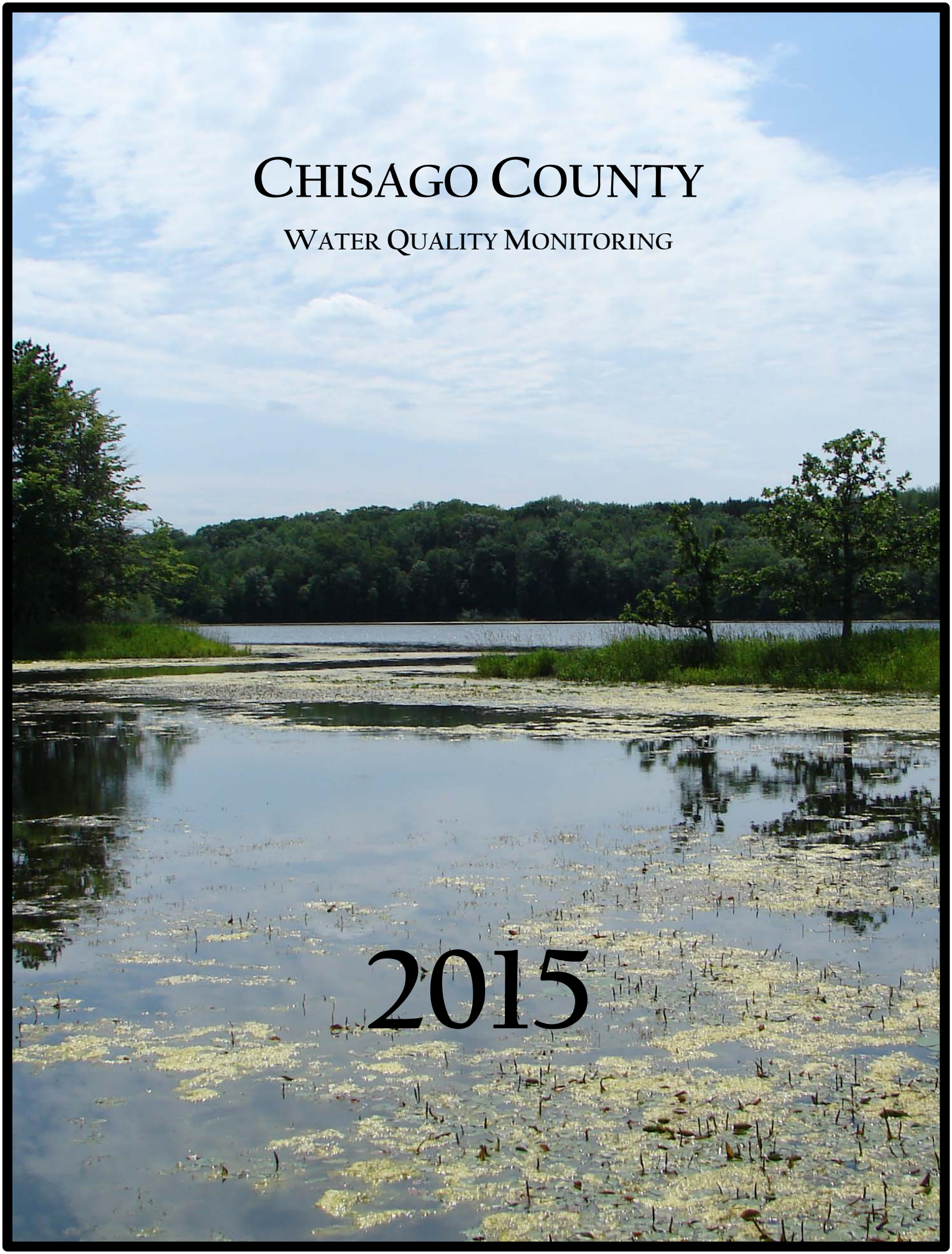
CHISAGO COUNTY

WATER QUALITY MONITORING



2015

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Definitions

Ammonia Nitrogen: An inorganic form of nitrogen contained in fertilizers, septic system effluent, and animal wastes. It is also a product of bacterial decomposition of organic matter. Ammonia nitrogen becomes a concern if high levels of the un-ionized form are present. In this form, it can be toxic to aquatic organisms. The presence of un-ionized ammonia is a function of the ammonia nitrogen concentration, pH, and temperature. Conversion of ammonia nitrogen to nitrite nitrogen by nitrification requires large quantities of oxygen which can kill aquatic organisms due to the lowered dissolved oxygen concentrations in water. The lowest reported limit is 0.07 mg/L. Any samples below 0.07 mg/L are reported as 0.07 mg/L or <0.07 mg/L.

Chlorophyll-a (Chl-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.

Color of Filtered Water: This is a description of the color of the algae which remains after lake water is drawn through a filter. In order to provide an accurate description of the color, which can be compared year to year, the colors of the filtered water are compared to those colors illustrated in the Martha Stewart Living – complete color palette.

Secchi Disk (SD): 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 record a reading. The higher the reading, the clearer the water will be.

Temperature: A specific degree of hotness or coldness as indicated on or referred to a standard scale.

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

Physical Condition: Describe the Physical condition of the lake water at your sampling point	
1	Crystal clear water
2	Not quite crystal clear-a little algae present/visible
3	Definite algae, green, yellow, or brown color
4	High algae levels, limited clarity and/or mild odor apparent
5	Severely high algae levels with the following: massive floating scums, strong foul odor, fish kill
Recreational Suitability: Describe your opinion of how suitable the lake water is for recreation and aesthetics at your sampling site.	
1	Beautiful, could NOT be better
2	Very minor aesthetic problems; excellent for swimming, boating
3	Swimming/aesthetic enjoyment slightly impaired because of algae levels
4	Desire to swim and level of enjoyment of the lake substantially reduced because of the algae levels (would not swim but boating okay)
5	Swimming and aesthetic enjoyment of the lake nearly impossible due to the algae levels.

Trophic Levels

Trophic State Index: A formula used to determine the Trophic Level of a lake. Total Phosphorus, Chlorophyll-a and Secchi Transparency will each have an individual Trophic Level that allows the parameters to be compared to one another when the actual values cannot be compared.

Oligotrophic: Clear water, oxygen throughout the year in the hypolimnion (area below the thermocline or cold layer that separates the upper mixed portion of the lake and the lower calm portion of the lake). 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 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.

Carlson Trophic State Index (Carlson, R.E. and J. Simpson. 1996. *A Coordinator's Guide to Volunteer Lake Monitoring Methods*. North American Lake Management Society.)

TSI	<30	30-40	40-50	50-60	60-70	70-80	>80
Chl-*a* (µg/L)	<0.95	0.95-2.6	2.6-7.3	7.3-20	20-56	56-155	>155
SD (m)	>8	8-4	4-2	2-1	0.5-1	0.25-0.5	<0.25
TP (µg/L)	<6	6-12	12-24	24-48	48-96	96-192	192-384

Impairments and Standards

Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority ranking for waters on the lists and develop Total Maximum Daily Loads (TMDL) for these waters. A TMDL is a calculation of the maximum amount of pollution that a waterbody can receive and still safely meet water quality standards. (United States Environmental Protection Agency)

The Minnesota Pollution Control Agency (MPCA) has set the standards for Total Phosphorus, Chlorophyll-a, and Secchi Disk Depth for lakes in Minnesota. A lake must have a minimum set of data to prove that it is Impaired (not meeting the MPCA standards) or Not Impaired (does meet the MPCA standards) before it is listed on the 303(d) Impaired Waters list, at which point a TMDL study is required.

Two lakes (Rabour and Mandall) in this report have not reached the minimum required sampling data to receive a listing on the 303(d) Impaired Waters list. They are reported here as meeting or not meeting the MPCA standards, and it is noted that they have not been assessed for 303(d) Impaired Waters listing.

Project Objective

The purpose of the 2015 Chisago County Water Quality and Aquatic Invasive Species Monitoring program is to help achieve goals identified in the Chisago County Local Water Management Plan and the Chisago Lakes Lake Improvement District Water Resource Management Plan.

Chisago County Local Water Management Plan:

Monitoring and Assessment

11. Develop a County wide annual water quality monitoring plan for nutrients, aquatic life, and other parameters to determine ambient water quality concentration trends and loading for all public waters in Chisago County, including lakes with public accesses and the main stems and selected tributaries of Rock Creek, Rush Creek, Goose Creek, Sunrise River, and Lawrence Creek.
12. Implement a County wide lake water quality monitoring plan.
14. Develop an annual water quality monitoring report for Chisago County describing the water resources that were monitored and what parameters they were monitored for. The annual report will provide a complete summary of the monitoring results.

Chisago Lakes Lake Improvement District Water Resource Management Plan:

Goal 1: Preserve, protect, and enhance water quality within the Chisago Chain of Lakes watershed. Objective 2: Annually monitor nutrients, aquatic life, and other parameters to determine water quality concentrations, trends, and loading. The resultant report will provide information about lake water quality and interpretation of trends.

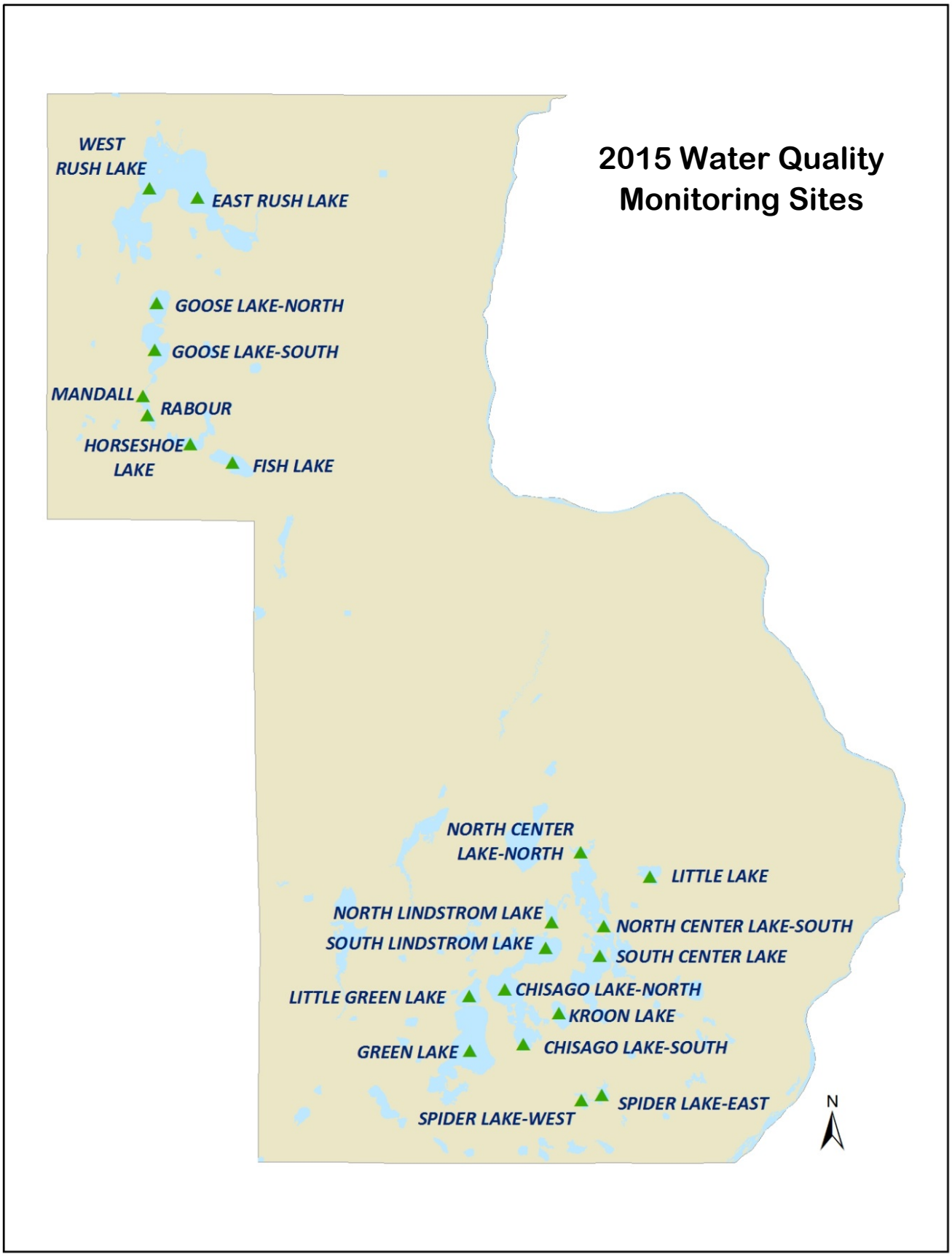
Past water quality monitoring has been useful in determining long term water quality trends. In addition, water quality monitoring data is essential for completing the Total Maximum Daily Load Studies within the County. Continuing the water quality monitoring will help determine progress in obtaining water quality goals.

Seventeen lakes were monitored through this program in 2015. Four of these lakes (Chisago, North Center, Spider, and Goose) had 2 monitoring locations each. Each lake was monitored 5 times, once a month, May through September. Samples were collected at the deepest part of the lakes.

Graphs represent 2015 data only. In some cases, 2009, 2010, 2011, 2012, 2013, and 2014 data is listed below the chart for comparison.

- Thanks to the Chisago Lakes Lake Improvement District and Chisago County Water Plan for providing partial staff and funding for the program.
- Thanks to the Chisago Soil & Water Conservation District for providing review of data, interpretation, submittal to MPCA's EQuIS program, and preparation of this report.
- Special thanks to the Chisago County Sherriff's Department for use of a Water Patrol boat to collect samples.

Monitoring Locations



Explanation of Parameters

Parameter	Unit	MPCA Deep Lake Standard**	MPCA Shallow Lake Standard**	Expected Range Chisago County
Chlorophyll-a	µg/L	14.0	20.0	5.0-22.0
Secchi Disk	Meters	>1.4	>1.0	1.5-3.2
Ammonia Nitrogen*	mg/L	No Standard	No Standard	None
*Minimum reporting level 0.01. Samples reported as 0.01 are actually 0.01 or less.				
Total Phosphorus	µg/L	40.0	60.0	23.0-50.0
Temperature	°F	No Standard	No Standard	None
A lake that fails to meet two of the three standards (Chlorophyll-a, Secchi Disk, Total Phosphorus) does not meet standards. Impaired or Not Impaired status is based on the 303(d) Impaired Waters list.				

Source: Heiskary, 1991

**Standards are based on June-September average. Shallow lakes have a maximum depth of 15 feet or less, or more than 80% of the lake is shallow enough to support emergent vegetation (littoral area). Deep lakes are generally more than 15 feet deep and have less than 80% littoral area.

Lake Classification

Parameter	Oligotrophic	Mesotrophic	Eutrophic	Hypereutrophic
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

Source: Osgood, 1989b, Osgood, 1989c

Lake Water Quality Grades

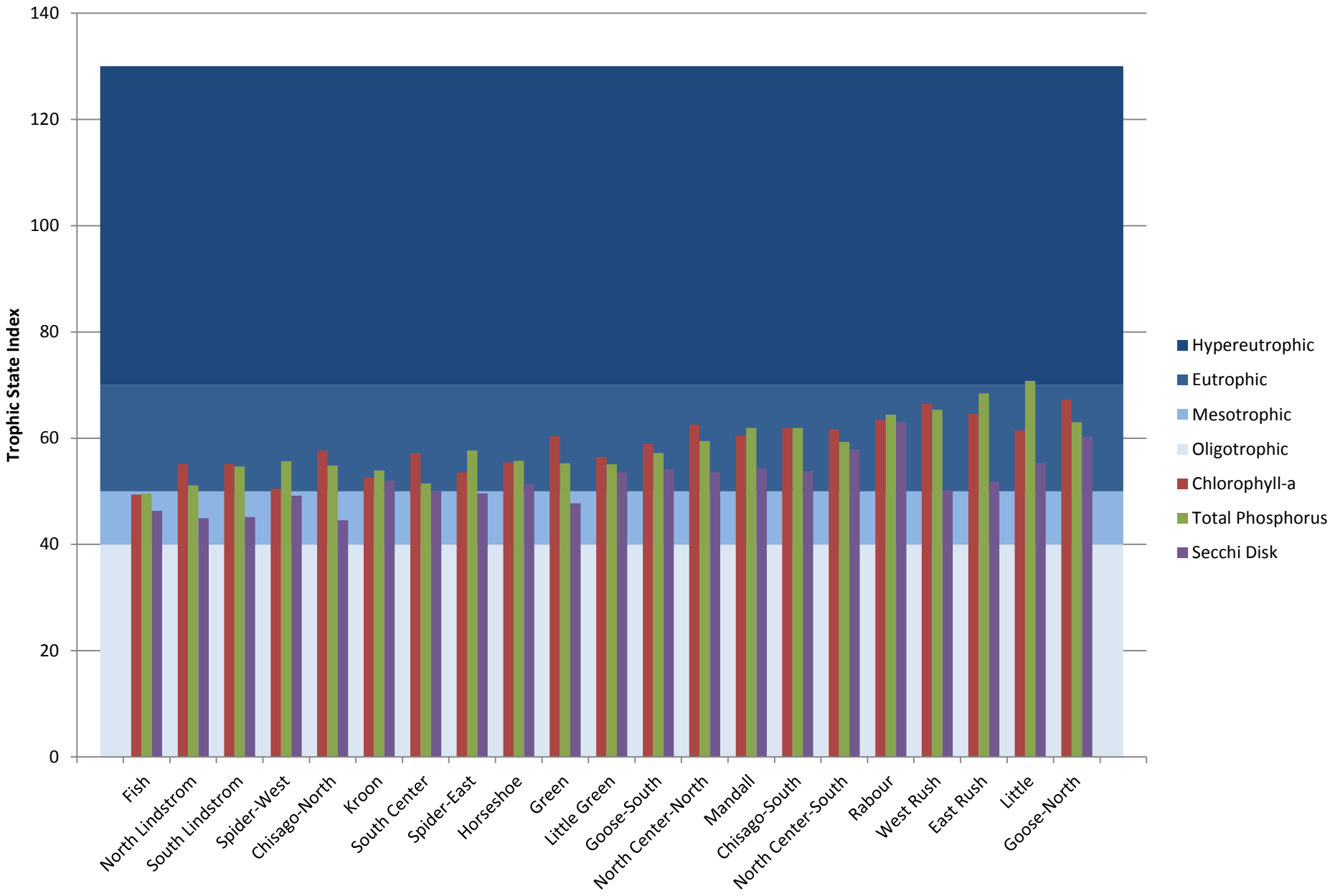
Grade	Percentile	Total Phosphorus (µg/L)	Chlorophyll-a (µg/L)	Secchi Transparency (m)
A	<10	<23	<10	>3.0
B	10-30	23-32	10-20	2.2-3.0
C	30-70	32-68	20-48	1.2-2.2
D	70-90	68-152	48-77	0.7-1.2
F	>90	>152	>77	<0.7

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

Rank of Lakes Monitored

2015 Rank	Lake	2015 Grade	2014 Grade	2013 Grade	2012 Grade	2011 Grade	Trophic State Index	Chlorophyll-a (ug/L)	Secchi Disk (meters)	Total Phosphorus (ug/L)	Classification	Shallow versus Deep	Meets MPCA Standards
1	Fish	B	B	B	B	----	48.45	7.50	2.30	22.25	Mesotrophic	Deep	Y
2	North Lindstrom	B	B	B	C	B	50.41	14.75	2.55	27.25	Eutrophic	Deep	Y
3	South Lindstrom	B	C+	C	C	B	51.65	14.75	2.25	34.50	Eutrophic	Deep	Y
4	Spider-West	B-	C+	B	B-C	----	51.78	9.00	2.08	34.00	Eutrophic	Shallow	Y
5	Chisago –North	B	C+	C	C	B	52.35	19.00	2.35	36.50	Eutrophic	Deep	Y
6	Kroon	B	B	B	C	B	52.85	11.25	1.50	33.50	Eutrophic	Deep	Y
7	**South Center**	**B**	**C+**	**C**	**C**	**C**	**52.88**	**18.00**	**1.75**	**27.25**	**Eutrophic**	**Deep**	**Y**
8	Spider-East	C	C+	C	C	C	53.62	12.00	2.00	42.50	Eutrophic	Shallow	Y
9	**Horseshoe**	**C**	**C**	**C**	**C**	**----**	**54.19**	**14.00**	**1.75**	**35.75**	**Eutrophic**	**Deep**	**Y**
10	Green	C	C+	C	B-C	C	54.46	25.50	1.83	38.75	Eutrophic	Deep	Y
11	Little Green	C	B-	C	C-D	C	55.06	17.00	1.30	36.50	Eutrophic	Deep	N
12	**Goose-South**	**C**	**D**	**C**	**C**	**----**	**56.77**	**17.00**	**1.50**	**36.00**	**Eutrophic**	**Deep**	**Y**
13	**North Center-North**	**C**	**C**	**C**	**C**	**C**	**58.55**	**31.50**	**1.23**	**49.00**	**Eutrophic**	**Shallow**	**Y**
14	Mandall	C	D	----	----	----	58.95	24.75	1.40	58.75	Eutrophic	Shallow	N
15	Chisago –South	C	C	D	D	C	59.22	30.25	1.33	62.25	Eutrophic	Shallow	N
16	**North Center-South**	**C**	**C+**	**C**	**C**	**C**	**59.59**	**26.75**	**1.00**	**47.75**	**Eutrophic**	**Shallow**	**N**
17	Rabour	C	D	----	----	----	60.30	33.00	1.53	68.00	Eutrophic	Shallow	N
18	**West Rush**	**C**	**D+**	**C**	**D**	**----**	**60.64**	**47.75**	**1.40**	**81.25**	**Eutrophic**	**Deep**	**N**
19	**East Rush**	**C**	**D**	**C**	**D**	**----**	**61.63**	**39.50**	**1.20**	**75.50**	**Eutrophic**	**Deep**	**N**
20	**Little**	**C**	**D**	**C**	**D**	**C-**	**62.52**	**27.50**	**1.08**	**110.00**	**Eutrophic**	**Deep**	**N**
21	**Goose-North**	**C**	**D**	**D**	**C**	**----**	**63.50**	**50.50**	**0.80**	**65.25**	**Eutrophic**	**Shallow**	**N**
	***Shaded cells do not meet the Water Quality Standards in 2015**												
	****Lakes in** BOLD **are listed as Impaired on the 303(d) Impaired Waters list (Mandall and Rabour Lakes have not been assessed)**												

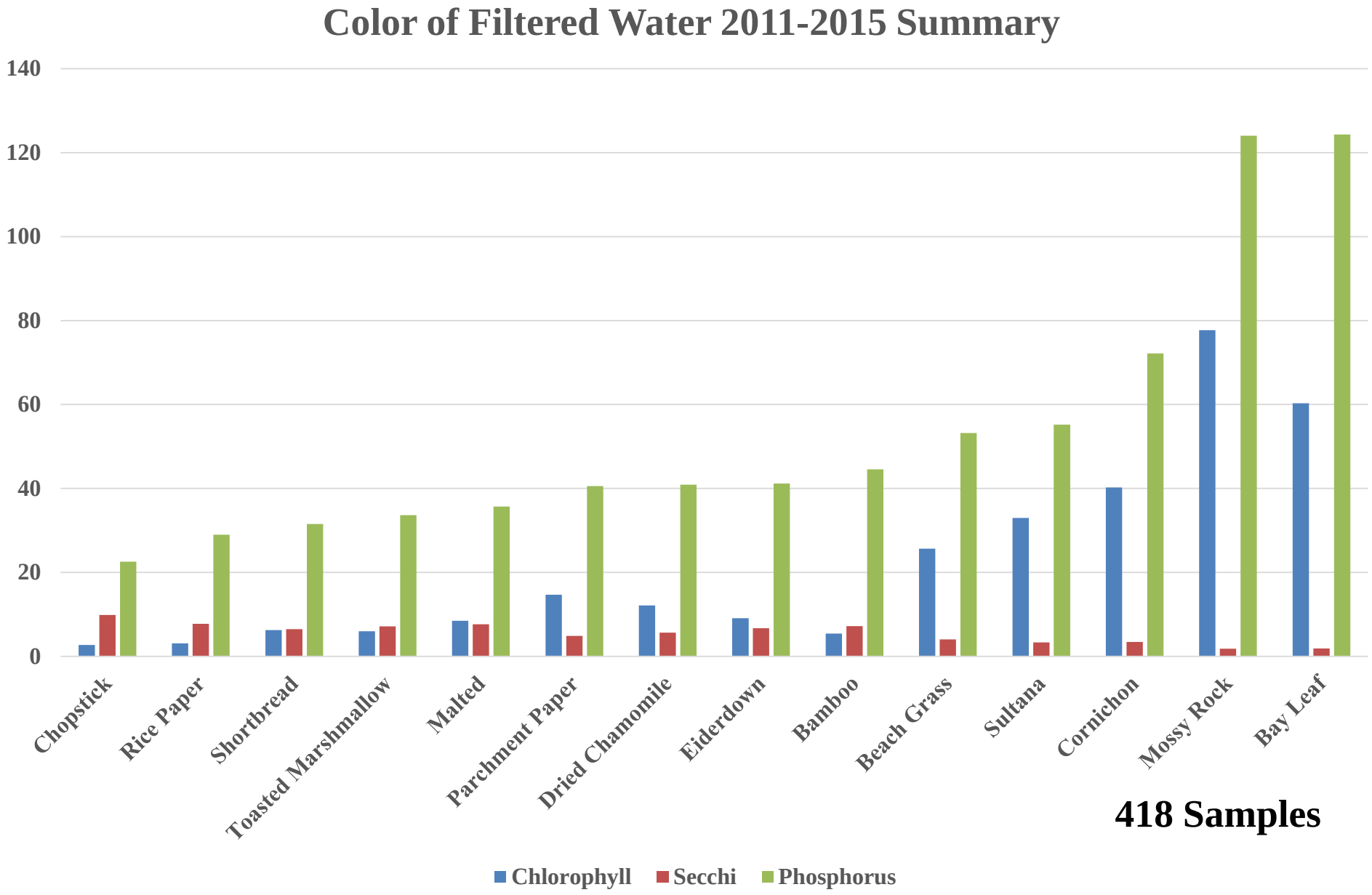
Lake Classification Chart



Explanation of Color Classification

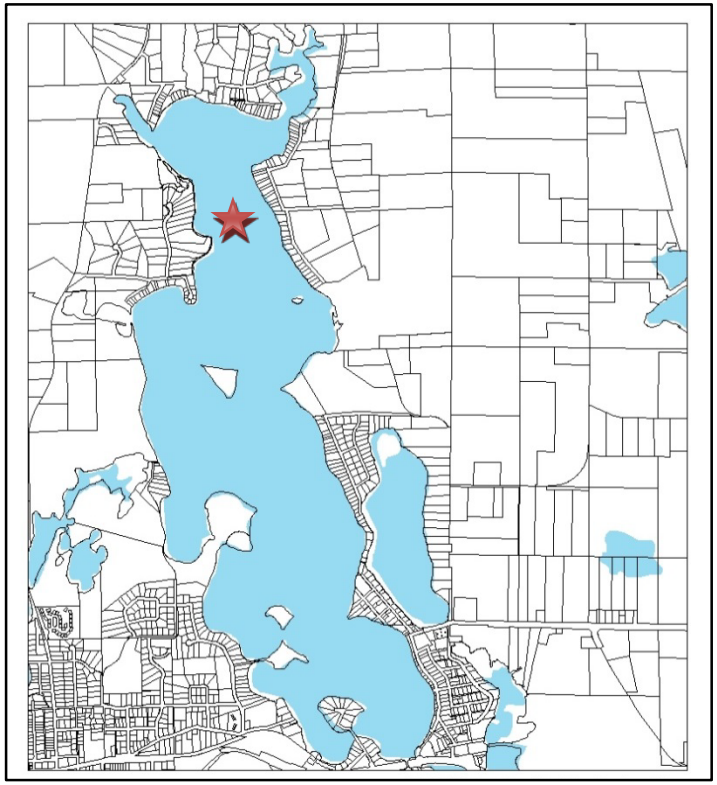
During each sample, water was run through filter paper. Algae remain on filter paper. The **color of the filter paper** was compared to paint samples and matched as closely as possible. The averages for Chlorophyll-a, Secchi transparency, and Phosphorus concentration for each color were determined from the average values of the samples within that color. The following chart is sorted according to phosphorus concentrations from lowest to highest. Only colors with 5 or more samples collected were included in the chart. A total of 418 samples were collected. There is a correlation between the algae color on the filter paper and the concentrations of Chlorophyll-a, Secchi transparency, and Phosphorus.

Color Name		Chlorophyll-a Concentrations (average µg/L)	Secchi Transparency (average M)	Phosphorus Concentrations (average µg/L)	Number of Samples
Chopstick		2.69	9.88	22.57	16
Rice Paper		3.11	7.77	28.97	15
Shortbread		6.26	6.49	31.55	17
Toasted Marshmallow		6	7.15	33.62	30
Malted		8.46	7.66	35.69	13
Parchment Paper		14.67	4.85	40.57	37
Dried Chamomile		12.15	5.63	40.92	43
Eiderdown		9.1	6.7	41.2	10
Bamboo		5.44	7.21	44.57	7
Beach Grass		25.67	4.02	53.18	108
Sultana		33	3.3	55.2	21
Cornichon		40.25	3.45	72.18	84
Mossy Rock		77.72	1.84	124.05	10
Bay Leaf		60.3	1.9	124.3	7


Color of Filtered Water 2011-2015 Summary
140
120
100
80
60
40
20
0
Chopstick
Rice Paper
Shortbread
Toasted Marshmallow
Malted
Parchment Paper
Dried Chamomile
Eiderdown
Bamboo
Beach Grass
Sultana
Cornichon
Mossy Rock
Bay Leaf
418 Samples
Chlorophyll
Secchi
Phosphorus

North Center Lake-North

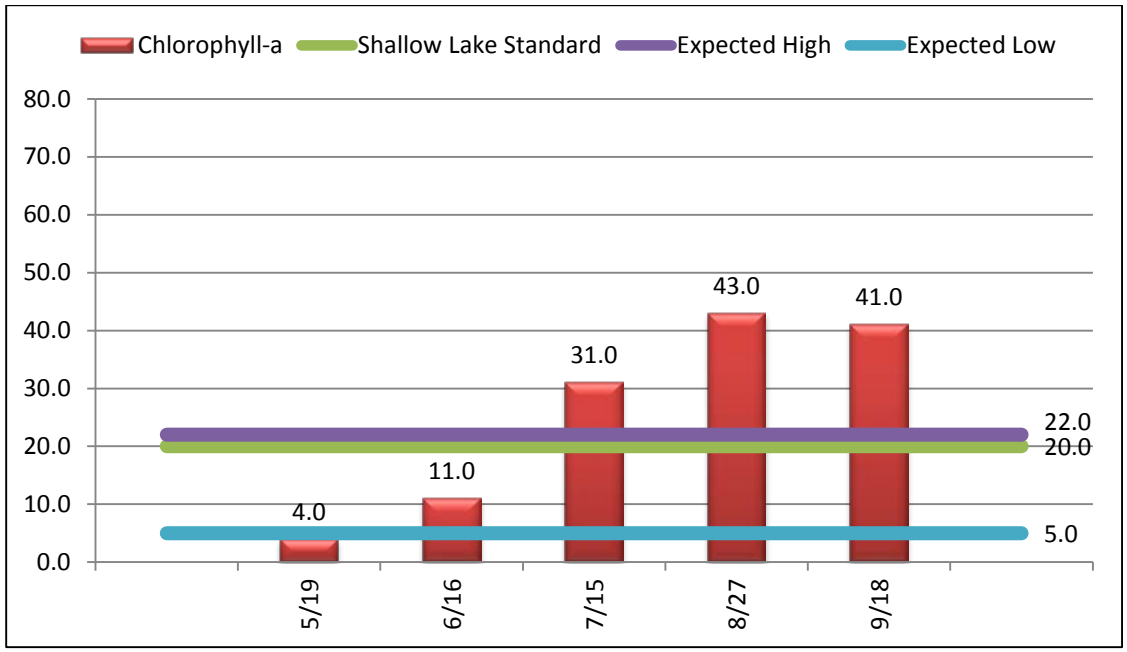
Lake 13-0032-01 Site 202



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	Yes Impaired
2015 Ranking	13 of 21

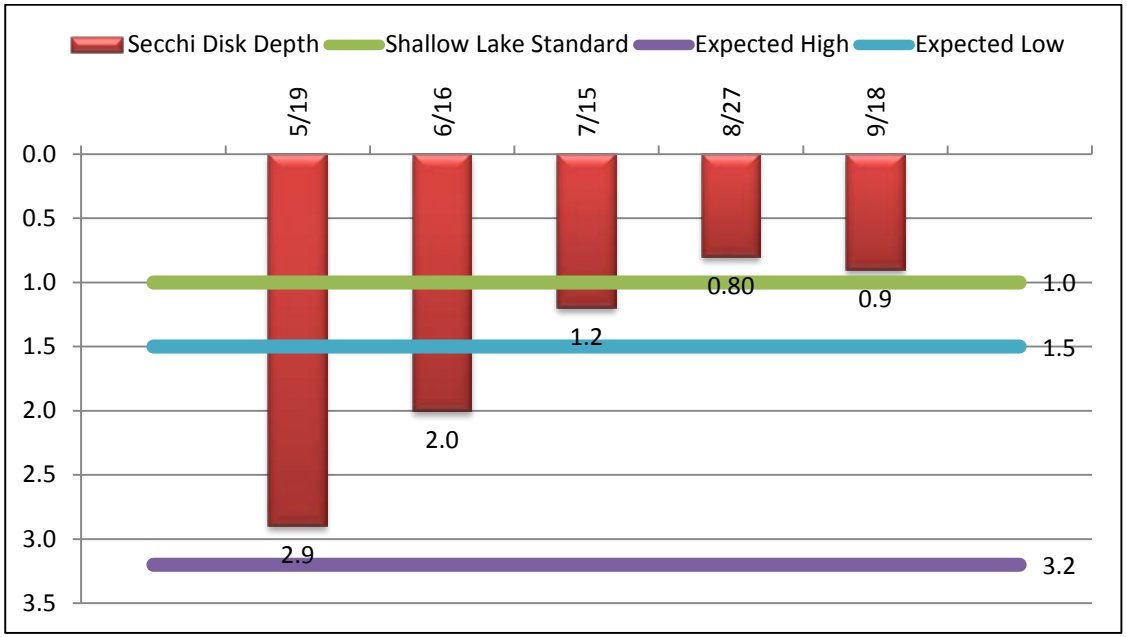
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	62.6	53.6	59.5	58.6
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	26.0 µg/L	1.6 meters	46.4 µg/L	-----
Grade	C	C	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1 meter	60.0 µg/L	-----
2015 Average (June-Sept)	31.5 µg/L	1.2 meters	49.0 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **North Center Lake-North**



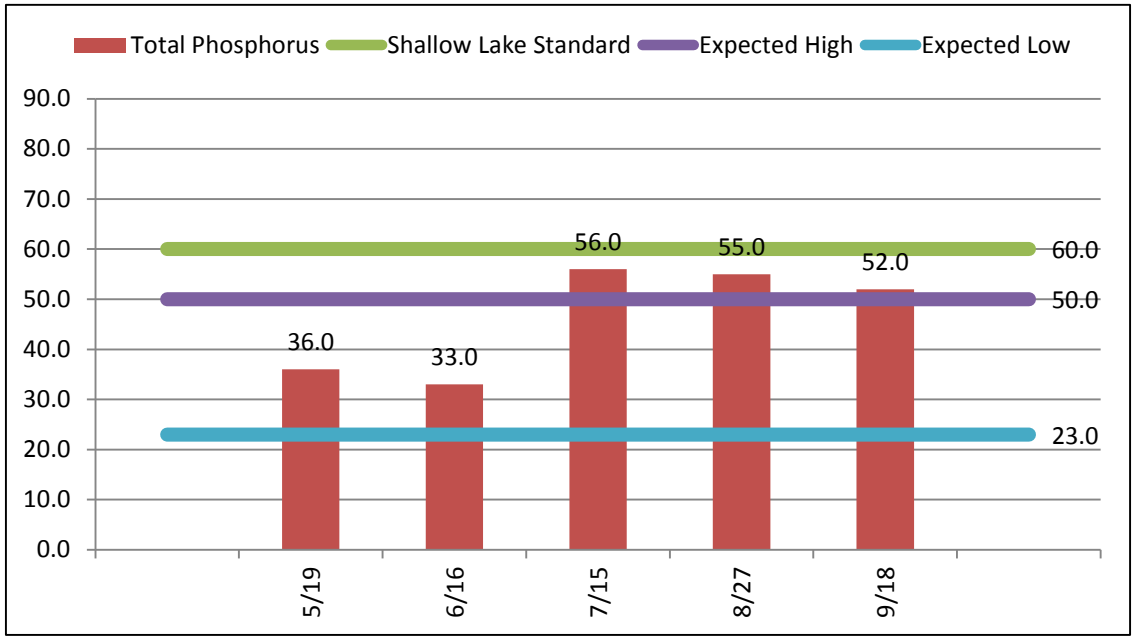
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	40.9	31.2	26.8	41.2	19.0	20.4	**26.0**
Grade	C	C	C	C	B	C	**C**
Average (June-Sept) µg/L	49.5	39.0	31.8	50.8	20.3	23.8	**31.5**
Meets Standard (20.0 µg/L)	No	No	No	No	Yes	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **North Center Lake-North**



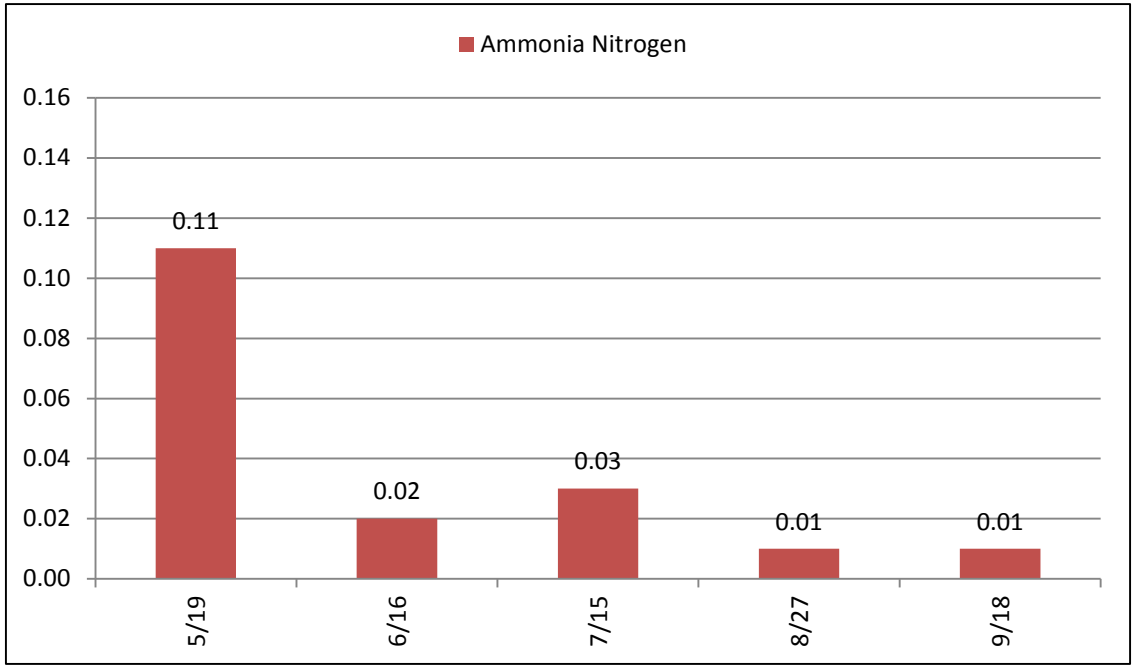
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	0.9	1.1	1.4	1.2	1.2	1.2	**1.6**
Grade	D	D	C	C-D	C-D	C-D	**C**
Average (June-Sept) meters	0.7	0.8	1.3	0.8	1.2	1.2	**1.2**
Meets Standard (>1.0 meter)	No	No	Yes	No	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L |**North Center Lake-North**



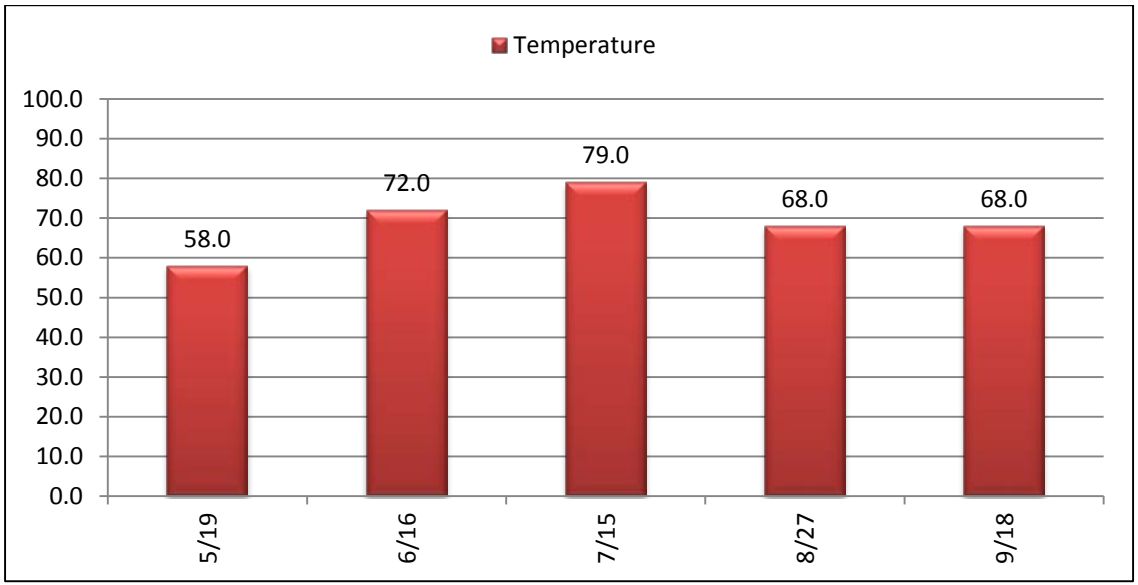
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	80.0	74.0	52.6	60.6	41.2	49.6	**46.4**
Grade	D	D	C	C	C	C	**C**
Average (June-Sept) µg/L	87.0	82.0	56.0	67.0	40.5	52.3	**49.0**
Meets Standard (60.0 µg/L)	No	No	Yes	No	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **North Center Lake-North**



Average mg/L	
2009	<0.05
2010	<0.05
2011	0.07
2012	0.17
2013	0.016
2014	0.04
2015	0.04

Surface Water Temperature |Expected Range: None | Shallow Lake Standard: None | **North Center Lake-North**



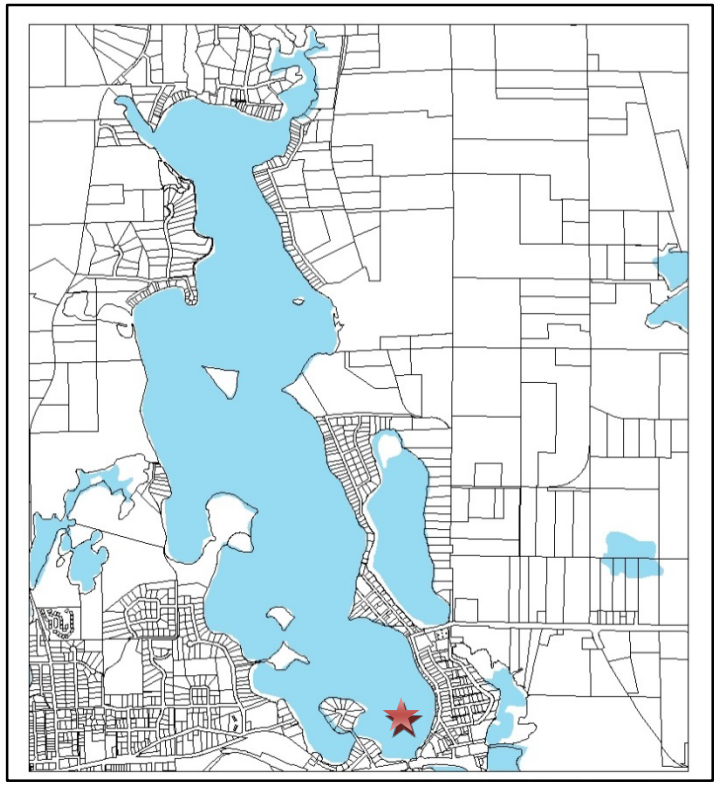
Year	Average ° F
2009	71.7
2010	No Data
2011	65.8
2012	70.0
2013	73.8
2014	68.6
2015	69.0

General Observations | **North Center Lake-North**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	Other Notes
May	2.5	2.5	Malted	
June	2.5	2.5	Parchment Paper	Curly leaf pondweed present in shallow areas.
July	3	3	Cornichon	
August	3	3	Beach Grass	
September	3	3	Beach Grass	

North Center Lake-South

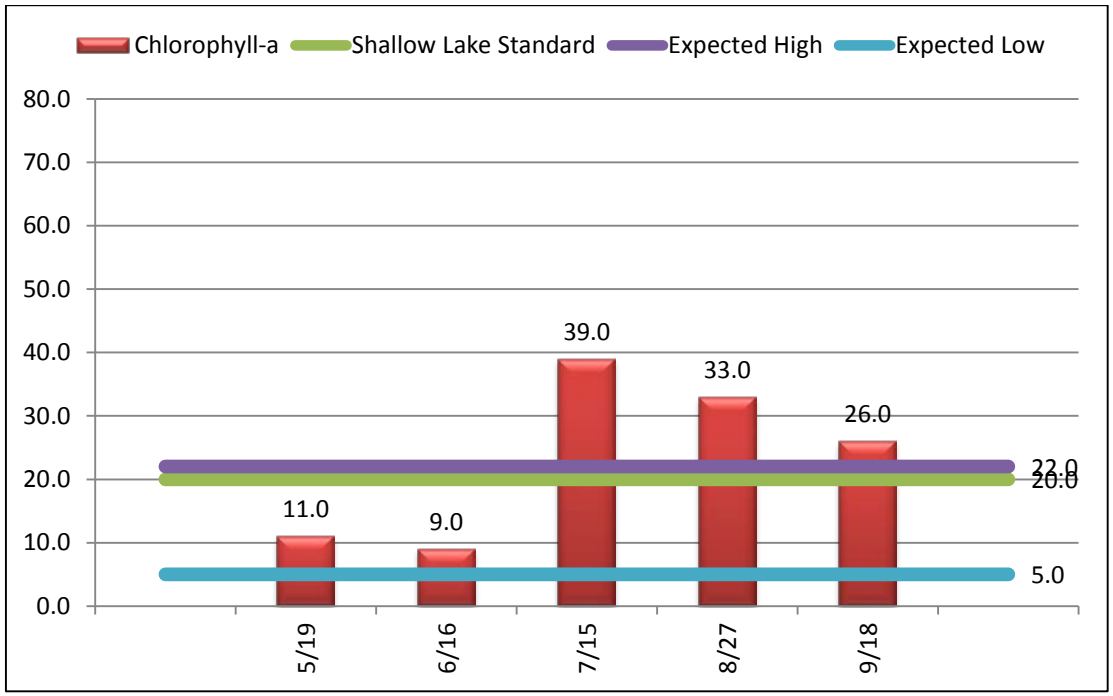
Lake 13-0032-01 Site 201



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Impaired
2015 Ranking	16 of 21

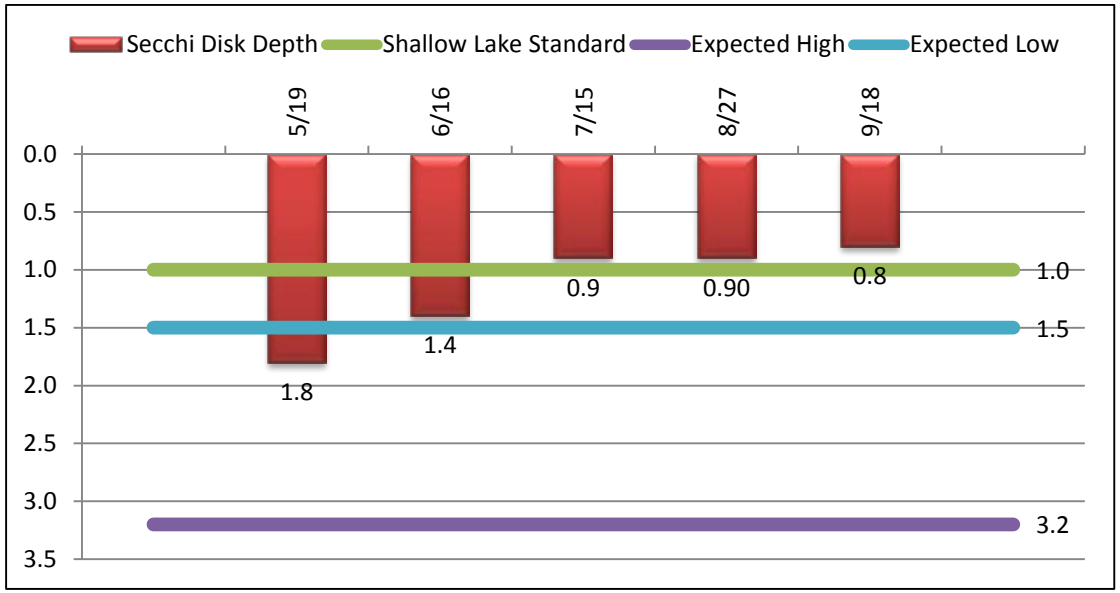
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	61.6	57.9	59.3	59.6
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	23.6 µg/L	1.2 meters	45.8 µg/L	-----
Grade	C	C-D	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1 meter	60.0 µg/L	-----
2015 Average (June-Sept)	26.8 µg/L	1.0 meter	47.8 µg/L	-----
Meets Standard	No	No	Yes	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **North Center Lake-South**



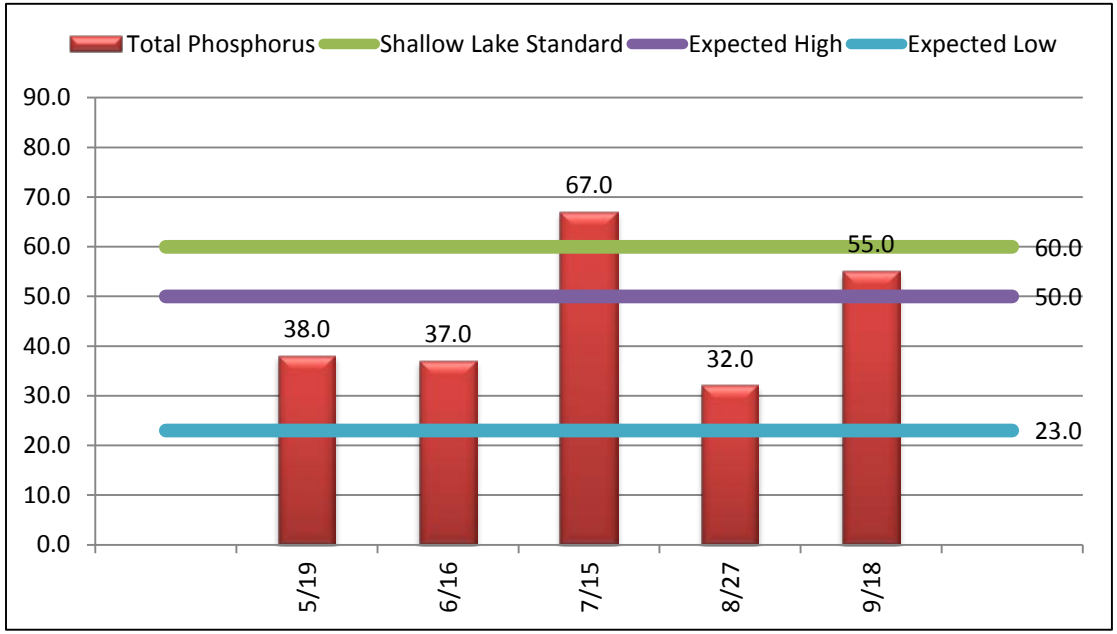
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	24.9	19.5	17.2	38.4	14.4	7.4	**23.6**
Grade	C	B	B	C	B	A	**C**
Average (June-Sept) µg/L	29.9	22.8	20.5	47.0	15.3	8.5	**26.8**
Meets Standard (20.0 µg/L)	No	No	No	No	Yes	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **North Center Lake-South**



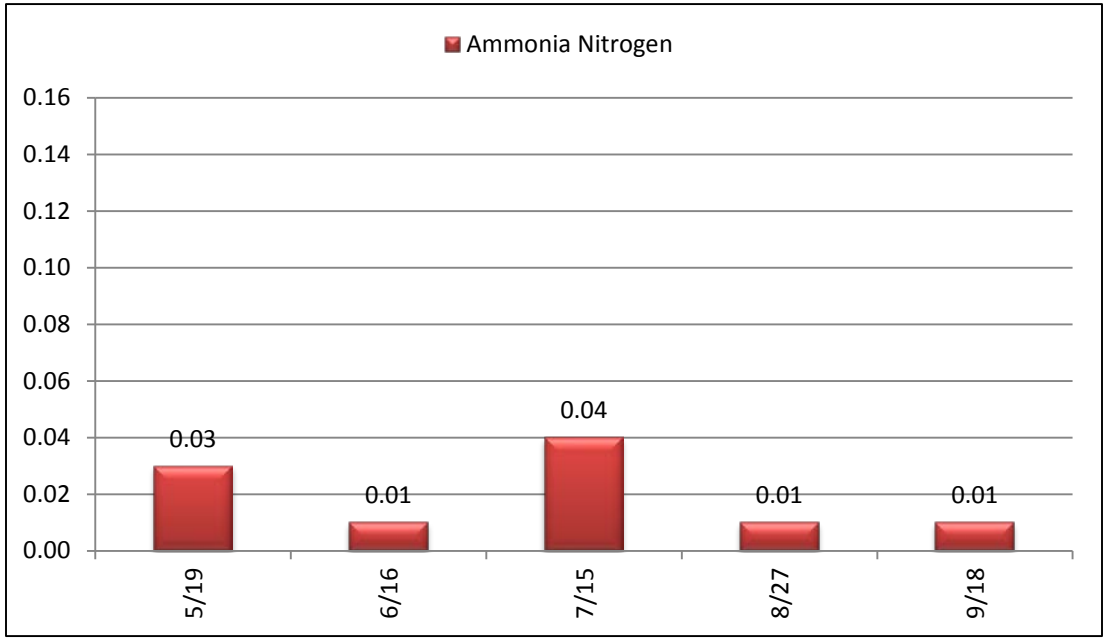
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	1.6	1.4	1.2	1.1	1.2	1.3	**1.2**
Grade	C	C	C-D	D	C-D	C	**C-D**
Average (June-Sept) meters	1.4	1.2	1.0	0.9	1.2	1.2	**1.0**
Meets Standard (>1.0 meter)	Yes	Yes	No	No	Yes	Yes	**No**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **North Center Lake-South**



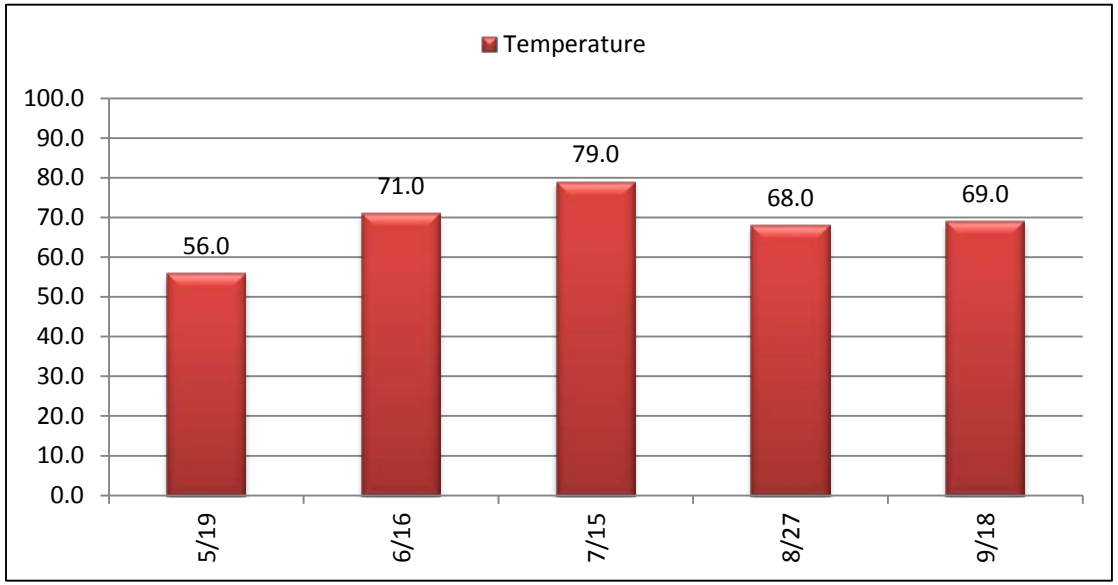
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	70.0	60.0	61.0	54.8	47.2	**47.8**	**45.8**
Grade	D	C	C	C	C	**C**	**C**
Average (June-Sept) µg/L	78.0	65.0	62.3	60.3	49.8	**52.5**	**47.8**
Meets Standard (60.0 µg/L)	No	No	No	No	Yes	**Yes**	**Yes**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **North Center Lake-South**



Average mg/L	
2009	<0.05
2010	<0.05
2011	0.06
2012	0.08
2013	0.05
2014	0.03
2015	0.02

Surface Water Temperature |Expected Range: None | Shallow Lake Standard: None | **North Center Lake-South**



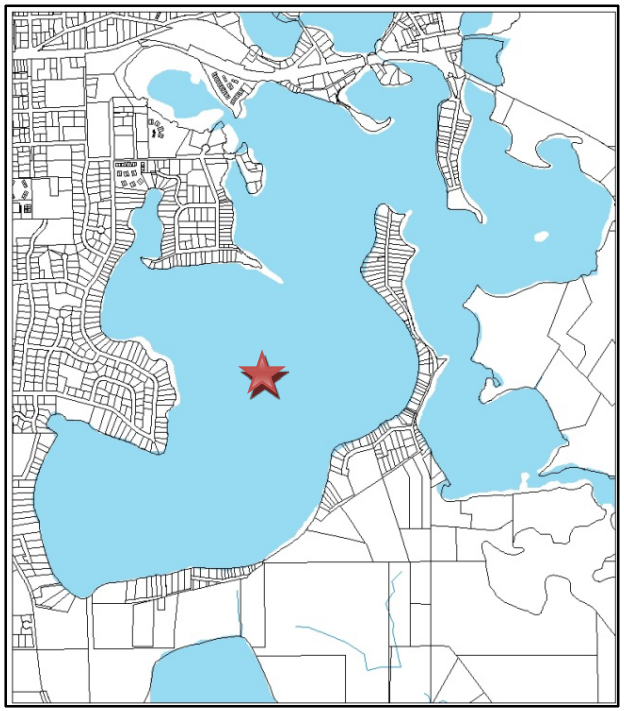
Year	Average ° F
2009	69.8
2010	No Data
2011	65.4
2012	69.6
2013	73.0
2014	68.8
2015	68.6

General Observations | **North Center Lake-South**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Short Bread	
June	3	3	Parchment Paper	Curly leaf pondweed present in shallow areas.
July	3	3	Beach Grass	
August	2.5	2.5	Beach Grass	
September	3	3	Beach Grass	

South Center Lake

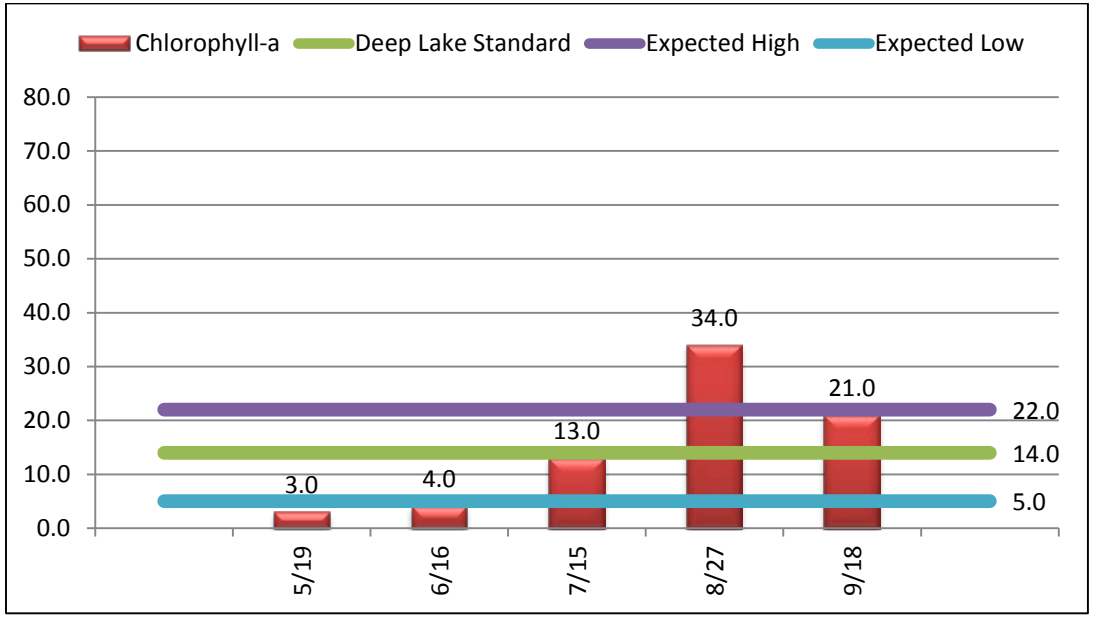
Lake 13-0027-00 Site 207



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	B
Meets MPCA Standards	Yes Impaired
2015 Ranking	7 of 21

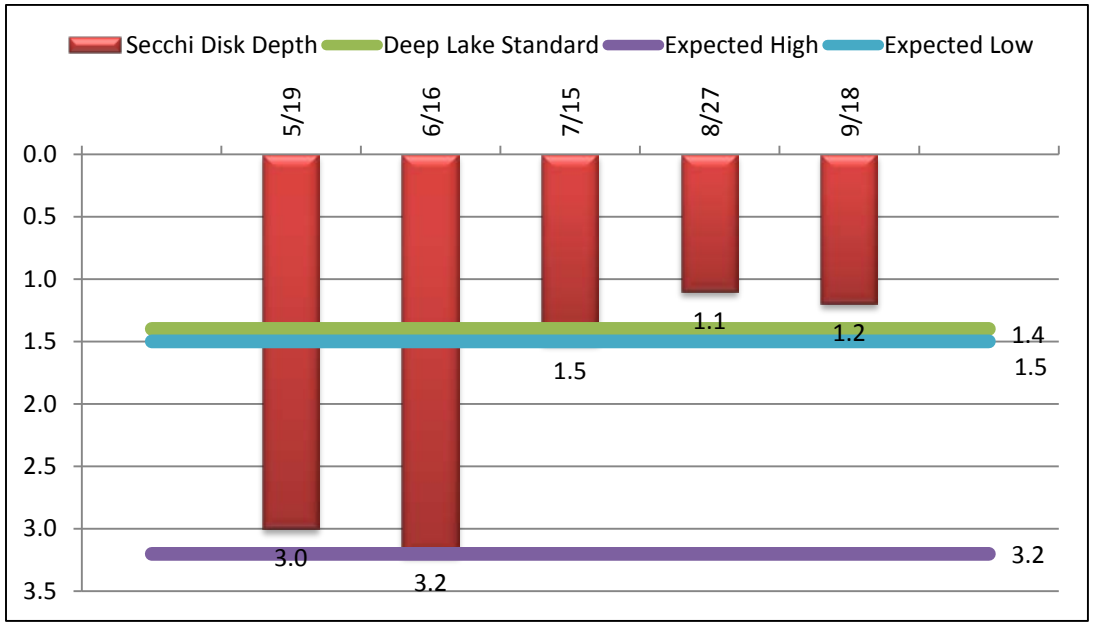
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	57.2	50.0	51.5	52.9
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	15.0 µg/L	2.0 meters	26.6 µg/L	-----
Grade	B	C	B	B
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	18.0 µg/L	1.8 meters	27.3 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **South Center Lake**



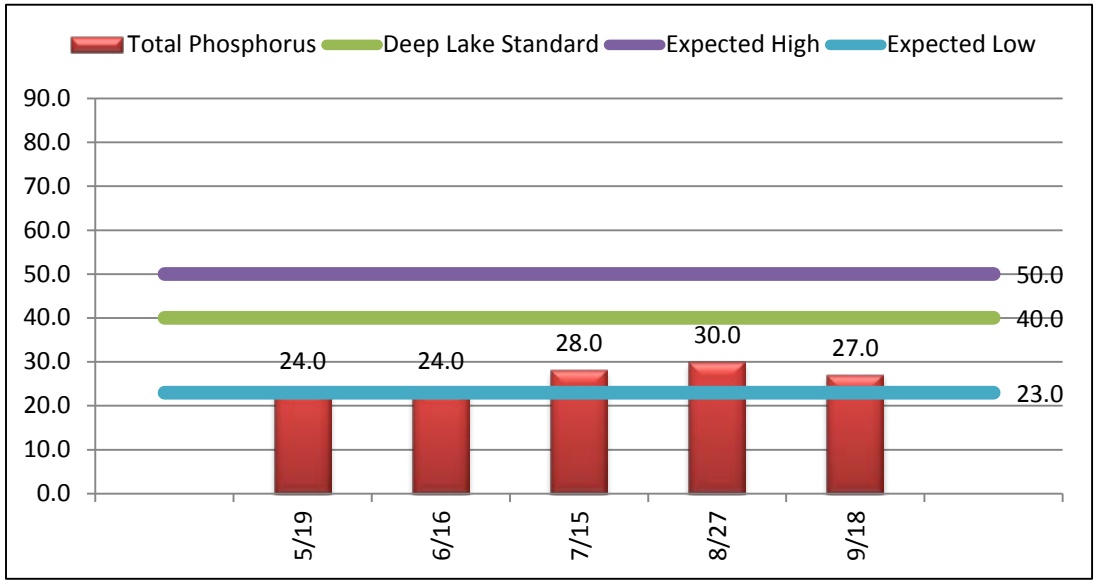
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	17.4	36.4	14.0	**12.8**	**15.0**
Grade	No Data	No Data	B	C	B	**B**	**B**
Average (June-Sept) µg/L	No Data	No Data	21.0	44.0	16.0	**14.5**	**18.0**
Meets Standard (14.0 µg/L)	No Data	No Data	No	No	No	**No**	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **South Center Lake**



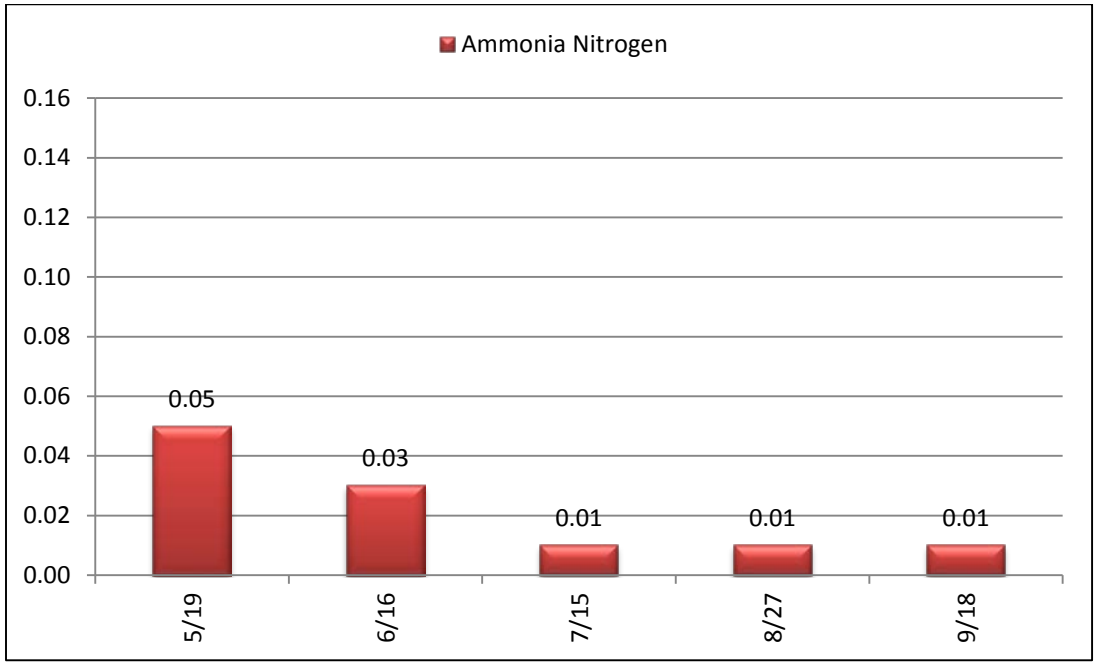
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	1.2	1.3	1.6	1.3	**2.0**
Grade	No Data	No Data	C-D	C	C	C	**C**
Average (June-Sept) meters	No Data	No Data	1.0	0.7	1.5	1.3	**1.8**
Meets Standard (>1.4 meters)	No Data	No Data	No	No	Yes	No	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **South Center Lake**



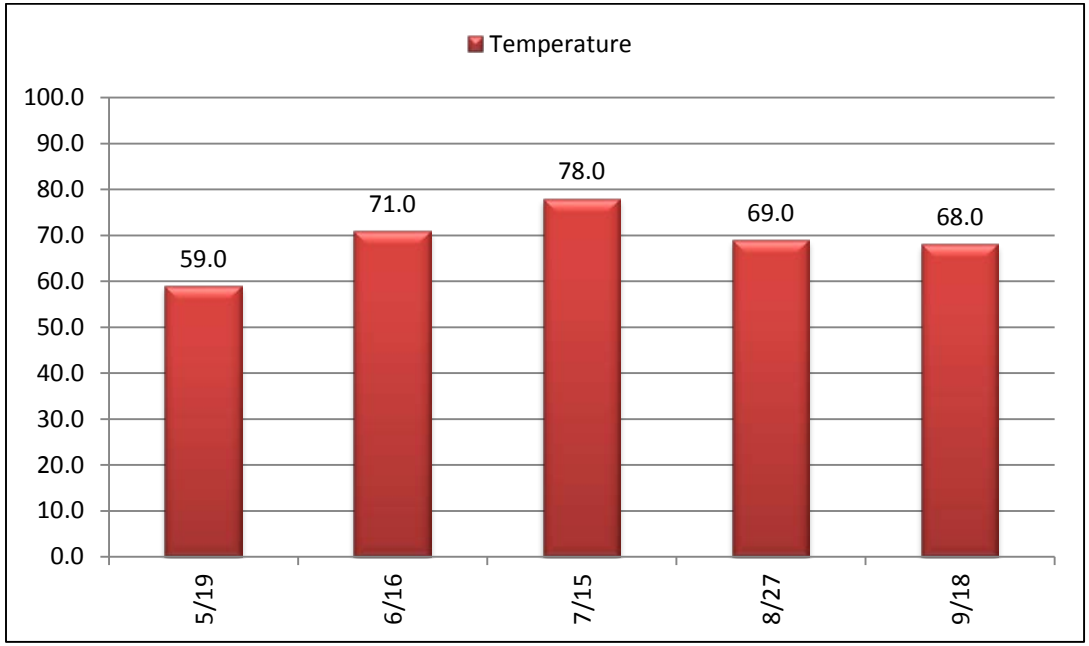
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	43.6	39.4	33.8	37.2	**26.6**
Grade	No Data	No Data	C	C	C	C	**B**
Average (June-Sept) µg/L	No Data	No Data	47.5	44.3	34.8	38.3	**27.3**
Meets Standard (40.0 µg/L)	No Data	No Data	No	No	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **South Center Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	0.04
2012	0.07
2013	0.02
2014	0.03
2015	0.02

Surface Water Temperature |Expected Range: None | Deep Lake Standard: None | **South Center Lake**



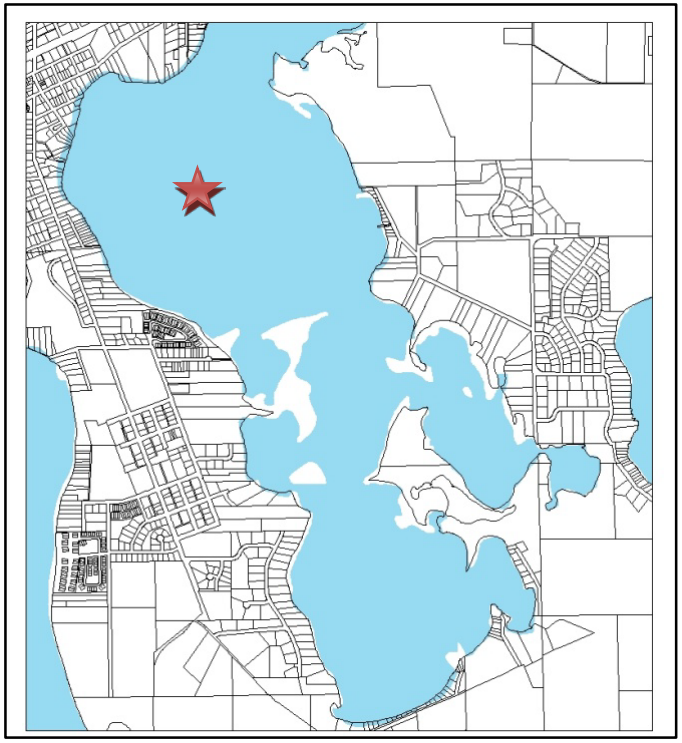
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	70.0
2013	71.8
2014	68.2
2015	69.0

General Observations | **South Center Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Malted	Curly leaf pondweed active.
June	2.5	2.5	Malted	Curly leaf pondweed present in shallow areas.
July	3	3	Parchment Paper	
August	2.5	2.5	Cornichon	
September	3	3	Beach Grass	

Chisago Lake-North

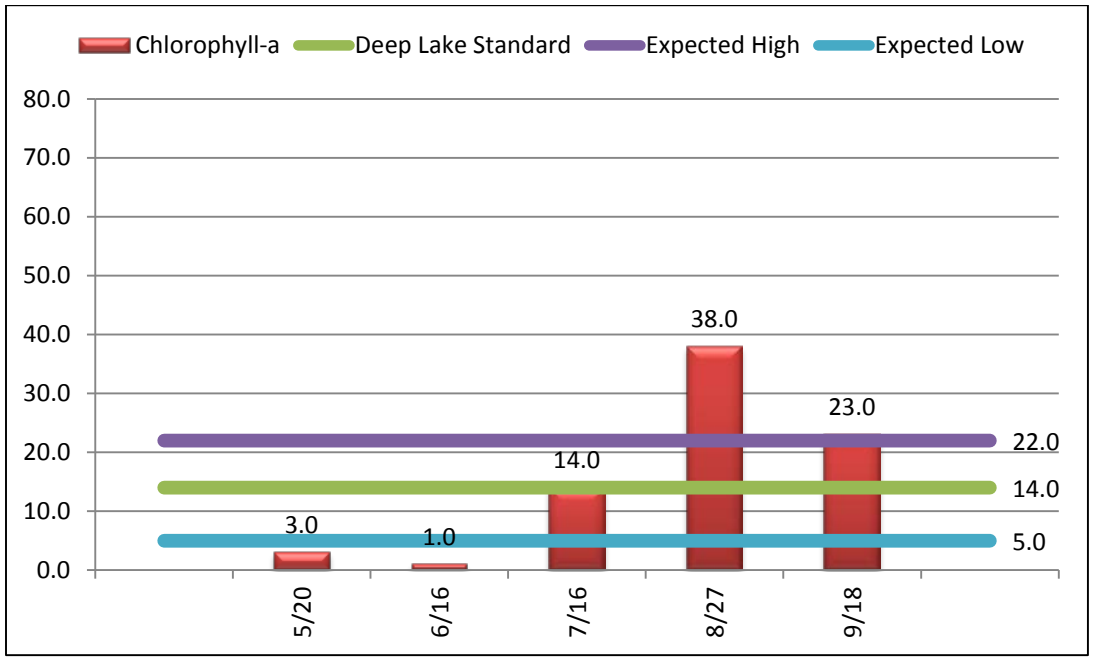
Lake 13-0012-01 Site 202



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	B
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	5 of 21

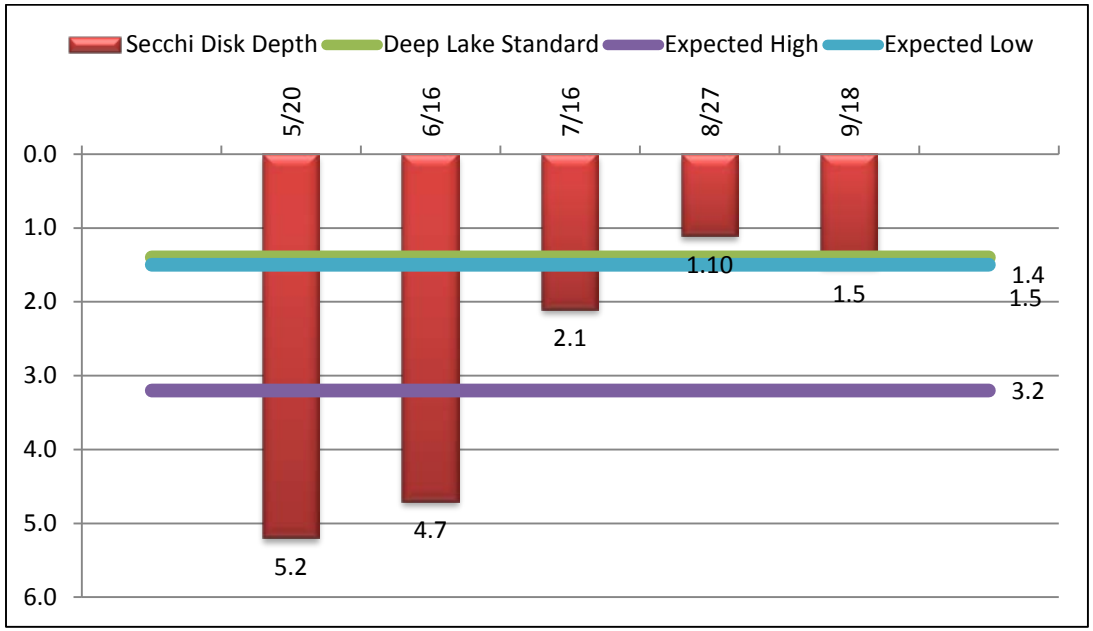
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	57.7	44.6	54.8	52.4
Classification	Eutrophic	Mesotrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	15.8 µg/L	2.9 meters	33.6 µg/L	-----
Grade	B	B	C	B
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	19.0 µg/L	2.4 meters	36.5 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Chisago Lake-North**



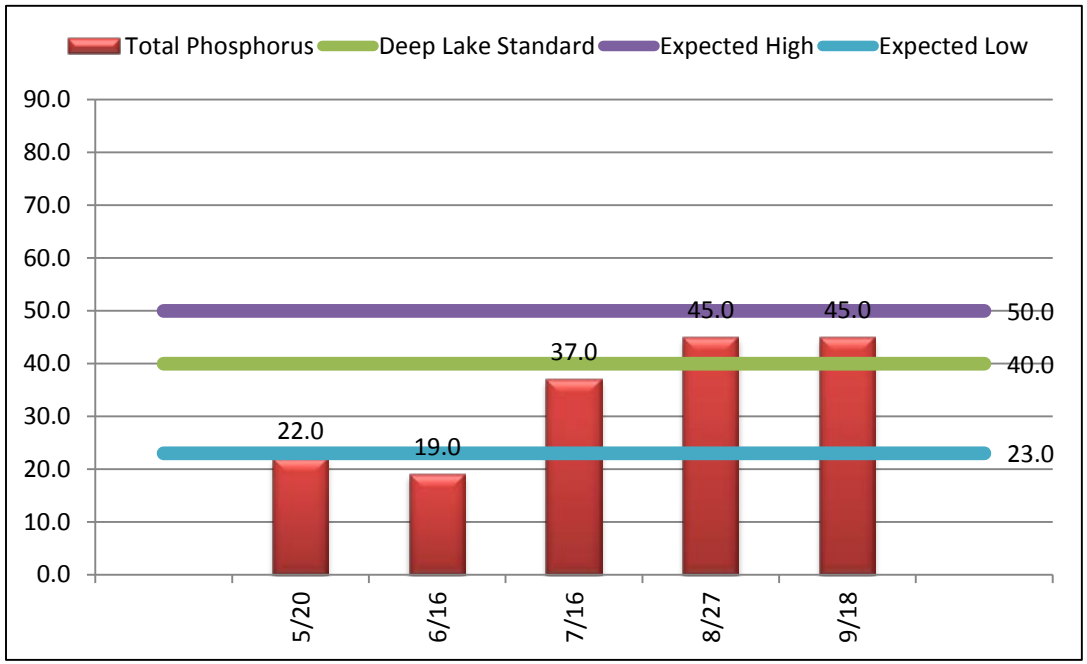
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	12.2	31.3	10.4	41.6	27.4	11.6	**15.8**
Grade	B	C	B	C	C	B	**B**
Average (June-Sept) µg/L	13.7	31.3	12.8	51.5	33.5	14.0	**19.0**
Meets Standard (14.0 µg/L)	Yes	No	Yes	No	No	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Chisago Lake-North**



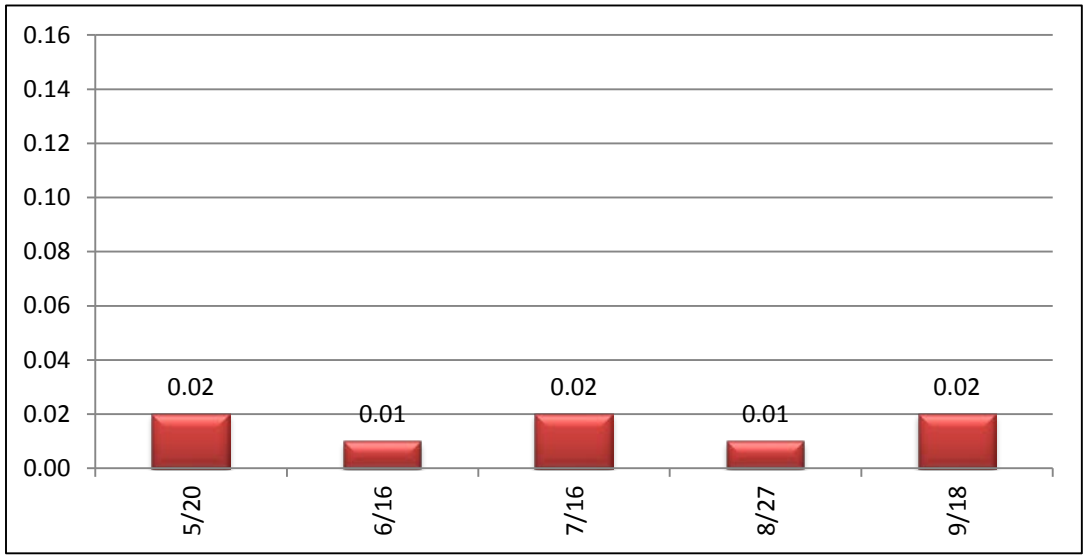
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	2.3	1.8	2.2	1.3	1.3	1.9	**2.9**
Grade	B	C	C	C	C	C	**B**
Average (June-Sept) meters	2.0	1.8	1.9	0.9	1.2	1.8	**2.4**
Meets Standard (>1.4 meters)	Yes	Yes	Yes	No	No	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | Chisago Lake-North



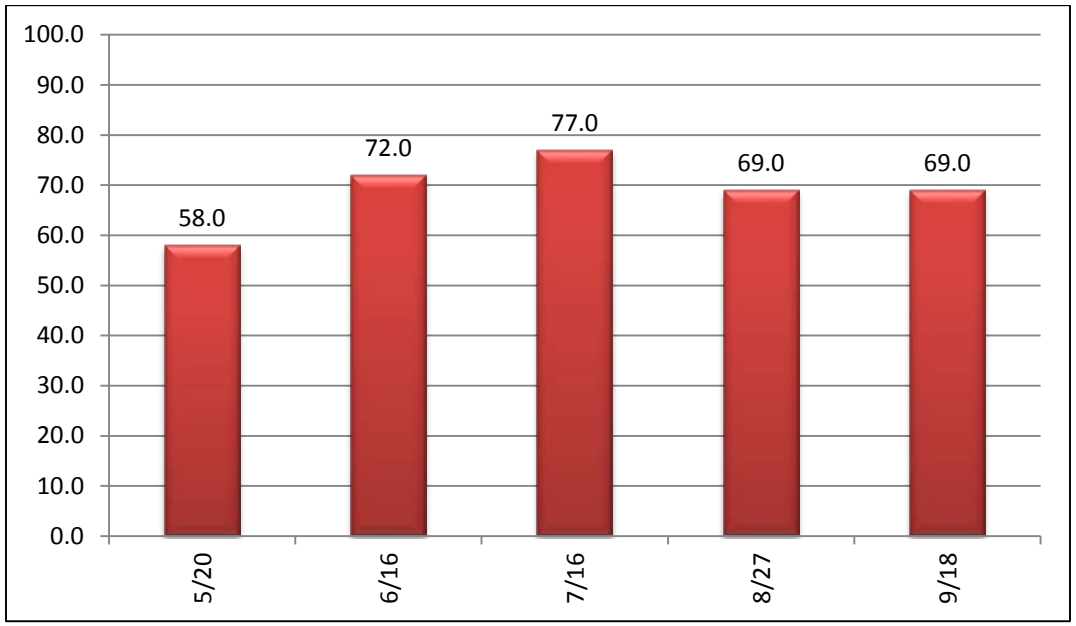
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	28.0	48.0	37.8	66.8	48.4	42.4	**33.6**
Grade	B	C	C	C	C	C	**C**
Average (June-Sept) µg/L	28.0	48.0	42.8	79.0	53.3	40.3	**36.5**
Meets Standard (40.0 µg/L)	Yes	No	No	No	No	No	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | Chisago Lake-North



Average mg/L	
2009	<0.05
2010	<0.05
2011	0.04
2012	0.07
2013	0.04
2014	0.03
2015	0.02

Surface Water Temperature |Expected Range: None | Deep Lake Standard: None | **Chisago Lake-North**



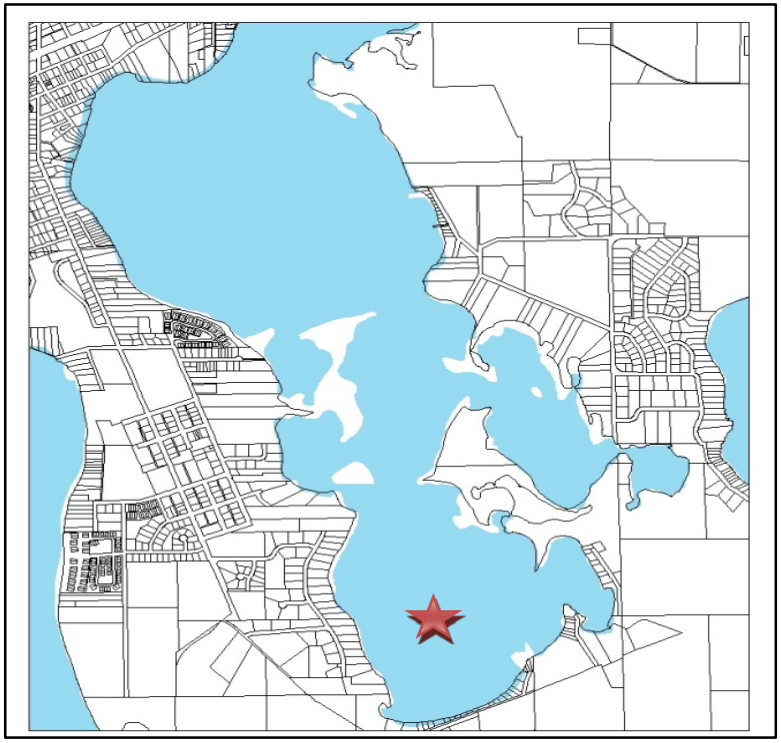
Year	Average ° F
2009	71.8
2010	73.0
2011	65.6
2012	72.4
2013	72.0
2014	69.4
2015	69.0

General Observations | **Chisago Lake-North**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Chop Stick	
June	2.5	2.5	Rice Paper	Curly leaf pondweed present in shallow areas. Very large percentage of shoreline without vegetation.
July	2.5	2.5	Beach Grass	
August	3	3	Beach Grass	
September	2.5	2.5	Dried Chammomile	

Chisago Lake-South

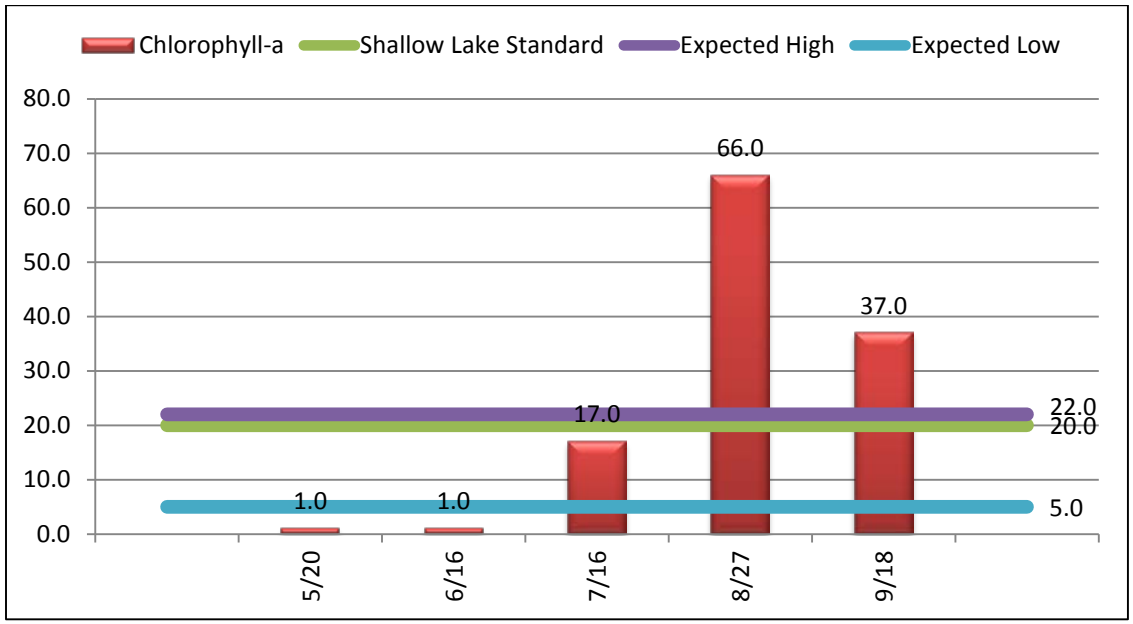
Lake 13-0012-02 Site 201



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Not Impaired
2015 Ranking	15 of 21

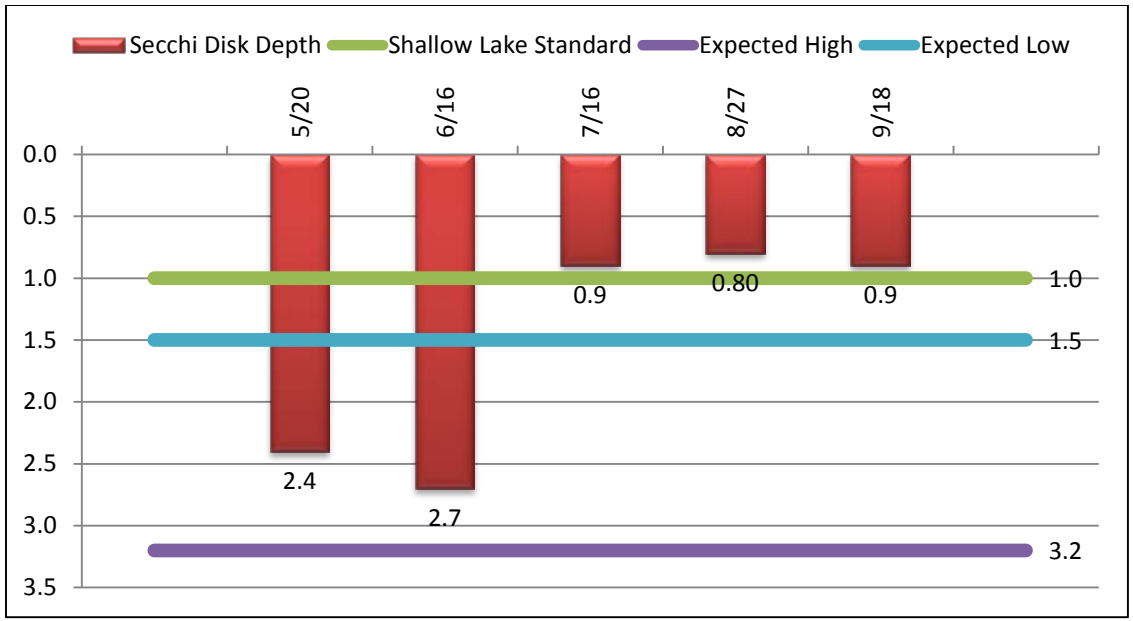
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	61.9	53.8	61.9	59.2
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	24.4 µg/L	1.5 meters	55.0 µg/L	-----
Grade	C	C	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1.0 meter	60.0 µg/L	-----
2015 Average (June-Sept)	30.3 µg/L	1.3 meters	62.3 µg/L	-----
Meets Standard	No	Yes	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **Chisago Lake-South**



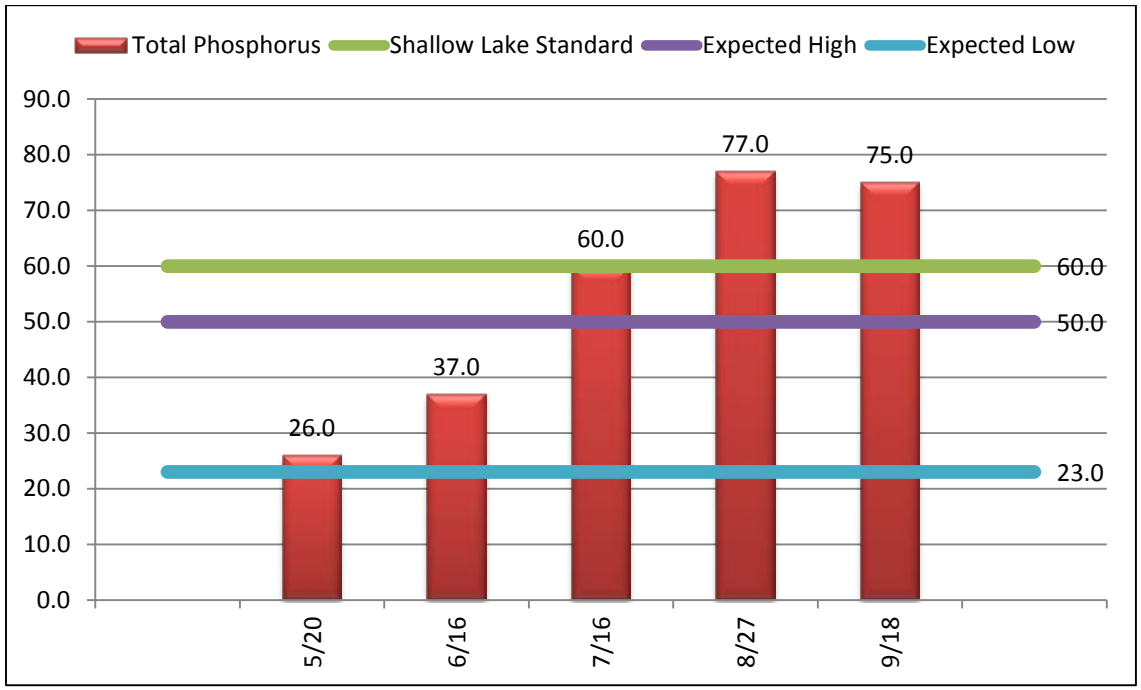
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	15.8	42.6	15.0	56.8	31.8	13.6	**24.4**
Grade	B	C	B	D	C	B	**C**
Average (June-Sept) µg/L	19.1	57.7	18.3	70.3	38.5	16.3	**30.3**
Meets Standard (20.0 µg/L)	Yes	No	Yes	No	No	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **Chisago Lake-South**



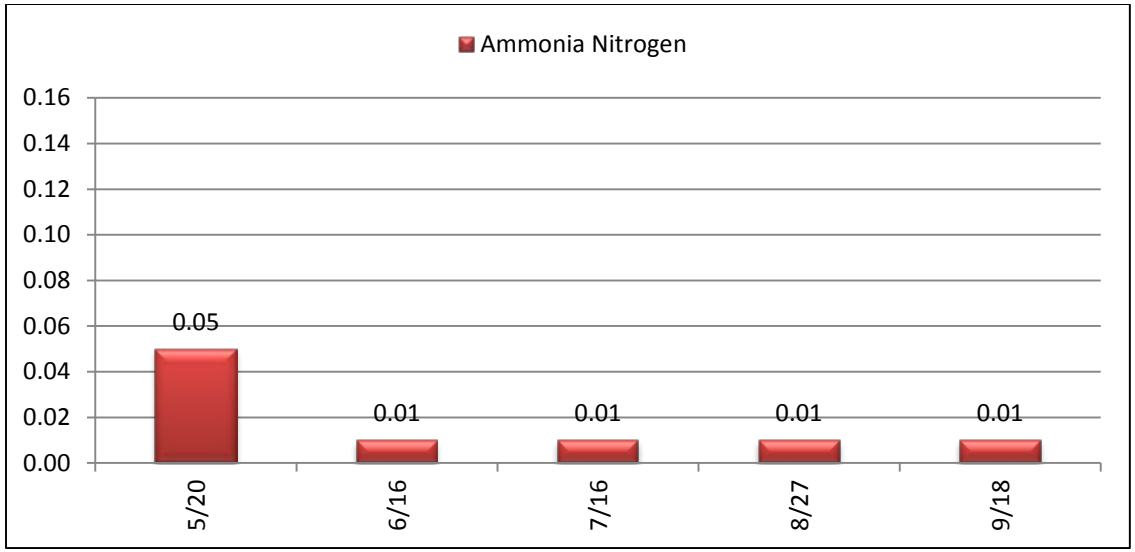
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	1.8	1.3	1.8	2.4	1.0	1.2	**1.5**
Grade	C	C	C	B	D	C-D	**C**
Average (June-Sept) meters	1.7	1.1	1.2	1.6	0.9	1.1	**1.3**
Meets Standard (>1.0 meter)	Yes	Yes	Yes	Yes	No	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **Chisago Lake-South**



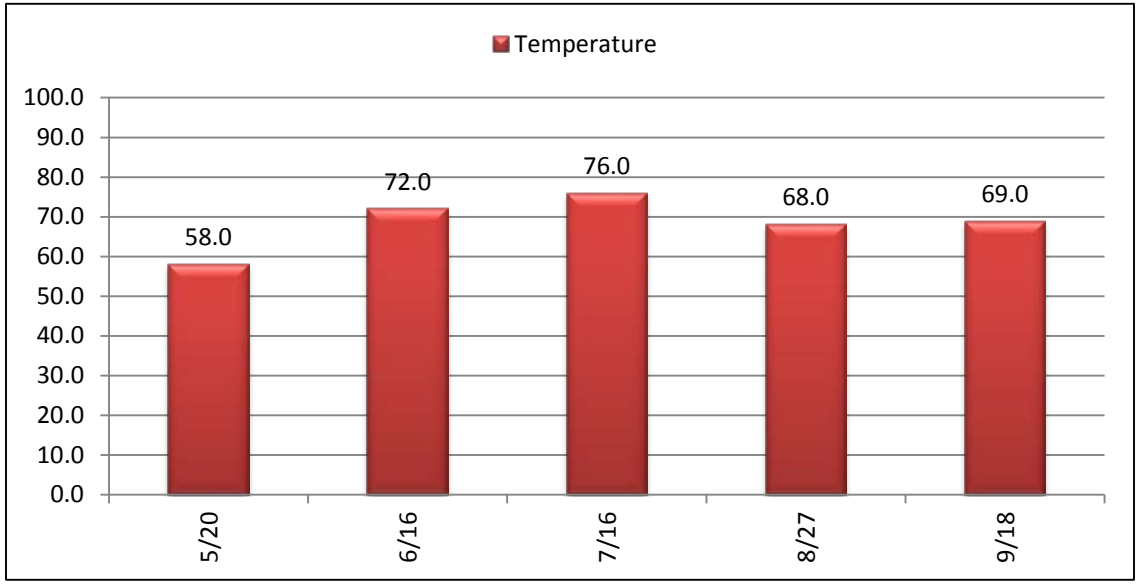
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	38.0	69.0	52.8	99.0	76.0	62.2	**55.0**
Grade	C	D	C	D	D	C	**C**
Average (June-Sept) µg/L	42.0	80.0	60.8	117.3	83.8	68.8	**62.3**
Meets Standard (60.0 µg/L)	Yes	No	No	No	No	No	**No**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **Chisago Lake-South**



Average mg/L	
2009	<0.05
2010	<0.05
2011	0.03
2012	0.08
2013	0.04
2014	0.05
2015	0.02

Surface Water Temperature |Expected Range: None | Shallow Lake Standard: None | **Chisago Lake-South**



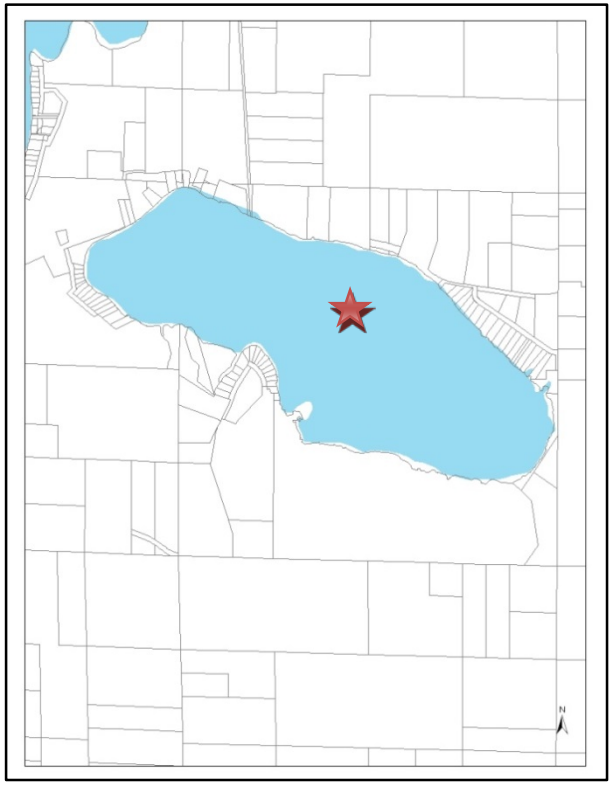
Year	Average ° F
2009	No Data
2010	No Data
2011	64.0
2012	72.8
2013	73.5
2014	70.2
2015	68.6

General Observations | **Chisago Lake-South**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Chop Stick	Curly leaf pondweed coming up from bottom.
June	2.5	2.5	Malted	Curly leaf pondweed present in shallow areas. Very large percentage of shoreline without vegetation.
July	3	3	Beach Grass	
August	3.5	3.5	Beach Grass	
September	3	3	Cornichon	

Fish Lake

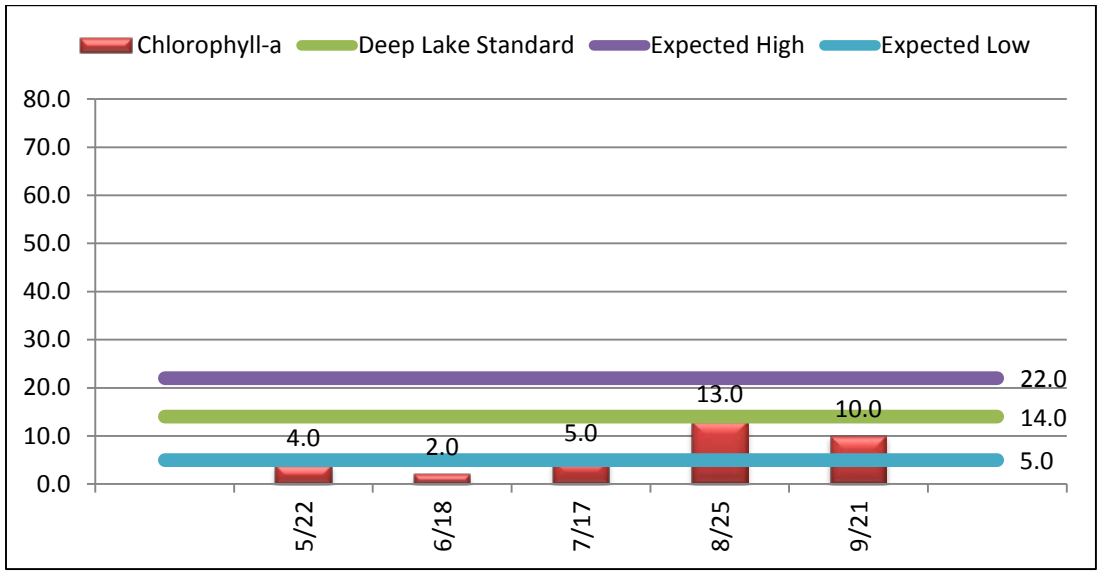
Lake 13-0068-00 Site 101



2015 Report Card: Deep Lake	
Lake Classification	Mesotrophic
Overall Lake Quality Grade	B
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	1 of 21

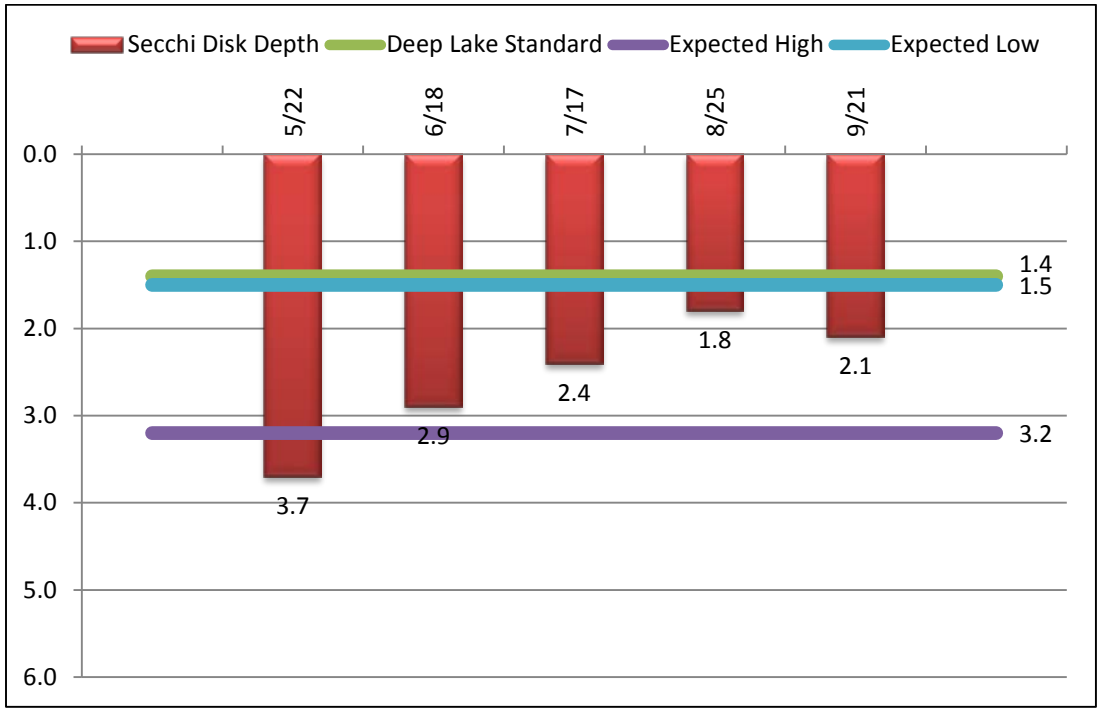
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	49.4	46.3	49.6	48.5
Classification	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic
2015 Average (May-Sept)	6.8 µg/L	2.6 meters	23.4 µg/L	-----
Grade	A	B	B	B
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	7.5 µg/L	2.3 meters	22.3 µg/L	-----
Meets Standard	Yes	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Fish Lake**



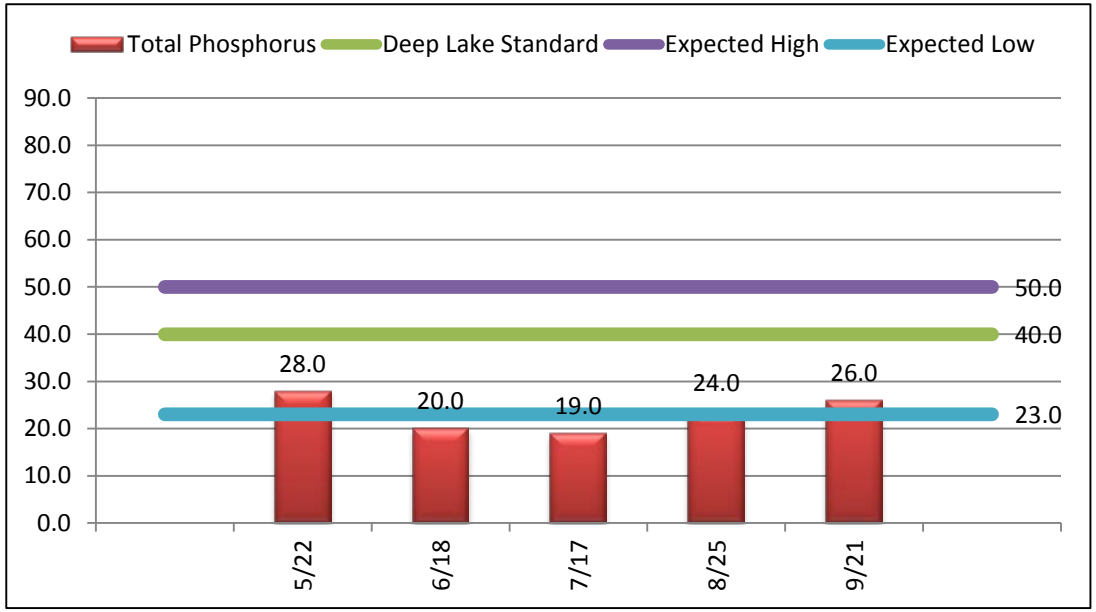
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	6.8	4.0	**5.0**	**6.8**
Grade	-----	-----	-----	A	A	**A**	**A**
Average (June-Sept) µg/L	No Data	No Data	No Data	7.3	4.0	**5.3**	**7.5**
Meets Standard (14.0 µg/L)	-----	-----	-----	Yes	Yes	**Yes**	**Yes**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Fish Lake**



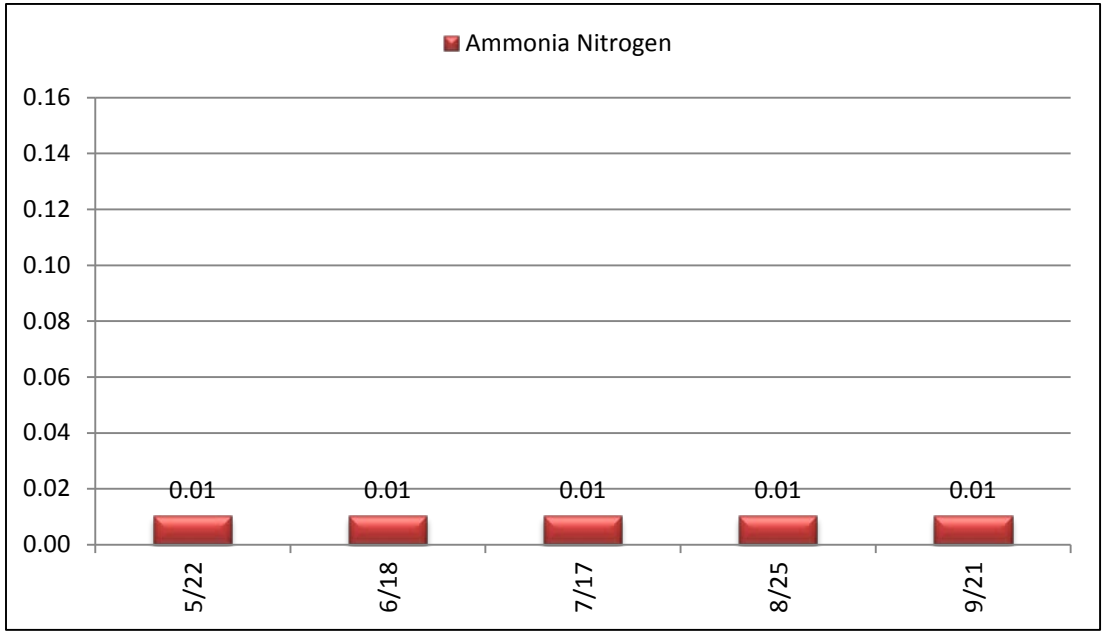
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	2.7	2.6	2.4	**2.6**
Grade	-----	-----	-----	B-C	B	B	**B**
Average (June-Sept) meters	No Data	No Data	No Data	2.1	2.9	2.4	**2.3**
Meets Standard (>1.4 meters)	-----	-----	-----	Yes	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Fish Lake**



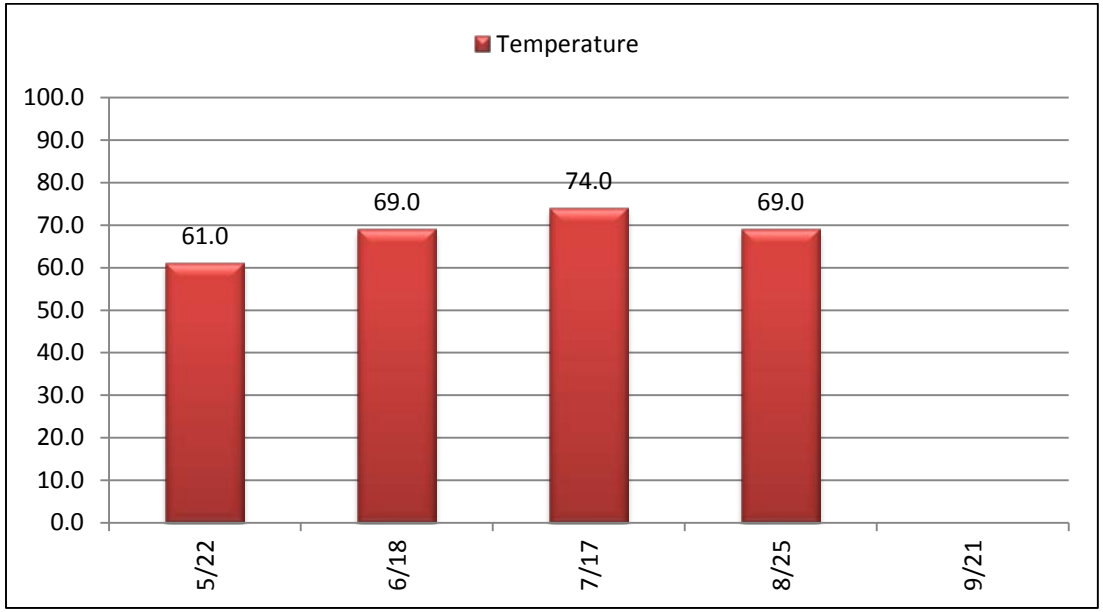
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	22.8	23.0	32.8	**23.4**
Grade	-----	-----	-----	A	B	C	**B**
Average (June-Sept) µg/L	No Data	No Data	No Data	21.8	20.5	35.0	**22.3**
Meets Standard (40.0 µg/L)	-----	-----	-----	Yes	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Fish Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.07
2013	0.01
2014	0.04
2015	0.01

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Fish Lake**



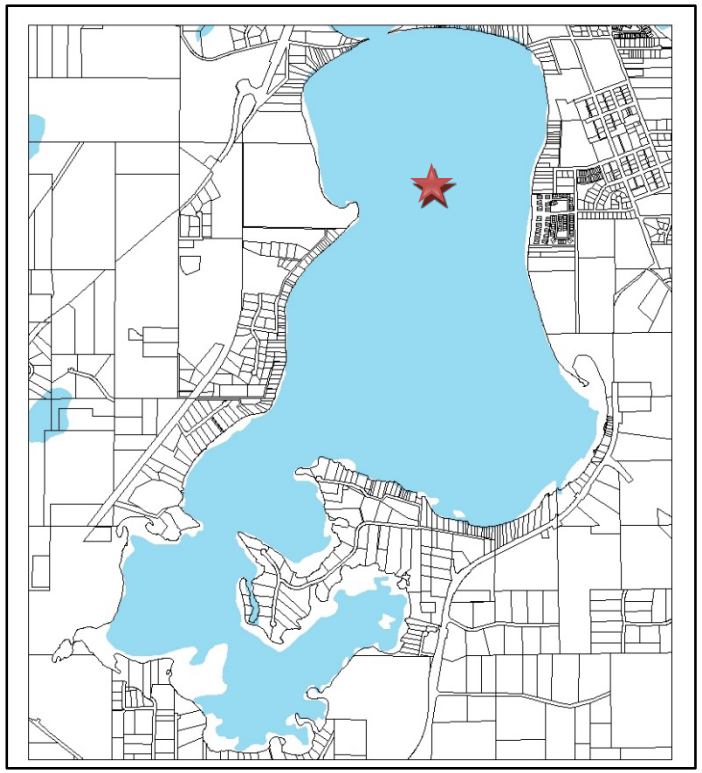
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	71.6
2013	72.6
2014	69.4
2015	68.3

General Observations | **Fish Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Toasted Marshmallow	
June	2	2	Short Bread	Curly leaf pondweed in shallow areas.
July	2	2	Dried Chamomile	
August	2.5	2.5	Cornichon	
September	2.5	2.5	Dried Chamomile	

Green Lake

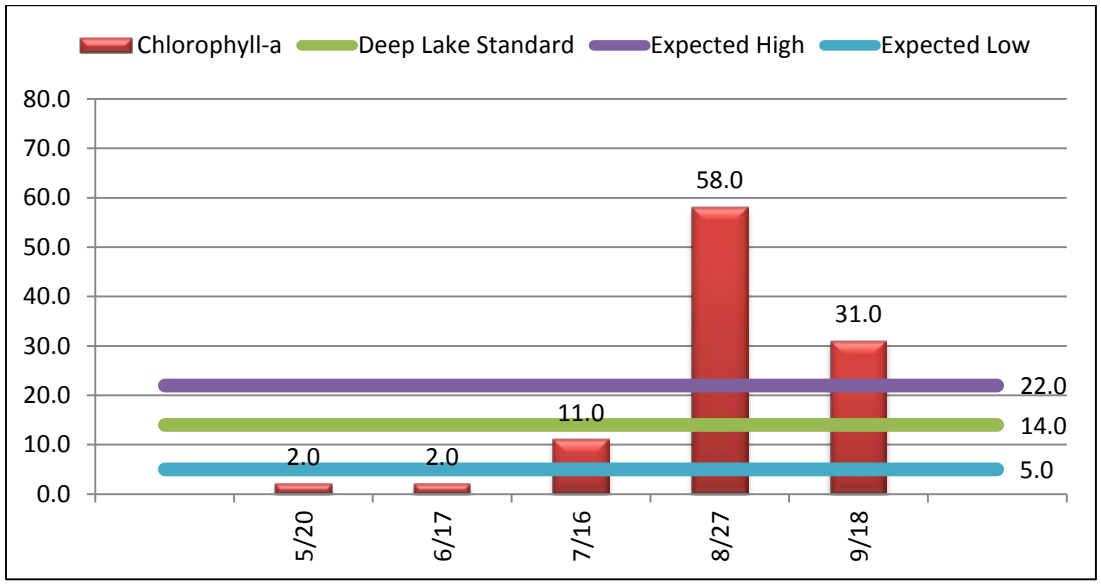
Lake 13-0041-02 Site 202



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	10 of 21

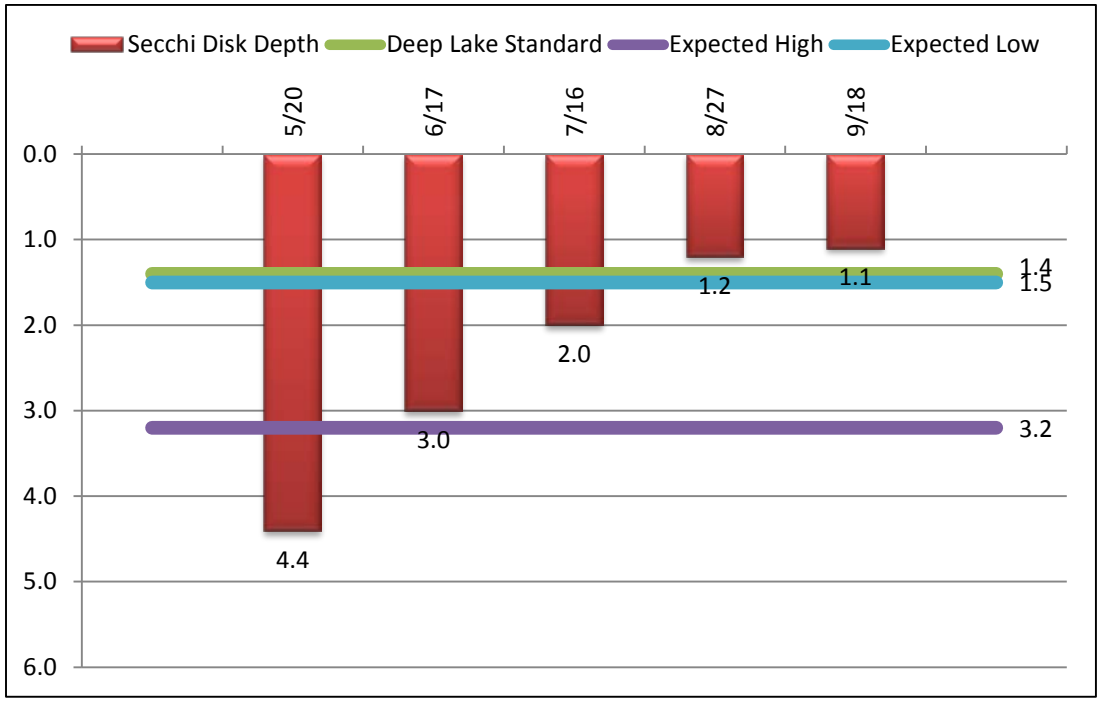
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	60.1	47.8	55.3	54.5
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	20.8 µg/L	2.3 meters	34.6 µg/L	-----
Grade	C	B	C	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	25.5 µg/L	1.8 meters	38.8 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Green Lake**



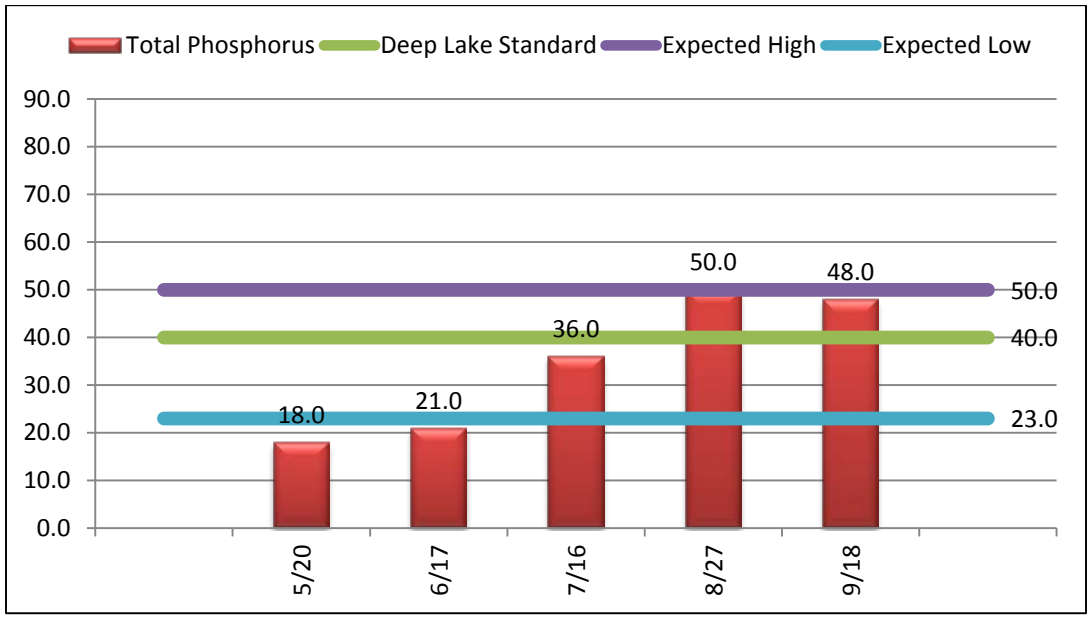
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	28.4	14.0	16.8	16.4	16.8	11.6	**20.1**
Grade	C	B	B	B	B	B	**C**
Average (June-Sept) µg/L	34.8	20.2	18.8	19.5	20.3	13.8	**25.5**
Meets Standard (14.0 µg/L)	No	No	No	No	No	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Green Lake**



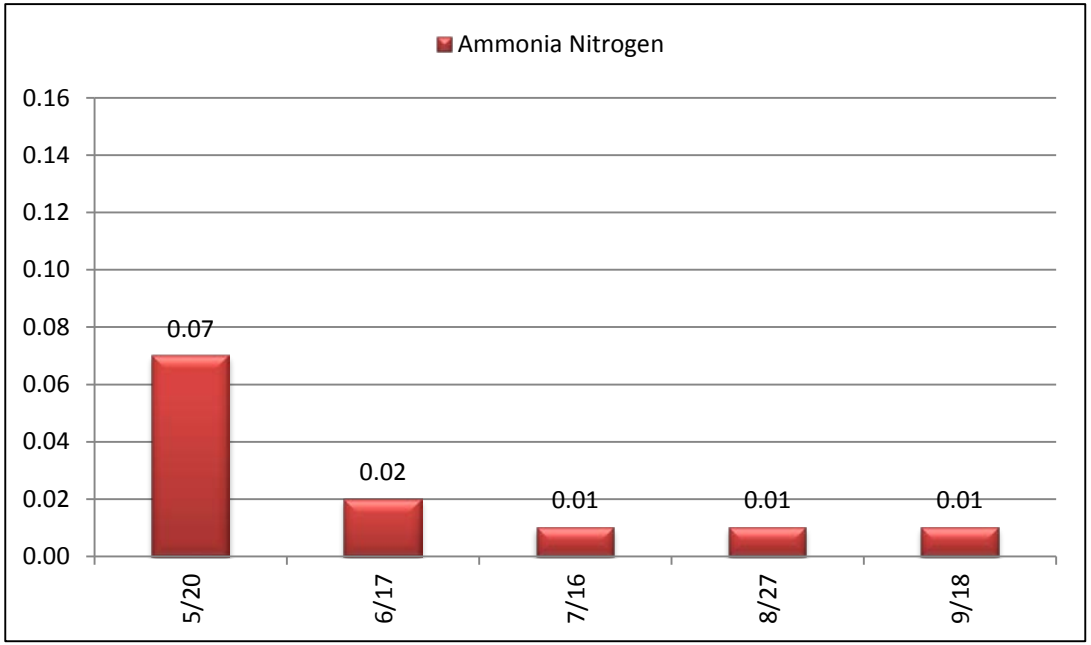
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	2.5	2.4	1.6	2.1	1.8	1.9	**2.3**
Grade	B	B	C	C	C	C	**B**
Average (June-Sept) meters	2.4	1.5	1.3	1.9	1.6	1.8	**1.8**
Meets Standard (>1.4 meters)	Yes	Yes	No	Yes	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Green Lake**



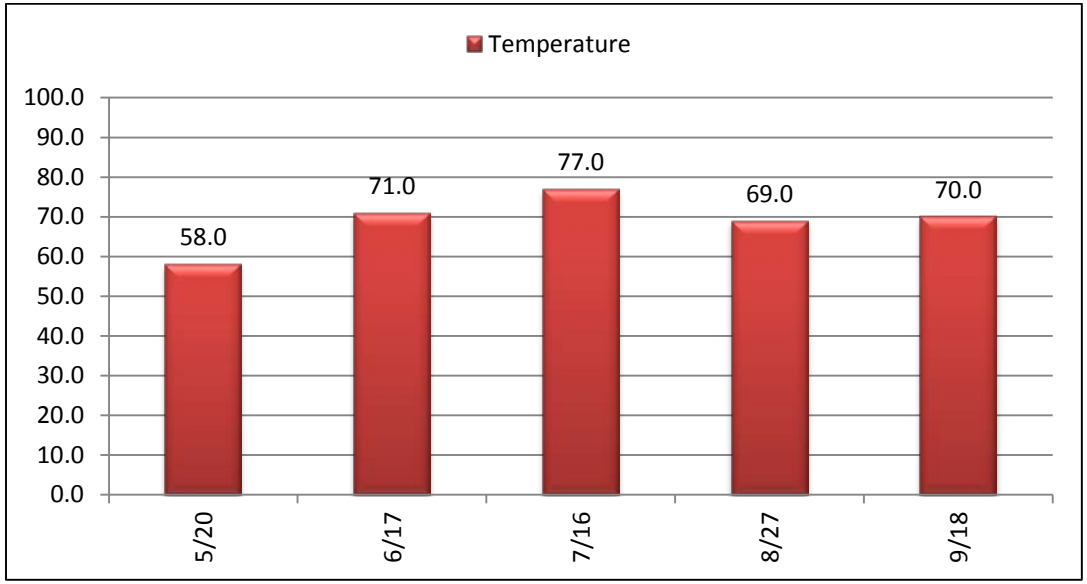
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	51.0	22.0	40.6	32.4	42.6	31.4	**34.6**
Grade	C	A	C	B-C	C	C	**C**
Average (June-Sept) µg/L	57.0	24.0	45.5	35.8	48.3	33.3	**38.8**
Meets Standard (40.0 µg/L)	No	Yes	No	Yes	No	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Green Lake**



Average mg/L	
2009	<0.05
2010	0.09
2011	0.04
2012	0.07
2013	0.04
2014	0.03
2015	0.02

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Green Lake**



Year	Average ° F
2009	74.8
2010	72.9
2011	65.8
2012	71.0
2013	71.0
2014	69.6
2015	69.0

General Observations | **Green Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Short Bread	Curly leaf pondweed recently treated.
June	2.5	2.5	Malted	Curly leaf pondweed present in shallow areas.
July	3	3	Dried Chamomile	
August	3	3	Cornichon	
September	3.5	3.5	Cornichon	

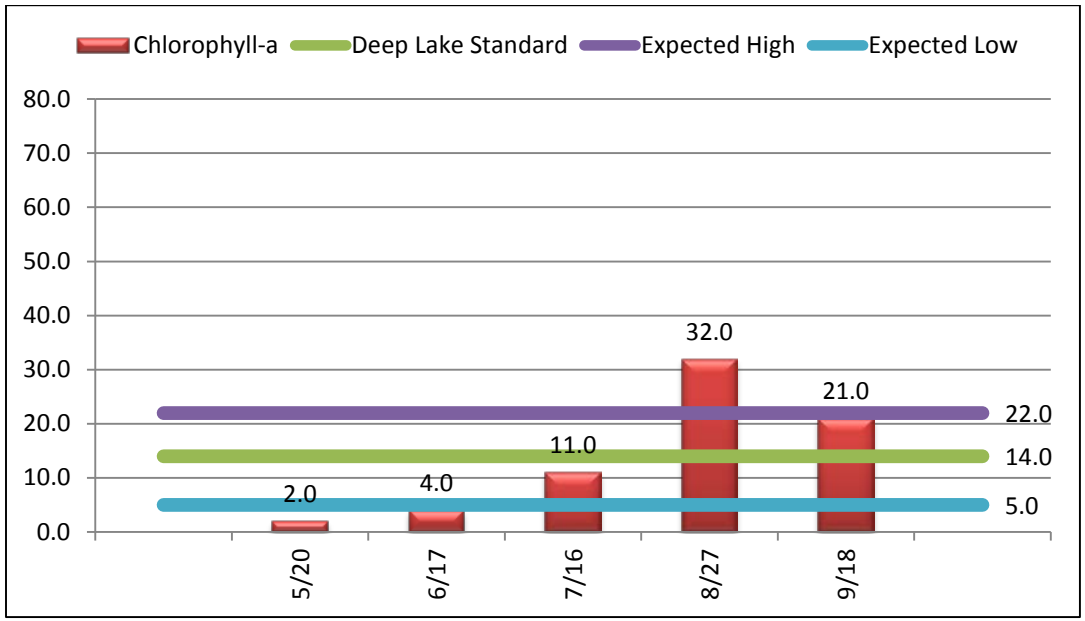
Little Green Lake

Lake 13-0041-01 Site 202

2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Not Impaired
2015 Ranking	11 of 21

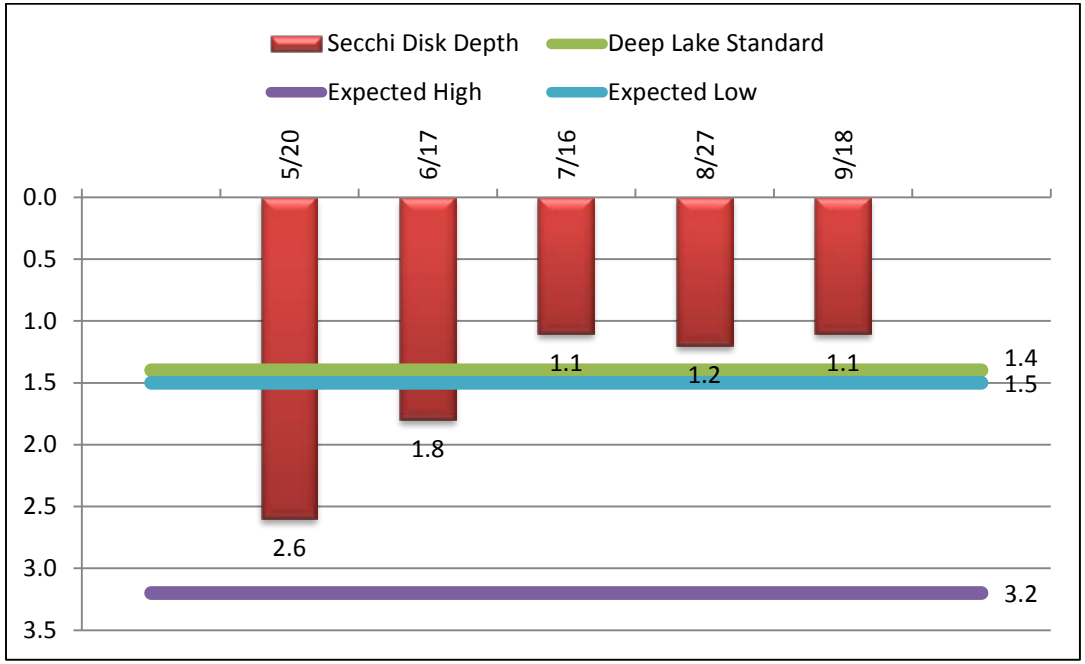
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	56.5	53.6	55.1	55.1
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	14.0 µg/L	1.6 meters	34.2 µg/L	-----
Grade	B	C	C	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	17.0 µg/L	1.3 meters	36.5 µg/L	-----
Meets Standard	No	No	Yes	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Little Green Lake**



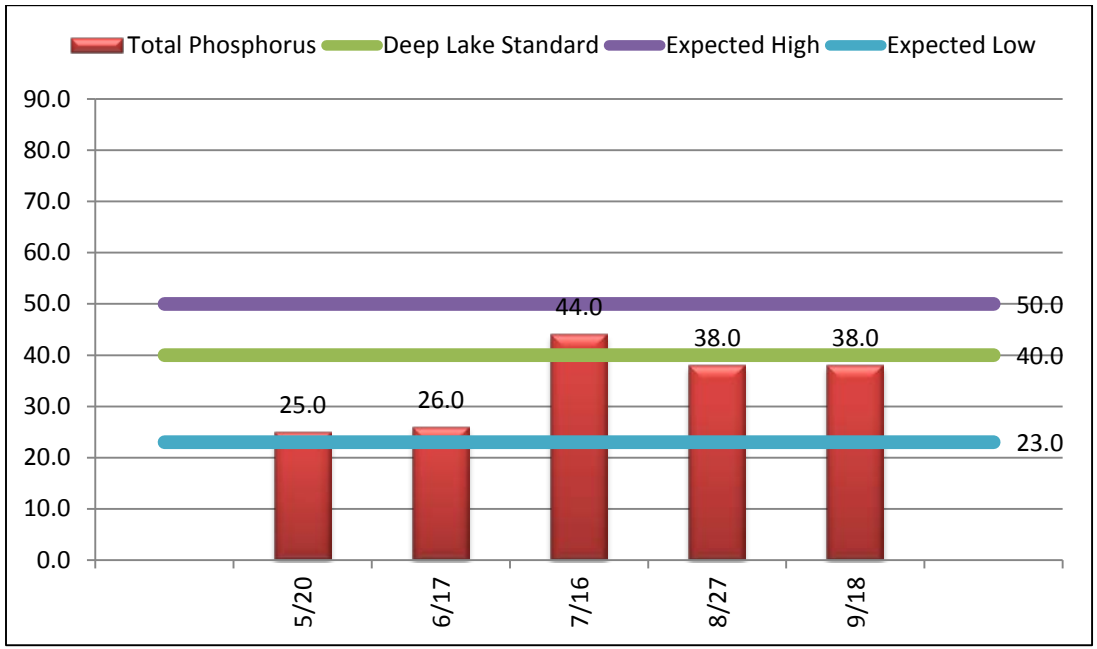
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	14.6	10.0	13.2	11.6	13.4	7.0	**14.0**
Grade	B	B	B	B	B	A	**B**
Average (June-Sept) µg/L	16.8	14.4	15.3	13.5	15.0	7.8	**17.0**
Meets Standard (14.0 µg/L)	No	No	No	Yes	No	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Little Green Lake**



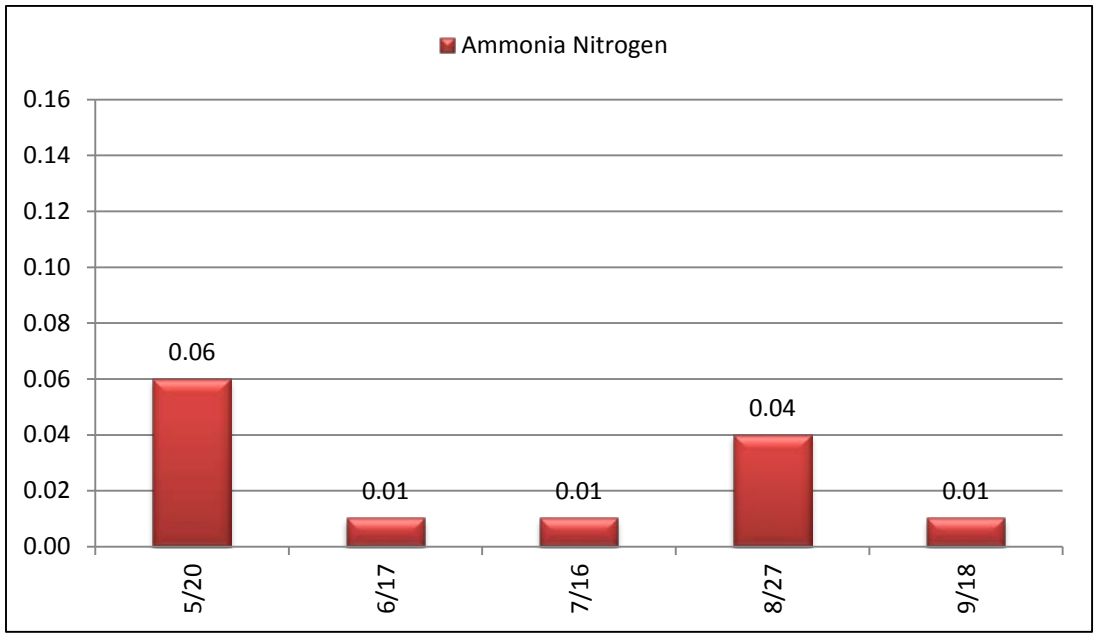
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	1.4	1.8	1.2	1.2	1.3	1.6	**1.6**
Grade	C	C	C-D	C-D	C	C	**C**
Average (June-Sept) meters	1.3	1.1	1.0	1.0	1.2	1.6	**1.3**
Meets Standard (>1.4 meters)	No	No	No	No	No	Yes	**No**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Little Green Lake**



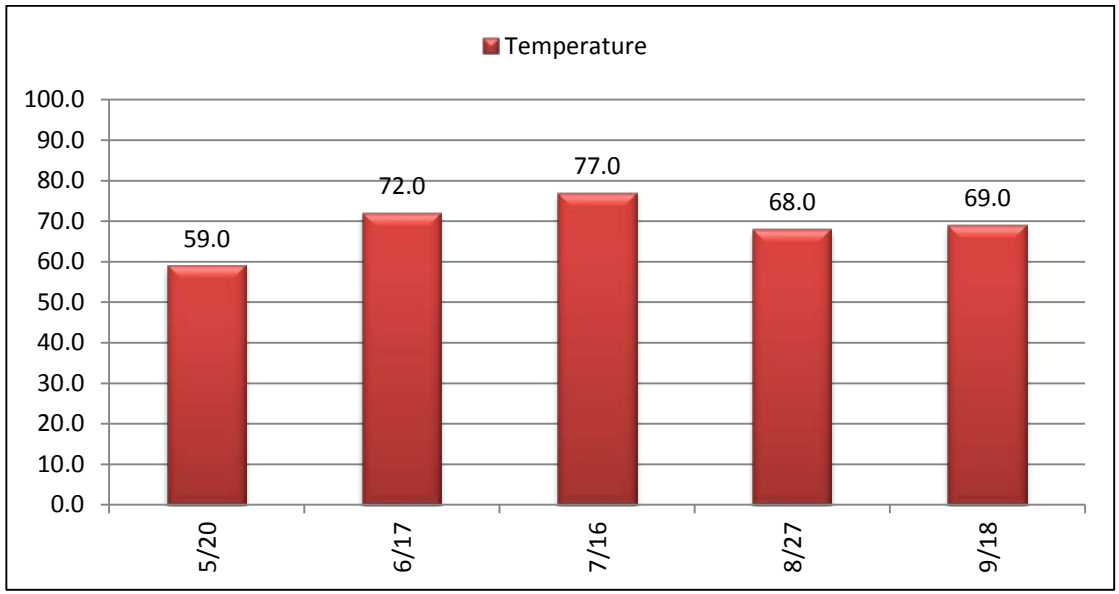
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	54.0	32.0	40.0	34.6	32.4	32.8	**34.2**
Grade	C	B-C	C	C	C	C	**C**
Average (June-Sept) µg/L	58.0	41.0	39.9	35.5	32.8	33.3	**36.5**
Meets Standard (40.0 µg/L)	No	No	Yes	Yes	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Little Green Lake**



Average mg/L	
2009	<0.05
2010	<0.05
2011	0.03
2012	0.07
2013	0.02
2014	0.03
2015	0.03

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Little Green Lake**



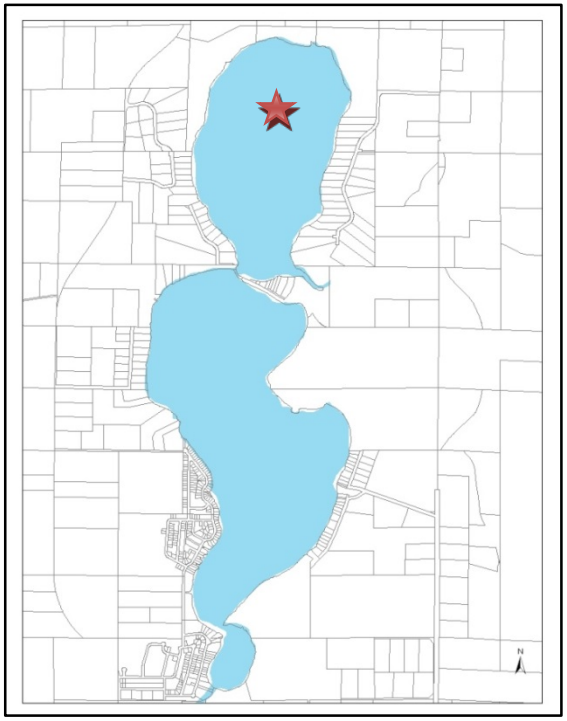
Year	Average ° F
2009	74.9
2010	74.0
2011	63.4
2012	71.8
2013	71.8
2014	69.8
2015	69.0

General Observations | **Little Green Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	Other Notes
May	2	2	Short Bread	Curly leaf pondweed recently treated.
June	2.5	2.5	Dried Chamomile	Curly leaf pondweed present in shallow areas.
July	3	3	Dried Chamomile	
August	3	3	Cornichon	
September	3.5	3.5	Cornichon	

Goose Lake-North

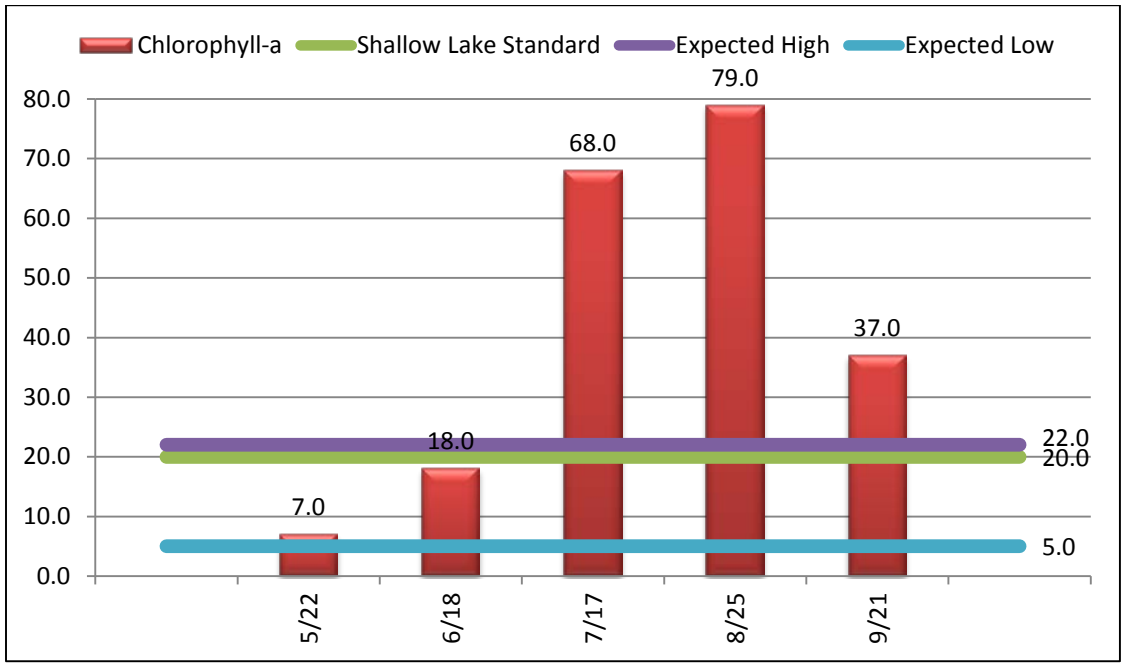
Lake 13-0083-01 Site 202



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Impaired
2015 Ranking	21 of 21

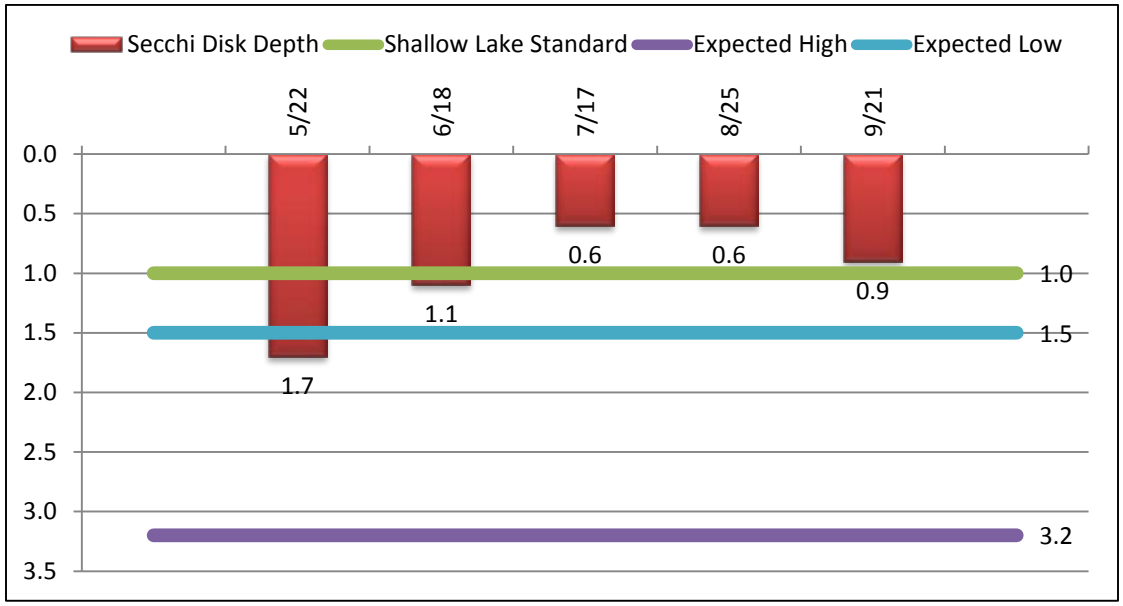
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	67.2	60.3	63.0	63.5
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	41.8 µg/L	1.0 meter	59.2 µg/L	-----
Grade	C	D	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1.0 meter	60.0 µg/L	-----
2015 Average (June-Sept)	50.5 µg/L	0.8 meters	65.3 µg/L	-----
Meets Standard	No	No	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **Goose Lake-North**



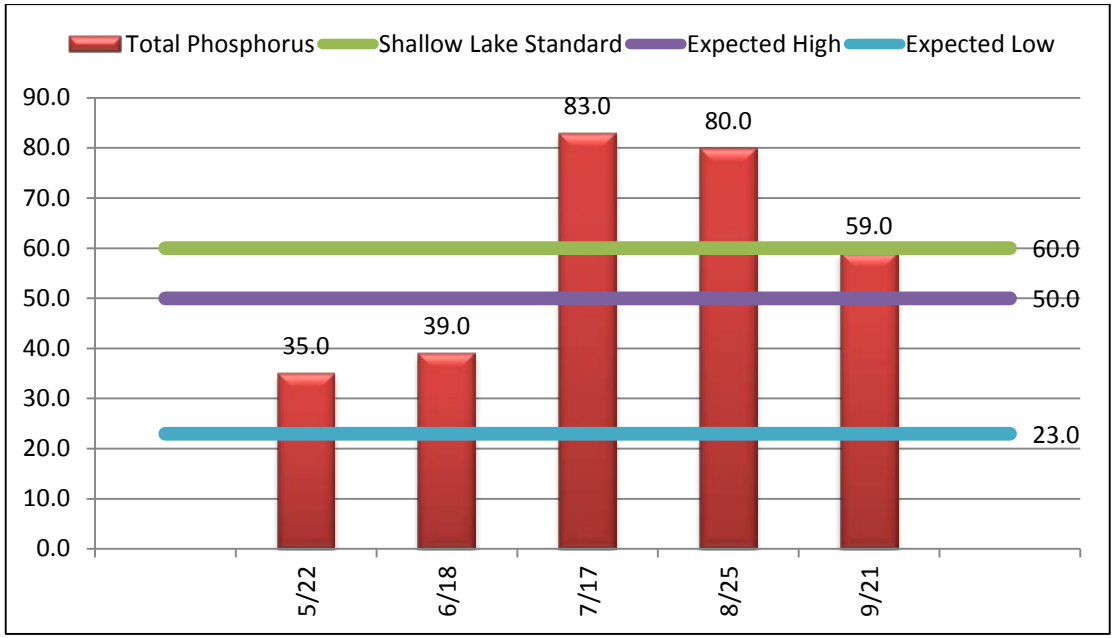
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	38.6	37.0	29.6	**41.8**
Grade	-----	-----	-----	C	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	42.5	43.3	34.0	**50.5**
Meets Standard (20.0 µg/L)	-----	-----	-----	No	No	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **Goose Lake-North**



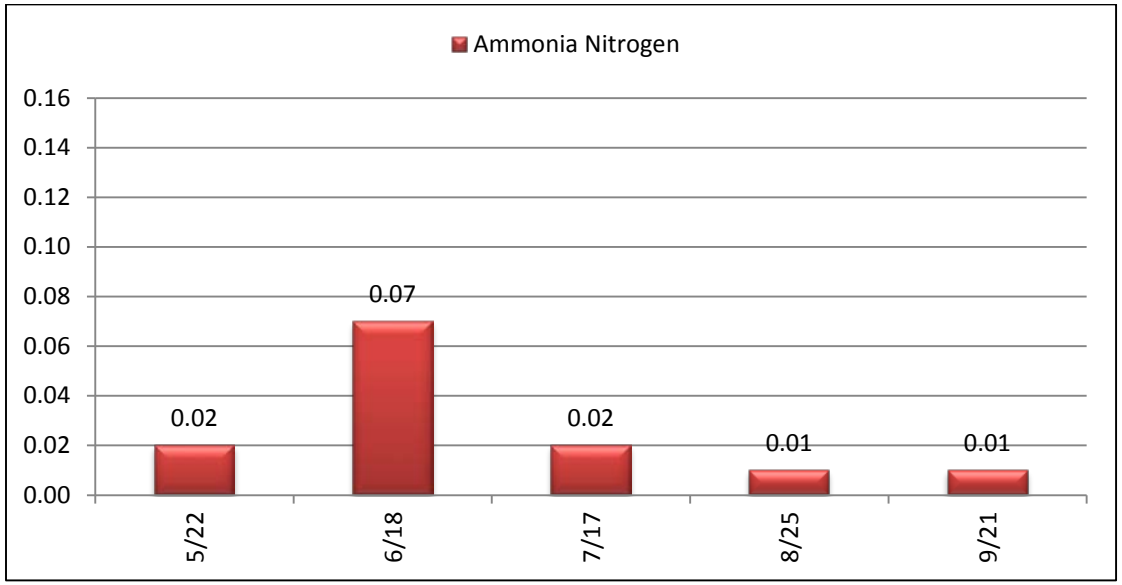
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	0.9	1.0	0.7	**1.0**
Grade	-----	-----	-----	D	D	D-F	**D**
Average (June-Sept) meters	No Data	No Data	No Data	0.8	1.0	0.6	**0.8**
Meets Standard (>1.0 meter)	-----	-----	-----	No	No	No	**No**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **Goose Lake-North**



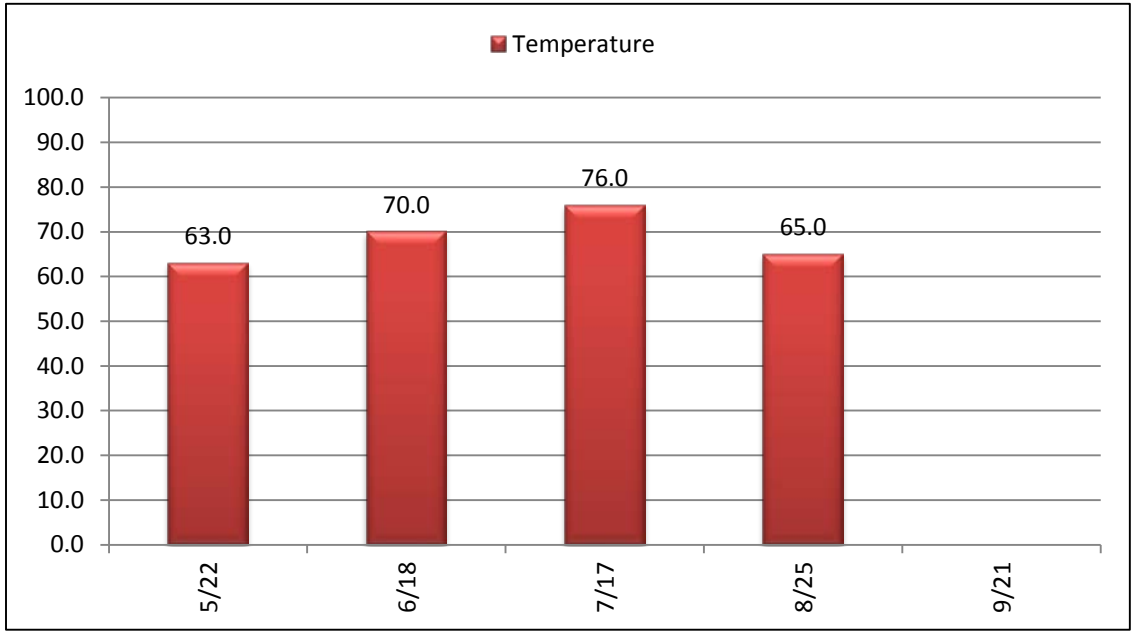
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	63.2	77.6	88.0	**59.2**
Grade	-----	-----	-----	C	D	D	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	68.8	85.8	94.5	**65.3**
Meets Standard (40.0 µg/L)	-----	-----	-----	No	No	No	**No**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **Goose Lake-North**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.07
2013	0.02
2014	0.02
2015	0.03

Surface Water Temperature |Expected Range: None |Shallow Lake Standard: None | **Goose Lake-North**



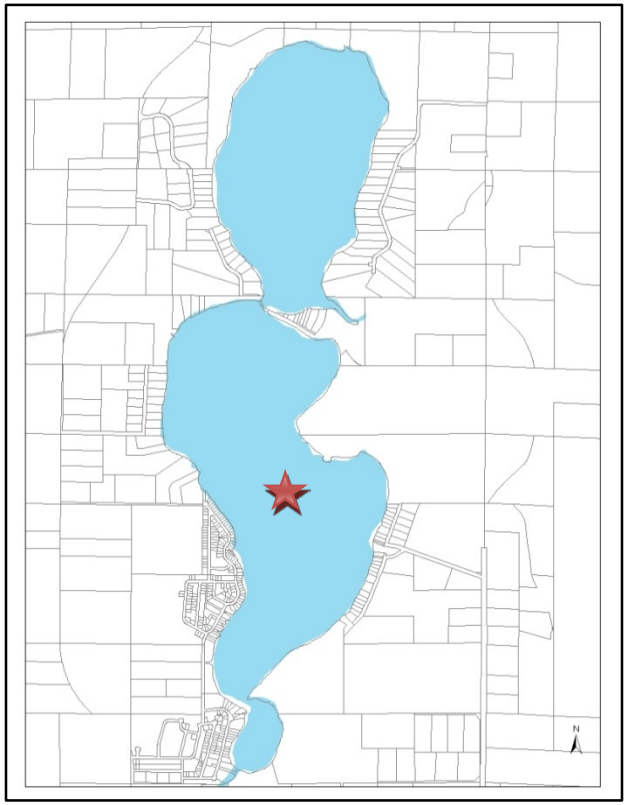
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	71.0
2013	72.8
2014	70.2
2015	68.5

General Observations | **Goose Lake-North**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Toasted Marshmallow	Curly leaf pondweed flowering.
June	3.5	3.5	Beach Grass	
July	3.5	3.5	Beach Grass	
August	4	4	Cornichon	
September	3	3	Beach Grass	

Goose Lake-South

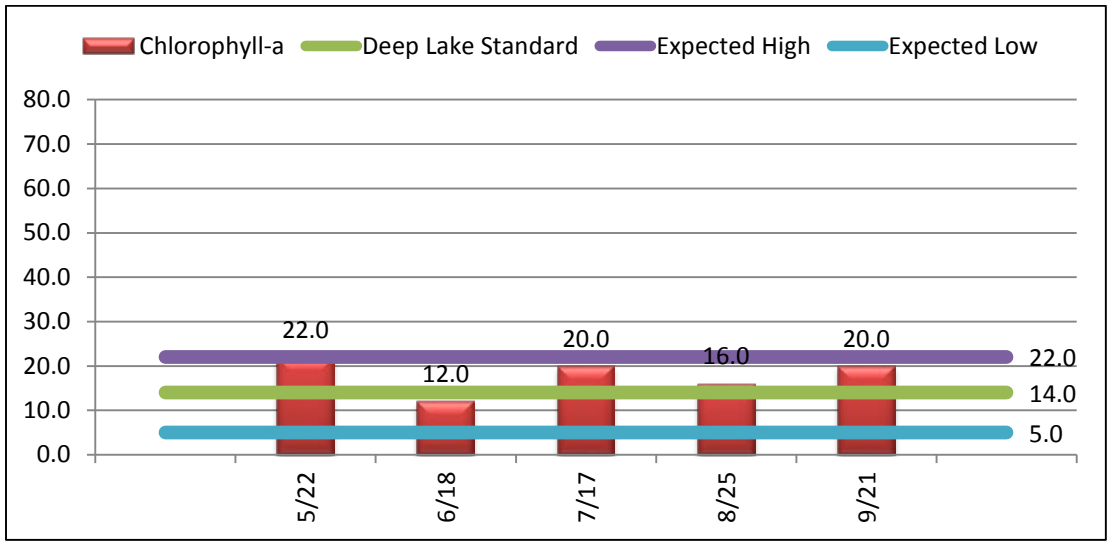
Lake 13-0083-02 Site 201



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	Yes Impaired
2015 Ranking	12 of 21

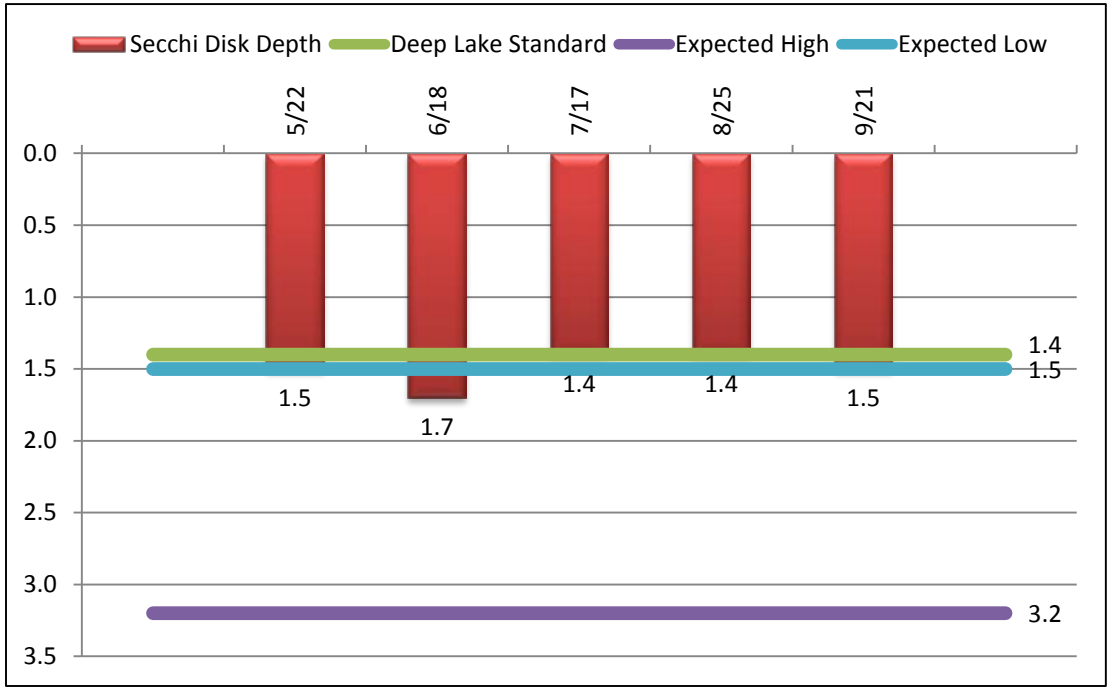
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	59.0	54.2	57.2	56.8
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	18.0 µg/L	1.5 meters	39.6 µg/L	-----
Grade	B	C	C	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	17.0 µg/L	1.5 meters	36.0 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Goose Lake-South**



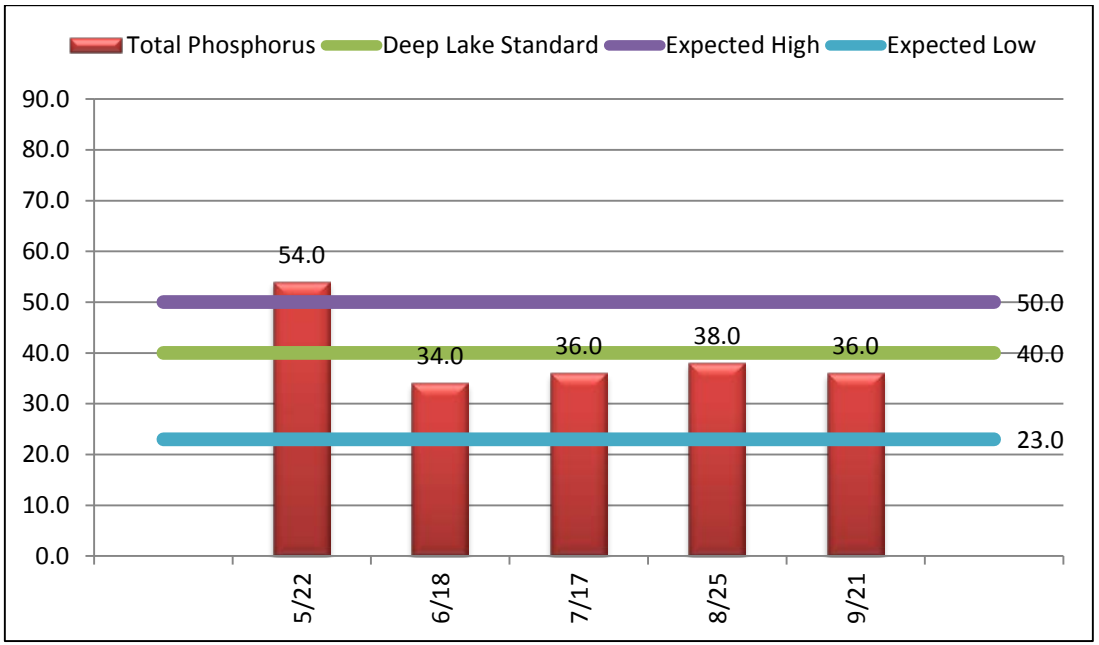
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	18.2	17.0	22.4	**18.0**
Grade	-----	-----	-----	B	B	C	**B**
Average (June-Sept) µg/L	No Data	No Data	No Data	20.5	19.5	27.0	**17.0**
Meets Standard (14.0 µg/L)	-----	-----	-----	No	No	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Goose Lake-South**



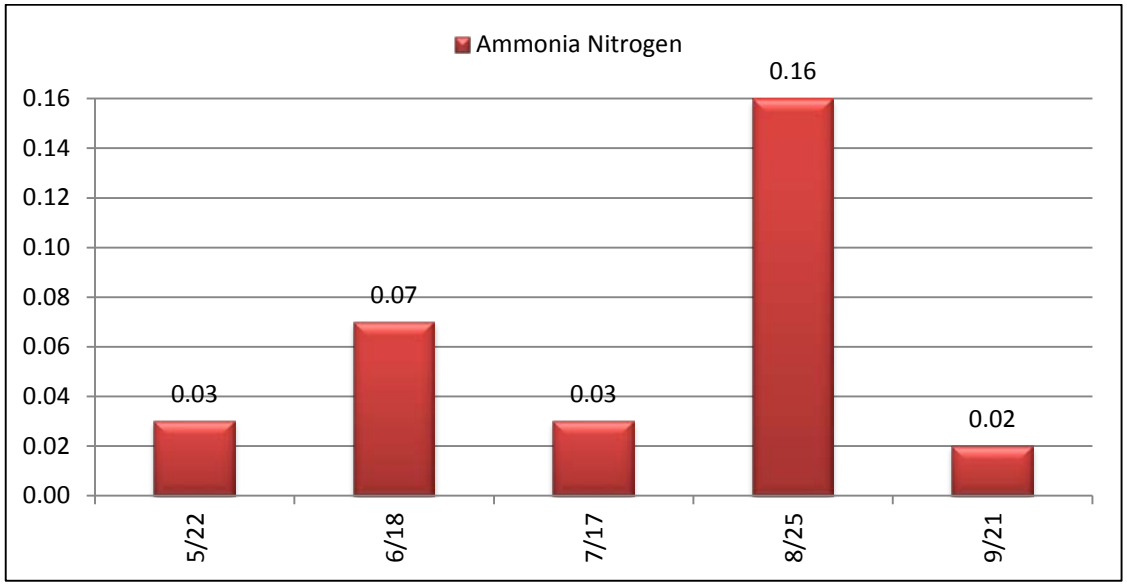
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	1.4	1.5	1.2	**1.5**
Grade	-----	-----	-----	C	C	C	**C**
Average (June-Sept) meters	No Data	No Data	No Data	1.4	1.3	1.1	**1.5**
Meets Standard (>1.4 meters)	-----	-----	-----	Yes	No	No	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Goose Lake-South**



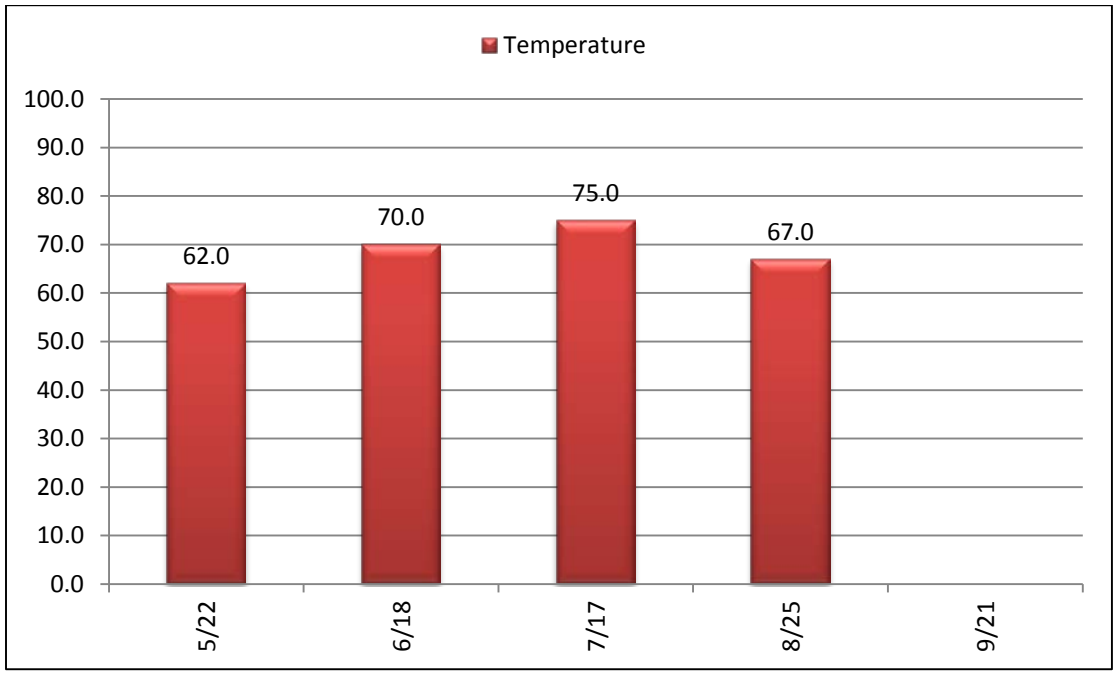
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	39.0	34.8	54.8	**39.6**
Grade	-----	-----	-----	C	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	38.0	34.0	58.0	**36.0**
Meets Standard (40.0 µg/L)	-----	-----	-----	Yes	Yes	No	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Goose Lake-South**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.10
2013	0.03
2014	0.02
2015	0.06

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Goose Lake-South**



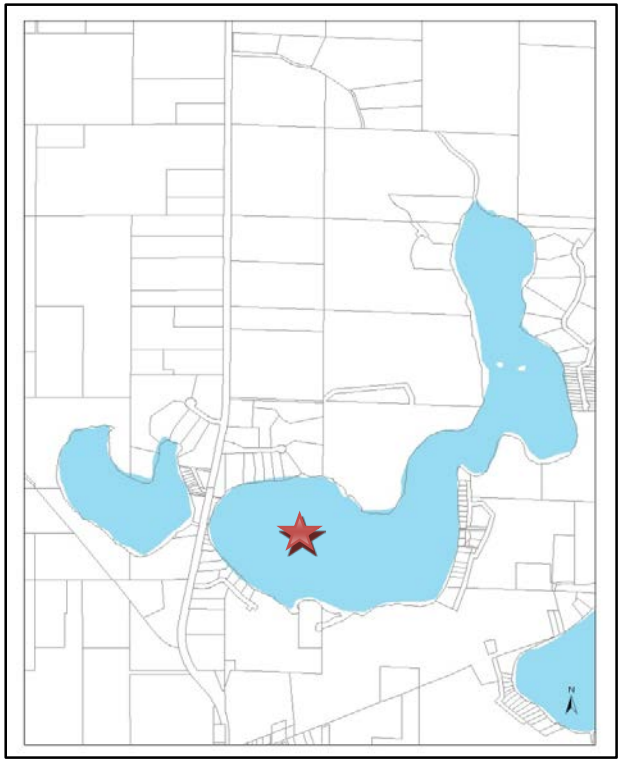
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	71.2
2013	73.0
2014	70.0
2015	68.5

General Observations | **Goose Lake-South**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Beach Grass	
June	3	3	Parchment Paper	Curly leaf pondweed present in shallow areas.
July	3	3	Beach Grass	
August	3	3	Dried Chamomile	
September	2.5	2.5	Parchment Paper	

Horseshoe Lake

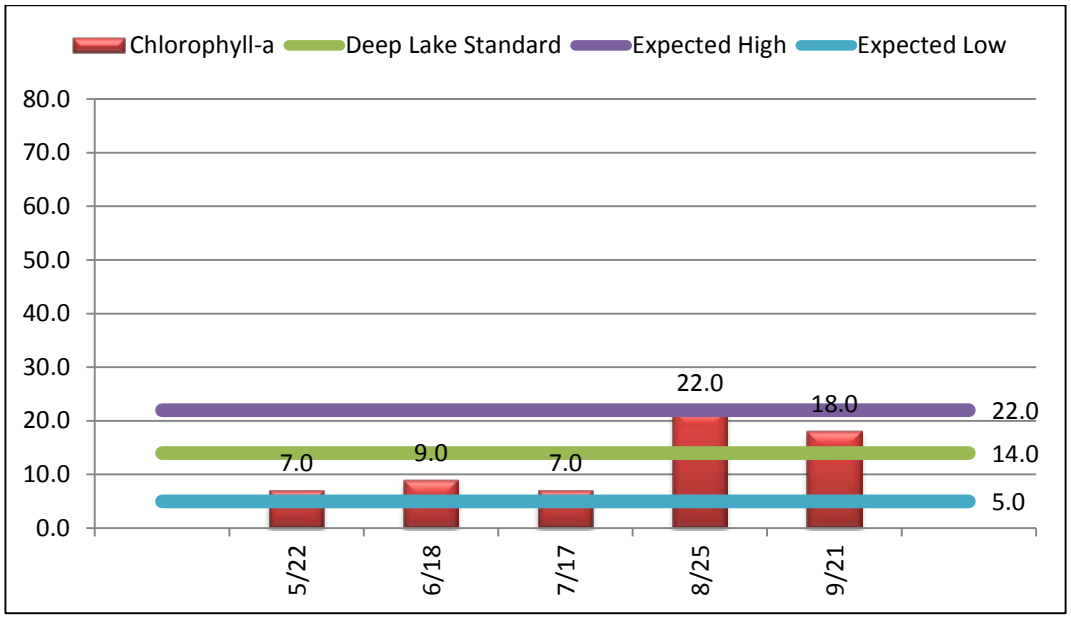
Lake 13-0073-00 Site 201



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	Yes Impaired
2015 Ranking	9 of 21

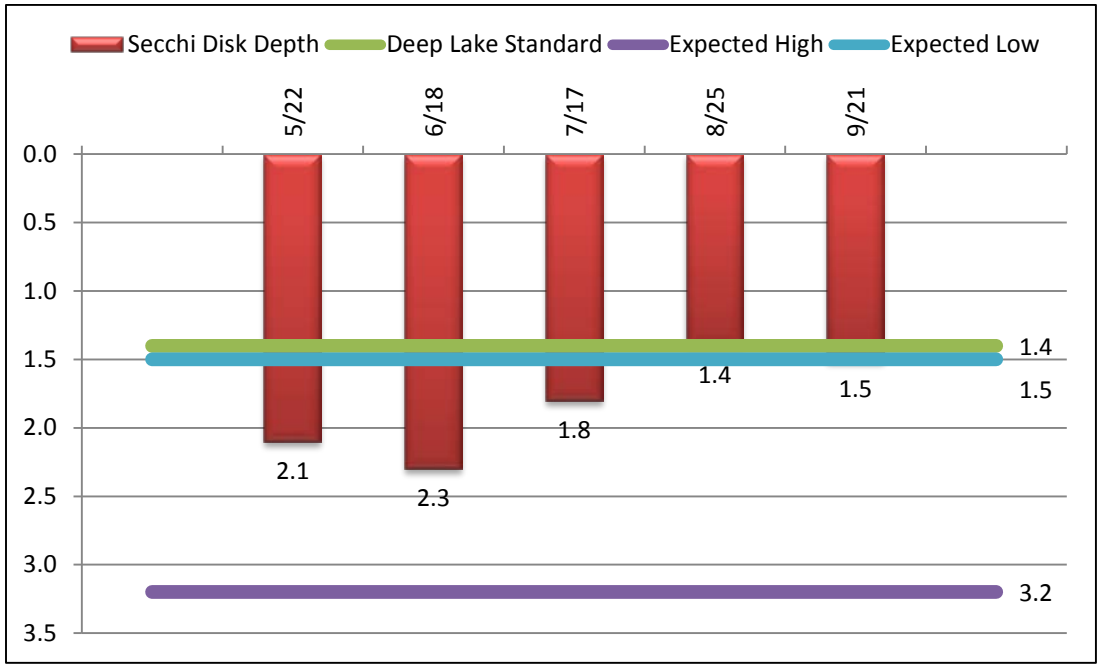
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	55.5	51.4	55.7	54.2
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	12.6 µg/L	1.8 meters	35.8 µg/L	-----
Grade	B	C	C	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	14.0 µg/L	1.8 meters	35.8 µg/L	-----
Meets Standard	Yes	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Horseshoe Lake**



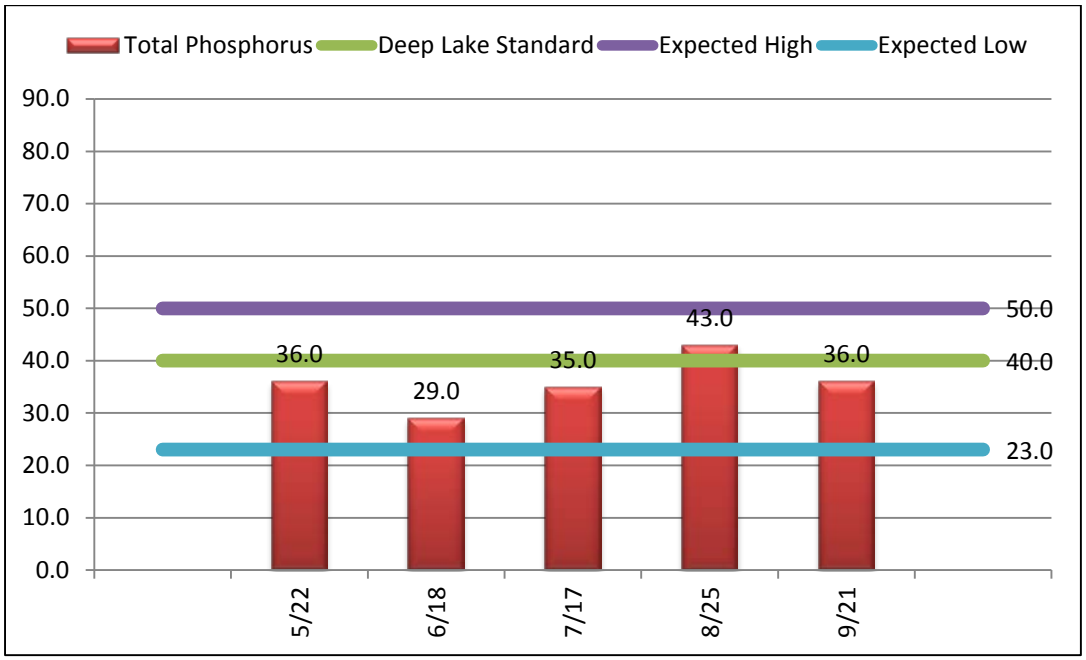
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	20.0	17.4	13.0	**12.6**
Grade	-----	-----	-----	B-C	B	B	**B**
Average (June-Sept) µg/L	No Data	No Data	No Data	16.5	18.8	12.5	**14.0**
Meets Standard (14.0 µg/L)	-----	-----	-----	No	No	Yes	**Yes**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Horseshoe Lake**



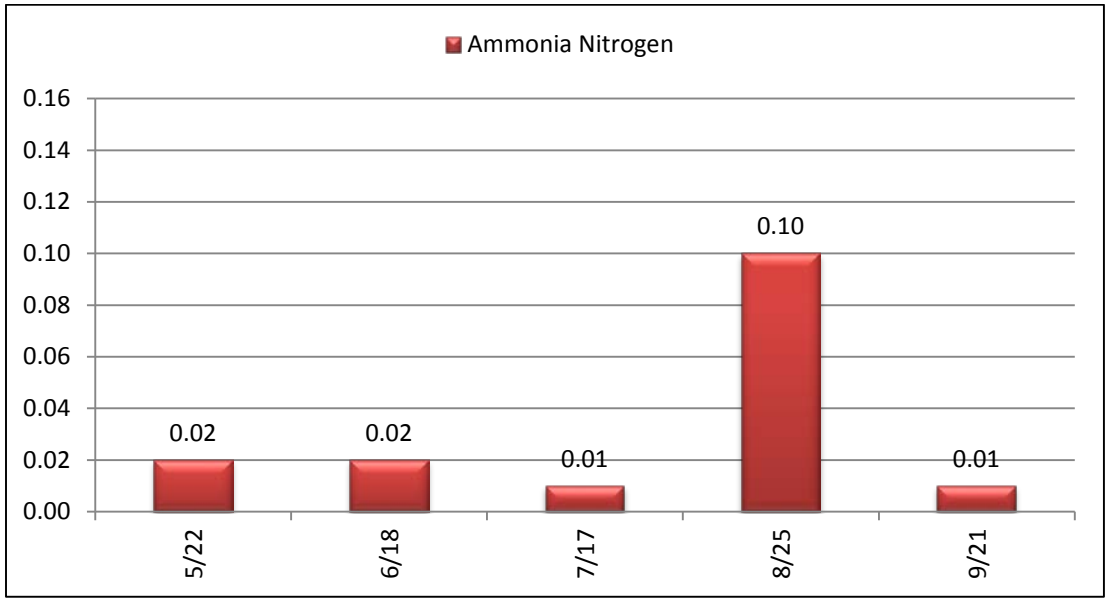
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	1.6	1.5	**1.2**	**1.8**
Grade	-----	-----	-----	C	C	**C-D**	**C**
Average (June-Sept) meters	No Data	No Data	No Data	1.7	1.6	**1.2**	**1.8**
Meets Standard (>1.4 meters)	-----	-----	-----	Yes	Yes	**No**	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Horseshoe Lake**



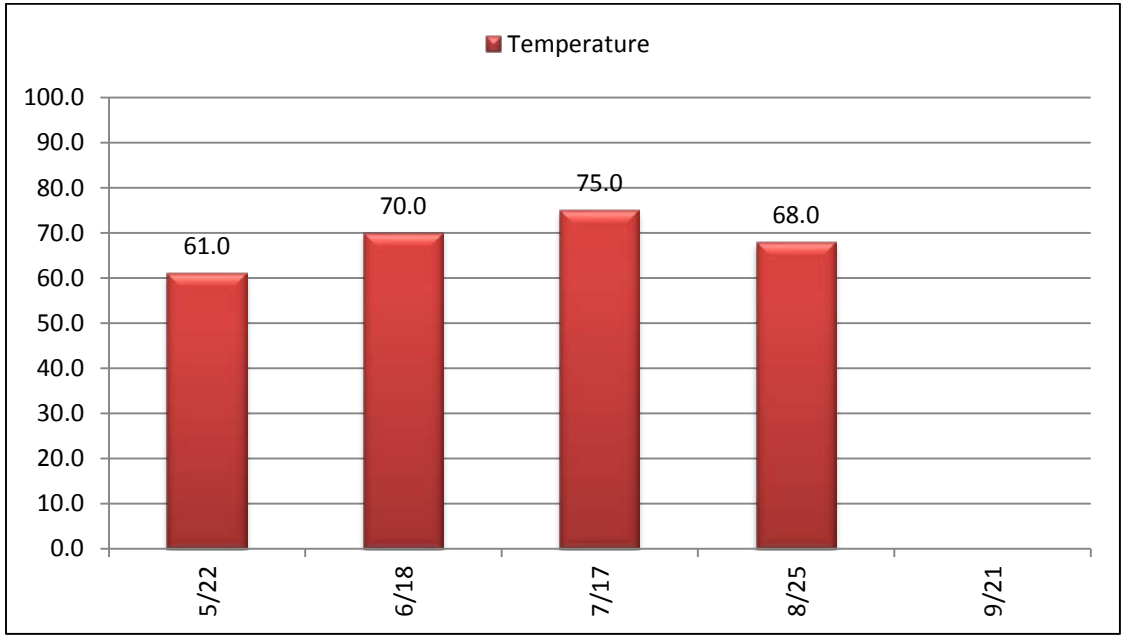
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	47.0	38.0	40.0	**35.8**
Grade	-----	-----	-----	C	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	43.5	37.5	40.3	**35.8**
Meets Standard (40.0 µg/L)	-----	-----	-----	No	Yes	No	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Horseshoe Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.07
2013	0.03
2014	0.01
2015	0.03

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Horseshoe Lake**



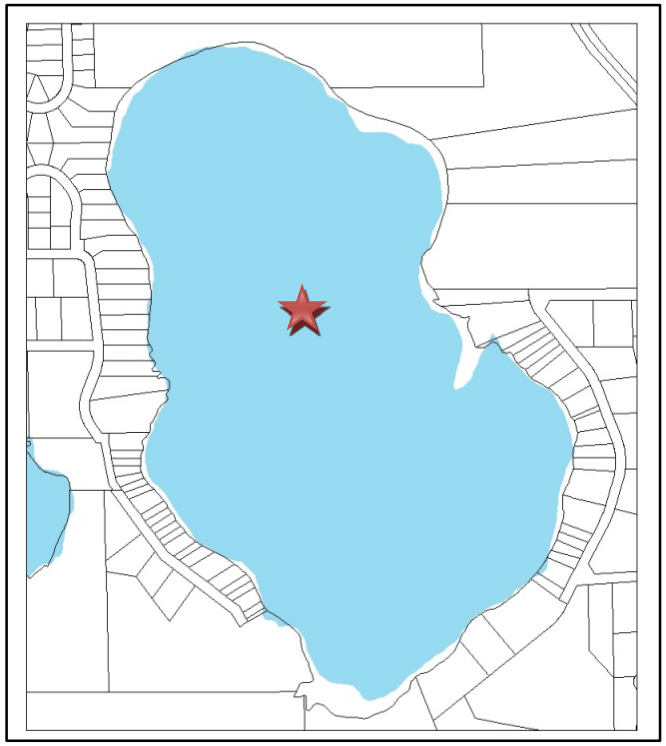
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	71.4
2013	72.6
2014	70.2
2015	68.5

General Observations | **Horseshoe Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Short Bread	
June	2.5	2.5	Dried Chamomile	
July	2.5	2.5	Dried Chamomile	
August	3	3	Dried Chamomile	
September	2.5	2.5	Parchment Paper	

Kroon Lake

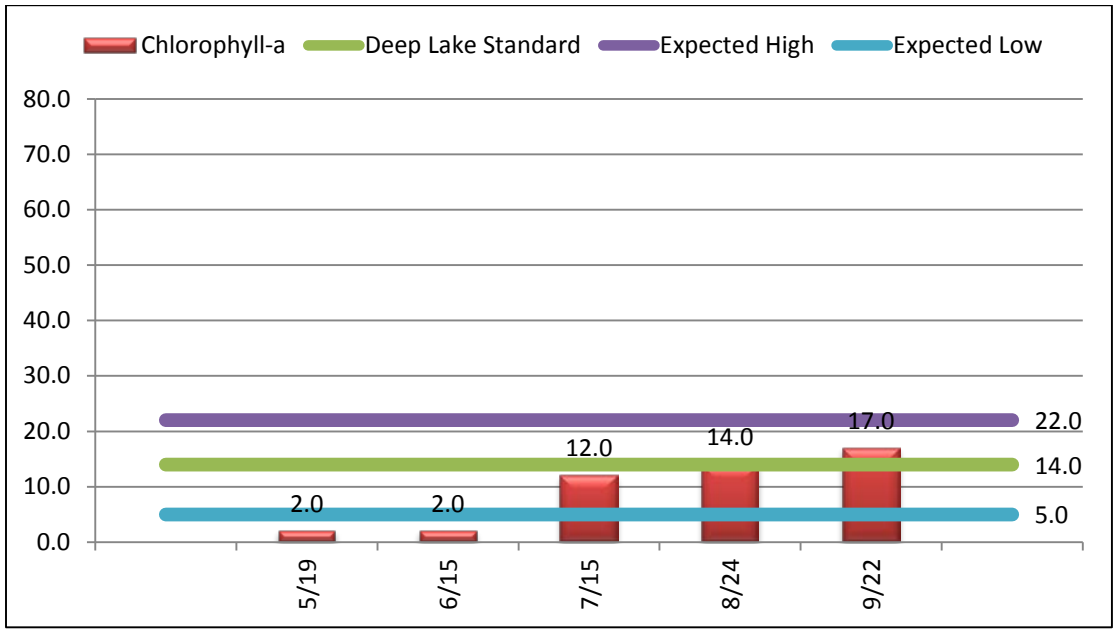
Lake 13-0013-00 Site 202



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	B
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	6 of 21

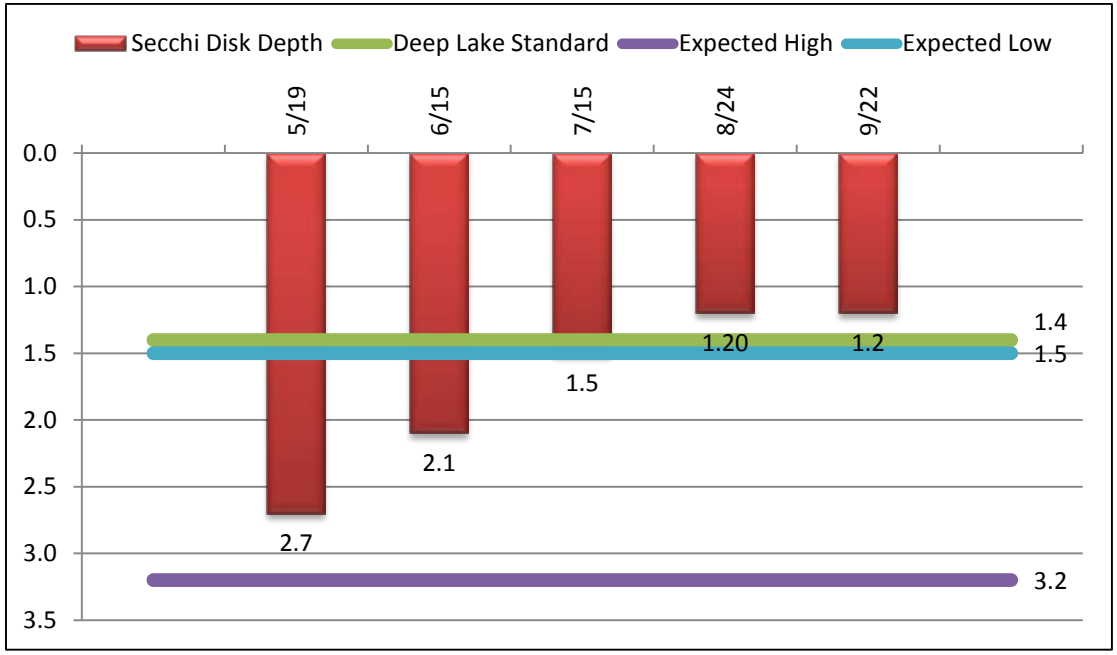
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	52.6	52.0	53.9	52.6
Classification	Mesotrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	9.4 µg/L	1.7 meters	53.9 µg/L	-----
Grade	A	C	B	B
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	11.3 µg/L	1.5 meters	33.5 µg/L	-----
Meets Standard	Yes	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Kroon Lake**



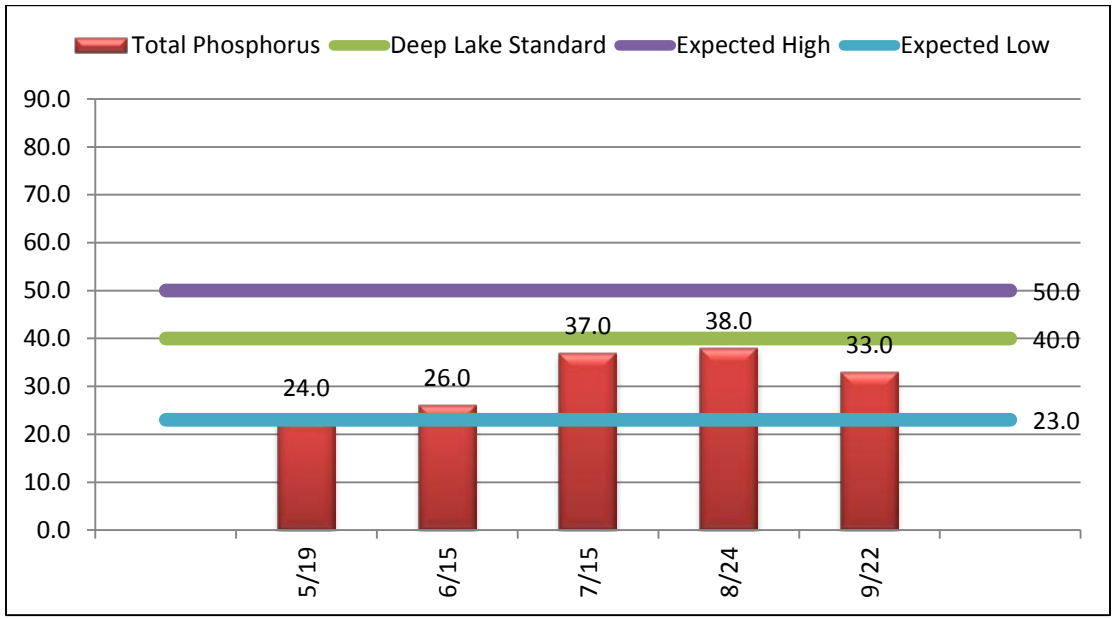
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	10.8	20.3	8.6	9.8	7.4	5.6	**9.4**
Grade	B	C	A	A	A	A	**A**
Average (June-Sept) µg/L	13.6	20.3	10.0	11.3	9.0	6.3	**11.3**
Meets Standard (14.0 µg/L)	Yes	No	Yes	Yes	Yes	Yes	**Yes**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Kroon Lake**



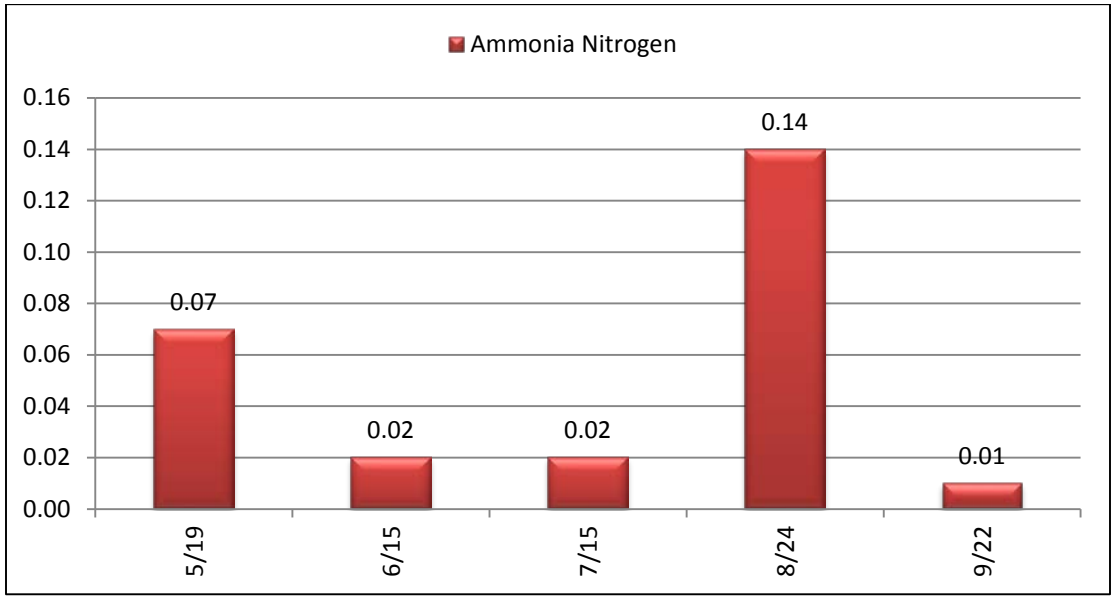
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	1.9	1.7	2.0	1.7	2.0	1.8	**1.7**
Grade	C	C	C	C	C	C	**C**
Average (June-Sept) meters	1.3	1.7	1.6	1.4	1.5	1.7	**1.5**
Meets Standard (>1.4 meters)	No	Yes	Yes	Yes	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Kroon Lake**



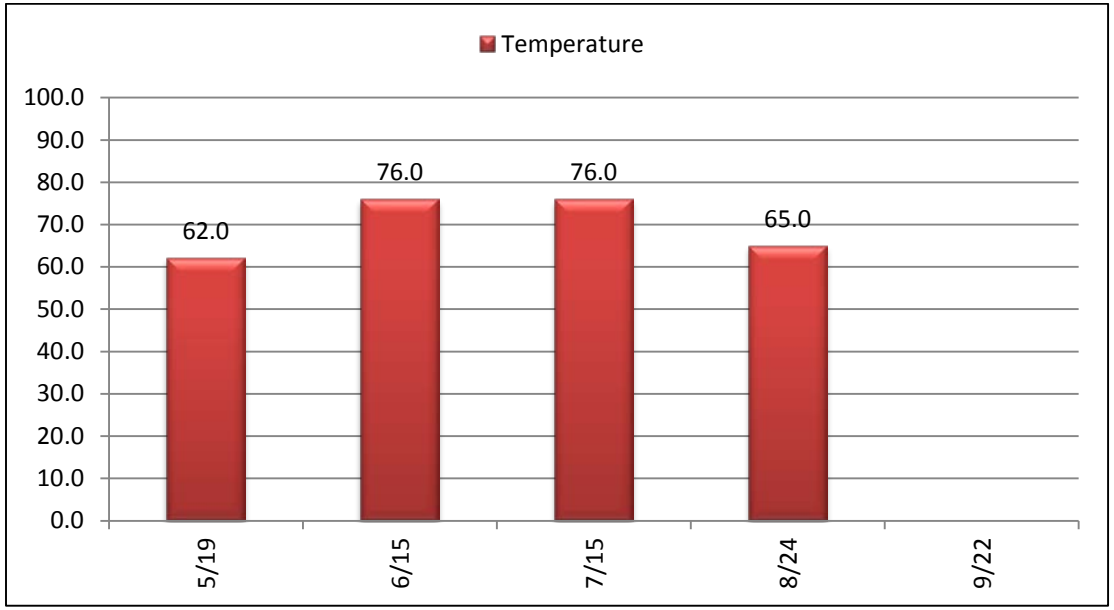
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	35.0	31.0	35.6	28.8	28.2	30.2	**31.6**
Grade	C	B	C	B	B	B	**B**
Average (June-Sept) µg/L	37.0	31.0	38.3	30.5	29.0	30.3	**33.5**
Meets Standard (40.0 µg/L)	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Kroon Lake**



Average mg/L	
2009	0.09
2010	<0.05
2011	0.08
2012	0.07
2013	0.04
2014	0.03
2015	0.05

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Kroon Lake**



Year	Average ° F
2009	73.3
2010	No Data
2011	64.0
2012	72.2
2013	75.0
2014	69.8
2015	69.8

General Observations | **Kroon Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Malted	Limited Curly leaf pondweed control in treated areas.
June	2.5	2.5	Malted	Curly leaf pondweed present in shallow areas.
July	2.5	2.5	Dried Chamomile	
August	2.5	2.5	Cornucopia	
September	2.5	2.5	Dried Chamomile	

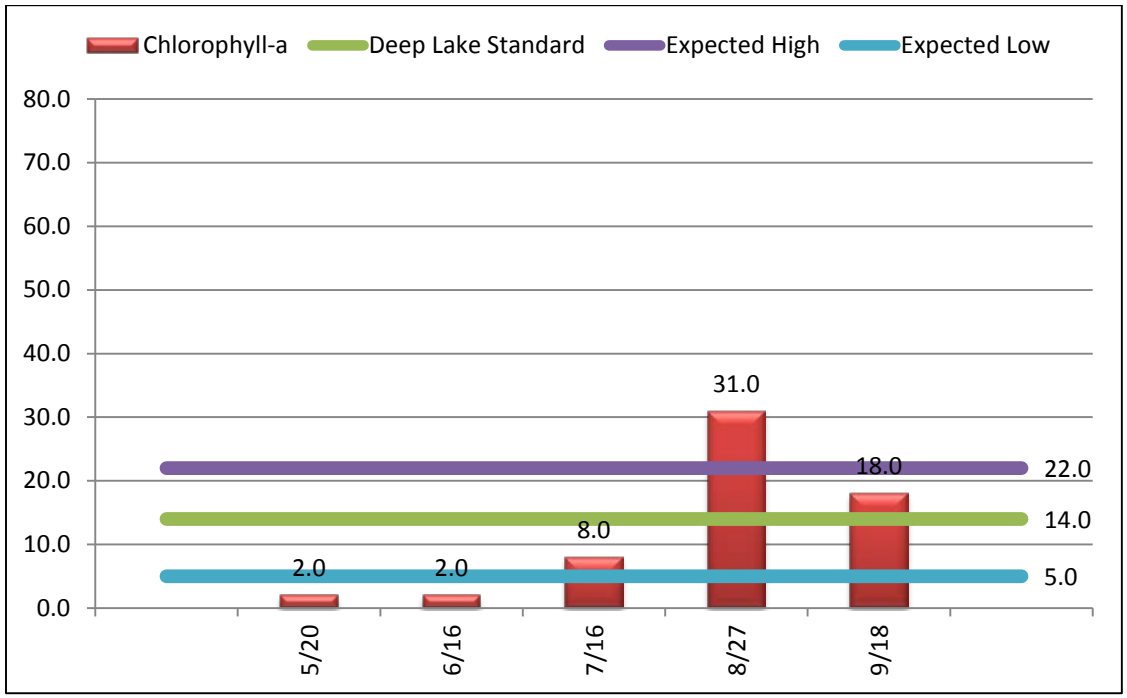
North Lindstrom Lake

Lake 13-0035-00 Site 201

2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	B
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	2 of 21

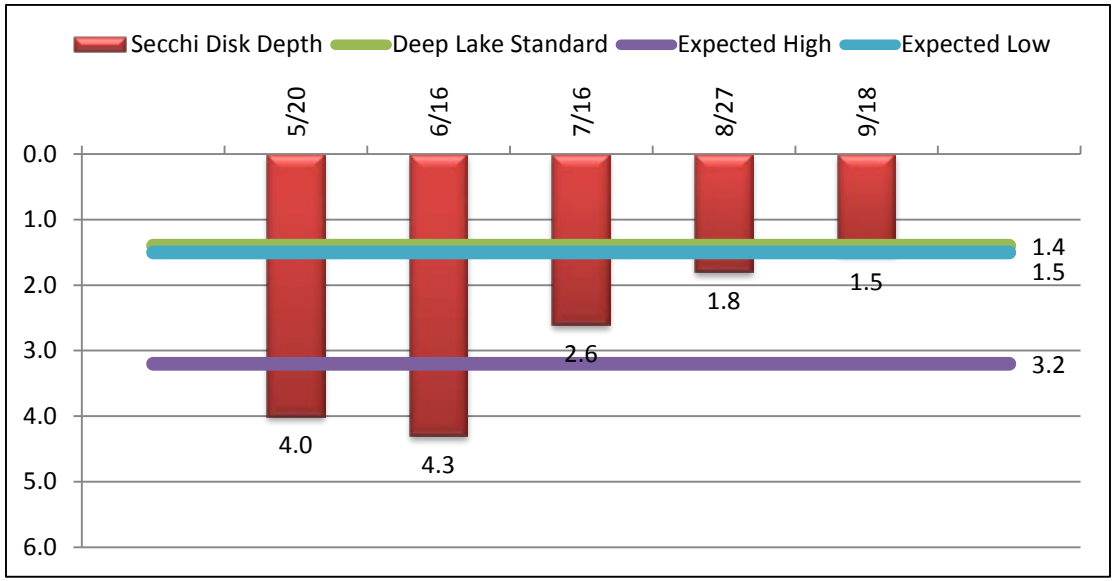
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	55.1	45.0	51.1	50.4
Classification	Eutrophic	Mesotrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	12.2 µg/L	2.8 meters	26.0 µg/L	-----
Grade	B	B	B	B
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	14.8 µg/L	2.6 meters	27.3 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **North Lindstrom Lake**



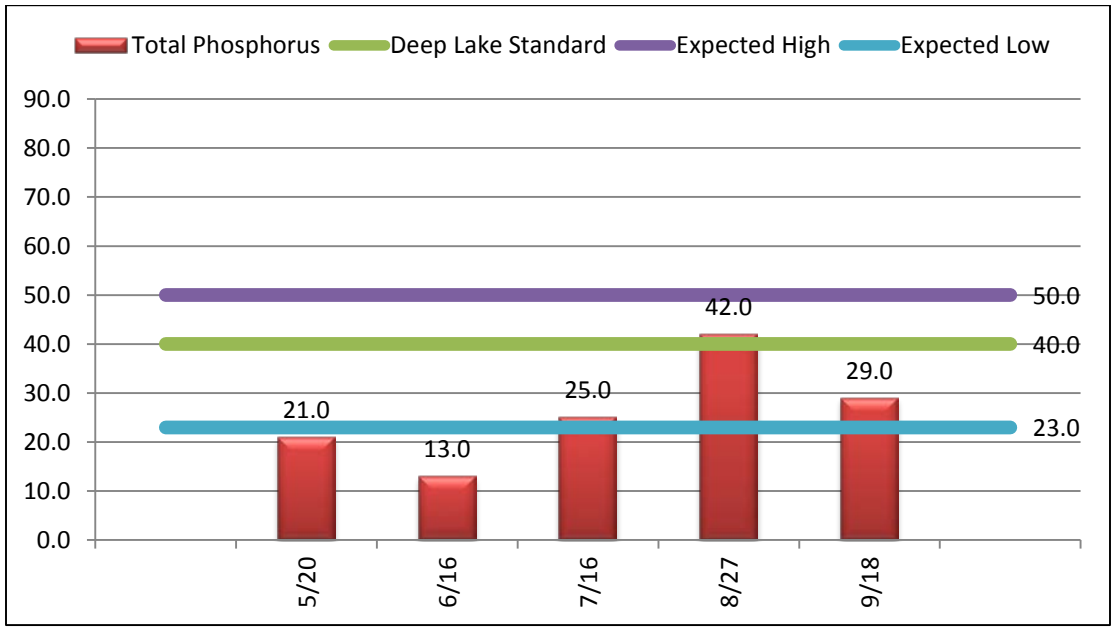
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	14.0	17.7	9.4	23.0	9.2	9.8	**12.2**
Grade	B	B	A	C	A	A	**B**
Average (June-Sept) µg/L	15.6	19.6	11.5	28.0	10.8	12.0	**14.8**
Meets Standard (14.0 µg/L)	No	No	Yes	No	Yes	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **North Lindstrom Lake**



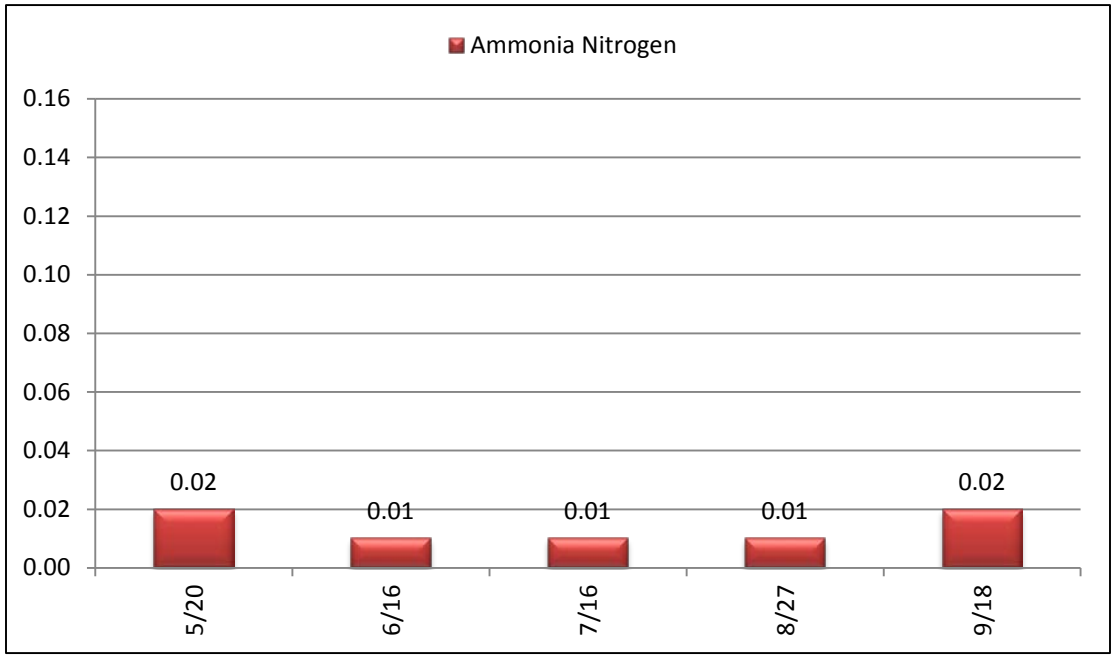
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	2.0	2.1	2.8	1.8	2.7	2.1	**2.8**
Grade	C	C	B	C	B	C	**B**
Average (June-Sept) meters	1.5	2.1	2.5	1.6	2.7	1.8	**2.6**
Meets Standard (>1.4 meters)	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **North Lindstrom Lake**



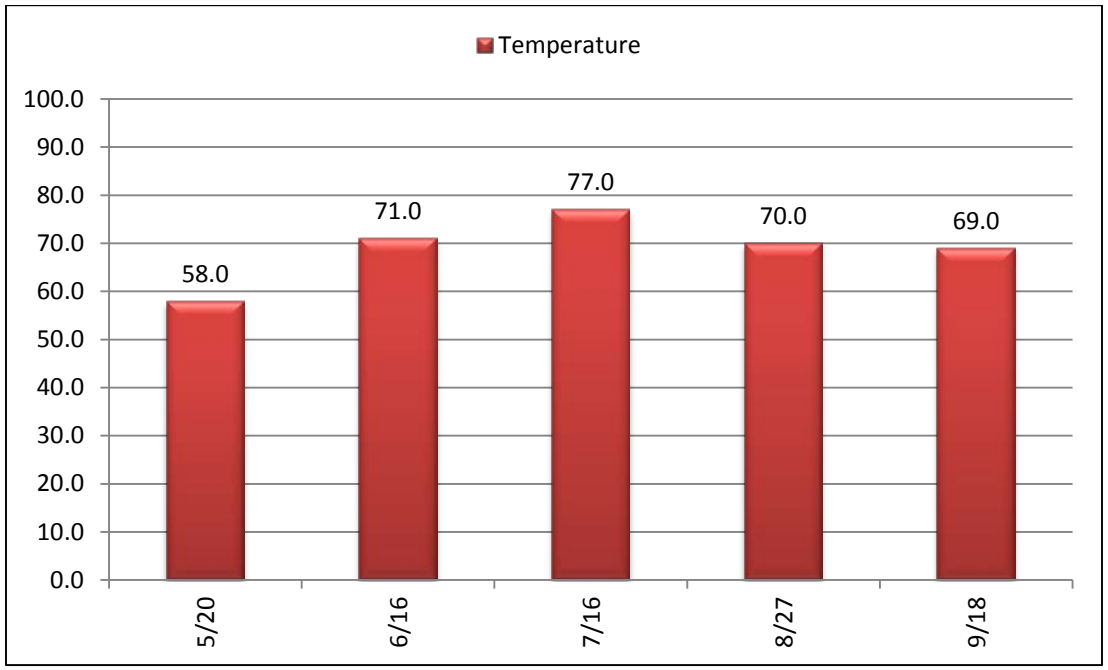
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	33.0	34.0	25.0	29.6	23.4	29.2	**26.0**
Grade	C	C	B	B	B	B	**B**
Average (June-Sept) µg/L	32.0	33.0	26.0	32.5	23.0	31.5	**27.3**
Meets Standard (40.0 µg/L)	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **North Lindstrom Lake**



Average mg/L	
2009	0.1
2010	0.1
2011	0.05
2012	0.12
2013	0.03
2014	0.02
2015	0.01

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **North Lindstrom Lake**



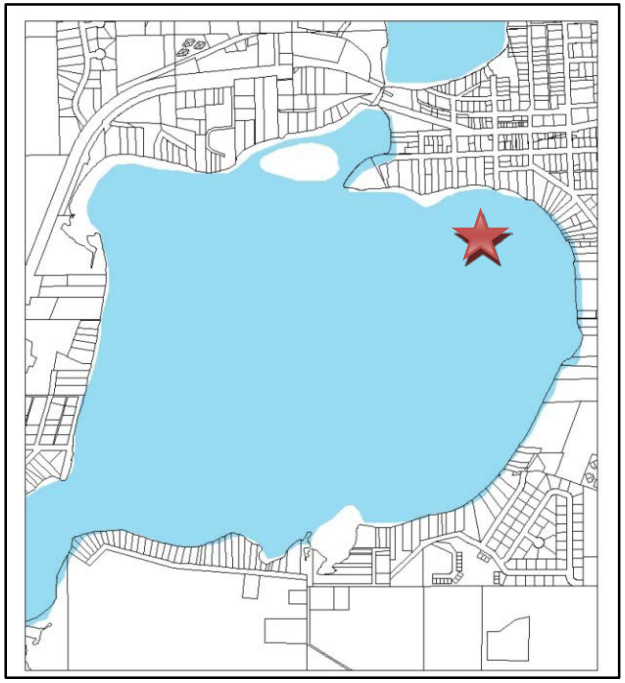
Year	Average ° F
2009	No Data
2010	No Data
2011	65.8
2012	69.8
2013	73.0
2014	70.0
2015	69.0

General Observations | **North Lindstrom Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Chop Stick	
June	2	2	Chop Stick	Curly leaf pondweed in shallow areas. Very large percentage of shoreline without vegetation.
July	2.5	2.5	Dried Chamomile	
August	2.5	2.5	Cornichon	
September	2.5	2.5	Beach Grass	

South Lindstrom Lake

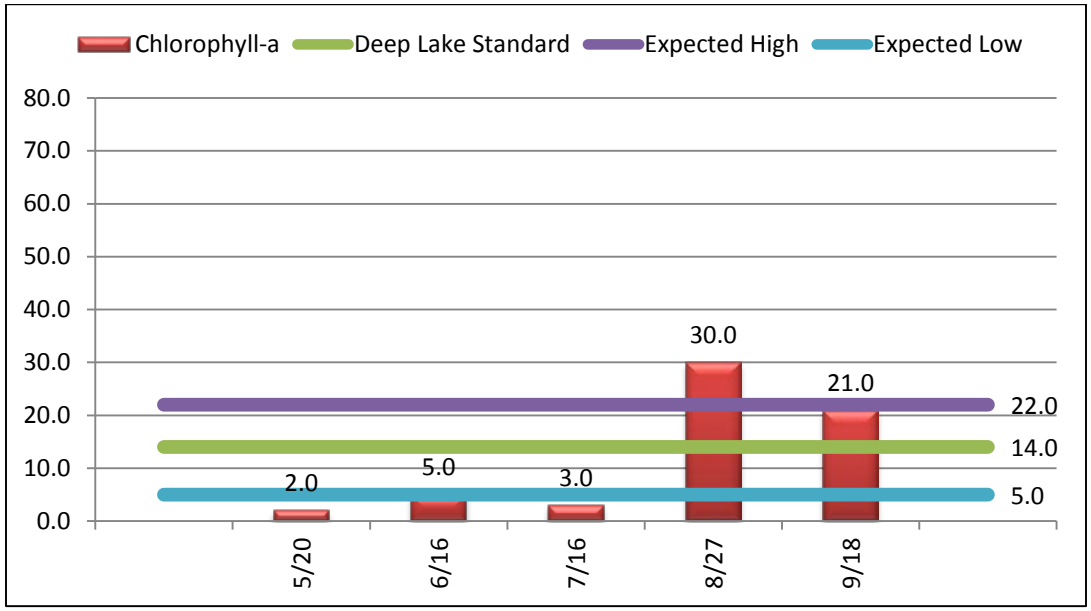
Lake 13-0028-00 Site 203



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	B
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	3 of 21

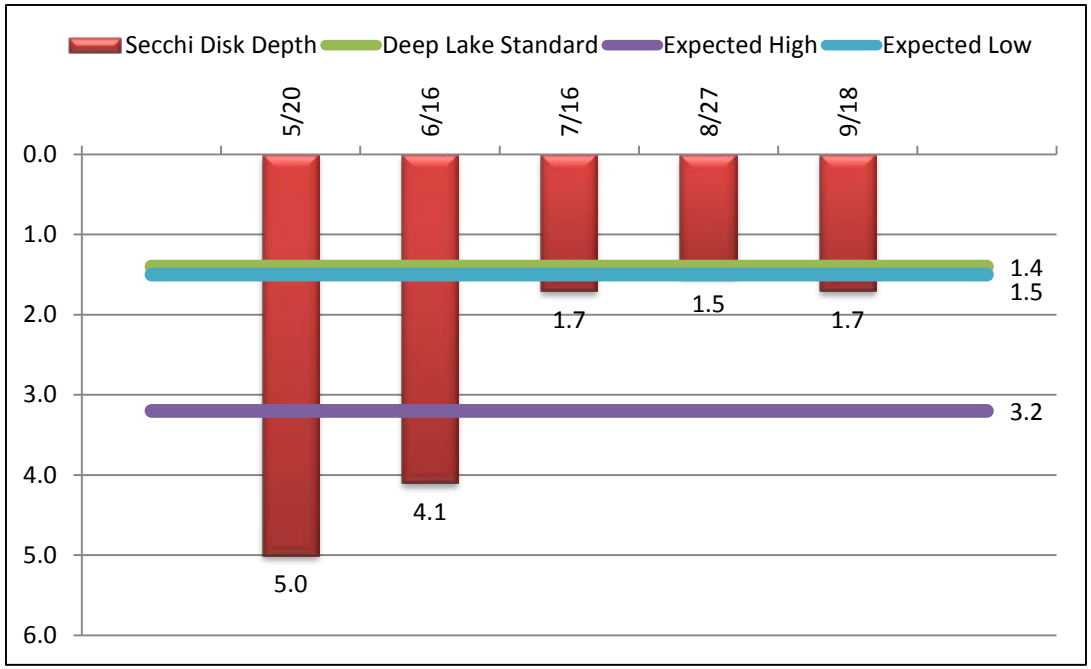
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	55.1	45.2	54.7	51.7
Classification	Eutrophic	Mesotrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	12.2 µg/L	2.8 meters	33.2 µg/L	-----
Grade	B	B	C	B
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	14.8 µg/L	2.3 meters	34.5 µg/L	-----
Meets Standard	No	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **South Lindstrom Lake**



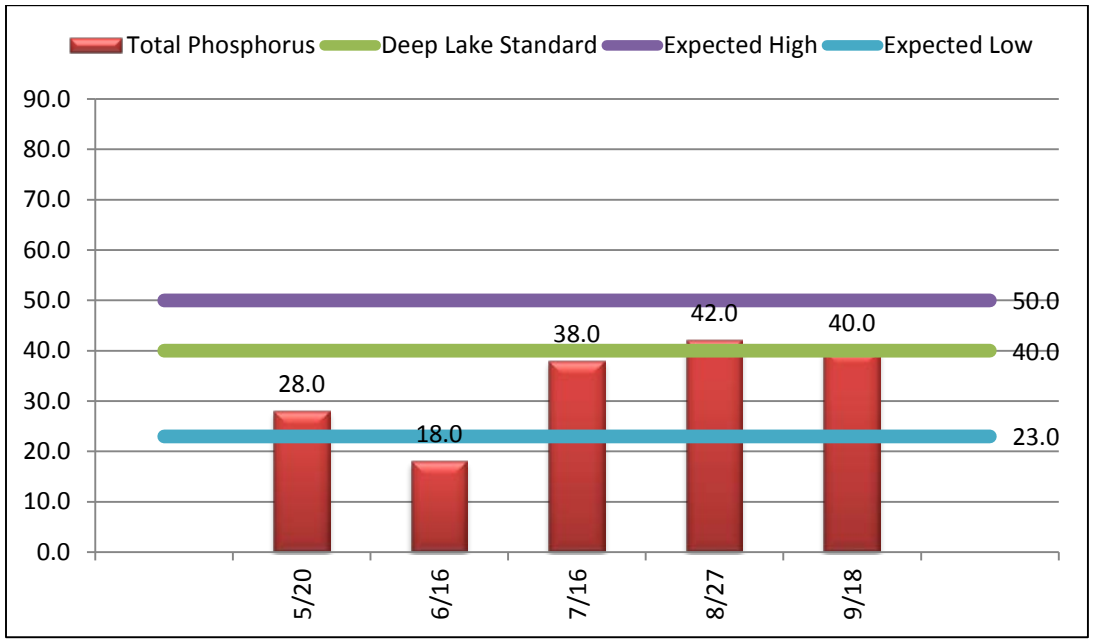
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	11.8	20.0	11.2	35.0	16.8	11.6	**12.2**
Grade	B	B	B	C	B	B	**B**
Average (June-Sept) µg/L	13.2	20.0	13.8	43.0	19.5	14.0	**14.8**
Meets Standard (14.0 µg/L)	Yes	No	Yes	No	No	Yes	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **South Lindstrom Lake**



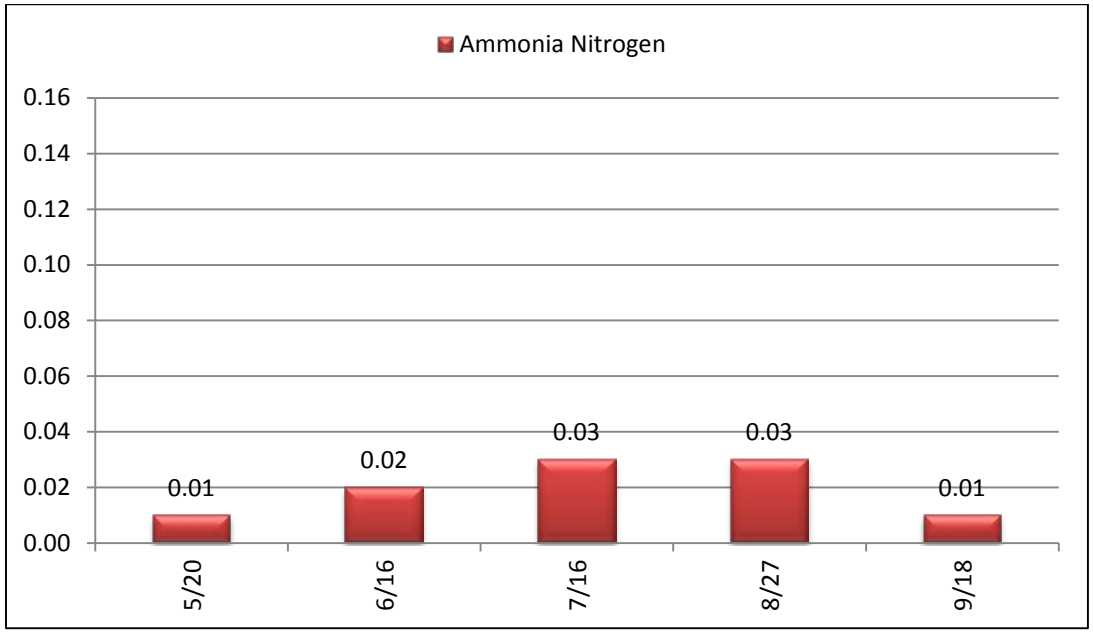
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	3.3	1.9	2.3	1.5	1.8	1.9	**2.8**
Grade	A	C	B	C	C	C	**B**
Average (June-Sept) meters	2.9	1.9	1.9	1.1	1.9	1.7	**2.3**
Meets Standard (>1.4 meters)	Yes	Yes	Yes	No	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **South Lindstrom Lake**



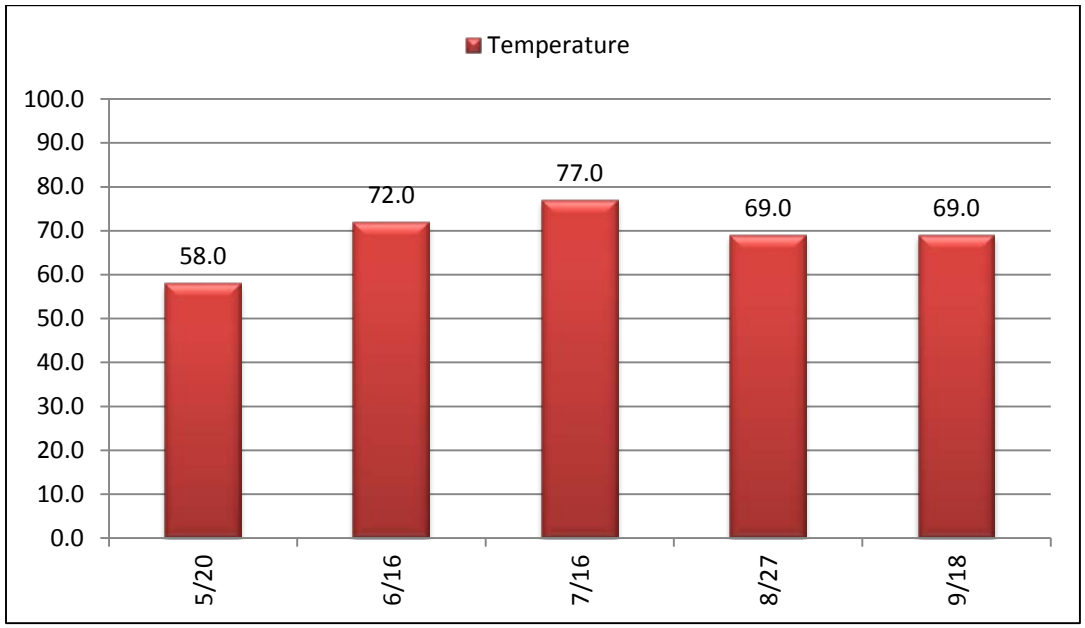
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	26.0	38.0	34.6	53.0	42.6	36.2	**33.2**
Grade	B	C	C	C	C	C	**C**
Average (June-Sept) µg/L	27.0	38.0	38.5	61.8	46.3	40.3	**34.5**
Meets Standard (40.0 µg/L)	Yes	Yes	Yes	No	No	No	**Yes**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **South Lindstrom Lake**



Average mg/L	
2009	<0.05
2010	<0.05
2011	0.03
2012	0.07
2013	0.04
2014	0.04
2015	0.02

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **South Lindstrom Lake**



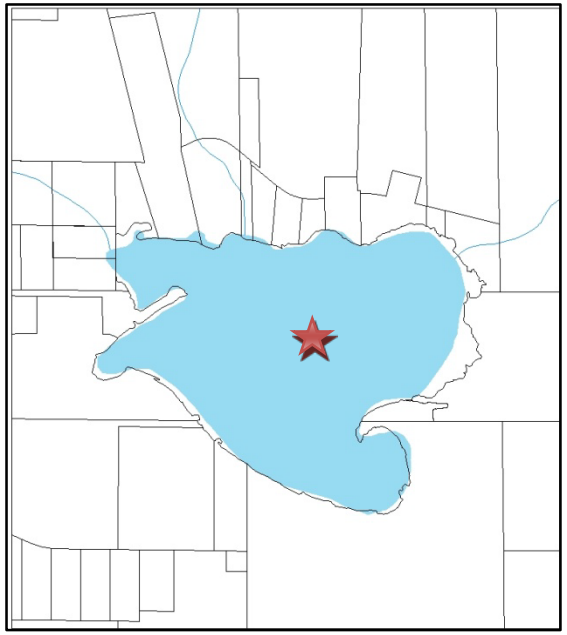
Year	Average ° F
2009	73.2
2010	72.5
2011	66.2
2012	72.6
2013	70.6
2014	69.8
2015	69.0

General Observations | **South Lindstrom Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Macadamia	Curly leaf pondweed recently treated.
June	2	2	Chopstick	Curly leaf pondweed present in shallow areas. Very large percentage of shoreline without vegetation.
July	2.5	2.5	Beach Grass	
August	2.5	2.5	Beach Grass	
September	2.5	2.5	Cornichon	

Little Lake

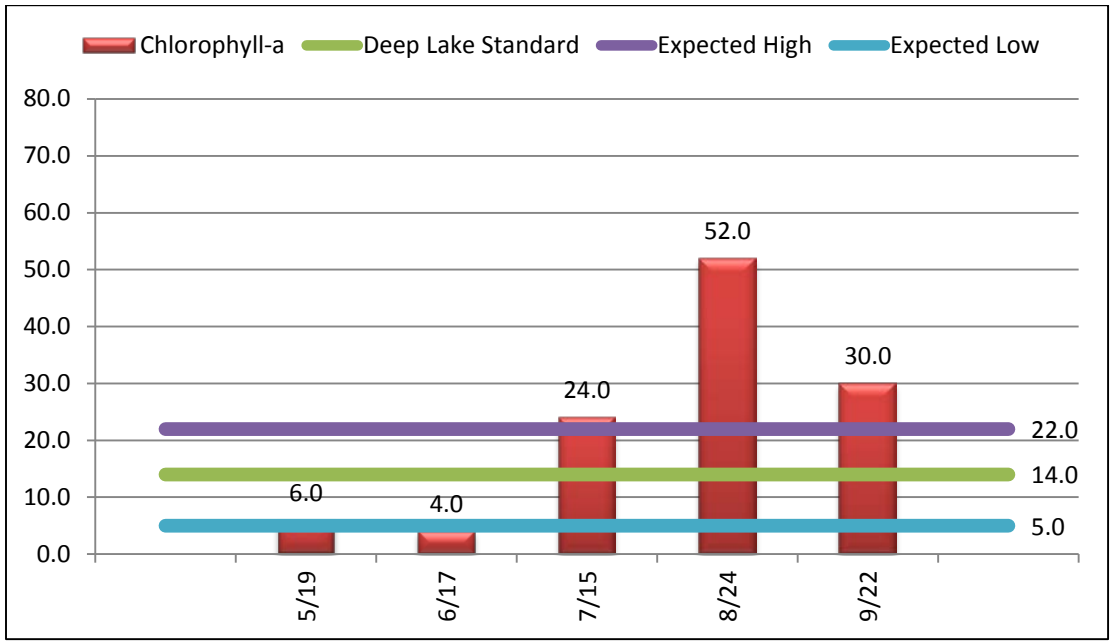
Lake 13-0033-00 Site 201



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Impaired
2015 Ranking	20 of 21

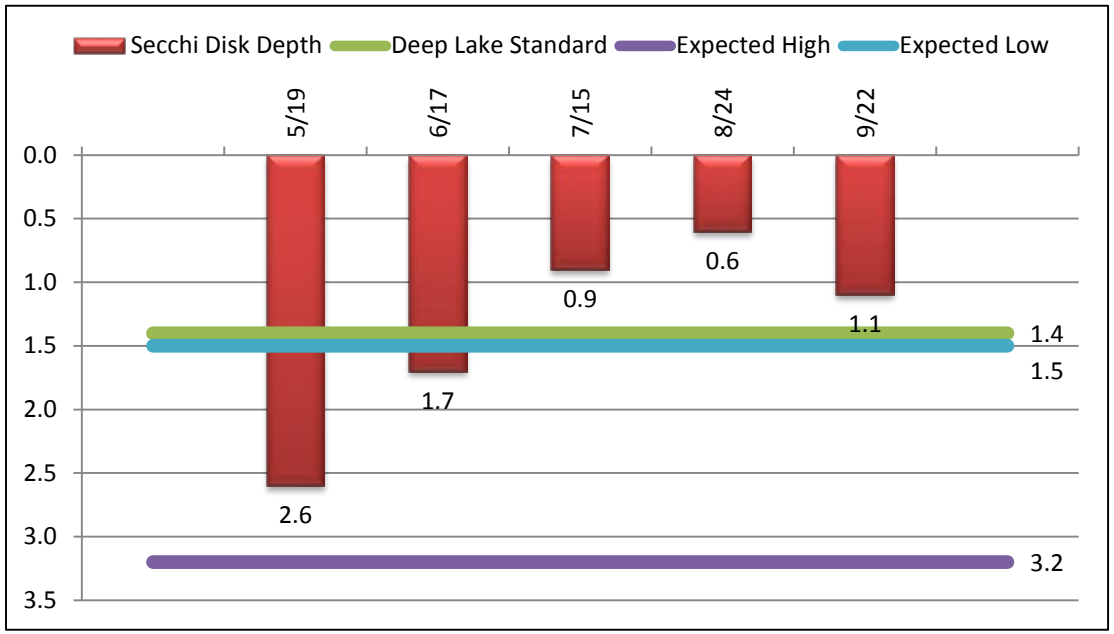
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	61.4	55.4	70.8	62.5
Classification	Eutrophic	Eutrophic	Hyper-eutrophic	Eutrophic
2015 Average (May-Sept)	23.2 µg/L	1.4 meters	101.4 µg/L	-----
Grade	C	C	D	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	27.5 µg/L	1.1 meters	110.0 µg/L	-----
Meets Standard	No	No	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **Little Lake**



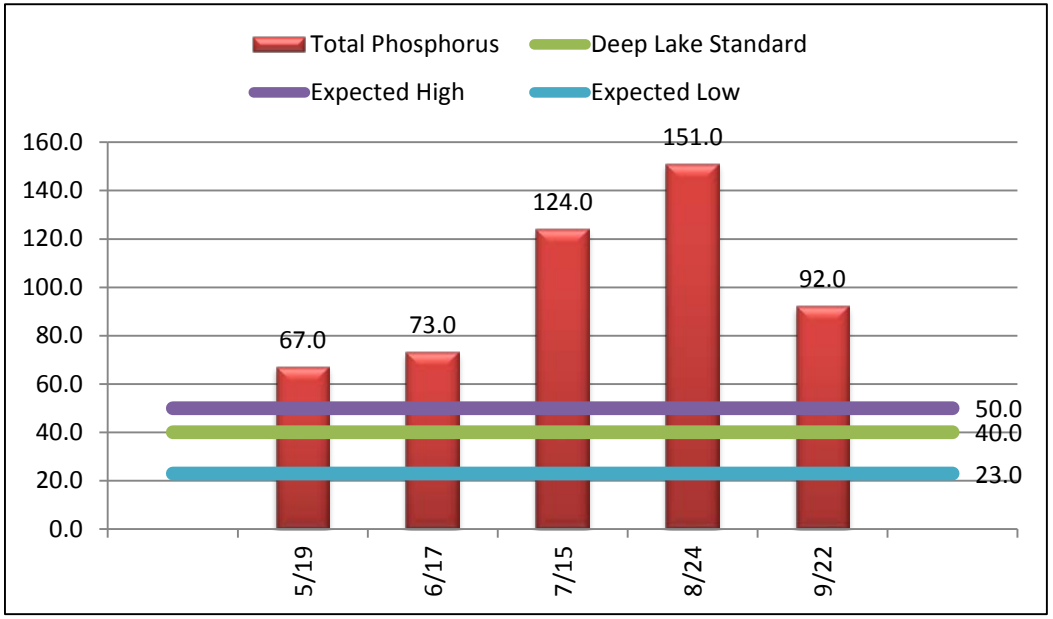
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	43.2	49.0	38.8	26.0	**23.2**
Grade	-----	-----	C	D	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	52.5	60.3	48.0	27.0	**27.5**
Meets Standard (14.0 µg/L)	-----	-----	No	No	No	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **Little Lake**



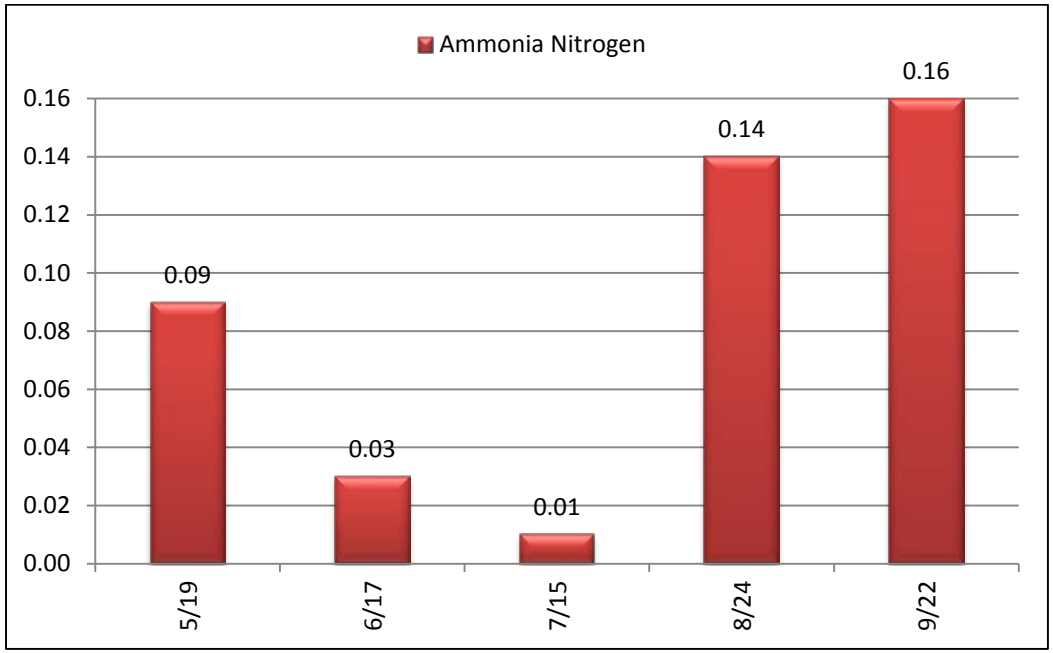
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	1.2	1.8	1.5	1.1	**1.4**
Grade	-----	-----	C-D	D	C	D	**C**
Average (June-Sept) meters	No Data	No Data	0.9	0.9	1.2	1.2	**1.1**
Meets Standard (>1.4 meters)	-----	-----	No	No	No	No	**No**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **Little Lake**



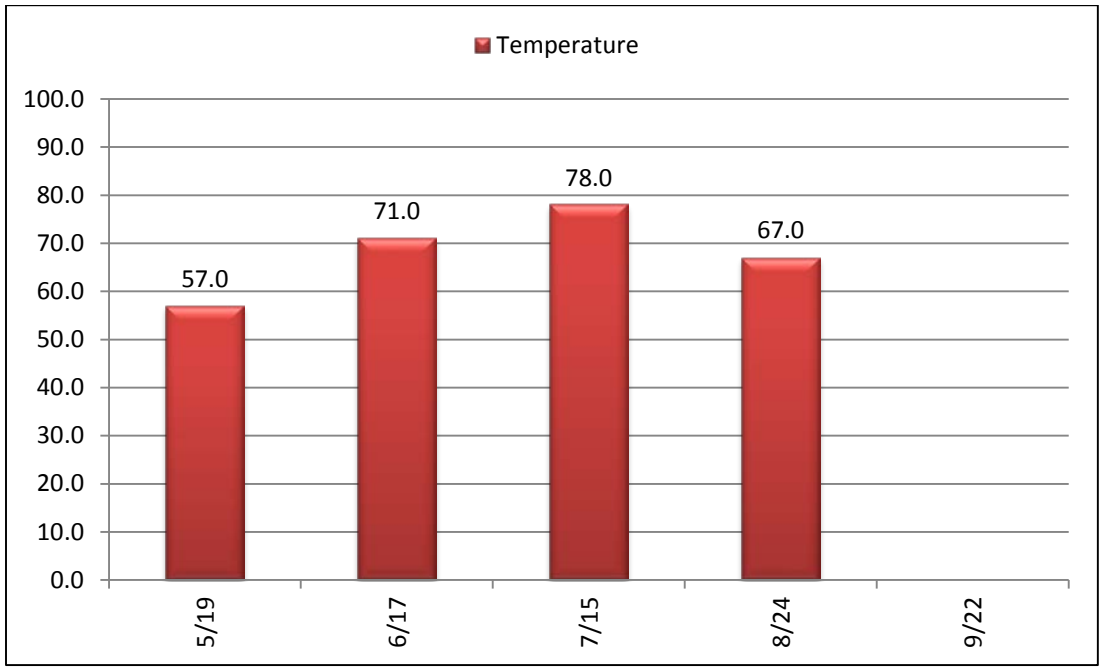
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	117.0	92.0	73.2	109.0	**101.4**
Grade	-----	-----	D	D	D	D	**D**
Average (June-Sept) µg/L	No Data	No Data	125.5	102.5	75.5	118.0	**110.0**
Meets Standard (40.0 µg/L)	-----	-----	No	No	No	No	**No**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **Little Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	0.24
2012	0.15
2013	0.05
2014	0.06
2015	0.09

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **Little Lake**



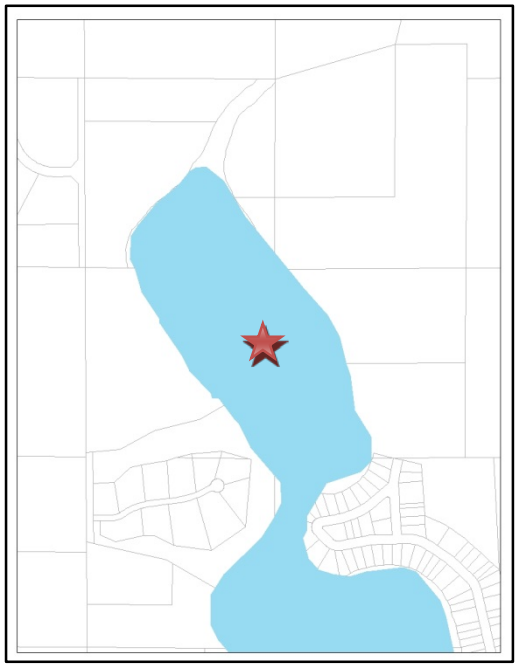
Year	Average ° F
2009	No Data
2010	No Data
2011	61.6
2012	70.8
2013	76.6
2014	69.6
2015	68.3

General Observations | **Little Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Bamboo	
June	2.5	2.5	Dried Chamomile	
July	3	3	Beach Grass	
August	3	3	Cornichon	
September	3.5	3.5	Cornichon	

Mandall Lake

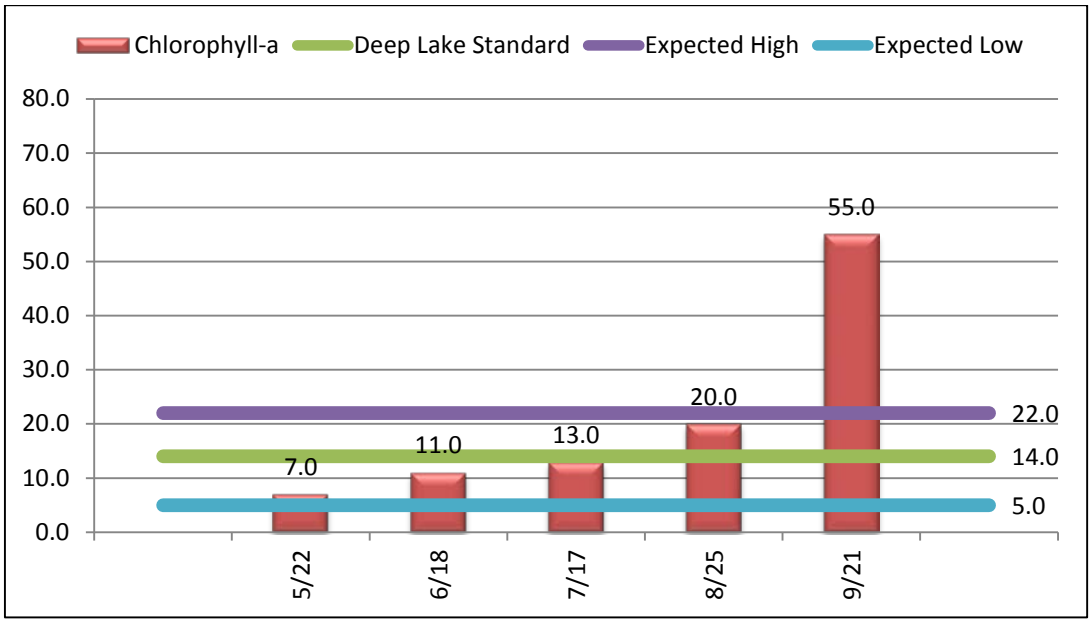
Lake 13-0074-00 Site 201



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No *Not assessed for 303(d) impairment status
2015 Ranking	14 of 21

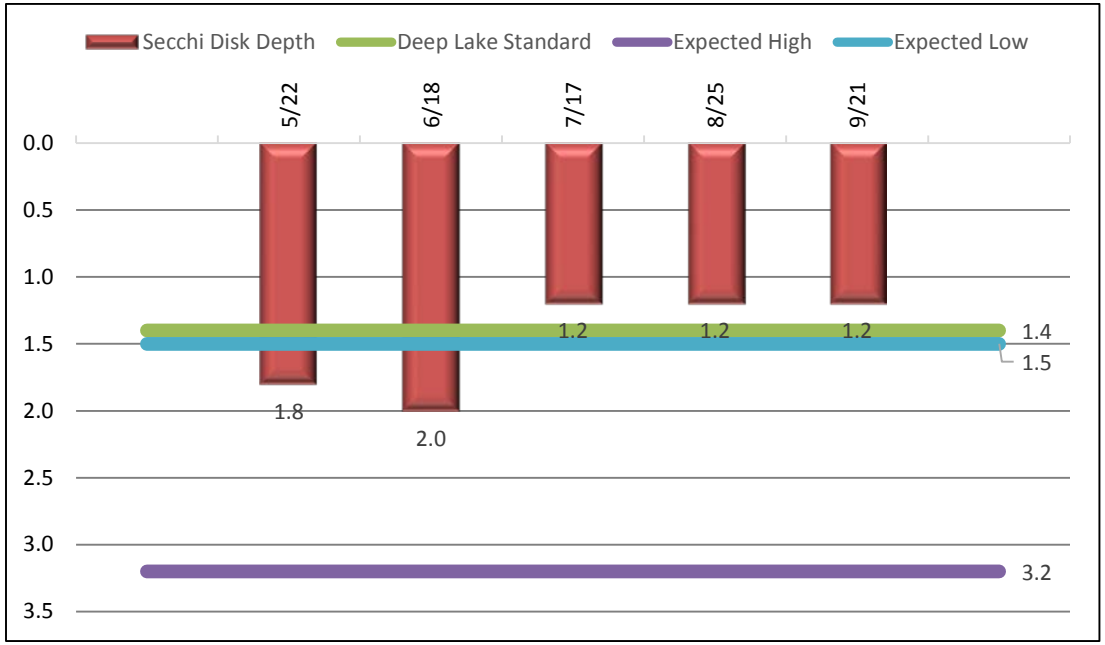
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	60.6	54.4	61.9	59.0
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	21.2 µg/L	1.5 meters	55.0 µg/L	-----
Grade	C	C	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1.0 meter	60.0 µg/L	-----
2015 Average (June-Sept)	24.8 µg/L	1.4 meters	58.8 µg/L	-----
Meets Standard	No	Yes	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **Mandall Lake**



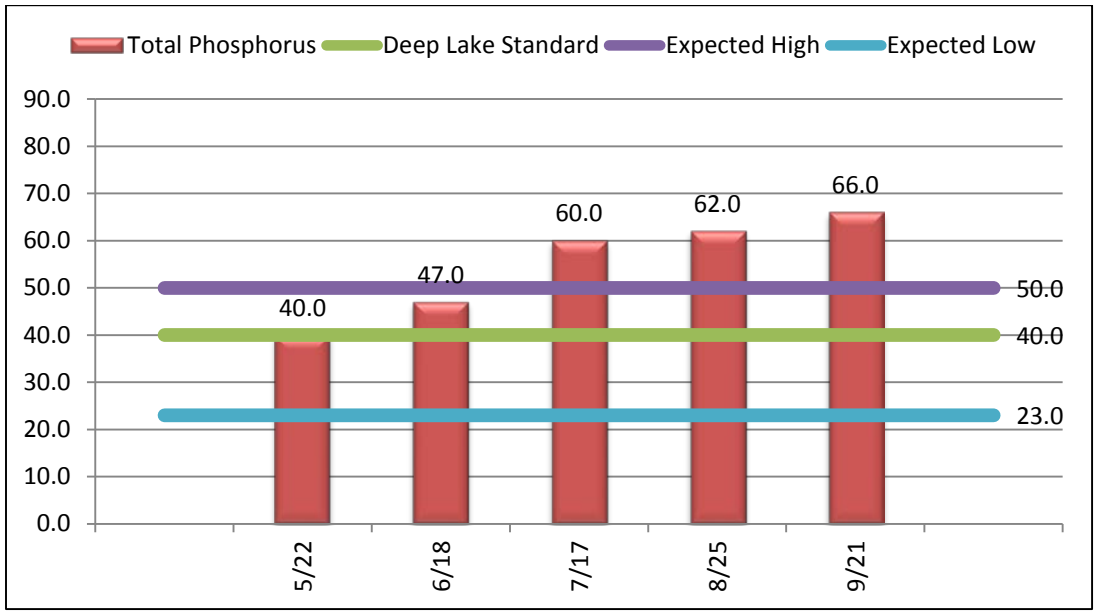
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	29.2	**21.2**
Grade	-----	-----	-----	-----	-----	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	32.3	**24.8**
Meets Standard (20.0 µg/L)	-----	-----	-----	-----	-----	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **Mandall Lake**



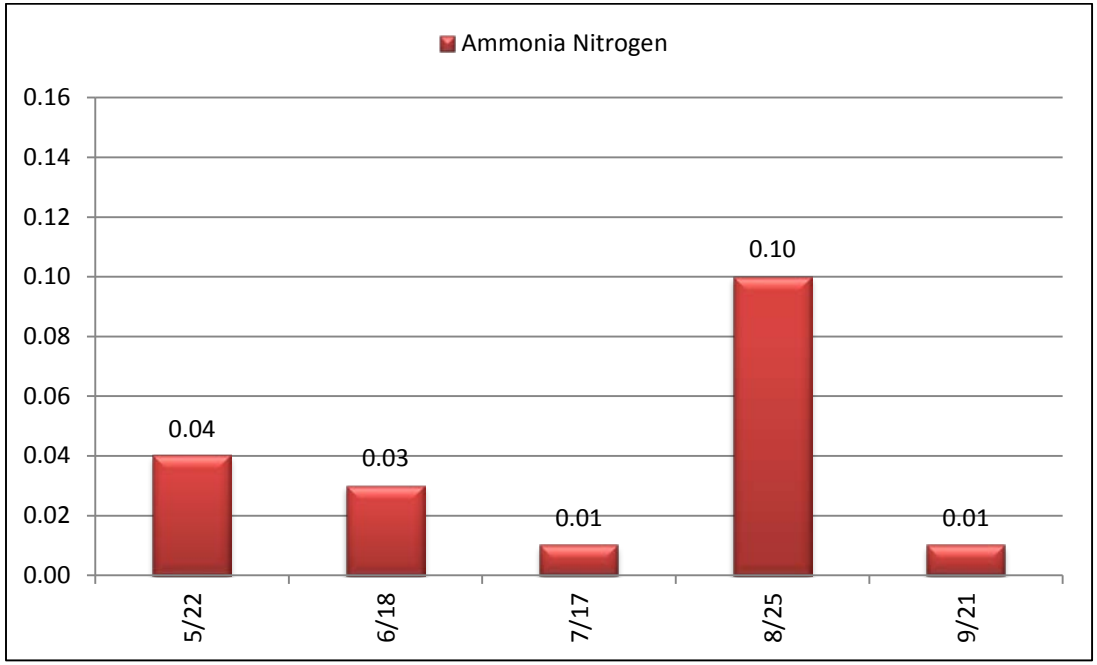
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	No Data	No Data	0.9	**1.5**
Grade	-----	-----	-----	-----	-----	D	**C**
Average (June-Sept) meters	No Data	No Data	No Data	No Data	No Data	0.9	**1.4**
Meets Standard (>1.0 meter)	-----	-----	-----	-----	-----	No	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **Mandall Lake**



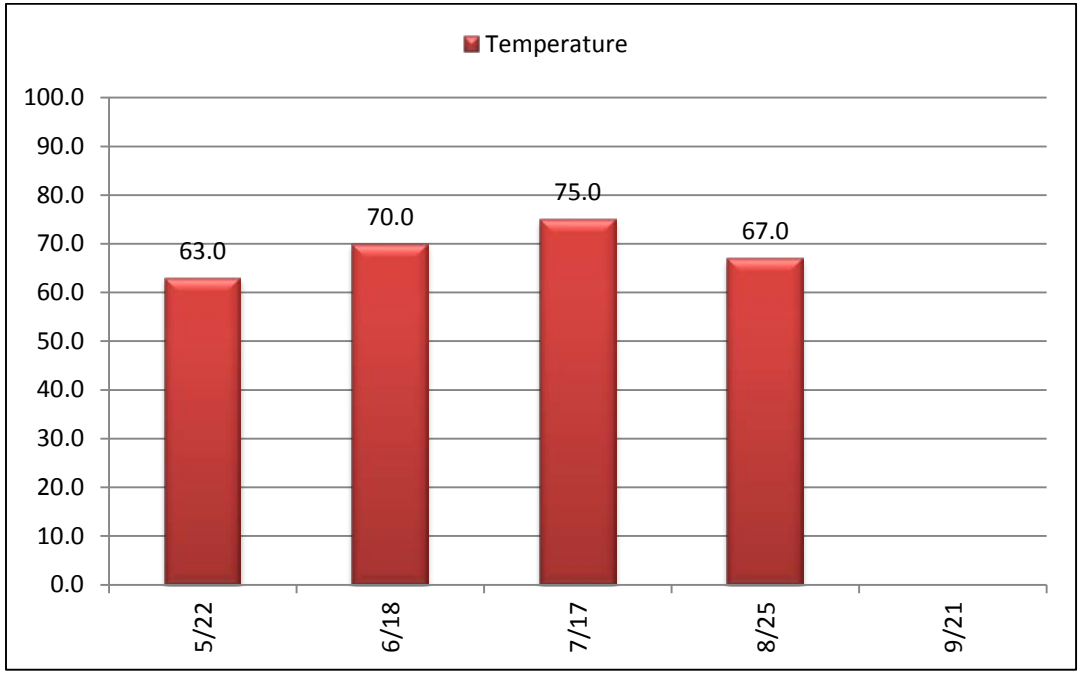
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	89.8	**55.0**
Grade	-----	-----	-----	-----	-----	D	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	94.3	**58.8**
Meets Standard (60.0 µg/L)	-----	-----	-----	-----	-----	No	**No**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **Mandall Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	0.04
2015	0.04

Surface Water Temperature |Expected Range: None |Shallow Lake Standard: None | **Mandall Lake**



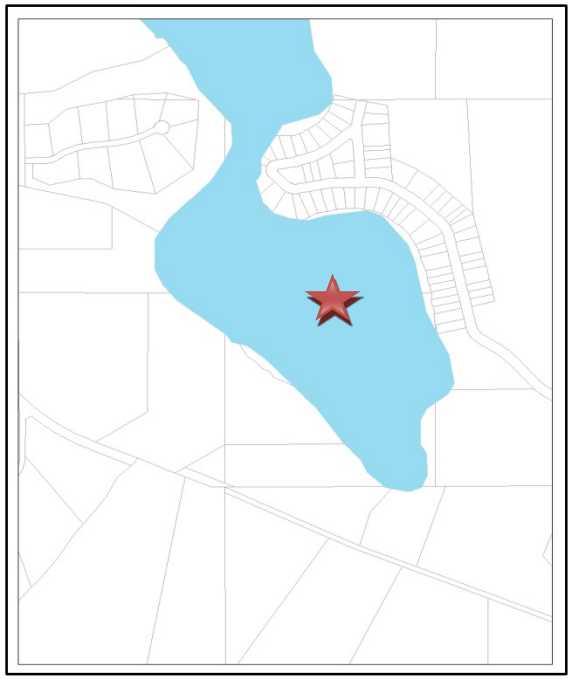
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	70.4
2015	68.8

General Observations | **Mandall Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Toasted Marshmallow	Curly leaf pondweed surfacing.
June	2.5	2.5	Beach Grass	Curly leaf pondweed present in shallow areas.
July	3	3	Beach Grass	
August	3	3	Dried Chamomile	
September	2.5	2.5	Dried Chamomile	

Rabour Lake

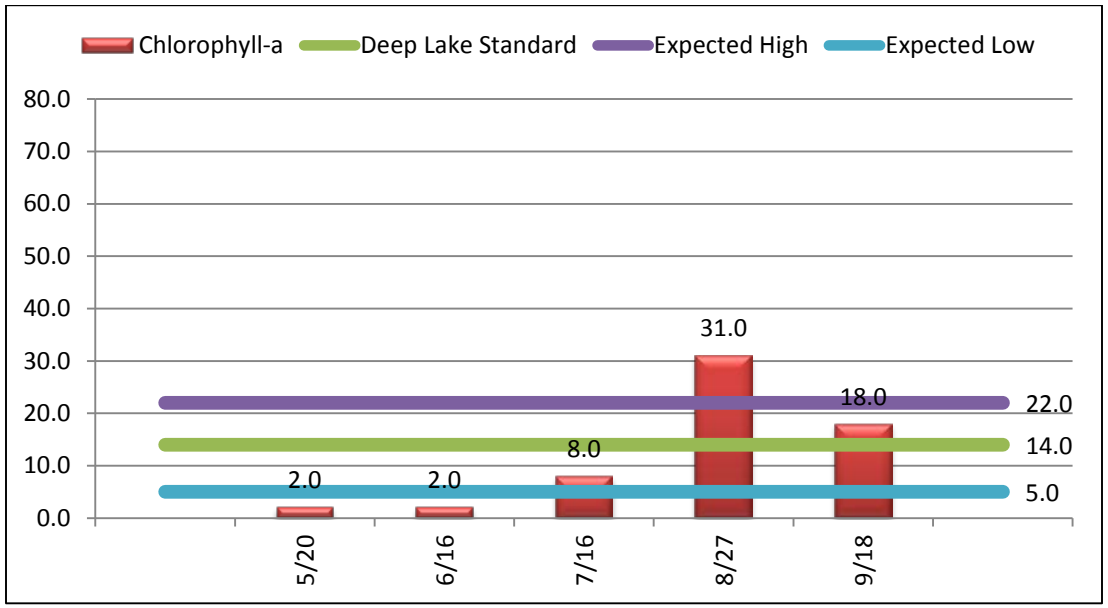
Lake 13-0079-00 Site 201



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No *Not assessed for 303(d) impairments list
2015 Ranking	17 of 21

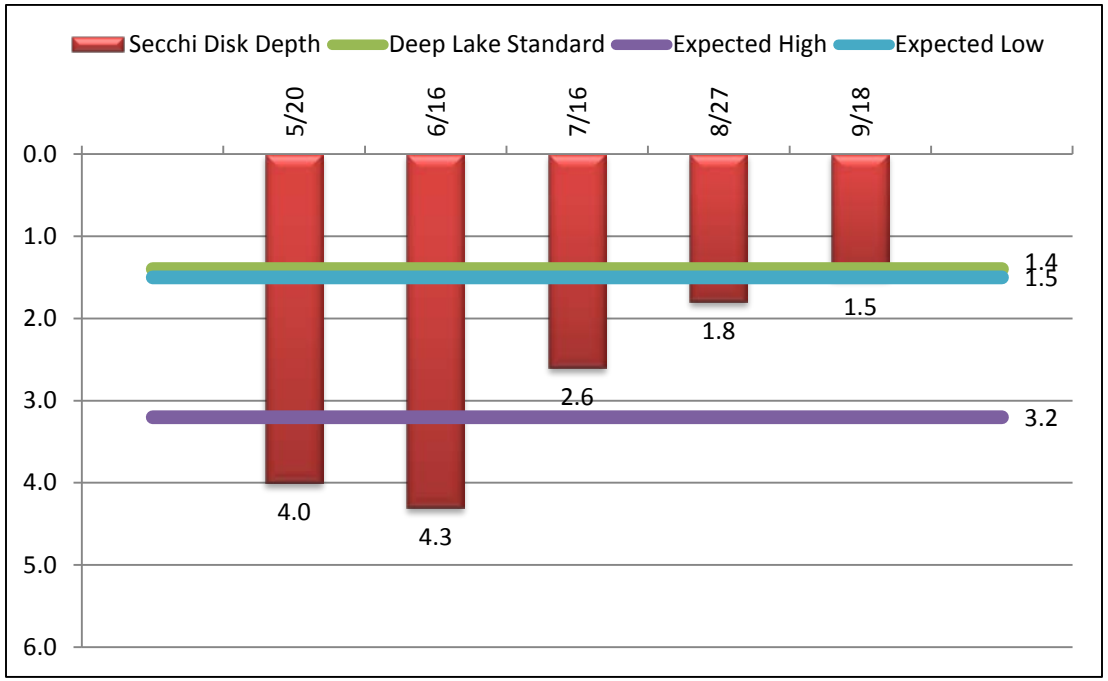
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	63.4	53.1	64.4	60.3
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	28.4 µg/L	1.6 meters	65.4 µg/L	-----
Grade	C	C	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1.0 meter	60.0 µg/L	-----
2015 Average (June-Sept)	33.0 µg/L	1.5 meters	68.0 µg/L	-----
Meets Standard	No	Yes	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **Rabour Lake**



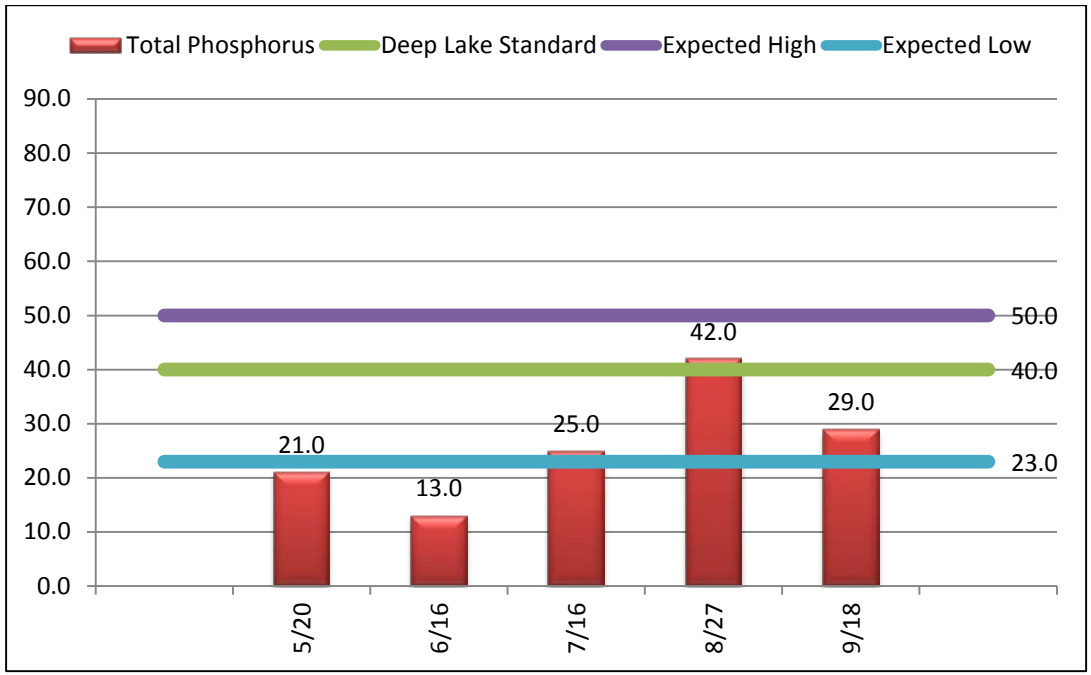
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	23.4	**28.4**
Grade	-----	-----	-----	-----	-----	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	26.3	**33.0**
Meets Standard (20.0 µg/L)	-----	-----	-----	-----	-----	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **Rabour Lake**



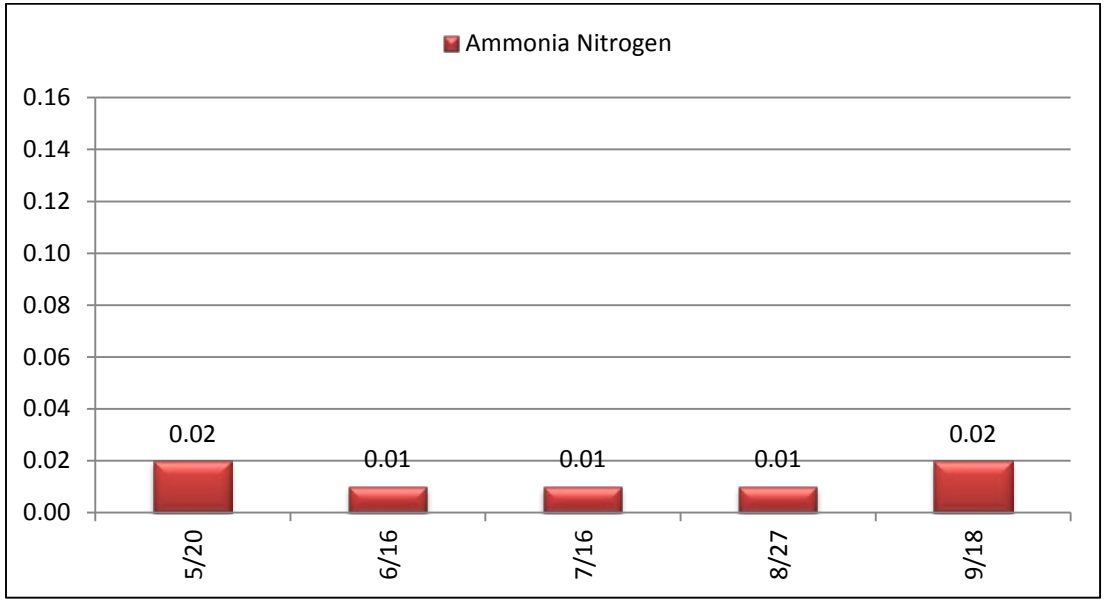
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	No Data	No Data	0.9	**1.6**
Grade	-----	-----	-----	-----	-----	D	**C**
Average (June-Sept) meters	No Data	No Data	No Data	No Data	No Data	0.8	**1.5**
Meets Standard (>1.0 meter)	-----	-----	-----	-----	-----	No	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **Rabour Lake**



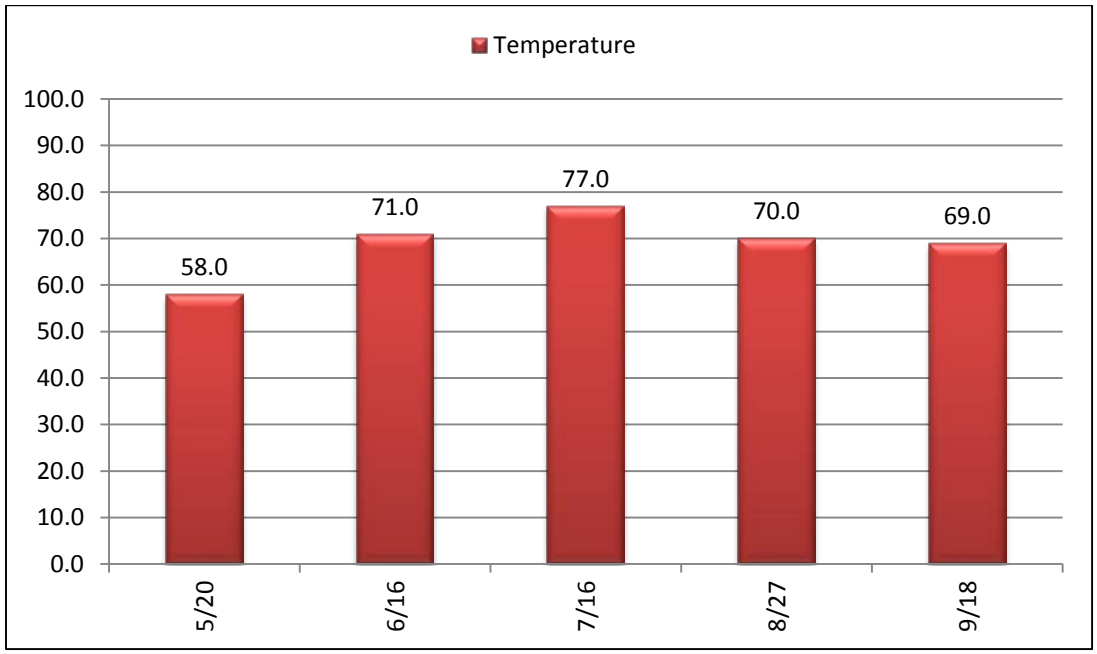
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	84.2	**65.4**
Grade	-----	-----	-----	-----	-----	D	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	No Data	No Data	90.5	**68.0**
Meets Standard (60.0 µg/L)	-----	-----	-----	-----	-----	No	**No**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **Rabour Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	0.03
2015	0.05

Surface Water Temperature |Expected Range: None |Shallow Lake Standard: None | **Rabour Lake**



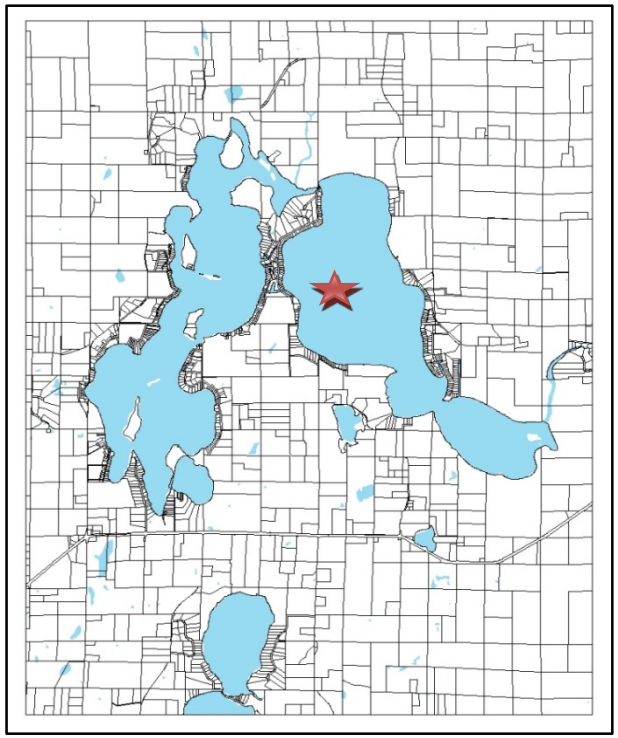
Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	70.8
2015	68.3

General Observations | **Rabour Lake**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Toasted Marshmallow	Curly leaf pondweed surfacing.
June	2.5	2.5	Malted	Curly leaf pondweed present in shallow areas.
July	3	3	Dried Chamomile	
August	3	3	Cornucopia	
September	2.5	2.5	Parchment Paper	

East Rush Lake

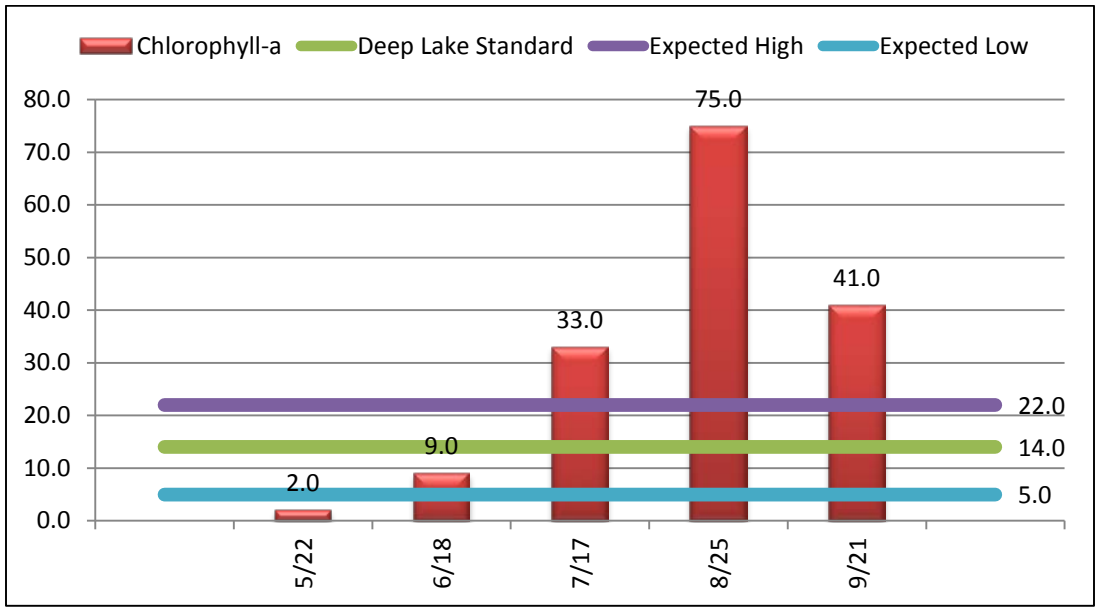
Lake 13-0069-01 Site 207



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Impaired
2015 Ranking	19 of 21

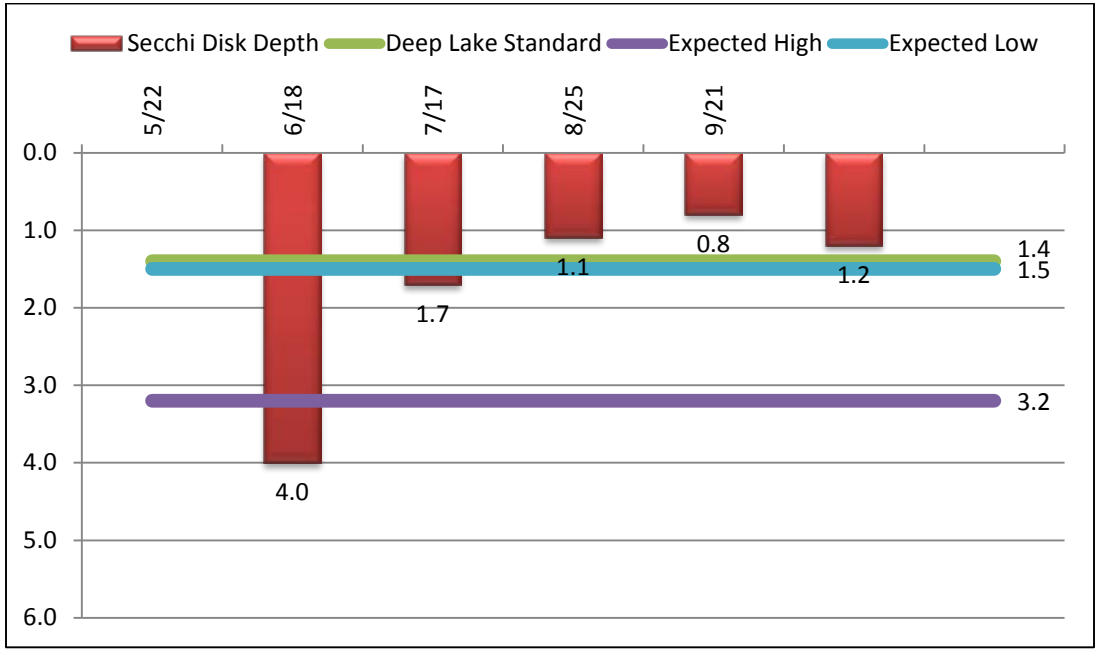
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	64.6	51.9	68.5	61.6
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	32.0 µg/L	1.8 meters	86.4 µg/L	-----
Grade	C	C	D	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	39.5 µg/L	1.2 meters	75.5 µg/L	-----
Meets Standard	No	No	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **East Rush Lake**



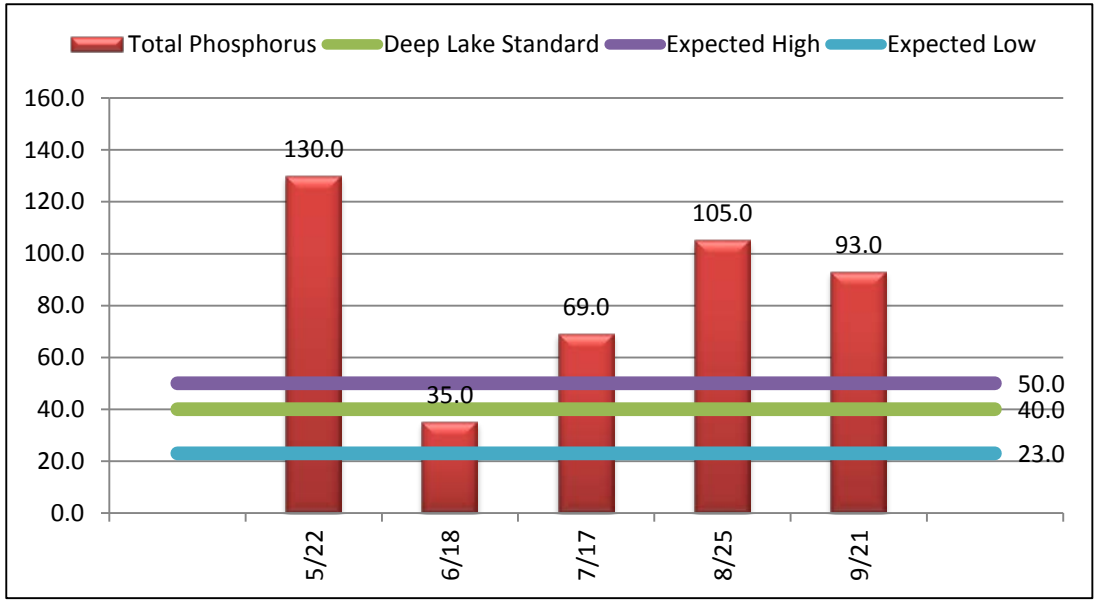
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	54.4	40.4	31.6	**32.0**
Grade	-----	-----	-----	D	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	65.5	49.0	35.8	**39.5**
Meets Standard (14.0 µg/L)	-----	-----	-----	No	No	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **East Rush Lake**



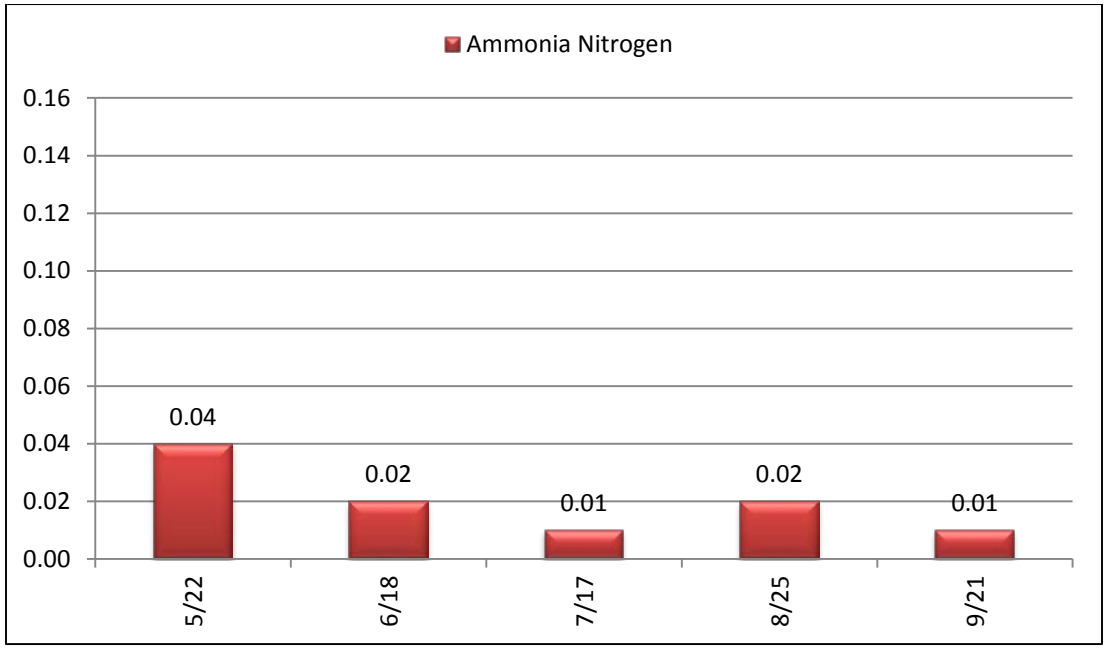
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	0.8	1.5	1.0	**1.8**
Grade	-----	-----	-----	D	C	D	**C**
Average (June-Sept) meters	No Data	No Data	No Data	0.7	1.3	0.9	**1.2**
Meets Standard (>1.4 meters)	-----	-----	-----	No	No	No	**No**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **East Rush Lake**



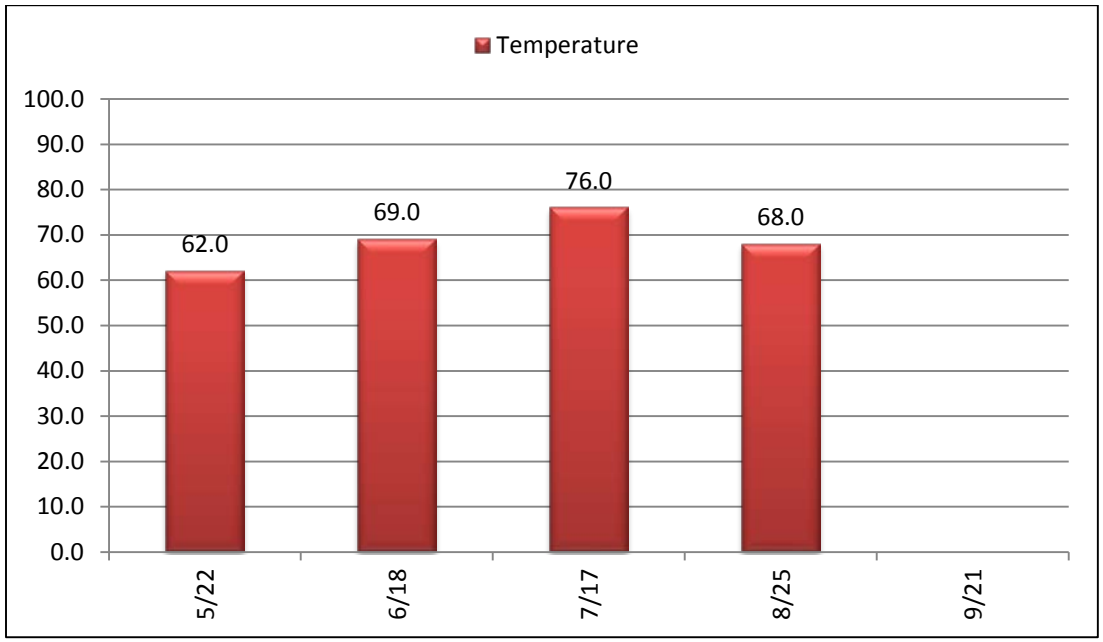
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	90.0	89.0	97.2	**86.4**
Grade	-----	-----	-----	D	D	D	**D**
Average (June-Sept) µg/L	No Data	No Data	No Data	101.3	97.3	110.0	**75.5**
Meets Standard (40.0 µg/L)	-----	-----	-----	No	No	No	**No**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **East Rush Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.07
2013	0.05
2014	0.04
2015	0.02

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **East Rush Lake**

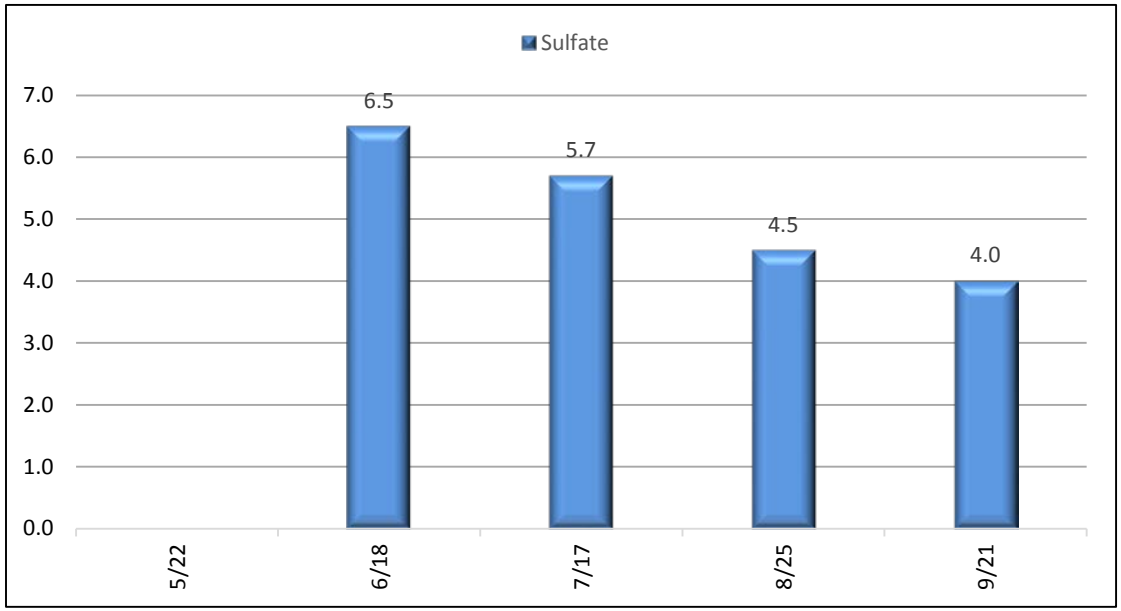


Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	70.6
2013	73.0
2014	70.6
2015	68.8

General Observations | **East Rush Lake**

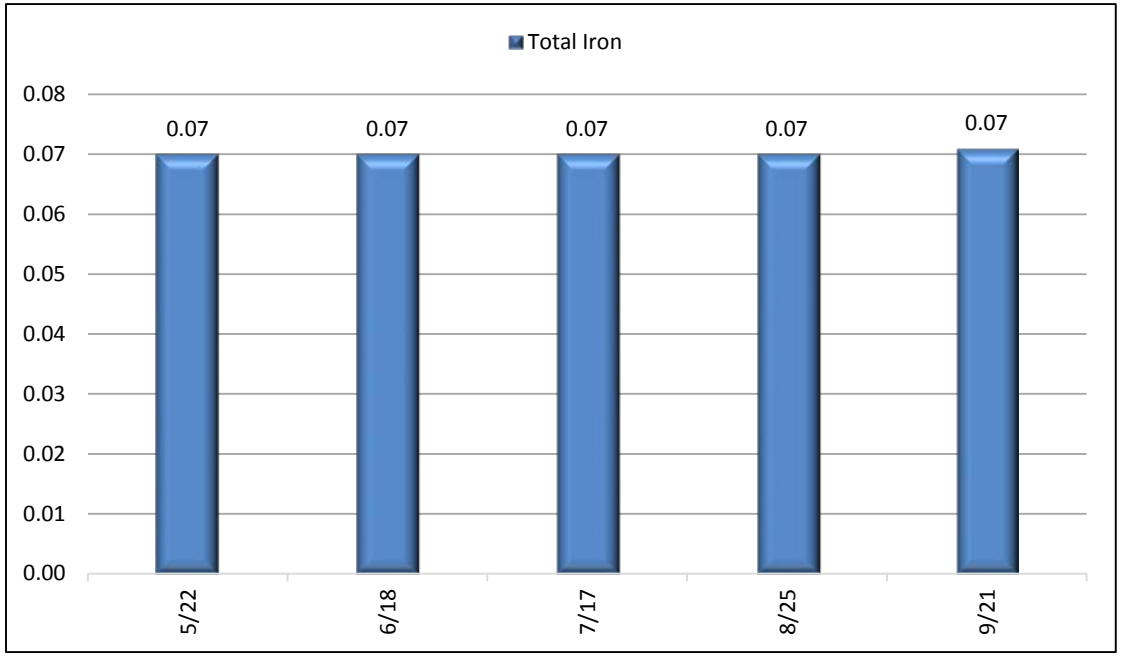
Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Macadamia	
June	2.5	2.5	Dune	Curly leaf pondweed present in shallow areas.
July	3.5	3.5	Cornichon	
August	4	4	Cornichon	
September	4	4	Mossy Rock	

Sulfate | Expected Range: None |Deep Lake Standard: None | **East Rush Lake**



Year	Average mg/L
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	No Data
2015	5.18

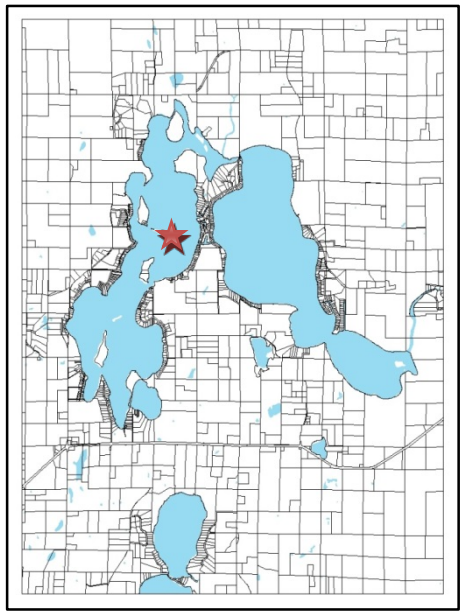
Total Iron | Expected Range: None |Deep Lake Standard: None | **East Rush Lake**



Year	Average mg/L
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	No Data
2015	0.07

West Rush Lake

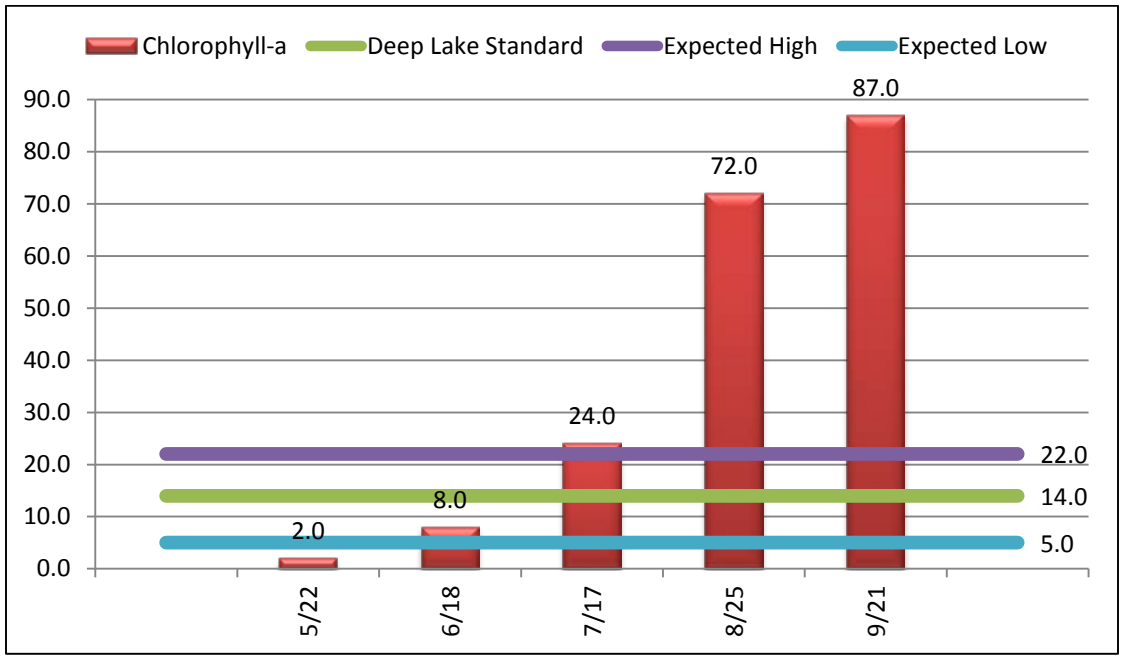
Lake 13-0069-02 Site 204



2015 Report Card: Deep Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	No Impaired
2015 Ranking	18 of 21

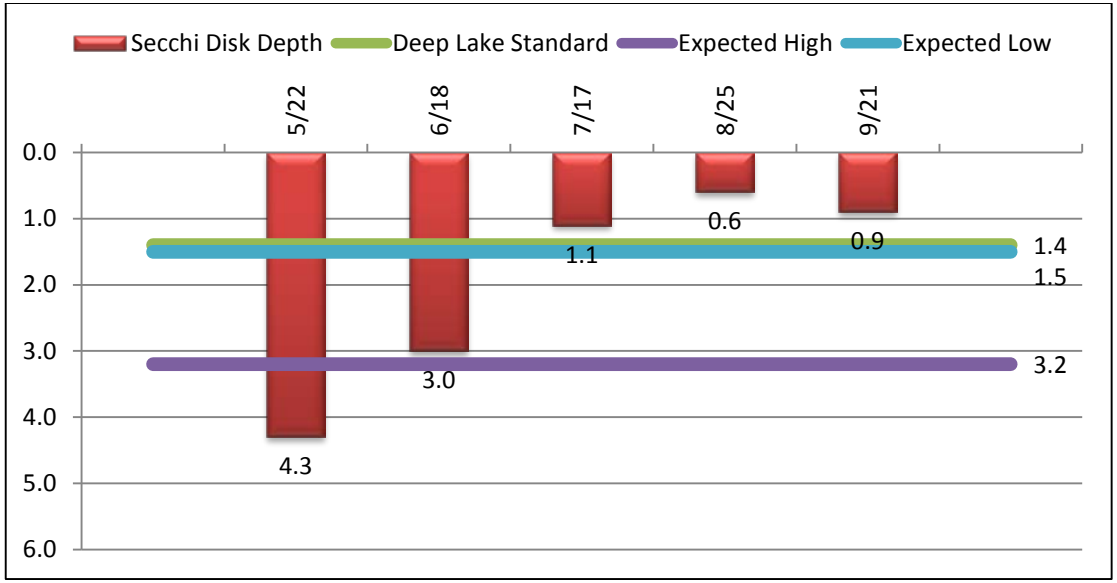
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	66.4	50.2	65.3	60.6
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	38.6 µg/L	2.0 meters	69.6 µg/L	-----
Grade	C	C	D	C
MPCA Standard (Deep)	14.0 µg/L	>1.4 meters	40.0 µg/L	-----
2015 Average (June-Sept)	47.8 µg/L	1.4 meters	81.3 µg/L	-----
Meets Standard	No	No	No	No

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Deep Lake Standard: 14.0 µg/L | **West Rush Lake**



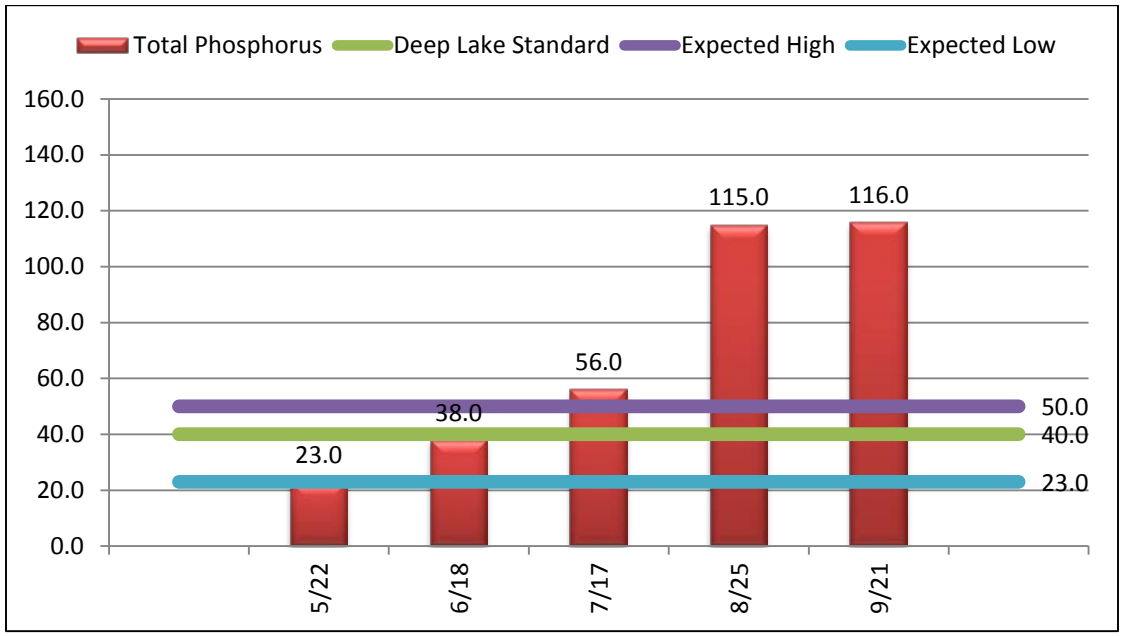
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	57.2	47.6	33.0	**38.6**
Grade	-----	-----	-----	D	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	67.8	59.3	39.8	**47.8**
Meets Standard (14.0 µg/L)	-----	-----	-----	No	No	No	**No**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Deep Lake Standard: >1.4 meters | **West Rush Lake**



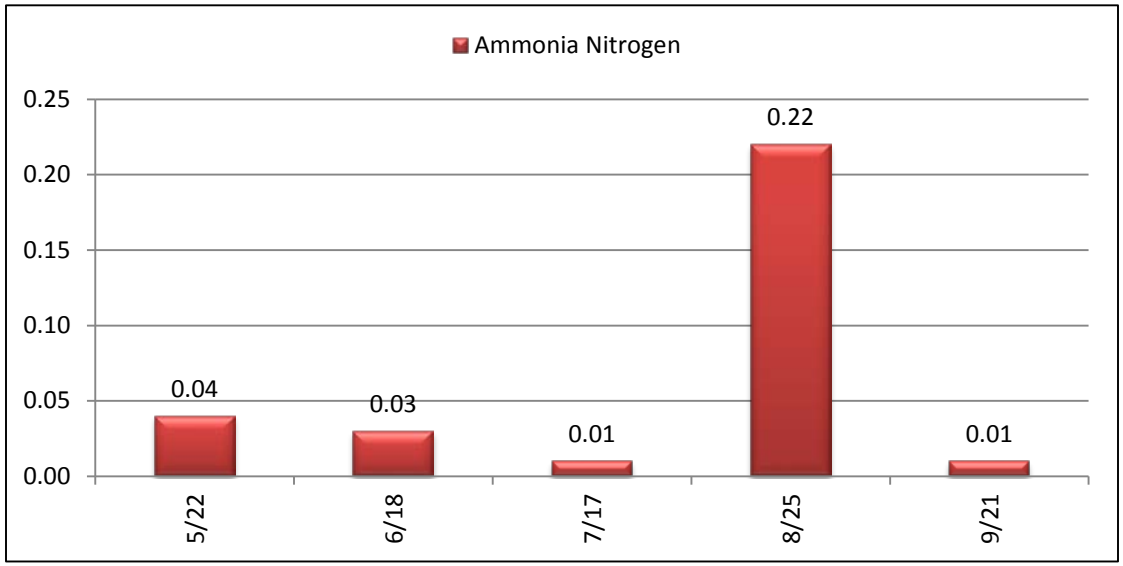
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	0.9	2.0	1.2	**2.0**
Grade	-----	-----	-----	D	C	C-D	**C**
Average (June-Sept) meters	No Data	No Data	No Data	0.7	0.9	1.0	**1.4**
Meets Standard (>1.4 meters)	-----	-----	-----	No	No	No	**No**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Deep Lake Standard: 40.0 µg/L | **West Rush Lake**



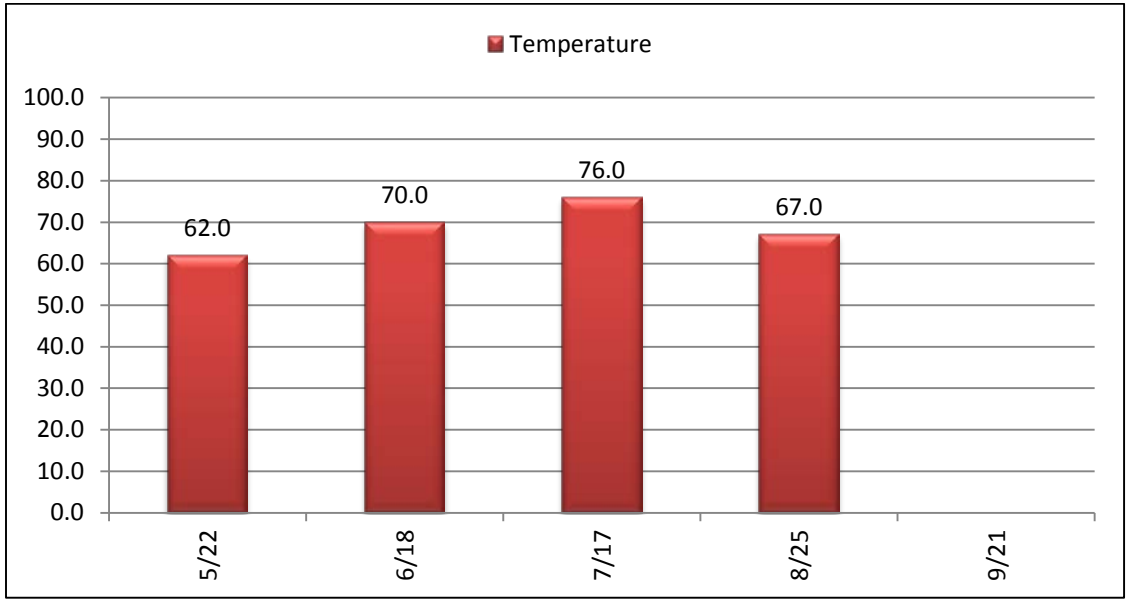
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	80.0	70.8	82.2	**69.6**
Grade	-----	-----	-----	D	D	D	**D**
Average (June-Sept) µg/L	No Data	No Data	No Data	88.0	77.5	92.0	**81.3**
Meets Standard (40.0 µg/L)	-----	-----	-----	No	No	No	**No**

Ammonia Nitrogen | Expected Range: None | Deep Lake Standard: None | **West Rush Lake**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.10
2013	0.07
2014	0.04
2015	0.06

Surface Water Temperature |Expected Range: None |Deep Lake Standard: None | **West Rush Lake**

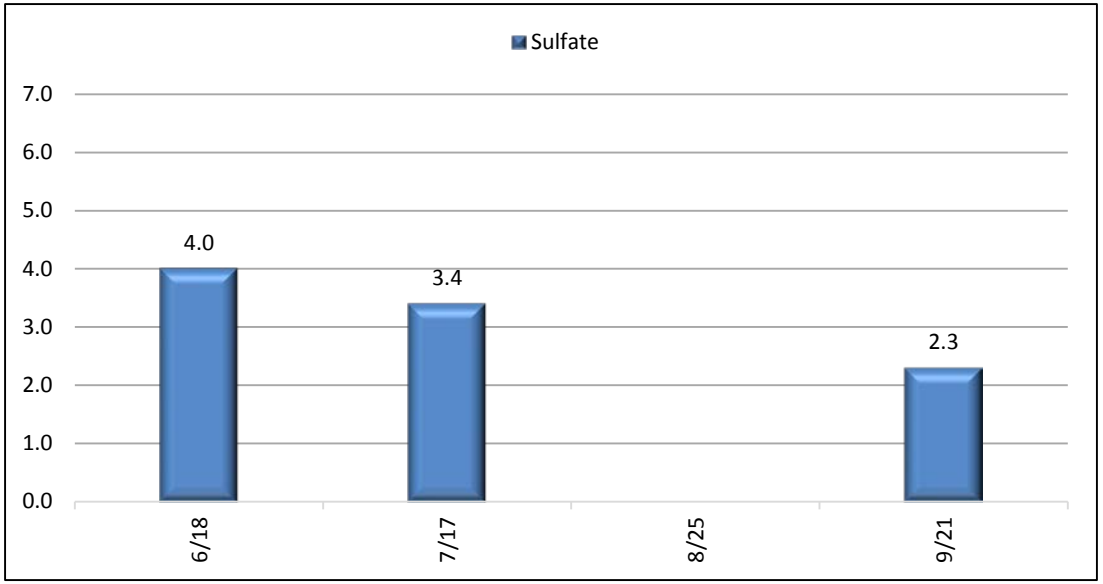


Year	Average °F
2009	No Data
2010	No Data
2011	No Data
2012	70.6
2013	74.2
2014	70.6
2015	68.8

General Observations | **West Rush Lake**

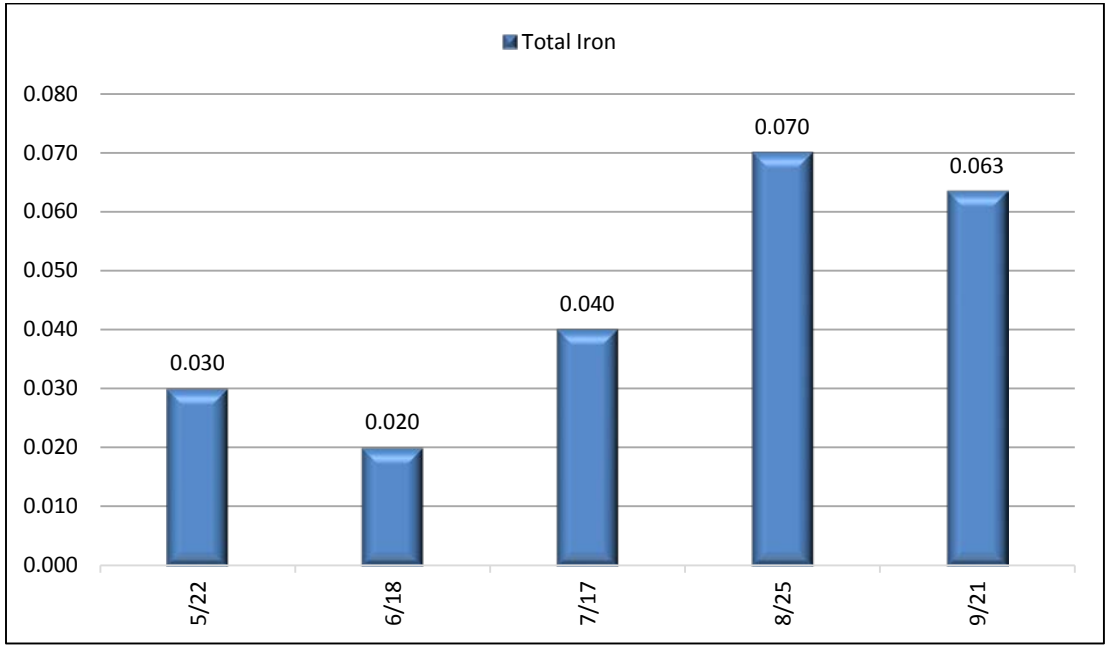
Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Chop Stick	Curly leaf pondweed active.
June	2.5	2.5	Beach Grass	Curly leaf pondweed present in shallow areas.
July	3.5	3.5	Cornichon	
August	4	4	Cornichon	
September	4	4	Cornichon	

Sulfate | Expected Range: None |Deep Lake Standard: None | **West Rush Lake**



Year	Average mg/L
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	No Data
2015	3.2

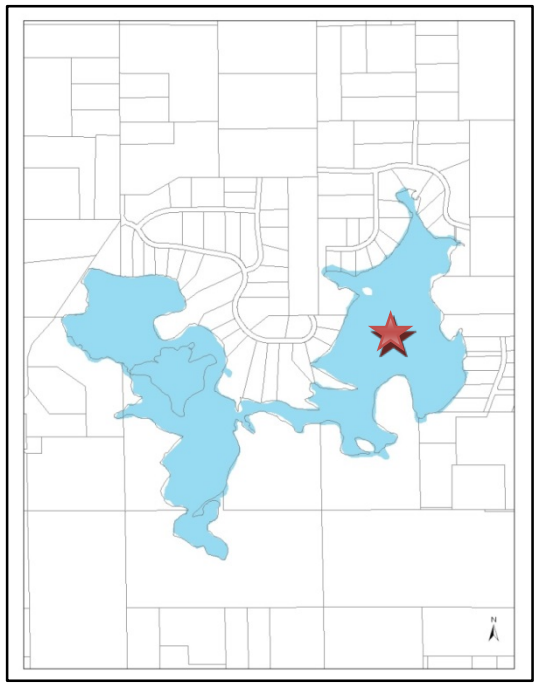
Total Iron | Expected Range: None |Deep Lake Standard: None | **West Rush Lake**



Year	Average mg/L
2009	No Data
2010	No Data
2011	No Data
2012	No Data
2013	No Data
2014	No Data
2015	0.05

Spider Lake-East

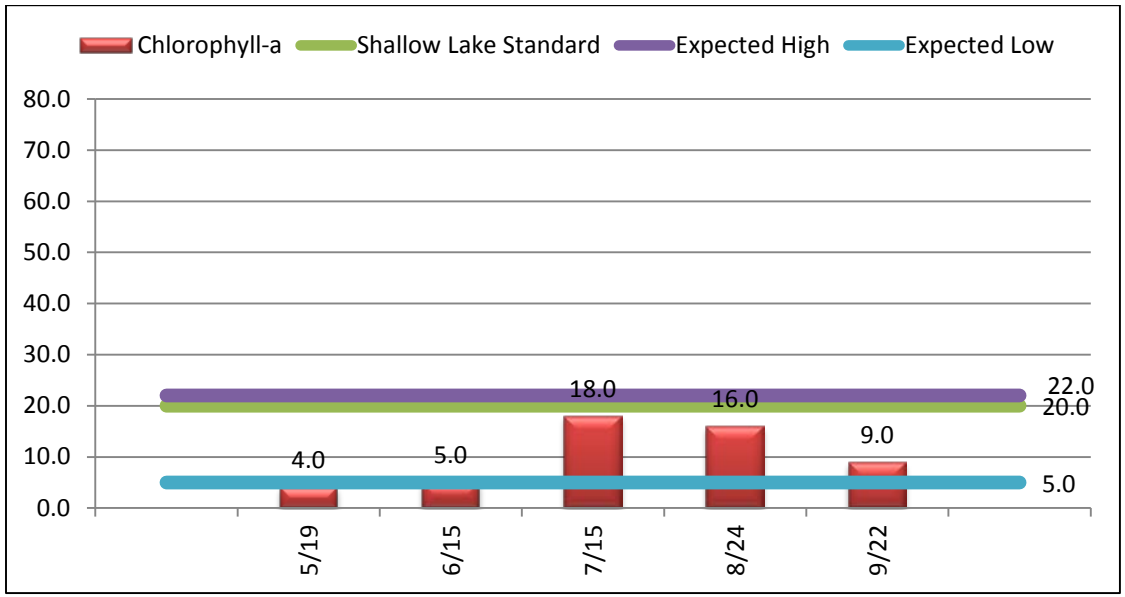
Lake 13-0019-00 Site 202



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	C
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	8 of 21

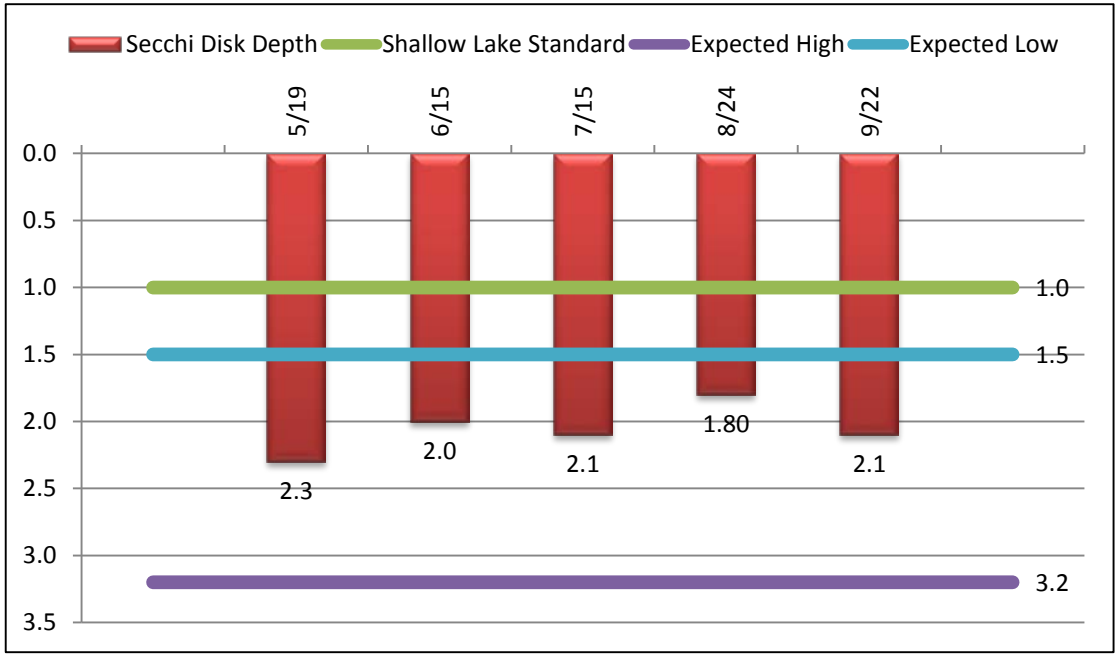
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	53.6	49.6	57.7	53.6
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	10.4 µg/L	2.1 meters	41.0 µg/L	-----
Grade	B	C	C	C
MPCA Standard (Shallow)	20.0 µg/L	>1.0 meter	60.0 µg/L	-----
2015 Average (June-Sept)	12.0 µg/L	2.0 meters	42.5 µg/L	-----
Meets Standard	Yes	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **Spider Lake-East**



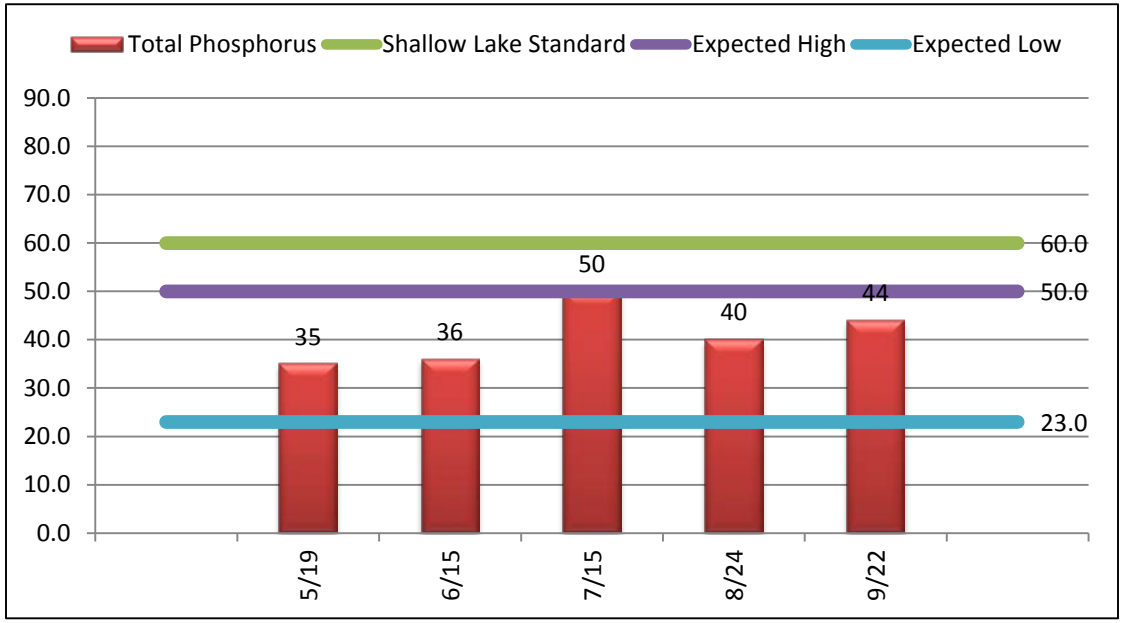
	2009	2010	2011	2012	2013	2014	
Average (May-Sept) µg/L	No Data	No Data	16.4	23.8	12.0	3.8	**10.4**
Grade	-----	-----	B	C	B	A	**B**
Average (June-Sept) µg/L	No Data	No Data	17.0	25.5	12.5	4.0	**12.0**
Meets Standard (20.0 µg/L)	-----	-----	Yes	No	Yes	Yes	**Yes**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **Spider Lake-East**



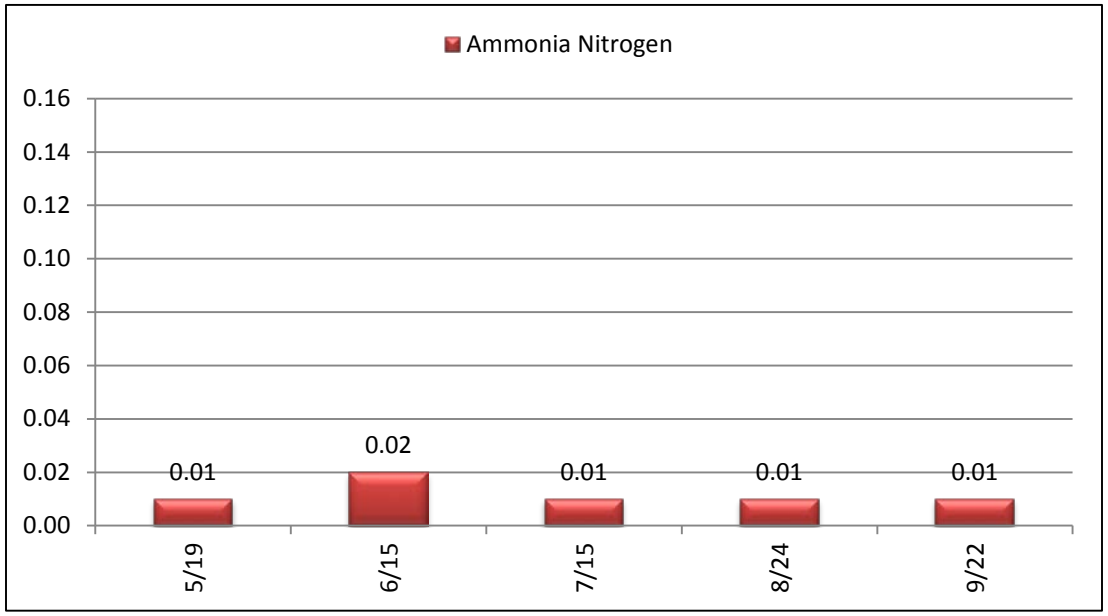
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	1.2	0.9	1.6	2.1	**2.1**
Grade	-----	-----	C	D	C	C	**C**
Average (June-Sept) meters	No Data	No Data	1.2	0.9	1.7	2.1	**2.0**
Meets Standard (>1.0 meter)	-----	-----	Yes	No	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **Spider Lake-East**



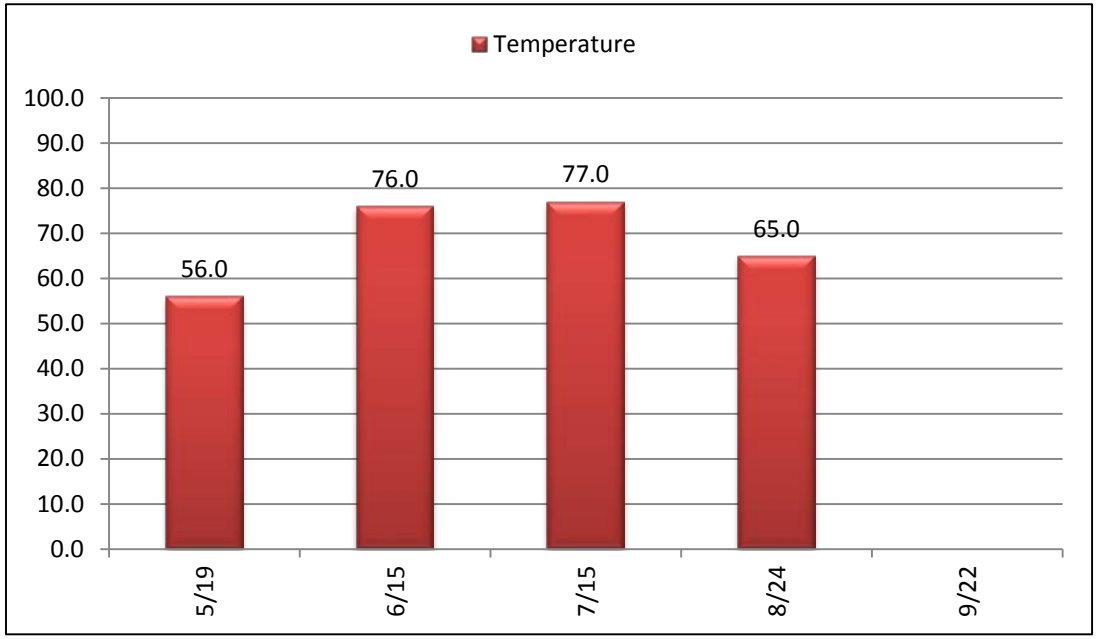
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	55.0	62.4	43.6	46.0	**41.0**
Grade	-----	-----	C	C	C	C	**C**
Average (June-Sept) µg/L	No Data	No Data	52.0	56.8	40.0	42.5	**42.5**
Meets Standard (60.0 µg/L)	-----	-----	Yes	Yes	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **Spider Lake-East**



Average mg/L	
2009	No Data
2010	No Data
2011	0.04
2012	0.07
2013	0.02
2014	0.03
2015	0.01

Surface Water Temperature |Expected Range: None |Shallow Lake Standard: None | **Spider Lake-East**



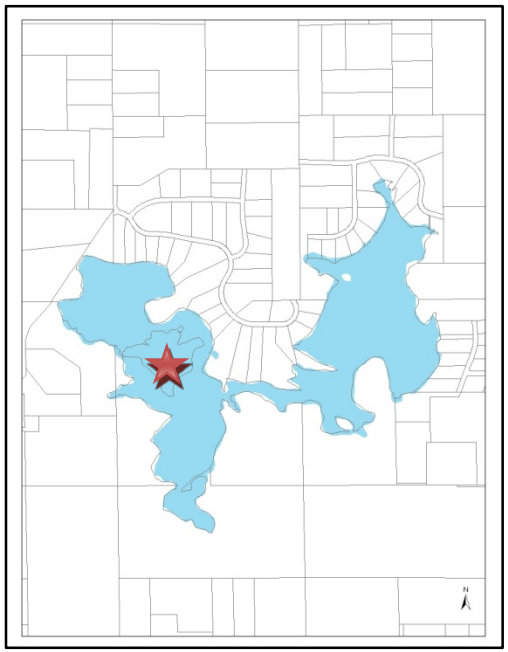
Year	Average ° F
2009	No Data
2010	No Data
2011	63.2
2012	72.6
2013	72.6
2014	70.8
2015	68.5

General Observations | **Spider Lake-East**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Malted	
June	2.5	2.5	Bamboo	Curly leaf pondweed present in shallow areas.
July	2.5	2.5	Beach Grass	
August	2.5	2.5	Calibash	
September	2.5	2.5	Bamboo	

Spider Lake-West

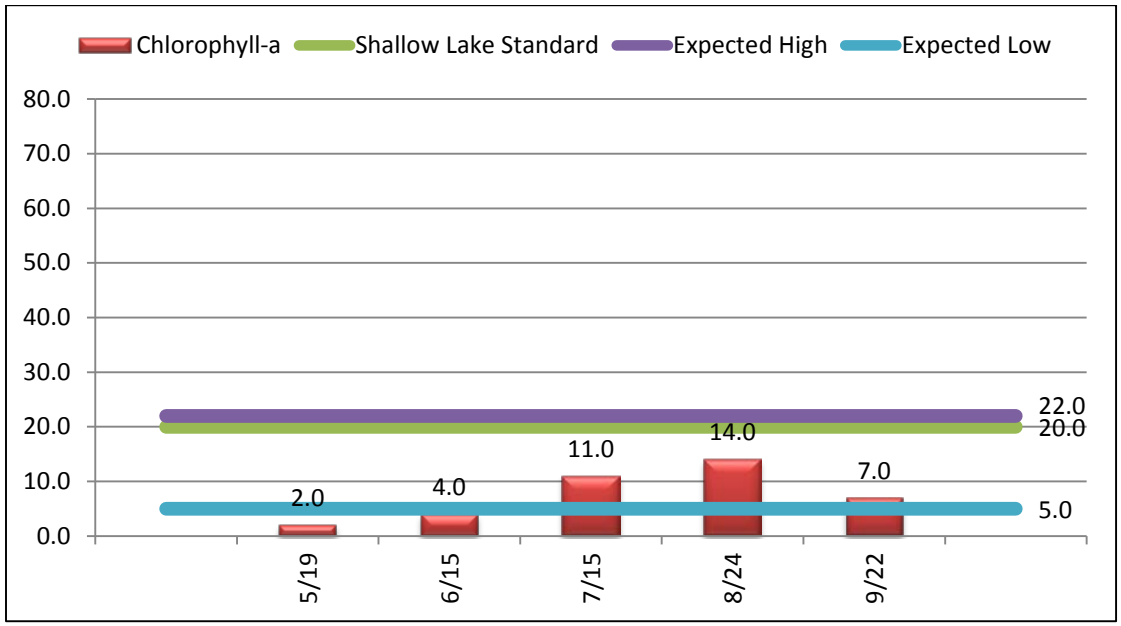
Lake 13-0019-00 Site 201



2015 Report Card: Shallow Lake	
Lake Classification	Eutrophic
Overall Lake Quality Grade	B-
Meets MPCA Standards	Yes Not Impaired
2015 Ranking	4 of 21

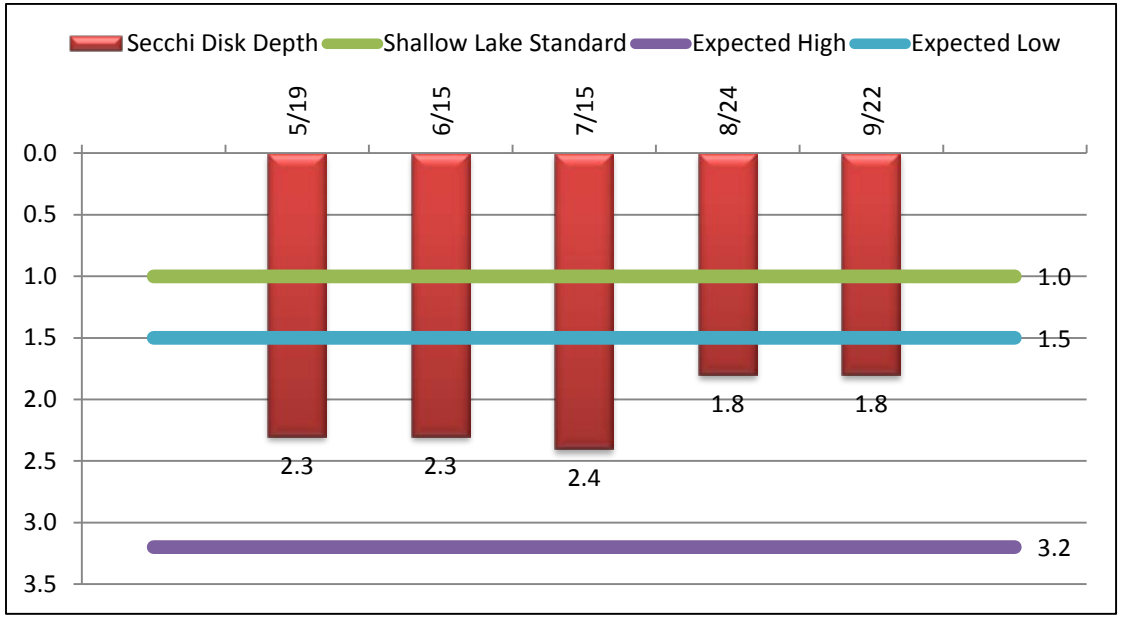
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
Trophic State Index	50.5	49.2	55.7	51.8
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic
2015 Average (May-Sept)	7.6 µg/L	2.1 meters	35.6 µg/L	-----
Grade	A	C+	C+	B-
MPCA Standard (Shallow)	20.0 µg/L	>1.0 meter	60.0 µg/L	-----
2015 Average (June-Sept)	9.0 µg/L	2.1 meters	34.0 µg/L	-----
Meets Standard	Yes	Yes	Yes	Yes

Chlorophyll-a | Expected Range: 5.0-22.0 µg/L | Shallow Lake Standard: 20.0 µg/L | **Spider Lake-West**



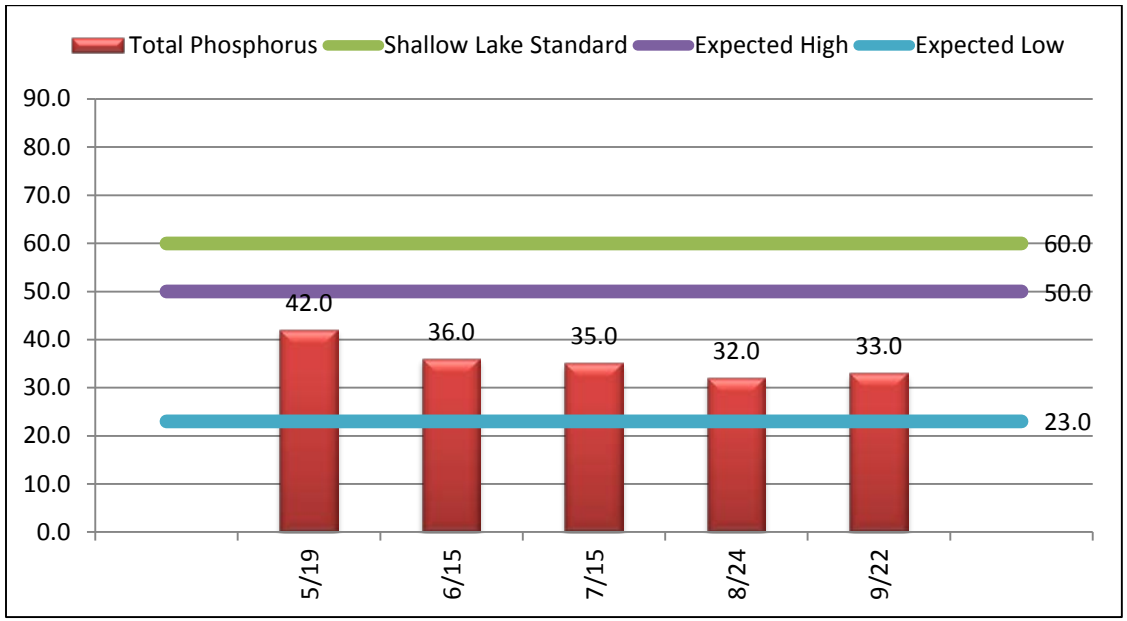
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	3.8	3.4	8.8	**7.6**
Grade	-----	-----	-----	A	A	A	**A**
Average (June-Sept) µg/L	No Data	No Data	No Data	4.5	3.8	10.5	**9.0**
Meets Standard (20.0 µg/L)	-----	-----	-----	Yes	Yes	Yes	**Yes**

Secchi Disk Depth | Expected Range: 1.5-3.2 meters | Shallow Lake Standard: >1.0 meter | **Spider Lake-West**



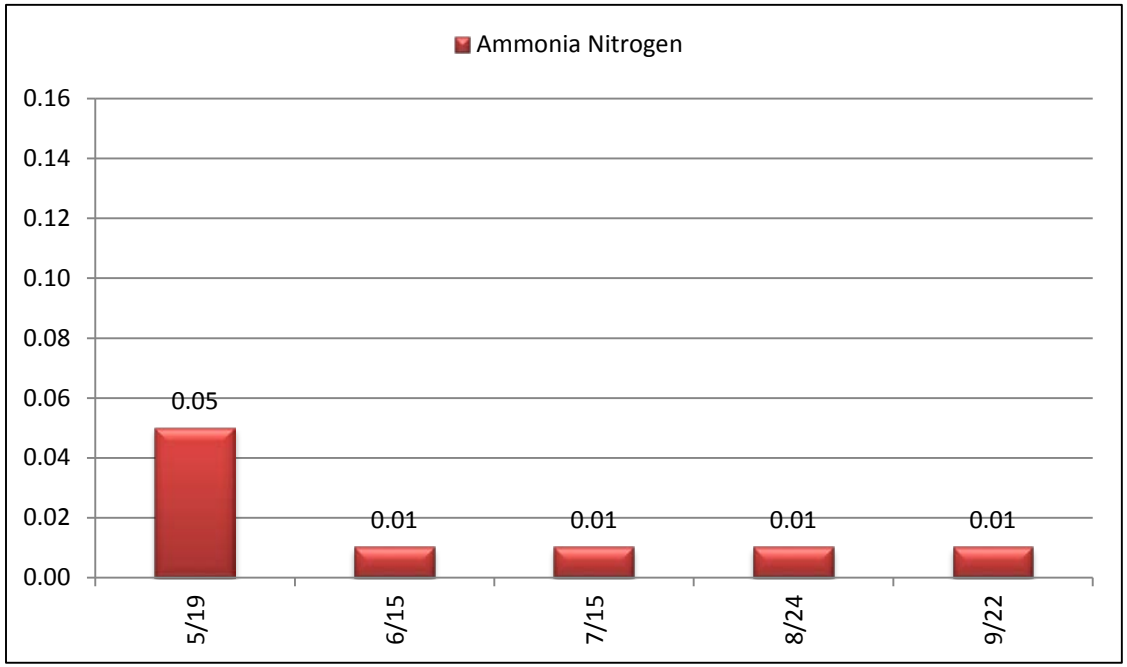
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) meters	No Data	No Data	No Data	1.9	1.9	2.0	**2.3**
Grade	-----	-----	-----	C	C	C	**C**
Average (June-Sept) meters	No Data	No Data	No Data	1.9	1.9	1.9	**2.1**
Meets Standard (>1.0 meter)	-----	-----	-----	Yes	Yes	Yes	**Yes**

Total Phosphorus | Expected Range: 23.0-50.0 µg/L | Shallow Lake Standard: 60.0 µg/L | **Spider Lake-West**



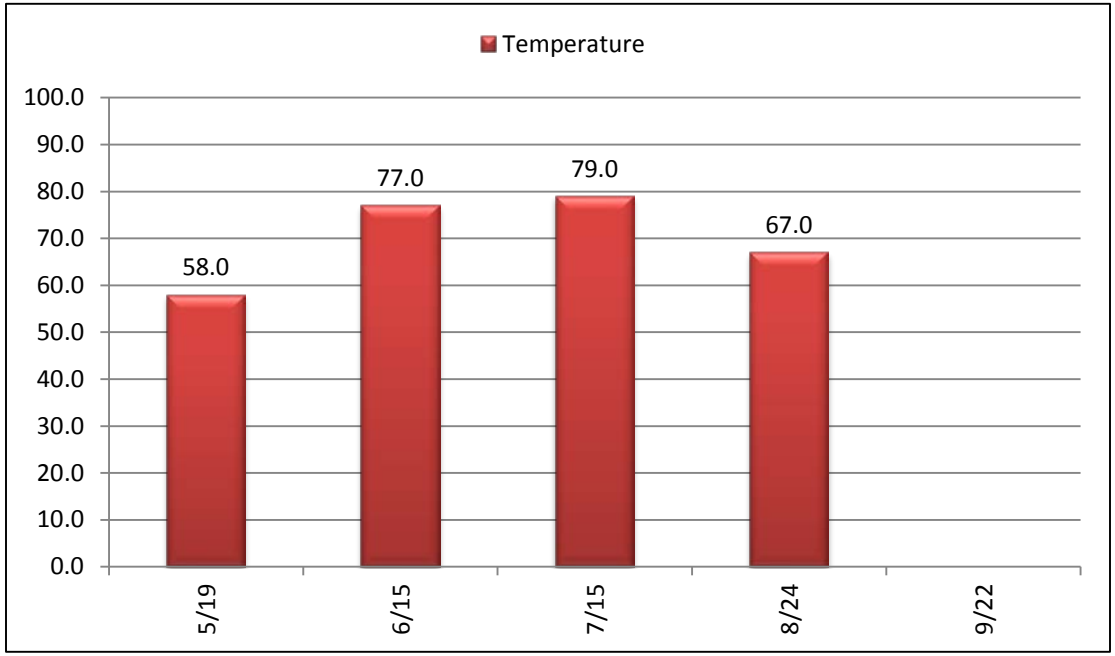
	2009	2010	2011	2012	2013	2014	2015
Average (May-Sept) µg/L	No Data	No Data	No Data	35.2	31.8	45.2	**35.6**
Grade	-----	-----	-----	C	B	C	**C**
Average (June-Sept) µg/L	No Data	No Data	No Data	35.5	32.3	49.0	**34.0**
Meets Standard (60.0 µg/L)	-----	-----	-----	Yes	Yes	Yes	**Yes**

Ammonia Nitrogen | Expected Range: None | Shallow Lake Standard: None | **Spider Lake-West**



Average mg/L	
2009	No Data
2010	No Data
2011	No Data
2012	0.08
2013	0.03
2014	0.04
2015	0.02

Surface Water Temperature |Expected Range: None |Shallow Lake Standard: None | **Spider Lake-West**



Year	Average ° F
2009	No Data
2010	No Data
2011	No Data
2012	72.6
2013	73.6
2014	71.6
2015	70.3

General Observations | **Spider Lake-West**

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Chop Stick	
June	2.5	2.5	Rice Paper	Curly leaf pondweed present in shallow areas.
July	2.5	2.5	Beach Grass	
August	2.5	2.5	Calibash	
September	2	2	Bamboo	

Chisago COUNTY