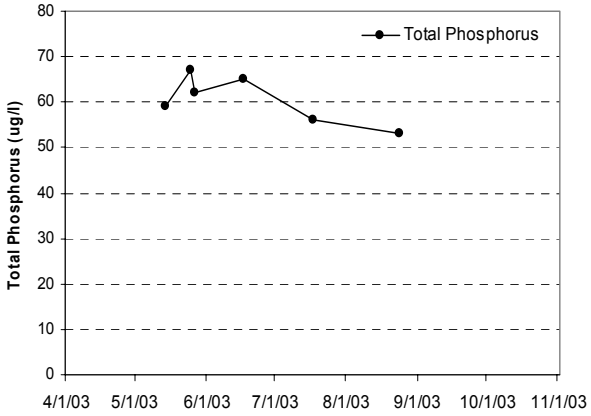
**Woodbury, Washington Co.**

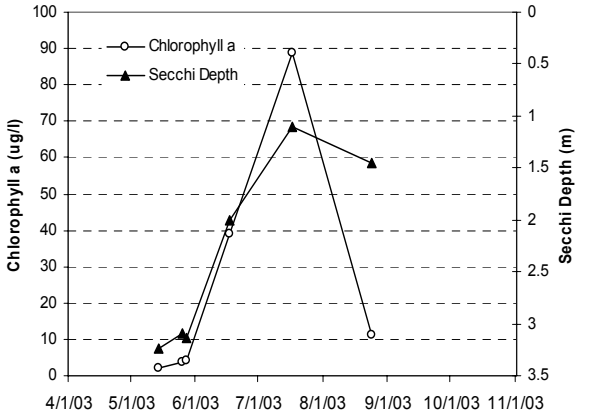



Lake ID: 820097
WD: Ramsey-Washington Metro
Volunteers: Dorthe and Ken Mahle

● Sampling site
Contours in meters

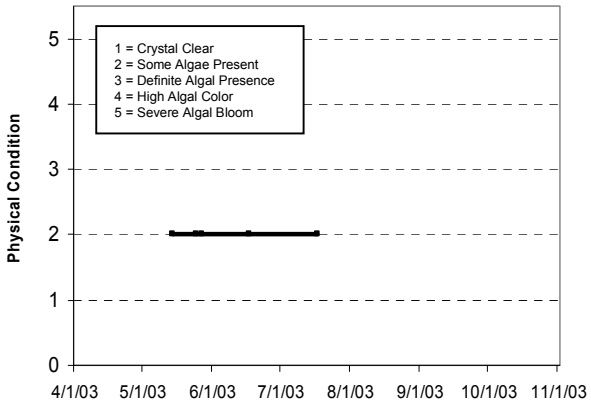



### 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/14/03 | 16.8 | | | | 2.2 | 59 | | 3.24 | 2 | 2 |
| 05/25/03 | 19 | | | | 3.7 | 67 | | 3.1 | 2 | 2 |
| 05/27/03 | 20.2 | | | | 4.3 | 62 | | 3.13 | 2 | 2 |
| 06/17/03 | 25.8 | | | | 39 | 65 | | 2 | 2 | 2 |
| 07/17/03 | 25.8 | | | | 89 | 56 | | 1.1 | 2 | 2 |
| 08/24/03 | 26.9 | | | | 11 | 53 | | 1.45 | | 2 |

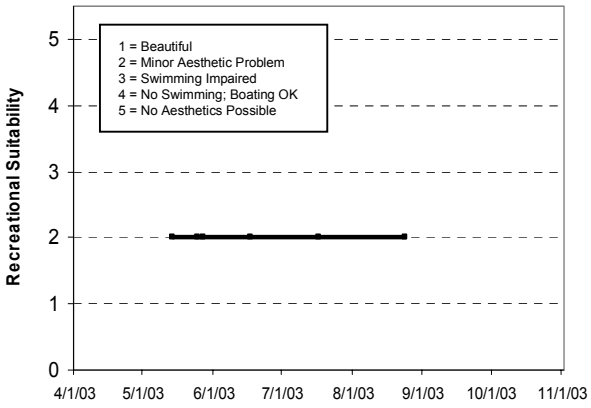



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | C | D | D | C | D | D | D | D | C |
| Chlorophyll a | | | B | A | B | C | B | C | C | C | B | C |
| Secchi Depth | | | C | B | C | C | B | C | C | C | C | B |
| **Overall** | | | **C** | **B** | **C** | **C** | **B** | **C** | **C** | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Lac Lavon Lake (19-0446) *Black Dog Watershed Management Commission*

This was the seventh year that Lac Lavon has been involved in CAMP. A data search on the lake came up fairly empty. The only water quality data found for the lake were Secchi transparency data in 1989-1991 and CAMP data for 1997-2003.

The lake, located within the City of Apple Valley in Dakota County, is actually an abandoned gravel pit maintained by groundwater (MDNR 1996). The lake is a unique resource in the Twin Cities Metropolitan Area because it is one of only six lakes in the seven-county area stocked with trout (rainbows). The 55-acre lake (2.3 miles in circumference) has a maximum depth of 9.8 m (32 feet) and 65 percent of the lake is considered littoral zone (the 0-15 foot depth zone of the lake dominated by aquatic vegetation). The lake's fishing pier is located on the eastern end of the lake. An area of concern and need for future management is the recent detection of Eurasian Water Milfoil (*Myriophyllum spicatum*) in the lake.

Lac Lavon was monitored 12 times between mid-May and mid-October, 2003. The data and resulting graphs showing seasonal variability in TP and CLA concentrations, Secchi transparency, and user perceptions are presented on the information sheet following these written comments.

The summertime (May - September) mean TP concentration of 20.6 µg/l (minimum of 13.0 µg/l, maximum of 36.0 µg/l), corresponded to a lake water quality grade of A as did the Secchi transparency mean of 3.7m (minimum of 2.4 m, maximum of 4.8 m). The CLA mean of 3.8 µg/l (minimum of 1.6 µg/l and maximum of 10.0 µg/l) also resulted in a lake water quality grade of A. The lake's mean TKN concentration was 0.48 mg/l (minimum of 0.36 mg/l and maximum of 0.59 mg/l). The overall lake quality grade for Lac Lavon in 2003 was A (similar to those recorded in 1997 -2002), which means that the water quality of the lake falls within the top 10 percent in the TCMA.

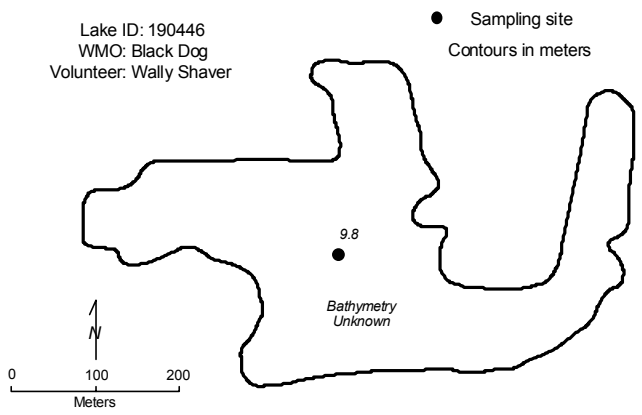
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The mean physical condition ranking was 1.2 (between 1-"crystal clear" and 2- "some algae present"), while the mean recreational suitability ranking was 1.1 (roughly equal to 1- "beautiful"). No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's water quality seems well represented by an overall grade of A. In order to detect any possible long-term trends, more years of data collection are needed.

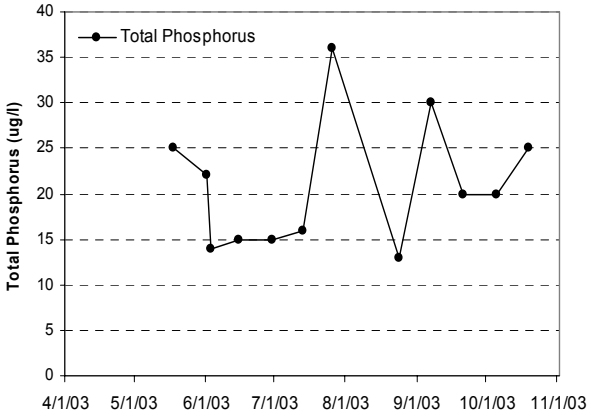
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

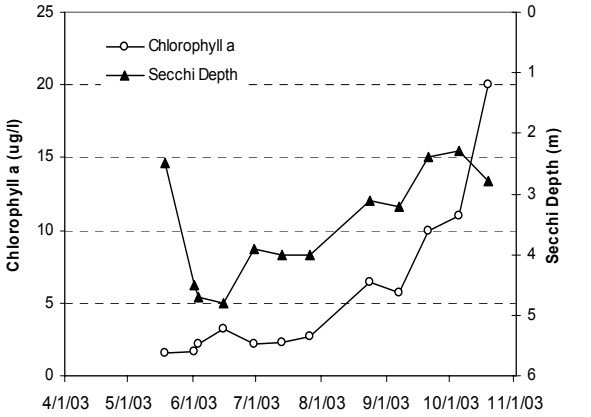
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Lac Lavon

**Apple Valley/Burnsville, Dakota Co.**

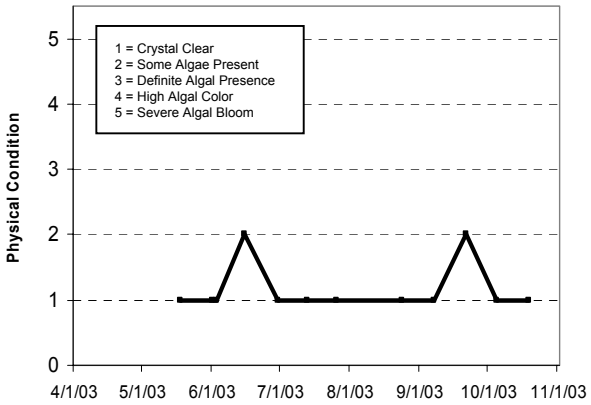



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/18/03 | 18 | | | | 1.6 | 25 | | 2.5 | 1 | 1 |
| 06/01/03 | 20 | | | | 1.7 | 22 | | 4.5 | 1 | 1 |
| 06/03/03 | 20 | | | | 2.2 | 14 | | 4.7 | 1 | 1 |
| 06/15/03 | 23 | | | | 3.2 | 15 | | 4.8 | 2 | 2 |
| 06/30/03 | 26 | | | | 2.2 | 15 | | 3.9 | 1 | 1 |
| 07/13/03 | 26 | | | | 2.3 | 16 | | 4 | 1 | 1 |
| 07/26/03 | 26 | | | | 2.7 | 36 | | 4 | 1 | 1 |
| 08/24/03 | 27 | | | | 6.4 | 13 | | 3.1 | 1 | 1 |
| 09/07/03 | 25 | | | | 5.7 | 30 | | 3.2 | 1 | 1 |
| 09/21/03 | 19 | | | | 10 | 20 | | 2.4 | 2 | 1 |
| 10/05/03 | 16 | | | | 11 | 20 | | 2.3 | 1 | 1 |
| 10/19/03 | 15 | | | | 20 | 25 | | 2.8 | 1 | 1 |

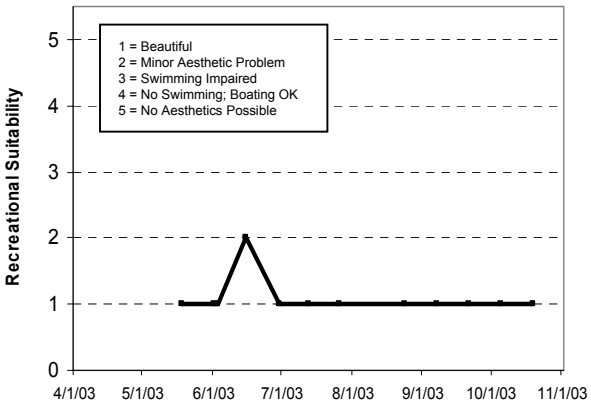



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | A | A | A | A | B | A | A |
| Chlorophyll a | | | | | | A | A | A | A | A | A | A |
| Secchi Depth | | | | | | A | A | A | A | A | A | A |
| **Overall** | | | | | | **A** | **A** | **A** | **A** | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Laddie Lake (2-0072) *Six Cities Watershed District*

Laddie Lake is a shallow lake with maximum and mean depths of 3.0 m and 1.0 m, respectively (10 feet and 3 feet). Located within the cities of Blaine and Spring Lake Park (Anoka County), its littoral zone (dominated by aquatic vegetation) makes up the majority, if not all, of its 73-acre surface area. With an approximate volume of 219 ac-ft, it outlets to the northwest, eventually flowing into Springbrook Creek.

The major land use within the lake's 542-acre watershed is urban/developed (translating to a watershed-to-lake size ratio of 7.5:1). The City of Blaine has operated an aeration system to help improve lake quality. Laddie Lake, which was involved in CAMP in 1993-1995 and 2000-2002, was monitored 10 times between mid-April and late-August, 2003. During each monitoring event, the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as the perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration for the lake was 45.2 µg/l (minimum of 17.0 µg/l, maximum of 137.0 µg/l). The mean CLA and Secchi transparency readings were 4.0 µg/l (minimum of 2.1 µg/l, maximum of 5.9 µg/l) and 1.2 m (minimum of 1.2 m, maximum of 1.3 m), respectively. The lake's mean surface TKN concentration was 0.93 mg/l. The lake quality grades assigned to the 2003 summertime means are TP= C; CLA= A; and Secchi= C, resulting in an overall grade of B.

The 2003 overall grade is similar to those recorded in 1993-1995 and 2000-2002, and better to historical data collected in 1980. The overall grade in 1993-1995 and 2000-2003 could have been better than B because the mean Secchi depths of 1.2 m, which corresponds to a C grade, was at the bottom of the lake. If the lake was deeper, the Secchi transparencies and corresponding grade might have been better, resulting in a better overall grade.

Very little water quality data is available for Laddie Lake. The only year other than the CAMP data of 1993-1995 and 2000-2003 is 1980. While the limited historical database makes it impossible to determine any long-term trends, the lake report card grades (see next page). In the short-term however, the lake's water quality seems well represented by an overall grade B. In order to detect any possible long-term trends, more years of data collection are needed.

Throughout the course of the study, the volunteer monitors ranked their perceptions of the lake's physical and recreational condition on a 1-to-5 scale. These rankings, as well as the data and graphs discussed above, are shown on the lake's information sheet on the following page. The mean physical condition ranking was 3.4 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability ranking was 4.0 (4- "no swimming – boating ok").

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/.

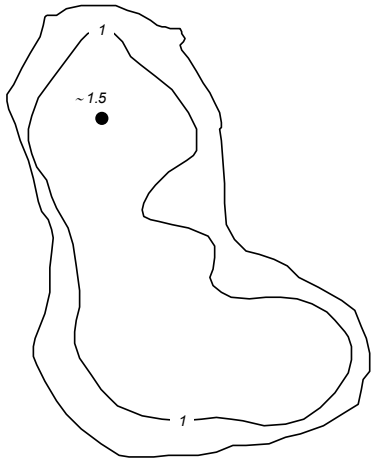
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

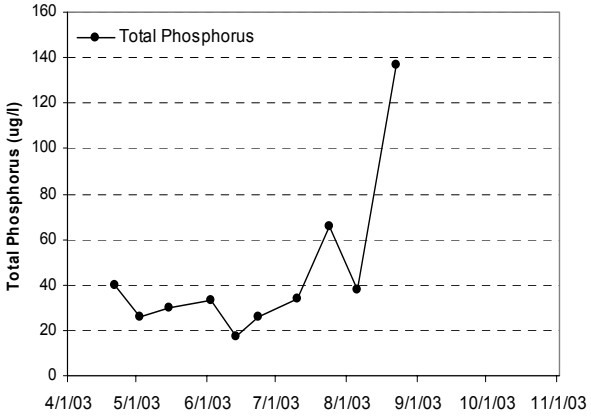
# Laddie Lake

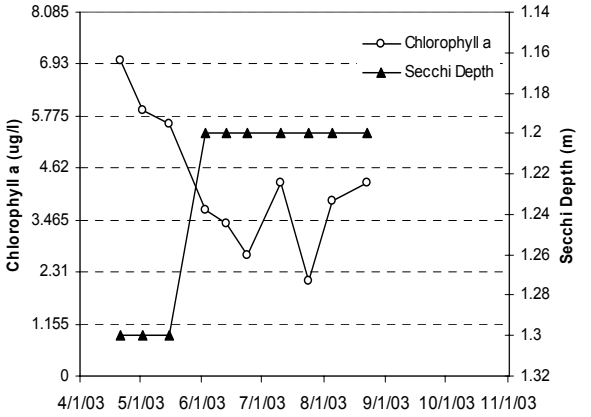
**Blaine/Spring Lake Park, Anoka Co.**

Lake ID: 20072
WMO: Six Cities
Volunteer: City of Blaine

● Sampling site
Contours in meters

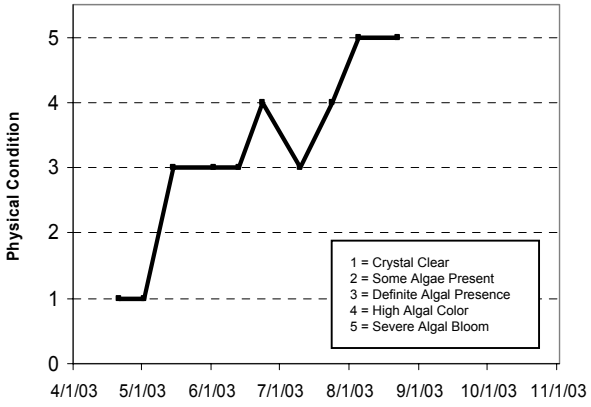



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 10 | | | | 7 | 40 | | 1.3 | 1 | 4 |
| 05/02/03 | 15 | | | | 5.9 | 26 | | 1.3 | 1 | 4 |
| 05/15/03 | 17 | | | | 5.6 | 30 | | 1.3 | 3 | 4 |
| 06/02/03 | 20 | | | | 3.7 | 33 | | 1.2 | 3 | 4 |
| 06/13/03 | 20 | | | | 3.4 | 17 | | 1.2 | 3 | 4 |
| 06/23/03 | 24 | | | | 2.7 | 26 | | 1.2 | 4 | 4 |
| 07/10/03 | 22 | | | | 4.3 | 34 | | 1.2 | 3 | 4 |
| 07/24/03 | 24 | | | | 2.1 | 66 | | 1.2 | 4 | 4 |
| 08/05/03 | 24 | | | | 3.9 | 38 | | 1.2 | 5 | 4 |
| 08/22/03 | 26 | | | | 4.3 | 137 | | 1.2 | 5 | 4 |

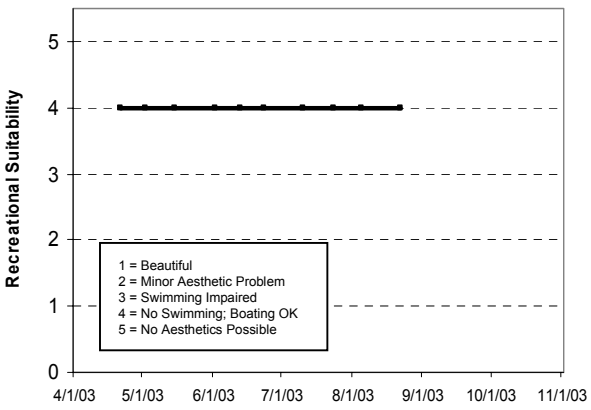



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | A | B | B | | | | | B | B | B | C |
| Chlorophyll a | | A | A | B | | | | | A | A | A | A |
| Secchi Depth | | C | C | C | | | | | D | C | C | C |
| **Overall** | | **B** | **B** | **B** | | | | | **B** | **B** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Lee Lake (19-0029) *Black Dog Watershed Management Commission*

Lee Lake, a 25-acre land-locked lake with a maximum depth of 5.2 m (17 feet), is located in Lakeville (Dakota County). The shoreline length of the lake is 1.0 miles. The majority of its 324-acre watershed (which translates to a watershed-to-lake size ratio of 13:1) is now developed with urban uses; however, past cattle farming is the primary phosphorus source to the lake and may have left behind an internal loading problem. To determine if this is the case, a more in-depth monitoring program is needed. An abundance of submerged aquatic vegetation (Curlyleaf pondweed) has been a continuing problem in the lake. Not only is it an aesthetic and recreational problem, but the decaying of plants in late-summer adds to concentrations of phosphorus in the water column.

The lake has been involved in CAMP in 1994-1997 and 2000-2002. In an attempt to inhibit algal populations within the lake, barley straw has been added. Barley straw has been used for algal control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes. Therefore, in an attempt to determine if the straw method successfully reduced algal biomass on Lee Lake in 2003, TP, TKN, CLA and Secchi transparency were tested nine times between early-April and mid-October. The resulting data and graphs appear on the next page.

The 2003 overall lake quality grade for Lee Lake, a C, was calculated from the individual grades for each water quality parameter. The summertime (May through September) mean TP concentration of 58.1 µg/l (minimum of 40.0 µg/l, maximum of 88.0 µg/l) resulted in a water quality grade of C, as did the Secchi transparency mean of 1.2 m (minimum of 0.5, and a maximum of 2.3 m). The lake's summertime mean CLA of 35.5 µg/l (minimum and maximum of 5.6 and 89.0 µg/l) earned a grade of C. The lake's mean TKN concentration was 1.27 mg/l (minimum of 0.92 mg/l, maximum of 2.00 mg/l).

The in-lake scenario noticed in 2002—where the lake's mean Secchi transparency and TP concentration were worse than what the lake's mean CLA concentration would have suggested—was not as apparent in 2003. Continual years of data will provide a better picture of the barley straws influence on the lake's algal population and water clarity.

The lake's 2003 water quality was similar to that recorded in the previous years of CAMP (where the lake consistently received an overall grade of C) and better than that recorded in 2000 (D). No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake seems well represented by an overall grade of C. In order to determine any long-term trends or to better define the lake's normal water quality range, more data are needed.

Throughout the course of the study, the volunteer monitors ranked their perceptions of the lake's physical and recreational condition on a 1-to-5 scale. These rankings, as well as the data and graphs discussed above, are shown on the lake's information sheet on the following page. The mean physical condition ranking was 3.1 (roughly equal to 3- "definite algae present"), while the mean recreational suitability ranking was 4.0 (4- "no swimming – boating ok").

The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) conducted a fisheries survey on the lake in 1991. 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/.

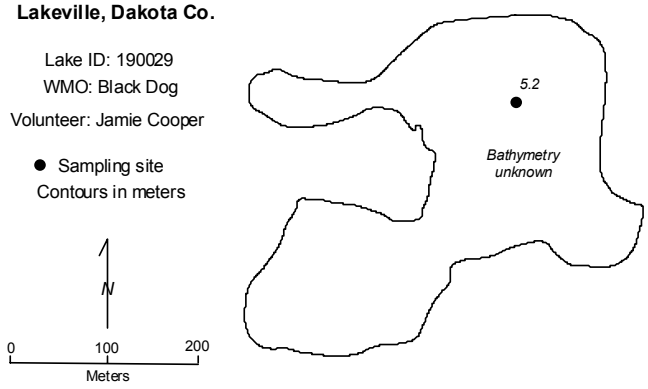
If you know of any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

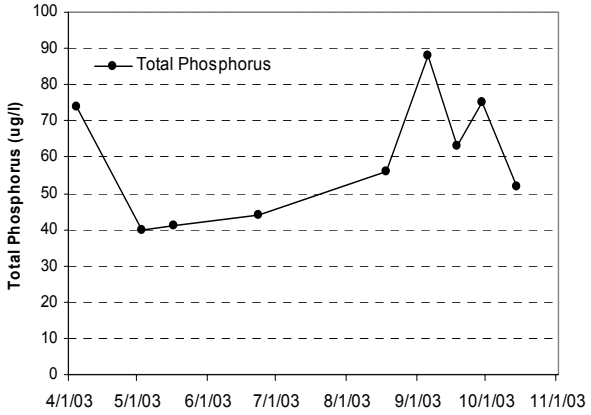
# Lee Lake

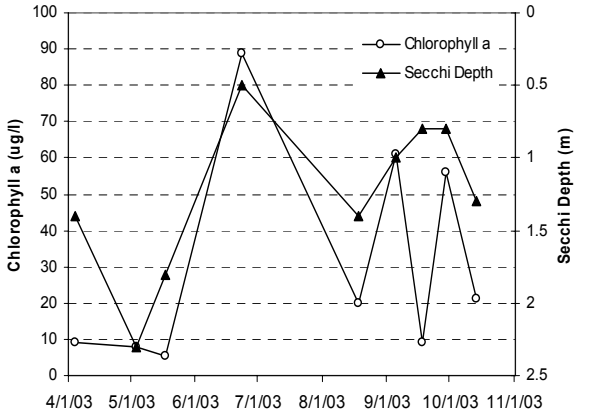
**Lakeville, Dakota Co.**

Lake ID: 190029
WMO: Black Dog
Volunteer: Jamie Cooper

● Sampling site
Contours in meters

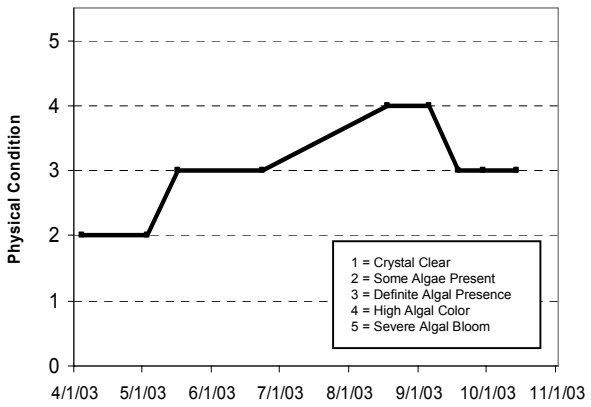



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/04/03 | 10 | | | | 9.2 | 74 | | 1.4 | 2 | 4 |
| 05/03/03 | 15 | | | | 7.9 | 40 | | 2.3 | 2 | 4 |
| 05/17/03 | 18.5 | | | | 5.6 | 41 | | 1.8 | 3 | 4 |
| 06/23/03 | 26.9 | | | | 89 | 44 | | 0.5 | 3 | 4 |
| 08/18/03 | 26.9 | | | | 20 | 56 | | 1.4 | 4 | 4 |
| 09/05/03 | 23.5 | | | | 61 | 88 | | 1 | 4 | 4 |
| 09/18/03 | 20.2 | | | | 9.2 | 63 | | 0.8 | 3 | 4 |
| 09/29/03 | 12.9 | | | | 56 | 75 | | 0.8 | 3 | 4 |
| 10/14/03 | 14.6 | | | | 21 | 52 | | 1.3 | 3 | |

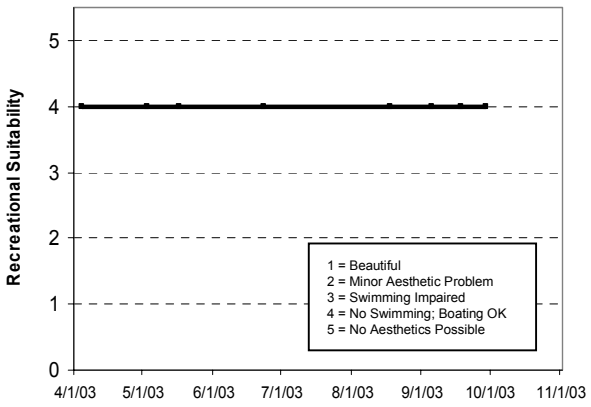



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | C | C | C | | | D | C | C | C |
| Chlorophyll a | | | C | B | B | B | | | C | B | B | C |
| Secchi Depth | | | C | C | C | C | | | D | C | C | C |
| **Overall** | | | **C** | **C** | **C** | **C** | | | **D** | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Lily Lake (82-0023) *City of Stillwater*

Lily Lake, located in the City of Stillwater in Washington County, was monitored seven times between mid-April and early-October, 2003. The lake has been monitored through CAMP since 1995.

The 52-acre lake has a maximum depth of 17.4 m (57 feet), and has public access located on the lake's northern shore and a fishing pier on its southern shore. On each sampling date Lily Lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The 2003 mean summertime (May through September) surface TP concentration for the lake was 38.2 µg/l (minimum of 32.0 µg/l, maximum of 46.0 µg/l). The mean CLA and Secchi transparency readings were 11.8 µg/l (minimum of 4.6 µg/l, maximum of 19.0 µg/l), and 2.0 m (minimum of 1.4 m and maximum of 2.9 m), respectively. The lake's mean surface TKN concentration was 0.87 mg/l (minimum of 0.66 mg/l, maximum of 1.20 mg/l).

The 2003 summertime means resulted in a TP grade of C, CLA grade of B, and Secchi transparency grade of C. The overall grade determined by averaging all three parameters was a C. The lake's 2003 overall water quality grade is similar to those recorded in 1966-2000 and 2002, and worse than those of 1995 and 2001 (B). The 2003 summer means were better than those of 2002.

The physical and recreational conditions of Lily Lake as perceived by the volunteer(s) were ranked on a 1-to-5 scale. These rankings are also graphed on the lake's information sheet. The mean physical condition ranking was 2.2 (between 2- "some algae present" and 3- definite algae present"), while the mean recreational suitability ranking was 2.4 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

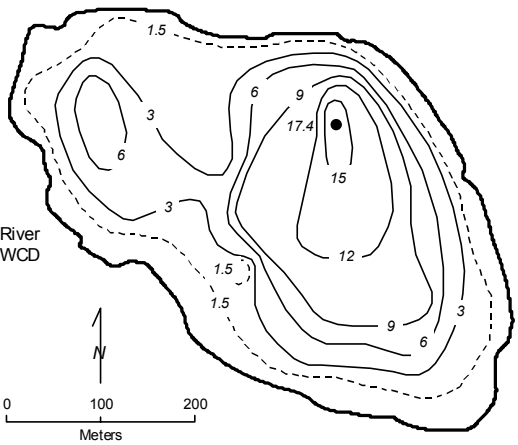
A search for water quality data through Council, MPCA, and STORET files resulted in a moderate amount of data. While 1995-2003 are the only years for which nutrient data are available, Secchi transparencies were collected through the MPCA's Citizen Lake Monitoring Program in 1985, and 1987-1992. The data seem to show a wide fluctuation in the lake's mean CLA concentration and water clarity. The best conditions were recorded in 1995 and 2001 (A's and B's), while 1996-2000 and 2002-2003 conditions were mainly represented by C's.

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.

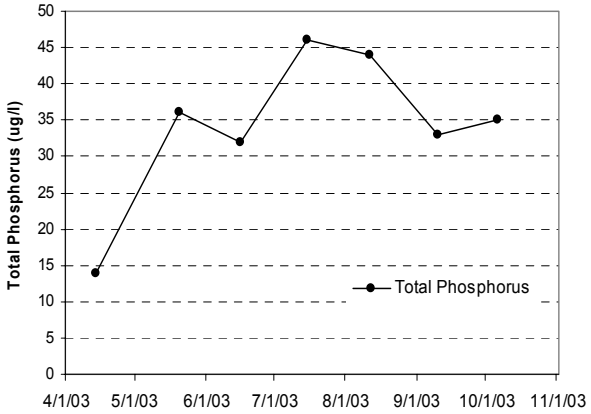
# Lily Lake

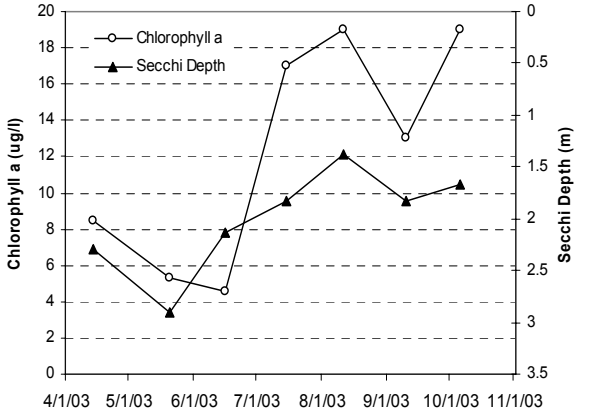
**Stillwater,**
**Washington Co.**




Lake ID: 820023
WMO: Middle St. Croix River
Volunteer: Wash. Co. SWCD

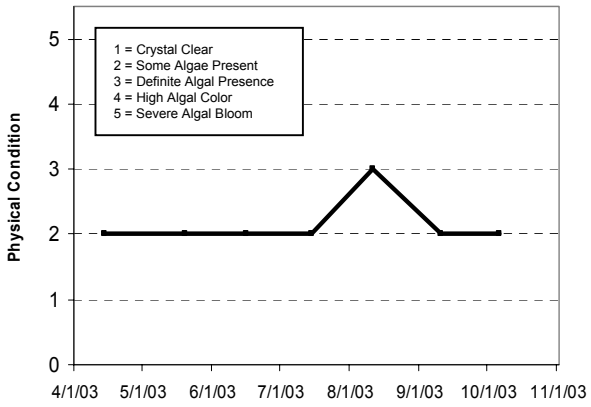
● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 10 | | 10.2 | | 8.5 | 14 | | 2.288 | 2 | 2 |
| 05/20/03 | 17.7 | | 5.33 | | 5.3 | 36 | | 2.898 | 2 | 2 |
| 06/16/03 | 26.4 | | 7.44 | | 4.6 | 32 | | 2.135 | 2 | 2 |
| 07/15/03 | 24.6 | | 9.76 | | 17 | 46 | | 1.83 | 2 | 2 |
| 08/11/03 | 27 | | 12.3 | | 19 | 44 | | 1.373 | 3 | 3 |
| 09/10/03 | 22.9 | | 5.8 | | 13 | 33 | | 1.829 | 2 | 3 |
| 10/06/03 | 13.1 | | 11.39 | | 19 | 35 | | 1.676 | 2 | 3 |

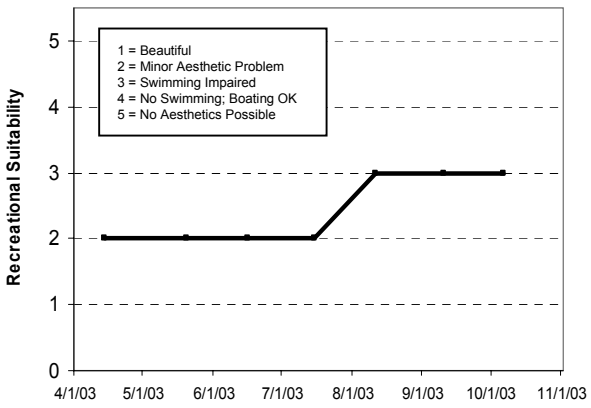



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | C | C | C | C | C | C | C | C | C |
| Chlorophyll a | | | | B | C | B | C | C | C | A | B | B |
| Secchi Depth | B | | | A | B | C | C | C | C | B | C | C |
| **Overall** | | | | **B** | **C** | **C** | **C** | **C** | **C** | **B** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Little Carnelian (82-0014) *Carnelian - Marine Watershed District*

This was the the fourth year of CAMP monitoring in Little Carnelian Lake which is located in Stillwater Township (Washington County). The lake was first enrolled in the program in 2000. The 162-acre lake (which has a shoreline length of 1.7 miles), has a mean and maximum depth of 10.7 m (35 feet) and 21.3 m (70 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 5,686 ac-ft. The lake does not have a public access and its 565-acre watershed translates to a meager 3.5:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lake was monitored 14 times between mid-April and mid-October, 2003. 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.

The mean summertime (May through September) surface TP concentration for the lake was 15.2 µg/l (minimum of 7.0µg/l, maximum of 33.0 µg/l). The mean CLA and Secchi transparency readings were 4.6 µg/l (minimum of 2.6 µg/l, maximum of 6.5 µg/l) and 4.6 m (minimum of 3.5 m, maximum of 5.3 m), respectively. The lake's mean surface TKN concentration was 0.51 mg/l. Similar to that recorded in 2000-2002, the lake quality grades assigned to the 2003 summertime means are TP= A; CLA= A; and Secchi= A. These individual grades result in overall 2003 lake grade of A for Little Carnelian Lake. This places the lakes water quality within the top 10 percent of Metro Area lakes for the years 2000-2003.

The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 1.2 (between 1- "crystal clear" and 2- "some algae present"), while the mean recreational suitability ranking was 1.1 (roughly equal to 1- "beautiful").

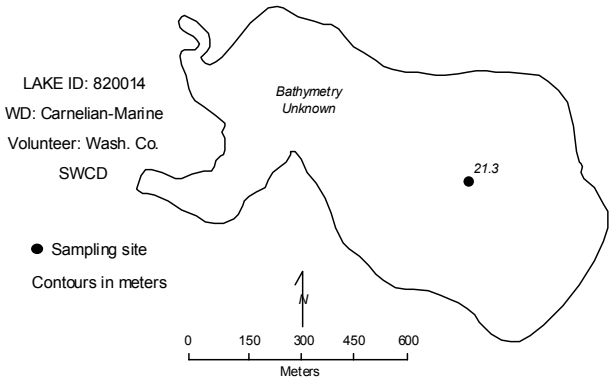
A search of the STORET nationwide water quality database for data on the lake revealed a moderate database throughout the 1990's with nutrient data available in 1991-1996 and 1998-2002. The lake's database indicates that the lake's water quality is well represented by an overall grade of A. Furthermore, a recent MPCA conducted trend analysis on the lake's Secchi transparency data, revealed a statistically significant improvement in recent water clarity.

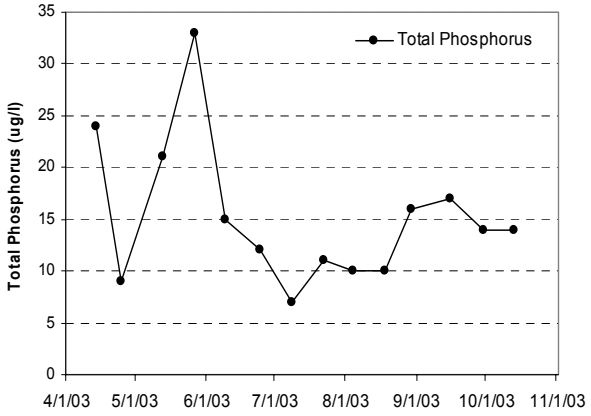
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) conducted a fisheries survey on the lake in 1991. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

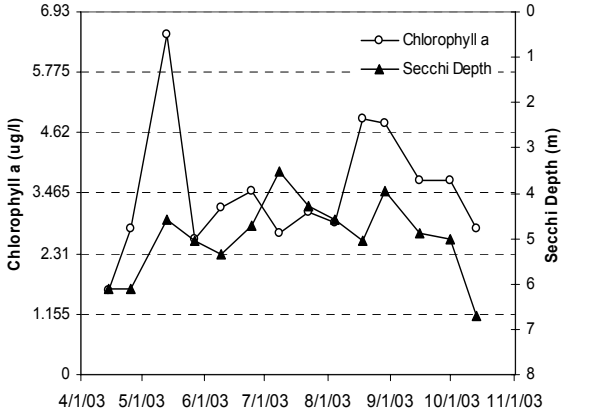
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Little Carnelian Lake

**Stillwater Twp., Washington Co.**

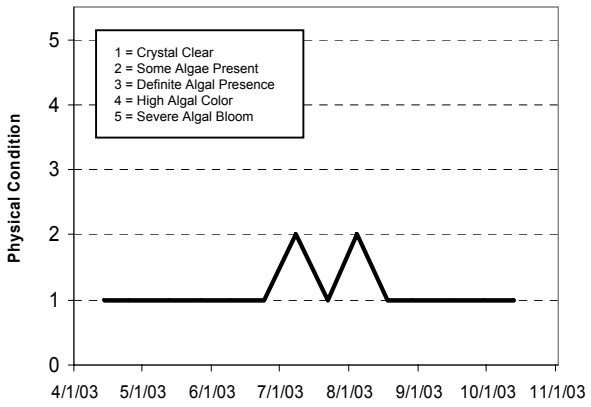



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/14/03 | 8.2 | | 9.8 | | 1.6 | 24 | | 6.1 | 1 | 1 |
| 04/25/03 | 10.6 | | 6.2 | | 2.8 | 9 | | 6.1 | 1 | 1 |
| 05/13/03 | 13.1 | | 8.73 | | 6.5 | 21 | | 4.57 | 1 | 1 |
| 05/27/03 | 18 | | 5.27 | | 2.6 | 33 | | 5.03 | 1 | 1 |
| 06/09/03 | 19.8 | | 7.72 | | 3.2 | 15 | | 5.34 | 1 | 1 |
| 06/24/03 | 23.9 | | 8 | | 3.5 | 12 | | 4.73 | 1 | 1 |
| 07/08/03 | 25.9 | | 9.24 | | 2.7 | 7 | | 3.51 | 2 | 2 |
| 07/22/03 | 24.5 | | 4.65 | | 3.1 | 11 | | 4.27 | 1 | 1 |
| 08/04/03 | 24.9 | | 8.42 | | 2.9 | 10 | | 4.575 | 2 | 2 |
| 08/18/03 | 26.6 | | 9.25 | | 4.9 | 10 | | 5.03 | 1 | 1 |
| 08/29/03 | 25 | | 6.49 | | 4.8 | 16 | | 3.962 | 1 | 1 |
| 09/15/03 | 21.5 | | 6.97 | | 3.7 | 17 | | 4.877 | 1 | 1 |
| 09/30/03 | 14.9 | | 9.55 | | 3.7 | 14 | | 5.029 | 1 | 1 |
| 10/13/03 | 14.5 | | 9.98 | | 2.8 | 14 | | 6.706 | 1 | 1 |

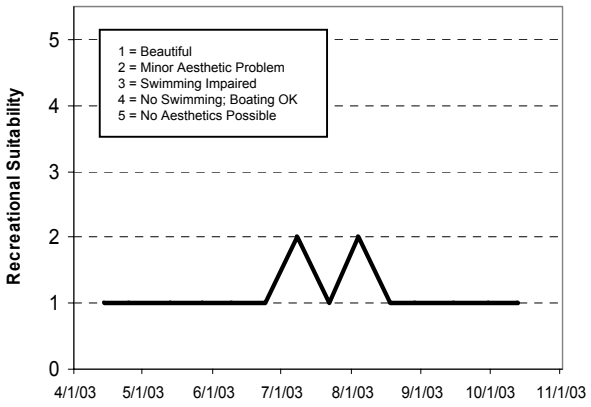



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | A | | | | A | A | | | A | B | A | A |
| Chlorophyll a | A | | | | A | A | | | A | A | A | A |
| Secchi Depth | A | A | A | A | A | A | A | | A | A | A | A |
| **Overall** | **A** | | | | **A** | **A** | | | **A** | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Little Johanna (62-0058) *Rice Creek Watershed District*

This was the third year that Little Johanna Lake, which is located on the boundary between the Cities of Arden Hills and Roseville (Ramsey County), was monitored as part of CAMP. The 35-acre lake has a maximum depth of 12.0 m (39 feet). A search through the STORET nationwide water quality database for data on the lake came up empty other than for the 2001-2002 CAMP data.

The lake was monitored 15 times from mid-April to mid-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 98.3 µg/l (minimum concentration of 65.0 µg/l and a maximum value of 165.0 µg/l); surface chlorophyll-a= 28.1 µg/l (minimum of 2.8 µg/l and maximum of 69.0 µg/l); Secchi transparency= 1.3 m (minimum of 0.5 m and a maximum of 3.0 m); and TKN= 1.09 mg/l (minimum of 0.61 mg/l and maximum of 1.80 mg/l). The lake's summer means translate to water quality grades of D for TP, C, for CLA, and C for Secchi transparency. These grades result in an overall water quality grade of C for Little Johanna Lake in 2003. The 2003 overall grade is identical to those of 2001and 2002. The best parameter means were recorded in 2001.

Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 2.6 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 3.8 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

As mentioned earlier, there are no water quality data available for Little Johanna Lake other than the recent 2001-2003 data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

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/.

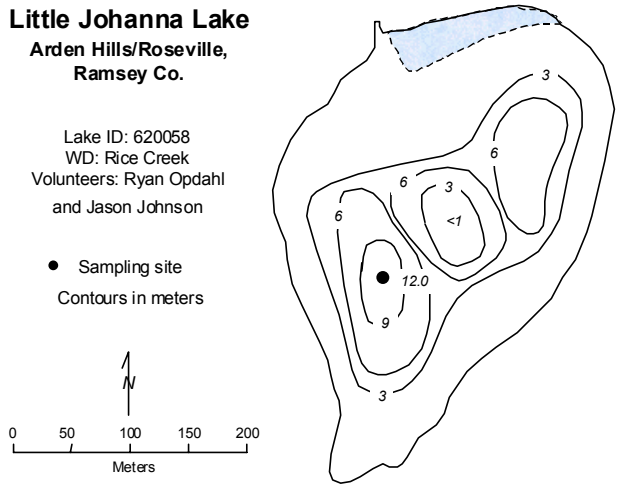
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

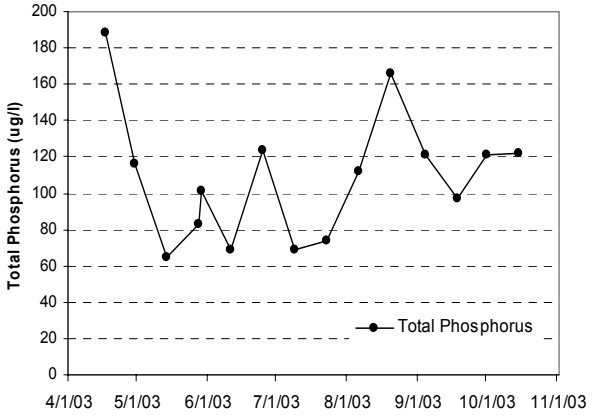
# Little Johanna Lake

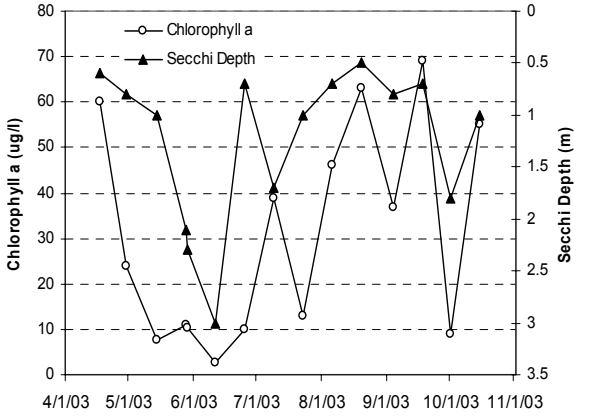
**Arden Hills/Roseville, Ramsey Co.**

Lake ID: 620058
WD: Rice Creek
Volunteers: Ryan Opdahl and Jason Johnson

● Sampling site
Contours in meters

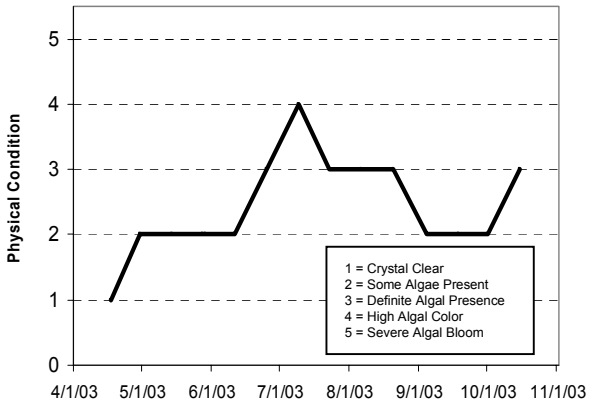



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/17/03 | 9 | | | | 60 | 188 | | 0.6 | 1 | 4 |
| 04/30/03 | 15 | | | | 24 | 116 | | 0.8 | 2 | 4 |
| 05/14/03 | 15 | | | | 7.6 | 65 | | 1 | 2 | 4 |
| 05/28/03 | 21 | | | | 11 | 83 | | 2.1 | 2 | 4 |
| 05/29/03 | 20 | | | | 10.2 | 101 | | 2.3 | 2 | 2 |
| 06/11/03 | 19 | | | | 2.8 | 69 | | 3 | 2 | 4 |
| 06/25/03 | 20 | | | | 10 | 124 | | 0.7 | 3 | 4 |
| 07/09/03 | 24 | | | | 39 | 69 | | 1.7 | 4 | 4 |
| 07/23/03 | 27 | | | | 13 | 74 | | 1 | 3 | 4 |
| 08/06/03 | 26 | | | | 46 | 112 | | 0.7 | 3 | 4 |
| 08/20/03 | 27 | | | | 63 | 166 | | 0.5 | 3 | 4 |
| 09/04/03 | 21 | | | | 37 | 121 | | 0.8 | 2 | 4 |
| 09/18/03 | 19 | | | | 69 | 97 | | 0.7 | 2 | 4 |
| 10/01/03 | 11 | | | | 9 | 121 | | 1.8 | 2 | 4 |
| 10/15/03 | 12 | | | | 55 | 122 | | 1 | 3 | 4 |

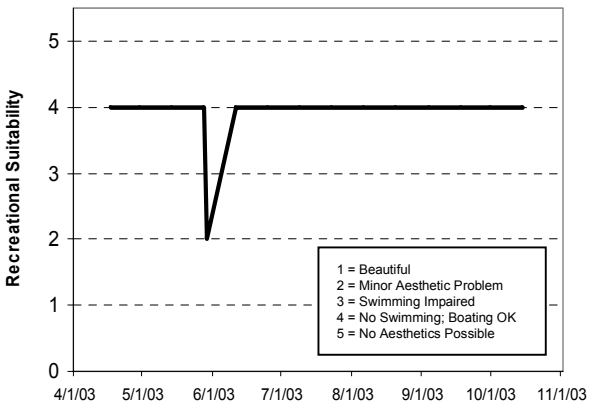



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | C | D | D |
| Chlorophyll a | | | | | | | | | | C | C | C |
| Secchi Depth | | | | | | | | | | C | C | C |
| **Overall** | | | | | | | | | | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Long Lake [Apple Valley] (19-0022) *Vermillion River Watershed Management Commission*

Long Lake, which has a surface area of roughly 36 acres, is located within the City of Apple Valley (Dakota County). Other than the fact that the maximum depth of the lake is approximately 3.5 m (10 feet), there is no known morphological data available for the lake. Because the lake is relatively shallow, it does not develop and maintain a thermocline (a density gradient owed to changing water temperatures throughout the water column), and the entire lake is considered littoral, (the shallow [0-15 feet] area dominated by aquatic plants).

This is the third year in which Long Lake was involved in CAMP (1997 and 2002 being the others). A search for historical water quality data for the lake came up empty.

As part of the 2003 volunteer monitoring program, Long Lake was monitored 13 times from mid-April to mid-October. Graphs as well as the actual data collected by the volunteer(s) show the seasonal variability in TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability). The graphs and data tables are presented on the next page.

The 2003 summertime mean concentrations for Long Lake were: TP= 369.0 µg/l (minimum of 143.0 µg/l, maximum of 494.0 µg/l); CLA= 281.0 µg/l (minimum of 38.0 µg/l, maximum of 810.0 µg/l m [the worst recorded in CAMP 2003]); Secchi transparency= 0.3 m (minimum of 0.1 m m [the worst recorded in CAMP 2003], maximum of 0.8 m); and TKN= 4.25 mg/l (minimum and maximum of 2.00 and 8.20 mg/l), respectively. The lake's 2003 CLA mean was the worst recorded in CAMP in 2003, while the TP mean was the second worst.

The summertime means resulted in a TP grade of F, CLA grade of F, and Secchi transparency grade of F. The lake's 2002 overall water quality grade calculated from the three individual parameter grades listed above, was F. The 2003 water quality of Long Lake is worse than that recorded in 1997 and 2002 (as shown by comparing the overall grades as well as individual means)

Because 2003 is only the third year of available data, no long- or short-term trends can be determined. To better understand the quality of the lake and what direction it may be heading, more years of data collection are needed.

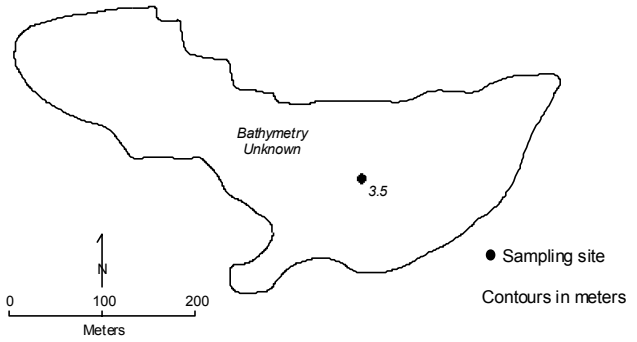
Throughout the course of the study, the volunteer monitors ranked their perceptions of the lake's physical and recreational condition on a 1-to-5 scale. These user perception rankings are shown on the lake's information sheet on the following page. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability was 3.6 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

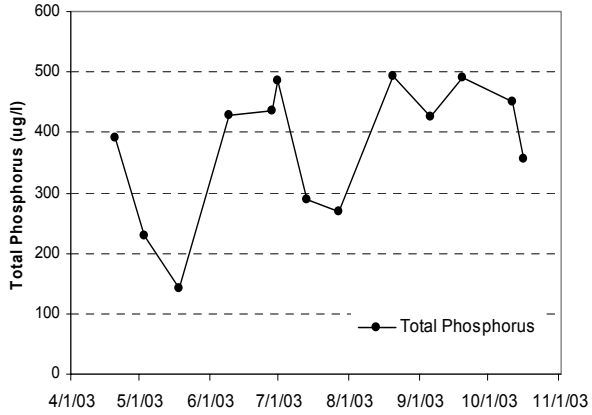
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

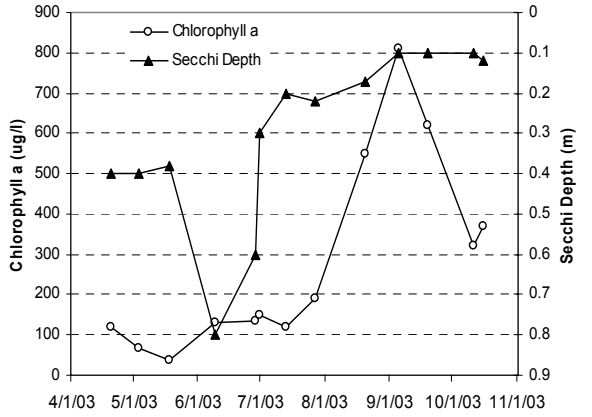
# Long Lake

**Apple Valley, Dakota Co.**

Lake ID: 190022
WMO: Dakota County
Volunteers: Cherie Serie and Al Kettelkamp

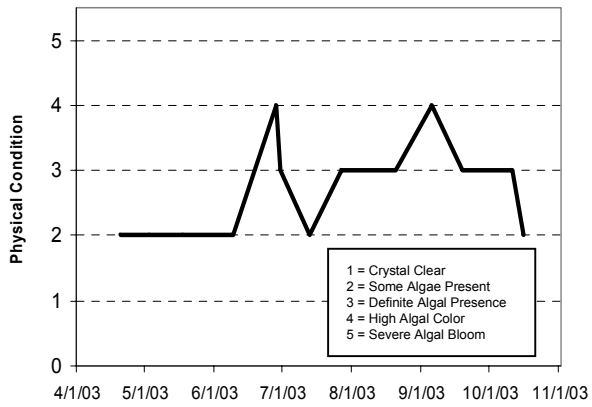



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/20/03 | 9 | | | | 120 | 390 | | 0.4 | 2 | 4 |
| 05/03/03 | 18 | | | | 67 | 228 | | 0.4 | 2 | 3 |
| 05/18/03 | 21 | | | | 38 | 143 | | 0.38 | 2 | 3 |
| 06/09/03 | 21 | | | | 130 | 428 | | 0.8 | 2 | 3 |
| 06/28/03 | 25.5 | | | | 135 | 435 | | 0.6 | 4 | 4 |
| 06/30/03 | 28 | | | | 150 | 485 | | 0.3 | 3 | 4 |
| 07/13/03 | 26 | | | | 120 | 290 | | 0.2 | 2 | 4 |
| 07/27/03 | 30 | | | | 190 | 270 | | 0.22 | 3 | 3 |
| 08/20/03 | 28 | | | | 550 | 494 | | 0.17 | 3 | 4 |
| 09/05/03 | 23 | | | | 810 | 426 | | 0.1 | 4 | 4 |
| 09/19/03 | 17.5 | | | | 620 | 491 | | 0.1 | 3 | 4 |
| 10/11/03 | 17 | | | | 320 | 451 | | 0.1 | 3 | 4 |
| 10/16/03 | 11 | | | | 370 | 356 | | 0.12 | 2 | 4 |

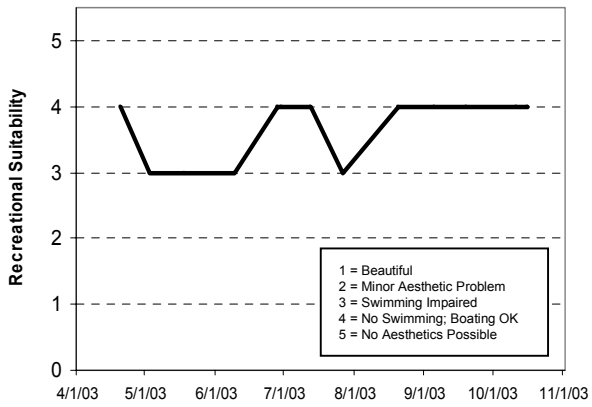



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | D | | | | | F | F |
| Chlorophyll a | | | | | | D | | | | | F | F |
| Secchi Depth | | | | | | F | | | | | F | F |
| **Overall** | | | | | | **D** | | | | | **F** | **F** |

Source: Metropolitan Council and STORET data



## Long Lake [Carver County] (10-0016) *Carver County Environmental Services*

This year marks the third year of CAMP monitoring on Long Lake (1999 [two sample dates] and a 2001), which is located in San Franciso Township (Carver County). Other than the 1999 and 2001 CAMP data, a search for any historical water quality data came up empty. The 56-acre lake has a maximum depth of roughly 2.0 m (just over six feet). Because of the shallowness of the lake, the majority of its are is 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). The lake does not have a public access.

The lake was monitored five times between late-May and late-July, 2003. Results are presented on graphs and data tables on the following page. During each monitoring event, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as its perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration for the lake was 203.4 µg/l (minimum of 144.0 µg/l, maximum of 298.0 µg/l). The mean CLA and Secchi transparency readings were 41.4 µg/l (minimum of 22.0 µg/l, maximum of 53.0 µg/l) and 0.4 m (minimum of 0.3 m, maximum of 0.5 m), respectively. The lake's mean surface TKN concentration was 1.62 mg/l. The lake quality grades assigned to the 2003 summertime means are TP= F; CLA= C; and Secchi= F, resulting in an overall grade of D. The 2003 overall grade is better than the overall grade recorded in 2001 (F).

The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 3.0 (3- "definite algae present"), while the mean recreational suitability ranking was 4.0 ("no swimming – boating ok").

Because 2003 was only the third year of available data (and the 1999 dataset is lacking at best), no long- or short-term trends can be determined. To better understand the lake's quality and what direction it may be heading, more years of data collection are needed.

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.

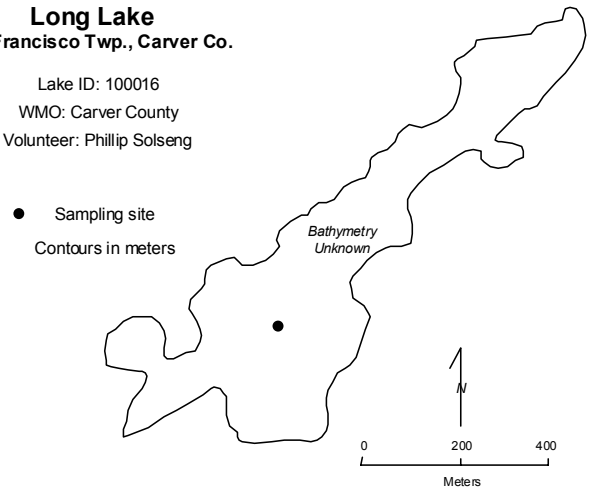
# Long Lake

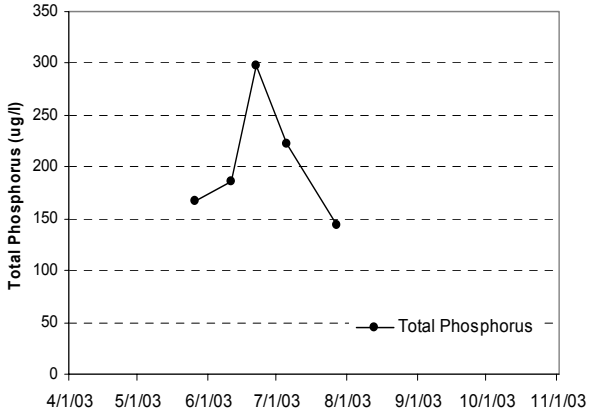
**San Francisco Twp., Carver Co.**

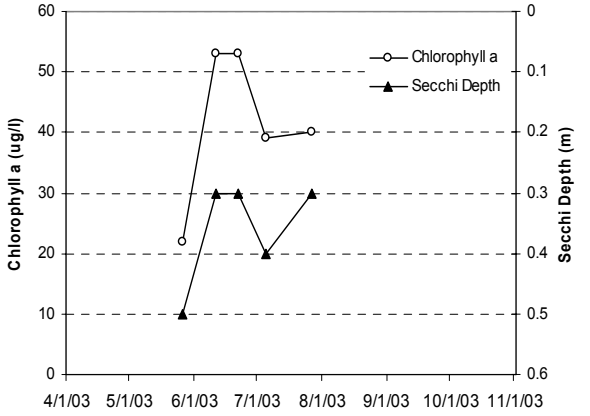
Lake ID: 100016

WMO: Carver County

Volunteer: Phillip Solseng

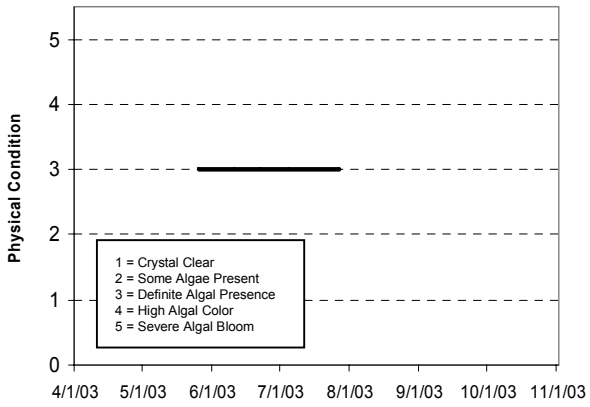



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/26/03 | 20 | | | | 22 | 167 | | 0.5 | 3 | 4 |
| 06/11/03 | 19 | | | | 53 | 186 | | 0.3 | 3 | 4 |
| 06/22/03 | 25 | | | | 53 | 298 | | 0.3 | 3 | 4 |
| 07/05/03 | 30 | | | | 39 | 222 | | 0.4 | 3 | 4 |
| 07/27/03 | 25 | | | | 40 | 144 | | 0.3 | 3 | 4 |

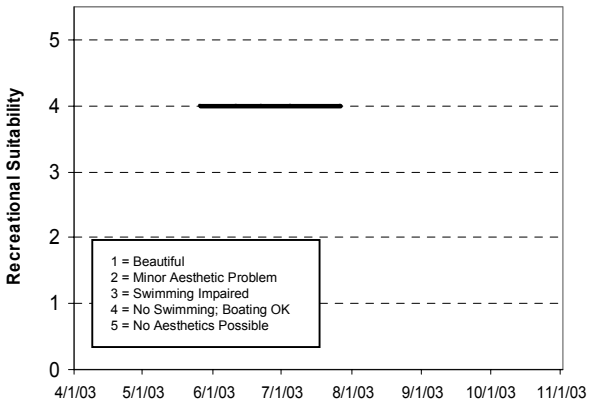



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | F | | F |
| Chlorophyll a | | | | | | | | | | D | | C |
| Secchi Depth | | | | | | | | | | F | | F |
| **Overall** | | | | | | | | | | **F** | | **D** |

Source: Metropolitan Council and STORET data



## Long Lake [Mahtomedi] (82-0130) *Rice Creek Watershed District*

Long Lake, a 48-acre lake with a maximum depth of 7.7 m (25 freet), is located within City of Mahtomedi (Washington County). Roughly 92 percent of the lake's surface 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).

Two thousand and three marks the first year in which Long Lake has been involved in CAMP. A search through the STORET nationwide water quality database for historic data on the lake was unsuccessful. Thus, 2003 is the only complete, year of available data. 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.

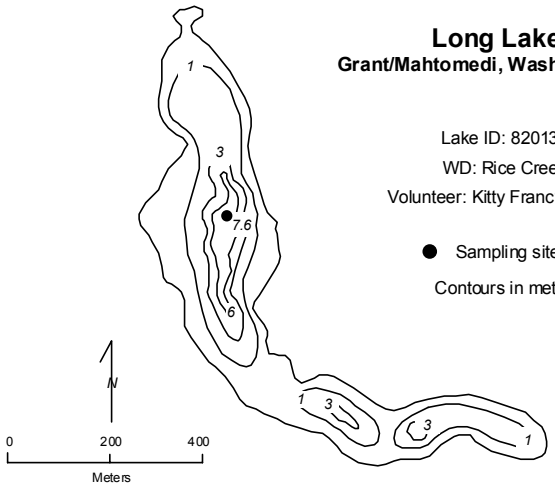
The lake was monitored 11 times between late-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of B was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 24.9 µg/l (minimum of 5.0 µg/l, maximum of 49.0 µg/l) corresponds to a lake water quality grade of B, as did the mean Secchi transparency of 2.3 m (minimum of 1.7 m, maximum of 3.2 m). The lake's the mean CLA concentration of 7.9 µg/l (minimum of 2.5 µg/l and maximum of 29.0 µg/l) also resulted in a grade of A. The mean TKN concentration over the same time period was 0.46 mg/l.

As mentioned earlier, there are no water quality data available for Long Lake other than the 2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 2.7 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 3.5 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

If you notice any errors in the lake 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




# Long Lake

**Grant/Mahtomedi, Washington Co.**

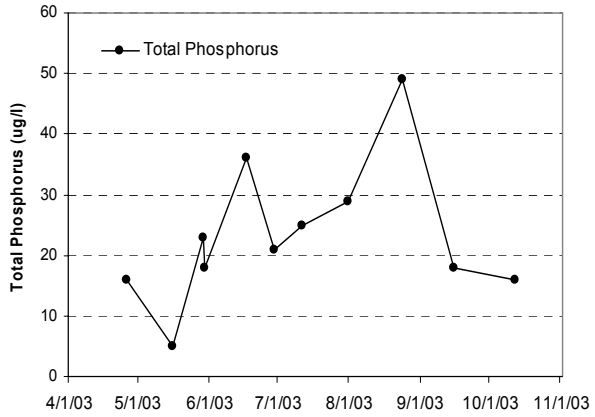
Lake ID: 820130

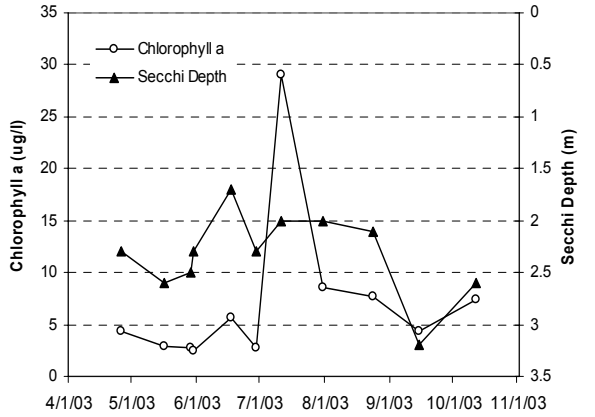
WD: Rice Creek

Volunteer: Kitty Francy-Payton

● Sampling site

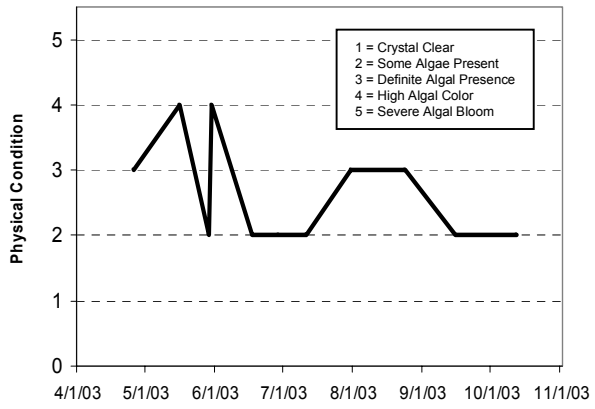
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/26/03 | 14 | | | | 4.3 | 16 | | 2.3 | 3 | 3 |
| 05/16/03 | 18.5 | | | | 2.9 | 5 | | 2.6 | 4 | 4 |
| 05/29/03 | 18.9 | | | | 2.7 | 23 | | 2.5 | 2 | 2 |
| 05/30/03 | 19.6 | | | | 2.5 | 18 | | 2.3 | 4 | 4 |
| 06/17/03 | 25.2 | | | | 5.7 | 36 | | 1.7 | 2 | 3 |
| 06/29/03 | 22.4 | | | | 2.8 | 21 | | 2.3 | 2 | 3 |
| 07/11/03 | 23.5 | | | | 29 | 25 | | 2 | 2 | 3 |
| 07/31/03 | 25.8 | | | | 8.5 | 29 | | 2 | 3 | 4 |
| 08/24/03 | 26.9 | | | | 7.7 | 49 | | 2.1 | 3 | 4 |
| 09/15/03 | 21.8 | | | | 4.3 | 18 | | 3.2 | 2 | 4 |
| 10/12/03 | 15.7 | | | | 7.4 | 16 | | 2.6 | 2 | 3 |

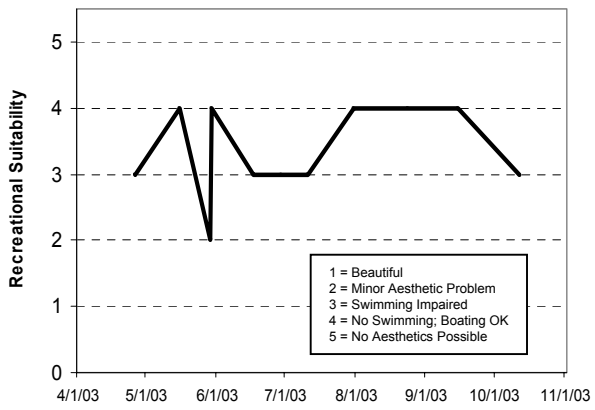



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | | B |
| Chlorophyll a | | | | | | | | | | | | A |
| Secchi Depth | | | | | | | | | | | | B |
| **Overall** | | | | | | | | | | | | **B** |

Source: Metropolitan Council and STORET data



## Long Lake [May Township] (82-0030) *Marine on St. Croix WMO*

Long Lake is a 88-acre lake located in May Township (Washington County). There is little morphological data available for the lake. Because the maximum depth is only 3.7 m (12 feet), the entire lake area is considered littoral (the 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, which was monitored through CAMP in 1993-1997 and 1999-2002, was sampled 14 times between mid-April and mid-October, 2003.

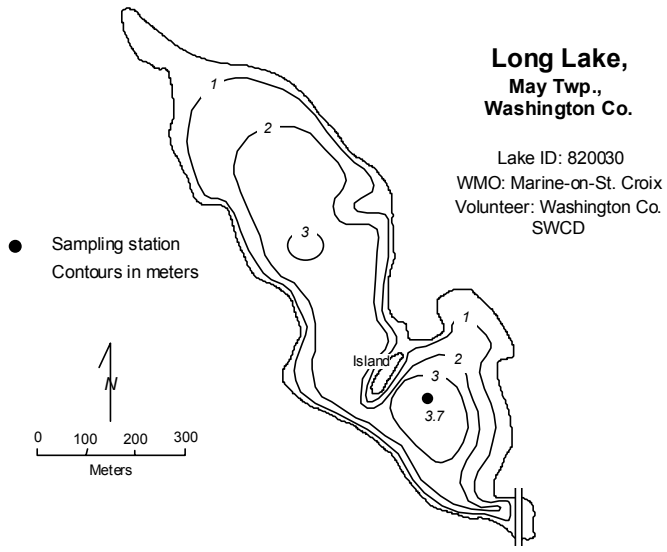
The overall lake quality grade of B was calculated from the individual grades for each parameter. The lake's summertime (May through September) mean TP concentration of 44.6 µg/l (minimum of 24.0 µg/l, maximum of 130.0 µg/l) reulted in a grade of C. The lake's the Secchi transparency mean of 2.3 m (minimum of 1.3 m, maximum of 2.7 m) translates to a grade of B. And, the lake's CLA mean of 7.4 µg/l (minimum and maximum of 2.9 and 27.0 µg/l), on the other hand, resulted in water qual ity grade of A. The lake's mean TKN concentration was 0.76 mg/l (minimum of 0.65 mg/l, maximum of 0.97 mg/l).

Statistical analysis on the lake's database fails to reveal any "statistically significant" long-term trends. The lake's 2003 overall grade was very similar to those recorded in 2000-2001, and better tha those of 1993-1997, 1999 and 2001 (C). Overall, the lake's water quality is representative of a high-C/B grade.

Throughout the course of the study, the volunteer monitor ranked their perceptions of the lake's physical and recreational condition on a 1-to-5 scale. These rankings as well as the data and graphs discussed above are shown on the lake's information sheet on the following page. The mean physical condition ranking was 2.7 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.9 (between 2- "minor aesthetic problem" and 3- "definite algae present").

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.



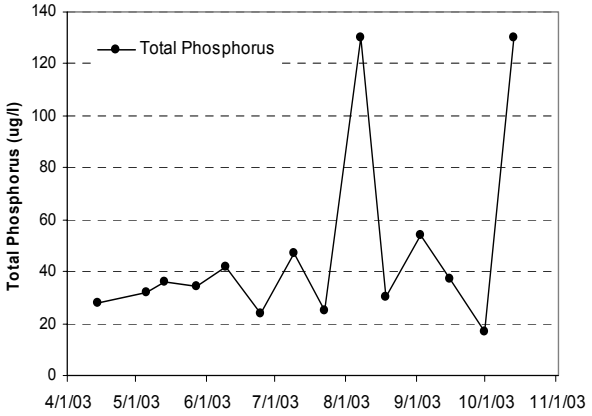

Sampling station

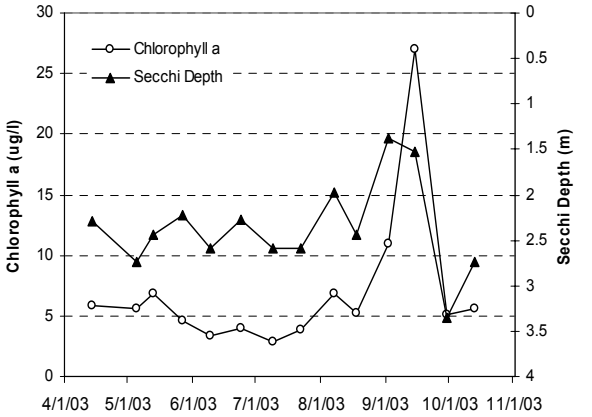
Contours in meters

## Long Lake,

**May Twp.,**
**Washington Co.**

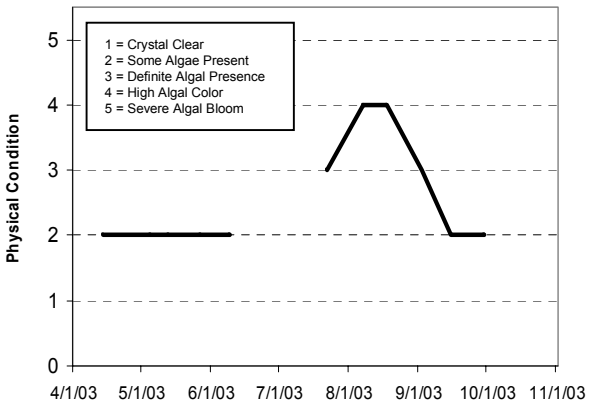
Lake ID: 820030
WMO: Marine-on-St. Croix
Volunteer: Washington Co. SWCD




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 12.5 | | 9.7 | | 5.9 | 28 | | 2.29 | 2 | 2 |
| 05/05/03 | 13.7 | | 7.4 | | 5.6 | 32 | | 2.745 | 2 | 2 |
| 05/13/03 | 15.4 | | 7.83 | | 6.8 | 36 | | 2.44 | 2 | 2 |
| 05/27/03 | 22 | | 5.19 | | 4.6 | 34 | | 2.23 | 2 | 2 |
| 06/09/03 | 22 | | 5.6 | | 3.3 | 42 | | 2.593 | 2 | 2 |
| 06/24/03 | 24.4 | | 7.91 | | 4 | 24 | | 2.28 | | |
| 07/09/03 | 24.4 | | 7.5 | | 2.9 | 47 | | 2.593 | | |
| 07/22/03 | 24.3 | | 4 | | 3.9 | 25 | | 2.593 | 3 | 3 |
| 08/07/03 | 24.6 | | 7.08 | | 6.9 | 130 | | 1.983 | 4 | 4 |
| 08/18/03 | 26.2 | | 7.3 | | 5.2 | 30 | | 2.44 | 4 | 4 |
| 09/02/03 | 22.5 | | | | 11 | 54 | | 1.372 | 3 | 4 |
| 09/15/03 | 21.4 | | 4.63 | | 27 | 37 | | 1.524 | 2 | 3 |
| 09/30/03 | 11.5 | | 9.56 | | 5.1 | 17 | | 3.353 | 2 | 1 |
| 10/13/03 | 14 | | 9.33 | | 5.6 | 130 | | 2.743 | | |

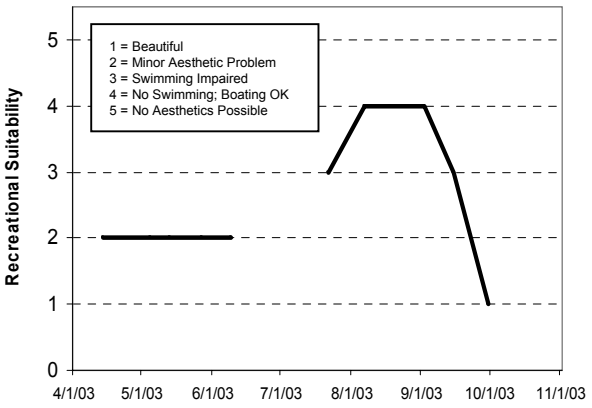



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | C | C | C | C | | C | C | C | C | C |
| Chlorophyll a | | C | C | C | B | C | | B | B | B | B | A |
| Secchi Depth | | B | C | C | C | C | | C | B | B | C | B |
| **Overall** | | **C** | **C** | **C** | **C** | **C** | | **C** | **B** | **B** | **C** | **B** |

Source: Metropolitan Council and STORET data



## Long Lake [Stillwater] (82-0021) *Browns Creek Watershed District*

Long Lake, which has a surface area of roughly 96 acres, is located on the western boundary of the City of Stillwater (Washington County). Its maximum depth is 6.7 m (22 feet).

As part of the 2003 volunteer monitoring program, Long Lake was monitored 14 times from mid-May to mid-October. This was the seventh year that Long Lake has been involved in CAMP. The lake was also involved in the program in 1995-1996, and 1998-2002. Graphs as well as the actual data collected by volunteers show the seasonal variability in TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability). The graphs and data tables are presented on the next page.

The 2003 summertime mean concentrations for Long Lake were as follows: TP= 113.0 µg/l (minimum of 56.0 µg/l, maximum of 156.0 µg/l); CLA= 65.5 µg/l (minimum of 33.0 µg/l, maximum of 100.0 µg/l); Secchi transparency= 0.6 m (minimum of 0.5 m, maximum of 0.9 m); and TKN= 1.86 mg/l (minimum and maximum of 1.50 and 2.30 mg/l), respectively. The summertime means resulted in a TP grade of D, CLA grade of D, and Secchi transparency grade of F. The 2003 overall water quality grade for the lake, D, is identical to those recorded in 1995-1996 and 2002, and better than the F's posted in 1998-2001.

A search for water quality data through Council, MPCA, and STORET files resulted in a minimal amount of data. The only years where nutrient data are available for the lake are 1995-1996, and 1998-2003. Additionally, Secchi transparencies collected through the MPCA's Citizen Lake Monitoring Program are available for 1987, 1989, and 1991-1994. When these data are analyzed, it reveals that the lake's water clarity has seemed fairly constant with grades of F in 1987, 1991-1995, 1998-2003, and a D in 1989 and 1996 (although the 1996 database is limited).

A recent MPCA conducted trend analysis on the lake's Secchi transparency data, revealed a statistically significant decrease in recent water clarity. In addition to the decreasing pattern in the lake's clarity, the lake's nutrient concentrations, until decreasing in 2002 (and then slightly increasing again in 2003), seemed to be increasing from 1998-2001. To better determine if the increasing nutrient concentrations are indeed a possible trend or is simply a flucuation within the lake's normal range (as shown from the 2002 data), more data are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The mean physical condition ranking was 3.4 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 3.9 (roughly equal to 4- "no swimming - boating ok"). These numbers are similar to those in past years.

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.

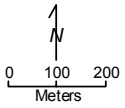
# Long Lake,

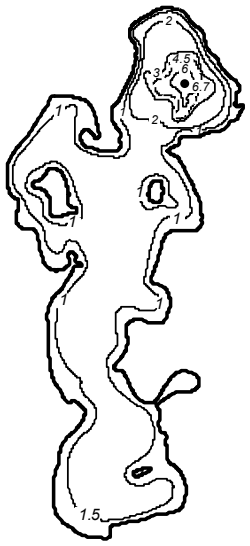
**Stillwater, Washington Co.**

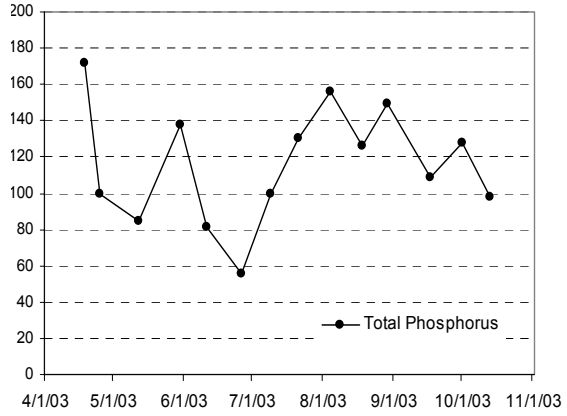
Lake ID: 820021
WMO: Browns Creek
Volunteer: Wash. Co. SWCD

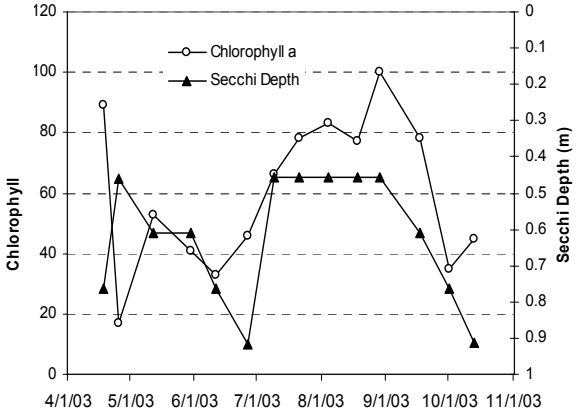
● Sampling site

Contours in meters



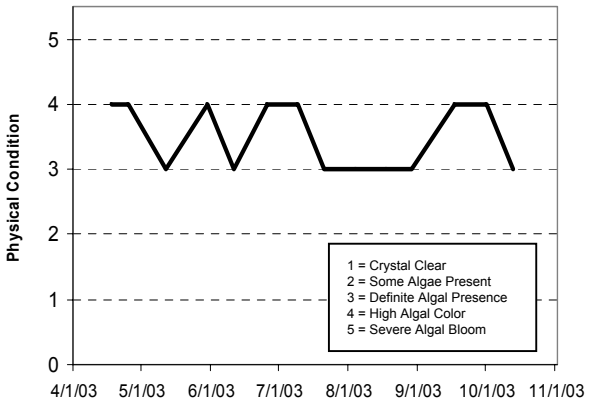




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 10.2 | | 7.2 | | 89 | 172 | | 0.763 | 4 | 4 |
| 04/25/03 | 15.5 | | 5.04 | | 17 | 100 | | 0.46 | 4 | 4 |
| 05/12/03 | 13.2 | | 6.47 | | 53 | 85 | | 0.61 | 3 | 4 |
| 05/30/03 | 20.8 | | 5.28 | | 41 | 138 | | 0.61 | 4 | 4 |
| 06/11/03 | 20.3 | | 2.03 | | 33 | 81 | | 0.763 | 3 | 3 |
| 06/26/03 | 22.8 | | 5.93 | | 46 | 56 | | 0.915 | 4 | 4 |
| 07/09/03 | 24.8 | | 8.9 | | 66 | 100 | | 0.458 | 4 | 5 |
| 07/21/03 | 25 | | 5.6 | | 78 | 130 | | 0.458 | 3 | 4 |
| 08/04/03 | 25.4 | | 11.8 | | 83 | 156 | | 0.458 | 3 | 4 |
| 08/18/03 | 28.5 | | 11.5 | | 77 | 126 | | 0.458 | 3 | 4 |
| 08/29/03 | 23.6 | | 4.37 | | 100 | 149 | | 0.457 | 3 | 3 |
| 09/17/03 | 20.6 | | 7.1 | | 78 | 109 | | 0.61 | 4 | 4 |
| 10/01/03 | 11.7 | | 4.6 | | 35 | 128 | | 0.762 | 4 | 4 |
| 10/13/03 | 15 | | 9.33 | | 45 | 98 | | 0.914 | 3 | 4 |

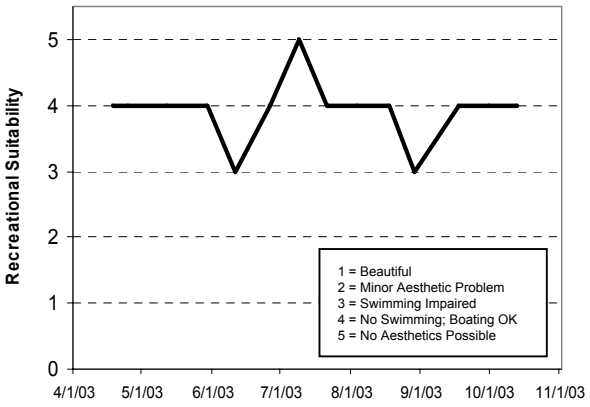



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | D | D | | D | D | F | D | D | D |
| Chlorophyll a | | | | D | D | | F | F | F | F | D | D |
| Secchi Depth | F | F | F | F | D | | F | F | F | F | F | F |
| **Overall** | | | | **D** | **D** | | **F** | **F** | **F** | **F** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Long Lake [Washington Co.] (82-0068) *Carnelian - Marine Watershed District*

Long Lake is a 35-acre lake located within New Scandia Township (Washington County). The maximum and mean depths of the lake are 2.1 m (roughly seven feet) and 1.1 m (three-and-a-half feet), respectively. 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 surface area and mean depth translates to an approximate volume of 126 ac-ft.

The majority of the land within the 381-acre watershed is undeveloped. The watershed-to-lake size ratio is 11:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake.

This was the fourth year that Long Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake was very limited. The only years in which data are available other than the 2000-2003 CAMP data, were 1998-1999. The lake was monitored seven times between late-April and early-October, 2003. The resulting data and graphs appear on the next page.

The 2003 overall lake quality grade for Long Lake, calculated from the individual parameter grades, is F. The 2003 summertime (May - September) mean TP concentration of 91.4 µg/l (minimum of 67.0 µg/l, maximum of 125.0 µg/l) corresponded to a lake water quality grade of D. The lake's CLA mean of 81.2 µg/l (minimum and maximum of 33.0 and 160.0 µg/l) translates to a grade of F, as does the Secchi transparency mean of 0.5 m (minimum of 0.3 m and maximum of 0.8 m). The lake's mean TKN concentration was 2.66 mg/l (minimum of 1.40 mg/l, maximum of 4.00 mg/l).

The lake's 2003 overall grade, which is identical to those recorded in 1998-2000 (F), shows a degration from the D in 2001 and C in 2002. In fact, the 2003 parameter means are all worse by approximately a factor of two than those of 2002.

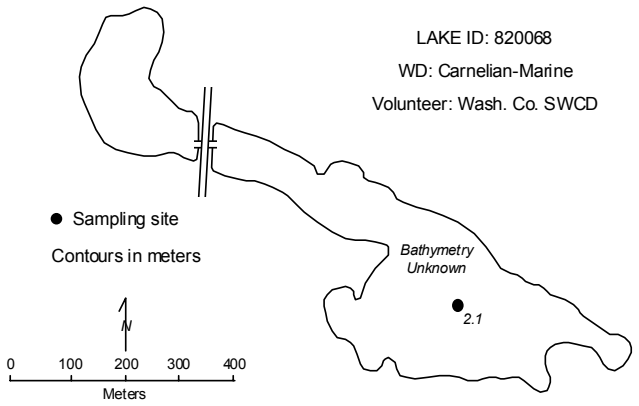
As mentioned earlier, there is very little water quality data available for Long Lake. Therefore it is not possible to determine any long-term or short-term trends. In the short-term however, the lake's quality which had shown some recent improvement in 2001-2002, fell back to pre-2001 conditions. The reason for this dramatic decrease in water quality is not known. To better understand the lake's water quality and where it may be heading, more data are needed.

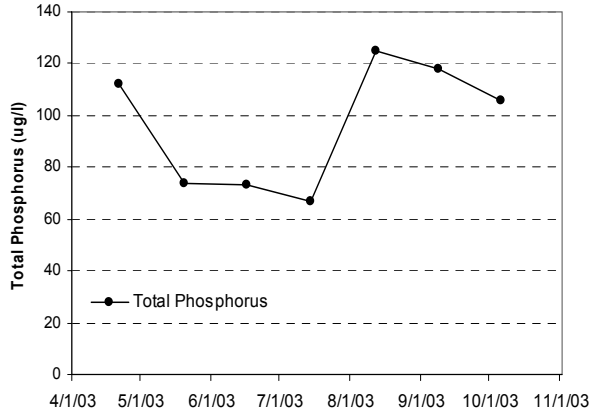
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 3.2 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 3.6 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

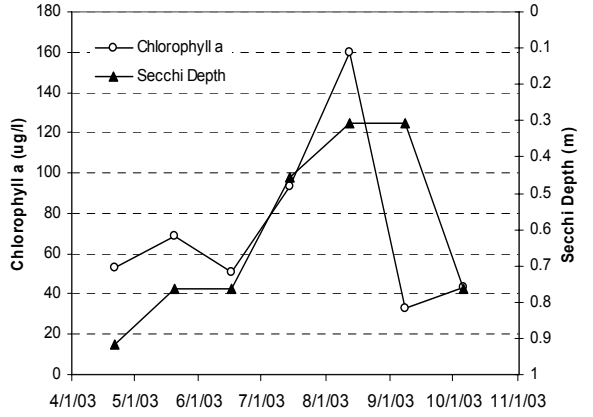
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Long Lake

**New Scandia Twp., Washington Co.**

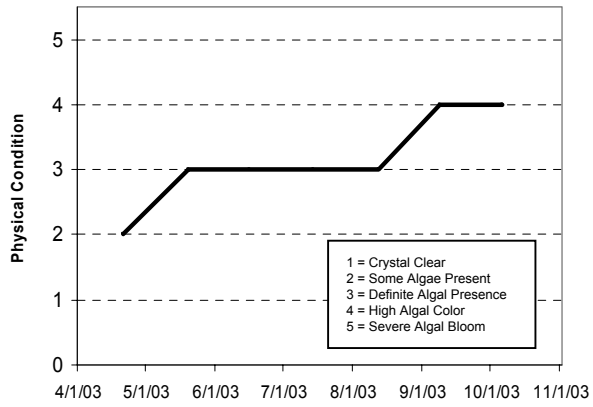



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 9.4 | | 8.26 | | 53 | 112 | | 0.915 | 2 | 3 |
| 05/20/03 | 16.1 | | 5.05 | | 69 | 74 | | 0.763 | 3 | 3 |
| 06/16/03 | 25.7 | | 7.61 | | 51 | 73 | | 0.763 | 3 | 3 |
| 07/14/03 | 25.5 | | 10.5 | | 93 | 67 | | 0.458 | 3 | 4 |
| 08/12/03 | 24.6 | | 9.72 | | 160 | 125 | | 0.305 | 3 | 4 |
| 09/08/03 | 22.9 | | 10.2 | | 33 | 118 | | 0.305 | 4 | 4 |
| 10/06/03 | 11.8 | | 9.87 | | 43 | 106 | | 0.762 | 4 | 4 |

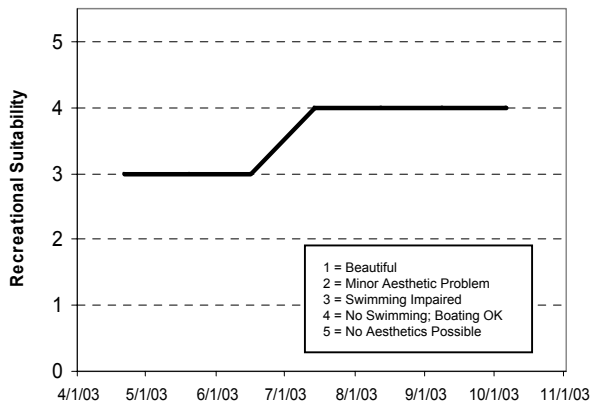



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | D | D | D | C | C | D |
| Chlorophyll a | | | | | | | F | F | F | D | C | F |
| Secchi Depth | | | | | | | F | F | F | D | D | F |
| **Overall** | | | | | | | **F** | **F** | **F** | **D** | **C** | **F** |

Source: Metropolitan Council and STORET data



## Loon Lake (82-0015) *Carnelian - Marine Watershed District*

This was the fourth year of CAMP monitoring in Loon Lake, which is located in the Stillwater Township (Washington County). A search for any historical water quality data provided limited water quality data (1996-2000). The 64-acre lake has a mean and maximum depth of 2.4 m (eight feet) and 4.9 m (16 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 206 ac-ft. Because of the shallowness of the lake, the majority of its area is 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). The lake does not have a public access and its 407-acre watershed translates to a 6.4:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lake was monitored seven times between late-April and early-October, 2003. 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.

The 2003 mean summertime (May through September) surface TP concentration for the lake was 131.8 µg/l (minimum of 100.0 µg/l, maximum of 173.0 µg/l). The mean CLA and Secchi transparency readings were 129.4 µg/l (minimum of 87.0 µg/l, maximum of 170.0 µg/l) and 0.4 m (minimum of 0.3 m, maximum of 0.6 m), respectively. The lake's mean surface TKN concentration was 3.12 mg/l. The lake quality grades assigned to the 2002 summertime means are TP= D; CLA= F; and Secchi= F, resulting in an overall grade of F. While the lake's 2003 overall grade was identical to those recorded in 1996-1998 and worse than those in 2000-2002.

The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

Throughout the summer, the volunteer ranked the lake's physical and recreational conditions on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 3.6 (between 3- "definite agale present" and 4- "high algal color"), while the mean recreational suitability ranking was 3.8 (between 3-"swimming slightly impaired" and 4- "no swimming - boating ok").

Because of the limitedness of the lake's water quality database, no long-trend can be determined. In the short-term however, the lake's water quality seems to be well represented by D/F+. To better understand the quality of the lake and what direction it may be heading, more years of data collection are needed.

The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) conducted a fisheries survey on the lake in 1991. 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.

# Loon Lake

**Stillwater Twp., Washington Co.**

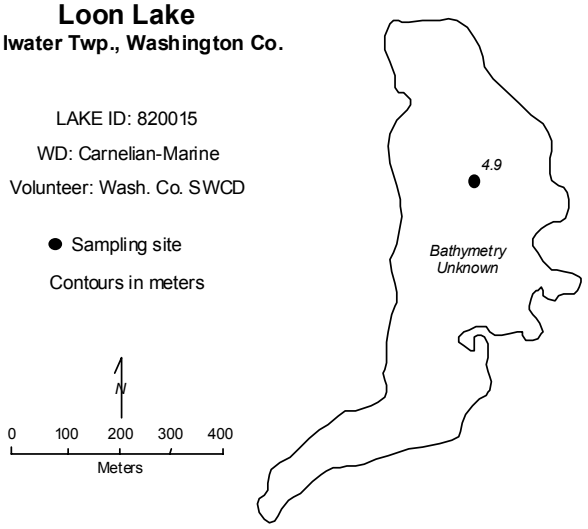
LAKE ID: 820015

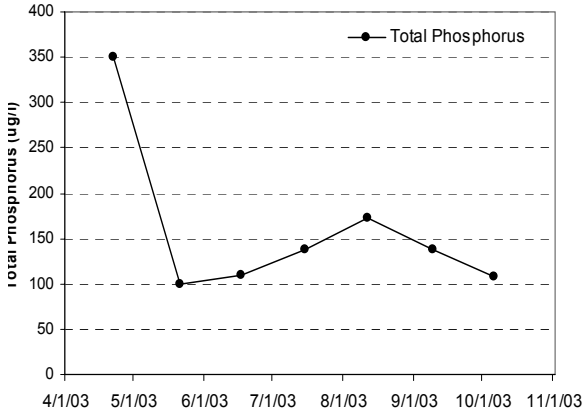
WD: Carnelian-Marine

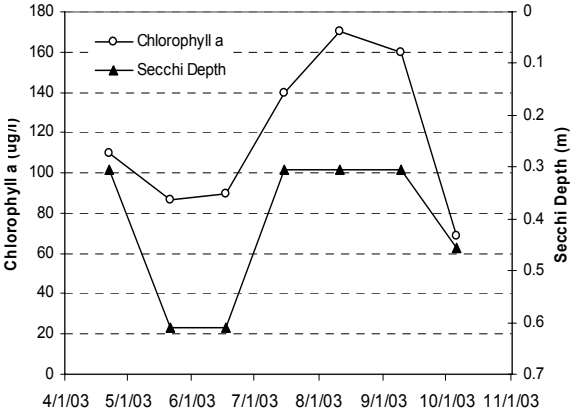
Volunteer: Wash. Co. SWCD

● Sampling site

Contours in meters

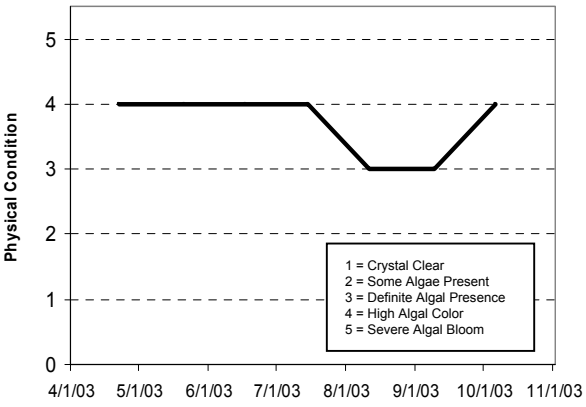



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 11.6 | | 7.25 | | 110 | 350 | | 0.305 | 4 | 4 |
| 05/21/03 | 16.7 | | 5.1 | | 87 | 100 | | 0.61 | 4 | 4 |
| 06/17/03 | 25.1 | | 9 | | 90 | 110 | | 0.61 | 4 | 4 |
| 07/15/03 | 23.1 | | 6.1 | | 140 | 138 | | 0.305 | 4 | 4 |
| 08/11/03 | 25.8 | | 10.7 | | 170 | 173 | | 0.305 | 3 | 4 |
| 09/09/03 | 23.3 | | 7.84 | | 160 | 138 | | 0.305 | 3 | 3 |
| 10/06/03 | 12.7 | | 10.45 | | 69 | 108 | | 0.457 | 4 | 4 |

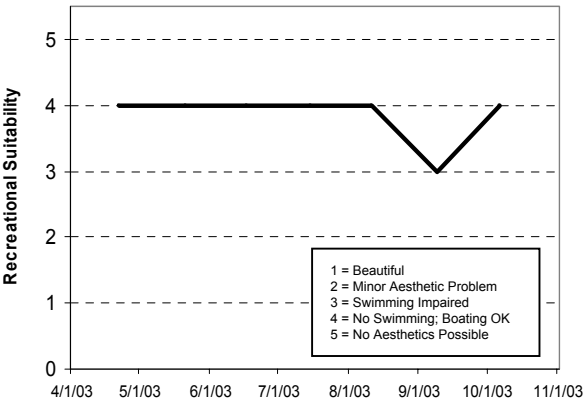



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | F | F | F | F | D | D | D | D |
| Chlorophyll a | | | | | D | D | D | D | D | D | D | F |
| Secchi Depth | | | | | F | F | F | F | D | D | F | F |
| **Overall** | | | | | **F** | **F** | **F** | **F** | **D** | **D** | **D** | **F** |

Source: Metropolitan Council and STORET data



## Lotus Lake (10-0006) *City of Chanhassen*

While Lotus Lake has previously been monitored by Council staff (1985, 1990 and 1999-2000) and the MPCA's volunteer Secchi program (1980, 1988-1991), 2003 marks the first year the lake has been monitored through CAMP. Lotus Lake, with a surface area of 246 acres, is located within the City of Chanhassen (Carver County) [public access to the lake is possible on the southern end of the lake]. The lake's surface area and its 1,033-acre watershed translates to a 4:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lake's maximum and mean depths of 8.9 and 4.3 (29.2 and 14.2 feet), along with its surface area, translates to a lake volume of approximately 3,500 ac-ft. Roughly 74 percent of the lake's surface 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 is considered a "Priority Lake" due to its multi-recreational uses. Eurasian Water Milfoil (*Myriophyllum spicatum*) [EWM] has been reported on the lake.

A point of empahsis for Lotus Lake in 2003 was a break in a sewer line next to the lake on August 2, 2003. This break lead to the discharge of roughly 2,000 gallons of sewage into the south end of the lake.

In 2003, Lotus Lake was monitored five times between early-August and late-September. Unfortunately the lake was not monitored prior to the sewer break, for this reason it is difficult to get a true idea of the lakes "whole" 2003 water quality. A more representative sample program (data collected throughout the summer months [May-September], rather than bunched over two months) would give a clearer picture of the lake's true 2003 conditions.

That said, the lake's 2003 summertime (May through September) means were: surface TP= 92.6 µg/l (minimum of 36.0 µg/l, maximum value of 234.0 µg/l); surface CLA= 39.0 µg/l (minimum of 24.0 µg/l, maximum of 53.0 µg/l); Secchi transparency= 1.3 m (minimum of 0.5 m, maximum of 2.7 m); and TKN= 1.36 mg/l (minimum of 1.20 mg/l, maximum of 1.70 mg/l). Lake quality grades for the summertime means were TP= D; CLA= C; and Secchi= D, and an overall grade of D was calculated for 2003. The lake's 2003 overall grade of D is worse than those recorded in 1985, 1999 and 2000 (overall grades of C).

A recent MPCA conducted trend analysis on the lake's Secchi transparency data, revealed a statistically significant improvement in recent water clarity.

Throughout the summer, the volunteer ranked their opinion of the lake's physical and recreational condtions on a 1-to-5 scale (see lake information sheet). The mean physical condition was 3.0 (3- "definite algae present"), while the recreational suitability ranking was 3.2 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

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.

# Lotus Lake

**Chanhassen, Carver Co.**

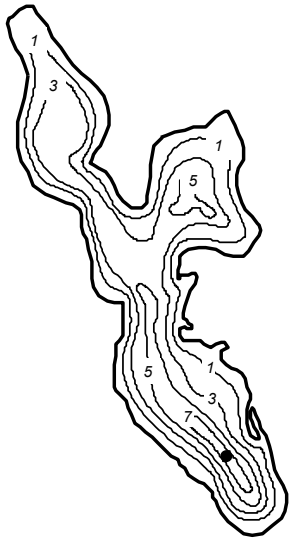
Lake ID: 100006

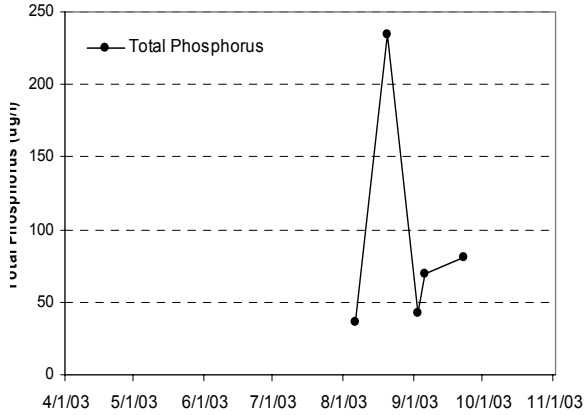
WD: Riley-Purgatory-Bluff Creek

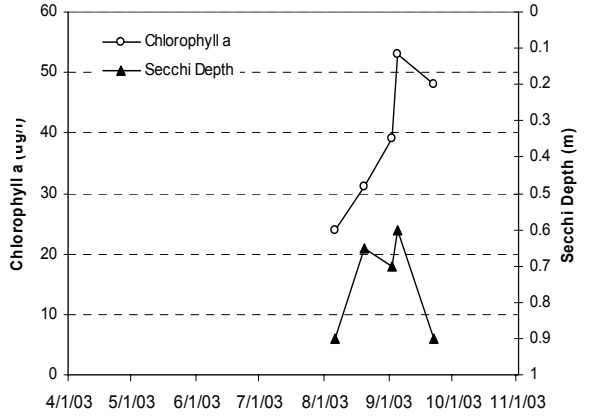
Volunteer: Shelly Strohmaier

● Sampling site

Contours in meters

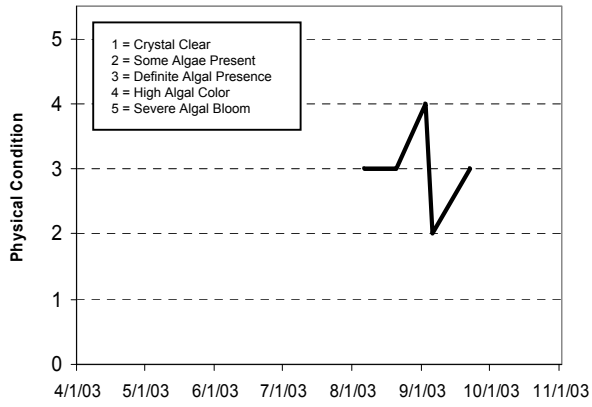



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 08/06/03 | 26.2 | | | | 24 | 36 | | 0.9 | 3 | 3 |
| 08/20/03 | | | | | 31 | 234 | | 0.65 | 3 | 3 |
| 09/02/03 | 25.2 | | | | 39 | 43 | | 0.7 | 4 | 4 |
| 09/05/03 | 23.2 | | | | 53 | 69 | | 0.6 | 2 | 3 |
| 09/22/03 | 18.9 | | | | 48 | 81 | | 0.9 | 3 | 3 |

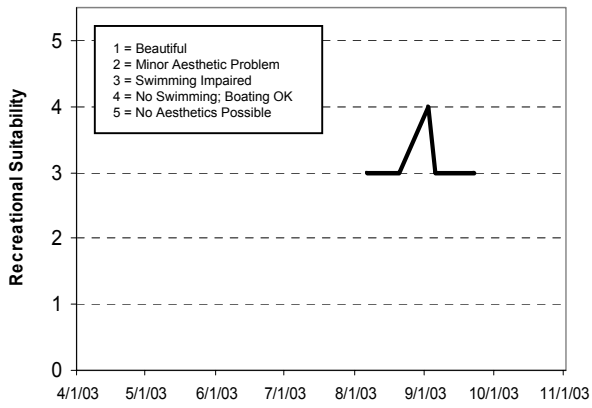



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | C | C | | | D |
| Chlorophyll a | | | | | | | | C | C | | | C |
| Secchi Depth | | | | | | | | C | C | | | D |
| **Overall** | | | | | | | | **C** | **C** | | | **D** |

Source: Metropolitan Council and STORET data



## Louise Lake (82-0025) *Carnelian - Marine Watershed District*

Louise Lake is a 48-acre lake located within Stillwater Township (Washington County). The maximum and mean depths of the lake are 3.7 m (roughly 12 feet) and 1.8 m (six feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 283 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 616-acre watershed and surface area translates to a watershed-to-lake size ratio of 13:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake.

This was the fourth year that Louise Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake provided limited information (1996-2002).

The lake's Secchi transparency was monitored seven times from late-April to early-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 2.5 m (minimum of 1.2 m and a maximum of 3.3 m). This translates to a grade of B for water clarity. The lake's 2003 water clarity was dramatically better than that recorded in 2002 (1.2 m) and 2001 (0.9 m). In fact, the 2003 water clarity mean is the best recorded to date.

Because of the limitedness of the lake's water quality database, no long-term can be determined. In the short-term however, the data seems to show that the lake, consistantly flucuates between an overall C and D grade (although the lake's 2003 overall water quality may have exceeded the C/D grade). To better understand the lake's water quality and where it may be heading, more data are needed.

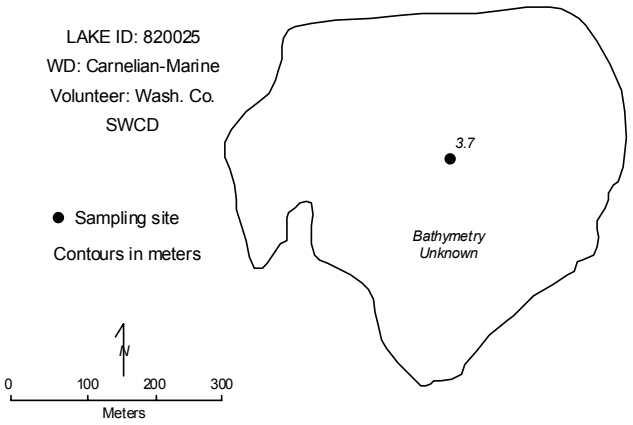
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 2.8 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 3.6 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

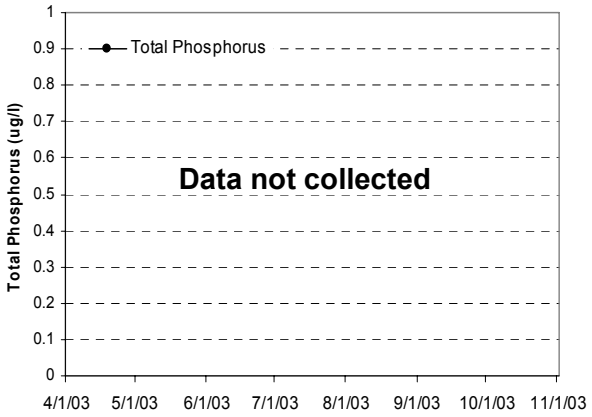
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

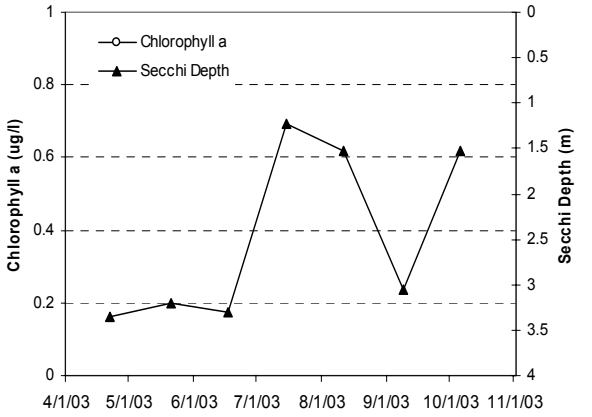
# Lake Louise

**Stillwater Twp., Washington Co.**

LAKE ID: 820025
WD: Carnelian-Marine
Volunteer: Wash. Co. SWCD

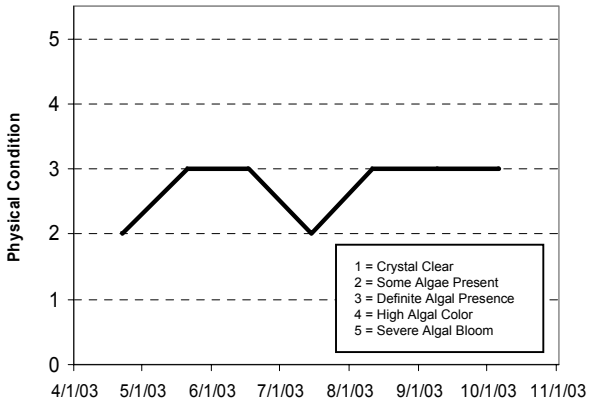



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 11.2 | | 6.68 | | | | | 3.355 | 2 | 2 |
| 05/21/03 | 16.7 | | 5.44 | | | | | 3.205 | 3 | 4 |
| 06/17/03 | 24.6 | | 6.3 | | | | | 3.305 | 3 | 4 |
| 07/15/03 | 23.3 | | 9.72 | | | | | 1.22 | 2 | 3 |
| 08/11/03 | 27.1 | | 12.4 | | | | | 1.525 | 3 | 4 |
| 09/09/03 | 23.7 | | 9.47 | | | | | 3.048 | 3 | 3 |
| 10/06/03 | 12.6 | | 13.45 | | | | | 1.525 | 3 | 3 |

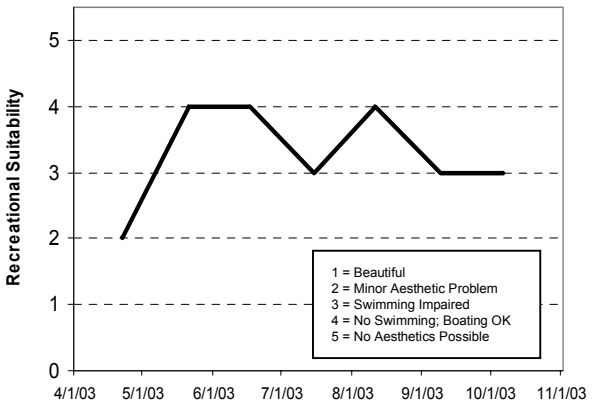



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | D | D | B | C | D | D | D | |
| Chlorophyll a | | | | | D | D | D | F | B | D | C | |
| Secchi Depth | | | | | B | C | C | C | C | D | D | B |
| **Overall** | | | | | **C** | **D** | **C** | **D** | **C** | **D** | **D** | |

Source: Metropolitan Council and STORET data



## Magda Lake (27-0065) *Shingle Creek Watershed Management Commission*

Magda Lake is a 15-acre lake located within City of Brooklyn Park (Hennepin County). There is very little known morphological data available for the lake.

The year 2003 marks the third year that Magda Lake has been involved in CAMP. CAMP data for 1999-2000 and now 2003, are the only years for which data on the lake are known. 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.

The lake was monitored 11 times between mid-April and mid-September, 2003. The resulting data and graphs appear on the next page.

The lake's overall lake quality grade in 2003 (determined from the individual parameter grades) was F. The summertime (May through September) mean TP concentration of 175.4 µg/l (minimum of 62.0 µg/l, maximum of 627.0 µg/l) and the lake's mean CLA concentration of 81.3 µg/l (minimum of 14.0 µg/l and maximum of 220.0 µg/l) both translated to a grade of F. The lake's the mean Secchi transparency of 0.6 m (minimum of 0.3 m, maximum of 1.1 m) also resulted in a grade of F. The mean TKN concentration over the same time period was 2.10 mg/l (minimum of 1.20 mg/l and maximum of 4.10 mg/l). The lake's overall grade for 2003 is worse than those recorded in 1999 or 2000.

As mentioned in the 1999 and 2000 report, there is a lack of water quality data available for Magda Lake. The only available data are the 1999-2000 and 2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 3.5 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 3.8 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

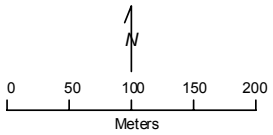
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

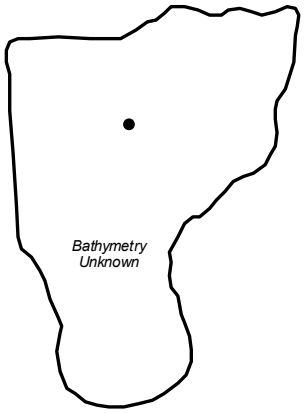
# Lake Magda

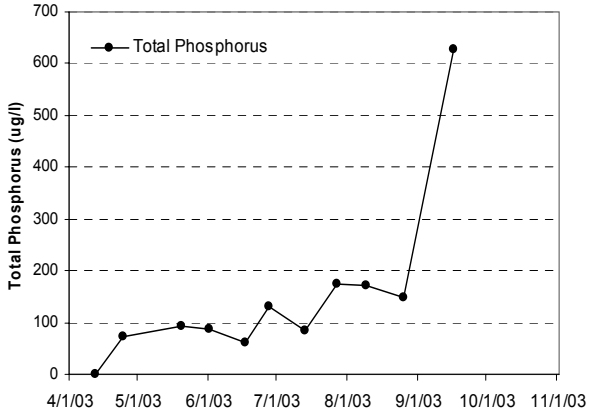
**Brooklyn Park, Hennepin Co.**

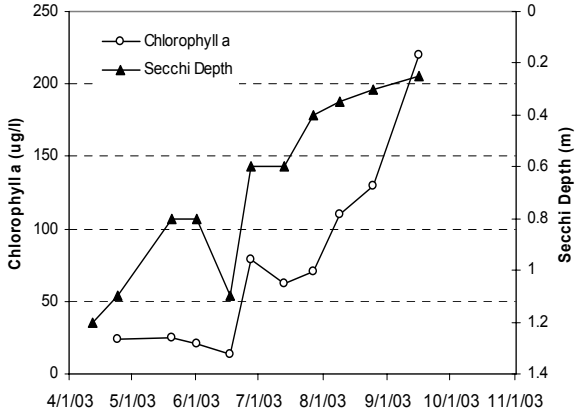
Lake ID: 270065
WD: Shingle Creek
Volunteer: Carolyn Dindorf

● Sampling site
Contours in meters



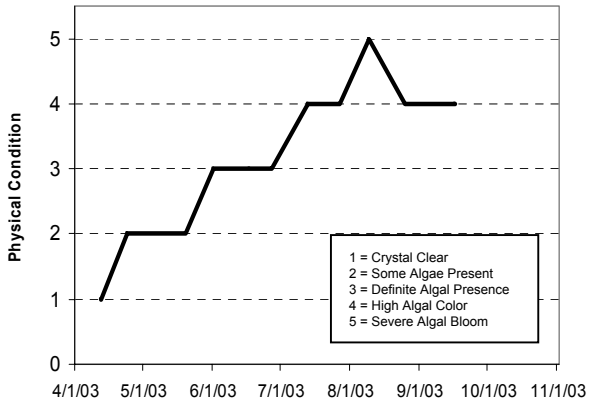




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/12/03 | 14 | | | | | 0 | | 1.2 | 1 | 2 |
| 04/24/03 | 18 | | | | 24 | 72 | | 1.1 | 2 | 3 |
| 05/20/03 | 20 | | | | 25 | 92 | | 0.8 | 2 | 4 |
| 06/01/03 | 25 | | | | 21 | 87 | | 0.8 | 3 | 3 |
| 06/17/03 | 27.5 | | | | 14 | 62 | | 1.1 | 3 | 4 |
| 06/27/03 | 22 | | | | 79 | 131 | | 0.6 | 3 | 4 |
| 07/13/03 | 26 | | | | 62 | 84 | | 0.6 | 4 | 4 |
| 07/27/03 | 29 | | | | 71 | 175 | | 0.4 | 4 | 4 |
| 08/09/03 | 27.5 | | | | 110 | 172 | | 0.35 | 5 | 4 |
| 08/25/03 | 28 | | | | 130 | 148 | | 0.3 | 4 | 4 |
| 09/16/03 | 25 | | | | 220 | 627 | | 0.25 | 4 | 4 |

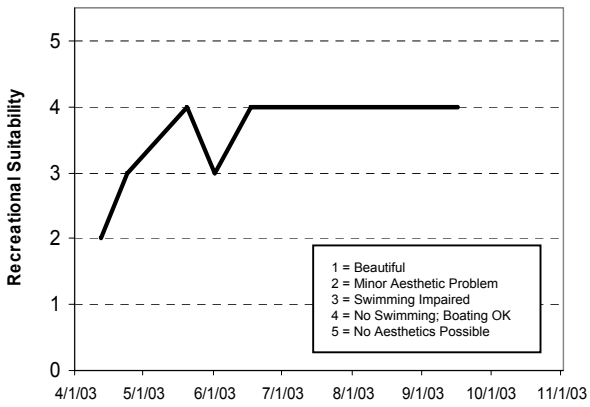



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | D | | | F |
| Chlorophyll a | | | | | | | | D | C | | | F |
| Secchi Depth | | | | | | | | F | F | | | F |
| **Overall** | | | | | | | | **D** | **D** | | | **F** |

Source: Metropolitan Council and STORET data



## Maple Marsh (82-0038) *Carnelian - Marine Watershed District*

Maple Marsh Lake is a 38-acre lake located within May Township (Washington County). The maximum and mean depths of the lake are 3.4 m (roughly 11 feet) and 1.7 m (five-and-a-half feet), respectively. 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 surface area and mean depth translates to an approximate volume of 126 ac-ft.

The majority of the land within the 148-acre watershed is undeveloped. The watershed-to-lake size ratio is 4:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff).

This was the third year that Maple Marsh Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake provided limited information (1997-2002).

The lake's Secchi transparency was monitored seven times from late-April to early-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 1.16 m (minimum of 0.61 m and a maximum of 2.14 m). This translates to a grade of D for water clarity (similar to those recorded in 1997 and 1999-2001). The lake received a water clarity grade of F in 1998 and C in 2002.

Because of the limited nature of the lake's water quality database the determination of any statistically significant long-term trend is not possible. With this in mind, the lake's water quality data seems to show a consistant fluctuation between an overall grade of C and D. To better understand the lake's overall water quality and where it may be heading, more data are needed.

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 3.0 for physical condition (3- "definite algae present"), and 4.0 for recreational suitability (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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Maple Marsh

**May Twp., Washington Co.**

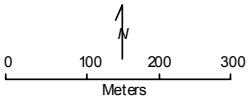
LAKE ID: 820038

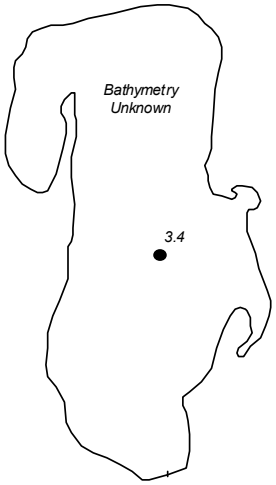
WD: Carnelian-Marine

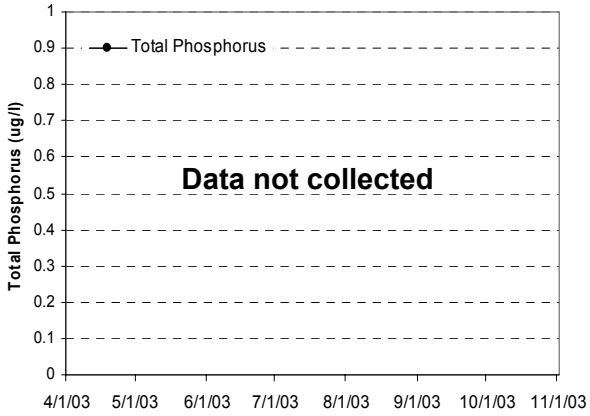
Volunteer: Wash. Co. SWCD

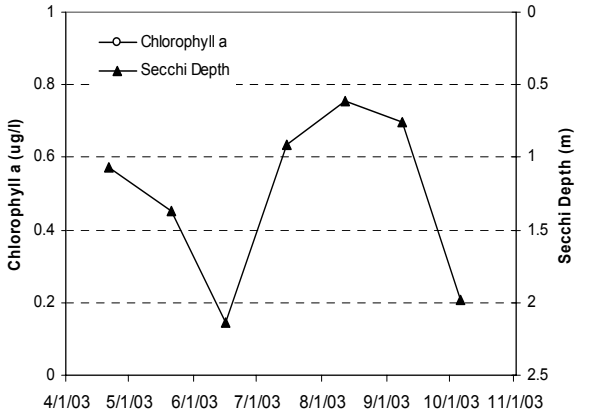
● Sampling site

Contours in meters



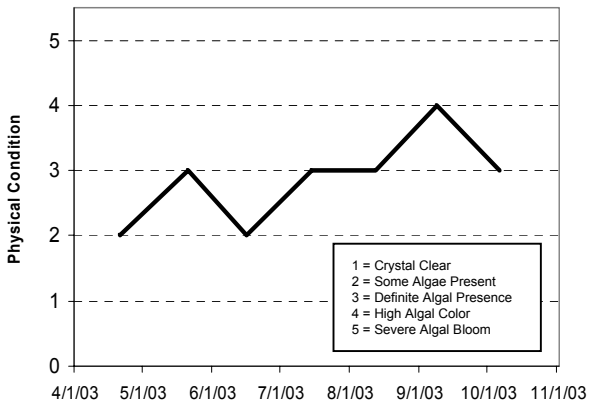




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 9.2 | | 8.63 | | | | | 1.068 | 2 | 3 |
| 05/21/03 | 16.4 | | 4.9 | | | | | 1.373 | 3 | 4 |
| 06/16/03 | 24.6 | | 6.32 | | | | | 2.135 | 2 | 4 |
| 07/15/03 | 23 | | 8.23 | | | | | 0.915 | 3 | 4 |
| 08/12/03 | 27 | | 10.4 | | | | | 0.61 | 3 | 4 |
| 09/08/03 | 24.9 | | 6.38 | | | | | 0.762 | 4 | 4 |
| 10/06/03 | 11.2 | | 8.71 | | | | | 1.981 | 3 | 4 |

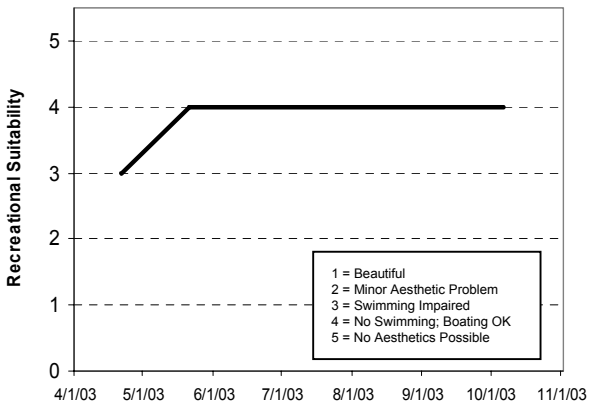



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | F | F | C | D | F | | |
| Chlorophyll a | | | | | | D | F | F | C | D | | |
| Secchi Depth | | | | | | D | F | D | D | D | C | D |
| **Overall** | | | | | | **D** | **F** | **D** | **D** | **D** | | |

Source: Metropolitan Council and STORET data



## Marion Lake (19-0026) *City of Lakeville*

This was the sixth year that Marion Lake has been a part of CAMP (the others were 1994 and 1999-2002). The area around Lake Marion, located in the City of Lakeville (Dakota County), is rapidly developing. The lake covers an area of roughly 560 acres and has a maximum depth of 6.4 m (21 feet). There are two public accesses to the lake. One access is located in the park while the other is located on the western side of the lake off of 195th Street West. Lake Marion is considered a "Priority Lake" by the Metropolitan Council because of its multi-recreational uses.

The lake gets heavy use by area fishermen and other lake users during the winter and summer months. The MDNR manages the lake for northern pike-panfish, and has stocked the lake with walleye over the past decade. Because of past winterkills, the lake's oxygen levels are monitored throughout the winter, and the lake is aerated when needed (during the last three winters aeration was not needed).

As part of the 2003 volunteer monitoring program, Lake Marion was monitored 14 times from mid-April to mid-October. During each monitoring event the lake was monitored for TP, CLA, TKN, and Secchi transparency, and the lake's perceived physical condition and recreational suitability. Graphs as well as the actual data collected by volunteers, show the seasonal variability of the collected data (see lake information sheet on the next page).

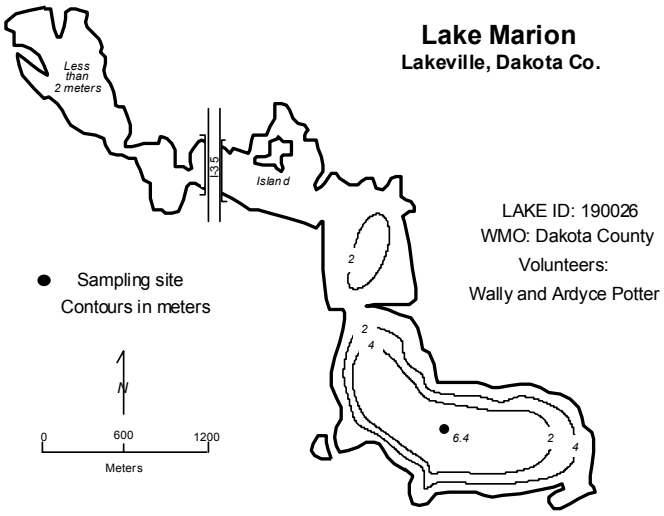
The 2003 summertime (May through September) mean concentrations for Lake Marion were as follows: TP= 28.1 µg/l (minimum of 19.0 µg/l, and maximum of 41.0 µg/l); CLA= 22.7 µg/l (minimum of 3.1 µg/l and maximum of 100.0 µg/l); Secchi transparency= 2.1 m (minimum of 1.3 m and maximum of 2.9 m); and TKN= 0.80 mg/l (minimum and maximum of 0.48 and 1.30 mg/l), respectively. The summertime means resulted in a TP grade of B, CLA grade of C, and Secchi transparency grade of C. The resulting overall grade in 2003 (C) (similar to that recorded in 2002), represents a decrease in water quality as compared to the overall grade of B the lake received in 1994, and 1999-2001.

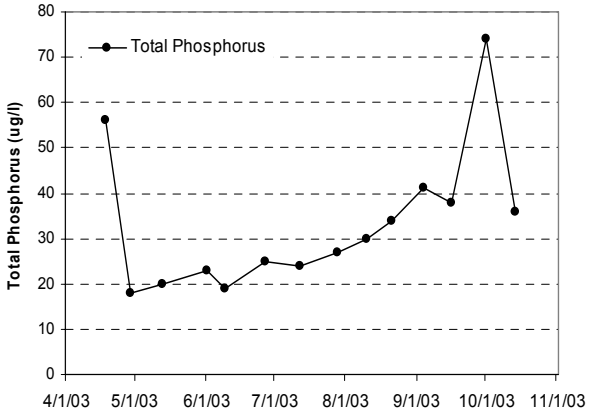
The physical and recreational conditions of the lake, as observed by the volunteer monitors, were ranked on a 1 to 5 ranking scale. The volunteer's user perception rankings are shown on the lake's information sheet. The mean physical condition ranking was 1.8 (between 1- "crystal clear" and 2- "some algae present"), while the lake's mean recreational suitability ranking was 1.1 (between 1- "beautiful" and 2- "minor aesthetic problem").

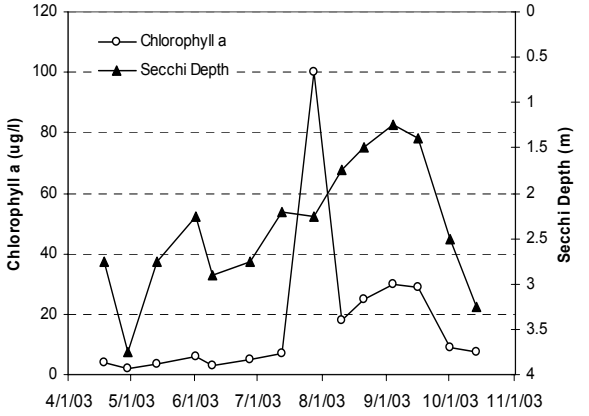
While Lake Marion does have 13 years of data (11 of which contain some nutrient measurements) over the past 24 years, it is difficult to determine what is happening with the lake's water quality. The available data shows a wide range in the lake's quality with the water quality showing an improvement in the 1990's as compared to the 1980's. The lake received an overall water quality grade of D in 1981; C in 1980, 1983, 1987, and 2002-2003; and finally received a B in 1994, and 1999-2001. A recent MPCA conducted trend analysis on the lake's Secchi transparency data, revealed a statistically significant improvement in recent water clarity.

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.

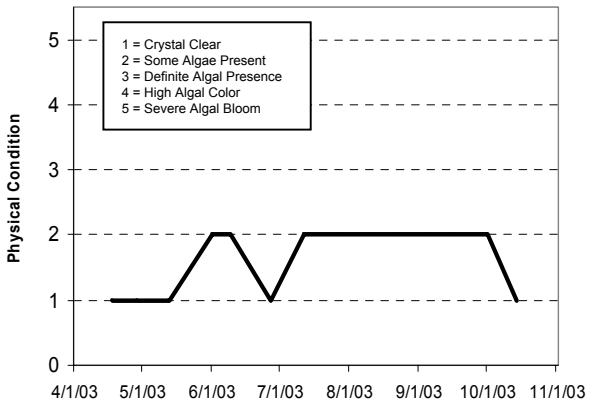



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 7 | | | | 4.2 | 56 | | 2.75 | 1 | |
| 04/29/03 | 12 | | | | 1.9 | 18 | | 3.75 | 1 | 1 |
| 05/13/03 | 13 | | | | 3.7 | 20 | | 2.75 | 1 | 1 |
| 06/01/03 | 18 | | | | 6.2 | 23 | | 2.25 | 2 | 1 |
| 06/09/03 | 22.4 | | | | 3.1 | 19 | | 2.9 | 2 | 1 |
| 06/27/03 | 20 | | | | 4.8 | 25 | | 2.75 | 1 | 1 |
| 07/12/03 | 23 | | | | 7 | 24 | | 2.2 | 2 | 1 |
| 07/28/03 | 25 | | | | 100 | 27 | | 2.25 | 2 | 1 |
| 08/10/03 | 24 | | | | 18 | 30 | | 1.75 | 2 | 1 |
| 08/21/03 | 25 | | | | 25 | 34 | | 1.5 | 2 | 1 |
| 09/04/03 | 22 | | | | 30 | 41 | | 1.25 | 2 | 2 |
| 09/16/03 | 21 | | | | 29 | 38 | | 1.4 | 2 | 1 |
| 10/01/03 | 10 | | | | 9.2 | 74 | | 2.5 | 2 | 1 |
| 10/14/03 | 12 | | | | 7.3 | 36 | | 3.25 | 1 | 1 |

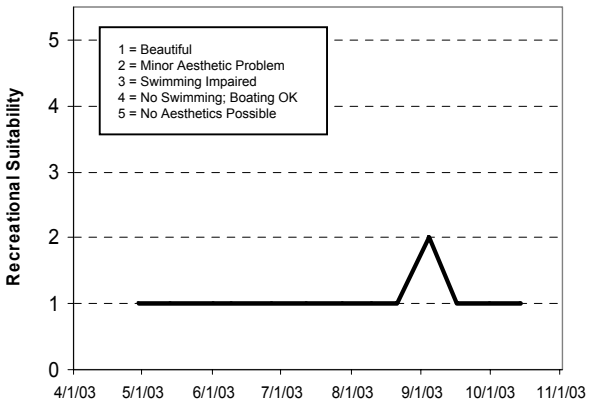



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | B | | | | | B | B | B | C | B |
| Chlorophyll a | | | A | | | | | B | A | B | B | C |
| Secchi Depth | | | B | | | | | C | B | B | C | C |
| **Overall** | | | **B** | | | | | **B** | **B** | **B** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Markgrafs Lake (82-0089) *City of Woodbury*

Markgrafs Lake, located within the City of Woodbury (Washington County), has a surface area of approximately 46 acres (2.6 miles around), and a maximum depth of 2.4 m (8 feet). The lake, which is used by the MDNR Fisheries as a rearing pond for walleyes, has no outlet. The 413-acre drainage area to the lake is presently made up of open/undeveloped areas. Future land uses are projected to be 11.5 percent single-family residential, 14.8 percent multi-family residential, 51.8 percent commercial/retail, 15.1 percent parks/open space, and 6.8 percent ponds/wetlands. The lake's watershed-to-lake size ratio is 10:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). Because of the lake's shallowness, much of the lake is considered littoral zone (the 0-15 foot depth area of the lake dominated by aquatic vegetation). It does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

The lake has been involved in CAMP since 1994. Between late-April and mid-October 2003, the lake was monitored 14 times. During each monitoring event; TP, CLA, TKN, and Secchi transparency were measured, as was the lake's perceived physical condition and recreational suitability. The 2002 overall lake quality report card grade, determined from the lake's mean TP, CLA and Secchi transparency, was D (C in 1995-1996, and 2000, D in 1994, 1997, 1999, and 2001-2003, and F in 1998).

The 2003 summertime (May - September) mean TP concentration of 137.7 µg/l (minimum of 47.0 µg/l, maximum of 323.0 µg/l), corresponded to a grade of D as does the lake's mean Secchi transparency of 0.8 m (minimum of 0.3 m, maximum of 1.1 m). The 2003 CLA mean of 34.3 µg/l (minimum and maximum of 8.4 µg/l and 86.0 µg/l), resulted in a grade of C for algal biomass. The lake's mean TKN concentration was 1.72 mg/l (minimum of 0.90 mg/l, maximum of 2.90 mg/l).

By comparing the lakes TP (nutrient), CLA (algal biomass estimator), and Secchi (water clarity) grades, it is apparent that the TP and Secchi grades are quite a bit worse than the CLA grade (as was the case in the majority of previous years of monitoring). In a most cases, the three should be fairly comparable. One possible explanation for the lake's findings may be that the majority of the lake's TP comes from either in-lake suspended sediments (re-suspension), or the intrusion of sediment-laden runoff to the lake, which in turn lessens the clarity of the water and inhibits algal growth.

A moderate amount historical water quality data is available for Markgrafs Lake. Data found were collected through CAMP in 1994-2003. While no statistically significant long-term trend is evident from the lake's whole water quality database (including TP, CLA and Secchi data), a recent MPCA conducted trend analysis using just the lake's Secchi transparency data, revealed a statistically significant decrease in recent water clarity. The lake's overall quality generally fluctuates between a low C (1995-1996, and 2000) and a D (1994, 1997, 1999, and 2001-2003). The lake experienced its worst recorded overall water quality (F) in 1998 and its best water quality in 1995.

Throughout the course of the monitoring season the volunteer monitor ranked the lake's perceived physical and recreational conditions on a 1-to-5 scale. The mean physical condition was 3.8 (between 3- "definite algae present" and 4- "high algal color") while the mean recreational suitability was 4.0 (4- "no swimming – boating ok").

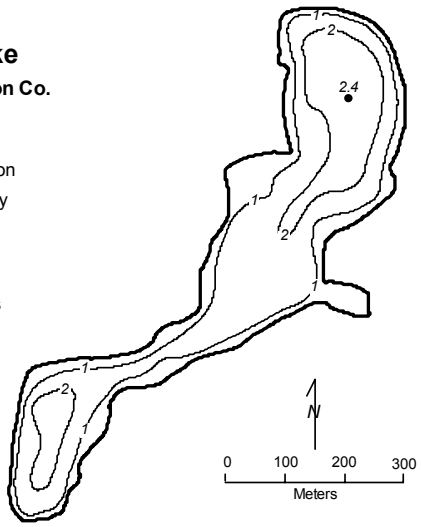
If you know of any errors in the lake's data/physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

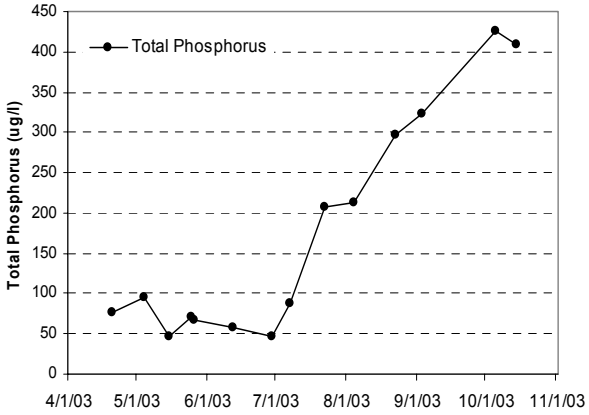
## Markgrafs Lake

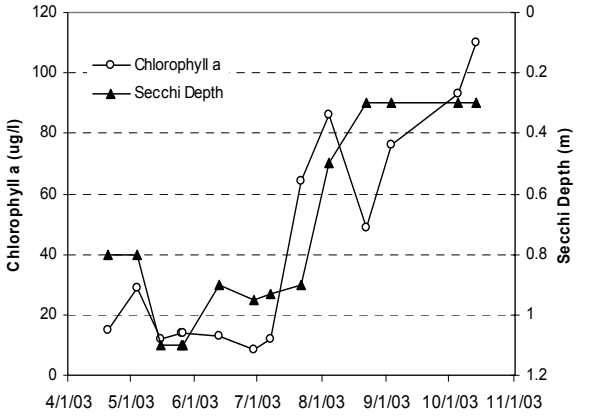
**Woodbury, Washington Co.**

Lake ID: 820089
WD: South Washington
Volunteer: Terry Riley

● Sampling site
Contours in meters

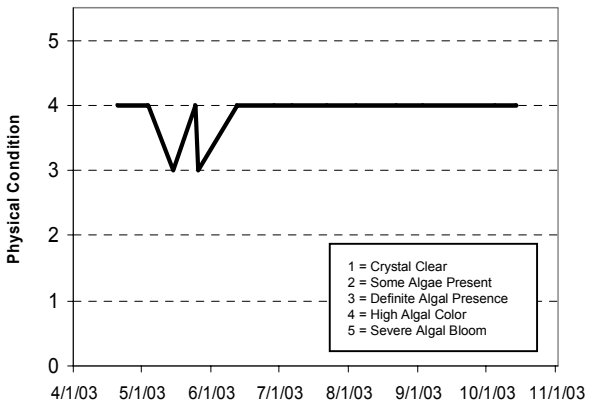



### 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/20/03 | 10 | | | | 15 | 76 | | 0.8 | 4 | 4 |
| 05/04/03 | 11.2 | | | | 29 | 96 | | 0.8 | 4 | 4 |
| 05/15/03 | 16.2 | | | | 12 | 47 | | 1.1 | 3 | 4 |
| 05/25/03 | 18.2 | | | | 14 | 71 | | 1.1 | 4 | 4 |
| 05/26/03 | 17.4 | | | | 14 | 68 | | 1.1 | 3 | 4 |
| 06/12/03 | 26.9 | | | | 13 | 58 | | 0.9 | 4 | 4 |
| 06/29/03 | 26.1 | | | | 8.4 | 47 | | 0.95 | 4 | 4 |
| 07/07/03 | 26.7 | | | | 12 | 88 | | 0.93 | 4 | 4 |
| 07/22/03 | 26.9 | | | | 64 | 207 | | 0.9 | 4 | 4 |
| 08/04/03 | 26.3 | | | | 86 | 213 | | 0.5 | 4 | 4 |
| 08/22/03 | 26.9 | | | | 49 | 297 | | 0.3 | 4 | 4 |
| 09/03/03 | 26.9 | | | | 76 | 323 | | 0.3 | 4 | 4 |
| 10/05/03 | 16.2 | | | | 93 | 426 | | 0.3 | 4 | 4 |
| 10/14/03 | 14.6 | | | | 110 | 409 | | 0.3 | 4 | 4 |

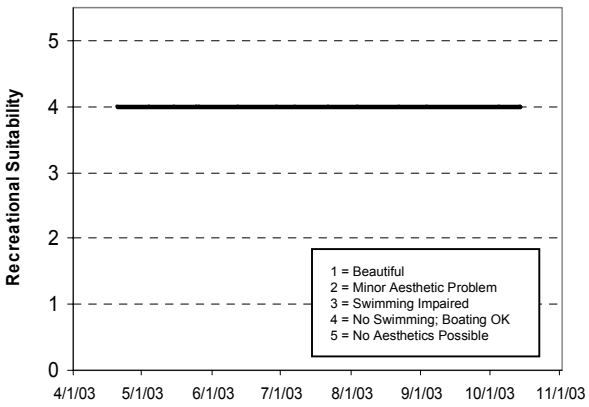



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | D | C | D | D | F | D | D | F | F | D |
| Chlorophyll a | | | C | B | B | C | F | C | C | C | C | C |
| Secchi Depth | | | D | C | C | D | F | D | C | D | F | D |
| **Overall** | | | **D** | **C** | **C** | **D** | **F** | **D** | **C** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Markley Lake (70-0021) *City of Prior Lake*

This was the seventh year that Markley Lake has been monitored for lake water quality information. The lake, which has a surface area of roughly 27 acres (because of high water, the actual surface area of the lake may be slightly larger) is located within the City of Prior Lake (Scott County). Its maximum depth is 3.7 m (22 feet). Because of the lake's shallowness the entire lake area is considered littoral (the 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).

As part of the 2003 volunteer monitoring program, Markley Lake was monitored six times from late-April to late-September. Graphs as well as the actual data collected by volunteers show the seasonal variability in TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the next page.

The 2003 summertime mean concentrations for Markley Lake were as follows: TP= 56.4 µg/l (minimum of 34.0 µg/l, maximum of 96.0 µg/l), CLA= 17.6 µg/l (minimum of 4.8 µg/l, maximum of 36.0 µg/l), Secchi transparency= 1.2 m (minimum of 0.8 m, maximum of 2.0 m), and TKN= 0.89 mg/l (minimum and maximum of 0.68 and 1.20 mg/l), respectively. The summertime means resulted in a TP grade of C, CLA grade of B, and Secchi transparency grade of C. The individual parameter grades resulted in an overall grade of C (similar to past years

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's water quality seems to be well represented by an overall grade of C. In order to detect any possible long-term water quality trends, more years of data collection are needed.

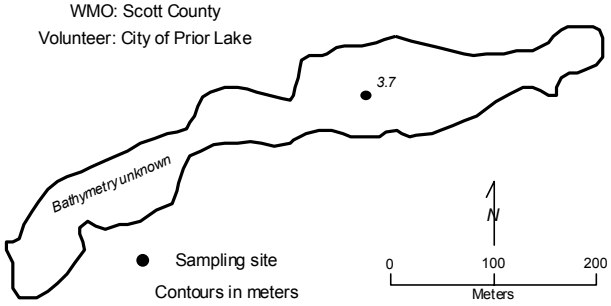
The average user perception rankings of Markley Lake correspond to the overall quality of the lake. On a 1-to-5 ranking scale, the mean physical condition ranking was 2.3 (between 2- "some algae present" and 3- "swimming slightly impaired"), while the mean recreational suitability was 3.8 (between 3- "swimming slightly impaired" and 4- "no swimming - boating ok").

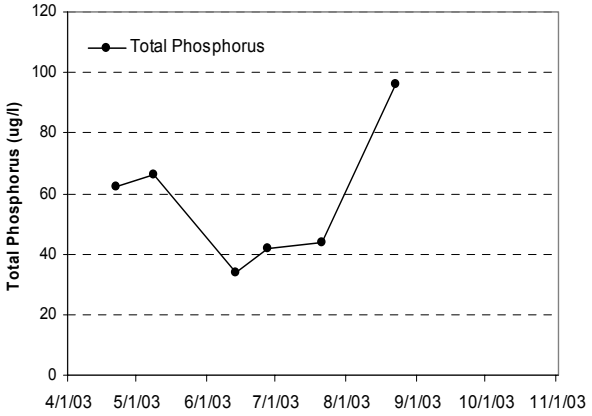
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

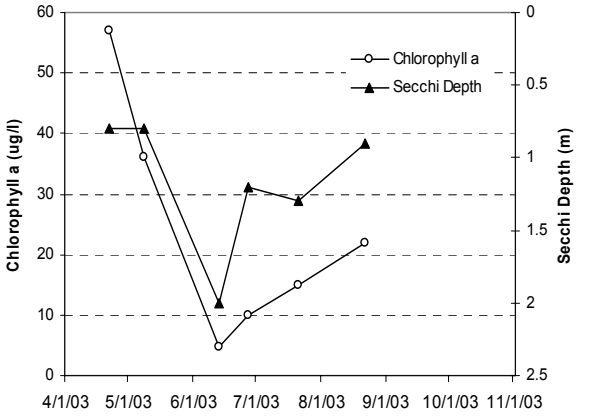
# Markley Lake

**Credit River Twp./Prior Lake, Scott Co.**

Lake ID: 700021
WMO: Scott County
Volunteer: City of Prior Lake

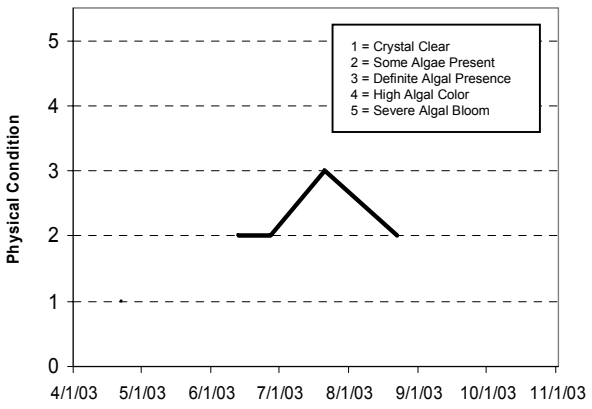



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/22/03 | 15 | | | | 57 | 62 | | 0.8 | 1 | 4 |
| 05/08/03 | 20 | | | | 36 | 66 | | 0.8 | | |
| 06/13/03 | 26 | | | | 4.8 | 34 | | 2 | 2 | 3 |
| 06/27/03 | 24 | | | | 10 | 42 | | 1.2 | 2 | 4 |
| 07/21/03 | 27 | | | | 15 | 44 | | 1.3 | 3 | 4 |
| 08/22/03 | 30 | | | | 22 | 96 | | 0.9 | 2 | 4 |

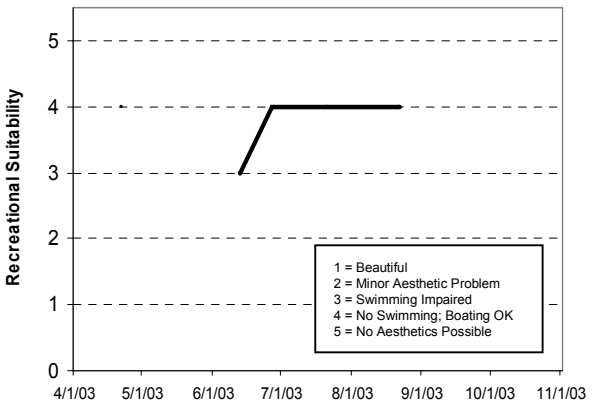



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | C | C | C | C | C | C | C |
| Chlorophyll a | | | | | | B | B | B | C | B | B | B |
| Secchi Depth | | | | | | C | C | C | C | C | C | C |
| **Overall** | | | | | | **C** | **C** | **C** | **C** | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## McDonald Lake (82-0010) *Valley Branch Watershed District*

McDonald Lake is a 36-acre land-locked (no outlet) lake located within Baytown Township (Washington County). The maximum depth of the lake is 3.7 m (roughly 12 feet). 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). Additionally, approximately 60 percent of the lake's 424-acre immediate watershed is either developed or under development. The lake's surface area and watershed size translates to a 12:1 watershed-to-lake size ratio. Generally the larger the ratio, the greater the potential stress on the lake from surface runoff.

This was the fourth year in which McDonald Lake has been involved in CAMP (the lake was enrolled in the program in 1999 and 2001-2002 as well). The only historical water quality data found for McDonald Lake were Secchi transparency data for 1998 and CAMP data from 1999 and 2001-2002. Thus, 1999 and 2001-2003 are the only year of available nutrient data. 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.

The lake was monitored 12 times between late-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of C was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 38.9 µg/l (minimum of 16.0 µg/l, maximum of 80.0 µg/l) corresponds to a lake water quality grade of C, as did the mean Secchi transparency of 2.1 m (minimum of 0.6 m, maximum of 4.0 m). The lake's the mean CLA concentration of 29.5 µg/l (minimum of 1.3 µg/l and maximum of 110.0 µg/l) also resulted in a grade of C. The mean TKN concentration over the same time period was 1.27 mg/l (minimum of 0.62 mg/l and maximum of 2.50 mg/l).

As mentioned earlier, there are no nutrient data available for McDonald Lake other than the 1999 and 2001-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. That said, the lake's water quality seems well represened by the overall grade of C. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

The perceived physical and recreational conditions (ranked on a 1-to-5 scale) are shown on the lake's information sheet on the next page. The average user perception rankings, were 3.2 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 3.0 for recreational suitability (3- "swimming slightly impaired").

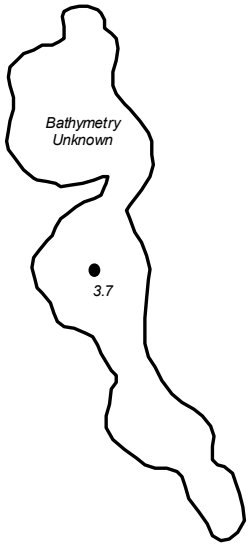
If you notice any errors in the lake data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

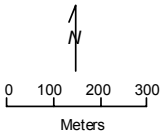
# McDonald Lake

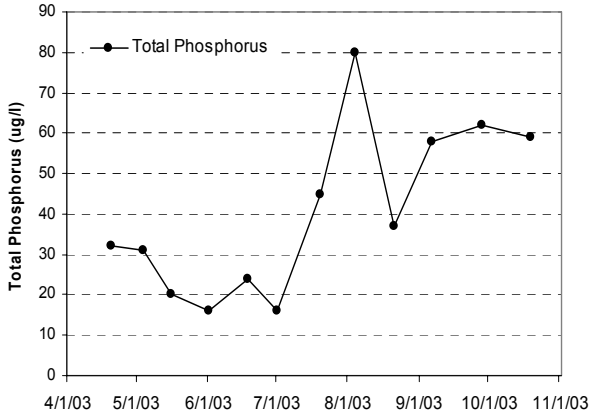
**Baytown Twp., Washington Co.**

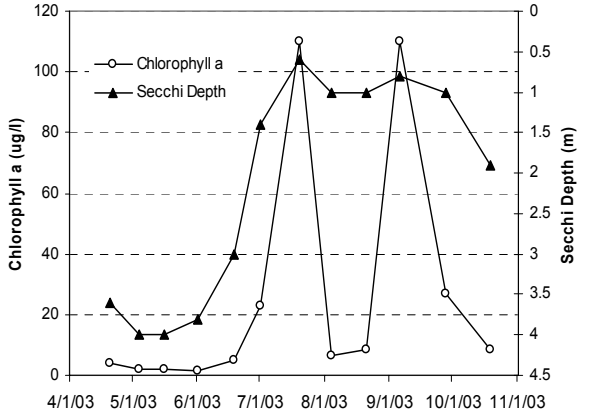
Lake ID: 820010
WD: Valley Branch
Volunteer: Steve Groves

● Sampling site
Contours in meters



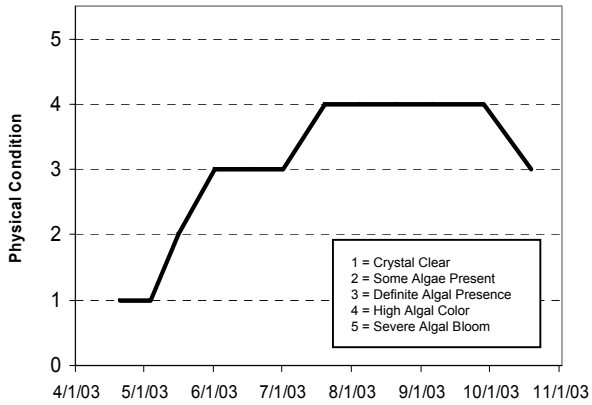




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/20/03 | 10 | | | | 4.2 | 32 | | 3.6 | 1 | 1 |
| 05/04/03 | 15.2 | | | | 1.8 | 31 | | 4 | 1 | 1 |
| 05/16/03 | 20.8 | | | | 2 | 20 | | 4 | 2 | 1 |
| 06/01/03 | 22.3 | | | | 1.3 | 16 | | 3.8 | 3 | 2 |
| 06/18/03 | 26.4 | | | | 4.9 | 24 | | 3 | 3 | 3 |
| 07/01/03 | 27.7 | | | | 23 | 16 | | 1.4 | 3 | 3 |
| 07/20/03 | 27.3 | | | | 110 | 45 | | 0.6 | 4 | 4 |
| 08/04/03 | 26 | | | | 6.7 | 80 | | 1 | 4 | 4 |
| 08/21/03 | 25 | | | | 8.4 | 37 | | 1 | 4 | 4 |
| 09/06/03 | 22 | | | | 110 | 58 | | 0.8 | 4 | 4 |
| 09/28/03 | 17 | | | | 27 | 62 | | 1 | 4 | 4 |
| 10/19/03 | 13 | | | | 8.3 | 59 | | 1.9 | 3 | 4 |

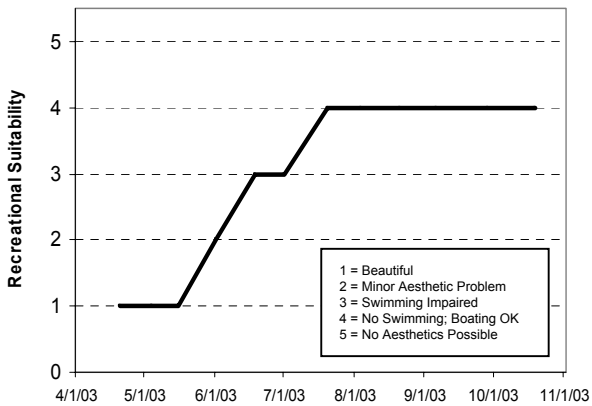



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | C | | C | C | C |
| Chlorophyll a | | | | | | | | B | | C | C | C |
| Secchi Depth | | | | | | | C | C | C | C | C | C |
| **Overall** | | | | | | | | **C** | | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## McKusick Lake (82-0020) *Middle St. Croix Watershed Management Organization*

Lake McKusick, a 46-acre lake located within the City of Stillwater (Washington County) has a maximum depth of 4.7 m (roughly 15.5 feet). The lake has been involved in CAMP since 1994. In 2003, the lake was monitored 14 times between mid-April and mid-October.

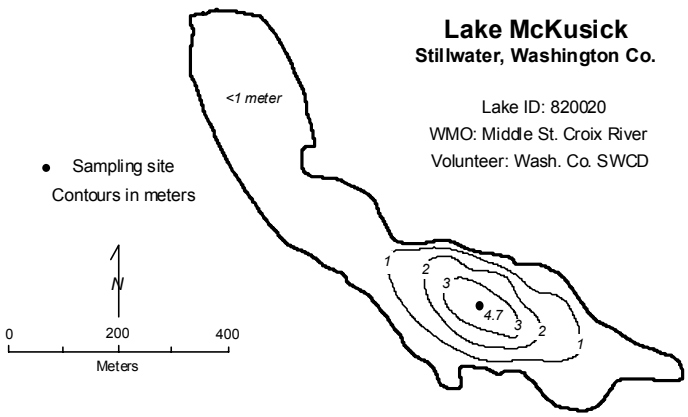
The overall lake quality grade for Lake McKusick in 2003 was C as calculated from the individual grades for each parameter. The summertime (May through September) mean TP concentration of 46.7 µg/l (minimum of 32.0 µg/l, maximum of 67.0 µg/l) resulted in a water quality grade of C, as did the lake's Secchi transparency mean of 1.7 m (minimum of 1.1 m, maximum of 2.4 m). The lake's CLA mean of 12.7 µg/l (minimum and maximum of 5.3 and 22.0 µg/l), on the other hand, resulted in a grade of B. The lake's mean TKN concentration was 0.92 mg/l (minimum of 0.78 mg/l, maximum of 1.20 mg/l).

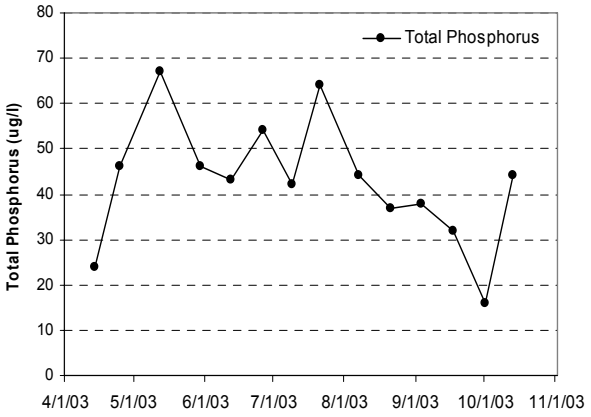
The lake's 2003 overall grade of C is identical to that recorded in 1997 and 2002, better than the D's recorded in 1994-1996 and 1998-1999, and worse than the B's recorded in 2000-2001. The overall grade of B recorded in 2000 and 2001 is the lake's best-recorded overall grade to date.

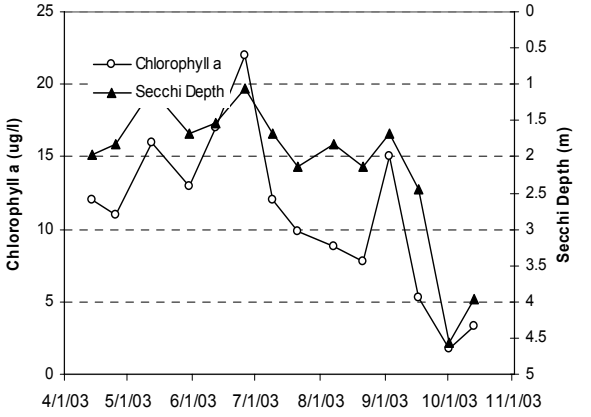
Throughout the monitoring period, the volunteer(s) ranked their opinions of physical and recreational conditions of the lake on a 1-to-5 scale. The resulting user perception rankings are shown on the lake information sheet. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 3.3 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

Because of the wide variation in the lake's 1994-2003 water quality database, no long-term trends can be determined. In the short-term howver, it seems that the lake was well represented by an overall grade of D/C until recently (2000-2001) when the lake's overall grade has improved to C+/B. In order to detect any possible long-term water quality trends, additional years of data collection are needed.

If you know of any errors in the lake's data/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.

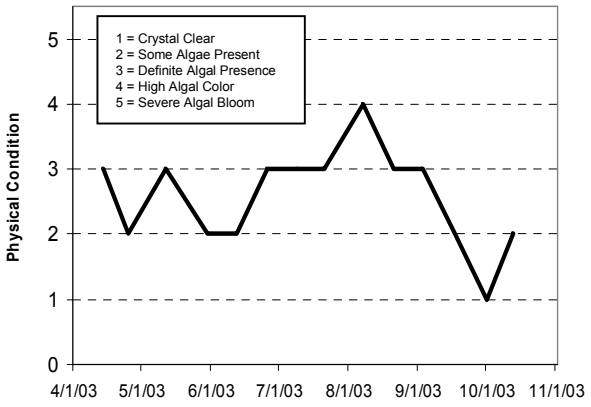



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 15.2 | | 8.7 | | 12 | 24 | | 1.98 | 3 | 3 |
| 04/25/03 | 14.5 | | 4.68 | | 11 | 46 | | 1.83 | 2 | 3 |
| 05/12/03 | 12.9 | | 7.75 | | 16 | 67 | | 1.07 | 3 | 4 |
| 05/30/03 | 20.6 | | 5.08 | | 13 | 46 | | 1.678 | 2 | 2 |
| 06/12/03 | 18.9 | | 8.81 | | 17 | 43 | | 1.525 | 2 | 3 |
| 06/26/03 | 22 | | 6.7 | | 22 | 54 | | 1.063 | 3 | 4 |
| 07/09/03 | 24.5 | | 7.7 | | 12 | 42 | | 1.678 | 3 | 4 |
| 07/21/03 | 25 | | 4.6 | | 9.9 | 64 | | 2.135 | 3 | 4 |
| 08/07/03 | 25.1 | | 9.66 | | 8.8 | 44 | | 1.83 | 4 | 4 |
| 08/21/03 | 26.3 | | 5.4 | | 7.8 | 37 | | 2.135 | 3 | 3 |
| 09/03/03 | 21.9 | | 6.19 | | 15 | 38 | | 1.676 | 3 | 3 |
| 09/17/03 | 20.5 | | 8.09 | | 5.3 | 32 | | 2.438 | 2 | 2 |
| 10/01/03 | 10 | | 12.67 | | 1.8 | 16 | | 4.572 | 1 | 3 |
| 10/13/03 | 14.5 | | 10.42 | | 3.3 | 44 | | 3.962 | 2 | 2 |

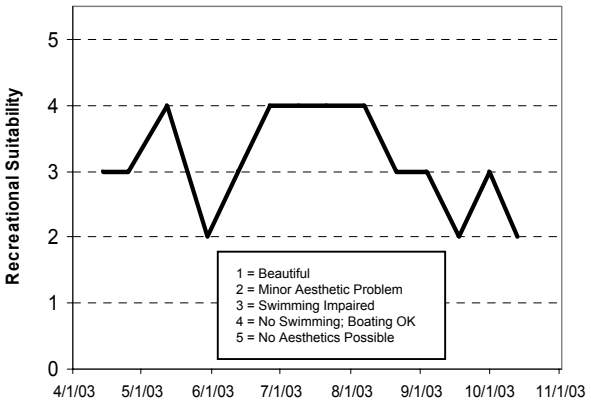



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | D | D | D | C | D | D | C | C | C | C |
| Chlorophyll a | | | D | C | C | C | D | D | B | B | C | B |
| Secchi Depth | | | D | D | D | C | D | D | B | B | D | C |
| **Overall** | | | **D** | **D** | **D** | **C** | **D** | **D** | **B** | **B** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Mergen's Lake (82-0482) *Valley Branch Watershed District*

Mergen's Lake is a 20-acre land-locked lake located within West Lakeland Township (Washington County). The maximum depth of the lake is 1.3 m (roughly 4 feet). 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 surface area and watershed size (424 acres) translates to a 12:1 watershed-to-lake size ratio. Generally the larger the ratio, the greater the potential stress on the lake from surface runoff.

This was the second year that Mergen's Lake has been involved in CAMP (2000 being the first). On each of the sampling days the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. Unfortunately, the lake was only monitored three times in 2003 (once in May, once in June, and once in September). For this reason, little can be determined from the lake's 2003 water quality.

Although there were only three monitoring events for Mergen's Lake in 2003, the following are the averages of the three events for each of the parameters tested. The summertime (May - September) mean TP concentration of 93.7 µg/l corresponds to a lake water quality grade of D. The CLA mean of 6.6 µg/l translates to a grade of A and Secchi mean of 1.6 m results in a grade of C. The overall lake quality grade from the lake's limited 2003 database was C (which is better than the overall grade of D recorded in 2000). Again, because of the limitedness of the 2003 dataset, it's summermeans and resulting grades should not be compared to the more comprehensive database of 2000.

As mentioned earlier, there are little nutrient data available for Mergen's Lake other than the 2000 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

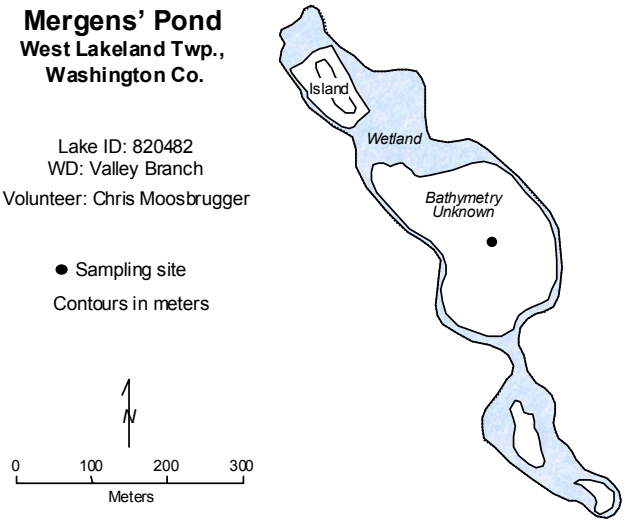
The perceived physical and recreational conditions (ranked on a 1-to-5 scale) are shown on the lake's information sheet on the next page. The average user perception rankings, were 1.0 for physical condition (1- "crystal clear"), and 1.0 for recreational suitability (1- "beautiful").

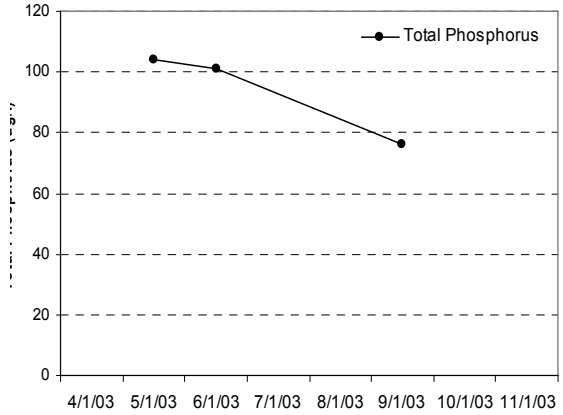
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

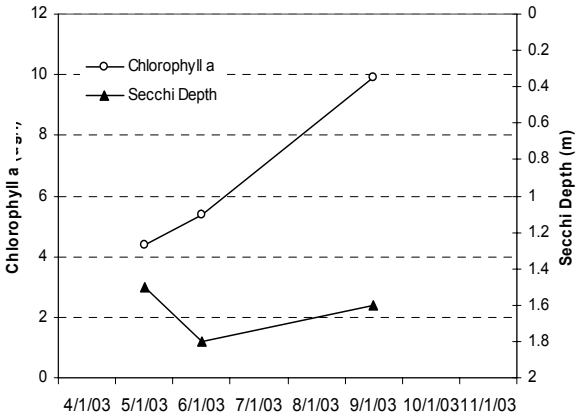
# Mergens' Pond

**West Lakeland Twp., Washington Co.**

Lake ID: 820482
WD: Valley Branch
Volunteer: Chris Moosbrugger

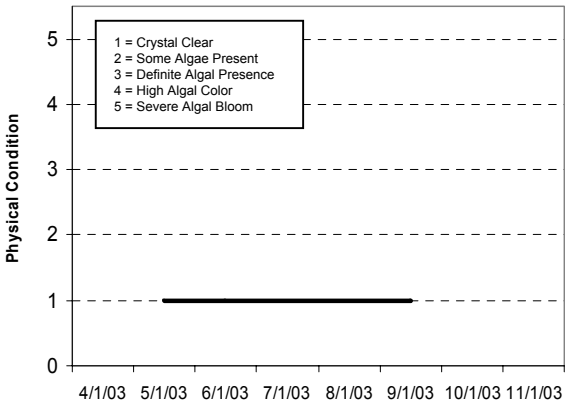



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/01/03 | 18 | | | | 4.4 | 104 | | 1.5 | 1 | |
| 06/04/03 | 21.2 | | | | 5.4 | 101 | | 1.8 | 1 | |
| 09/09/03 | 24.7 | | | | 9.9 | 76 | | 1.6 | 1 | 1 |

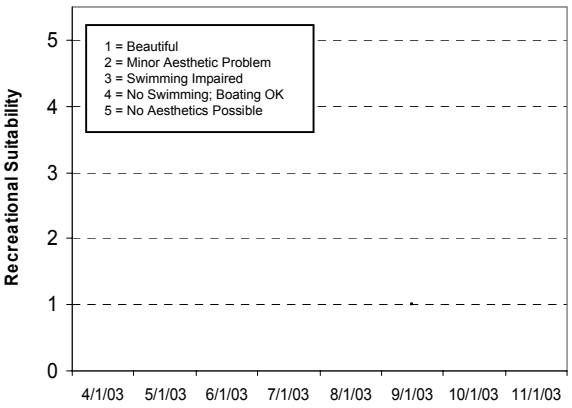



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | D | | | D |
| Chlorophyll a | | | | | | | | | C | | | A |
| Secchi Depth | | | | | | | | | D | | | C |
| **Overall** | | | | | | | | | **D** | | | **C** |

Source: Metropolitan Council and STORET data



## Miller Lake (10-0029) *Carver County Environmental Services*

Miller Lake, a 145-acre lake located within Dahlgren Township (Carver County) is considered a Metropolitan Area "Priority Lake" because of its multi-recreational uses. The mean and maximum depths of the lake are 3.1 m (10 feet) and 4.3 m (roughly 14 feet), respectively. The lake's mean depth and surface area translate to an approximate lake volume of 1,479 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 has a 16,701-acre immediate watershed, which translates to a watershed-to-lake area ratio of 115:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: four percent residential, 71 percent agricultural, two percent commercial/industrial, and 23 percent open/undeveloped (Carver County Planning 1999).

This was the eighth year that Miller Lake has been involved in CAMP. A search through the STORET nationwide water quality database revealed a limited water quality database with water quality data available for 1995-1997, and 1999-2002.

The lake was monitored 14 times between mid-April and mid-October, 2003. Results are presented on graphs and data tables on the following page.

The lake's overall 2003 lake quality grade of F was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 220.9 µg/l (minimum of 113.0 µg/l, maximum of 344.0 µg/l) corresponds to a lake water quality grade of F, as did the Secchi transparency mean of 0.6 m (minimum of 0.3 m, maximum of 0.9 m). The lake's mean CLA concentration of 61.5 µg/l (minimum and maximum of 32.0 and 100.0 µg/l) corresponds to a lake quality grade of D. The mean TKN concentration over the same time period was 1.95 mg/l (minimum of 1.20 mg/l, maximum of 2.50 mg/l).

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, it seems that the lake is well represented by an overall D/F grade. Also, the lake's CLA grade had steadly improved from F's in 1995-1996, D's in 1997 and 1999, to C'sin 2000-2002 before falling back to a D in 2003.

Throughout the monitoring period, the volunteer(s) ranked the perceived physical condition of the lake on a 1-to-5 scale. The mean perceived physical condition of Miller Lake was 3.2 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 2.8 (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.

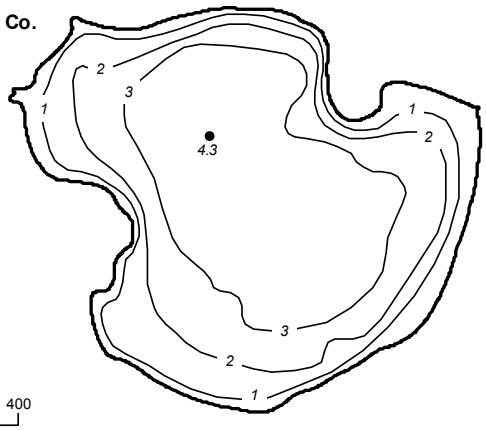
# Miller Lake

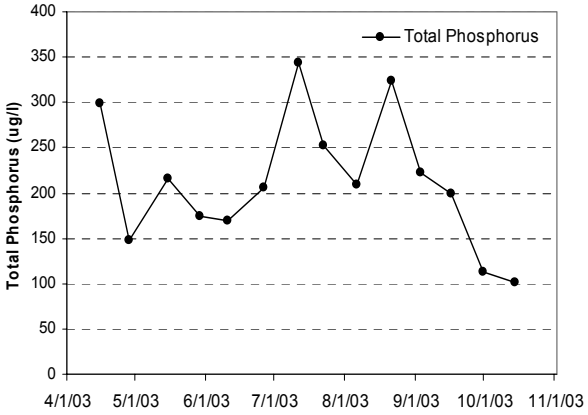
**Dahlgren Twp., Carver Co.**

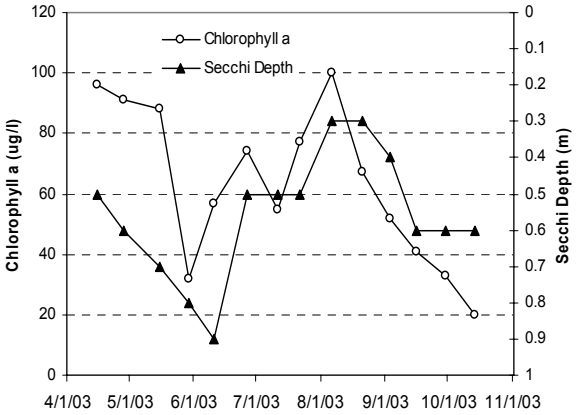
Lake ID: 100029
WMO: Carver County
Volunteer: Carver Co. Env. Services

● Sampling site

Contours in meters

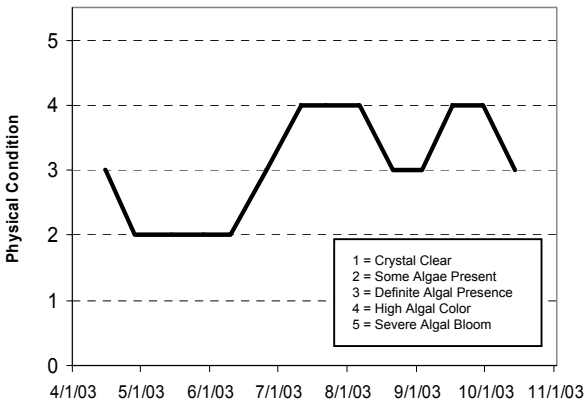



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/15/03 | 13.7 | | | | 96 | 298 | | 0.5 | 3 | 3 |
| 04/28/03 | 13.1 | | | | 91 | 147 | | 0.6 | 2 | 2 |
| 05/15/03 | 15.3 | | 12.5 | | 88 | 216 | | 0.7 | 2 | 1 |
| 05/29/03 | 19.3 | | 9.65 | | 32 | 174 | | 0.8 | 2 | 2 |
| 06/10/03 | 20.5 | | 12.08 | | 57 | 169 | | 0.9 | 2 | 2 |
| 06/26/03 | 21.3 | | 7.44 | | 74 | 206 | | 0.5 | 3 | 3 |
| 07/11/03 | 23 | | 5.3 | | 55 | 344 | | 0.5 | 4 | 3 |
| 07/22/03 | 24.7 | | 10.9 | | 77 | 253 | | 0.5 | 4 | 3 |
| 08/06/03 | 24.8 | | 8.01 | | 100 | 209 | | 0.3 | 4 | 4 |
| 08/21/03 | 26.1 | | 6.62 | | 67 | 324 | | 0.3 | 3 | 3 |
| 09/03/03 | 22.1 | | 9.34 | | 52 | 223 | | 0.4 | 3 | 3 |
| 09/16/03 | 20.2 | | 8.8 | | 41 | 199 | | 0.6 | 4 | 4 |
| 09/30/03 | 11.7 | | 4.86 | | 33 | 113 | | 0.6 | 4 | 3 |
| 10/14/03 | 13.4 | | 8.74 | | 20 | 101 | | 0.6 | 3 | 3 |

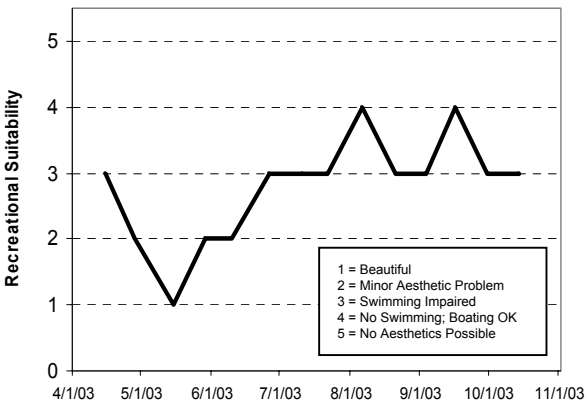



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | F | F | F | | F | F | F | F | F |
| Chlorophyll a | | | | F | F | D | | D | C | C | C | D |
| Secchi Depth | | | | F | F | D | | D | D | C | C | F |
| **Overall** | | | | **F** | **F** | **D** | | **D** | **D** | **D** | **D** | **F** |

Source: Metropolitan Council and STORET data



## Mud Lake (82-0026) *Carnelian - Marine Watershed District*

Mud Lake is a 62-acre lake located within May Township (Washington County). The maximum and mean depths of the lake are 2.1 m (roughly seven feet) and 1.1 m (three-and-a-half feet), respectively. The lake's size and mean depth results in an approximate lake volume of 224 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 small 93-acre immediate watershed translates to a small watershed-to-lake size ratio of 2:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the fourth year that Mud Lake has been involved in CAMP (2000-2002 being the others). A search through the STORET nationwide water quality database for historical data on Mud Lake provided data for eight years (1995-2002).

The lake's Secchi transparency was monitored seven times from late-April to early-October 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 1.19 m (minimum of 0.91 m and a maximum of 1.53 m). This translates to a grade of D for water clarity. The 2003 grade of D is the lake's best-recorded water clarity grade to date. The 2003 Secchi mean of roughly 1.2 m, is dramatically better than pre-2003 means (nothing better than 0.7 m).

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's water quality seems to be well represented by a overall grade of F. To better understand the lake's water quality and where it may be heading, more data are needed.

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 3.6 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 4.2 for recreational suitability (roughly equal to 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Mud Lake

**May Twp., Washington Co.**

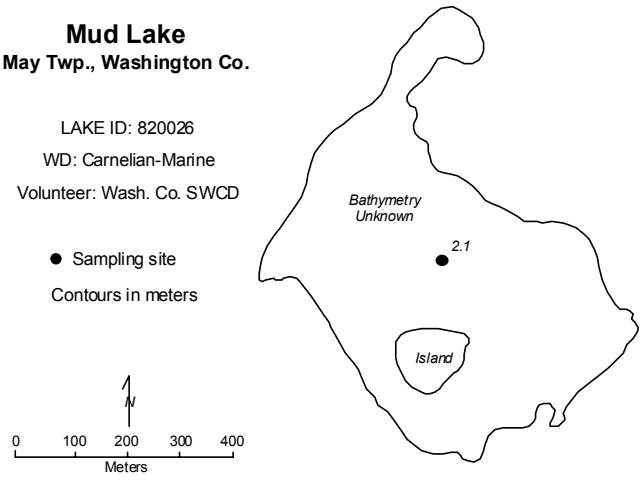
LAKE ID: 820026

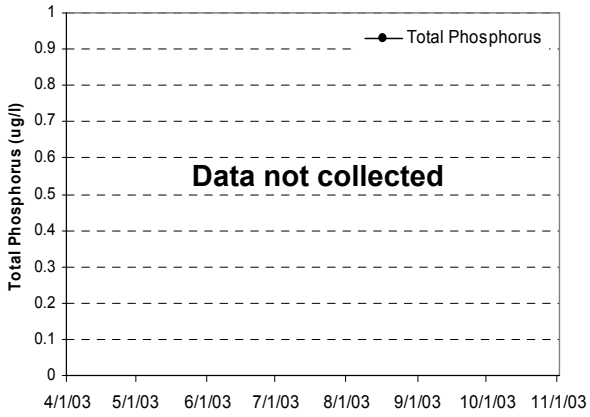
WD: Carnelian-Marine

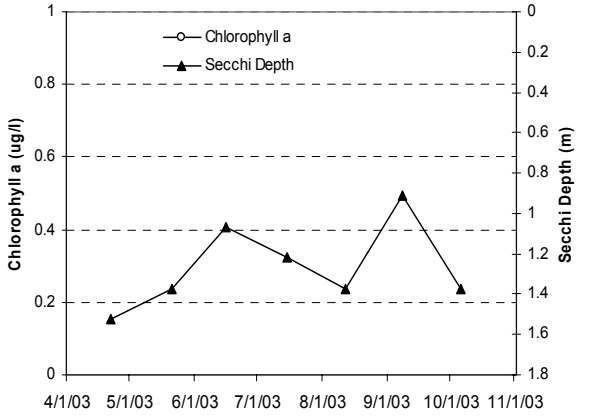
Volunteer: Wash. Co. SWCD

● Sampling site

Contours in meters

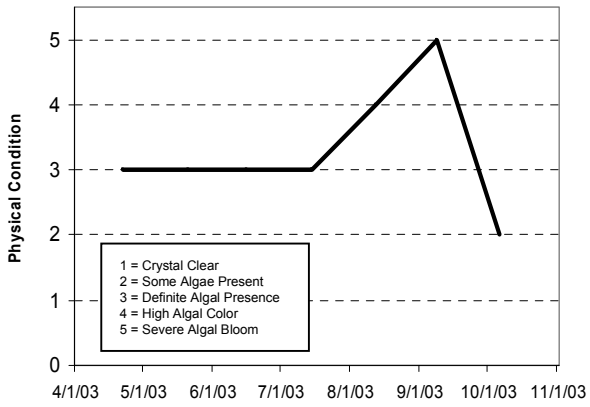



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 11.5 | | 5.34 | | | | | 1.525 | 3 | 3 |
| 05/21/03 | 16.9 | | 4.4 | | | | | 1.373 | 3 | 4 |
| 06/16/03 | 25.7 | | 8.32 | | | | | 1.068 | 3 | 4 |
| 07/15/03 | 24 | | 6.64 | | | | | 1.22 | 3 | 4 |
| 08/12/03 | 27.6 | | 9.2 | | | | | 1.373 | 4 | 5 |
| 09/08/03 | 24.5 | | 9.65 | | | | | 0.914 | 5 | 4 |
| 10/06/03 | 11.1 | | 9.44 | | | | | 1.372 | 2 | 5 |

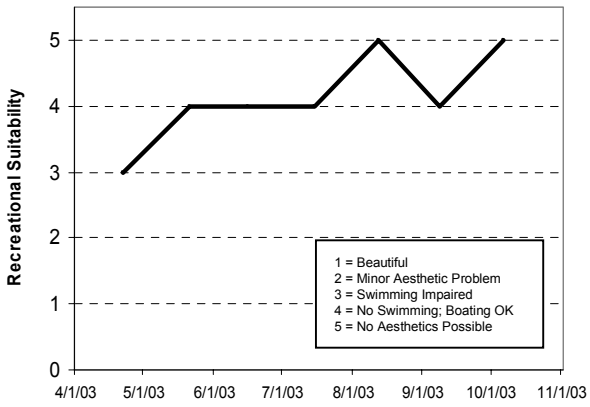



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | D | F | F | F | F | D | | |
| Chlorophyll a | | | | | D | D | F | D | F | F | | |
| Secchi Depth | | | | F | F | F | F | F | F | F | D | D |
| **Overall** | | | | | **D** | **F** | **F** | **F** | **F** | **F** | | |

Source: Metropolitan Council and STORET data



## North Twin Lake (82-0018) *Carnelian - Marine Watershed District*

North Twin Lake is a 69-acre lake located in Stillwater Township (Washington County). The maximum and mean depths of the lake are 1.8 m (roughly six feet) and 0.9 m (three feet), respectively. The lake's size and mean depth results in an approximate lake volume of 207 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 187-acre immediate watershed translates to a small watershed-to-lake size ratio of 3:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the fourth year that North Twin Lake has been involved in CAMP (2000-2002 being the others). A search through the STORET nationwide water quality database for data on the lake provided limited information (1996-2002).

The lake's was monitored seven times from late-April to early-October 2003. 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.

The mean summertime (May through September) surface TP concentration for the lake was 29.0 µg/l (minimum of 17.0 µg/l, maximum of 59.0 µg/l). The mean CLA and Secchi transparency readings were 4.7 µg/l (minimum of 2.1 µg/l, maximum of 8.0 µg/l) and 1.3 m (minimum of 1.2 m, maximum of 1.7 m), respectively. The lake's mean surface TKN concentration was 0.66 mg/l. The lake quality grades assigned to the 2003 summertime means are TP= B; CLA= A; and Secchi= C, resulting in an overall grade of B (similar to that recorded in 1997 and 1999-2001).

This overall grade is skewed however, due to the shallowness of the lake. When examining the lake's mean TP and CLA concentrations, it seems that the lake's Secchi readings were limited by the shallowness rather than algal abundance. So, while the lake only received an overall grade of B, the actual water quality may have been better.

As mentioned earlier, there is a limited amount of historic water quality data available for North Twin Lake (1996-2001). Therefore it is not possible to determine any long-term trends. In the short-term however, the lake seemd well represented by an overall B/C+ grade. To better understand the lake's water quality and where it may be heading, more data are needed.

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 2.4 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 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.

# North Twin Lake

**Stillwater Twp., Washington Co.**

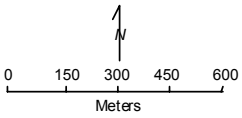
LAKE ID: 820018

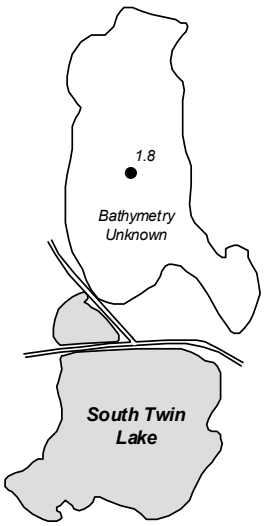
WD: Carnelian-Marine

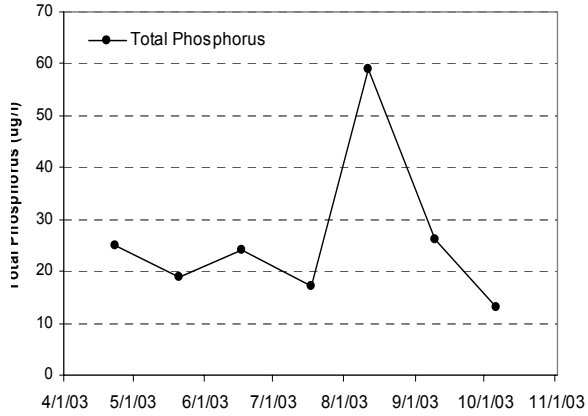
Volunteer: Wash. Co. SWCD

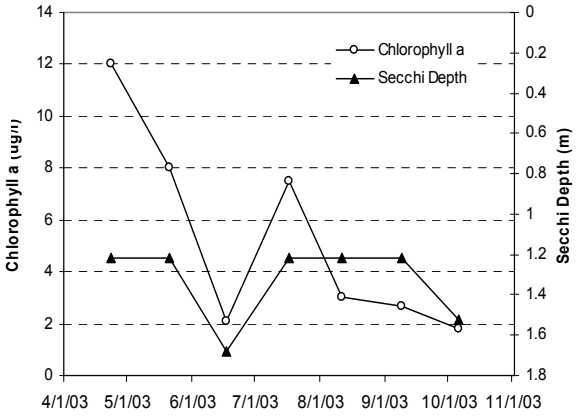
● Sampling site

Contours in meters



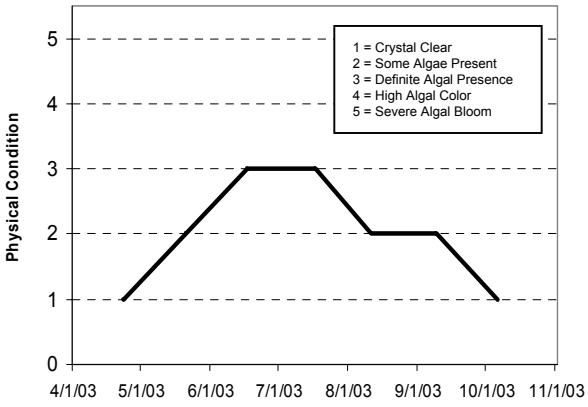




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/23/03 | 11.7 | | 3.3 | | 12 | 25 | | 1.22 | 1 | 3 |
| 05/21/03 | 17.5 | | 5.7 | | 8 | 19 | | 1.22 | 2 | 2 |
| 06/17/03 | 25.9 | | 9.15 | | 2.1 | 24 | | 1.678 | 3 | 4 |
| 07/17/03 | 25.1 | | 9.4 | | 7.5 | 17 | | 1.22 | 3 | 4 |
| 08/11/03 | 27.3 | | 10.7 | | 3 | 59 | | 1.22 | 2 | 4 |
| 09/09/03 | 22.8 | | 6.96 | | 2.7 | 26 | | 1.219 | 2 | 4 |
| 10/06/03 | 14.2 | | 14.27 | | 1.8 | 13 | | 1.524 | 1 | 2 |

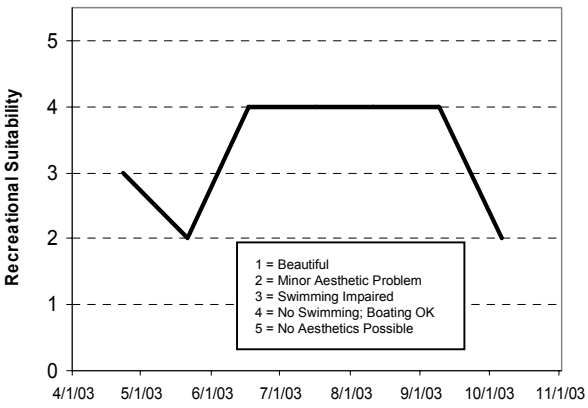



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | B | B | A | B | B | | B |
| Chlorophyll a | | | | | D | C | D | B | A | B | | A |
| Secchi Depth | | | | | B | B | B | B | C | C | C | C |
| **Overall** | | | | | **C** | **B** | **C** | **B** | **B** | **B** | | **B** |

Source: Metropolitan Council and STORET data



## 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 fourth year that Northwood Lake has been involved in CAMP. The lake was also enrolled in the program in 2000-2002. Other than the 2000-2002 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty. Thus, 2000-2003 are the only years of available data.

The lake has been involved in CAMP in 2000-2003 as part of a barley straw project on the lake. In an attempt to inhibit algal populations within the lake, barley straw has been added. Barley straw has been used for algal control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes. Therefore, in order to determine if the straw method successfully reduced algal biomass within Northwood Lake in 2003, TP, TKN, CLA and Secchi transparency were tested 12 times between mid-May and early-October. The resulting data and graphs appear on the next page.

The summertime (May through September) means for the monitored variables were: surface TP= 154.5 µg/l (minimum concentration of 99.0 µg/l and a maximum value of 270.0 µg/l); surface chlorophyll-a= 26.5 µg/l (minimum of 3.9 µg/l and maximum of 63.0 µg/l); Secchi transparency= 1.1 m (minimum of 0.9 m and a maximum of 1.3 m); and TKN= 1.04 mg/l (minimum of 0.72 mg/l and maximum of 1.40 mg/l). The lake's 2003 mean Secchi reading was the best recorded to date.

The lake's summer means translate to water quality grades of F for TP, C for CLA, and D for Secchi transparency. These grades result in an overall water quality grade of D for Northwood Lake in 2003. The lake's 2003 overall grade is simialr to those the recorded in 2000-2001 and worse than the C recorded in 2002.

Similar to that record in 2001-2002, the lake's 2003 CLA grade was better than the TP and Secchi grade. This may indicate that the barley straw did indeed somewhat inhibit algal growth over the summer months (continual years of data will provide a better picture of the barley straws influence on the lake's algal population). The reason that the reduced CLA mean did not result in an improved Secchi transparency mean is due the shallowness of the lake. There were many times throughout the summer, that the Secchi disk could be seen on or near the lake's bottom (at the sampling site). Therefore the lake's Secchi mean was actually limited by its shallow depth rather than the amount of algae in the water.

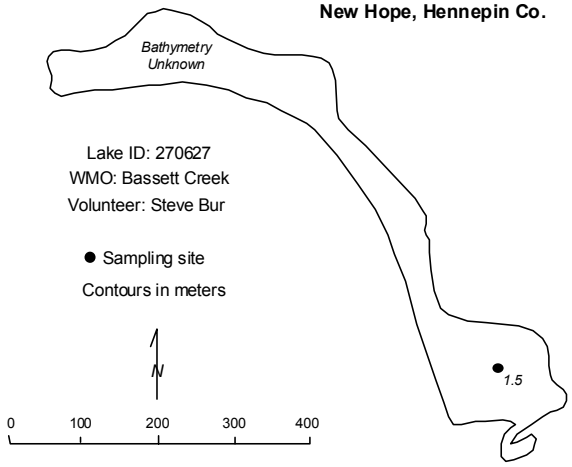
As mentioned earlier, there is no water quality data available for Northwood Lake other then the 2000-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

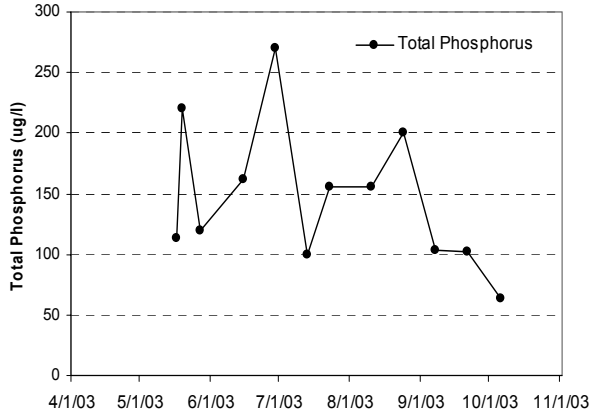
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 3.8 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 4.4 for recreational suitability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

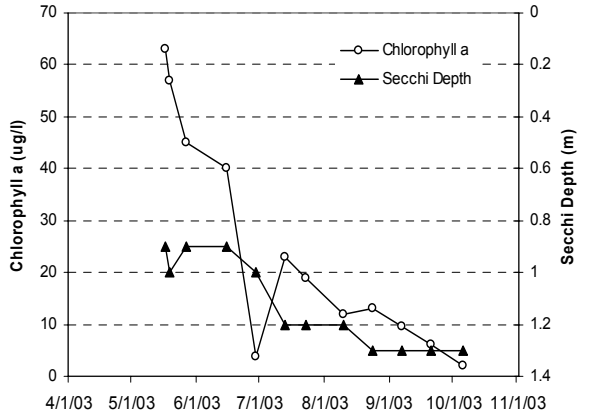
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Northwood Pond

**New Hope, Hennepin Co.**

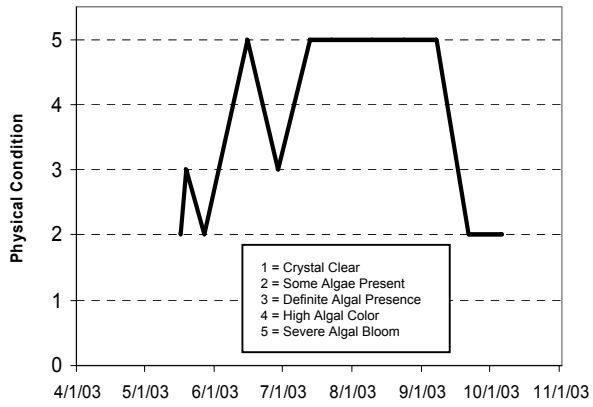



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 05/17/03 | 23.5 | | | | 63 | 113 | | 0.9 | 2 | 2 |
| 05/19/03 | 24.2 | | | | 57 | 220 | | 1 | 3 | 4 |
| 05/27/03 | 25 | | | | 45 | 120 | | 0.9 | 2 | |
| 06/15/03 | 27 | | | | 40 | 162 | | 0.9 | 5 | 5 |
| 06/29/03 | 25.5 | | | | 3.9 | 270 | | 1 | 3 | 4 |
| 07/13/03 | 27 | | | | 23 | 99 | | 1.2 | 5 | 5 |
| 07/23/03 | 26.5 | | | | 19 | 156 | | 1.2 | 5 | 5 |
| 08/10/03 | 28 | | | | 12 | 156 | | 1.2 | 5 | 5 |
| 08/24/03 | 28 | | | | 13 | 200 | | 1.3 | 5 | 5 |
| 09/07/03 | 27 | | | | 9.7 | 103 | | 1.3 | 5 | 5 |
| 09/21/03 | 17 | | | | 6.1 | 102 | | 1.3 | 2 | 4 |
| 10/06/03 | 15 | | | | 1.9 | 63 | | 1.3 | 2 | 4 |

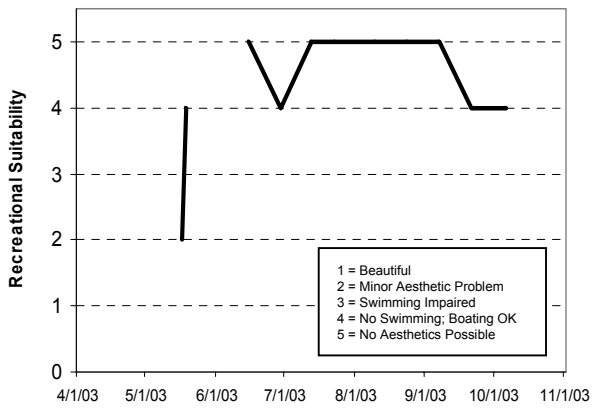



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | F | F | D | F |
| Chlorophyll a | | | | | | | | | B | C | B | C |
| Secchi Depth | | | | | | | | | D | D | D | D |
| **Overall** | | | | | | | | | **D** | **D** | **C** | **D** |

Source: Metropolitan Council and STORET data



## Oak Lake (10-0093) *Carver County Environmental Services*

Oak Lake is 339-acre lake located within Watertown Township (Carver County). The maximum depth of the lake is 3.4 m (roughly 11 feet). 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).

This was the third year in which Oak Lake has been involved in CAMP (2001-2002 being the others). A search through the STORET nationwide water quality database for historic data on the lake was unsuccessful. Thus, 2001-2003 are the only complete years of available data. 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.

The lake was monitored 12 times between mid-April and late-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of D was determined from the individual parameter grades (similar to that recorded in 2000-2001). The summertime (May through September) mean TP concentration of 160.8 µg/l (minimum of 35.0 µg/l, maximum of 253.0 µg/l) corresponds to a lake water quality grade of F. The mean CLA concentration of 34.7 µg/l (minimum of 4.6 µg/l and maximum of 65.0 µg/l) and the mean Secchi transparency of 1.4 m (minimum of 0.3 m, maximum of 3.0 m) both resulted in a grade of C. The mean TKN concentration over the same time period was 0.80 mg/l (minimum of 0.51 mg/l and maximum of 1.10 mg/l). While the lake's individual CLA and Secchi grades were identical to those recorded in 2001, the 2002, the 2003 TP mean was the worst to date.

As mentioned earlier, there are no water quality data available for Oak Lake other than 2001-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

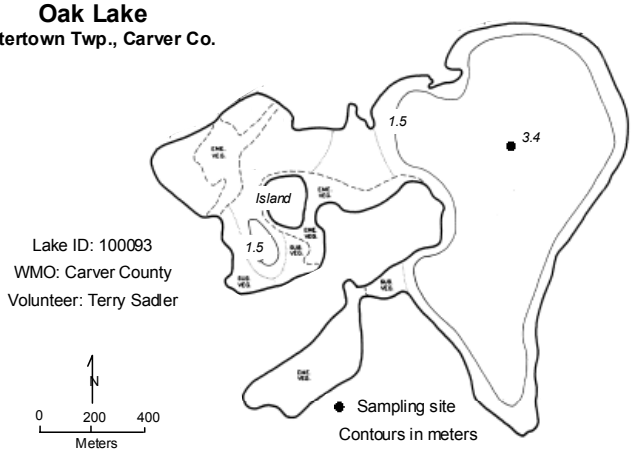
Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 2.6 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 2.6 for recreational suitability (between 2- minor aesthetic problem and 3- "swimming slightly impaired").

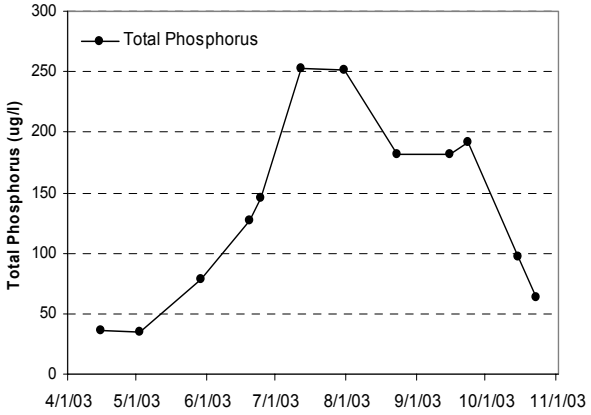
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

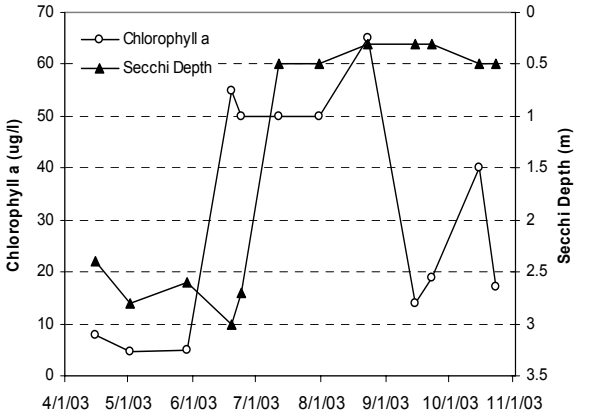
If you notice any errors in the lake data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Oak Lake

**Watertown Twp., Carver Co.**

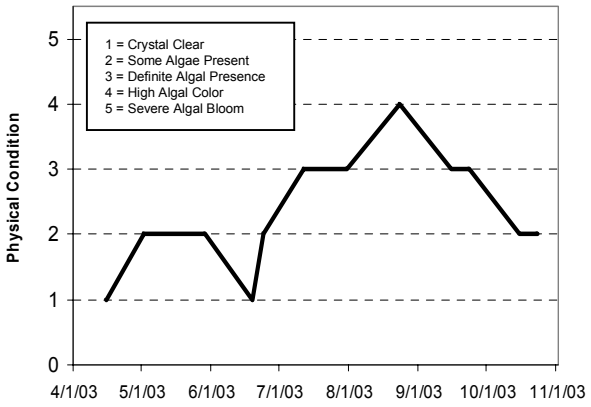



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/15/03 | 12.5 | | | | 7.7 | 36 | | 2.4 | 1 | 1 |
| 05/02/03 | 16 | | | | 4.6 | 35 | | 2.8 | 2 | 2 |
| 05/29/03 | 20 | | | | 4.9 | 78 | | 2.6 | 2 | 2 |
| 06/19/03 | 26 | | | | 55 | 127 | | 3 | 1 | 1 |
| 06/24/03 | 27 | | | | 50 | 146 | | 2.7 | 2 | 2 |
| 07/12/03 | 28 | | | | 50 | 253 | | 0.5 | 3 | 3 |
| 07/31/03 | 27 | | | | 50 | 252 | | 0.5 | 3 | 3 |
| 08/23/03 | 29.4 | | | | 65 | 182 | | 0.3 | 4 | 4 |
| 09/15/03 | 23 | | | | 14 | 182 | | 0.3 | 3 | 3 |
| 09/23/03 | 19 | | | | 19 | 192 | | 0.3 | 3 | 3 |
| 10/15/03 | 15 | | | | 40 | 97 | | 0.5 | 2 | 3 |
| 10/23/03 | 12 | | | | 17 | 63 | | 0.5 | 2 | 3 |

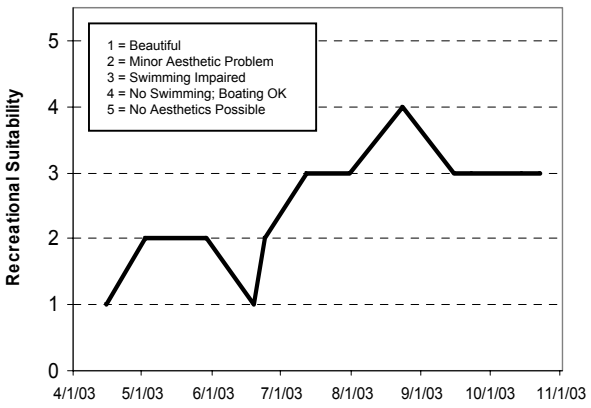



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | D | D | F |
| Chlorophyll a | | | | | | | | | | C | C | C |
| Secchi Depth | | | | | | | | | | C | C | C |
| **Overall** | | | | | | | | | | **C** | **C** | **D** |

Source: Metropolitan Council and STORET data



## Oneka Lake (82-0140) *Rice Creek Watershed District*

This was the fifth year that Oneka Lake has been involved in CAMP. The 381-acre lake is located in the City of Hugo (Washington County). The lake has a mean and maximum depth of 1.2 m (4 feet) and 2.1 m (7 feet), respectively. The lake's surface area and mean depth translates to an approximate lake volume of 1,524 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). A canoe access is located on the lake's southern shore.

A search through the STORET nationwide water quality database revealed that data were collected on the lake in 1981-1983, 1985, 1987, 1990-1992 (the majority of the years only had one or two sampling events however) and 1999-2002. Because of the lack of monitoring frequency resulting in a limited database, no short- or long-term trends can be determined. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Oneka Lake was monitored six times between early-May and early-September, 2003. The resulting data and graphs appear on the next page.

The 2003 mean summertime (May through September) TP concentration for the lake was 17.2 µg/l (minimum of 14.0 µg/l and maximum of 23.0 µg/l). The summertime mean CLA concentration was 4.1 µg/l (minimum of 2.8 µg/l and maximum of 6.0 µg/l). The summertime mean Secchi transparency for the lake in 2003 was 1.5 m (minimum of 1.2 m and a maximum of 1.7 m). Additionally, the lake's summertime mean surface TKN concentration was 0.85 mg/l (minimum of 0.69 mg/l and maximum of 1.00 mg/l). The resulting individual water quality grades for Oneka Lake in 2003 were as follows: A for TP, A for CLA, and C for Secchi transparency. The three individual grades translate to a 2003 overall water quality grade of B.

The 2003 overall grade may well be skewed however, due to the shallowness of the lake. When examining the lake's mean TP and CLA concentrations, it seems that the lake's Secchi readings were limited by the shallowness rather than algal abundance. So, while the lake only received an overall grade of B, the actual water quality may have been better.

The 2003 individual and overall grades are identical to those recorded in 1999. In fact, the overall B grade was also recorded in 1981, 1985, 1987, 1992, and 1999-2000. The lake recently had received overall grades of C in 2001 and 2002.

The physical and recreational conditions of Oneka Lake as perceived by the volunteer(s) were ranked on a 1-to-5 scale. These rankings are also graphed on the lake's information sheet. The average user perception rankings, on a 1-to-5 scale, were 1.3 for physical condition (between 1- "crystal clear" and 2- "some algae present"), and 1.2 for recreational suitability (between 1- "beautiful" and 2- "minor aesthetic problems").

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/.

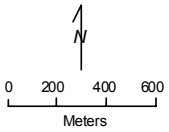
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

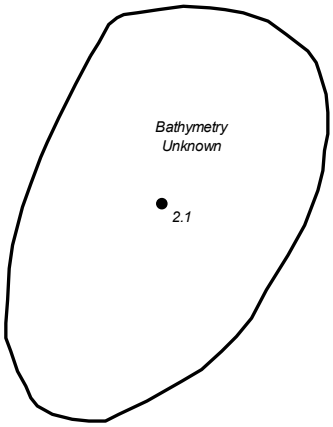
# Oneka Lake

**Hugo, Washington Co.**

Lake ID: 820140
WD: Rice Creek
Volunteer: Rice Creek WD

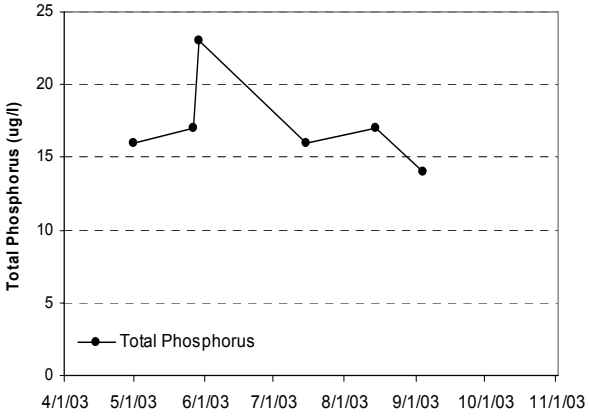
● Sampling site
Contours in meters

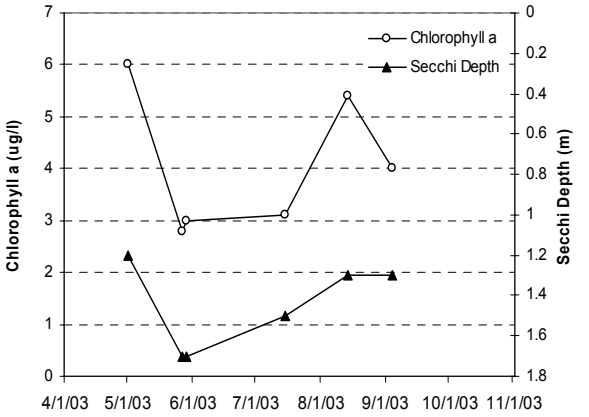


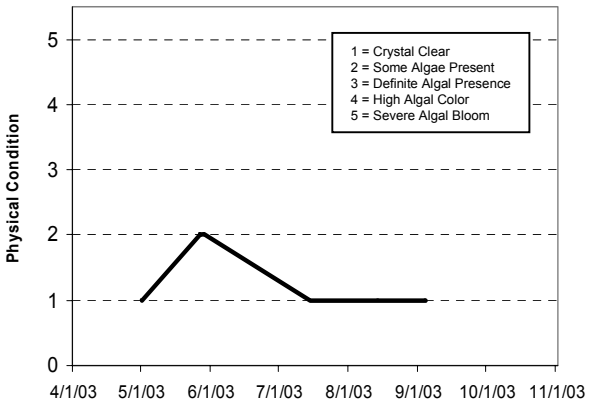




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/01/03 | 15 | | 4.8 | | 6 | 16 | | 1.2 | 1 | 1 |
| 05/27/03 | 20.4 | | 12.1 | | 2.8 | 17 | | 1.7 | 2 | 1 |
| 05/29/03 | 22.3 | | | | 3 | 23 | | 1.7 | 2 | 2 |
| 07/15/03 | 23.5 | | | | 3.1 | 16 | | 1.5 | 1 | 1 |
| 08/14/03 | 25.3 | | | | 5.4 | 17 | | 1.3 | 1 | 1 |
| 09/04/03 | 26 | | | | 4 | 14 | | 1.3 | 1 | 1 |



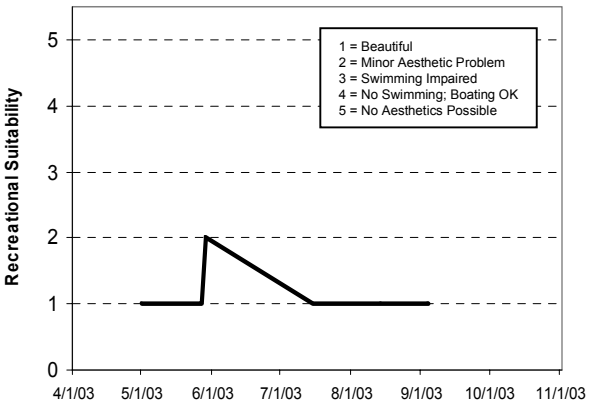




### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | C | | | | | | | A | B | C | C | A |
| Chlorophyll a | A | | | | | | | A | A | B | B | A |
| Secchi Depth | C | | | | | | | C | C | C | C | C |
| **Overall** | **B** | | | | | | | **B** | **B** | **C** | **C** | **B** |

Source: Metropolitan Council and STORET data



## Orchard Lake (19-0031) *City of Lakeville*

Orchard Lake, managed by the MDNR as a centrachid lake (bass and panfish), is lake located within the City of Lakeville (Dakota County). The 250-acre lake has a 2,012-acre watershed, which translates to a 8:1 watershed-to-lake size ratio (generally the larger the ratio, the greater the potential stress on the lake from surface runoff). The maximum and mean depths of the lake are 10.0 m (roughly 33 feet) and 3.0 m (10 feet), respectively. The lake's surface area and mean depth translate to an approximate volume of 2,500 acre-feet. Approximately 75 percent of the lake's surface area are considered littoral zone (area of aquatic plant dominance). A public access is located within the City Park on the lake's southeastern end, and because of its multi-recreational uses, it is considered a "Priority Lake" in the Metropolitan Area.

This was the fourth year that Orchard Lake has been involved in CAMP (also invovled in 1999-2001). Council staff has also monitored the lake in the past. A search through the STORET nationwide water quality database for data on the lake resulted in nutrient and Secchi transparency information for 1980-1981, 1983, 1989, 1993, and 1998-2001, as well as just Secchi data for 1987-1988.

As part of the city's involvement in CAMP in 2003, the lake was monitored six times between mid-April and mid-October. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration was 38.3 µg/l (minimum of 35.0 µg/l, maximum of 44.0 µg/l). The mean CLA and Secchi transparency readings were 22.3 µg/l (minimum of 19.0 µg/l, maximum of 27.0 µg/l), and 1.2 m (minimum of 1.1 m, maximum of 1.4 m), respectively. The lake's mean surface TKN concentration was 1.30 mg/l (minimum of 1.20 mg/l and a maximum of 1.40 mg/l). The summertime means resulted in a TP grade of C, CLA of C, and a Secchi transparency grade of C. The overall grade determined through the calculation of all three parameters was C. The lake's 2001 water quality was the best recorded since the early-1980's.

The lake's 2003 overall grade was similar to those recorded in 1980, 1993, and 1998-2000, and worse than those of to that of 1981, 1983, 1989 and 2001 (B). The lake's water quality seems to be well represented by an overall grade of high-C/low-B.

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 following page. The mean physical condition ranking was 2.0 (2- "some algae present"), while the mean recreational suitability ranking was 2.0 (2- "minor aesthetic problem").

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.

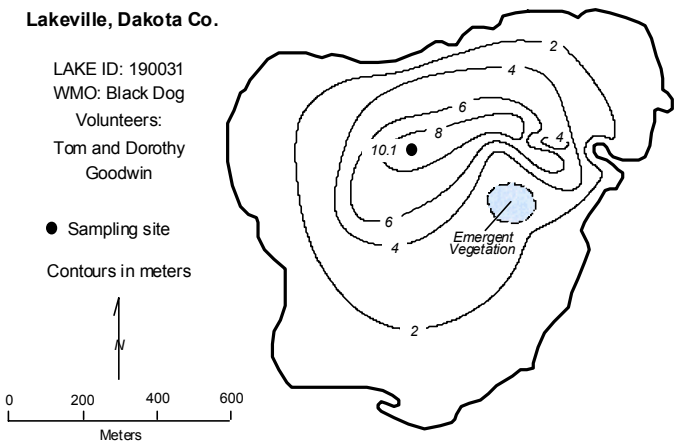
# Orchard Lake

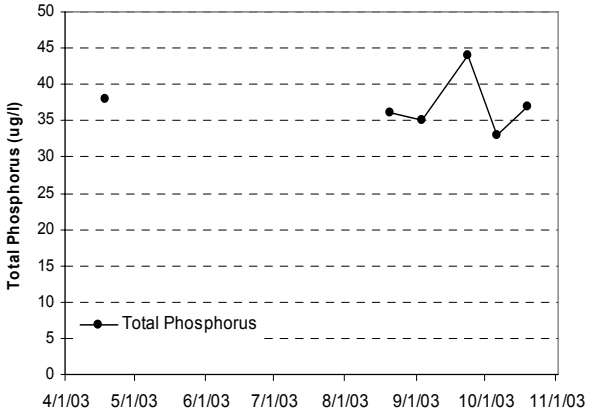
**Lakeville, Dakota Co.**

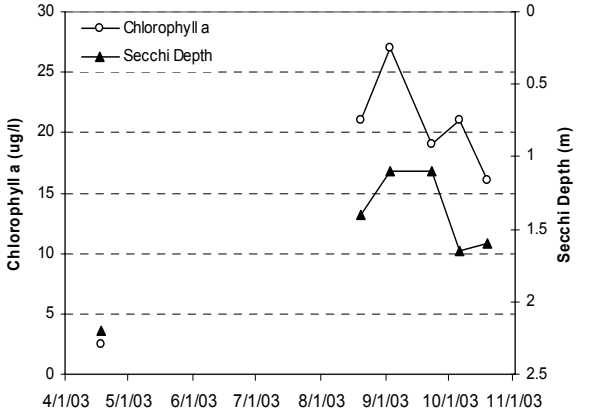
LAKE ID: 190031
WMO: Black Dog
Volunteers:
Tom and Dorothy Goodwin

● Sampling site

Contours in meters

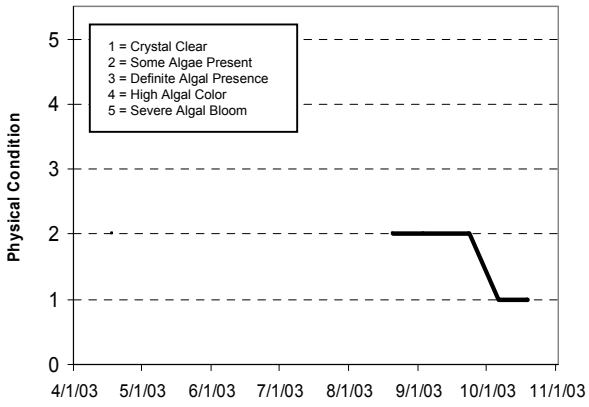



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 17.9 | | | | 2.5 | 38 | | 2.2 | 2 | 3 |
| 08/20/03 | 24 | | | | 21 | 36 | | 1.4 | 2 | 2 |
| 09/03/03 | 20 | | | | 27 | 35 | | 1.1 | 2 | 2 |
| 09/23/03 | 10 | | | | 19 | 44 | | 1.1 | 2 | 2 |
| 10/06/03 | 10 | | | | 21 | 33 | | 1.65 | 1 | 1 |
| 10/19/03 | 10 | | | | 16 | 37 | | 1.6 | 1 | 1 |

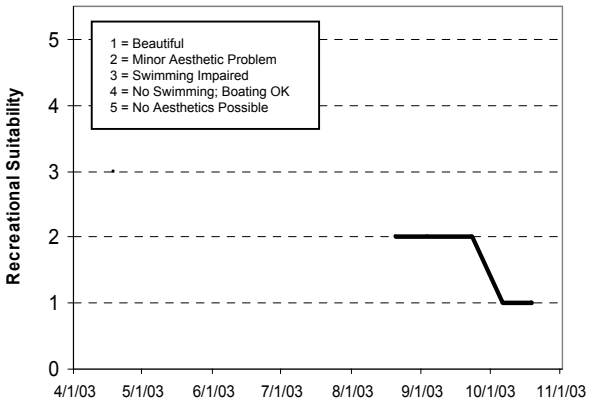



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | | | | | C | C | C | B | | C |
| Chlorophyll a | | B | | | | | C | C | C | B | | C |
| Secchi Depth | | C | | | | | C | C | C | B | | C |
| **Overall** | | **C** | | | | | **C** | **C** | **C** | **B** | | **C** |

Source: Metropolitan Council and STORET data



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

This was the third 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. 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 late-April to mid-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 31.3 µg/l (minimum concentration of 5.0 µg/l, and a maximum value of 55.0 µg/l); surface chlorophyll-a= 10.3 µg/l (minimum of 1.9 µg/l and maximum of 21.0 µg/l); Secchi transparency= 2.7 m (minimum of 1.0 m and a maximum of 5.0 m); and TKN= 0.82 mg/l (minimum of 0.52 mg/l and maximum of 1.20 mg/l). The lake's summer means translate to water quality grades of B for TP, B, for CLA, and B for Secchi transparency.

The lake's 2003 overall grade, although better than the C's recorded in 1980, 1995, and 1999, 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 2002-2003 water quality years represent the lake's best-monitored water quality. The lake's water quality shows a markable improvement in water quality since 2000. In fact, a recent MPCA conducted trend analysis on the lake's Secchi transparency data, revealed a statistically significant improvement in recent water clarity. To better understand the lake's water quality and where it truely may be heading, more data (especially nutrient data) are needed.

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 2.8 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 2.8 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.

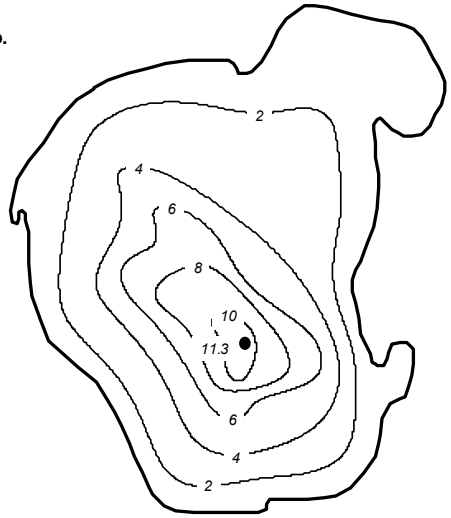
# Parkers Lake

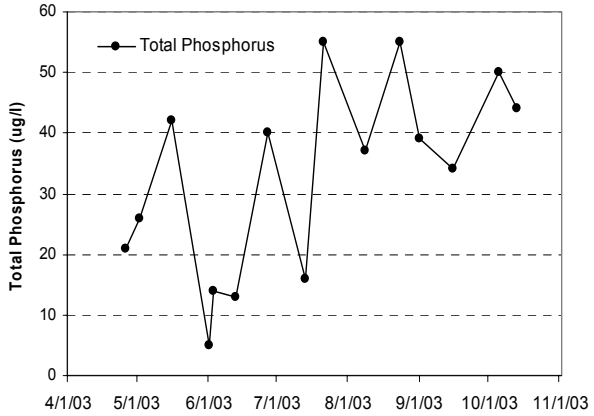
**Plymouth, Hennepin Co.**

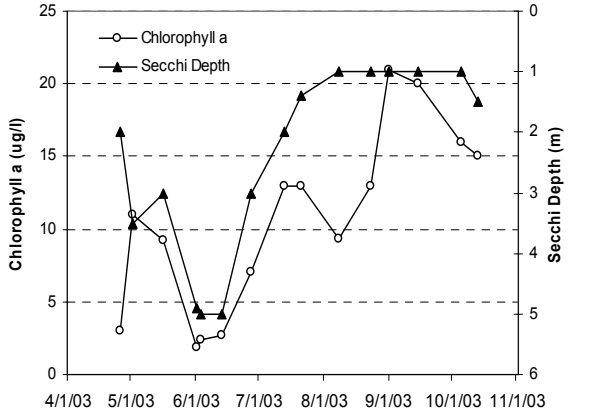
Lake ID: 270107
WMO: Bassett Creek
Volunteer: Bob Videen

● Sampling site

Contours in meters

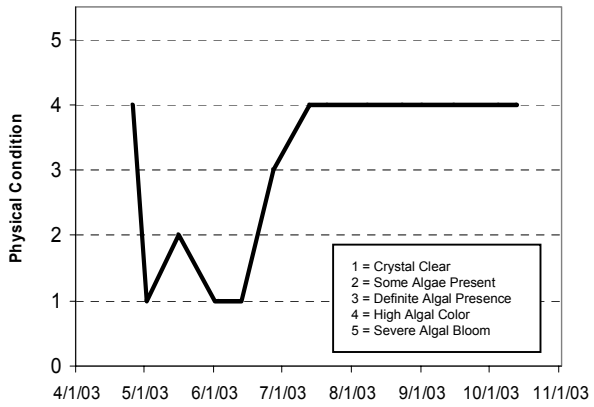



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/26/03 | 14 | | | | 3 | 21 | | 2 | 4 | 4 |
| 05/02/03 | 15.5 | | | | 11 | 26 | | 3.5 | 1 | 2 |
| 05/16/03 | 18 | | | | 9.2 | 42 | | 3 | 2 | 2 |
| 06/01/03 | 19 | | | | 1.9 | 5 | | 4.9 | 1 | 1 |
| 06/03/03 | 19.9 | | | | 2.4 | 14 | | 5 | 1 | 1 |
| 06/13/03 | 21 | | | | 2.7 | 13 | | 5 | 1 | 1 |
| 06/27/03 | 22 | | | | 7.1 | 40 | | 3 | 3 | 3 |
| 07/13/03 | 25.5 | | | | 13 | 16 | | 2 | 4 | 4 |
| 07/21/03 | 26.5 | | | | 13 | 55 | | 1.4 | 4 | 4 |
| 08/08/03 | 26.5 | | | | 9.3 | 37 | | 1 | 4 | 4 |
| 08/23/03 | 26.5 | | | | 13 | 55 | | 1 | 4 | 4 |
| 09/01/03 | 25 | | | | 21 | 39 | | 1 | 4 | 4 |
| 09/15/03 | 23 | | | | 20 | 34 | | 1 | 4 | 4 |
| 10/05/03 | 13 | | | | 16 | 50 | | 1 | 4 | 4 |
| 10/13/03 | 15.5 | | | | 15 | 44 | | 1.5 | 4 | 4 |

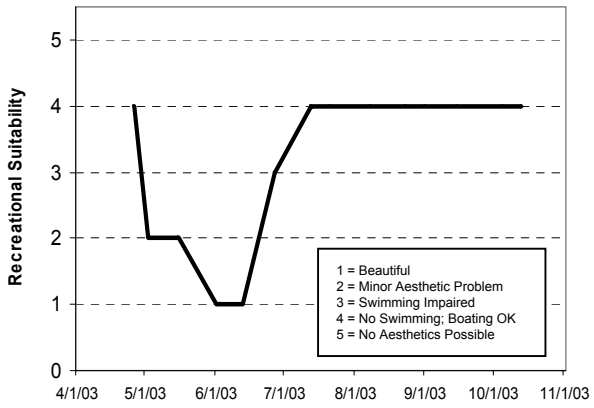



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | C | | | | C | A | | A | B |
| Chlorophyll a | | | | B | | | | B | A | | A | B |
| Secchi Depth | | | | C | | | | C | B | | A | B |
| **Overall** | | | | **C** | | | | **C** | **A** | | **A** | **B** |

Source: Metropolitan Council and STORET data



## Peltier Lake (2-0004) *Rice Creek Watershed District*

Lake Peltier, with a surface area of 465 acres, is located one mile north of the City of Centerville (Anoka County). The maximum and mean depths of the lake are 4.9 and 2.1 m (16 and seven feet), respectively. The approximate volume of the lake is 3,255 ac-ft. The lake has a drainage area of roughly 68,082 acres, which translates to a extremely large watershed-to-lake size ratio of 391:1. The greater the ratio, the greater the potential stress on the lake from surface runoff. Public access is possible on the southwestern end of the lake through the Rice Creek Chain of Lakes Regional Park.

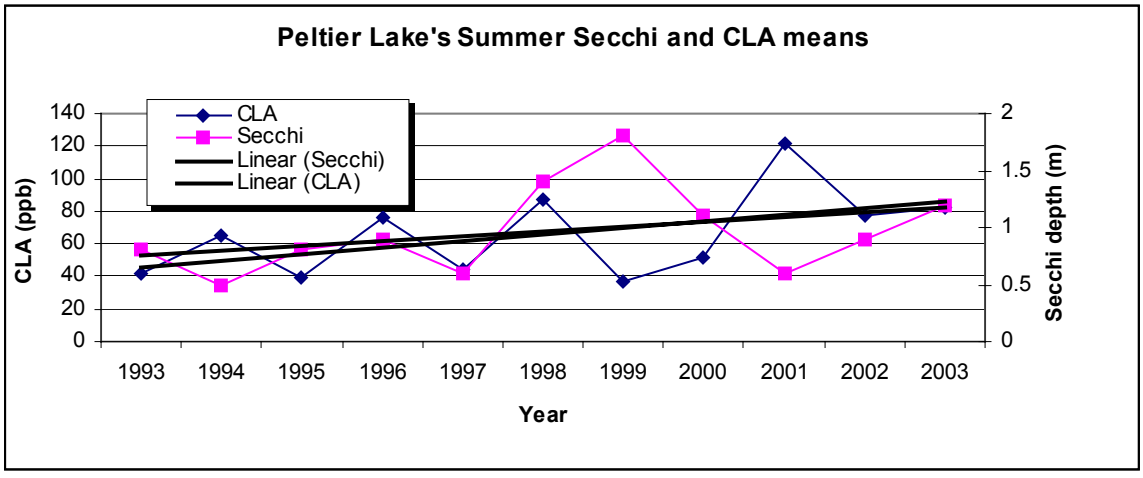
Peltier Lake is managed by the St. Paul Water Utility as a back-up water supply, and due to its multi-recreational uses, is considered a "Priority Lake" in the area by the Metropolitan Council. One aspect which may hinder recreational uses on the lake is the recent discovery of Eurasian Water Milfoil (*Myriophyllum spicatum*) [EWM]. Additionally, the lake, which is managed by the MDNR as a gamefish lake, experiences frequent winterkills.

Lake Peltier has been involved in CAMP since 1993 and was monitored 15 times from late-April to mid-October, 2003. Results are presented in graphs and data tables on the following page.

Summertime (May through September) means were: surface TP= 146.9 µg/l (minimum of 57.0 µg/l, maximum value of 344.0 µg/l); surface CLA= 82.1 µg/l (minimum of 4.5 µg/l, maximum of 450.0 µg/l); Secchi transparency= 1.2 m (minimum of 0.4 m, maximum of 2.6 m); and TKN= 1.67 mg/l (minimum of 0.95 mg/l, maximum of 3.30 mg/l). Lake quality grades for the summertime means were TP= D; CLA= F; and Secchi= D, resulting in an overall grade of D for 2003.

The 2003 overall grade of D is similar to those recorded in 1993, 1995-1997, and 1999-2000. This is better than the overall grade of F recorded in 1994, and 2001-2002.

Of the 11 years of CAMP data the best water quality was in 1995 and 1999, while the worst was 2001 (1994 was the second worst). Other than the 1993-2003 CAMP data, the only other data found through a search of the STORET database was from 1983. While statistical analysis on the lake's water quality




database revealed no "statistically significant" trends, and grades seems to promote the idea that the lake's overall quality has remained fairly constant over the past decade [fluctuating between a low D and F], a

simple trend line calculated from the annual summer means shows a slight degradation in the lake's Secchi and chlorophyll-a means (see graph).

The average user perception rankings, on a 1-to-5 scale, was 2.5 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 1.8 for recreational suitability (between 1- "beautiful" and 2- "minor aesthetic problem"). The 2003 user perception ranking represent the best to date.

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/.

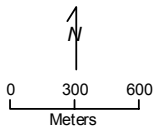
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

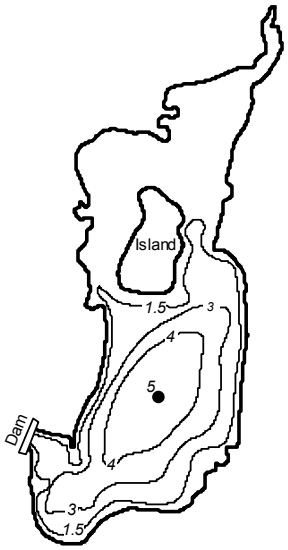
# Peltier Lake

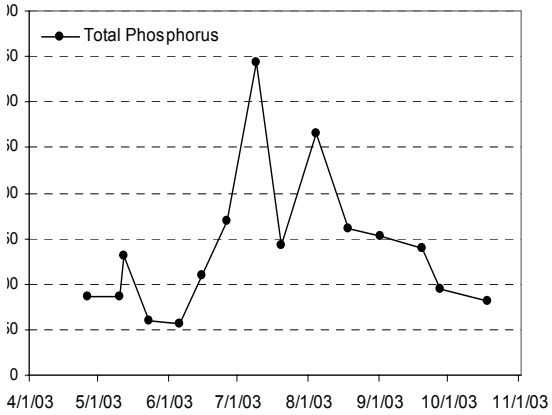
**Centerville/Lino Lakes, Anoka Co.**

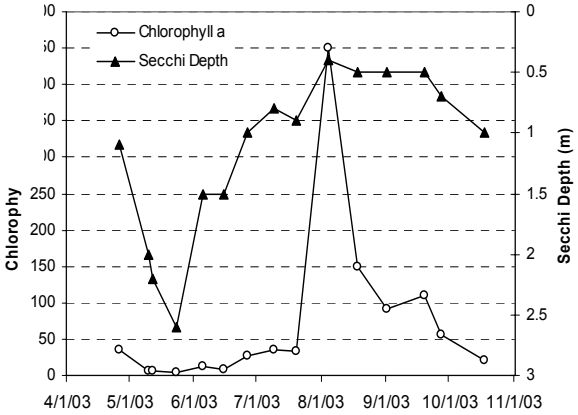
Lake ID: 20004
WD: Rice Creek
Volunteer: Wayne LeBlanc

● Sampling site
Contours in meters



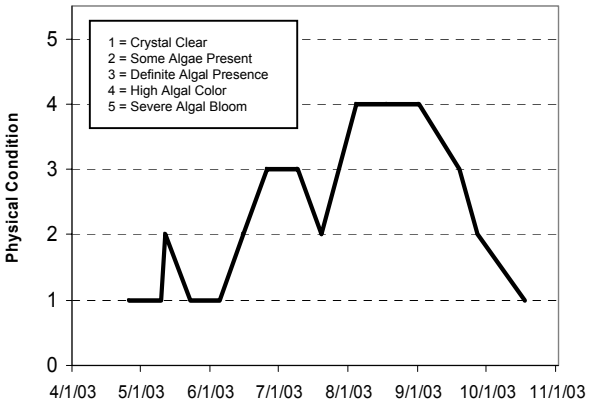




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/26/03 | 12 | | | | 35 | 86 | | 1.1 | 1 | 1 |
| 05/10/03 | 13 | | | | 7 | 86 | | 2 | 1 | 1 |
| 05/12/03 | 17.2 | | | | 5.5 | 131 | | 2.2 | 2 | 2 |
| 05/23/03 | 16 | | | | 4.5 | 60 | | 2.6 | 1 | 1 |
| 06/05/03 | 20 | | | | 12 | 57 | | 1.5 | 1 | 1 |
| 06/15/03 | 25 | | | | 8.2 | 109 | | 1.5 | 2 | 1 |
| 06/26/03 | 19 | | | | 26 | 169 | | 1 | 3 | 2 |
| 07/09/03 | 21 | | | | 36 | 344 | | 0.8 | 3 | 2 |
| 07/20/03 | 22 | | | | 34 | 142 | | 0.9 | 2 | 1 |
| 08/04/03 | 25 | | | | 450 | 265 | | 0.4 | 4 | 3 |
| 08/18/03 | 25 | | | | 150 | 161 | | 0.5 | 4 | 3 |
| 09/01/03 | 23 | | | | 91 | 152 | | 0.5 | 4 | 3 |
| 09/19/03 | 16 | | | | 110 | 140 | | 0.5 | 3 | 2 |
| 09/27/03 | 12 | | | | 56 | 94 | | 0.7 | 2 | 1 |
| 10/18/03 | 11 | | | | 21 | 81 | | 1 | 1 | 1 |

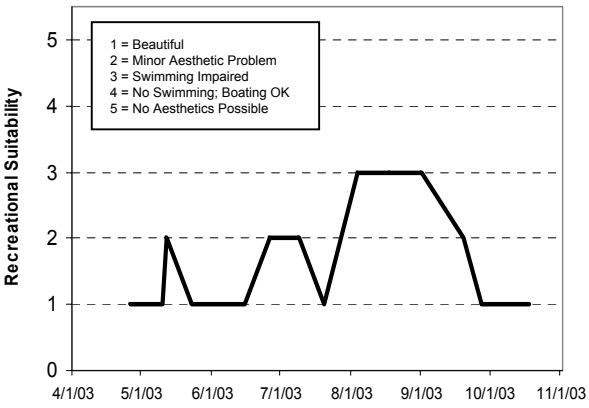



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | F | F | D | F | D | F | F | F | F | F | D |
| Chlorophyll a | | C | D | C | D | C | F | C | D | F | F | D |
| Secchi Depth | | D | F | D | D | F | C | C | D | F | D | D |
| **Overall** | | **D** | **F** | **D** | **D** | **D** | **D** | **D** | **D** | **F** | **F** | **D** |

Source: Metropolitan Council and STORET data



## Pike Lake [Ramsey Co.] (62-0069) *Rice Creek Watershed District*

Pike Lake is a 35-acre lake located within the City of New Brighton (Ramsey County). The mean and maximum depths of the lake are 2.1 m (7 feet) and 4.9 m (16 feet). The lake's mean depth and surface area translate to a lake volume of 245 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).

This was the fifth year that Pike Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake resulted in nutrient and Secchi transparency information for 1981-1983, 1985-1991, and 1999-2002, as well as just Secchi data for 1992-1993.

As part of the watershed district's involvement in CAMP in 2003, the lake was monitored 14 times between mid-April and mid-October. During each sampling event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The mean summertime (May through September) surface TP concentration was 85.0 µg/l (minimum of 23.0 µg/l, maximum of 138.0 µg/l). The mean CLA and Secchi transparency readings were 58.8 µg/l (minimum of 9.8 µg/l, maximum of 110.0 µg/l), and 0.8 m (minimum of 0.4 m, maximum of 2.0 m), respectively. The lake's mean surface TKN concentration was 1.60 mg/l (minimum of 0.85 mg/l and a maximum of 2.40 mg/l). When comparing the lake's 2003 summer means to historic summer means it is apparent that lake's 2003 water quality was slightly worse that that recorded in 1999-2002.

The 2003 summertime means translate to a TP grade of D, CLA of D, and a Secchi transparency grade of D. The overall grade determined through the calculation of all three parameters was D. The lake's 2003 overall grade was similar to that of 1981-1982, 1987-1990, and 1999-2002, better than 1991 (F), and worse than that of 1983, and 1985-1986 (all of which were B's). Thus, the lake's quality seems fluctuate quite a bit, but many fall with the overall grade range of low-C/high-D.

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 following page. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.3 (between 2- "minor aesthetic problems" and 3- "swimming slightly impaired").

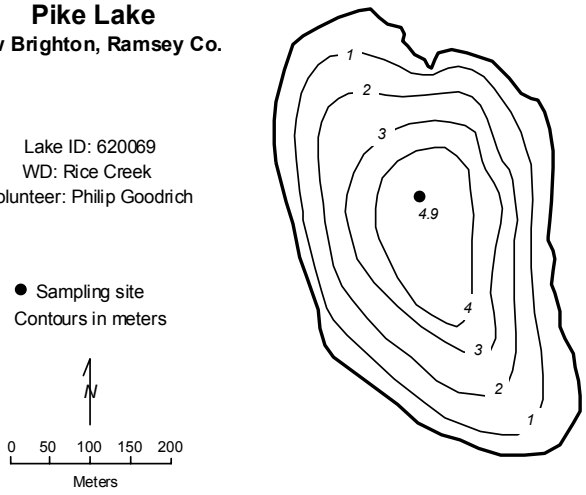
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

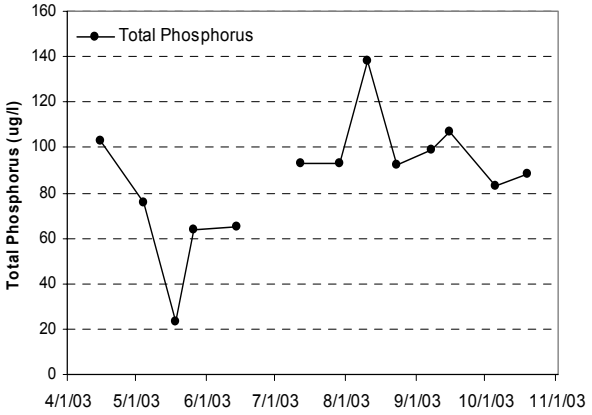
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

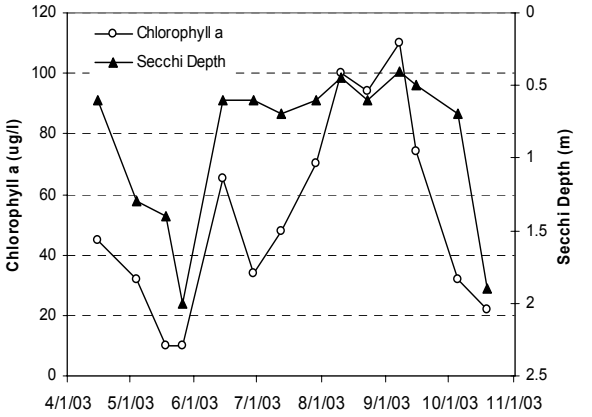
# Pike Lake

**New Brighton, Ramsey Co.**

Lake ID: 620069
WD: Rice Creek
Volunteer: Philip Goodrich

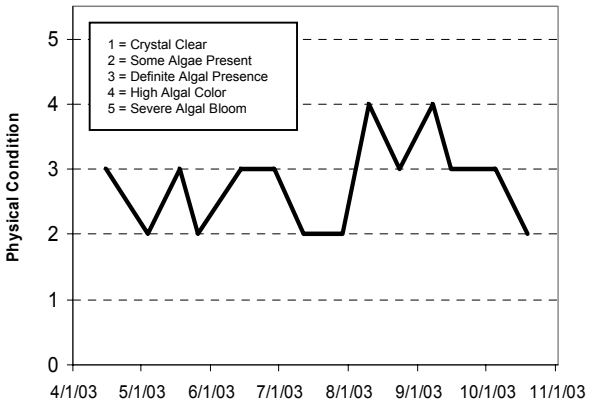



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 14 | | | | 45 | 103 | | 0.6 | 3 | 2 |
| 05/04/03 | 17 | | | | 32 | 76 | | 1.3 | 2 | 2 |
| 05/18/03 | 20 | | | | 9.8 | 23 | | 1.4 | 3 | 2 |
| 05/26/03 | 20 | | | | 10 | 64 | | 2 | 2 | 2 |
| 06/14/03 | 24 | | | | 65 | 65 | | 0.6 | 3 | 2 |
| 06/29/03 | 22 | | | | 34 | | | 0.6 | 3 | 2 |
| 07/12/03 | 26 | | | | 48 | 93 | | 0.7 | 2 | 2 |
| 07/29/03 | 25 | | | | 70 | 93 | | 0.6 | 2 | 2 |
| 08/10/03 | 26 | | | | 100 | 138 | | 0.45 | 4 | 3 |
| 08/23/03 | 26 | | | | 94 | 92 | | 0.6 | 3 | 2 |
| 09/07/03 | 27 | | | | 110 | 99 | | 0.4 | 4 | 3 |
| 09/15/03 | 24 | | | | 74 | 107 | | 0.5 | 3 | 3 |
| 10/05/03 | 14 | | | | 32 | 83 | | 0.7 | 3 | 3 |
| 10/19/03 | 13 | | | | 22 | 88 | | 1.9 | 2 | 3 |

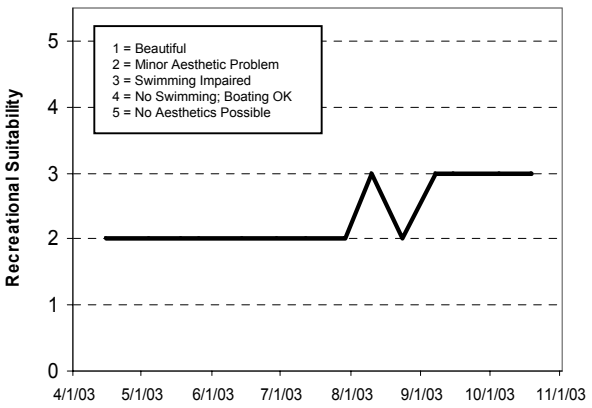



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | D | D | D | D |
| Chlorophyll a | | | | | | | | C | C | D | C | D |
| Secchi Depth | D | D | | | | | | D | D | C | D | D |
| **Overall** | | | | | | | | **D** | **D** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Pike Lake [Scott County] [Site-1] (70-0076) *Prior Lake - Spring Lake Watershed District*

Pike Lake is a 57-acre lake located within the City of Prior Lake (Scott County). The maximum depth of the lake is 2.7 m (roughly 9 feet). 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 majority of the land within the 1,991-acre watershed is undeveloped. The watershed-to-lake size ratio is 35:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the fifth year that Pike Lake has been involved in CAMP (the lake was also involved in 1997 and 1999-2002). A search through the STORET nationwide water quality database for data on the lake came up empty. Thus, 1997 and 1999-2002 are the only years of available data. The resulting data and graphs appear on the next page.

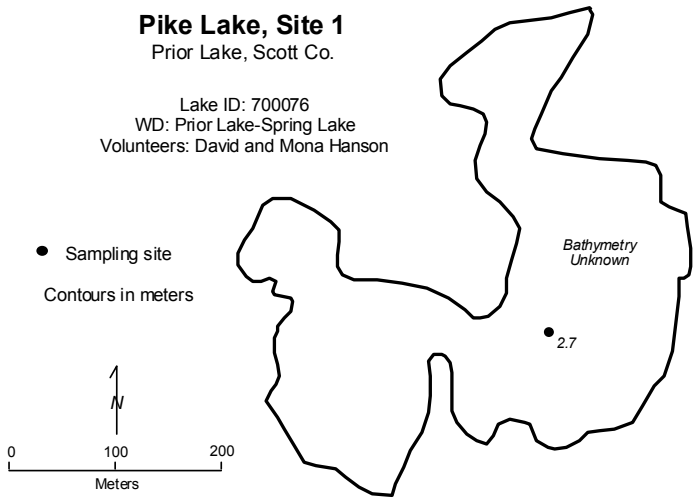
Pike Lake was monitored 15 times from late-April to late-October, 2003. Results are presented on graphs and data tables on the following page. Summertime (May through September) means for the monitored variables were: surface TP= 225.6 µg/l (minimum concentration of 80.0 µg/l and a maximum value of 409.0 µg/l), surface chlorophyll-a= 120.3 µg/l (minimum of 8.9 µg/l and maximum of 520.0 µg/l), Secchi transparency= 0.8 m (minimum of 0.1 m [the worst recorded in CAMP 2003] and a maximum of 1.5 m), and TKN= 2.17 mg/l (minimum of 1.10 mg/l and maximum of 5.30 mg/l). Associated lake quality grades for the 2003 summertime means were TP= F, CLA= F, Secchi= D. The lake's 2003 overall water quality grade, calculated from the TP, CLA, and Secchi grades, was F (identical to that recorded in 2002).

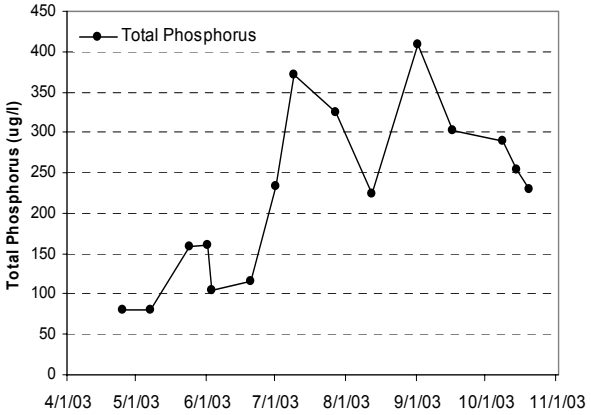
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean perceived physical condition of Pike Lake was 3.7 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 4.3 (falling between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

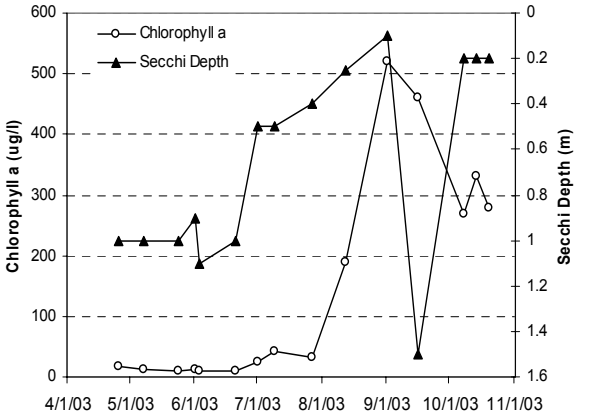
As mentioned earlier, there are no water quality data available for Pike Lake other than the 1997, and 1999-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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.

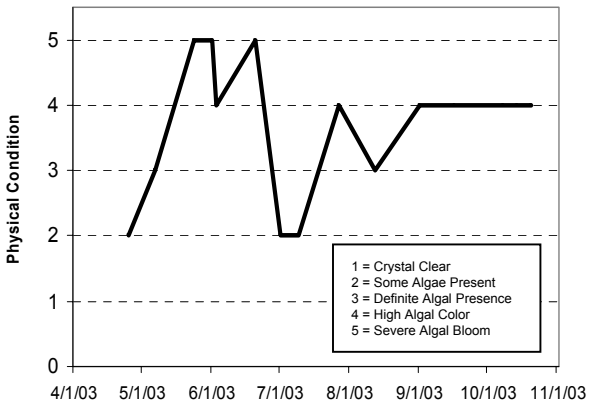



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/25/03 | 20.2 | | | | 17 | 80 | | 1 | 2 | 4 |
| 05/07/03 | 20.2 | | | | 12 | 80 | | 1 | 3 | 4 |
| 05/24/03 | 20.7 | | | | 10 | 158 | | 1 | 5 | 5 |
| 06/01/03 | 21.3 | | | | 12 | 160 | | 0.9 | 5 | 5 |
| 06/03/03 | 22.5 | | | | 9 | 105 | | 1.1 | 4 | 4 |
| 06/20/03 | 30.2 | | | | 8.9 | 116 | | 1 | 5 | 5 |
| 07/01/03 | 28 | | | | 26 | 233 | | 0.5 | 2 | 4 |
| 07/09/03 | 26.3 | | | | 43 | 371 | | 0.5 | 2 | 4 |
| 07/27/03 | 31.3 | | | | 32 | 324 | | 0.4 | 4 | 4 |
| 08/12/03 | 29.1 | | | | 190 | 224 | | 0.25 | 3 | 4 |
| 09/01/03 | 29.6 | | | | 520 | 409 | | 0.1 | 4 | 4 |
| 09/16/03 | 24.6 | | | | 460 | 302 | | 1.5 | 4 | 4 |
| 10/08/03 | 20.2 | | | | 270 | 290 | | 0.2 | 4 | 4 |
| 10/14/03 | 15.7 | | | | 330 | 254 | | 0.2 | 4 | 4 |
| 10/20/03 | 15.7 | | | | 280 | 230 | | 0.2 | 4 | 4 |

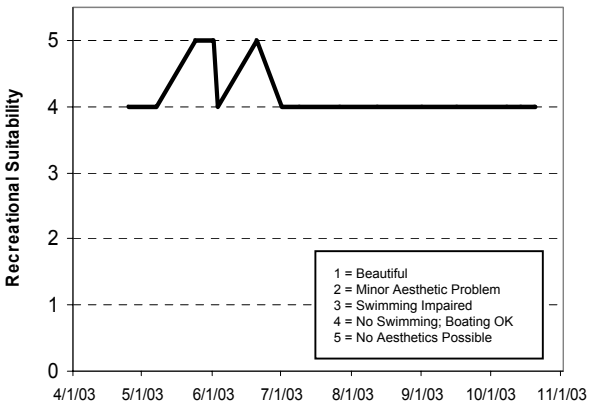



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | D | | D | D | D | F | F |
| Chlorophyll a | | | | | | B | | C | C | F | D | F |
| Secchi Depth | | | | | | D | | F | F | C | F | D |
| **Overall** | | | | | | **C** | | **D** | **D** | **D** | **F** | **F** |

Source: Metropolitan Council and STORET data



## Pine Tree Lake (82-0122) *Rice Creek Watershed District*

Pine Tree Lake, located on the eastern edge of the City of Dellwood (Washington County), covers an area of 174 acres and has a maximum depth of 7.9 m (26 feet). The mean depth of the lake, 3.0 m (10 feet), and its surface area translate to an approximate lake volume of 1,740 ac-ft. Because of its multi-recreational uses, it is considered a "Priority Lake" in the Metropolitan Area.

Pine Tree Lake has been a part of CAMP since 1993. In 2003, the lake was monitored seven times between late-June and early-October. On each outing, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The mean summertime (May through September) surface TP concentration for the lake was 34.0 µg/l (minimum of 16.0 µg/l, maximum of 54.0 µg/l). The mean CLA and Secchi transparency readings were 21.9 µg/l (minimum of 6.4 µg/l, maximum of 36.0 µg/l) and 1.4 m (minimum of 1.0 m, maximum of 2.0 m), respectively. The lake's mean surface TKN concentration was 0.96 mg/l (minimum of 0.74 mg/l, maximum of 1.20 mg/l).

Lake quality grades associated with the 2003 summertime means are as follows: TP= C; CLA= C; and Secchi transparency= C. The resulting overall water quality grade for the lake, calculated from TP, CLA, and Secchi grades, was C. After five straight years of overall water quality grades of B for the lake, the 2002 and 2003 overall grade falls back to 1995-1996 levels. No statistically significant long-term trend is evident from the lake's overall water quality database (including TP, CLA, and Secchi data), in the short-term however, it seems that the lake's overall water quality is well represented by a B/C grade. A recent trend analysis (by the MPCA) on just the lake's Secchi transparency data, however, revealed a statistically significant improvement in recent water clarity.

The physical and recreational conditions of the lake, as perceived by the volunteer(s), were ranked on a 1-to-5 scale. These rankings are shown in both table and graphic form on the following page. The mean physical condition ranking was 2.3 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.7 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

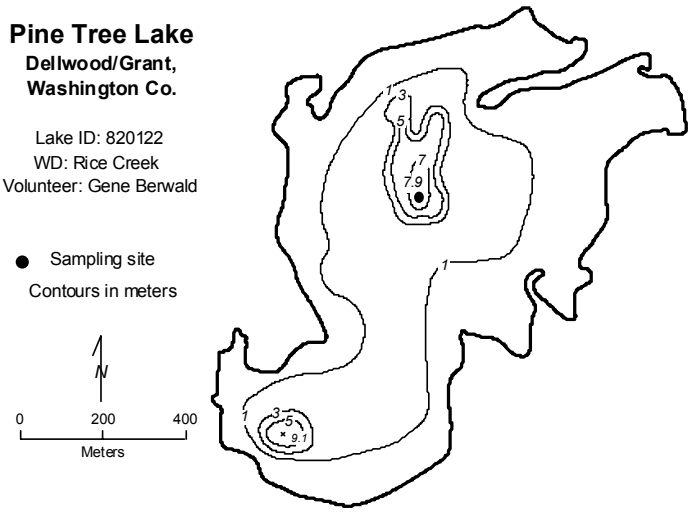
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

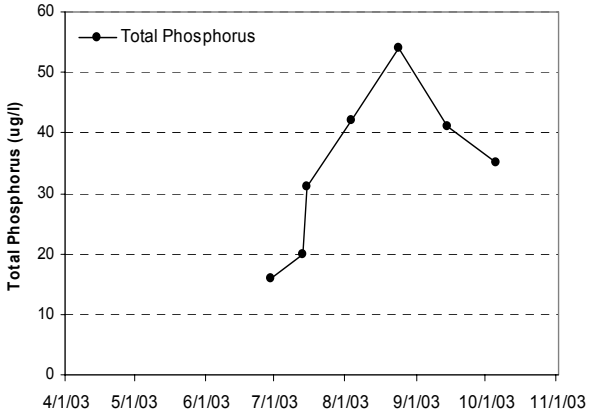
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

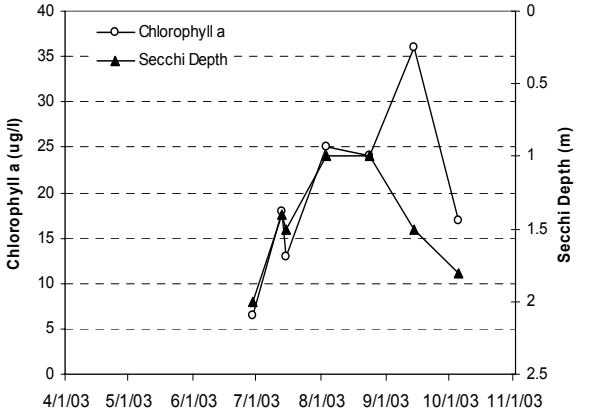
# Pine Tree Lake

**Dellwood/Grant, Washington Co.**

Lake ID: 820122
WD: Rice Creek
Volunteer: Gene Berwald

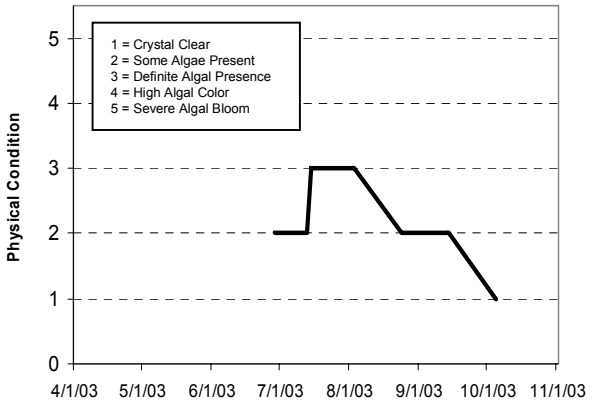



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 06/29/03 | 22 | | | | 6.4 | 16 | | 2 | 2 | 3 |
| 07/13/03 | 24 | | | | 18 | 20 | | 1.4 | 2 | 3 |
| 07/15/03 | 23.2 | | | | 13 | 31 | | 1.5 | 3 | 3 |
| 08/03/03 | 25.8 | | | | 25 | 42 | | 1 | 3 | 3 |
| 08/24/03 | 28 | | | | 24 | 54 | | 1 | 2 | 1 |
| 09/14/03 | 20 | | | | 36 | 41 | | 1.5 | 2 | 3 |
| 10/05/03 | 12.2 | | | | 17 | 35 | | 1.8 | 1 | 1 |

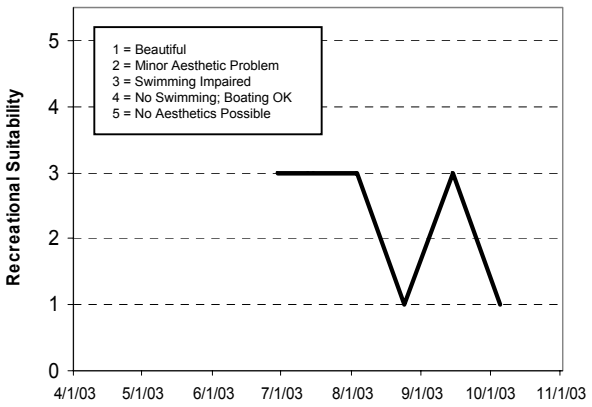



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | B | B | C | C | B | B | B | C | C | C | C |
| Chlorophyll a | | A | A | C | B | A | B | B | A | A | B | C |
| Secchi Depth | | C | B | C | C | B | C | C | A | B | C | C |
| **Overall** | | **B** | **B** | **C** | **C** | **B** | **B** | **B** | **B** | **B** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Pomerleau Lake (27-0100) *Shingle Creek Watershed Management Commission*

Pomerleau Lake is a 35-acre lake located within the City of Plymouth (Hennepin County). The maximum and mean depths of the lake are 7.9 and 2.7 m (26 and 9 feet), and the approximate volume of the lake is 450 ac-ft. Roughly half of the lake is considered littoral zone (the area of aquatic vegetation dominance). The majority of the land within the 1,140-acre watershed is undeveloped, and the watershed-to-lake size ratio is 33:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the fourth year in which Pomerleau Lake has been involved in CAMP (the lake was also enrolled in CAMP in 1996, 1999 and 2001). This CAMP data represents the only known water quality data available for the lake. Unfortunately, the lake was only monitored three times in 2003 (once in April, once in June, and once in July). For this reason, little can be determined from the lake's 2003 water quality. The resulting data and graphs appear on the next page.

Although there were only three monitoring events for Pomerleau Lake in 2003, the following are the averages of the three events for each of the parameters tested. The summertime (May - September) mean TP concentration of 69.5 µg/l corresponds to a lake water quality grade of D. The CLA mean of 62.5 µg/l translates to a grade of D and Secchi mean of 1.5 m results in a grade of C. The overall lake quality grade from the lake's limited 2003 database was D (which is worse than the overall grades of C recorded in 1996, 1999 and 2001). Again, because of the limitedness of the 2003 dataset, it's summermeans and resulting grades should not be compared to the more comprehensive databases.

As mentioned earlier, there are no water quality data available for Pomerleau Lake other than the 1996, 1999, 2001 and 2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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 2.0 for physical condition (2- "some algae present"), while the mean recreational suitability was 4.0 (4- "no swimming - boating ok").

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 the reader is 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.

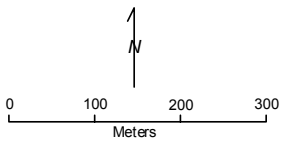
# Pomerleau Lake

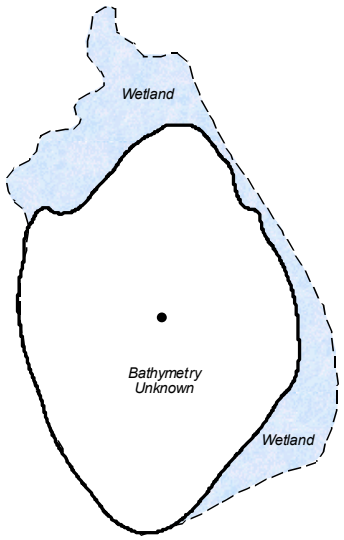
**Plymouth, Hennepin Co.**

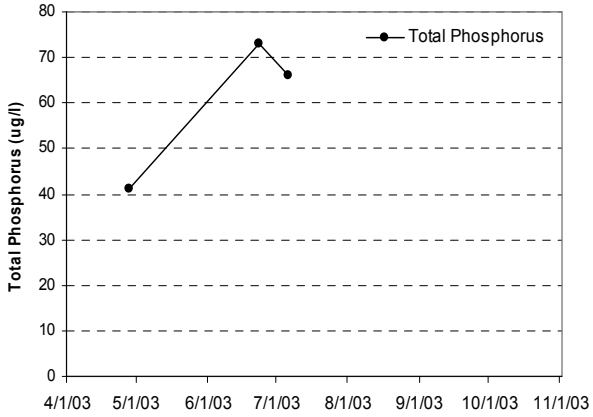
Lake ID: 270100
WMO: Shingle Creek
Volunteer: John Engstrom

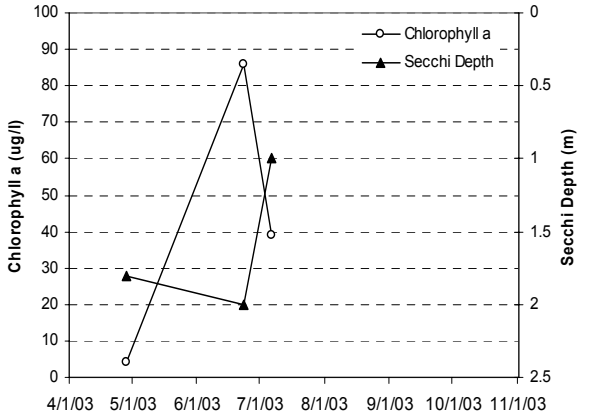
● Sampling site

Contours in meters



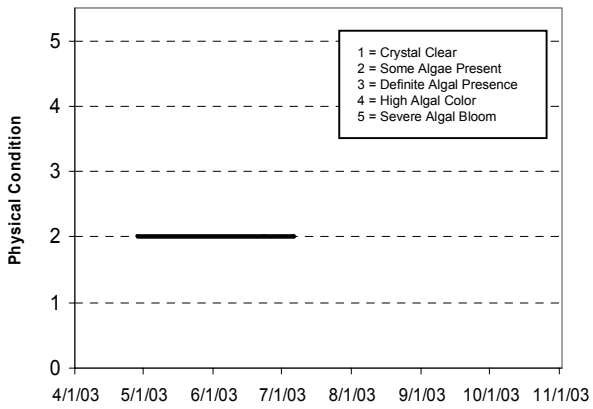




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/28/03 | 16 | | | | 4.2 | 41 | | 1.8 | 2 | |
| 06/23/03 | 23.5 | | | | 86 | 73 | | 2 | 2 | 4 |
| 07/06/03 | 28 | | | | 39 | 66 | | 1 | 2 | |

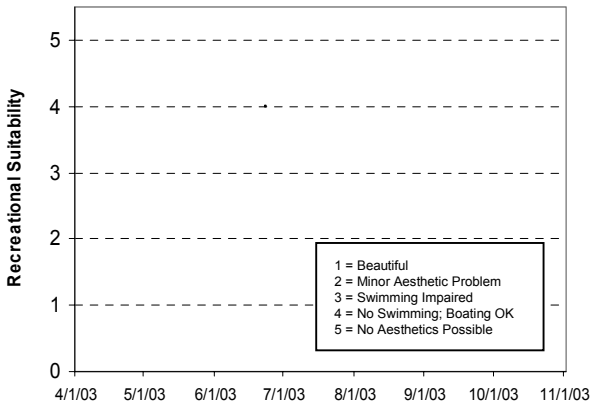



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | | | D | | D | | D |
| Chlorophyll a | | | | | B | | | C | | C | | D |
| Secchi Depth | | | | | C | | | C | | C | | C |
| **Overall** | | | | | **C** | | | **C** | | **C** | | **D** |

Source: Metropolitan Council and STORET data



## Powers Lake (82-0092) *City of Woodbury*

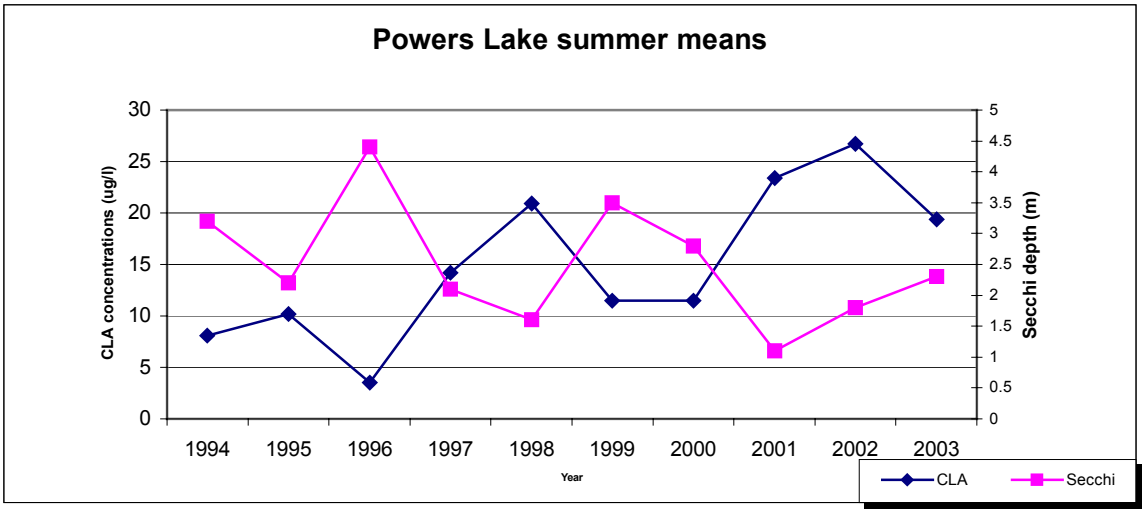
Powers Lake, located within the City of Woodbury (Washington County), has a surface area of approximately 57 acres (a shoreline length of 1.75 miles), and maximum depth of 12.5 m (41.0 feet). Approximately 50 percent of the lake's surface area is considered littoral, the shallow (0-15 feet) area dominated by aquatic vegetation. While the lake has no public access, there is one private access on the northwest end of the lake near one of its two inlets. The lake has no outlet.

Currently, about 47 percent of the lake's 1,238-acre watershed is open/undeveloped land with the rest either residential or open water/wetlands. Eventually nearly 84 percent of the lake's watershed will be developed as single-family and multi-family residential units. The lake's watershed-to-lake size ratio is 22:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

Powers Lake has been involved in CAMP since 1994. Between mid-April and mid-October, 2003, the lake was monitored 14 times. Similar to past years, the lake was monitored on each sampling date for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

The 2003 summertime (May through September) mean concentrations for Powers Lake were as follows: TP= 33.7 µg/l (minimum of 19.0 µg/l, maximum of 70.0 µg/l); CLA= 19.5 µg/l (minimum of 3.2 µg/l, maximum of 42.0 µg/l); Secchi transparency= 2.3 m (minimum of 1.1 m, maximum of 3.8 m); and TKN= 0.97 mg/l (minimum and maximum of 0.66 and 1.40 mg/l), respectively. The summer means resulted in a TP grade of C, CLA grade of B, and Secchi transparency grade of B. The 2003 overall grade, calculated by averaging the three parameter grades, was B.

While breaking the recent tendency of the lake experiencing worse and worse water quality each year, the 2003 water quality is still inferior to that recorded in 1994-1997 and 1999-2000. The lake has received overall grades of A in 1994, 1996, and 1999, B in 1995, 1997, 2000 and 2003, and C in 1998 and now 2001-2002.



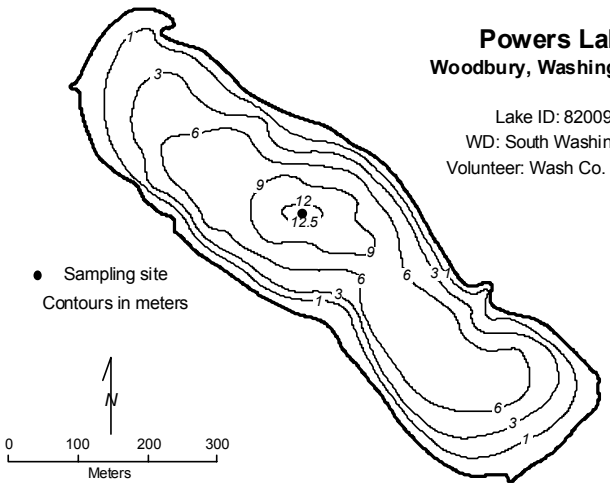

Because only 10 years of data are available, and the wide flucuation in the available data, no long-term trends can statistically be determined. In the short-term however, while the lake recently had water

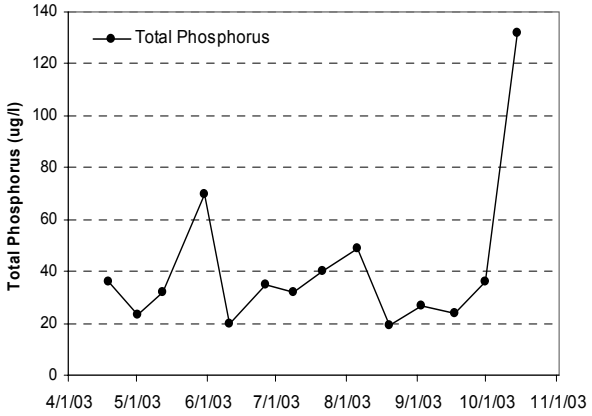
quality generally falling within or near the TCMA top 10-percentile range (overall grade of A/B), its water quality in 2001-2002 dramatically fell away from this range before inching back to a B in 2003. In fact, until 2003, the lake's water quality over the past four years has shown a continued degradation. More data are needed, however, to determine if this flucuation is falls within the lake's normal range, or if the increased development around the lake has added to the lake's nutrient load resulting in an increase in algal abundance and reduced clarity. Continued monitoring is suggested.

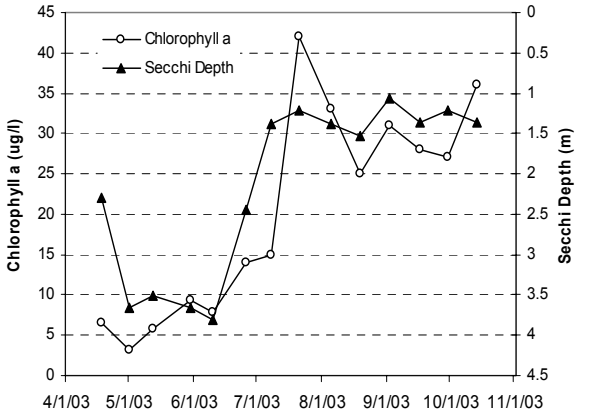
The physical and recreational conditions of the lake, as perceived by the volunteer, were ranked on a 1-to-5 scale and are displayed on the next page. The mean physical condition ranking was 2.6 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 3.0 (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.

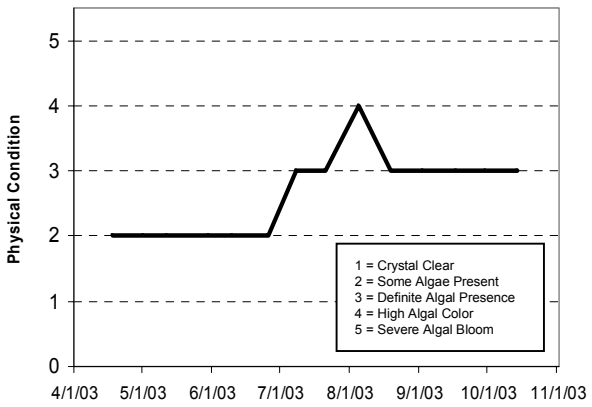



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/18/03 | 8.8 | | 8.17 | | 6.5 | 36 | | 2.29 | 2 | 2 |
| 05/01/03 | 15.2 | | 0.75 | | 3.2 | 23 | | 3.66 | 2 | 2 |
| 05/12/03 | 12.6 | | 7.91 | | 5.8 | 32 | | 3.51 | 2 | 2 |
| 05/30/03 | 19.8 | | 5.63 | | 9.3 | 70 | | 3.66 | 2 | 2 |
| 06/10/03 | 20.5 | | 2.58 | | 7.8 | 20 | | 3.81 | 2 | 2 |
| 06/26/03 | 22.3 | | 8.01 | | 14 | 35 | | 2.44 | 2 | 3 |
| 07/08/03 | 26 | | 8.01 | | 15 | 32 | | 1.373 | 3 | 4 |
| 07/21/03 | 25.1 | | 4.93 | | 42 | 40 | | 1.22 | 3 | 4 |
| 08/05/03 | 24.9 | | 8.04 | | 33 | 49 | | 1.373 | 4 | 4 |
| 08/19/03 | 27.5 | | 9.9 | | 25 | 19 | | 1.524 | 3 | 4 |
| 09/02/03 | 23.4 | | 6.77 | | 31 | 27 | | 1.067 | 3 | 3 |
| 09/17/03 | 21.1 | | 7.3 | | 28 | 24 | | 1.372 | 3 | 3 |
| 09/30/03 | 13.4 | | 7.89 | | 27 | 36 | | 1.219 | 3 | 3 |
| 10/14/03 | 13.9 | | 9.38 | | 36 | 132 | | 1.372 | 3 | 3 |

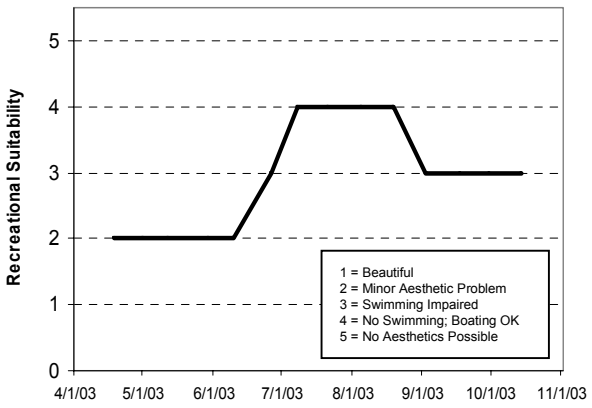



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | B | B | A | A | C | A | B | C | B | C |
| Chlorophyll a | | | A | B | A | B | C | B | B | C | C | B |
| Secchi Depth | | | A | B | A | C | C | A | B | C | C | B |
| **Overall** | | | **A** | **B** | **A** | **B** | **C** | **A** | **B** | **C** | **C** | **B** |

Source: Metropolitan Council and STORET data



## Prior Lake [Lower Basin] [Site-1] (70-0026) *Prior Lake - Spring Lake Watershed District*

Prior Lake is divided into two distinct basins (the results of the 2003 monitoring on Prior Lake will be discussed as individual basins, Lower Prior and Upper Prior). Because of the lake's multi-recreational uses it is considered a "Priority Lake" in the Metropolitan Area.

The entire 1,167-acre lake is located within the City of Prior Lake (Scott County). The acreage of each basin is as follows: lower basin= 827 acres, and upper basin= 340 acres. The maximum and mean depths of the lower basin are 18.3 and 4.1 m (60 and 13 feet), which along with the surface area, translate to a lower basin volume of approximately 11,120 ac-ft. Roughly 46 percent of the lake's surface area is considered littoral, (the shallow [0-15 feet] area dominated by aquatic plants). The lower basin's 2,090-acre watershed translates to a rather small watershed-to-lake area ratio of 2.5:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lower basin's public access is located at the southern end of the lake. The lower basin of Prior Lake has one inlet (that from the upper basin of Prior Lake), and one outlet. The outlet structure, located on the southwestern portion of the basin, is a man-made structure that was installed to regulate surface water elevations. Eurasian Water Milfoil (*Myriophyllum spicatum*) [EWM] has been reported on the lower basin of the lake.

While the Metropolitan Council has monitored the lower and upper basins of Prior Lake in the past, the sites have been a part of CAMP since 1997.

Lower Prior was monitored 13 times from late-April to mid-October, 2003. Results are presented on graphs and data tables on the following page). Summertime (May through September) means for the monitored were: surface TP= 40.4 µg/l (minimum concentration of 18.0 µg/l and a maximum value of 68.0 µg/l), surface chlorophyll-a= 8.0 µg/l (minimum of 1.7 µg/l and maximum of 22.0 µg/l), Secchi transparency= 3.3 m (minimum of 1.4 m and a maximum of 6.0 m), and TKN= 0.86 mg/l (minimum of 0.66 mg/l and maximum of 1.10 mg/l).

Associated lake quality grades for the 2002 summertime means were TP= C, CLA= A, Secchi= A. The 2003 overall water quality grade, calculated from the TP, CLA, and Secchi grades, was B. The 2003 overall grade is similar to that recorded in 1996, 1998 and 2000-2002, and worse than the A's recorded in 1997 and 1999.

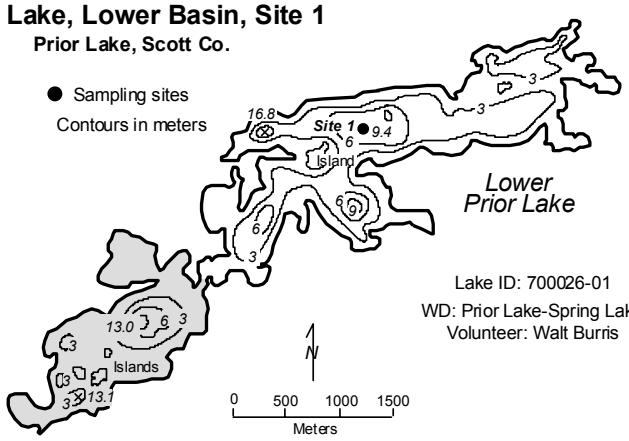
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean perceived physical condition of Lower Prior Lake was 2.0 (2- "some algae present"), while the mean recreational suitability was 1.4 (falling between 1- "beautiful" and 2- "minor aesthetics problem").

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/.

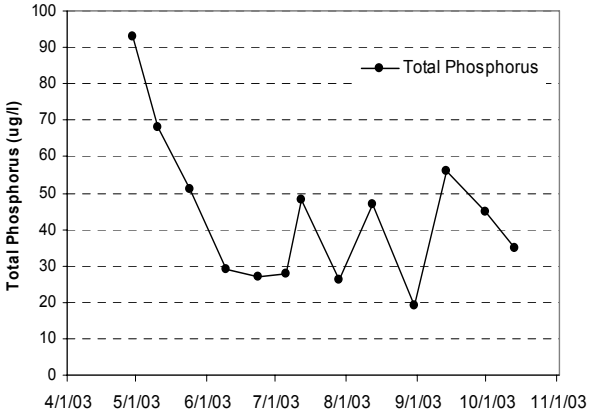
If you detect any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

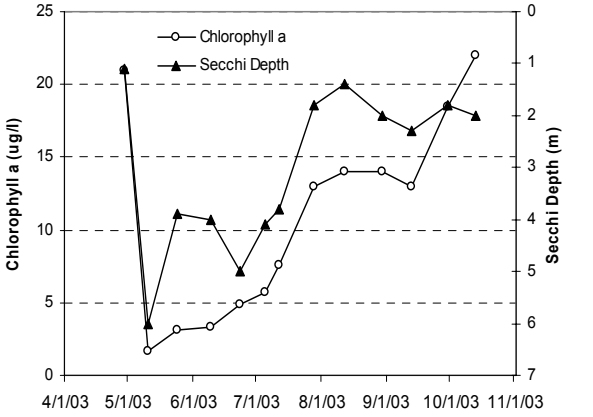
# Prior Lake, Lower Basin, Site 1

**Prior Lake, Scott Co.**



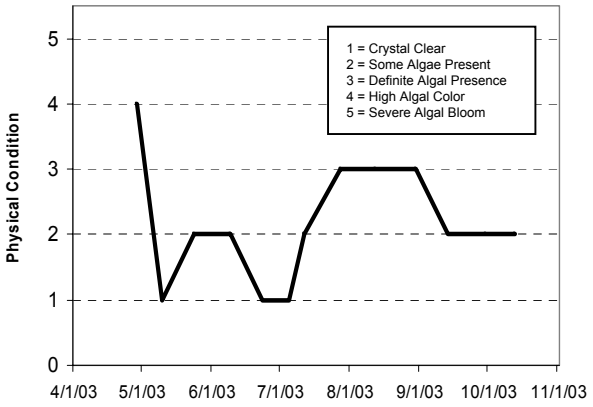

Lake ID: 700026-01
WD: Prior Lake-Spring Lake
Volunteer: Walt Burris




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/29/03 | 11 | | | | 21 | 93 | | 1.1 | 4 | 3 |
| 05/10/03 | 13 | | | | 1.7 | 68 | | 6 | 1 | 1 |
| 05/24/03 | 17 | | | | 3.1 | 51 | | 3.9 | 2 | 1 |
| 06/09/03 | 22 | | | | 3.3 | 29 | | 4 | 2 | 1 |
| 06/23/03 | 25 | | | | 4.9 | 27 | | 5 | 1 | 1 |
| 07/05/03 | 24 | | | | 5.7 | 28 | | 4.1 | 1 | 1 |
| 07/12/03 | 25 | | | | 7.6 | 48 | | 3.8 | 2 | 1 |
| 07/28/03 | 27 | | | | 13 | 26 | | 1.8 | 3 | 2 |
| 08/12/03 | 26 | | | | 14 | 47 | | 1.4 | 3 | 2 |
| 08/30/03 | 23 | | | | 14 | 19 | | 2 | 3 | 2 |
| 09/13/03 | 21 | | | | 13 | 56 | | 2.3 | 2 | 1 |
| 09/30/03 | 13 | | | | | 45 | | 1.8 | 2 | 2 |
| 10/13/03 | 14 | | | | 22 | 35 | | 2 | 2 | 2 |

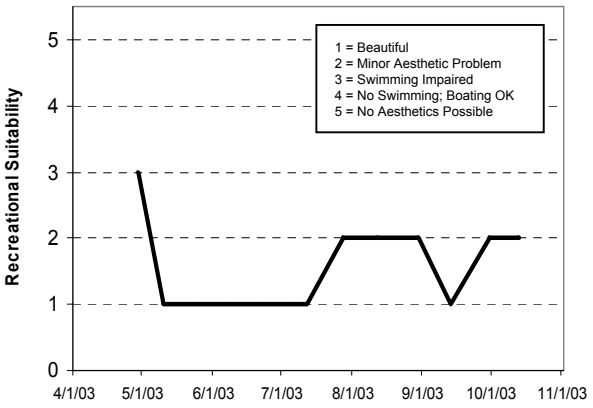



**Lake Water Quality Grades Based on Summertime Averages**

| Year | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | C | A | | | B | | | | | | | | C | | |
| Chlorophyll a | B | | | | B | | | | | A | B | | B | | |
| Secchi Depth | C | C | B | C | B | C | B | C | C | B | B | C | C | B | B |
| **Overall** | **C** | | | | **B** | | | | | | | | **C** | | |

| Year | 1995 | 1996 | 1997 | 1998 Site 1 | 1998 Site 2 | 1999 Site 1 | 1999 Site 2 | 2000 Site 1 | 2000 Site 2 | 2001 Site 1 | 2001 Site 2 | 2002 Site 1 | 2002 Site 2 | 2003 Site 1 | 2003 Site 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | A | A | B | A | C | B | B | A | B | B | C | C | |
| Chlorophyll a | | A | A | B | C | A | B | B | B | B | C | B | C | A | |
| Secchi Depth | B | B | B | C | C | B | C | B | C | B | C | B | C | A | |
| **Overall** | | **B** | **A** | **B** | **C** | **A** | **C** | **B** | **B** | **B** | **C** | **B** | **C** | **B** | |

Source: Metropolitan Council and STORET data



## Prior Lake [Upper Basin] [Site-1] (70-0072) *Prior Lake - Spring Lake Watershed District*

The maximum and mean depths of the upper basin of Prior Lake are 15.2 and 3.1 m (50 and 10 feet), respectively. The resulting water volume of the 340-acre upper basin is 3,460 ac-ft. About 93 percent of the lake's surface area is considered littoral, (the shallow [0-15 feet] area dominated by aquatic plants). The upper basin's 3,430-acre watershed translates to a watershed-to-lake area ratio of 10:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). The upper basin's public access is located at the northwestern end of the lake.

The upper basin of Prior Lake has two natural inlets, inflow from Spring Lake and the inlet from Rice and Crystal Lake drainage. Agriculturally derived non-point source nutrient loading released through the Spring Lake outlet heavily impacts water quality of the upper basin of Prior Lake.

The upper basin of Prior Lake were monitored 13 times from late-April to mid-October, 2003. Results are presented on graphs and data tables on the following page. Summertime (May through September) means for the monitored variables were: surface TP= 64.5 µg/l (minimum concentration of 24.0 µg/l and a maximum value of 100.0 µg/l), surface chlorophyll-a= 54.9 µg/l (minimum of 2.3 µg/l and maximum of 140.0 µg/l), Secchi transparency= 1.4 m (minimum of 0.5 m and a maximum of 3.75 m), and TKN= 1.40 mg/l (minimum of 0.80 mg/l and maximum of 1.90 mg/l). Associated lake quality grades for the 2003 summertime means were TP= C, CLA= D, Secchi= C. The lake's 2003 water quality grade, calculated from the TP, CLA, and Secchi grades, was C. The 2003 overall grade was similar to those recorded in 1996-1997, and better than those of the 1980s, and 1998-2002. The lake's best water quality year was1996, while the worst was 1999-2002.

Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The mean perceived physical condition of Upper Prior Lake was 3.3 (ranking between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 2.6 (falling between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

Historical data for the upper basin of Prior Lake indicate that the water quality of the basin has remained fairly constant over the past decade fluctuating between overall grades of C and D. Lake quality grades (see the lake's information sheet on the following page) show that when nutrient data were collected on the upper basin of Prior Lake, overall grades ranged from C in 1981, 1990, 1996-1997 and 2003, and a D in 1980, 1984, 1989, and 1998-2002.

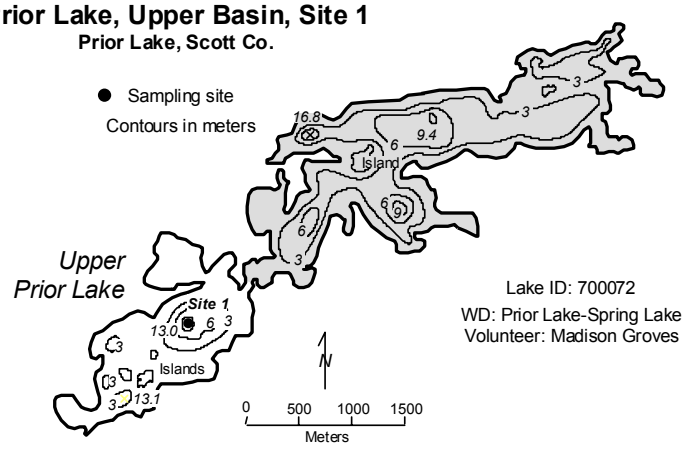
As apparent by the historic lake water quality grades, the lower basin of Prior Lake has better water quality than the upper basin. The reason being that the upper basin actually acts as a sort of detention basin for the lower basin. That is, the majority of the water entering the lakes goes through the upper basin first, allowing the settlement of sediments and associated nutrients before it enters the lower basin of the lake. The result is better quality water entering the lower basin of Prior Lake than is entering the upper basin.

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/.

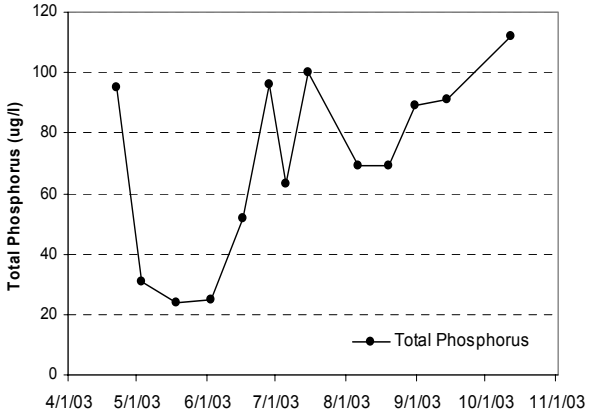
If you recognize any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

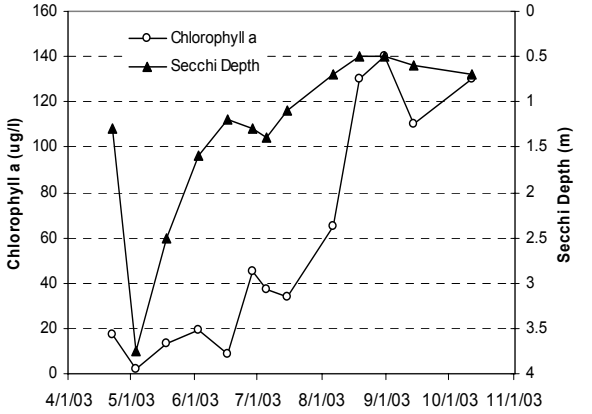
# Prior Lake, Upper Basin, Site 1

**Prior Lake, Scott Co.**



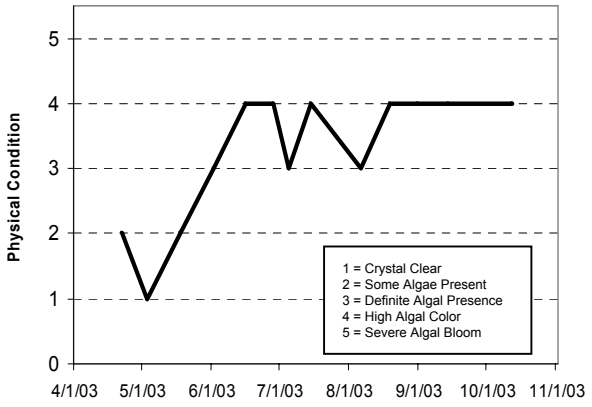

Lake ID: 700072
WD: Prior Lake-Spring Lake
Volunteer: Madison Groves




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 12.7 | | | | 17 | 95 | | 1.3 | 2 | 2 |
| 05/03/03 | 15.1 | | | | 2.3 | 31 | | 3.75 | 1 | 1 |
| 05/18/03 | 19.5 | | | | 13 | 24 | | 2.5 | 2 | 1 |
| 06/02/03 | 20.5 | | | | 19 | 25 | | 1.6 | 3 | 2 |
| 06/16/03 | 27.4 | | | | 8.4 | 52 | | 1.2 | 4 | 3 |
| 06/28/03 | 23 | | | | 45 | 96 | | 1.3 | 4 | 4 |
| 07/05/03 | 24.2 | | | | 37 | 63 | | 1.4 | 3 | 3 |
| 07/15/03 | 25 | | | | 34 | 100 | | 1.1 | 4 | 3 |
| 08/06/03 | 26.9 | | | | 65 | 69 | | 0.7 | 3 | 2 |
| 08/19/03 | 28 | | | | 130 | 69 | | 0.5 | 4 | 3 |
| 08/31/03 | 24.8 | | | | 140 | 89 | | 0.5 | 4 | 3 |
| 09/14/03 | 21.8 | | | | 110 | 91 | | 0.6 | 4 | 3 |
| 10/12/03 | 15.1 | | | | 130 | 112 | | 0.7 | 4 | 3 |

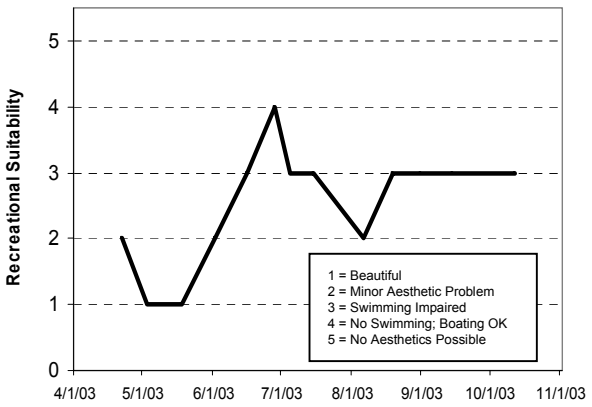



**Lake Water Quality Grades Based on Summertime Averages**

| Year | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | C | C | | | D | | | | | D | | | | | |
| Chlorophyll a | D | D | | | D | | | | | C | C | | | | |
| Secchi Depth | D | C | D | F | D | D | D | F | F | D | C | D | D | D | D |
| **Overall** | **D** | **D** | | | **D** | | | | | **D** | | | | | |

| Year | 1995 | 1996 | 1997 | 1998 Site 1 | 1998 Site 2 | 1999 Site 1 | 1999 Site 2 | 2000 Site 1 | 2000 Site 2 | 2001 Site 1 | 2001 Site 2 | 2002 Site 1 | 2002 Site 2 | 2003 Site 1 | 2003 Site 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | C | C | | D | | D | | D | | D | D | C | |
| Chlorophyll a | | C | C | D | | D | | D | | F | | D | D | D | |
| Secchi Depth | C | C | D | D | | D | | C | | D | | D | D | C | |
| **Overall** | | **C** | **C** | **D** | | **D** | | **D** | | **D** | | **D** | **D** | **C** | |

Source: Metropolitan Council and STORET data



## Regional Park Lake (82-0086) *South Washington Watershed District*

Regional Park Lake is a 16-acre lake located within the City of Cottage Grove (Washington County). The maximum depth of the lake is 5.8 m (roughly 19 feet). 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 majority of the land within the 600-acre watershed is undeveloped. The watershed-to-lake size ratio is 38:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake.

This was the sixth year that Regional Park Lake has been involved in CAMP. Other than the 1998-2003 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, 2003. The resulting data and graphs appear on the next page.

The 2003 overall lake quality grade for Regional Park Lake, calculated from the individual parameter grades, is D. The 2003 summertime (May - September) mean TP concentration of 71.9 µg/l (minimum of 32.0 µg/l, maximum of 122.0 µg/l) corresponded to a lake water quality grade of D. The CLA mean of 34.0 µg/l (minimum and maximum of 10.0 and 61.0 µg/l) translates to a grade of C. Regional Park Lake's mean Secchi transparency of 0.6 m (minimum of 0.3 m and maximum of 1.5 m) corresponds to an F for water clarity. The lake's mean TKN concentration was 1.08 mg/l (minimum of 0.67 mg/l, maximum of 1.90 mg/l). The lake's 2003 overall grade is identical to that recorded in 1998 and 2000-2002 which is worse than that recorded in 1999 (C). The lake's individual parameter means in 2003 are better than those recorded in 2001-2002.

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's water quality seems well represented by an overall grade of D. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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 3.2 for physical condition (between 3- "definite algae present" and 4- " high algal color"), and 4.0 for recreational suitability (4- "no swimming - boating ok").

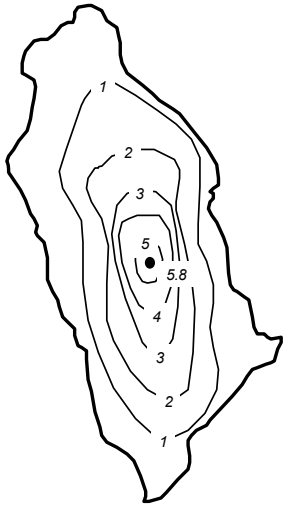
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

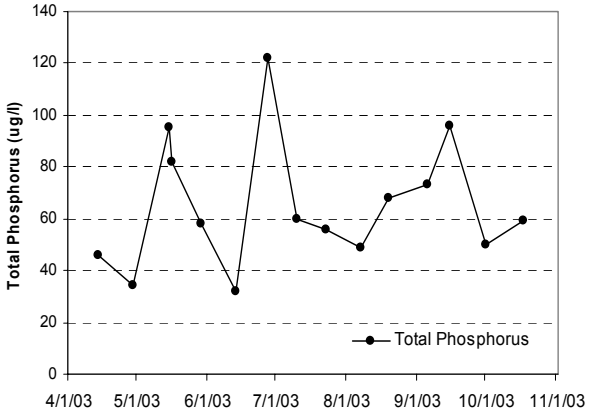
# Regional Park Lake

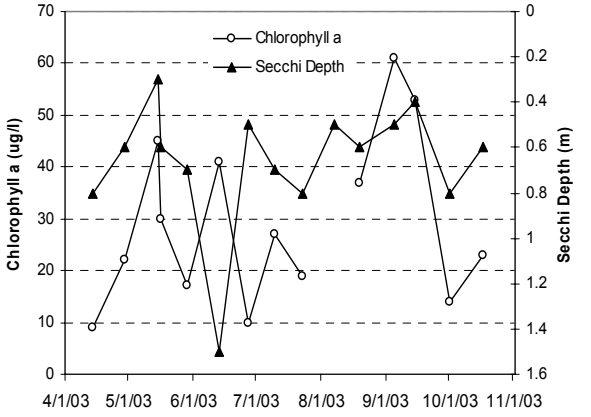
**Cottage Grove, Washington Co.**

Lake ID: 820086
WD: South Washington
Volunteer: City of Cottage Grove

● Sampling site
Contours in meters

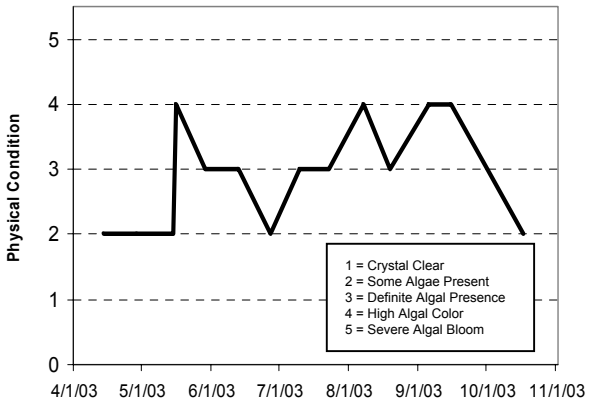



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 10 | | | | 9 | 46 | | 0.8 | 2 | 2 |
| 04/29/03 | 17 | | | | 22 | 34 | | 0.6 | 2 | 4 |
| 05/15/03 | 15 | | | | 45 | 95 | | 0.3 | 2 | 4 |
| 05/16/03 | 17.2 | | | | 30 | 82 | | 0.6 | 4 | 4 |
| 05/29/03 | 19 | | | | 17 | 58 | | 0.7 | 3 | 4 |
| 06/13/03 | 21 | | | | 41 | 32 | | 1.5 | 3 | 4 |
| 06/27/03 | 22 | | | | 10 | 122 | | 0.5 | 2 | 4 |
| 07/10/03 | 23 | | | | 27 | 60 | | 0.7 | 3 | 4 |
| 07/23/03 | 23 | | | | 19 | 56 | | 0.8 | 3 | 4 |
| 08/07/03 | 25 | | | | | 49 | | 0.5 | 4 | 4 |
| 08/19/03 | 27 | | | | 37 | 68 | | 0.6 | 3 | 4 |
| 09/05/03 | 20 | | | | 61 | 73 | | 0.5 | 4 | 4 |
| 09/15/03 | 19 | | | | 53 | 96 | | 0.4 | 4 | 4 |
| 10/01/03 | 11 | | | | 14 | 50 | | 0.8 | 3 | 4 |
| 10/17/03 | 11.2 | | | | 23 | 59 | | 0.6 | 2 | 4 |

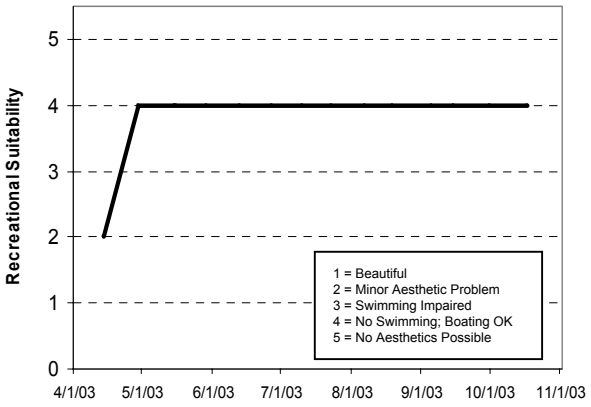



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | F | C | D | D | D | D |
| Chlorophyll a | | | | | | | B | B | C | C | D | C |
| Secchi Depth | | | | | | | F | D | F | F | F | F |
| **Overall** | | | | | | | **D** | **C** | **D** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Reitz Lake (10-0052) *Carver County Environmental Services*

Reitz Lake, a 79-acre lake located within Laketown Township (Carver County), is considered a Metropolitan Area "Priority Lake" because of its multi-recreational uses. A public access is located on its northeastern shore. The mean and maximum depths of the lake are 4.0 m (13 feet) and 11.0 m (36 feet). Roughly 58 percent of the lake area is considered littoral zone (area of aquatic plant dominance). The lake's mean depth and surface area translate to an approximate volume of 1,027 ac-ft.

The lake has a 3,711-acre immediate watershed, which translates to a watershed-to-lake area ratio of 47:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: two percent residential, 69 percent agricultural, one percent commercial/industrial, and 28 percent open/undeveloped (Carver County Planning 1999).

This was the fifth year that Reitz Lake has been involved in CAMP. Council staff, however, has monitored the lake, in the past. A search through the STORET nationwide water quality database for historical data on the lake, provided only three years of data (1985, 1991 and 1993) prior to the 1999-2003 CAMP data.

The lake was monitored 14 times between mid-April and mid-October, 2003. 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. The mean summertime (May through September) surface TP concentration was 111.3 µg/l (minimum of 63.0 µg/l, maximum of 176.0 µg/l). The mean CLA and Secchi transparency readings were 52.7 µg/l (minimum of 1.0 µg/l, maximum of 180.0 µg/l) and 2.8 m (minimum of 0.5 m, maximum of 6.0 m), respectively. The lake's mean surface TKN concentration was 1.91 mg/l (minimum of 1.20 mg/l, maximum of 2.90 mg/l). The 2003 Secchi transparency mean is the lake's best recorded water clarity to date.

The lake quality grades determined from each parameter's summertime mean are TP= D, CLA= D, and Secchi transparency= B, resulted in a 2003 overall grade of C. The 2003 overall grade is similar to those recorded in 1999-2000 and 2002, and better than those of 1985, 1991, 1993, and 2001.

No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, in the short-term however, the lake's water quality seems to be well represented by an overall grade of D/low-C. In order to detect any possible long-term trends, additional years of data collection are needed.

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 2.9 for physical condition (between 2- "some algae present and 3- "definite algae present"), and 2.3 for recreational suitability (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

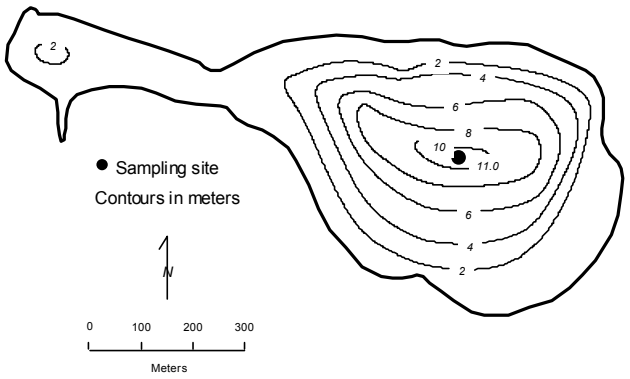
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

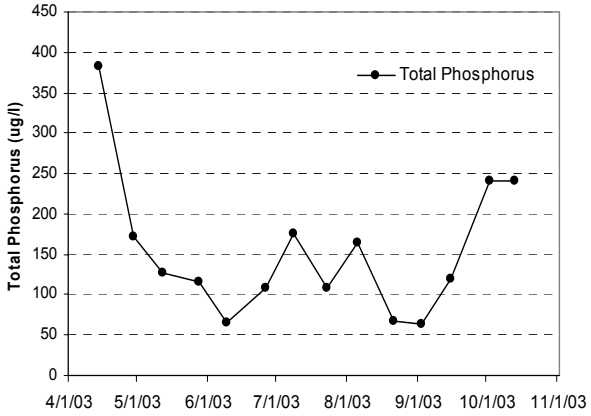
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us

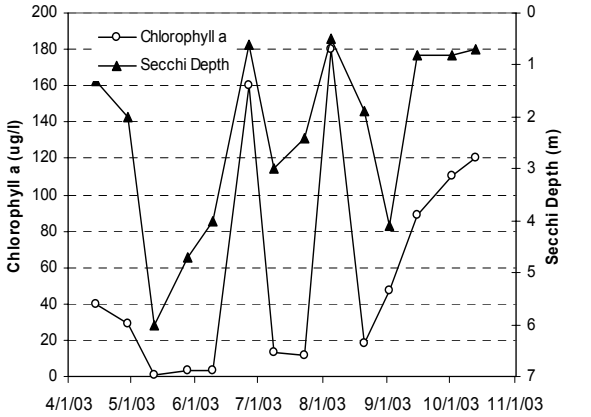
# Reitz Lake

Laketown Twp.,Carver Co.

Lake ID: 100052
WMO: Carver County
Volunteer: Carver Co. Env. Services

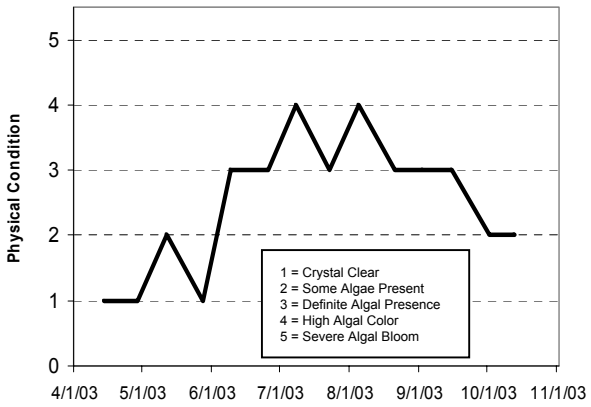



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 9.6 | | 12.73 | | 40 | 382 | | 1.3 | 1 | 1 |
| 04/29/03 | 13 | | 10.84 | | 29 | 172 | | 2 | 1 | 1 |
| 05/12/03 | 13.2 | | 8.31 | | 1 | 127 | | 6 | 2 | 1 |
| 05/28/03 | 19.6 | | 8.3 | | 3.2 | 116 | | 4.7 | 1 | 1 |
| 06/09/03 | 22.2 | | 8.44 | | 3.7 | 65 | | 4 | 3 | 2 |
| 06/26/03 | 24 | | 11.81 | | 160 | 108 | | 0.6 | 3 | 3 |
| 07/08/03 | 25.8 | | 6.26 | | 13 | 176 | | 3 | 4 | 2 |
| 07/23/03 | 24.7 | | 8.27 | | 12 | 108 | | 2.4 | 3 | 1 |
| 08/05/03 | 25.5 | | | | 180 | 164 | | 0.5 | 4 | 4 |
| 08/21/03 | 27.1 | | 11 | | 18 | 67 | | 1.9 | 3 | 3 |
| 09/02/03 | 23.9 | | 8.43 | | 47 | 63 | | 4.1 | 3 | 3 |
| 09/15/03 | 21.8 | | 5.84 | | 89 | 119 | | 0.8 | 3 | 3 |
| 10/02/03 | 12.2 | | 9.22 | | 110 | 241 | | 0.8 | 2 | 3 |
| 10/13/03 | 14.3 | | 8.16 | | 120 | 240 | | 0.7 | 2 | 2 |

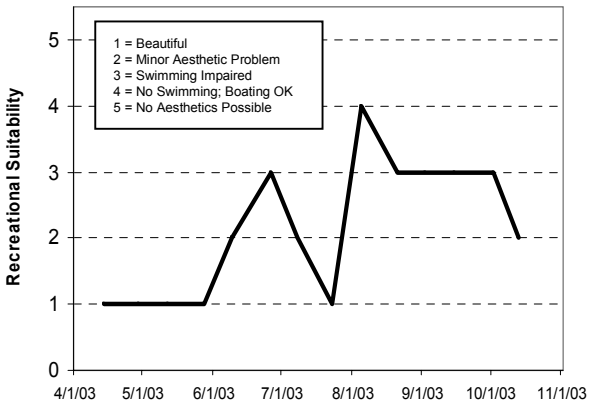



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | D | | | | | | C | C | D | D | D |
| Chlorophyll a | | C | | | | | | B | C | D | C | D |
| Secchi Depth | | D | | | | | | C | C | F | C | B |
| **Overall** | | **D** | | | | | | **C** | **C** | **D** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Riley Lake (10-0002) *City of Chanhassen*

While Riley Lake has previously been monitored by Council staff, 2003 marks the first year the lake has been monitored through CAMP. Riley Lake, with a surface area of 297 acres (2.9 miles in circumference), is located with the cities of Chanhassen and Eden Prairie (Carver and Hennepin counties). The maximum and mean depths of the lake are 15.0 and 6.6 m (49 and 21.6 feet), respectively. Roughly 34 percent of the lake's surface 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 approximate volume of the lake is 6,429 ac-ft.

The lake has a 4,796-acre immediate watershed, which translates to a watershed-to-lake area ratio of 16:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). Public access is possible on the southeasternern end of the lake. The lake is considered a "Priority Lake" due to its multi-recreational uses. Eurasian Water Milfoil (*Myriophyllum spicatum*) [EWM] has been reported on the lake.

In 2003 Riley Lake was monitored 14 times from mid-April to mid-October. Summertime (May through September) means were: surface TP= 46.5 µg/l (minimum of 27.0 µg/l, maximum value of 76.0 µg/l); surface CLA= 55.5 µg/l (minimum of 2.1 µg/l, maximum of 180.0 µg/l); Secchi transparency= 1.8 m (minimum of 0.7 m, maximum of 6.0 m); and TKN= 1.38 mg/l (minimum of 1.00 mg/l, maximum of 1.80 mg/l). The 2003 mean CLA concentration was the worst recorded for the lake to date.

Lake quality grades determined from the 2003 summertime means were TP= C; CLA= D; and Secchi= C, which translates to an overall grade of C. The lake's 2003 overall grade of C is identical to those recorde in eac of the past 15 yeats of monitoring. Therefore, the lake seems well represent by an overall grade of C.

The 2003 average user perception rankings, on a 1-to-5 scale, were 3.2 for physical condition (between 3- "definite algae present" and 4- "high algal color"), 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

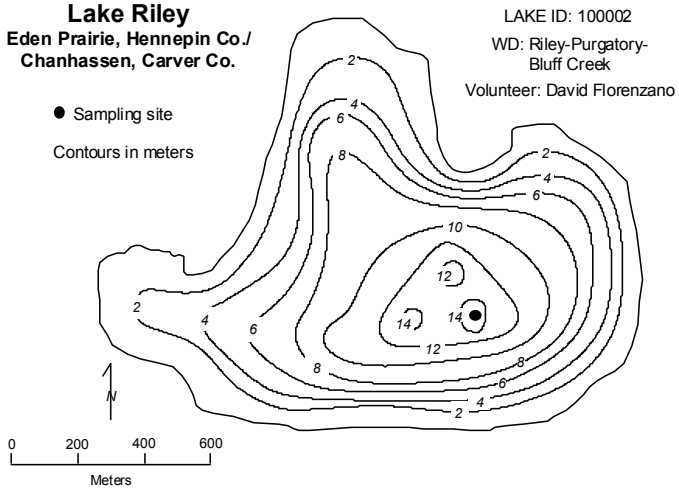
## Lake Riley

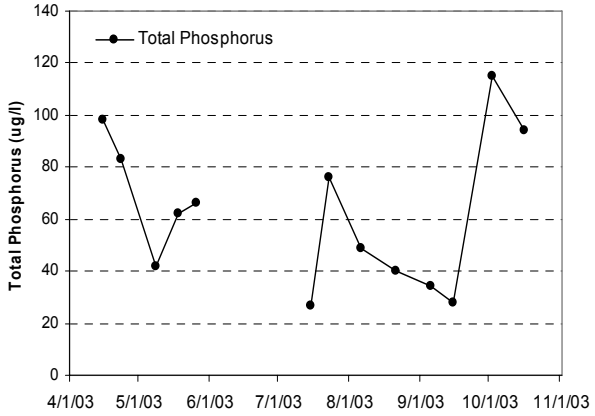
**Eden Prairie, Hennepin Co./ Chanhassen, Carver Co.**

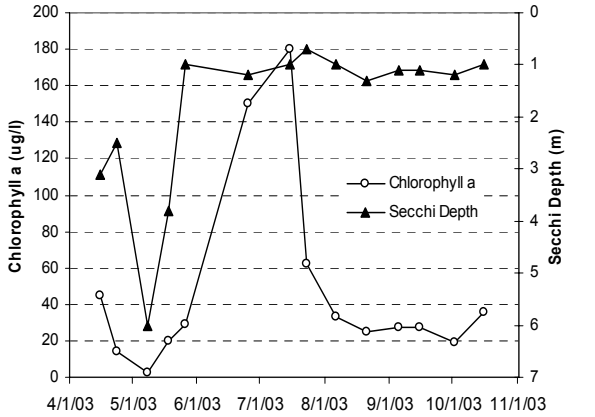
LAKE ID: 100002

WD: Riley-Purgatory-Bluff Creek

Volunteer: David Florenzano

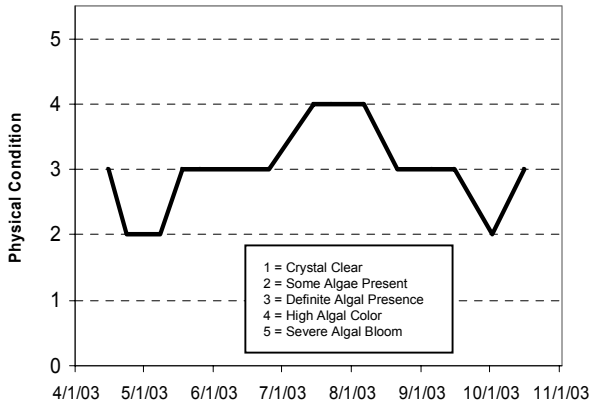



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 10.5 | | | | 45 | 98 | | 3.1 | 3 | 2 |
| 04/23/03 | 11.8 | | | | 14 | 83 | | 2.5 | 2 | 2 |
| 05/08/03 | 14.4 | | | | 2.1 | 42 | | 6 | 2 | 2 |
| 05/18/03 | 21 | | | | 20 | 62 | | 3.8 | 3 | 2 |
| 05/26/03 | 19 | | | | 29 | 66 | | 1 | 3 | 3 |
| 06/25/03 | 22.5 | | | | 150 | | | 1.2 | 3 | 3 |
| 07/15/03 | 23.6 | | | | 180 | 27 | | 1 | 4 | 2 |
| 07/23/03 | 24.3 | | | | 62 | 76 | | 0.7 | 4 | 3 |
| 08/06/03 | 25.4 | | | | 33 | 49 | | 1 | 4 | 2 |
| 08/21/03 | 27.1 | | | | 25 | 40 | | 1.3 | 3 | 1 |
| 09/05/03 | 22.6 | | | | 27 | 34 | | 1.1 | 3 | 1 |
| 09/15/03 | 21.3 | | | | 27 | 28 | | 1.1 | 3 | 2 |
| 10/02/03 | 12.9 | | | | 19 | 115 | | 1.2 | 2 | 2 |
| 10/16/03 | 13 | | | | 36 | 94 | | 1 | 3 | 2 |

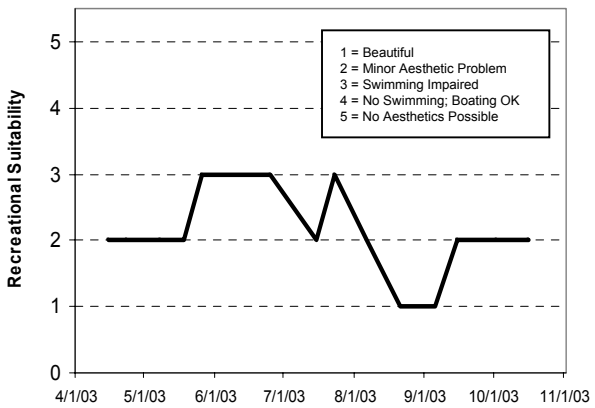



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | | | | C | | | C | | C | C |
| Chlorophyll a | | C | | | | C | | | C | | C | D |
| Secchi Depth | | C | | | | C | | | C | | C | C |
| **Overall** | | **C** | | | | **C** | | | **C** | | **C** | **C** |

Source: Metropolitan Council and STORET data



## Ryan Lake (27-0058) *Shingle Creek Watershed Management Commission*

This was the fifth year that Ryan Lake, located within the City of Robbinsdale (Hennepin County), was monitored as part of CAMP (the others being 1996, 1998, 2000and 2002). As part of the volunteer monitoring program the lake was sampled omly six times from late-April to early-July, 2003. The 35-acre lake has a maximum depth of approximately 10.7 m (35 feet) and a 5,510-acre contributing watershed. This translates to a very large watershed-to-lake size ratio of 157:1. The larger the ratio the greater the potential stress on the lake from surface runoff.

Summertime (May - September) means for the monitored variables were: surface TP= 51.4 µg/l (minimum concentration of 38.0 µg/l, maximum value of 81.0 µg/l), surface chlorophyll-a= 8.6 µg/l (minimum of 1.8 µg/l, maximum of 12.0 µg/l), Secchi transparency= 2.6 m (minimum of 1.8 m, maximum of 3.2 m), and TKN= 0.90 mg/l (minimum of 0.71 mg/l, maximum of 1.10 mg/l).

Lake quality grades associated with the 2003 summertime means were: TP= C; CLA= A; and Secchi= B. The lake's overall 2003 quality grade calculated from the TP, CLA, and Secchi grades, was B (similar to1998 and 2002, and better than 1996 (C), and 2000 (D)).

There is little historical data available for Ryan Lake (see lake information sheet on the following page). A STORET data search revealed minimal data from 1980-1981, 1994-1995 (Secchi data), 1996, 1998, 2000 and 2002. The only years when TP, CLA and Secchi data are available are 1996, 1998, 2000, 2002 and now 2003. While studies by Dr. Joe Shapiro were thought to have been undertaken in the mid-1980's no data are found.

Because of the sporadic and limited nature of the database no long-term trends can be determined. The lake's overall water quality grade over the past five years of monitoring range from a low of D to a high of B. To better understand the quality of the lake and what direction it may be heading, more data are needed.

Throughout the course of the monitoring season the volunteers ranked their perception of the lake's physical and recreational conditions on a 1-to-5 scale as shown on the attached information sheet. The summertime mean recorded physical condition was 2.6 (between 2- "some algae present" and 3- "definite algae present"). The mean suitability for recreation ranking was 2.6 (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/.

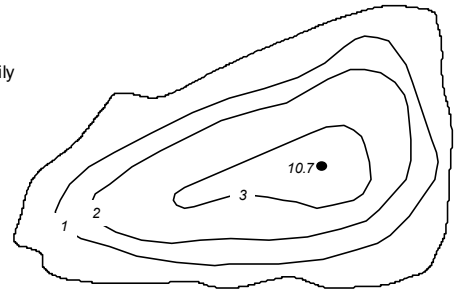
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

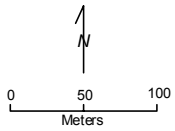
# Ryan Lake

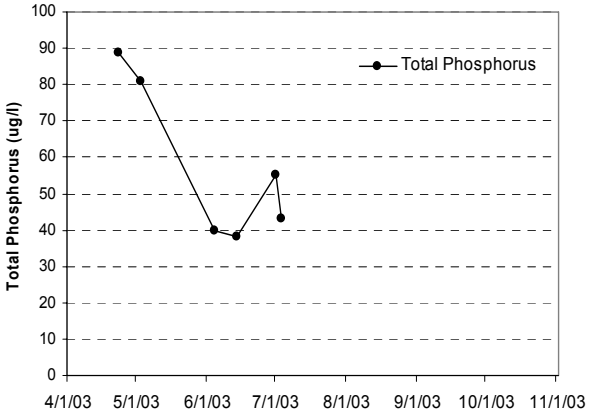
**Crystal, Hennepin Co.**

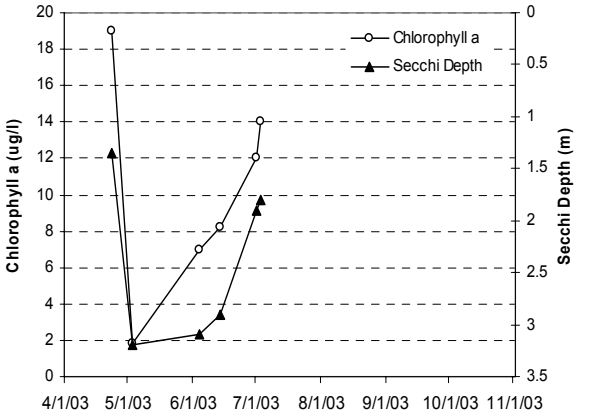
Lake ID: 270058
WMO: Shingle Creek
Volunteers: The Spector Family

● Sampling site
Contours in meters



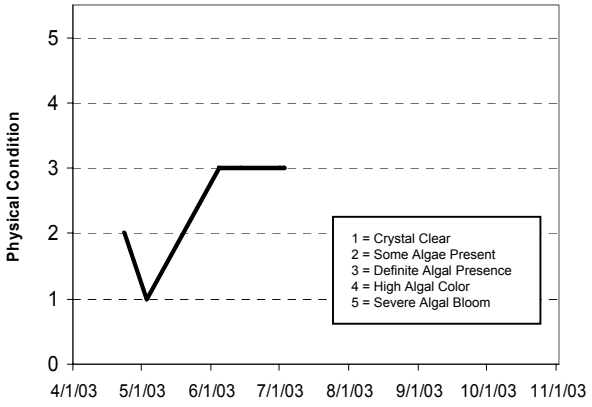




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/23/03 | 15 | | | | 19 | 89 | | 1.35 | 2 | 3 |
| 05/03/03 | 16.5 | | | | 1.8 | 81 | | 3.2 | 1 | 2 |
| 06/04/03 | 22.3 | | | | 7 | 40 | | 3.1 | 3 | 3 |
| 06/14/03 | 22.7 | | | | 8.2 | 38 | | 2.9 | 3 | 3 |
| 07/01/03 | 27 | | | | 12 | 55 | | 1.9 | 3 | 2 |
| 07/03/03 | 26 | | | | 14 | 43 | | 1.8 | 3 | 3 |

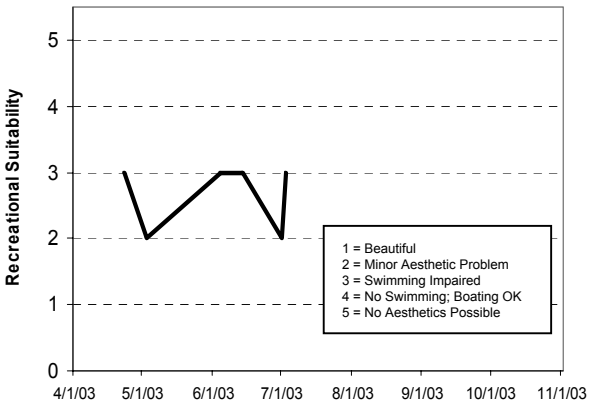



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | | C | | D | | C | C |
| Chlorophyll a | | | | | B | | B | | C | | A | A |
| Secchi Depth | | | C | C | C | | B | | D | | C | B |
| **Overall** | | | | | **C** | | **B** | | **D** | | **B** | **B** |

Source: Metropolitan Council and STORET data



## Sand Lake (82-0067) *Marine on St. Croix Watershed Management Organization*

Sand Lake is a 46-acre lake located within New Scandia Township (Washington County). The lake has a surface area of 46 acres (1.8 miles in circumference) and a mean and maximum depth of 2.4 m (8 feet) and 5.5 m (18 feet), respectively. The lake, which has two inlets has an approximate volume of 368 ac-ft. Approximately 46 percent of the lake's surface area is considered littoral, the shallow (0-15 foot) area dominated by aquatic vegetation.

This was the sixth year that Sand Lake has been involved in CAMP (the lake was previously enrolled in 1993-1996 and 2002). The 1993-1996 and 2002 CAMP data were the only historic water quality data found for the lake. In 2003, the lake was monitored seven times from late-April to early-October. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 53.6 µg/l (minimum concentration of 30.0 µg/l and a maximum value of 79.0 µg/l); surface chlorophyll-a= 27.6 µg/l (minimum of 3.1 µg/l and maximum of 90.0 µg/l); Secchi transparency= 1.4 m (minimum of 0.8 m and a maximum of 2.1 m); and TKN= 1.23 mg/l (minimum of 0.87 mg/l and maximum of 1.70 mg/l). The lake's summer means translate to water quality grades of C for TP, C for CLA, and C for Secchi transparency. These grades result in an overall water quality grade of C for Sand Lake in 2003 (identical to those recorded for 1993-1996 and 2002).

While the lake's overall water quality grades were identical for each of the six years of CAMP, the individual summer means and corresponding grades were similar to those of 1996. The lake's best water quality was recorded in 2002, while its worst was in 1993.

The perceived conditions of the lake (both physical and recreational) were ranked on a 1-to-5 scale by the volunteer monitors. These user perception rankings are shown on the lake's information sheet. The mean physical condition ranking was 2.6 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.6 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

Limited amount of water quality data exists for Sand Lake. The database consists of only five years of CAMP monitoring information for 1993-1996, 2002 and 2003. Because of its limited water quality database, the determination of any long-term trends is not possible. In the short-term however, it seems apparent that the lake's water quality has remained fairly constant since 1993 continually receiving overall grades of C.

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.

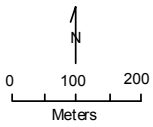
# Sand Lake

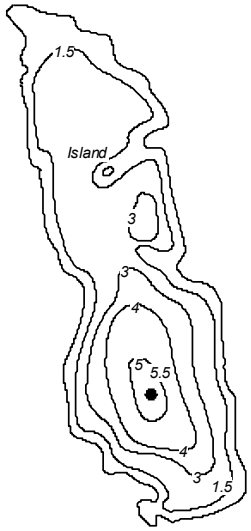
**New Scandia Twp., Washington Co.**

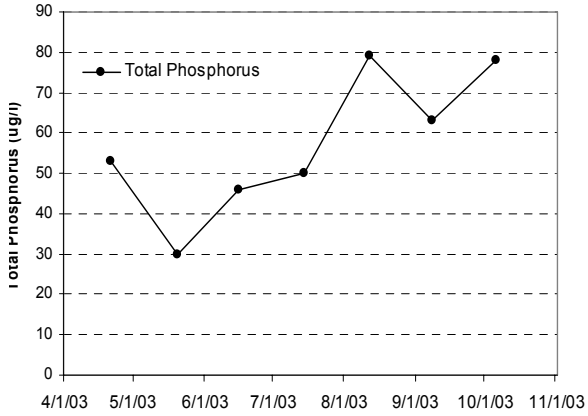
Lake ID: 820067
WMO: Marine-on-St. Croix
Volunteer: Wash. Co. SWCD

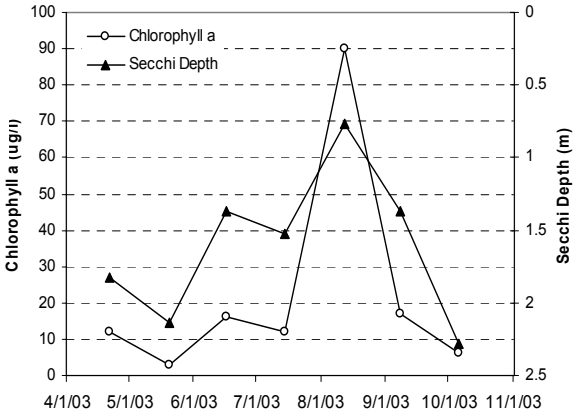
● Sampling site

Contours in meters



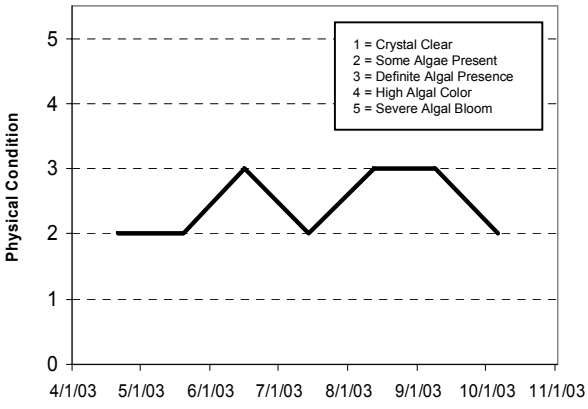




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 8.6 | | 7.95 | | 12 | 53 | | 1.83 | 2 | 1 |
| 05/20/03 | 16.1 | | 4.64 | | 3.1 | 30 | | 2.135 | 2 | 2 |
| 06/16/03 | 24.3 | | 7.7 | | 16 | 46 | | 1.373 | 3 | 3 |
| 07/14/03 | 24.1 | | 7.7 | | 12 | 50 | | 1.525 | 2 | 2 |
| 08/12/03 | 27 | | 11.27 | | 90 | 79 | | 0.763 | 3 | 3 |
| 09/08/03 | 23.8 | | 7.36 | | 17 | 63 | | 1.372 | 3 | 3 |
| 10/06/03 | 11.7 | | 7.69 | | 6.3 | 78 | | 2.286 | 2 | 2 |

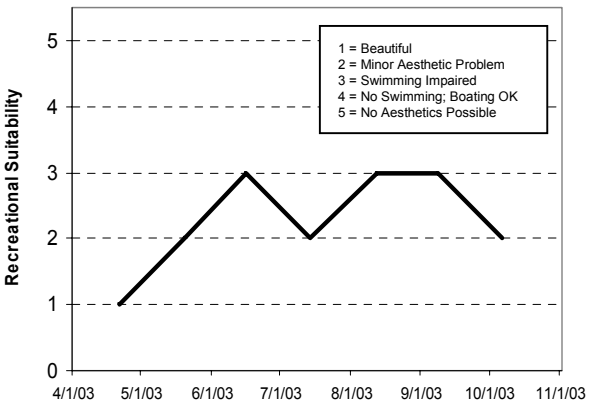



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | C | C | C | | | | | | C | C |
| Chlorophyll a | | C | C | B | C | | | | | | B | C |
| Secchi Depth | | D | D | C | C | | | | | | C | C |
| **Overall** | | **C** | **C** | **C** | **C** | | | | | | **C** | **C** |

Source: Metropolitan Council and STORET data



## Schutz Lake (10-0018) *Minnehaha Creek Watershed District*

Schutz Lake is a 105-acre lake located within the City of Victoria (Carver County). The maximum and mean depths of the lake are 15.0 m (roughly 49.2 feet) and 6.0 m (19.5 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 2,100 ac-ft. Approximately 27 percent of the lake's area is considered littoral zone (area of aquatic plant dominance).

The lake's 943-acre immediate watershed and surface area translates to a watershed-to-lake size ratio of 9:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake. An area of concern and need for future management is the presence of Eurasian Water Milfoil (*Myriophyllum spicatum*) in the lake.

This was the fourth year that Schutz Lake has been involved in CAMP (the lake was also monitored by Council staff back in 1984). Other than the 1984 and 2000-2002 data, a search through the STORET nationwide water quality database solely includes Secchi data (1981-1988 and 1990-1991). Thus, 1984 and 2000-2003 are the only years of available nutrient data.

The lake was monitored eight times from mid-May to late-August, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 32.1 µg/l (minimum concentration of 15.0 µg/l and a maximum value of 47.0 µg/l); surface chlorophyll-a= 18.0 µg/l (minimum of 12.0 µg/l and maximum of 26.0 µg/l); Secchi transparency= 1.3 m (minimum of 0.8 m and a maximum of 2.3 m); and TKN= 0.88 mg/l (minimum of 0.68 mg/l and maximum of 1.00 mg/l). The lake's summer means translate to water quality grades of C for TP, B, for CLA, and C for Secchi transparency. These grades result in an overall water quality grade of C for Schutz Lake in 2003 (identical to that recorded in 2000-2002 and better than that recorded in 1984).

As mentioned earlier, other then the 1984 and 2000-2002 Council data, the lake's historic database includes Secchi readings from 1981-1988 and 1990-1991. The lake does not seem to show any long-term water clarity trends and seems to be represented with a water quality grade of C. There is very little TP and CLA data available however, and to better understand the lake's TP and CLA conditions and to determine any possible trends, more data are needed.

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 2.6 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 1.0 for recreational suitability (1- "beautiful").

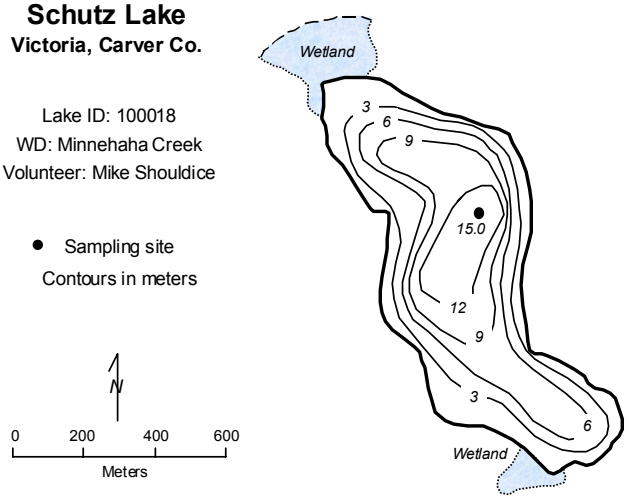
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

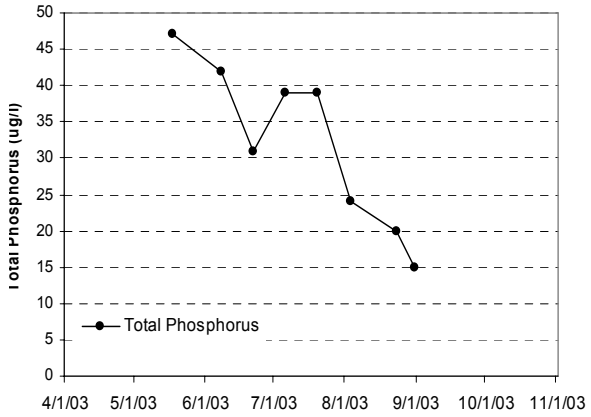
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

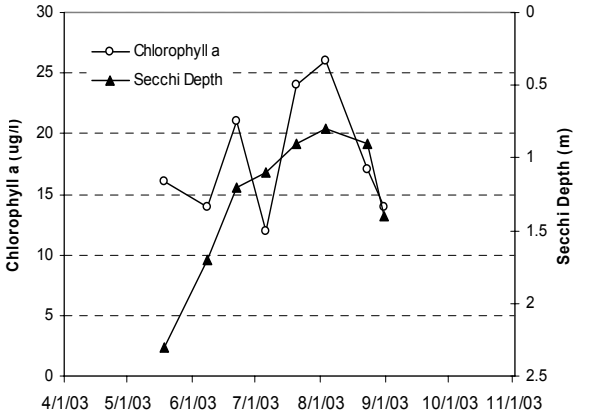
# Schutz Lake

**Victoria, Carver Co.**

Lake ID: 100018
WD: Minnehaha Creek
Volunteer: Mike Shouldice

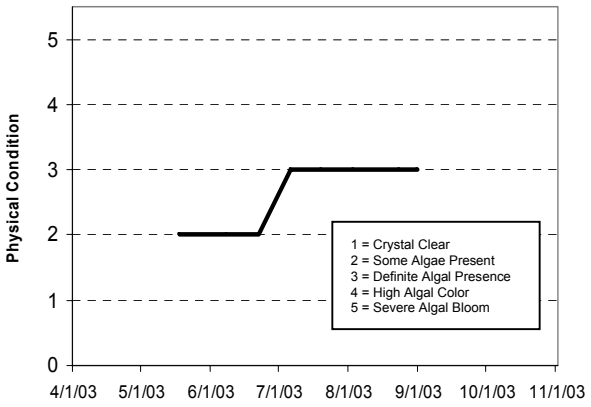



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/18/03 | 15.7 | | | | 16 | 47 | | 2.3 | 2 | 1 |
| 06/08/03 | 19.6 | | | | 14 | 42 | | 1.7 | 2 | 1 |
| 06/22/03 | 21.8 | | | | 21 | 31 | | 1.2 | 2 | 1 |
| 07/06/03 | 27.7 | | | | 12 | 39 | | 1.1 | 3 | 1 |
| 07/20/03 | 26.9 | | | | 24 | 39 | | 0.9 | 3 | 1 |
| 08/03/03 | 25.2 | | | | 26 | 24 | | 0.8 | 3 | 1 |
| 08/23/03 | 25.8 | | | | 17 | 20 | | 0.9 | 3 | 1 |
| 08/31/03 | 25.8 | | | | 14 | 15 | | 1.4 | 3 | 1 |

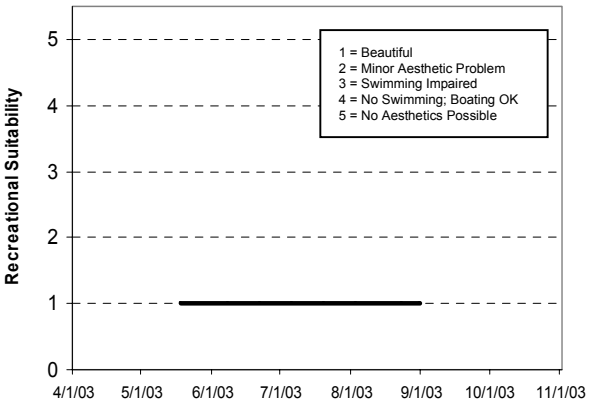



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | B | B | B | C |
| Chlorophyll a | | | | | | | | | A | B | B | B |
| Secchi Depth | | | | | | | | | C | C | B | C |
| **Overall** | | | | | | | | | **B** | **B** | **B** | **C** |

Source: Metropolitan Council and STORET data



## Seidl Lake (19-0095) *Seidl Lake Association*

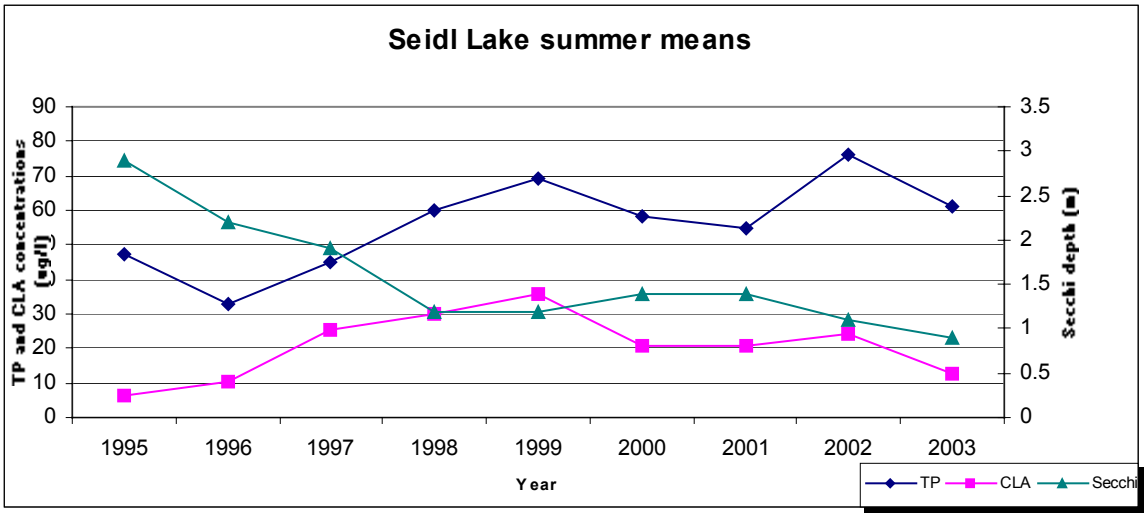
Seidl Lake is a 14-acre lake located in the City of Inver Grove Heights (Dakota County) which receives inflow from five inlets. Other than the fact that the maximum depth of the lake is approximately 5.0 m (17 feet), there is very little known morphological data available. The lake has been enrolled in CAMP since 1995. In 2003 it was monitored eight times from mid-May to late-September. On each sampling date the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability.

Summertime (May through September) means for the monitored variables were: surface TP= 61.3 µg/l (minimum concentration of 36.0 µg/l, maximum value of 140.0 µg/l); surface chlorophyll-a= 12.7 µg/l (minimum of 3.8 µg/l, maximum of 26.0 µg/l); Secchi transparency= 0.9 m (minimum of 0.3 m, maximum of 1.5 m); and TKN= 1.04 mg/l (minimum of 0.76 mg/l, maximum of 1.80 mg/l). Associated lake quality grades for the 2003 summertime means were as follows: TP= C, CLA= B, Secchi= D. The lake's overall 2003 quality grade is C, identical to those of 1991, 1997-1998,and 2000-2001, worse than the B's of 1995-1996, but better than the D recorded in 1999 and 2002.

Similar to that reported in past lake reports (and noticed again in 2003), the difference between the TP, CLA and Secchi grades in current and past years (see report grade on the lake's information page), may indicate that suspended sediments may play a large role in the inner workings of the lake. This scenario can be fairly typical for small shallow lakes where wind action and storm sewer inflow either increase the influx of sediments to the system or cause the re-suspension of existing bottom sediments. That is, the suspended sediments influence the lake's phosphorus make-up (a larger portion of the in-lake phosphorus in particulate form rather than a soluble form more readily available for algal uptake), reduce water clarity, and could actually be limiting the amount of light available for algal growth, thus keeping the CLA concentrations down (resulting in a better than expected grade).

This influx of sediments was dramatically increased in 2002, when heavy rains caused a section of a hillside (including an approximate 50 feet x 30 feet x 20 feet washout of a bank) within a housing project had collapsed sending silt and water into the lake's southern end. This not only resulted in a much higher water level after the documented erosion, but also resulted in elevated phosphorus concentrations and reduced Secchi transparencies.

The water quality database for Seidl Lake consists of nutrients and Secchi data in 1991, Secchi data in 1993-1994, and CAMP data in 1995-2003. While the lake's database is expanding, it is lacking in pre-1995 data. Statistical analysis on the lak's water quality database revealed, no "statistically significant" long-trends are evident. A simple regression on the lake's available water quality data, does reveal a slight decrease in the lakes qualiity. Over this time span, The lake's oveal water quality grades fluctuated between an overall C and low-B grade in 1991-1998, 2000-2001 and 2003, and a low grade of D in 1999 and 2002.



In an attempt to address the lake's possible degradation concerns and watershed influences on said degradation, lake area homeowners have been trying to work with the local communities to address areas of concern to the lake's future management. They are currently working on garnering city involvement and outside funding to further initiate the lake planning/improvement process.

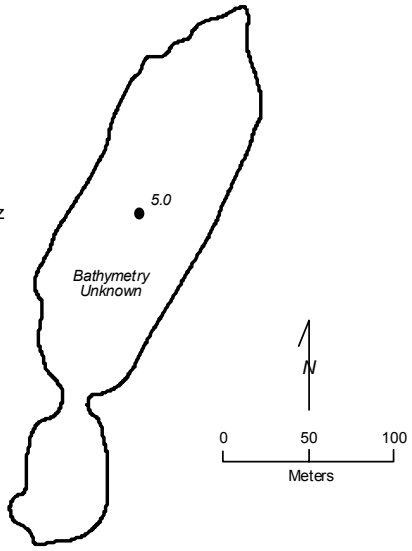
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The summertime mean recorded physical condition was 3.0 (3- "definite algae present"), while the mean suitability for recreation ranking was 4.1 (roughly equal to 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

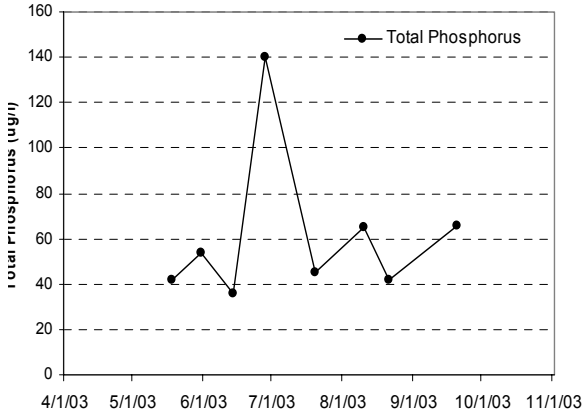
# Seidl Lake

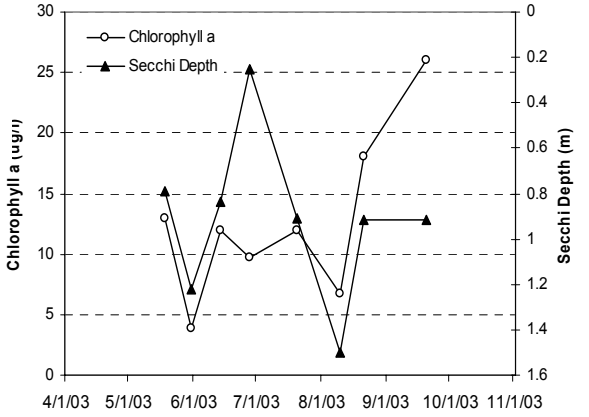
**Inver Grove Heights, Dakota Co.**

Lake ID: 190095
WMO: Lower Mississippi River
Volunteers: Janet and Harv Bartz



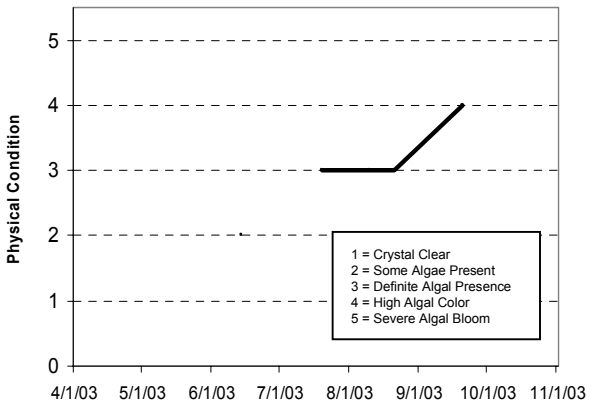

● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 05/18/03 | 19 | | | | 13 | 42 | | 0.792 | | 4 |
| 05/31/03 | 20 | | | | 3.8 | 54 | | 1.22 | | 4 |
| 06/14/03 | 25 | | | | 12 | 36 | | 0.838 | 2 | 4 |
| 06/28/03 | 23 | | | | 9.7 | 140 | | 0.254 | | 5 |
| 07/20/03 | 27 | | | | 12 | 45 | | 0.91 | 3 | 4 |
| 08/10/03 | 27 | | | | 6.7 | 65 | | 1.5 | 3 | 4 |
| 08/21/03 | 27 | | | | 18 | 42 | | 0.914 | 3 | 4 |
| 09/20/03 | 19 | | | | 26 | 66 | | 0.914 | 4 | 4 |

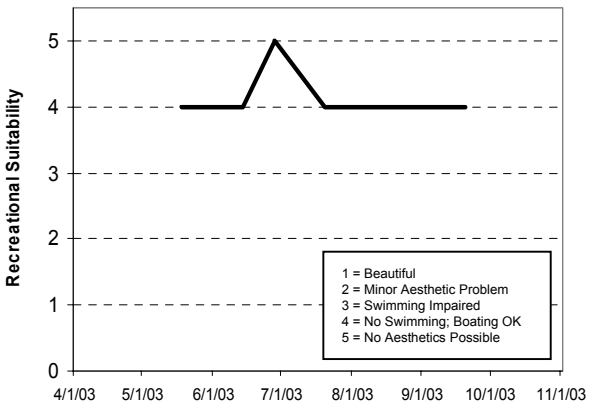



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | C | C | C | C | D | C | C | D | C |
| Chlorophyll a | | | | A | B | B | C | C | C | C | C | B |
| Secchi Depth | | D | D | B | B | C | D | D | C | C | D | D |
| **Overall** | | | | **B** | **B** | **C** | **C** | **D** | **C** | **C** | **D** | **C** |

Source: Metropolitan Council and STORET data



## Shields Lake (82-0162) *Comfort Lake-Forest Lake Watershed District*

Shields Lake is located in the City of Forest Lake in Washington County. The lake has a surface area of 27 acres (0.8 miles in circumference) and a maximum depth of 8.2 m (27 feet). About 85 percent of the lake's area is considered littoral, the shallow (0-15 foot depth) area dominated by aquatic vegetation.

Shields Lake has been involved in CAMP since 1993. The lake was monitored 14 times between mid-April and mid-October, 2003. 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. The mean summertime (May through September) surface TP concentration of 316.4 µg/l (minimum of 150.0 µg/l, maximum of 624.0 µg/l). The mean CLA and Secchi transparency readings were 35.7 µg/l (minimum of 4.4 µg/l, maximum of 110.0 µg/l) and 1.5 m (minimum of 0.8 m, maximum of 2.6 m), respectively. The lake's mean surface TKN concentration was 1.94 mg/l (minimum of 1.30 mg/l, maximum of 3.00 mg/l).

The lake quality grades determined from each parameter's summertime mean are: TP= F, CLA= C, and Secchi transparency= C, resulted in a 2003 overall grade of D. While the lake's 2003 individual grades were identical to those recorded in 1998-2002, the lake's 2003 TP mean is the worsted recorded to date.

The lake's worst water quality was recorded in 1999, 2002 and 2003, while the best water quality year was 1997. Nineteen hundred and ninety-seven, had a TP mean of 159.0 µg/l, CLA mean of 7.0 µg/l, and a Secchi mean of 2.8 m (which resulted in individual grades of F, A, and B, for an overall grade of C).

Typical of what has been shown in past years, the lake's CLA and water clarity conditions are better than expected due to very high TP concentrations. Generally such elevated TP concentrations would result in an equal increase in CLA and decrease in water clarity. A reason for this scenario continues to be the biomanipulation project undertaken on the lake in 1994. As part of the project, rotenone (a piscicide) was used to eliminate the lake's large population of roughfish in order to allow a more dense and diverse macrophyte population. This project switched the lake from being phytoplankton (algae) dominant to being macrophyte dominant. The result has been a very desirable littoral macrophtye population, which filters sediments from the water column (reducing turbidity) and acts a refuge for zooplankton. Zooplankton are beneficial to the water quality of the lake because they graze on the lake's algal population, thus reducing CLA and increasing water clarity.

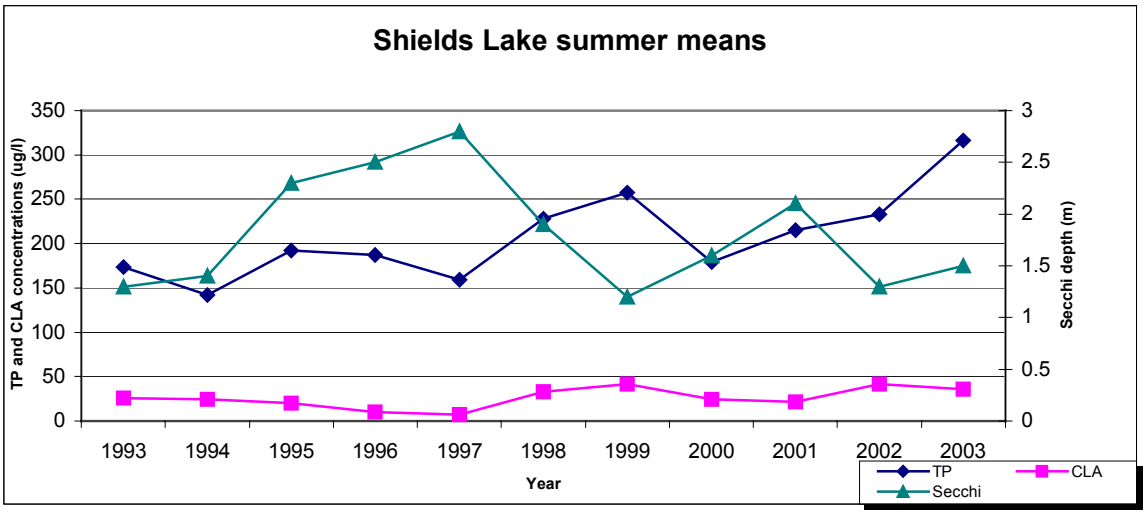
While the water quality database for Shields Lake is not extensive, it is growing. Twelve years (1991, 1993-2003) of TP, CLA, and Secchi transparency data are available to calculate annual grades. Overall grades were C in 1991 and 1994-1997, D in 1993 and 1998-2003. Additional data found for 1988-1989 had only TP and CLA concentrations, and 1990 had only Secchi depth information.

A quick look at the lake's database seems to show that the its TP concentrations have remained consistently high (between D and F). The CLA and Secchi numbers, which improved slightly after the biomanipulation of 1994, degraded in 1998 and 1999 and, until 2002-2003, had shown improvement in 2000-2001. However, because of the absence of historic data and the great variability of existing data, statistically accurate long-trend analysis is difficult. To better understand the quality of the lake and what direction it may be heading, continued monitoring is suggested.

While the lake's CLA concentrations (corresponding to algal abundance) and Secchi transparencies had recently shown some improvement, concern about their degradation in 1998-1999 (and now 2002-2003), has been raised in past reports. It was mentioned in the 1998 and 1999 lake report that TP, CLA, and Secchi transparency conditions in 1998 were similar to that of 1994 and 1995 until early-July, and after the big storms (extreme winds, heavy rains) of late-June, when the lake started to experience below normal water quality conditions. It was further mentioned that, during the July 7, 1998 monitoring event 12 dead turtles were seen at the lake's inlet, no "freshwater shrimp" (zooplankton) were seen in the water samples, and the lake had no oxygen in the water below one meter (approximately three feet). At this point the lake's TP concentrations rose, but more abnormally, the lake's CLA and Secchi readings dramatically worsened. The lake's CLA and Secchi readings did not start to rebound until

again until late-September of that year. It is thought that the 1998 storms started the degradation of the lake's water quality by increasing runoff from the surrounding watershed, and riling up the lake's sediments. This potentially resulted in an increased TP and sediment load to the lake, increasing turbidity, TP concentrations, algal populations, and reducing water clarity and in-lake oxygen levels (Anhorn 1999).

While it looked as thought the lake was starting to improve in 2000 and 2001, the 2002-2003 data show conditions similar to those of 1998-1999. Continued monitoring will hopefully indicate if the recent (2000-2001) CLA and Secchi improvements continue, or if the degradation seen in 1998-1999 and 2002-2003 prevail.




The perceived physical and recreational conditions of the lake, recorded by the volunteer(s), were ranked on a 1-to-5 scale. The rankings are shown in both tabular and graphical form on the lake's associated information sheet. The mean physical condition ranking was 3.4 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability ranking was 4.0 (4- "no swimming - boating ok").

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.

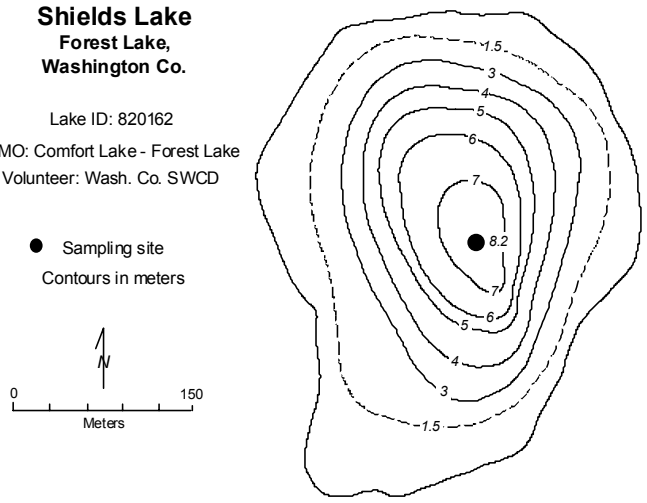
# Shields Lake

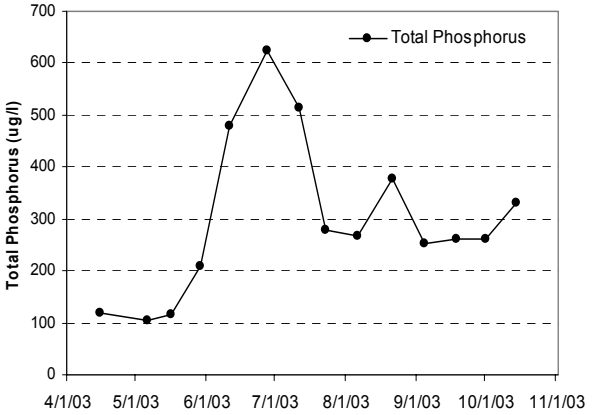
**Forest Lake,**
**Washington Co.**

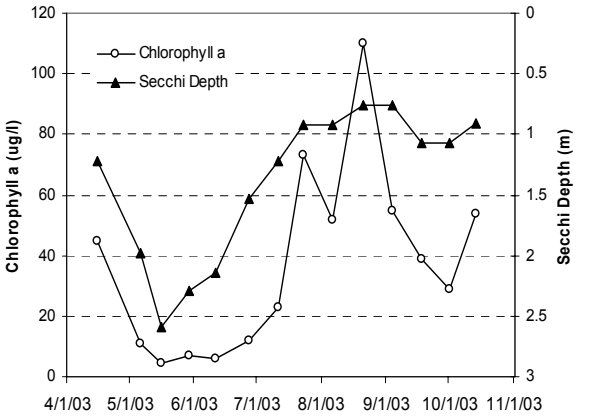
Lake ID: 820162

WMO: Comfort Lake - Forest Lake

Volunteer: Wash. Co. SWCD

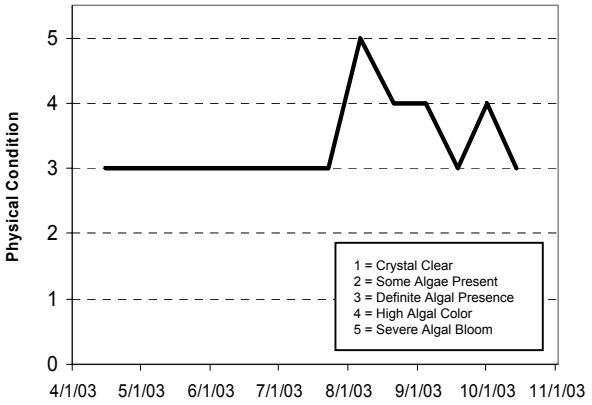



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 27 | | | | 45 | 119 | | 1.22 | 3 | 4 |
| 05/06/03 | 13.1 | | 8.16 | | 11 | 105 | | 1.983 | 3 | 4 |
| 05/16/03 | 17.5 | | 5.89 | | 4.4 | 116 | | 2.593 | 3 | 3 |
| 05/29/03 | 20 | | 4.8 | | 7.2 | 209 | | 2.288 | 3 | 4 |
| 06/11/03 | 18.3 | | 2.37 | | 6.1 | 478 | | 2.135 | 3 | 4 |
| 06/27/03 | 21.7 | | 4.64 | | 12 | 624 | | 1.525 | 3 | 4 |
| 07/11/03 | 21.9 | | 4.05 | | 23 | 513 | | 1.22 | 3 | 4 |
| 07/23/03 | 27.4 | | 7.15 | | 73 | 279 | | 0.915 | 3 | 4 |
| 08/06/03 | 24.3 | | 11.55 | | 52 | 267 | | 0.915 | 5 | 5 |
| 08/21/03 | 26.5 | | 5 | | 110 | 377 | | 0.763 | 4 | 4 |
| 09/04/03 | 22.7 | | 8.91 | | 55 | 252 | | 0.763 | 4 | 4 |
| 09/18/03 | 20.3 | | 5.35 | | 39 | 260 | | 1.067 | 3 | 4 |
| 10/01/03 | 10.6 | | 5.68 | | 29 | 261 | | 1.067 | 4 | 4 |
| 10/14/03 | 13.8 | | 12.23 | | 54 | 332 | | 0.914 | 3 | 4 |

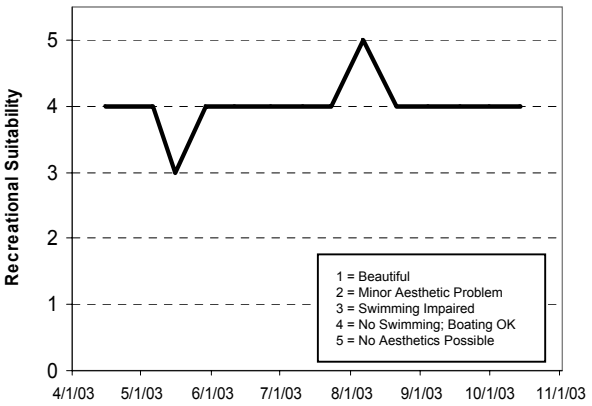



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | F | D | F | F | F | F | F | F | F | F | F |
| Chlorophyll a | | C | C | C | B | A | C | C | C | C | C | C |
| Secchi Depth | | C | C | B | B | B | C | C | C | C | C | C |
| **Overall** | | **D** | **C** | **C** | **C** | **C** | **D** | **D** | **D** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## Silver Lake (82-0016) *Carnelian - Marine Watershed District*

Silver Lake is a 98-acre lake located within Stillwater Township (Washington County). The maximum and mean depths of the lake are 3.4 m (roughly 11 feet) and 1.7 m (five-and-a-half feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 549 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 455-acre watershed and surface area translates to a watershed-to-lake size ratio of 4.6:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake.

This was the fourth year that Silver Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake was very limited. The only years in which data were found, other than the 2000-2003 CAMP data, was 1997-1999.

The lake's Secchi transparency was monitored seven times from late-April to early-October 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 2.6 m (minimum of 1.5 m and a maximum of 3.4 m). This translates to a grade of B for water clarity. The lake's 2003 water clarity grade of B is the best recorded to date. The lake had water clarity grades of C in 1996 and 2000-2002, and D in 1997-1999.

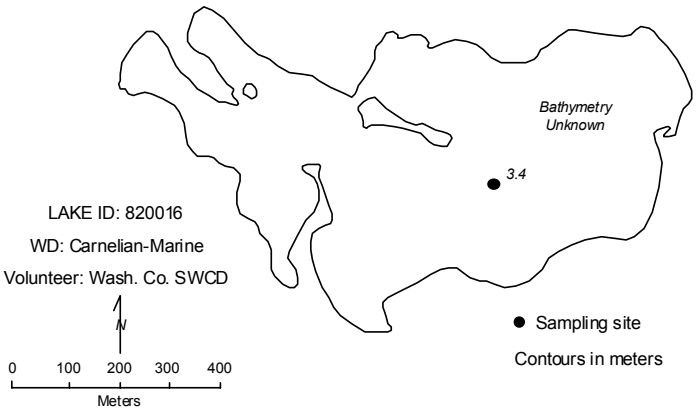
Because of the limited nature of the lake's water quality database the determination of any statistically significant long-term trend detection is not possible. In the short-term however, the lake's water quality seems to be well represened by an overall grade of C, in which the lake's water clarity bounces between a C and D (until the B recorded in 2003). To better understand the lake's overall water quality and where it may be heading, more data are needed.

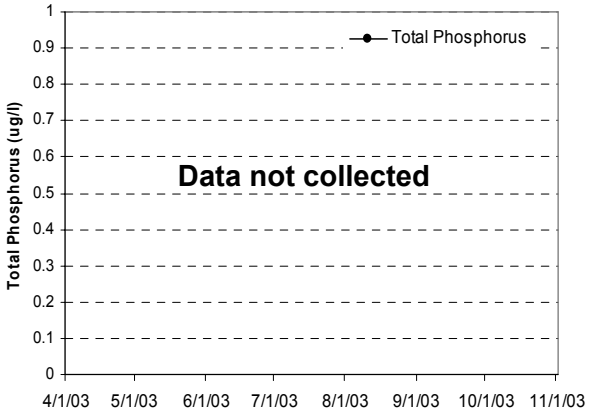
The last two graphs show seasonal variation in the lake's perceived physical condition and recreational suitability. The average user perception rankings, on a 1-to-5 scale, were 2.2 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 2.6 for recreational suitability (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

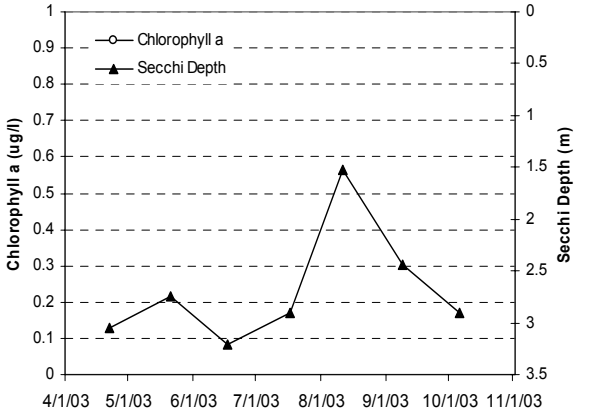
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Silver Lake

**Stillwater Twp., Washington Co.**

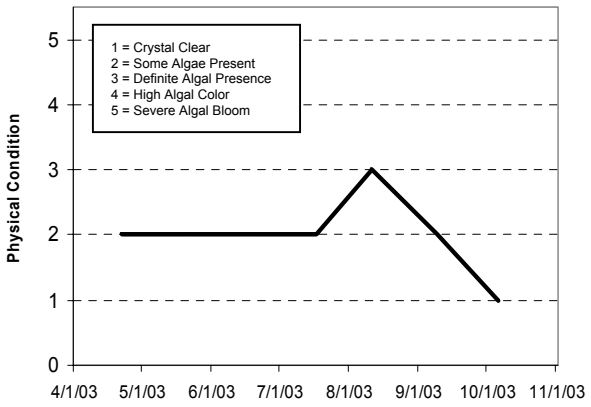



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 12.5 | | 7.3 | | | | | 3.05 | 2 | 2 |
| 05/21/03 | 17.7 | | 5.47 | | | | | 2.745 | 2 | 2 |
| 06/17/03 | 24.9 | | 8.16 | | | | | 3.203 | 2 | 2 |
| 07/17/03 | 26.2 | | 9.5 | | | | | 2.898 | 2 | 2 |
| 08/11/03 | 26.7 | | 10 | | | | | 1.525 | 3 | 4 |
| 09/09/03 | 23.4 | | 7.37 | | | | | 2.438 | 2 | 3 |
| 10/06/03 | 12.8 | | 11.6 | | | | | 2.898 | 1 | 1 |

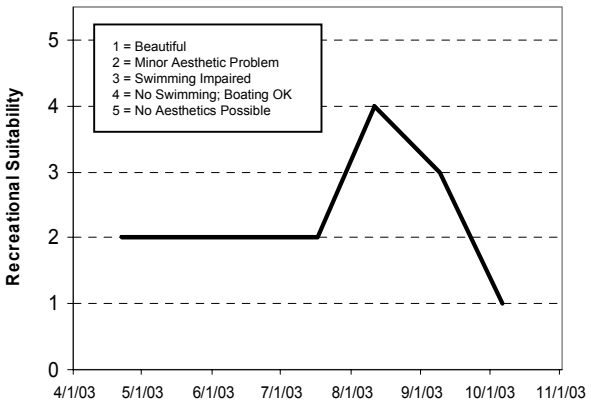



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | C | C | D | C | C | | |
| Chlorophyll a | | | | | C | C | C | D | B | B | | |
| Secchi Depth | | | | | C | D | D | D | C | C | C | B |
| **Overall** | | | | | **C** | **C** | **C** | **D** | **C** | **C** | | |

Source: Metropolitan Council and STORET data



## South Oak Lake (27-0661) *City of St. Louis Park*

South Oak is a small shallow lake located within City of St. Louis Park (Hennepin County). There is very little known morphological data available for the lake.

Two thousand and three marks the second year in which South Oak Lake has been involved in CAMP. A search through the STORET nationwide water quality database for historic data on the lake was unsuccessful. Thus, 2002 is the only complete, year of available data. 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.

The lake was monitored 15 times between late-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of D was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 93.0 µg/l (minimum of 37.0 µg/l, maximum of 217.0 µg/l) corresponds to a lake water quality grade of D, while the mean CLA concentration of 39.3 µg/l (minimum of 9.7 µg/l and maximum of 130.0 µg/l) resulted in a grade of C. The lake's mean Secchi transparency of 0.6 m (minimum of 0.3 m, maximum of 0.9 m) translates to a grade of F. The mean TKN concentration over the same time period was 1.19 mg/l.

As mentioned earlier, there are no water quality data available for South Oak Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 2.2 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 4.3 for recreational suitability (between 4- "no swimming - boating ok" and 5- "no asethetics possible").

If you notice any errors in the lake 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

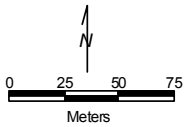
# South Oak Lake

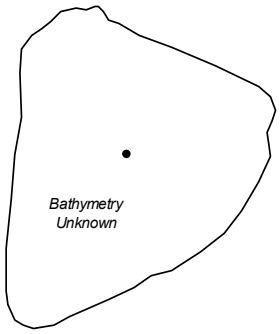
**St. Louis Park, Hennepin Co.**

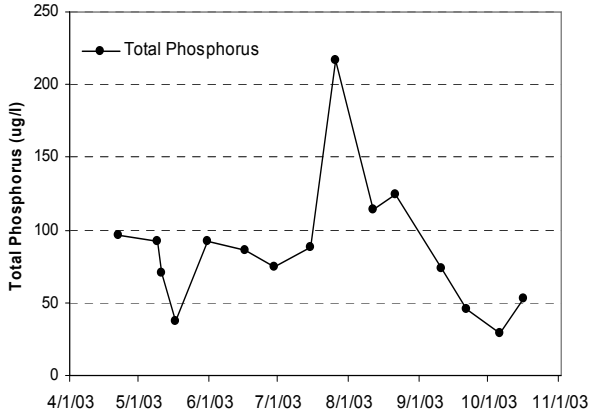
Lake ID: 270661
WD: Minnehaha Creek
Volunteer: Jim Kellogg

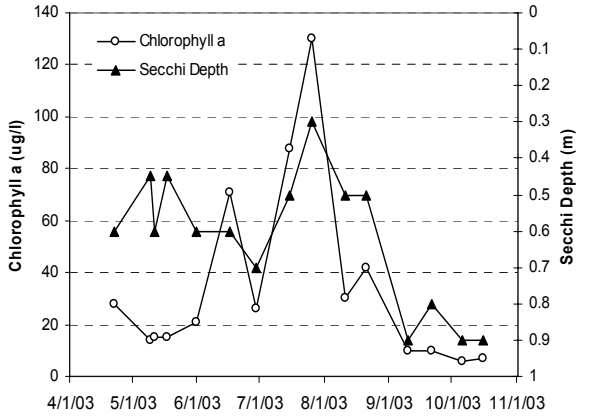
• Sampling site

Contours in meters



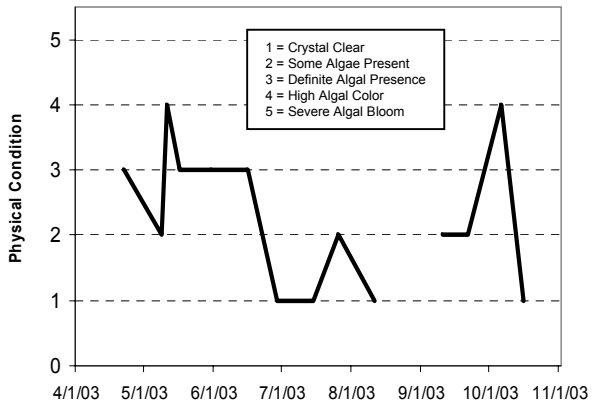




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 15 | | | | 28 | 96 | | 0.6 | 3 | 4 |
| 05/09/03 | 16.5 | | | | 14 | 92 | | 0.45 | 2 | 5 |
| 05/11/03 | 18 | | | | 15 | 71 | | 0.6 | 4 | 4 |
| 05/17/03 | 19 | | | | 15 | 37 | | 0.45 | 3 | 5 |
| 05/31/03 | 20 | | | | 21 | 92 | | 0.6 | 3 | 5 |
| 06/16/03 | 27 | | | | 71 | 86 | | 0.6 | 3 | 5 |
| 06/29/03 | 26 | | | | 26 | 75 | | 0.7 | 1 | 4 |
| 07/15/03 | 27 | | | | 88 | 88 | | 0.5 | 1 | 4 |
| 07/26/03 | 26 | | | | 130 | 217 | | 0.3 | 2 | 4 |
| 08/11/03 | 26 | | | | 30 | 114 | | 0.5 | 1 | 4 |
| 08/21/03 | 26 | | | | 42 | 124 | | 0.5 | | 4 |
| 09/10/03 | 25 | | | | 9.7 | 74 | | 0.9 | 2 | 4 |
| 09/21/03 | 17 | | | | 10 | 46 | | 0.8 | 2 | 4 |
| 10/06/03 | 17 | | | | 5.9 | 29 | | 0.9 | 4 | |
| 10/16/03 | 12 | | | | 6.7 | 53 | | 0.9 | 1 | 4 |

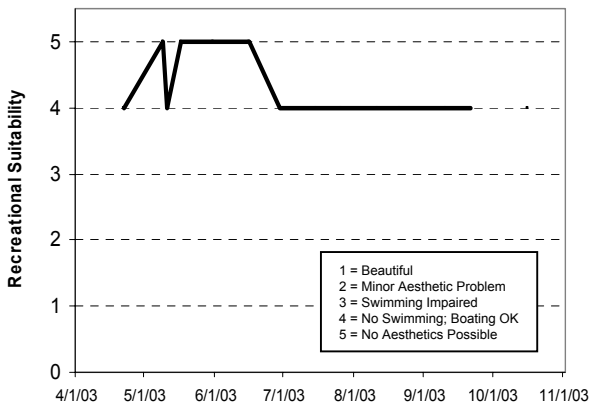



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | D | D |
| Chlorophyll a | | | | | | | | | | | D | C |
| Secchi Depth | | | | | | | | | | | D | F |
| **Overall** | | | | | | | | | | | **D** | **D** |

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 fourth year that South Rice Lake has been involved in CAMP (it was also involved in 2000-2002). Other than the 2000-2002 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 late-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The summertime (May through September) means for the monitored variables were: surface TP= 276.5 µg/l (minimum concentration of 78.0 µg/l and a maximum value of 501.0 µg/l); surface chlorophyll-a= 21.0 µg/l (minimum of 4.0 µg/l and maximum of 86.0 µg/l); Secchi transparency= 0.5 m (minimum of 0.3 m and a maximum of 1.0 m). The lakes 2003 TKN mean was 1.52 mg/l. The lake's summer means translate to water quality grades of F for TP, C, for CLA, and F for Secchi transparency. These grades result in an overall water quality grade of D for South Rice Lake in 2003.

While the lake's 2003 overall grade is identical to those recorded in 2001 and 2002 (and better than the F recorded in 2000), the individual TP and CLA means were worse than thery were in 2001 and 2002. Of the four years of monitoring data available for the lake, it is apparent that the lake experienced its best water quality year in 2002 and worst in 2000).

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 report that the alum treatment was successful in the reducting of in-lake TP and CLA (indicating a reduction in algal biomass) in 2002. The lake's 2003 summer mean TP concentration more than doubled that recorded in 2002 however. 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 3.4 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").

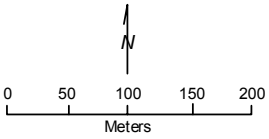
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

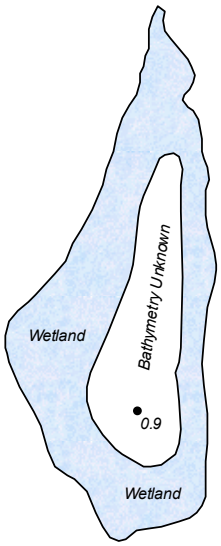
# South Rice Pond

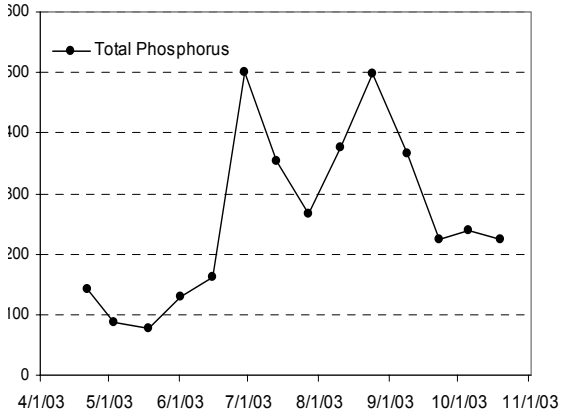
**Golden Valley, Robbinsdale, Hennepin Co.**

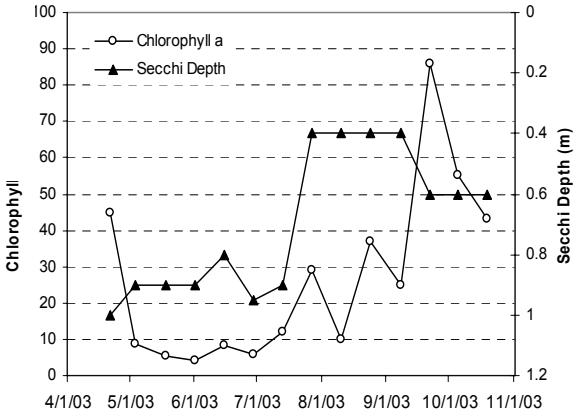
Lake ID: 270645
WMO: Bassett Creek
Volunteer: Steve Streff

• Sampling site
Contours in meters



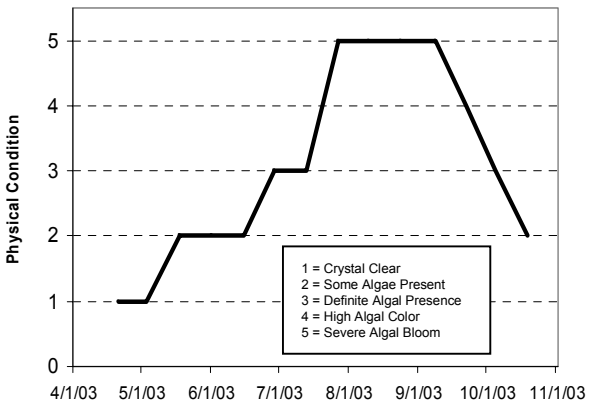




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/21/03 | 13.4 | | | | 45 | 143 | | 1 | 1 | 4 |
| 05/03/03 | 17.9 | | | | 8.8 | 88 | | 0.9 | 1 | 4 |
| 05/18/03 | 19 | | | | 5.5 | 78 | | 0.9 | 2 | 4 |
| 06/01/03 | 20.2 | | | | 4 | 130 | | 0.9 | 2 | 4 |
| 06/15/03 | 25 | | | | 8.4 | 161 | | 0.8 | 2 | 4 |
| 06/29/03 | 20.2 | | | | 5.8 | 501 | | 0.95 | 3 | 4 |
| 07/13/03 | 24.5 | | | | 12 | 354 | | 0.9 | 3 | 4 |
| 07/27/03 | 23.5 | | | | 29 | 266 | | 0.4 | 5 | 5 |
| 08/10/03 | 24.1 | | | | 10 | 375 | | 0.4 | 5 | 5 |
| 08/24/03 | 19.6 | | | | 37 | 498 | | 0.4 | 5 | 5 |
| 09/08/03 | 20.2 | | | | 25 | 365 | | 0.4 | 5 | 5 |
| 09/22/03 | 14.6 | | | | 86 | 225 | | 0.6 | 4 | 4 |
| 10/05/03 | 12.3 | | | | 55 | 239 | | 0.6 | 3 | 4 |
| 10/19/03 | 16.2 | | | | 43 | 225 | | 0.6 | 2 | 4 |

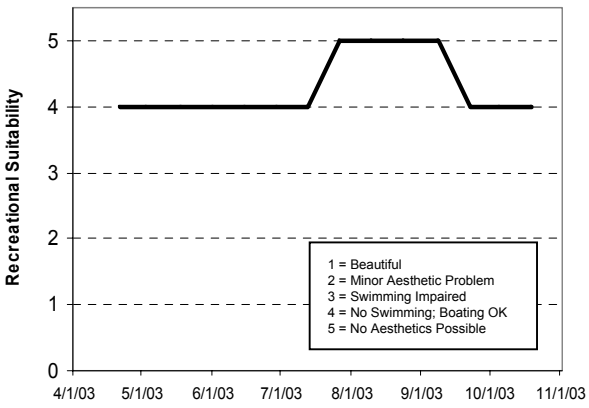



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | F | F | D | F |
| Chlorophyll a | | | | | | | | | F | B | B | C |
| Secchi Depth | | | | | | | | | F | F | F | F |
| **Overall** | | | | | | | | | **F** | **D** | **D** | **D** |

Source: Metropolitan Council and STORET data



## South Twin Lake (82-0019) *Carnelian - Marine Watershed District*

South Twin Lake is a 54-acre lake located within Stillwater Township (Washington County). The maximum and mean depths of the lake are 4.0 m (roughly 13 feet) and 2.0 m (six-and-a-half feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 356 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 very small watershed-to-lake size ratio of 1.2:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake.

This was the fourth year that South Twin Lake has been involved in CAMP (it was also involved in CAMP in 2000-2002). A search through the STORET nationwide water quality database for data on the lake was very limited. The only years in which data were found, other than the 2000-2003 CAMP data, was 1996-1999.

The lake's Secchi transparency was monitored seven times from late-April to early-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 2.0 m (minimum of 1.4 m and a maximum of 3.4 m) [dramatically better than the 2001 and 2002 means]. This translates to a grade of C for water clarity. The lake's 2003 water clarity grade of C is the best recorded to date. The lake had water clarity grades of D in 1996-1997, 2000 and 2002, and F in 1998-1999 and 2001.

As mentioned earlier, there is little historic data available for South Twin Lake. Therefore it is not possible to determine any long-term trends in water quality. In the short-term however, the lake seems well represented by an overall grade of D with some "normal" variability in the low C and F ranges. To better understand the lake's water quality and where it may be heading, more data are needed.

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 3.2 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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# South Twin Lake

**Stillwater Twp., Washington Co.**

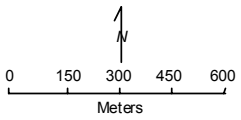
LAKE ID: 820019

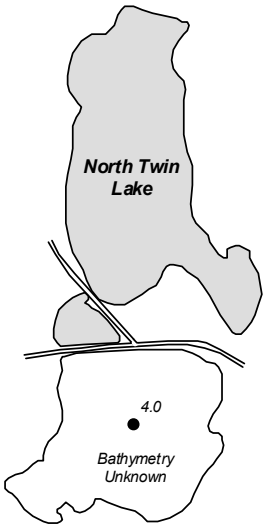
WD: Carnelian-Marine

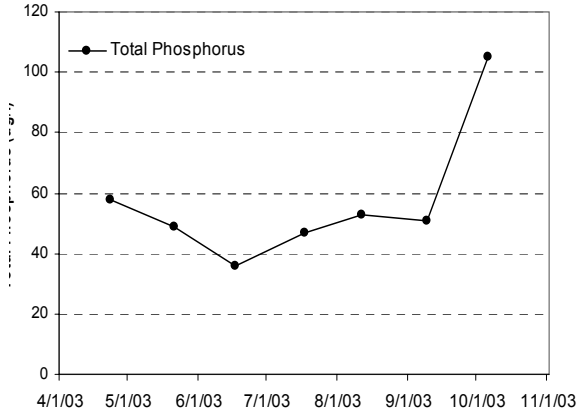
Volunteer: Wash. Co. SWCD

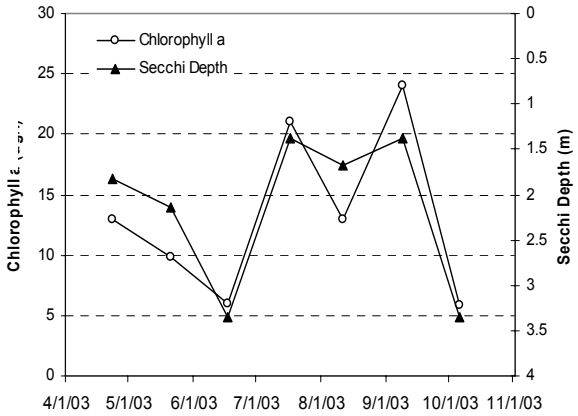
● Sampling site

Contours in meters



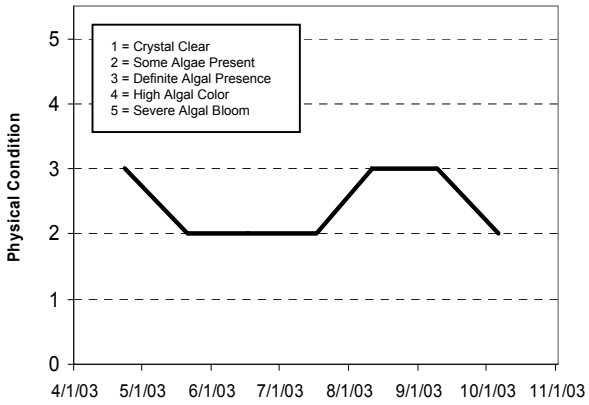




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/23/03 | 11 | | 5.29 | | 13 | 58 | | 1.83 | 3 | 4 |
| 05/21/03 | 17.1 | | 5.5 | | 9.8 | 49 | | 2.135 | 2 | 2 |
| 06/17/03 | 24.6 | | 7.6 | | 6 | 36 | | 3.355 | 2 | 2 |
| 07/17/03 | 25 | | 10.1 | | 21 | 47 | | 1.373 | 2 | 3 |
| 08/11/03 | 26.9 | | 10.6 | | 13 | 53 | | 1.678 | 3 | 4 |
| 09/09/03 | 23.6 | | 10.26 | | 24 | 51 | | 1.372 | 3 | 4 |
| 10/06/03 | 12.9 | | 10.8 | | 5.9 | 105 | | 3.353 | 2 | 2 |

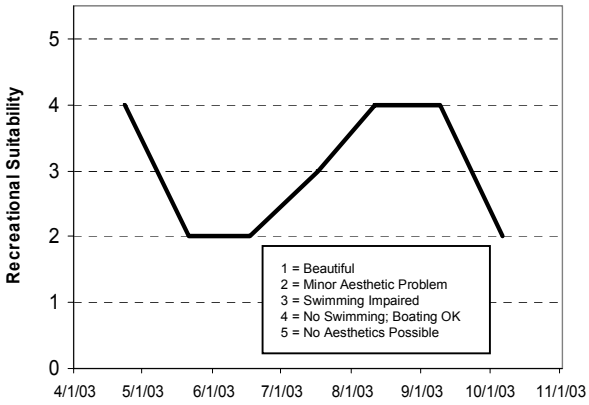



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | C | D | D | C | D | | C |
| Chlorophyll a | | | | | D | D | D | F | C | D | | B |
| Secchi Depth | | | | | D | D | F | F | D | F | D | C |
| **Overall** | | | | | **D** | **D** | **D** | **F** | **C** | **D** | | **C** |

Source: Metropolitan Council and STORET data



## Spring Lake [Scott County] (70-0054) *Prior Lake - Spring Lake Watershed District*

Spring Lake, located in southeastern Spring Lake Township in Scott County, was monitored 14 times between late-April and mid-October, 2003. The 630-acre lake (5.0 miles in circumference) is considered a "Priority Lake" by the Metropolitan Council because of its multi-recreational uses.

The lake has a large 13,500-acre watershed. The lake and watershed areas translate to a large watershed-to-lake area ratio of 21:1. The larger the ratio, the greater the potential stress on the lake's quality from surface runoff. The majority of the lake's watershed is agricultural.

The maximum and mean depths of the lake are 11.3 and 5.6 m (37 and 18 feet), respectively. About 50 percent of the lake's area is considered littoral (the 0-15 foot depth area dominated by aquatic vegetation). The approximate volume of the lake is approximately 11,500 acre-feet (ac-ft) and a public access to the lake is located on its southwestern shores.

Spring Lake is very fertile, receiving nutrients from runoff and from internal sources. The great fertility causes legendary algal growths. The blue-green algal blooms are a serious nuisance, and purportedly have been the cause of the death of four dogs, which died after drinking the water in 1980.

In an attempt to improve the lake's water quality, a ferric chloride addition system was constructed at the outlet of the Highway 13 wetland in 1998 with continuous operation starting in 1999. The system, which consists of a dosing station at the outlet of the wetland, followed by a desiltation (settling) basin, meters ferric chloride into stormwater to enhance phosphorus removal prior to entering the lake. The ferric chloride removes nutrients from the water column, thereby reducing their availability to algal growth. As the ferric chloride dosed stormwater enters the desiltation basin the ferric chloride rapidly dissociates to form free iron which reacts with soluble phosphorus to form relatively insoluble iron-phosphorus complex (referred to as floc). The desiltation basin then provides an area where the floc can settle out through the water column and can be eventually removed.

The results from the monitoring of the system in 1999 indicate that there is significant reductions in the ortho-phosphorus load (41 percent) and some reduction in the total phosphorus load (21 percent) from the ditch prior to entering the lake (Prior Lake – Spring Lake Watershed District 2001). The watershed district has continued to monitor the effectiveness of the system

While Spring Lake has been monitored by Metropolitan Council staff in the past, 2003 was the fifth year it has been involved in CAMP (the others being 1997 and 2000-2002). On each monitoring event, the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The mean 2003 summertime surface TP concentration for the lake was 103.9 µg/l (minimum of 42.0 µg/l, maximum of 183.0 µg/l). The mean CLA and Secchi transparency readings were 44.2 µg/l (minimum of 2.1 µg/l, maximum of 110.0 µg/l), and 1.6 m (minimum of 0.6 m, maximum of 4.0 m) [dramatically better than the 2002 mean of 0.6 m]. The lake's mean surface TKN concentration was 1.55 mg/l (minimum of 1.20 mg/l and maximum of 2.40 mg/l).

The 2003 summertime means resulted in a TP grade of D, CLA grade of C, and Secchi transparency grade of C. The resulting 2003 overall grade calculated from all three parameters was C. A year after experiencing the lake's worst water quality (overall grade of F in 2002), the lake's 2003 water quality is better than it has been since the early 1980's.

The physical and recreational conditions of Spring Lake as perceived by the volunteer(s) were ranked on a 1-to-5 scale. These rankings are shown on the lake's information sheet on the next page. The summertime mean physical condition was 2.8 (between 2- "some algae present" and 3- "definite algae present"). The mean suitability for recreation ranking was 3.0 (3- "swimming slightly impaired").

Historical data for the Spring Lake indicates that the water quality of the basin has remained fairly constant over the past decade fluctuating between overall grades of C and D (before the F the lake recevied this year). Lake quality grades (see the lake's information sheet on the following page) show that when nutrient data were collected on the lake it corresponded to overall grades of C in 1981-1982 and 2003, and a D in 1980, 1984, 1996-1997, and 2000-2001, and F in 2002. Because of the fluctuation in the lake's overall grades, no long-term trends are apparent. Annual Secchi transparency means, however, seem to indicate a slight decreasing trend in water clarity since 1980 (although the 2003 Secchi mean represents an improvement over recent means). To better understand all aspects of the lake's water quality and what direction it may be heading, more years of data collection are needed.

In an attempt to address issues either contributing to the eutrophication of Spring Lake or the symptoms from the rsulting eutrophication, the Prior Lake - Spring Lake Watershed District is in the process of developing a Sustainable Water Quality Mangement Plan for its lakes (including Spring Lake). The process will set goals addressing the lakes' biological and chemical make-up and develop implementation strategies enabling the lakes' goals to be met.

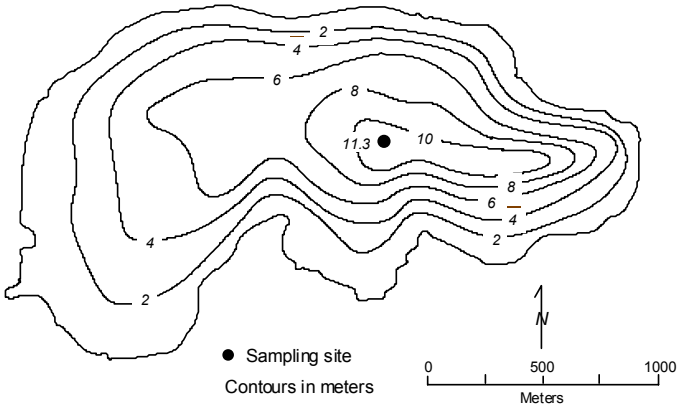
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

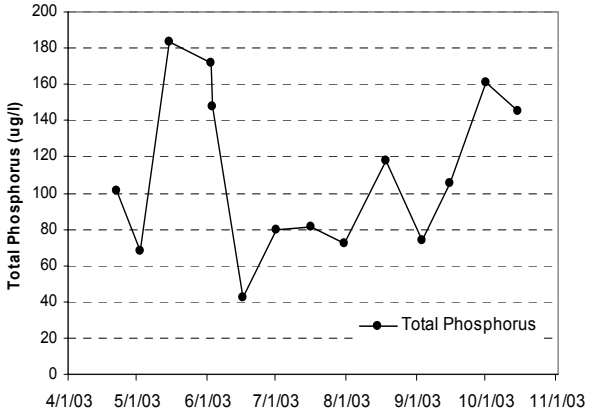
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

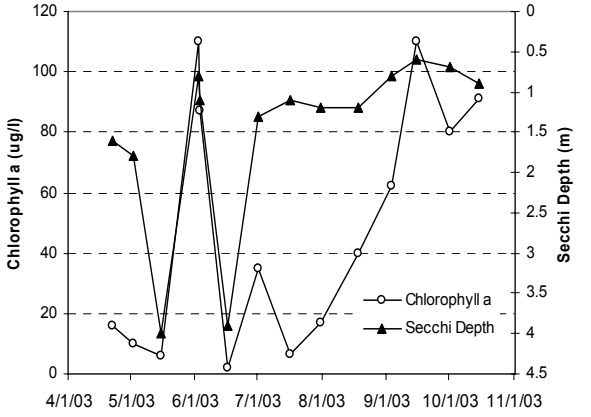
# Spring Lake

**Prior Lake/Spring Lake Twp., Scott Co.**

Lake ID: 700054
WD: Prior Lake-Spring Lake
Volunteer: Bob Tisdell

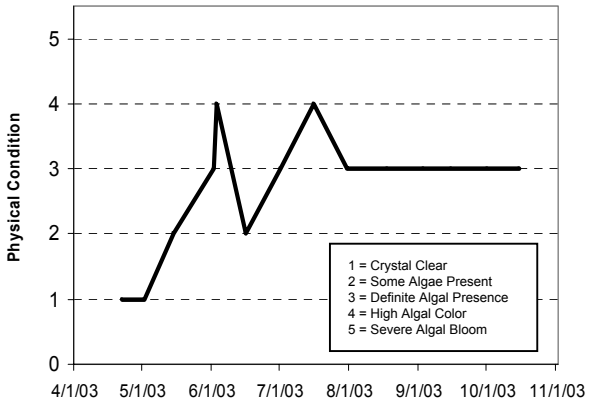



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 10 | | | | 16 | 101 | | 1.6 | 1 | 1 |
| 05/02/03 | 14.4 | | | | 10 | 68 | | 1.8 | 1 | 1 |
| 05/15/03 | 16.5 | | | | 5.9 | 183 | | 4 | 2 | 1 |
| 06/02/03 | 19.3 | | | | 110 | 172 | | 0.8 | 3 | 3 |
| 06/03/03 | 20.2 | | | | 87 | 148 | | 1.1 | 4 | 4 |
| 06/16/03 | 27.2 | | | | 2.1 | 42 | | 3.9 | 2 | 4 |
| 07/01/03 | 25.4 | | | | 35 | 80 | | 1.3 | 3 | 3 |
| 07/16/03 | 24.5 | | | | 6.7 | 81 | | 1.1 | 4 | 3 |
| 07/31/03 | 25 | | | | 17 | 72 | | 1.2 | 3 | 4 |
| 08/18/03 | 27.2 | | | | 40 | 118 | | 1.2 | 3 | 4 |
| 09/03/03 | 23.1 | | | | 62 | 74 | | 0.8 | 3 | 3 |
| 09/15/03 | 22.3 | | | | 110 | 105 | | 0.6 | 3 | 3 |
| 10/01/03 | 13.2 | | | | 80 | 161 | | 0.7 | 3 | 3 |
| 10/15/03 | 13.8 | | | | 91 | 145 | | 0.9 | 3 | 3 |

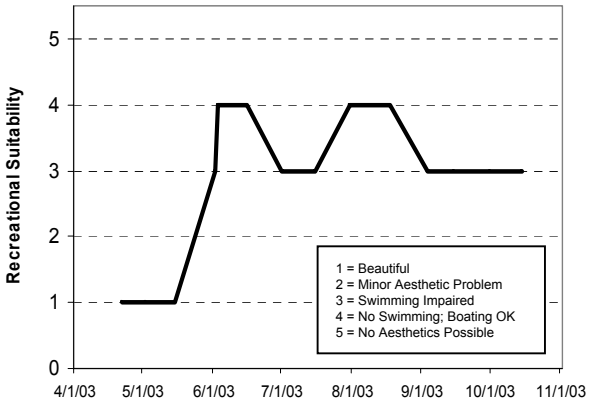



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | D | D | | | F | D | D | D |
| Chlorophyll a | | | | | C | C | | | D | D | F | C |
| Secchi Depth | C | C | C | C | D | D | | | C | D | F | C |
| **Overall** | | | | | **D** | **D** | | | **D** | **D** | **F** | **C** |

Source: Metropolitan Council and STORET data



## Square Lake (82-0046) *Marine on St. Croix Watershed Management Organization*

Square Lake, located in eastern May Township (Washington County), is a 193-acre lake (shoreline length of about 2.2 miles) with a maximum and mean depth of 20.7 and 9.0 m (68.0 and 29.5 feet), respectively, for an approximate lake volume of 5,694 ac-ft. About 65 percent of the lake's area is considered littoral (the 0-15 foot depth area dominated by aquatic vegetation). The lake can be accessed through the county park on the southeastern end of the lake. Because of its multi-recreational uses, it is considered a metropolitan "Priority Lake."

The lake is only one of six lakes in the seven-county metropolitan area stocked with trout (rainbows). The lake's level is maintained by a combination of groundwater/ and runoff from the lake's watershed (MDNR 1996).

The lake's watershed is small (about 782 acres) and rural. The watershed and lake size translate to a very small watershed-to-lake size ratio of 4:1 (the smaller the ratio the less the stress on the lake from surface runoff). The watershed is largely undeveloped; wetlands, parks and open spaces, grasslands and woodlands comprise about 70 percent of the watershed's area.

Square Lake, which was involved in CAMP in 1993-1997, and monitored by Council staff in 1998 (as an in-kind contribution to a Clean Water Partnership project on the lake), was a part of CAMP again from 1999-2003. The lake was monitored 14 times from mid-April to mid-October, 2003. Summertime (May through September) means for the monitored variables were: surface TP= 11.2 μg/l (minimum concentration of 7.0 μg/l, maximum of 17.0 μg/l); surface chlorophyll-a= 3.0 μg/l (minimum of 1.7 μg/l, maximum of 5.0 μg/l); Secchi transparency= 6.0 m (minimum of 4.6 m, maximum of 9.2 m [best Secchi reading in CAMP 2003]); and TKN= 0.39 mg/l (minimum of 0.20 mg/l, maximum of 0.61 mg/l). Associated lake quality grades for the 2003 summertime means were as follows: TP= A; CLA= A; and Secchi= A. The lake's overall 2003 quality grade calculated from the TP, CLA, and Secchi grades was A (identical to CAMP 1993-1997, and 1999-2002).

While the lake's 2003 summer means are better than those recorded in 2002, the lake's Secchi mean is not as good as it had been throughout the 1980's and 1990's. In fact, trend analysis (by the MPCA) on just the lake's historical (1970-present) Secchi transparency database, revealed a statistically significant decline in recent water clarity.

The water quality graphs show seasonal trends in TP and CLA concentrations, and Secchi transparency for 2003, which closely resemble those of past years. In most metro area lakes, TP, CLA and Secchi transparency generally have a tightly linked relationship such that as TP concentrations increase, algal biomass increases resulting in higher CLA concentrations and lower water clarity. This issue is one that has been addressed as part of the Clean Water Partnership on the lake (Square Lake 2001).

As was mentioned in the previous Council lake reports, the data for Square Lake, shows that the above mentioned relationships are not exclusively dependent on each other. While the graphs show a correlation between CLA and Secchi transparency (clarity increases as CLA decreases and vice versa), TP seemed independent of the other two. An increase or decrease in TP does not automatically result in the same reaction in CLA concentration, which means that phosphorus is not the limiting factor in Square Lake's algal abundance. In fact, earlier Council studies have noted that the lake has lower CLA concentrations than would be expected based on its nutrient levels (Osgood 1981). The reason was discussed in a 1980 Council report and a more recent Clean Water Partnership report on Square Lake which both state that CLA is limited by the presence of large zooplankton (*Daphnia pulicaria*) which are

herbivores that graze on algae and keep the lake's CLA concentrations in check. Therefore, the lake's excellent clarity of Square Lake is due to the presence of *Daphnia* rather than limited by nutrients.

More detailed discussions on the lake, its water chemistry, biological make-up, and hydrologic and nutrient influence the lake's watershed has on the lake can be found in the recent diagnostic-feasibility study completed on the lake as part of a Clean Water Partnership (Square Lake 2001). The complete report highlights the concern of a degrading water clarity trend, the importance of the lake's biological make-up on its overall water quality, the and influence the lake's surface and groundwater watersheds have on the lake's phosphorous load. The Clean Water Partnership report also includes proposed watershed, shoreland, and in-lake projects designed to address issues affecting the lake's quality. An addtional resource is an October 2002 report summarizing the lakes recent zooplanton population from monitoring conducted from August 2001-July 2002 (Washington Coservation District 2002)

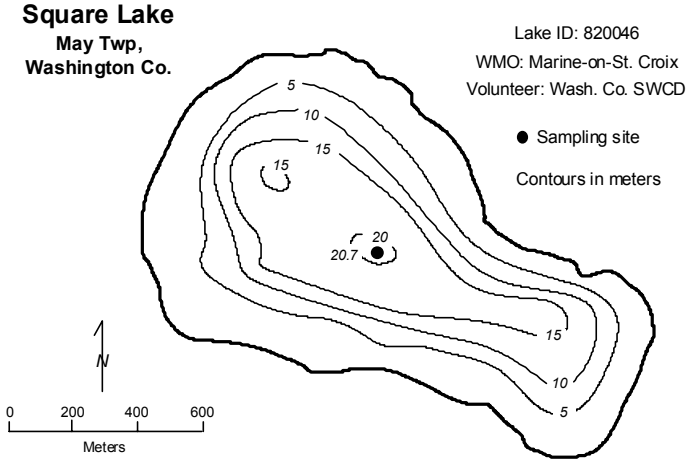
On each monitoring date, volunteers ranked their opinions of physical and recreational conditions of the lake on a 1-to-5 scale, which are graphed on the lake information sheet. The summertime mean recorded physical condition was 1.2 (between 1- "crystal clear" and 2- "some algae present"). The mean suitability for recreation ranking was 1.1 (roughly equal to 1- "beautiful").

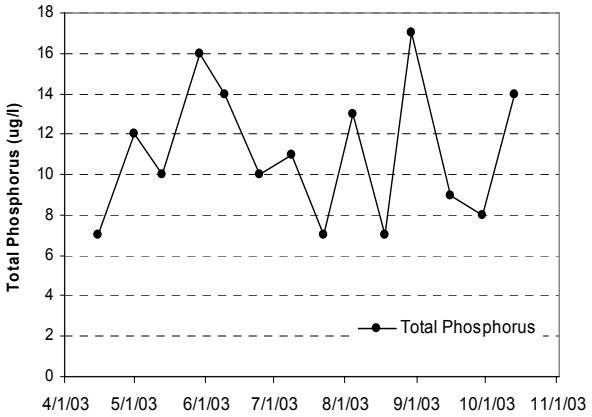
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

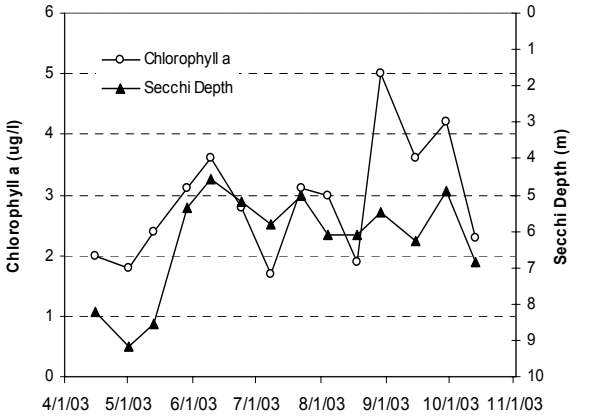
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

## Square Lake

**May Twp,**
**Washington Co.**

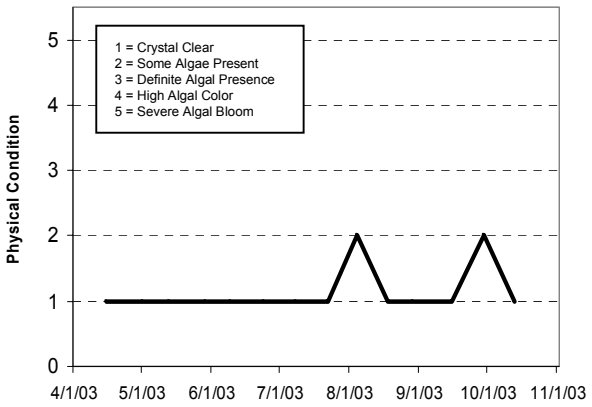



### 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 9.8 | | 9.71 | | 2 | 7 | | 8.23 | 1 | 1 |
| 05/01/03 | 13.5 | | 0.94 | | 1.8 | 12 | | 9.15 | 1 | 1 |
| 05/13/03 | 14.2 | | 8.36 | | 2.4 | 10 | | 8.54 | 1 | 1 |
| 05/29/03 | 18.5 | | 5.92 | | 3.1 | 16 | | 5.34 | 1 | 1 |
| 06/09/03 | 19.3 | | 7.78 | | 3.6 | 14 | | 4.57 | 1 | 1 |
| 06/24/03 | 23.8 | | 8.5 | | 2.8 | 10 | | 5.185 | 1 | 1 |
| 07/08/03 | 26.1 | | 9.15 | | 1.7 | 11 | | 5.79 | 1 | 1 |
| 07/22/03 | 24.5 | | 4.7 | | 3.1 | 7 | | 5.033 | 1 | 1 |
| 08/04/03 | 24.9 | | 8.27 | | 3 | 13 | | 6.1 | 2 | 2 |
| 08/18/03 | 26.7 | | 10.4 | | 1.9 | 7 | | 6.096 | 1 | 1 |
| 08/29/03 | 24.9 | | 6.43 | | 5 | 17 | | 5.486 | 1 | 1 |
| 09/15/03 | 21.6 | | 7.24 | | 3.6 | 9 | | 6.248 | 1 | 1 |
| 09/29/03 | 15.1 | | 7.63 | | 4.2 | 8 | | 4.877 | 2 | 1 |
| 10/13/03 | 14.4 | | 9.78 | | 2.3 | 14 | | 6.858 | 1 | 1 |

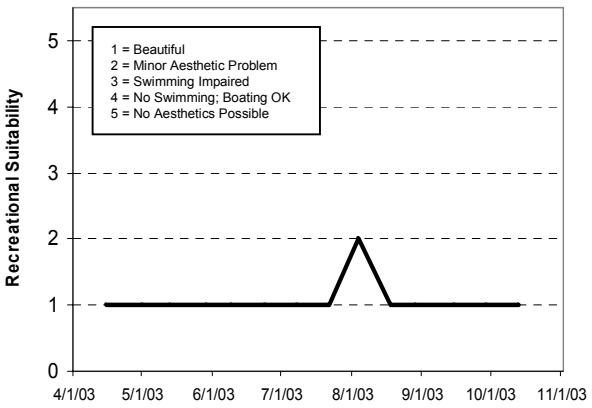



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | A | A | A | A | A | A | A | A | A | A | A |
| Chlorophyll a | | A | A | A | A | A | A | A | A | A | A | A |
| Secchi Depth | | A | A | A | A | A | A | A | A | A | A | A |
| **Overall** | | **A** | **A** | **A** | **A** | **A** | **A** | **A** | **A** | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Staples Lake (82-0028) *Carnelian - Marine Watershed District*

Staples Lake is a 24-acre lake located within May Township (Washington County). The maximum and mean depths of the lake are 4.3 m (roughly 14 feet) and 2.1 m (seven feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 165 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 127-acre watershed and surface area translates to a watershed-to-lake size ratio of 5.3:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff). There is no formal boat access point on the lake.

This was the fourth year that Staples Lake has been involved in CAMP. A search through the STORET nationwide water quality database for data on the lake was very limited. The only years in which data were found, other than the 2000-2003 CAMP data, was 1997-1999.

The lake's Secchi transparency was monitored seven times from late-April to early-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

Water samples to be analyzed for TP, TKN and chlorophyll were not collected for the lake in 2003. Because Secchi transparcy was the only data collected there are no nutrient of chlorophyll concentration means to compare to previous years. The lake's 2003 summertime (May through September) mean Secchi transparency was 2.1 m (minimum of 1.7 m and a maximum of 2.6 m). This translates to a grade of C for water clarity. The 2003 water clarity grade is slightly worse than those recorded in 1997-2002 (B).

As mentioned earlier, there is a limited amount of historic data available for Staple Lake other then the 2000-2003 CAMP data. Therefore it is not possible to determine any long-term trends. In the short-term however, the lake seems well represented by an overall grade of B. To better understand the lake's water quality and where it may be heading, more data are needed.

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 2.2 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 2.6 for recreational suitability (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

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.

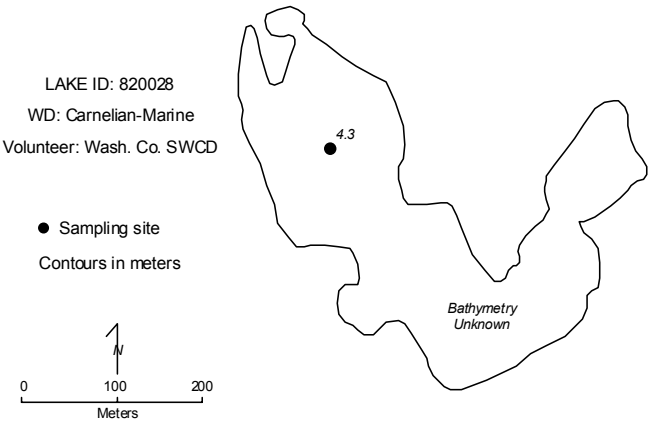
# Staples Lake

**May Twp., Washington Co.**

LAKE ID: 820028

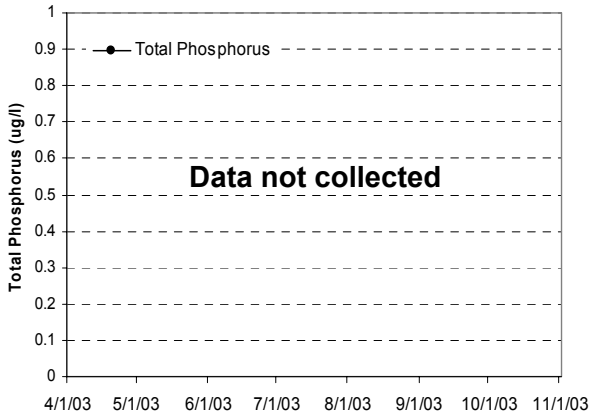
WD: Carnelian-Marine

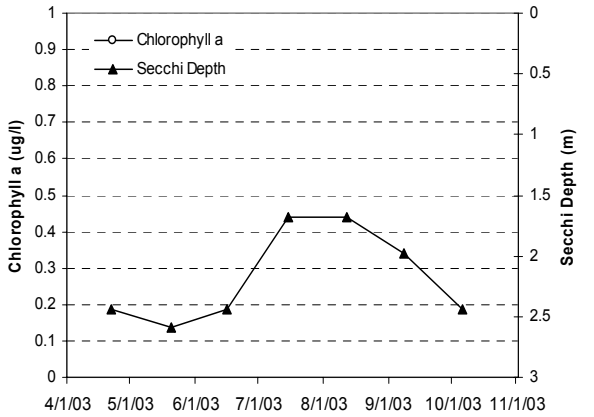
Volunteer: Wash. Co. SWCD




● Sampling site

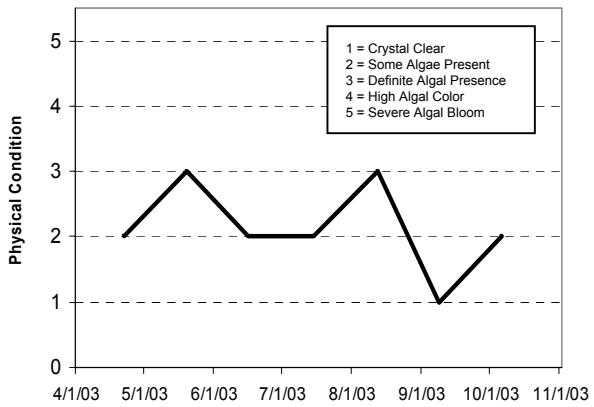
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 10.9 | | 5.77 | | | | | 2.44 | 2 | 2 |
| 05/20/03 | 17.5 | | 4.6 | | | | | 2.593 | 3 | 3 |
| 06/16/03 | 24.2 | | 6.33 | | | | | 2.44 | 2 | 3 |
| 07/15/03 | 22.8 | | 4.73 | | | | | 1.678 | 2 | 2 |
| 08/12/03 | 25.9 | | 4.4 | | | | | 1.678 | 3 | 3 |
| 09/08/03 | 23.7 | | 4.63 | | | | | 1.981 | 1 | 2 |
| 10/06/03 | 11.2 | | 11.2 | | | | | 2.44 | 2 | 2 |

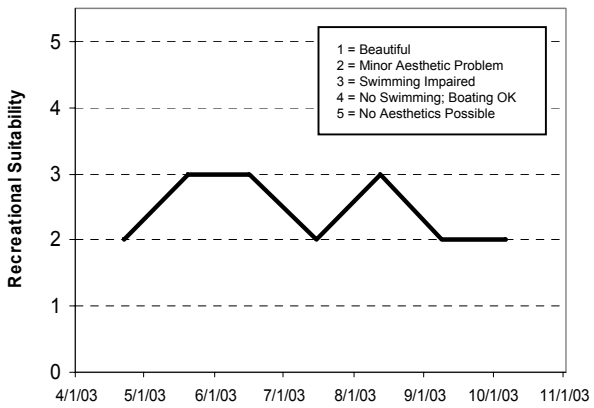



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | B | A | A | C | B | | |
| Chlorophyll a | | | | | | C | B | B | B | B | | |
| Secchi Depth | | | | | | B | B | B | B | B | B | C |
| **Overall** | | | | | | **B** | **B** | **B** | **B** | **B** | | |

Source: Metropolitan Council and STORET data



## Success Lake (27-0634) *Shingle Creek Watershed Management Commission*

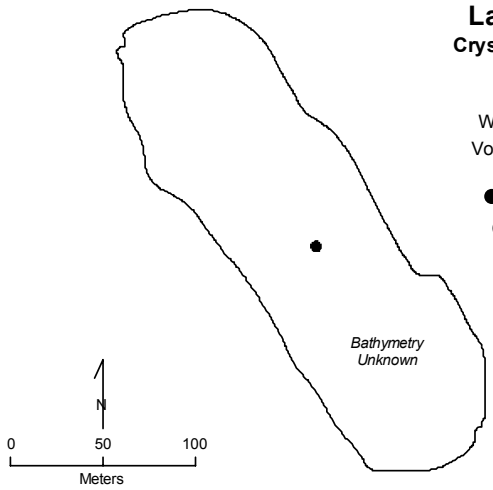
Two thousand and three marks the second year of CAMP monitoring in Success Lake, located in the City of Brooklyn Park (Hennepin County). The lake was also monitored in 1996. The lake was monitored 11 times between mid-May and mid-September, 2004. On each monitoring event, the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as the lake's perceived physical condition and recreational suitability Results are presented on graphs and data tables on the following page.

The overall 2003 lake quality grade of C was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 43.0 µg/l (minimum of 20.0 µg/l, maximum of 86.0 µg/l) corresponds to a lake water quality grade of C, while the mean Secchi transparency of 1.0 m (minimum of 0.6 m, maximum of 1.0 m) translates to a grade of D. The lake's mean CLA concentration of 14.9 µg/l (minimum and maximum of 4.2 and 44.0 µg/l) resulted in an B grade. The mean TKN concentration over the same time period was 0.61 mg/l (minimum of 0.40 mg/l and maximum of 0.96 mg/l).

Because 1996 and 2003 are the only years of available data, no long- or short-term trends can be determined. To better understand the quality of the lake and what direction it may be heading, more years of data collection are needed.

Throughout the monitoring period, the volunteers ranked the perceived physical condition of the lake on a 1-to-5 scale. The mean perceived physical condition of the north basin of Success Lake was 3.1 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability was 2.8 (between 2- "minor aesthetics problem" and 3- "swimming impaired").

If the reader is 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.

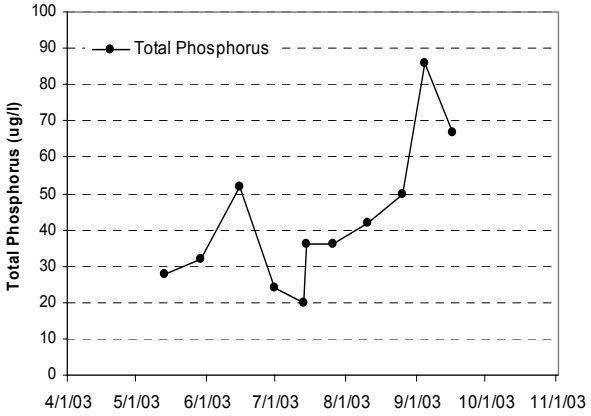


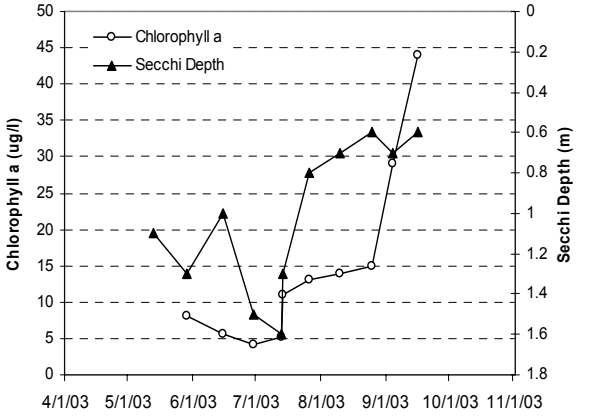

# Lake Success

**Crystal, Hennepin Co.**

Lake ID: 270634
WMO: Shingle Creek
Volunteer: Stuart Ruud

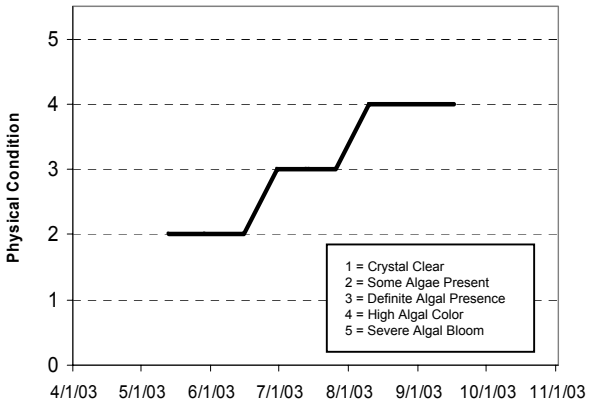
● Sampling site
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/13/03 | 20 | | | | | 28 | | 1.1 | 2 | 2 |
| 05/29/03 | 21 | | | | 8 | 32 | | 1.3 | 2 | 2 |
| 06/15/03 | 23 | | | | 5.7 | 52 | | 1 | 2 | 2 |
| 06/30/03 | 26 | | | | 4.2 | 24 | | 1.5 | 3 | 2 |
| 07/13/03 | 25 | | | | 5.2 | 20 | | 1.6 | 3 | 3 |
| 07/14/03 | 27 | | | | 11 | 36 | | 1.3 | 3 | 3 |
| 07/26/03 | 26 | | | | 13 | 36 | | 0.8 | 3 | 3 |
| 08/10/03 | 27 | | | | 14 | 42 | | 0.7 | 4 | 3 |
| 08/25/03 | 26 | | | | 15 | 50 | | 0.6 | 4 | 3 |
| 09/04/03 | 25 | | | | 29 | 86 | | 0.7 | 4 | 4 |
| 09/16/03 | 22 | | | | 44 | 67 | | 0.6 | 4 | 4 |

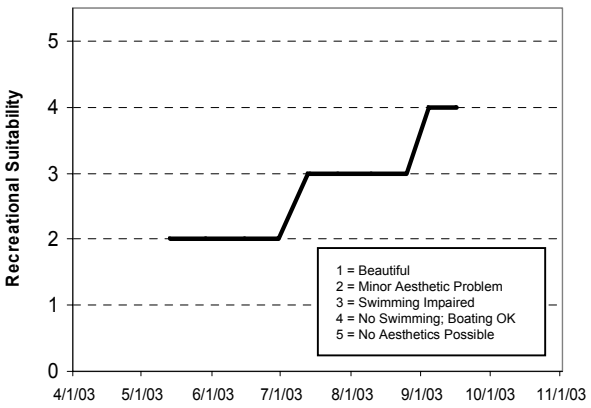



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | B | | | | | | | C |
| Chlorophyll a | | | | | A | | | | | | | B |
| Secchi Depth | | | | | B | | | | | | | D |
| **Overall** | | | | | **B** | | | | | | | **C** |

Source: Metropolitan Council and STORET data



## Sullivan Lake (2-0080) *Six Cities Watershed District*

Sullivan Lake is a 19-acre lake located within the City of Columbia Heights (Anoka County) which receives inflow from four inlets. The maximum and mean depths of the lake are 2.1 and 1.0 m (seven and three feet), respectively, and the approximate volume of the lake is 57 ac-ft. Because the maximum depth is only 2.1 m, the entire lake area is considered littoral zone (the area of aquatic vegetation dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column).

The majority of the land within the 480-acre watershed is urban/developed. The lake and watershed areas translate to a large watershed-to-lake area ratio of 25:1. The larger the ratio, the greater the potential stress on the lake's quality from surface runoff.

Sullivan Lake, which was involved in CAMP from 1993-1995, and 1997-2002, was monitored 12 times between mid-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The 2003 overall lake quality grade for Sullivan Lake, calculated from the individual parameter grades, is D, similer to those recorded in 1993-1995 and 1997-2001 and better than the F of 2002. The 2003 summertime (May - September) mean TP concentration of 143.4 µg/l (minimum of 63.0 µg/l, maximum of 269.0 µg/l) corresponded to a lake water quality grade of D, as did the CLA mean of 70.3 µg/l (minimum and maximum of 12.0 and 150.0 µg/l). The lake's Secchi transparency mean of 0.5 m (minimum of 0.2 m and maximum of 1.0 m) translates to a grade of F. The lake's mean TKN concentration was 2.03 mg/l (minimum of 0.93 mg/l, maximum of 3.70 mg/l).

No "statistically significant" long-term trends can be determined from the lake's water quality database overall (including TP, CLA, and Secchi data), in the short-term, the lake seems to be well represented by an overall water quality grade of D. A recent trend analysis (by the MPCA) on just the lake's Secchi transparency data, however, revealed a statistically significant decrease in recent water clarity.

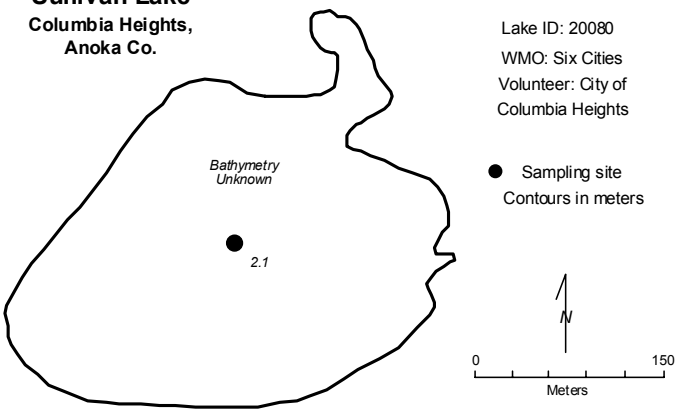
The lake's best water quality, was probably that monitored in 1994 and 1997. To better understand the lake's long-term water quality and what direction it may be heading, more years of data collection are needed.

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 were: 3.4 for physical condition (between 3- "definite algae present" and 4- "high algal color"), and 4.0 for recreational suitability (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 Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

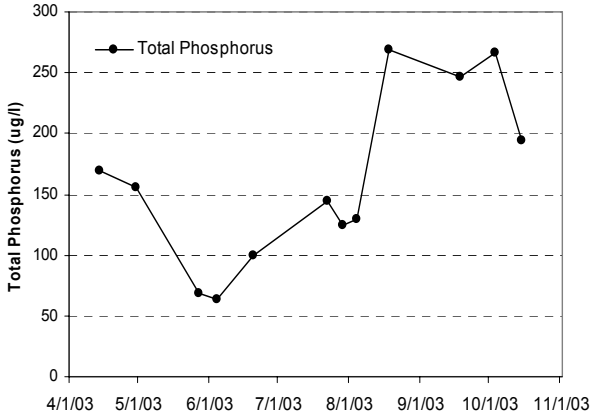
## Sullivan Lake

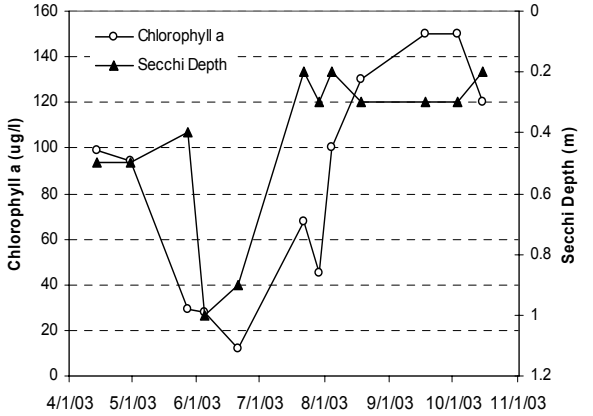
**Columbia Heights, Anoka Co.**




Lake ID: 20080
WMO: Six Cities
Volunteer: City of Columbia Heights

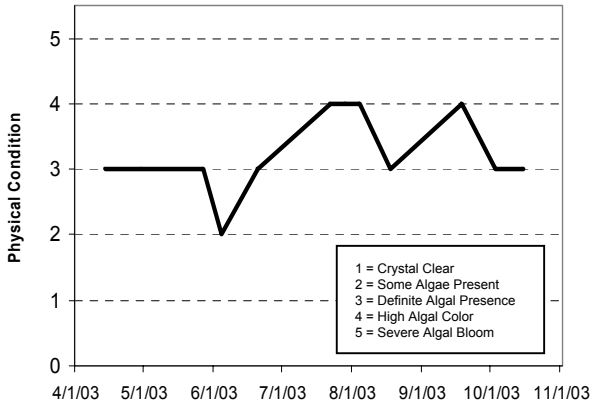
Sampling site
Contours in meters




### 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/14/03 | 15 | | | | 99 | 169 | | 0.5 | 3 | 4 |
| 04/30/03 | 15 | | | | 94 | 155 | | 0.5 | 3 | 4 |
| 05/27/03 | 18 | | | | 29 | 69 | | 0.4 | 3 | 4 |
| 06/04/03 | 22 | | | | 28 | 63 | | 1 | 2 | 4 |
| 06/20/03 | 24 | | | | 12 | 100 | | 0.9 | 3 | 4 |
| 07/22/03 | 25 | | | | 68 | 144 | | 0.2 | 4 | 4 |
| 07/29/03 | 25.8 | | | | 45 | 125 | | 0.3 | 4 | 4 |
| 08/04/03 | 26.8 | | | | 100 | 130 | | 0.2 | 4 | 4 |
| 08/18/03 | 25 | | | | 130 | 269 | | 0.3 | 3 | 4 |
| 09/18/03 | 20 | | | | 150 | 247 | | 0.3 | 4 | 4 |
| 10/03/03 | 12 | | | | 150 | 267 | | 0.3 | 3 | 4 |
| 10/15/03 | 12 | | | | 120 | 194 | | 0.2 | 3 | 4 |

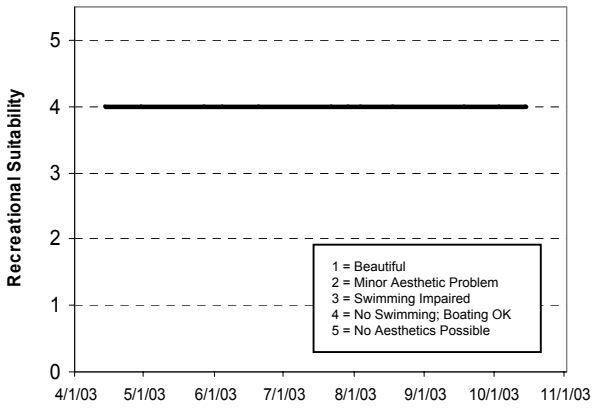



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | D | D | D | | D | D | D | D | D | D | D |
| Chlorophyll a | | C | C | C | | C | D | C | D | D | F | D |
| Secchi Depth | | D | F | D | | D | F | D | D | D | F | F |
| **Overall** | | **D** | **D** | **D** | | **D** | **D** | **D** | **D** | **D** | **F** | **D** |

Source: Metropolitan Council and STORET data



## Sunnybrook Lake (82-0133) *Valley Branch Watershed District*

Sunnybrook Lake is a 16-acre lake located within Grant Township (Washington County). The maximum and mean depths of the lake are 6.1 and 2.0 m (20.0 and 6.5 feet), respectively, and the approximate volume of the lake is 104 ac-ft. The majority of the lake's area is considered littoral zone (the area of aquatic vegetation dominance). The lake has a 666-acre immediate watershed, which translates to a watershed-to-lake area ratio of 42:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff).

This was the fourth year in which Sunnybrook Lake has been involved in CAMP (1999 and 2001-2002 being the others). The lake was monitored 12 times between early-May and mid-October, 2003. Other than for the 1999 and 2001-2002 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty. Thus, 1999 and 2001-2003 is the only year of available data.

During each monitoring event, 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 on graphs and data tables on the following page.

The lake's overall 2003 lake quality grade of B (similar to that recorded in 2001 and 2002), was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 32.1 µg/l (minimum of 16.0 µg/l, maximum of 59.0 µg/l) corresponds to a lake water quality grade of C, as did the mean Secchi transparency of 2.1 m (minimum of 1.2 m, maximum of 3.1 m). The lake's mean CLA concentration of 7.4 µg/l (minimum of 1.9 µg/l and maximum of 23.0 µg/l) resulted in a grade of A. The mean TKN concentration over the same time period was 0.82 mg/l (minimum of 0.41 mg/l and maximum of 1.50 mg/l).

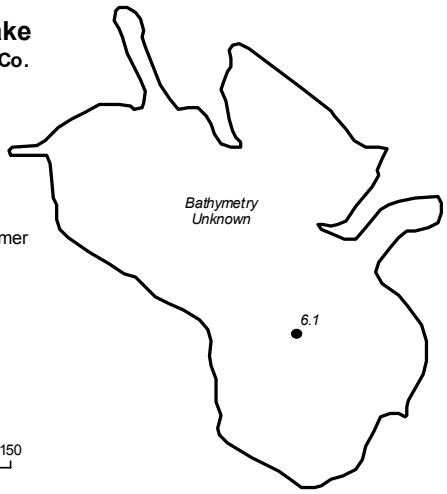
As mentioned earlier, there are no water quality data available for Sunnybrook Lake other than the 1999 and 2001-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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 1.9 for recreational suitability (between 1- "beautiful" and 2- "minor aesthetic problem").

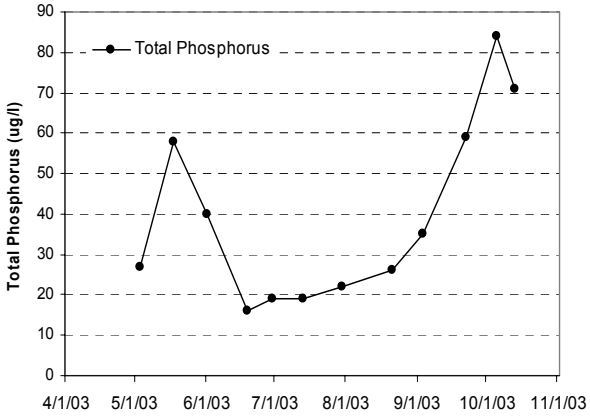
If you notice any errors in the lake data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

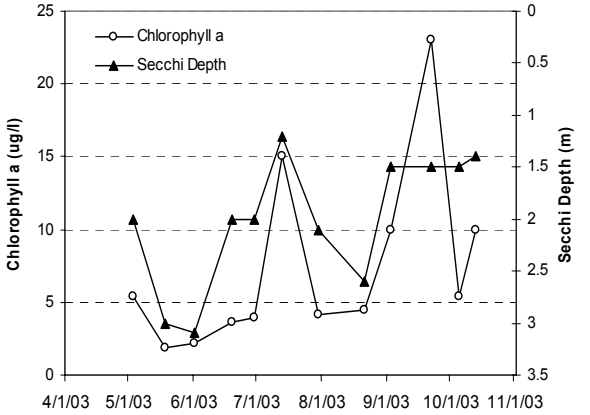
## Sunnybrook Lake
**Grant, Washington Co.**

Lake ID: 820133
WD: Valley Branch
Volunteer: Candice Kraemer



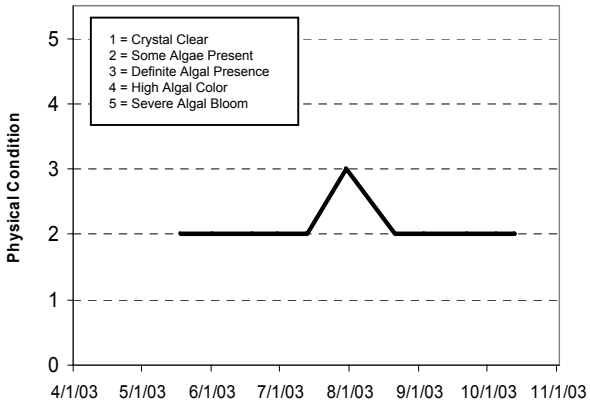

- Sampling site
- Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/03/03 | 14 | | | | 5.4 | 27 | | 2 | | |
| 05/18/03 | 19 | | | | 1.9 | 58 | | 3 | 2 | 1 |
| 06/01/03 | 21.8 | | | | 2.2 | 40 | | 3.1 | 2 | |
| 06/19/03 | 26.8 | | | | 3.6 | 16 | | 2 | 2 | 1 |
| 06/30/03 | 25.2 | | | | 3.9 | 19 | | 2 | 2 | 3 |
| 07/13/03 | 25.8 | | | | 15 | 19 | | 1.2 | 2 | 1 |
| 07/30/03 | 27.4 | | | | 4.2 | 22 | | 2.1 | 3 | 2 |
| 08/21/03 | 26.9 | | | | 4.5 | 26 | | 2.6 | 2 | 2 |
| 09/03/03 | 21.8 | | | | 10 | 35 | | 1.5 | 2 | 2 |
| 09/22/03 | 17.4 | | | | 23 | 59 | | 1.5 | 2 | 3 |
| 10/05/03 | 16.8 | | | | 5.4 | 84 | | 1.5 | 2 | 2 |
| 10/13/03 | 14.6 | | | | 10 | 71 | | 1.4 | 2 | 2 |

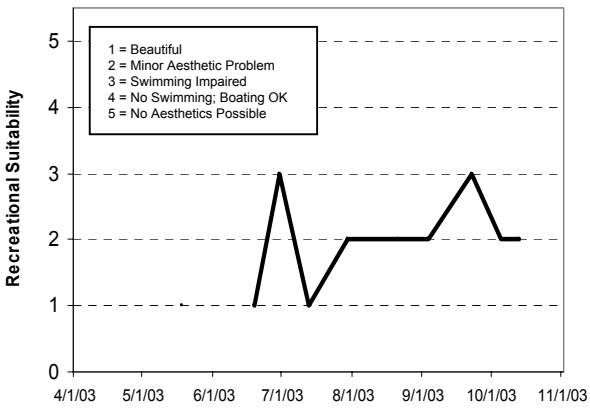



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | C | | B | B | C |
| Chlorophyll a | | | | | | | | B | | A | A | A |
| Secchi Depth | | | | | | | | C | | B | B | C |
| **Overall** | | | | | | | | **C** | | **B** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Sunset Lake (82-0153) *Rice Creek Watershed District*

Sunset Lake, with a surface area of about 124 acres (2.3 miles in circumference), is located in the southern portion of the City of Hugo (Washington County). The lake is considered a "Priority Lake" by the Metropolitan Council due to its multi-recreational uses. Its deepest point is approximately 5.2 m (17 feet).

Sunset Lake has been involved in CAMP since 1993. The lake was monitored 20 times from late-April to mid-October, 2003. The data and resulting graphs showing seasonal variability in TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake information sheet.

The 2003 summertime (May through September) mean concentrations for Sunset Lake were as follows: TP= 18.6 µg/l (minimum of 12.0 µg/l, maximum of 28.0 µg/l); CLA= 3.6 µg/l (minimum of 1.0 µg/l, maximum of 7.8 µg/l); Secchi transparency= 3.7 m (minimum of 2.5 m, maximum of 5.0 m); and TKN= 0.51 mg/l (minimum and maximum of 0.35 and 0.66 mg/l), respectively. The 2003 summer means were nearly identical to those recorded in 2002.

The 2003 summertime means resulted in a TP grade of A, CLA grade of A, and Secchi transparency grade of A. The lake's overall water quality grade for 2003 was A (falling within the top 10 percentile of lakes in the area).

When comparing the 2003 overall grade to those of previously monitored years it becomes apparent that the lake's 2001-2003 water quality (A) was the best monitored to date (compared to B's in 1994 and 2000, and C's in 1993 and 1995-1999).

Besides the lake's CAMP data, Secchi transparencies had been measured throughout the mid- and late-1980's as part of the MPCA's volunteer program. The lake's historic individual parameter and overall water quality grades (shown on the following information sheet) indicate that the lake's water quality has fluctuated over the years. Because of the range in the lake's quality, a baseline quality for the lake as well as an overall water quality trend is difficult to determine. With this in mind, however, a primitive interpretation of the data seems to show that the lake has maintained a C+/B grade average (with normal fluctuations). Recently, however, the lake's quality has shown improvement. In fact, a recent trend analysis on the lake's Secchi transparency data by the MPCA, revealed a statistically significant improvement in recent water clarity.

The average user perception rankings on a 1-to-5 scale were 2.0 for physical condition (2- "some algae present"), and 1.8 for recreational suitability (between 1- " beautiful" and 2- "minor aesthetic problem").

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/.

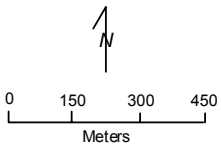
If you know of errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

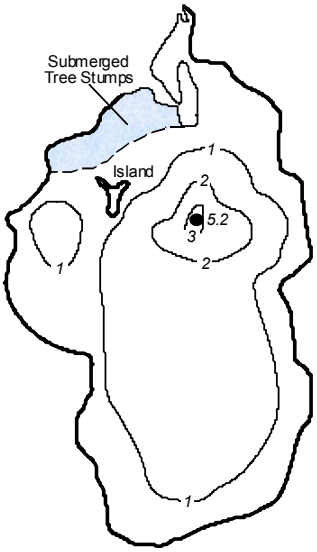
# Sunset Lake

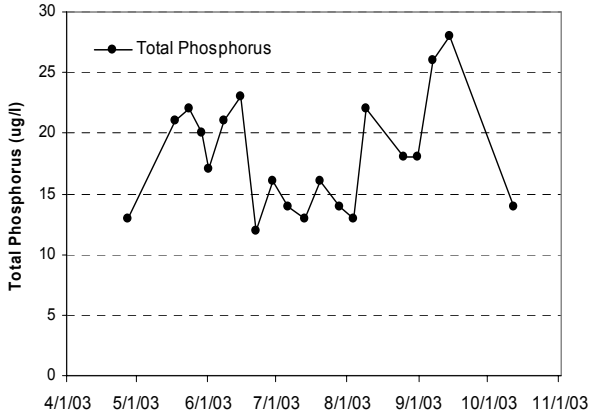
**Hugo, Washington Co.**

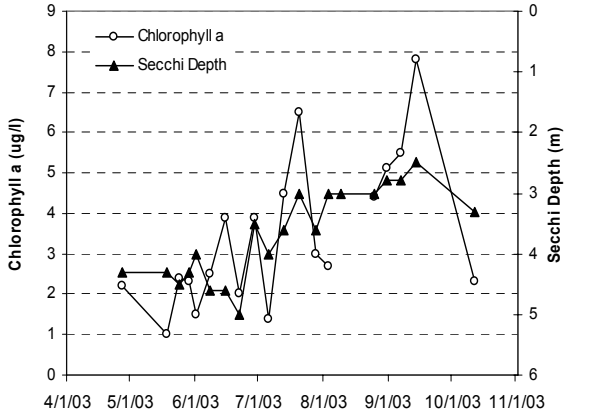
Lake ID: 820153
WD: Rice Creek
Volunteers:
Diane and Bob Coderre

● Sampling site
Contours in meters



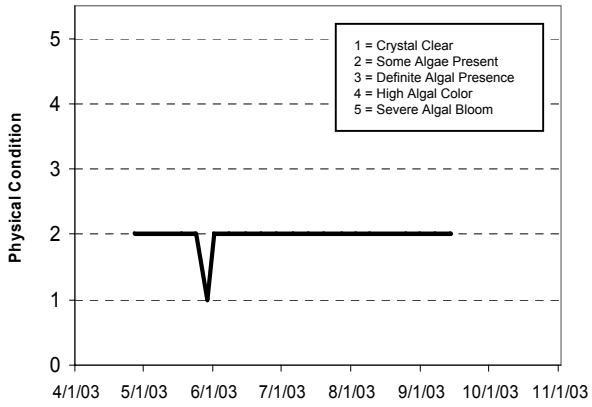




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/27/03 | 16 | | | | 2.2 | 13 | | 4.3 | 2 | 1 |
| 05/18/03 | 20 | | | | 1 | 21 | | 4.3 | 2 | 1 |
| 05/24/03 | 20 | | | | 2.4 | 22 | | 4.5 | 2 | 1 |
| 05/29/03 | 21 | | | | 2.3 | 20 | | 4.3 | 1 | 1 |
| 06/01/03 | 21 | | | | 1.5 | 17 | | 4 | 2 | 1 |
| 06/08/03 | 20 | | | | 2.5 | 21 | | 4.6 | 2 | 2 |
| 06/15/03 | 21 | | | | 3.9 | 23 | | 4.6 | 2 | 2 |
| 06/22/03 | 25 | | | | 2 | 12 | | 5 | 2 | 2 |
| 06/29/03 | 25 | | | | 3.9 | 16 | | 3.5 | 2 | 2 |
| 07/06/03 | 38 | | | | 1.4 | 14 | | 4 | 2 | 2 |
| 07/13/03 | 26 | | | | 4.5 | 13 | | 3.6 | 2 | 2 |
| 07/20/03 | 26 | | | | 6.5 | 16 | | 3 | 2 | 2 |
| 07/28/03 | 27 | | | | 3 | 14 | | 3.6 | 2 | 2 |
| 08/03/03 | 26 | | | | 2.7 | 13 | | 3 | 2 | 2 |
| 08/09/03 | 28 | | | | | 22 | | 3 | 2 | 2 |
| 08/25/03 | 27 | | | | 4.4 | 18 | | 3 | 2 | 2 |
| 08/31/03 | 24 | | | | 5.1 | 18 | | 2.8 | 2 | 2 |
| 09/07/03 | 26 | | | | 5.5 | 26 | | 2.8 | 2 | 2 |
| 09/14/03 | 21 | | | | 7.8 | 28 | | 2.5 | 2 | 2 |
| 10/12/03 | 16 | | | | 2.3 | 14 | | 3.3 | | |

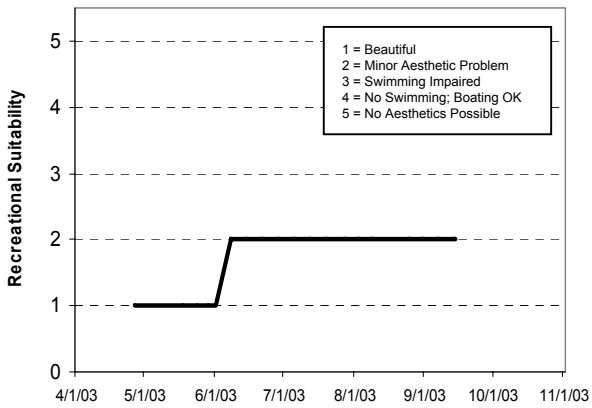



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | B | C | C | C | C | C | B | A | A | A |
| Chlorophyll a | | B | B | B | C | C | B | B | A | A | A | A |
| Secchi Depth | | C | B | C | B | C | C | C | B | A | A | A |
| **Overall** | | **C** | **B** | **C** | **C** | **C** | **C** | **C** | **B** | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



## Sunset Pond Lake (19-0364) *Black Dog Watershed Management Commission*

Sunset Pond, a 60-acre man-made lake (1.9 miles in circumference) located in the City of Burnsville (Dakota County), has been involved in CAMP since 1994 (with an omission in 1999). In 2002, the lake was monitored 10 times between mid-May and early-October.

Because of the shallow depth of the lake ("normal" maximum depth of 3.7 m [about 12 feet]), the entire lake is 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). Because the lake was created to detain stromwater, it collects drainage from a portion of the city of Burnsville and Savage's stormwater conveyance systems, including outflow from Crystal and Earley lakes, it can experience extreme bounce in its water level during wet conditions.

During each sampling event, the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as perceived physical condition and recreational suitability. The mean summertime (May through September) surface TP concentration for the lake was 71.5 µg/l (minimum of 52.0 µg/l, maximum of 102.0 µg/l). The mean CLA and Secchi transparency readings were 10.5 µg/l (minimum of 4.0 µg/l, maximum of 27.0 µg/l) and 1.9 m (minimum of 1.7 m, maximum of 2.0 m), respectively. The lake's mean surface TKN concentration was 0.75 mg/l (minimum of 0.52 mg/l and maximum of 1.20 mg/l). The lake quality grades associated with the 2003 summertime means are: TP= D; CLA= B; and Secchi= C. The 2003 overall water quality grade for the lake was C.

While the lake's 2003 overall lake grade is identical to those recorded in 1995-1997, it is worse than B's recorded more recently (1998, and 2000-2002). In fact, a review of the lake's past and present individual parameter means reveal that 2002 represents the lake's best-monitored water quality year to date. Hopefully 2004 monitoring will reveal a return to the lake's 1998-2002 water quality levels.

No statistically significant long-term trends can be determined from the lake's water quality database, in the short-term however, the lake seems to be well represent by an overall grade of C+/B. To better understand the long-term quality of the lake and what direction it may be heading, more years of sampling data are needed.

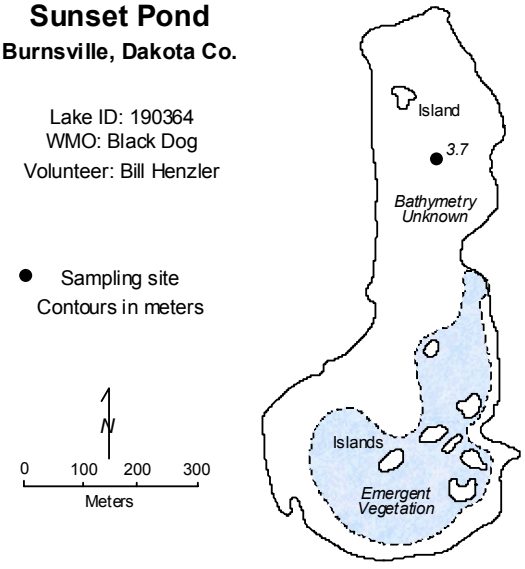
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The mean physical condition ranking was 4.8 (between 4- "high algal color" and 5- "severe bloom"), and the mean recreational suitability ranking 4.0 (4- "no swimming - boating ok).

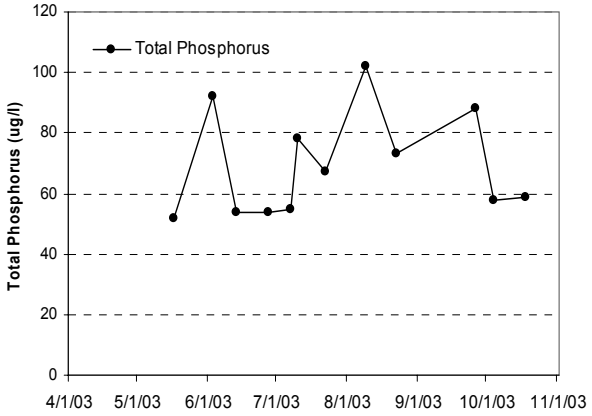
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

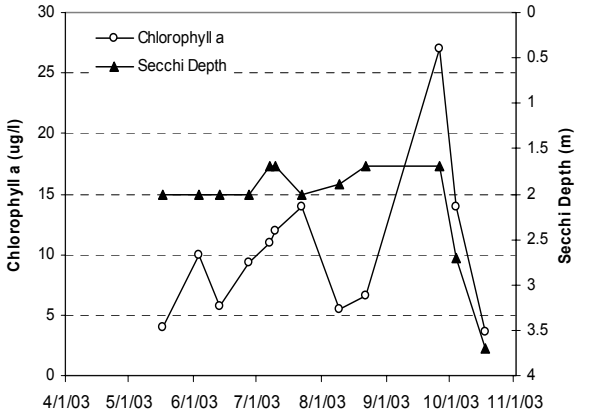
# Sunset Pond

**Burnsville, Dakota Co.**

Lake ID: 190364
WMO: Black Dog
Volunteer: Bill Henzler

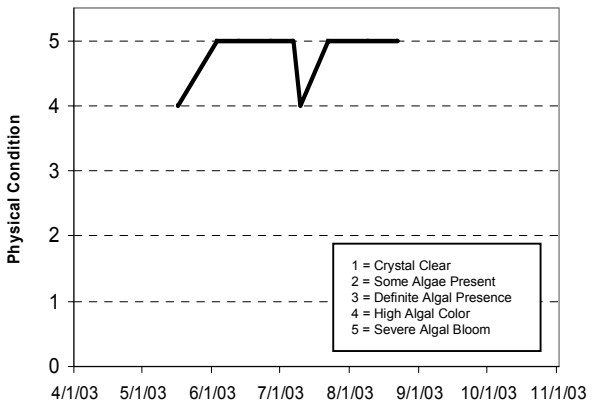



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/17/03 | 21 | | | | 4 | 52 | | 2 | 4 | |
| 06/03/03 | 23 | | | | 10 | 92 | | 2 | 5 | |
| 06/13/03 | 25 | | | | 5.7 | 54 | | 2 | 5 | |
| 06/27/03 | 23 | | | | 9.3 | 54 | | 2 | 5 | |
| 07/07/03 | 25 | | | | 11 | 55 | | 1.7 | 5 | |
| 07/10/03 | 24 | | | | 12 | 78 | | 1.7 | 4 | 4 |
| 07/22/03 | 23 | | | | 14 | 67 | | 2 | 5 | |
| 08/09/03 | 29.1 | | | | 5.5 | 102 | | 1.9 | 5 | |
| 08/22/03 | 28 | | | | 6.6 | 73 | | 1.7 | 5 | |
| 09/26/03 | 14 | | | | 27 | 88 | | 1.7 | | |
| 10/04/03 | 12 | | | | 14 | 58 | | 2.7 | | |
| 10/18/03 | 13 | | | | 3.6 | 59 | | 3.7 | 1 | |

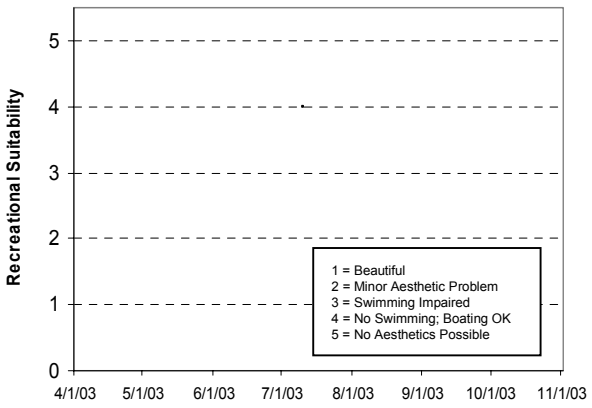



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | C | C | C | C | | C | C | C | D |
| Chlorophyll a | | | A | B | B | B | A | | A | A | A | B |
| Secchi Depth | | | C | C | C | C | C | | C | B | B | C |
| **Overall** | | | **B** | **C** | **C** | **C** | **B** | | **B** | **B** | **B** | **C** |

Source: Metropolitan Council and STORET data



## Swede Lake (10-0095) *Carver County Environmental Services*

Swede Lake is a 376-acre lake located in Watertown Township (Carver County) with a maximum depth of approximately 4.0 m (13.1 feet). Because of the shallowness of the lake, its entire surface area is considered littoral (the shallow [0-15 foot depth] area dominated by aquatic vegetation).

The year 2003 marks the second year that Swede Lake has been involved in CAMP (2002 being the first). Additionally, Metropolitan Council staff has monitored the lake in 1996 and 2001. The 1996, and 2001-2002 data were the only water quality data found for the lake.

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. The lake was monitored 16 times between mid-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The summertime (May through September) means for the monitored variables in 2003 were: surface TP= 264.3 µg/l (minimum concentration of 56.0 µg/l and a maximum value of 524.0 µg/l); surface chlorophyll-a= 110.9 µg/l (minimum of 12.0 µg/l and maximum of 310.0 µg/l); Secchi transparency= 0.6 m (minimum of 0.3 m and a maximum of 1.5 m); and TKN= 2.26 mg/l (minimum of 1.10 mg/l and maximum of 4.20 mg/l). The lake's 2003 summer means translate to water quality grades of F for TP, F, for CLA, and F for Secchi transparency. These grades result in an overall water quality grade of F for Swede Lake in 2003. While the lake's 2003 overall grade is similar to that of 1996 (and worse than those of 2001-2002), a review of past and present parameter means, reveal that 2003 represented the lake's worst monitored water quality to date.

As mentioned earlier, there is a limited amount of water quality data available for Swede Lake. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, more data are needed.

Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 2.8 for physical condition (between 2- " some algae present" and 3- "definite algae present"), and 4.0 for recreational suitability (4- "no swimming - boating ok").

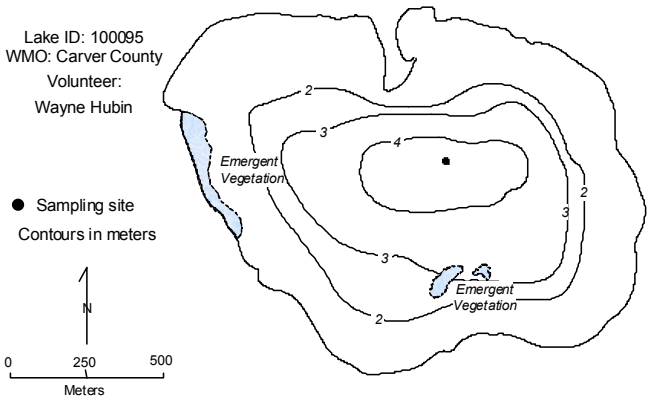
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

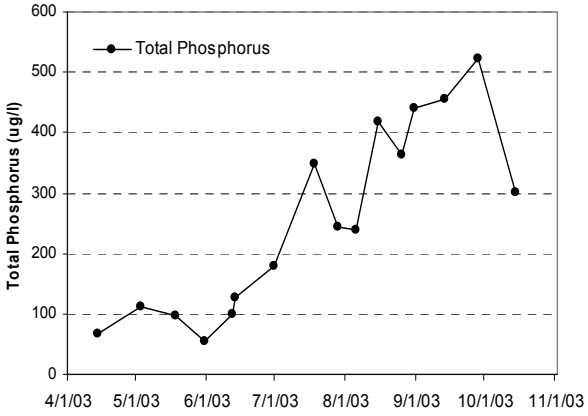
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

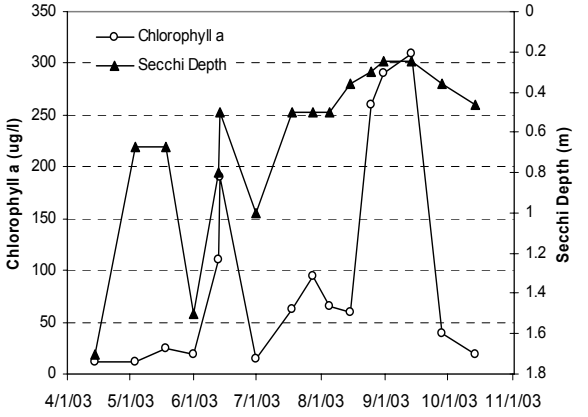
# Swede Lake

**Watertown Twp., Carver Co.**

Lake ID: 100095
WMO: Carver County
Volunteer:
Wayne Hubin

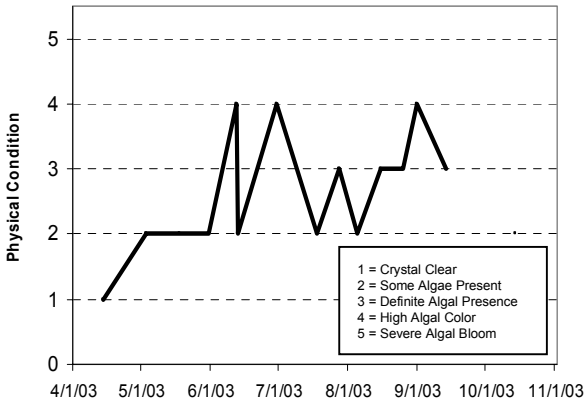



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 10.5 | | 11.49 | | 12 | 68 | | 1.7 | 1 | 3 |
| 05/03/03 | 15 | | | | 12 | 111 | | 0.67 | 2 | 4 |
| 05/18/03 | 15 | | | | 25 | 97 | | 0.67 | 2 | 4 |
| 05/31/03 | 15 | | | | 19 | 56 | | 1.5 | 2 | 4 |
| 06/12/03 | 22.1 | | | | 110 | 99 | | 0.8 | 4 | 4 |
| 06/13/03 | 25 | | | | 190 | 126 | | 0.5 | 2 | 4 |
| 06/30/03 | 27.8 | | | | 15 | 179 | | 1 | 4 | 4 |
| 07/18/03 | 24.4 | | | | 63 | 348 | | 0.5 | 2 | 4 |
| 07/28/03 | 24.4 | | | | 95 | 243 | | 0.5 | 3 | 4 |
| 08/05/03 | 24.4 | | | | 65 | 240 | | 0.5 | 2 | 4 |
| 08/15/03 | 25.6 | | | | 59 | 418 | | 0.36 | 3 | 4 |
| 08/25/03 | 26.7 | | | | 260 | 364 | | 0.3 | 3 | 4 |
| 08/31/03 | 23.9 | | | | 290 | 440 | | 0.25 | 4 | 4 |
| 09/13/03 | 19.4 | | | | 310 | 455 | | 0.25 | 3 | 4 |
| 09/28/03 | 11.7 | | | | 39 | 524 | | 0.36 | | |
| 10/14/03 | 11.1 | | | | 19 | 302 | | 0.46 | 2 | 4 |

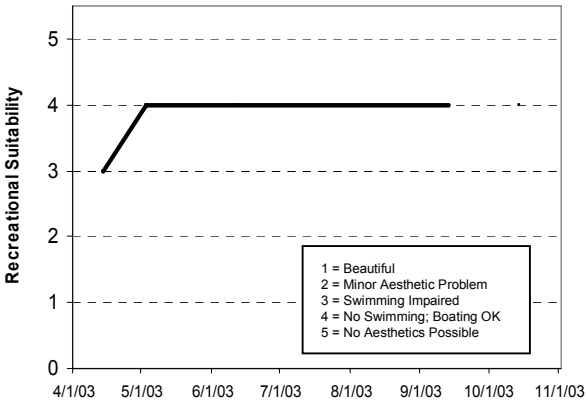



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | D | | | | | D | F | F |
| Chlorophyll a | | | | | F | | | | | D | C | F |
| Secchi Depth | | | | | F | | | | | D | C | F |
| **Overall** | | | | | **F** | | | | | **D** | **D** | **F** |

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 fourth 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 2003. The lake was monitored 13 times between mid-April and early-October, 2003. 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.

Summertime (May through September) means for the monitored variables were: surface TP= 35.4 µg/l (minimum concentration of 20.0 µg/l and a maximum value of 69.0 µg/l), surface chlorophyll-a= 14.5 µg/l (minimum of 3.5 µg/l and maximum of 34.0 µg/l), Secchi transparency= 1.5 m (minimum of 0.9 m and a maximum of 2.2 m), and TKN= 0.84 mg/l (minimum of 0.52 mg/l and maximum of 1.20 mg/l). Associated lake quality grades for the 2003 summertime means were TP= C, CLA= B, Secchi= C. While the overall 2003 quality grade of C (calculated from the TP, CLA, and Secchi grades) was identical to that of 2000-2003, the TP, CLA and Secchi means were slightly better in 2003 than those of 2000-2002 (this after it was reported that the 2002 means were better than those of 2000-2001). This seems to indicate that the lake, which experienced years of increased sedimentation from the HWY 100-construction project within its watershed, is "bouncing back" due to the further stabilization project area.

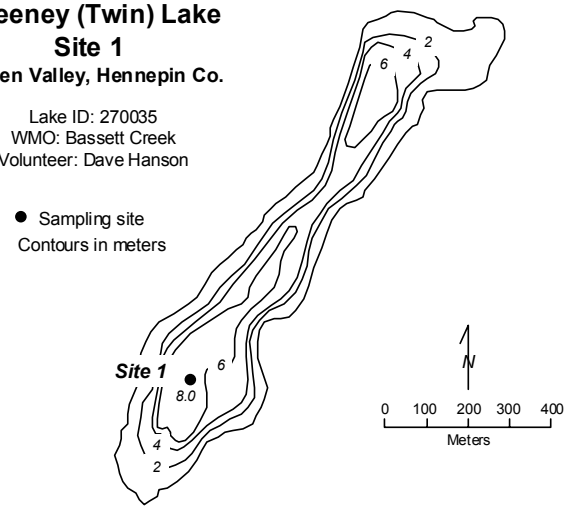
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. The 2003 mean perceived physical condition of the lake was 1.0 (1- "crystal clear"), while the mean recreational suitability was 1.0 (1- "beautiful").

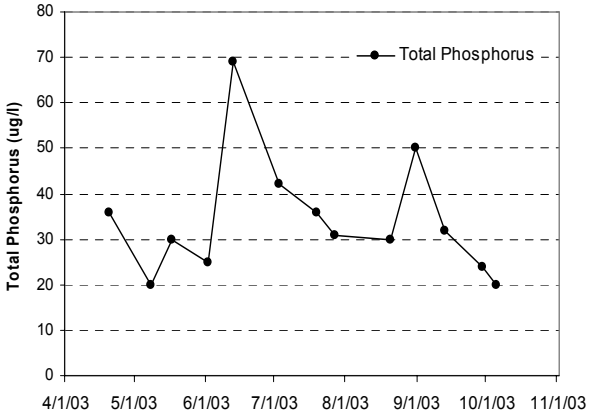
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

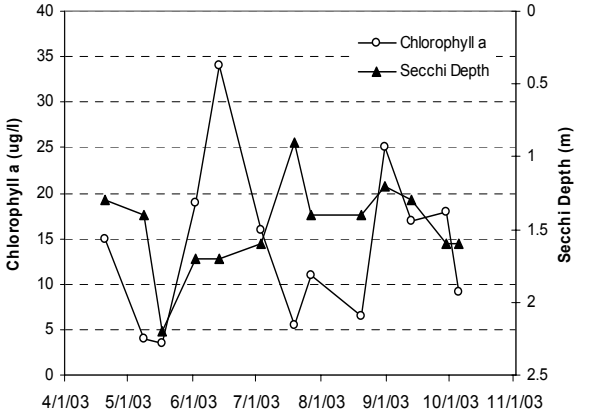
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

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

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

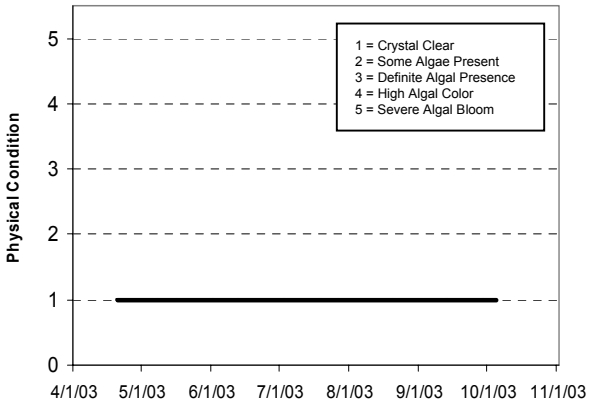



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/20/03 | 11 | | | | 15 | 36 | | 1.3 | 1 | 1 |
| 05/08/03 | 15 | | | | 4 | 20 | | 1.4 | 1 | 1 |
| 05/17/03 | 19 | | | | 3.5 | 30 | | 2.2 | 1 | 1 |
| 06/02/03 | 19.8 | | | | 19 | 25 | | 1.7 | 1 | 1 |
| 06/13/03 | 23 | | 11 | | 34 | 69 | | 1.7 | 1 | 1 |
| 07/03/03 | 25.5 | | 9.7 | | 16 | 42 | | 1.6 | 1 | 1 |
| 07/19/03 | 25 | | 8.6 | | 5.4 | 36 | | 0.9 | 1 | 1 |
| 07/27/03 | 27 | | 10.6 | | 11 | 31 | | 1.4 | 1 | 1 |
| 08/20/03 | 27.7 | | 7.9 | | 6.5 | 30 | | 1.4 | 1 | 1 |
| 08/31/03 | 25 | | 7.9 | | 25 | 50 | | 1.2 | 1 | 1 |
| 09/13/03 | 23 | | 9.75 | | 17 | 32 | | 1.3 | 1 | 1 |
| 09/29/03 | 15.3 | | 9 | | 18 | 24 | | 1.6 | 1 | 1 |
| 10/05/03 | 15.5 | | 10.6 | | 9.2 | 20 | | 1.6 | 1 | 1 |

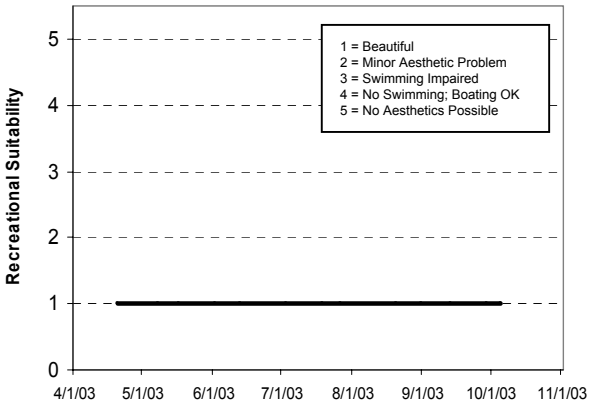



**Lake Water Quality Grades Based on Summertime Averages**

| Year | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | | | | |
| Chlorophyll a | | | | | | | | | | | | | | |
| Secchi Depth | | | | | | | | | | | | | | |
| **Overall** | | | | | | | | | | | | | | |

| Year | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 Site 1 | 2000 Site 2 | 2001 Site 1 | 2001 Site 2 | 2002 Site 1 | 2002 Site 2 | 2003 Site 1 | 2003 Site 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | C | C | C | C | C | | C | |
| Chlorophyll a | | | | | | | C | C | B | C | B | | B | |
| Secchi Depth | | | | | | | D | D | C | C | C | | C | |
| **Overall** | | | | | | | **C** | **C** | **C** | **C** | **C** | | **C** | |

Source: Metropolitan Council and STORET data



## Tamarack Lake (10-0010) *Minnehaha Creek Watershed Dirtrict*

This was the third year that Tamarack Lake has been involved in CAMP (the lake was initially enrolled in 2001). While the 24-acre lake has an unexpected maximum depth of roughly 20.0 m (66 feet), the majority of the lake surface area is considered littoral zone (the shallow 0-15 foot area dominated by aquatic plants. A search through the STORET nationwide water quality database for data on the lake provided limited data (just Secchi data in 1985 and Secchi and nutrient data for 2000-2002).

The lake was monitored 12 times from early-May to mid-October, 2003. Results are presented in both graphs and data tables on the lake's information sheet on the following page.

The summertime (May through September) means for the monitored variables were: surface TP= 37.1 µg/l (minimum concentration of 29.0 µg/l and a maximum value of 49.0 µg/l); surface chlorophyll-a= 12.8 µg/l (minimum of 2.5 µg/l and maximum of 27.0 µg/l); Secchi transparency= 1.7 m (minimum of 1.1 m and a maximum of 2.9 m); and TKN= 1.11 mg/l (minimum of 0.77 mg/l and maximum of 1.40 mg/l). The lake's summer means translate to water quality grades of C for TP, B for CLA, and C for Secchi transparency. These grades result in an overall water quality grade of C for Tamarack Lake in 2003 (identical to that of 2000 and worse than the overall grade of B recorded in 2001-2002).

As mentioned earlier, there are very limited amounts of water quality data available for Tamarack Lake. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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 2.7 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 1.0 for recreational suitability (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/.

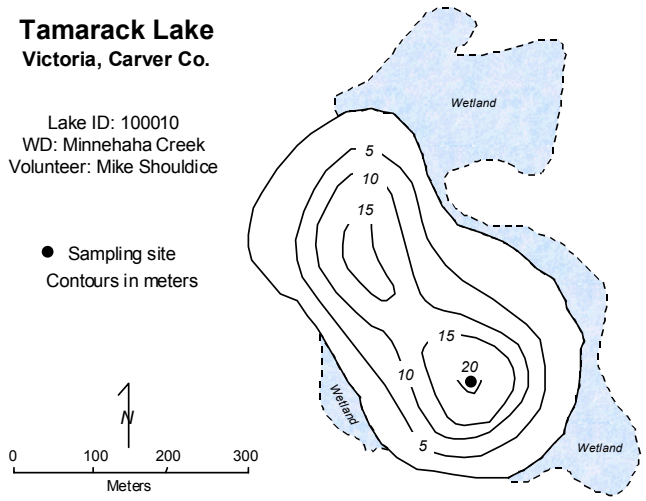
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

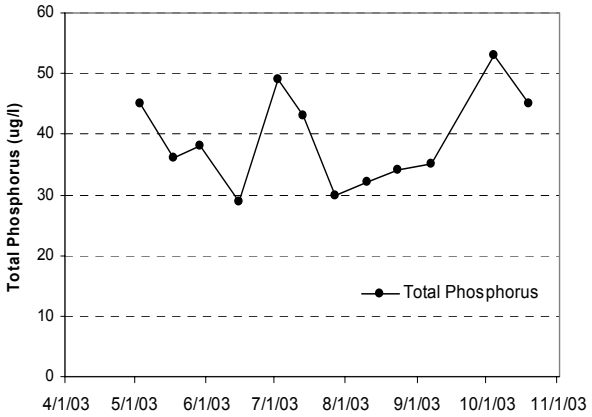
# Tamarack Lake

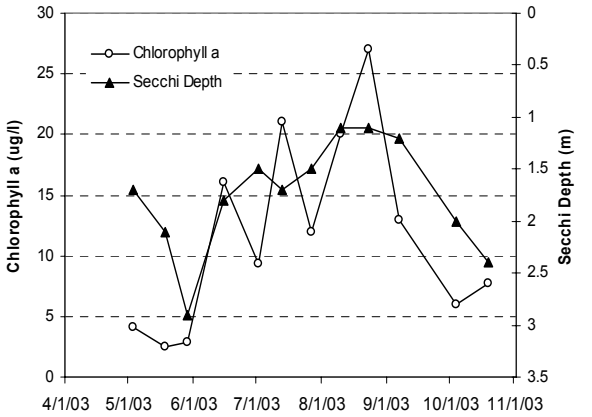
**Victoria, Carver Co.**

Lake ID: 100010
WD: Minnehaha Creek
Volunteer: Mike Shouldice

● Sampling site
Contours in meters

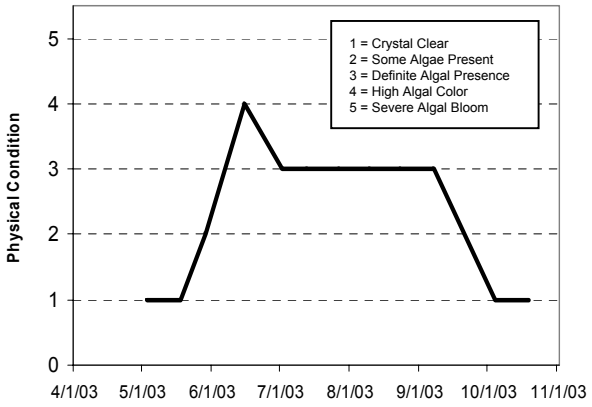



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/03/03 | 14.6 | | | | 4.1 | 45 | | 1.7 | 1 | 1 |
| 05/18/03 | 17.9 | | | | 2.5 | 36 | | 2.1 | 1 | 1 |
| 05/29/03 | 19.6 | | | | 2.9 | 38 | | 2.9 | 2 | 1 |
| 06/15/03 | 25.6 | | | | 16 | 29 | | 1.8 | 4 | 1 |
| 07/02/03 | 26.3 | | | | 9.3 | 49 | | 1.5 | 3 | 1 |
| 07/13/03 | 24.1 | | | | 21 | 43 | | 1.7 | 3 | 1 |
| 07/27/03 | 26.9 | | | | 12 | 30 | | 1.5 | 3 | 1 |
| 08/10/03 | 26.9 | | | | 20 | 32 | | 1.1 | 3 | 1 |
| 08/23/03 | 26.9 | | | | 27 | 34 | | 1.1 | 3 | 1 |
| 09/07/03 | 25.2 | | | | 13 | 35 | | 1.2 | 3 | 1 |
| 10/04/03 | 11.8 | | | | 6 | 53 | | 2 | 1 | 1 |
| 10/19/03 | 13.4 | | | | 7.7 | 45 | | 2.4 | 1 | 1 |

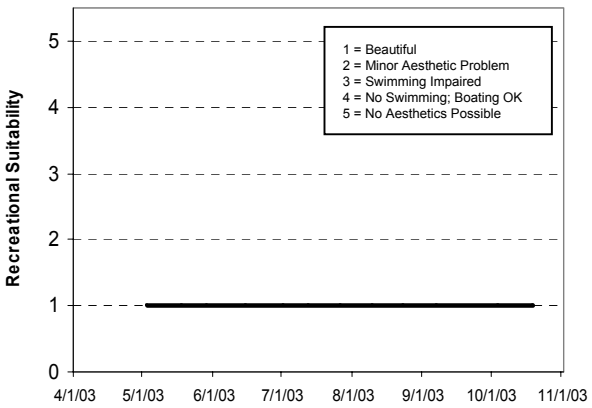



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | C | B | B | C |
| Chlorophyll a | | | | | | | | | C | A | B | B |
| Secchi Depth | | | | | A | | | | C | B | C | C |
| **Overall** | | | | | | | | | **C** | **B** | **B** | **C** |

Source: Metropolitan Council and STORET data



## Turtle Lake (82-0036) *Carnelian - Marine Watershed District*

This was the fourth year of CAMP monitoring in Turtle Lake which is located in the May Township (Washington County). A search through the STORET nationwide water quality database revealed a moderate amount of recent data on the lake. Other than for the 2000-2003 CAMP data (only Secchi transperncies were collected in 2002), data were found for 1991-1999 (just Secchi data) and nutrient data from 1991-1992 and 1996-1999.

The 44-acre lake has a mean and maximum depth of 2.4 m (eight feet) and 1.2 m (four feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 172 ac-ft. 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). The lake does not have a public access and its 699-acre watershed translates to a 16:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lake was monitored seven times between late-April and early-October, 2003. 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.

The lake's mean summertime (May through September) surface TP concentration was 99.4 µg/l (minimum of 53.0 µg/l, maximum of 166.0 µg/l). The mean CLA and Secchi transparency readings were 10.2 µg/l (minimum of 4.3 µg/l, maximum of 17.0 µg/l) and 1.4 m (minimum of 0.8 m, maximum of 1.8 m), respectively. The lake's mean surface TKN concentration was 0.81 mg/l (minimum of 0.63 mg/l, maximum of 1.00 mg/l).

The lake quality grades determined from each parameter's summertime mean are TP= D, CLA= B, and Secchi transparency= C, resulted in a 2003 overall grade of C. The 2003 overall grade is similar to those recorded in 1999-2001, and better than those of 1991-1992 (F), and 1996-1998 (D).

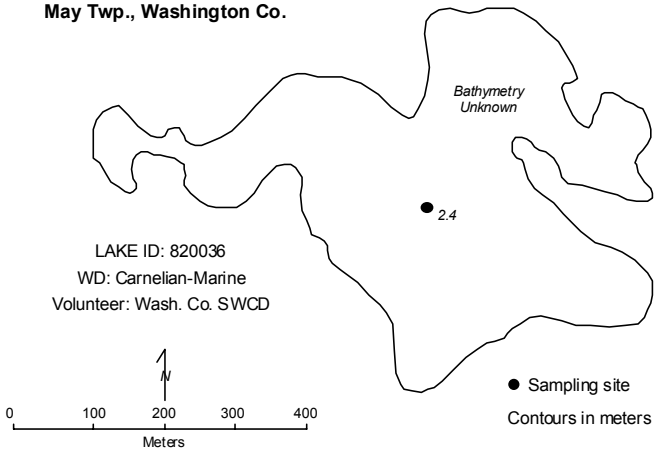
As mentioned earlier, there is a moderate amount of historic data available for Turtle Lake recent data collected in the 1990's and early-2000's. While no "statistically significant" long-term trends were determined through statistical analysis, a glance at the lake's overall grades from 1991-2003 seems to indicate that the lake's water quality has improved. In the short-term , the lake seems well represented by an overall grade of C. To better understand the lake's water quality and where it may be heading, more data are needed.

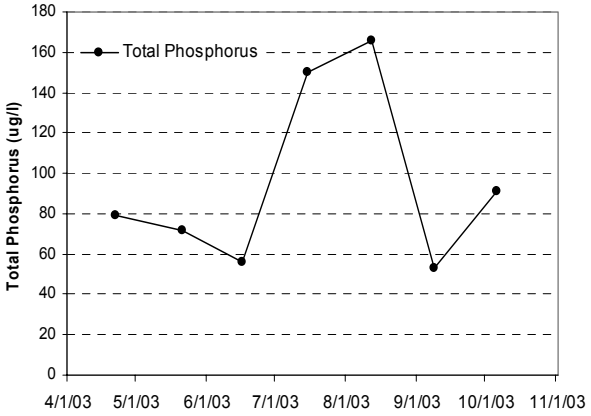
Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 3.4 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability ranking was 4.4 (between 4- "no swimming - boating ok" and 5- "no aesthetics possible").

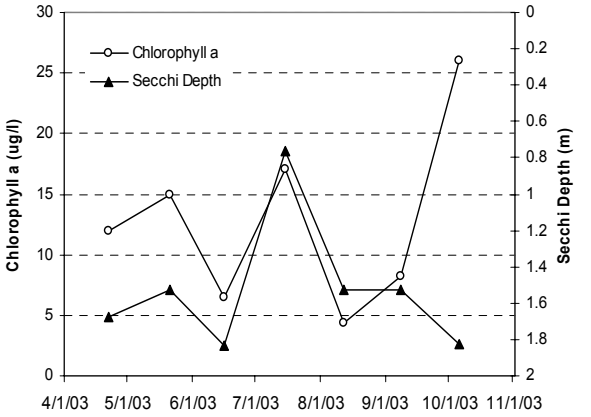
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

# Turtle Lake

**May Twp., Washington Co.**

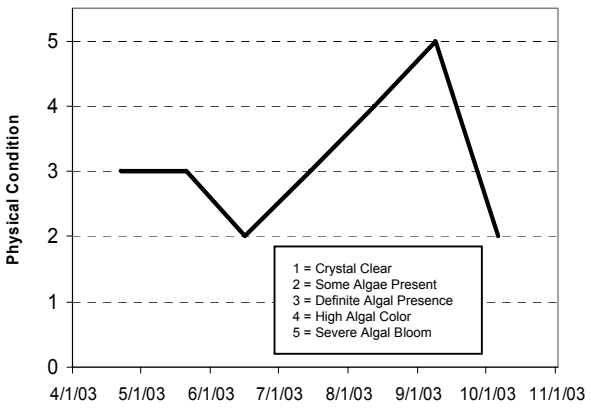



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/22/03 | 10.8 | | 4.16 | | 12 | 79 | | 1.678 | 3 | 3 |
| 05/21/03 | 16.3 | | 4.1 | | 15 | 72 | | 1.525 | 3 | 4 |
| 06/16/03 | 26.3 | | 10.16 | | 6.5 | 56 | | 1.83 | 2 | 4 |
| 07/15/03 | 23.3 | | 7.04 | | 17 | 150 | | 0.763 | 3 | 4 |
| 08/12/03 | 28.4 | | 9.07 | | 4.3 | 166 | | 1.525 | 4 | 5 |
| 09/08/03 | 23.8 | | 8.57 | | 8.2 | 53 | | 1.524 | 5 | 5 |
| 10/06/03 | 10.9 | | 14.41 | | 26 | 91 | | 1.829 | 2 | 5 |

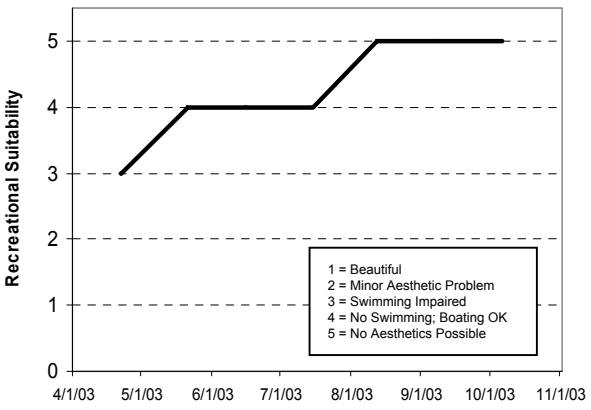



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | F | | | | C | C | C | B | D | C | | D |
| Chlorophyll a | F | | | | D | D | D | C | B | B | | B |
| Secchi Depth | F | D | C | D | D | D | D | C | C | C | C | C |
| **Overall** | **F** | | | | **D** | **D** | **D** | **C** | **C** | **C** | | **C** |

Source: Metropolitan Council and STORET data



## Twin Lake (Robbins.) [Lower Basin] (27-0042) *Shingle Creek Watershed Man. Comm.*

Two thousand and three was the third year that the lower basin of Twin Lake, which is located in the City of Robbinsdale (Hennepin County), was monitored as part of CAMP (1993 and 1998 being the others). The upper basin of Twin Lake has also been a part of CAMP in 1993, 1998, 2000 and 2002, while the middle basin of the lake was enrolled in CAMP in 1997, 1999 and 2003 (discussed latter in this report). As part of the volunteer monitoring program the lower basin of Twin Lake was sampled 13 times from mid-April to mid-October, 2003.

The entire 212-acre lake has maximum and mean depth of 14.0 and 2.1 m (46 and 7 feet), respectively. The acreage of each basin is as follows: lower basin= 46 acres, middle basin= 69 acres, and the upper basin= 137 acres. The middle basin itself has a mean and maximum depth of 14.0 m and 4.9 m (46 and 16 feet). The total volume of the whole lake is approximately 1,490 ac-ft (918 ac-ft of which is contained within the middle basin). About 81 percent of the whole lake's area is considered littoral (the 0-15 foot depth area dominated by aquatic vegetation). Access to the lake can be obtain at two locations, the southern end of the lake and the lake's eastern shore.

The 2003 summertime (May through September) means for the monitored variables were: surface TP= 42.0 µg/l (minimum concentration of 22.0 µg/l and a maximum value of 70.0 µg/l), surface chlorophyll-a= 17.5 µg/l (minimum of 1.6 µg/l and maximum of 51.0 µg/l), Secchi transparency= 1.6 m (minimum of 0.6 m and a maximum of 3.6 m), and TKN= 1.20 mg/l (minimum of 0.60 mg/l and maximum of 3.00 mg/l). The 2003 parameter means represent the best recorded to date. Lake quality grades for the 2003 summertime means were TP= C, CLA= B, Secchi= C. The lake's overall 2003 quality grade of C was calculated from the TP, CLA, and Secchi grades.

Nineteen hundred and one, 1993, 1996, 1998 and 2000 were the only years of data prior to 2003 where water quality data were found for the lower basin of Twin Lake. While the limited database restricts the ability to determine any long-term trends, it is obvious that the lake's quality in 1993, 1996, 1998, 2000 and 2003 (overall grades of C) was better than that in 1991 (D). A closer look reveals that 2003 was the lake's best water quality year and 1991 being the worst. Because of the small amount of water quality data available for the lake, there are not nearly enough data to determine any long-term water quality trends, for the lake. In the short-term, however the lake's water quality seems to be well represented by an overall grade of C. To better understand the quality of the lake and what direction it may be heading, more data are needed.

Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 2.1 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.2 (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 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.

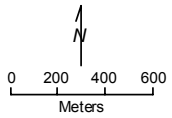
# Twin Lake, Lower Basin,

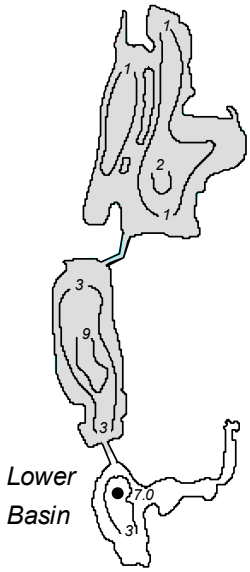
**Robbinsdale, Hennepin Co.**

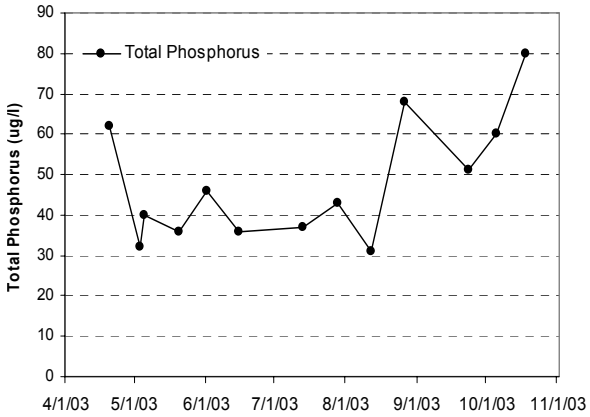
Lake ID: 270042-01
WMO: Shingle Creek
Volunteers: Roni Brunner and Bob Hill

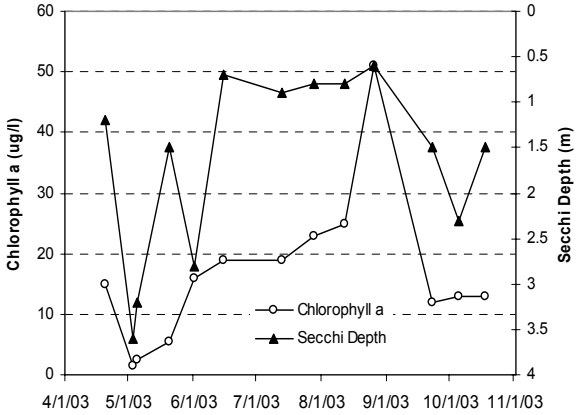
● Sampling site

Contours in meters



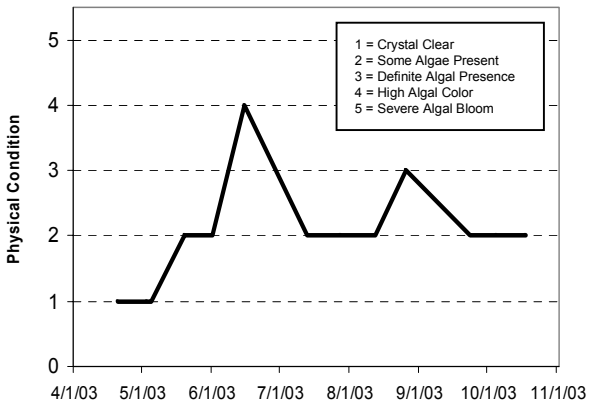




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/20/03 | 8.4 | | | | 15 | 62 | | 1.2 | 1 | 1 |
| 05/03/03 | 16.5 | | | | 1.6 | 32 | | 3.6 | 1 | 5 |
| 05/05/03 | 18.7 | | | | 2.4 | 40 | | 3.2 | 1 | 1 |
| 05/20/03 | 19 | | | | 5.6 | 36 | | 1.5 | 2 | 2 |
| 06/01/03 | 22.5 | | | | 16 | 46 | | 2.8 | 2 | 1 |
| 06/15/03 | 27.4 | | | | 19 | 36 | | 0.7 | 4 | 3 |
| 07/13/03 | 26.9 | | | | 19 | 37 | | 0.9 | 2 | 2 |
| 07/28/03 | 28.1 | | | | 23 | 43 | | 0.8 | 2 | 2 |
| 08/12/03 | 29.3 | | | | 25 | 31 | | 0.8 | 2 | 2 |
| 08/26/03 | 27.7 | | | | 51 | 68 | | 0.6 | 3 | 2 |
| 09/23/03 | 18.3 | | | | 12 | 51 | | 1.5 | 2 | 2 |
| 10/05/03 | 14 | | | | 13 | 60 | | 2.3 | 2 | |
| 10/18/03 | 13.5 | | | | 13 | 80 | | 1.5 | 2 | 2 |

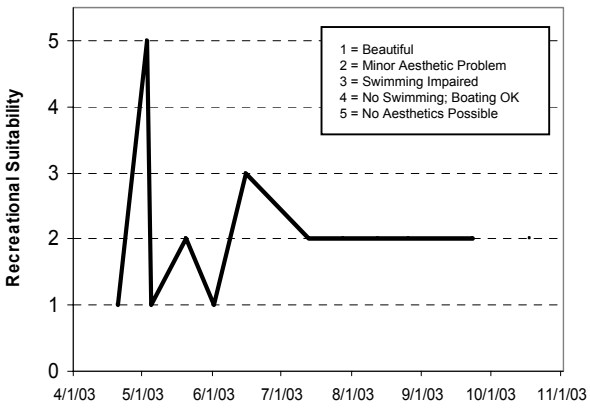



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | | | C | | C | | D | | | C |
| Chlorophyll a | | C | | | C | | B | | C | | | B |
| Secchi Depth | | D | | | C | | C | | C | | | C |
| **Overall** | | **C** | | | **C** | | **C** | | **C** | | | **C** |

Source: Metropolitan Council and STORET data



## Twin Lake (Crystal) [Middle Basin] (27-0042) *Shingle Creek Watershed Man. Comm.*

Between mid-April and mid-October 2003, the middle basin of Twin Lake was monitored 13 times. On each monitoring event the lake was monitored for TP, CLA, TKN, Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The lake was also enrolled in CAMP in 1997 and 1999.

The mean summertime (May - September) surface TP concentration for the lake was 52.7 µg/l (minimum of 28.0 µg/l and maximum of 114.0 µg/l). The mean CLA and Secchi transparency readings were 23.8 µg/l (minimum of 1.2 µg/l and maximum of 67.0 µg/l) and 1.7 m (minimum of 0.6 m and maximum of 3.9 m), respectively. Additionally, the lake's mean surface TKN concentration was 1.14 mg/l. Summertime means resulted in a TP grade of C, CLA grade of C, and a Secchi transparency grade of C. Therefore the overall grade, determined through the calculation of all three parameter grades, was C. When comparing the 2003 summertime means with those of past years (including; 1985, 1991, 1996-1997, 1999 and 2000), it is apparent that 1985 and 1997 were the lae's best recorded water quality years.

The volunteer monitor's perception of the lake's physical and recreational conditions were ranked on a 1-to-5 scale during each monitoring event. The rankings are shown on the information sheet on the next page. The mean physical condition ranking was 2.2 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.2 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

While the water quality database for the middle basin of Twin Lake (see lake information sheet on the following page) is growing, a STORET data search revealed a only a sporadic amount data from 1985, 1991, 1996–1997, 1999-2000 and now 2003. The lake basin received an overall grade of B in 1985 and 1997, C in 1996 and 1999-2000, and D in 1991. Because of the sporadic and limited nature of the database no long-term or short-term trends can be determined. To better understand the quality of the lake and what direction it may be heading, more data collection is needed.

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 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.

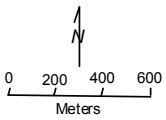
# Twin Lake, Middle Basin,

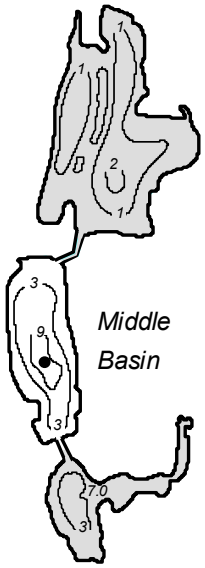
**Crystal, Hennepin Co.**

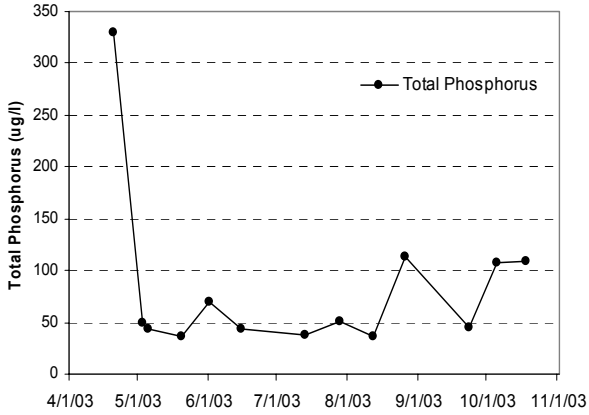
Lake ID: 270042-02
WMO: Shingle Creek
Volunteers: Roni Brunner and Bob Hill

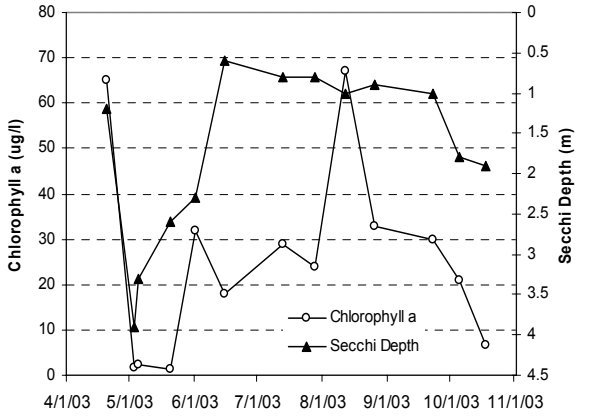
● Sampling site

Contours in meters



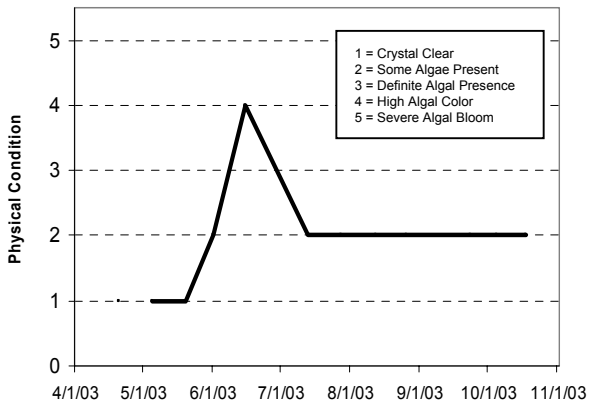




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/20/03 | 10.5 | | | | 65 | 330 | | 1.2 | 1 | 1 |
| 05/03/03 | 15.6 | | | | 1.6 | 49 | | 3.9 | | 5 |
| 05/05/03 | 18.2 | | | | 2.4 | 44 | | 3.3 | 1 | 1 |
| 05/20/03 | 16.8 | | | | 1.2 | 36 | | 2.6 | 1 | 2 |
| 06/01/03 | 29.9 | | | | 32 | 69 | | 2.3 | 2 | 1 |
| 06/15/03 | 27.3 | | | | 18 | 44 | | 0.6 | 4 | 3 |
| 07/13/03 | 25.3 | | | | 29 | 38 | | 0.8 | 2 | 2 |
| 07/28/03 | 28 | | | | 24 | 51 | | 0.8 | 2 | 2 |
| 08/12/03 | 28.1 | | | | 67 | 37 | | 1 | 2 | 2 |
| 08/26/03 | 27.7 | | | | 33 | 114 | | 0.9 | 2 | 2 |
| 09/23/03 | 18.5 | | | | 30 | 45 | | 1 | 2 | 2 |
| 10/05/03 | 13.8 | | | | 21 | 108 | | 1.8 | 2 | |
| 10/18/03 | 14.4 | | | | 6.8 | 109 | | 1.9 | 2 | 2 |

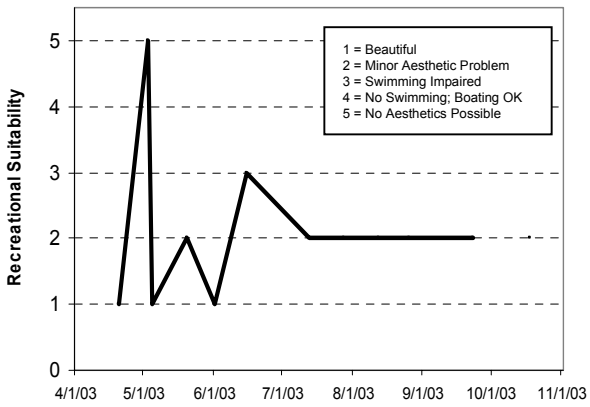



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | C | | C | C | | | C |
| Chlorophyll a | | | | | C | A | | B | C | | | C |
| Secchi Depth | | | | | C | C | | C | C | | | C |
| **Overall** | | | | | **C** | **B** | | **C** | **C** | | | **C** |

Source: Metropolitan Council and STORET data



## Twin Lake [Burnsville] (19-0028) *Black Dog Watershed Management Commission*

Twin Lake, an 11-acre lake located in the City of Burnsville (Dakota County). Because of the shallowness of the lake, its entire area is considered littoral zone (the area of aquatic vegetation dominance) and it does not maintain a thermocline (a density gradient owed to changing water temperatures throughout the lake's water column). There is very little known morphological data available for the lake.

This was the fourth year in which Twin Lake has been involved in CAMP (1999 and 2001-2002 being the others). The lake was monitored six times between mid-May and mid-August, 2003. Other than for the 1999 and 2001-2002 CAMP data, a search through the STORET nationwide water quality database for data on the lake came up empty.

In an attempt to inhibit algal populations within the lake, barley straw has been added. Barley straw has been used for algal control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes. In order to determine if the straw method successfully reduced algal biomass within the lake; TP, TKN, CLA and Secchi transparency were tested during each monitoring event. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of B was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 47.7 µg/l (minimum of 11.0 µg/l, maximum of 117.0 µg/l) corresponds to a lake water quality grade of C, as did the mean Secchi transparency of 1.5 m (minimum of 0.5 m, maximum of 2.1 m). The lake's mean CLA concentration of 9.95 µg/l (minimum of 4.00 µg/l and maximum of 25.00 µg/l) resulted in a grade of A. The mean TKN concentration over the same time period was 0.73 mg/l (minimum of 0.45 mg/l and maximum of 1.20 mg/l).

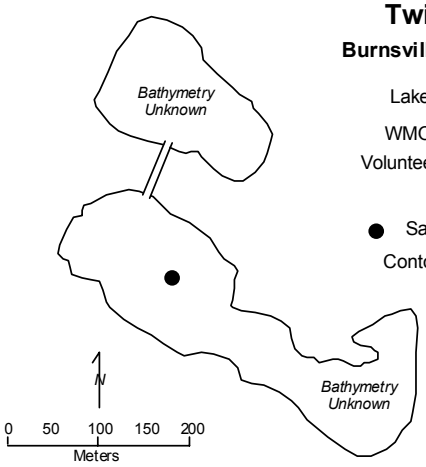
The lake's 2003 individual and overall water quality grades were identical to those recorded in 20010-2002, and better than those recorded in 1999.

The lake's mean Secchi transparency and TP concentration are worse than what the lake's mean CLA concentration would suggest. An explanation for this scenario could be that the majority of the lake's TP comes from in-lake suspended sediments, which in turn decreases the clarity of the water and inhibits algal growth. Or, this may indicate that the barley straw did indeed somewhat inhibit algal growth over the summer months (continual years of data will provide a better picture of the barley straws influence on the lake's algal population).

As mentioned earlier, there are no water quality data available for Twin Lake other than the 1999 and 2001-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. While the lake has recorded better water quality grades since the use of barley straw began, there is little pre-barley straw data to compare against. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

The average user perception rankings, on a 1-to-5 scale, were 3.2 for physical condition (between 3- "definite algae present" and 4- "high algal color") and 3.8 for recreational suitability (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

If you notice any errors in the lake 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.




# Twin Lake

**Burnsville, Dakota Co.**

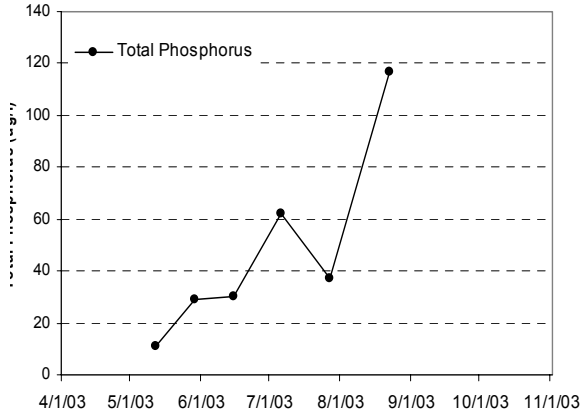
Lake ID: 190028

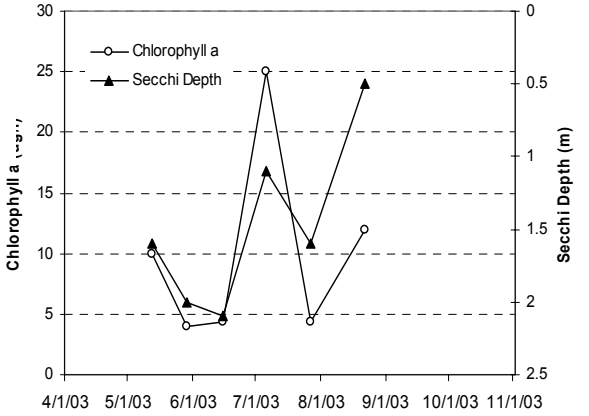
WMO: Black Dog

Volunteer: Nigel Linden

Sampling site

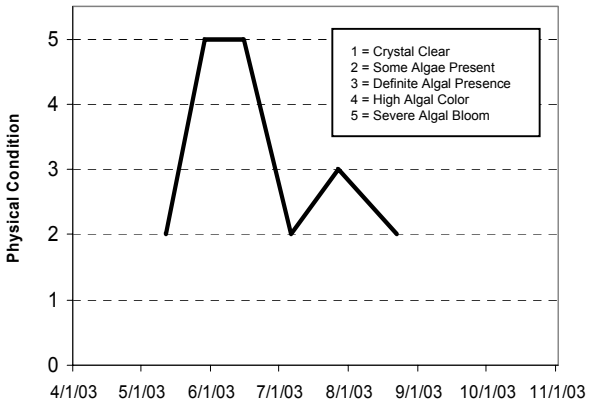
Contours in meters




## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/12/03 | 14.3 | | | | 10 | 11 | | 1.6 | 2 | 1 |
| 05/29/03 | 20.8 | | | | 4 | 29 | | 2 | 5 | 5 |
| 06/15/03 | 22 | | | | 4.3 | 30 | | 2.1 | 5 | 5 |
| 07/06/03 | 28.4 | | | | 25 | 62 | | 1.1 | 2 | 4 |
| 07/27/03 | 27 | | | | 4.4 | 37 | | 1.6 | 3 | 4 |
| 08/22/03 | 25.2 | | | | 12 | 117 | | 0.5 | 2 | 4 |

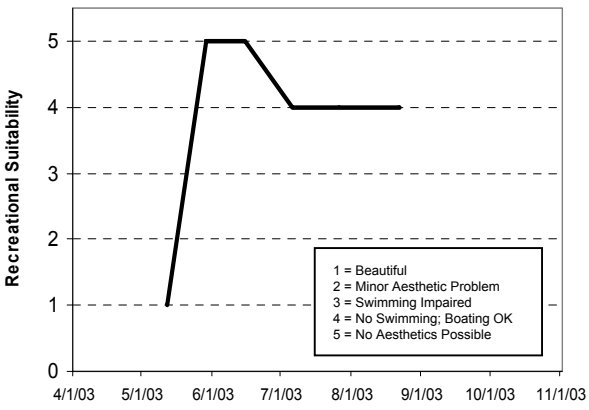



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | D | | C | C | C |
| Chlorophyll a | | | | | | | | B | | A | A | A |
| Secchi Depth | | | | | | | | D | | C | C | C |
| **Overall** | | | | | | | | **C** | | **B** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Twin Lake [St. Louis Park] (27-0656) *City of St. Louis Park*

Twin Lake is a small shallow lake located within City of St. Louis Park (Hennepin County). There is very little known morphological data available for the lake.

Two thousand and three marks the second year in which Twin Lake has been involved in CAMP (2002 being the other). Other than for the 2002 CAMP sdata, a search through the STORET nationwide water quality database for historic data on the lake was unsuccessful. Thus, 2002-2003 are the only complete, year of available data. 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.

The lake was monitored 14 times between mid-April and early-October, 2003. The resulting data and graphs appear on the next page.

The lake's overall 2003 lake quality grade of D was determined from the individual parameter grades. The summertime (May through September) mean TP concentration of 178.4 µg/l (minimum of 110.0 µg/l, maximum of 383.0 µg/l) corresponds to a lake water quality grade of F, while the mean Secchi transparency of 0.9 m (minimum of 0.5 m, maximum of 1.3 m) corresponds to a grade of D. The lake's the mean CLA concentration of 34.5 µg/l (minimum of 10.0 µg/l and maximum of 93.0 µg/l), on the other hand, resulted in a grade of C. The mean TKN concentration over the same time period was 1.12 mg/l.

By comparing the lake' 2002 and 2003 TP (nutrient), CLA (algal biomass estimator), and Secchi (water clarity) grades, it is apparent that the TP and Secchi grades are worse than the CLA grade. In a most cases, the three should be fairly comparable. One possible explanation for the lake's 2002 and 2003 findings may be that the majority of the lake's TP comes from either in-lake suspended sediments (re-suspension), or the intrusion of sediment-laden runoff to the lake, which in turn lessens the clarity of the water and inhibits algal growth.

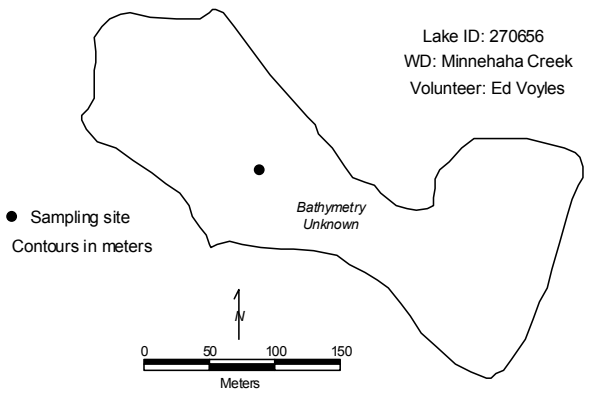
As mentioned earlier, there are no water quality data available for Twin Lake other than the 2002-2003 CAMP data. Therefore it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

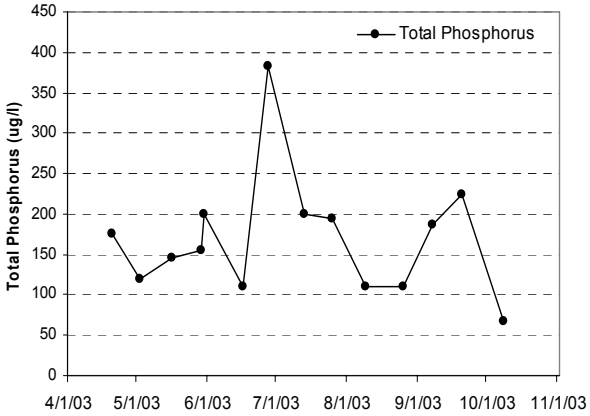
Throughout the monitoring period, the volunteer(s) ranked their opinions of the lake's physical and recreational conditions on a 1-to-5 scale. The average user perception rankings were 2.7 for physical condition (between 2- "some algae present" and 3- "definite algae present"), and 4.0 for recreational suitability (4- "no swimming – boating ok").

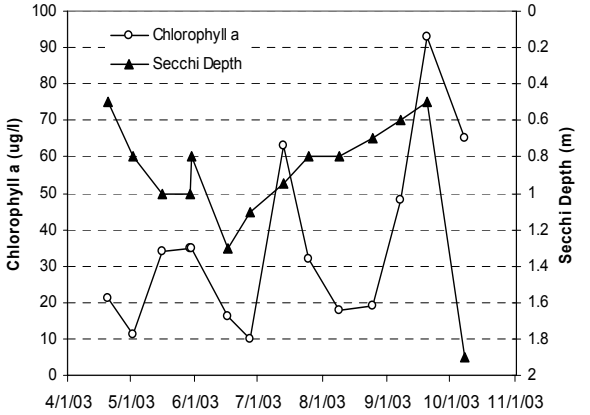
If you notice any errors in the lake data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us

# Twin Lake

**St. Louis Park, Hennepin Co.**

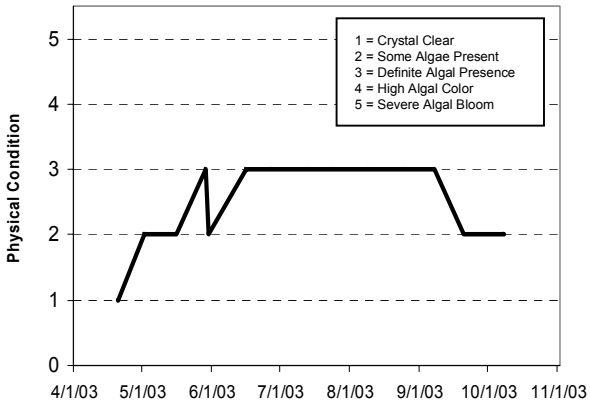



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/20/03 | 8.5 | | | | 21 | 176 | | 0.5 | 1 | 4 |
| 05/02/03 | 18 | | | | 11 | 120 | | 0.8 | 2 | 4 |
| 05/16/03 | 20 | | | | 34 | 146 | | 1 | 2 | 4 |
| 05/29/03 | 21 | | | | 35 | 155 | | 1 | 3 | 4 |
| 05/30/03 | 22 | | | | 35 | 200 | | 0.8 | 2 | 4 |
| 06/16/03 | 24.5 | | | | 16 | 110 | | 1.3 | 3 | 4 |
| 06/27/03 | 22.5 | | | | 10 | 383 | | 1.1 | 3 | 4 |
| 07/13/03 | 24 | | | | 63 | 200 | | 0.95 | 3 | 4 |
| 07/25/03 | 25 | | | | 32 | 195 | | 0.8 | 3 | 4 |
| 08/09/03 | 28 | | | | 18 | 110 | | 0.8 | 3 | 4 |
| 08/25/03 | 27 | | | | 19 | 110 | | 0.7 | 3 | 4 |
| 09/07/03 | 24 | | | | 48 | 187 | | 0.6 | 3 | 4 |
| 09/20/03 | 19 | | | | 93 | 225 | | 0.5 | 2 | 4 |
| 10/08/03 | 16 | | | | 65 | 68 | | 1.9 | 2 | 4 |

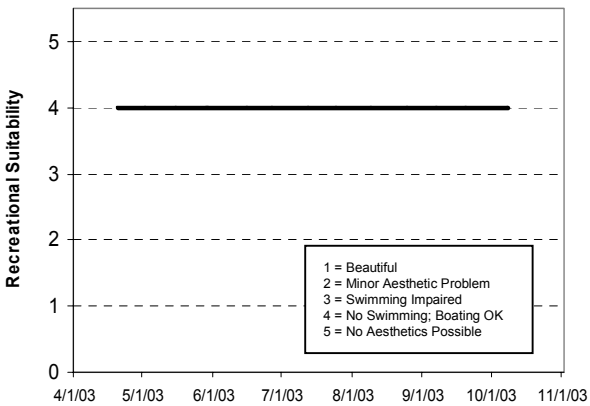



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | | F | F |
| Chlorophyll a | | | | | | | | | | | B | C |
| Secchi Depth | | | | | | | | | | | D | D |
| **Overall** | | | | | | | | | | | **D** | **D** |

Source: Metropolitan Council and STORET data



## Valentine Lake (62-0071) *Rice Creek Watershed District*

Valentine Lake is located within the City of Arden Hills in Ramsey County. The lake has a surface area of 60-acres, and a maximum and mean depth of 4.0 m (13.1 feet) and 1.5 m (4.9 feet), respectively. Because of the shallowness of the lake, its entire surface area is considered littoral, the shallow (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). The mean depth and surface area of the lake translates to an approximate volume of 300 ac-ft. The result of comparing the lake's surface area to its 2,237-acre drainage area (watershed) is a rather large 37:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff).

This was the third year that Valentine Lake has been involved in CAMP (2001-2002 being the others). In fact, the 2001-2002 CAMP data were the only data found through STORET nationwide water quality database search. Therefore 2001-2003 represents the only water quality data readily available for the lake.

The lake was monitored 12 times between mid-April and mid-October, 2003. 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. The mean summertime (May through September) surface TP concentration was 67.8 µg/l (minimum of 32.0 µg/l, maximum of 106.0 µg/l). The mean CLA and Secchi transparency readings were 31.1 µg/l (minimum of 4.9 µg/l, maximum of 88.0 µg/l) and 1.18 m (minimum of 0.50 m, maximum of 1.96 m), respectively. The lake's mean surface TKN concentration was 0.93 mg/l (minimum of 0.73 mg/l, maximum of 1.10 mg/l).

The lake's 2003 quality grades determined from each parameter's summertime mean are TP= C, CLA= C, and Secchi transparency= D. While the resulting overall grade for 2003 (C) is identical to those of 2001-2002, the individual grades of 2001-2002 were better. The lake's 2003 nutrient concentrations and Secchi transparencies are graphed on the following page.

Because of the limitedness of the lake's water quality database, the determination of any only long- or short-term trends are not possible to determine. It is reported on the MPCA website, however, that a recently conducted trend analysis on the lake's Secchi transparency data revealed a statistically significant improvement in recent water clarity. To better understand the lake's water quality and what direction it may be heading, more years of data collection are needed.

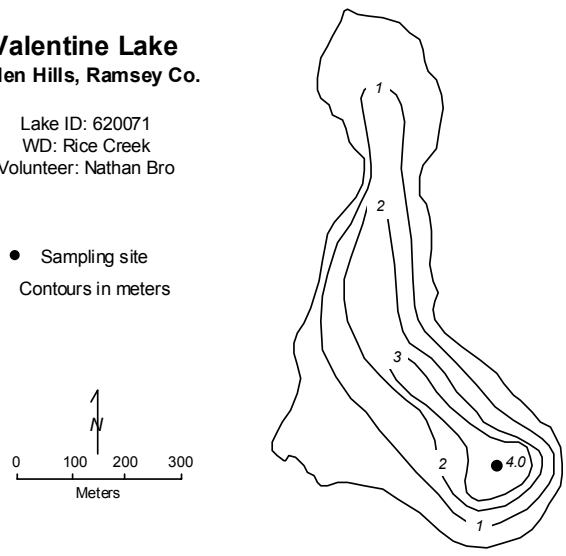
The perceived physical and recreational conditions of the lake, recorded by the volunteers, were ranked on a 1-to-5 scale. The rankings are shown in both tabular and graphical form on the lake's associated information sheet. The mean physical condition ranking was 2.6 (between 2- "some algae present" and 3- "definite algae present"), while the mean recreational suitability ranking was 2.0 (2- "minor asethetic problem").

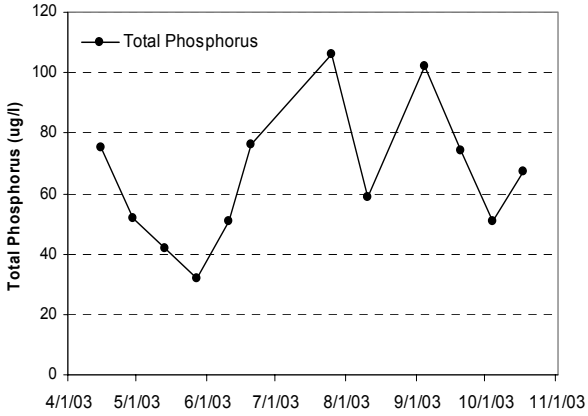
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

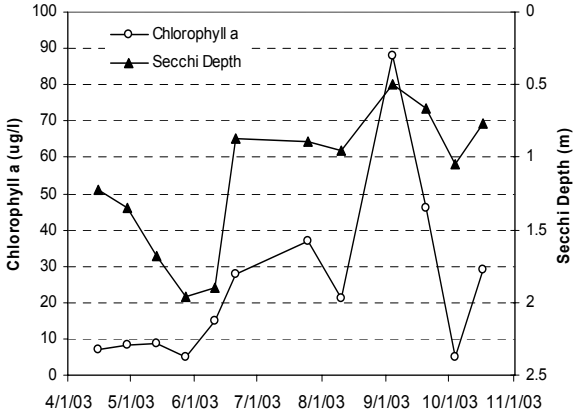
# Valentine Lake

**Arden Hills, Ramsey Co.**

Lake ID: 620071
WD: Rice Creek
Volunteer: Nathan Bro

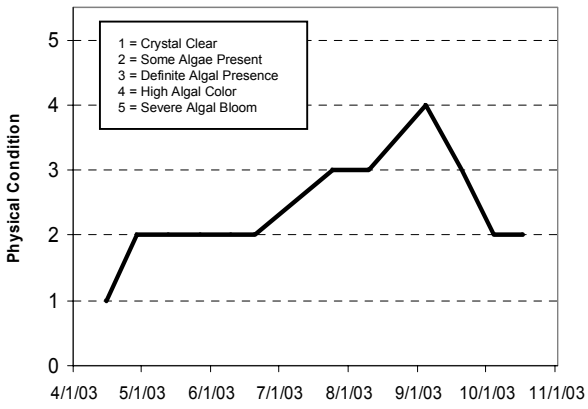



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 15.6 | | 10.1 | | 7.1 | 75 | | 1.22 | 1 | 1 |
| 04/29/03 | 15.6 | | 9.9 | | 8.5 | 52 | | 1.35 | 2 | 1 |
| 05/13/03 | 14 | | 9.44 | | 8.9 | 42 | | 1.68 | 2 | 1 |
| 05/27/03 | 21.5 | | 11.1 | | 4.9 | 32 | | 1.96 | 2 | 2 |
| 06/10/03 | 19.5 | | 8.23 | | 15 | 51 | | 1.9 | 2 | 1 |
| 06/20/03 | 20 | | 9.73 | | 28 | 76 | | 0.87 | 2 | 1 |
| 07/25/03 | 19.2 | | 7.22 | | 37 | 106 | | 0.89 | 3 | 2 |
| 08/10/03 | 26.9 | | 8.07 | | 21 | 59 | | 0.953 | 3 | 2 |
| 09/04/03 | 21.3 | | 9.2 | | 88 | 102 | | 0.5 | 4 | 4 |
| 09/20/03 | 17.7 | | 7.83 | | 46 | 74 | | 0.66 | 3 | 3 |
| 10/04/03 | 11.2 | | 10.86 | | 4.9 | 51 | | 1.05 | 2 | 2 |
| 10/17/03 | 12.3 | | 8.55 | | 29 | 67 | | 0.77 | 2 | 1 |

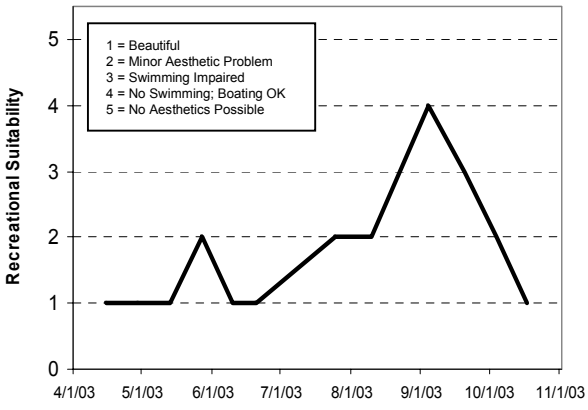



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | | C | C | C |
| Chlorophyll a | | | | | | | | | | B | B | C |
| Secchi Depth | | | | | | | | | | C | C | D |
| **Overall** | | | | | | | | | | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



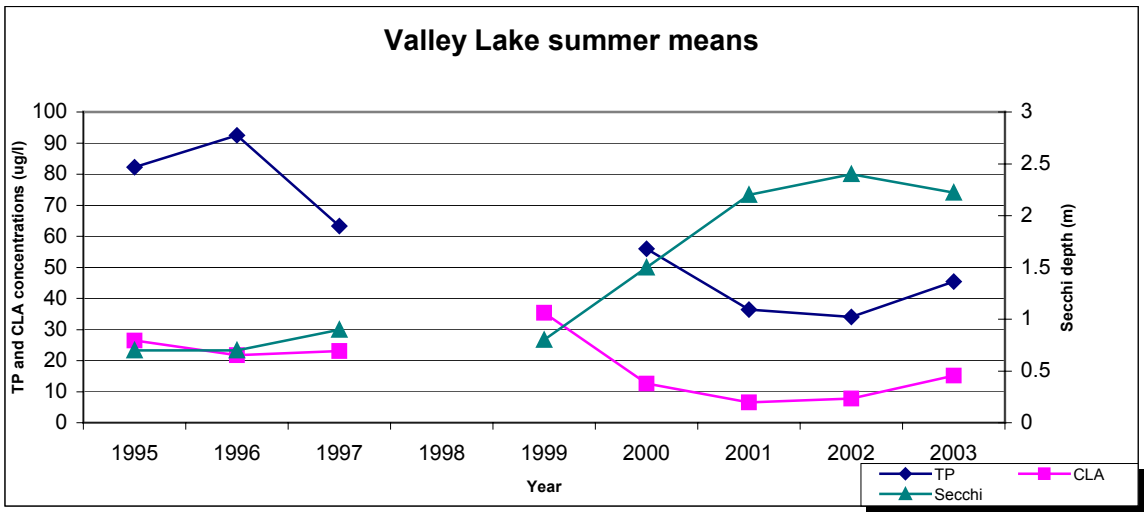
## Valley Lake (19-0348) *City of Lakeville*

This was the eighth year that Valley Lake, located in the City of Lakeville (Dakota County), has been involved in CAMP. The lake had been monitored through CAMP in 1995-1997 and 1999-2002. A search through the nationwide water quality database (STORET) found no water quality data on the lake prior to the 1995 CAMP data.

The 15-acre lake has a maximum depth of 3.2 m (10 feet). Because of the shallowness of the lake, the entire lake is considered littoral (the area of dominated by aquatic vegetation). The majority of the land within the lake's 117-acre watershed is parkland or single-family residential homes. The watershed-to-lake size ratio is 8:1 (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lake has been involved in CAMP in 1999-2003 as part of a barley straw project on the lake. In an attempt to inhibit algal populations within the lake, barley straw has been added. Barley straw has been used for algal control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes. Therefore, in order to determine if the straw method successfully reduced algal biomass within Valley Lake in 2003, TP, TKN, CLA, total and dissolved carbon and Secchi transparency were tested 14 times between mid-April and mid-October. The resulting data and graphs appear on the next page.

The mean summertime (May through September) surface TP concentration for the lake was 45.4 µg/l (minimum of 22.0 µg/l, maximum of 84.0 µg/l). The mean CLA and Secchi transparency readings were 15.2 µg/l (minimum of 5.3 µg/l, maximum of 54.0 µg/l) and 2.22 m (minimum of 1.30 m, maximum of 3.40 m), respectively. The lake's mean surface TKN concentration was 0.74 mg/l. The lake quality grades assigned to the 2002 summertime means are TP= C; CLA= B; and Secchi= B, resulting in an overall grade of B. The lake's water quality grades (and associated parameter means), were slightly worse than those recorded in 2001 and 2002 (2002 was the lake's best recorded water quality year).




While the above graph shows a definite improvement in lake water quality since the use of barley straw first began in 1999, more data are needed to determine a "statistically significant" short-term (let alone long-term) trend the barley straw may have on the lake and its algal population. With this in mind the

lake will continue to be a part of CAMP in 2004. The lake has, however shown an improvement in water quality during each of the years the barley straw was used.

While barley straw seems to inhibit algal growth as well phosphorus, which in turn results in improved water clarity, the reason is not truly understood. In an attempt to identify the algal inhibitor released by the decaying barley straw, additional in-lake water samples were taken in 2001-2003 in Valley Lake along with monthly samples in a nearby sediment basin where barley straw was not used (viewed as a control). These additional samples, which in the past had centered around the break down of phenols concentrations (one of the theories behind the barley straw inhibitor) as a part of 57 base neutral acids organic compounds (BNAs), as well as total and dissolved carbon. Because the breakdown of BNA compounds for each of the collected samples in 2002 came back below detection limit (< 2.0 μg/l), it is not thought that chemical compounds (such as phenols) released from the decomposing straw is the mechanism inhibiting the algal growth.

The examination of the Valley Lake and sedimentation basin carbon data was the focus of the additional monitoring in 2003. The thought is that the carbon may aid another potential algal inhibiting process, that is the microbial competition for phosphorus (McComas 2003). Therefore, the presence of decaying barley straw results in the lake's algal biomass actually being phosphorus-limited not inhibited by a released chemical compound. Initial analysis of the 2003 carbon and chlorophyll data seem s to indicate that this is the case. Initial analysis of the 2003 carbon, nutrient and chlorophyll data seems to indicat that this is the case. Continued monitorng and analysis of carbon (as well as additional analyses) will continue on Valley Lake and its associated sedimentation basin throughout the upcoming 2004-monitoring season.

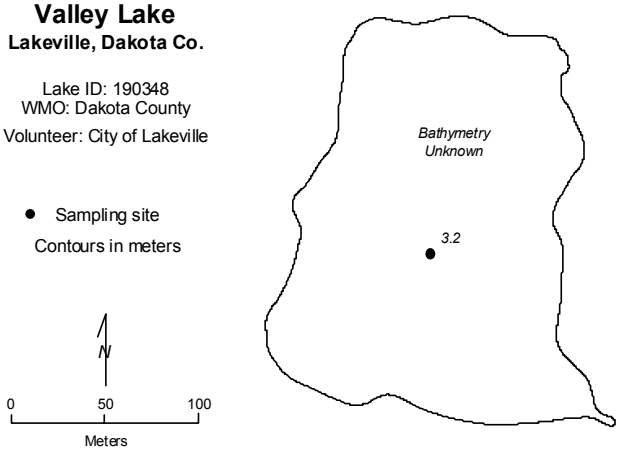
In addition to the collection of TP, TKN, CLA and Secchi information during each monitoring event in 2003, the volunteer(s) ranked their perception of the lake's physical and recreational conditions on a 1-to-5 scale as shown on the attached information sheet. The summertime mean recorded physical condition was 2.6 (between 2- "some algae present" and 3- "definite algae present"). The mean suitability for recreation ranking was 3.1 (between 3- "swimming slightly impaired" and 4- "no swimming – boating ok").

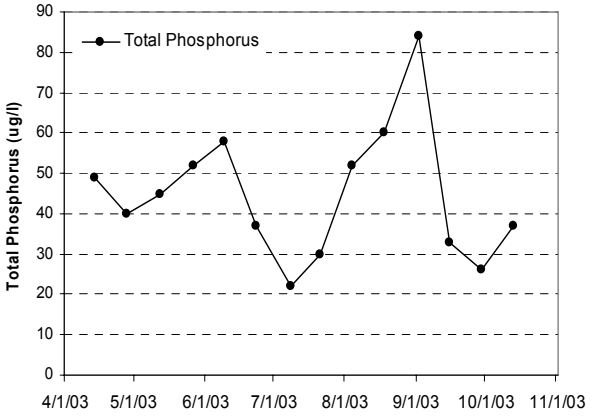
If you know of any errors in the lake's data, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

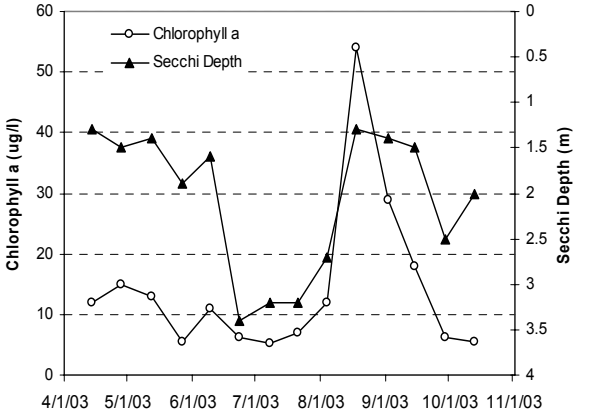
# Valley Lake

**Lakeville, Dakota Co.**

Lake ID: 190348
WMO: Dakota County
Volunteer: City of Lakeville

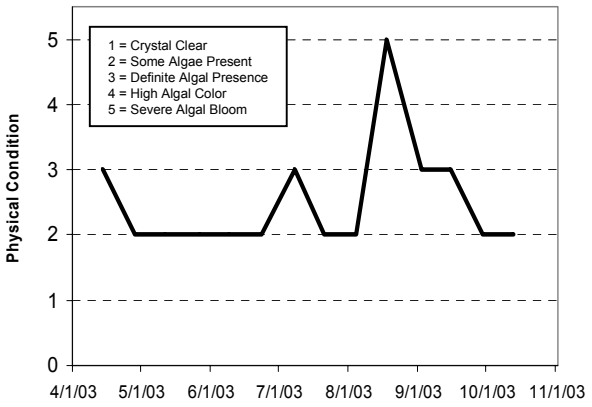



## 2003 Data

| Date | Surf. Temp. | Bot. Temp. | Surf. DO | Bot. DO | CLA | Surf. TP | Bot. TP | Secchi | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| | (C) | (C) | (mg/l) | (mg/l) | (ug/l) | (ug/l) | (ug/l) | (m) | | |
| 04/14/03 | 15.7 | | | | 12 | 49 | | 1.3 | 3 | 2 |
| 04/28/03 | 14.6 | | | | 15 | 40 | | 1.5 | 2 | 2 |
| 05/12/03 | 15.7 | | | | 13 | 45 | | 1.4 | 2 | 2 |
| 05/27/03 | 18.5 | | | | 5.5 | 52 | | 1.9 | 2 | 2 |
| 06/09/03 | 21.8 | | | | 11 | 58 | | 1.6 | 2 | 3 |
| 06/23/03 | 24.1 | | | | 6.1 | 37 | | 3.4 | 2 | 3 |
| 07/08/03 | 25.8 | | | | 5.3 | 22 | | 3.2 | 3 | 3 |
| 07/21/03 | 26 | | | | 6.9 | 30 | | 3.2 | 2 | 3 |
| 08/04/03 | 24.7 | | | | 12 | 52 | | 2.7 | 2 | 3 |
| 08/18/03 | 26.3 | | | | 54 | 60 | | 1.3 | 5 | |
| 09/02/03 | 24.1 | | | | 29 | 84 | | 1.4 | 3 | 3 |
| 09/15/03 | 21.3 | | | | 18 | 33 | | 1.5 | 3 | 4 |
| 09/29/03 | 11.2 | | | | 6.1 | 26 | | 2.5 | 2 | 4 |
| 10/13/03 | 14.6 | | | | 5.5 | 37 | | 2 | 2 | 4 |

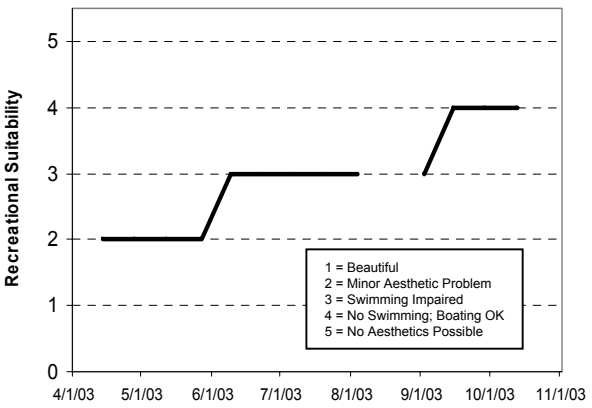



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | D | D | C | | | C | C | C | C |
| Chlorophyll a | | | | C | C | C | | C | B | A | A | B |
| Secchi Depth | | | | D | D | D | | D | C | C | B | B |
| **Overall** | | | | **D** | **D** | **C** | | | **C** | **B** | **B** | **B** |

Source: Metropolitan Council and STORET data



## Virginia Lake (10-0015) *Minnehaha Creek Watershed District*

This was the fourth year of CAMP monitoring in Virginia Lake, which is located in the City of Victoria (Carver County). A search through the STORET nationwide water quality database revealed a limited amount of historic data on the lake (1988-1991[consisting of just a single monitoring event] and 2000-2002). The 110-acre lake has a mean and maximum depth of 3.3 m (11 feet) and 10.4 m (34 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 1,210 ac-ft. Roughly 88 percent of the lake's area is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation). Additionally, the lake's 450-acre immediate watershed translates to a 7:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff). An area of concern and need for future management is the presence of Eurasian Water Milfoil (*Myriophyllum spicatum*) in the lake.

The lake was monitored 12 times between mid-May and mid-October, 2003. 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. The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

The mean summertime (May through September) surface TP concentration for the lake was 44.9 µg/l (minimum of 19.0 µg/l, maximum of 90.0 µg/l). The mean CLA and Secchi transparency readings were 22.8 µg/l (minimum of 1.6 µg/l, maximum of 55.0 µg/l) and 1.6 m (minimum of 0.6 m, maximum of 2.9 m), respectively. The lake's mean surface TKN concentration was 1.07 mg/l. Identical to those recorded in 2000-2002, the lake quality grades assigned to the 2003 summertime means are TP= C; CLA= C; and Secchi= C, resulting in an overall grade of C.

Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 3.2 (between 3- "definite algae present" and 4- "high algal color"), while the mean recreational suitability ranking was 2.8 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

As mentioned earlier, there is a limited amount of historic data available for Virginia Lake other then the single event moitoring of 1988-1991 (no grades are shown for these data due the limited number of events) and 2000-2003 CAMP data. Therefore it is not possible to determine any long-term trends. In the short-term however, the lake seem well represented by an overall water quality grade of C. To better understand the lake's water quality and where it may be heading, more data are needed.

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.

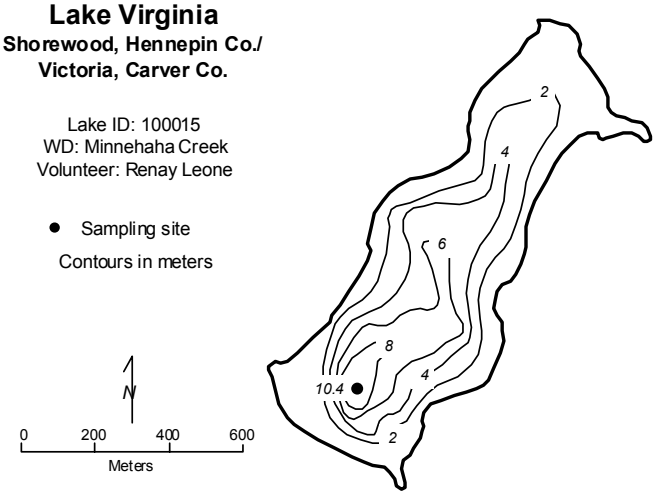
# Lake Virginia

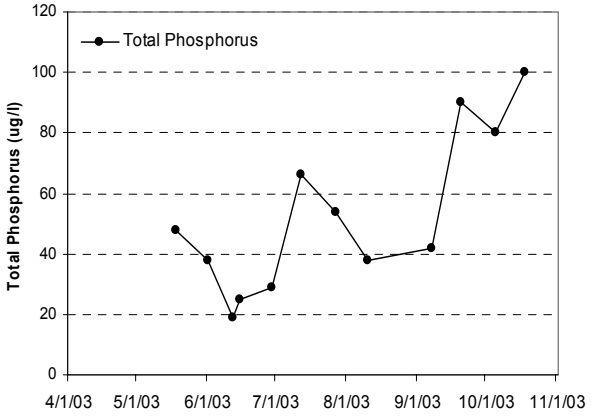
**Shorewood, Hennepin Co./**
**Victoria, Carver Co.**

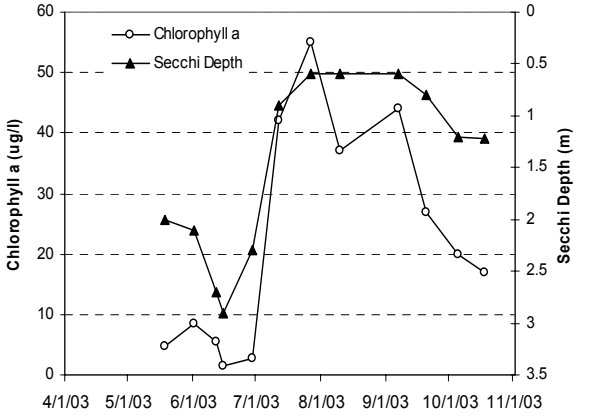
Lake ID: 100015
WD: Minnehaha Creek
Volunteer: Renay Leone

● Sampling site

Contours in meters

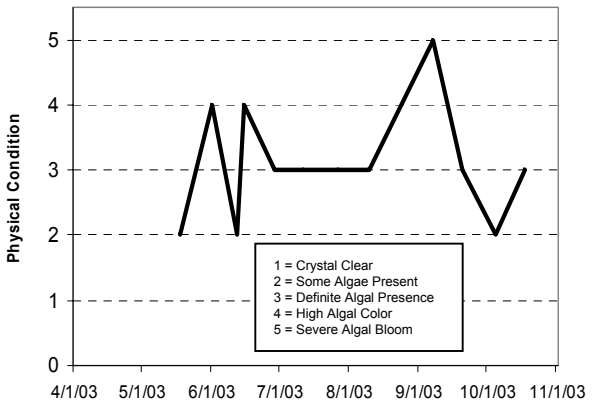



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 05/18/03 | 17.9 | | | | 4.8 | 48 | | 2 | 2 | 2 |
| 06/01/03 | 18.8 | | | | 8.4 | 38 | | 2.1 | 4 | 4 |
| 06/12/03 | 21.2 | | | | 5.4 | 19 | | 2.7 | 2 | 2 |
| 06/15/03 | 24.1 | | | | 1.6 | 25 | | 2.9 | 4 | 4 |
| 06/29/03 | 22.4 | | | | 2.8 | 29 | | 2.3 | 3 | 3 |
| 07/12/03 | 24.1 | | | | 42 | 66 | | 0.9 | 3 | 2 |
| 07/27/03 | 25.8 | | | | 55 | 54 | | 0.6 | 3 | 3 |
| 08/10/03 | 26.9 | | | | 37 | 38 | | 0.6 | 3 | 3 |
| 09/07/03 | 22.4 | | | | 44 | 42 | | 0.6 | 5 | 3 |
| 09/20/03 | 16.8 | | | | 27 | 90 | | 0.8 | 3 | 2 |
| 10/05/03 | 11.8 | | | | 20 | 80 | | 1.2 | 2 | 2 |
| 10/18/03 | 10.1 | | | | 17 | 100 | | 1.22 | 3 | 2 |

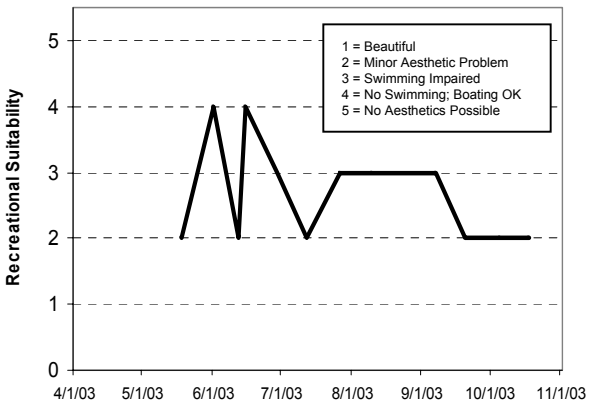



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | | | | | C | C | C | C |
| Chlorophyll a | | | | | | | | | C | C | C | C |
| Secchi Depth | | | | | | | | | C | C | C | C |
| **Overall** | | | | | | | | | **C** | **C** | **C** | **C** |

Source: Metropolitan Council and STORET data



## Waconia Lake (10-0059) *Carver County Environmental Services*

Lake Waconia, located next to the City of Waconia in Carver County, is considered a Metropolitan Area "Priority Lake" because of its multi-recreational uses. Lake Waconia is one of the largest bodies of water in the region. It has a surface area of approximately 3,000 acres (6.8 miles in circumference), and mean and maximum depths of 4.0 and 11.3 m (13.1 and 47.1 feet), respectively. The lake has an approximate volume of 38,632 ac-ft (resulting in a retention time of about 10 years) and an approximate watershed-to-lake size ratio of 4:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

There are a couple of public accesses on the lake to support its high-volume recreational use. One access is a city-owned access on the southern end of the lake while the other is a state-owned access on the northeastern shore. In the future, the recreational use on and around the lake may increase if a proposed regional park on the lake's southeastern shores becomes a reality. 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.

A variety of land uses around Lake Waconia may contribute to the lake's nutrient load. There are residential areas along the lake's shoreline (25.9 homes/shoreline mile), wetlands, commercial/ industrial areas, and rural/agricultural uses. The predominant uses associated with rural/agricultural areas are livestock and crop farming (51 percent), while those affiliated with the City of Waconia include: single and multi-family residential, commercial/industrial, and paved areas such as parking lots and city streets. All the land uses around the lake pose a potential runoff and pollution problem to the lake. Shoreline homes provide the possibility of lawn runoff of herbicides and fertilizers. Rural/agricultural uses, if not properly managed, can result in herbicides, fertilizers, and eroded soils ending up in the lake. City uses, where a majority of the area is paved, can result in large amounts of nutrient rich debris entering the lake after a rainstorm. These non-point pollution problems can hasten the lake's natural eutrophication process, resulting in a lake that cannot support all of its recreational uses.

Lake Waconia has been involved in CAMP since 1994. In 2003, the lake was monitored 14 times between mid-April and mid-October. During each monitoring event the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. The mean summertime (May-September) surface TP concentration for the lake was 35.1 µg/l (minimum of 25.0 µg/l, and maximum of 49.0 µg/l). The mean CLA and Secchi transparency readings were 13.1 µg/l (minimum of 4.3 µg/l and maximum of 27.0 µg/l) and 1.9 m (minimum of 1.1 m and maximum of 3.5 m), respectively. The lake's mean surface TKN concentration was 0.94 mg/l (minimum of 0.63 mg/l and maximum of 1.30 mg/l). Summertime means resulted in a TP grade of C, CLA grade of B, and a Secchi transparency grade of C. Waconia Lake's overall grade for 2003, determined through the calculation of all three parameter grades, was C. The 2003 overall grade (identical to those recorded in 1998-2000) is worse than those recorded in 1995-1997 and 2001. The lake's best water quality year recorded through CAMP was 1994 (TP= 21.0 µg/l, CLA= 6.3 µg/l, and Secchi= 3.1 m resulting in an overall grade of A), while the worst was 1998 (TP= 39.1 µg/l, CLA= 18.2 µg/l, and Secchi= 2.0 m resulting in an overall grade of C).

A search of Council, MPCA, and STORET databases revealed nutrient water quality data for 1980, 1981, 1985, 1990, 1994-2002 (all as a part of the Council's lake monitoring programs). Additionally, Secchi transparencies have been collected through the MPCA's Citizen Lake Monitoring Program since 1974. The lake received C's in 1980,, and B's and C's in 1981, 1985 and 1990, an A in 1994 a strong B in 1995 and 2002, moderate B in 1996-1997 and 2001, and a C in 1998-2000 and 2003. Supplemental Secchi

data from 1980-1993 has resulted in annual grades of C or D. The lake's overall water quality grade seems to be well represent by an overall grade of C+/B. Additionally, the MPCA recently conducted a trend analysis on the lake's Secchi transparency data, which revealed a statistically significant improvement in recent water clarity

The volunteer monitor's perception of the lake's physical and recreational conditions were ranked on a 1-to-5 scale during each monitoring event. The rankings are shown on the information sheet on the next page. The mean physical condition ranking was 1.3 (between 1- "crystal clear" and 2- "some algae present"), while the mean recreational suitability ranking was 1.0 (1- "beautiful").

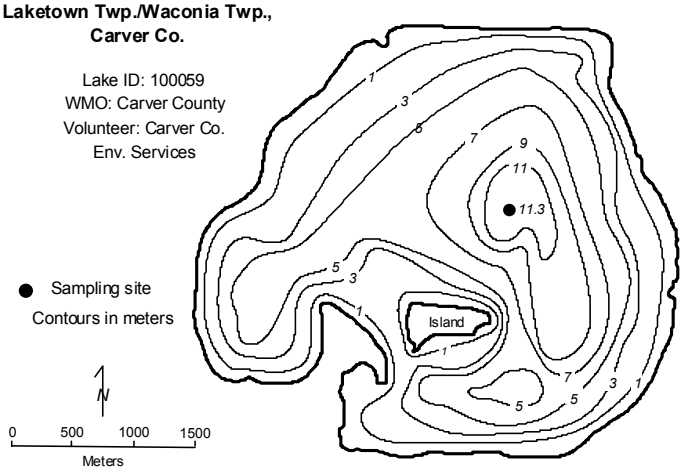
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

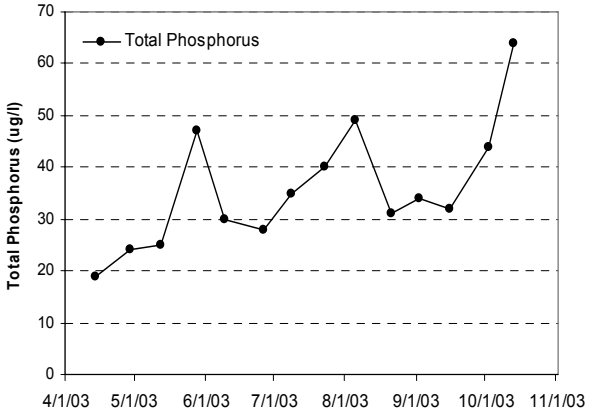
If you know of any errors in the lake's data or physical information, or are aware of any additional information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

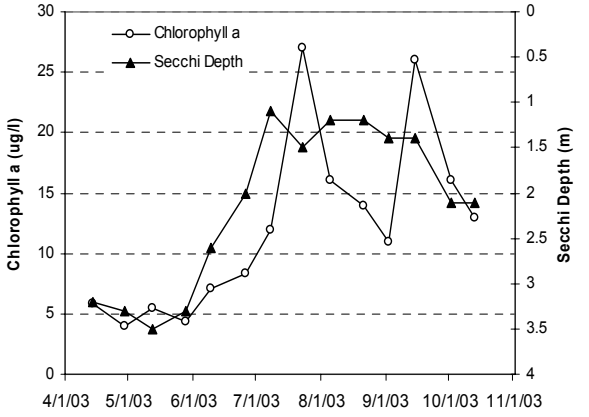
# Lake Waconia

**Laketown Twp./Waconia Twp., Carver Co.**

Lake ID: 100059
WMO: Carver County
Volunteer: Carver Co. Env. Services

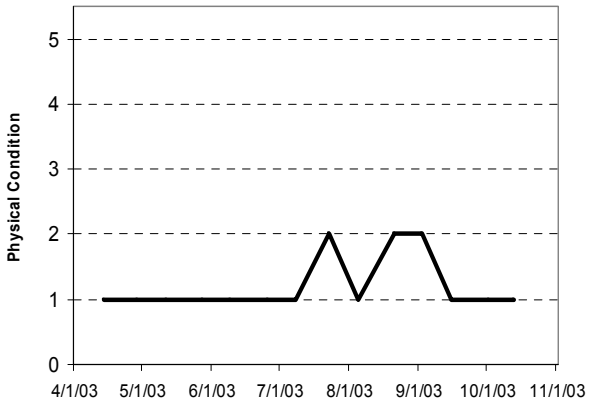



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 7.1 | | 8.93 | | 5.9 | 19 | | 3.2 | 1 | 1 |
| 04/29/03 | 12.9 | | 10.24 | | 4 | 24 | | 3.3 | 1 | 1 |
| 05/12/03 | 12.3 | | 11.68 | | 5.5 | 25 | | 3.5 | 1 | 1 |
| 05/28/03 | 18.4 | | 10.58 | | 4.3 | 47 | | 3.3 | 1 | 1 |
| 06/09/03 | 21.7 | | 7.67 | | 7.1 | 30 | | 2.6 | 1 | 1 |
| 06/26/03 | 22 | | 7.42 | | 8.4 | 28 | | 2 | 1 | 1 |
| 07/08/03 | 24.2 | | 7.98 | | 12 | 35 | | 1.1 | 1 | 1 |
| 07/23/03 | 23.9 | | 9.47 | | 27 | 40 | | 1.5 | 2 | 1 |
| 08/05/03 | 24.6 | | | | 16 | 49 | | 1.2 | 1 | 1 |
| 08/21/03 | 26.1 | | 15.58 | | 14 | 31 | | 1.2 | 2 | 1 |
| 09/02/03 | 23.7 | | 5.24 | | 11 | 34 | | 1.4 | 2 | 1 |
| 09/15/03 | 21.4 | | 5.13 | | 26 | 32 | | 1.4 | 1 | 1 |
| 10/02/03 | 12.1 | | 8.85 | | 16 | 44 | | 2.1 | 1 | 1 |
| 10/13/03 | 14.1 | | 8.71 | | 13 | 64 | | 2.1 | 1 | 1 |

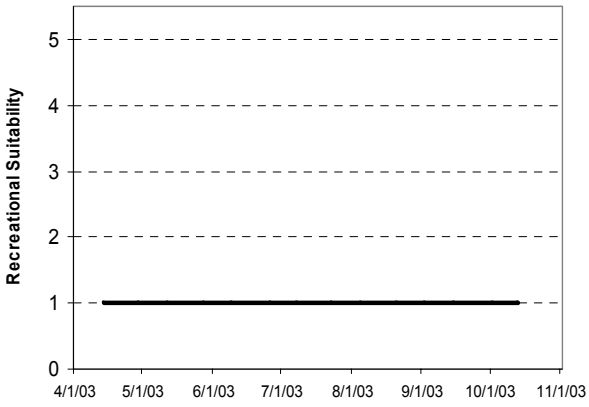



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | A | A | B | B | C | C | C | C | B | C |
| Chlorophyll a | | | A | B | B | B | B | B | B | B | B | B |
| Secchi Depth | C | C | A | B | C | C | C | C | C | B | B | C |
| **Overall** | | | **A** | **B** | **B** | **B** | **C** | **C** | **C** | **B** | **B** | **C** |

Source: Metropolitan Council and STORET data



## West Boot Lake (82-0044) *Carnelian - Marine Watershed District*

This was the fourth year of CAMP monitoring in West Boot Lake which is located in May Township (Washington County). A search through the STORET nationwide water quality database revealed a moderate amount of data on the lake over the past 10+ years (1991 and 1996-1999 and the 2000-2002CAMP data). The 110-acre lake has a mean and maximum depth of 5.9 m (19 feet) and 11.9 m (39 feet), respectively. The mean depth of the lake and its surface area translate to an approximate lake volume of 2,090 ac-ft. Roughly 56 percent of the lake's ares is considered littoral zone (the 0-15 foot depth area dominated by aquatic vegetation). The lake's 209-acre immediate watershed translates to a 2:1 watershed-to-lake size ratio (the greater the ratio, the greater the potential stress on the lake from surface runoff).

The lake was monitored 14 times between mid-April and mid-October, 2003. 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.

The mean summertime (May through September) surface TP concentration for the lake was 27.5 µg/l (minimum of 13.0 µg/l, maximum of 83.0 µg/l). The mean CLA and Secchi transparency readings were 4.4 µg/l (minimum of 2.7 µg/l, maximum of 8.0 µg/l) and 3.24m (minimum of 2.1 m, maximum of 4.6 m), respectively. The lake's mean surface TKN concentration was 0.62 mg/l. The lake quality grades assigned to the 2003 summertime means were TP= B; CLA= A; and Secchi= A, resulting in an overall grade of A. The 2003 overall grade is identical to those of 1999-2002.

An abnormal TP reading for the lake on August 19, 2003 (the 83.0 µg/l reading was roughly 3-4 times the reading from either of the surrounding monitoring dates), however, resulted in the lake slipping out of the A-grade range for TP in 2003. The data point was included in the determination of the mean because in-lab processes and QA/QC runs within the batch where the questionable sample was analyzed, were checked and okayed.

The collected data and resulting graphs showing TP and CLA concentrations, Secchi transparency, and user perception (physical condition and recreational suitability) are presented on the lake's information sheet on the following page.

Throughout the summer, the volunteer ranked the lake's perceived physical condition on a 1-to-5 scale (see lake information sheet). The mean physical condition ranking was 2.5 (between 2- "some algae present" and 3- "swimming slightly impaired"), while the mean recreational suitability ranking was 2.7 (between 2- "minor aesthetic problem" and 3- "swimming slightly impaired").

Since there is a limited amount of historic data available for West Boot Lake, it is not possible to determine any long-term trends. In the short-term however, the lake seems to have a wide range of fluctuation (overall grade of B in 1996, C in 1997, B in 1998 and A's in 1999-2003). To better understand the lake's water quality and where it may be heading, more data are needed.

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.

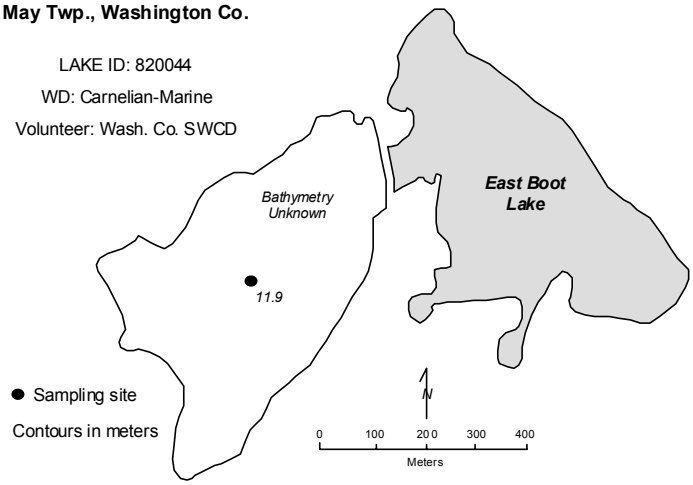
# West Boot Lake

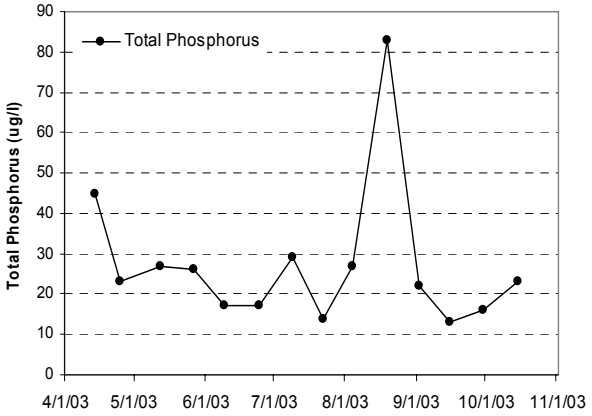
**May Twp., Washington Co.**

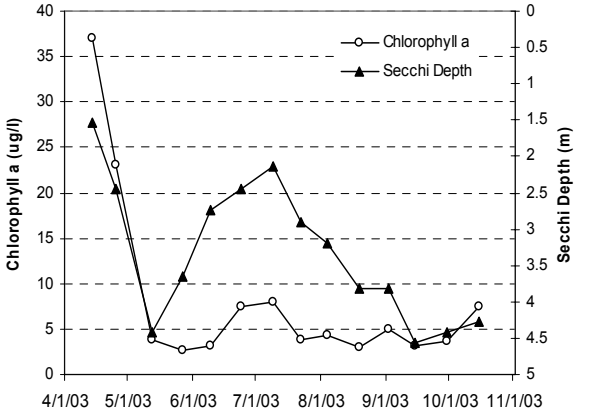
LAKE ID: 820044

WD: Carnelian-Marine

Volunteer: Wash. Co. SWCD

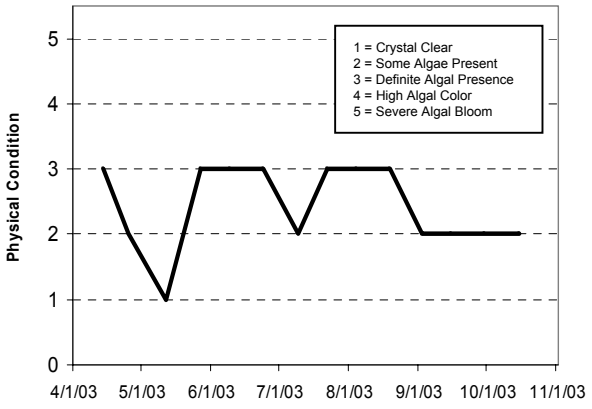



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/14/03 | 10 | | 11.12 | | 37 | 45 | | 1.53 | 3 | 3 |
| 04/25/03 | 12.6 | | 4.5 | | 23 | 23 | | 2.44 | 2 | 1 |
| 05/12/03 | 13.7 | | 7.08 | | 3.9 | 27 | | 4.42 | 1 | 2 |
| 05/27/03 | 21.9 | | 4.99 | | 2.7 | 26 | | 3.66 | 3 | 3 |
| 06/09/03 | 21.9 | | 4.7 | | 3.1 | 17 | | 2.74 | 3 | 3 |
| 06/24/03 | 25 | | 6.91 | | 7.5 | 17 | | 2.44 | 3 | 3 |
| 07/09/03 | 25.3 | | 7.62 | | 8 | 29 | | 2.13 | 2 | 3 |
| 07/22/03 | 24.9 | | 3.82 | | 3.8 | 14 | | 2.898 | 3 | 3 |
| 08/04/03 | 25.8 | | 6.3 | | 4.3 | 27 | | 3.2 | 3 | 3 |
| 08/19/03 | 27.3 | | 7.91 | | 3 | 83 | | 3.81 | 3 | 3 |
| 09/02/03 | 22.9 | | 5.42 | | 4.9 | 22 | | 3.81 | 2 | 2 |
| 09/15/03 | 21.5 | | 6 | | 3.2 | 13 | | 4.57 | 2 | 2 |
| 09/30/03 | 12.8 | | 8.64 | | 3.6 | 16 | | 4.42 | 2 | 2 |
| 10/15/03 | 13.3 | | 9.04 | | 7.5 | 23 | | 4.267 | 2 | 1 |

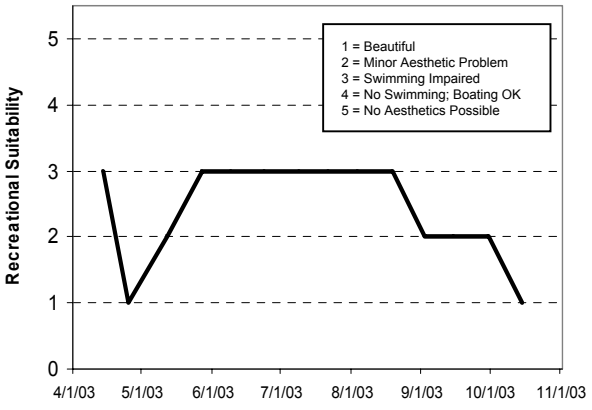



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | B | C | A | A | A | A | A | B |
| Chlorophyll a | | | | | A | B | C | A | A | A | A | A |
| Secchi Depth | | | | | B | C | B | A | A | A | A | A |
| **Overall** | | | | | **B** | **C** | **B** | **A** | **A** | **A** | **A** | **A** |

Source: Metropolitan Council and STORET data



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

This was the fifth year of CAMP monitoring in Westwood Lake (1993 and 2000-2002 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 nine times between mid-April and late-August, 2003. Results from the monitoring are presented on the information sheet on the next page.

The overall lake quality grade for 2003 Westwood Lake was B as determined from the individual parameter grades (C for TP, A for CLA and C for Secchi transparency). The summertime (May through September) mean TP concentration was 36.4 µg/l (minimum of 26.0 µg/l and maximum of 77.0µg/l), while the mean CLA concentration was 9.1 µg/l (minimum and maximum of 2.8 µg/l and 14.0µg/l). Westwood Lake's mean Secchi transparency was 1.26 m (minimum of 1.20 m and maximum of 1.50 m). The lake's mean TKN concentration was 0.90 mg/l (minimum of 0.54 mg/l and maximum of 1.50 mg/l).

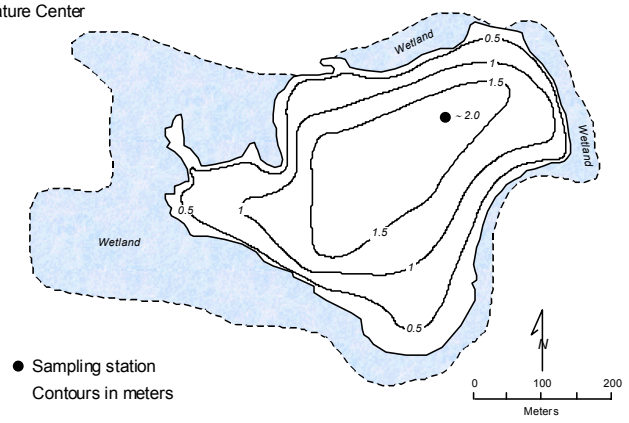
Since there is a limited amount of historic data available for Westwood Lake, it is not possible to determine any long-term trends. In the short-term however, the lake seems to have a wide range of fluctuation (overall grade of D in 1982, C in 1993 and 2001-2002, and B in 2000 and 2003). To better understand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

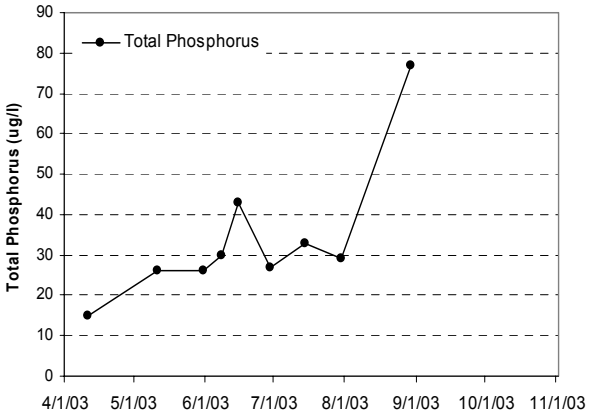
Throughout the monitoring period, the volunteers' opinion of the lake's physical and recreational conditions were ranked on a 1-to-5 scale. These user perception rankings are shown on the lake information sheet. The average user perception rankings, on a 1-to-5 scale, were 1.8 for physical condition (between 1- "crystal clear" and 2- "some algae present"), and 3.1 for recreational suitability (roughly equal to 3- "swimming slightly impaired").

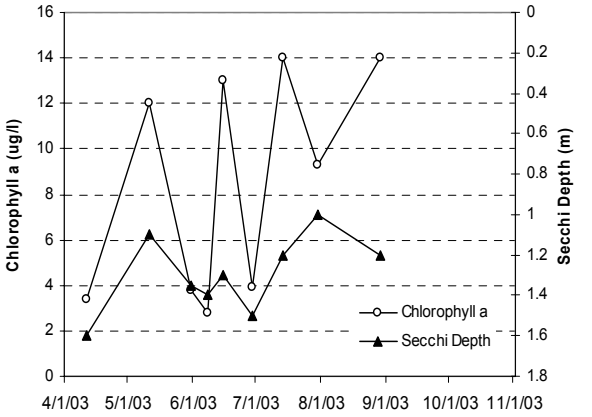
If you know of any errors in the lake's data or physical information, or are aware of any additional information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

Lake ID: 270711
WMO: Bassett Creek
Volunteer:Westwood Hills Nature Center

# Westwood Lake,
**St. Louis Park, Hennepin Co.**

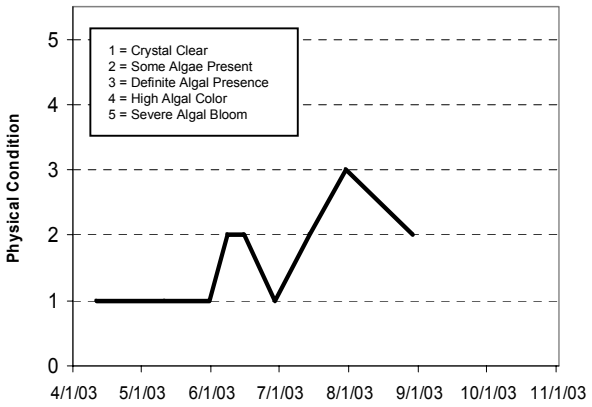



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/11/03 | 12.3 | | | | 3.4 | 15 | | 1.6 | 1 | 4 |
| 05/11/03 | 17 | | | | 12 | 26 | | 1.1 | 1 | 3 |
| 05/31/03 | 18 | | | | 3.8 | 26 | | 1.35 | 1 | 3 |
| 06/08/03 | 21 | | | | 2.8 | 30 | | 1.4 | 2 | 3 |
| 06/15/03 | 29 | | | | 13 | 43 | | 1.3 | 2 | 4 |
| 06/29/03 | 25 | | | | 3.9 | 27 | | 1.5 | 1 | 3 |
| 07/14/03 | | | | | 14 | 33 | | 1.2 | 2 | 4 |
| 07/30/03 | | | | | 9.3 | 29 | | 1 | 3 | 3 |
| 08/29/03 | | | | | 14 | 77 | | 1.2 | 2 | 2 |

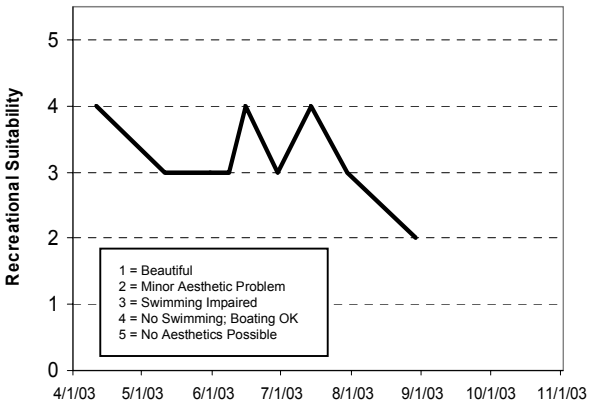



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | C | | | | | | | B | B | C | C |
| Chlorophyll a | | C | | | | | | | B | C | B | A |
| Secchi Depth | | C | | | | | | | C | C | C | C |
| **Overall** | | **C** | | | | | | | **B** | **C** | **C** | **B** |

Source: Metropolitan Council and STORET data



## Wilmes Lake (82-0090) *City of Woodbury*

Wilmes Lake, located in the City of Woodbury (Washington County) is classified as a minnow lake that experiences frequent fish kills. The lake has a surface area of 41 acres (1.3 miles around) and a maximum depth of 5.5 m (18 feet). While there is currently no public access to the lake, one is planned at the northern end of the lake. The lake's 2,247-acre watershed translates to a large watershed-to-lake size ratio of 55:1. The larger the ratio, the greater the potential stress on the lake quality from surface runoff.

The future "ultimate" land uses within the lake's contributing watershed are expected to be: 16.4 percent single-family residential, 4.5 percent multi-family residential, 10.5 percent commercial/retail, 3.7 percent parks/open space, 1.0 percent ponds/wetlands, and 63.9 percent indirect drainage (City of Woodbury 1994).

Wilmes Lake has been involved in CAMP since 1994. In 2003, the lake was monitored 12 times between late-April and late-September. Results are presented on the next page. The overall lake quality grade for Wilmes Lake in 2002 was C (similar to 1995-1996 and 1999-2000). The 2003 overall grade is better than the overall grade of D recorded in 1997-1998 and 2001, and worse than 1994 (B). The summertime (May through September) mean TP concentration of 97.6 µg/l (minimum of 33.0 µg/l, maximum of 234.0 µg/l) corresponded to a grade of D. The mean CLA concentration was 33.9 µg/l (minimum of 9.9 µg/l, maximum of 110.0 µg/l) equates to a C, as does the mean Secchi transparency of 1.21 m (minimum of 0.90 m and maximum of 1.80 m). The lake's mean TKN concentration was 1.16 mg/l (minimum of 0.87 mg/l, maximum of 1.60 mg/l).

While the lake was monitored through CAMP in 1994 and 1995, past data comparisons to the 1996-2003 data cannot really be made because in 1994-1995 the lake was monitored in the northern basin and in 1996-2003 the southern basin has been monitored. No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the overall lake grade in the north basin seems to be C/B, while the overall grade of the south basin seems to be C/D.

Throughout the monitoring period, the perceived physical condition and recreational suitability of the lake were ranked on a 1-to-5 scale by the volunteer monitors. These user perception rankings are presented in data tables and graphs on the information sheet. The mean physical condition ranking was 2.8 (between 2- "some algae present" and 3-"definite algae present"). The mean recreational suitability ranking was 2.5 (between 2- " minor aesthetic problem" and 3- "swimming slightly impaired").

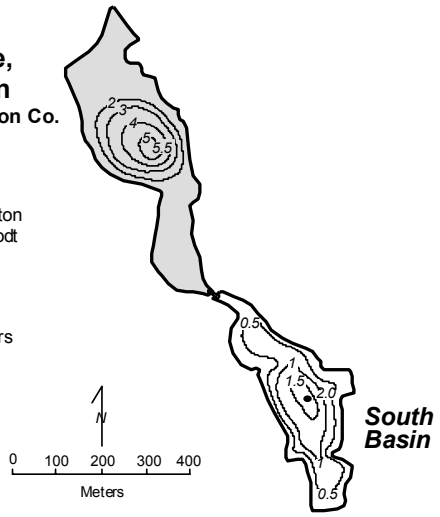
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

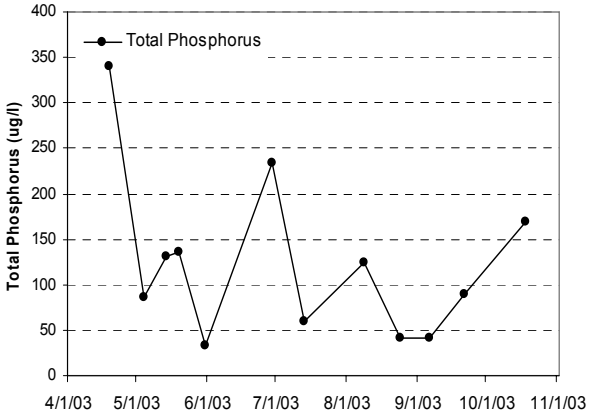
# Wilmes Lake, South Basin

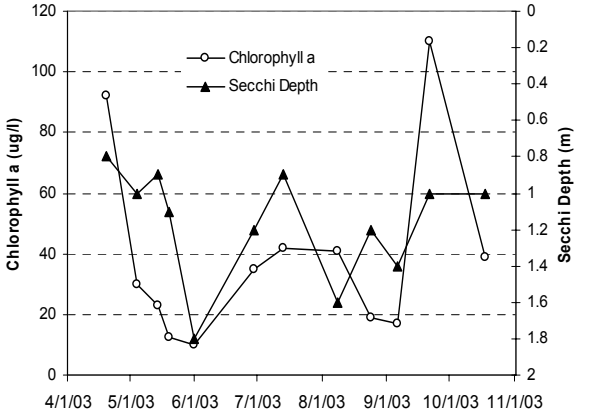
**Woodbury, Washington Co.**

Lake ID: 820090
WD: South Washington
Volunteer: Bill Aamodt

● Sampling site
Contours in meters

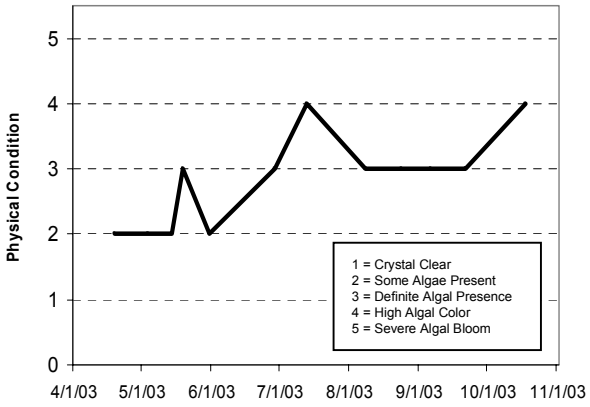



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/19/03 | 8.5 | | | | 92 | 341 | | 0.8 | 2 | 2 |
| 05/04/03 | 14 | | | | 30 | 86 | | 1 | 2 | 2 |
| 05/14/03 | 15 | | | | 23 | 131 | | 0.9 | 2 | 2 |
| 05/19/03 | 19.2 | | | | 12.4 | 136 | | 1.1 | 3 | 3 |
| 05/31/03 | 19 | | | | 9.9 | 33 | | 1.8 | 2 | 1 |
| 06/29/03 | 23.5 | | | | 35 | 234 | | 1.2 | 3 | 3 |
| 07/13/03 | 25.5 | | | | 42 | 60 | | 0.9 | 4 | 3 |
| 08/08/03 | 25 | | | | 41 | 124 | | 1.6 | 3 | 3 |
| 08/24/03 | 25 | | | | 19 | 42 | | 1.2 | 3 | 3 |
| 09/06/03 | 24 | | | | 17 | 41 | | 1.4 | 3 | 3 |
| 09/21/03 | 18 | | | | 110 | 89 | | 1 | 3 | 2 |
| 10/18/03 | 13 | | | | 39 | 170 | | 1 | 4 | 3 |

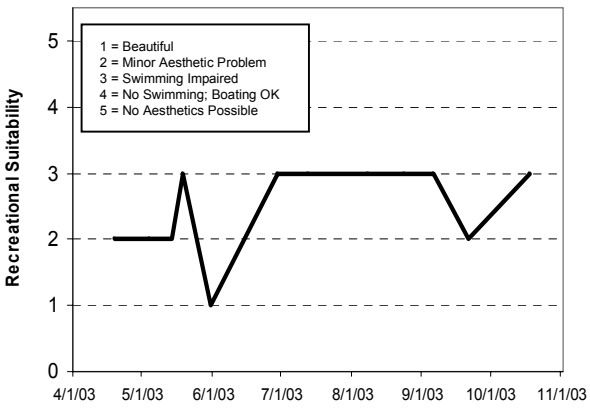



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | C | D | D | D | D | D | D | D | D | D |
| Chlorophyll a | | | B | B | C | C | C | C | C | C | D | C |
| Secchi Depth | | | B | C | C | D | D | C | C | D | D | C |
| **Overall** | | | **B** | **C** | **C** | **D** | **D** | **C** | **C** | **D** | **D** | **C** |

Source: Metropolitan Council and STORET data



## Winkler Lake (10-0066) *Carver County Environmental Services*

Winkler Lake is a 129-acre lake located within Benton Township (Carver County). The lake has a 2,758-acre immediate watershed, which translates to a watershed-to-lake area ratio of 21:1 (the larger the ratio the greater the potential stress put on the lake from surface runoff). A 1999 water quality report on water resources in Carver County estimates land use for the watershed at: three percent residential, 77 percent agricultural, two percent commercial/industrial, and 18 percent open/undeveloped (Carver County Planning 1999). The lake is the receiving waterbody for the Bongard's wastewater treatment plant.

This was the fourth year that Winkler Lake has been involved in CAMP (the others being 1999 and 2000-2001). The lake was monitored 13 times between mid-April and mid-October, 2003. A search through the STORET nationwide water quality database provided only one additional year of data (1995) as well as the CAMP data.

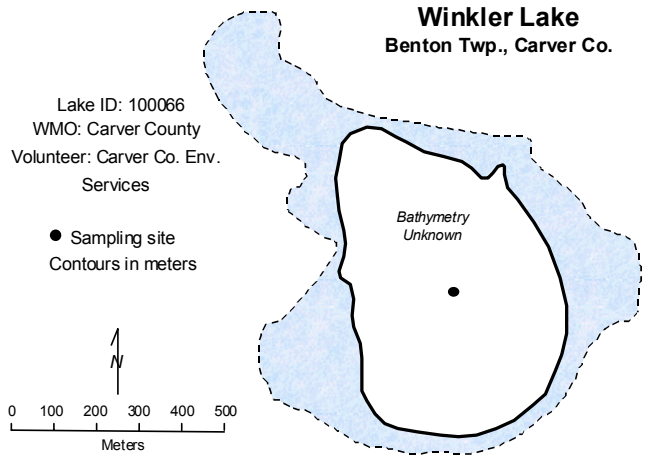
During each monitoring event, the lake was monitored for TP, CLA, TKN, and Secchi transparency, as well as the lake's perceived physical condition and recreational suitability. Results are presented on graphs and data tables on the following page.

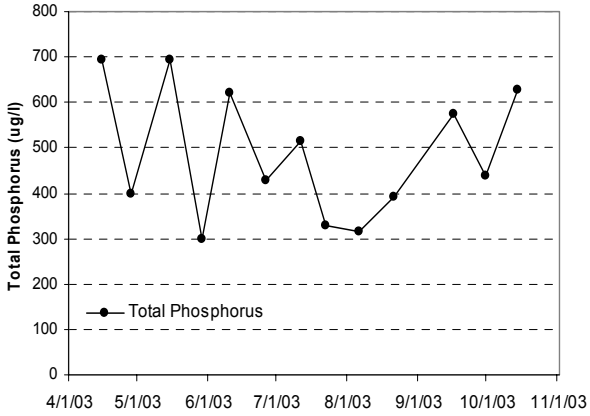
The lake's overall 2003 lake quality grade of F was determined from the individual parameter grades (the lake received an F for all three parameters). The summertime (May through September) mean TP concentration was 460.3 µg/l (the worst TP mean recorded in CAMP 2003)(minimum of 298.0 µg/l, maximum of 694.0 µg/l), while the lake's summer mean Secchi transparency was 0.4 m (minimum of 0.2 m, maximum of 1.2 m). The mean CLA concentration was 120.0 µg/l (minimum of 47.0 µg/l and maximum of 290.0 µg/l). The mean TKN concentration over the same time period was 3.90 mg/l (minimum of 1.60 mg/l and maximum of 2.80 mg/l).

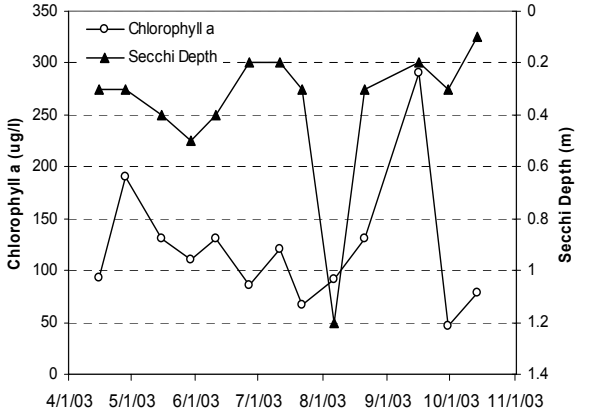
The average user perception rankings, on a 1-to-5 scale, were 3.5 for physical condition (between 3- “”definite algae present” and 4- “high algal color”) and 4.1 for recreational suitability ranking (between 4- “no swimming - boating ok” and 5- “no aesthetics possible”).

As mentioned earlier, there is very little water quality data available for Winkler Lake. Therefore, it is not possible to determine any long-term or short-term trends. To better understand the lake's water quality and where it may be heading, additional years of data collection are needed.

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.

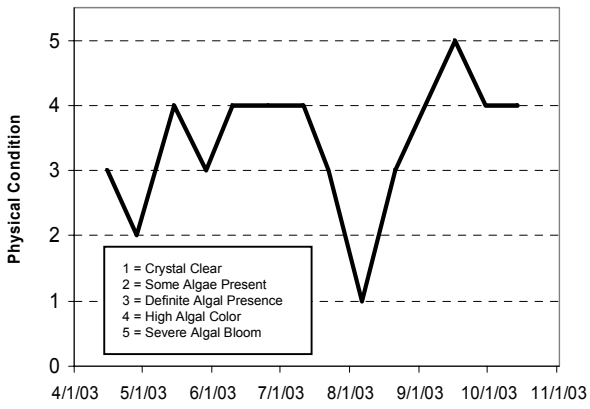



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 16.9 | | 10.2 | | 93 | 694 | | 0.3 | 3 | 4 |
| 04/28/03 | 13.8 | | 11.41 | | 190 | 398 | | 0.3 | 2 | 5 |
| 05/15/03 | 15.1 | | 13.76 | | 130 | 694 | | 0.4 | 4 | 5 |
| 05/29/03 | 19.6 | | 10.91 | | 110 | 298 | | 0.5 | 3 | 4 |
| 06/10/03 | 19.6 | | 14.45 | | 130 | 622 | | 0.4 | 4 | 4 |
| 06/26/03 | 17.4 | | 7.76 | | 85 | 429 | | 0.2 | 4 | 5 |
| 07/11/03 | 21.8 | | 11.87 | | 120 | 513 | | 0.2 | 4 | 5 |
| 07/22/03 | 22.4 | | 5.42 | | 67 | 328 | | 0.3 | 3 | 4 |
| 08/06/03 | 24.6 | | | | 91 | 316 | | 1.2 | 1 | 1 |
| 08/21/03 | 21.6 | | 11.79 | | 130 | 393 | | 0.3 | 3 | 4 |
| 09/16/03 | 17.7 | | 12.02 | | 290 | 573 | | 0.2 | 5 | 5 |
| 09/30/03 | 6.9 | | 5.96 | | 47 | 437 | | 0.3 | 4 | 4 |
| 10/14/03 | 9.1 | | 11.75 | | 79 | 629 | | 0.1 | 4 | 4 |

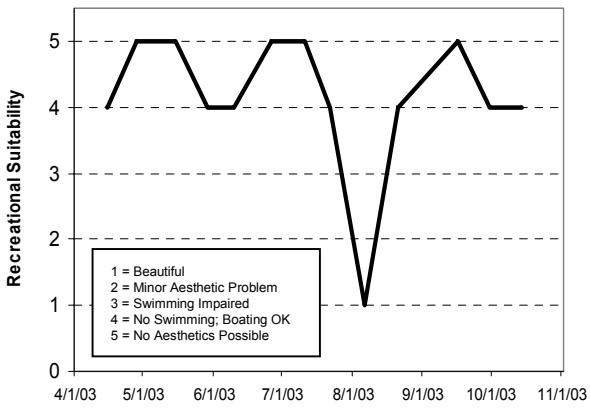



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | F | | | | F | F | F | | F |
| Chlorophyll a | | | | A | | | | D | F | C | | F |
| Secchi Depth | | | | C | | | | F | F | F | | F |
| **Overall** | | | | **C** | | | | **F** | **F** | **D** | | **F** |

Source: Metropolitan Council and STORET data



## Wood Lake [Burnsville] (19-0024) *Black Dog Watershed Management Commission*

Wood Lake is a 9-acre lake located within the City of Burnsville (Dakota County). The maximum depth of the lake is 4.5 m (14.7 feet). Because the maximum depth is only 4.5 m (almost 15 feet), the entire lake area is considered littoral zone (the area of aquatic vegetation dominance). The majority of the land within the lake's 157-acre immediate watershed is urban/developed. The resulting watershed-to-lake size ratio is 17:1. The greater the ratio, the greater the potential stress on the lake from surface runoff.

This was the eighth year that Wood Lake has been involved in CAMP. The lake (which has been enrolled in CAMP since 1996) was monitored 14 times between mid-April and mid-October, 2003. The resulting data and graphs appear on the next page.

The 2003 overall lake quality grade for Wood Lake, calculated from the individual parameter grades, is C (similar to 1996, 1997, and 1999-2002, but worse than the B of 1998). The 2003 summertime (May - September) mean TP concentration of 40.4 µg/l (minimum of 3.0 µg/l, maximum of 77.0 µg/l) translates to a lake water quality grade of C, as does the mean Secchi transparency of 1.9 m (minimum of 0.68 m and maximum of 3.6 m). The 2003 CLA mean of 13.3 µg/l (minimum and maximum of 1.6 and 32.0 µg/l) also resulted in a grade of B. The lake's mean TKN concentration was 0.99 mg/l (minimum of 0.64 mg/l, maximum of 1.40 mg/l).

As mentioned in previous reports, an alum sulfate (alum) treatment in October of 1997 resulted in the lake's best water quality year in 1998. An alum treatment to a lake involves adding the chemical to bind and precipitate phosphorus, removing it from the water column, and sealing the bound phosphorus in the sediment rendering it inactive for release to the overlying water. By removing the phosphorus from the water column and locking it in the sediments, its availability for plant growth is reduced. The success of this treatment depends on the lake's residence time (the time it would take to entirely refill the lake basin with water if it were empty) and external phosphorus load. The shorter the residence time and the larger the external phosphorus load, the quicker new sources of phosphorus will replenish the water column. Since 1998, however, the lake's water quality has been more comparable to that of the pre-alum treatment years of 1996 and 1997 as opposed to that of 1998. For this reason it seems that the alum treatment has not been wholly successful.

Other than the data collected through CAMP, there are no historical water quality data available for Wood Lake. A search through STORET (EPA's nationwide water quality database) came up empty. Therefore the only summertime data available are those from 1996-2003. No statistically significant long-term trend is evident from the lake's water quality database, in the short-term however, the lake's water quality seems well represented by an overall grade of C. To better understand the water quality of the lake and determine in what direction the water quality is heading, additional years of data collection are needed.

The volunteer monitor's perception of the lake's physical and recreational conditions were ranked on a 1-to-5 scale during each monitoring event. The rankings are shown on the information sheet on the next page. The average user perception rankings were 3.2 for physical condition (which falls between 3- "definite algae present" and 4- "high algal color"), and 3.6 for recreational suitability (between 3-"swimming slightly impaired " and 4- "no swimming: boating ok").

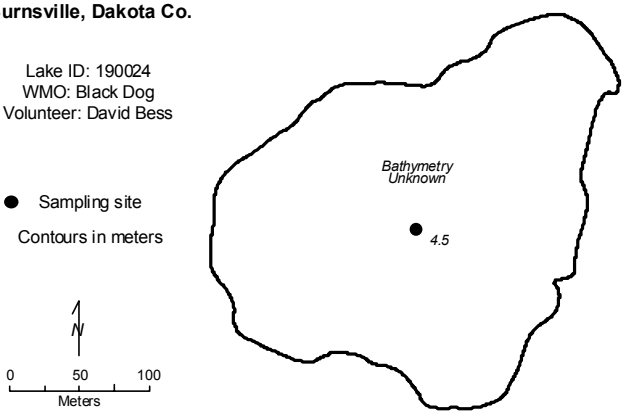
The Fisheries Section of the Minnesota Department of Natural Resources (MDNR) has conducted a fisheries survey on the lake. Information on the survey can be obtained through the MDNR Fisheries Section by calling (651) 297-4916 or by downloading the information off the Internet at http://www.dnr.state.mn.us/lakefind/.

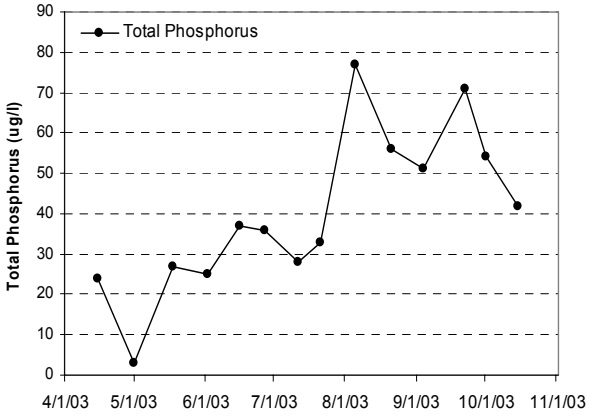
If you notice any errors in the lake's data or physical information, or are aware of any additional or missing information, please contact Randy Anhorn of the Metropolitan Council at (651) 602-8743 or randy.anhorn@metc.state.mn.us.

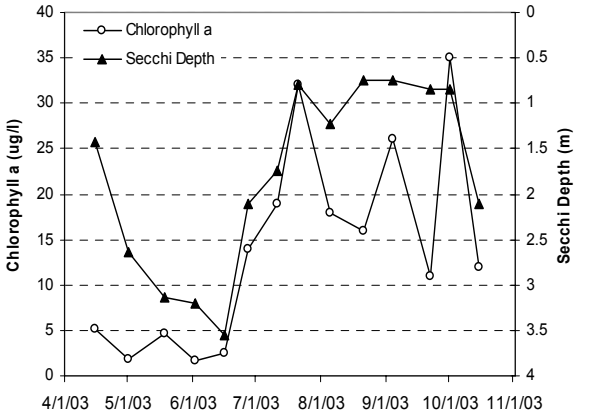
# Wood Lake

**Burnsville, Dakota Co.**

Lake ID: 190024
WMO: Black Dog
Volunteer: David Bess

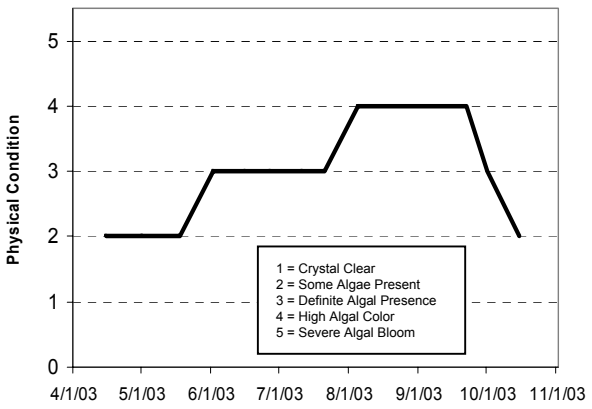



## 2003 Data

| Date | Surf. Temp. (C) | Bot. Temp. (C) | Surf. DO (mg/l) | Bot. DO (mg/l) | CLA (ug/l) | Surf. TP (ug/l) | Bot. TP (ug/l) | Secchi (m) | PC | RS |
|---|---|---|---|---|---|---|---|---|---|---|
| 04/15/03 | 13.6 | | | | 5.2 | 24 | | 1.42 | 2 | 2 |
| 05/01/03 | 15.5 | | | | 1.9 | 3 | | 2.64 | 2 | 2 |
| 05/18/03 | 19 | | | | 4.7 | 27 | | 3.13 | 2 | 2 |
| 06/02/03 | 20.1 | | | | 1.6 | 25 | | 3.2 | 3 | 3 |
| 06/16/03 | 25 | | | | 2.5 | 37 | | 3.56 | 3 | 4 |
| 06/27/03 | 21.6 | | | | 14 | 36 | | 2.1 | 3 | 4 |
| 07/11/03 | 23.1 | | | | 19 | 28 | | 1.74 | 3 | 4 |
| 07/21/03 | 26.2 | | | | 32 | 33 | | 0.8 | 3 | 4 |
| 08/05/03 | 24.9 | | | | 18 | 77 | | 1.23 | 4 | 4 |
| 08/21/03 | 27.2 | | | | 16 | 56 | | 0.75 | 4 | 4 |
| 09/04/03 | 22.5 | | | | 26 | 51 | | 0.75 | 4 | 4 |
| 09/22/03 | 17.8 | | | | 11 | 71 | | 0.84 | 4 | 4 |
| 10/01/03 | 12.5 | | | | 35 | 54 | | 0.85 | 3 | 4 |
| 10/15/03 | 12.8 | | | | 12 | 42 | | 2.1 | 2 | 4 |

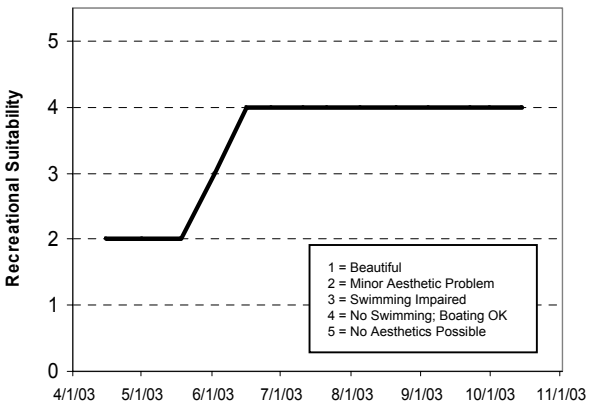



### Lake Water Quality Grades Based on Summertime Averages

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

| Year | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Phosphorus | | | | | C | C | B | C | C | C | C | |
| Chlorophyll a | | | | | B | B | B | B | B | C | C | |
| Secchi Depth | | | | | C | C | C | C | C | C | C | |
| **Overall** | | | | | **C** | **C** | **B** | **C** | **C** | **C** | **C** | |

Source: Metropolitan Council and STORET data



## CONCLUSIONS

The year 2003 marked the eleveth year of the Citizen-Assisted Monitoring Program (CAMP). Evidenced by the increase in the program enrollment and the quality of data collected, CAMP has proven to be a successful and economical tool to determine and/or track the quality of lake resources. Volunteers collected water quality data, including CLA, TKN, and TP concentrations, Secchi transparencies, and user perceptions on 128 lakes in the Twin Cities Metropolitan Area. Thirty-one lakes were enrolled in 1993, 38 lakes in 1994, 45 lakes in 1995, 51 in 1996, 59 in 1997, 57 in 1998, 99 in 1999, 110 in 2000, 20 in 2001 and 125 lake sites on 121 lakes in 2002.

This year's volunteer monitoring program included two lakes never before monitored by the Council, and 108 lake sites returning from 2002 (six of which just included Secchi transparency readings). The 2003 program included lake data from 23 of the 26 watersheds/municipalities/counties represented in the 2002 program. Additionally, the 2003 CAMP program added two new citizen-based entities (Conservation League of Edina and Seidl Lake Association), and one new watershed district (Minnehaha Creek Watershed District) to its growing list of monitoring partners.

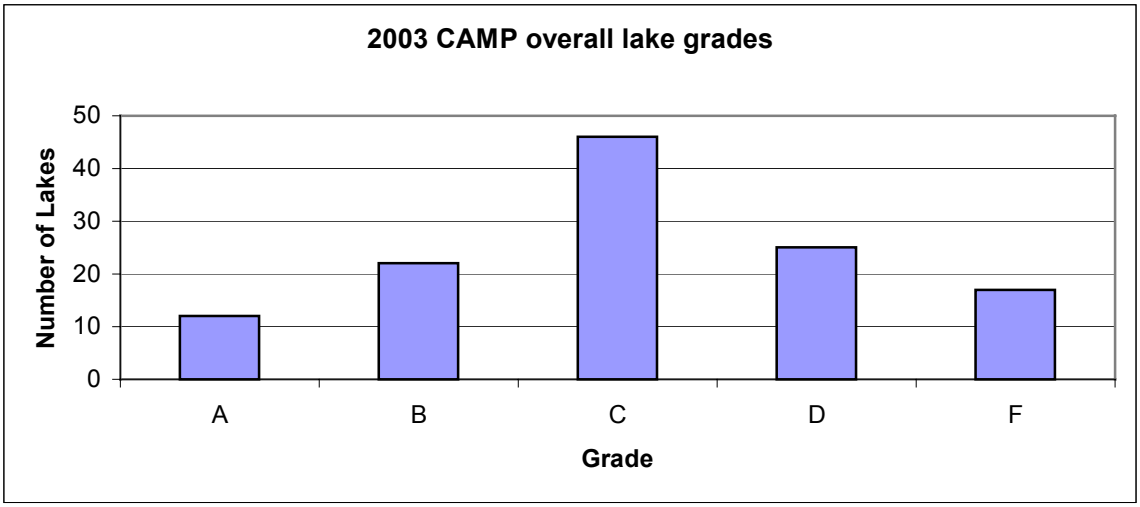
Of the 128 lake sites involved in CAMP in 2003, two lake sites (Cornelia and Long [Mahtomedi] lakes) had never been monitored by the Council prior to 2003. No pre-2003 water quality data could be found for either of the lakes. Thirteen of the 125 lake sites (Brickyard, Cate, Dean, Fish [Grant Township], German, Goetschel, Grace, Island [Linwood], Klawitter, Mergen's, South Oak, Success, and Twin [St. Louis Park]), had only one year of Council-collected data prior to 2003. The greatest percentage of the lakes monitored through CAMP in 2003 received an overall water quality grade of "C" (37.7 percent). The water quality of these lakes is considered average as compared to others in the seven-county metropolitan area.

When comparing the percentage of above-average lakes (those receiving grades of "A" or "B") to below-average lakes (those receiving "D" or "F"), more lakes were below average (34.4 percent to 27.9 percent). The complete 2003 CAMP lake report card grade tally assigned "A's" to 12 lakes (9.9 percent) and "B's" to 22 lakes (18.0 percent). Forty-six lakes acquired "C's" (37.7 percent), 25 received "D's" (20.5 percent), and 17 obtained an "F" (13.9 percent).

The 12 lakes that received "A" grades, within the top 10-percentile range for Metro Area lakes include: Big Carnelian Lake, Big Marine Lake, Brickyard Lake, Cenaiko Lake, Courthouse Lake, Fireman's Lake, Half Breed (Sylvan) Lake, Lac Lavon Lake, Little Carnelian Lake, Square Lake, Sunset Lake, and West Boot Lake. Big Marine and Courthouse lakes, which both received overall water quality grades of "A" in 2001, fell to a "B" overall grade in 2002, returned to an "A" grade in 2003. Kingsley Lake, on the other hand, which received a "B" overall water quality grade in 2001, rebounded to an "A" in 2002, fell back to a "B" in 2003.

The lakes receiving the lowest water quality grade "F" include: Benton Lake, Colby Lake, Cedar Island Lake, Cornelia Lake, Farquhar Lake, Fish Lake (Washington County), French Lake, Goose Lake (Waconia), Grace Lake, Highland Lake (Anoka County), Long Lake (Apple Valley) Long Lake (Washington County), Loon Lake, Miller Lake, Pike Lake (Scott County), Swede Lake, and Winkler Lake. Six of the 17 lakes receiving an overall "F" in 2003 (Colby Lake, Fish Lake (Washington County), Goose Lake (Waconia), Loon Lake, Miller Lake, and Swede Lake), had received a overall grade of "D" in 2002. One lake (Long Lake (Washington County) received its overall "F" grade in 2003 after recording a "C" in 2002. Seven lakes on the other hand (Dean Lake, Downs Lake, Eagle Lake (Carver County), George Watch Lake, Peltier Lake, Sullivan Lake and Twin Lake (St. Louis Park),) which had

received overall grades of "F" in 2002, improved to a D in 2003. One lake (Spring Lake (Scott County), which recorded an "F" grade in 2002, received a "C" in 2003.




Winkler Lake (Carver County) recorded the worst summertime TP mean in 2003 (**460.3** µg/l), while the worst CLA mean was recorded in Long Lake (Apple Valley) (**281.0** µg/l). Long Lake (Apple Valley) flows into Farquhar Lake, which had recorded the worst CAMP CLA means in 2001and 2002. And finally, the lowest Secchi transparency mean of **0.3** m was recorded on Benton (Carver County), French (Hennepin County), and Long (Apple Valley) lakes.

Similar to past years, there is no distinct pattern as to where lakes with specific water quality were located. As was observed in the past, the only similarity between the majority of the D and F grade lakes is their size and mean depth. These lakes are generally shallow with small surface areas. In some cases, the lakes are nothing more than deep marshes with an excess of emergent and submergent vegetation. As was mentioned in past reports, this distinction is important for three reasons: 1) deeper lakes have a greater ability to incorporate nutrients and trap them in the sediments, where they are not available for plant growth (macrophyte and/or algae), 2) shallow lakes tend not to stratify during the summer months, allowing the potential release of phosphorus from bottom sediments to rise through the water column and become available for plant growth, and 3) the small surface areas of these lakes generally result in larger watershed-to-lake ratios. Lakes with large watershed-to-lake ratios, have to handle larger runoff loads for their size than do larger lakes in a similar-sized watershed.

The lakes with above-average water quality (grades of "A" and "B") similarly were not area specific. They were located in all seven of the region's counties (lakes receiving an "A" grade were found in six counties). Common characteristics of the above-average lakes were: they have deeper maximum and mean depths, they develop and maintain a thermocline, they have small contributing watersheds relative to the lakes' surface area, and there was little construction within the lakes' watershed.

Similar to that mentioned in past reports, no "statistically significant" long-term water quality trends could be determined from the nutrient databases of any of this year's CAMP lakes. Reasons for not being able to determine trends are: 1) the majority of lakes in the Metropolitan Area have limited and/or fluctuating databases, or 2) if a sufficient database does exist, analysis revealed no "statistically significant" trend. That being said, however, Farquhar and Long lakes located in Apple Valley have shown a recent, or short-term, decline in overall water quality. The lakes are hydrologically linked, with

Long Lake flowing into Farquhar. Valley Lake, on the other hand, has shown a recent improvement in overall water quality which (the improvement coincides with the use of barley straw to inhibit algal growth). One lake mentioned in the 2002 report as showing some recent decreases in water quality was Powers Lake, located in Woodbury. The lake's 2003 water quality however, was much improved over that recorded in 2001-2002.

Accurate conclusions are difficult because within a lakes' database one year's data may represent only one monitoring date or parameter, water quality may fluctuate greatly from year to year, and/or the lakes' historic water quality database may be lacking (only monitored once or twice over the past ten years). This is especially true when looking at lakes' historic nutrient databases (i.e. phosphorus, and nitrogen). To fully determine if a lake's water quality has truly changed (if it has changed), either additional years of data collection are needed in the future to compare with the present condition of the lake, and/or a complete historical baseline database is needed. Without a complete and accurate historical database, which is rare, it is difficult to determine if a lake's quality has changed because its former quality is not known. Constructing such a database through continued monitoring is essential so that future lake quality trends can be determined.

In many cases, however, lakes' Secchi transparency databases are much more extensive than their related nutrient database. The reasons being that: 1) it is much less expensive to do Secchi readings than it is to have water samples analyzed at a laboratory, and 2) the development of the MPCA coordinated a volunteer Secchi transparency monitoring program in the early-1970's. For these reasons, a few CAMP lakes do have sufficient information to determine statistically significant trends in Secchi transparency.

In fact, recently conducted trend analysis by MPCA on lakes with extensive Secchi transparency databases, revealed that while the majority of statistically assessed lakes showed no trends in water clarity (either negative or improving), more lakes showed an improving trend than a negative trend (MPCA 2003). Of the CAMP 2003 lakes assessed (those with sufficinet data), 11 showed an improving trend in water clarity (Big Marine, Halfbreed/Sylvan, Little Carnelian, Lotus, Marion, Parkers, Sand, Silver, Sunset, Valentine, and Waconia lakes) and four showed a negative trend (Farquhar, Markgrafs, Square, and Sullivan lakes) (MPCA 2003).

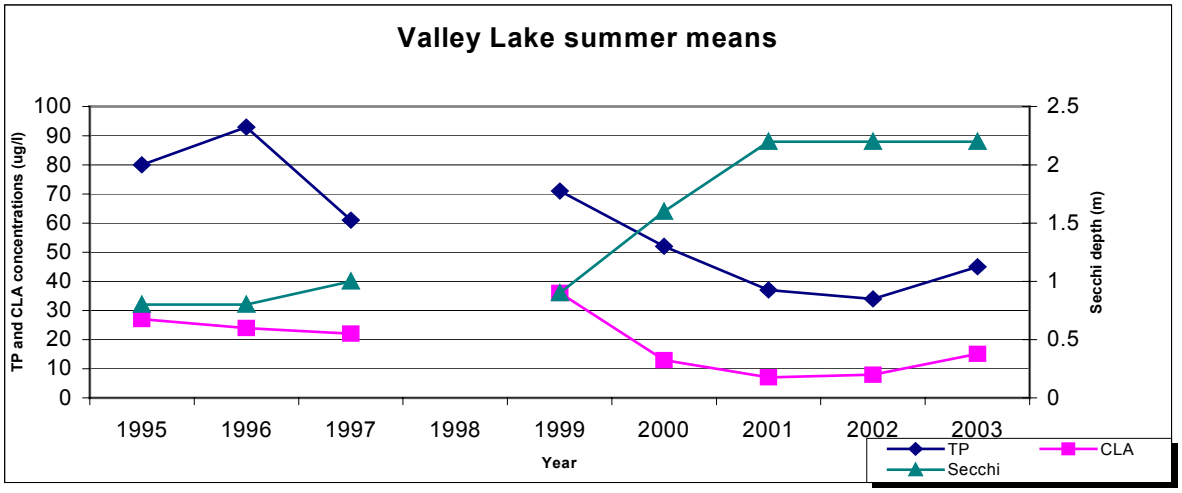
Of the 108 repeat CAMP lakes from 2002, 22 had a better overall water quality grade in 2003 (Big Marine, Courthouse, Dean, Downs, Eagle [Carver County], Fish [Scott County], Fish [Grant Township], Goggins, Hydes, Kismet, Long [May Township], Louise, Oneka, Peltier, Lower Prior, Upper Prior, Seidl, Silver, Spring [Scott County], Sullivan, Westwood, and Wilmes lakes), and 18 had worse overall water quality grades in 2003 (Bass [Washington County], Colby, Fish [Washington County], Goose [Waconia], Keller [Burnsville], Kingsley, Klawitter, Long [Washington County], Loon, Miller, Maple Marsh, Oak, Parkers, Schutz, Staples, Swede, Tamarack, and Waconia lakes), and 68 had the same overall water quality grade for both years. By further breaking down the 68 lakes that had identical overall grades in 2002 and 2003, 40 had similar summertime mean conditions in both 2002 and 2003 (mean TP, CLA and Secchi transparency), 13 had better means in 2003, and 15 had worse or somewhat worse means in 2002. Therefore, water quality analysis of the repeat lakes water quality grades seems to indicate that the Metro Area lakes experienced similar to slightly better water quality conditions in 2003 as compared to 2002

The location breakdown of the 22 lakes with better water quality in 2003 than in 2002 was: two lakes in Anoka County, three in Carver County, one in Dakota County, one in Hennepin County, five in Scott County and 10 in Washington County. The 18 lakes with worse water quality in 2003 were located in Carver County (seven), Dakota County (two), Hennepin County (one) and Washington County (eight).

Similar to 2002, five lakes monitored through CAMP 2003 used barley straw in order to inhibit algal growth and improve water clarity (Jellum's Bay, Lee, Northwood, Twin [Burnsville], and Valley lakes). Barley straw has been used for algae control in the United Kingdom for many years. The principal behind the use of barley straw to control algae, while not truly known, has been thought to involve the release of a chemical(s) (which inhibit algal growth) as the submerged straw decomposes. In an attempt to identify the mechanism behind the decaying barley straw actually reducing in-lake phosphorus concentrations and reducing algal biomass, research has been underway on Valley Lake (and its associated sedimentation basin), since 2001.

Valley Lake was monitored through CAMP in 1995-1997 when barley straw treatments were not used in the lake and 1999-2003 when barley straw was used. This has provided an opportunity to compare the five years where barley straw has been used in the lake, to the three years where it was not. The Valley Lake data indicate that the barley straw not only inhibit algal growth on Valley Lake in 1999-2003, but has also reduced total phosphorus in the lake's surface waters. While the 2003 summer mean TP, CLA and Secchi transparency were similar to or slightly worse than those recorded in 2001 and 2002, they were quite a bit better than those recorded prior to the use of barley straw.

As part of the barley straw research on Valley Lake and its associated sedimentation basin (viewed as a control), past sampling centered on trying to identify the chemical compound released by the decaying barley straw. Samples within the lake and sedimentation basin were analyzed for a break down of phenol concentrations (one of the theories behind the barley straw inhibitor) as a part of 57 base neutral acids organic compounds (BNAs). Because the breakdown of BNA compounds for each of the collected samples came back below detection limit (< 2.0 µg/l), it is not thought that chemical compounds (such as phenols) released from the decomposing straw is the mechanism inhibiting the algal growth.




Since the release of a chemical compund such as a phenol is not thought to be the algal inhibitor (as a result of our research), recent Valley Lake research monitoring has centered on the decaying straw actually acting as a carbon source for carbon-limited microbial growth. With the carbon availability secure, the microbial community production soars and phosphorus uptake is shunted through the microbial loop ecosystem (McComas 2003). Therefore, the presence of decaying barley straw results in the lake's algal biomass actually being phosphorus-limited not inhibited by a released chemical compound. Initial analysis of the 2003 carbon and chlorophyll data seems to indicate that this is the case.

Continued monitoring and analysis of carbon (as well as additional analyses), will continue on Valley Lake and its associated sedimentation basin throughout the upcoming 2004-monitoring season.

Since 1980, 273 area lakes have been monitored through the Council's Lake Program (including Council-staff monitoring and CAMP). Some of the lakes have multiple monitoring sites [288 sites]. The list of lakes in the Council's monitoring database is shown in Appendix C. The resulting data from the Council's lake monitoring program are permanently stored in the U.S. EPA's national water quality data bank, STORET (stands for STOrage and RETrievel). The majority of the 288 lake sites have been revisited on a rotating schedule throughout the past 24 years to develop a working baseline to help determine possible trends and to aid lake and watershed managers in their decision making. While the Council has done its best to enhance and expand the region's lake water quality database, it is apparent that one of the most economical and efficient method to expand knowledge of our lakes has been with the assistance of volunteers and cooperation and financial support of watershed management organizations, counties, and cities. So while the first 11 years of CAMP have been very successful, our future goal is to continue to expand the coverage of our lake monitoring program in order to better understand and manage the areas water resources.

If you have questions pertaining to the lake data or descriptions contained in this report, inquiries about CAMP, or suggestions of lakes the Council should consider monitoring in the future, please contact Randy Anhorn at the Metropolitan Council (651) 602-8743 or randy.anhorn@metc.state.mn.us.

## REFERENCES


American Public Health Association. 1992. *Standard Methods for the Examination of Water and Wastewater*. 18th ed.

Anhorn, R.J. 1993. *Handbook for the Citizen-Assisted Lake Monitoring Program*. Metropolitan Council. St. Paul, MN.

Anhorn, R.J. 1994. *A 1993 Study of the Water Quality of 43 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-94-012.

Anhorn, R.J. 1995. *A 1994 Study of the Water Quality of 51 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-95-011.

Anhorn, R.J. 1996. *A 1995 Study of the Water Quality of 59 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-96-014.

Anhorn, R.J. 1997. *A 1996 Study of the Water Quality of 66 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-97-004.

Anhorn, R.J. 1998. *A 1997 Study of the Water Quality of 71 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-98-007.

Anhorn, R.J. 1999. *A 1998 Study of the Water Quality of 70 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-99-008.

Anhorn, R.J. 2000. *A 1999 Study of the Water Quality of 113 Metropolitan Area Lakes*. Metropolitan Council Publ. No. EPE-00-479.

Anhorn, R.J. 2001. *A 2000 Study of the Water Quality of 124 Metropolitan Area Lakes*. Metropolitan Council Publ. No. EPE-01-502.

Anhorn, R.J. 2002. *A 2001 Study of the Water Quality of 132 Metropolitan Area Lakes*. Metropolitan Council Publ. No. EPE-02-516.

Anhorn, R.J. 2003. *A 2002 Study of the Water Quality of 137 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 32-03-019.

Barr Engineering. 1993. *1993 Marcott Lakes Water Quality Study: EP-78 and EP-80*. Barr Engineering. Minneapolis, MN.

Barr Engineering. 1993. *1990 and 1991 Lake water Quality Inventory and Historical Water Quality Trend Analysis: Lakes Ann, Duck, Hyland, Lotus, Lucy, Mitchell, Red Rock, Rice Marsh, Riley, Round, Staring and Susan*. Barr Engineering. Minneapolis, MN.

Barr Engineering. 1994. *Sweeney Lake: Watershed and Lake Management Plan*. Barr Engineering. Minneapolis, MN.

Barr Engineering. 1997. *Project Assessment and Evaluation for the Crystal/Keller Lake Water Quality Improvement Project*. Barr Engineering. Minneapolis, MN.

Barr Engineering. 1997. *North Rice, South Rice, and Grimes Ponds Watershed and Lake Management Plan*. Barr Engineering. Minneapolis, MN.

Barr Engineering. 2001. *2000 Lake Water Quality Study: Northwood Lake, Parkers Lake, Sweeney Lake, and Twin Lake*. Barr Engineering. Minneapolis, MN.

Barr Engineering. *Personal Communication*. Barr Engineering. Minneapolis, MN.

Beduhn, R.J. 1993. *LCMR Lake Monitoring Study: The Effects of Aeration/Circulation on Lake and Reservoirs*. Prepared for the Legislative Commission on Minnesota Resources.

Black Dog Watershed Management Commission. 1987. *Watershed Management Plan*. Orr, Schelen, Mayeron and Associates. St. Paul, MN.

Bokenmeier, D. 1989. *Staying Ahead of the Game*. North American Lake Management Society: Lake Line. 9(8): 2-16.

Browns Creek Watershed Management Organization . 1990. *Watershed Management Plan*. Washington County Soil and Water Conservation District.

Carlson, R.E. 1977. *Trophic Status Index Indicator of Lakes*. Limnology Oceanography 22:361-369.

Capital Region Watershed District. 2003. *Lake McCarrons Management Plan*. The Osgood Group. Shorewood, MN.

Carver County Planning and Zoning Department. 1999. *Carver County 1999 Water QualityReport*. Carver County Planning and Zoning Department.

Carver Creek Watershed Management Organization. 1990. *Water Management Plan*. Carver County Soil and Water Conservation District.

City of Inver Grove Heights. 1993. *Simley Lake Water Quality Study*. Orr, Schelen, Mayeron and Associates.

City of Woodbury. 1994. *Surface Water Management Plan*. Bonestroo Rosene Andelik & Associates. St. Paul, MN.

Cole, G.A. 1983. *Textbook of Limnology: 3rd ed*. C.V. Mosby Company. St. Louis, MI.

Coon Creek Watershed District. 1985. *MSA-509 Plan*. Israelson and Associates, Inc Bloomington, MN.

Environmental Research Group, Inc. 1986. *Management Alternatives Report on the Diagnostic-Feasibility Study for Golden Lake. Anoka County, MN.* Environmental Research Group, Inc.

Forest Lake Watershed Management Organization. 1988. *Surface Water Management Plan*. Washington County Soil and Water Conservation District.

Gersmehl, C., J. Drake and D. Brown. 1986. *Minnesota Water: A Geographical Perspective*. Water Resources Research Center. Public Report Series No. 4.

Gun Club Lake WMO. 1989. *Management Plan*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

Hartsoe, J.A. and R.A Osgood. 1991. *A 1991 Study of the Water Quality of 17 Metropolitan Area Lakes*. Metropolitan Council Publ. 590-92-006.

Hanson, K. 1995. *Personal Communication*. City of Inver Grove Heights, MN.

Kernik, S. 1995-1999. *Personal Communication*. City of Woodbury, MN.

Ludvig, M. 1994. *Lake Waconia Surface Water Report*. Carver County Environmental Services. Chaska, MN.

Maloney, T.E. (ed.). 1979. *Lake and Reservoir Classification Systems*. U.S. EPA Environmental Research Lab. Corvallis, OR. EPA-600/3-79-074.

Marine on St. Croix Watershed Management Organization. 1991. *Water Management Plan*. Washington County Soil and Water Conservation District.

McComas, S. 2003. *Using Barley Straw to Improve Water Clarity in Valley Lake, in 2002, Lakeville Minnesota.* Blue Water science. St. Paul, MN.

Metropolitan Council. 1986. *Water Resources Management: Development Guide/Policy Plan*. St. Paul, MN.

Metropolitan Council. 1997. *Lake McCarrons Wetland Treatment System—Phase III Study Report*. St. Paul, MN.

Middle St. Croix Watershed Management Organization. 1991. *Watershed Management Plan*. Washington County Soil and Water Conservation District.

Minnehaha Creek Watershed District. 1987. *Water Resources Management Plan*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

Minnehaha Creek Watershed District. 1996. *Water Resources Management Plan*. Wenck Associates. Maple Plain, MN.

Minnesota Department of Conservation. 1967. *Metropolitan Lake Inventory*. Minnesota Department of Conservation. St. Paul, MN.

Minnesota Department of Conservation. 1968. *Inventory of Minnesota Lakes*. Minnesota Department of Conservation. St. Paul, MN.

Minnesota Department of Natural Resources. Various years. *Lake Fishery Surveys*. Minnesota Department of Natural Resources. St. Paul, MN.

Minnesota Department of Natural Resources. 1996. *Report on the Status of the DNR Metro Region Trout Resources*. A Metro Region Trout Committee Report. Minnesota Department of Natural Resources. St. Paul, MN.

Minnesota Pollution Control Agency. 1985. *A Citizens' Guide to Lake Protection*. Minnesota Pollution Control Agency. St. Paul, MN.

Minnesota Pollution Control Agency. 1994. *Lake Assessment Program: Lake Waconia*. Minnesota Pollution Control Agency. St. Paul, MN.

Minnesota Pollution Control Agency. 2003. *Fact Sheets on Lake Transparency Trends*. Minnesota Pollution Control Agency. St. Paul, MN.

Montgomery Watson. 1990. *Lake Alimagnet Diagnostic - Feasibility Study*. Montgomery Watson. Wayzata, MN.

Montgomery Watson. 1994-1998. *Personal Communication*. Montgomery Watson. Wayzata, MN.

Newman, R.M., D.W. Ragsdale, and D.D. Biesboer. 1996. *Can Eurasian Watermilfoil be Managed in Minnesota by Biological Control with Native or Naturalized Insects?* Third progress report to the Minnesota Department of Natural Resources, Ecological Services, St. Paul, MN.

Nichols, A.B. 1992. *Citizens Monitor Water Quality*. Water Environment and Technology. March, 1993. pp.55-59.

Oberts, G.L. 1982. *Nonpoint Source Pollution in the Metropolitan Area: Technical Completion Report*. Metropolitan Council Publ. No. 10-82-016.

Oberts, G.L and R.A Osgood. 1988. *Lake McCarrons Wetland Treatment System: Final Report the Function of the Wetland Treatment System and the Impacts on Lake McCarrons*. Metropolitan Council Publ. No. 590-88-095.

Osgood, R. 1981. *A Study of the Water Quality of 60 Lakes in the Seven-County Metropolitan Area*. Metropolitan Council Publ. No. 01-81-047.

Osgood, R. 1982a. *A 1981 Study of the Water Quality of 30 Lakes in the Seven-County Metropolitan Area*. Metropolitan Council Publ. No. 10-82-005.

Osgood, R.A. 1982b. *Using Carlson's Trophic State Indices in Regional Water Quality Assessment*. Water Resources Bulletin 18:67-74.

Osgood, R.A. 1983. *Diagnostic-Feasibility Study of Seven Metropolitan Area Lakes. Part One: General Overview*. Metropolitan Council Publ. No. 10-83-092. *Part Two: Bryant, Elmo, Fish, George, Riley, Spring and Square Lakes*. Metropolitan Council Publ. Nos. 10-83-093 a-g.

Osgood, R.A. 1984a. *A 1983 Study of the Water Quality of 28 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 10-84-037.

Osgood, R.A. 1984b. *A 1984 Study of the Water Quality of 43 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 10-84-172.

Osgood, R.A. 1985. *A 1985 Study of the Water Quality of 32 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 10-85-156.

Osgood, R.A. 1988a. *A 1986/1987 Study of the Water Quality of 10 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 590-88-037.

Osgood, R.A. 1988b. *The Limnology, Ecology and Management of Twin Cities Metropolitan Area Lakes*. Metropolitan Council Publ. No. 590-88-123.

Osgood, R.A. 1989a. *An Evaluation of the Effects of Watershed Treatment Systems on the Summertime Phosphorus Concentration in Metropolitan Area Lakes*. Metropolitan Council Publ. No. 590-89-062b.

Osgood, R.A. 1989b. *A 1989 Study of the Water Quality of 20 Metropolitan Area Lakes*. Metropolitan Council Publ. No. 590-89-129.

Osgood, R.A. 1989c. *An Evaluation of Lake and Stream Monitoring Programs in the Twin Cities Metropolitan Area*. Metropolitan Council Publ. 590-89-128.

Osgood, R.A. 1989d. *Assessment of Lake Use-Impairment in the Twin Cities Metropolitan Area*. Metropolitan Council Publ. No. 590-89-130.

Osgood, R.A. 1990. *A 1990 Study of the Water Quality of 21 Lakes in the Twin Cities Metropolitan Area*. Metropolitan Council Publ. No. 590-90-182.

Osgood, R.A. and J.E. Stiegler. 1990. *The Effects of Artificial Circulation on a Hypereutrophic Lake*. Water Resource Bulletin 26:209-217.

Osgood, R.A. 2000. *City of Victoria Local Water Resources Management Plan: Victoria Lakes – 2000*. Ecosystem Strategies. Shorewood, MN.

Prior Lake - Spring Lake Watershed District. 1991. *Water Resources Management Plan*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

Prior Lake - Spring Lake Watershed District. 1998. *Draft-Water Resources Management Plan*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

Prior Lake - Spring Lake Watershed District. 2001. *Final Report on the Prior-Sprin Lake Improvement Project*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

Rice Creek Watershed District. 1987. *Water Resources Management Plan*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

Riley-Purgatory-Bluff Creek Watershed District. 1982. *Management Plan*. Barr Engineering. Minneapolis, MN.

Short Elliot Hendrickson Inc. 1998. *How's the Water? Plymouth, Minnesota Water Resources Management Plan*. Short Elliot Hendrickson. St. Paul, MN.

Shingle Creek Watershed Management Organization. 1988. *Watershed Management Plan*. James M. Montgomery Engineers (Montgomery Watson). Wayzata, MN.

South Washington Watershed District. 1997. *Watershed Management Plan*. Bonestrro, Rosene, Anderlik and Associates. St. Paul, MN.

Simpson, J.T. 1991. *Volunteer Lake Monitoring: A Methods Manual*. EPA 440/4-91-002.

Six Cities Watershed Management Organization. 1988. *Water Management Plan*. Barr Engineering. Minneapolis, MN.

Square Lake Clean Water Partnership Report. 2001. *Square Lake, Washington County Phase I Resource Investigation.*. Washington County Soil and Water Conservation District. Stillwater, MN.

U.S. Environmental Protection Agency. 1990. *Volunteer Water Monitoring: A Guide For State Managers.* EPA-440/4-90-010.

U.S. Environmental Protection Agency. 1997. *Watershed Protection: Clean Lakes Case Study. Use of Aquatic Weevils to Control a Nuisance Weed in Lake Bomoseen, Vermont*. EPA-841-F-97-002.

U.S. Geological Survey. 1976. *Hydrology of the Lakes in the Minneapolis-St.Paul Metropolitan Area: A Summary of Available Data.* Water-Resources Investigations 76-85.

Valley Branch Watershed District. 1995. *Watershed Management Plan*. Valley Branch Watershed District. Lake Elmo, MN.

Vermillion River Watershed Management Commission. 1989. *Watershed Management Plan*. James M. Montgomery Engineering. Wayzata, MN.

Washington Conservation District. 2002. *August 2001-July 2002 Zooplanton Monitirng Summary Report for Square Lake in Washington County, MN*. Washington Conservation District. Stillwater, MN.

Wenck Associates, Inc. 1987. *Lake Diagnostic/Feasibility Study: Prepared for Forest Lake Watershed Management Organization*. Wenck Associates Inc. Wayzata, MN.

Wenck Associates, Inc. 1987. *Diagnostic/Feasibility Study for Crooked Lake, Anoka County*. Wenck Associates Inc. Wayzata, MN.

Wetzel, R.G. 1983. *Limnology*. Saunders College Publishing. Chicago, IL.

Wilson, B. 1990. *Lake Water Quality Summary of Shields, Bone, Half Breed, and Forest Lakes*. Forest Lake Watershed Management Organization.

# APPENDIX A
# 2003 CAMP Lake/Watershed Characteristics

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alimagnet 19-21 | 109 | 1,288 | 12:1 | 3.0 | 1.5 | 545 | 100 | 12 | N | C | 3.2 | |
| Armstrong 82-116-02 | 39 | | | 1.5 | 1.0 | 128 | 100 | | N | N | | |
| Barker 82-76 | 45 | 823 | 19:1 | 9.0 | 4.4 | 648 | | | Y | N | | |
| Bass (StLP) 27-15 | 95 | | | | | | | | | | | |
| Bass (Wash)82-35 | 81 | | | 4.3 | | | 100 | | N | N | | |
| Bavaria 10-19 | 200 | 711 | 3.5:1 | 18.3 | 5.6 | 3,674 | 40 | | Y | Y | | Centrachid |
| Benton 10-69 | 115 | 322 | 3:1 | 2.0 | | | 100 | | N | N | | |
| Big Carnelian 82-49 | 455 | 1,900 | 4:1 | 20.0 | 9.8 | 14,560 | 28 | | Y | Y | | |
| Big Comfort 13-53 | 219 | | | 14.3 | | | 41 | | Y | Y | | |
| Big Marine 82-52 | 1,706 | 2,659 | 1.5:1 | 15.2 | 7.6 | 42,527 | 67 | | Y | Y | | |
| Black Dog 19-83 | 391 | | | 1.2 | | | 100 | | N | N | 8.0 | |
| Bone 82-54 | 212 | 5,177 | 24:1 | 9.8 | 3.7 | 2,820 | 59 | 3 | Y | Y | | |
| Brickyard 10-225 | 17 | | | 13.1 | | | 35 | | Y | | | |
| Campbell 10-127 | 72 | | | 2.0 | | | 100 | | N | N | | |
| Carol 82-17 | 63 | 375 | 6:1 | 1.8 | 0.9 | 186 | 100 | | N | N | | |
| Cates 70-18 | 27 | | | 4.0 | | | 100 | | N | N | | |
| Cedar Island27-119 | 80 | 800 | 10:1 | 2.1 | 1.4 | 368 | 100 | | N | N | | |
| Cenaiko 2-654 | 29 | | | 9.1 | | | 40 | | Y | N | 0.6 | Stocked w/Trout - Fishing Pier |
| Clear 82-163 | 400 | | | 8.5 | 3.7 | 4,800 | 67 | | Y | Y | 3.9 | Walleye |

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cloverdale 82-9 | 37 | 671 | 18:1 | 8.5 | | | 86 | | N | N | | |
| Colby 82-94 | 71 | 8,088 | 114:1 | 3.4 | | | 100 | | N | N | | |
| Cornelia 27-28 | | | | | | | | | | N | | |
| Courthouse 10-5 | 10 | | | 17.4 | | | 30 | | Y | N | 0.6 | Stocked w/Trout |
| Crystal(Bnsv)9-27 | 292 | 2,001 | 7:1 | 11.3 | 3.1 | 2,920 | 72 | | Y | Y | | Panfish - Fishing Pier |
| Dean 70-74 | 128 | | | | | | 100 | | N | N | | |
| Downs 82-110 | 35 | 2,400 | 69:1 | 2.1 | 1.5 | 175 | 100 | | N | N | | |
| Eagle(Crv)10-121 | 233 | 1,050 | 4.5:1 | 4.0 | 1.2 | 920 | 100 | | N | Y | | Natural Environment |
| Earley 19-33 | 29 | 1,629 | 56:1 | | | | | | | N | | |
| East Boot 82-34 | 47 | 93 | 2:1 | 8.2 | 0.9 | 282 | 84 | | Y | Y | | |
| Farquhar 19-23 | 63 | 353 | 6:1 | 3.0 | 1.4 | 290 | 100 | | N | N | | |
| Fireman's 10-226 | 8 | | | 7.0 | | | 88 | | | | | |
| Fish (Grant) 82-137 | 21 | | | 10.4 | | | 67 | | | | | |
| Fish(Scott) 70-69 | 171 | 660 | 4:1 | 8.5 | 4.4 | 2,468 | 43 | | Y | Y | | Centrachid |
| Fish (Wash) 82-64 | 72 | 683 | 9.5:1 | 3.0 | 1.5 | 360 | 100 | | N | N | | |
| Forest 82-159 | 2,249 | 4,285 | 2:1 | 11.5 | 3.4 | 24,986 | 68 | 14 | Y | Y | | |
| French 27-127 | 352 | | | 1.0 | | | | | | | | |
| George Watch 2-5 | 528 | | | 2.0 | 1.5 | 2,587 | 100 | | N | Y | | |
| German 82-56 | 109 | | | | | | | | | | | |
| Goetschel 82-313 | 23 | 4,317 | 188:1 | 4.2 | 1.2 | 92 | 100 | | N | N | | |
| Goggins 82-77 | 11 | | | | | | 100 | | | N | | |
| Golden 2-45 | 57 | 7,680 | 135:1 | 7.3 | 2.5 | 463 | 90 | 1 | Y | Y | 1.5 | |

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Goose(Wac)10-89 | 407 | 1,100 | 27:1 | 3.0 | 1.5 | 2,035 | 100 | | N | C | | Natural Environment |
| Grace 10-218 | 22 | | | 6.7 | | | 79 | | | | | |
| Half Breed 82-80 | 75 | 303 | 4:1 | 10.3 | 1.7 | 420 | 67 | 0 | Y | N | | |
| Hay 82-65 | 33 | | | | | | | | | N | | |
| Highland 2-79 | 22 | | | 1.0 | | | 100 | | N | N | | |
| Hydes 10-88 | 215 | 430 | 2:1 | 5.5 | 3.0 | 2,150 | 88 | | Y | Y | | |
| Island 2-22 | 67 | | | 6.7 | | | 87 | | Y | N | | |
| Jellum's 82-5202 | 72 | 333 | 4.6:1 | 4.9 | 2.4 | 569 | 100 | | N | N | | |
| Keller (Brn)19-25 | 60 | | | 2.5 | 1.5 | 300 | 100 | | N | N | | |
| Kingsley 19-30 | 44 | 193 | 4:1 | 4.0 | | | 100 | | N | N | 1.7 | |
| Kismet 82-333 | | | | | | | | | | N | | |
| Klawitter 82-368 | | | | | | | | | | | | |
| La 82-97 | 35 | | | 3.5 | | | 100 | | N | N | 1.3 | |
| Lac Lavon19-446 | 69 | 306 | 4:1 | 9.8 | | | 26 | | Y | N | 2.3 | Stocked w/Trout - Fishing Pier |
| Laddie 2-72 | 73 | 542 | 7.5:1 | 1.5 | 1.0 | 228 | 100 | | N | N | | |
| Lee 19-29 | 25 | 324 | 13:1 | 5.2 | | | 100 | | N | N | 1.0 | |
| Lily 82-23 | 52 | | | 17.4 | | | 73 | | Y | Y | | Centrachid - Fishing Pier |
| Little Carnelian 82-14 | 162 | 565 | 3.5:1 | 21.3 | 10.7 | 5,686 | | | Y | N | 1.7 | |
| Little Johanna 62-58 | 35 | | | 12.0 | | | 67 | | N | N | | |
| Long(ap val)19-22 | 36 | | | 3.5 | | | 100 | | N | N | | |
| Long(Carv) 10-16 | | | | | | | | | | | | |
| Long(Maht) 82-130 | 48 | | | 7.7 | | | 92 | | Y | N | | |

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Long (May)82-30 | 88 | | | 3.7 | | | 100 | | N | Y | | |
| Long(Still) 82-21 | 71 | | | 6.7 | | | 96 | | N | N | | |
| Long (Wash) 82-68 | 35 | 381 | 11:1 | 2.1 | 1.1 | 126 | 100 | | N | N | | |
| Loon 82-15 | 64 | 407 | 6.4:1 | 4.9 | 2.4 | 206 | 100 | | N | N | | |
| Lotus 10-6 | 246 | 1,033 | 4:1 | 8.8 | 4.3 | 3,500 | 74 | | | Y | | |
| Louise 82-25 | 48 | 616 | 13:1 | 3.7 | 1.8 | 283 | 100 | | N | N | | |
| Magda 27-65 | 15 | | | | | | | | | | | |
| Maple Marsh 82-38 | 38 | 148 | 4:1 | 3.4 | 1.7 | 212 | 100 | | N | N | | |
| Marcott(2) 19-41 | 30 | | | 7.9 | | | 90 | | Y | N | | Rearing |
| Marion 19-26 | 560 | | | 6.4 | | | 81 | | Y | Y | | |
| Markgrafs 82-89 | 46 | 413 | 10:1 | 2.4 | | | 100 | | N | N | 2.6 | Rearing |
| Markley 70-21 | 27 | | | 3.7 | | | 100 | | N | N | | |
| McDonald 82-10 | 36 | 424 | 12:1 | 3.7 | | | 100 | | N | N | | |
| McKusick 82-20 | 46 | | | 4.7 | | | 100 | | N | N | 1.6 | |
| Mergen's 82-482 | 20 | 1,239 | 62:1 | 1.3 | | | 100 | | N | N | | |
| Miller 10-29 | 145 | 16,701 | 115:1 | 4.3 | 3.1 | 1,479 | 100 | | N | N | | |
| Mud 82-26 | 62 | 899 | 15:1 | 2.1 | 1.1 | 224 | 100 | | N | N | | |
| North Twin 82-18 | 69 | 187 | 3:1 | 1.8 | 0.9 | 207 | 100 | | N | N | | |
| Northwood 27-627 | 15 | 1,341 | 89:1 | 1.5 | 0.8 | 41 | 100 | | N | N | | |
| Oak 10-93 | 339 | | | 3.4 | | | 100 | | N | N | | |
| Oneka 82-140 | 381 | | | 2.1 | 1.2 | 1,524 | 100 | | N | N | | Wildlife |
| Orchard 19-31 | 250 | 2,012 | 8:1 | 10.0 | 3.0 | 2,500 | 75 | | Y | Y | | Centrachid |

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parkers 27-107 | 97 | 950 | 10:1 | 11.3 | 3.7 | 1,164 | 70 | | Y | Y | | |
| Peltier 2-4 | 174 | 68,082 | 391:1 | 4.9 | 2.1 | 3,255 | 100 | | N | Y | | Gamefish |
| Pike(ramsy)62-69 | 35 | | | 4.9 | 2.1 | 252 | 100 | | N | N | | Gamefish |
| Pike (scott) 70-76 | 57 | 1,991 | 35:1 | 2.7 | | | 100 | | N | N | | |
| Pine Tree 82-122 | 174 | | | 7.9 | 3.0 | 1,740 | 91 | | Y | N | | Centrachid |
| Pomerleau 27-100 | 35 | 1,140 | 33:1 | 7.9 | 2.7 | 450 | 50 | | Y | N | | |
| Powers 82-92 | 57 | 1,238 | 22:1 | 12.5 | | | 57 | 2 | Y | N | 1.8 | Centrachid |
| Prior(lower)70-26 | 827 | 19,560 | 24:1 | 18.3 | 4.1 | 11,120 | 46 | 1 | Y | Y | | Centrachid |
| Prior(upper)70-72 | 340 | 16,460 | 48:1 | 15.2 | 3.1 | 3,460 | 93 | 2 | Y | Y | | Centrachid |
| Region Prk 82-86 | 16 | 600 | 38:1 | 5.8 | | | 100 | | N | N | | |
| Reitz 10-52 | 79 | 3,711 | 47:1 | 11.0 | 4.0 | 1,027 | 58 | | Y | Y | | |
| Riley 10-2 | 297 | 4,796 | 16:1 | 15.0 | 6.6 | 6,429 | 34 | | Y | Y | 2.9 | |
| Ryan 27-58 | 35 | 5,510 | 157:1 | 10.7 | | | 56 | | Y | N | | |
| Sand 82-67 | 46 | | | 5.5 | 2.4 | 368 | 46 | 2 | | N | 1.8 | |
| Schutz 10-18 | 105 | 943 | 9:1 | 15.0 | 6.0 | 2,100 | 27 | | Y | N | | |
| Seidl 19-95 | 14 | 415 | 30:1 | 5.0 | | | 100 | 5 | N | N | | Rearing |
| Shields 82-162 | 27 | | | 8.2 | | | 85 | | Y | N | 0.8 | |
| Silver 82-16 | 98 | 455 | 4.6:1 | 3.4 | 1.7 | 549 | 100 | | N | N | | |
| Simley 19-37 | 15 | 472 | 31:1 | 5.0 | 2.4 | 170 | 100 | | N | N | | Children Fishing |
| South Oak 27-661 | | | | | | | | | | | | |
| South Rice 27-645 | 3.2 | 63 | 20:1 | 2.5 | 0.5 | 5.4 | 100 | | N | N | | |
| South Twin 82-19 | 54 | 63 | 1.2:1 | 4.0 | 2.0 | 356 | 100 | | N | N | | |

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spring (Scott)70-54 | 630 | 13,500 | 21:1 | 11.3 | 5.6 | 11,500 | 50 | 2 | Y | Y | 5.0 | |
| Square 82-46 | 193 | 782 | 4:1 | 20.7 | 9.0 | 5,694 | 65 | 5 | Y | Y | 2.2 | Stocked w/Trout |
| Staples 82-28 | 24 | 127 | 5.3:1 | 4.3 | 2.1 | 165 | 100 | | N | N | | |
| Success 27-?? | | | | | | | | | N | N | | |
| Sullivan 2-80 | 19 | 480 | 25:1 | 2.1 | 1.0 | 57 | 100 | 4 | N | N | | |
| Sunnybrook 82-133 | 16 | 666 | 42:1 | 6.1 | 2.0 | 104 | | | Y | N | | |
| Sunset 82-153 | 124 | | | 5.2 | | | 100 | | N | N | 2.3 | Gamefish |
| Sunset Pnd19-364 | 60 | | | 3.7 | | | 100 | | N | N | 1.9 | |
| Swede 10-95 | 376 | | | 4.0 | | | 100 | | N | Y | | |
| Sweeney 27-35 | 66 | 2,400 | 36:1 | 8.0 | 3.6 | 790 | 52 | | Y | N | | Panfish |
| Tamarack 10-10 | 24 | | | 20.0 | | | | | | | | |
| Turtle 82-36 | 44 | 699 | 16:1 | 2.4 | 1.2 | 172 | 100 | | N | N | | |
| Twin(Bnsv)19-28 | 11 | | | | | | 100 | | | | | |
| Twin(L)(rob)27-42 | 46 | | | 6.7 | 2.3 | 340 | | | Y | Y | | Centrachid |
| Twin(M)(cry)27-42 | 69 | | | 14.0 | 4.9 | 918 | | | Y | Y | | Centrachid |
| Twin(StLP) 27-656 | | | | | | | | | | | | |
| Valentine 62-71 | 60 | 2,237 | 37:1 | 4.0 | 1.5 | 300 | 100 | | N | | | |
| Valley 19-348 | 15 | 117 | 8:1 | 3.2 | | | 100 | 1 | N | N | | |
| Virginia 10-18 | 110 | 772 | 7:1 | 10.4 | 3.3 | 1,210 | 88 | | Y | Y | | |
| Waconia 10-59 | 3,000 | 7,880 | 4:1 | 11.3 | 4.0 | 38,632 | 53 | | Y | Y | 6.8 | Centrachid |
| West Boot 82-44 | 110 | 209 | 2:1 | 11.9 | 5.9 | 2,090 | 56 | | Y | Y | | |
| Westwood 27-711 | 41 | | | 2.0 | | | 100 | | N | N | | |

| Lake DNR # | Surface Area(ac) | Watershed Area(ac) | Ratio | Max Depth(m) | Mean Depth(m) | Volume (ac-ft) | % Littoral | # Inlets | Termo-cline? | Public Access | Shr Length (miles) | DNR Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wilmes 82-90 | 41 | 2,247 | 55:1 | 5.5 | | | | | | Y | 1.3 | |
| Winkler 10-66 | 129 | 2,758 | 21:1 | | | | | | | | | |
| Wood(Brns)19-24 | 9 | 157 | 17:1 | 4.5 | | | 100 | 1 | N | N | | Panfish |

# APPENDIX B
# 2003 Volunteer Lake Monitors

| WMO/WD/City | Lake | DNR # | Volunteer |
|---|---|---|---|
| **Anoka Co. Parks** | Cenaiko | 2-654 | Anoka Co. Parks |
| | Highland | 2-79 | Anoka Co. Parks |
| | Island | 2-22 | Anoka Co. Parks |
| **Apple Valley** | Farquhar | 19-23 | Rick Bruneau |
| | Lac Lavon | 19-449 | Wally Shaver |
| | Long (Apple Val) | 19-22 | Cherie Serie/Al Kettelkamp |
| **Bassett Creek** | Northwood | 27-627 | Steve Bur |
| | Parkers | 27-107 | Bob Videen |
| | South Rice | 27-645 | Steve Streff |
| | Sweeney (Site-1) | 27-35 | Dave Hanson |
| | Westwood | 27-711 | Westwood Hills Nature Center |
| **Black Dog** | Alimagnet | 19-21 | John Ritter |
| | Crystal | 19-27 | Arnett Family |
| | Earley | 19-33 | Mary Oaster |
| | Keller | 19-25 | Glen Gramse |
| | Kingsley | 19-30 | Green Family |
| | Orchard | 19-31 | Tom/Dorothy Goodwin |
| | Sunset Pond | 19-364 | Bill Henzler |
| | Twin (Burnsv) | 19-28 | Nigel Linden |
| | Wood | 19-24 | David Bess |
| **Browns Creek** | Goggins | 82-77 | Washington Co. SWCD |
| | Kismet | 82-333 | Washington Co. SWCD |
| | Long (Stillwater) | 82-21 | Washington Co. SWCD |
| **Carnelian-Marine** | Barker | 82-76 | Washington Co. SWCD |
| | Bass | 82-35 | Washington Co. SWCD |
| | Big Carnelian | 82-49 | Washington Co. SWCD |
| | Big Marine | 82-52 | Washington Co. SWCD |
| | Carol | 82-17 | Washington Co. SWCD |
| | East Boot | 82-34 | Washington Co. SWCD |
| | Fish | 82-64 | Washington Co. SWCD |
| | German | 82-56 | Washington Co. SWCD |
| | Jellum's (Site-1) | 82-5202-01 | Washington Co. SWCD |
| | Little Carnelian | 82-14 | Washington Co. SWCD |
| | Long | 82-68 | Washington Co. SWCD |
| | Loon | 82-15 | Washington Co. SWCD |
| | Louise | 82-25 | Washington Co. SWCD |
| | Maple Marsh | 82-38 | Washington Co. SWCD |
| | Mud | 82-26 | Washington Co. SWCD |
| | North Twin | 82-18 | Washington Co. SWCD |
| | Silver | 82-16 | Washington Co. SWCD |
| | South Twin | 82-19 | Washington Co. SWCD |
| | Staples | 82-28 | Washington Co. SWCD |
| | Turtle | 82-36 | Washington Co. SWCD |
| | West Boot | 82-44 | Washington Co. SWCD |

WMO/WD/City Lake DNR # Volunteer

| | | | | |
|---|---|---|---|---|
| **Chanhassen** | Lotus | 10-6 | | Shelly Strohmaier |
| | Riley | 10-2 | | David Florenzano/ Bushey |
| **Carver Co.** | Bavaria | 10-19 | | John Ryski |
| | Benton | 10-69 | | Carver Co. Env. Services |
| | Brickyard | | 10-225 | Carver Co. Env. Services |
| | Courthouse | 10-5 | | Carver Co. Env. Services |
| | Eagle (Carver) | 10-121 | | Carver Co. Env. Services |
| | Fireman's | 10-226 | | Carver Co. Env. Services |
| | Goose (Waconia) | 10-89 | | Carver Co. Env. Services |
| | Grace | 10-218 | | Carver Co. Env. Services |
| | Hydes | 10-88 | | Dan Palmer |
| | Long (Carver) | 10-16 | | Phillip Solseng |
| | Miller | 10-29 | | Carver Co. Env. Services |
| | Oak | 10-93 | | Terry Sadler |
| | Reitz | 10-52 | | Carver Co. Env. Services |
| | Swede | 10-95 | | Wayne Hubin |
| | Waconia | 10-59 | | Carver Co. Env. Services |
| | Winkler | 10-66 | | Carver Co. Env. Services |
| **Comfort Lk-Forest Lk** | Big Comfort | 13-53 | | Washington Co. SWCD |
| | Bone | 82-54 | | Washington Co. SWCD |
| | Forest-West | 82-159 | | Washington Co. SWCD |
| | Halfbreed (Sylvan) | 82-80 | | Washington Co. SWCD |
| | Shields | 82-162 | | Washington Co. SWCD |
| **Conservation League/Edina** | Cornelia | 27-28 | | Conservation League of Edina |
| **Elm Creek** | French | 27-127 | | Steve Fowler |
| **Lakeville** | Lee | 19-29 | | Jamie Cooper |
| | Marion | 19-26 | | Wally and Ardyce Potter |
| | Valley | 19-348 | | City of Lakeville |
| **Marine/St.Crx** | Hay | 82-65 | | Washington Co. SWCD |
| | Long (May) | 82-30 | | Washington Co. SWCD |
| | Sand | 82-67 | | Washington Co. SWCD |
| | Square | 82-46 | | Washington Co. SWCD |
| **Middle St. Croix** | McKusick | 82-20 | | Washington Co. SWCD |
| **Minnehaha Creek** | Schutz | | 10-18 | Mike Shouldice |
| | Tamarack | | 10-10 | Mike Shouldice |
| | Virginia | 10-15 | | Renay Loene |
| **Prior Lake** | Markley | 70-21 | | City of Prior Lake |
| **Prior Lake-Spring Lake** | Cates | 70-18 | | Tom Sletta |
| | Fish | 70-69 | | Charlie/Camille Robin |
| | Pike (Site-1) | 70-76 | | David/Mona Hanson |
| | Prior (Lower S-1) | 70-26-01 | | Walt Burris |
| | Prior (Upper S-1) | 70-72 | | Madison Groves |
| | Spring | 70-54 | | Bill Tisdell |

| WMO/WD/City | Lake | DNR # | Volunteer |
|---|---|---|---|
| **Rice Creek** | Clear | 82-163 | Joel Buys |
| | Fish (Grant TWP) | 82-137 | Rice Creek Watershed District |
| | George Watch | 2-5 | Wargo Nature Center |
| | Golden | 2-45 | City of Circle Pines |
| | Little Johanna | 62-58 | Jason Johnson |
| | Long (Mahtomedi) | 82-130 | Kitty Francy-Payton |
| | Oneka | 82-140 | Rice Creek Watershed District |
| | Peltier | 2-4 | Wayne LeBlanc |
| | Pike | 62-69 | Philip Goodrich |
| | Pine Tree | 82-122 | Gene Berwald |
| | Sunset | 82-153 | Diane and Bob Coderre |
| | Valentine | 62-71 | Bob Kistler |
| **Saint Louis Park** | South Oak | 27-661 | Jim Kellogg |
| | Twin (St. Louis Pk) | 27-656 | Ed Voyles |
| **Seidl Lake Assoc.** | Seidl | 19-95 | Janet and Harv Bartz |
| **Shakopee** | Dean | 70-74 | Gerlach Family |
| **Shingle Creek** | Bass | 27-98 | Marvin Groth |
| | Cedar Island | 27-119 | Steve Lane |
| | Magda | 27-65 | Carolyn Dindorf |
| | Pomerleau | 27-100 | John Engstrom |
| | Ryan | 27-58 | The Spector Family |
| | Success | 27-634 | Stuart Ruud |
| | Twin (Lower) | 27-42-02 | Roni Brunner and Bob Hill |
| | Twin (Middle) | 27-42-02 | Roni Brunner and Bob Hill |
| **Six Cities** | Laddie | 2-72 | City of Blaine |
| | Sullivan | 2-80 | City of Columbia Heights |
| **South Washington** | Armstrong | 82-116 | Washington Co. SWCD |
| | Regional Park | 82-86 | City of Cottage Grove |
| **Stillwater** | Lily | 82-23 | Washington Co. SWCD |
| **Valley Branch** | Cloverdale | 82-9 | Kevin Bjork |
| | Downs | 82-110 | Wesley Sly Family |
| | Goetschel | 82-313 | Allan and Linda Kellar |
| | Klawitter | 82-368 | Bonnie Jurand |
| | McDonald | 82-10 | Steve Groves |
| | Mergen' | 82-482 | Chris Moosbrugger |
| | Sunnybrook | 82-133 | Candice Kraemer |
| **Woodbury** | Colby | 82-94 | Beth and Claire Hvass |
| | La | 82-97 | Dorthe and Ken Mahle |
| | Marksgraf | 82-89 | Terry Riley |
| | Powers | 82-92 | Washington Co. SWCD |
| | Wilmes | 82-90 | Bill Aamodt |

# APPENDIX C

# LAKES SAMPLED BY THE METROPOLITAN COUNCIL, 1980-2003

## APPENDIX C
## Lakes Sampled either by Metropolitan Council or Volunteer Programs, 1980 - 2003
(Numbers indicate sampling visits per year, while v denotes volunteer monitoring)

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alimagnet | 19-21 | | | | | | | | | | | | | | | | v12 | v10 | v10 | v10 | v10 | v10 | v8 | v9 | v12 |
| Ann | 10-12 | | | | | | 5 | | | | 13 | | | | | | | | | | | | | 13 | |
| Armstrong | 82-116 -02 | | | | | | | | | | | | | | | | | | | v15 | v10 | v13 | v14 | v15 | v14 |
| Assumption | 10-63 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Auburn-East | 10-44 | | | | 10 | | | | | | | | | | | | | | | | | | | | |
| Auburn-West | 10-44 | | | | 10 | | | 17 | 18 | | | | 12 | | | 13 | | | | | | | | | |
| Aue | 10-28 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Bald Eagle | 62-2 | 4 | 5 | | 5 | | | | | | | | | | | | | | | | | | | | |
| Barnes | 10-109 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Barker | 82-96 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Bass | 27-98 | 4 | | | | | | | | | | | | | | v16 | | | v15 | | v15 | | v13 | | v9 |
| Bass (St. Louis Park) | 27-15 | | | | | | | | | | | | | | | | | | | | | | | v12 | |
| Bass (Washington Co.) | 82-35 | | | | | | | | | | | | | | | | | | | | | v14 | v5 | v7 | v7 |
| Battle Creek | 82-91 | | | | | | | | | | | | | | v14 | v13 | v11 | v13 | | | | | | | |
| Bavaria | 10-19 | | | | 5 | | | 17 | 18 | | | | | | | 13 | | v11 | v12 | v15 | v12 | v14 | v14 | v14 | v19 |
| Benton | 10-69 | | | | | | | | | | | | | | | | | | | | v13 | v14 | v14 | v14 | v15 |
| Benz | 82-120 | | | | | | | | | | | | | | | | | | | v8 | | | | | |
| Berliner | 10-103 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Big Carnelian | 82-49 | | | | | 5 | | | | | 13 | | | | | 13 | | | 13 | | | v14 | v7 | v14 | v14 |
| Big Comfort | 13-53 | | | | | | | | | | | | | | | | | | | v3 | | v14 | v14 | v14 | v14 |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Big Marine | 82-52 | 4 | 5 | | | 5 | | | | | 13 | | | | | 13 | | | 13 | | | v14 | v7 | v14 | v14 |
| Birch | 62-24 | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| Bluebill Bay | 19-449 | | | | | | | | | | | | | | | | | | v8 | | | | | | |
| Bone | 82-54 | | | | | 5 | | | | | 13 | | | | v7 | | v14 | | v14 | v14 | v14 | | v14 | v14 | v14 |
| Brand | 10-110 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Braunworth | 10-107 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Brickyard | 10-225 | | | | | | | | | | | | | | | | | | | | | | | v14 | v13 |
| Bryant | 27-67 | 2 | 5 | 16 | | 5 | | | | | 13 | 13 | 12 | | | | | | | | | | | | |
| Burandt | 10-84 | | | | | | | | | | | | | | | | | | | | v7 | v13 | v9 | | |
| Bush | 27-47 | | | | | 5 | | | | | | | | | 13 | 13 | | | | | 13 | | 13 | | |
| Byllesby | 19-6 | | | | | | | | | | | | | | v14 | v14 | v13 | | | | | | | | |
| Calhoun | 27-31 | | 5 | | | 5 | | | | | | | | | | | | | | | | | | | |
| Campbell | 10-127 | | | | | | | | | | | | | | | | | | | | v2 | v14 | | v10 | |
| Carol | 82-17 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Carver | 82-166 | | | | | | | | | 20 | | | | | v15 | v15 | v16 | v9 | | | | | | | |
| Cate | 70-18 | | | | | | | | | | | | | | | | | | | | | | | v14 | v13 |
| Cedar (Minneapolis) | 27-39 | | | | | 5 | | | | | | | | | | | | | | | | | | | |
| Cedar (Helena TWP) | 70-91 | 4 | 5 | | | 5 | | | | | | 13 | | | 14 | | | | | 13 | | | 13 | | |
| Cedar Island | 27-119 | | | | | | | | | | | | | | | | v13 | | | | | | v13 | | v11 |
| Cenaiko | 2-654 | | | | | | | | | | | | | | | | | | v12 | v11 | v13 | v11 | v13 | v12 | v12 |
| Centerville | 2-6 | 4 | 5 | | 5 | | | | | | | | | | | | | | | | | 13 | 13/v4 | v1 | 13 |
| Charley | 62-62 | | | | | | 5 | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Christmas | 27-137 | 4 | 5 | | | | 5 | | | | | | | | | | | | 13 | 13 | 13 | | | 13 | 13 |
| Chub | 19-20 | 2 | | | | | | | | | | | | | v14 | v14 | v11 | | | | | | | | |
| Clear (Forest Lake) | 82-163 | 4 | | | | 5 | | | | | | 13 | | | v11 | v12 | v12 | v11 | v10 | v11 | v10 | v9 | v12 | v12 | v12 |
| Cleary | 70-22 | | | | | 5 | | | | | | | | | | | | | | | | | | | |
| Cloverdale | 82-9 | | | | | | | | | | | | | | | | | | | | | | v10 | v10 | v11 |
| Cobble Crest | 27-53 | | | | | | | | | | | | | | | | | | | | | | | v4 | |
| Colby | 82-94 | | | | | | | | | | | | | | | v13 | v14 | v13 | v13 | v12 | v12 | v9 | v10 | v10 | v10 |
| Comfort | 13-53 | | | | | | | | | | | | | | | | | | v3 | | | | | | |
| Coon | 2-42 | 4 | | | | 5 | | | | | | | | | | 13 | | | 13 | | | | | | |
| Cornelia | 27-28 | | | | | | | | | | | | | | | | | | | | | | | | v7 |
| Courthouse (Chaska) | 10-5 | | | | | | | | | | | | | | | | | v2 | v14 | v13 | v13 | v14 | v14 | v14 | v14 |
| Cowley | 27-169 | | | | | | | | | | | | | | | | | v12 | | | | | | | |
| Crane | 27-734 | | | | | | | | | | | | | | v9 | | | | | | | | | | |
| Crooked | 2-84 | | | | 5 | | | | | | 13 | | | | v15 | v15 | v14 | v14 | v12 | v14 | v14 | | | | |
| Crystal (Burnsville) | 19-27 | 2 | | | 5 | | | | | | 13 | | | | | 13 | 13 | 13 | 13 | 13 | v12 | v10 | v14 | v15 | v15 |
| Crystal (Robbinsdale) | 27-34 | | | | | | | 17 | 19 | 19 | | | | | | v15 | | | v11 | | | | v8 | | |
| Crystal (Spring Lake) | 70-61 | | | | | | | | | | | | | | | | | | v12 | | v11 | | | | |
| Cynthia | 70-52 | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| Dan Patch | 70-16 | | | | | | | | | | | | | | | | | | v15 | | | | | | |
| Dean | 70-74 | | | | | | | | | | | | | | | | | | | | | | | v7 | v7 |
| Deeg | 19-117 | | | | | | | | | | | | | | | | | | | | | | v12 | | |
| Deep | 62-18 | | | | | | 5 | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DeMontreville | 82-101 | 4 | | | | 5 | | | | | | | 12 | | v15 | | 14 | | | | | 13 | | | 13 |
| Diamond (Dayton) | 27-125 | 2 | | | | | | | | | | | | | | v13 | | | | | | | | | |
| Downs | 82-110 | | | | | | | | | | | | | | | | | | | | v14 | | v9 | v9 | v6 |
| Dutch | 27-181 | | | | | 5 | | | | | | | | | | | | | | | | | | | |
| Eagle (Maple Grove) | 27-111-01 | 4 | | | 5 | | | 17 | 18 | | | | 11 | | v15 | | | v14 | v14 | v14 | | v6 | | v4 | |
| Eagle (Young America) | 10-121 | 4 | 5 | | | | 5 | | | | | | | | | | | 12 | | v15 | v14 | v14 | v12 | v14 | v14 |
| Eagle Point | 82-109 | | | 2 | | | | | | | | | | | v14 | | | | | | | | | | |
| Earley | 19-33 | | | | | | | | | | | | | | | v10 | v11 | v9 | v10 | v10 | v9 | v8 | v6 | v10 | v9 |
| East Boot | 82-34 | | | | | | | | | | | | | | | | | | | | | v14 | v14 | v14 | v14 |
| East Twin | 2-133 | 2 | 5 | | 5 | | | | | | 13 | | | | | | 13 | | | 13 | | | | | |
| Egg | 82-147 | | | | | | | | | | | | | | | | | | | | | | v3 | | |
| Elmo | 82-106 | 4 | 5 | 16 | | 5 | | | | 19 | | | 12 | | | v11 | | | | | | | | | |
| Farquhar | 19-23 | 4 | | | | | | | | | | | | | | v15 | v16 | v14 | v15 | | v15 | v13 | v11 | v13 | v14 |
| Fireman's | 10-226 | | | | | | | | | | | | | | | | | | | | | | v12 | v14 | v14 |
| Fish (Eagan) | 19-57 | | | | | | | | | | 13 | | | | | | | | | | | | | | |
| Fish (Grant Twnsp) | 82-64 | | | | | | | | | | | | | | | | | | | | | | | v5 | v5 |
| Fish (Maple Grove) | 27-118 | 4 | 5 | 16 | | | 5 | | | | | 13 | | | | | | | | | | | | | |
| Fish (Scott County) | 70-69 | 4 | | | | 5 | | | | | | 13 | | | | | 13 | | v2 | v13 | v8 | v12 | v9 | v14 | v13 |
| Fish (Washington Co.) | 82-64 | | | | | | | | | | | | | | | | | | | | | v5 | v14 | v7 | v7 |
| Forest - East (3) | 82-159 | 4 | | | | 5 | | | | | | 13 | | | v7 | | | v12 | | | | | | 13 | |
| Forest - Middle (2) | 82-159 | | | | | 5 | | | | | | 13 | | | v7 | | | v12 | | | | | | 13 | |
| Forest - West (1) | 82-159 | | | | | 5 | | | | | | 13 | | | v7 | | | v12 | v14 | v15 | v14 | v14 | v14 | v14 | v14 |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| French | 21-127 | | | | | | | | | | | | | | | | | | | | | | v11 | v10 | v7 |
| Gables | 82-82 | | | | | | | | | | | | | | | | | | | v8 | v5 | | | | |
| Gaystock | 10-31 | | | | | | | | | | | | | | | | | | | | v2 | v14 | v14 | | |
| George | 2-91 | 4 | 5 | 16 | | 5 | | | | | 13 | | | | | 13 | | | | 13 | | | | | |
| George Watch | 2-5 | | | | | | | | | | | | | | | | | v14 | v12 | v11 | v11 | v6 | v7 | v8 | v9 |
| German | 82-56 | | | | | | | | | | | | | | | | | | | | | | | v7 | v7 |
| Gervais | 62-7 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Goetschel | 82-313 | | | | | | | | | | | | | | | | | | | | | | | v11 | v9 |
| Goggins | 82-77 | | | | | | | | | | | | | | | | | | | | v13 | v14 | v14 | v14 | v14 |
| Golden | 2-45 | 2 | | | | | | | | | | | 12 | | 14 | | | v13 | v11 | v15 | v13 | v13 | v12 | v11 | v11 |
| Goose (Lakeville) | 19-360 | | | | | | | | | | | | | | | | v13 | v13 | | | | | | | |
| Goose (New Scandia) | 82-59 | | | | | | | | | | | | | | | v15 | v15 | v13 | v13 | v15 | | | | | |
| Goose (Waconia) | 10-89 | | | | | | | | | | | | | | | | v9 | v7 | v15 | v15 | v14 | v11 | v14 | v14 | v14 |
| Grace | 10-218 | | | | | | | | | | | | | | | | | | | | | | | v11 | v14 |
| Grass | 27-681 | | | | | | | | | | | | | | | | | | v12 | | | | | | |
| Hafften | 27-0199 | | | | | | | | | | | | | | | | | | | | | 13 | 13 | | |
| Half Breed (Sylvan) | 82-80 | | | | | | | | | | | | | | v7 | | | v14 | | v15 | v14 | v14 | v14 | v14 | v14 |
| Ham | 2-53 | | | | | 5 | | | | | | | | | v15 | v13 | | v13 | v9 | v14 | | | | | |
| Harriet | 27-16 | | | | | 5 | | | | | | | | | | | | | | | | | | | |
| Haughey | 27-187 | | | | | | | | | | | | | | | | | | | | | | | v4 | |
| Hay | 82-65 | | | | | | | | | | | | | | | | | | | v14 | v13 | v14 | v14 | v4 | v7 |
| Hazeltine | 10-14 | | | | | | | | | | | | | | | | | | | | v1 | v14 | v14 | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Henry | 27-175 | | | | | | | | | | | | | | | | v10 | | | | | | | | |
| Highland | 2-79 | | | | | | | | | | | | | | | | | | | | v13 | v11 | v13 | v12 | v12 |
| Holland | 19-65 | | | | 10 | 16 | 15 | | | 20 | | | | | 13 | | | | | | 13 | | | | |
| Horseshoe (Wash. Co.) | 82-74 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Horseshoe (Dakota Co.) | 19-32 | | | | | | | | | | | | | | | | v11 | v10 | | | | | | | |
| Hydes | 10-88 | | | | | | 5 | | | | | | 12 | | 13 | | | 12 | | | v11 | v4 | v9 | v14 | v15 |
| Independence | 27-176 | 4 | 5 | | 5 | | | | | | | 13 | | | v14 | v15 | | | | | | | | | |
| Isabelle | 19-4 | | | | | | | | | | | | | | | v14 | | | | | | | | | |
| Island (Linwood) | 2-22 | | | | 7 | | | | | | | | | | | | | | | | | | | | v12 |
| Jane | 82-104 | | | | | 5 | | 17 | 18 | | | | 12 | | | v12 | | | | | | 13 | | | |
| Jellum's (Site-1) | 82-0052-02 | | | | | | | | | | | | | | | | | | | | | v14 | v14 | v12 | v14 |
| Jellum's (Site-2) | 82-0052-02 | | | | | | | | | | | | | | | | | | | | | | | v11 | v11 |
| Johanna | 62-78 | | 5 | | | | 5 | | | | 13 | | | | | | | | | | | | | | |
| Jonathan | 10-217 | | | | | | | | | | | | | | | | | | | | | | | v13 | |
| Josephine | 62-57 | | | | | | 5 | | | | 13 | | | | | | | | | | | | | | |
| Jubert | 27-165 | | | | | | | | | | | | | | | | | | | | | v11 | | | |
| Keller (Burnsville) | 19-25 | | | | | | | | | | | | | | | | | 13 | 13 | v13 | v15 | v14 | v12 | v13 | v15 |
| Keller (Maplewood) | 62-10 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Kingsley | 19-30 | | | | | | | | | | | | | | 5 | | v11 | v10 | v9 | | | v14 | v14 | v15 | v14 |
| Kismet | 82-333 | | | | | | | | | | | | | | | | | | | v14 | v13 | v14 | v14 | v14 | v14 |
| Klawitter | 82-368 | | | | | | | | | | | | | | | | | | | | | | | v13 | v13 |
| Kohlman | 62-6 | | | | | | 5 | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| La | 82-97 | | | | | | | | | | | | | | | v13 | v11 | v13 | v11 | v10 | v10 | v8 | v6 | v5 | v6 |
| Lac Lavon | 19-446 | | | | | | | | | | | | | | | | | | v11 | v10 | v10 | v9 | v2 | v7 | v12 |
| Laddie | 2-72 | 4 | | | | | | | | | | | | | v13 | v14 | v12 | | | | | v13 | v13 | v14 | v10 |
| Lake of the Isles | 27-40 | | | | | 5 | | | | | | | | | | | | | | | | | | | |
| Langdon | 27-182 | | | | | 5 | | | | | | | | | | | | | | | | | | | |
| Lee | 19-29 | | | | | | | | | | | | | | | v14 | v15 | v14 | v13 | | | v12 | v13 | v11 | v9 |
| Lily | 82-23 | | | | | | | | | | | | | | | | v15 | v14 | v14 | v15 | v13 | v14 | v14 | v14 | v7 |
| Linwood | 2-26 | 4 | 5 | | 7 | | | | | | 13 | | | | | 13 | | | 13 | | | | | | |
| Lippert | 10-104 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Little Carnelian | 82-14 | | | | | | | | | | | | | | | | | | | | | v14 | v7 | v14 | v14 |
| Little Johanna | 62-58 | | | | | | | | | | | | | | | | | | | | | | v12 | v16 | v15 |
| Little Long | 27-179-02 | 4 | | | | 5 | | | | | | 13 | | | | | | | | 13 | | | 13 | | 13 |
| Long (Apple Valley) | 19-22 | | | | | | | | | | | | | | | | | | v16 | | | | | v11 | v13 |
| Long (Carver Co.) | 10-16 | | | | | | | | | | | | | | | | | | | | v2 | | v13 | | v5 |
| Long (Mahtomedi) | 82-130 | | | | | | | | | | | | | | | | | | | | | | | | v11 |
| Long (May Twnsp) | 82-30 | | | | | | | | | | | | | | v14 | v14 | v14 | v13 | v14 | | v14 | v14 | v14 | v14 | v14 |
| Long N (New Brighton) | 62-67 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Long S (New Brighton) | 62-67 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Long (Orono) | 27-160 | | | | 5 | | | | | | | | | | | | | | | | | | | | |
| Long (Pine Springs) | 82-118 | | | | | | | | | | | | | | v14 | | | | | | | | | | 13 |
| Long (Stillwater) | 82-21 | | | | | | | | | | | | | | | | v14 | v7 | | v14 | v13 | v14 | v14 | v14 | v14 |
| Long (Washington Co.) | 82-68 | | | | | | | | | | | | | | | | | | | | | v5 | v14 | v7 | v7 |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Loon | 82-15 | | | | | | | | | | | | | | | | | | | | | v14 | v14 | v7 | v7 |
| Lost | 27-103 | | | | | | | | | | | | | | v13 | | | | | | | | | | |
| Lotus | 10-6 | | | | | | 5 | | | | | 13 | | | | | | | | | 13 | 13 | | | v5 |
| Louise | 82-25 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Lucy | 10-7 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Magda | 27-65 | | | | | | | | | | | | | | | | | | | | v14 | v13 | | | v11 |
| Maple Marsh | 82-38 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Marcott (site 1) | 19-263 | | | | | | | | | | | | | | | | v15 | | | | | | | | |
| Marcott (site 2) | 19-41 | | | | | | | | | | | | | | | | v15 | v13 | v10 | v10 | v12 | v10 | v6 | v5 | |
| Maria | 10-58 | | | | | | | | | | | | | | | | | | | | v2 | v14 | v14 | | |
| Marion (Lakeville) | 19-26 | 2 | 5 | | 5 | | | | | | 13 | | | | | v15 | | | | | v15 | v14 | v13 | v14 | v14 |
| Markgrafs | 82-89 | | | | | | | | | | | | | | | v15 | v11 | v12 | v10 | v15 | v10 | v10 | v9 | v13 | v14 |
| Markley | 70-21 | | | | | | | | | | | | | | | | | | v11 | v13 | v12 | v14 | v13 | v9 | v6 |
| Marsh | 10-54 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Marshan | 2-7 | | | | | | | | | | | | | | | | | v10 | v13 | v10 | v9 | v8 | v7 | | |
| Martin | 2-34 | | | | 7 | | | | | | | | | | | | | | | 13 | | | | | |
| McCarrons | 62-54 | | | | | 12 | 20 | 17 | 18 | 19 | 13 | 13 | 12 | | 14 | 13 | 16 | 13 | | | 18 | 13 | 13 | 13 | |
| McDonald | 82-10 | | | | | | | | | | | | | | | | | | | | v11 | | v14 | v9 | v12 |
| McDonough | 19-76- | | | | | | 5 | | | | | | | | | | | | | | 13 | | | | |
| McKusick | 82-20 | | | | | | | | | | | | | | | v14 | v14 | v14 | v14 | v14 | v13 | v14 | v14 | v14 | v14 |
| McMahon (Carls) | 70-50 | 2 | | | | 5 | | | | | | | | | | | 13 | | | 13 | | | 13 | | |
| Meadow | 27-57 | | | | | | | | | | | | | | | | | v12 | | | v12 | | | v9 | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Medicine | 27-104 | 4 | 5 | | 10 | | | | | | | 13 | 12 | | | | | | | | | | | | |
| Mergen's | 82-482 | | | | | | | | | | | | | | | | | | | | | v10 | | | v3 |
| Meuwissen | 10-70 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Miller | 10-29 | | | | | | | | | | | | | | | | | v6 | v13 | | v12 | v14 | v13 | v13 | v14 |
| Minnetonka (Lower) | 27-133 | 4 | 5 | | | | | | | | | | | | | | | | | | | | | | |
| Minnetonka (Upper) | 27-133 | 2 | 5 | | | | | | | | | | | | | | | | | | | | | | |
| Minnewashta | 10-9 | | | | | 5 | | | | | | 13 | | | 13 | | | | 13 | 13 | 13 | | | 13 | 13 |
| Mitchell | 27-70 | | | | | | | | | | | | | | | | 13 | | | | 13 | 13 | | | 13 |
| Mooney | 27-134 | | | | | | | | | | | | | | v14 | v10 | | | | | | | | | |
| Moore | 2-75 | | | | | | | | | | | | | | | | | | | | v14 | | | | |
| Mud | 82-26 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Myers | 10-68 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Nokomis | 27-19 | 4 | | | | 5 | | | | | | | | | | | | | | | | | | | |
| North Twin | 82-18 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Northwood | 27-627 | | | | | | | | | | | | | | | | | | | | | v12 | v10 | v13 | v12 |
| Oak | 10-93 | | | | | | | | | | | | | | | | | | | | v2 | | v14 | v13 | v12 |
| O'Dowd | 70-95 | | | | | 5 | | | | | | | | | | 13 | | | 13 | | | 13 | | 13 | |
| Olson | 82-103 | | | | | | | | | | | | 12 | | v15 | | 14 | | | | | 13 | | | 13 |
| Oneka | 82-140 | | | | | | | | | | | | | | | | | | | | v13 | v11 | v11 | v9 | v6 |
| Orchard | 19-31 | 4 | 5 | | 5 | | | | | | 13 | | | | 13 | | | | | 13 | v15 | v13 | v13 | | v6 |
| Otter | 2-3 | 2 | | | 5 | | | | | | | | | | | | | | | | | | | | |
| Owasso | 62-56 | 4 | | | 5 | | | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parkers | 27-107 | 4 | | | | | | | | | | 13 | | | | | 13 | | | | 13 | v12 | | v14 | v15 |
| Parley | 10-42 | | | | | 5 | | 17 | 18 | | | | 12 | | | | | 12 | | | 13 | | 13 | | 13 |
| Patterson | 10-86 | | | | | | | | | | | | | | | | | | | | v2 | | | | |
| Peltier | 2-4 | | | | 5 | | | | | | | | | | v14 | v16 | v15 | v14 | v14 | v13 | v13 | v14 | v13 | v17 | v15 |
| Phalen | 62-13 | 4 | 5 | | | | 5 | | | | | | | | | | | | | | | | | | |
| Pickerel | 2-103 | 2 | | | | | | | | | | | | | | | 13 | | | | | | | | |
| Pierson | 10-53 | 2 | 5 | | 5 | | | | | | 13 | | | | | | 13 | | | | | | 13 | 13 | 13 |
| Pike (Maple Grove) | 27-111-02 | | | | | | | | | | | | | | | | | v14 | v15 | v13 | | v13 | | | |
| Pike (Ramsey Co.) | 62-69 | | | | | | | | | | | | | | | | | | | | v14 | v10 | v14 | v14 | v14 |
| Pike (Scott Co.) [Site-1] | 70-76-1 | | | | | | | | | | | | | | | | | | v9 | | v10 | v9 | v9 | v11 | v15 |
| Pike {Scott Co.} [Site-2] | 70-76-2 | | | | | | | | | | | | | | | | | | | | | | | v11 | |
| Pine Tree | 82-122 | | | | | | 5 | | | | | | | | v14 | v14 | v16 | v14 | v15 | v15 | v13 | v14 | v9 | v12 | v7 |
| Pleasant (New Prague) | 70-98 | | | | | | | | | | | | | | 13 | | | | | | | | | | |
| Pleasant (North Oaks) | 62-46 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Pomerleau | 27-100 | | | | | | | | | | | | | | | | | v9 | | | v10 | | v6 | | v3 |
| Powers | 82-92 | | | | | | | | | | | | | | | v12 | v13 | v13 | v12 | v9 | v10 | v8 | v5 | v7 | v14 |
| Prior (Lower) [Site-1] | 70-26-1 | | | | | 5 | | | | | | 13 | | | | | | 13 | v15 | v14 | v13 | v9 | v14 | v16 | v13 |
| Prior (Lower) [Site-2] | 70-26-2 | | | | | | | | | | | | | | | | | | | v14 | v13 | v9 | v14 | v15 | |
| Prior (Upper) [Site-1] | 70-72-1 | 4 | 5 | | | 5 | | | | | | 13 | | | | | | 13 | v15 | v14 | v13 | v9 | v14 | v12 | v13 |
| Prior {Upper} [Site-2] | 70-72-2 | | | | | | | | | | | | | | | | | | | | | | | v12 | |
| Raven | 19-369 | | | | | | | | | | | | | | | | v13 | v6 | v8 | | | | | | |
| Rebecca | 27-192 | | | | 10 | 12 | 12 | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Red Rock | 27-76 | | | | | | | | | | | | | | | | | | | | 12 | 13 | | | 13 |
| Regional Park | 82-86 | | | | | | | | | | | | | | | | | | | ˅12 | ˅14 | ˅12 | ˅13 | ˅14 | ˅15 |
| Reitz | 10-52 | | | | | | 5 | | | | | | 12 | | 13 | | | | | | ˅15 | ˅13 | ˅7 | ˅13 | ˅14 |
| Reshanau | 2-9 | 2 | | | | | | | | | | | | | | | | | | | ˅7 | ˅1 | ˅6 | | |
| Rice | 10-78 | 2 | | | | | | | | | | | | | | | | | | | ˅1 | | | | |
| Riley | 10-2 | 2 | 5 | 16 | | | 5 | 17 | 18 | | | 13 | 12 | | 13 | | | | 13 | | | 13 | | 13 | ˅14 |
| Rutz | 10-89 | | | | | | | | | | | | | | | | | | | | ˅1 | ˅14 | ˅14 | ˅14 | |
| Ryan | 27-58 | | | | | | | | | | | | | | | | | ˅14 | | ˅5 | | ˅9 | | ˅4 | ˅6 |
| Sand (New Scandia) | 82-67 | | | | | | | | | | | | | | ˅7 | ˅14 | ˅14 | ˅13 | | | | | | ˅14 | ˅7 |
| Sarah | 27-191 | 4 | | | 5 | | | | | | | | | | | | | | | | | | | | |
| Scheuble | 10-85 | | | | | | | | | | | | | | | | | | | | ˅1 | | | | |
| Schmidt (Smith) | 27-102 | | | | | | | | | | | | | | | | ˅14 | | | ˅12 | | ˅12 | ˅9 | | |
| Schultz | 19-75 | | | | | 5 | 5 | | | | | | | | | | | | | | 13 | | | | |
| Schutz | 10-18 | | | | | 5 | | | | | | | | | | | | | | | | ˅6 | ˅10 | ˅6 | ˅8 |
| Seidl | 19-95 | | | | | | | | | | | | | | | | ˅15 | ˅14 | ˅14 | ˅15 | ˅16 | ˅14 | ˅14 | ˅15 | ˅8 |
| Shields | 82-162 | | | | | | | | | | | | | | ˅6 | ˅14 | ˅14 | ˅13 | ˅13 | ˅14 | ˅14 | ˅14 | ˅14 | ˅14 | ˅14 |
| Silver | 82-16 | | | | | | | | | | | | | | | | | | | | | ˅14 | ˅5 | ˅7 | ˅7 |
| Simley | 19-37 | | | | | | | | | | | | | | | | ˅10 | ˅16 | ˅14 | ˅15 | ˅16 | ˅14 | ˅12 | ˅14 | |
| Snail | 62-73 | 4 | | | | | 5 | | | | | | | | | | | | | | | | | | |
| South Oak | 27-661 | | | | | | | | | | | | | | | | | | | | | | | ˅12 | ˅15 |
| South Rice | 27-645 | | | | | | | | | | | | | | | | | | | | | ˅9 | ˅14 | ˅15 | ˅14 |
| South School Section | 82-151 | | | | | | | | | | | | | | | | ˅14 | ˅7 | | ˅14 | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South Twin | 82-19 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Spring (Anoka Co.) | 2-71 | | | | | | | | | | | | | | | | | | | | | | v11 | | |
| Spring (Prior Lake) | 70-54 | 4 | 5 | 16 | | 5 | | | | | | 13 | | | | | | 13 | v12 | | | v6 | v11 | v13 | v14 |
| Square | 82-46 | 4 | 5 | 16 | 6 | 7 | 7 | | | | 13 | | | | v11 | v14 | v14 | v13 | v14 | 19 | v14 | v14 | v15 | v14 | v14 |
| Staring | 27-78 | 4 | | | | | 5 | | | | | | | | | | 13 | | | | 13 | | 13 | | |
| Staples | 82-28 | | | | | | | | | | | | | | | | | | | | | v14 | v5 | v7 | v7 |
| Steiger | 10-45 | | | | | 12 | | | | | 13 | | | | | | 13 | | | | | | | | |
| Success | 27-634 | | | | | | | | | | | | | | | | | v10 | | | | | | | v11 |
| Sucker | 62-28 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Sullivan | 2-80 | | | | | | | | | | | | | | v14 | v14 | v15 | | v15 | v14 | v13 | v11 | v11 | v12 | v12 |
| Sunfish | 82-107 | | | | | | | | | | | | | | | | | | | | | v10 | | | |
| Sunnybrook | 82-133 | | | | | | | | | | | | | | | | | | | | v14 | | v13 | v10 | v12 |
| Sunset | 82-153 | | | | | 5 | | | | | | | | | v14 | v14 | v12 | v13 | v16 | v12 | v10 | v13 | v13 | v18 | v20 |
| Sunset Pond | 19-??? | | | | | | | | | | | | | | | v14 | v14 | v14 | v12 | v10 | | v13 | v11 | v10 | v12 |
| Swan | 10-82 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Swede | 10-95 | 2 | | | | | | | | | | | | | | | | 13 | | | | | 13 | v14 | v16 |
| Sweeney (South) [Site-1] | 27-35 | | | | | | | | | | | | | | | | | | | | | v11 | v9 | v14 | v13 |
| Sweeney (North) [Site-2] | 27-35 | | | | | | | | | | | | | | | | | | | | | v11 | v9 | | |
| Tamarack | 10-10 | | | | | | | | | | | | | | | | | | | | | | v10 | v11 | v12 |
| Tanners | 82-115 | 2 | | | | | | | | 20 | | | | | v14 | v13 | v12 | v14 | | | | | | | |
| Thole | 70-120 | | | | | 5 | | | | | | | | | | 13 | | | 13 | | | 13 | | 13 | |
| Thomas | 19-67 | 2 | | | | | | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tiger | 10-108 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Turtle | 62-61 | 4 | 5 | | 5 | | | | | | | | | | | | | | | | | | | | |
| Turtle (Washington Co.) | 82-36 | | | | | | | | | | | | | | | | | | | | | v5 | v5 | v7 | v7 |
| Twin (Burnsville) | 19-28 | | | | | | | | | | | | | | | | | | | | v6 | | v13 | v11 | v6 |
| Twin-Lower (Robbinsd.) | 27-42-01 | | | | | | | | | | | | 12 | | v14 | | | 13 | | v5 | | 13 | | | v13 |
| Twin-Middle (Crystal) | 27-42-02 | | | | | | 5 | | | | | | 12 | | | | | 13 | v11 | | v13 | 13 | | | v13 |
| Twin-Upper (Br. Center) | 27-42-03 | | | | | | | | | | | | 12 | | v14 | | | 11 | | v15 | | v11 | | v13 | |
| Twin-South (May Twnsp) | 82-48 | | | | | | | | | | | | | | | | | | v13 | v13 | | | | | |
| Twin (St. Louis Park) | 27-656 | | | | | | | | | | | | | | | | | | | | | | | v12 | v14 |
| Vadnais | 62-38 | | | | | | 5 | | | | | | | | | | | | | | | | | | |
| Valentine | 62-71 | | | | | | | | | | | | | | | | | | | | | | v14 | v13 | v12 |
| Valley | 19-348 | | | | | | | | | | | | | | | | v15 | v14 | v11 | | v8 | v14 | v14 | v14 | v14 |
| Virginia | 10-15 | | | | | | | | | | | | | | | | | | | | | v11 | v12 | v14 | v12 |
| Wabasso | 62-82 | 4 | 5 | | 5 | | | | | | 12 | | | | | | | | | | | | | | |
| Waconia | 10-59 | 4 | 5 | | | | 5 | | | | | 13 | | | | v16 | v13 | v15 | v17 | v15 | v14 | v14 | v14 | v15 | v14 |
| Wasserman | 10-48 | | | | 5 | | | 17 | 18 | | | | | | | 13 | | | 13 | 13 | 13 | | | 13 | 13 |
| Weaver | 27-117 | | | | 5 | | | 17 | 18 | | | | | | | | | | | | | | | | |
| West Boot | 82-44 | | | | | | | | | | | | | | | | | | | | | v14 | v14 | v14 | v14 |
| West Lakeland | 82-488 | | | | | | | | | | | | | | | | | | | | | v2 | | | |
| Westwood | 27-711 | | | | | | | | | | | | | | v13 | | | | | | | v15 | v14 | v10 | v9 |
| Whaletail | 27-184-02 | 4 | | | | 5 | | | | | | | | | | | | | | 13 | | | 13 | | |
| White Bear | 82-167 | 4 | 5 | | | 5 | | | | | | | | | | | | | | | | | | | |

| LAKE | ID # | '80 | '81 | '82 | '83 | '84 | '85 | '86 | '87 | '88 | '89 | '90 | '91 | '92 | '93 | '94 | '95 | '96 | '97 | '98 | '99 | '00 | '01 | '02 | '03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wilmes | 82-90 | | | | | | | | | | | | | | | v14 | v15 | v14 | v15 | v15 | v14 | v13 | v13 | v10 | v12 |
| Winkler | 10-66 | | | | | | | | | | | | | | | | | | | | v8 | v6 | v6 | | v13 |
| Wolsfeld | 27-157 | 4 | | | | | | | | | | | | | | | | | | | | | | | |
| Wood (Burnsville) | 19-24 | | | | | | | | | | | | | | | | | v10 | v14 | v15 | v15 | v14 | v13 | v14 | v14 |
| Young America | 10-105 | | | | | | | | | | | | | | | | | | | | v1 | | | | |
| Zumbra | 10-41 | | | | | 5 | | | | | | 13 | | | | | | | | | | | | 13 | |

**Metropolitan Council Lake Report Questionnaire**

1. The Council publishes a lake water quality report annually.

   - Are you familiar with the report? yes no
   - Have you used any of the data? yes no
   - Describe how you have used report findings.

2. These questions pertain to the content of the Lake Report.

   - What types of information from the report do you find most useful?

   - What portions of the report should be reduced, removed or are not useful?

   - What types of new data should be included in the report? Why?

   - Is the information in the report explained fully? Is it easy to understand?

   - Are the charts and graphs easy to understand?

   - Does the format add to understanding the information?

   - Other suggestions pertaining to writing, format design and graphics:

3. How often should the report be published? less frequently more frequently annually

4. Demographics of report users

   - Please circle occupation/employer

   City County State

   Government Official Government Staff Other (please specify)

Thank you for your help. Please return to:

Metropolitan Council
c/o Randy Anhorn
2400 Childs Road
St. Paul, MN 55106