

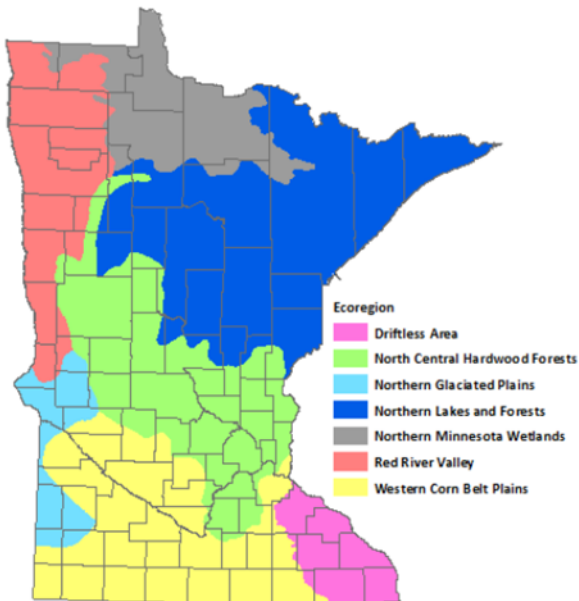
Water Quality Data

Hubbard, Schultz, Wheeler Shallow Chain of Lakes



Middle Fork Crow River
WATERSHED DISTRICT

Lakes and streams around Minnesota have different physical and chemical properties based on where they are located. Water quality reflects the variety of geographic and environmental conditions in the state. This diversity makes it difficult to explain what constitutes “good” water quality for an individual body of water in Min-



To make it easier, Minnesota Pollution Control Agency offers a guide to typical water quality conditions in these seven “ecoregions,” large expanses of land containing a geographically distinct collection of plants, animals, natural communities and environmental conditions. A numeric and narrative water quality standard is prescribed in Minnesota Statute which provides the qualities and properties of the water that are necessary for the aquatic life

There is a specific water quality standard for shallow lakes in the North Central Hardwood Forest ecoregion. If the standards in this ecoregion are exceeded the shallow lake basin is considered indicative of a polluted condition which is actually or potentially harmful for public uses and benefits to aquatic and terrestrial

The Hubbard, Schultz, Wheeler Shallow Chain of Lakes project lies in the North Central Hardwood Forest eco region.

This ecoregion is an area of transition between the forested areas to the north and east and the agricultural areas to the south and west. The terrain varies from rolling hills to smaller plains. Upland areas are forested by hardwoods and conifers. Plains include livestock pastures, hay fields and row crops such as potatoes, beans, peas and corn.



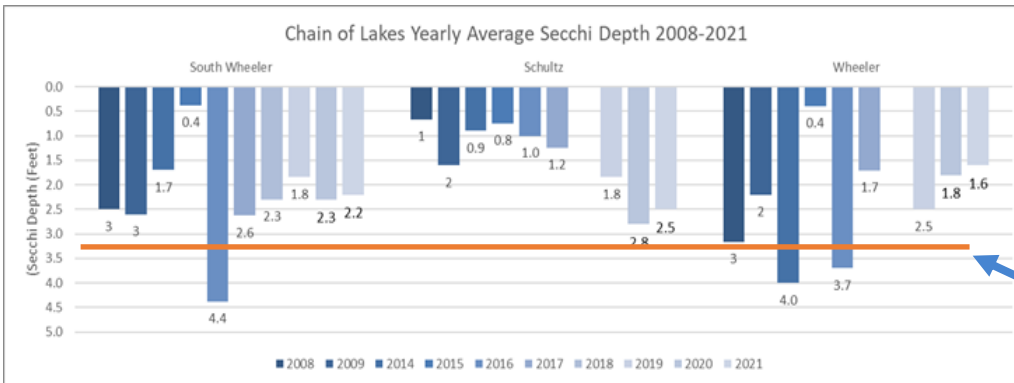
Water Quality Data

Hubbard, Schultz, Wheeler Shallow Chain of Lakes



Middle Fork Crow River
WATERSHED DISTRICT

Secchi disk measurements over time can give a general indication of issues in a lake by assessing the water clarity, or turbidity. Turbidity is suspended materials such as algae, silt, and organic matter in the water.



- The 0.00 is the surface of the water body.
- Deeper secchi disk readings (larger numbers) indicate clearer water.

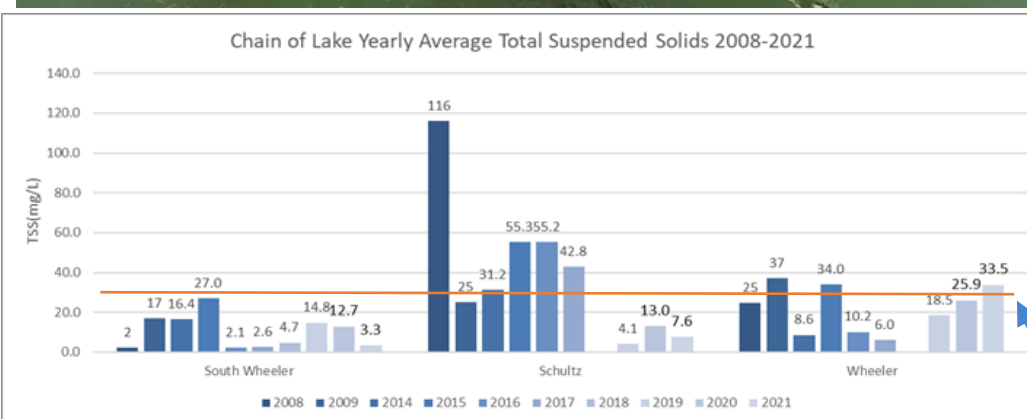
3.28 ft (1 m) = MPCA Shallow Lake Ecoregion Average for North Central Hardwood Forest



Schultz Lake

North Wheeler Lake

A measure of the material suspended in water. Total suspended solids (TSS) cause: a) interference with light penetration, b) buildup of sediment and c) potential reduction in aquatic habitat. Solids also carry nutrients that cause algal blooms and other toxic pollutants that are harmful to fish.



30 mg/L TSS = MPCA Shallow Lake Ecoregion Average for North Central Hardwood Forest

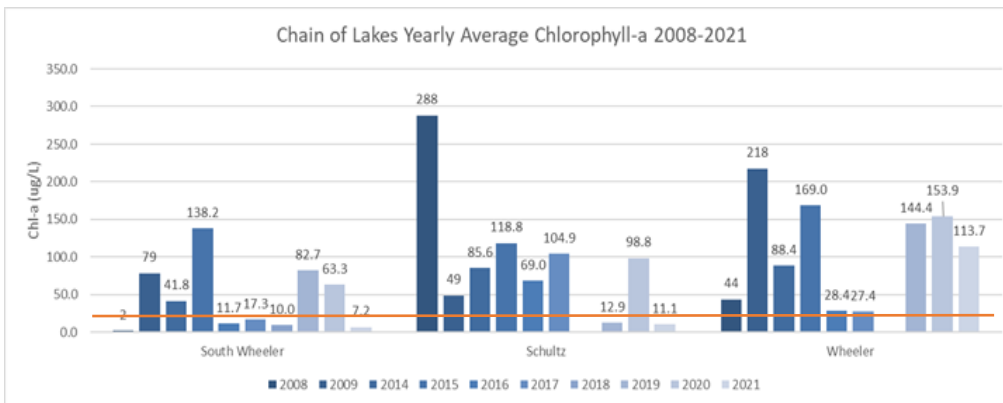
Water Quality Data

Hubbard, Schultz, Wheeler Shallow Chain of Lakes



Middle Fork Crow River
WATERSHED DISTRICT

Grab samples provide insight into the chemical condition of the water body and determine its suitability for fisheries, recreational activities, and groundwater recharge. They also become an important indicator of potential land use problems in the watershed. Lake samples are collected monthly or bimonthly from May through September and tested for TP, TSS, and Chlo-

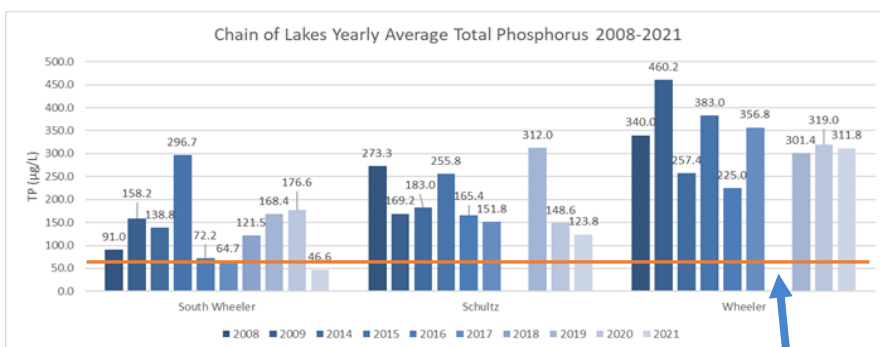


Chlorophyll-a – Chlorophyll-a is the pigment in plants that make them look green. Measuring chlorophyll-a indicates the amount of algae in the water column.

20 µg/L = MPCA Shallow Lake Ecoregion Average for North Central Hardwood Forest

In 2011, the Middle Fork Crow River Watershed District partnered with Ducks Unlimited to actively manage the Hubbard, Schultz, Wheeler Chain of Lakes. A project unlike any other in the state of Minnesota with four separate basins ranging in size from 57 acres to 238 acres. This chain of lakes contributes 45% of the surface water to the impaired waterbody of Diamond Lake but provided 78% of the Total Phosphorus. During 2017 and 2018, four water control structures and a 2,100-foot underground pipeline were installed to empty the lake chain to create a “winterkill” condition, eradicating the invasive carp, returning once turbid lakes to a clean, health condition. The four-basin uniqueness of this project provided an unprecedented and exciting challenge for conservation minded organizations and solidified the success of partnerships with Ducks Unlimited, DNR, along with local support of the Middle Fork Crow River Watershed District.

A lake drawdown is the temporary lowering of a lake water level via removal of outlet structure stoplogs. Drawdowns are used to mimic droughts. This is necessary due to hydrologic changes, including enhanced agricultural drainage, which results in less frequent occurrence of natu-



60 µg/L = MPCA Shallow Lake Ecoregion Average for North Central Hardwood Forest

Phosphorus – Phosphorus is one of the key elements necessary for growth of plants and animals. If too much phosphorus enters the waterway, algae and aquatic plants will grow excessively and choke up the waterway. As the algae and plants die, their decomposition depletes the water body’s oxygen supply, leading to the loss of aquatic life. Some sources of phosphorus include cropland (fertilizer and soil), human and animal waste, and stormwater runoff from urban areas.

Streams Monitoring



Middle Fork Crow River
WATERSHED DISTRICT

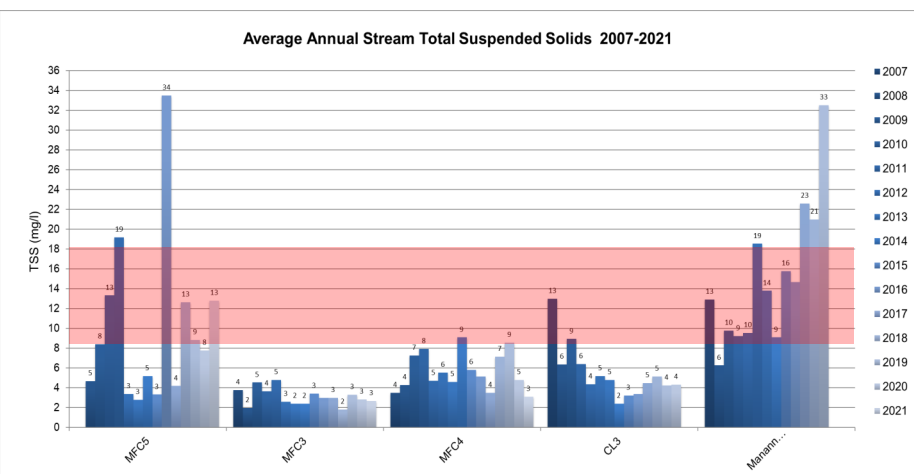
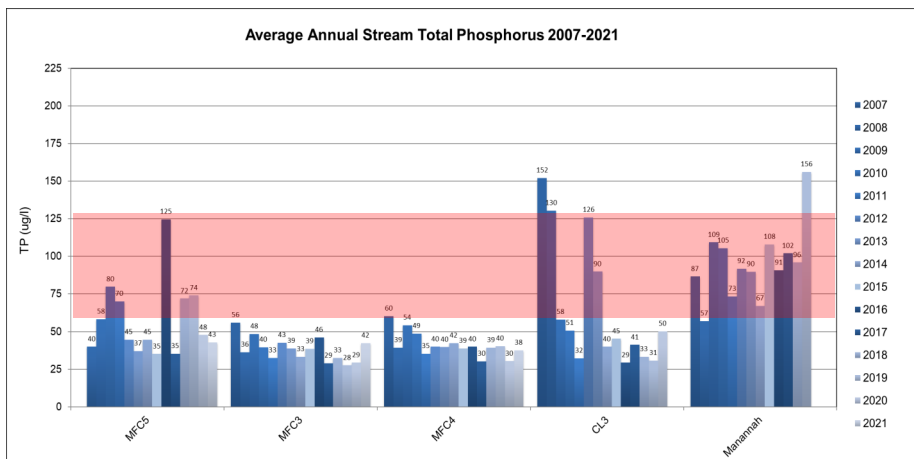
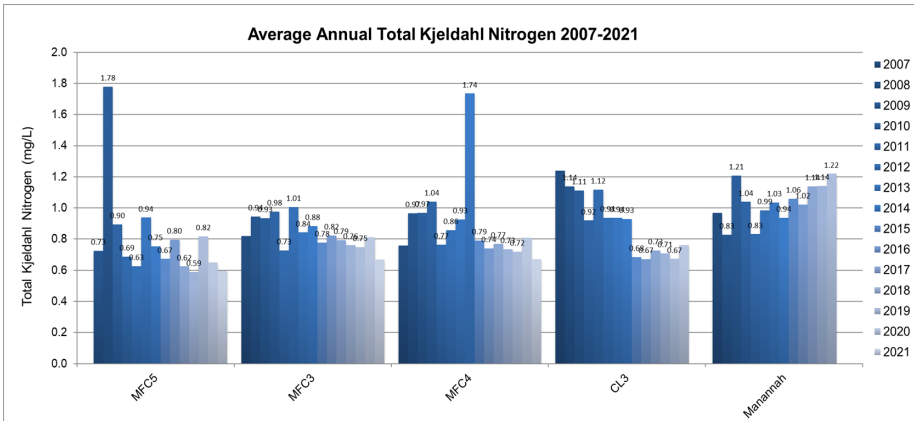
MFC4 Monitoring Site



To the left you will see three graphs one for Total Kjeldahl Nitrogen, Total Phosphorus, and Total Suspended Solids. The Red boxes on the graphs indicate the typical measurements one might find based on the North Central Hardwood Forest Ecoregion for streams. Total Kjeldahl Nitrogen does not have established typical values. One thing to note is that the Manannah stream site is event based monitoring. So values at Manannah are higher than monthly sampling.



CL3 Monitoring Site



Diamond Lake



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 635 acres

Surface Area: 1,609.52

Contributing waters: 17,990 acres

Upstream Waters: Middle
Fork Crow River

Maximum Depth: 27 feet

Common Fish

Bluegill, Northern Pike, Large-mouth bass

Dominant Vegetation

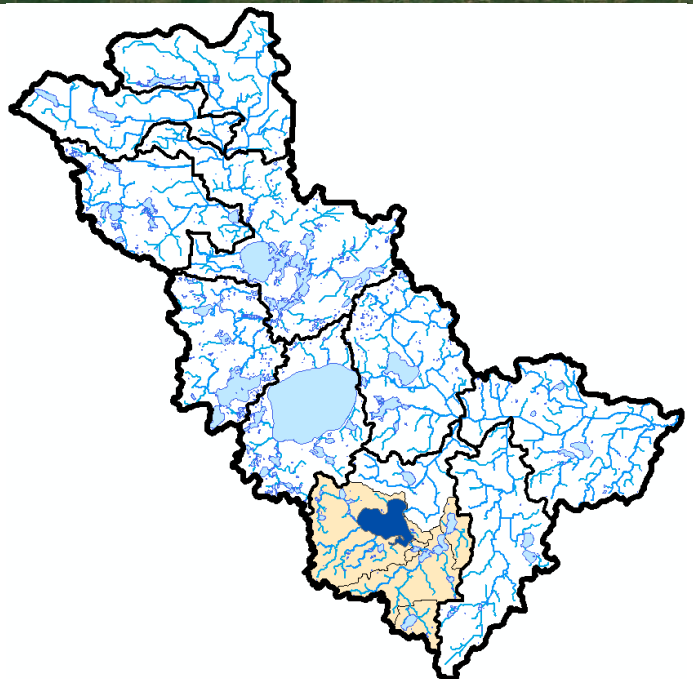
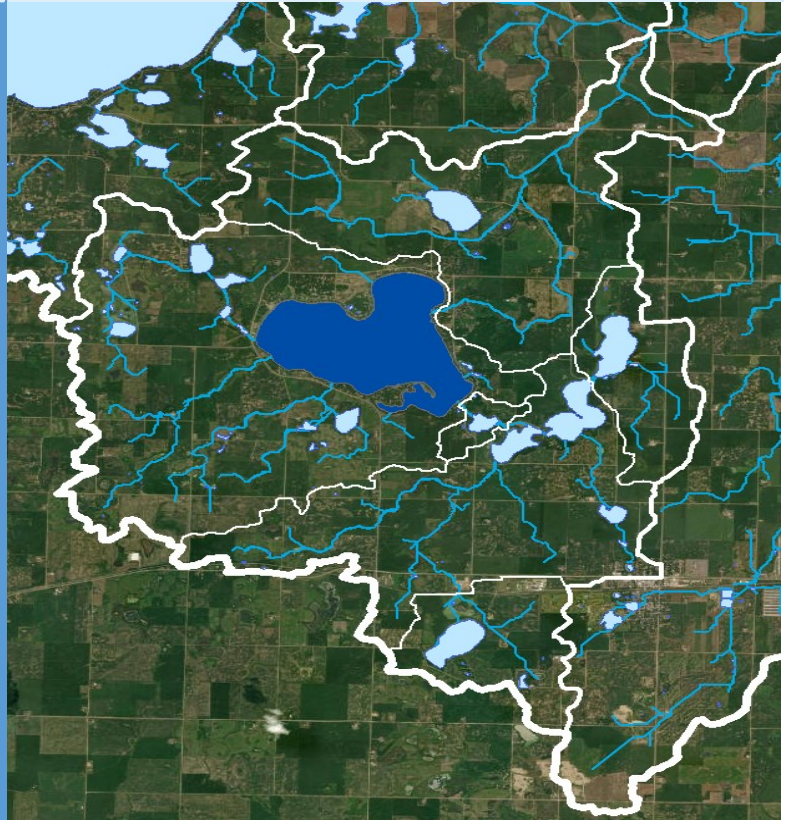
Sago Pondweed, Muskgrass, Narrow-leaf Pondweed, WaterMoss

Invasive Species

Curly-leaf Pondweed, Zebra Muscle

Impairment Status

Mercury in fish tissue, Nutrients phosphorus

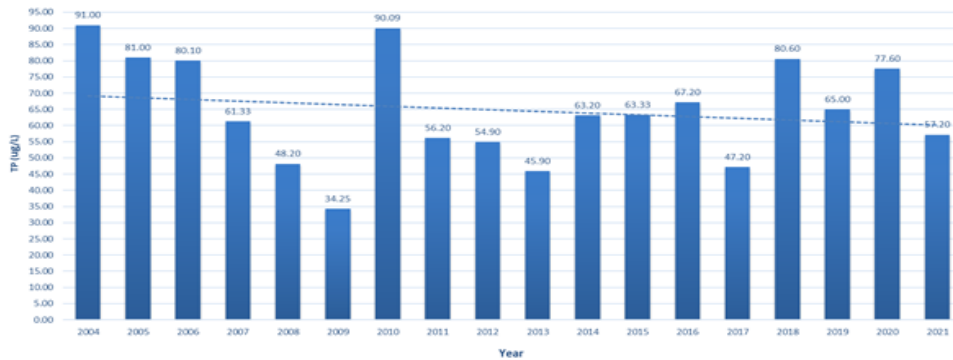


Diamond Lake



Middle Fork Crow River
WATERSHED DISTRICT

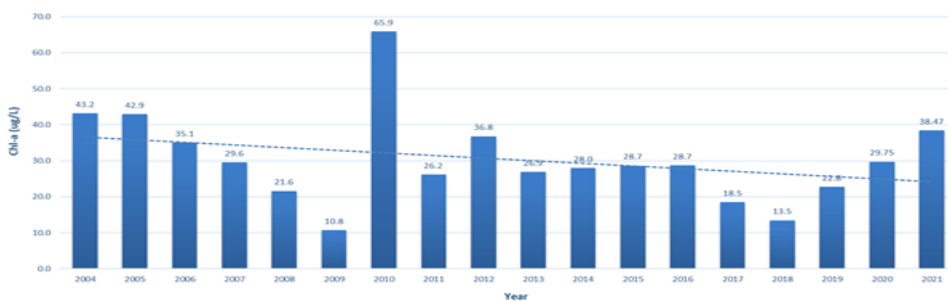
Diamond Lake Annual Ave TP Readings 2004-2021



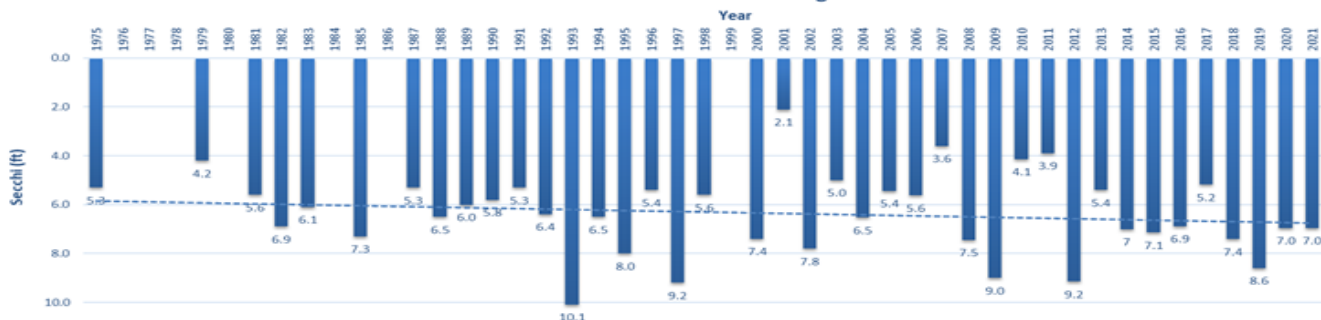
Diamond Lake Annual Ave TSS Readings 2006-2021



Diamond Annual Ave Chl-a Readings 2004-2021



Diamond Lake Annual Ave Secchi Readings 1975-2021



Diamond Lake trends for total phosphorus (TP), Chlorophyll-a (Chl-a), and Secchi have all been showing consistent improvement when looking at the trend lines. Total Suspended Solids (TSS) has remained relatively consistent over the last 16 years. In 2019 the first successful drawdown of the Hubbard, Schultz, Wheeler chain of lakes was completed. This will hopefully have a further positive effect on Diamond lake. This along with many other projects completed around Diamond Lake and its surround watershed should continue to help improve water quality.

Calhoun



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Shoreline Length: 4.81 miles

Surface Area: 647.12 acres

Contributing waters: 7,578 acres

Upstream Waters: Green Lake

Maximum Depth: 13 feet

Common Fish

Bluegill, Northern Pike, Black Crappie, Yellow Bullhead

Dominant Vegetation

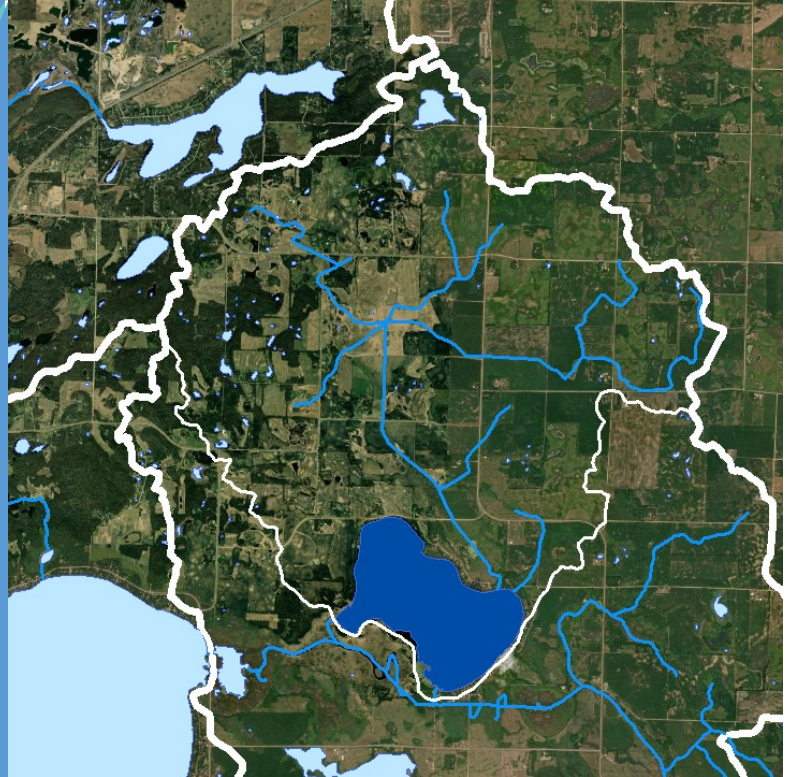
Filamentous algae, Muskgrass, Northern Milfoil, Sago Pondweed

Invasive Species

Eurasian Watermilfoil, Zebra mussel

Impairment Status

Impaired for Mercury in fish tissue

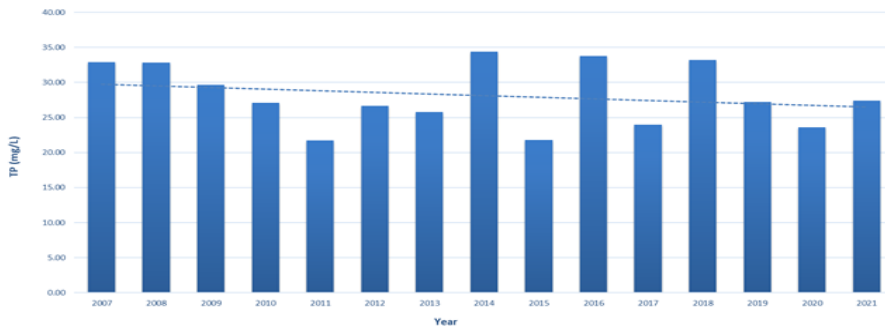


Calhoun

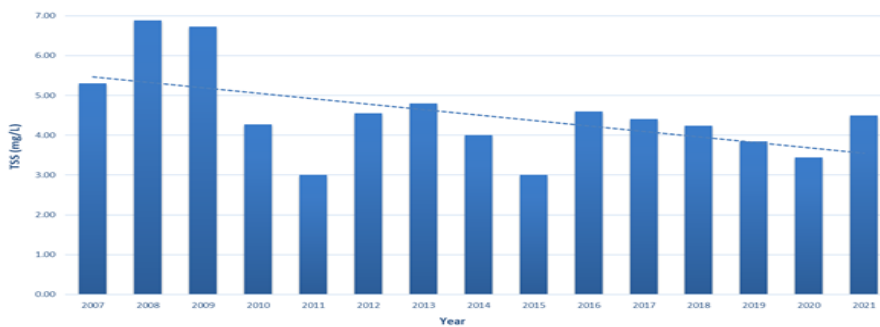


Middle Fork Crow River
WATERSHED DISTRICT

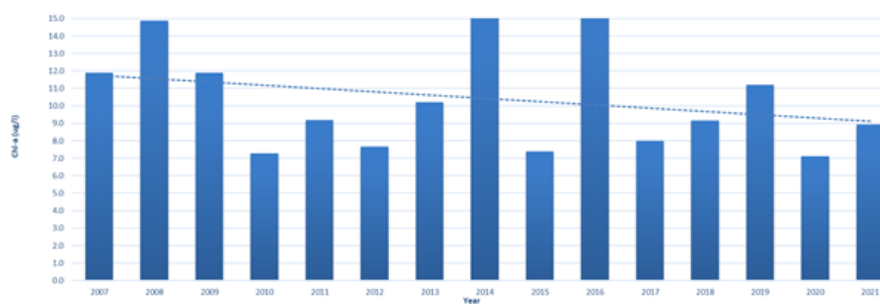
Calhoun Lake Annual Ave TP Readings 2007-2021



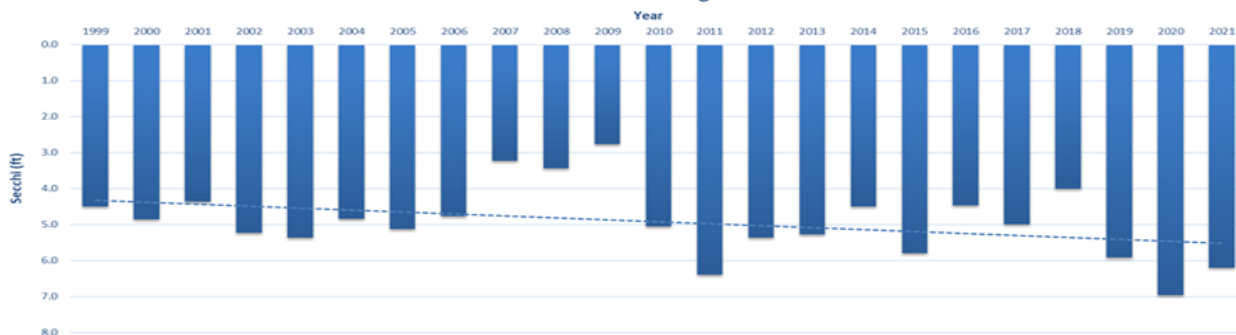
Calhoun Lake Annual Ave TSS Readings 2007-2021



Calhoun Lake Annual Ave Chl-a 2007-2021



Calhoun Lake Annual Ave Secchi Readings 1999-2021



Calhoun is showing improving water quality values over the last 15 years. There has been some improvement when looking at trends for Total Phosphorus (TP), Chlorophyll-A (Chl-a), clarity (secchi) and total suspended solids (TSS). Calhoun is suitable for swimming and wading with good clarity and low algae levels throughout the open water season. Being in the North Central Hardwood Forest Ecoregion Calhoun has been predominately located within the eutrophic zone but is trending towards more of a mesotrophic state. 2021 was a very dry year which makes the results from the 2021 monitoring season hard to interpret. We will continue to monitor long term trends and watch for any evidence that points to declining water quality.

Elkhorn Lake



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 30 acres

Surface Area: 79 acres

Contributing waters: 1,602 acres

Upstream Waters: Gina and
Thompson lake

Maximum Depth: 41 feet

Common Fish

Bluegill, Northern Pike, Large-mouth bass

Dominant Vegetation

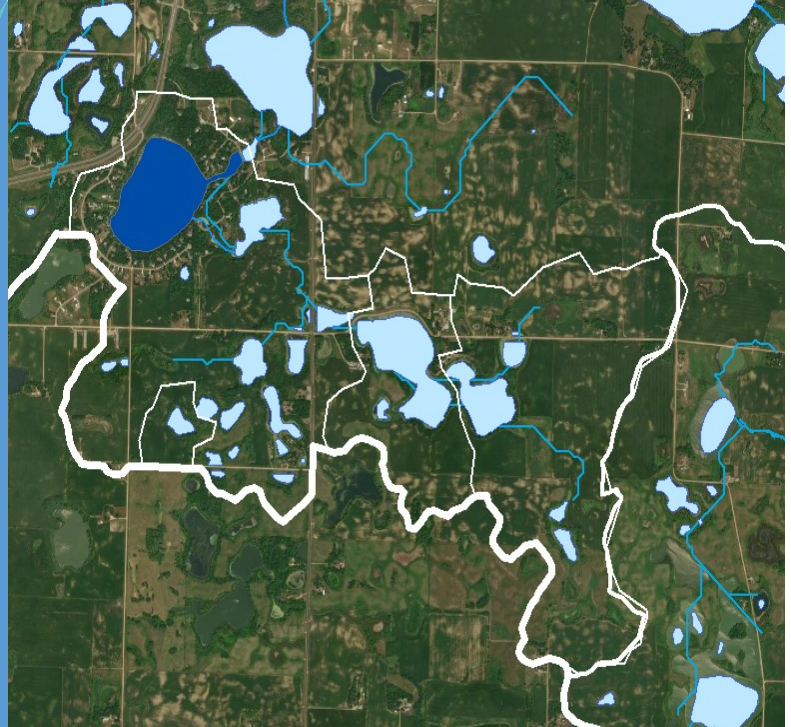
Clasping-leaf Pondweed, Coontail, Flat-stemmed pondweed, Sago

Invasive Species

Eurasian Watermilfoil, Curly-leaf pondweed, Zebra mussel

Impairment Status

Non-impaired

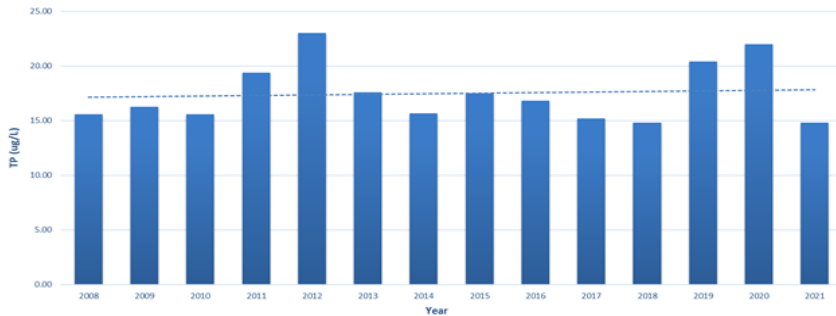


Elkhorn Lake

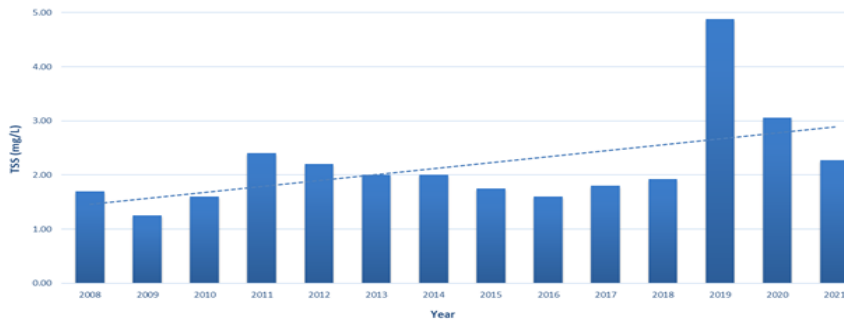


Middle Fork Crow River
WATERSHED DISTRICT

Elkhorn Lake Annual Ave TP Readings 2008-2021



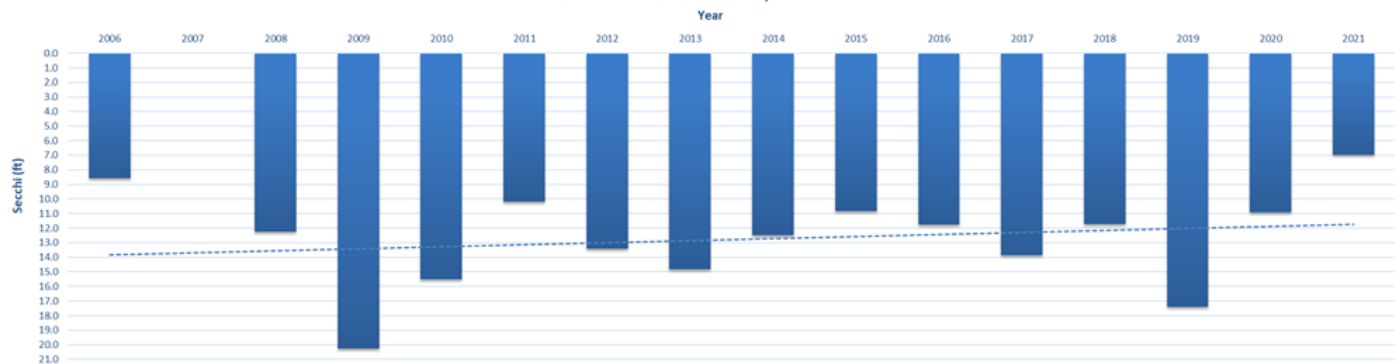
Elkhorn Lake Annual Ave TSS 2008-2021



Elkhorn Lake Annual Ave Chl-a Readings 2008-2021



Elkhorn Lake Annual Ave Secchi 2006, 2008-2021



Elkhorn is showing a decline in water quality looking at the 14 year trend line. In 2019 and 2020 there was a spike in TP, TSS, and Chl-a. This did have a noticeable impact on the historical trend. The watershed did conduct a study with Wenck Associates. This study looked at lake hydrology and the replacement of the dam on Elkhorn. With a relatively small contributing watershed efforts taken withing the immediate are to protect water quality are likely to have a bigger impact that waterbodies with a larger contributing watershed. Elkhorn has been situated predominately in the Mesotrophic zone for water quality. We will be watching for any confirming data that shows a trend towards more of a eutrophic state.

George Lake



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 112 acres

Surface Area: 231 acres

Contributing waters: 479 acres

Upstream Waters: 3 small inlets

Maximum Depth: 34 feet

Common Fish

Bluegill, Northern Pike, Wall-eye

Dominant Vegetation

Flat-stemmed pondweed, Muskgrass, Bushy Pondweed, Sago

Invasive Species

Zebra Mussel

Impairment Status

Mercury in fish tissue

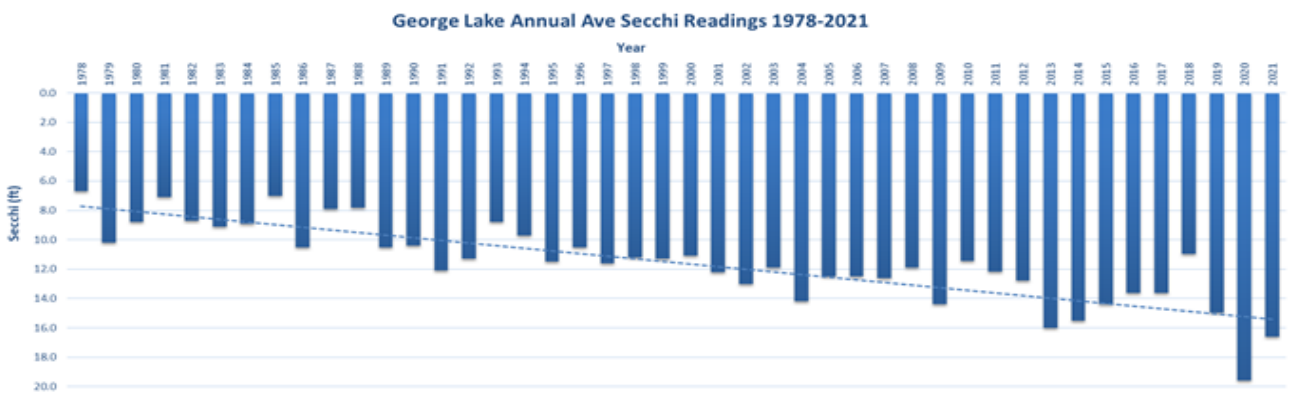
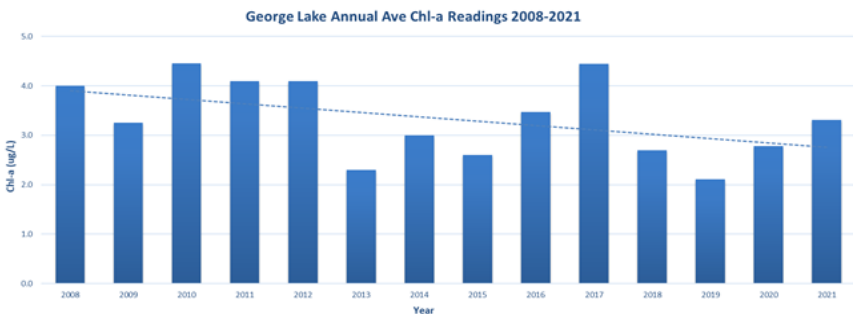
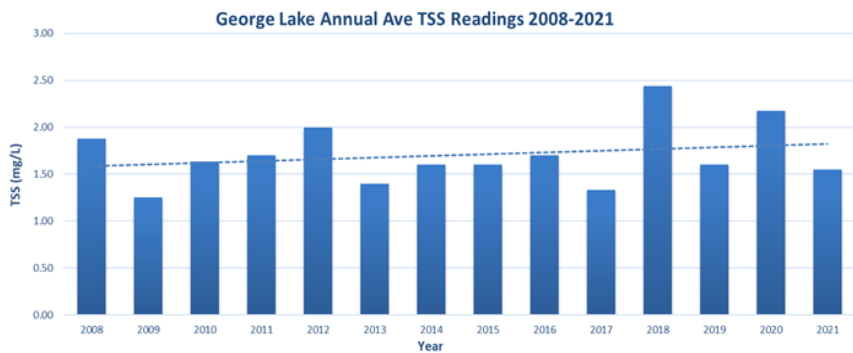
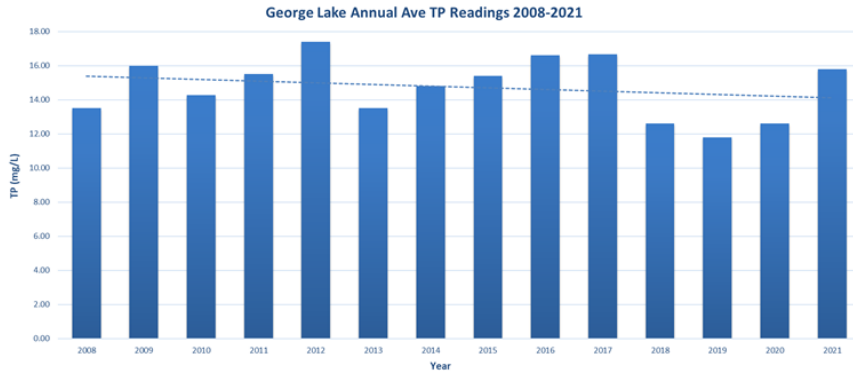


George Lake



Middle Fork Crow River
WATERSHED DISTRICT

George Lake has shown improvement in most water quality parameters. Although, Total Suspended Solids (TSS) has a slight up trend. This is primarily due to high readings in 2018 and 2020. Secchi readings have continually improved since 1978 which is quite impressive. But again, you can see 2018 as an outlier since it was a very wet summer with multiple big rain events. 2021 was an abnormal year with very little rain. This makes 2021 hard to interpret within the overall picture of water quality in George Lake. We will continue to monitor George Lake for any divergence from the current trends of the lake.



Nest Lake



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 525 acres

Surface Area: 969 acres

Contributing waters: 78,682 acres

Upstream Waters:
Middle Fork Crow River

Maximum Depth: 40

Common Fish

Bluegill, Northern Pike, Large-mouth bass

Dominant Vegetation

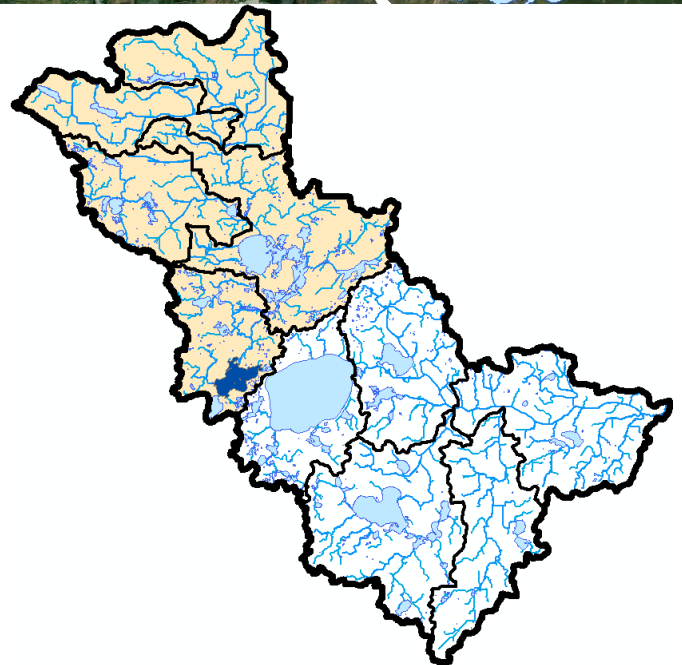
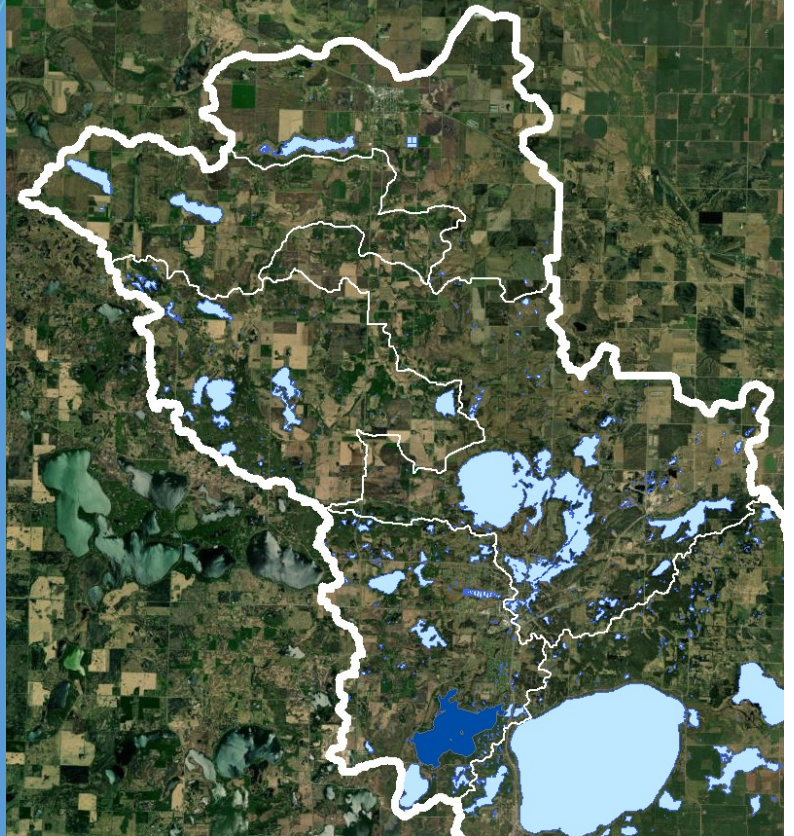
Coontail, Water moss, Filamentous algae, Star duckweed

Invasive Species

Zebra mussel, Curly-leaf pondweed

Impairment Status

Impaired for:
Mercury in fish tissue,
Phosphorus,

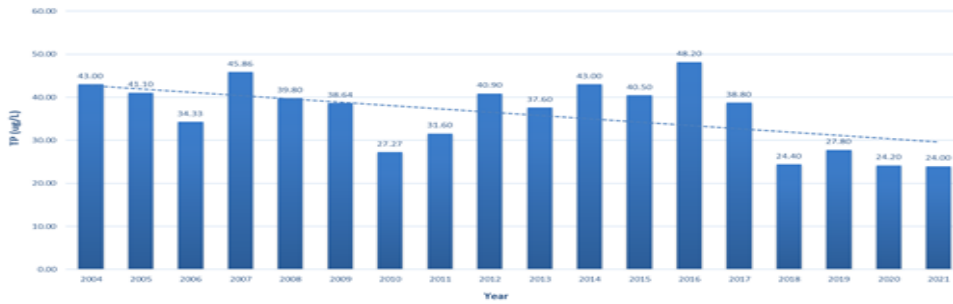


Nest Lake

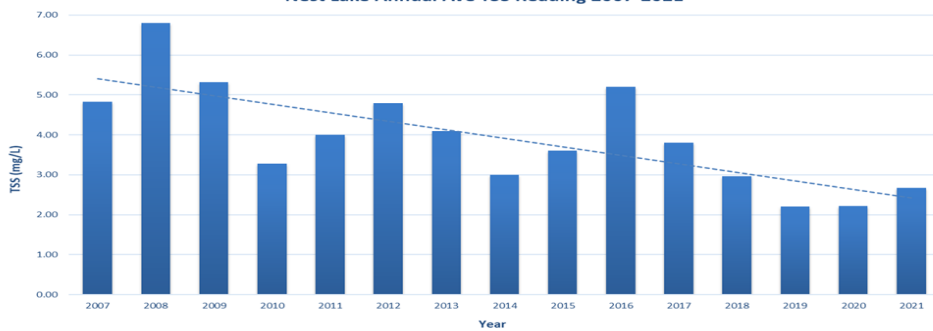


Middle Fork Crow River
WATERSHED DISTRICT

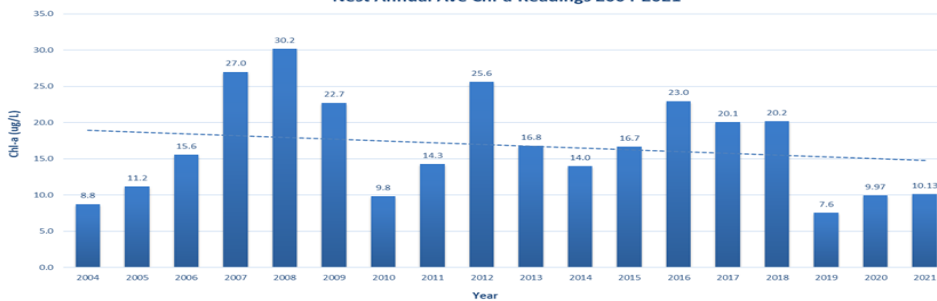
Nest Lake Annual Ave TP Readings 2004-2021



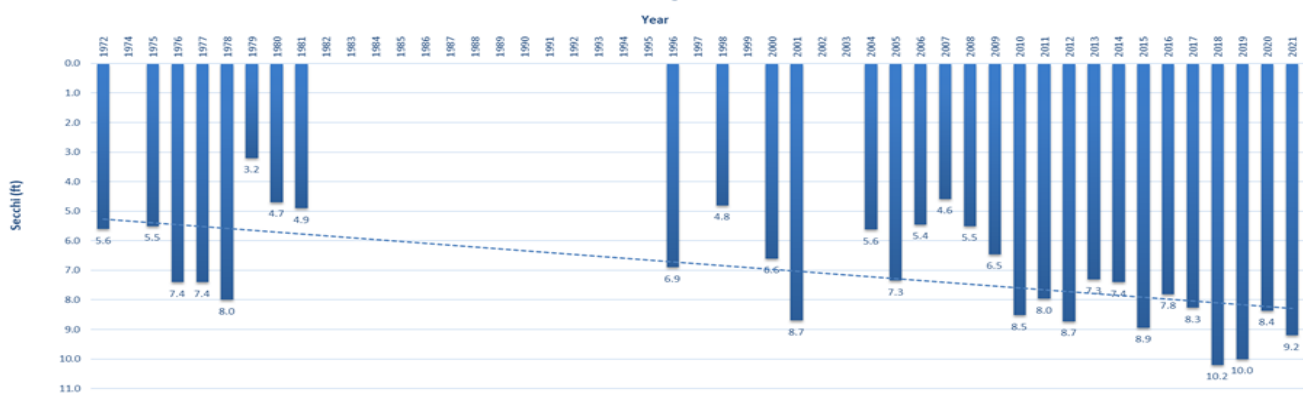
Nest Lake Annual Ave TSS Reading 2007-2021



Nest Annual Ave Chl-a Readings 2004-2021



Nest Lake Annual Ave Secchi Reading 1972-2021



Nest Lake water quality parameters have shown improvement since 2004. Especially total phosphorus (TP) and total suspended solids (TSS). Chlorophyll-a has remained fairly consistent over the years. The District is currently working on a study that looks at legacy phosphorus within the Nest lake sediments. One component of this is taking dissolved oxygen profiles. This data will help us determine next steps to address legacy phosphorus that persists in the sediments at the bottom of the lake.

Green Lake



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 2,035 acres

Surface Area: 5,569 acres

Contributing waters: 95,196 acres

Upstream Waters: Nest Lake

Maximum Depth: 110 feet

Common Fish

Rock Bass,
Northern Pike,
Walleye

Dominant Vegetation

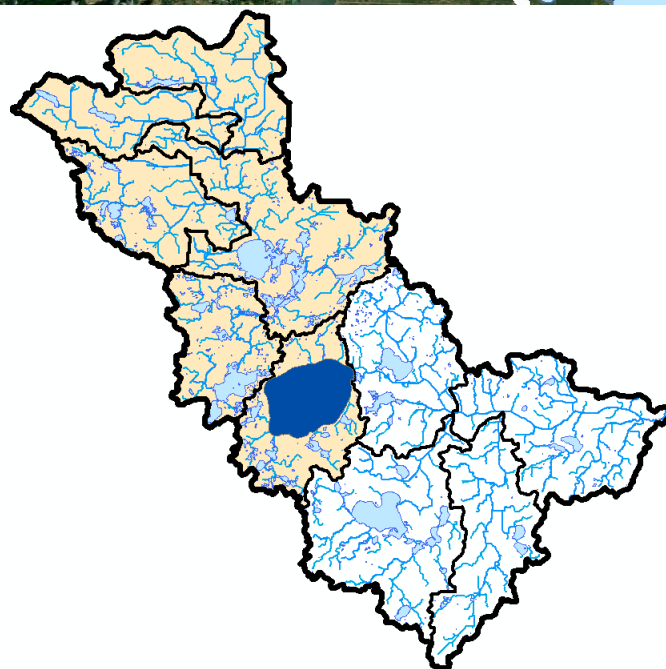
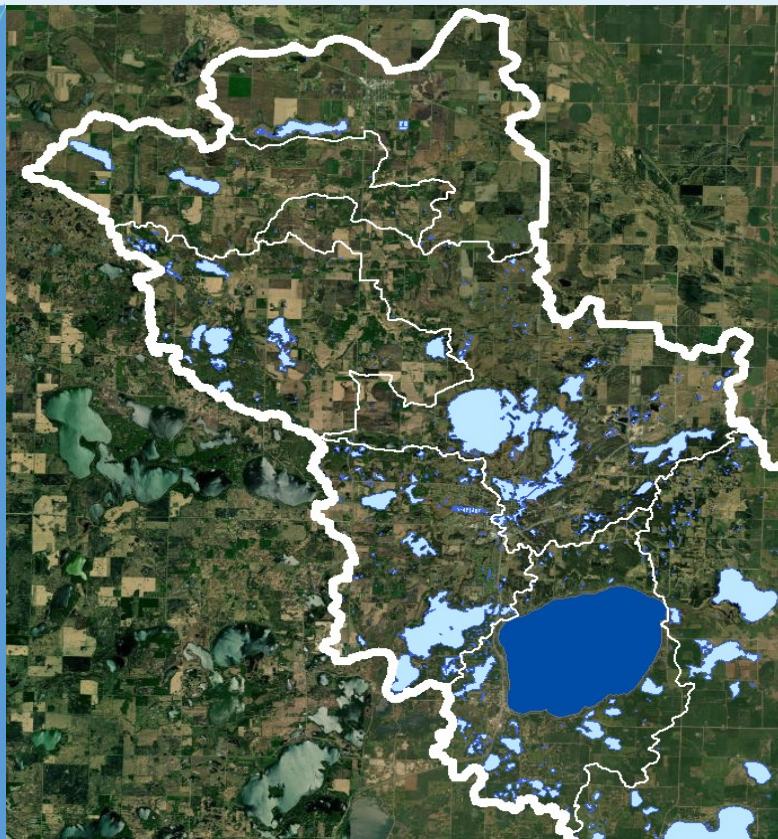
Muskgrass, Clasp-
leaf pondweed, Eurasian
water milfoil

Invasive Species

Zebra mussel,
Eurasian water-
milfoil

Impairment Status

Mercury in fish
tissue

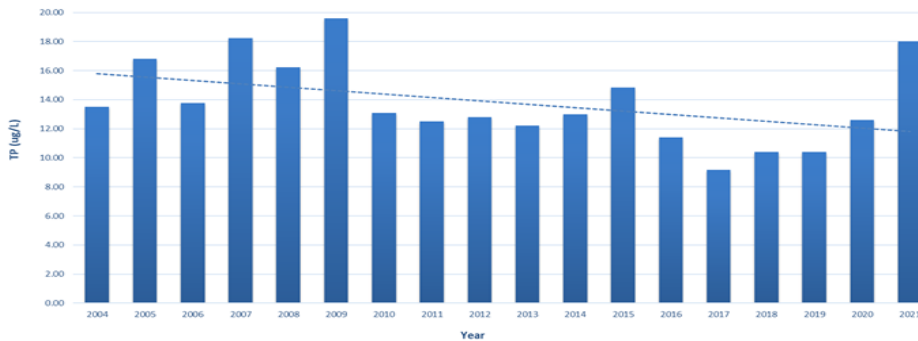


Green Lake

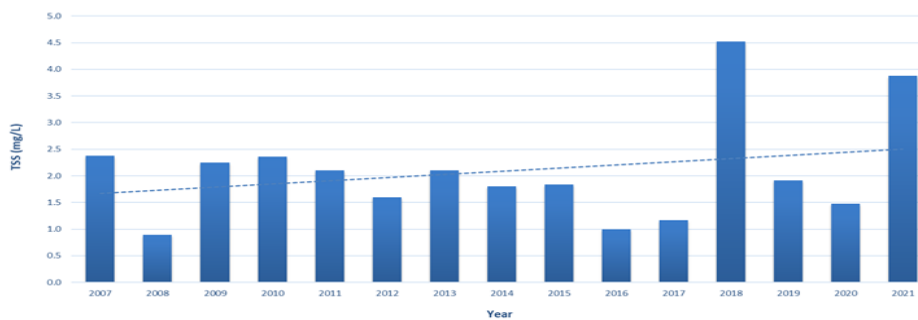


Middle Fork Crow River
WATERSHED DISTRICT

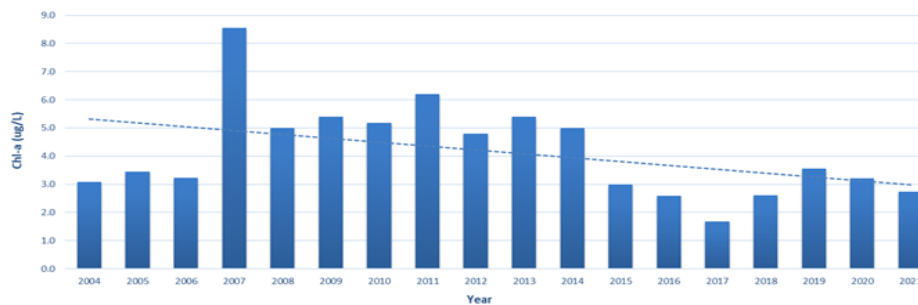
Green Lake Annual Ave Total Phosphorus Readings 2004-2021



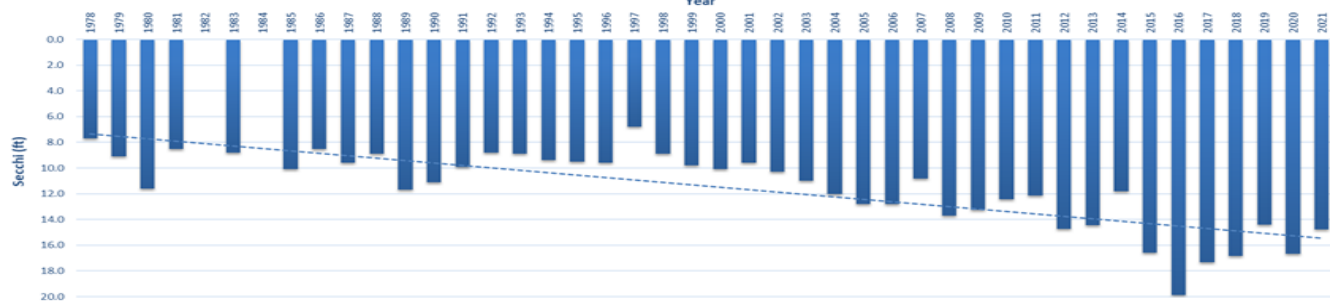
Green Lake Annual Ave TSS Readings 2007-2021



Green Lake Annual Ave Chl-a Readings 2004-2021



Green Lake Annual Ave Secchi Reading 1978-2021



Green Lake, has seen a nice overall trend towards better water quality since 2004. Total Suspended Solids (TSS) had high results in 2018 and 2021. Both years were outliers with regards to precipitation. The introduction of Zebra mussels and the drought in 2021 does make it harder to interpret the data but we will continue to monitor the waters to see what the long term trends are. We have also begun taking profile measurements but it will take a few years of data to draw any conclusions. Green lake's trophic state is on the border between oligotrophic and mesotrophic which is confirmed by its lack of algal blooms and limited nutrients.

Long Lake



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 127 acres

Surface Area: 324.4 acres

Contributing waters: 2,426 acres

Upstream Waters: Shoemaker
Lake

Maximum Depth: 46 Feet

Common Fish

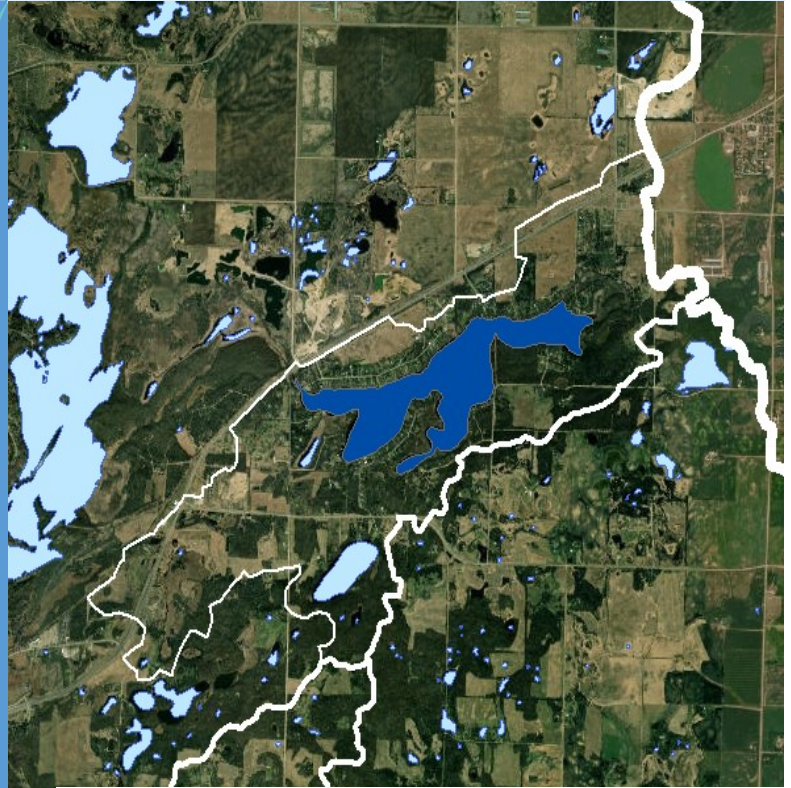
Bluegill, North-
ern Pike, Large-
mouth bass

Dominant Vegetation

Fries' pondweed,
Muskgrass,
Coontail, Sago

Impairment Status

Mercury in Fish
Tissue

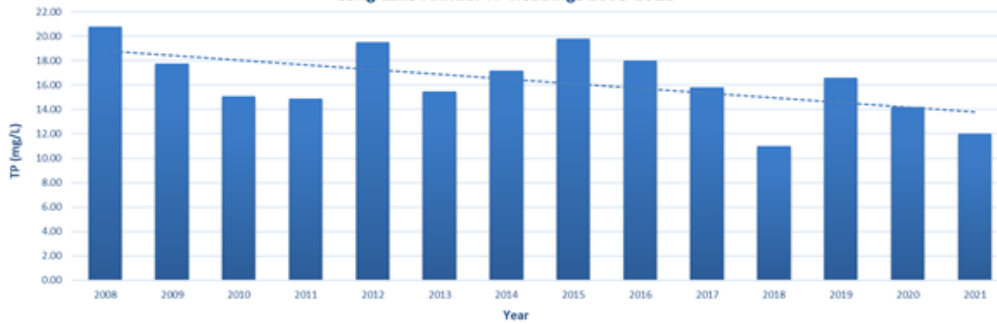


Long Lake



Middle Fork Crow River
WATERSHED DISTRICT

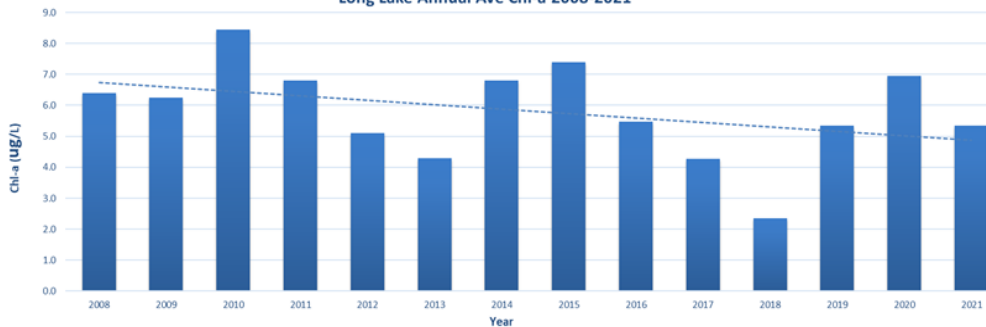
Long Lake Annual TP Readings 2008-2021



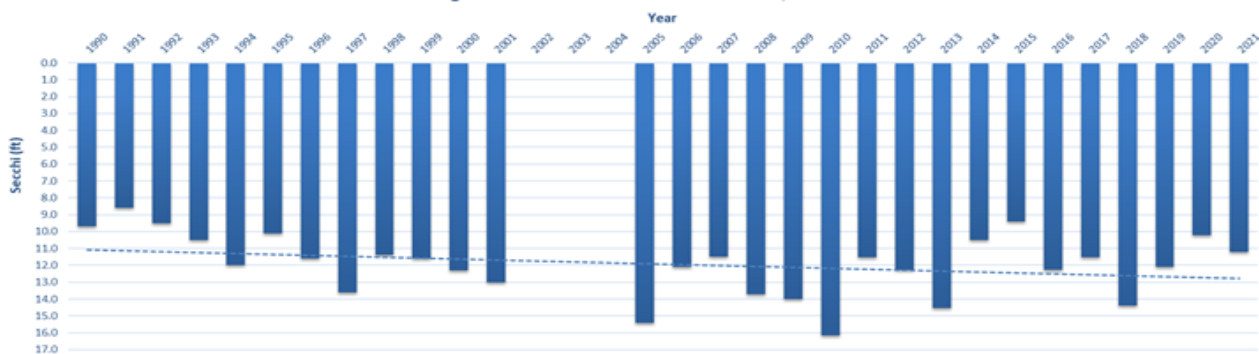
Long Lake Annual Ave TSS Readings 2008-2021



Long Lake Annual Ave Chl-a 2008-2021



Long Lake Annual Ave Secchi 1990-2001, 2005-2021



Long Lake, has seen a nice overall trend with improving water quality parameters. total phosphorus, chlorophyll –a, Secchi, and total suspended solids have all shown improvement since 2008. This is a relatively small data set so we will continue to monitor Long and watch for any changes that might point to a change in water quality. At the end of this document you will find Trophic State Index (TSI) for lakes within the Middle Fork Watershed and will see that Long Lake is doing well and staying within the mesotrophic TSI range.

Monongalia



Middle Fork Crow River
WATERSHED DISTRICT

Quick Facts

Littoral Area: 2,270 acres

Surface Area: 2,290 acres

Contributing waters: 65,653 acres

Upstream Waters: Middle
Fork Crow River

Maximum Depth: 14 feet

Common Fish

Bluegill, North-
ern Pike, Large-
mouth bass

Dominant Vegetation

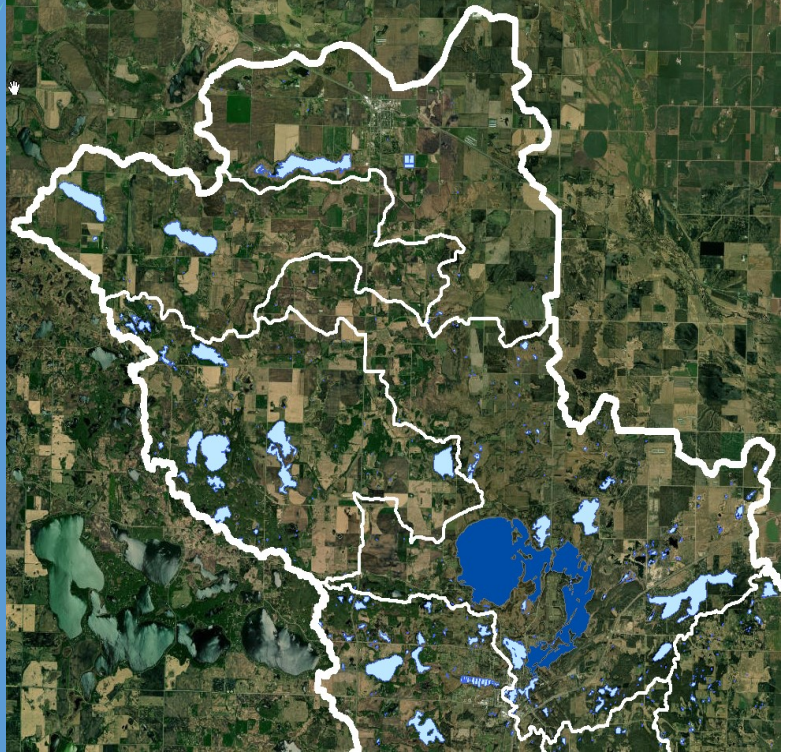
Sago Pondweed,
Muskgrass, Rice
Group, Water
Celery

Invasive Species

Curly leaf
pond weed

Impairment Status

Mercury in fish
tissue

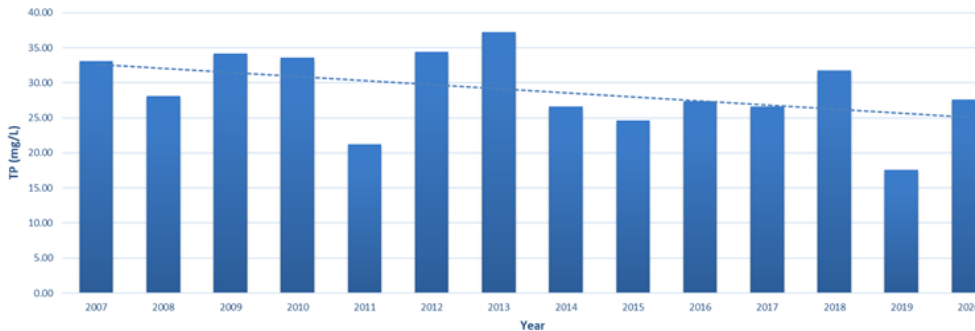


Monongalia



Middle Fork Crow River
WATERSHED DISTRICT

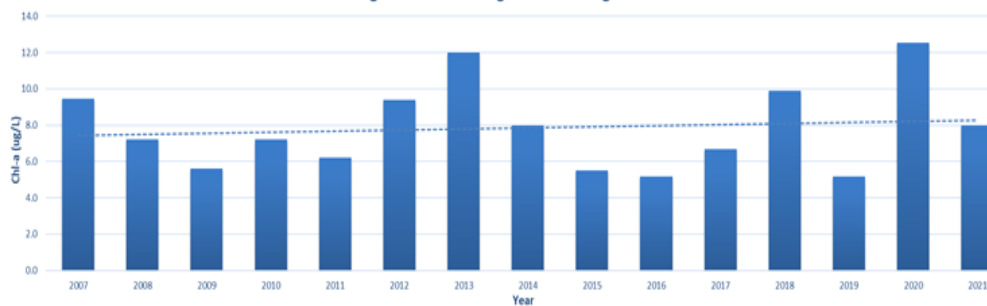
Monongalia Annual Average TP Readings 2007-2021



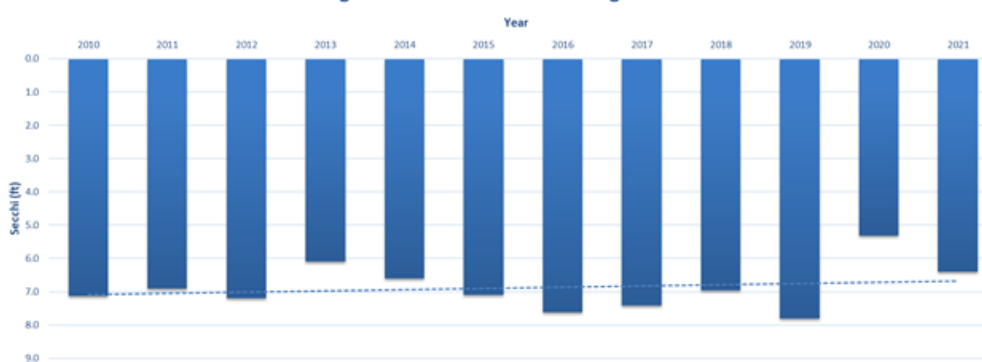
Monongalia Lake Annual Ave TSS Readings 2007-2021



Monongalia Annual Average Chl-a Readings 2007-2021



Monongalia Annual Ave Secchi Readings 2010-2021



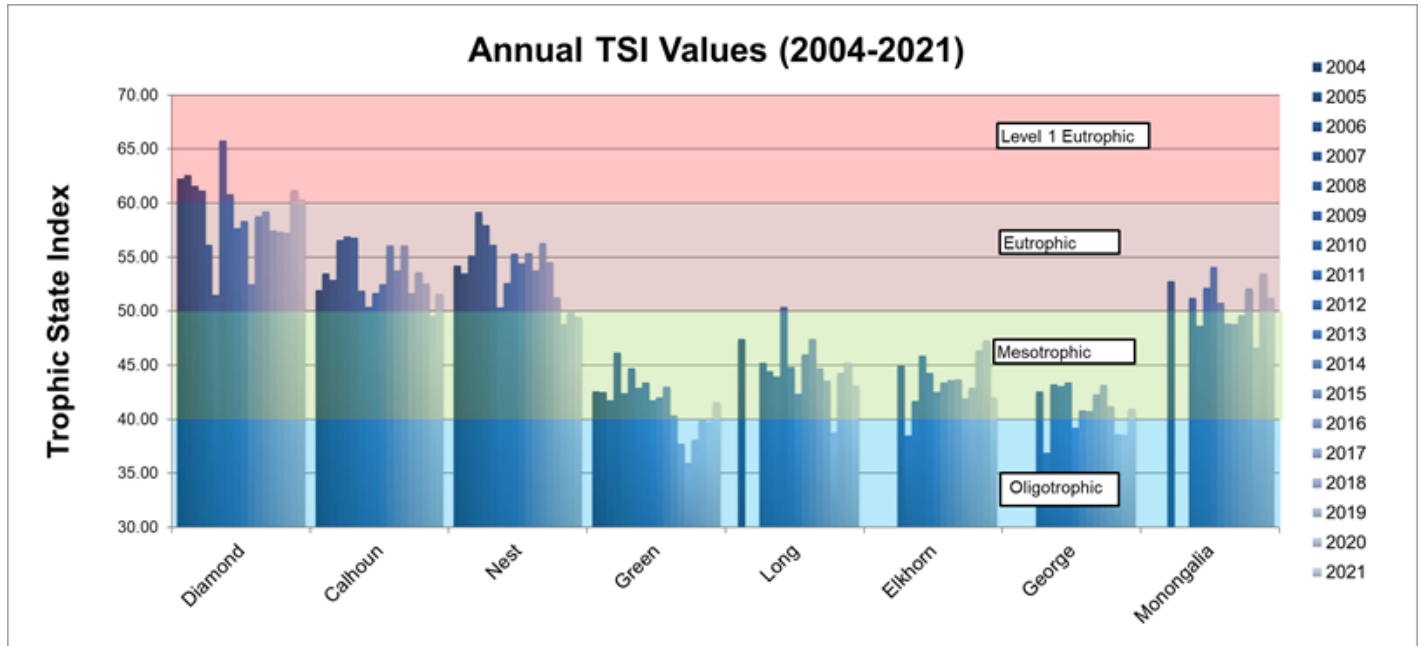
Monongalia, has shown improving water quality when looking at total phosphorus, Chlorophyll-a and Secchi readings. Total suspended solids have shown a slight uptrend but part of that increase is largely due to the very wet year in 2007 which drove run off and resulted in higher than normal sediment entering waters. We will continue to monitor Monongalia for any changes in water quality.

Trophic State



Middle Fork Crow River
WATERSHED DISTRICT

To determine the overall health of a lake one can look at Carlson's Trophic State Index (TSI). Trophic state indicates the overall productivity, or plant and algae growth, occurring in a lake. The TSI uses algal biomass as its basis and is determined by using three productivity parameters: total phosphorus, chlorophyll-a, and secchi disk.



When looking at the above data one can see that the lakes have been fairly consistent since 2004 with a slight improvement in TSI values. We are making lower lows and lower highs as you look at each individual lake.

TSI 30-40 Oligotrophic – clear water, hypolimnion oxygenated throughout the year (except in shallow lakes)

TSI 40-50 Mesotrophic – Water moderately clear, but anoxia becoming more likely in hypolimnion during the summer

TSI 50-60 Lower Boundary of classical eutrophy: Decreased transparency, anoxic hypolimnia during the summer, aquatic plant problems evident, warm water fisheries only.

TSI 60-70 Eutrophic: Dominance of blue-green algae, algal scums probable, extensive aquatic plant problems

TSI 70-80 Hypereutrophic: Heavy algal blooms possible throughout the summer, dense aquatic plant beds, but extent limited by light penetration.