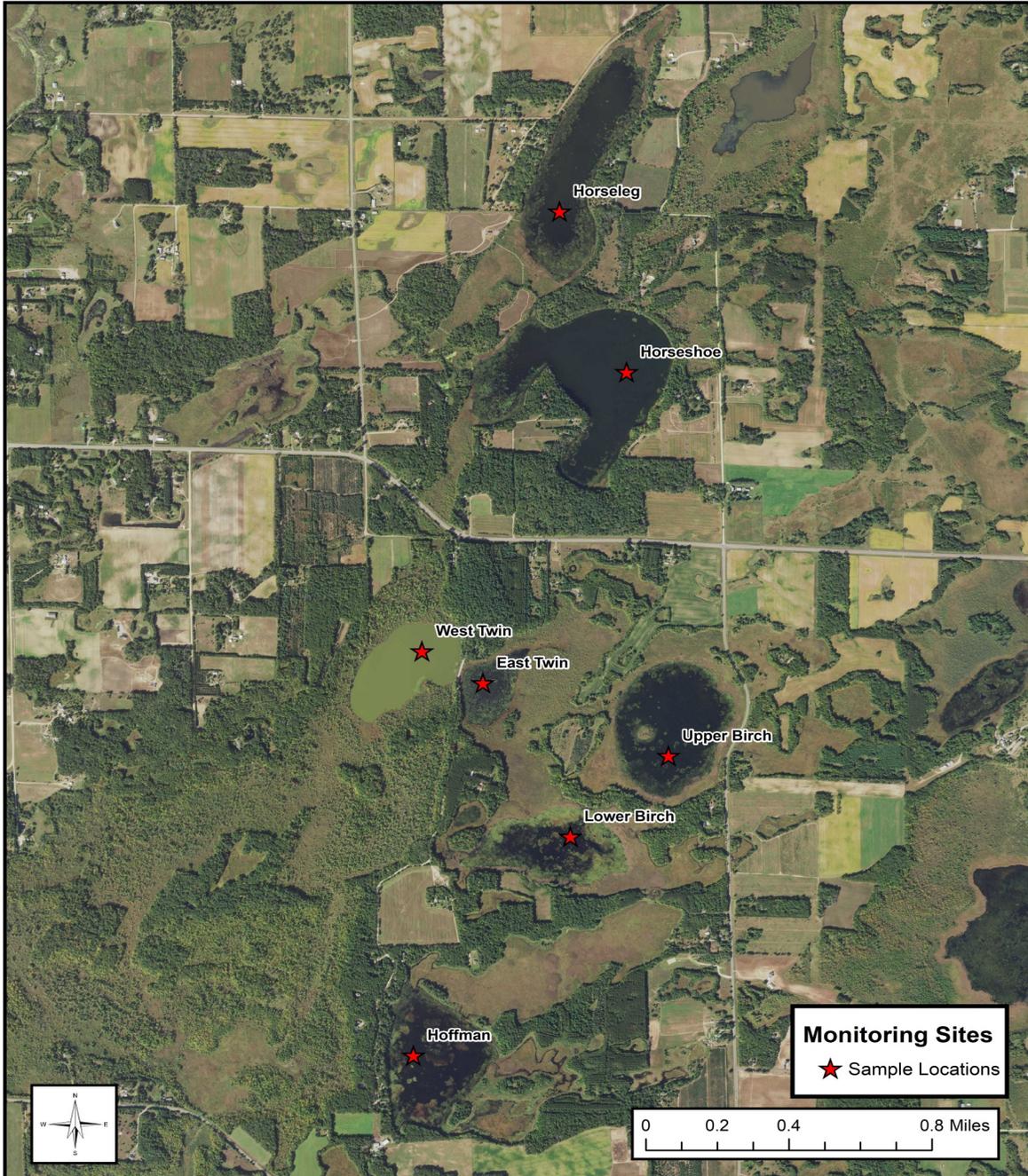


2018 Oxford Township Monitoring Report

Oxford Township Surface Water Monitoring 2018



Completed By: Thomas Zimmermann, Isanti SWCD

Completed for Oxford Township

By Isanti Soil and Water Conservation District



2018 Oxford Township Monitoring Report

2018 was the second year that Oxford Township partnered with the Isanti Soil and Water Conservation District (SWCD) to monitor the health of seven surface waters located in Oxford Township:

Horseleg Lake	West Twin Lake	Lower Birch Lake
Horseshoe Lake	East Twin Lake	
Hoffman Lake	Upper Birch Lake	

2018 Precipitation Summary

2018 was a relatively dry year. The majority of rain 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.

Monitoring

What: Seven lakes were sampled once every month from May to September. Lake samples were tested for total phosphorus (TP) and Chlorophyll-a (Chl-a). Field measurements were recorded for transparency, dissolved oxygen, temperature and conductivity.

Why: The information will help land and water resource management entities such as Isanti County Zoning, Oxford Township, and the Isanti SWCD to make informed decisions. For example, for lakes that have very good water quality, it would be important to focus on management activities that keep the water healthy (it’s cheaper than waiting for water to become degraded and then trying to fix it). Activities that would keep water healthy include: updated shoreline zoning ordinances, low impact development, and protection of existing healthy lands via land easements (wetlands, forested areas and intact prairie).



General Definitions

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

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Horseleg Lake

MN Clean Water Goals for Shallow Lakes

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: ≥ 3.28

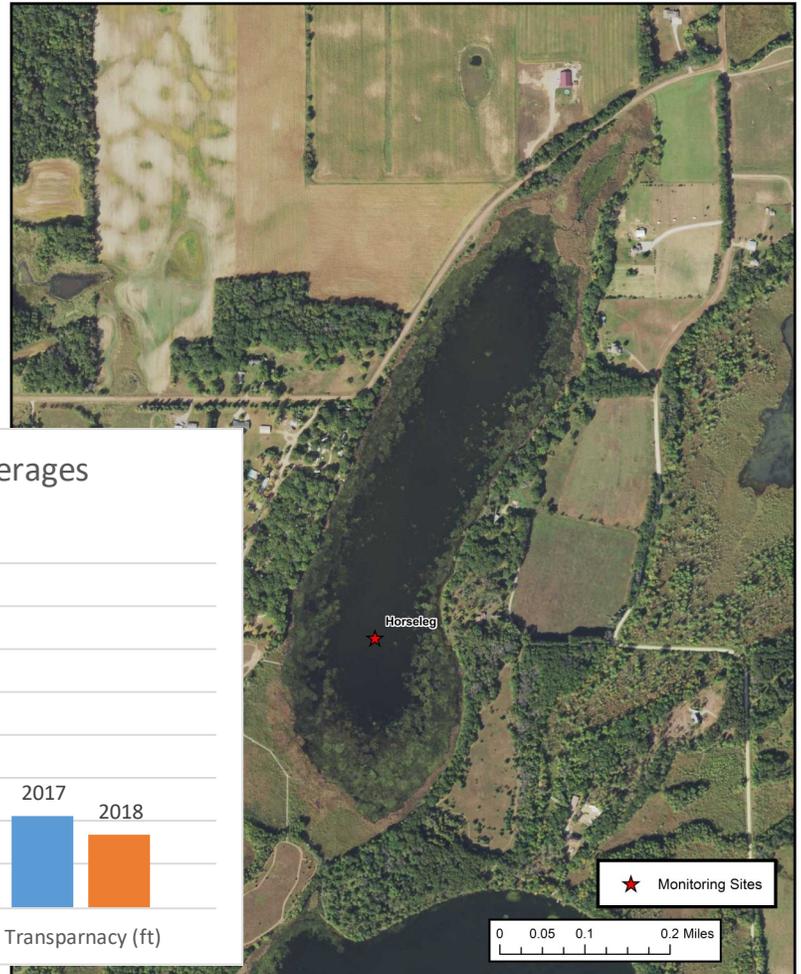
Year	Total Phosphorus (TP)	Chlorophyll-a	Transparency
2017 Growing season average (June-September)	13 $\mu\text{g/L}$	1.7 $\mu\text{g/L}$	4.2 ft
2018 Growing season average (June-September)	14 $\mu\text{g/L}$	4.3 $\mu\text{g/L}$	3.4 ft

Horseleg Lake is 75 acres and has a maximum depth of 6 feet. It is classified as a shallow water lake. 2017 and 2018 data suggest the lake has excellent water quality!

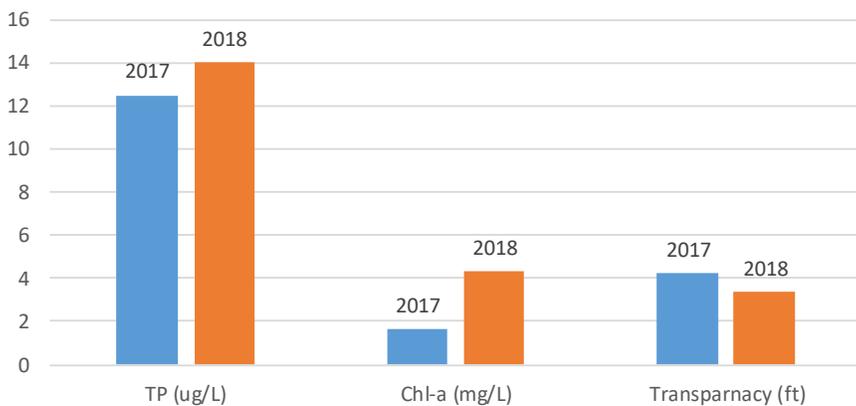
Low water levels in 2018 may have caused an increase in nutrients and corresponding reduced clarity.

This lake drains north to the North Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Horseleg Lake- Growing Season Averages (June-Sept)



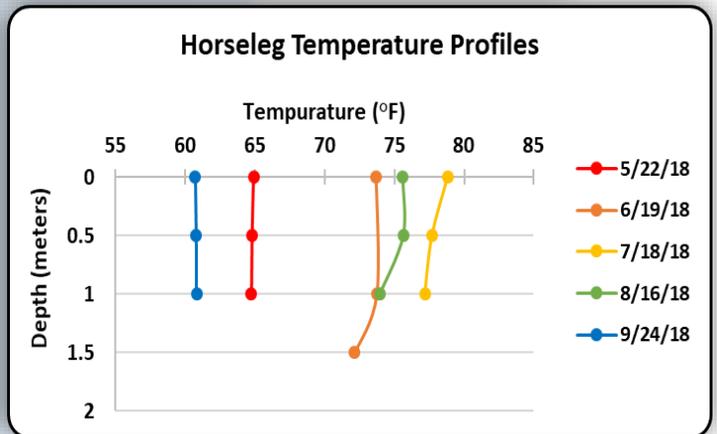
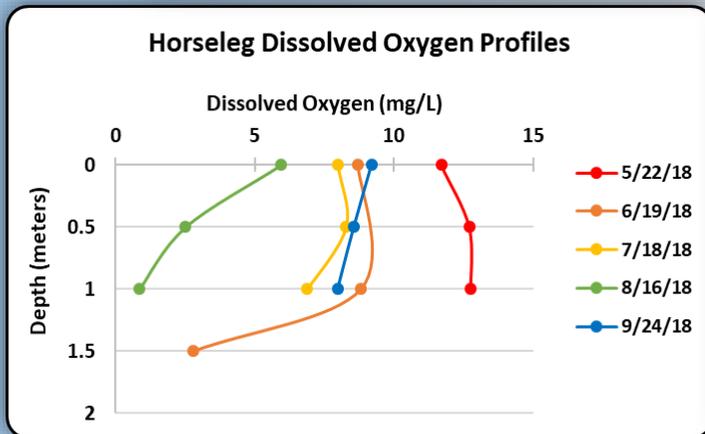
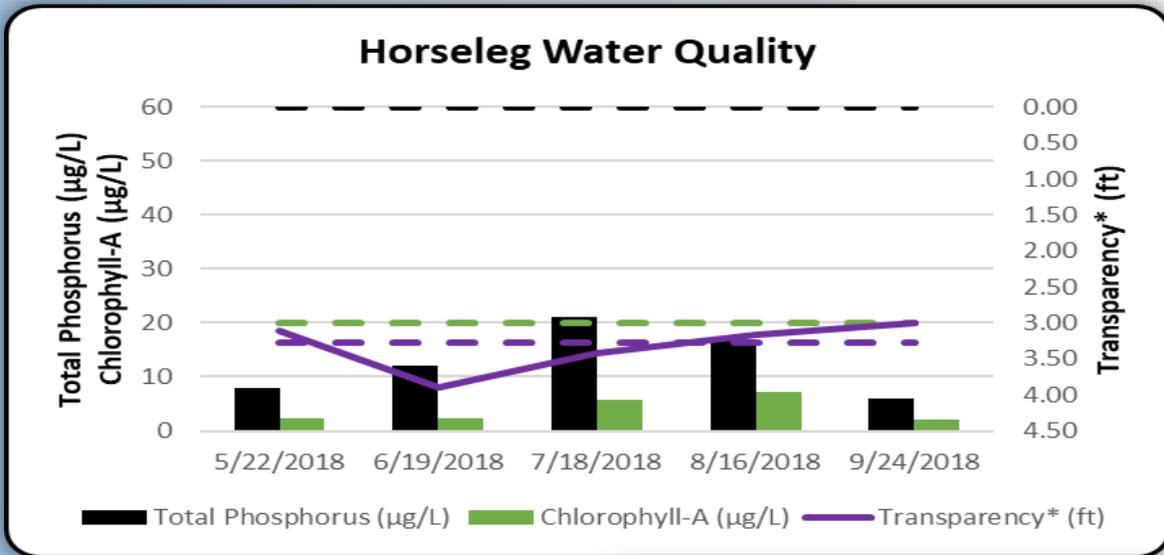
Completed By: Thomas Zimmermann, Isanti SWCD

Help keep Horseleg Lake Healthy: Because this lake is currently healthy it is important to focus on preservation of current natural lands. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements. Isanti County currently owns a majority of land around the lake!

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Horseleg Lake



Data Analysis and Hypothesis:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake meets water quality goals for total phosphorus, chlorophyll-a and transparency (water clarity).
- Dense aquatic vegetation restricted transparency observations; nonetheless, clarity was excellent.
- The aquatic vegetation on the lake bottom helps to keep the water healthy.
- Phosphorus and chlorophyll-a increase throughout the season. This is normal for shallow lakes.
- The temperature and dissolved oxygen profiles indicate that the water column typically remains well mixed; however, it does stratify for short periods (forms layers due to temperature) on calm days.

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Horseshoe Lake

MN Clean Water Goals for Shallow Lakes

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: $\geq 3.28 \text{ ft}$

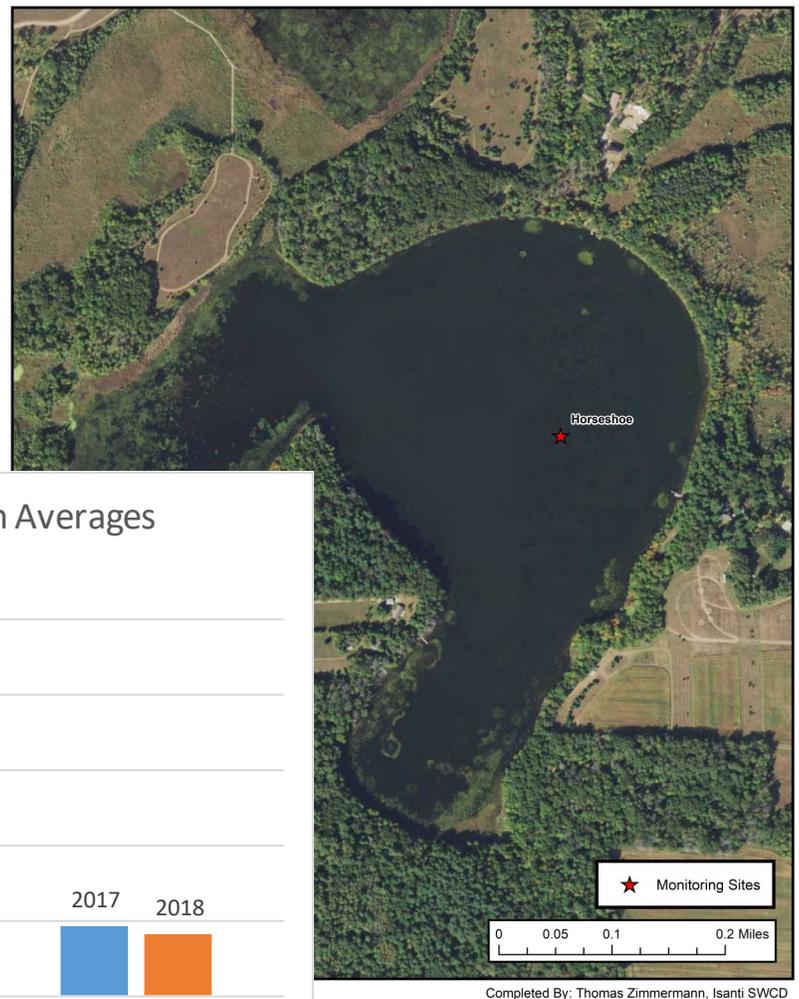
Year	Total Phosphorus (TP)	Chlorophyll-a	Transparency
2017 Growing season average (June-September)	12 $\mu\text{g/L}$	1 $\mu\text{g/L}$	4.7 ft
2018 Growing season average (June-September)	19 $\mu\text{g/L}$	3 $\mu\text{g/L}$	4.1 ft

Horseshoe Lake is 100 acres and has a maximum depth of 5 feet. The lake is classified as a shallow water lake. 2017 and 2018 data suggest Horseshoe Lake has excellent water quality.

Low water levels in 2018 may have caused an increase in nutrients and corresponding reduced clarity.

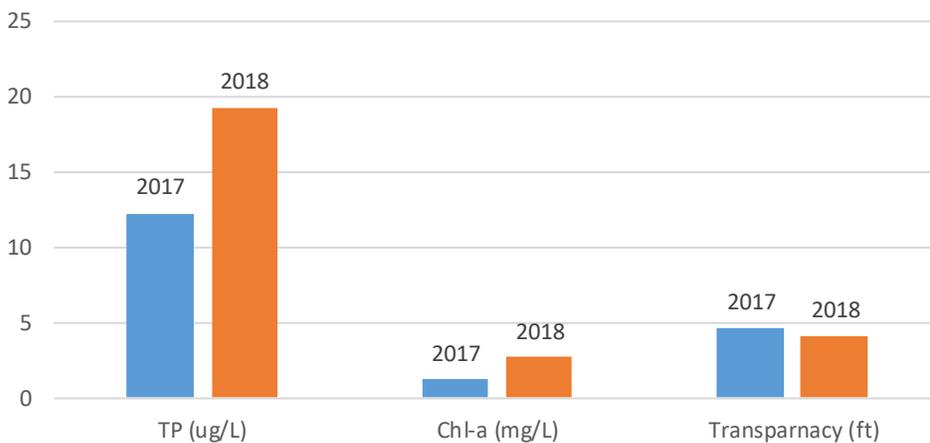
This lake drains north to the North Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Completed By: Thomas Zimmermann, Isanti SWCD

Horseshoe Lake- Growing Season Averages (June-Sept)

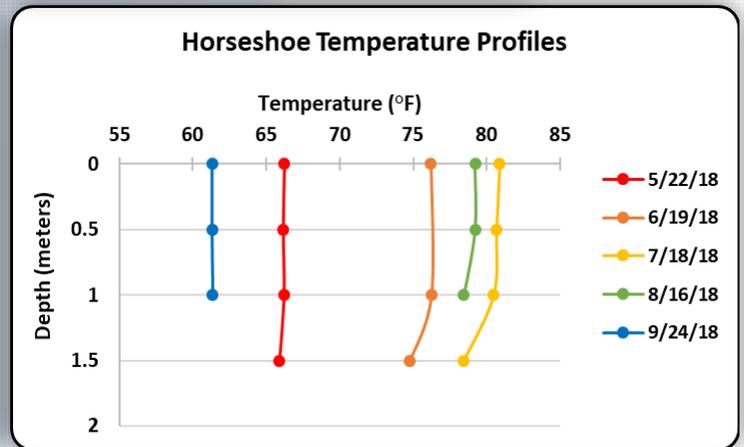
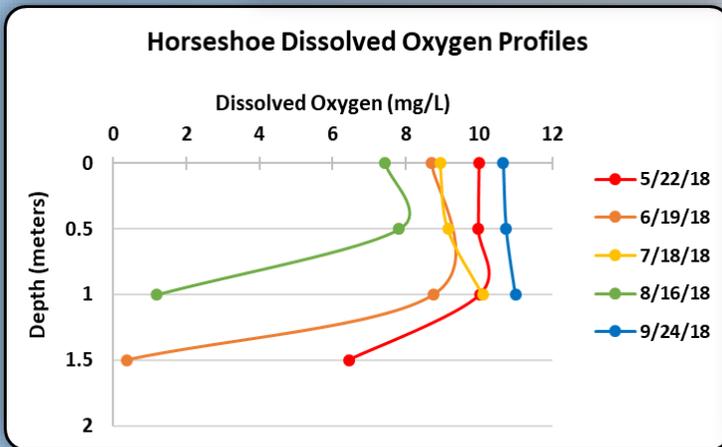
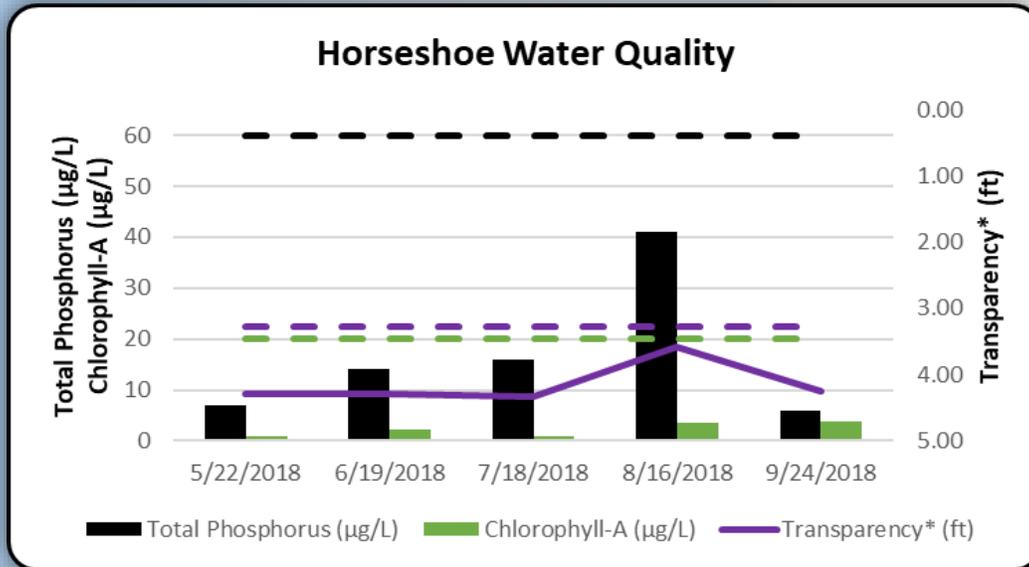


Help keep Horseshoe Lake Healthy: Because this lake is currently healthy it is important to focus on preservation of current natural lands. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements. Isanti County and the State of MN currently own a significant amount of land around the lake!

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Horseshoe Lake



2018 Data Summary:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake meets water quality goals for total phosphorus, chlorophyll-a and transparency (water clarity).
- Dense aquatic vegetation restricted transparency observations; nonetheless, clarity was excellent.
- The aquatic vegetation on the lake bottom helps to keep the water healthy
- The spike in total phosphorus and Chlorophyll-a in August may have been due to dry, hot and calm weather conditions that resulted in the loss of oxygen at the bottom of the lake. This occurrence is known to cause sediment to release phosphorus.
- The temperature and dissolved oxygen profiles indicate that the water column typically remains well mixed; however, it does stratify for short periods (forms layers due to temperature) on calm days.

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

West Twin Lake

MN Clean Water Goals for Shallow Lakes (MCWG)

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: $\geq 3.28 \text{ ft}$

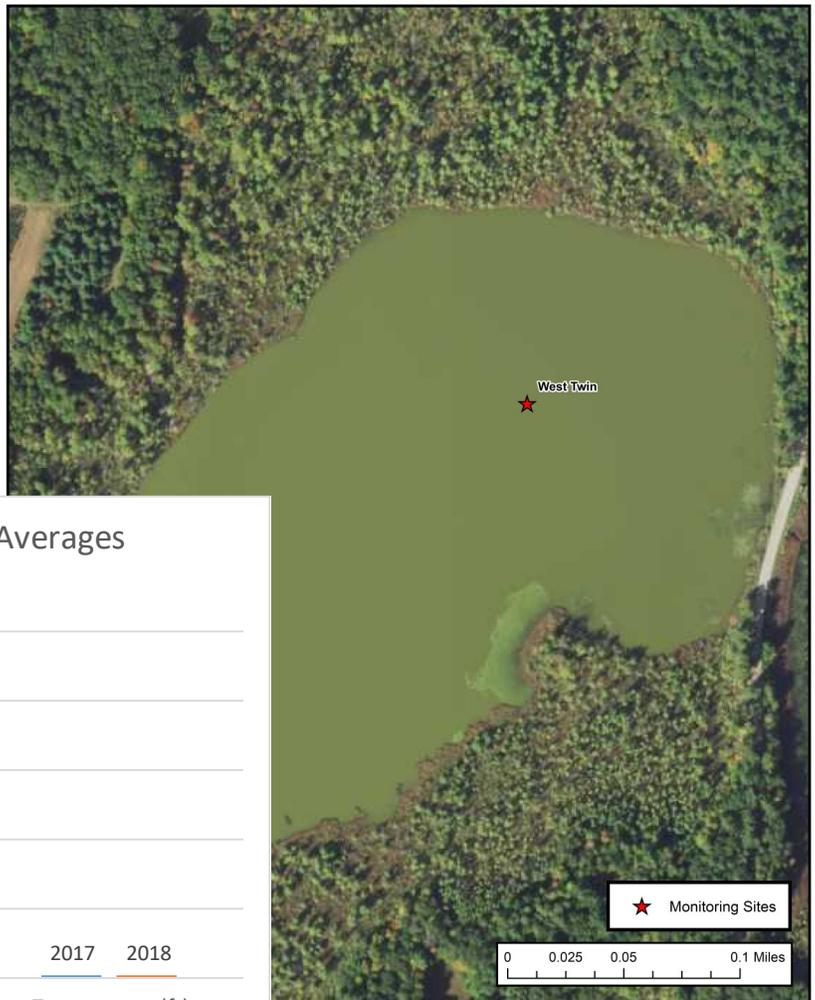
Year	Total Phosphorus (TP) ($\mu\text{g/L}$)	Chlorophyll-a ($\mu\text{g/L}$)	Transparency (ft)
2017 Growing season average (June-September)	149 $\mu\text{g/L}$	59 $\mu\text{g/L}$	0.9 ft
2018 Growing season average (June-September)	214 $\mu\text{g/L}$	101 $\mu\text{g/L}$	0.6 ft

West Twin Lake is 52 acres, has a maximum depth of 6 feet and is classified as a shallow water lake. West Twin Lake is impaired when comparing nutrient concentrations to the Minnesota clean water goals.

Low water levels in 2018 may have caused an increase in nutrients and corresponding reduced clarity.

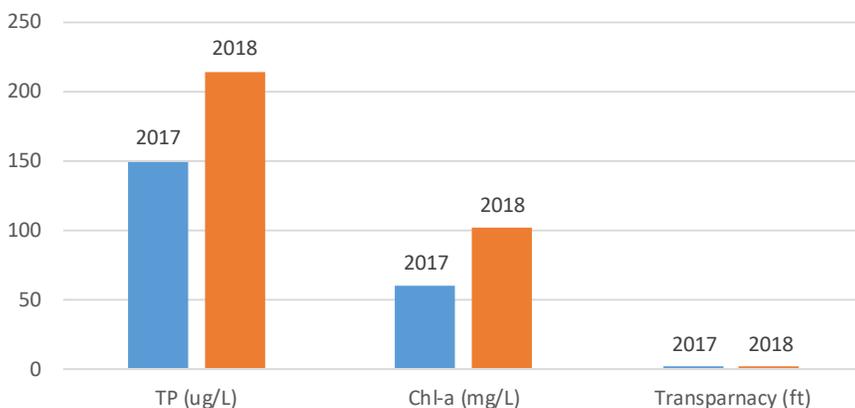
This lake drains south to the West Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Completed By: Thomas Zimmermann, Isanti SWCD

West Twin Lake- Growing Season Averages (June-Sept)

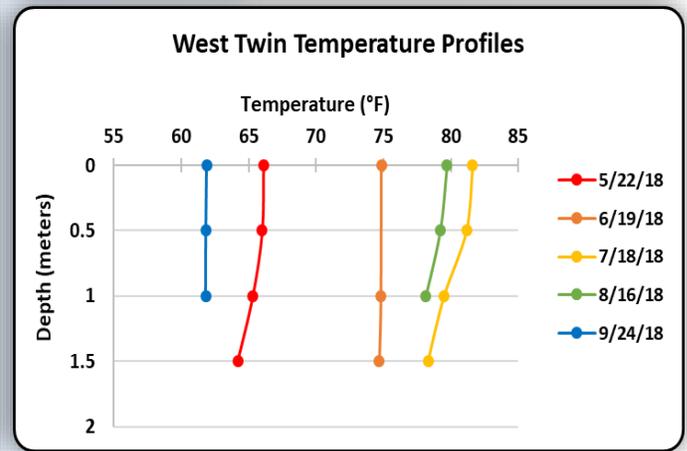
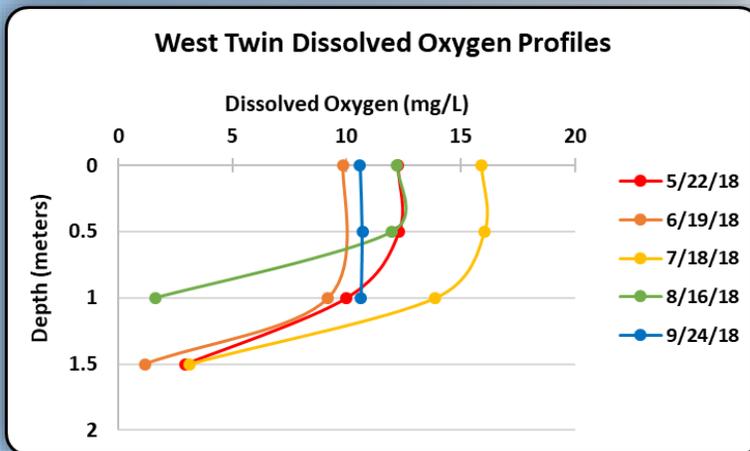
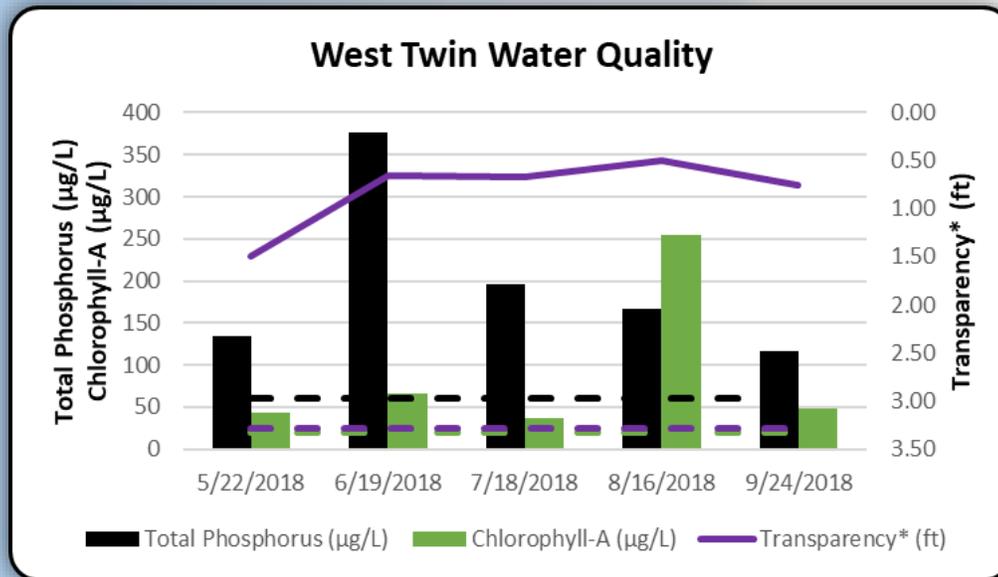


Help keep West Twin Lake Healthy: While West Twin Lake does not meet water health standards, the area surrounding the lake including the plant species found within it are healthy. As such, we suggest focusing on preservation of current natural lands around the lake. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements.

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

West Twin Lake



2018 Data Summary:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake does not meet water quality goals for total phosphorus, chlorophyll-a or transparency (water clarity).
- This lake is representative of a shallow lake in the turbid-water state meaning it has high nutrients, minimal aquatic plant cover and plenty of algae.
- Temperature profiles remain consistent from top to bottom throughout the entire growing season. This indicates that the water column is continually mixing (as expected).
- Consistent low dissolved oxygen at the lake bottom indicates there is phosphorus being released from the lake bottom.

2018 Lake Monitoring Results

Chlorophyll-A , Total Phosphorus, and Transparency

East Twin Lake

MN Clean Water Goals for Shallow Lakes (MCWG)

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: ≥ 3.28

Year	Total Phosphorus (TP)	Chlorophyll-a	Transparency
2017 Growing season average (June-September)	36 $\mu\text{g/L}$	8 $\mu\text{g/L}$	3.9 ft
2018 Growing season average (June-September)	34 $\mu\text{g/L}$	5 $\mu\text{g/L}$	3.4 ft

East Twin Lake is 17.5 acres and has a maximum depth of 5 feet. The lake is classified as a shallow lake. 2017 and 2018 data suggests East Twin Lake has excellent water quality.

There was no difference in water health from 2017 to 2018.

Even though it is connected to West Twin via a culvert, it does not have the same water health issues.

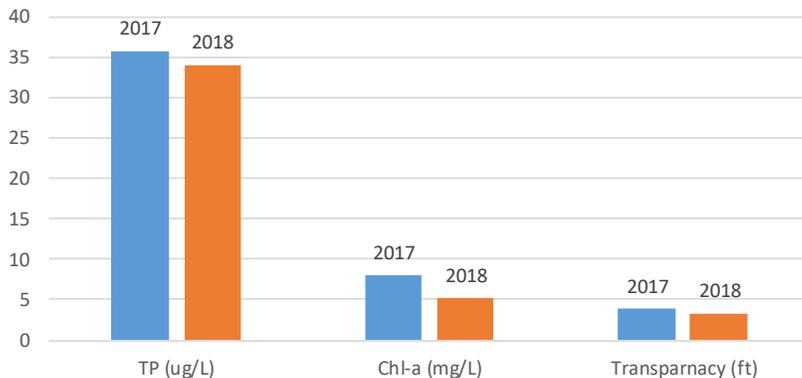
This lake drains south to the West Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Completed By: Thomas Zimmermann, Isanti SWCD

East Twin Lake- Growing Season Averages (June-Sept)

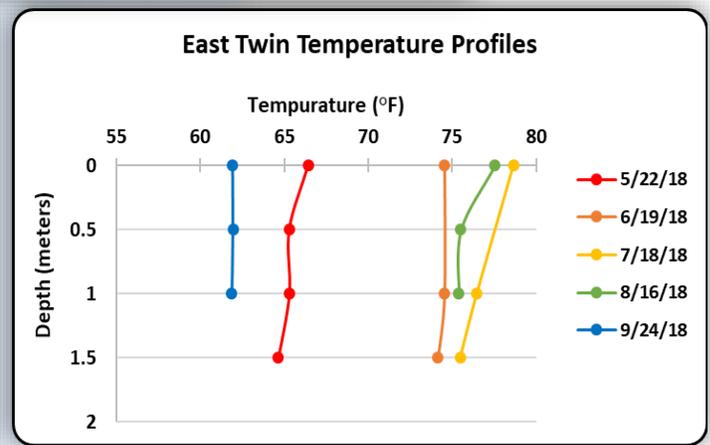
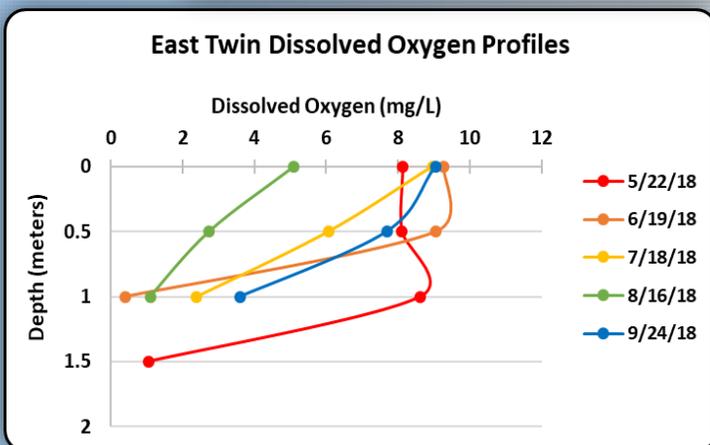
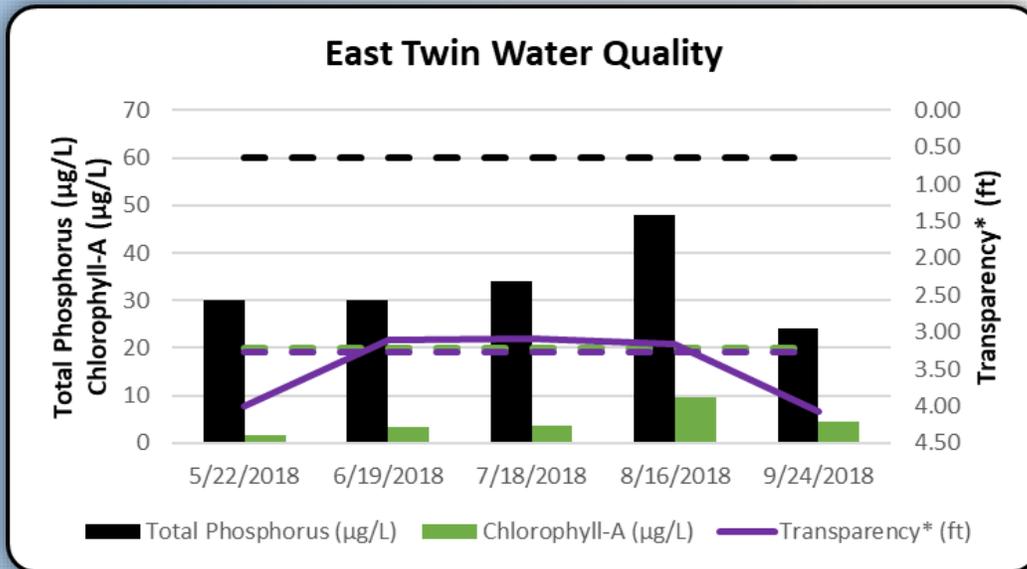


Help keep East Twin Lake Healthy: Because this lake is currently healthy it is important to focus on preservation of current natural lands. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements. Isanti County and the State of MN currently own a significant amount of land around the lake!

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

East Twin Lake



2018 Data Summary:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake meets water quality goals for total phosphorus, chlorophyll-a and transparency (water clarity).
- Dense aquatic vegetation restricted transparency observations; nonetheless, clarity was excellent with the exception of late summer.
- The aquatic vegetation on the lake bottom helps to keep the water healthy
- July and August were the only months transparency did not extend to the lake bottom.
- Temperature profiles remain relatively consistent from top to bottom throughout the entire growing season. This indicates that the water column is continually mixing (as expected).
- Low dissolved oxygen at the lake bottom could indicate that nutrients are being released from the lake bottom.

2018 Lake Monitoring Results

Chlorophyll-A , Total Phosphorus, and Transparency

Upper Birch Lake

MN Clean Water Goals for Shallow Lakes (MCWG)

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: $\geq 3.28 \text{ ft}$

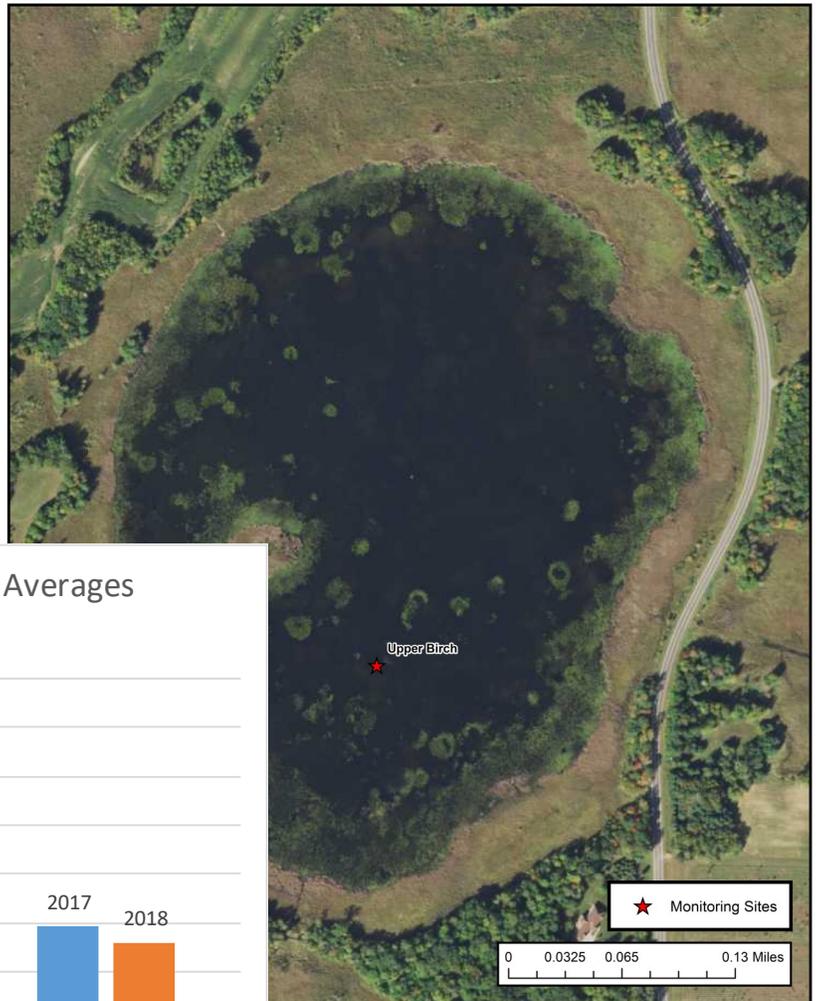
Year	Total Phosphorus (TP)	Chlorophyll-a	Transparency
2017 Growing season average (June-September)	11 $\mu\text{g/L}$	2 $\mu\text{g/L}$	3.90 ft
2018 Growing season average (June-September)	12 $\mu\text{g/L}$	3 $\mu\text{g/L}$	3.2 ft

Upper Birch Lake is 62 acres and has a maximum depth of 6 feet. The lake is classified as a shallow water lake. 2017 and 2018 data suggests Upper Birch Lake has excellent water quality.

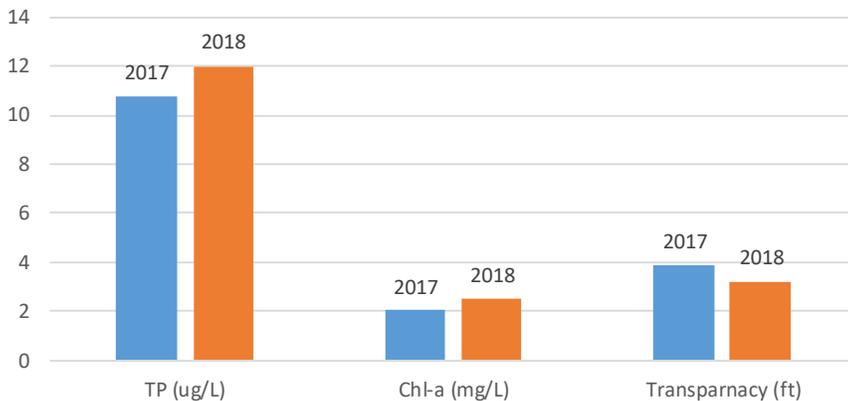
Low water levels in 2018 may have caused an increase in nutrients and corresponding reduced clarity.

This lake drains south to the West Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Upper Birch Lake- Growing Season Averages (June-Sept)



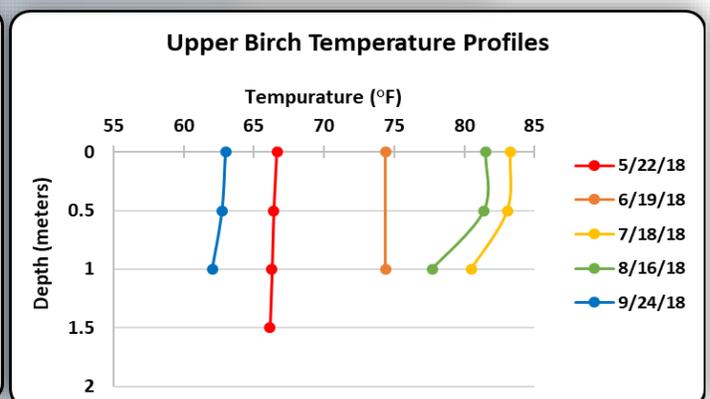
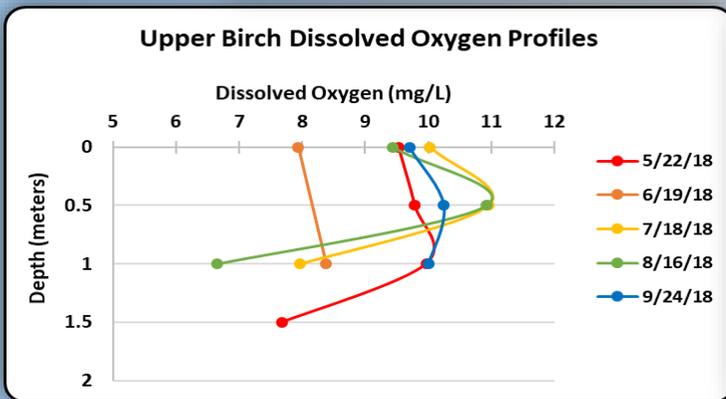
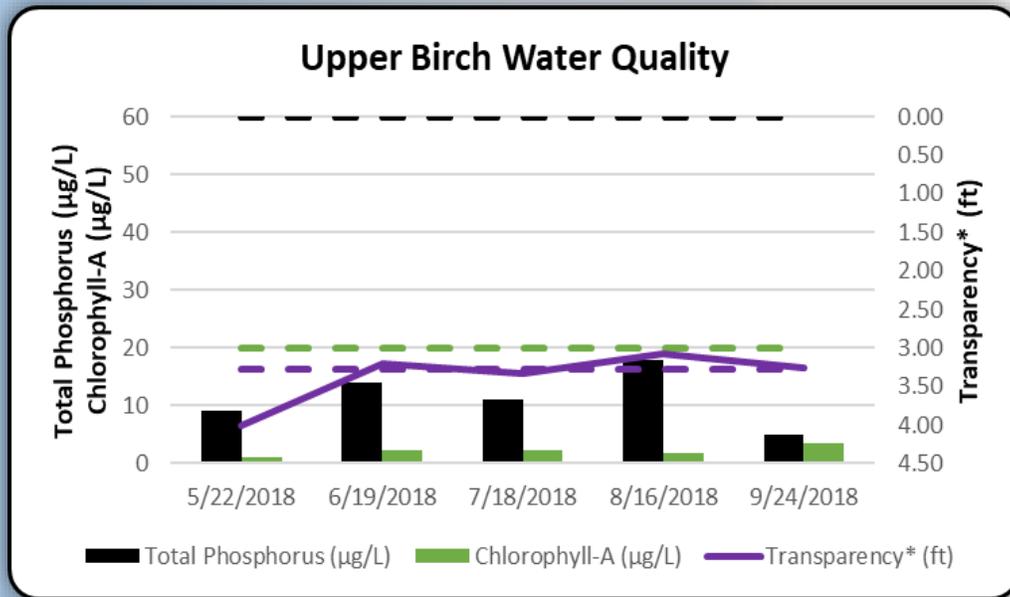
Completed By: Thomas Zimmermann, Isanti SWCD

Help keep Upper Birch Lake Healthy: Because this lake is currently healthy it is important to focus on preservation of current natural lands. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements.

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Upper Birch Lake



2018 Data Summary:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake meets water quality goals for total phosphorus, chlorophyll-a and transparency (water clarity).
- Dense aquatic vegetation restricted transparency observations; nonetheless, clarity was excellent.
- Both oxygen and temperature profiles remain relatively consistent from top to bottom throughout the growing season. This indicates that the water column is continually mixing (as expected).
- It was the only lake that had dissolved oxygen profile readings never drop below 5 mg/L throughout the sample season.

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Lower Birch Lake

MN Clean Water Goals for Shallow Lakes (MCWG)

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: $\geq 3.28 \text{ ft}$

Year	Total Phosphorus (TP)	Chlorophyll-a	Transparency
2017 Growing season average (June-September)	13 $\mu\text{g/L}$	2 $\mu\text{g/L}$	4.8 ft
2018 Growing season average (June-September)	21 $\mu\text{g/L}$	4 $\mu\text{g/L}$	3.6 ft

Lower Birch Lake is 62 acres and has a maximum depth of 6 feet. The lake is classified as a shallow water lake. 2017 and 2018 data suggests Lower Birch Lake has excellent water quality.

Low water levels in 2018 may have caused an increase in nutrients and corresponding reduced clarity.

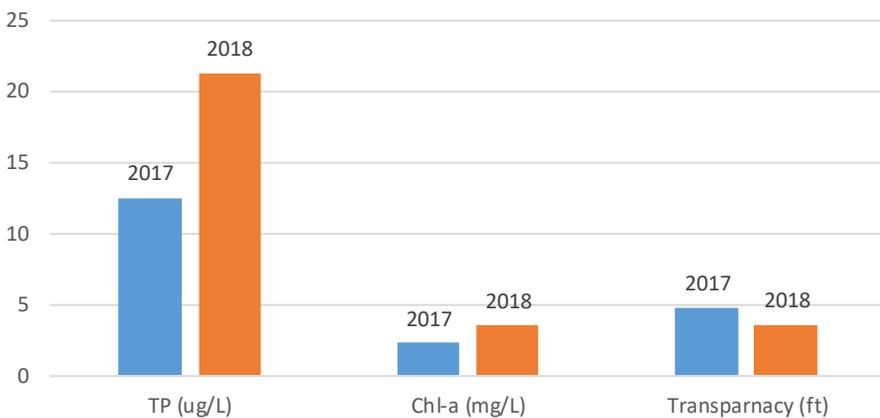
This lake drains south to the West Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Completed By: Thomas Zimmermann, Isanti SWCD

Lower Birch Lake- Growing Season Averages (June-Sept)

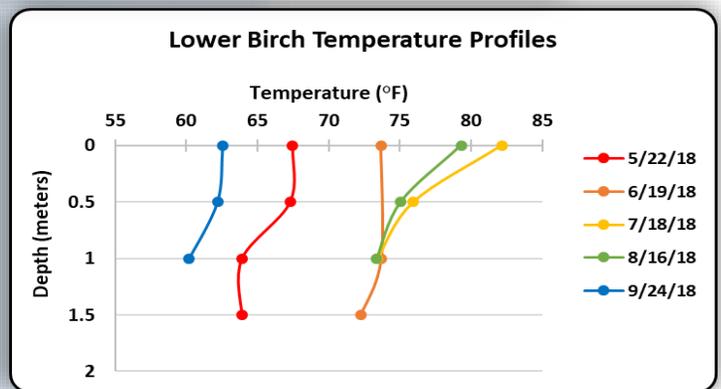
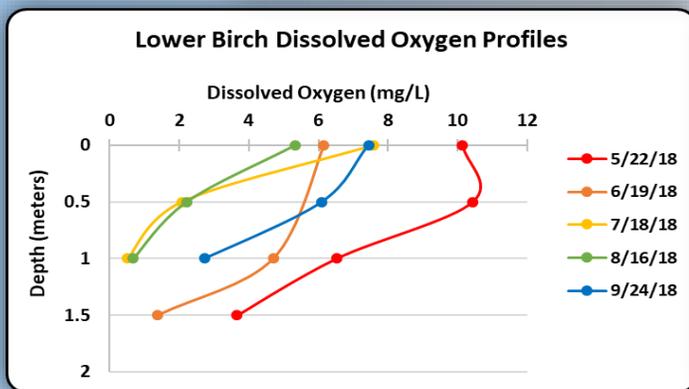
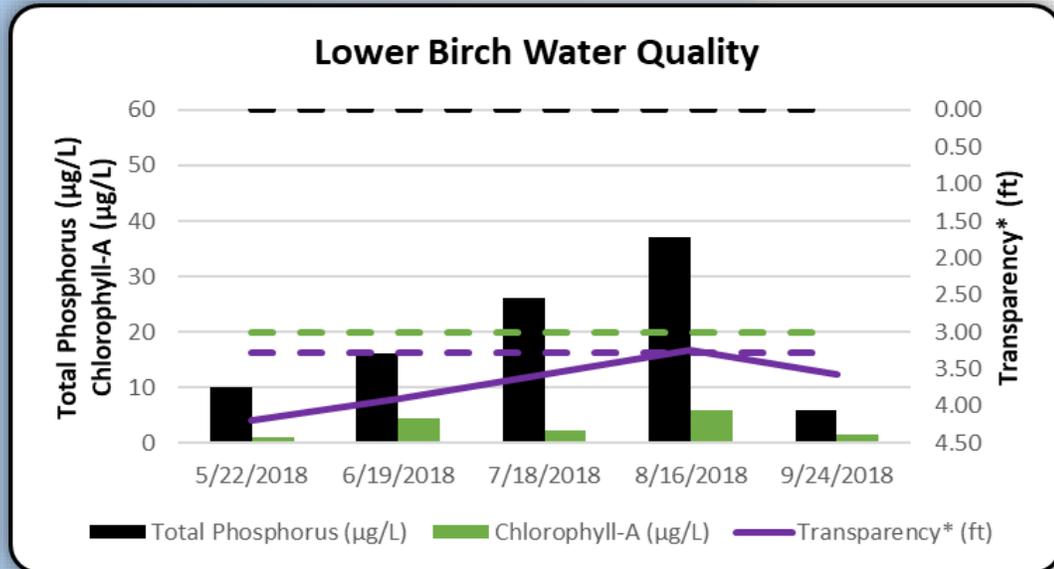


Help keep Lower Birch Lake Healthy: Because this lake is currently healthy it is important to focus on preservation of current natural lands. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements.

2018 Lake Monitoring Results

Chlorophyll-A, Total Phosphorus, and Transparency

Lower Birch Lake



2018 Data Summary:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake meets water quality goals for total phosphorus, chlorophyll-a and transparency (water clarity).
- Dense aquatic vegetation restricted transparency observations; nonetheless, clarity was excellent.
- The highest observed total phosphorus concentration in mid-August was still well below the state goal. This occurred during a period when dissolved oxygen was low at the bottom and indicates that the sediment was releasing phosphorus.
- The temperature and dissolved oxygen profiles indicate that the water column typically remains well mixed; however, it does stratify for short periods (forms layers due to temperature) on calm days.

2018 Lake Monitoring Results

Chlorophyll-A , Total Phosphorus, and Transparency

Hoffman Lake

MN Clean Water Goals for Shallow Lakes

Total Phosphorus (TP): $\leq 60 \mu\text{g/L}$ Chlorophyll-a: $\leq 20 \mu\text{g/L}$ Transparency: $\geq 3.28 \text{ ft}$

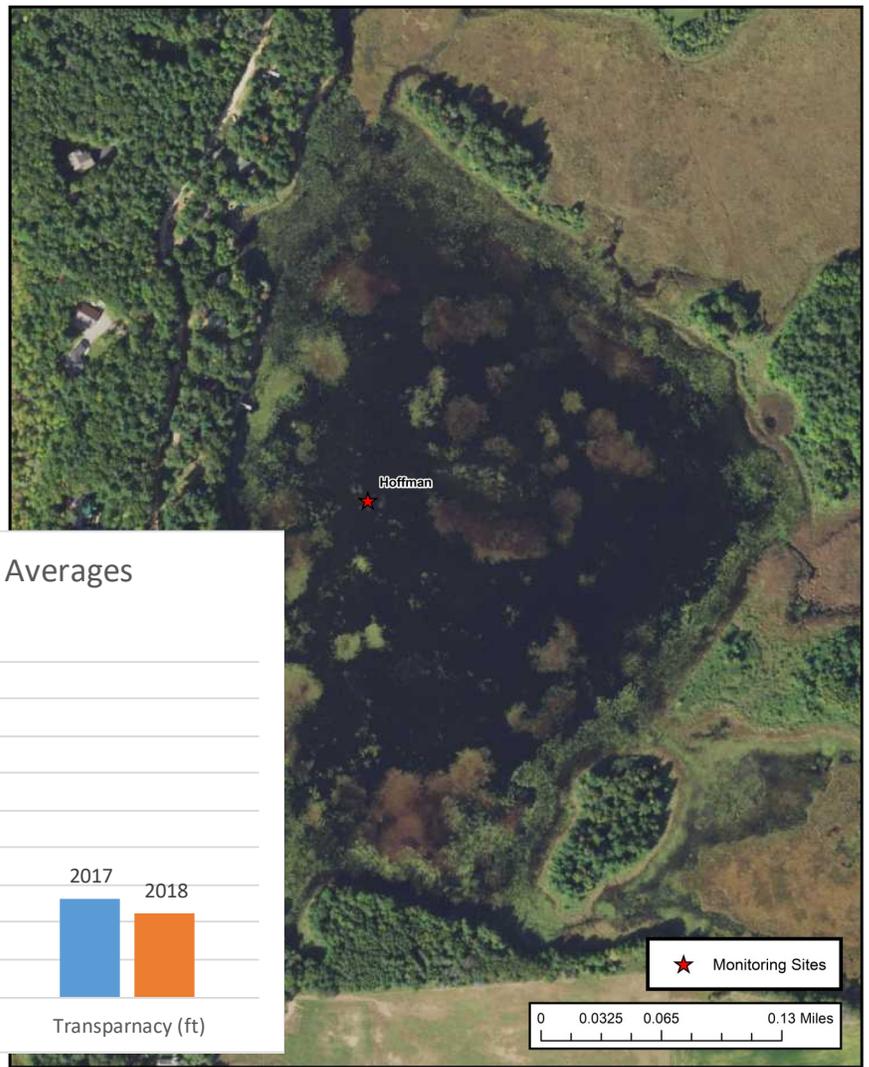
Year	Total Phosphorus (TP)	Chlorophyll-a	Transparency
2017 Growing season average (June-September)	14.5 $\mu\text{g/L}$	2.3 $\mu\text{g/L}$	5.3 ft
2018 Growing season average (June-September)	16 $\mu\text{g/L}$	3.6 $\mu\text{g/L}$	4.5 ft

Hoffman Lake is 52 acres and has a maximum depth of 6 feet. The lake is classified as a shallow water lake. 2017 and 2018 data suggests Hoffman Lake has excellent water quality.

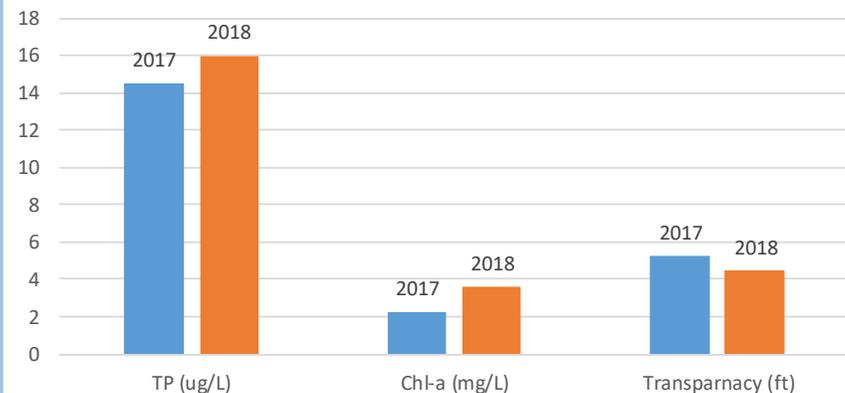
Low water levels in 2018 may have caused an increase in nutrients and corresponding reduced clarity.

This lake drains south to the West Branch of the Sunrise River.

Oxford Township Surface Water Monitoring 2018



Hoffman Lake- Growing Season Averages (June-Sept)



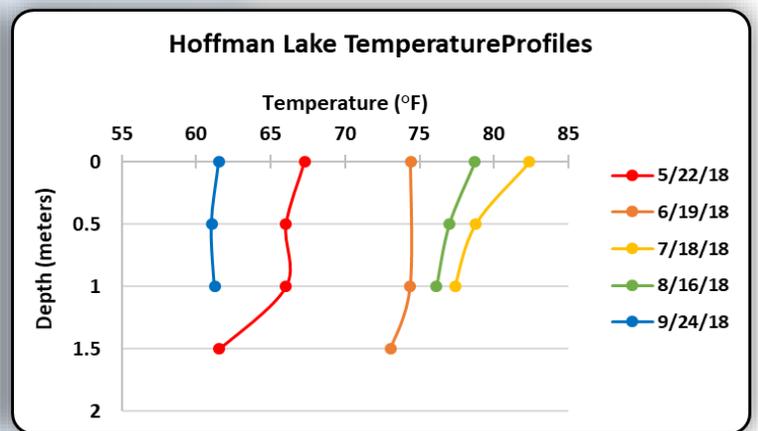
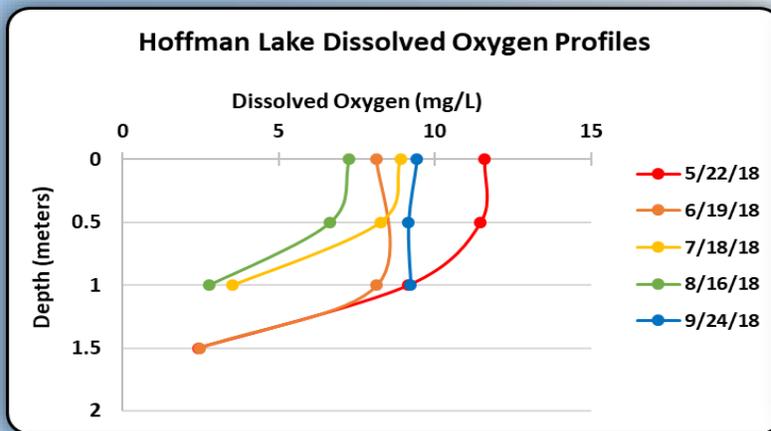
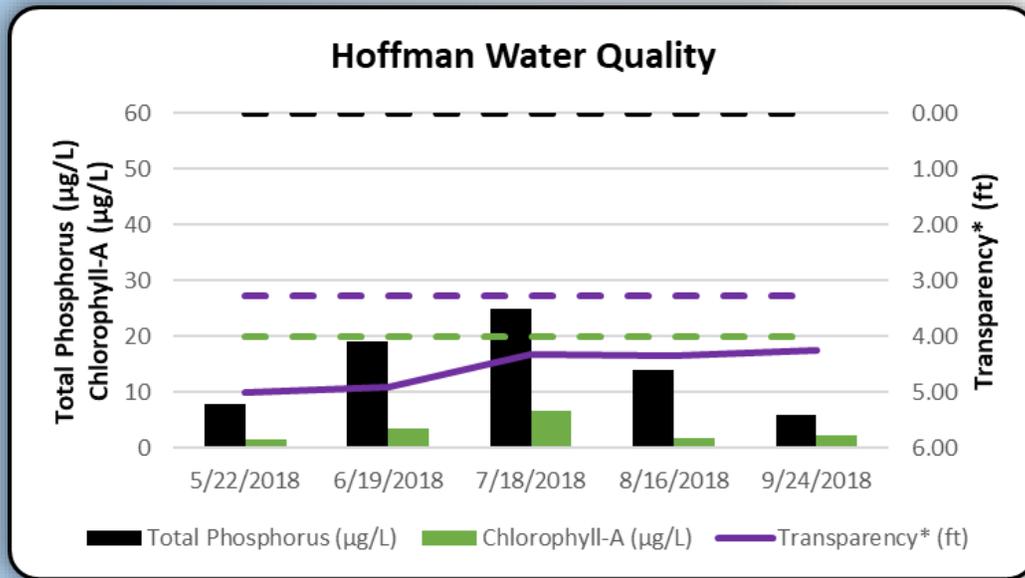
Completed By: Thomas Zimmermann, Isanti SWCD

Help keep Hoffman Lake Healthy: Because this lake is currently healthy, it is important to focus on preservation of current natural lands. How? Ordinances that preserve vegetative cover adjacent to the lake and wetlands, land purchases and conservation easements.

2018 Lake Monitoring Results

Chlorophyll-A , Total Phosphorus, and Transparency

Hoffman Lake



2018 Data Summary:

- Monitoring results are compared to state water quality goals (dashed lines on graph).
- Lake meets water quality goals for total phosphorus, chlorophyll-a and transparency (water clarity).
- Dense aquatic vegetation restricted transparency observations; nonetheless, clarity was excellent.
- The highest observed total phosphorus concentration was in July but was still well below the water quality goal.
- Both oxygen and temperature profiles do indicate that the water column forms layers during calm periods.

2018 West Twin– East Twin Comparison Investigation



West and East Twin Lakes are connected via a culvert. Interestingly, the two lakes have very different water health— West Twin has a lot of algae, minimal aquatic plants and high nutrients and East Twin is opposite. The SWCD has been doing some investigation to help determine why this is.

An aerial photograph review of the lakes from 1938 shows the two lakes in similar condition (i.e. both seem to be clear/healthy). Landowner interviews and aerials from the 1960's indicate that West Twin had made a switch to an algae dominated system. Clearly, something happened to West Twin between the late 1930's and the 1960's. Since land use surrounding the lakes is similar (healthy, intact wetlands) we are still uncertain as to what may have occurred. Anyone with history on these lakes is encouraged to contact the SWCD.

Twin Lakes 10/21/1938: lakes appear similar



Twin Lakes 07/07/1964: some evidence of water health difference



**Twin Lakes
06/05/2017**



2018 Results and Recommendations



Summary:

The first two years of data (2017-2018) indicate that all lakes, excluding West Twin Lake, have exceptional water health. It is important to note that even though West Twin Lake has somewhat degraded water health it does support a special plant community (i.e. water willows) and wildlife habitat (i.e. otters). Minimal shoreline development and land alterations around the lakes surely plays a large role in maintaining water health, healthy native plant communities and wildlife habitat. With only two years of data it is difficult to predict water health trends.

The water monitoring information gathered from this program has proven to be extremely valuable for the following reasons : 1) the data is being used to inform a long-term watershed protection plan being developed for the Lower St. Croix Watershed; 2) the data is being used to support need for updated shoreline ordinances within Isanti County, and; 3) the information has given us a baseline of information for which to compare future changes. We believe that this information will help protect the waters for generations to come.

Recommendations for 2019

- Continue with the same monitoring schedule as planned.

2019 costs: not to exceed \$9,185.00



Horseshoe Lake

For more information contact: **Isanti SWCD** 763-689-3271
Thomas Zimmermann, Conservation Tech TZimmermann@isantiswcd.org
Tiffany Determan, District Mgr TDeterman@isantiswcd.org