

Green Lake Monitoring Report 2018

2018 was the third consecutive year that the Green Lake Improvement District (GLID) and the Isanti Soil and Water Conservation District (ISWCD) partnered to monitor the health of Green Lake.

What: GLID volunteers collected Total Phosphorus (TP), Chlorophyll-a (Chl-a) and Transparency information every two weeks from May through September in the deepest part of the lake (see map). SWCD staff collected dissolved oxygen, pH, conductivity and temperature information throughout the water column once a month from June through September. SWCD Staff provided training, equipment and coordinated lab testing.



| Lake Data for Green Lake | |
|------------------------------|------------|
| Township | Wyanett |
| MN Lake ID | 30013600 |
| # of Public Boat Access | 1 |
| Aquatic Invasive Species | CLPW & EWM |
| Surface Area | 822 acres |
| Maximum Depth | 28ft |
| Total Phosphorus: Yes | |
| Lake Meets Clean Water Goals | |
| Chlorophyll-a: Yes | |
| Transparency: Yes | |

Why: Green Lake was added to the MN impaired waters list in 2008 for having high nutrients (too much phosphorus). The listing triggered the completion of a Total Maximum Daily Load (TMDL) study. TMDL's quantify the phosphorus reduction necessary in order to make the lake healthy again. The study identified the need for a 39% phosphorus reduction.

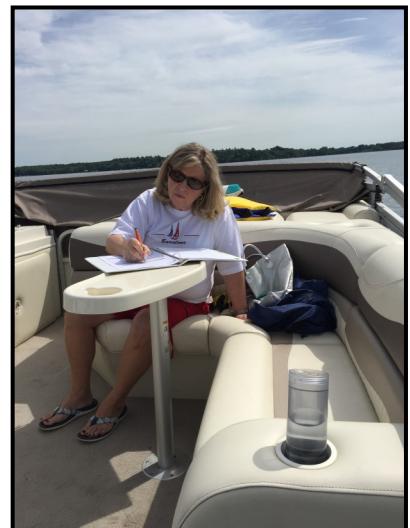
The monitoring data collected in 2018 helps us get a better understanding of the factors driving high phosphorus levels. Additionally, we can use the data to track trends over time and track the effectiveness of projects that are meant to improve lake health (i.e. raingardens, lakeshore restorations, ag practices).

Green Lake samples are summarized in this report.

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Volunteer Lake Monitors: Ken Murry, Barb Prince, Jim Haubenschild



2018 Rainfall Summary

While the total seasonal rainfall was similar to 2017, the majority of rainfall events occurred during the growing season (vegetation was growing and available to take up water) and nearly all events were under two inches. As a result, less sediment and phosphorus made its way into surface waters and water levels were lower than usual across the county.

Although precipitation did increase in the fall individual events were still quite “normal” (no events greater than 2+ inches) and they did not appear to have a large negative effect on water health.

General Definitions

Phosphorus (TP): an essential plant nutrient which can cause algal blooms in excess, measures all usable forms.

Chlorophyll-a (Chl-a): a pigment found in green plants, used to estimate amounts of algae in a lake.

Secchi Transparency: a measure of light penetration in water, which helps estimate algae concentration.

Green Lake Historical Water Quality Data

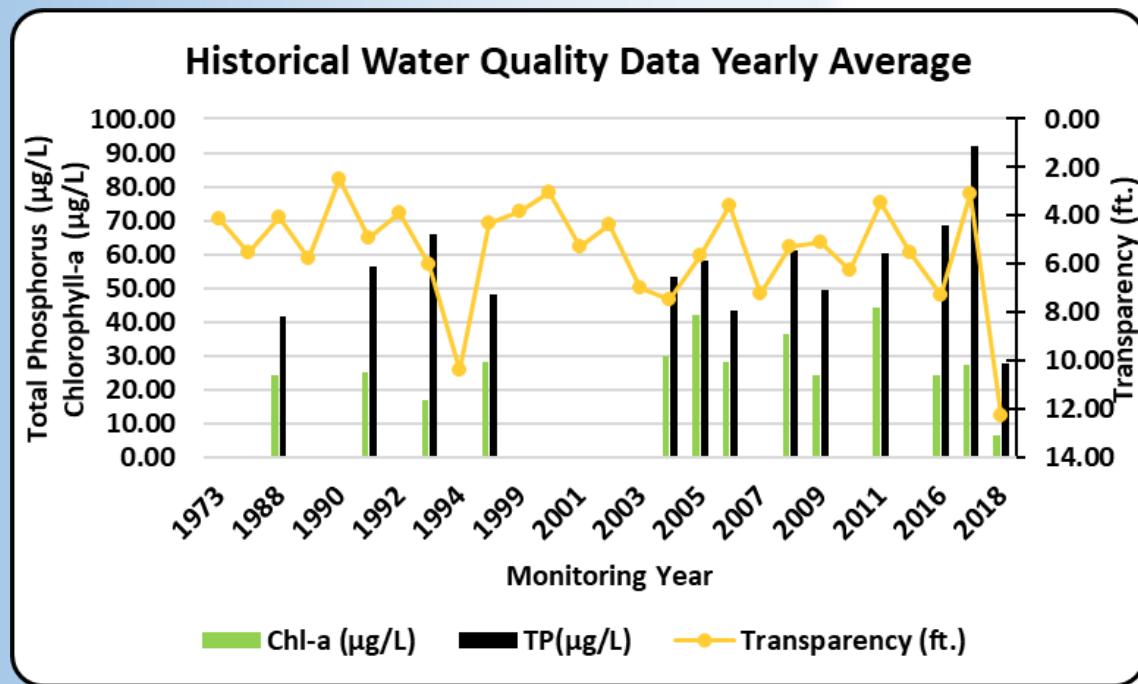
MN Clean Water Goals for Deep Lakes:

Total Phosphorus (TP): $\leq 40 \mu\text{g/L}$

Chlorophyll-a: $\leq 14\text{mg/m}^3$

Secchi Depth: ≥ 4.59 feet

In order to get an idea of lake health trends over time, we compiled historic TP, Chl-a and Secchi transparency data from the Minnesota Pollution Control (MPCA) website. While the data is beneficial for tracking general trends, it is important to note that there was a minimal amount of TP and Chl-a data available for each year prior to 2016 (i.e. 3 or fewer samples per year)—this has a tendency to skew annual averages. The data set for Secchi transparency is much more extensive and dates back to 1973.



- There is a slight trend towards improving water clarity and Chl-a over time. The improvement may reflect aquatic vegetation shifts.
- Conversely, there is a slight trend towards increasing TP over time.
- 2016- 2018 water monitoring included more samples than previous years and sampling into September. Late season samples tend to have high TP due to lake turnover and result in higher averages (with the exception of 2018).
- The graph above illustrates the that TP and Chl-a averages exceed state standards for every year monitored—except 2018.
- Good lake health in 2018 was likely due to the timing and amounts of rainfall.

Green Lake Monitoring Results 2018

Total Phosphorus (TP), Chlorophyll-a (Chl-a) and Secchi Transparency

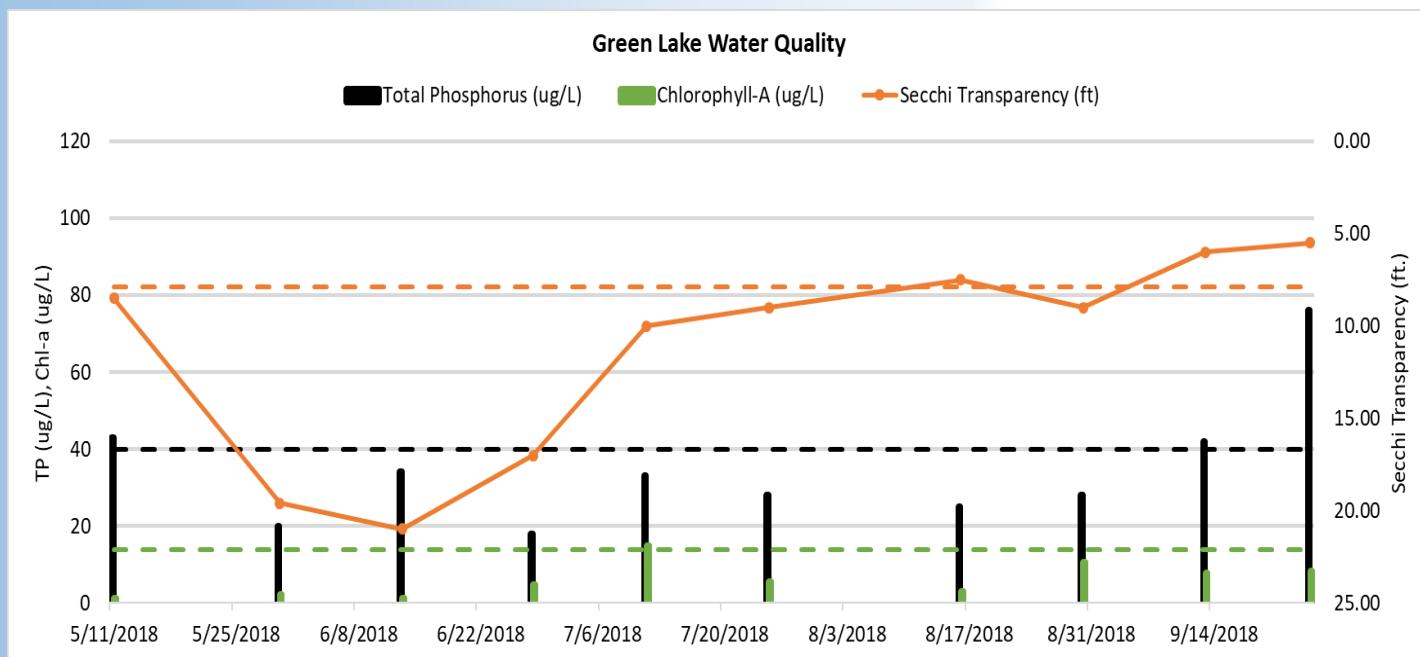
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| | | | |
|---|----------------------|----------------------|----------|
| 2018 Growing season average (June-September) | 27.7 $\mu\text{g/L}$ | 6.68 $\mu\text{g/L}$ | 12.25 ft |
|---|----------------------|----------------------|----------|



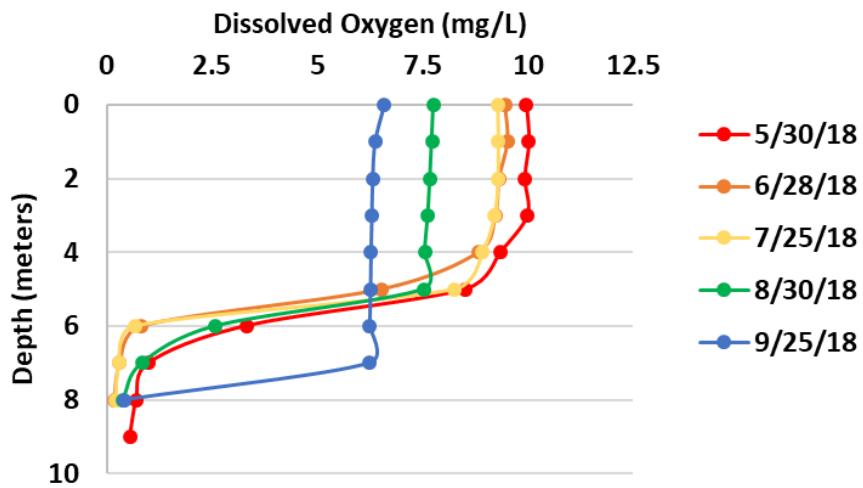
2018 Data Summary:

- The lake has a maximum depth of 28 feet and is categorized as a deep water lake.
- Monitoring results are compared to state water quality goals for deep lakes.
- Overall lake water quality was very good in 2018.
- Low TP through late August corresponds with low monthly rain and water temperature column stratification. (see temperature profiles on preceding page).
- TP, similar to previous years, increased late in the season. This suggests nutrients from the bottom of the lake are being mixed into the water column as the lake turns over (internal loading).
- Chl-a increased (more algae) mid-July. This corresponds with curlyleaf pondweed die off and is similar to previous years.
- 2018 was largely devoid of heavy rainfalls that would have contributed to pollutants in rainwater runoff. This undoubtedly influenced lake conditions for the year.

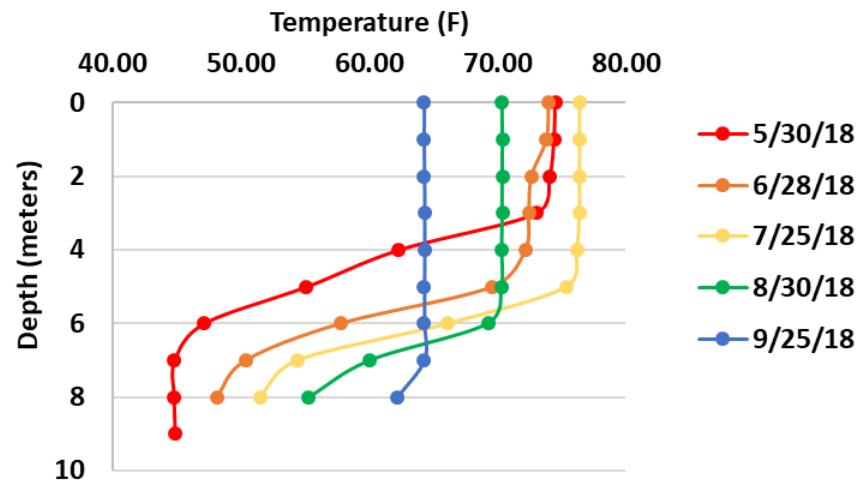
2018 Lake Stratification

In 2018 we measured temperature and dissolved oxygen profiles starting at the surface of the water and then at one meter increments to the bottom of the lake. This information adds to the story when we analyze lake water quality data. The graphs below are representations of the data collected.

Green Lake Dissolved Oxygen Profiles



Green Lake Temperature Profiles



Temperature was consistent throughout the water column late in the year and formed layers of water with different temperatures from May to late August. This process is called thermal stratification and is expected in a deep lake. The cool water acts as a barrier between the lake bottom and the warm waters above. Dissolved oxygen periodically decreases to near zero at the lake bottom. This phenomenon is typical in deep, nutrient rich lakes and can result in the release of phosphorus from the lake sediments. Phosphorus can also be released from the sediments during fall turnover (we think this happens on Green Lake) or other mixing events such as heavy rains or winds. This can result in algae blooms.

2018 Monitoring Program Review

The data collected thus far gives us valuable insight into lake health and how the lake responds to variables over time. At this time we feel that it is important to continue to reduce the amount of nutrients making their way into the lake from the land.

How?

Residential Properties: lakeshore restorations, rain gardens, pervious pavers, rain barrels, etc. The lakeshore restoration program that the LID is initiating this year will play a critical role in reducing TP from residential properties.

Agricultural Properties: cover crops, filter strips, water and sediment control basins, etc.

In an effort to help pin-point additional projects that would trap large amounts of TP regionally (such as wetland restorations), the SWCD has secured funding (to be matched by the GLID) to complete a phosphorus diagnostic study using the data collected by the SWCD. This work will also determine the need to address internal nutrient loading in the future.

Below are key points and recommendations for lake monitoring in 2019:

- No monitoring is scheduled for 2019. In the future we recommend sampling every other year OR three years on and three years off.
- Continue bi-weekly volunteer Secchi transparency readings.



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**Thanks to the GLID members
who have assisted with lake
monitoring.**