2013

Chisago County

Water Quality and Aquatic Invasive Species Monitoring

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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. Lakes in Chisago County meet the standard for temperature if the daily average temperature does not exceed 86.0˚F.

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

Project Objective

The purpose of the 2013 Chisago County Water Quality and Aquatic Invasive Species Monitoring program is to help achieve goals identified in the 2013 Chisago County Local Water Management Plan and the 2013 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.

Goal 8: Promote the reduction or control of non-native aquatic invasive species.

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.

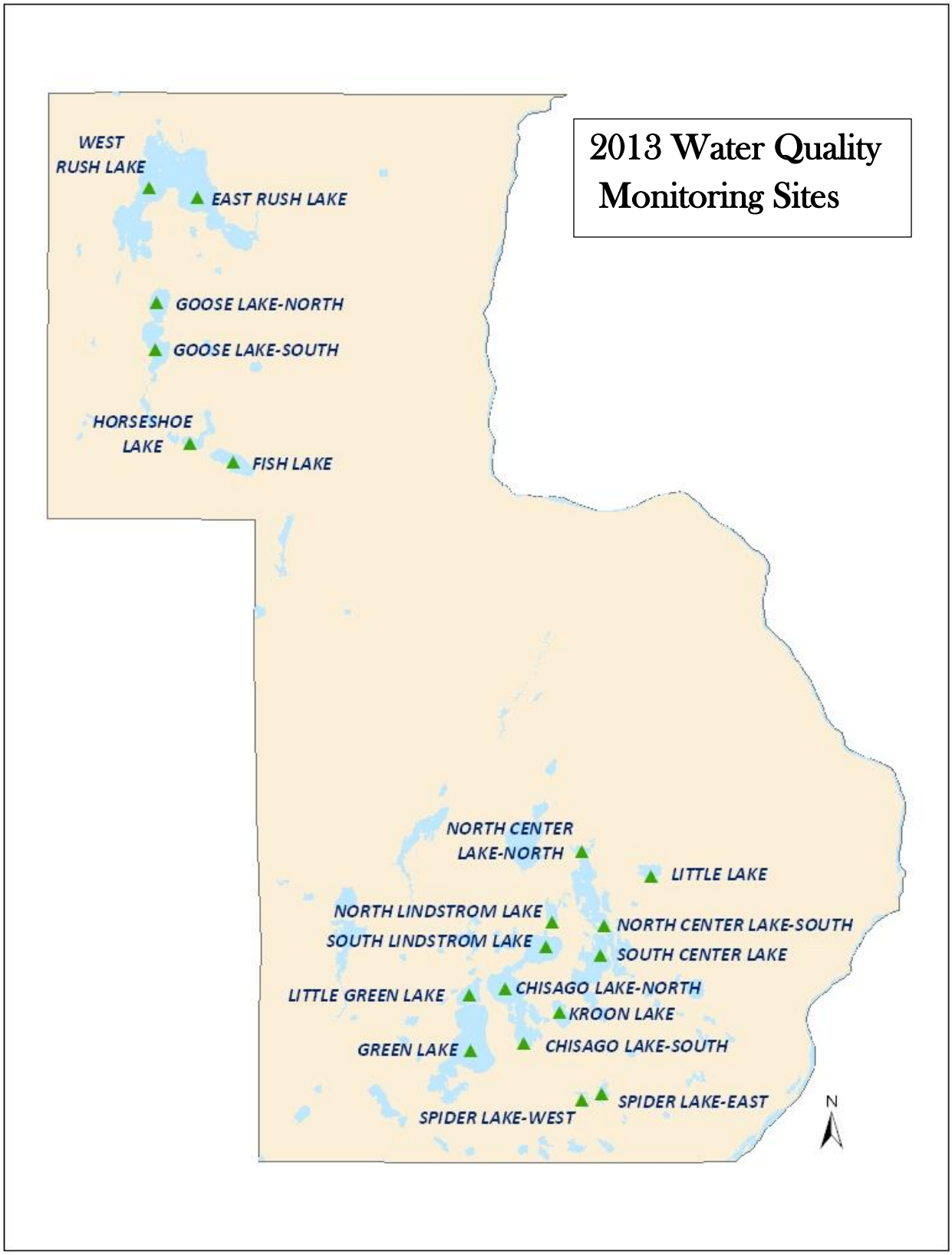
Visual inspections of the lakes were conducted looking for changes in the abundance or locations of aquatic invasive species, especially Eurasian Water Milfoil and Curly-leaf Pondweed. Potential interference with navigation was the primary consideration.

Fifteen lakes were monitored through this program in 2013. 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 2013 data only. In some cases, 2009, 2010, 2011 and 2012 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 0.07. Samples reported as 0.07 are actually 0.07 or less.				
Total Phosphorus	µg/L	40.0	60.0	23.0-50.0
Temperature	°F	Daily average should not exceed 86°F	Daily average should not exceed 86°F	None
A lake that fails to meet two of the three standards (Chlorophyll-a, Secchi Disk, Total Phosphorus) may be considered "impaired".				

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

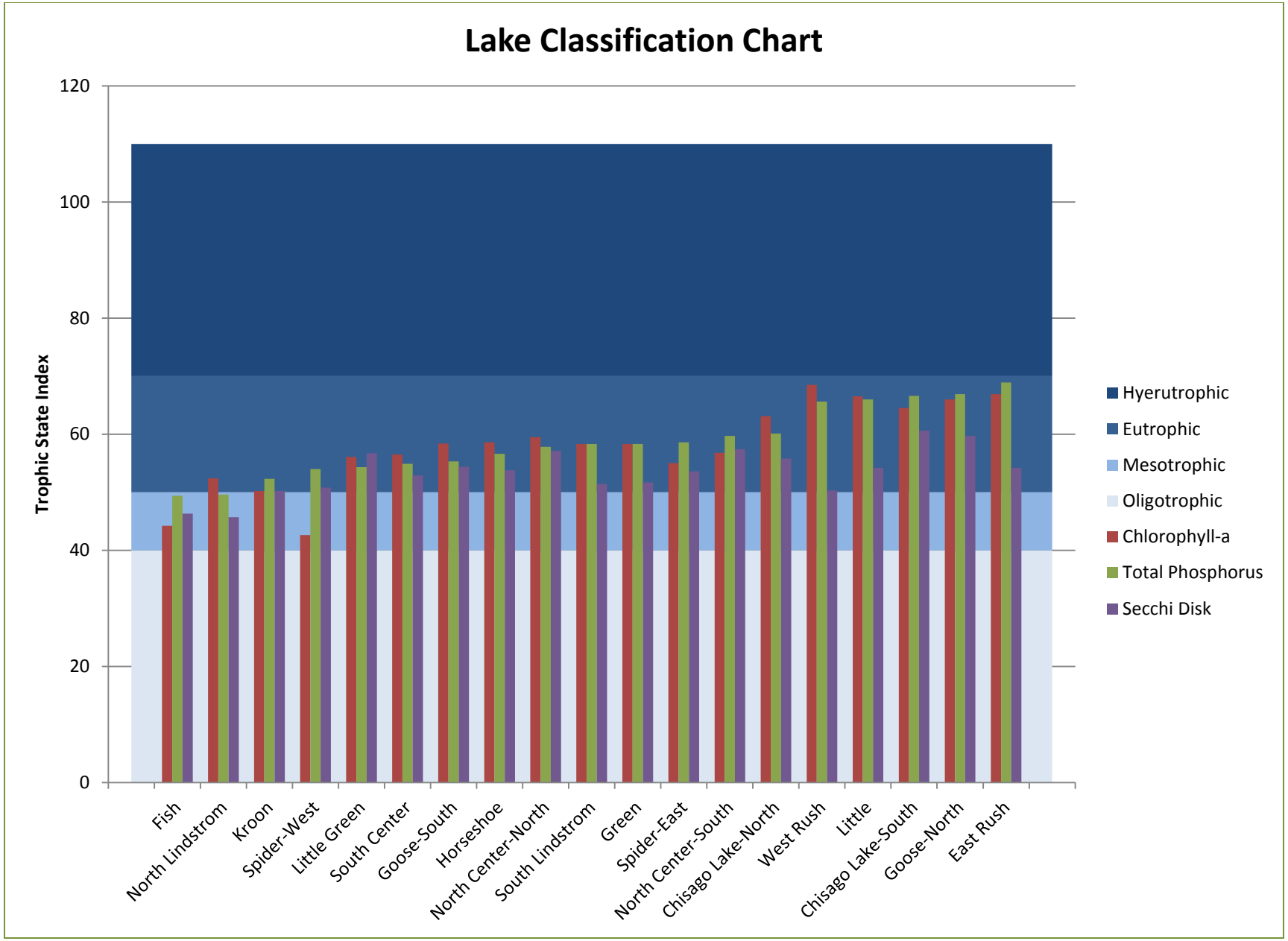
Lake Water Quality Grades

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

2013 Rank	Lake	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		46.6	4.0	2.9	20.5	Mesotrophic	Deep	Yes
2	Spider-West	B	B-C		49.1	3.8	1.9	32.2	Eutrophic	Shallow	Yes
3	North Lindstrom	B	C	B	49.2	10.8	2.7	23.0	Mesotrophic	Deep	Yes
4	Kroon	B	C	B	50.9	9.0	1.5	29.0	Eutrophic	Deep	Yes
5	North Center-South	C	C	C	52.6	15.3	1.2	49.8	Eutrophic	Shallow	Yes
6	South Center	C	C	C	54.8	16.0	1.5	34.8	Eutrophic	Deep	Yes
7	Little Green	C	C-D	C	55.7	15.0	1.2	32.8	Eutrophic	Deep	No
8	Spider-East	C	C	C	55.7	12.5	1.7	40.0	Eutrophic	Shallow	Yes
9	Goose-South	C	C		56.0	19.5	1.3	34.0	Eutrophic	Deep	No
10	South Lindstrom	C	C	B	56.0	19.5	1.9	48.3	Eutrophic	Deep	No
11	Green	C	B-C	C	56.1	20.3	1.6	48.3	Eutrophic	Deep	No
12	Horseshoe	C	C		56.3	18.8	1.6	37.5	Eutrophic	Deep	Yes
13	North Center-North	C	C	C	58.1	20.3	1.2	40.5	Eutrophic	Shallow	Yes
14	Chisago-North	C	C	B	59.7	33.5	1.2	53.3	Eutrophic	Deep	No
15	West Rush	C	D		61.5	59.3	0.9	77.5	Eutrophic	Deep	No
16	Little	C	D	C-	62.2	48.0	1.2	75.5	Eutrophic	Deep	No
17	East Rush	C	D		63.3	49.0	1.3	97.3	Eutrophic	Deep	No
18	Chisago-South	D	D	C	63.9	38.5	0.9	83.8	Eutrophic	Shallow	No
19	Goose-North	D	C		64.2	43.3	1.0	85.8	Eutrophic	Shallow	No
	***Shaded cells do not meet the Water Quality Standards in 2013**										

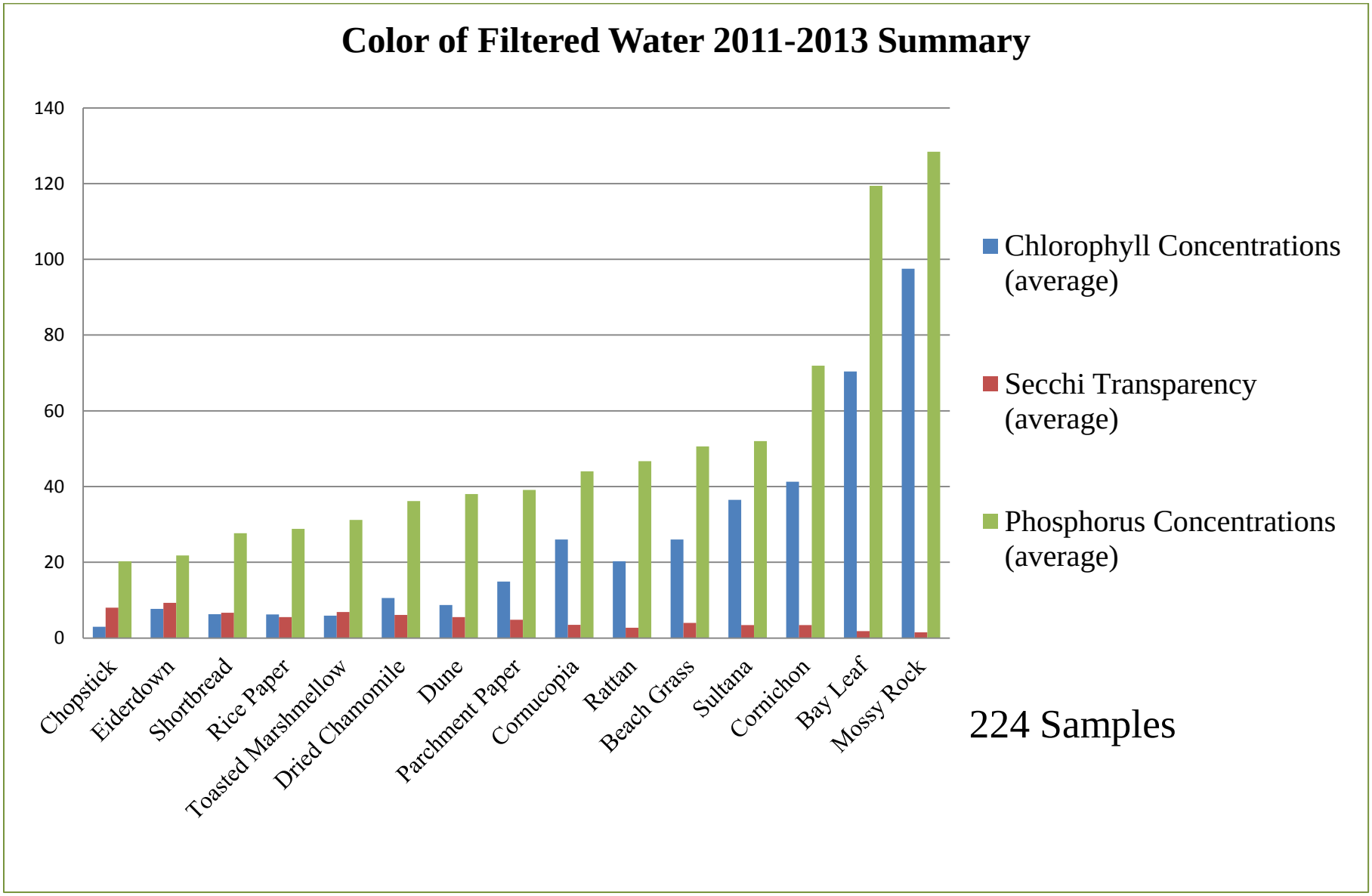

Lake Classification Chart
Trophic State Index
120
100
80
60
40
20
0
Fish
North Lindstrom
Kroon
Spider-West
Little Green
South Center
Goose-South
Horseshoe
North Center-North
South Lindstrom
Green
Spider-East
North Center-South
Chisago Lake-North
West Rush
Little
Chisago Lake-South
Goose-North
East Rush
Hyerutrophic
Eutrophic
Mesotrophic
Oligotrophic
Chlorophyll-a
Total Phosphorus
Secchi Disk

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 Martha Stewart 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. 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
Rice Paper		**6.2**	**5.5**	**28.8**	**5**
Chopstick		**3.0**	**8.0**	**20.3**	**6**
Toasted Marshmallow		**5.9**	**6.9**	**31.2**	**18**
Shortbread		**6.3**	**6.7**	**27.7**	**7**
Eiderdown		**7.7**	**9.3**	**21.8**	**4**
Dune		**8.7**	**5.5**	**38.0**	**3**
Dried Chamomile		**10.6**	**6.1**	**36.2**	**13**
Parchment Paper		**14.9**	**4.8**	**39.1**	**22**
Cornucopia		**26.0**	**3.5**	**44.0**	**1**
Rattan		**20.3**	**2.7**	**46.7**	**3**
Beach Grass		**26.0**	**4.0**	**50.6**	**57**
Cornichon		**41.3**	**3.4**	**71.9**	**58**
Sultana		**36.5**	**3.4**	**52.0**	**16**
Bay Leaf		**70.4**	**1.8**	**119.4**	**5**
Mossy Rock		**97.5**	**1.5**	**128.4**	**6**

Filter Color Classification Chart



Lake 13-0032-01 Site 202

North Center Lake-North

North Center Lake

Shallow Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	59.5	57.1	57.8	58.1
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	19.0 µg/L	1.2 meters	41.2 µg/L		
Grade	B	C-D	C	**C**	13th/19

MPCA Standards: Impaired but Meets Standards

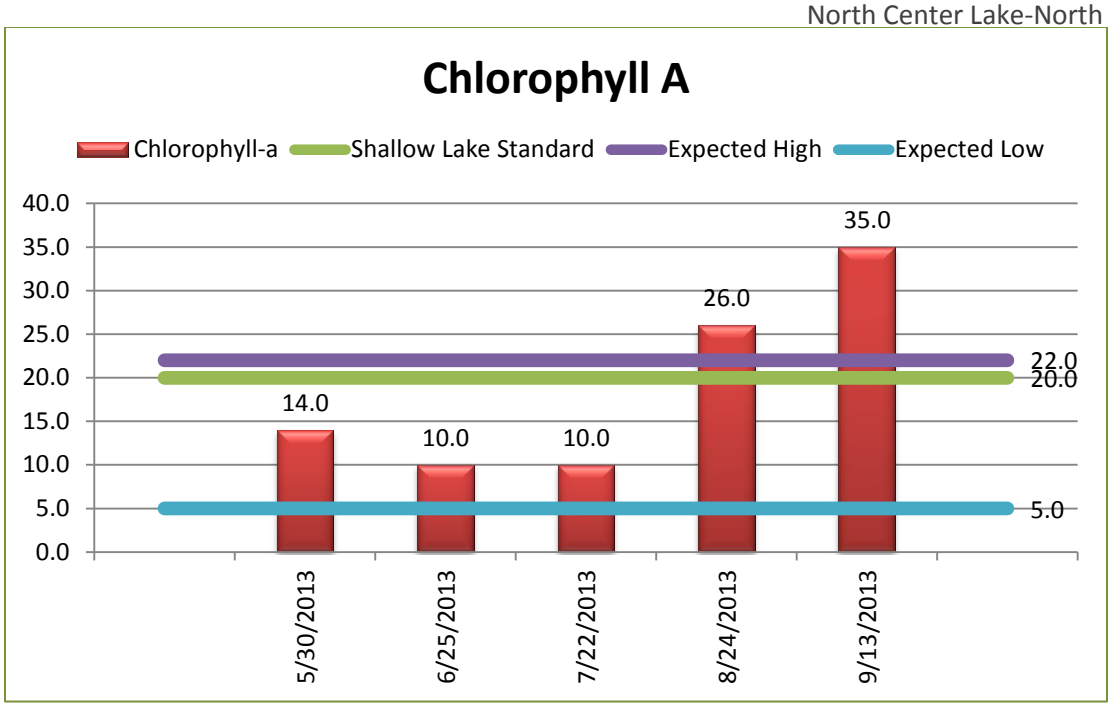
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Shallow lake)	20.0 µg/L	>1.0 meters	60.0 µg/L	
2013 Average (June-Sept)	20.3 µg/L	1.2 meters	40.5 µg/L	
Meets Standard	No	Yes	Yes	**Yes**

Chlorophyll-a

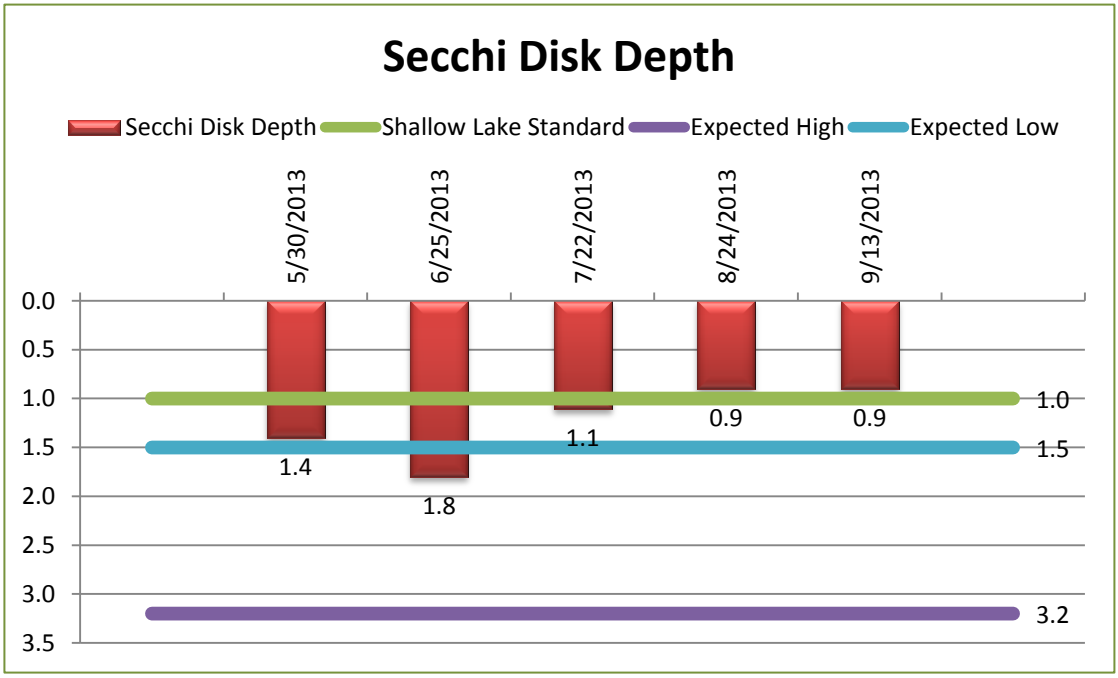
Expected Range: 5.0-22.0 µg/L

Shallow Lake Standard: 20.0 µg/L

This is the first year that the lake has met the standard for Chlorophyll A.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	40.9 µg/L	31.2 µg/L	26.8 µg/L	41.2 µg/L	**19.0 µg/L**
Grade	C	C	C	C	**B**
Average (June-Sept)	49.5 µg/L	39.0 µg/L	31.8 µg/L	50.8 µg/L	**20.3 µg/L**
Meets Standard (20.0 µg/L)	No	No	No	No	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Shallow Lake Standard: >1.0 meters

Clarity in this lake meets the standard.

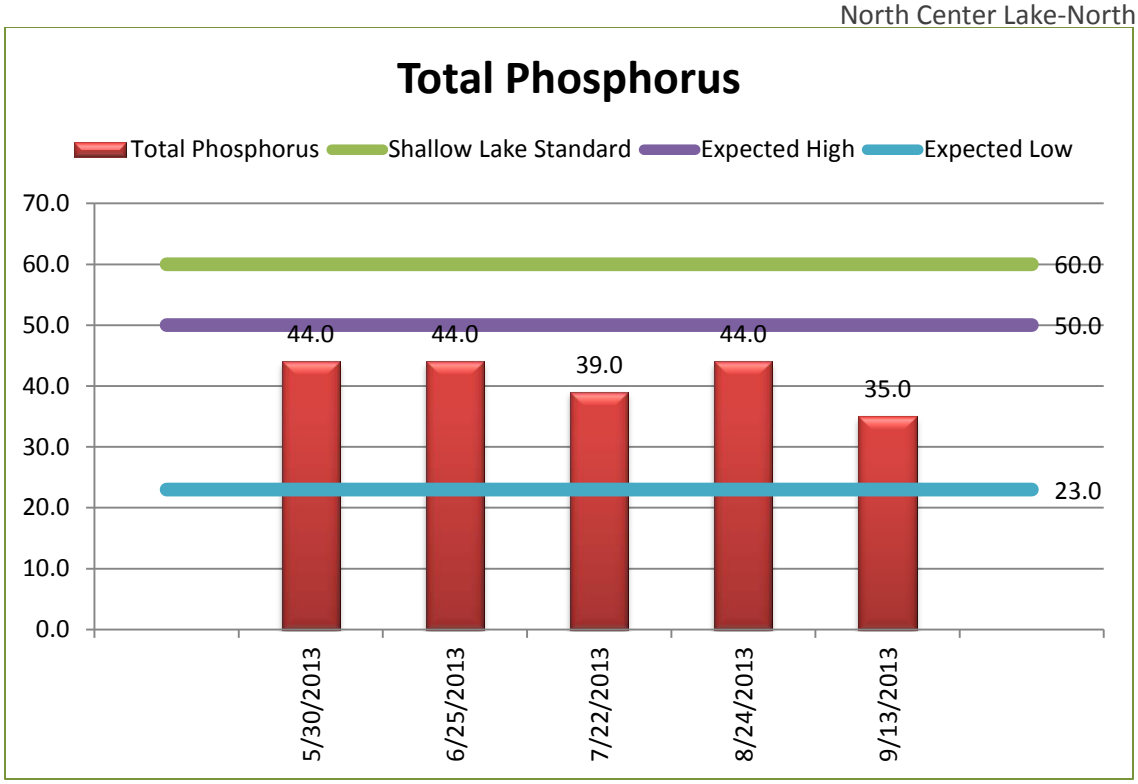
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	0.9 meters	1.1 meters	1.4 meters	1.2 meters	**1.2 meters**
Grade	D	D	C	C-D	**C-D**
Average (June-Sept)	0.7 meters	0.8 meters	1.3 meters	0.8 meters	**1.2 meters**
Meets Standard (>1.0 m)	No	No	Yes	No	**Yes**

Total Phosphorus

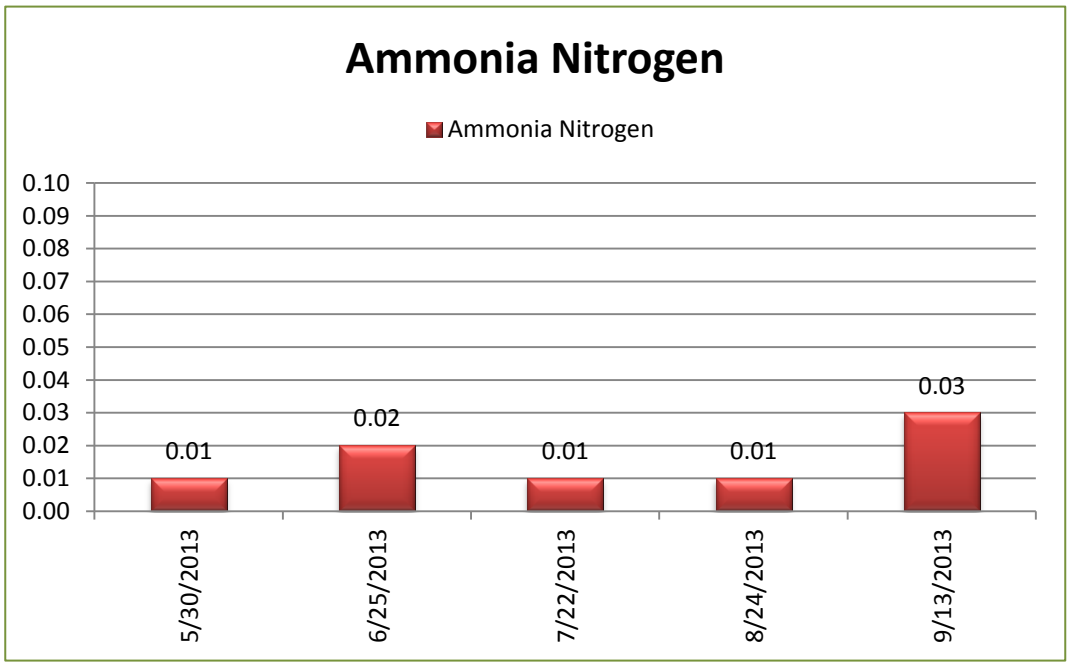
Expected Range: 23.0-50.0 µg/L

Shallow Lake Standard: 60.0 µg/L

All samples were consistently between 35.0 and 45.0 µg/L. They all meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	80.0 µg/L	74.0 µg/L	52.6 µg/L	60.6 µg/L	**41.2 µg/L**
Grade	D	D	C	C	**C**
Average (June-Sept)	87.0 µg/L	82.0 µg/L	56.0 µg/L	67.0 µg/L	**40.5 µg/L**
Meets Standard (60.0 µg/L)	No	No	Yes	No	**Yes**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

All samples were very low.

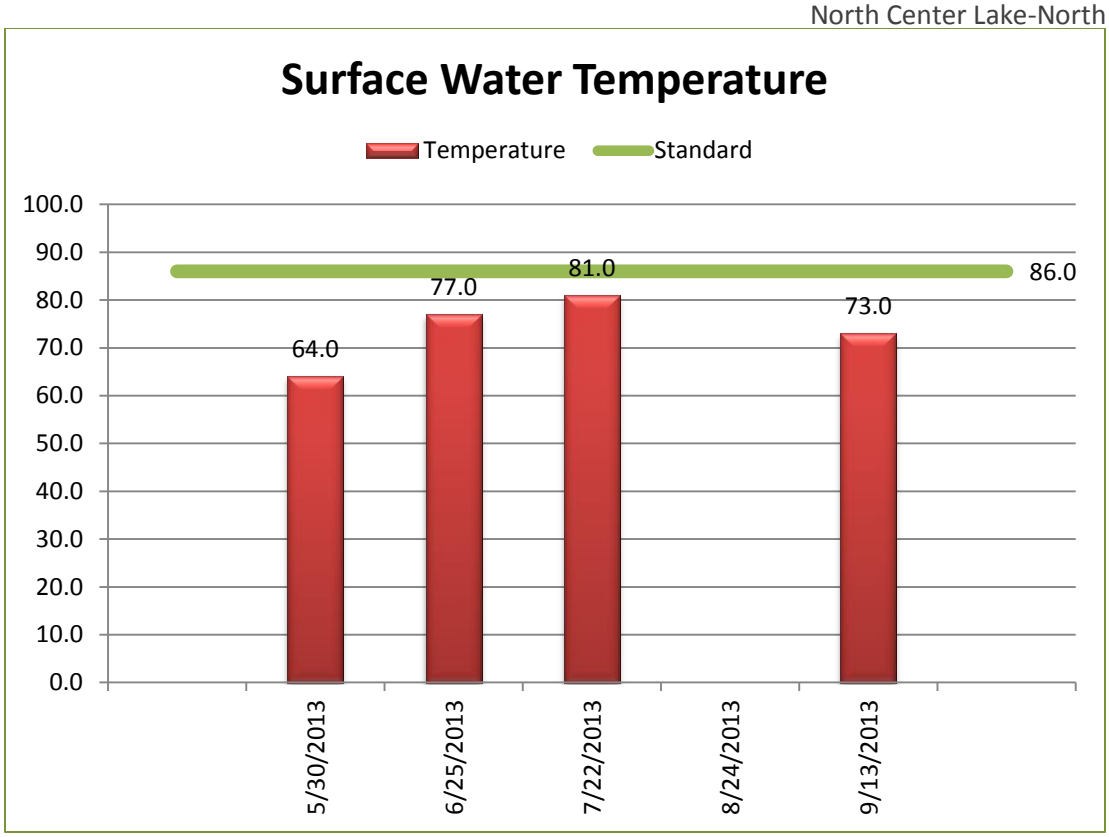
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	<0.05 mg/L	0.07 mg/L	0.17 mg/L	**0.016 mg/L**

Surface Water Temperature

Expected Range: None

Shallow Lake Standard: The daily average shall not exceed 86.0˚F

The temperatures were below 86˚F.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	71.7 ˚F	NO DATA	65.8˚F	70.0˚F	**73.8˚F**
Meets Standard (Not to exceed 86.0˚F)	Yes		Yes	Yes	**Yes**

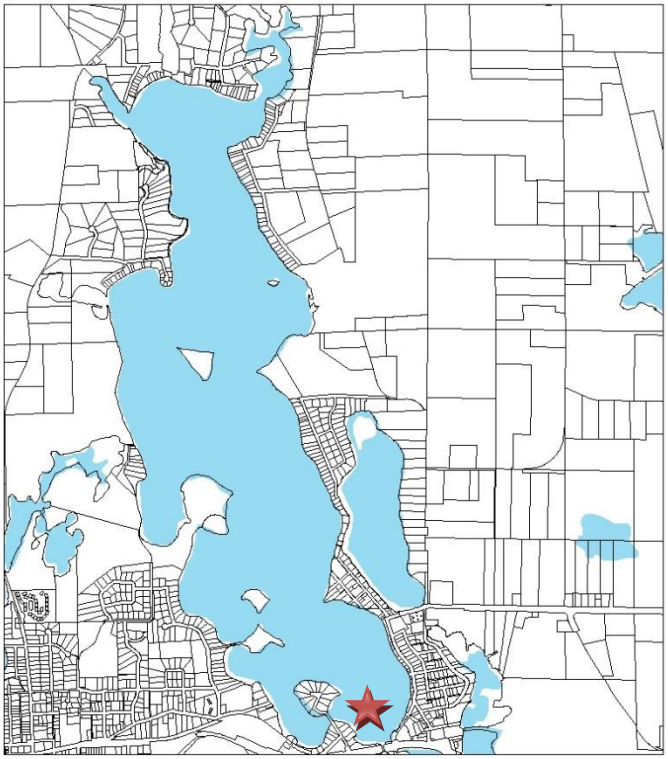
North Center Lake-North General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	Other Notes
May	2	2	Malted	Low weed pressure.
June	2.5	2.5	Parchment Paper	Good control of Eurasion watermilfoil and curlyleaf pondweed for navigation.
July	2.5	2.5	Sultana	Good control of Eurasion watermilfoil and curlyleaf pondweed for navigation.
August	3	3	Beach Grass	Hot weather.
September	3	3	Sultana	Eurasian watermilfoil seed heads up.

Lake 13-0032-01 Site 201

North Center Lake-South

North Center Lake



Shallow Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	56.8	57.4	59.7	52.6
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	14.4 µg/L	1.2 meters	47.2 µg/L		
Grade	B	C-D	C	**C**	5th/19

MPCA Standards: Impaired but Meets Standards

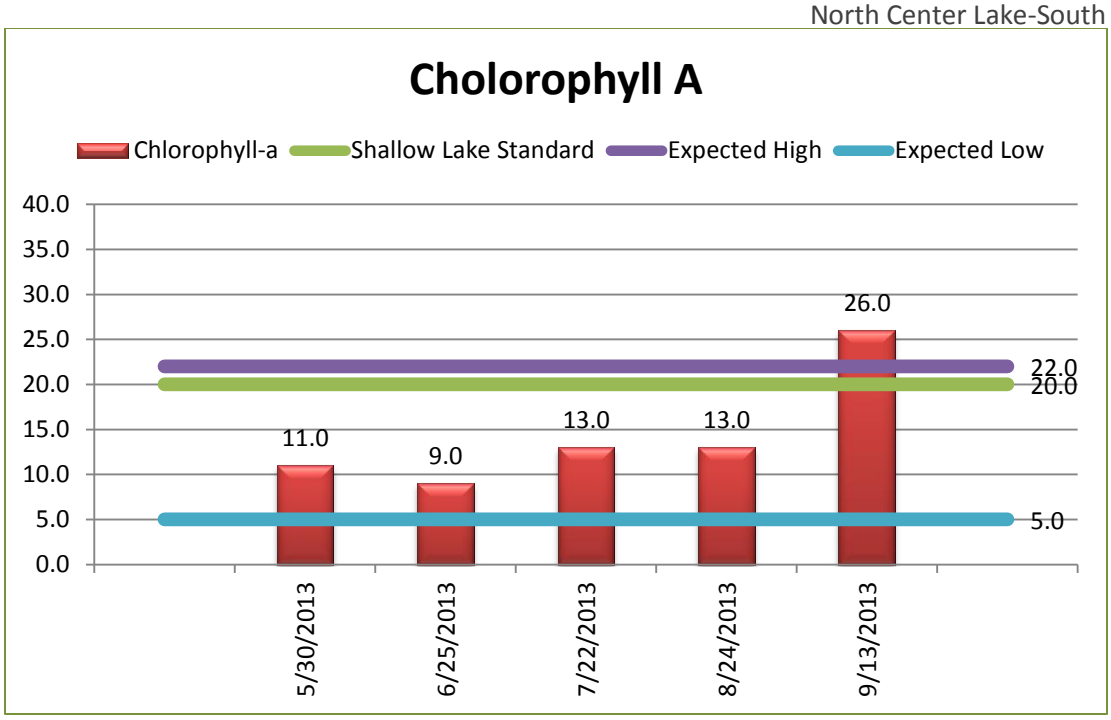
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Shallow lake)	20.0 µg/L	>1.0 meters	60.0 µg/L	
2013 Average (June-Sept)	15.3 µg/L	1.2 meters	49.8 µg/L	
Meets Standard	Yes	Yes	Yes	**Yes**

Chlorophyll-a

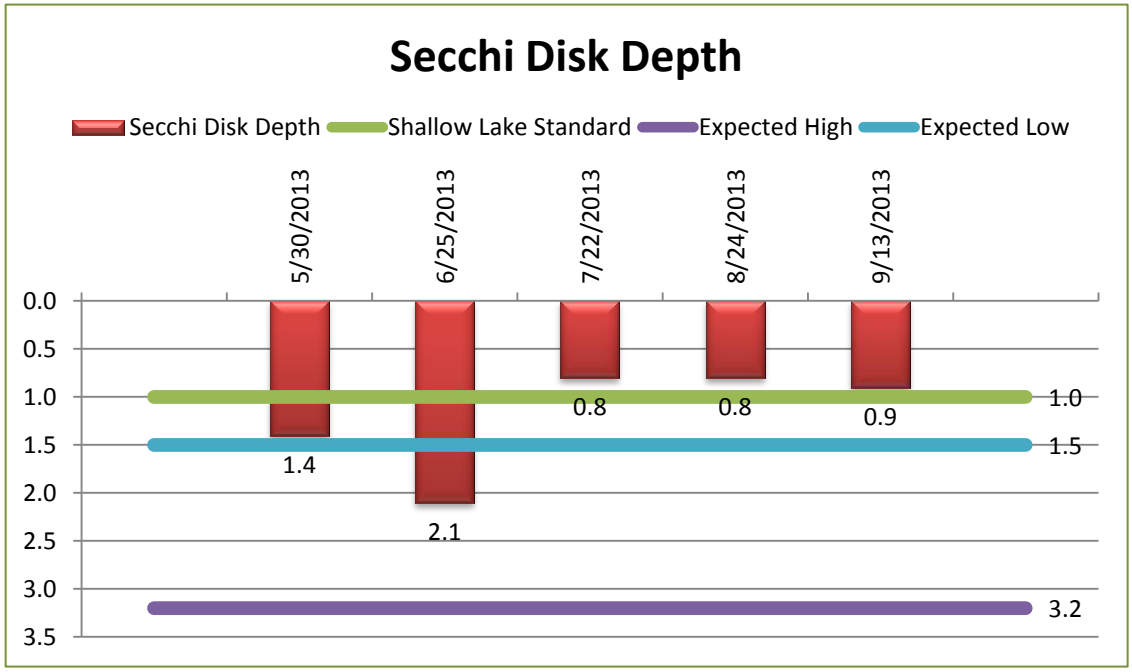
Expected Range: 5.0-22.0 µg/L

Shallow Lake Standard: 20.0 µg/L

All but one sample were within the expected range and met the standard. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	24.9 µg/L	19.5 µg/L	17.2 µg/L	38.4 µg/L	**14.4 µg/L**
Grade	C	B	B	C	**B**
Average (June-Sept)	29.9 µg/L	22.8 µg/L	20.5 µg/L	47.0 µg/L	**15.3 µg/L**
Meets Standard (20.0 µg/L)	No	No	No	No	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Shallow Lake Standard: >1.0 meters

Three out of five clarity readings did not meet the standard, but the average does meet the standard.

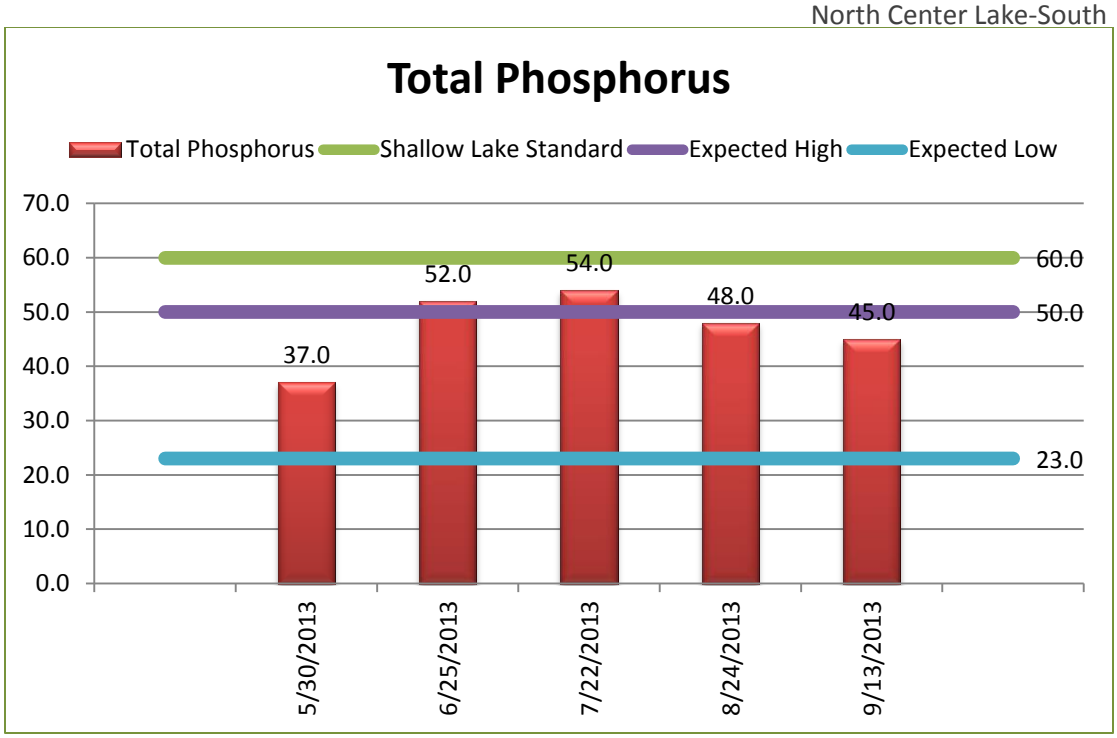
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	1.6 meters	1.4 meters	1.2 meters	1.1 meters	**1.2 meters**
Grade	C	C	C-D	D	**C-D**
Average (June-Sept)	1.4 meters	1.2 meters	1.0 meter	0.9 meters	**1.2 meters**
Meets Standard (>1.0 m)	Yes	Yes	No	No	**Yes**

Total Phosphorus

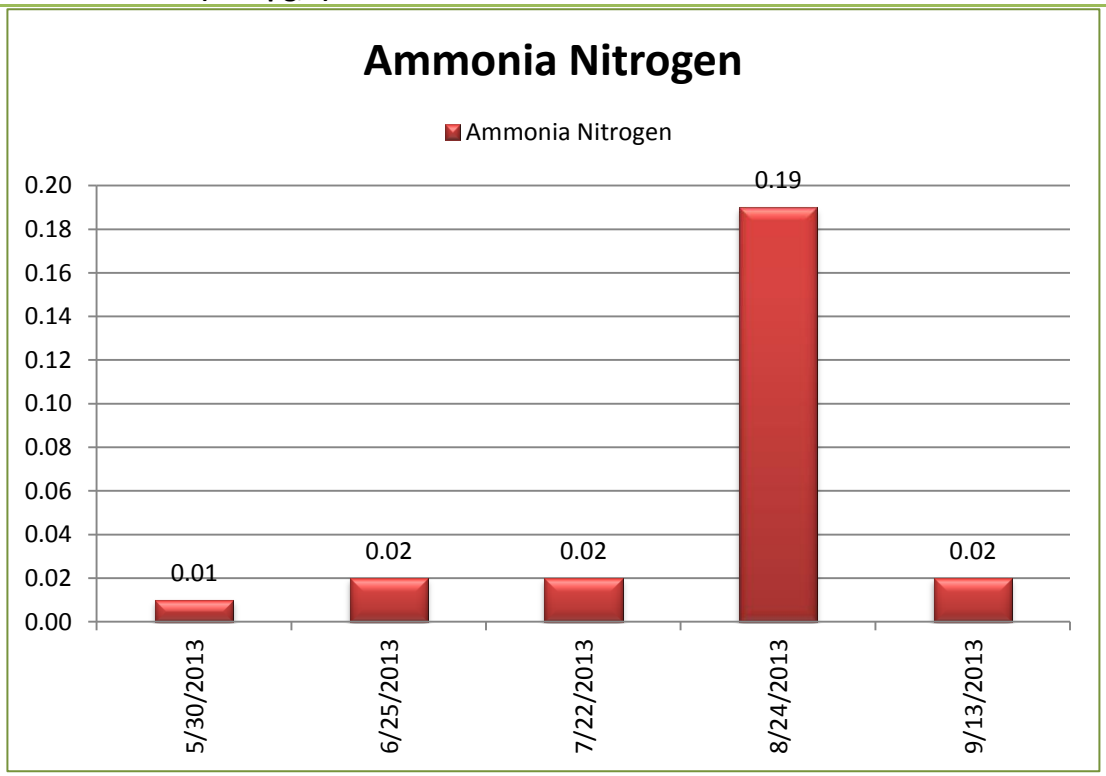
Expected Range: 23.0-50.0 µg/L

Shallow Lake Standard: 60.0 µg/L

All samples met the standard. The average meets the standard for the first time since at least 2009.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	70.0 µg/L	60.0 µg/L	61.0 µg/L	54.8 µg/L	**47.2 µg/L**
Grade	D	C	C	C	**C**
Average (June-Sept)	78.0 µg/L	65.0 µg/L	62.3 µg/L	60.3 µg/L	**49.8 µg/L**
Meets Standard (60.0 µg/L)	No	No	No	No	**Yes**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

There was one elevated sample taken in August.

This chart cannot be directly compared to other Ammonia Nitrogen charts due to a difference in scale.

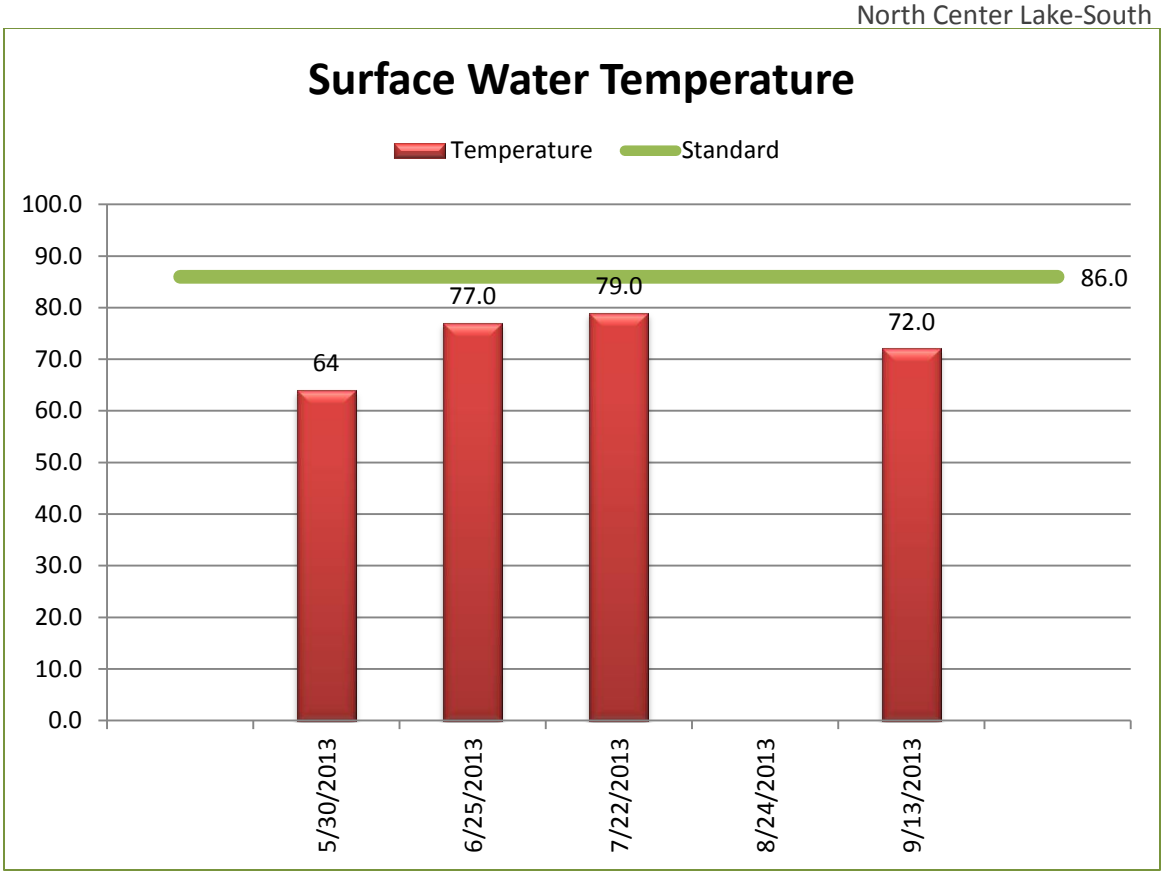
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	<0.05 mg/L	0.06 mg/L	0.08 mg/L	**0.05 mg/L**

Surface Water Temperature

Expected Range: None

Shallow Lake Standard: The daily average shall not exceed 86.0˚F

No temperatures exceeded the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	69.8 ˚F	NO DATA	65.4 ˚F	69.6˚F	**73.0˚F**
Meets Standard (Not to exceed 86.0˚F)			Yes	Yes	**Yes**

North Center Lake-South General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Toasted Marshmallow	Low weed pressure.
June	3	3	Parchment Paper	Good control of Eurasian watermilfoil and curlyleaf pondweed for navigation.
July	3	3	Beach Grass	Good control of Eurasian watermilfoil and curlyleaf pondweed for navigation.
August	3	3	Bamboo	Hot weather.
September	3	3	Parchment Paper	Eurasian watermilfoil seed heads up.

Lake 13-0027-00 Site 207

South Center Lake

South Center Lake

Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	56.5	52.9	54.9	54.8
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	14.0 µg/L	1.6 meters	33.8 µg/L		
Grade	B	C	C	**C**	6th/19

MPCA Standards: Impaired but Meets Standards

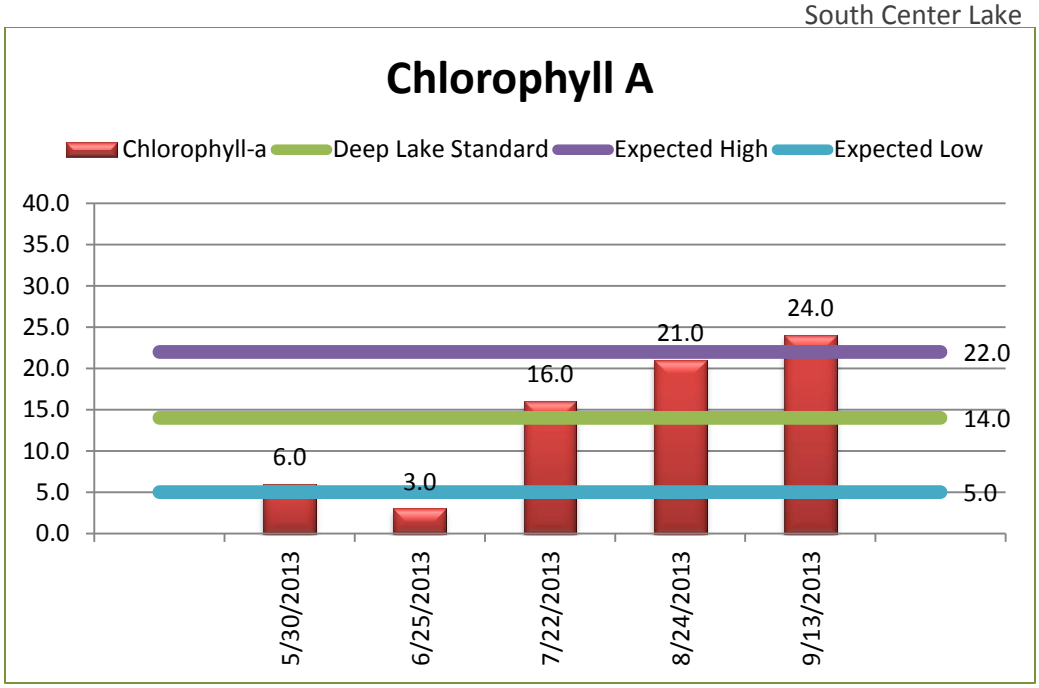
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	16.0 µg/L	1.5 meters	34.8 µg/L	
Meets Standard	No	Yes	Yes	**Yes**

Chlorophyll-a

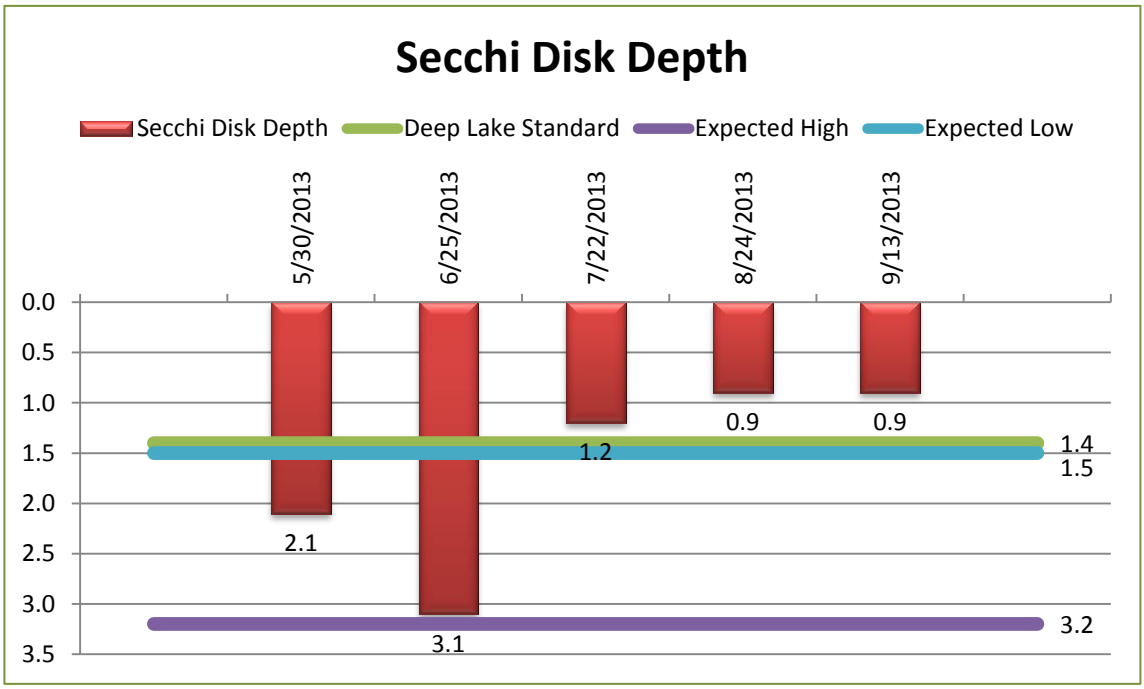
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

June through September readings are all above the standard. The average does not meet the standard. The Chl-a levels were significantly lower than 2012.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	17.4 µg/L	36.4 µg/L	**14.0 µg/L**
Grade			B	C	**B**
Average (June-Sept)	NO DATA	NO DATA	21.0 µg/L	44.0 µg/L	**16.0 µg/L**
Meets Standard (14.0 µg/L)			No	No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

Clarity improved over last year. The average does meet the standard.

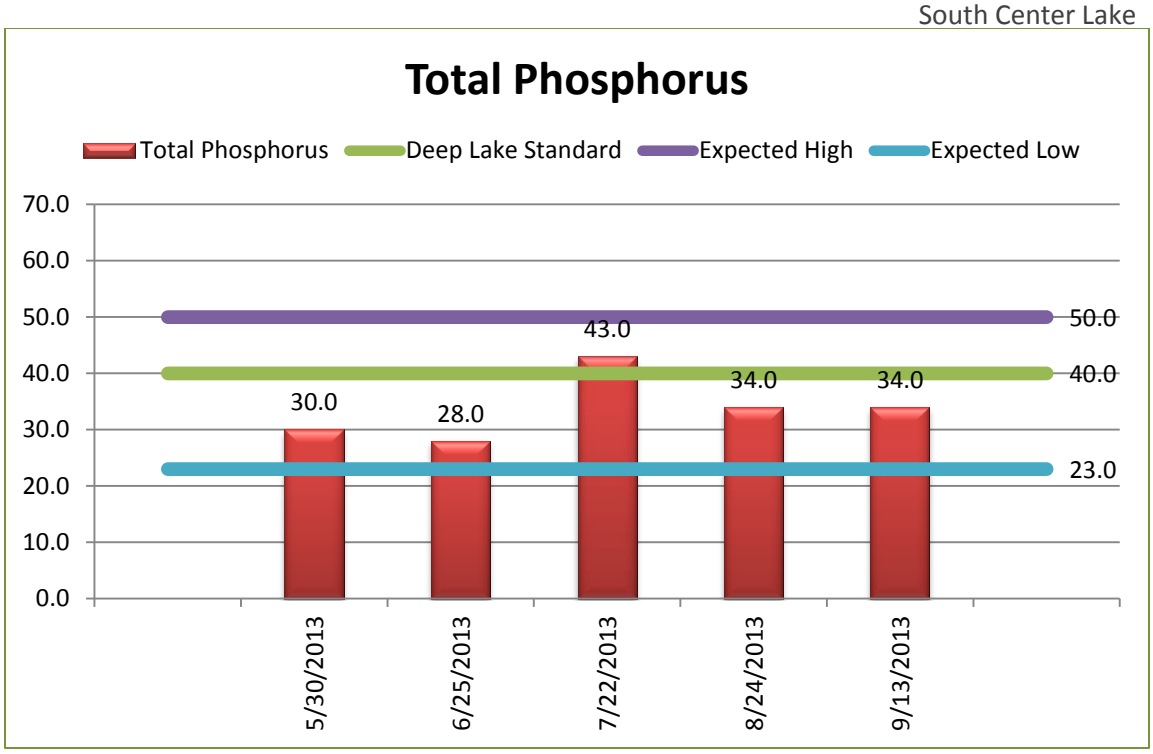
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	1.2 meters	1.3 meters	**1.6 meters**
Grade			C-D	C	**C**
Average (June-Sept)	NO DATA	NO DATA	1.0 meter	0.7 meters	**1.5 meters**
Meets Standard (>1.0 m)			No	No	**Yes**

Total Phosphorus

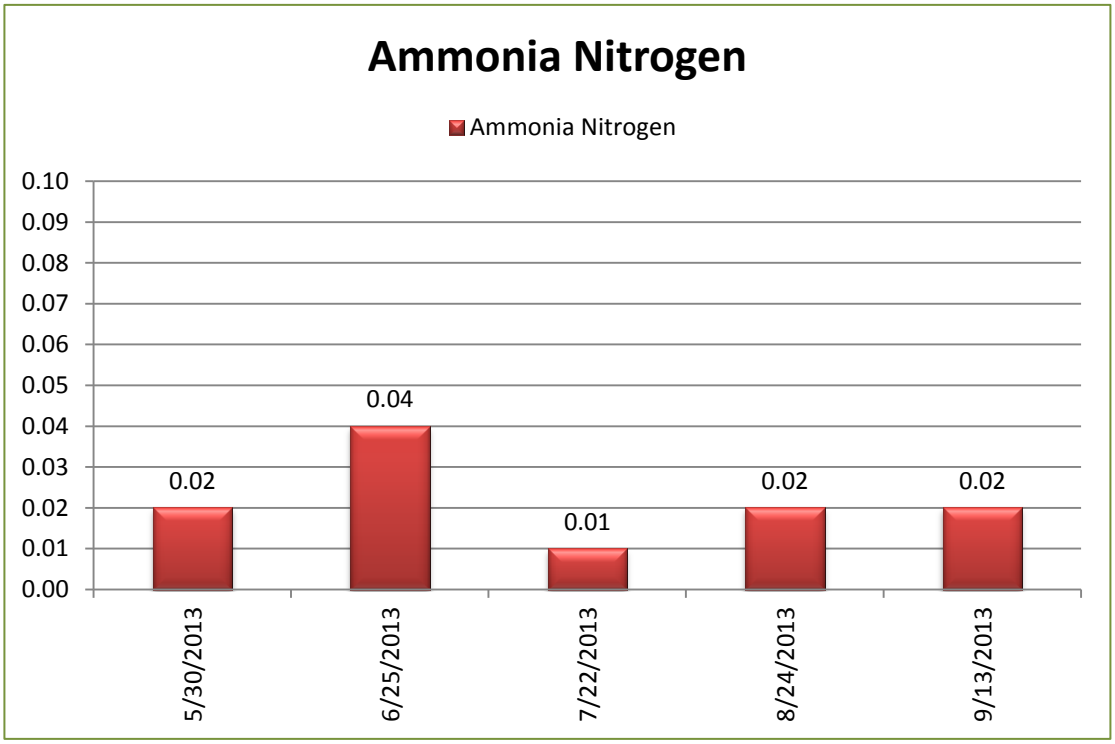
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

Only one sample exceeded the standard. All samples are within the expected range. The average does meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	43.6 µg/L	39.4 µg/L	**33.8 µg/L**
Grade			C	C	**C**
Average (June-Sept)	NO DATA	NO DATA	47.5 µg/L	44.3 µg/L	**34.8 µg/L**
Meets Standard (40.0 µg/L)			No	No	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There is no standard, but the ammonia nitrogen levels were very low.

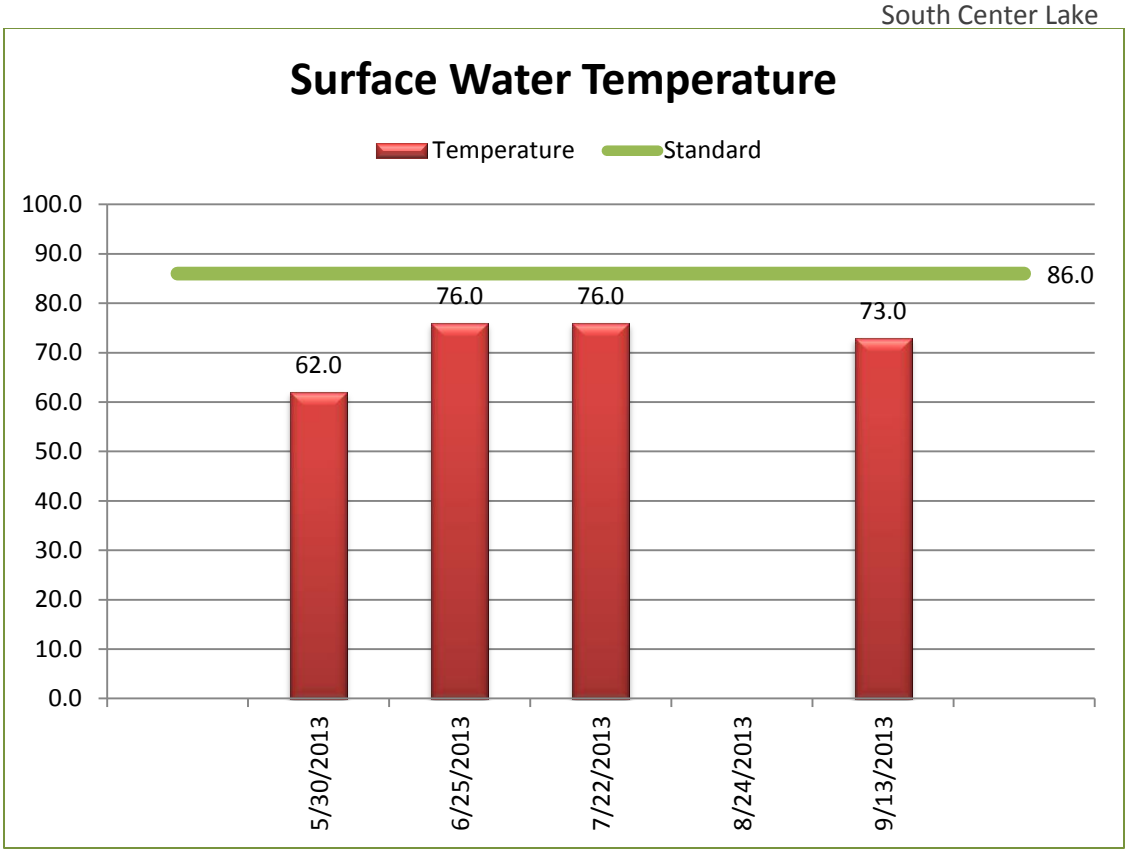
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	0.04 mg/L	0.07 mg/L	**0.02 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

All temperatures were below the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	70.0˚F	**71.8˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

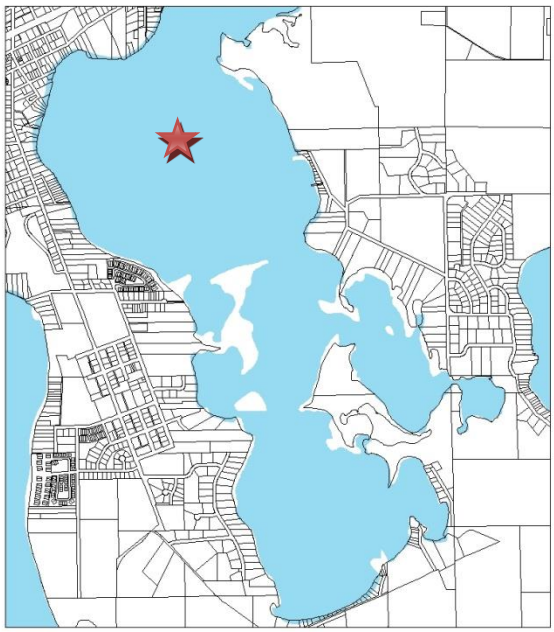
South Center Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Malted	Carp schooling to Lynn Lake.
June	2	2	Bamboo	Good control of Eurasion watermilfoil and curlyleaf pondweed for navigation.
July	3	3	Beach Grass	Good control of Eurasion watermilfoil and curlyleaf pondweed for navigation.
August	3	3	Malted	Hot weather.
September	3	3	Beach Grass	Eurasian watermilfoil seed heads up.

Lake 13-0012-01 Site 202

Chisago Lake-North

Chisago Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	63.1	55.8	60.1	59.7
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	27.4 µg/L	1.3 meters	48.4 µg/L		
Grade	C	C	C	**C**	14th/19

MPCA Standards: Does Not Meet Standards

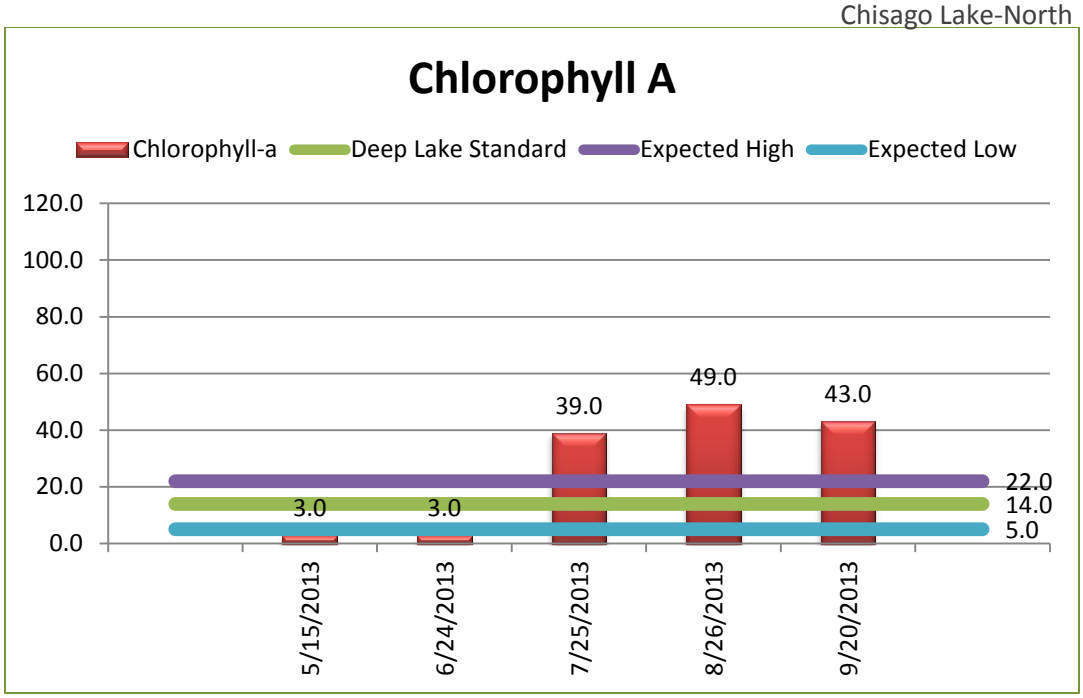
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	33.5 µg/L	1.2 meters	53.3 µg/L	
Meets Standard	No	No	No	**No**

Chlorophyll-a

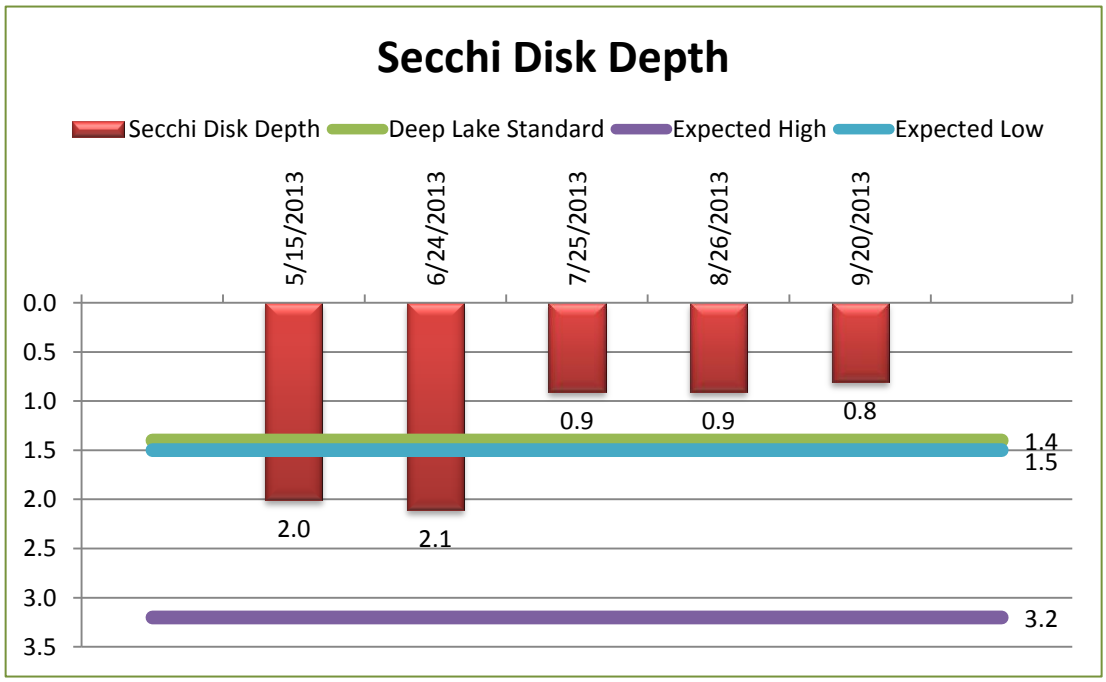
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Chlorophyll-a charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	12.2 µg/L	31.3 µg/L	10.4 µg/L	41.6 µg/L	**27.4 µg/L**
Grade	B	C	B	C	**C**
Average (June-Sept)	13.7 µg/L	31.3 µg/L	12.8 µg/L	51.5 µg/L	**33.5 µg/L**
Meets Standard (14.0 µg/L)	Yes	No	Yes	No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

The average clarity of this lake did not meet the standard.

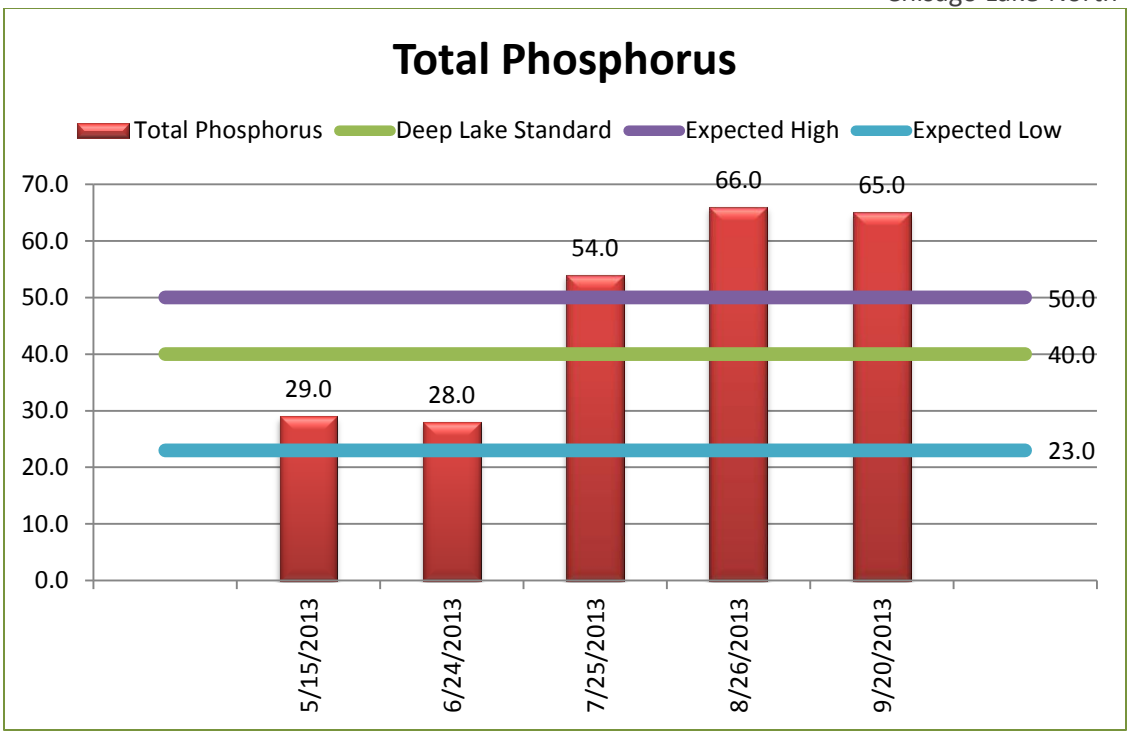
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	2.3 meters	1.8 meters	2.2 meters	1.3 meters	**1.3 meters**
Grade	B	C	C	C	**C**
Average (June-Sept)	2.0 meters	1.8 meters	1.9 meters	0.9 meters	**1.2 meters**
Meets Standard (>1.4 m)	Yes	Yes	Yes	No	**No**

Total Phosphorus

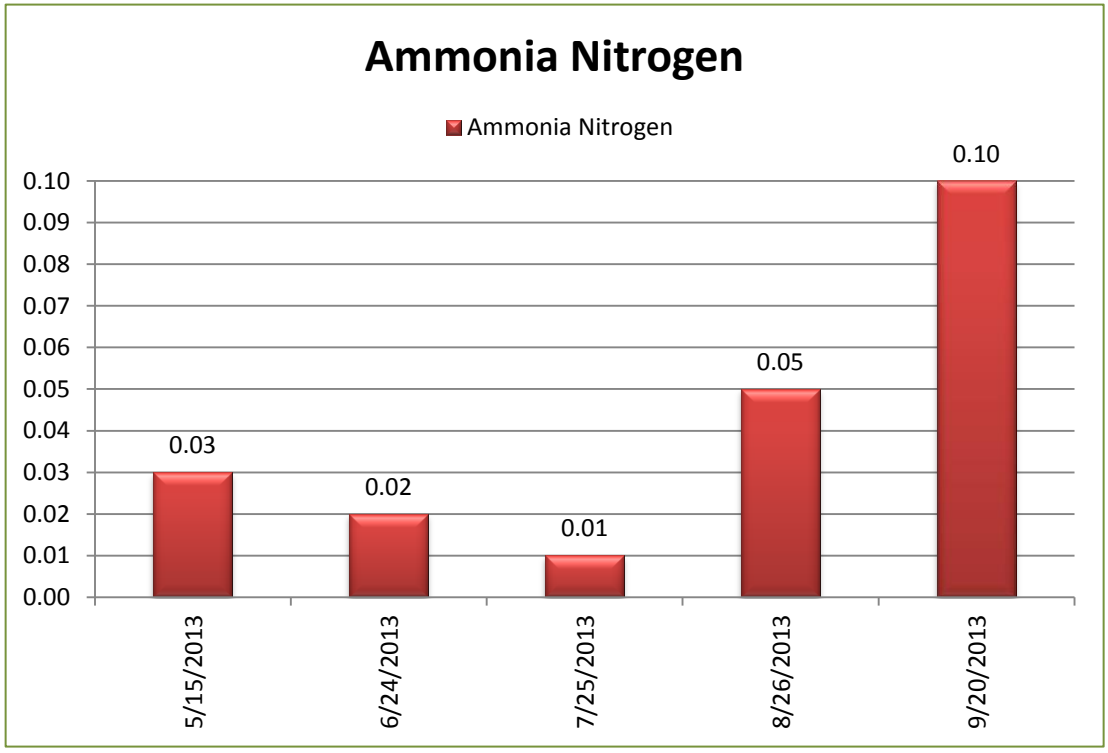
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

The average is significantly lower than 2012, but still does not meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	28.0 µg/L	48.0 µg/L	37.8 µg/L	66.8 µg/L	**48.4 µg/L**
Grade	B	C	C	C	**C**
Average (June-Sept)	28.0 µg/L	48.0 µg/L	42.8 µg/L	79.0 µg/L	**53.3 µg/L**
Meets Standard (40.0 µg/L)	Yes	No	No	No	**No**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There is no standard, but the ammonia nitrogen levels were very low.

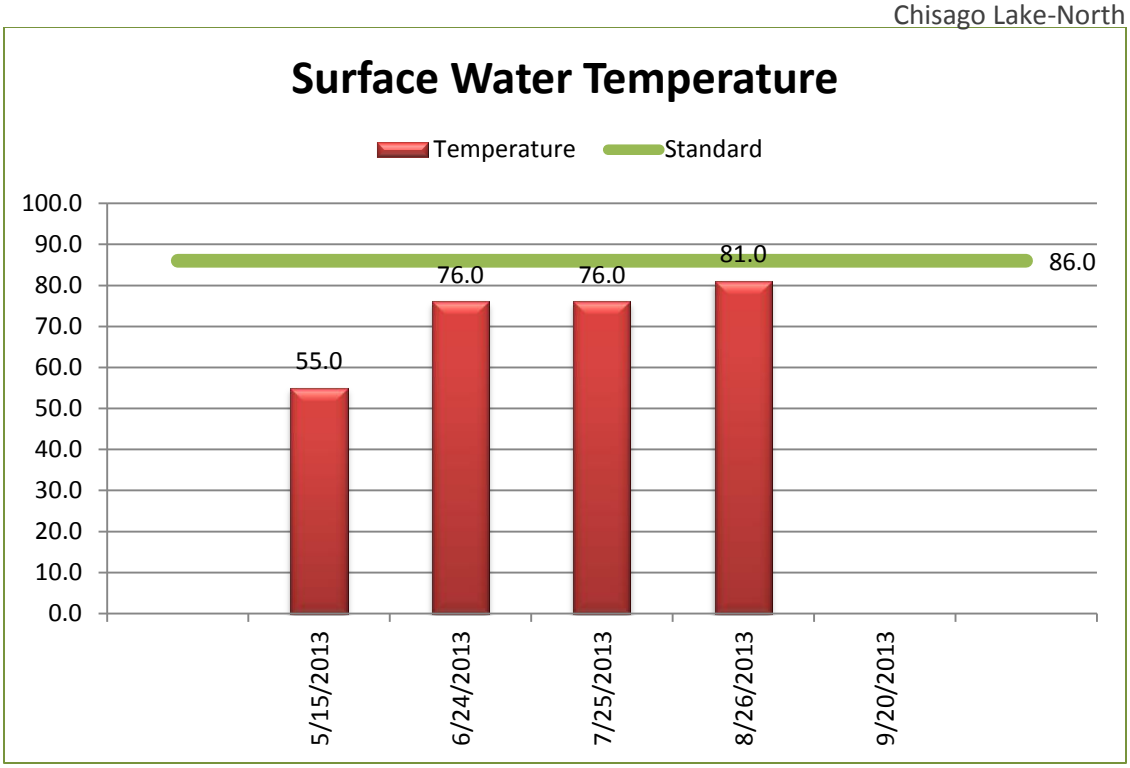
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	<0.05 mg/L	0.04 mg/L	0.07 mg/L	**0.04 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

The temperatures were all below the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	71.8 ˚F	73.0 ˚F	65.6 ˚F	72.4 ˚F	**72.0 ˚F**
Meets Standard (Not to exceed 86.0˚F)	Yes	Yes	Yes	Yes	**Yes**

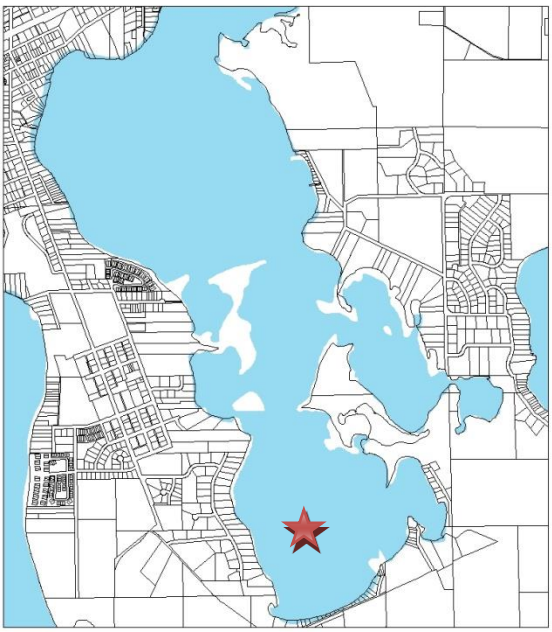
Chisago Lake-North General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Short Bread	Low weed pressure.
June	2	2	Bamboo	No notes.
July	3	3	Short Bread	No notes.
August	3.5	3.5	Beach Grass	Hot weather.
September	3	3	Cornichon	No notes.

Lake 13-0012-02 Site 201

Chisago Lake-South

Chisago Lake



Shallow Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	64.5	60.6	66.6	63.9
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: D

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	31.8 µg/L	1.0 meters	76.0 µg/L		
Grade	C	D	D	**D**	18th/19

MPCA Standards: Does Not Meet Standards

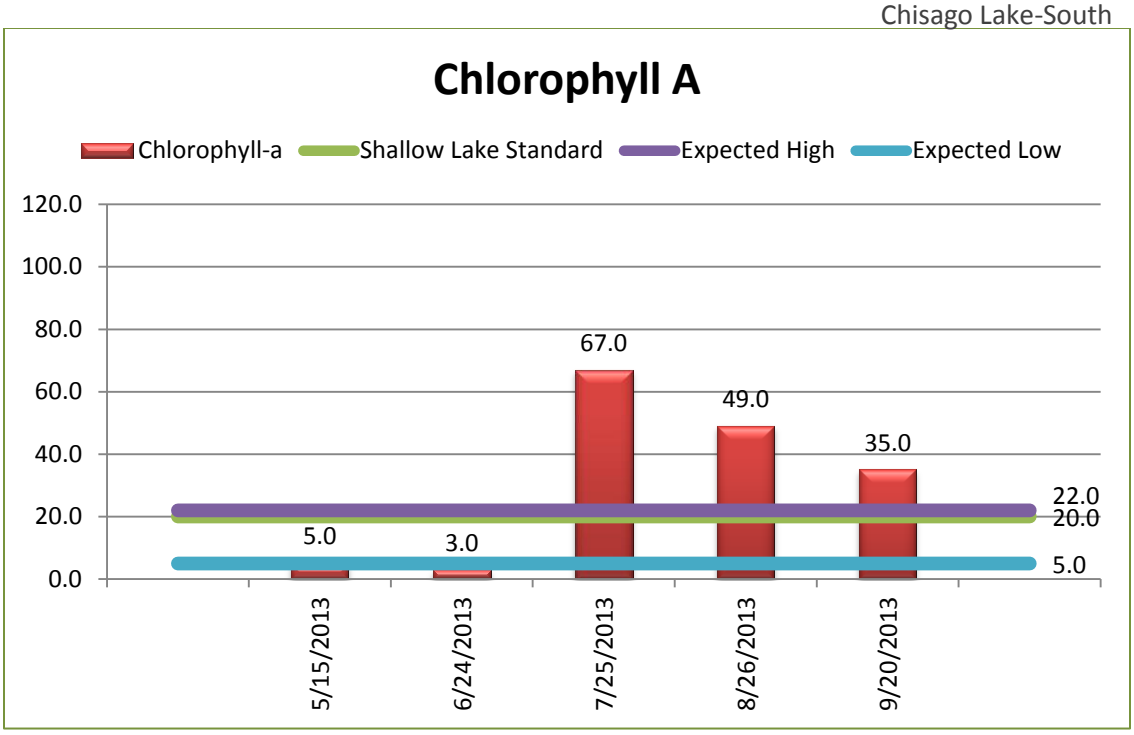
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Shallow lake)	20.0 µg/L	>1.0 meters	60.0 µg/L	
2013 Average (June-Sept)	38.5 µg/L	0.9 meters	83.8 µg/L	
Meets Standard	No	No	No	**No**

Chlorophyll-a

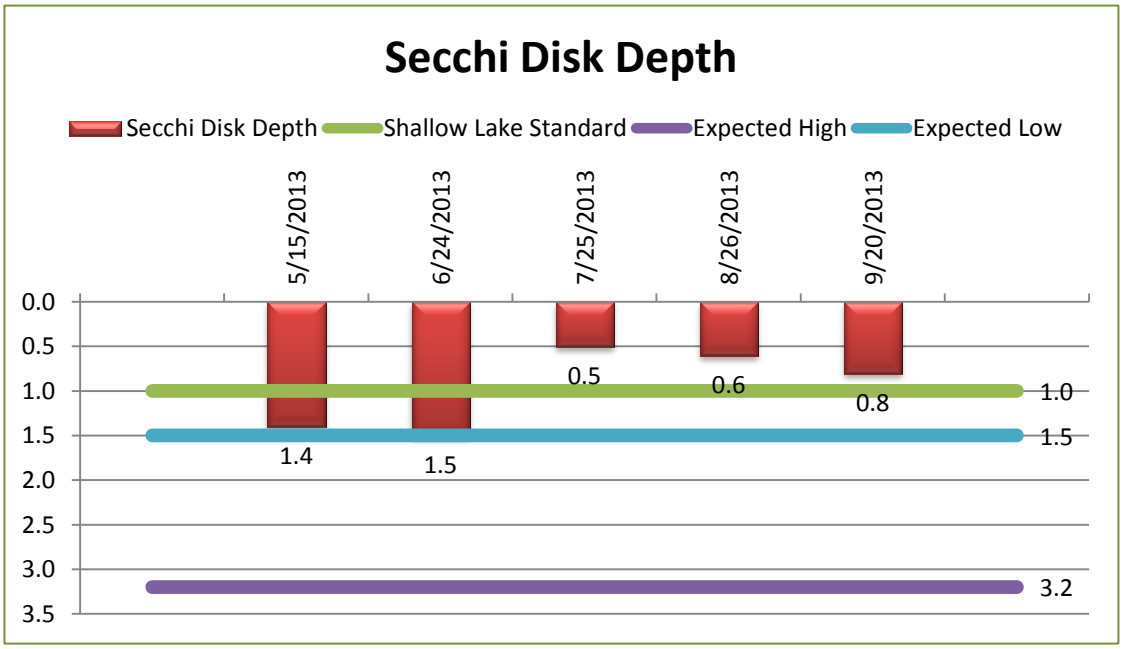
Expected Range: 5.0-22.0 µg/L

Shallow Lake Standard: 20.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Chlorophyll-a charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	15.8 µg/L	42.6 µg/L	15.0 µg/L	56.8 µg/L	**31.8 µg/L**
Grade	B	C	B	D	**C**
Average (June-Sept)	19.1 µg/L	57.7 µg/L	18.3 µg/L	70.3 µg/L	**38.5 µg/L**
Meets Standard (20.0 µg/L)	Yes	No	Yes	No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Shallow Lake Standard: >1.0 meters

Clarity became significantly worse compared to 2012. This is the first year that the average does not meet the standard.

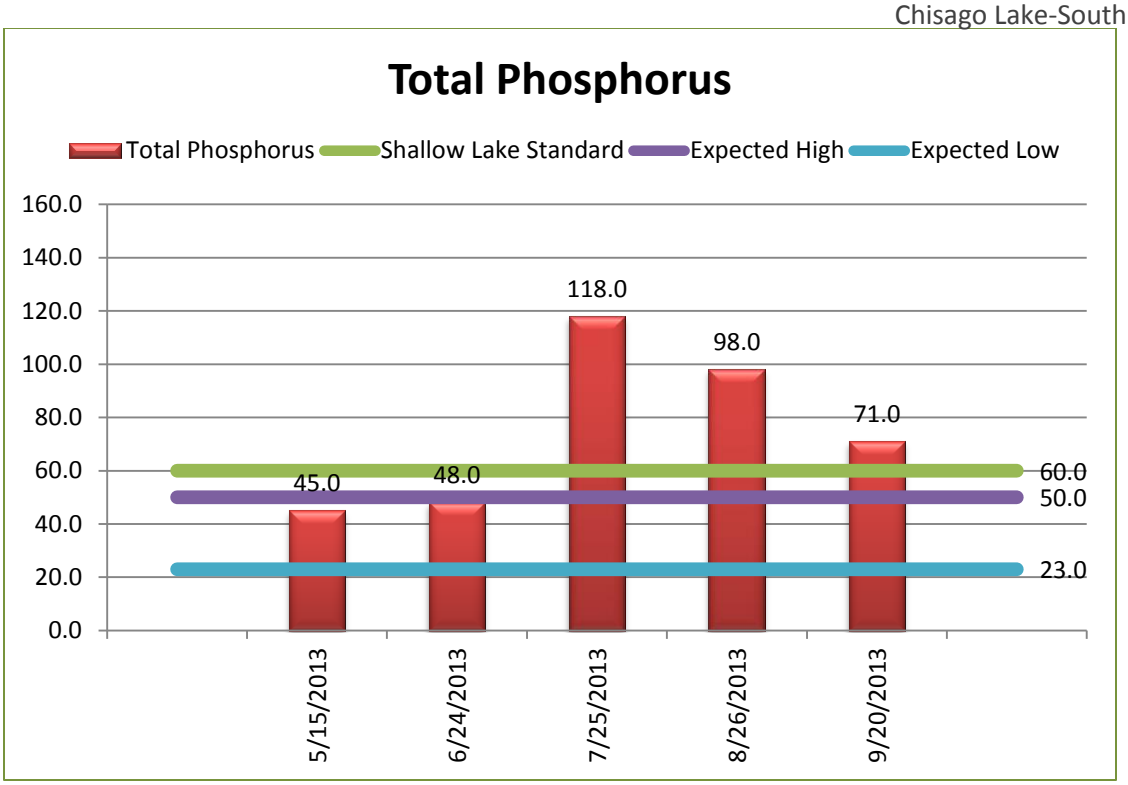
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	1.8 meters	1.3 meters	1.8 meters	2.4 meters	**1.0 meter**
Grade	C	C	C	B	**D**
Average (June-Sept)	1.7 meters	1.1 meters	1.2 meters	1.6 meters	**0.9 meters**
Meets Standard (>1.0 m)	Yes	Yes	Yes	Yes	**No**

Total Phosphorus

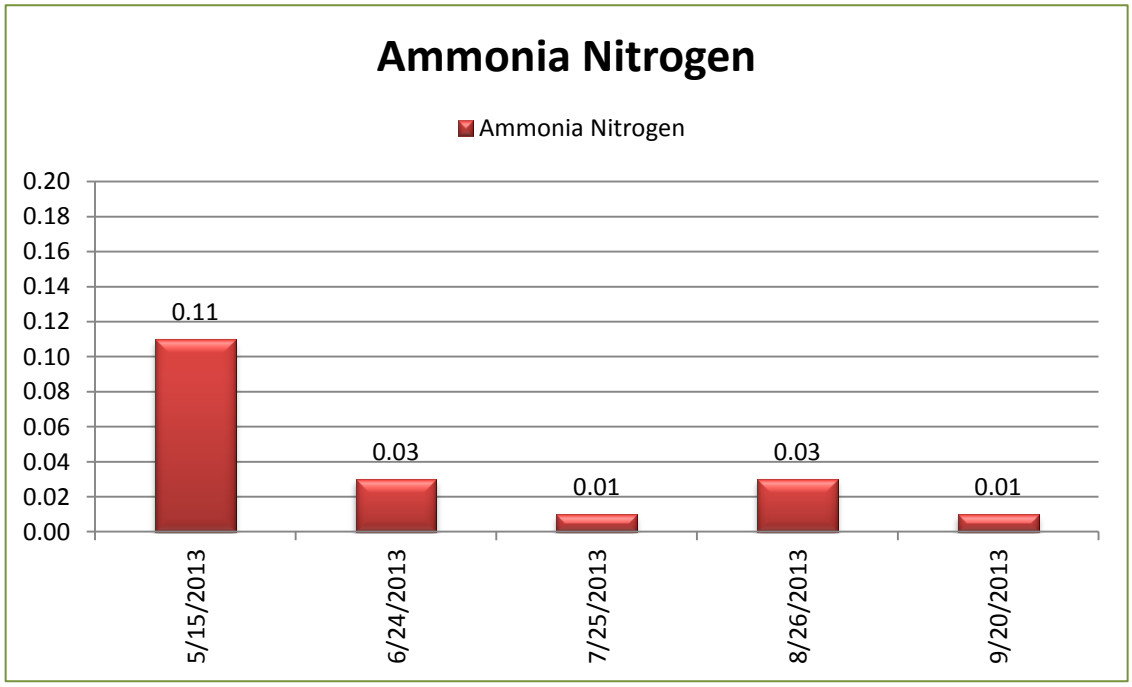
Expected Range: 23.0-50.0 µg/L

Shallow Lake Standard: 60.0 µg/L

The average does not meet the standard, although it is lower than 2012. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	38.0 µg/L	69.0 µg/L	52.8 µg/L	99.0 µg/L	**76.0 µg/L**
Grade	C	D	C	D	**D**
Average (June-Sept)	42.0 µg/L	80.0 µg/L	60.8 µg/L	117.3 µg/L	**83.8 µg/L**
Meets Standard (60.0 µg/L)	Yes	No	No	No	**No**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

The elevated May sample could be due to spring runoff. This chart cannot be directly compared to other Ammonia Nitrogen charts due to a difference in scale.

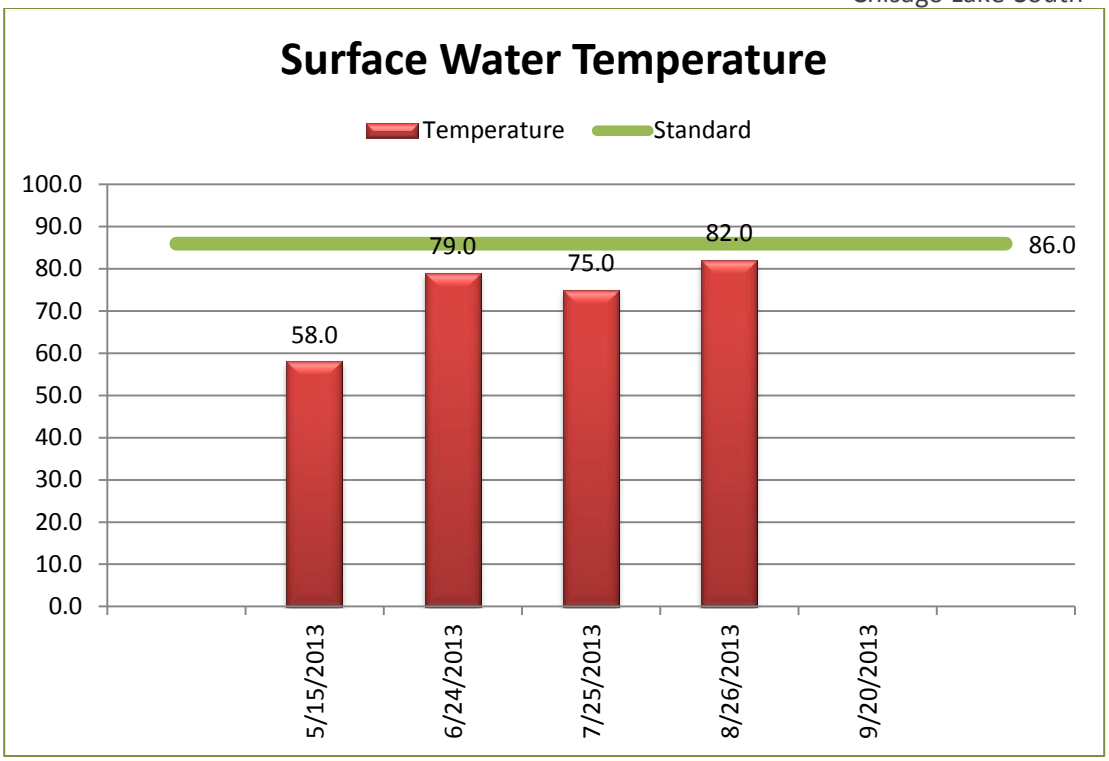
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	<0.05 mg/L	0.03 mg/L	0.08 mg/L	**0.04 mg/L**

Surface Water Temperature

Expected Range: None

Shallow Lake Standard: The daily average shall not exceed 86.0˚F

All temperatures were below the standard.

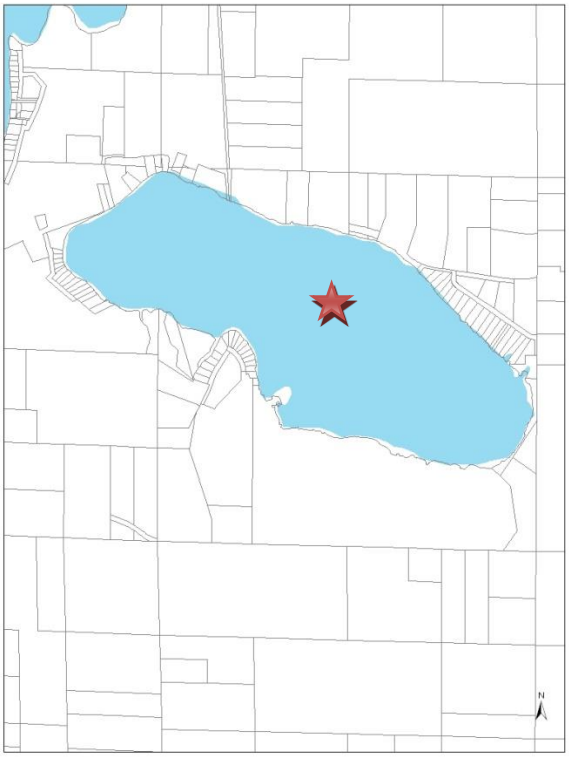


	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	No Data	No Data	64.0 ˚F	72.8 ˚F	**73.5 ˚F**
Within Expected Range			Yes	Yes	**Yes**

Chisago Lake-South General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Short Bread	Low weed pressure.
June	2	2	Macadamia	Thick curlyleaf pondweed.
July	3	3	Short Bread	No notes.
August	3.5	3.5	Cornichon	Hot weather.
September	3	3	Cornichon	No notes.

Fish Lake



Deep Lake

Lake Classification: MESOTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	44.2	46.3	49.4	46.6
Classification	Mesotrophic	Mesotrophic	Mesotrophic	Mesotrophic

Overall Lake Quality Grade: B

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	4.0 µg/L	2.6 meters	23 µg/L		
Grade	A	B	B	**B**	1st/19

MPCA Standards: Meets Standards

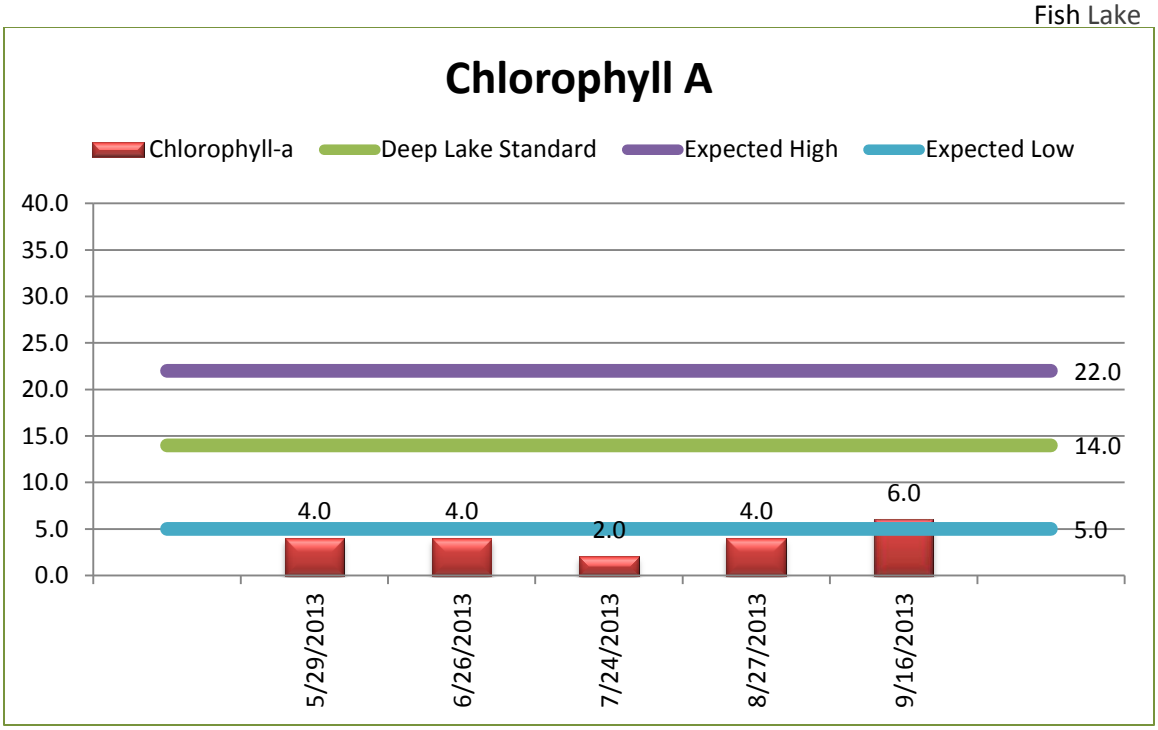
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	4.0 µg/L	2.9 meters	20.5 µg/L	
Meets Standard	Yes	Yes	Yes	**Yes**

Chlorophyll-a

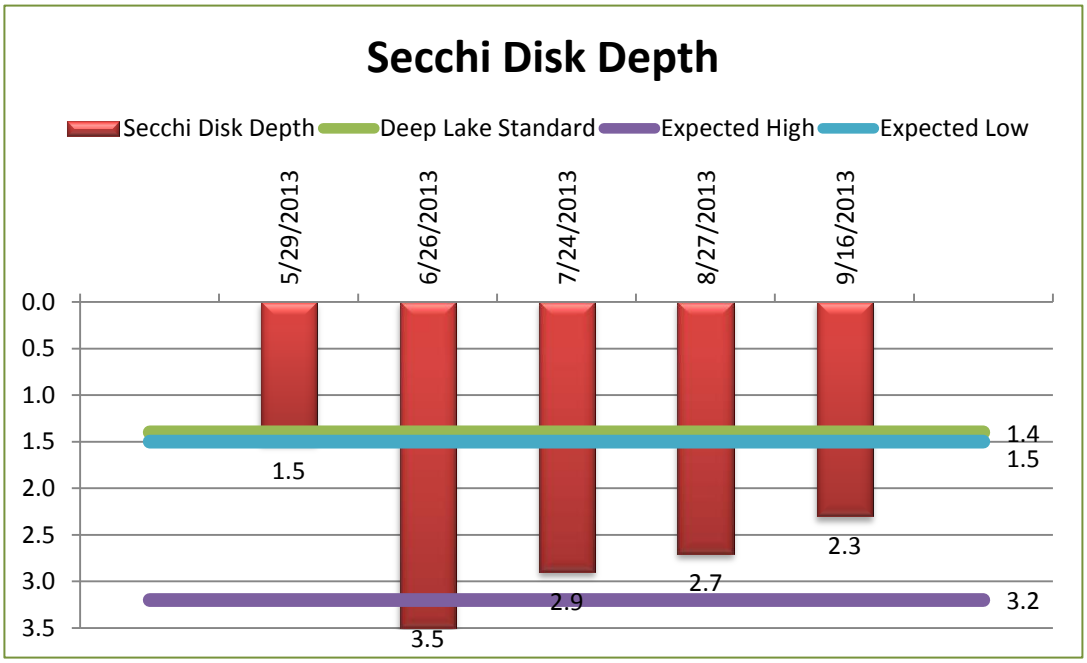
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

The readings for 2013 are very low. All but one sample were below the expected range. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	6.8 µg/L	**4.0 µg/L**
Grade				A	**A**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	7.3 µg/L	**4.0 µg/L**
Meets Standard (14.0 µg/L)				Yes	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

Clarity was good in this lake. The average does meet the standard.

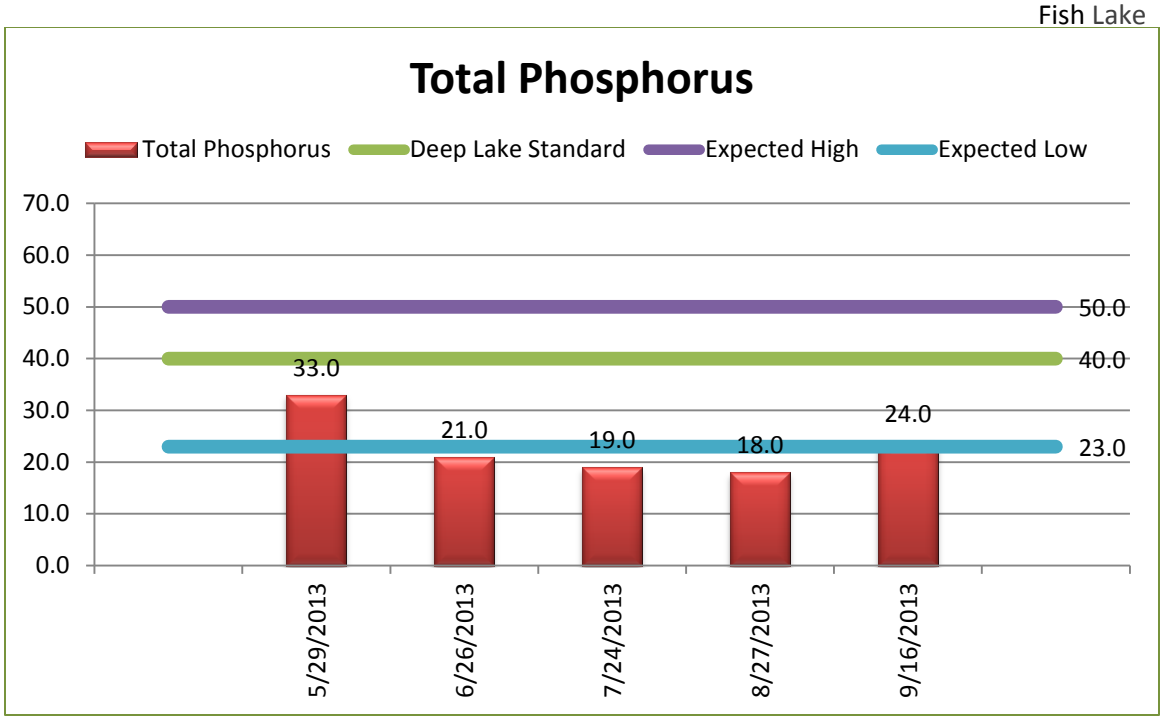
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	2.7 meters	**2.6 meters**
Grade				B-C	**B**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	2.1 meters	**2.9 meters**
Meets Standard (>1.4 m)				Yes	**Yes**

Total Phosphorus

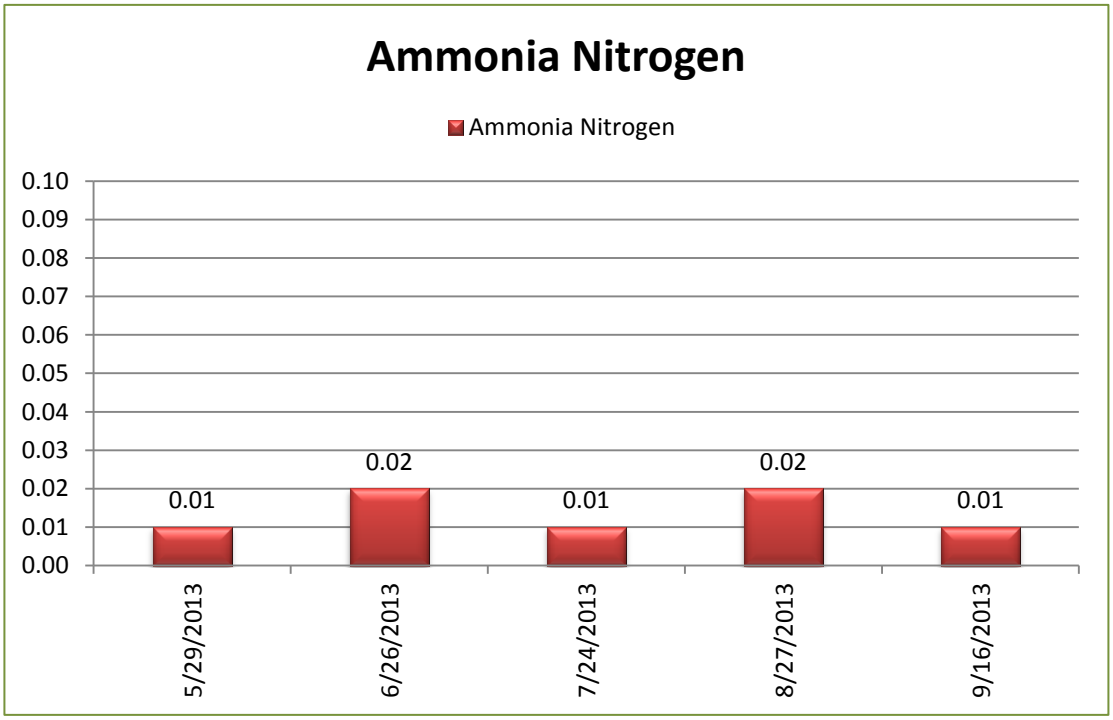
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

Most samples were below the expected range. The average easily meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	22.8 µg/L	**23.0 µg/L**
Grade				A	**B**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	21.8 µg/L	**20.5 µg/L**
Meets Standard (40.0 µg/L)				Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There is no standard, but the ammonia nitrogen levels were very low.

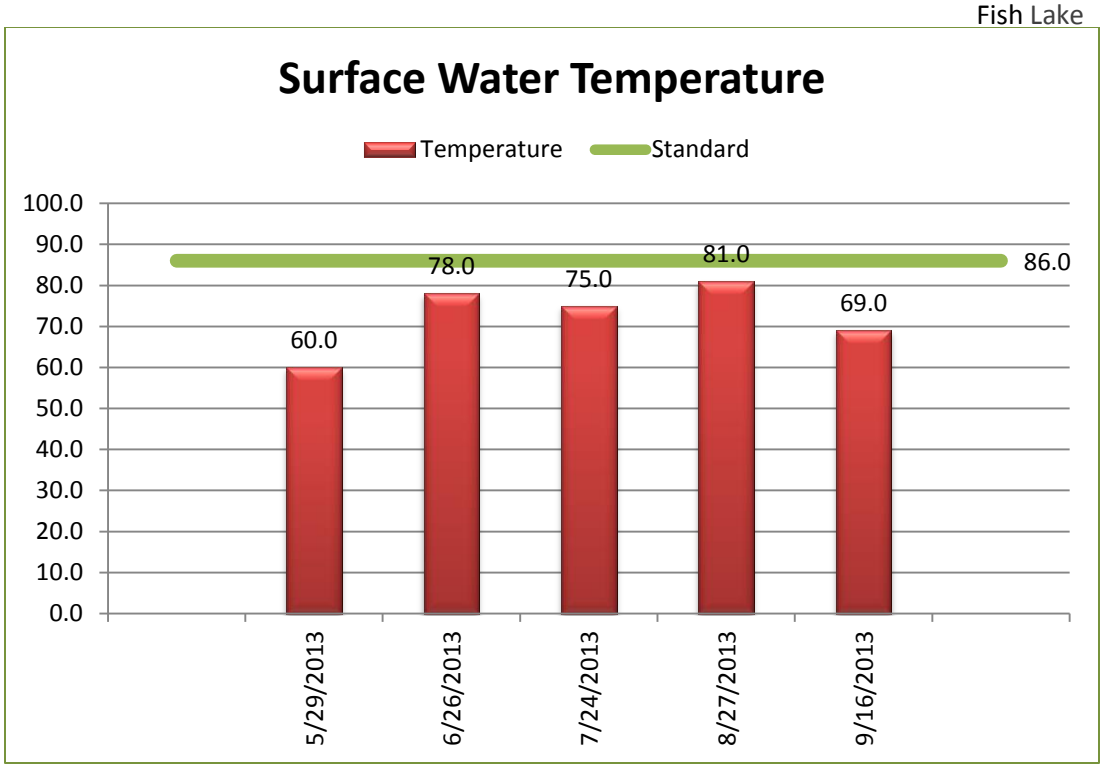
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.07 mg/L	**0.01 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	71.6˚F	**72.6˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

Fish Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Toasted Marshmallow	Low weed pressure.
June	2	2	Chop Stick	Recent heavy rains and thunderstorms.
July	1.5	1.5	Short Bread	Clear water.
August	2	2	Toasted Marshmallow	Very clear water.
September	2	2	Dune	Beautiful.

Green Lake

Green Lake

Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	58.3	51.7	58.3	56.1
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	16.8 µg/L	1.8 meters	42.6 µg/L		
Grade	B	C	C	**C**	11th/19

MPCA Standards: Does not meet Standards

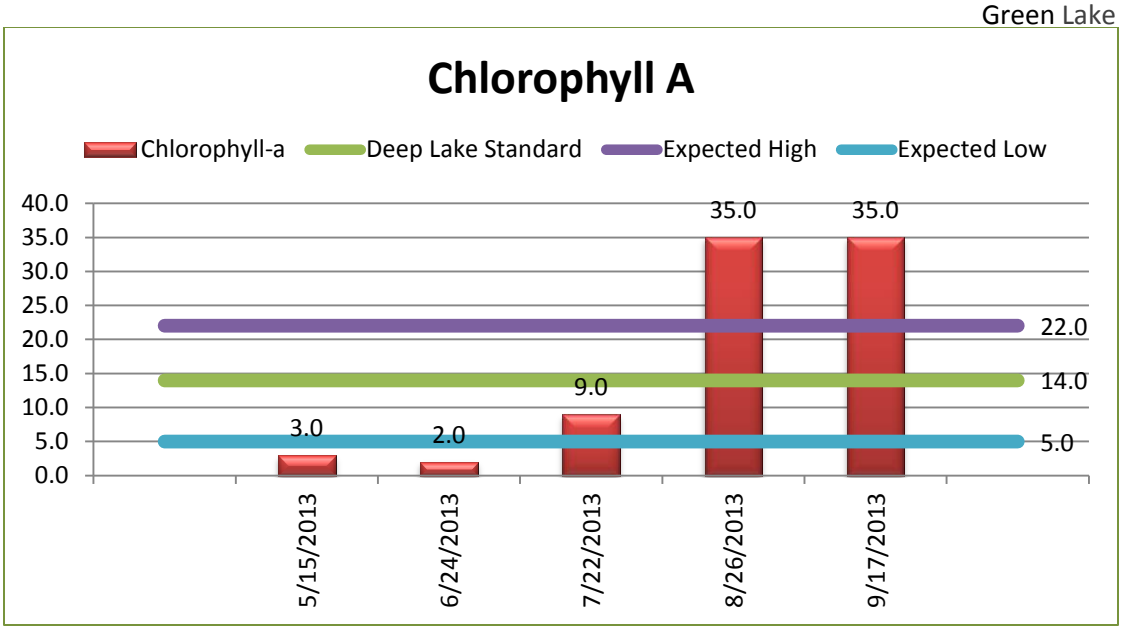
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	20.3 µg/L	1.6 meters	48.3 µg/L	
Meets Standard	No	Yes	No	**No**

Chlorophyll-a

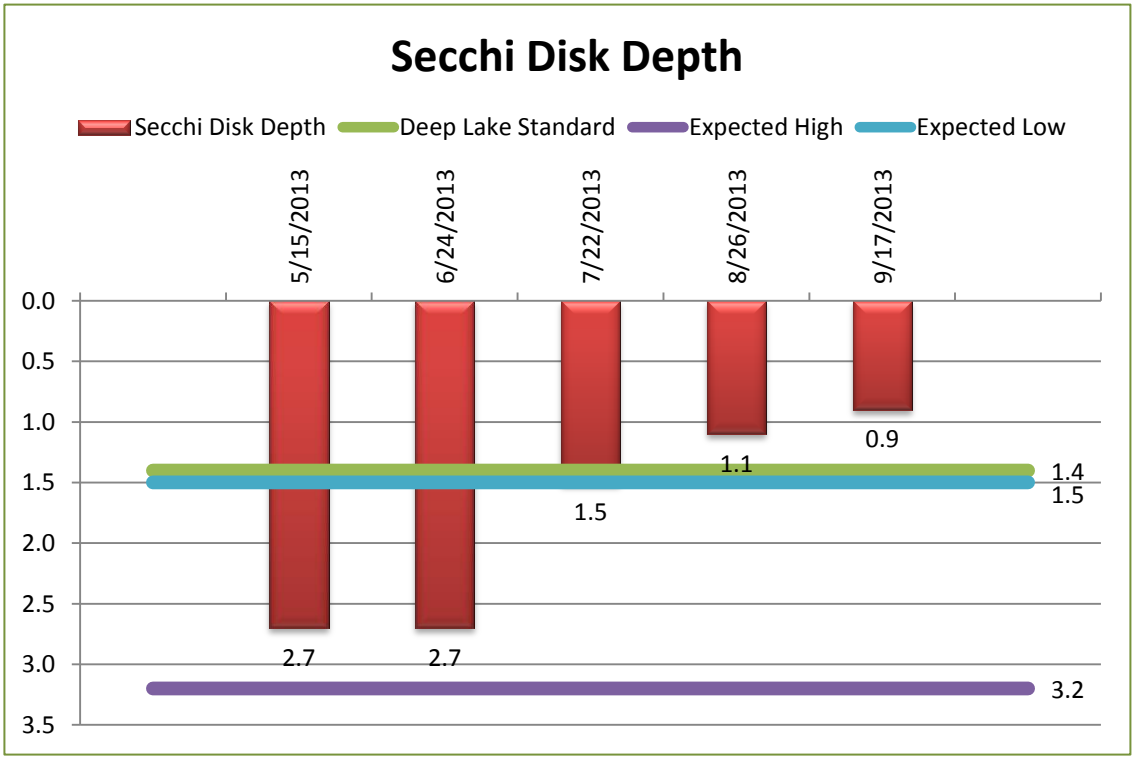
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

Late season samples were well above the standard and the expected range. The average did not meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	28.4 µg/L	14.0 µg/L	16.8 µg/L	16.4 µg/L	**16.8 µg/L**
Grade	C	B	B	B	**B**
Average (June-Sept)	34.8 µg/L	20.2 µg/L	18.8 µg/L	19.5 µg/L	**20.3 µg/L**
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

Clarity is good early in the year, but drops off in July. The average meets the standard.

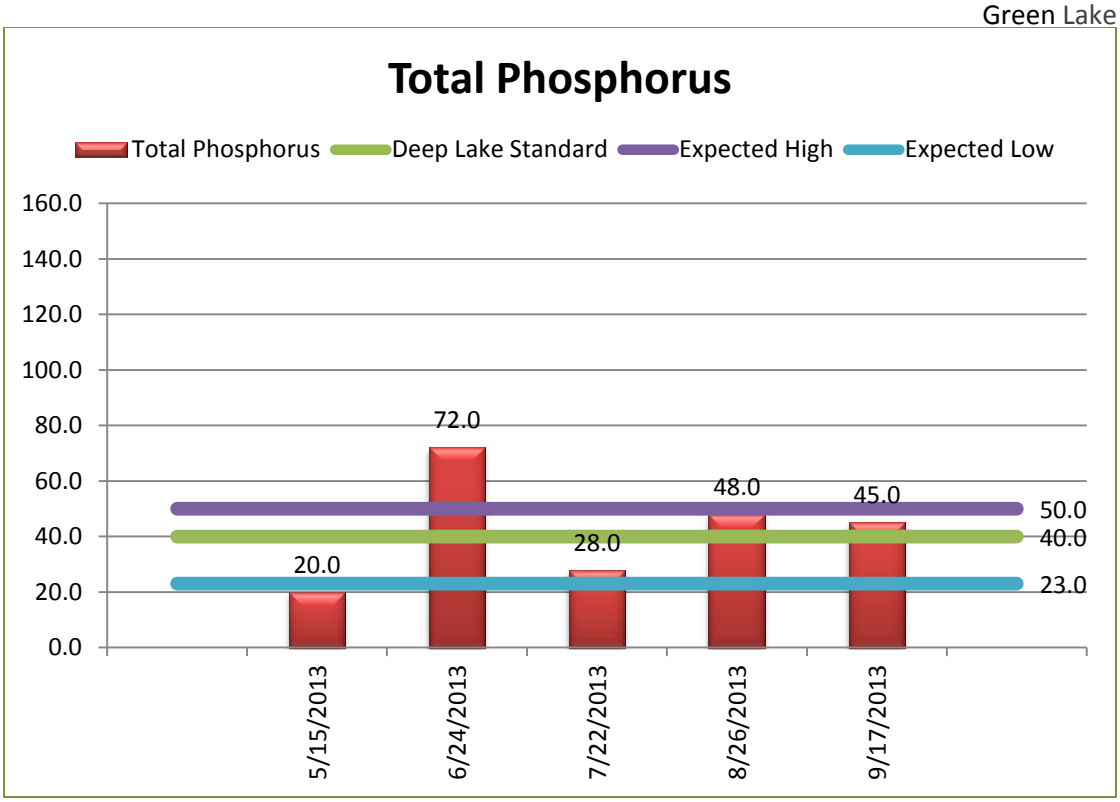
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	2.5 meters	2.4 meters	1.6 meters	2.1 meters	**1.8 meters**
Grade	B	B	C	C	**C**
Average (June-Sept)	2.4 meters	1.5 meters	1.3 meters	1.9 meters	**1.6 meters**
Meets Standard (>1.4 m)	Yes	Yes	No	Yes	**Yes**

Total Phosphorus

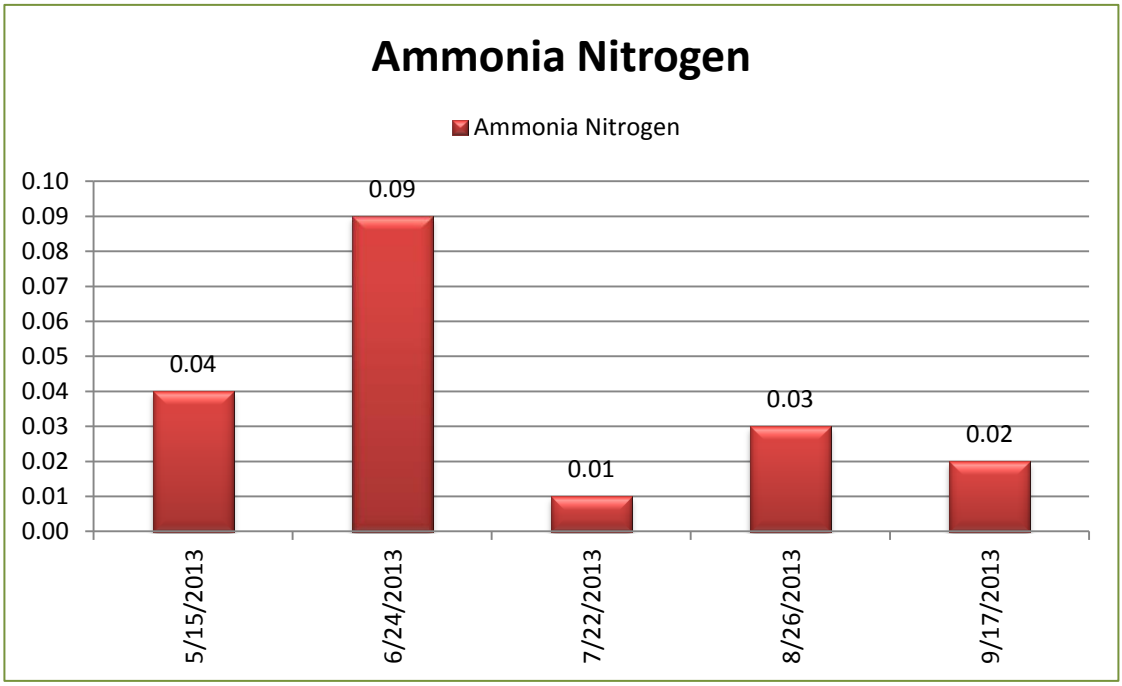
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	51.0 µg/L	22.0 µg/L	40.6 µg/L	32.4 µg/L	**42.6 µg/L**
Grade	C	A	C	B-C	**C**
Average (June-Sept)	57.0 µg/L	24.0 µg/L	45.5 µg/L	35.8 µg/L	**48.3 µg/L**
Meets Standard (40.0 µg/L)	No	Yes	No	Yes	**No**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There June reading was elevated. This could be due to stormwater runoff from heavy rain and thunderstorms that occurred shortly before the sample was taken.

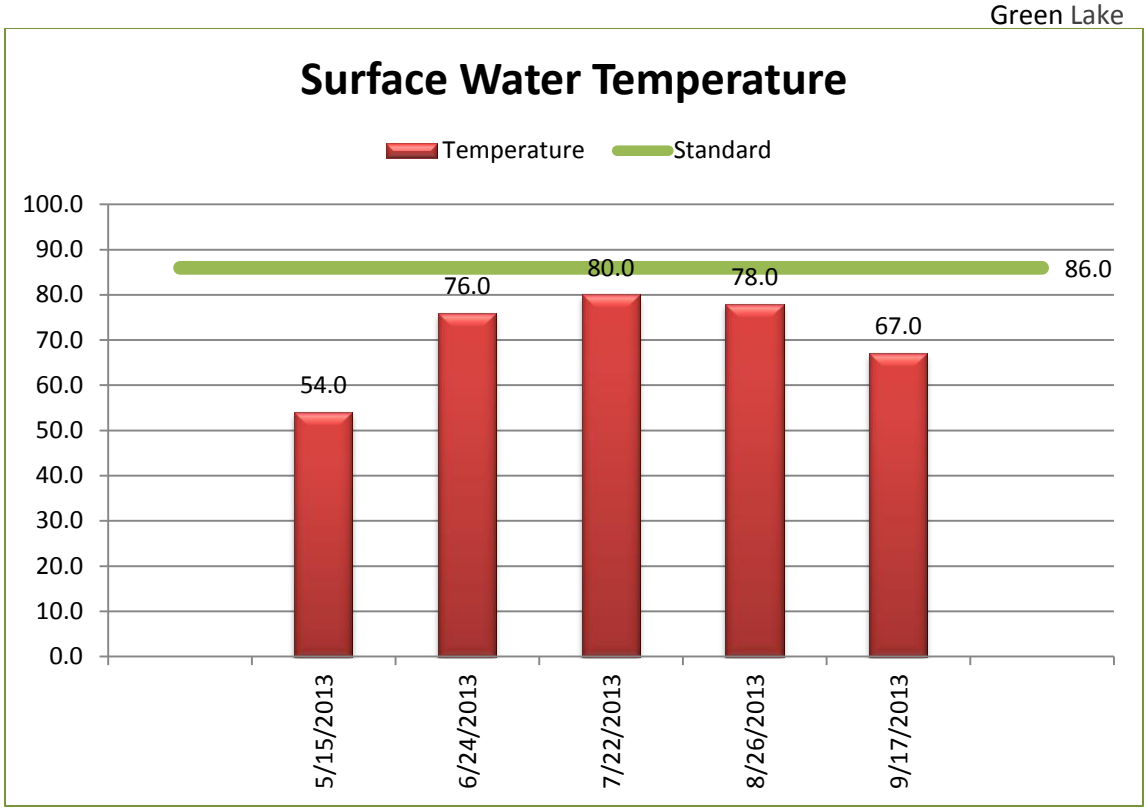
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	0.09 mg/L	0.04 mg/L	0.07 mg/L	**0.04 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	74.8 ˚F	72.9 ˚F	65.8 ˚F	71.0˚F	**71.0˚F**
Meets Standard (Not to exceed 86.0˚F)	Yes	Yes	Yes	Yes	**Yes**

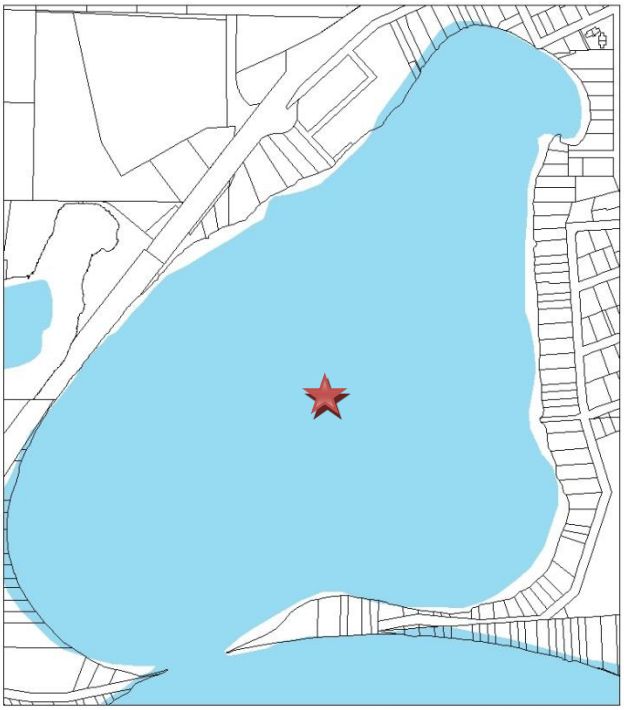
Green Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Chop Stick	Low weed pressure.
June	2.5	2.5	Toasted Marshmallow	Good control of Eurasian watermilfoil and curlyleaf pondweed for navigation.
July	2.5	2.5	Toasted Marshmallow	Good control of Eurasian watermilfoil and curlyleaf pondweed for navigation.
August	3	3	Cornichon	Hot weather.
September	3	3	Beach Grass	Good control of Eurasian watermilfoil.

Lake 13-0041-01 Site 202

Little Green Lake

Little Green Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	56.1	56.7	54.3	55.7
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	13.4 µg/L	1.3 meters	54.3 µg/L		
Grade	B	C	C	**C**	7th/19

MPCA Standards: Does not meet Standards

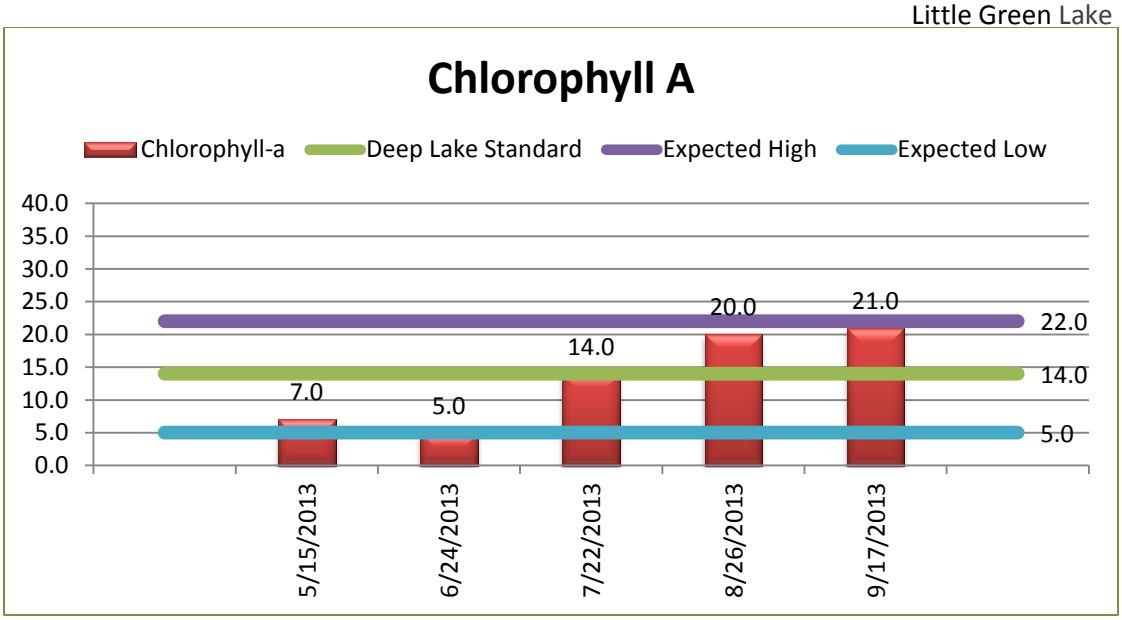
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	15.0 µg/L	1.2 meters	32.8 µg/L	
Meets Standard	No	No	Yes	**No**

Chlorophyll-a

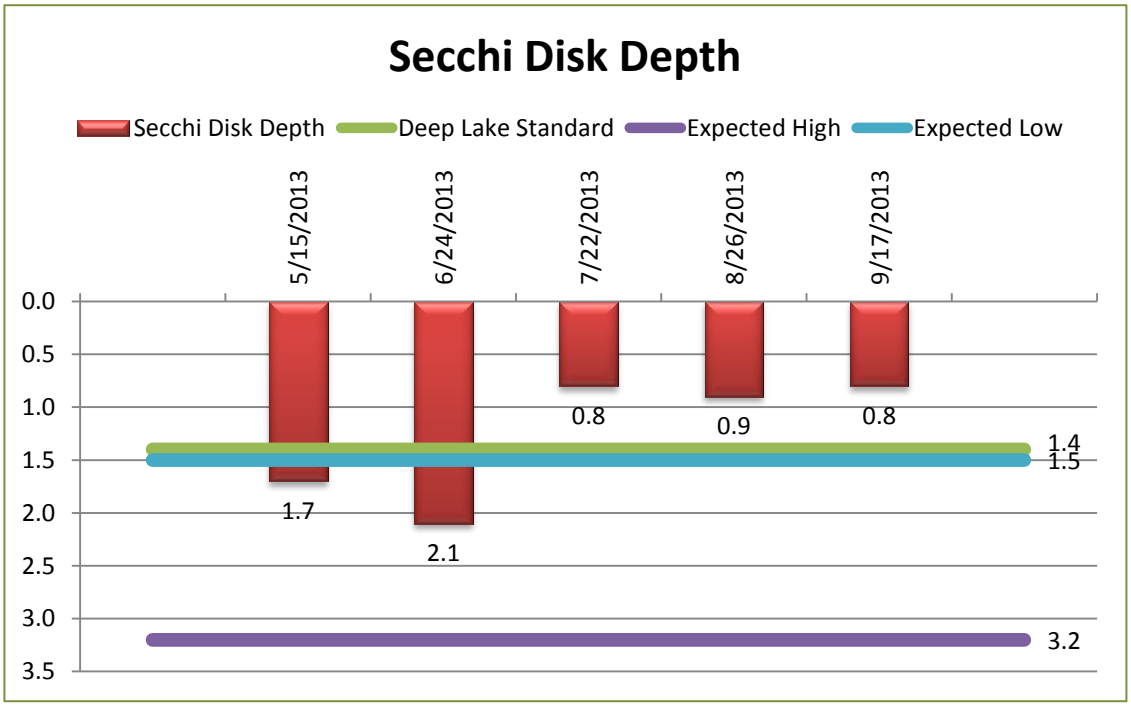
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

All samples were within the expected range. The average does not meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	14.6 µg/L	10.0 µg/L	13.2 µg/L	11.6 µg/L	**13.4 µg/L**
Grade	B	B	B	B	**B**
Average (June-Sept)	16.8 µg/L	14.4 µg/L	15.3 µg/L	13.5 µg/L	**15.0 µg/L**
Meets Standard (14.0 µg/L)	No	No	No	Yes	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

Three of the five samples did not meet the standard. The average also did not meet the standard.

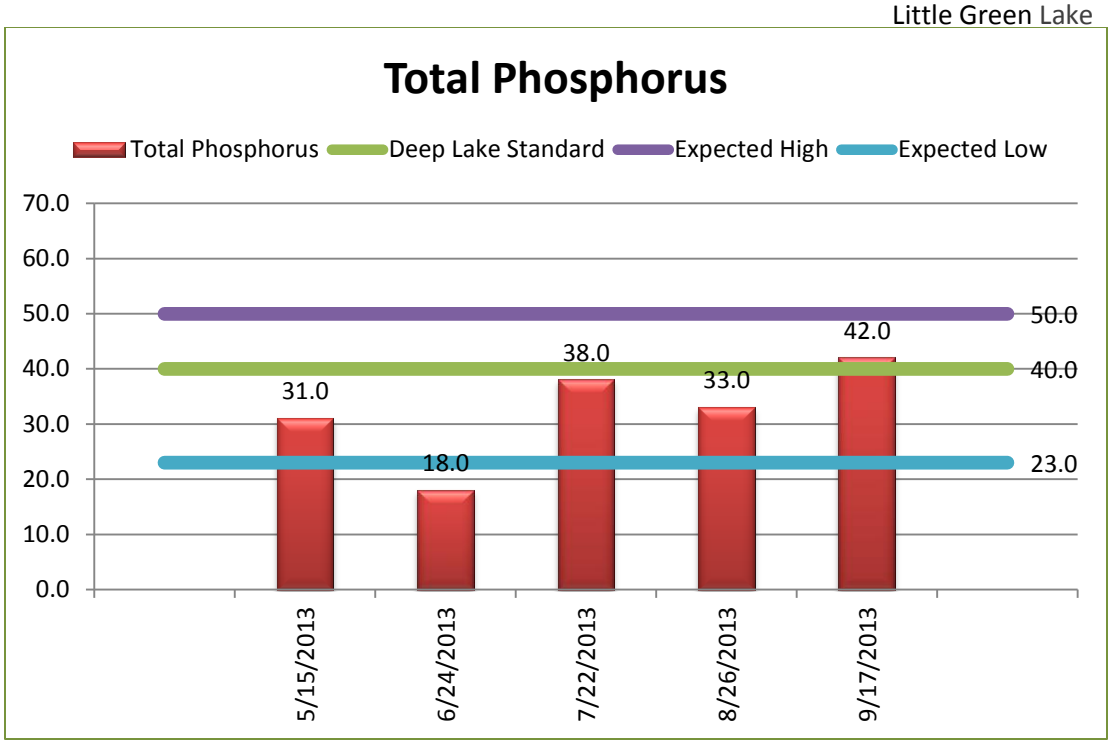
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	1.4 meters	1.8 meters	1.2 meters	1.2 meters	**1.3 meters**
Grade	C	C	C-D	C-D	**C**
Average (June-Sept)	1.3 meters	1.1 meters	1.0 meter	1.0 meter	**1.2 meters**
Meets Standard (>1.4 m)	No	No	No	No	**No**

Total Phosphorus

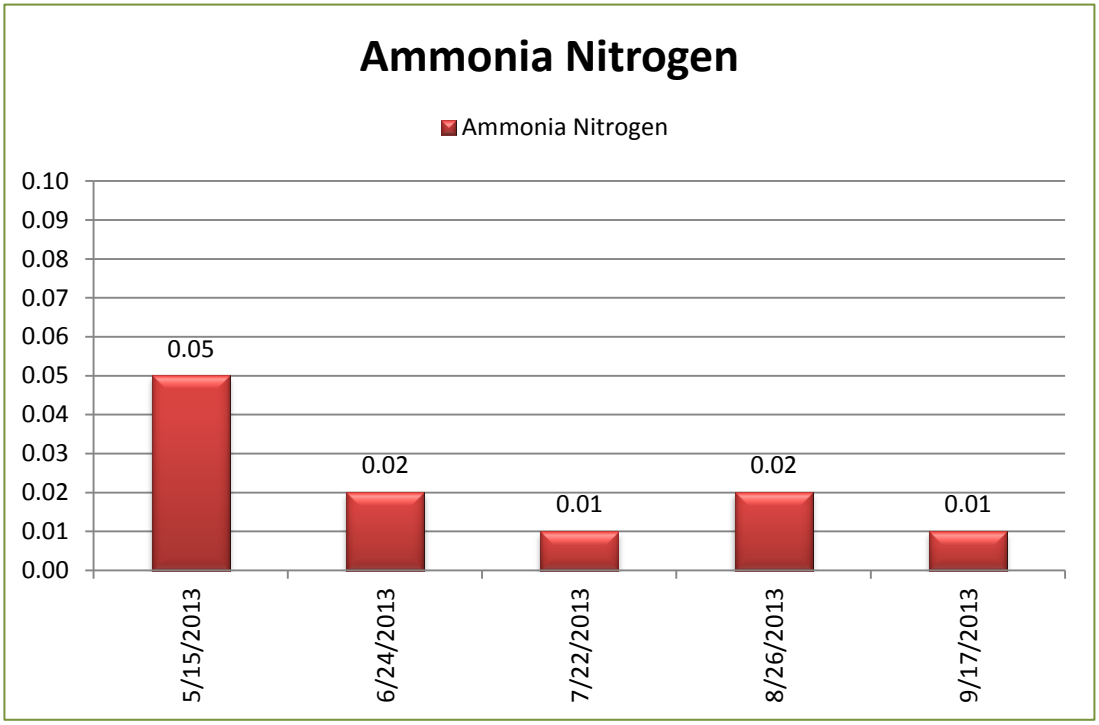
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

Four of five samples were within the expected range and the average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	54.0 µg/L	32.0 µg/L	40.0 µg/L	34.6 µg/L	**32.4 µg/L**
Grade	C	B-C	C	C	**C**
Average (June-Sept)	58.0 µg/L	41.0 µg/L	39.3 µg/L	35.5 µg/L	**32.8 µg/L**
Meets Standard (40.0 µg/L)	No	No	Yes	Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There is no standard, but the ammonia nitrogen levels were low.

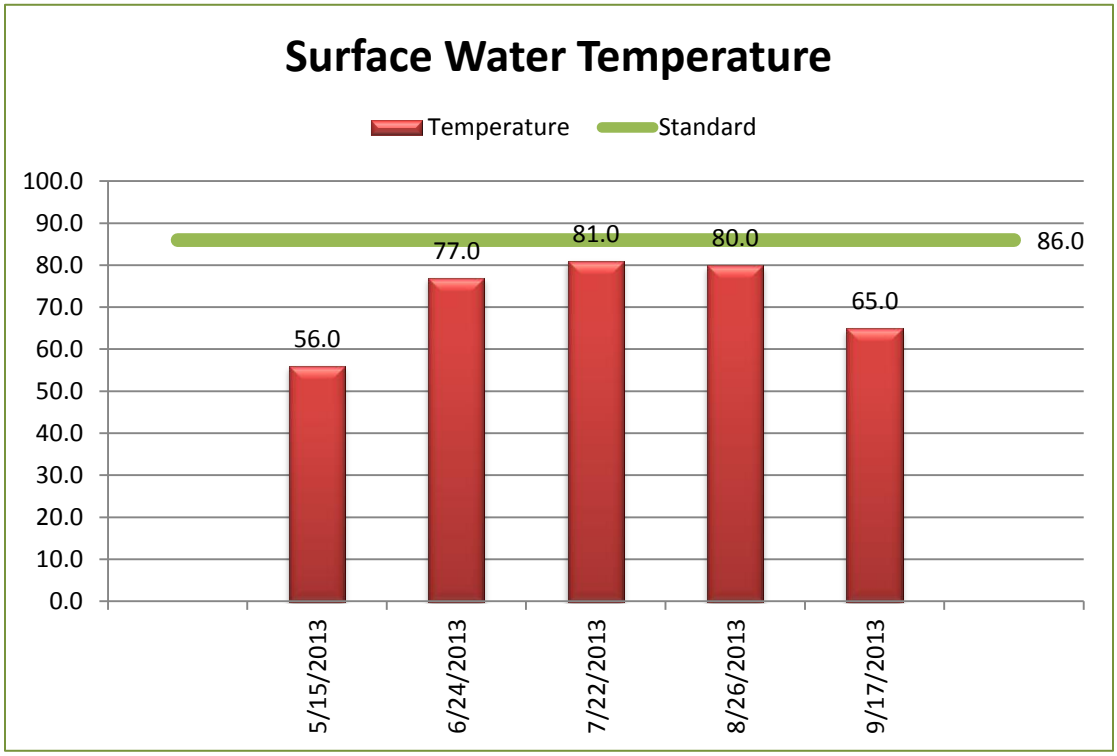
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	<0.05 mg/L	0.03 mg/L	0.07 mg/L	**0.02 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

The temperatures meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	74.9 ˚F	74.0 ˚F	63.4 ˚F	**71.8 ˚F**	**71.8 ˚F**
Meets Standard (Not to exceed 86.0˚F)	Yes	Yes	Yes	**Yes**	**Yes**

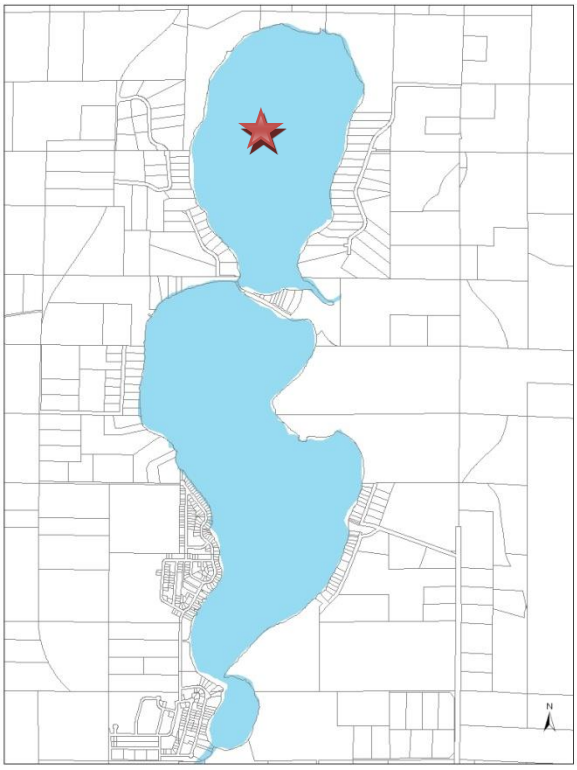
Little Green Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	Other Notes
May	2	2	Short Bread	Low weed pressure.
June	2.5	2.5	Short Bread	Good control of Eurasian watermilfoil and curlyleaf pondweed for navigation.
July	2.5	2.5	Short Bread	Good control of Eurasian watermilfoil and curlyleaf pondweed for navigation.
August	3	3	Toasted Marshmallow	Hot weather.
September	3	3	Parchment Paper	Good navigational control of Eurasian watermilfoil.

Lake 13-0083-01 Site 202

Goose Lake-North

Goose Lake



Shallow Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	66.0	59.7	66.9	64.2
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: D

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	37.0 µg/L	1.0 meters	66.9 µg/L		
Grade	C	D	D	**D**	19th/19

MPCA Standards: Impaired

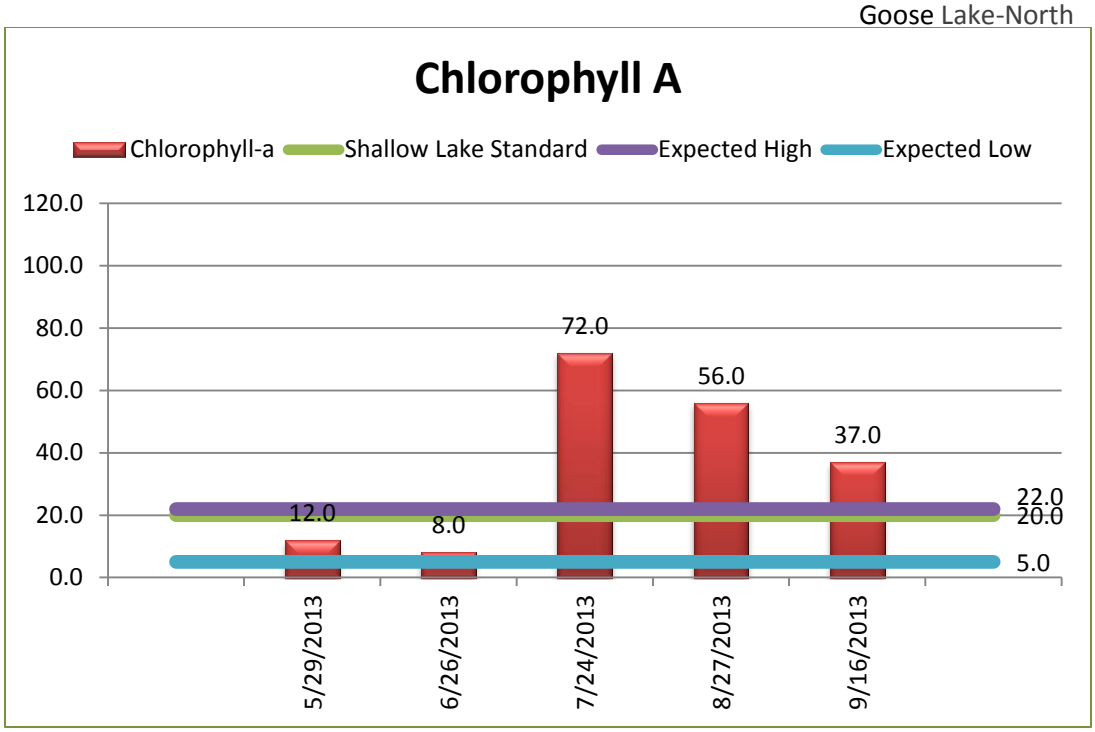
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Shallow lake)	20.0 µg/L	>1.0 meters	60.0 µg/L	
2013 Average (June-Sept)	43.3 µg/L	1.0 meters	85.8 µg/L	
Meets Standard	No	No	No	**No**

Chlorophyll-a

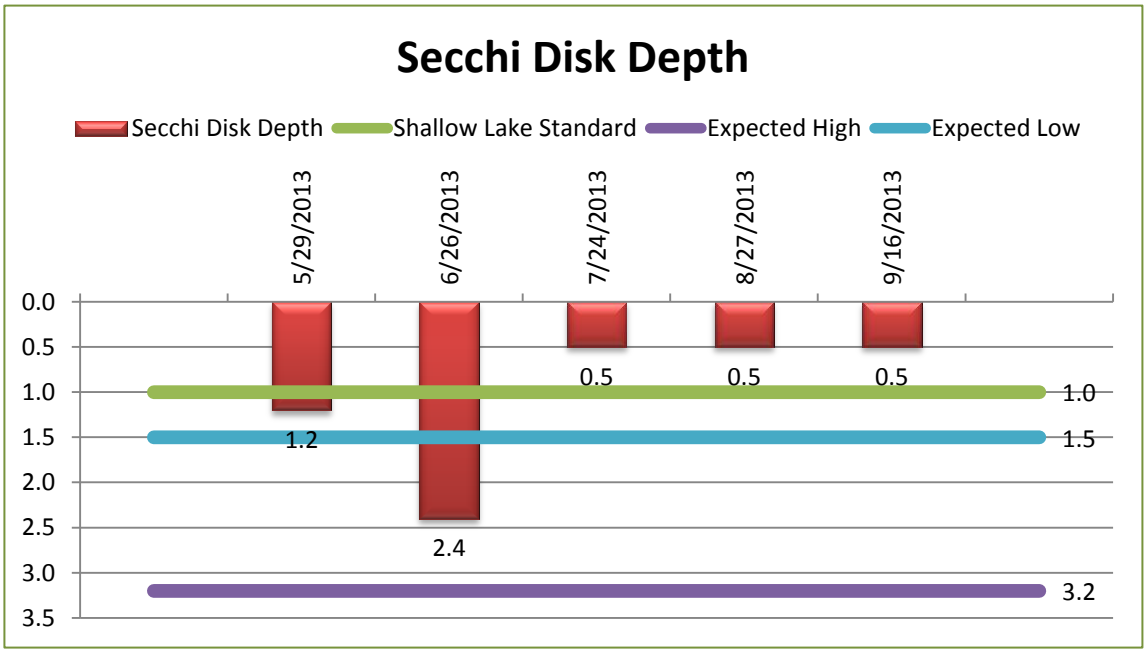
Expected Range: 5.0-22.0 µg/L

Shallow Lake Standard: 20.0 µg/L

The lake average does not meet the standard. This chart cannot be directly compared to other Chlorophyll-a charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	38.6 µg/L	**37.0 µg/L**
Grade				C	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	42.5 µg/L	**43.3 µg/L**
Meets Standard (20.0 µg/L)				No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Shallow Lake Standard: >1.0 meters

Clarity in this lake was poor throughout the year and does not meet the standard.

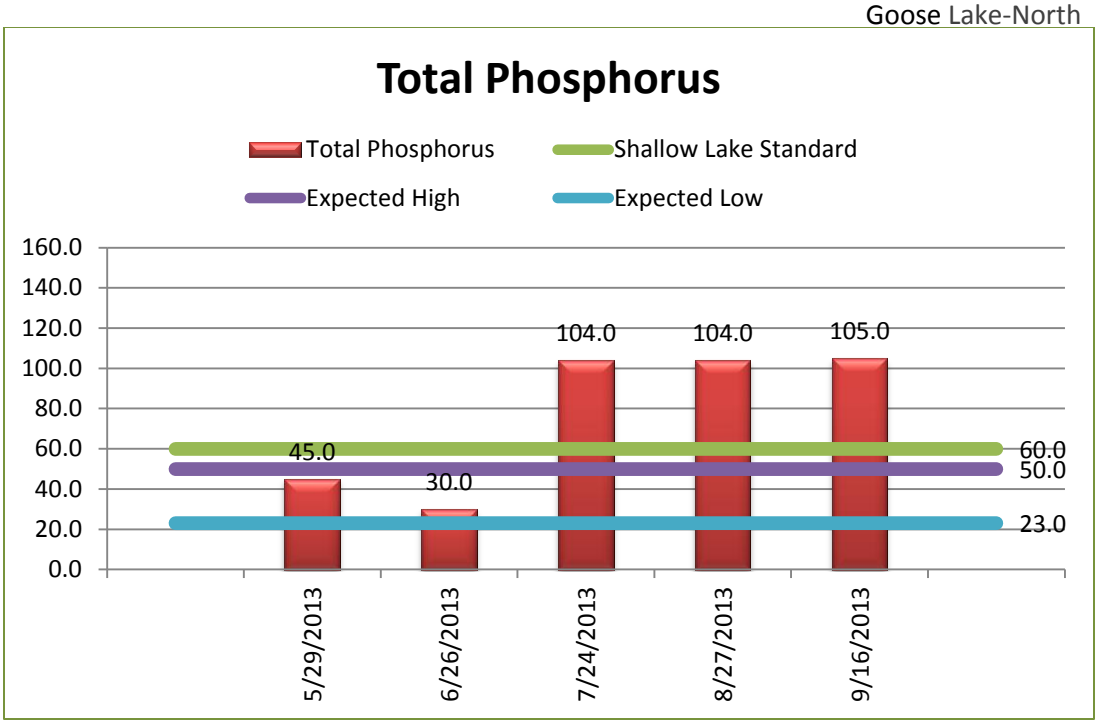
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	0.9 meters	**1.0 meter**
Grade				D	**D**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	0.8 meters	**1.0 meter**
Meets Standard (>1.0 m)				No	**No**

Total Phosphorus

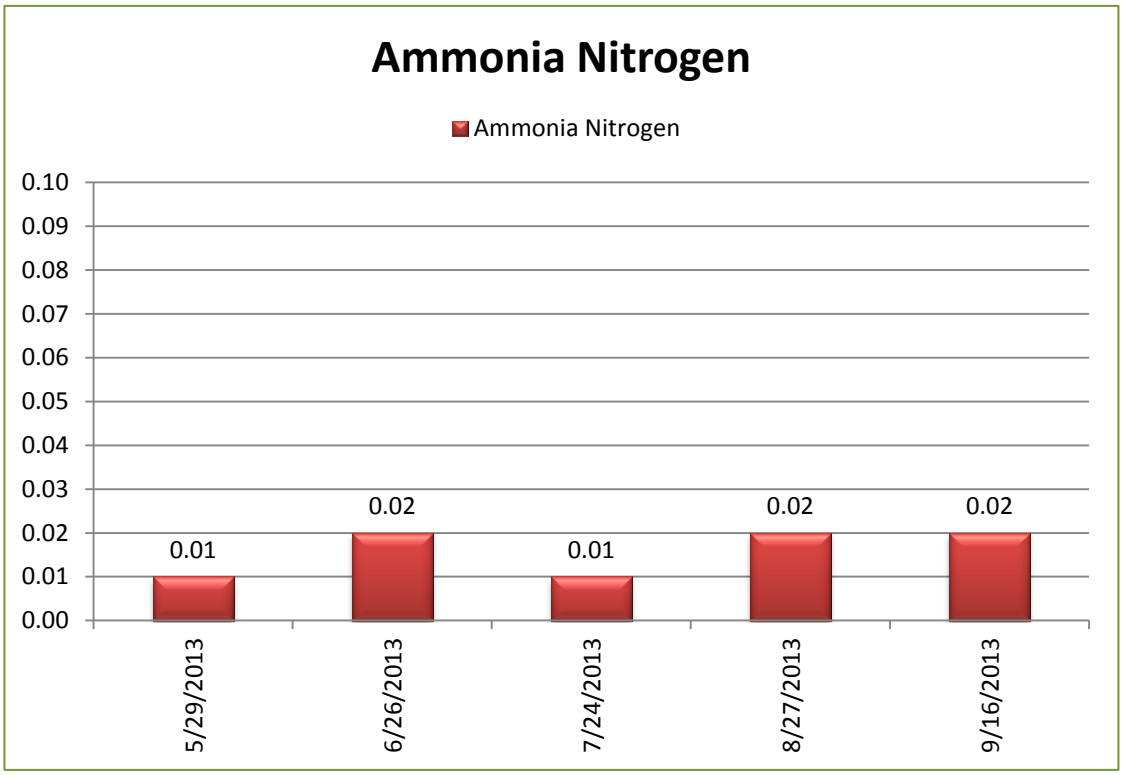
Expected Range: 23.0-50.0 µg/L

Shallow Lake Standard: 60.0 µg/L

The lake does not meet the standard. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	63.2 µg/L	**77.6 µg/L**
Grade				C	**D**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	68.8 µg/L	**85.8 µg/L**
Meets Standard (60.0 µg/L)				No	**No**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

There is no standard, but the ammonia nitrogen levels were very low.

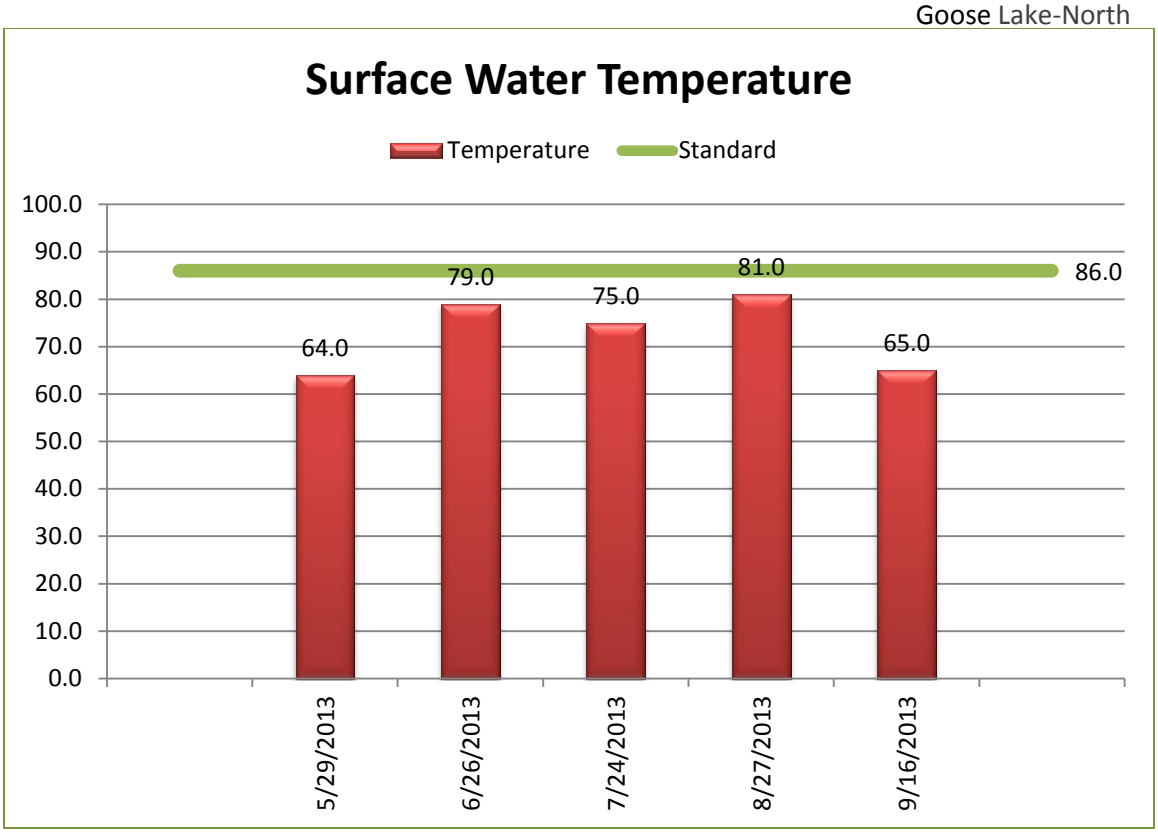
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.07 mg/L	**0.02 mg/L**

Surface Water Temperature

Expected Range: None

Shallow Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	**71.0˚F**	**72.8˚F**
Meets Standard (Not to exceed 86.0˚F)				**Yes**	**Yes**

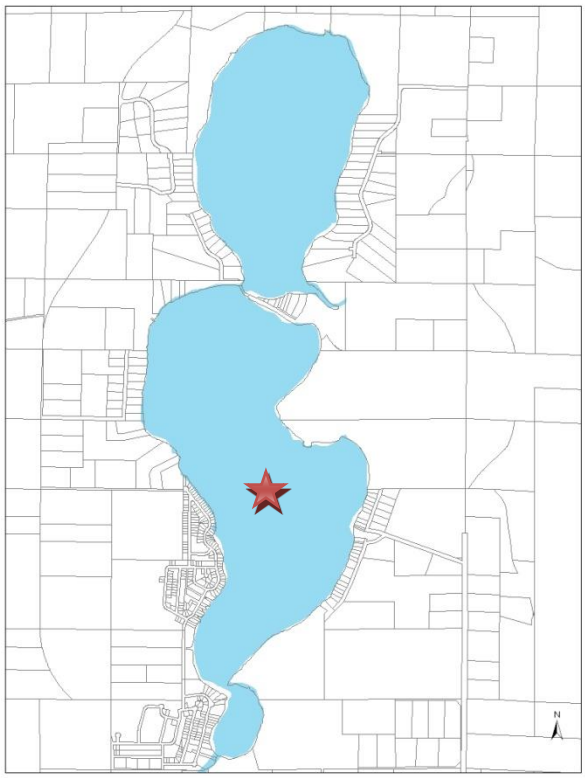
Goose Lake-North General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Short Bread	Low weed pressure.
June	2.5	2.5	Beach Grass	Recent heavy rains and thunderstorms.
July	3.5	3.5	Cornichon	Algae blooms forming across the lake.
August	4	4	Cornichon	Pea soup at boat launch.
September	3.5	3.5	Sultana	Algae blooms.

Lake 13-0083-02 Site 201

Goose Lake-South

Goose Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	58.4	54.4	55.3	56.0
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	17.0 µg/L	1.5 meters	34.8 µg/L		
Grade	B	C	C	**C**	9th/19

MPCA Standards: Impaired

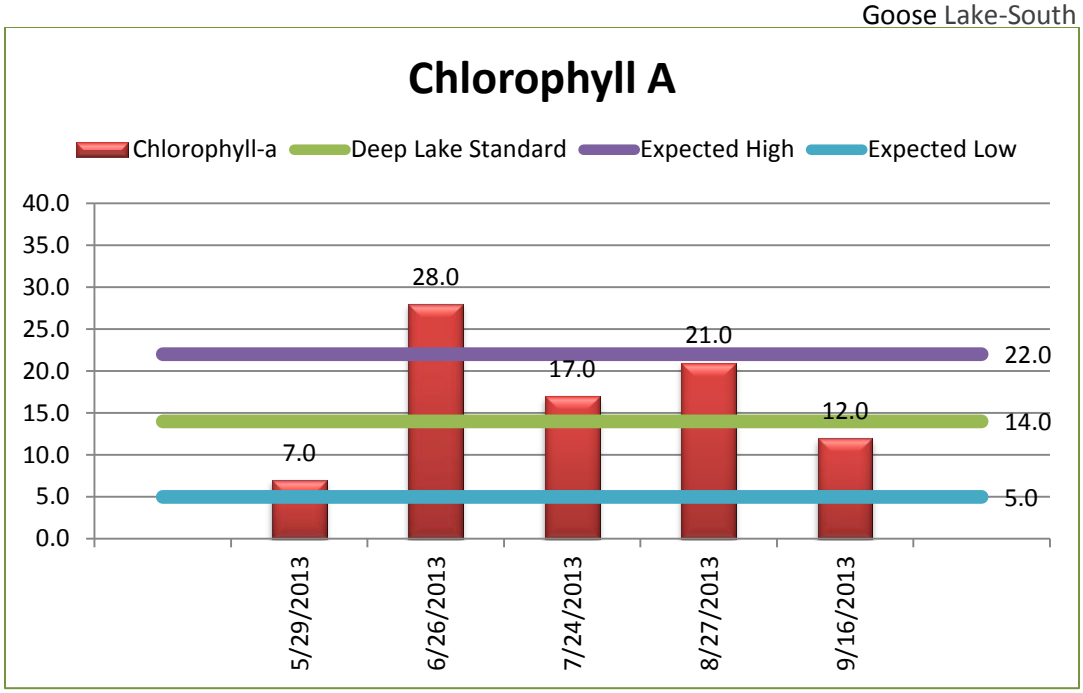
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	19.5 µg/L	1.3 meters	34.0 µg/L	
Meets Standard	No	No	Yes	**No**

Chlorophyll-a

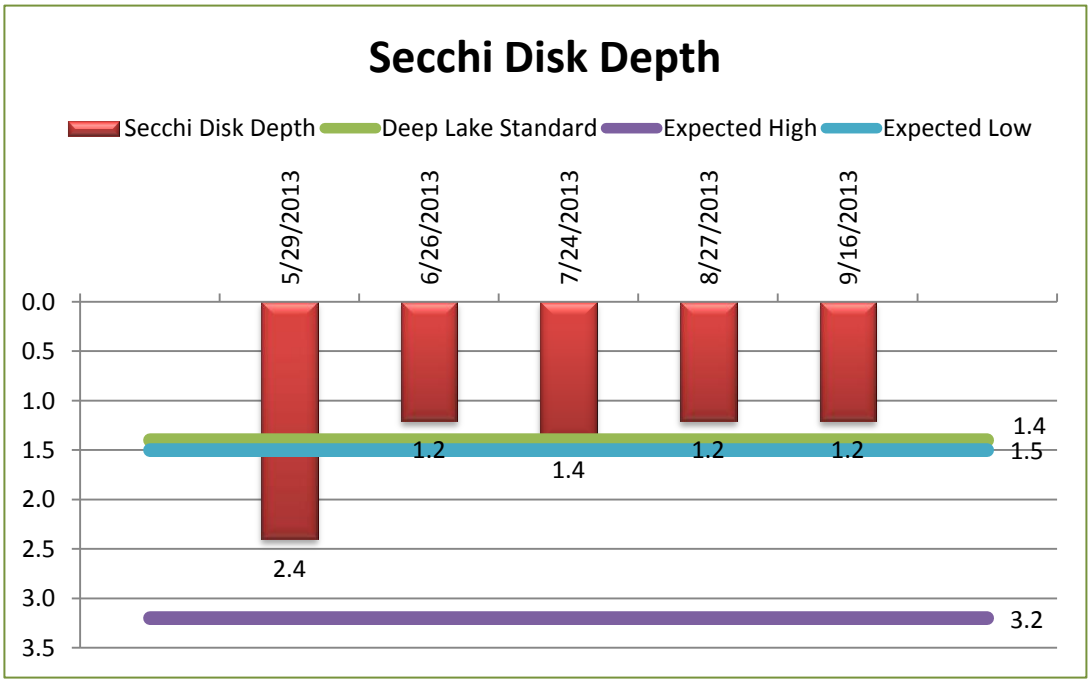
Expected Range:
5.0-22.0 µg/L

Deep Lake Standard:
14.0 µg/L

Three of five samples were above the standard. The average does not meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	18.2 µg/L	**17.0 µg/L**
Grade				B	**B**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	20.5 µg/L	**19.5 µg/L**
Meets Standard (14.0 µg/L)				No	**No**



Secchi Disk Depth

Expected Range:
1.5-3.2 meters

Deep Lake Standard:
>1.4 meters

The average for this lake is right at the standard.

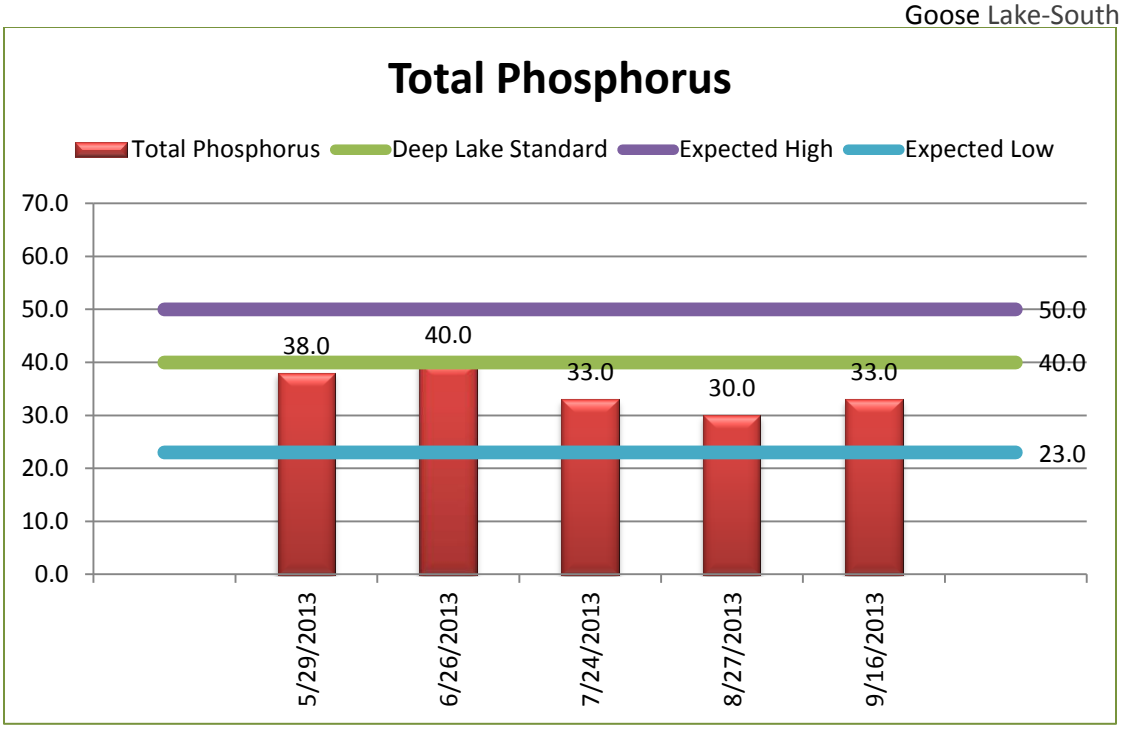
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	1.4 meters	**1.5 meters**
Grade				C	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	1.4 meters	**1.3 meters**
Meets Standard (>1.4 m)				Yes	**No**

Total Phosphorus

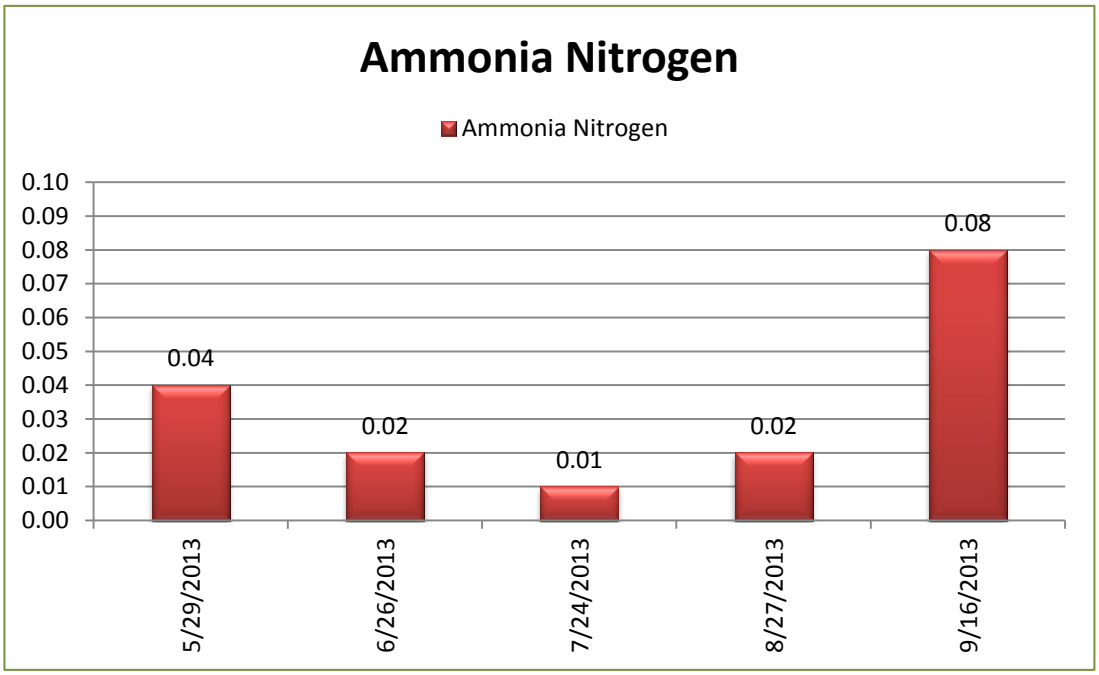
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

All five samples were at or below the standard and within the expected range. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	39.0 µg/L	**34.8 µg/L**
Grade				C	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	38.0 µg/L	**34.0 µg/L**
Meets Standard (40.0 µg/L)				Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

The September sample was elevated. This could be due to a runoff event.

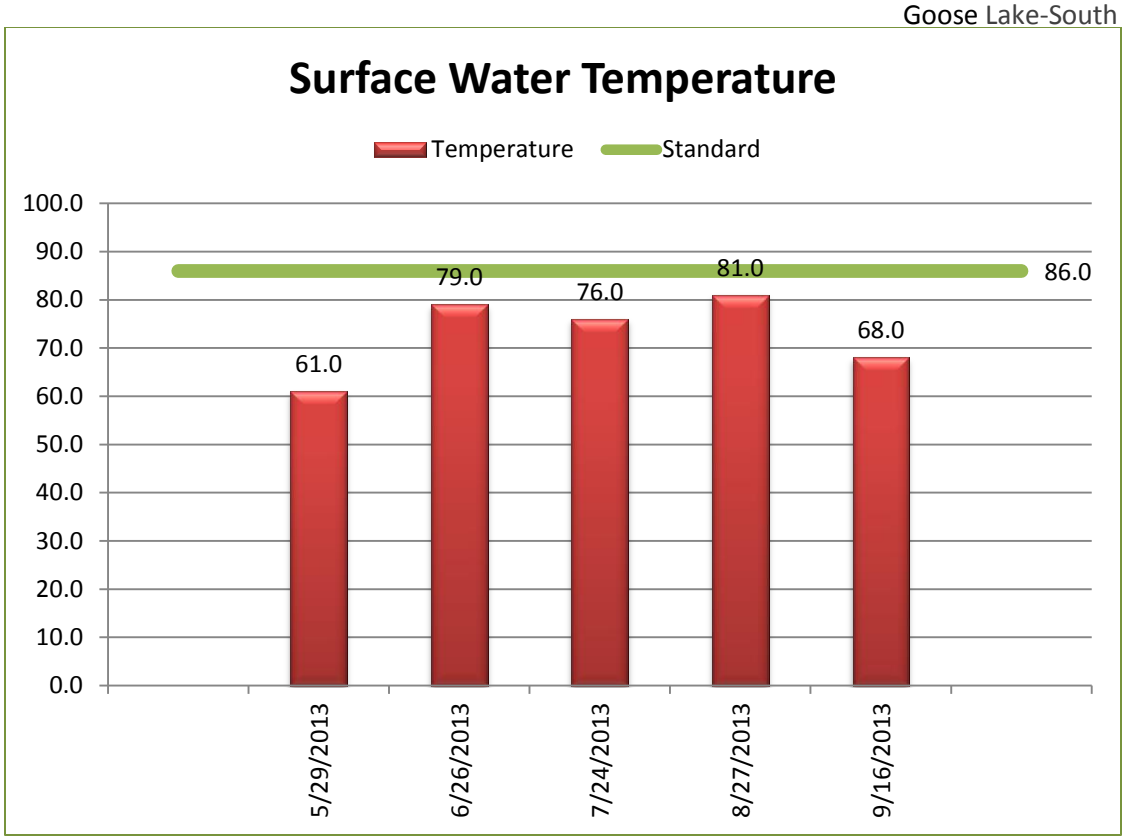
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.10 mg/L	**0.03 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	71.2˚F	**73.0˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

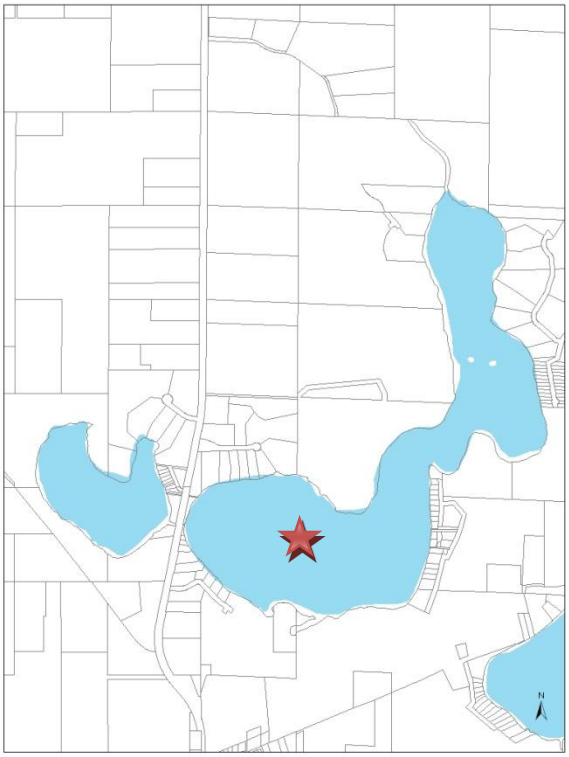
Goose Lake-South General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Malted	Low weed pressure.
June	3	3	Beach Grass	Recent heavy rains and thunderstorms.
July	2.5	2.5	Beach Grass	No notes.
August	3	3	Parchment Paper	No notes.
September	3	3	Dried Chamomile	No notes.

Lake 13-0073-00 Site 201

Horseshoe Lake

Horseshoe Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	58.6	53.8	56.6	56.3
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	17.4 µg/L	1.5 meters	56.6 µg/L		
Grade	B	C	C	**C**	12th/19

MPCA Standards: Impaired but Meets Standards

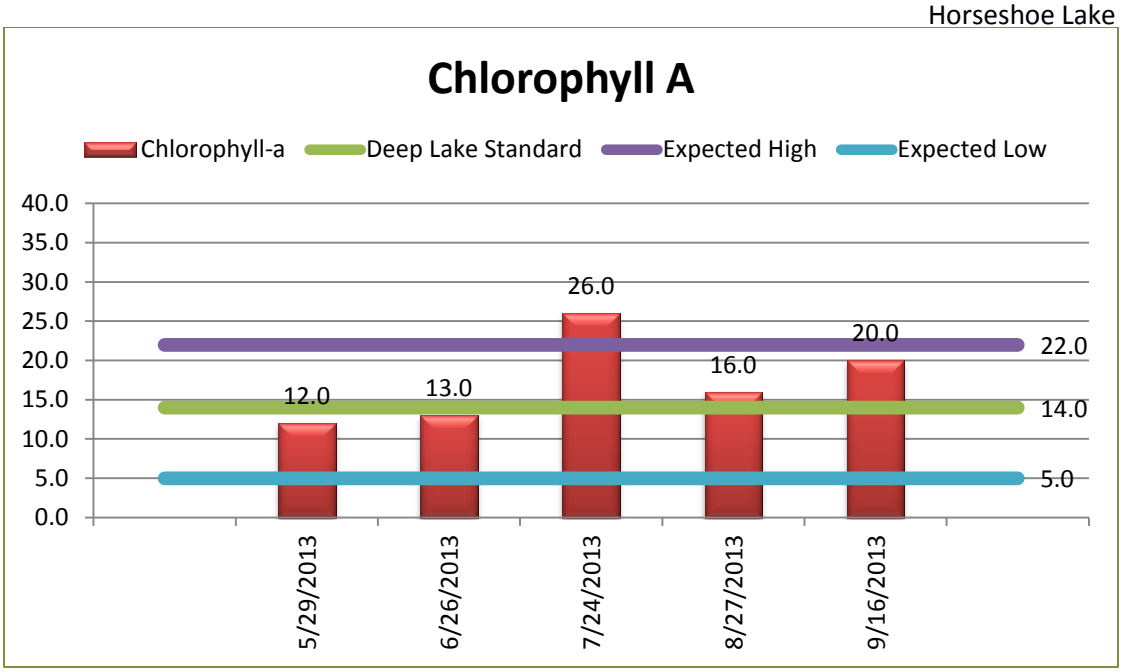
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	18.8 µg/L	1.6 meters	37.5 µg/L	
Meets Standard	No	Yes	Yes	**Yes**

Chlorophyll-a

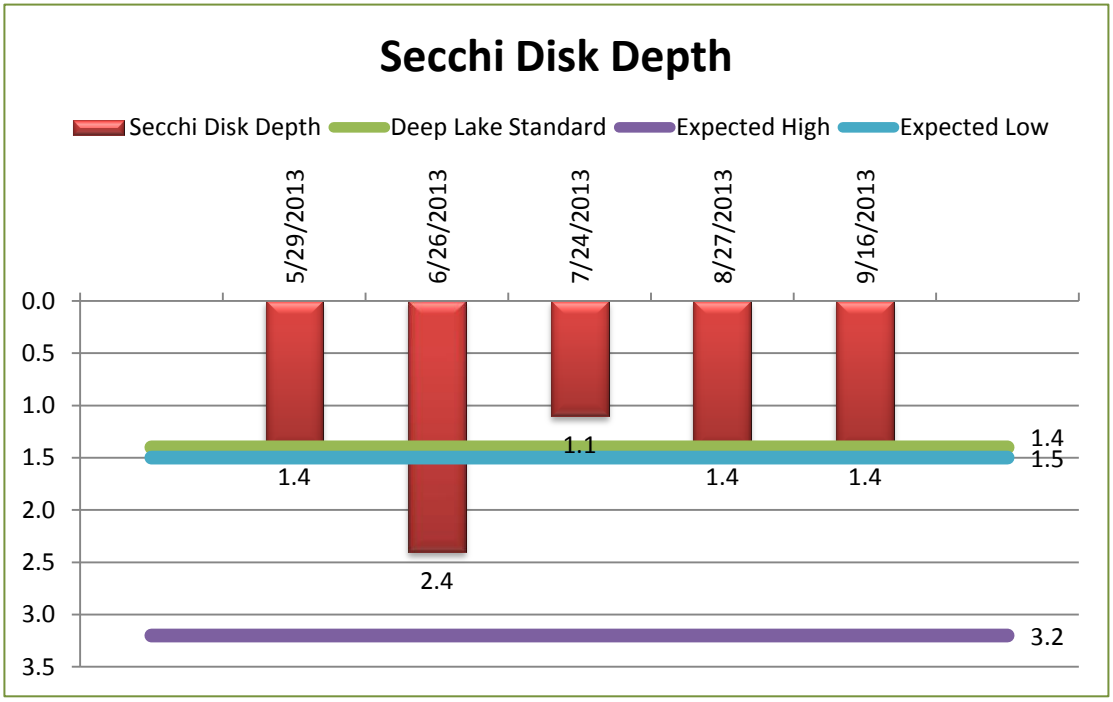
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

Three of five samples were above the standard. The average did not meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	20.0 µg/L	**17.4 µg/L**
Grade				B-C	**B**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	16.5 µg/L	**18.8 µg/L**
Meets Standard (14.0 µg/L)				No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

Three of the samples are right at the standard. One clear sample in June makes the overall average meet the standard.

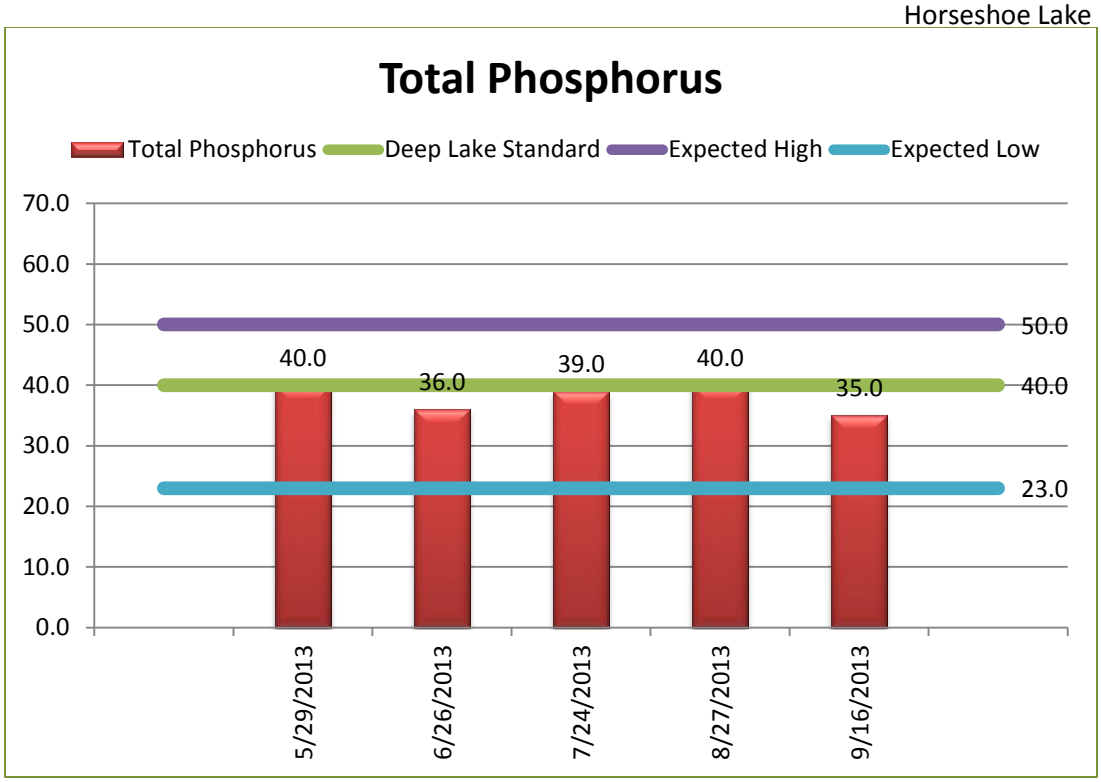
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	1.6 meters	**1.5 meters**
Grade				C	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	1.7 meters	**1.6 meters**
Meets Standard (>1.4 m)				Yes	**Yes**

Total Phosphorus

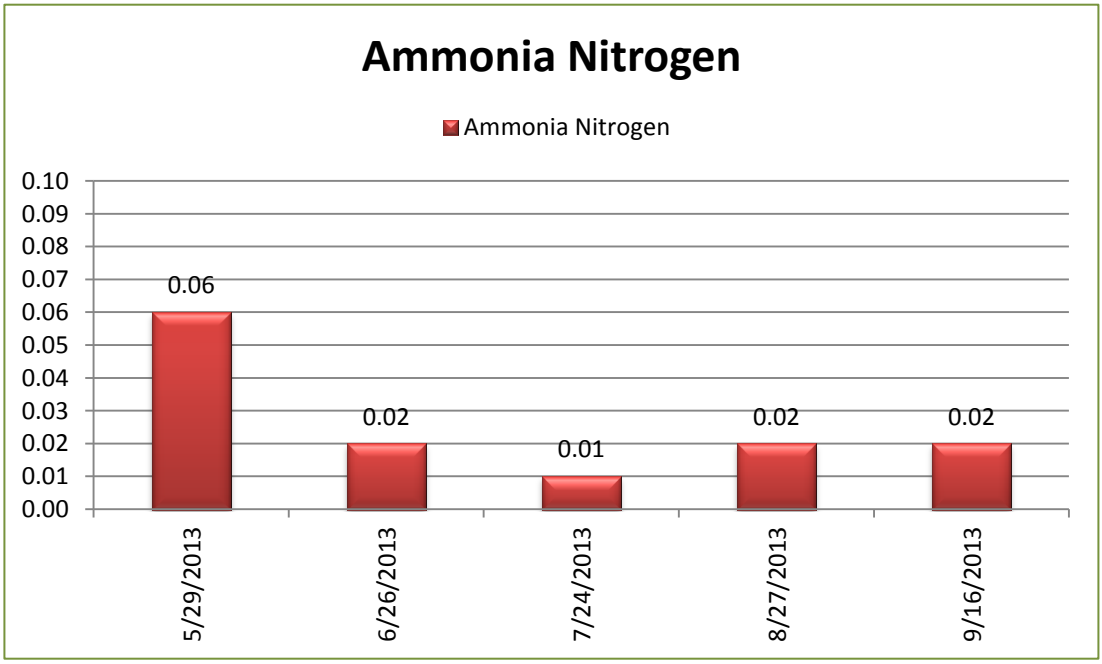
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

All samples were at or below the standard. The average does meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	47.0 µg/L	**38.0 µg/L**
Grade				C	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	43.5 µg/L	**37.5 µg/L**
Meets Standard (40.0 µg/L)				No	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There is no standard, but the ammonia nitrogen levels were low. The elevated May sample could be due to spring runoff.

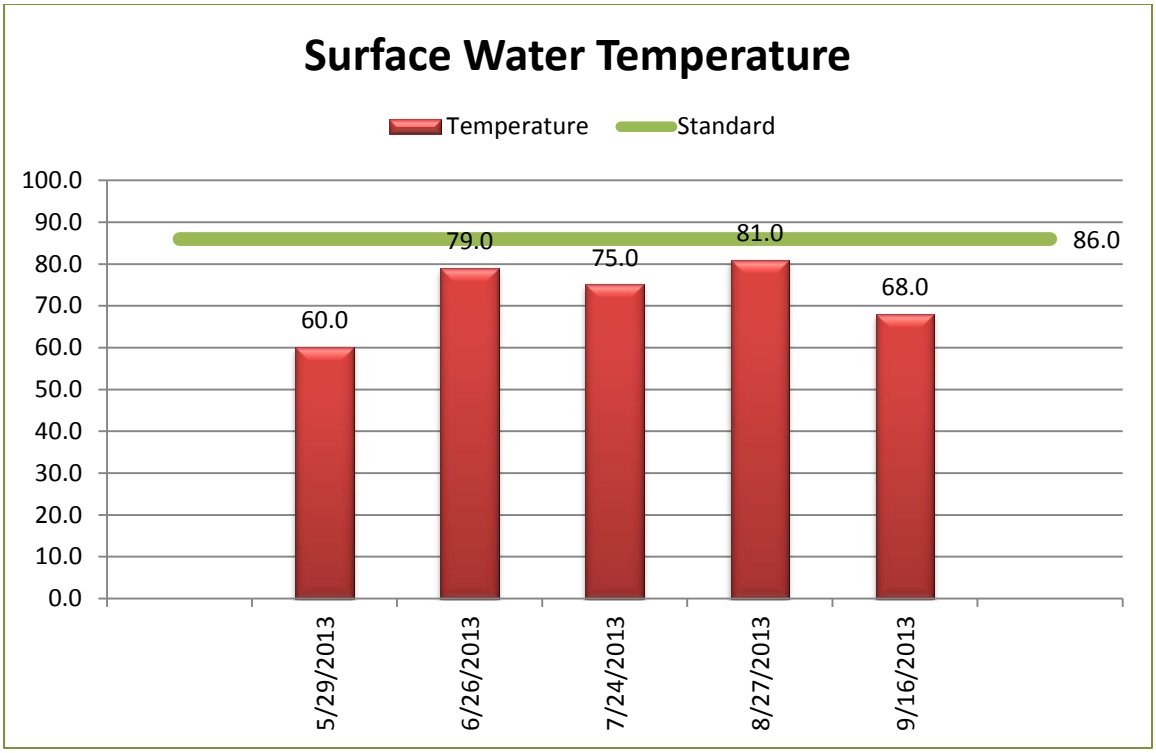
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.07 mg/L	**0.03 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	71.4˚F	**72.6˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

Horseshoe Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Parchment Paper	Low weed pressure.
June	2	2	Chop Stick	Recent heavy rains and thunderstorms.
July	2.5	2.5	Beach Grass	No notes.
August	2.5	2.5	Dried Chamomile	No notes.
September	2.5	2.5	Dried Chamomile	No notes.

Kroon Lake

Kroon Lake

Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	50.2	50.2	52.3	50.9
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: B

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	7.4 µg/L	2.07 meters	28.2 µg/L		
Grade	A	C	B	**B**	4th/19

MPCA Standards: Meets Standards

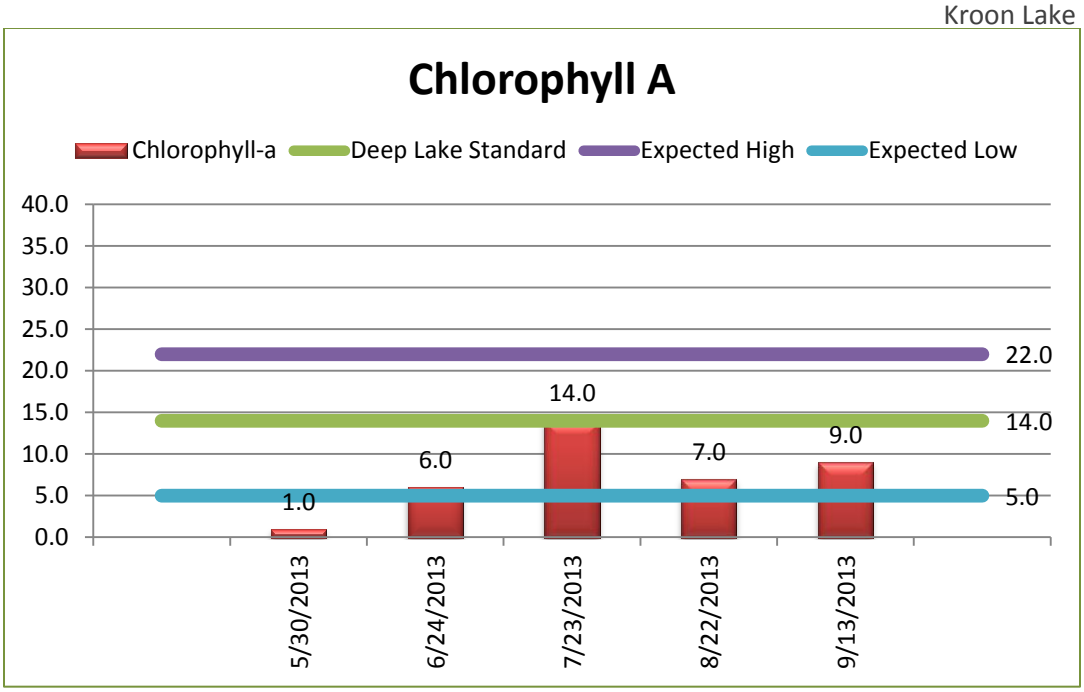
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	9.0 µg/L	1.5 meters	29.0 µg/L	
Meets Standard	Yes	Yes	Yes	**Yes**

Chlorophyll-a

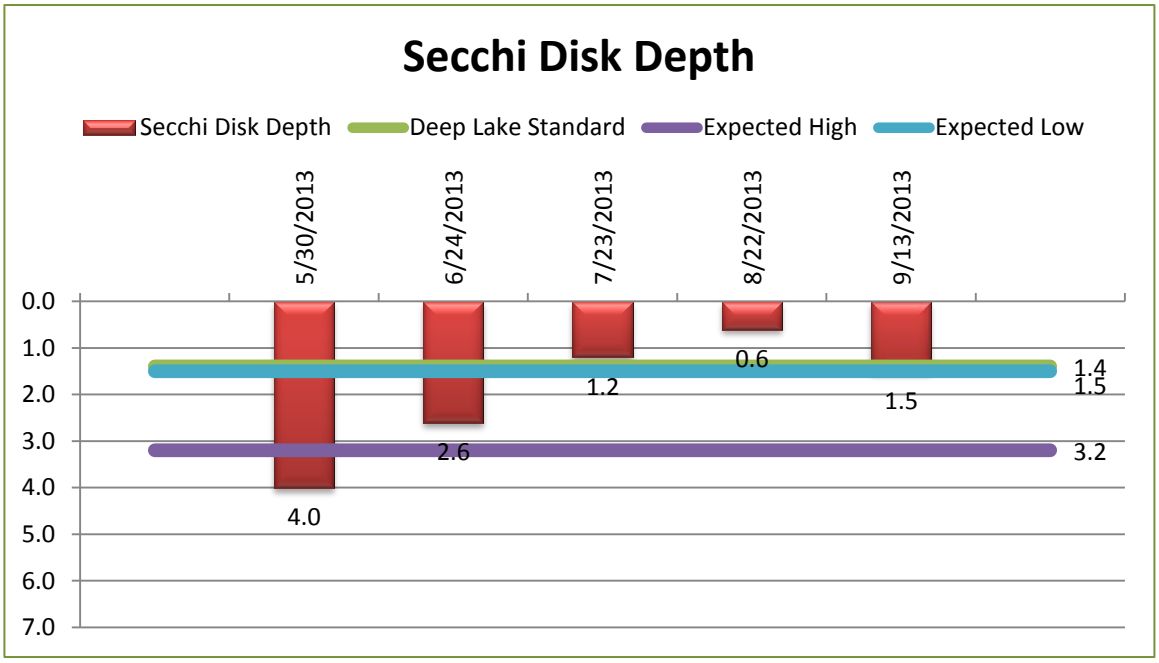
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

All samples were below the standard. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	10.8 µg/L	20.3 µg/L	8.6 µg/L	9.8 µg/L	**7.4 µg/L**
Grade	B	C	A	A	**A**
Average (June-Sept)	13.6 µg/L	20.3 µg/L	10.0 µg/L	11.3 µg/L	**9.0 µg/L**
Meets Standard (14.0 µg/L)	Yes	No	Yes	Yes	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

The average does meet the standard. This chart cannot be directly compared to other Secchi Disk Depth charts due to a difference in scale.

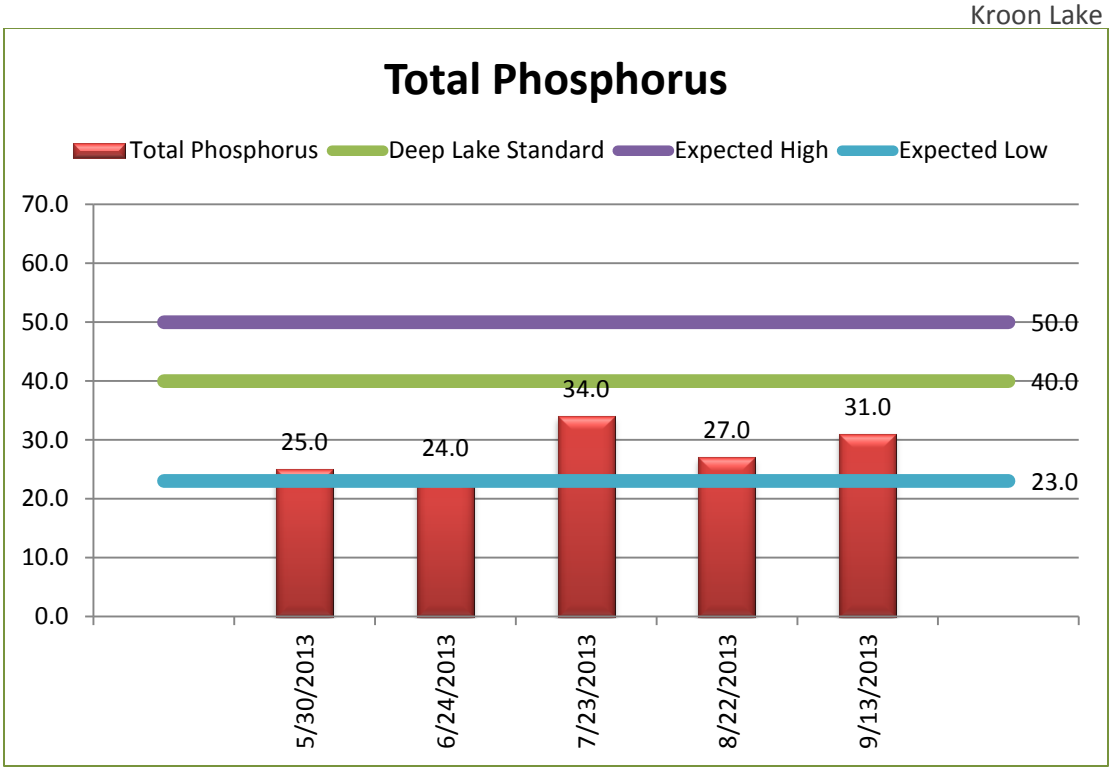
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	1.9 meters	1.7 meters	2.0 meters	1.7 meters	**2.0 meters**
Grade	C	C	C	C	**C**
Average (June-Sept)	1.3 meters	1.7 meters	1.6 meters	1.4 meters	**1.5 meters**
Meets Standard (>1.4 m)	No	Yes	Yes	Yes	**Yes**

Total Phosphorus

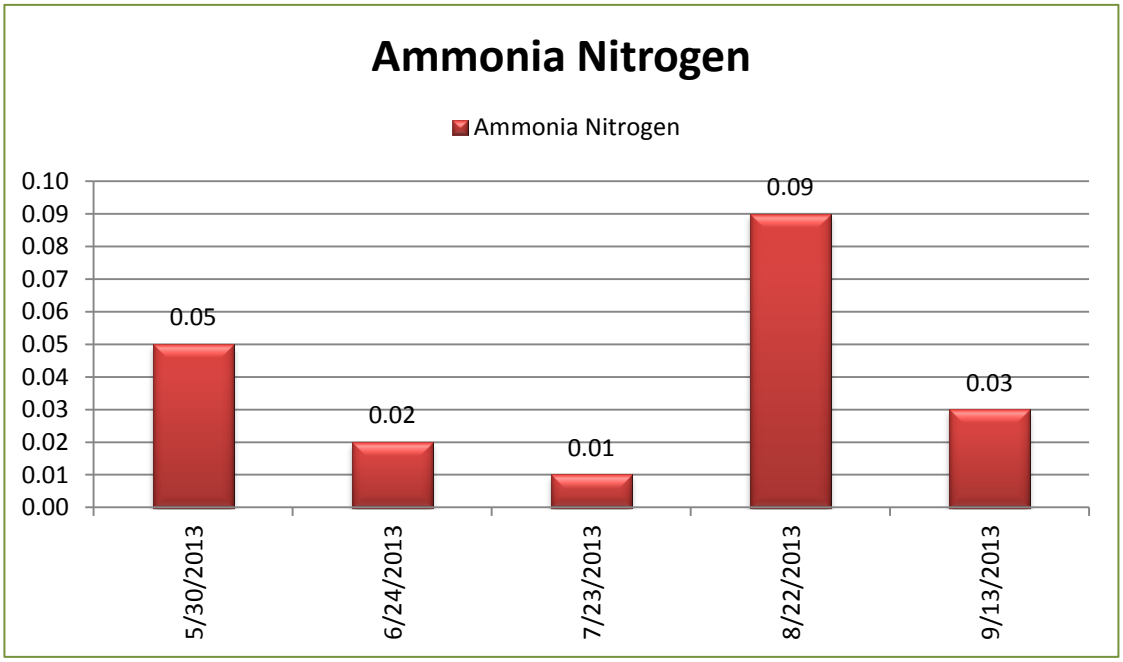
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

All samples were below the standard and within the expected range. The average does meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	35.0 µg/L	31.0 µg/L	35.6 µg/L	28.8 µg/L	**28.2 µg/L**
Grade	C	B	C	B	**B**
Average (June-Sept)	37.0 µg/L	31.0 µg/L	38.3 µg/L	30.5 µg/L	**29.0 µg/L**
Meets Standard (40.0 µg/L)	Yes	Yes	Yes	Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

The ammonia nitrogen levels fluctuated more in this lake than in others.

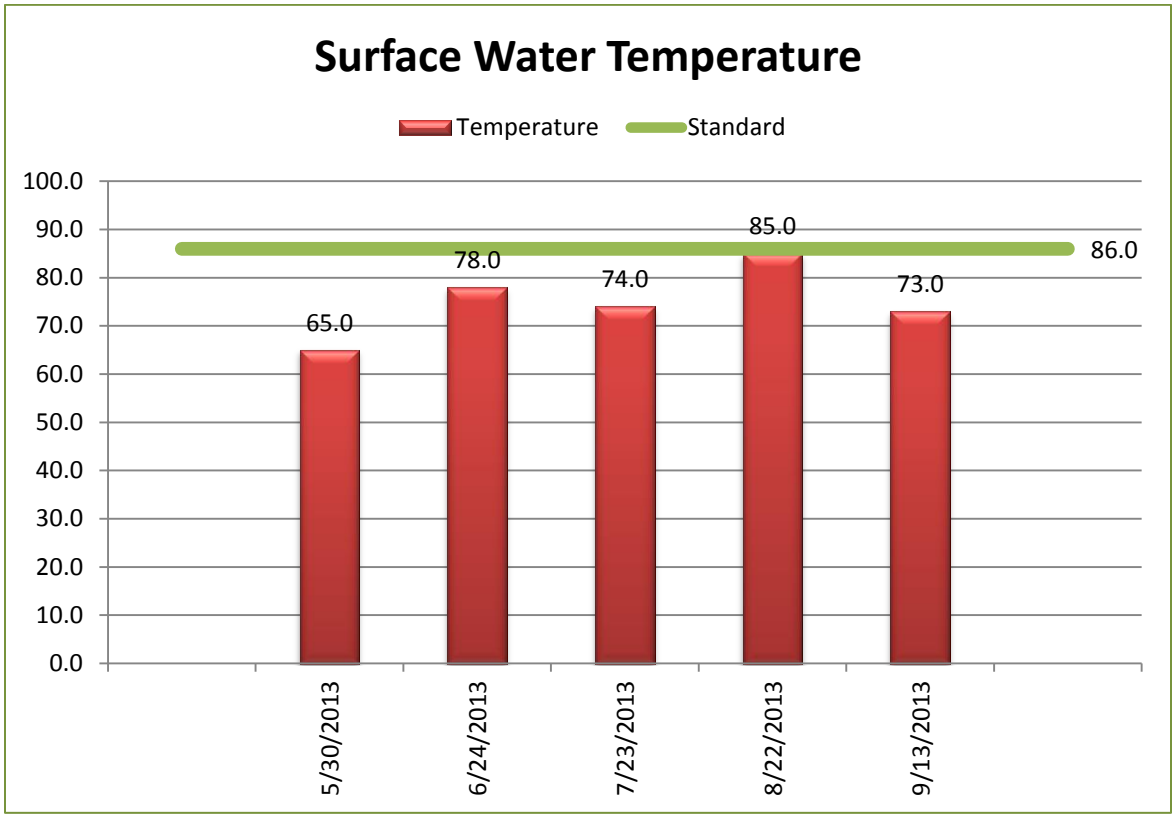
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	0.09 mg/L	<0.05 mg/L	0.08 mg/L	0.07 mg/L	**0.04 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

All temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	73.3 ˚F	NO DATA	64.0 ˚F	72.2 ˚F	**75.0 ˚F**
Meets Standard (Not to exceed 86.0˚F)	Yes		Yes	Yes	**Yes**

Kroon Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	1.5	1.5	Chop Stick	Low weed pressure.
June	2	2	Parchment Paper	No notes.
July	2.5	2.5	Dried Chamomile	No notes.
August	2	2	Malted	Hot weather.
September	2.5	2.5	Beach Grass	Northern milfoil present.

Lake 13-0035-00 Site 201

North Lindstrom Lake

North Lindstrom Lake

Deep Lake

Lake Classification: MESOTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	52.4	45.7	49.6	49.2
Classification	Eutrophic	Mesotrophic	Mesotrophic	Mesotrophic

Overall Lake Quality Grade: B

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	9.2 µg/L	2.7 meters	23.4 µg/L		
Grades	A	B	B	**B**	3rd/19

MPCA Standards: Meets standards

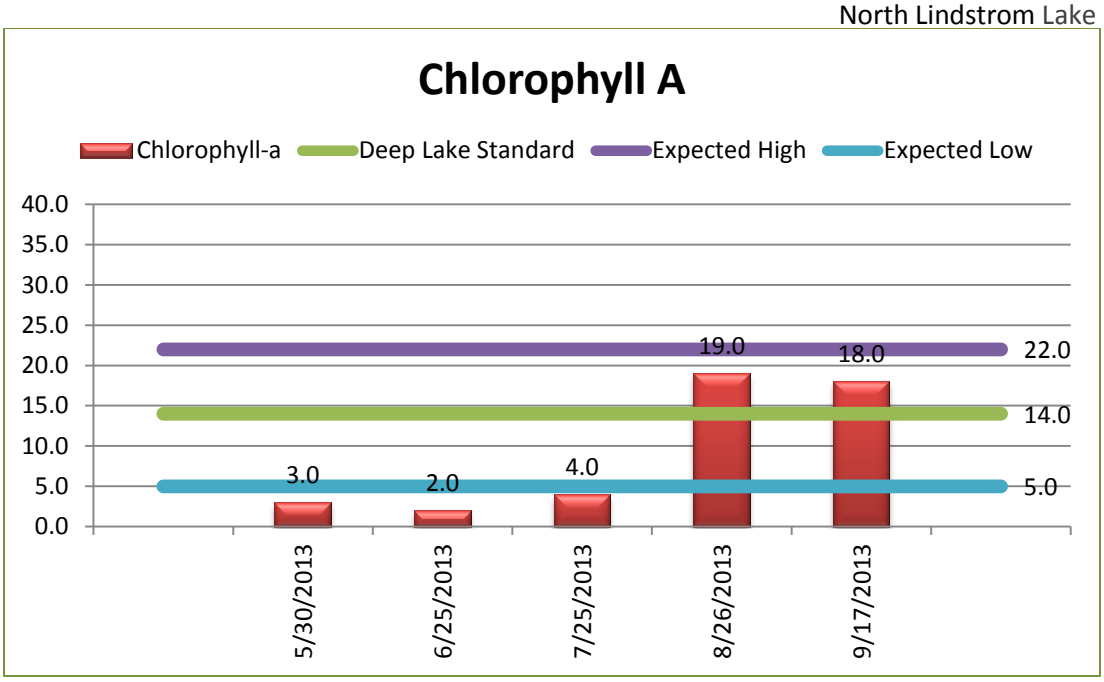
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	10.8 µg/L	2.7 meters	23.0 µg/L	
Meets Standard	Yes	Yes	Yes	**Yes**

Chlorophyll-a

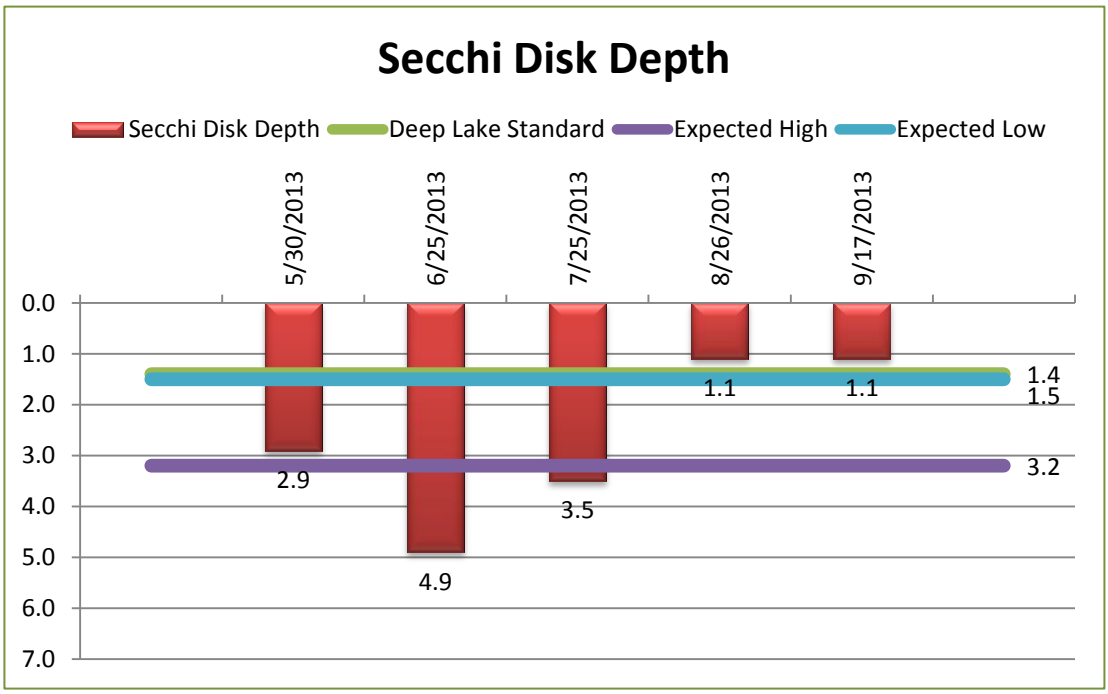
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

The August and September samples were above the standard but within the expected range. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	14.0 µg/L	17.7 µg/L	9.4 µg/L	23.0 µg/L	**9.2 µg/L**
Grade	B	B	A	C	**A**
Average (June-Sept)	15.6 µg/L	19.6 µg/L	11.5 µg/L	28.0 µg/L	**10.8 µg/L**
Meets Standard (14.0 µg/L)	No	No	Yes	No	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

The overall average does meet the standard. This chart cannot be directly compared to other Secchi Disk Depth charts due to a difference in scale.

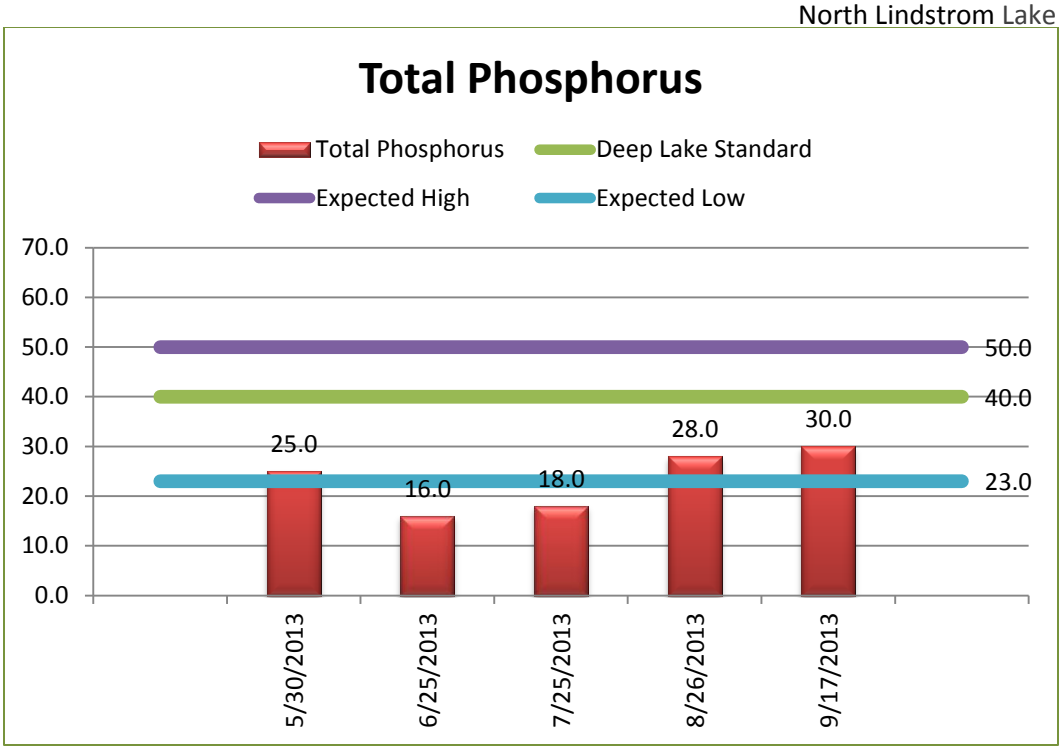
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	2.0 meters	2.1 meters	2.8 meters	1.8 meters	**2.7 meters**
Grade	C	C	B	C	**B**
Average (June-Sept)	1.5 meters	2.1 meters	2.5 meters	1.6 meters	**2.7 meters**
Meets Standard (>1.4 m)	Yes	Yes	Yes	Yes	**Yes**

Total Phosphorus

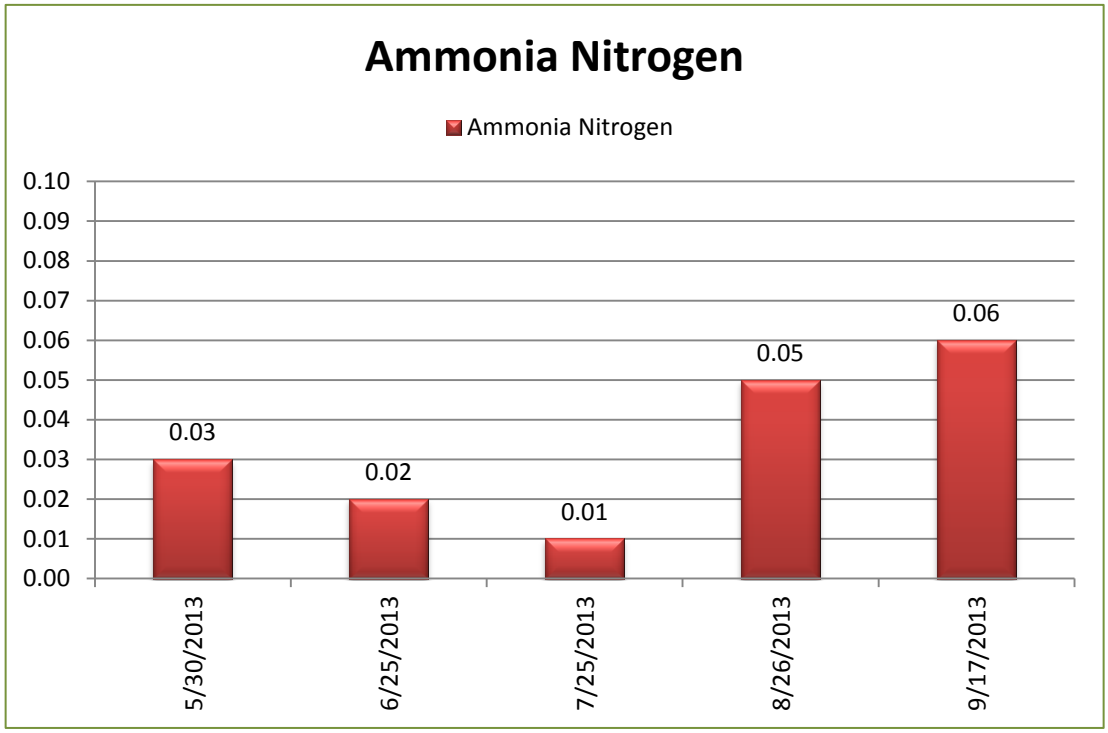
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

All samples were below the standard. The average met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	33.0 µg/L	34.0 µg/L	25.0 µg/L	29.6 µg/L	**23.4 µg/L**
Grade	C	C	B	B	**B**
Average (June-Sept)	32.0 µg/L	33.0 µg/L	26.0 µg/L	32.5 µg/L	**23.0 µg/L**
Meets Standard (40.0 µg/L)	Yes	Yes	Yes	Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

The ammonia nitrogen levels in this lake fluctuated more than in other lakes.

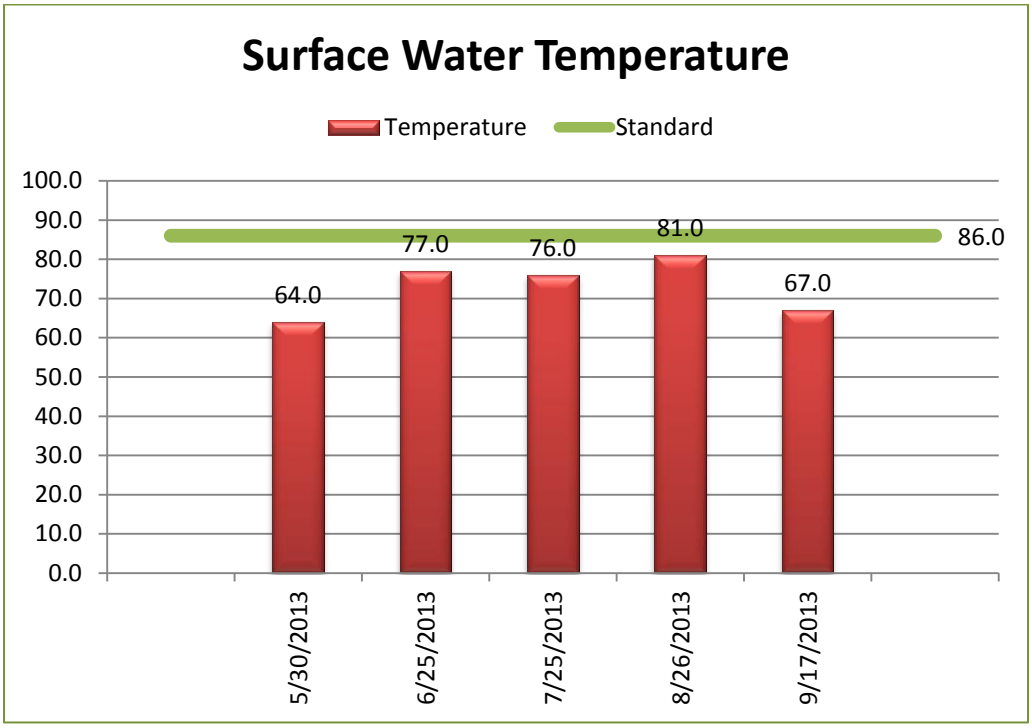
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	0.1 mg/L	0.1 mg/L	0.05 mg/L	0.12 mg/L	**0.03 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

The temperatures meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	65.8 ˚F	69.8˚F	**73.0˚F**
Meets Standard (Not to exceed 86.0˚F)			Yes	Yes	**Yes**

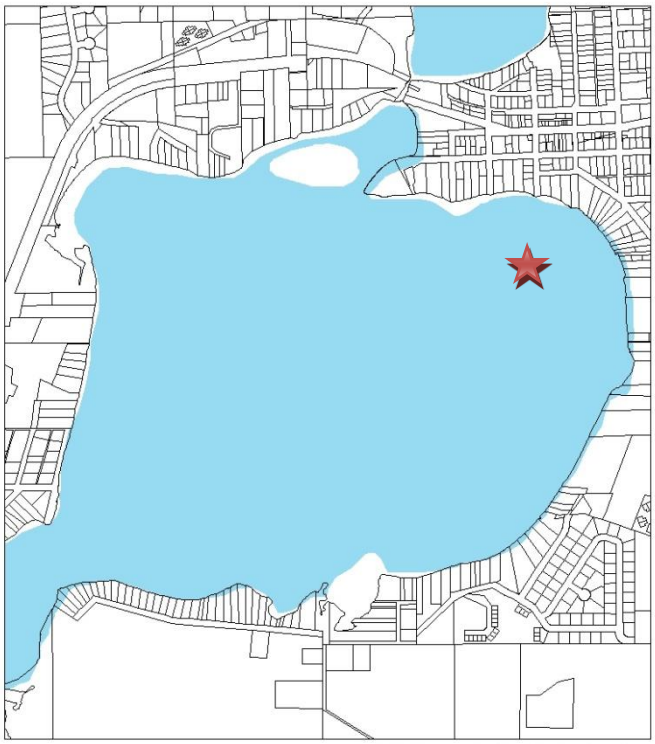
North Lindstrom Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	1.5	1.5	Eiderdown	Low weed pressure.
June	2	2	Bamboo	No notes.
July	1.5	1.5	Toasted Marshmallow	No notes.
August	2	2	Beach Grass	Hot weather.
September	2.5	2.5	Parchment Paper	No passage through NL-SL channel.

Lake 13-0028-00 Site 203

South Lindstrom Lake

South Lindstrom Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	58.3	51.4	58.3	56.0
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	16.8 µg/L	1.8 meters	58.3 µg/L		
Grade	C	C	C	**C**	10th/19

MPCA Standards: Does Not Meet Standards

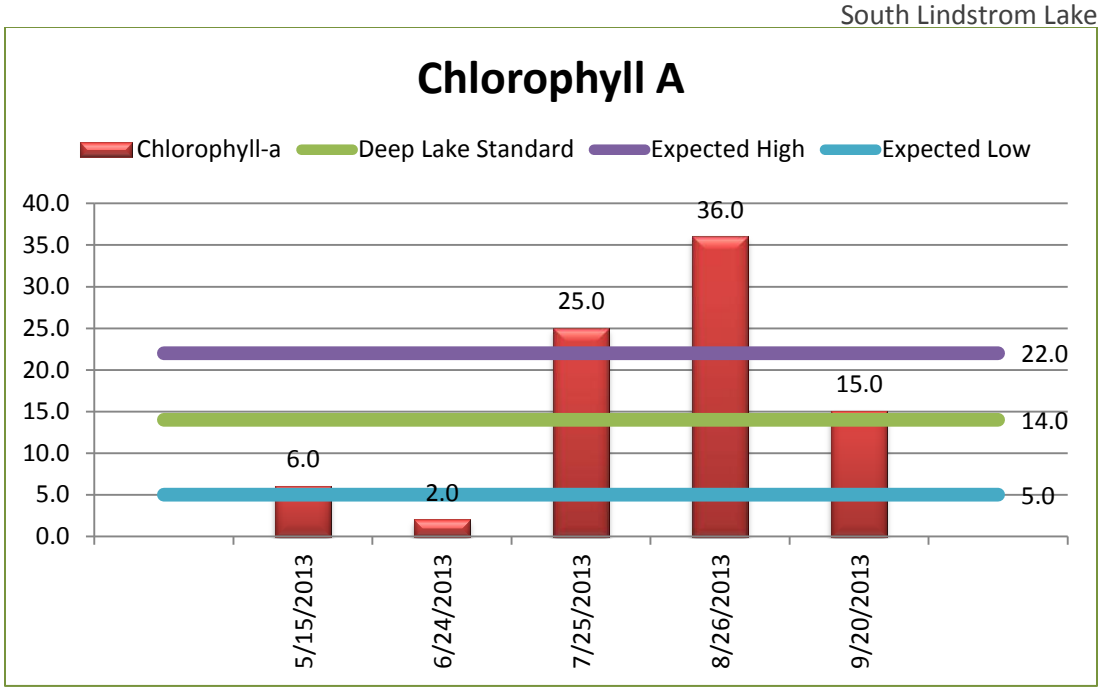
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	19.5 µg/L	1.9 meters	46.3 µg/L	
Meets Standard	No	Yes	No	**No**

Chlorophyll-a

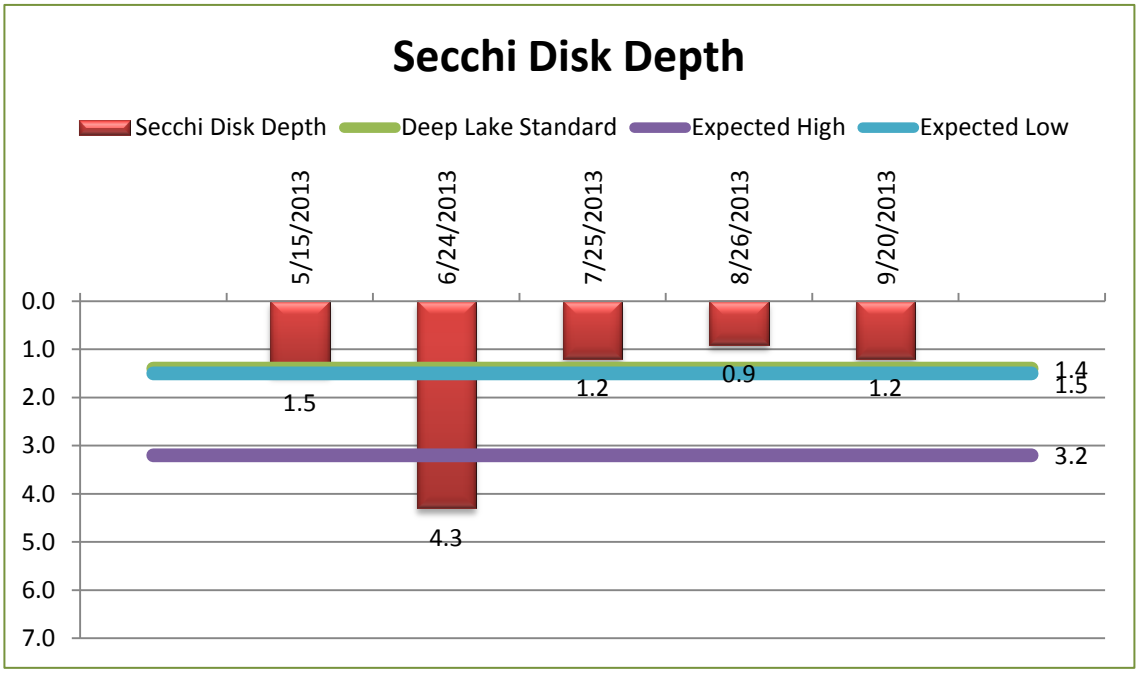
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

Late season samples were higher than the standard. The average reading did not meet the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	11.8 µg/L	20.0 µg/L	11.2 µg/L	35.0 µg/L	**16.8 µg/L**
Grade	B	B	B	C	**B**
Average (June-Sept)	13.2 µg/L	20.0 µg/L	13.8 µg/L	43.0 µg/L	**19.5 µg/L**
Meets Standard (14.0 µg/L)	Yes	No	Yes	No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

The average does meet the standard. This chart cannot be directly compared to other Secchi Disk Depth charts due to a difference in scale.

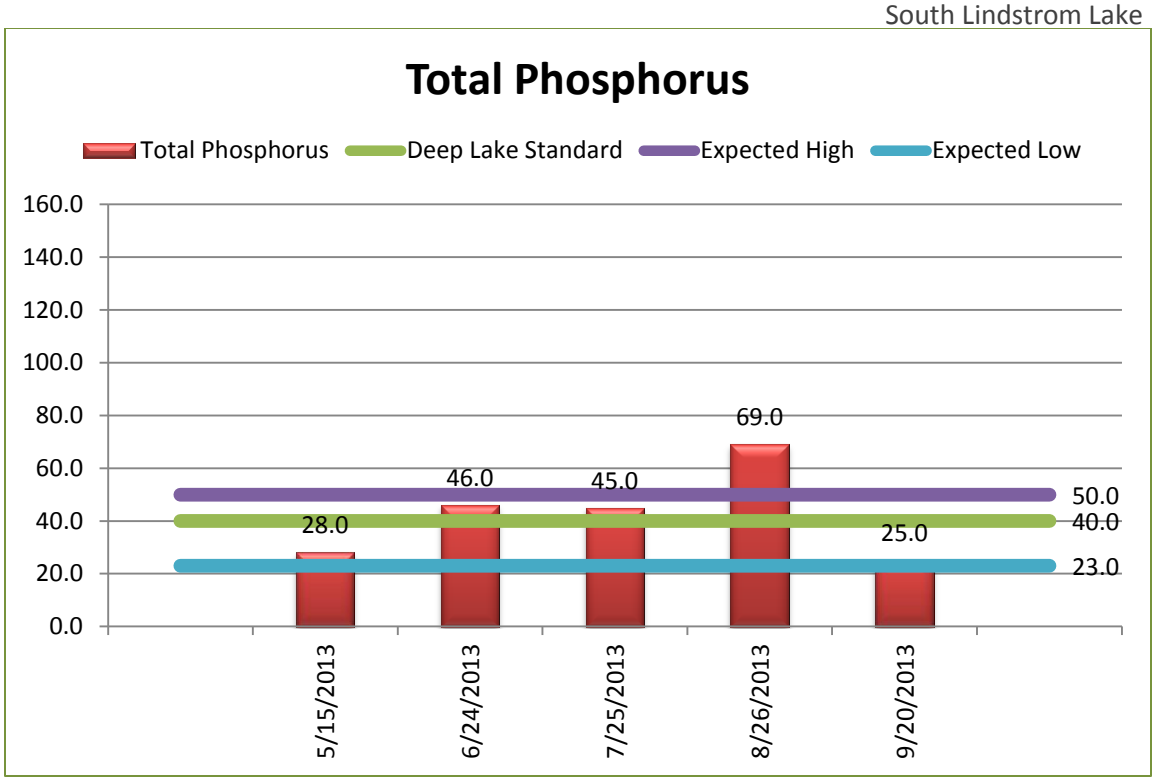
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	3.3 meters	1.9 meters	2.3 meters	1.5 meters	**1.8 meters**
Grade	A	C	B	C	**C**
Average (June-Sept)	2.9 meters	1.9 meters	1.9 meters	1.1 meters	**1.9 meters**
Meets Standard (>1.4 m)	Yes	Yes	Yes	No	**Yes**

Total Phosphorus

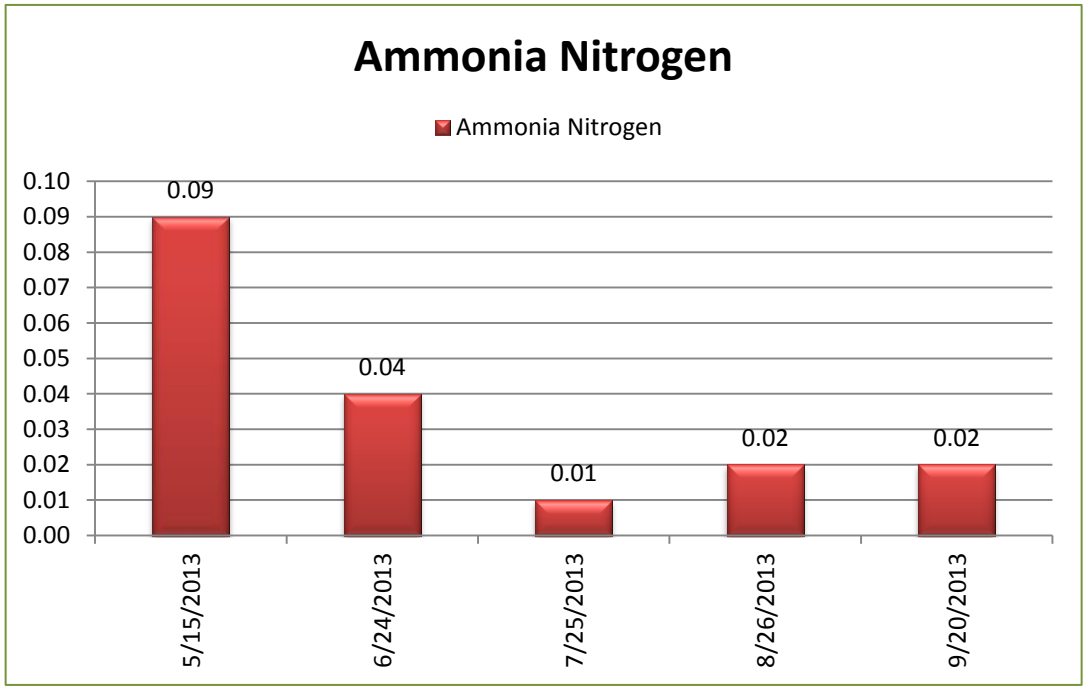
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	26.0 µg/L	38.0 µg/L	34.6 µg/L	53.0 µg/L	**42.6 µg/L**
Grade	B	C	C	C	**C**
Average (June-Sept)	27.0 µg/L	38.0 µg/L	38.5 µg/L	61.8 µg/L	**46.3 µg/L**
Meets Standard (40.0 µg/L)	Yes	Yes	Yes	No	**No**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

There is no standard, but the ammonia nitrogen levels were low. The elevated May reading could be due to spring runoff.

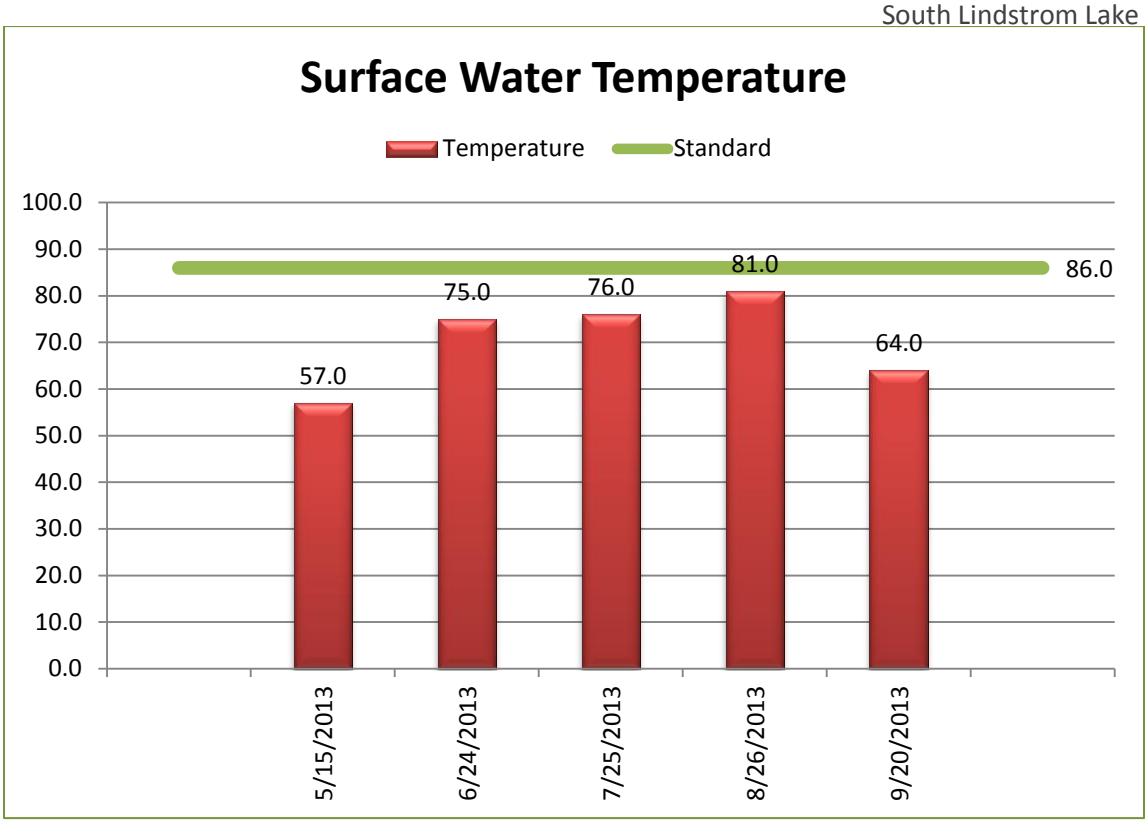
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	<0.05 mg/L	<0.05 mg/L	0.03 mg/L	0.07 mg/L	**0.04 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

All temperatures were below the standard.



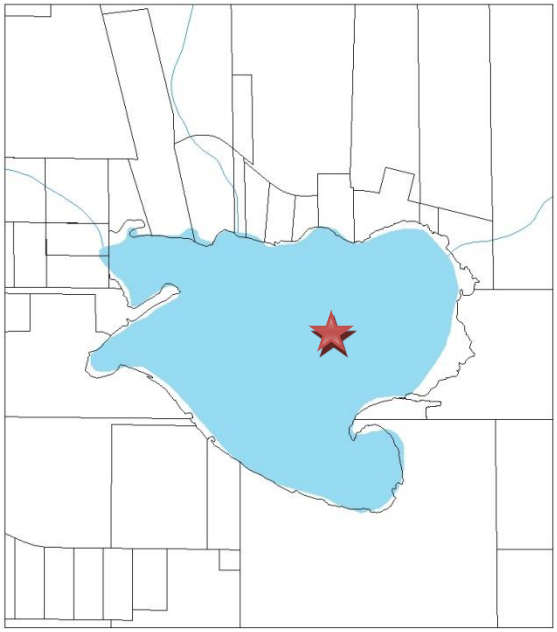
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	73.2 ˚F	72.5 ˚F	66.2 ˚F	72.6 ˚F	**70.6 ˚F**
Meets Standard (Not to exceed 86.0˚F)	Yes	Yes	Yes	Yes	**Yes**

South Lindstrom Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Short Bread	Low weed pressure.
June	2	2	Toasted Marshmallow	No notes.
July	2.5	2.5	Dried Chamomile	Unable to navigate through channel to North Lindstrom.
August	2.5	2.5	Cornichon	Hot weather.
September	3	3	Cornichon	No passage through NL-SL channel.

Little Lake

Little Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	66.5	54.2	66.0	62.2
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	38.8 µg/L	1.5 meters	73.2 µg/L		
Grades	C	C	D	**C**	16th/19

MPCA Standards: Impaired

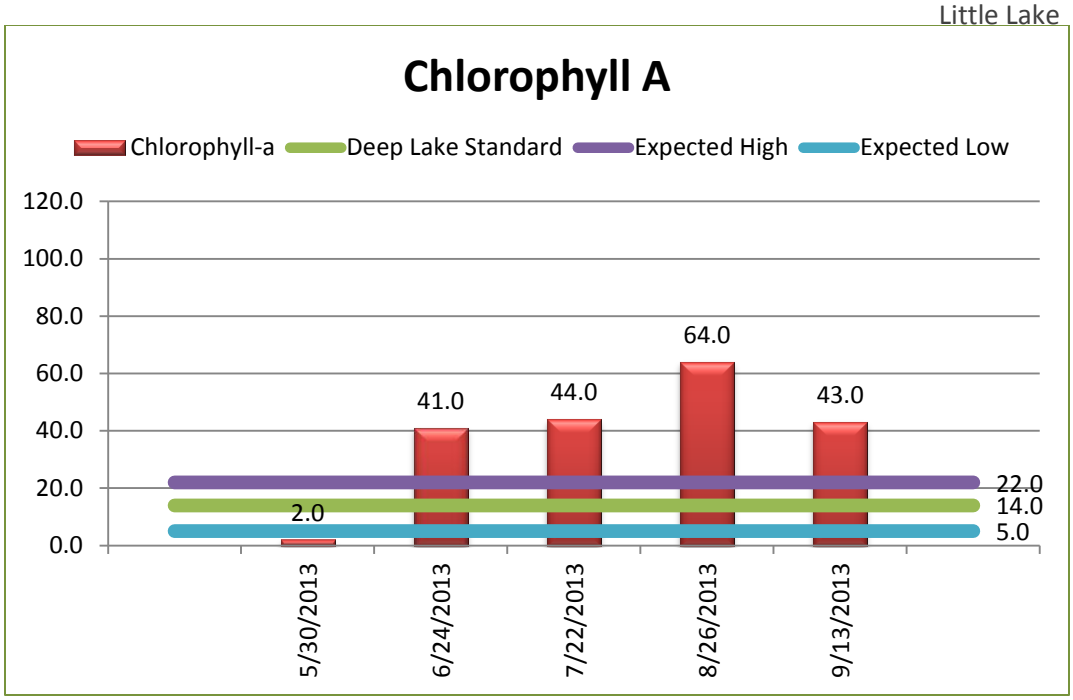
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 (June-Sept)	48.0 µg/L	1.2 meters	75.5 µg/L	
Meets Standard	No	No	No	**No**

Chlorophyll-a

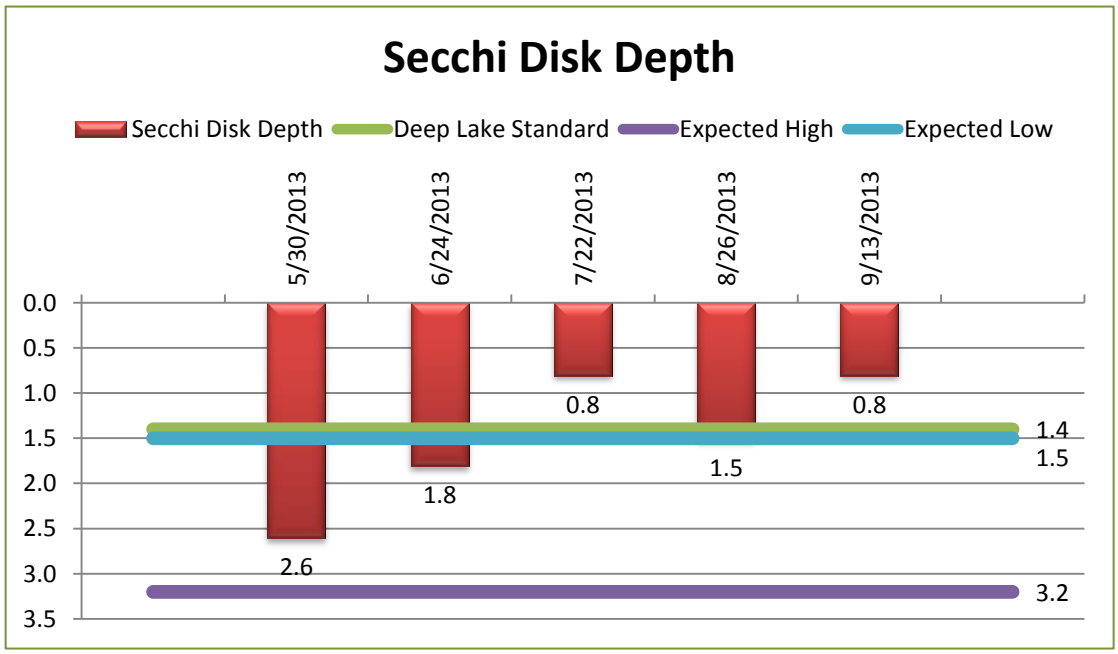
Expected Range:
5.0-22.0 µg/L

Deep Lake Standard:
14.0 µg/L

The average does not meet the standard, but is lower than the two previous years. This chart cannot be directly compared to other Chlorophyll-a charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	43.2 µg/L	49.0 µg/L	**38.8 µg/L**
Grade			C	D	**C**
Average (June-Sept)	NO DATA	NO DATA	52.5 µg/L	60.3 µg/L	**48.0 µg/L**
Meets Standard (14.0 µg/L)			No	No	**No**



Secchi Disk Depth

Expected Range:
1.5-3.2 meters

Deep Lake Standard:
>1.4 meters

Although three of five samples do meet the standard, the average does not meet the standard.

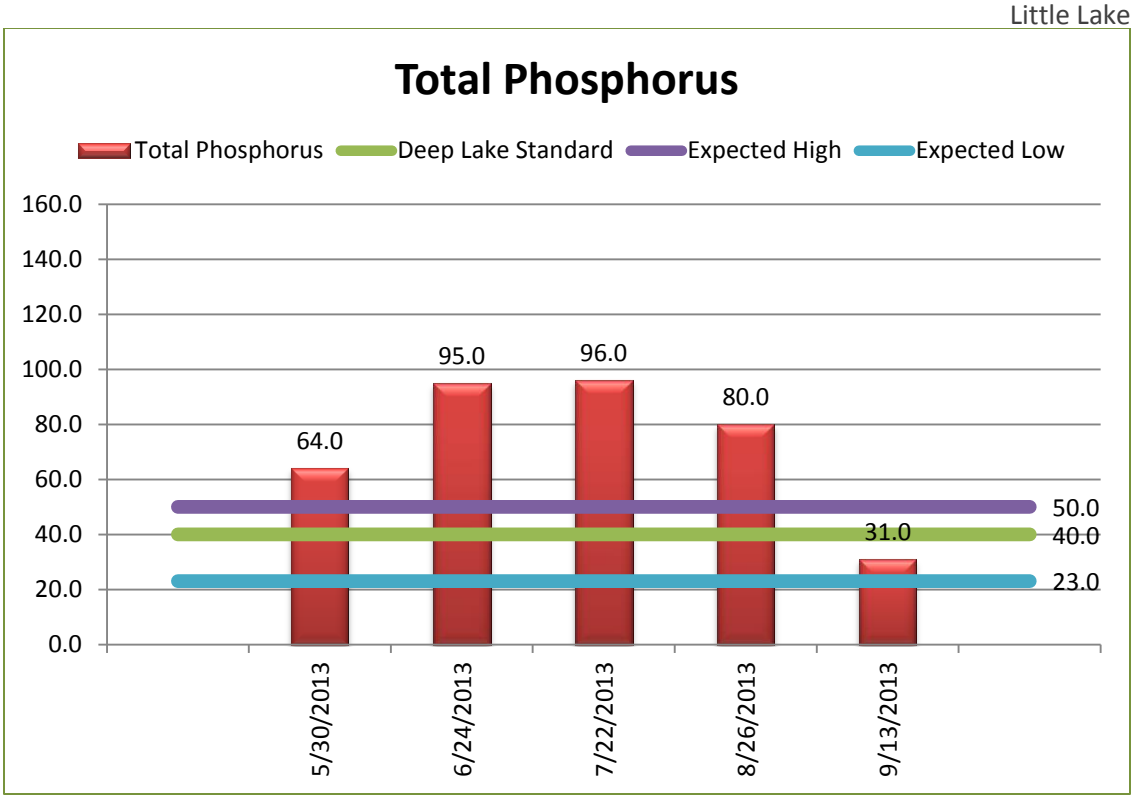
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	1.2 meters	1.8 meters	**1.5 meters**
Grade			C-D	D	**C**
Average (June-Sept)	NO DATA	NO DATA	0.9 meters	0.9 meters	**1.2 meters**
Meets Standard (>1.4 m)			No	No	**No**

Total Phosphorus

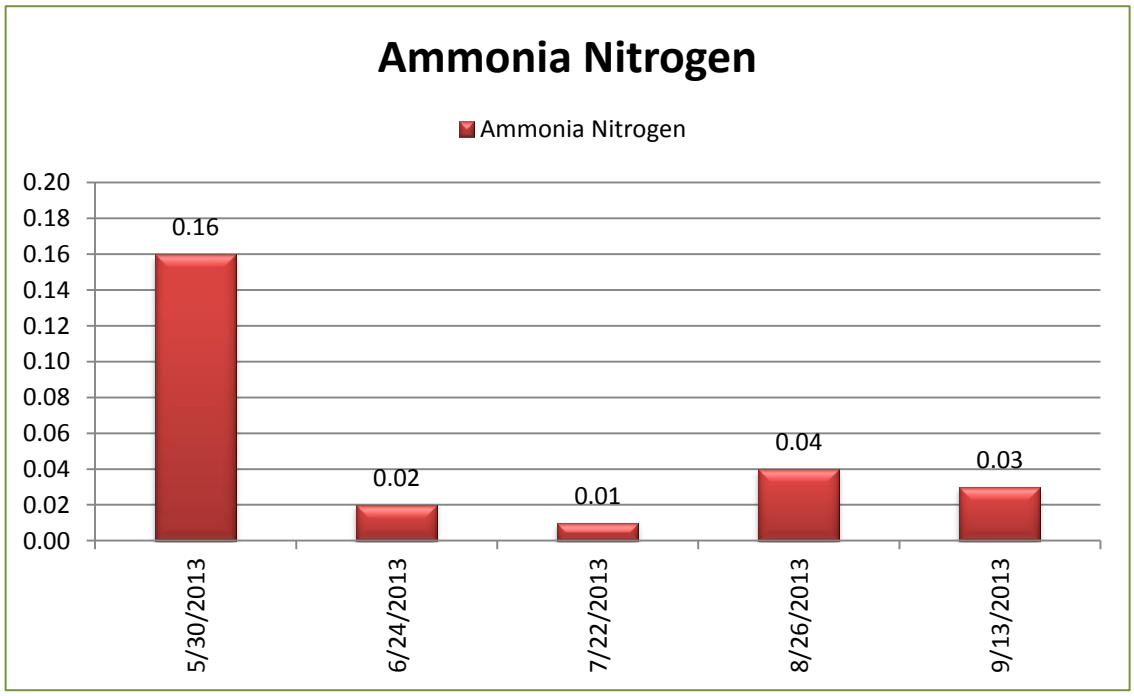
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

The readings are extremely high. This lake does not meet the standard. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	117.0 µg/L	92.0 µg/L	**73.2 µg/L**
Grade			D	D	**D**
Average (June-Sept)	NO DATA	NO DATA	125.5 µg/L	102.5 µg/L	**75.5 µg/L**
Meets Standard (60.0 µg/L)			No	No	**No**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

The May sample was elevated, which could be due to spring runoff. This chart cannot be directly compared to other Ammonia Nitrogen charts due to a difference in scale.

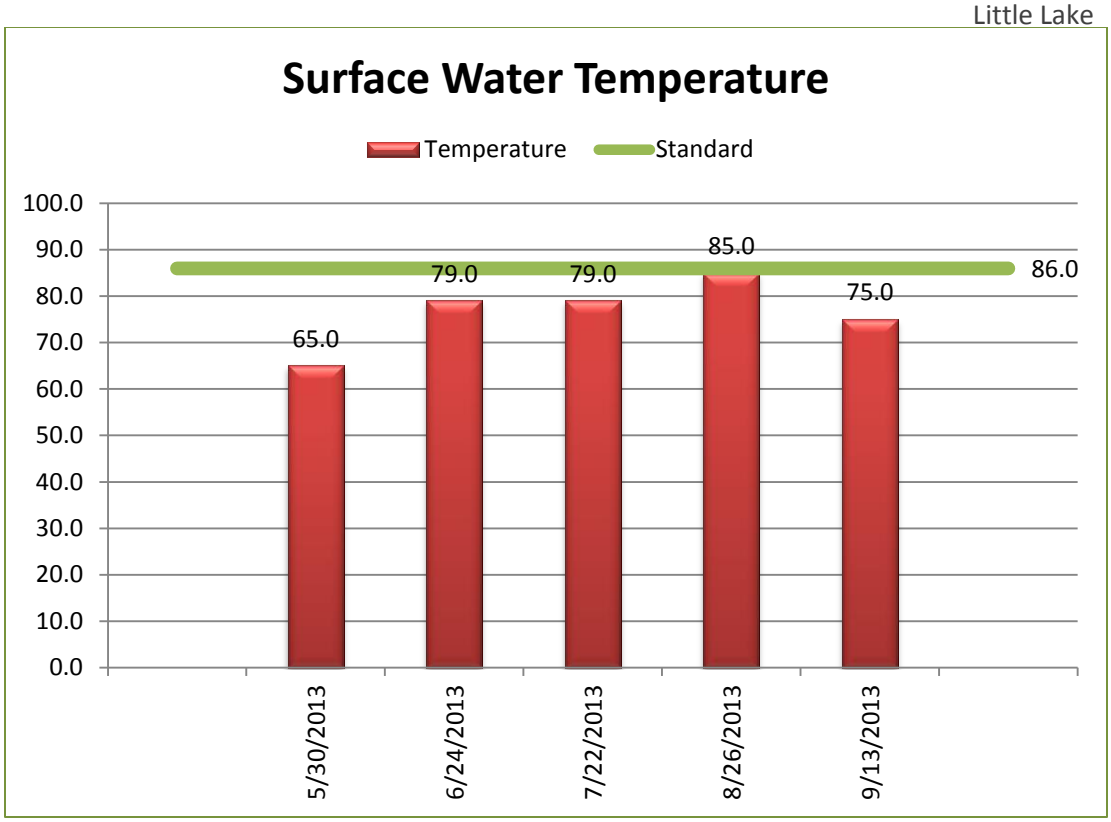
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	0.24 mg/L	0.15mg/L	**0.05 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F

The temperatures meet the standard. The average temperature has risen significantly over the last three



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	61.6 ˚F	70.8 ˚F	**76.6 ˚F**
Meets Standard (Not to exceed 86.0˚F)			Yes	Yes	**Yes**

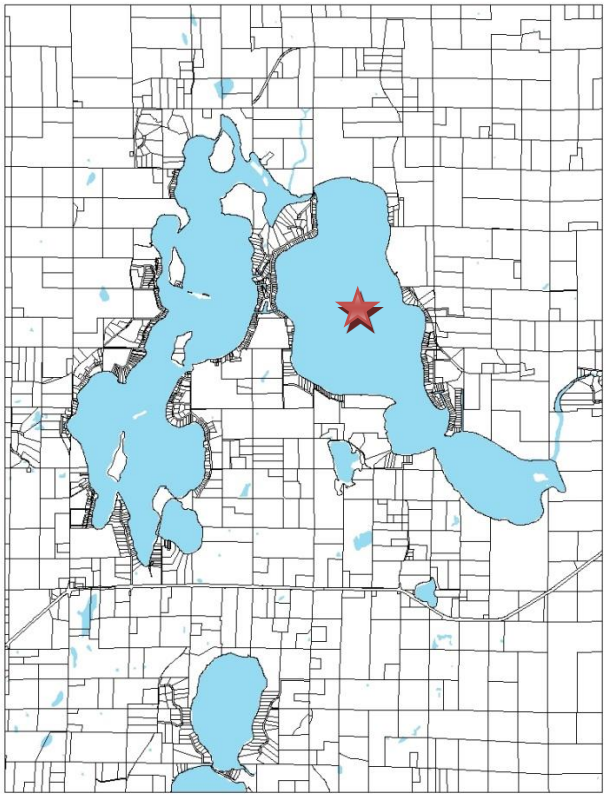
Little Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2	2	Macadamia	Low weed pressure.
June	2.5	2.5	Cornichon	No notes.
July	3	3	Sultana	No notes.
August	3	3	Cornichon	Hot weather.
September	3.5	3.5	Cornichon	Lots of people fishing.

Lake 13-0069-01 Site 207

East Rush Lake

East Rush Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	66.9	54.2	68.9	63.3
Classification	Eutrophic	Eutrophic	Hypereutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	40.4 µg/L	1.5 meters	89.0 µg/L		
Grade	C	C	D	**C**	17th/19

MPCA Standards: Impaired

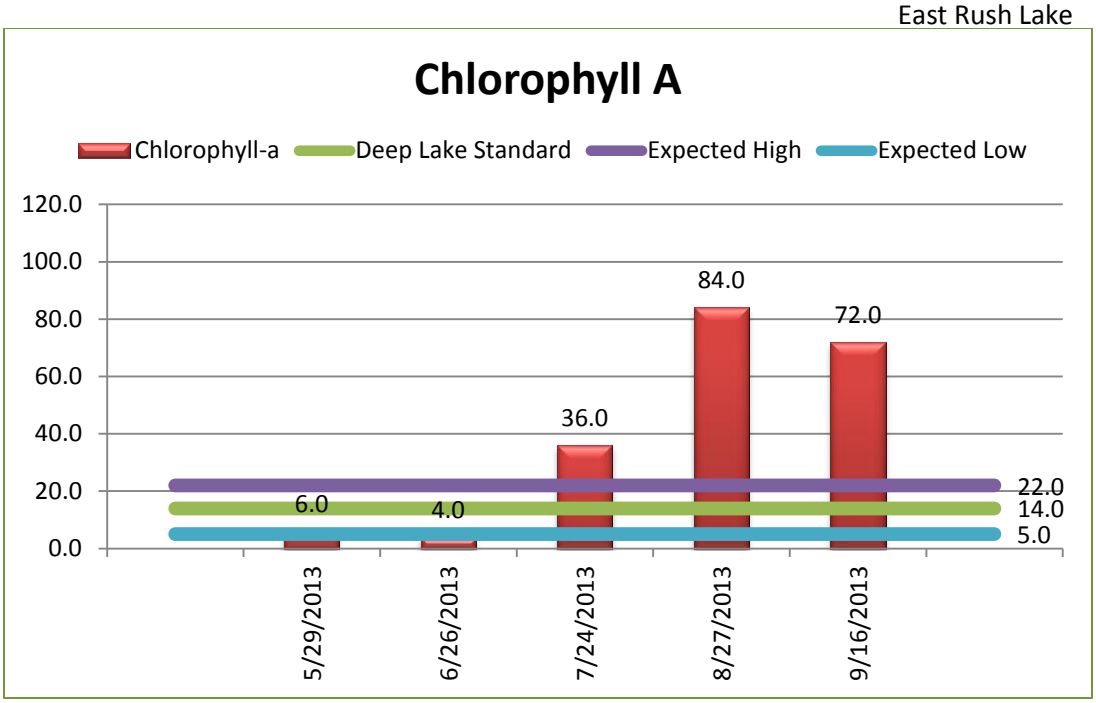
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	49.0 µg/L	1.3 meters	97.3 µg/L	
Meets Standard	No	No	No	**No**

Chlorophyll-a

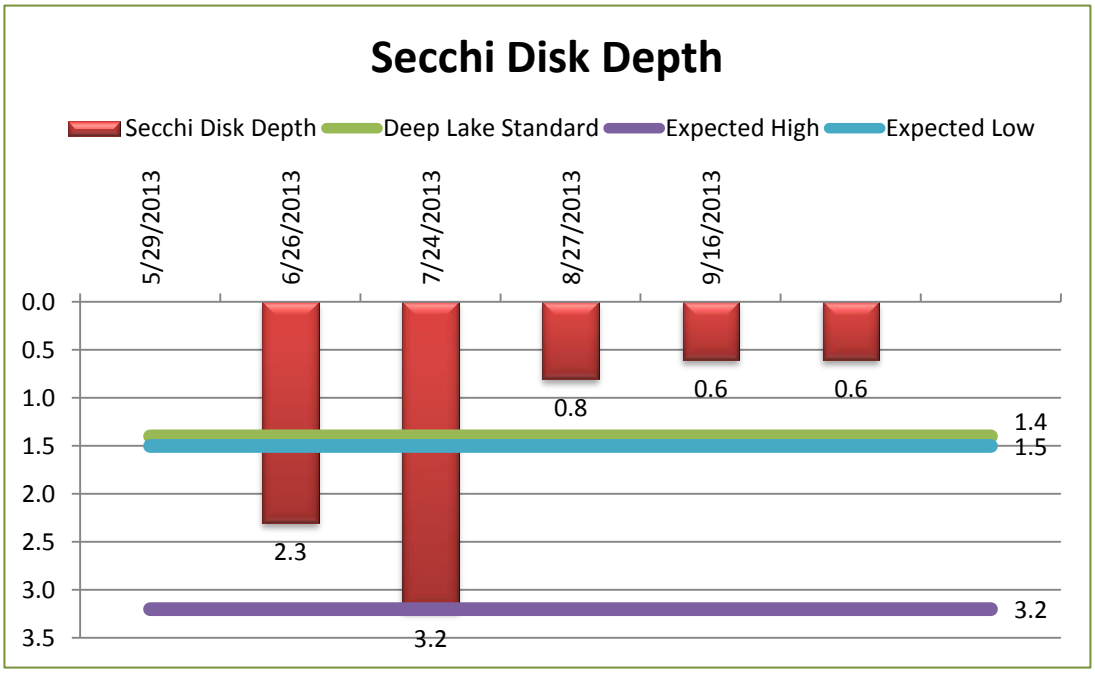
Expected Range:
5.0-22.0 µg/L

Deep Lake Standard:
14.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Chlorophyll-a charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	54.4 µg/L	**40.4 µg/L**
Grade				D	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	65.5 µg/L	**49.0 µg/L**
Meets Standard (14.0 µg/L)				No	**No**



Secchi Disk Depth

Expected Range:
1.5-3.2 meters

Deep Lake Standard:
>1.4 meters

Clarity in this lake is poor. The average does not meet the standard.

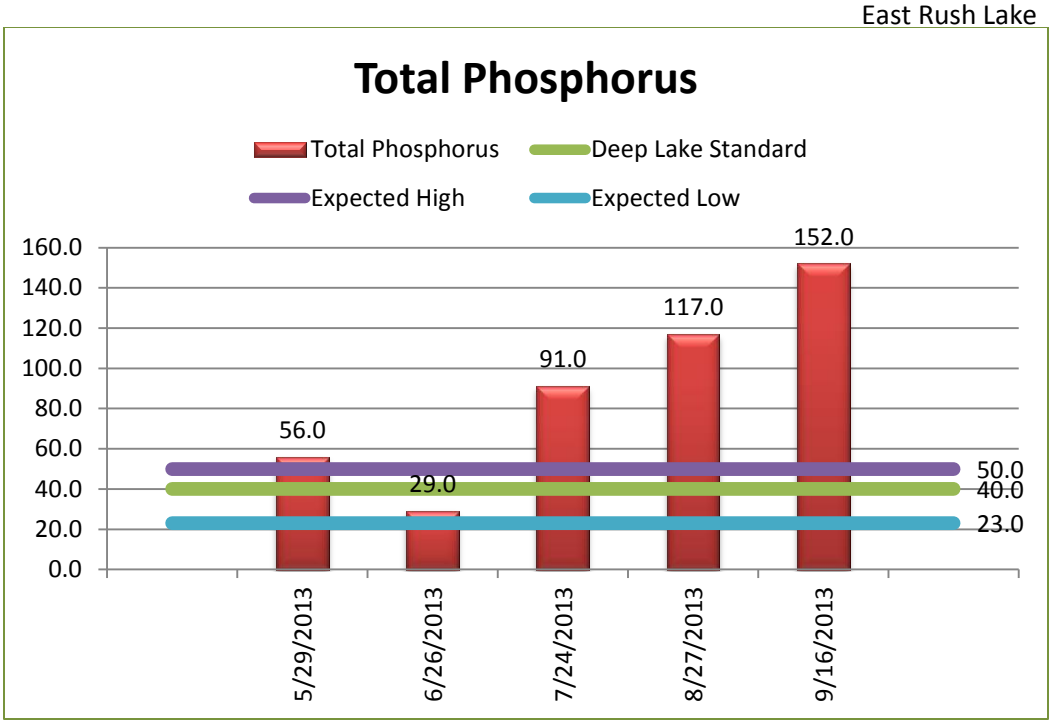
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	0.8 meters	**1.5 meters**
Grade				D	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	0.7 meters	**1.3 meters**
Meets Standard (>1.4 m)				No	**No**

Total Phosphorus

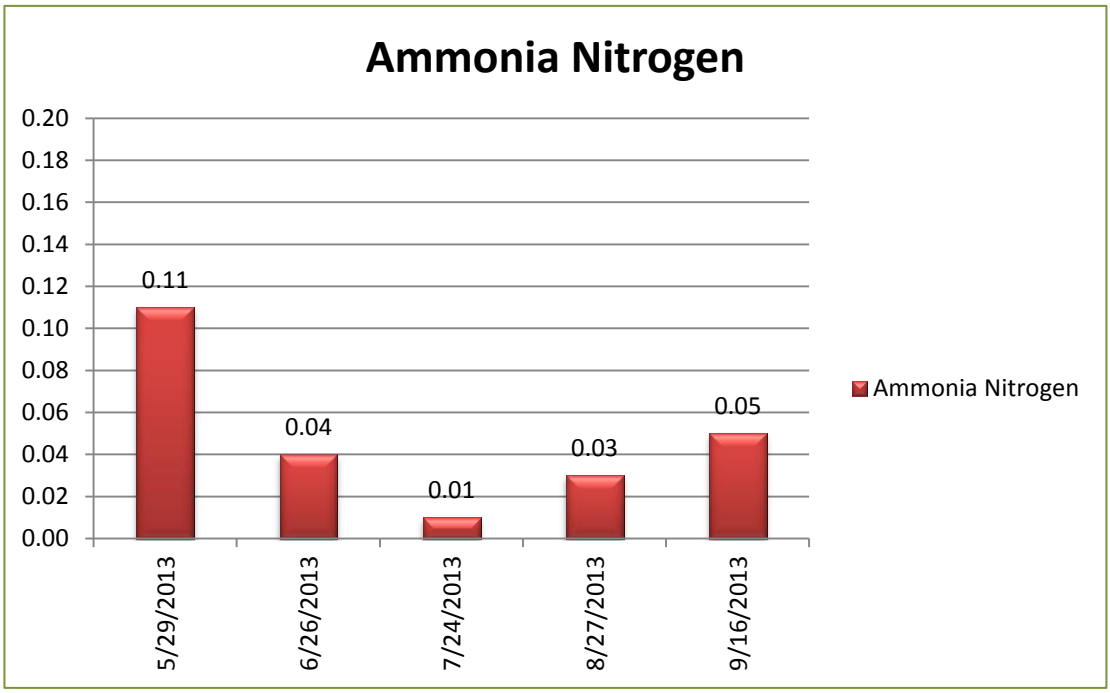
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	90.0 µg/L	**89.0 µg/L**
Grade				D	**D**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	101.3 µg/L	**97.3 µg/L**
Meets Standard (40.0 µg/L)				No	**No**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

The early season elevated reading could be due to stormwater runoff. This chart cannot be directly compared to other Ammonia Nitrogen charts due to a difference in scale.

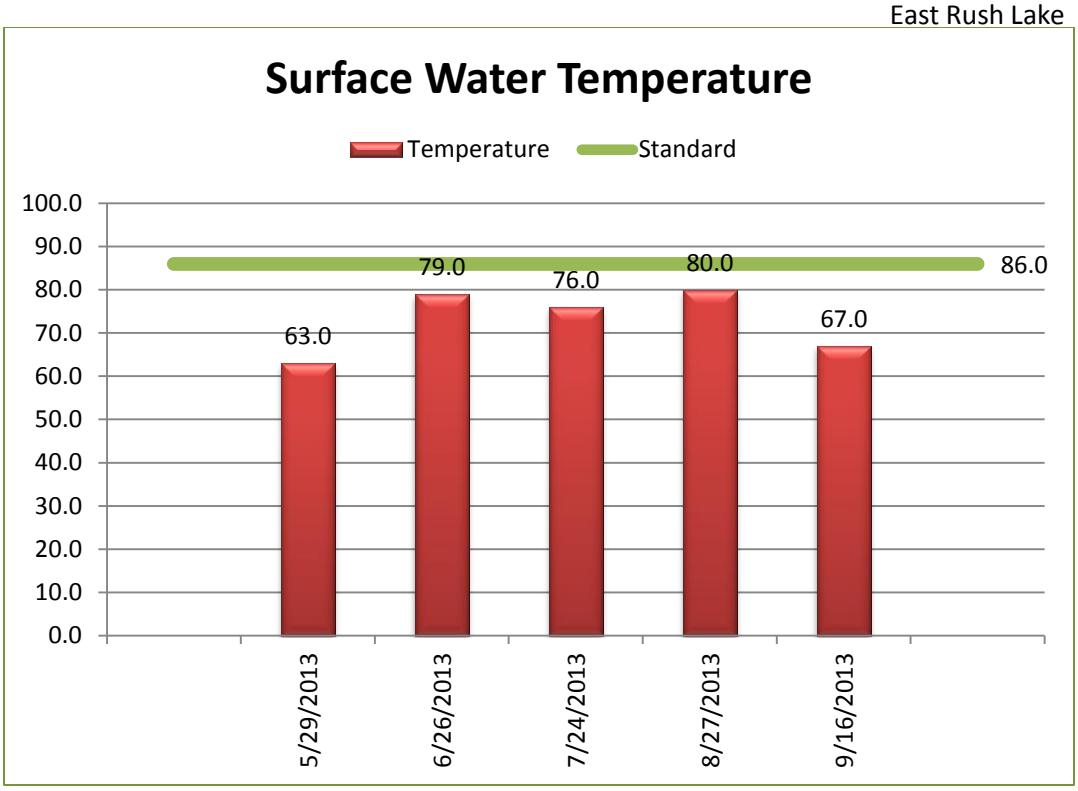
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.07 mg/L	**0.05 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	70.6˚F	**73.0˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

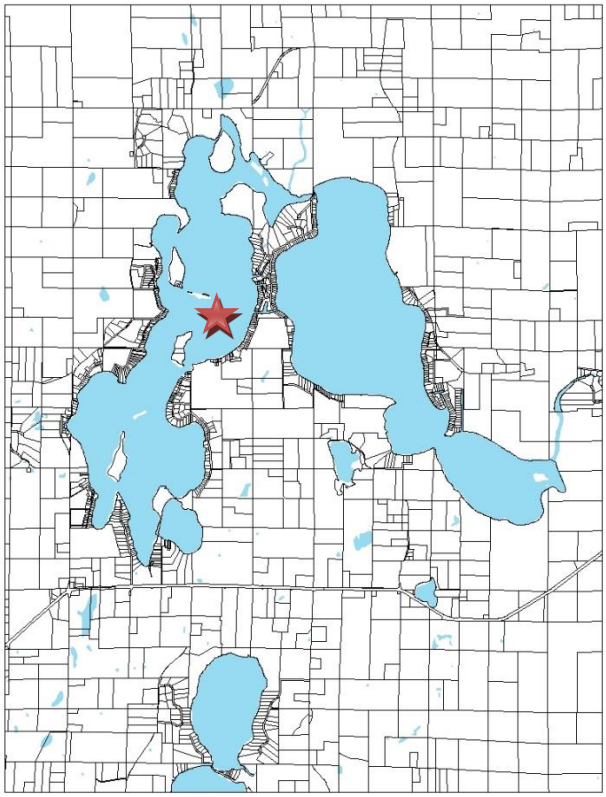
East Rush Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	3	3	Parchment Paper	No notes.
June	2.5	2.5	Beach Grass	Noticeable decrease in water quality since May.
July	3	3	Beach Grass	No notes.
August	4	4	Mossy Rock	Pea soup at boat launch.
September	4	4	Mossy Rock	Algae blooms.

Lake 13-0069-02 Site 204

West Rush Lake

West Rush Lake



Deep Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	68.5	50.3	65.6	61.5
Classification	Hypereutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	47.6 µg/L	2.0 meters	70.8 µg/L		
Grade	C	C	D	**C**	15th/19

MPCA Standards: Impaired

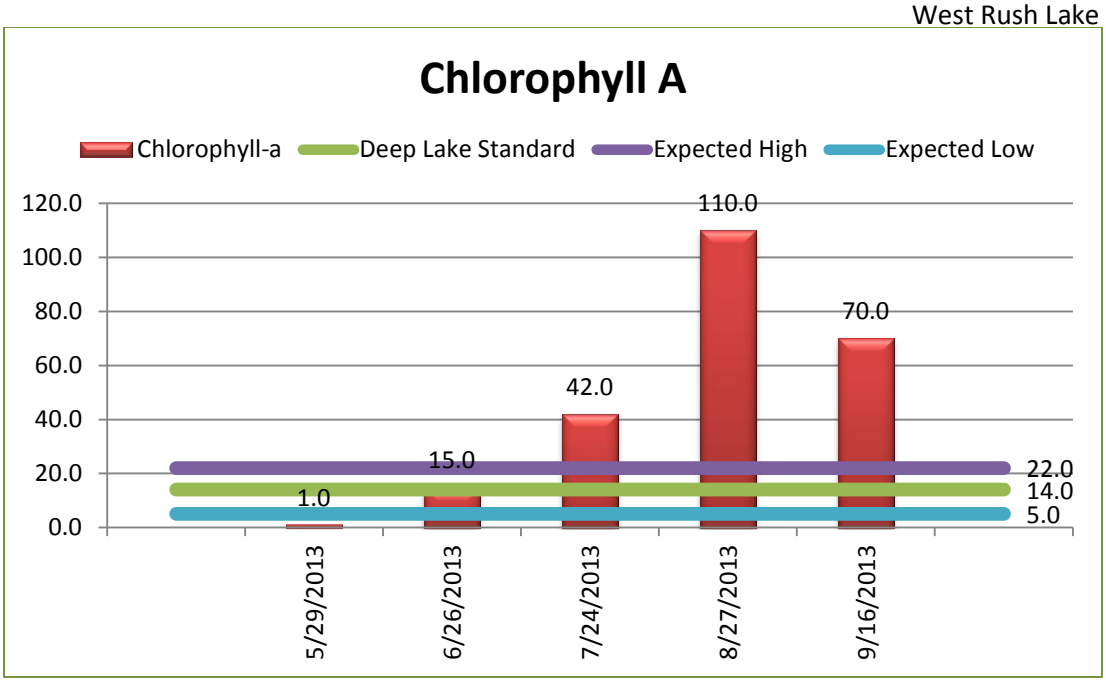
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Deep lake)	14.0 µg/L	>1.4 meters	40.0 µg/L	
2013 Average (June-Sept)	59.3 µg/L	0.9 meters	77.5 µg/L	
Meets Standard	No	No	No	**No**

Chlorophyll-a

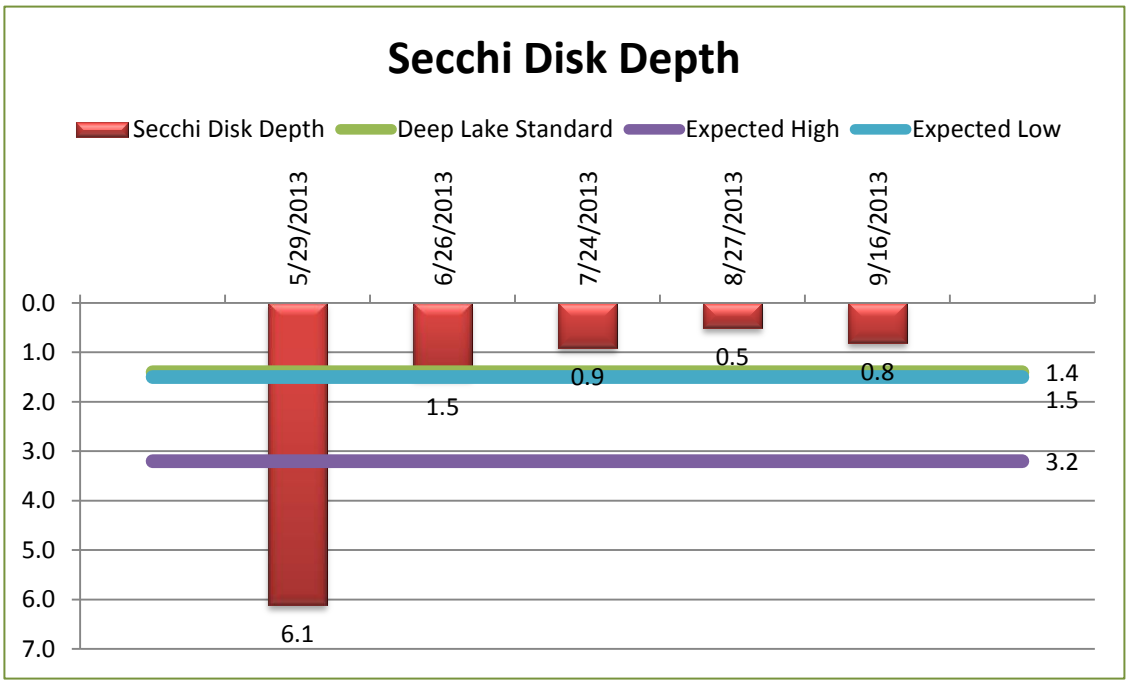
Expected Range: 5.0-22.0 µg/L

Deep Lake Standard: 14.0 µg/L

The average does not meet the standard. This chart cannot be directly compared to other Chlorophyll-a charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	57.2 µg/L	**47.6 µg/L**
Grade				D	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	67.8 µg/L	**59.3 µg/L**
Meets Standard (14.0 µg/L)				No	**No**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Deep Lake Standard: >1.4 meters

The average does not meet the standard. This chart cannot be directly compared to other Secchi Disk Depth charts due to a difference in scale.

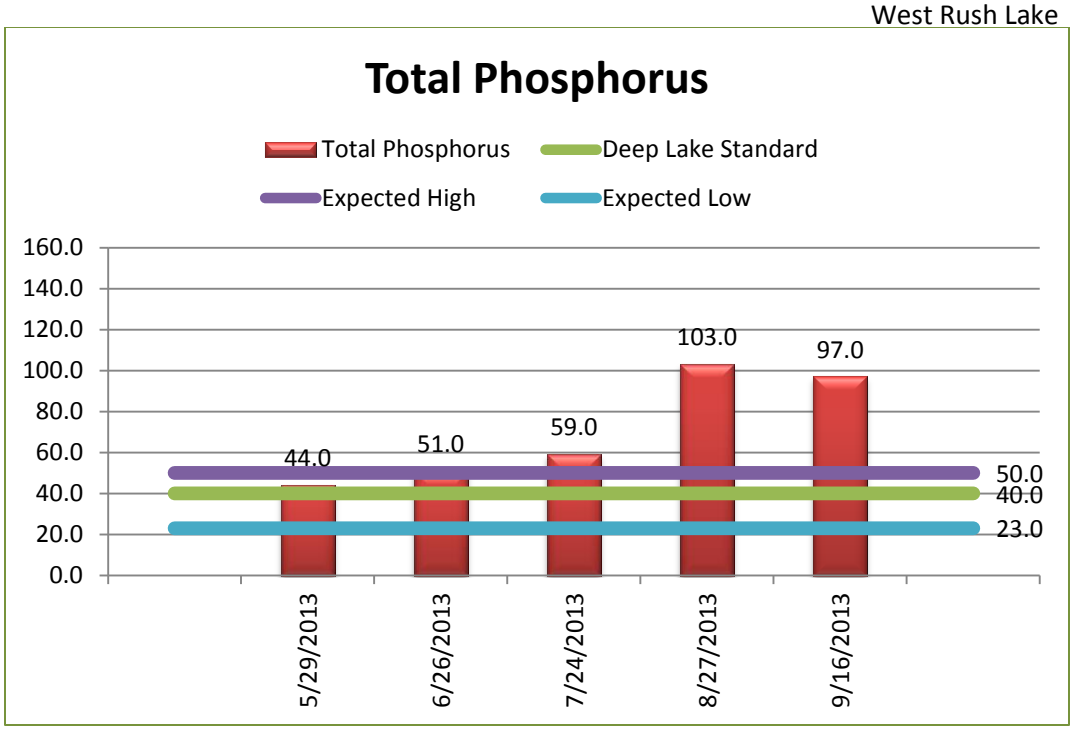
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	0.9 meters	**2.0 meters**
Grade				D	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	0.7 meters	**0.9 meters**
Meets Standard (>1.4 m)				No	**No**

Total Phosphorus

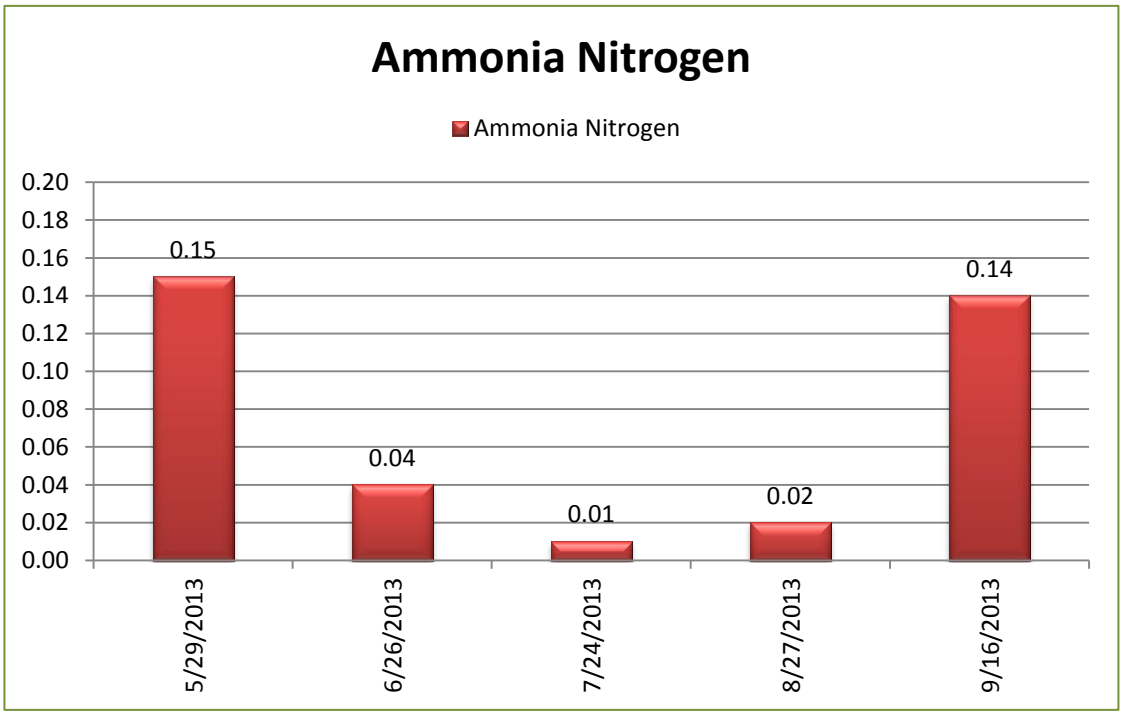
Expected Range: 23.0-50.0 µg/L

Deep Lake Standard: 40.0 µg/L

This lake does not meet the standard. This chart cannot be directly compared to other Total Phosphorus charts due to a difference in scale.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	80.0 µg/L	**70.8 µg/L**
Grade				D	**D**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	88.0 µg/L	**77.5 µg/L**
Meets Standard (40.0 µg/L)				No	**No**



Ammonia Nitrogen

Expected Range: None

Deep Lake Standard: None

May and September samples were elevated. This could be due to spring or stormwater runoff. This chart cannot be directly compared to other Ammonia Nitrogen charts due to a difference in scale.

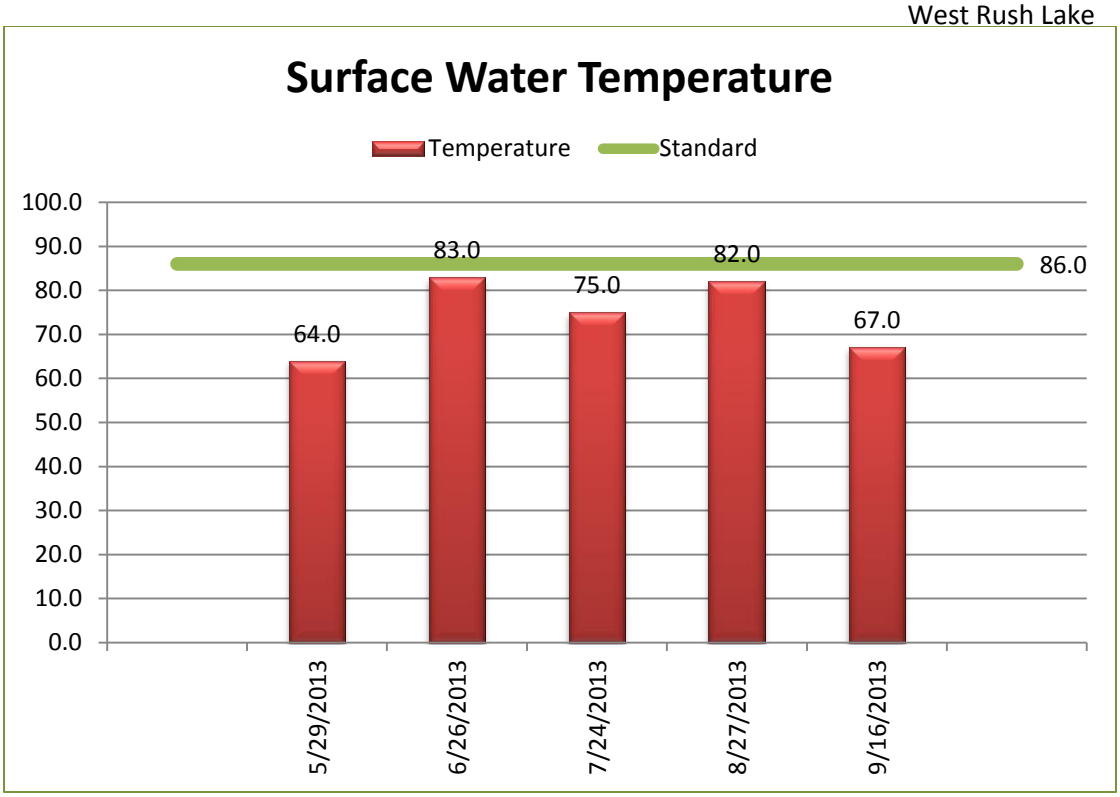
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.10 mg/L	**0.07 mg/L**

Surface Water Temperature

Expected Range: None

Deep Lake Standard: The daily average shall not exceed 86.0˚F.

The temperatures met the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	70.6˚F	**74.2˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

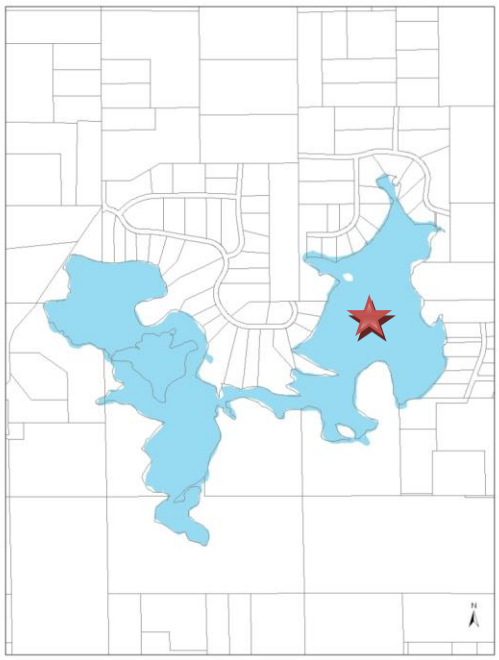
West Rush Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	1.5	1.5	Heavy Cream	Best clarity I've seen on this lake. Minimal algae.
June	3	3	Sultana	Noticeable decrease in water quality since May. Algae blooms and substantial curlyleaf pondweed north end of lake near Frandsen Park.
July	3	3	Beach Grass	Curlyleaf pondweed and algae blooms by Frandsen park dissipated.
August	4	4	Mossy Rock	Algae blooms.
September	4	4	Cornichon	Algae blooms.

Lake 13-0019-00 Site 202

Spider Lake-East

Spider Lake



Shallow Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	55.0	53.6	58.6	55.7
Classification	Eutrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: C

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	12.0 µg/L	1.6 meters	43.6 µg/L		
Grade	B	C	C	**C**	8th/19

MPCA Standards: Meets Standards

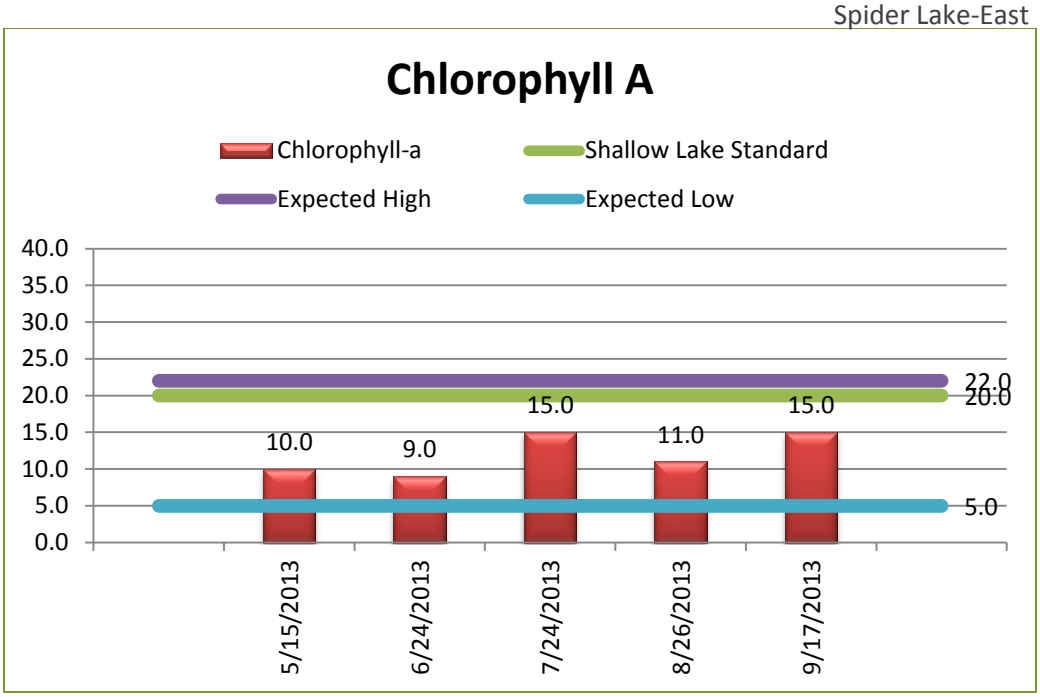
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Shallow lake)	20.0 µg/L	>1.0 meters	60.0 µg/L	
2013 Average (June-Sept)	12.5 µg/L	1.7 meters	40.0 µg/L	
Meets Standard	Yes	Yes	Yes	**Yes**

Chlorophyll-a

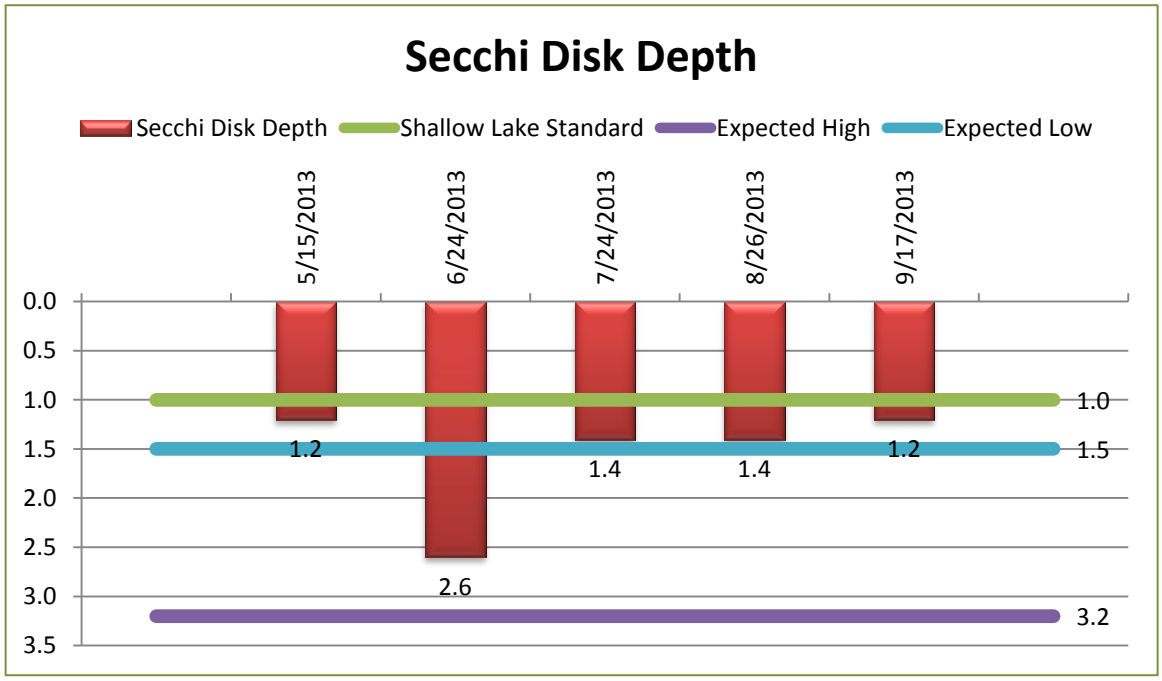
Expected Range: 5.0-22.0 µg/L

Shallow Lake Standard: 20.0 µg/L

All samples were below the standard. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	16.4 µg/L	23.8 µg/L	**12.0 µg/L**
Grade			B	C	**B**
Average (June-Sept)	NO DATA	NO DATA	17.0 µg/L	25.5 µg/L	**12.5 µg/L**
Meets Standard (20.0 µg/L)			Yes	No	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Shallow Lake Standard: >1.0 meters

Clarity in this lake was good. All samples and the average met the standard.

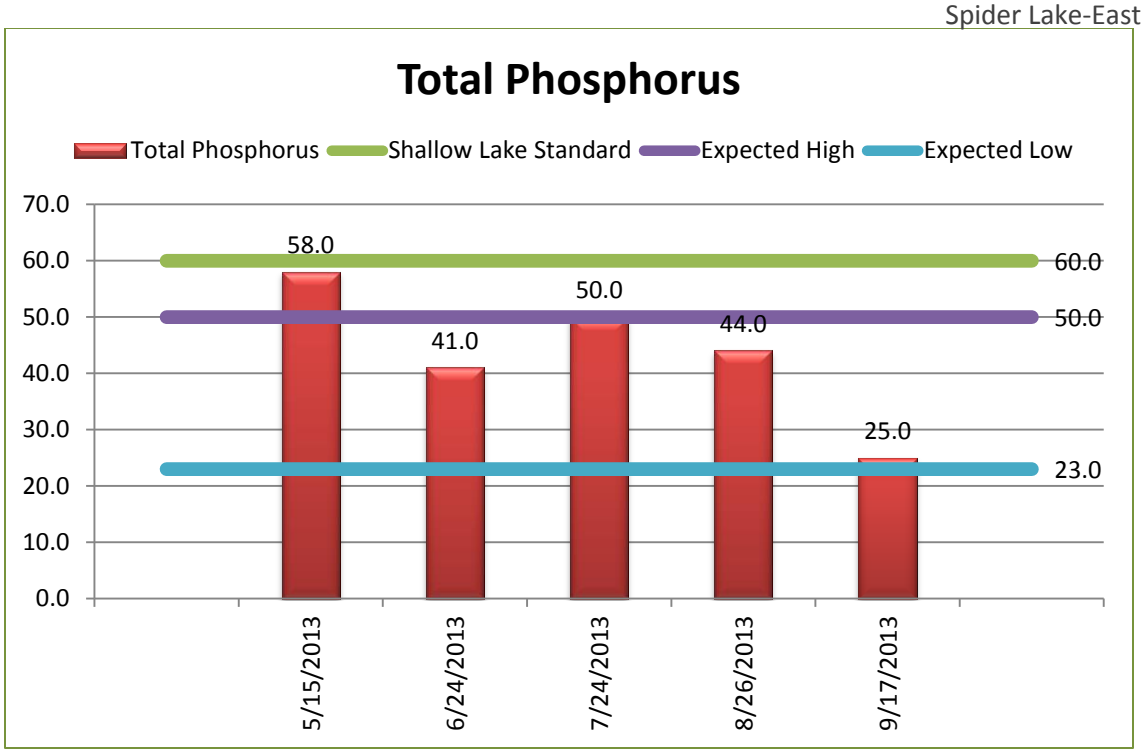
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	1.2 meters	0.9 meters	**1.6 meters**
Grade			C	D	**C**
Average (June-Sept)	NO DATA	NO DATA	1.2 meters	0.9 meters	**1.7 meters**
Meets Standard (>1.0 m)			Yes	No	**Yes**

Total Phosphorus

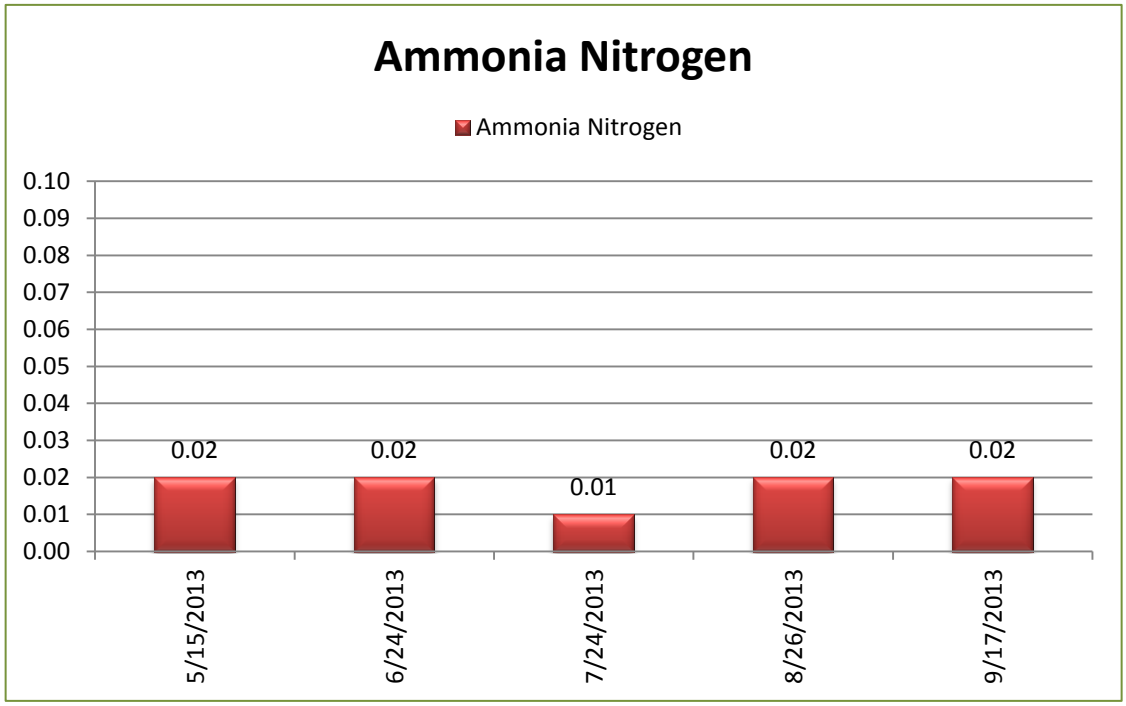
Expected Range: 23.0-50.0 µg/L

Shallow Lake Standard: 60.0 µg/L

All samples were below the standard. The average meets the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	55.0 µg/L	62.4 µg/L	**43.6 µg/L**
Grade			C	C	**C**
Average (June-Sept)	NO DATA	NO DATA	52.0 µg/L	56.8 µg/L	**40.0 µg/L**
Meets Standard (60.0 µg/L)			Yes	Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

There is no standard, but the ammonia nitrogen levels were very low.

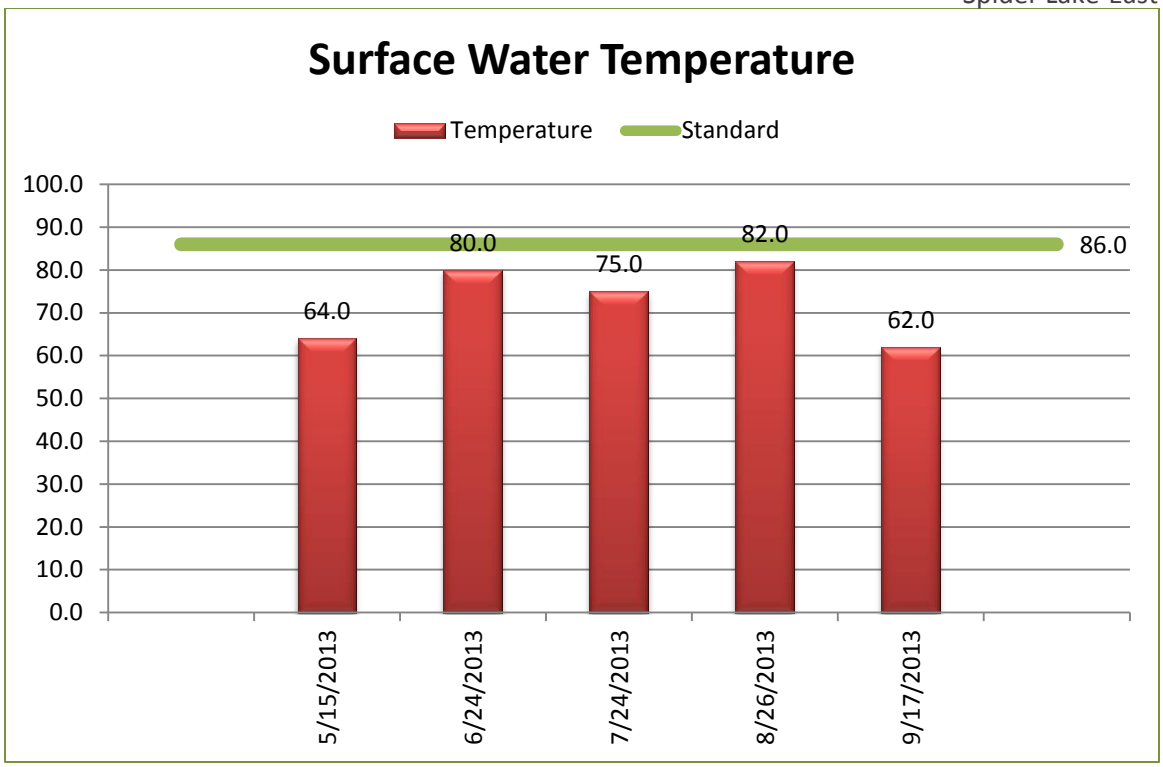
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	0.04 mg/L	0.07 mg/L	**0.02 mg/L**

Surface Water Temperature

Expected Range: None

Shallow Lake Standard: The daily average shall not exceed 86.0˚F

All temperatures were recorded below the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	63.2 ˚F	72.6˚F	**72.6˚F**
Meets Standard (Not to exceed 86.0˚F)			Yes	Yes	**Yes**

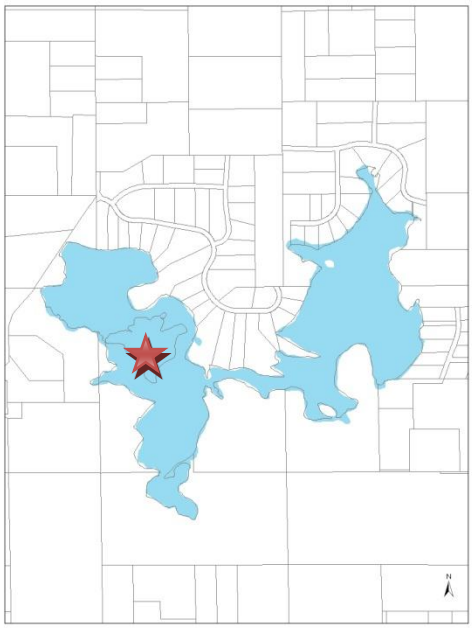
East Spider Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	2.5	2.5	Dried Chamomile	Low weed pressure.
June	2.5	2.5	Bamboo	Aquatic plants developing in shallows.
July	2.5	2.5	Short Bread	Filamentous algae, overall water quality appears to be.
August	3.5	3.5	Sultana	Hot weather.
September	3	3	Sultana	No notes.

Lake 13-0019-00 Site 201

Spider Lake-West

Spider Lake



Shallow Lake

Lake Classification: EUTROPHIC

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Classification
Trophic State Index	42.6	50.8	54.0	49.1
Classification	Mesotrophic	Eutrophic	Eutrophic	Eutrophic

Overall Lake Quality Grade: B

	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall Grade	Rank
2013 Average (May-Sept)	3.4 µg/L	1.9 meters	31.8 µg/L		
Grade	A	C	B	**B**	2nd/19

MPCA Standards: Meets Standards

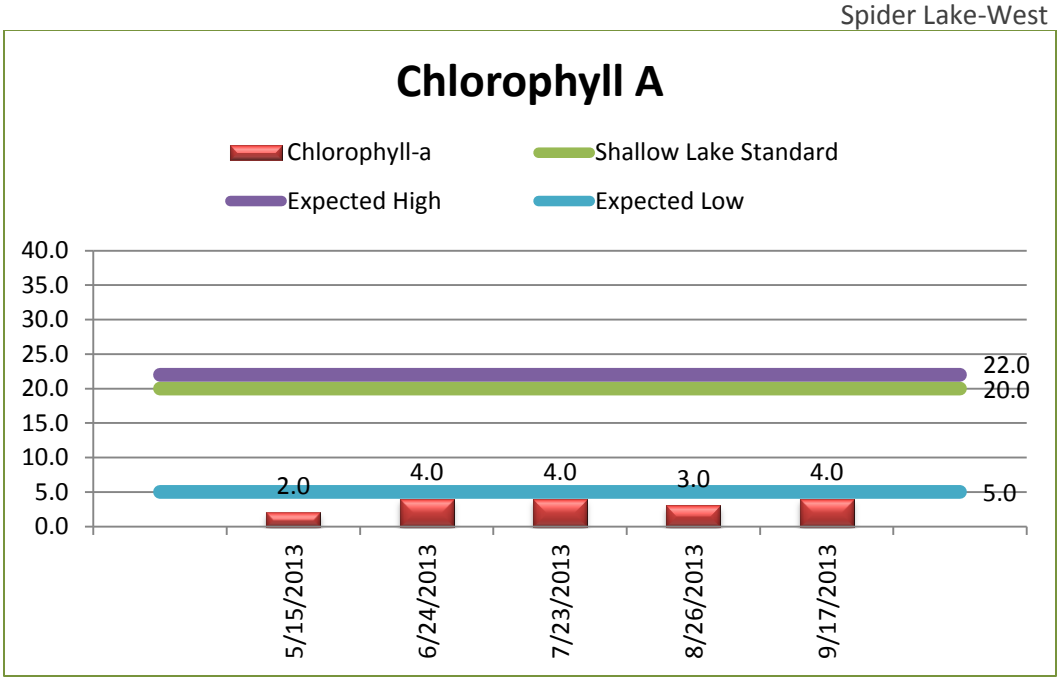
	Chlorophyll-a	Secchi Disk Depth	Total Phosphorus	Overall
MPCA Standard (Shallow lake)	20.0 µg/L	>1.0 meters	60.0 µg/L	
2013 Average (June-Sept)	3.8 µg/L	1.9 meters	32.3 µg/L	
Meets Standard	Yes	Yes	Yes	**Yes**

Chlorophyll-a

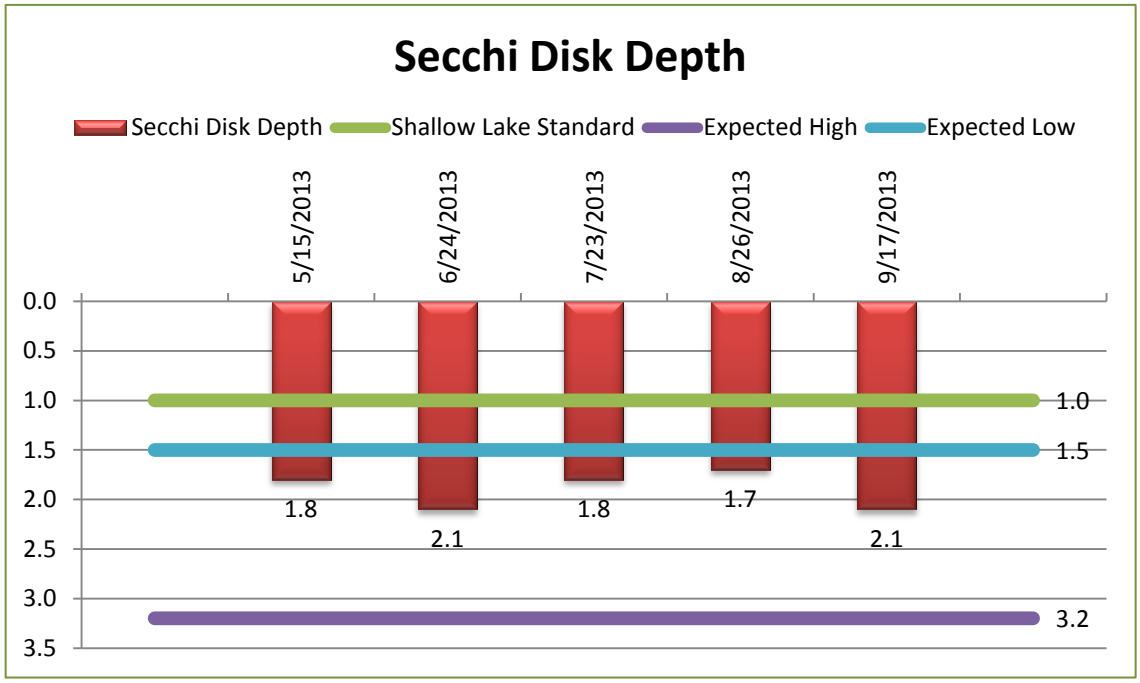
Expected Range: 5.0-22.0 µg/L

Shallow Lake Standard: 20.0 µg/L

The Chl-a levels in this lake were exceptionally low.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	3.8 µg/L	**3.4 µg/L**
Grade				A	**A**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	4.5 µg/L	**3.8 µg/L**
Meets Standard (20.0 µg/L)				Yes	**Yes**



Secchi Disk Depth

Expected Range: 1.5-3.2 meters

Shallow Lake Standard: >1.0 meters

Clarity was very good on this part of the lake. Each time the disk hit the lake bottom. Differences are due to changing lake depth.

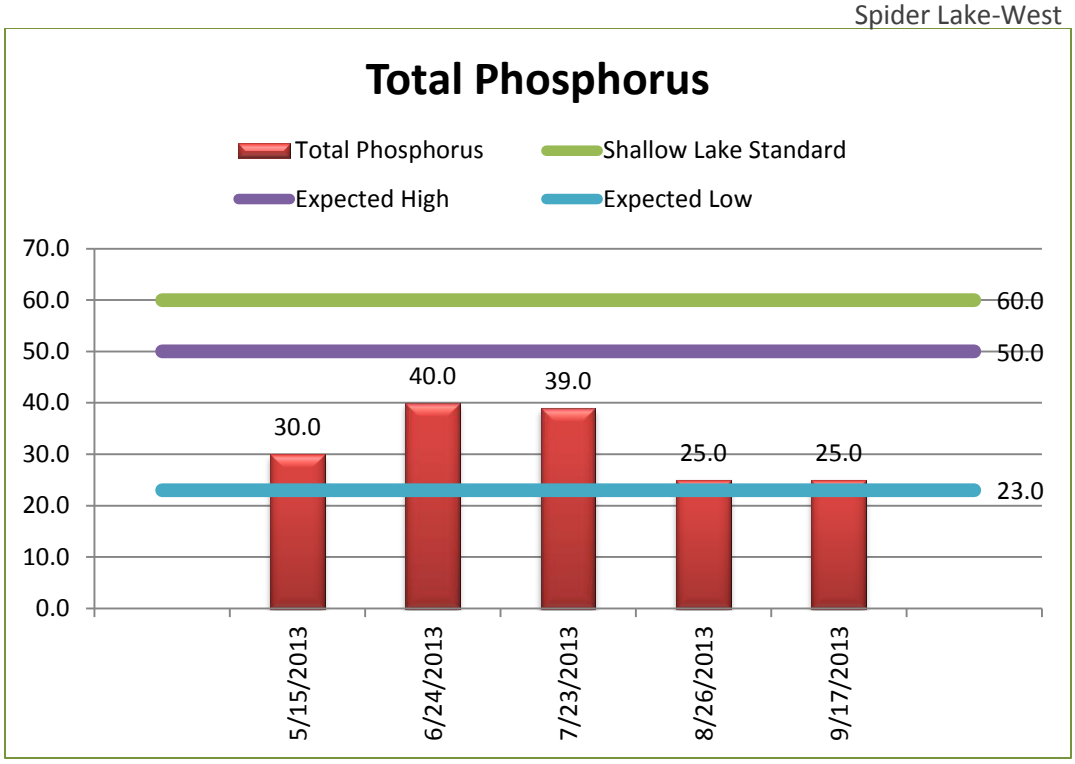
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	1.9 meters	**1.9 meters**
Grade				C	**C**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	1.9 meters	**1.9 meters**
Meets Standard (>1.0 m)				Yes	**Yes**

Total Phosphorus

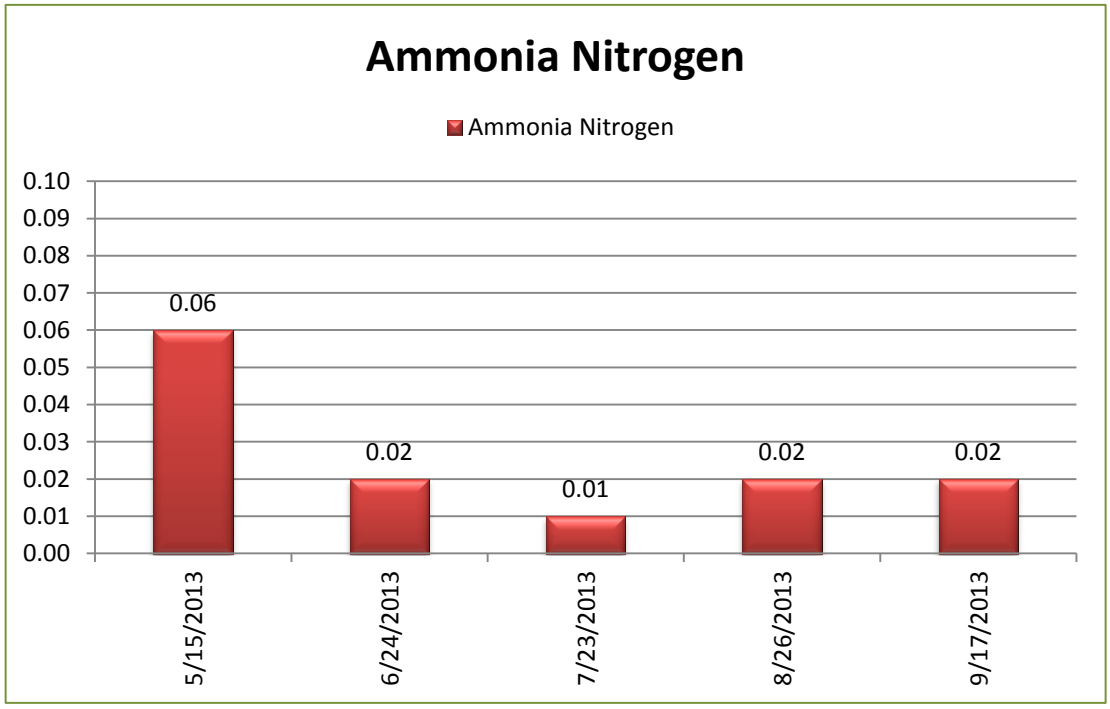
Expected Range: 23.0-50.0 µg/L

Shallow Lake Standard: 60.0 µg/L

All samples were within the expected range and below the standard. The average reading meets the standard for this part of the lake.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average (May-Sept)	NO DATA	NO DATA	NO DATA	35.2 µg/L	**31.8 µg/L**
Grade				C	**B**
Average (June-Sept)	NO DATA	NO DATA	NO DATA	35.5 µg/L	**32.3 µg/L**
Meets Standard (60.0 µg/L)				Yes	**Yes**



Ammonia Nitrogen

Expected Range: None

Shallow Lake Standard: None

There is no standard, but the ammonia nitrogen levels were very low. The elevated spring sample could be due to spring runoff.

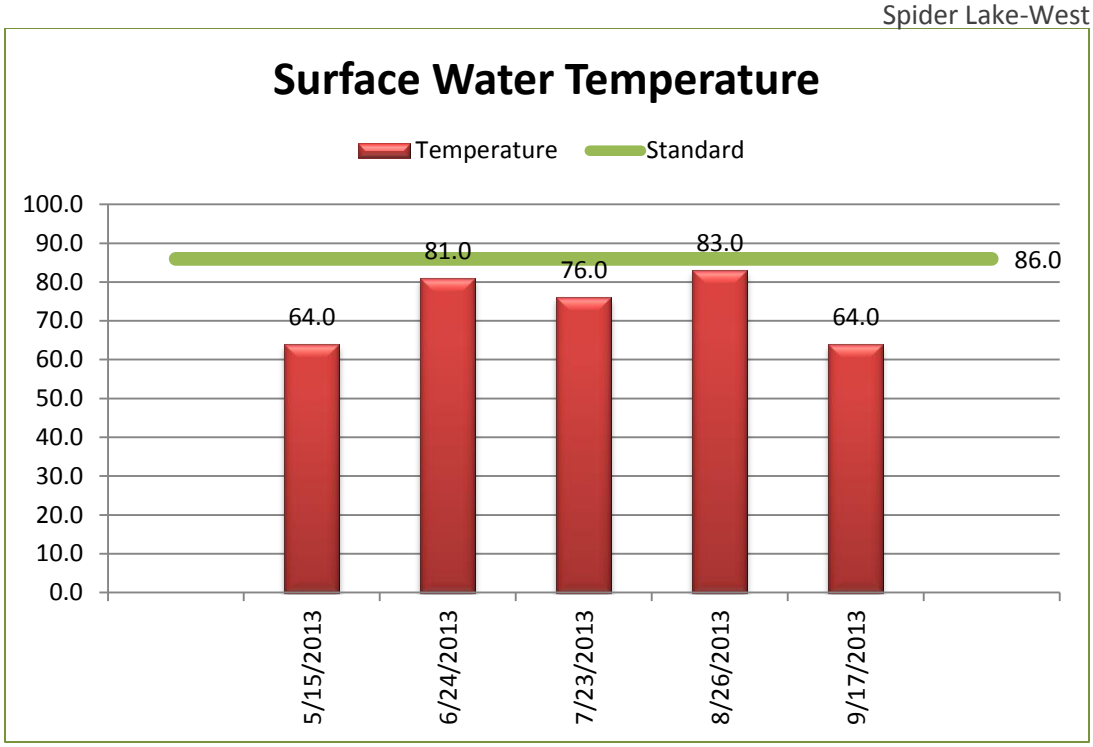
	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	2013
Average	NO DATA	NO DATA	NO DATA	0.08 mg/L	**0.03 mg/L**

Surface Water Temperature

Expected Range: None

Shallow Lake Standard: The daily average shall not exceed 86.0˚F

All temperatures were recorded below the standard.



	2009 (Not Graphed)	2010 (Not Graphed)	2011 (Not Graphed)	2012 (Not Graphed)	
Average	NO DATA	NO DATA	NO DATA	72.6˚F	**73.6˚F**
Meets Standard (Not to exceed 86.0˚F)				Yes	**Yes**

West Spider Lake General Observations

Month	Physical Condition	Recreational Suitability	Color of Filtered Water	General Lake Observations/ Aquatic Invasive Species
May	1.5	1.5	Rice Paper	Very clear water.
June	2	2	Rice Paper	Beautiful.
July	1.5	1.5	Short Bread	Beautiful.
August	2	2	Rice Paper	Hot weather.
September	2	2	Heavy Cream	No notes.

Chisago COUNTY