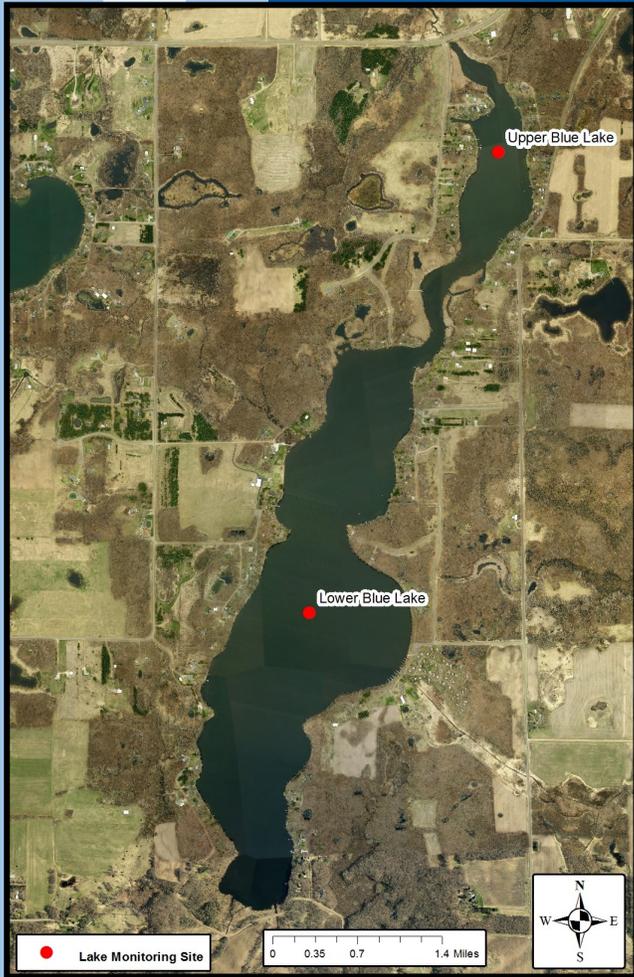


Blue Lake Monitoring Report 2019



What: LID volunteers collected Total Phosphorus (TP), Chlorophyll-a, and transparency information every two weeks from May through October in both Upper and Lower Blue Lake. SWCD staff provided training, equipment and coordinated lab testing.

Why: The lake was not monitored with any regularity before 2013. In 2015 the Blue Lake Improvement District began partnering with the Isanti SWCD in an effort to collect monitoring data on a regular basis. The data being gathered provides us with an understanding of the lake's health and water quality trends; furthermore, the data helps us diagnose areas of concern and provides evidence for the need to implement lake improvement projects (great for grant applications). In fact, monitoring data from 2015 and 2016 was used to obtain over \$250,000 of State grant funding to implement water quality projects around the lake.

Upper and Lower Blue Lake samples are summarized in this report individually.

| | Upper (Little) Blue Lake | Lower (Big) Blue Lake |
|--|---------------------------------|---------------------------------|
| Township | Spencer Brook | Spencer Brook/Stanford |
| MN Lake ID | 30010701 | 30010702 |
| # of Public Boat Access | 0 | 2 |
| Aquatic Invasive Species | Curly Leaf Pondweed | Curly Leaf Pondweed |
| Surface Area | 43 acres | 241 acres |
| Maximum Depth | 10ft | 30ft |
| Lake Meets Clean Water Goals | Total Phosphorus: YES | Total Phosphorus: NO |
| (When compared to shallow lake goals) | Chlorophyll-a: YES | Chlorophyll-a: YES |
| | Secchi Transparency: YES | Secchi Transparency: YES |

General Definitions

Total Phosphorus (TP): An essential plant nutrient in which an excess can cause severe algae blooms.

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

Secchi Transparency: A measure of light penetration in water, an indication to the amount of algae in the water.

2020 Monitoring Recommendations & Lake Health Improvement Projects

Water Health Improvement Projects:

Over the last several years the SWCD has been working towards installing lake health improvement projects identified in the Blue Lake Subwatershed Assessment (SWA) Study (www.isantiswcd.org/studies-plans). The SWA identifies project locations and types and ranks them based on how cost effective they are at removing phosphorus. The table below summarizes work completed to date by the SWCD. Additional projects are underway in 2020.

| Project | TP (lb/yr) |
|---|-------------|
| Stanford Township Public Access | 6.24 |
| Spencer Brook Raingardens and Sump | 1.5 |
| Paulson Shoreline and Stormwater Reduction Project | 1.32 |
| TOTAL | 9.06 |
| GOAL* (based on goal set in the 2019 diagnostic study – set to bring TP in lake to 31.5 ug/L) | 360 |

2020 Monitoring:

The data collected from 2015– 2018 gives us valuable insight into water health and how the lake responds to variables over time. The 2014–2023 monitoring plan does not include monitoring of the lake from 2019–2021. However, conversations with the Blue Lake Improvement District indicate that there may be interest in continuing to regularly monitor the health of the lake. Additionally, there is interest pursuing an internal load feasibility study as recommended in the 2019 Diagnostic Study.

Optional lake monitoring in 2020:

- Bi-weekly OR monthly lake sampling by the BLID. 2020 would not include temperature and dissolved oxygen profiles.
- Consider collecting lake sediment cores in 2020 or 2021 to determine internal recycling of phosphorus (per Wenck Inc. Recommendations) and potential solutions to the issue.

For more information contact: Isanti SWCD 763-689-3271

Tiffany Determan, District Manager, TDeterman@isantiswcd.org

Thanks to the BLID members who have assisted with lake and stream monitoring, especially Grant Warring!

Upper (Little) Blue Lake Monitoring Results 2019

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

MN Clean Water Goals for Shallow Lakes

Total Phosphorus (TP): ≤ 60 ug/L

Chlorophyll-a: ≤ 20 mg/L

Secchi Depth: ≥ 3.28 feet

2019 Growing season average
(June-September)

46.88 ug/L (TP)

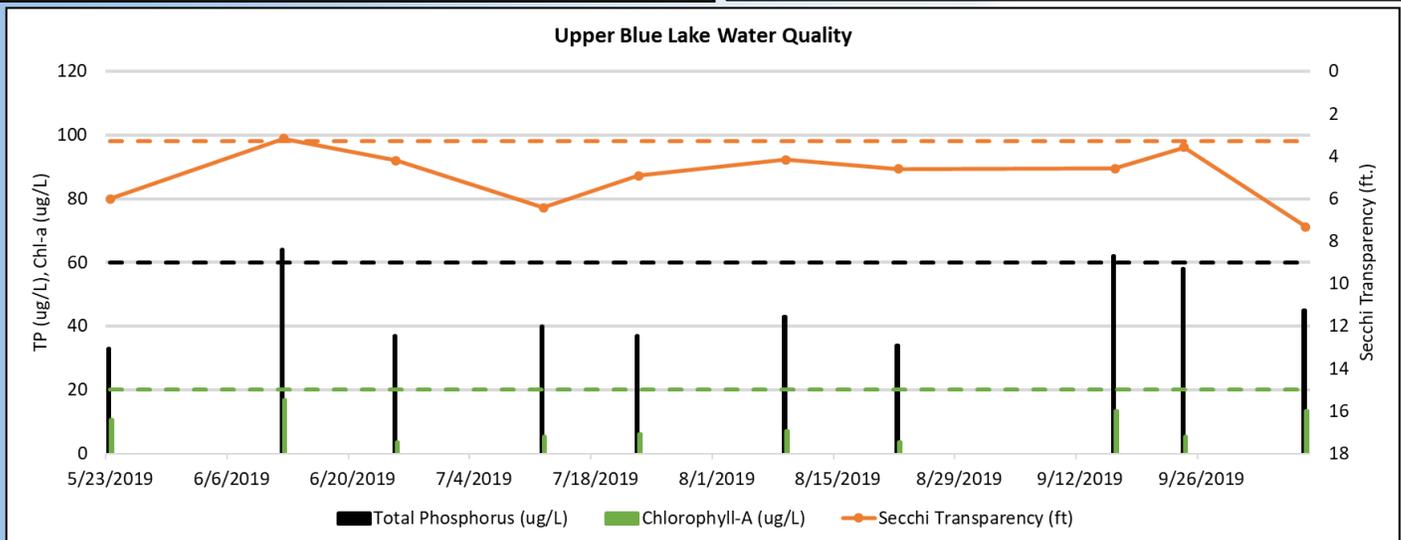
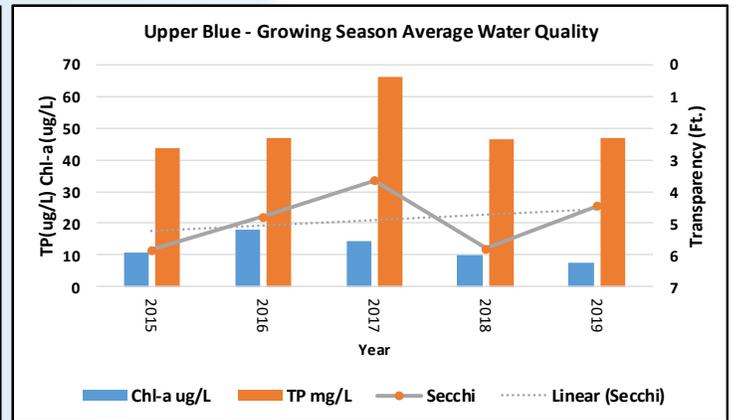
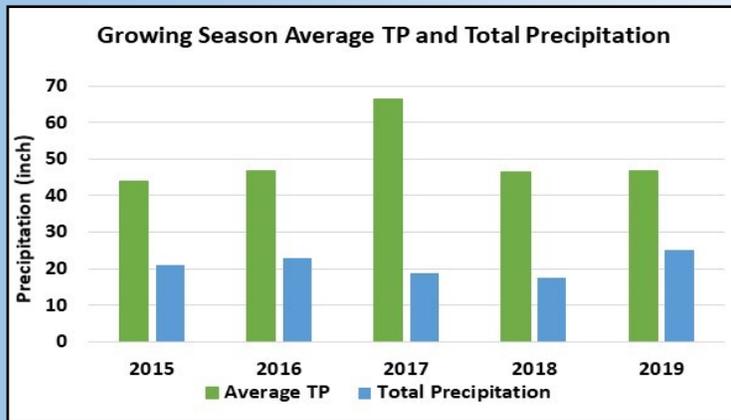
7.68 mg/L (Chl-a)

4.45 ft. (Secchi)

Data Summary:

- The physical appearance of the lake was rated as “clear” through early July and “low algae” after that.
- The recreational suitability of the lake was rates as “very good” throughout the entire sampling season.
- Seasonal fluctuations are typical of shallow lakes and are influenced by a number of factors such as die-off of curly leaf pondweed, precipitation, and water column mixing due to wind, boat traffic and temperature.
- Grades are based on Met Council lake grading system which creates an easy to understand way to communicate lake health.

| Year | Grade |
|------|-------|
| 2015 | C |
| 2016 | C |
| 2017 | C |
| 2018 | B |
| 2019 | B |



Lower (Big) Blue Lake Monitoring Results 2019

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

MN Clean Water Goals for Deep Lakes:

Total Phosphorus (TP): ≤ 40 ug/L

Chlorophyll-a: ≤ 14 mg/L

Secchi Depth: ≥ 4.59 feet

Growing season average
(June-September)

47.38 ug/L (TP)

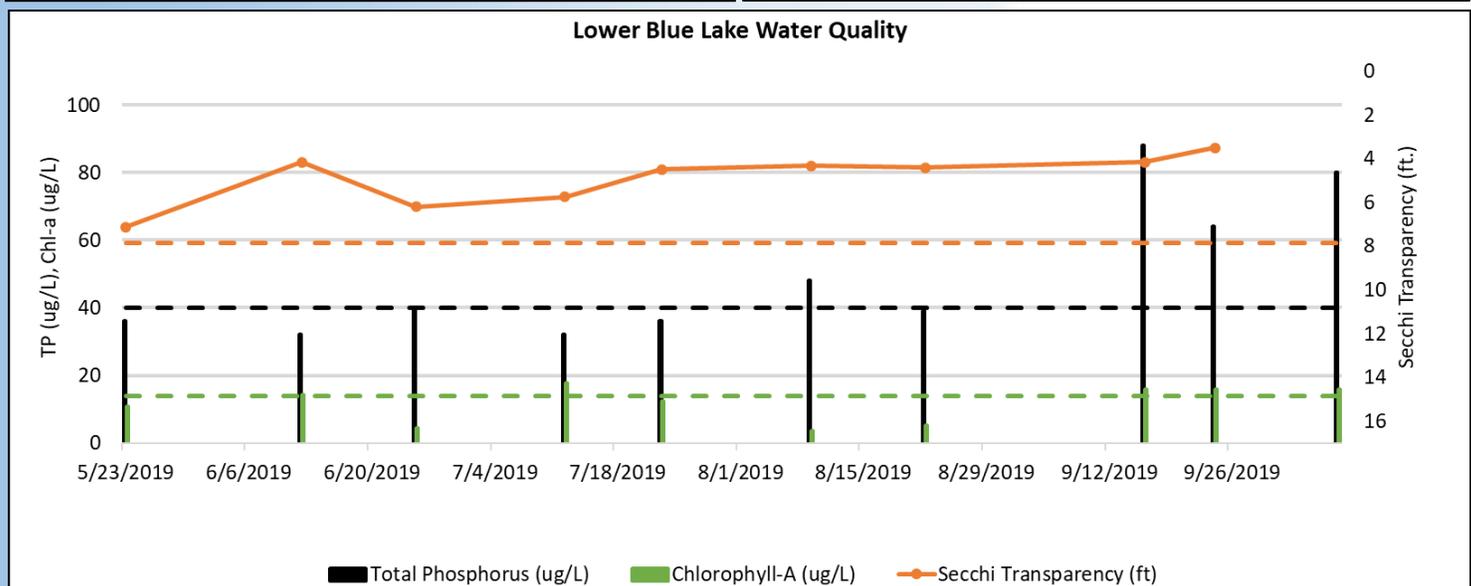
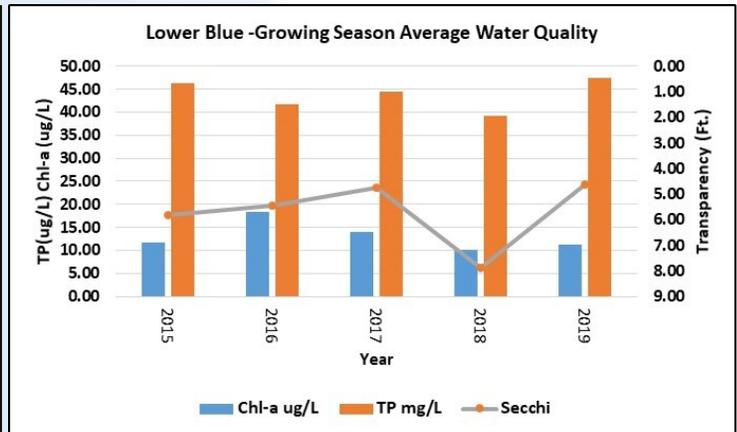
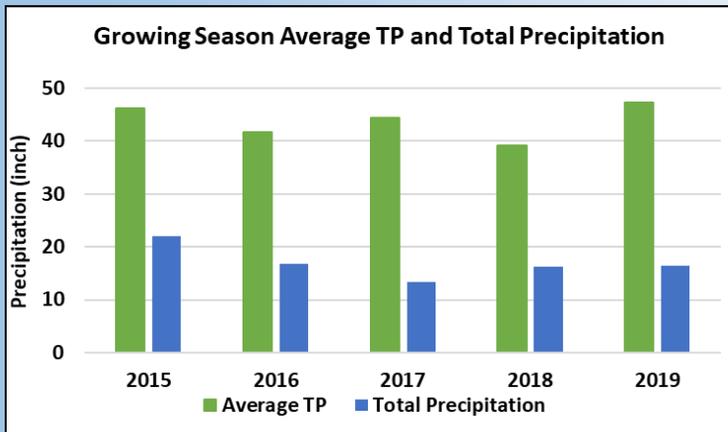
11.23 mg/L (Chl-a)

4.63 ft. (Secchi)

Data Summary:

- The physical appearance of the lake was rated as “clear” through the end of July and “low algae” after that.
- The recreational suitability of the lake was rates as “very good” throughout the entire sampling season.
- TP and Chl-a increase over the sample season, this is similar to pervious years and suggests nutrients from the lake bottom are mixed in to the water column when the lakes turns over.
- Grades are based on Met Council lake grading system which creates an easy to understand way to communicate lake health.

| Year | Grade |
|------|-------|
| 2015 | B |
| 2016 | B |
| 2017 | B |
| 2018 | B |
| 2019 | C |



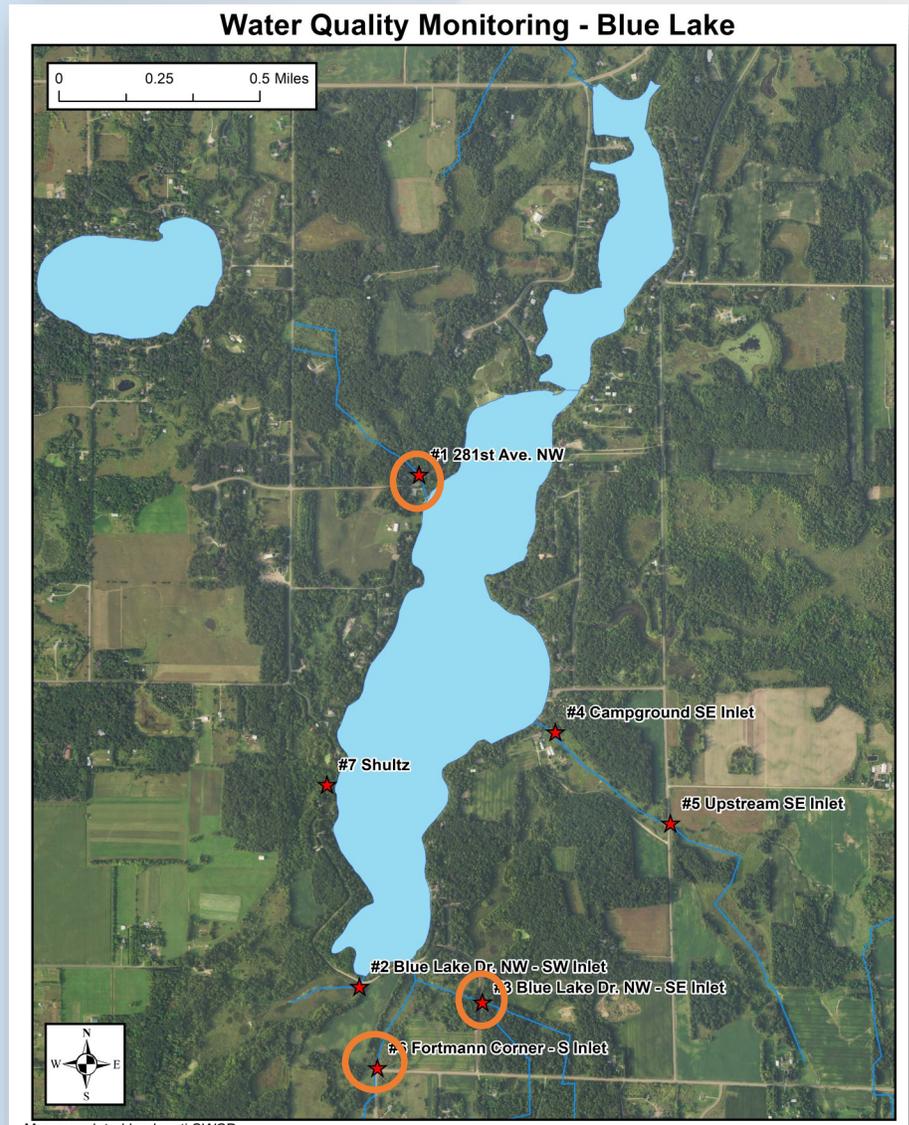
Blue Lake

Tributary Monitoring 2019

Introduction

2019 was the fifth year that the Blue Lake Improvement District (BLID) partnered with the Isanti Soil and Water Conservation District (SWCD) to monitor the health of tributaries draining into Blue Lake. Three tributaries were monitored:

- #1 — 281st Ave. NW
- #3 — Blue Lake Dr. NW
- #6 — Fortmann Curve



Tributary ID's were developed by the Isanti SWCD

Definitions

Total Phosphorus: An essential plant nutrient in which an excess can cause severe algal blooms.

Dissolved Phosphorus: The fraction of TP composed of VERY small organic particles and phosphates (OP).

Ortho-phosphorus The amount of phosphorus that is immediately available for algae and plant growth.

Total Suspended Solids: Tiny particles of soil and other matter that remain suspended in water making it cloudy. Particles include sediment and organic matter.

Transparency: An indirect measure of suspended and dissolved materials (soil particles and tea color caused by organic materials) in the water.

2019 Area Conditions

2019 Rainfall

2019 was a wet year; 7.4 more inches of rain fell over the growing season (May-September) than in 2018.

Flood forecasting data for the Rum River, compiled by the National Weather Service, indicated that high water levels were sustained throughout the season. According to data from the US Geological Survey, which operates the Rum River level gauge in Anoka County, over the last 86 years the median daily river flow only exceeded 1,000 cubic feet per second for a month in the spring. By comparison, in 2019 the river flows were above that level for six of eight open water months. While the data is compiled specifically for the Rum River, it is representative of conditions in the area.



Water level graphs for the Rum River, and many others across the country, are available on the National Weather Service website at: : <https://water.weather.gov/ahps>. The Rum River flood forecasts will be available on this same website starting in February 2020. Forecasts are only done when water is anticipated to approach critical levels.

Tributary Monitoring

Why: The primary reason for sampling in 2019 was to explore opportunities to restore hydrology in the flow-through wetlands located along the three tributaries. The wetland restorations are intended to improve the health of the water flowing into the lake. The sampling information was collected based on recommendations from the 2019 Blue Lake Diagnostic Study.

What: In 2019 seven sample events were targeted at three tributaries. Samples were tested for total phosphorus (TP), ortho-phosphorus (OP), dissolved phosphorus (DP), total suspended solids (TSS) and transparency. Dissolved oxygen, temperature, conductivity, pH and water flow were measured in the field. Additionally, water levels were continually tracked using in-stream data loggers at two sample locations (#3 and #6).

In addition to sampling the SWCD worked with Wenck Inc. to complete site inspections at each location to determine if a wetland restoration would be feasible.

2019 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

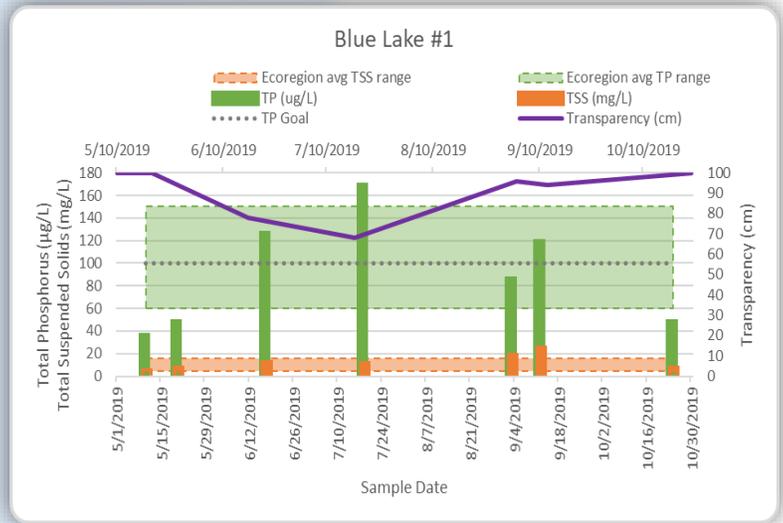


Site:

#1 281st Ave NW

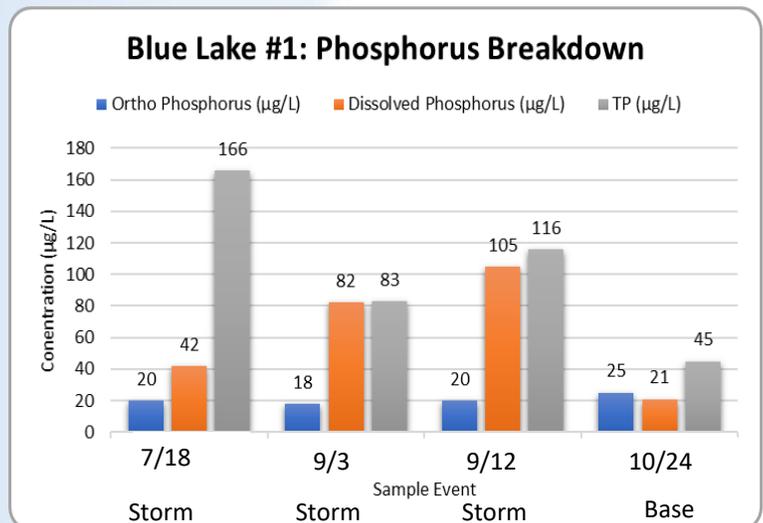
Water Monitoring

- 2019 average TP was 87 µg/L. The average TP range from 2015-2018 was 74-92 µg/L.
- 2019 average TSS was 9.1 mg/L. The average TSS range from 2015-2018 was 6.9-11.5 mg/L.
- 2019 average transparency was 91 cm. The average transparency range from 2015-2018 was 73-89 cm.
- TP concentrations at this site have been the lowest of all tributaries for five consecutive years.
- High phosphorus in July was following a 2" rain event. Sample results indicate that the majority of the phosphorus was attached to large particles (high TP and low DP and OP). This is likely do to sand moving in the system (the bottom of the channel is very sandy)



Site Investigation

- The channel has a sandy bottom.
- The wetland along the tributary had a healthy wetland plant community and functioning hydrology that would not benefit from a restoration.



Recommendations: The tributary and the drainage area are currently healthy; a wetland restoration and/or a settling pond would not be beneficial. Opportunities to protect existing forested and natural lands within the drainage area should be sought.

2019 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

#3 Blue Lake Dr. NW

Water Monitoring

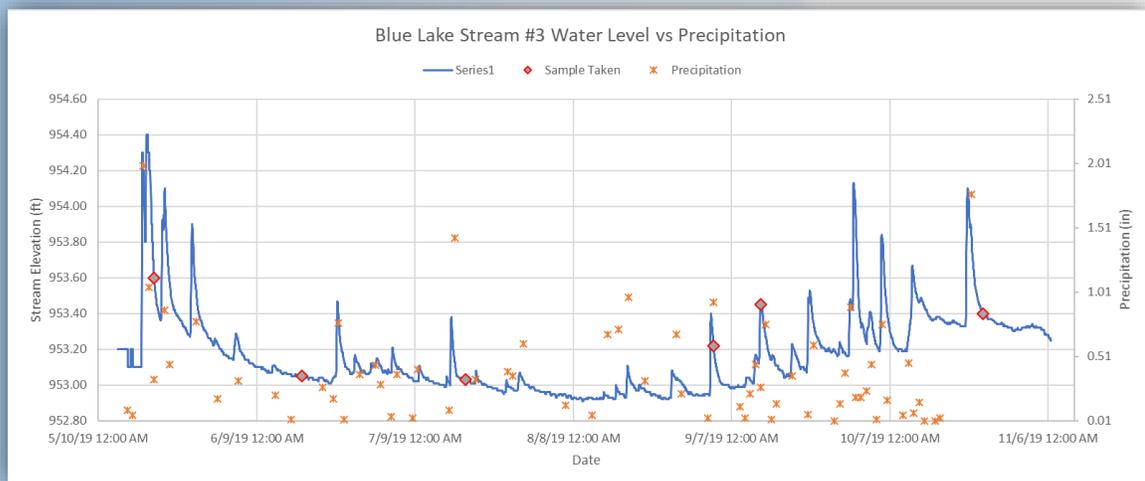
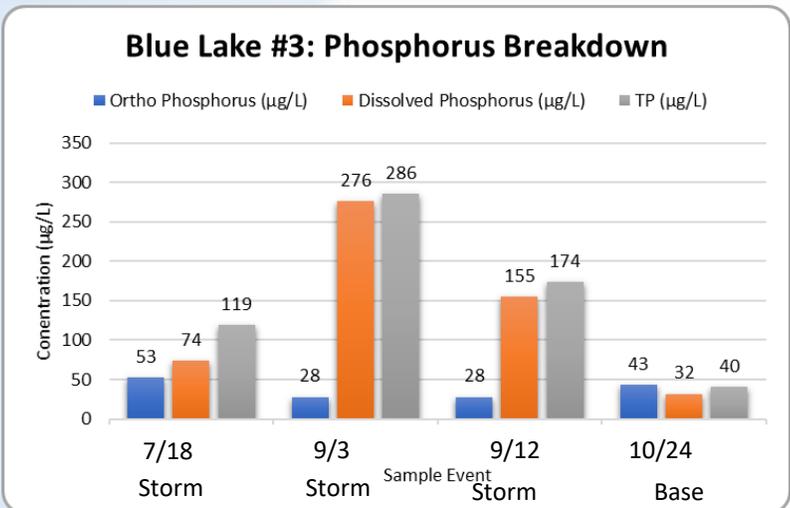
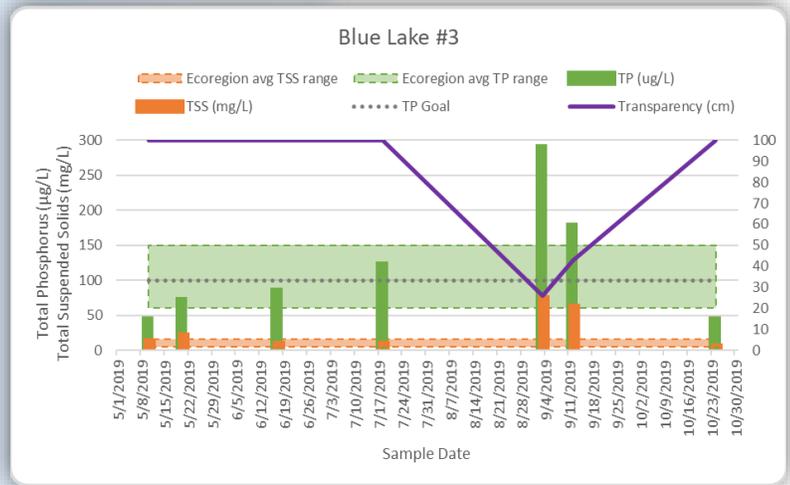
- 2019 average TP was 116 µg/L. The average TP range from 2015-2018 was 106-122 µg/L.
- 2019 average TSS was 24 mg/L. The average TSS range from 2015-2018 16-21 was mg/L.
- 2019 average transparency was 81 cm. The average transparency range from 2015-2018 was 75-87 cm.
- Sample results indicate that the majority of the phosphorus was attached to very small particles (high TP and high DP), the notes also indicated there was significant small debris present during the September storm events.

Site Investigation

- Two locations upstream of this site were investigated for the potential to restore wetlands.
- It was determined that holding water back would not be an option due to the potential to flood nearby driveways.

Recommendations:

Investigate opportunity for a project were site 3 and 6 meet (closer to the lake). Additionally, opportunities for agricultural and residential best management practices upstream should be investigated.



2019 Tributary Monitoring Results

Total Suspended Solids, Total Phosphorus and Transparency Tube

#6 Fortmann Corner

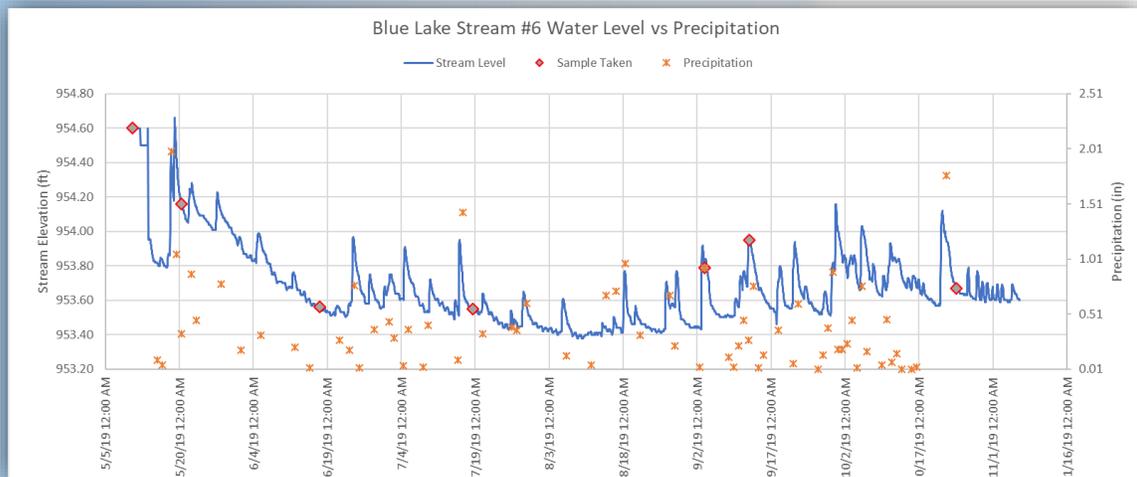
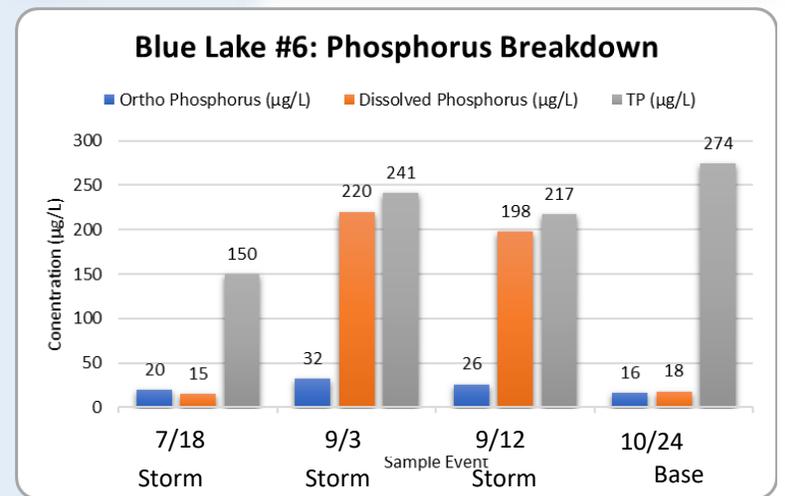
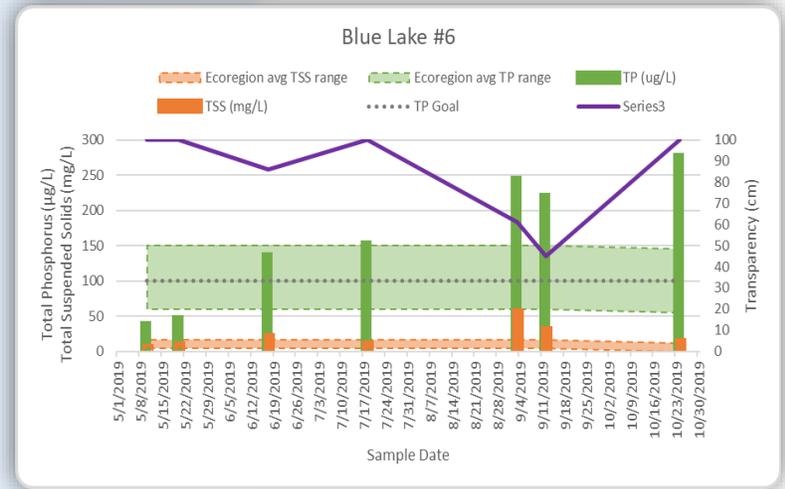
Water Monitoring

- The average concentration of TP at this location was 156 µg/L, the highest concentration measured among the three tributaries. In 2018 the average was 103 µg/L.
- The average concentration of TSS detected at this locations was 17.9 mg/L. TSS seems to increase in response to high water levels. In 2018 the average was 9.2 mg/L.
- Transparency readings averaged 85 cm (Transparency tubes only measure to 100 cm) this means the water is quite clear. In 2018 the average was 92 cm.
- Sediment/organic particles were noted in the water during the September sampling events.

Site Investigation

- Groundwater seeps were found approximately four to five feet above the bottom of the ditch.
- The wetland had functioning hydrology that would not benefit from a restoration.
- High groundwater levels would make the location ineffective at installing a best management practice.

Recommendations: Investigate opportunity for a project were site 3 and 6 meet (closer to the lake). Additionally, opportunities for agricultural best management practices upstream should be investigated.



2019 Results and Recommendations



Summary:

Site 1: The quality of water is generally quite good here. The health of the wetlands within this drainage area also appears to be good. Protection of the land area draining to this tributary is important and can occur through the use of land use ordinances, conservation easements, and forest stewardship plans.

Site 3 & 6: Phosphorus draining from these tributaries is elevated. These two tributaries come together before entering Blue Lake. While we did not find any suitable locations for a wetland restoration or pollution reduction project in 2019 we will continue to investigate opportunities where the two streams meet.

Site 4: This location remains the best location to treat polluted inflow from the lake and should be revisited from time-to-time.

Monitoring:

The data that has been collected over the last five years has been used to identify pollution reduction practices. We do not recommend any additional monitoring in 2020. The BLID should consider monitoring tributaries periodically to determine changes in water quality after land use change or after the implementation of a best management practice. Each year we will re-assess the need for monitoring



Todd Kulaf Stream Flow Monitoring

For more information contact: Isanti SWCD 763-689-3271

Tiffany Determan, District Mgr, TDeterman@isantiswcd.org