

CHISAGO SOIL AND WATER CONSERVATION DISTRICT

CHISAGO COUNTY
VOLUNTEER
LAKE MONITORING PROGRAM

2008 Monitoring Results

Chisago SWCD
38814 3rd Ave.
North Branch, MN 55056
www.chisagoswcd.org

Prepared by: Casey Thiel, Chisago SWCD

December 2008

The Chisago Volunteer Lake Monitoring Program is funded by a Surface Water Assessment Grant (SWAG) through the Minnesota Pollution Control Agency (MPCA). The lakes that are monitored in this program have been previously unassessed for pollutants. The work of the volunteers has aided in gathering critical data for these lakes. Each Lake will be monitored for two years. The data that has been collected will help the MPCA assess these waters for impairments and determine if they fit the criteria of the Environmental Protection Agency's 303D Impaired Waters List. If the waters are deemed impaired they will be part of a Total Daily Maximum Load study to determine the potential problems and find projects to help clean up the lakes and their watersheds.

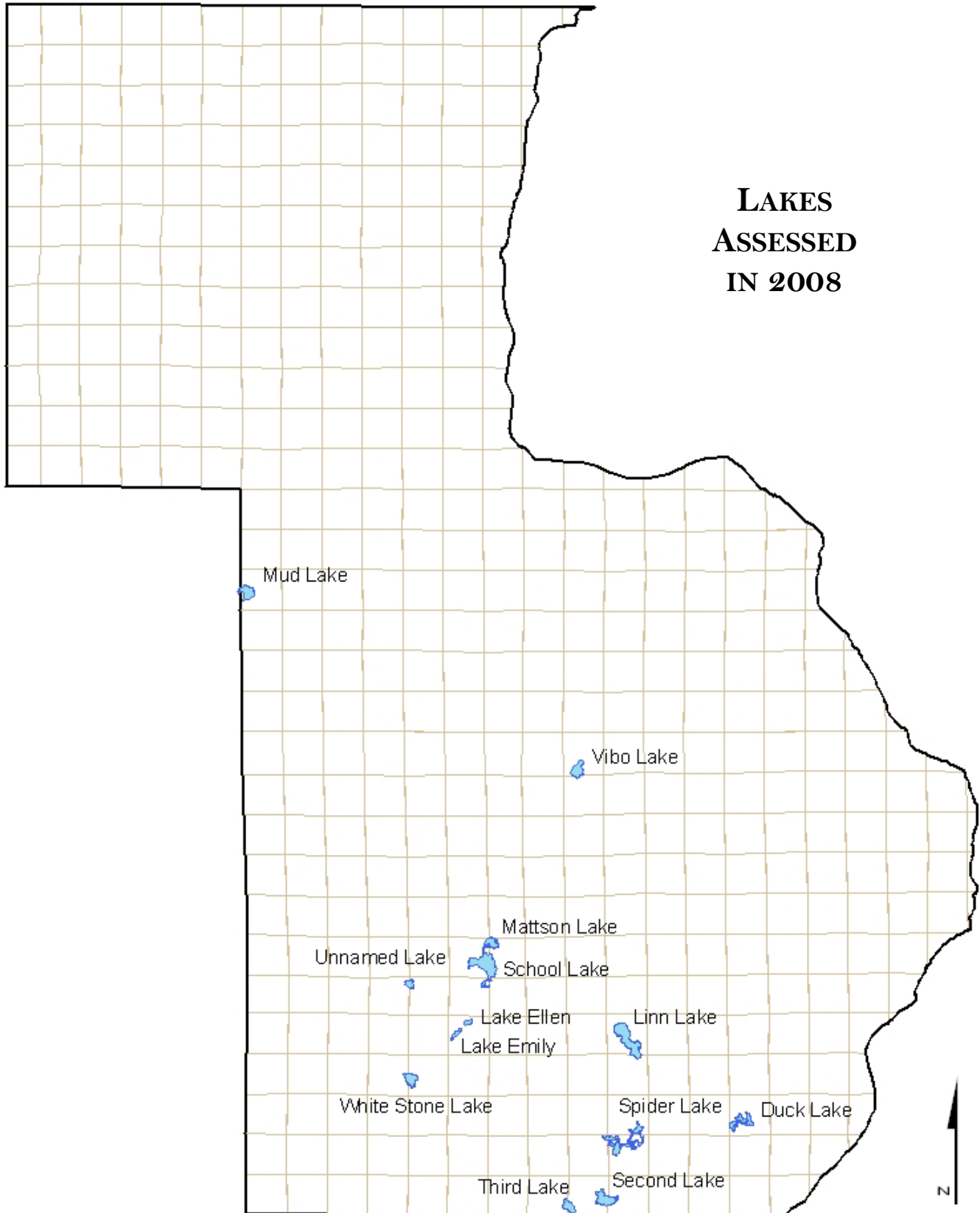
Please contact the Chisago Soil and Water Conservation District with any Questions, Comments or Concerns.

Casey Thiel | District Technician
Chisago SWCD | 651/674-2333
www.chisagoswcd.org
casey.thiel@mn.nacdnet.net

TABLE OF CONTENTS

Map of Assessed Lakes	4
Grading for all Lakes	5
Duck Lake	6-7
Lake Ellen	8-9
Lake Emily	10-11
Linn Lake	12-13
Mattson Lake	14-15
Mud Lake	16-17
Second Lake	18-19
School Lake	20-21
Spider Lake	22-23
Third Lake	24-25
Unnamed Lake	26-27
Vibo Lake	28-29
White Stone Lake	30-31
Photographs	32
Classification Criteria	33
Glossary	34-35

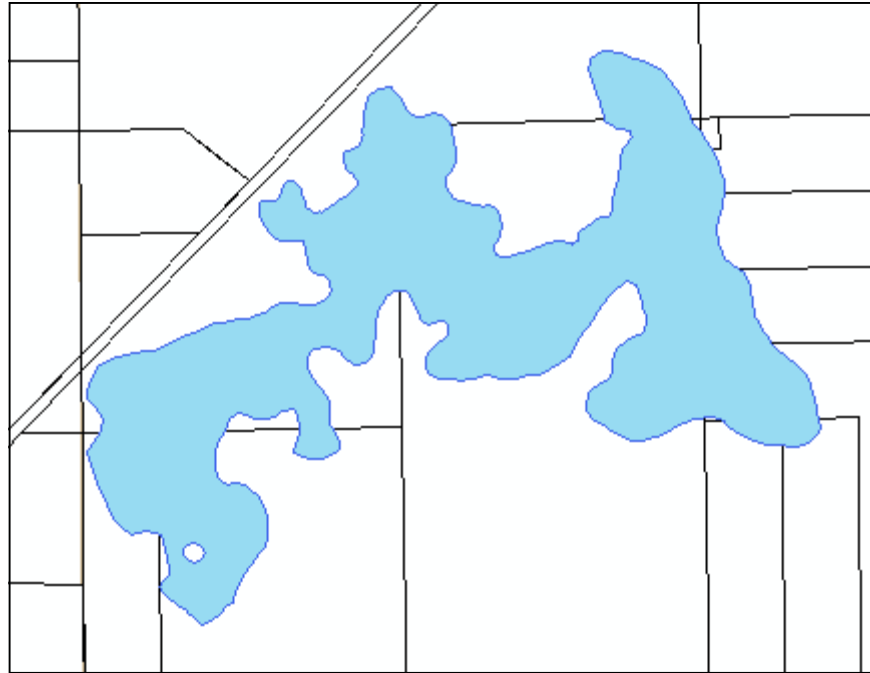
CHISAGO VOLUNTEER LAKE MONITORING PROGRAM



2008 RANKING	LAKE	2008 LAKE GRADE
1	Mattson	B+
2	Third	B+
3	Mud	B
4	Duck	B
5	Unnamed	B-
6	Spider	C+
7	Ellen	C
8	Second	C
9	White Stone	D+
10	School	D-
11	Vibo	F
12	Linn	F
13	Emily	F

Duck Lake

Franconia Township



Franconia Township, Section 19
61.0 acres
Shallow Lake

Lake Classification:
Eutrophic
Overall Lake Quality Grade:
B

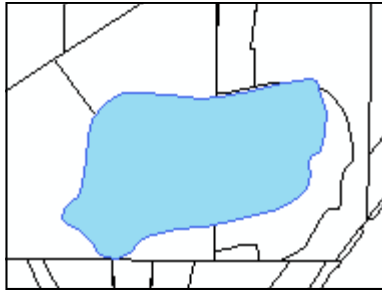
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Duck Lake	1.1	33	9.0	2.0
Grade	N/A	C	A	C
Meets MPCA Std.	N/A	yes	yes	yes

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/12/2008	0.82	47	8.8	1.0	15.5
5/27/2008	0.57	41	8.5	1.0	16.7
6/14/2008	0.97	33	6.7	1.0	17.2
6/25/2008	1.2	29	2.5	2.3	23.9
7/10/2008	1.1	40	8.8	3.0	22.8
7/24/2008	0.88	27	7.8	2.0	22.2
7/24/2008	1.0	32	7.7	2.0	25.9
8/11/2008	1.1	32	5.7	2.5	23.9
8/27/2008	1.4	39	12.0	3.0	20.0
9/7/2008	1.4	45	14.0	1.5	15.6
9/17/2008	-	-	10.0	1.0	24.4

Lake Ellen

Chisago City



Wyoming Township, Section 12

13.6 acres

Shallow Lake

Lake Classification:

Eutrophic

Overall Lake Quality Grade:

C

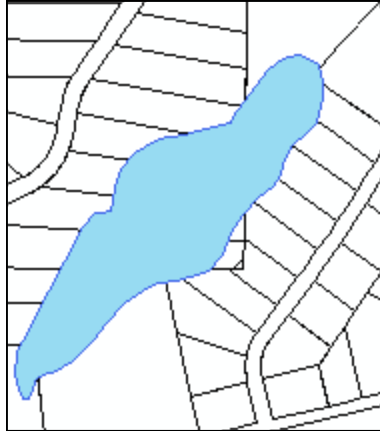
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Lake Ellen	1.0	39	3.2	0.9
Grade	N/A	C	A	D
Meets MPCA Std.	N/A	yes	yes	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/17/2008	1.1	44	7.2	0.9	16.7
6/15/2008	1.2	47	2.6	0.9	21.7
6/30/2008	0.73	30	3.7	0.9	21.7

Lake Emily

Chisago City



Wyoming Township, Section 12

15.0 acres

Shallow Lake

Lake Classification:

Hypereutrophic

Overall Lake Quality Grade:

F

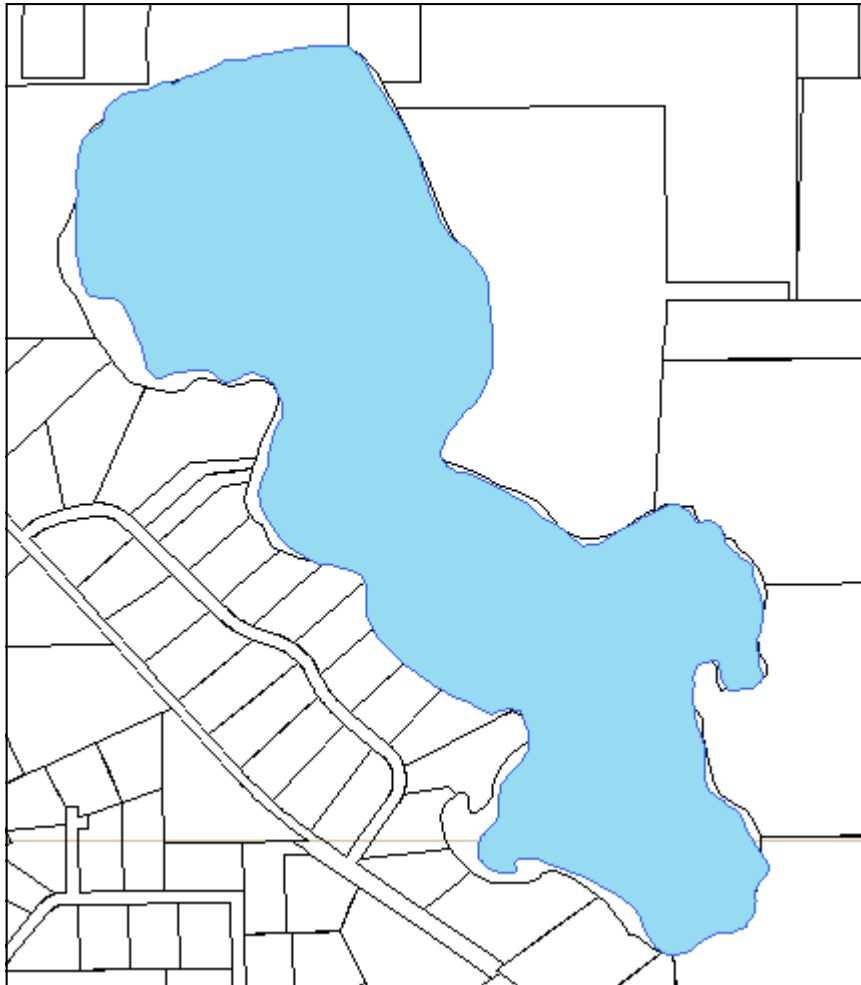
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Lake Emily	5.0	341	87.1	0.4
Grade	N/A	F	F	F
Meets MPCA Std.	N/A	no	no	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/15/2008	2.6	222	32	0.6	18.9
5/30/2008	2.7	234	39	0.3	17.8
6/15/2008	4.3	338	52	0.3	23.3
6/29/2008	3.8	314	56	0.5	26.1
7/14/2008	5.5	373	100	0.3	26.7
7/14/2008	4.8	289	110	0.3	23.4
8/6/2008	1.9	287	190	0.3	26.7
8/25/2008	5.2	347	120	0.3	25.6
9/14/2008	6.5	287	65	0.3	16.7
9/30/2008	7.6	494	56	0.5	17.8

Linn Lake

Lindstrom



South Chisago Lakes Township, Section 10
156.1 acres
Shallow Lake

Lake Classification:
Hypereutrophic
Overall Lake Quality Grade:
F

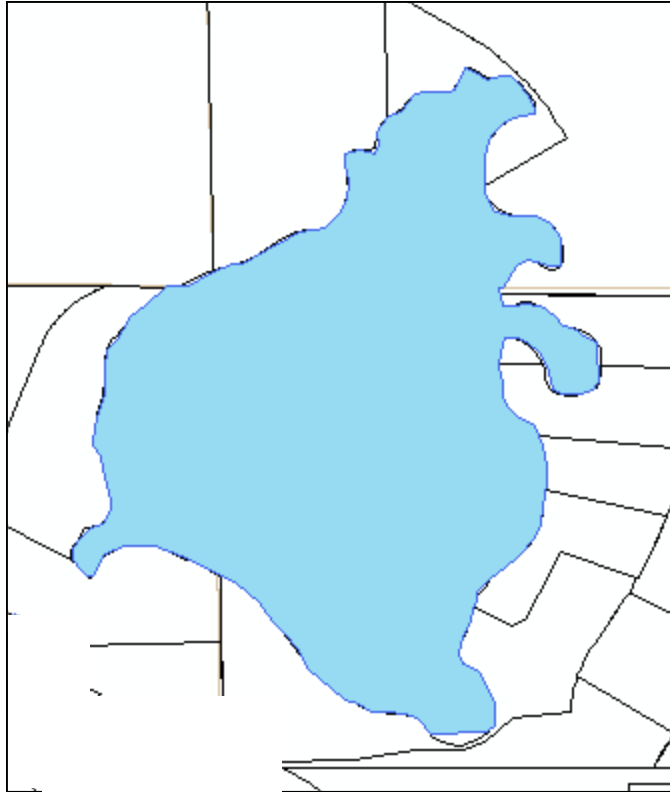
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Linn Lake	4.1	213	61	0.4
Grade	N/A	F	D	F
Meets MPCA Std.	N/A	no	no	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/22/2008	3.3	144	7.2	1.0	16.1
6/10/2008	3.6	186	18.0	1.0	17.8
6/15/2008	3.5	203	36.0	0.7	21.7
7/4/2008	4.2	188	-	0.4	25.0
7/15/2008	4.9	261	69.0	0.1	25.6
8/11/2008	4.1	216	110.0	0.2	25.6
8/11/2008	4.3	225	72.0	0.2	24.0

Mattson Lake

Chisago City



North Chisago Lakes Township, Section 31
80.4 acres
Shallow Lake

Lake Classification:
Mesotrophic
Overall Lake Quality Grade:
B+

Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

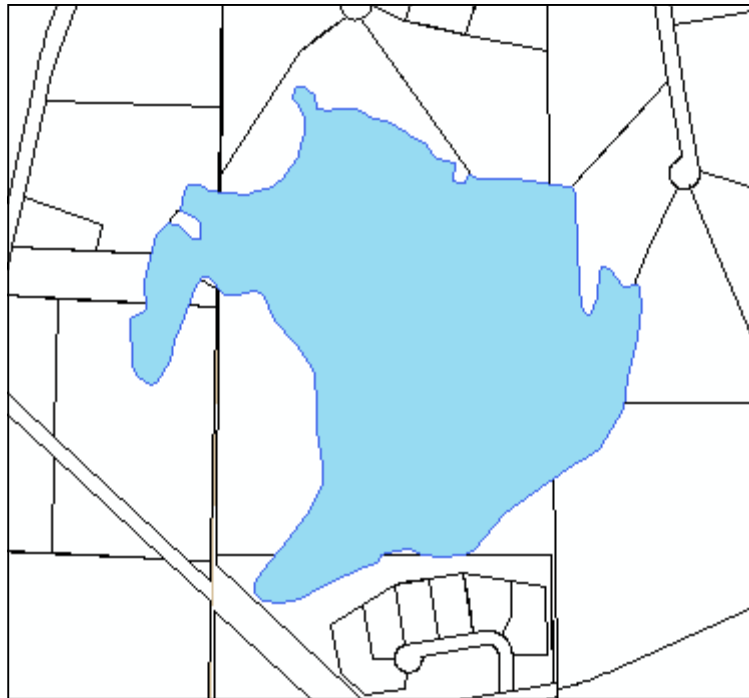
Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Mattson Lake	0.7	21	3.5	2.0
Grade	N/A	A	A	C*
Meets MPCA Std.	N/A	yes	yes	yes

*Grade may be artificially low due to aquatic plant growth.

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/7/2008	0.51	21	3.9	-	-
5/30/2008	0.77	22	1.2	1.5	17.7
6/12/2008	0.7	21	2.2	2.0	21.9
6/12/2008	0.7	19	2.0	2.0	18.9
7/30/2008	0.91	22	7.7	-	-
8/20/2008	0.54	22	2.2	-	13.2

Mud Lake

North Branch



City of North Branch, Section 18

58.4 acres

Shallow Lake

Lake Classification:

Eutrophic

Overall Lake Quality Grade:

B

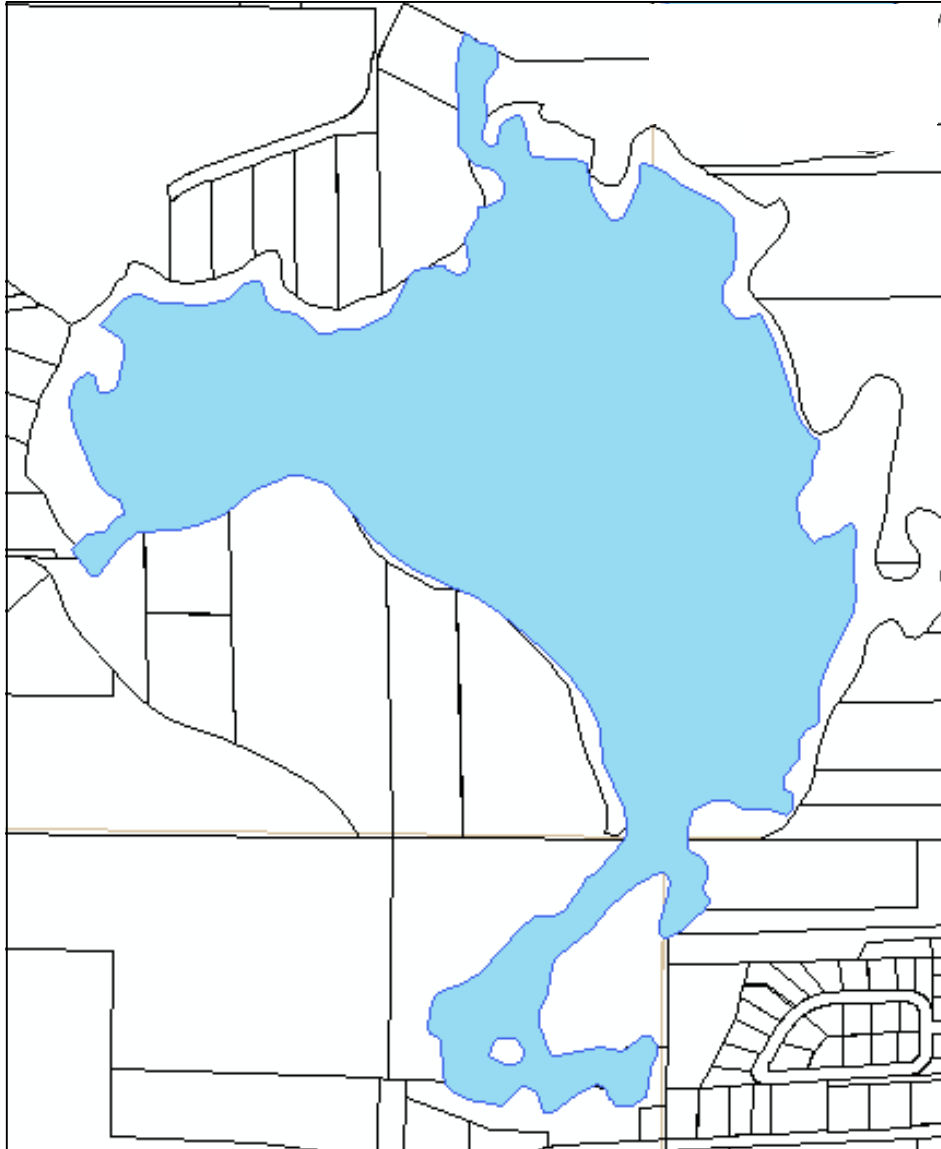
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Mud Lake	1.0	30	4.3	1.5
Grade	N/A	C	A	C
Meets MPCA Std.	N/A	yes	yes	yes

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/5/2008	0.54	65	1.7	1.5	15.5
5/21/2008	0.63	17	1.0	1.5	16.7
6/17/2008	0.89	36	3.0	1.5	21.1
7/8/2008	1.0	29	6.8	1.5	26.7
7/30/2008	1.1	26	1.5	1.5	27.8
8/11/2008	1.0	34	4.7	1.5	26.7
8/25/2008	1.1	28	6.4	1.5	25.6
8/25/2008	1.1	27	3.5	1.5	25.6

School Lake

Chisago City



Lent Township, Section 36
North Chisago Lakes Township, Section 31
157.7 acres

Lake Classification:
Hypereutrophic
Overall Lake Quality Grade:
D-

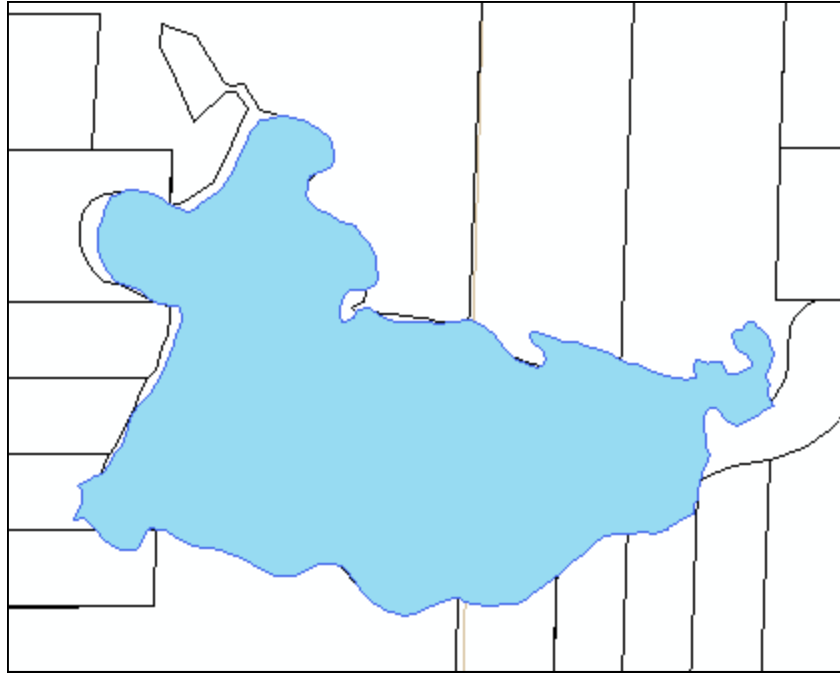
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1..2	23-50	5-22	1.5-3.2
School Lake	2.5	191	84.6	0.4
Grade	N/A	F	D	D
Meets MPCA Std.	N/A	no	no	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/5/2008	1.4	66	4.1	2.4	12.2
5/22/2008	1.6	74	13.0	2.3	19.4
6/12/2008	2.7	127	27.0	0.6	19.4
6/12/2008	2.4	123	61.0	0.7	20
6/24/2008	3.6	157	16.0	0.6	24.4
7/15/2008	4.6	244	220.0	0.2	26.7
7/25/2008	4.9	243	-	0.3	23.3
8/10/2008	-	-	-	0.2	23.9
8/25/2008	2.0	251	99.0	0.3	22.2
9/15/2008	-	-	-	0.5	14.4
9/28/2008	-	-	-	0.5	15.6

Second Lake

South Chisago Lakes Township



South Chisago Lakes Township, Section

33/34

75.3 acres

Shallow Lake

Lake Classification:

Eutrophic

Overall Lake Quality Grade:

C

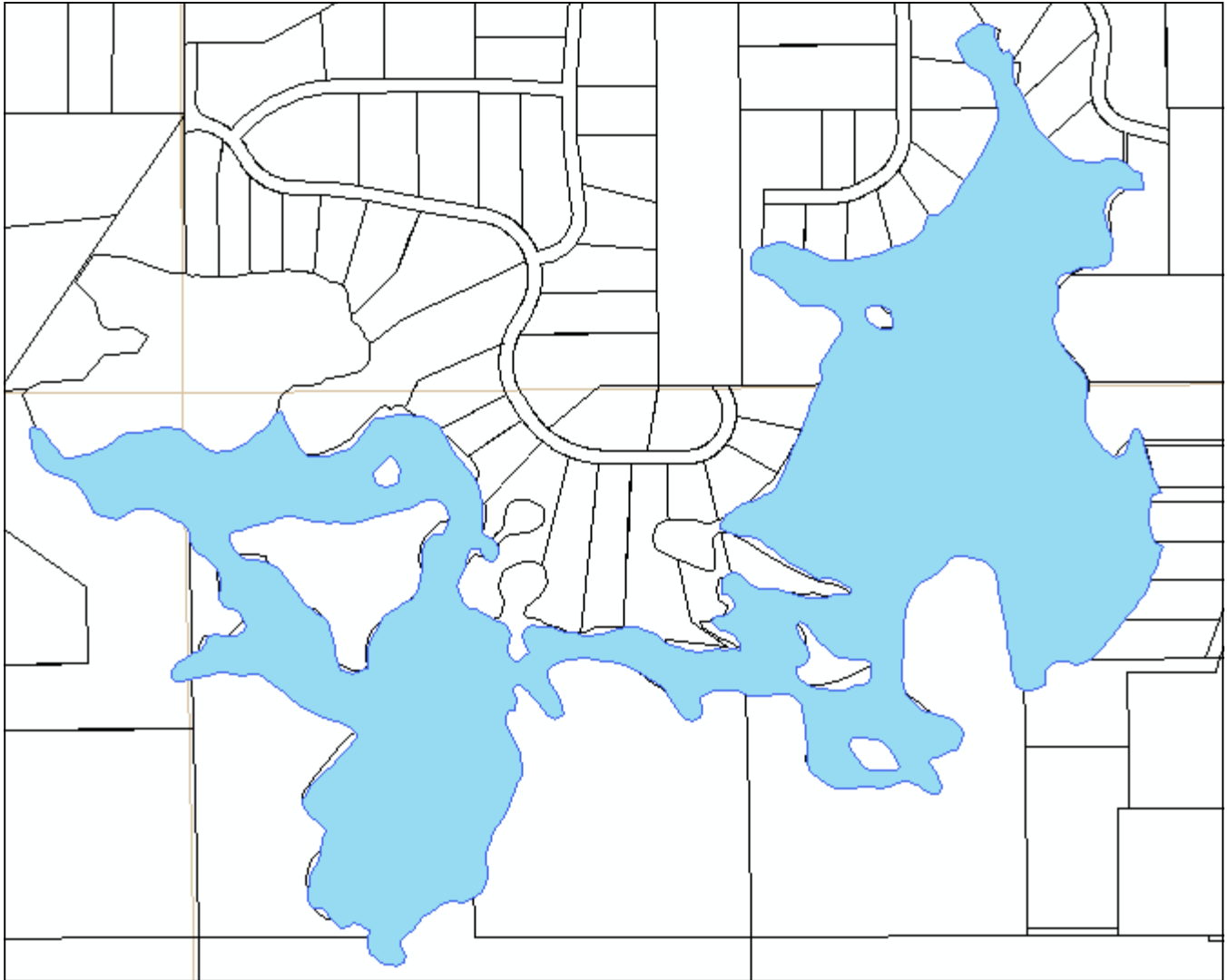
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Second Lake	2.5	71	16.1	0.8
Grade	N/A	C	B	C
Meets MPCA Std.	N/A	no	yes	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/8/2008	1.7	42	1.2	1.5	15.6
5/16/2008	1.7	43	3.6	1.4	16.7
6/7/2008	1.6	55	4.9	1.4	20.0
6/13/2008	1.8	61	8.7	1.3	18.9
6/13/2008	1.9	113	9.9	1.3	18.9
7/4/2008	1.9	49	19.0	0.6	20.0
7/25/2008	2.4	58	19.0	0.5	20.6
8/8/2008	5.7	47	13.0	0.5	23.3
8/23/2008	2.4	63	33.0	0.8	26.7
9/20/2008	2.6	128	15.0	0.5	26.1
9/22/2008	2.0	65	22.0	0.7	26.11

Spider Lake

South Chisago Lakes Township



South Chisago Lakes Township, Section 27/22

164.0 acres

Shallow Lake

Lake Classification:

Eutrophic

Overall Lake Quality Grade:

C+

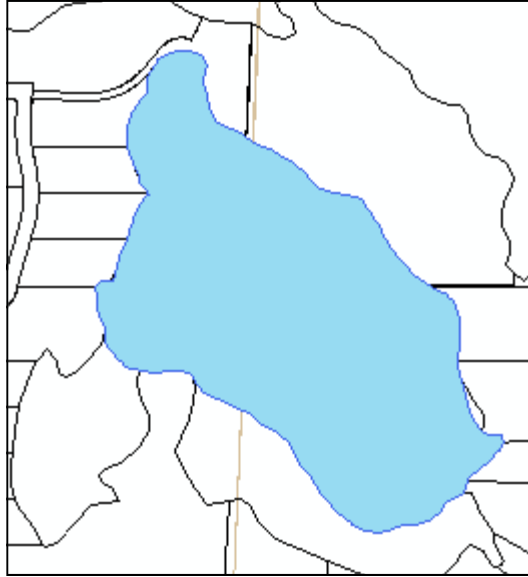
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Spider Lake	1.3	50	16.2	1.2
Grade	N/A	C	B	C
Meets MPCA Std.	N/A	yes	yes	yes

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/8/2008	0.56	26	1.3	1.6	15.6
5/23/2008	0.79	31	2.7	1.6	18.9
6/16/2008	0.57	38	1.6	2.0	19.4
6/26/2008	0.66	33	5.9	2.0	24.6
6/26/2008	0.9	69	7.7	2.1	24.6
7/17/2008	1.8	67	46.0	0.6	23.9
7/31/2008	1.9	51	35.0	0.7	25.6
8/19/2008	1.8	54	11.0	0.6	26.1
8/31/2008	1.3	42	13.0	1.0	22.2
9/16/2008	1.6	53	18.0	1.0	17.2
10/1/2008	1.3	44	8.0	1.1	13.9

Third Lake

South Chisago Lakes Township



South Chisago Lakes Township, Section 32/33

42.4 acres

Shallow Lake

Lake Classification:

Mesotrophic

Overall Lake Quality Grade:

B+

Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

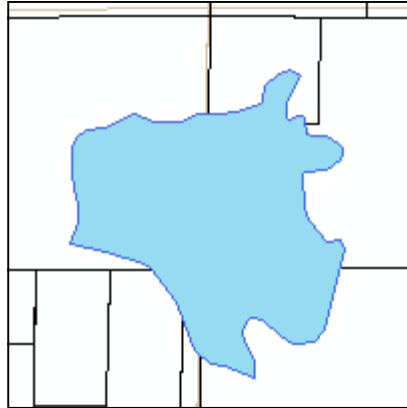
Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Third Lake	0.9	29	1.4	2.1
Grade	N/A	B	A	B*
Meets MPCA Std.	N/A	yes	yes	yes

*Grade may be artificially low due to aquatic plant growth.

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/26/2008	0.82	56	1.1	4.0	17.8
6/2/2008	0.79	23	1.8	1.5	20.0
6/9/2008	0.81	18	<1.0	2.0	21.1
6/9/2008	0.98	12	1.1	3.0	21.7
8/15/2008	0.82	19	1.5	2.0	22.2
8/31/2008	1.5	108	<1.0	2.0	24.4
9/15/2008	0.66	14	1.3	2.0	15.6
10/2/2008	0.77	11	2.4	2.0	11.7

Unnamed Lake

Wyoming



Wyoming Township, Section 2/3

21.3 acres

Shallow Lake

Lake Classification:

Eutrophic

Overall Lake Quality Grade:

B-

Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

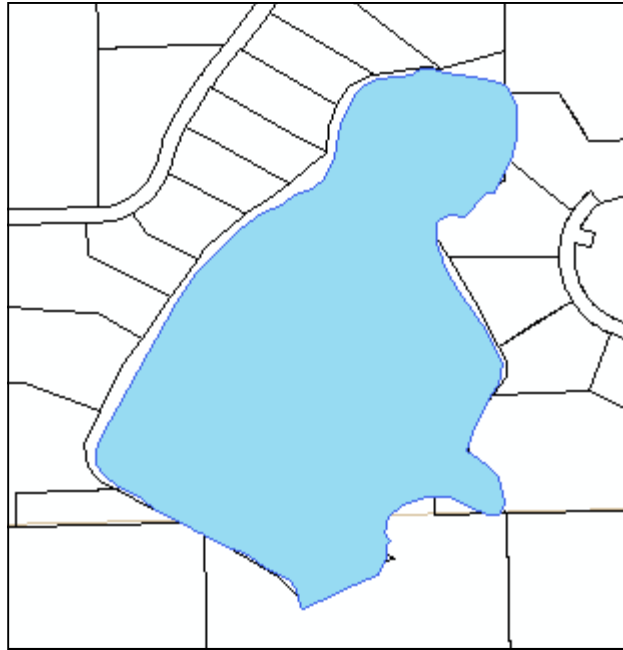
Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Unnamed Lake	0.9	35	5.2	1.0
Grade	N/A	C	A	D*
Meets MPCA Std.	N/A	yes	yes	yes

*Grade may be artificially low due to aquatic plant growth.

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/8/2008	0.47	22	3.0	1.3	17.8
5/31/2008	0.76	45	2.1	1.3	20.5
6/23/2008	0.71	66	4.4	1.1	23.3
6/28/2008	1.1	54	10	1.1	23.3
7/11/2008	1.2	52	3.7	1.0	21.1
7/29/2008	1.1	48	9.8	0.8	25.6
8/11/2008	0.7	22	2.3	0.8	21.7
8/28/2008	1.2	28	8.5	0.8	21.7
9/12/2008	1.1	33	4.1	0.8	18.3
9/27/2008	0.66	26	3.4	1.0	17.8
10/8/2008	0.6	13	2.0	1.1	15
10/8/2008	0.58	11	4.1	1.1	12.02

Vibo Lake

North Chisago Lakes Township



North Chisago Lakes Township, Section 4/9
56.5 acres
Shallow Lake

Lake Classification:
Hypereutrophic
Overall Lake Quality Grade:
F

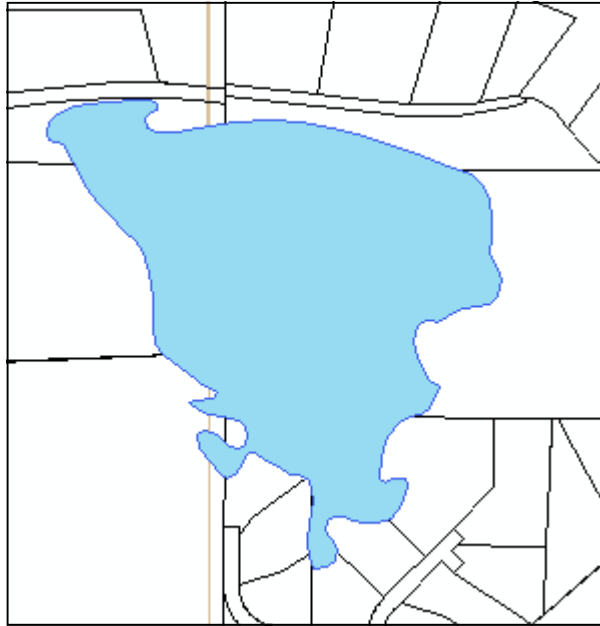
Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
Vibo Lake	2.7	420	62	0.4
Grade	N/A	F	D	F
Meets MPCA Std.	N/A	no	no	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/16/2008	2.1	343	18	0.6	18.3
5/30/2008	2.3	344	39	0.4	17.2
6/12/2008	2.2	391	49	0.4	20.5
6/26/2008	2.8	29	38	0.7	23.9
7/15/2008	2.9	504	38	0.4	22.2
7/15/2008	2.9	484	78	0.4	23.55
7/31/2008	3.6	584	-	0.4	22.8
8/5/2008	2.3	474	130	0.4	26.7
8/21/2008	3.2	656	57	0.4	23.9
9/4/2008	2.1	368	49	0.3	18.3
9/17/2008	5.0	293	57	0.3	21.1

White Stone Lake

Chisago City



Wyoming Township, Section 14/15

46.9 acres

Shallow Lake

Lake Classification:

Eutrophic

Overall Lake Quality Grade:

D+

Summer Average of Water Quality Values in the
North Central Hardwood Forest Ecoregion:

Lake	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (m)
Normal Range	0.6-1.2	23-50	5-22	1.5-3.2
White Stone Lake	1.9	84	29.7	0.9
Grade	N/A	D	C	D
Meets MPCA Std.	N/A	no	no	no

Date	TKN (mg/L)	TP (µg/L)	Chlorophyll-A (µg/L)	Secchi Disk Trans (m)	Temp (°C)
5/8/2008	1.8	66	12	1.2	15.6
5/24/2008	1.7	64	10	1.2	16.1
6/7/2008	1.8	69	13	1.0	21.1
6/20/2008	1.4	58	3.8	0.9	22.2
7/2/2008	1.9	68	6.3	0.9	23.9
7/17/2008	1.8	76	33	0.8	26.1
7/31/2008	2.6	163	56	0.7	25.6
8/14/2008	2.0	90	49	0.7	25.6
8/14/2008	1.9	82	53	1.0	23.8
8/29/2008	1.7	82	24	1.0	21.1
9/15/2008	2.0	86	37	1.0	16.7
9/30/2008	1.7	62	22	1.0	15.6



Spider Lake



School Lake



Mattson Lake



Second Lake

Parameter	Oligotrophic	Mesotrophic	Eutrophic	Hyper-eutrophic
Total Phosphorus (µg/L)	< 12	13—24	24—96	> 96
Chlorophyll-A (µg/L)	< 3	3—7	7—56	> 56
Secchi Transparency (m)	< 4.0	2.0—4.0	2.0—0.5	< 0.5

(Osgood, 1989b, Osgood, 1989c).

General Trophic Classification of Lakes

Grade	Percentile	Total Phosphorus (µg/L)	Chlorophyll-A (µg/L)	Secchi Transparency (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

Metropolitan Council - pg. 12, <http://www.metrocouncil.org/environment/RiversLakes/Lakes/07IntPurAcknMethResAn.pdf> Grades are based on an May - September average.

Summer Average Water Quality Values of Eco-region Lakes

Ecoregion	Percentile	Total Kjeldahl Nitrogen (mg/L)	Total Phosphorus (µg/L)	Chl-A (µg/L)	Secchi Trans. (m)
North Central Hardwood Forest	25—75	0.60-1.2	23—50	5—22	1.5—3.2

(Heiskary, 1991)

GLOSSARY

Total Kjeldahl Nitrogen (TKN): The sum of nitrogen and ammonia in a water body. High measurements of TKN typically result from sewage and manure discharges to water bodies (MPCA). The lower the reading, the clearer the water will be.

Total Phosphorus (TP): A nutrient essential to the growth of organisms, and is commonly the limiting factor in the primary productivity of surface water bodies. TP includes the amount of phosphorus in solution (reactive) and in particle form. Agricultural drainage, wastewater, and certain industrial discharges are typical sources of phosphorus, and can contribute to the eutrophication of surface water bodies (MPCA). The lower the reading, the clearer the water will be.

Chlorophyll-A: Photosynthetic pigment found in all green plants, and the main pigment in algae. The concentration of chlorophyll-A is used to estimate the amount of algae in surface water (MPCA). The lower the reading, the clearer the water will be.

Secchi Disk: A measure of water clarity taken with a black and white disk lowered into the water until it disappears, then raised until it barely appears and recording a reading. The higher the reading, the clearer the water will be.

Oligotrophic: Clear water, oxygen throughout the year the hypolimnion (area below the thermocline). Water may be suitable for an unfiltered water supply. Salmon can occupy these lakes.

Mesotrophic: Water is moderately clear, increasing probability of lack of oxygen in the hypolimnion during the summer. Iron, manganese, taste, and odor problems worsen. Walleye population may be predominant.

Eutrophic: The hypolimnion is without oxygen the majority of the year. There may be problems with the macrophyte plant population. Blue-green algae blooms may occur. The water supply may have episodes of severe taste and odor. Only warm water fisheries are present. Nuisance macrophytes, algae blooms, and very low transparency may discourage swimming and boating.

Hypereutrophic: Dense algae and macrophytes present. Rough fish dominate the fish population. The possibilities of summer fish kills exist.



CHISAGO SOIL AND WATER CONSERVATION DISTRICT

Chisago Soil and Water Conservation District

38814 Third Avenue

North Branch, MN 55056

Phone: 651/674-2333

Fax: 651/674-8828

Website: www.chisagoswcd.org