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9 MILE CREEK WATERSHED DISTRICT

Nine Mile Creek Watershed District

2024 Water Monitoring Program Summary

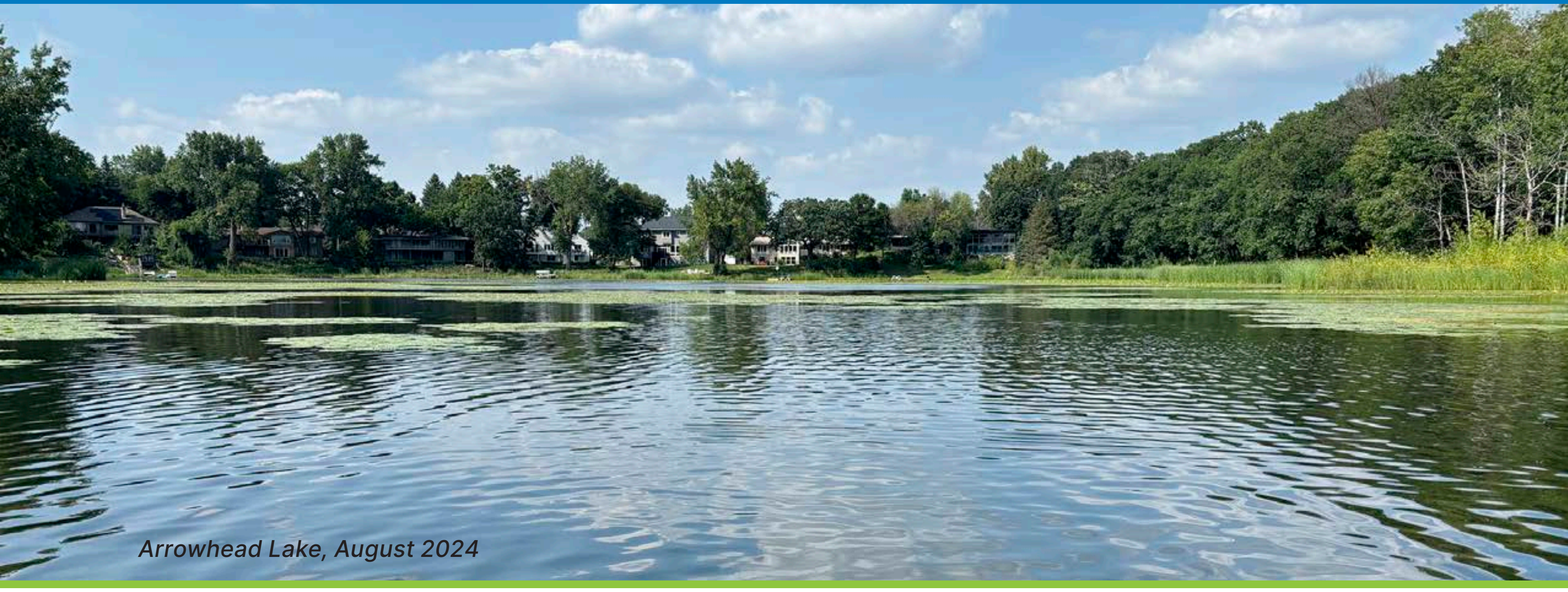
Prepared for
Nine Mile Creek Watershed District

Prepared by Barr Engineering Co. | September 2025

CONTENTS

APPENDICES

1 INTRODUCTION



Arrowhead Lake, August 2024

The Nine Mile Creek Watershed District (NMCWD, District) is a special-purpose unit of local government that works with its partners and community stakeholders to manage, protect, and enhance the water resources within the 50-square-mile watershed that drains to the Nine Mile Creek in the southwest portion of the Twin Cities.

Monitoring of waterbodies in the Nine Mile Creek watershed is essential to developing an understanding of past and present conditions within the watershed and determining the need for action by the District or other entities. The District annually implements a lake, groundwater, and stream monitoring program designed to establish baseline conditions, track changes, measure the effectiveness of past and ongoing improvement projects, and inform additional studies (e.g., feasibility studies, water quality studies), as needed. The monitoring program includes:

- Lake water quality and ecological conditions
- Stream water quality and ecological conditions
- Lake levels
- Groundwater levels

The District's 2024 water quality monitoring program included monitoring eleven lakes—Anderson Lakes, Arrowhead Lake, Bryant Lake, Lake Cornelia, Lake Holiday, Indianhead Lake, Normandale Lake, Lake Rose, Wing Lake—and Nine Mile Creek (Figure 1-1).

The following report summarizes the lake, groundwater, and stream monitoring data collected by the District in 2024 and compares this data to historically collected data to assess changes in water quality conditions.

The District has been conducting its **water quality and ecological monitoring** program since the late-1960s. Protecting and enhancing the surface water quality of Nine Mile Creek and the lakes within the watershed has been an important goal of the District for many decades. To help accomplish this goal, the District operates an extensive lake and stream management program. Generally, the program includes:

- Data collection (monitoring)
- Assessment (e.g., studies)
- Implementation of projects and programs

The District has been monitoring **lake levels** since 1960 and **groundwater levels** since 1962. This information has been used to monitor fluctuations in lake and groundwater levels, helping to understand the connections between groundwater and surface water throughout the watershed and providing important information during times of flooding and drought. In 2024, the District collected monthly levels at 29 lakes and 6 groundwater monitoring wells. Figure 1-2 shows the lake level and groundwater monitoring locations.

This report is organized by subject:

Lake Water Quality and Ecological Monitoring — Chapter 2

Summarizes the most recent and historical water quality and ecological monitoring data collected for District lakes, including a discussion of in-lake and watershed management actions implemented.

Stream Water Quality and Ecological Monitoring — Chapter 3

Summarizes the most recent and historical water quality and ecological monitoring data collected at locations along the Nine Mile Creek.

Lake Level Monitoring — Chapter 4

Includes lake level monitoring observations.

Groundwater Level Monitoring — Chapter 5

Includes groundwater level monitoring observations.

North Fork Nine Mile Creek, June 2024

Figure 1-1 2024 lake and stream monitoring locations

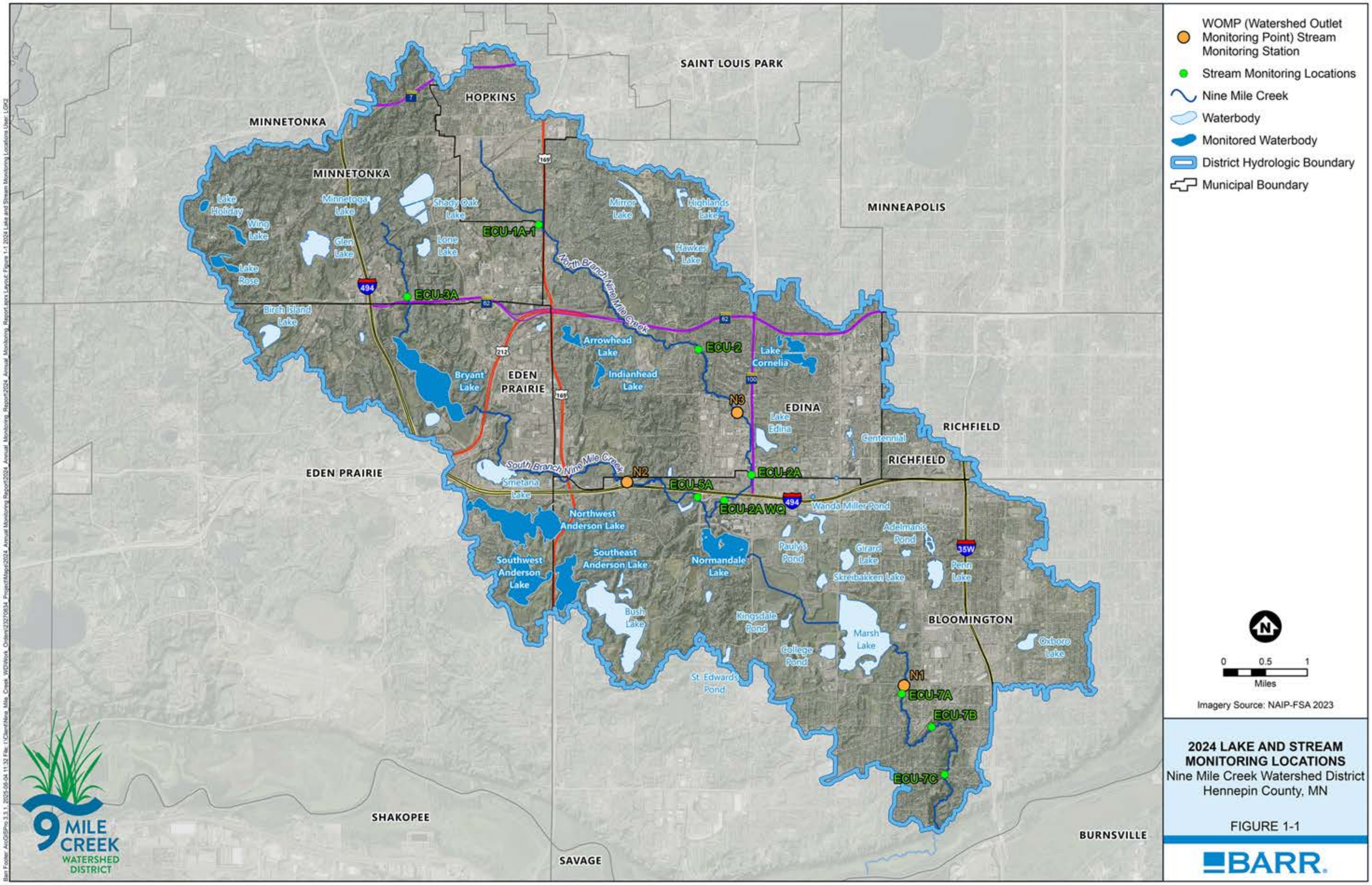
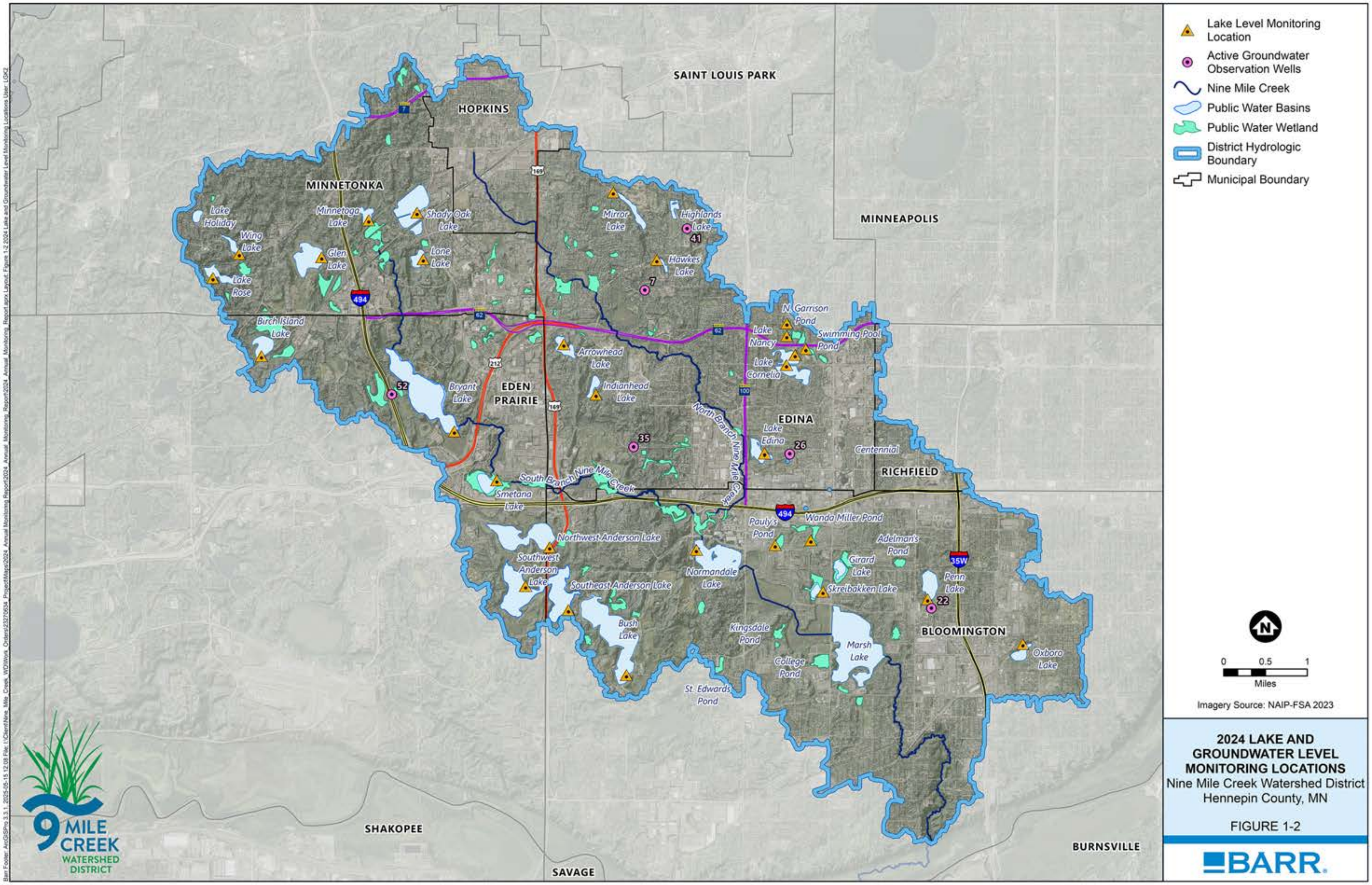


Figure 1-2 2024 lake and groundwater level monitoring locations



2 LAKE WATER QUALITY MONITORING

A summary of the 2024 and historical water quality and ecological monitoring data collected for District lakes, including a discussion of in-lake and watershed management actions implemented

Lake Cornelia's North Basin, July 2024

The Nine Mile Creek Watershed District monitors the water quality of its lakes on a rotating basis. Lakes monitored in a given year are selected to track water quality conditions, to gather additional information needed for consideration of potential management activities, to prepare for proposed projects, and/or to measure the effectiveness of past or ongoing improvement projects.

The District's full lake monitoring program typically consists of the following monitoring:

Water quality monitoring on six occasions (ice-out and five events during June through September)

Analysis of phytoplankton (algae) on five occasions (June through September)

Analysis of zooplankton on five occasions (June through September)

Aquatic plant (macrophyte) surveys during June and August

In some cases, the District opts to collect a more limited dataset for a given lake, based on specific data needs and budget considerations. Table 2-1 (next page) summarizes the lake monitoring completed by the District in 2024. Results of the District's 2024 lake monitoring are summarized in detail by lake in the subsections of this chapter.

Table 2-1 Summary of 2024 Lake Monitoring by the Nine Mile Creek Watershed District

Lake	Water Quality Monitoring	Zooplankton	Phytoplankton	Aquatic Plant Surveys
Anderson Lakes (Northwest, Southwest, and Southeast)	A	C	D	E
Arrowhead Lake	B			
Bryant Lake	A	C	D	E
Lake Cornelia (North and South Basins)	B		D	E
Lake Holiday				E
Indianhead Lake	B			
Normandale Lake	A		D	F
Lake Rose	B			
Wing Lake	B			

A Monitored parameters included total phosphorus (TP), total dissolved phosphorus (TDP), orthophosphate (OP), total Kjeldahl nitrogen (TKN), total dissolved nitrogen (TDN), nitrate/nitrite (N/N), ammonia (NH3), chloride (Cl), total suspended solids (TSS), Chlorophyll-*a*, Secchi Disk depth, temperature, dissolved oxygen (DO), pH, specific conductance, phycocyanin (in RFU)

B Monitored parameters included TP, TDP, OP, TKN, Cl, Chlorophyll-*a*, Secchi Disk depth, temperature, DO, pH, specific conductance, phycocyanin (in RFU)

C Zooplankton counts completed by Biologica Environmental Services

D Algal counts completed by GreenWater Laboratories

E Point intercept aquatic plant surveys conducted by Endangered Resource Services

F Point intercept aquatic plant surveys and biomass surveys conducted by Endangered Resource Services

NOTE: See next page for lake monitoring terms

2.1 Lake Monitoring Terms

The following parameters (terms) on this page are used to inform water quality monitoring.

Phosphorus

Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. Phosphorus can enter a lake from stormwater runoff and can be released from lake bottom sediment when certain environmental conditions are met. Reducing the amount of phosphorus entering a lake can help to reduce algal growth.

Chlorophyll-*a*

Chlorophyll-*a* is a photosynthetic pigment of algae (phytoplankton) and plants (macrophytes). For lake water quality monitoring, chlorophyll-*a* is used as a measure of algal abundance. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions.

Secchi Disk

A Secchi disk is a black and white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column.

Summer Average

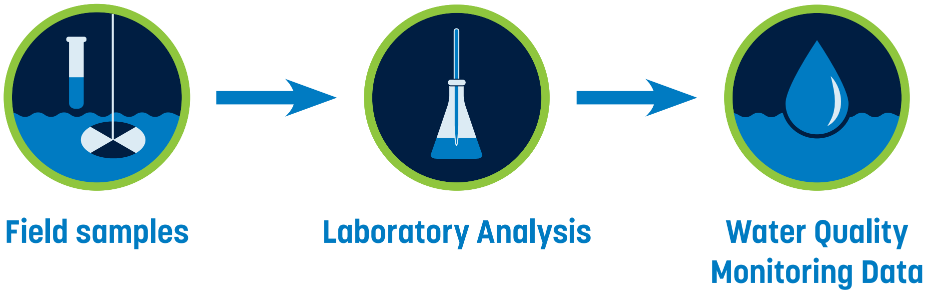
The MPCA lake eutrophication standards for total phosphorus, chlorophyll-*a*, and Secchi Disk transparency utilize summer averages. Summer averages are calculated by taking the mean of the monitoring data collected between June 1 and September 30.

Chloride

Chloride can accumulate in lakes and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians.

Nitrogen

Nitrogen is also an essential nutrient required for biological production and can enter a lake from stormwater runoff, from the atmosphere, and from the degradation of organic materials. In freshwater systems in Minnesota, phosphorus is most commonly the "limiting nutrient" controlling algal growth, although nitrogen can also be limiting for portions of the growing season. Reducing the amount of nitrogen entering a lake can help to reduce algal growth.



Eutrophication

Eutrophication is the process of gradual nutrient enrichment in lakes, which can lead to increased biological production, such as amplified growth of algae and aquatic plants. This process of increased fertility is natural in an aging aquatic ecosystem and results from the normal environmental forces that influence a lake. ***Cultural eutrophication*** is an acceleration of the natural processes and is caused by human activities. Nutrient inputs from urban, agricultural, and industrial stormwater runoff can far exceed the natural inputs to a lake, often creating excessive algal blooms, low oxygen levels, and loss of aquatic species diversity.

Macrophytes (Aquatic Plants)

Macrophytes, or aquatic plants, are the submerged, emergent, and floating plants that grow in or near the lake water. Macrophytes play vital roles in stabilizing sediment from wind driven suspension, providing spawning habitat for fish, providing refuge for small aquatic insects and fish, offering habitat for nesting birds, and competing with algae for nutrients.

Phytoplankton (Algae)

Phytoplankton, or algae, are photosynthetic, microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. High levels of nutrients (phosphorus, nitrogen) can lead to an overabundance of phytoplankton growth, creating low lake clarity and degraded water quality conditions.

Cyanobacteria (Blue Green Algae)

Cyanobacteria, or blue green algae, are a type of phytoplankton found in waterbodies. When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful (harmful algal blooms (HABs) since some species of cyanobacteria can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure.

Zooplankton

Zooplankton are microscopic aquatic animals that drift and move throughout the lake water column. They play major roles in the aquatic food web by consuming algae and are primary food sources for larger organisms such as fish.

2.2 NMCWD Water Quality Goals for Lakes—Minnesota State Standards

The table on the next page summarizes the lake water quality standards and ecological thresholds used by the NMCWD to assess lake health. These standards and thresholds are referenced throughout the report and shown on summary plots and figures.

- **Minnesota Lake Eutrophication Standards—**The Minnesota Pollution Control Agency (MPCA) has developed deep and shallow lake eutrophication standards based on ecoregion. The NMCWD is located within the North Central Hardwood Forest Ecoregion and as such has adopted the relevant lake eutrophication standards (phosphorus, chlorophyll-*a*, Secchi disk transparency) for that ecoregion.
- **Minnesota Chloride Standards—**Because high concentrations of chloride can harm fish and plant life, the MPCA has established acute and chronic exposure chloride standards. A lake is considered impaired if two or more exceedances of chronic criterion (230 mg/L or less) occur within a three-year period or one exceedance of acute criterion (860 mg/L) is measured.
- **Minnesota Aquatic Plant Thresholds—**For aquatic plant monitoring, the NMCWD uses the Lake Plant Eutrophication Index of Biological Integrity (IBI) thresholds developed by the Minnesota Department of Natural Resources (MNDNR). The Lake Plant Eutrophication IBI includes two metrics to measure the response of a lake plant community to eutrophication. The first metric is species richness—the estimated number of species in a lake. The second metric is floristic quality index (FQI), which distinguishes the quality of the plant community and can be a reflection of the quantity of nutrients in the lake. Lakes that score below the thresholds contain degraded plant communities and are likely stressed from cultural eutrophication.
- **World Health Organization Cyanobacteria Thresholds—**Blue-green algae are associated with water quality problems and can be a source of health concerns due to the possible production of hepatotoxins and neurotoxins. The World Health Organization (WHO) has established thresholds for assessing the probability of adverse health effects to lake users from exposure to blue-green algae. The probability of adverse health effects ranges from low to high depending on the abundance of algae (cells/mL) and risk of whole-body contact or ingestion/aspiration.
- **Minnesota Cyanotoxin Levels for Swimming Advisories—**The MPCA has provided cyanobacteria (blue-green algae) cyanotoxin advisory recommendations for counties, cities, and other local government entities to consider closing swimming beaches or posting advisories/notices to residents. Recreational guidelines are provided for the following toxins: microcystin, cylindrospermopsin, and anatoxin-a. The District does not routinely monitor cyanotoxins, but did monitor cyanotoxins in Lake Cornelia in 2024 as part of a pilot program with the Minnesota Department of Health (MDH).

Table 2-2 Water quality standards and ecological thresholds used by the NMCWD to assess lake health

Type	Parameter	Shallow Lakes[1]	Deep Lakes
Water Quality	Total Phosphorus (summer average, µg/L)	≤ 60	≤ 40
	Chlorophyll-*a* (summer average, µg/L)	≤ 20	≤ 14
	Secchi Disk transparency (summer average, meters)	> 1.0	> 1.4
	Chloride (mg/L)	≤ 230 (chronic) ≤ 860 (acute)	
Aquatic Plants (macrophytes)	Species richness (number of species)	≥ 11	≥ 12
	Floristic Quality Index (FQI)	≥ 17.8	≥ 18.6
Blue-Green Algae (Cyanobacteria)	Low Probability of Adverse Health Effects (i.e., skin irritation, allergic effects are possible, cells/mL)	20,000 – 100,000	
	Moderate Probability of Adverse Health Effects (i.e., long term illness from algae toxins is possible, cells/mL)	> 100,000	
	High Probability of Adverse Health Effects (i.e., acute poisoning from algal toxins is possible)	Areas where whole body contact or ingestion/aspiration with scums could occur (qualitative observations only)	
Blue-Green Algae Cyanotoxins	Microcystin (µg/L)	≤ 6	
	Cylindrospermopsin (µg/L)	≤ 15	
	Anatoxin-a (µg/L)	≤ 7	

[1] Shallow lakes have a maximum depth less than 15 feet or littoral area greater than 80% of the total lake surface area

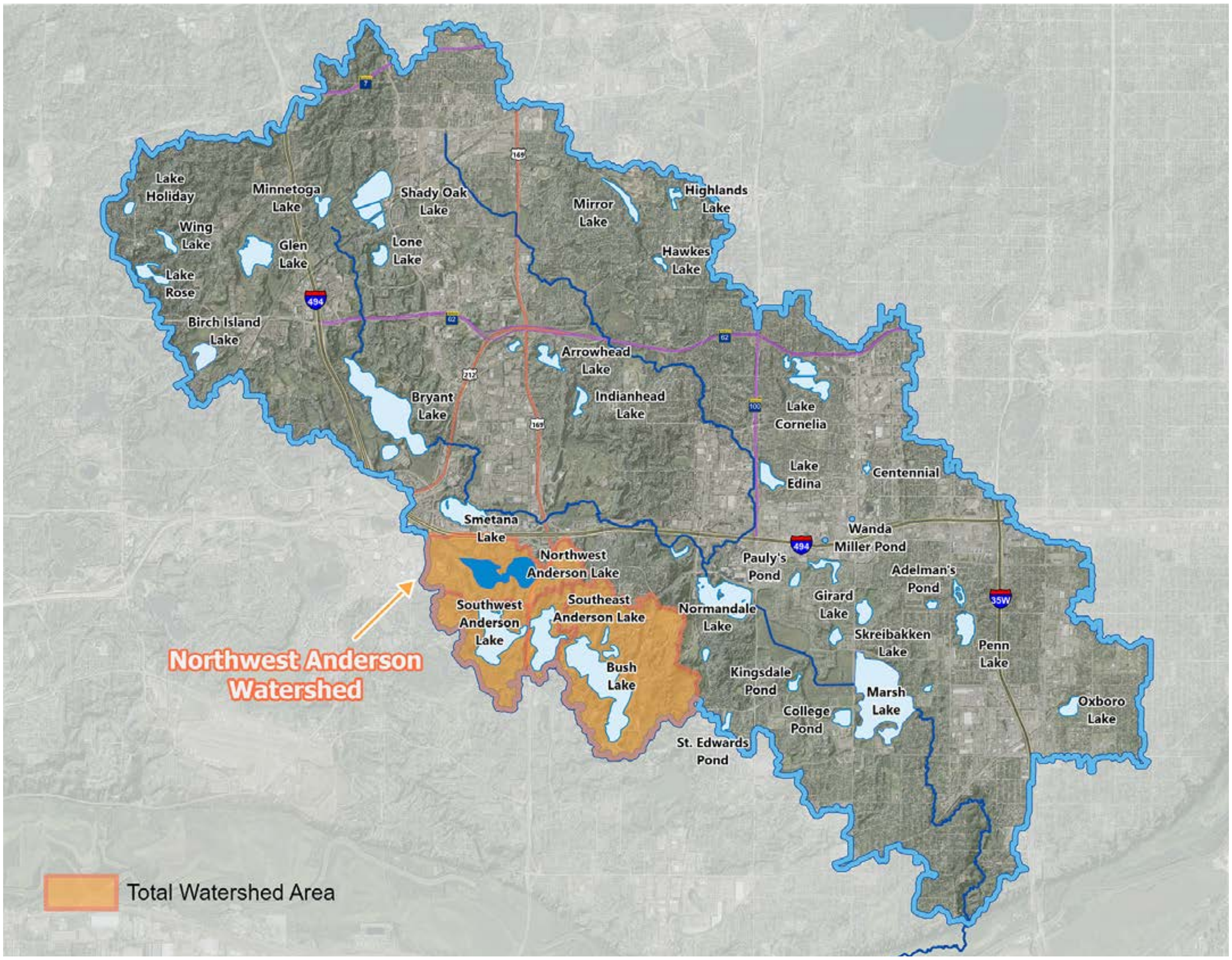
2.3 Northwest Anderson Lake

2024 MONITORED PARAMETERS

- **Water Quality**
- **Aquatic Plants (Macrophytes)**
- **Phytoplankton (Algae)**
- **Zooplankton**

APPENDICES: Maps showing aquatic plant survey results are included in Appendix A. Water quality, phytoplankton, and zooplankton monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Eden Prairie, Bloomington
Surface Area	185 acres
Average/Maximum Depth	4 feet / 10 feet
Direct Watershed Area	576 acres
Total Watershed Area	2,427 acres
Watershed: Surface Area	13:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Upstream Waterbody	Southwest Anderson
Downstream Waterbody	South Fork Nine Mile Creek



2.3.1 Water Quality Observations in Northwest Anderson Lake

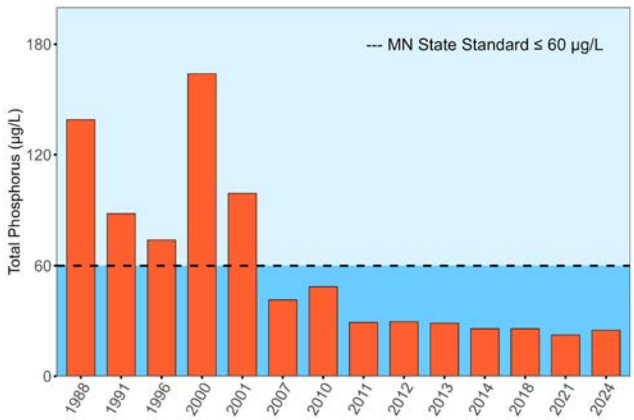
Northwest Anderson Lake is located in the cities of Eden Prairie and Bloomington and is used primarily for wildlife viewing. Northwest Anderson Lake is the most downstream of the Anderson Lakes. When water levels are high enough, water is pumped from Bush Lake to Southeast Anderson Lake, which discharges to Southwest Anderson Lake via gravity. Southwest Anderson Lake then discharges to Northwest Anderson Lake. Water from Northwest Anderson Lake flows under Interstate 494 through a storm sewer system and discharges to the South Fork of the Nine Mile Creek.

Northwest Anderson Lake has a water surface area of approximately 185 acres, a maximum depth of 10 feet, and a mean depth of approximately 4 feet. Northwest Anderson Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

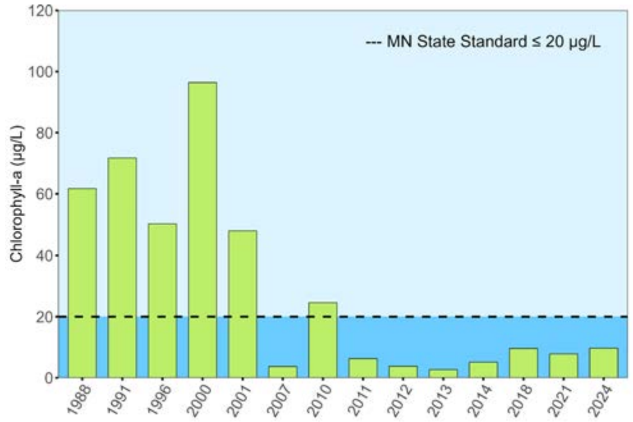
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Northwest Anderson Lake is not on the Minnesota impaired waters list.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Northwest Anderson Lake by the NMCWD during 1988, 1991, 1996, 2000, 2001, 2007, 2010–2014, 2018, 2021, and 2024. During the monitored years, summer average total phosphorus and chlorophyll-*a* concentrations, and Secchi depth failed to meet the MPCA standard prior to 2007, but met the standard during 2007 through 2024, except for the 2010 summer average chlorophyll-*a* concentration. Monitoring data indicate that the management activities completed as part of the Eden Prairie Lakes Water Quality Improvement Project between 2008 and 2014 have improved the lake's water quality. All water quality measurements after the completion of the water quality improvement project have met the state eutrophication standards for shallow lakes in the North Central Hardwood Forest Ecoregion.

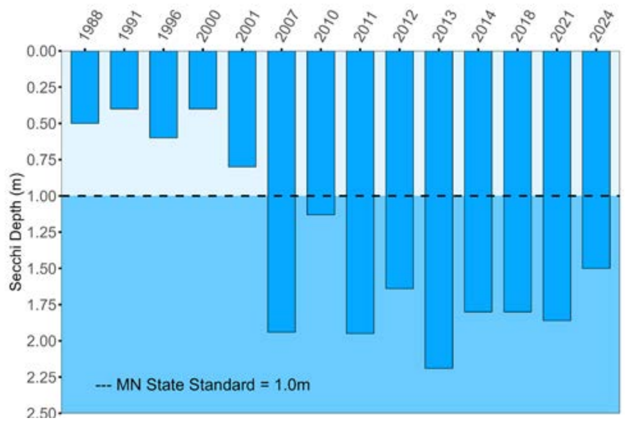
Chloride concentrations were measured by the NMCWD from 2010–2014 and in 2018, 2021, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. However, the 2024 monitored chloride concentrations in Northwest Anderson Lake were the highest observed on record. The highest observed chloride concentration was in April 2024 at 135 mg/L. The average chloride concentration between April and September 2024 was 126 mg/L.



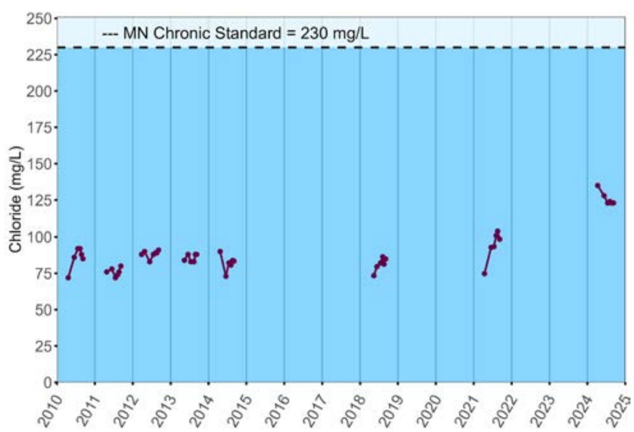
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Northwest Anderson Lake, the summer average total phosphorus concentrations have been better than the shallow lake state standard from 2007–2024. This is likely the result of water quality improvement projects that were implemented between 2008–2014. In 2024 the summer average total phosphorus concentration was 25 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Northwest Anderson Lake, the summer average chlorophyll-*a* concentrations have been better than the shallow lake state standard in 2007 and between 2011–2024. In 2024 the summer average chlorophyll-*a* concentration was 10 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Northwest Anderson Lake, the summer average Secchi disk transparency has been better than the shallow lake state standard from 2007–2024. In 2024 the summer average Secchi disk transparency was 1.5 meters.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Northwest Anderson Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. However, chloride concentrations in 2024 were the highest observed on record. The highest observed chloride concentration was 135 mg/L in April 2024. The average chloride concentration between April and September 2024 was 126 mg/L.

2.3.2 Water Quality Management Practices

The District completed a water quality study for the Anderson Lakes in 2005 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering the Anderson Lakes to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study in all three Anderson Lakes.

Management Practice	Basis	Year Implemented	Lead Agency
Upgrade Existing Stormwater Pond *Northwest Anderson*	Reduce pollutant loads entering Northwest Anderson from watershed runoff	2007	NMCWD
Lake Drawdown *Northwest and Southwest Anderson Lakes*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	Fall 2008 – Spring 2009	NMCWD
Herbicide Treatments *All Anderson Lakes*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions. Whole lake herbicide treatments performed on Southeast Anderson. Spot treatments on Northwest and Southwest Anderon (targeting areas not exposed during drawdown)	2009 – 2014	NMCWD
Alum Sediment Treatment *Southwest Anderson Lake*	Reduce internal sediment phosphorus load to Southwest Anderson Lake, which also reduces phosphorus inflows to Northwest Anderson Lake	2012	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	Ongoing	NMCWD

Lake Drawdown to manage curly-leaf pondweed on Northwest and Southwest Anderson Lakes. Herbicide treatments were applied to all Anderson Lakes following the drawdown.

Alum treatment on Southwest Anderson Lake. Reductions in nutrients from upstream lakes helps to reduce nutrient loading to downstream Northwest Anderson Lake.

2.3.3 Aquatic Plant Observations in Northwest Anderson Lake

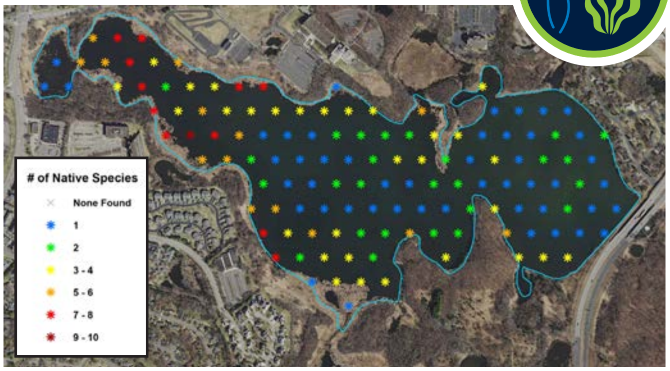
A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

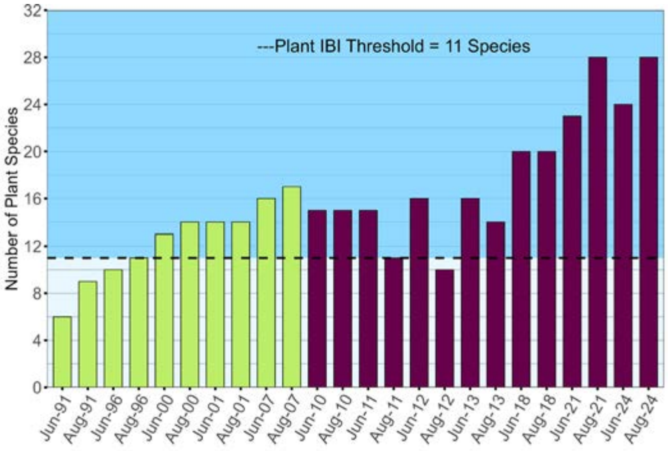
The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

The District conducted point intercept plant surveys of Northwest Anderson Lake in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix A. The following page provides a list of native plant species observed, summarizes their percent occurrence, and shows the locations native plants were found during the August survey. Graphs also summarize the historical plant IBI scores between 1991 and 2024, tracking how the plant health conditions have changed over time.

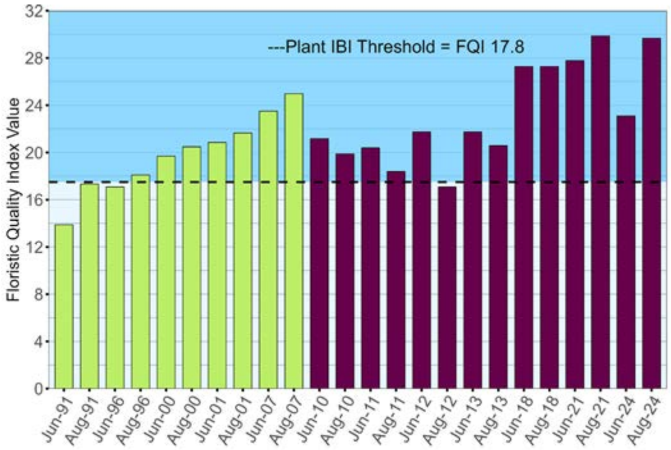
American Lotus on Northwest Anderson Lake

Native Plants	Common Name	% Occurrence in August 2024
All Plants (Combined) — Number of points with native plants: 130/130 sites		100%
Submerged Plants		
Lychnothamnus barbatus	Bearded stonewort	69%
Ceratophyllum demersum	Coontail	31%
Potamogeton zosteriformis	Flat-stem pondweed	21%
Elodea canadensis	Common waterweed	9%
Heteranthera dubia	Water star-grass	4%
Utricularia vulgaris	Common bladderwort	4%
Potamogeton pusillus	Small pondweed	2%
Potamogeton amplifolius	Large-leaf pondweed	2%
Potamogeton foliosus	Leafy pondweed	2%
Nitella sp.	Nitella	1%
Chara sp.	Muskgrasses	Visual Only
Najas flexilis	Slender naiad	Visual Only
Potamogeton nodosus	Long-leaf pondweed	Visual Only
Stuckenia pectinata	Sago pondweed	Visual Only
Vallisneria americana	Wild celery	Visual Only
Floating/Emergent Plants		
Nymphaea odorata	White water lily	36%
Lemna trisulca	Forked duckweed	35%
Spirodela polyrhiza	Large duckweed	17%
Wolffia columbiana	Common watermeal	11%
Lemna minor	Small duckweed	8%
Schoenoplectus tabernaemontani	Softstem bulrush	3%
Sagittaria latifolia	Common arrowhead	2%
Riccia fluitans	Slender riccia	2%
Eleocharis erythropoda	Bald spikerush	2%
Sparganium eurycarpum	Common bur-reed	2%
Sagittaria cristata	Crested arrowhead	1%
Schoenoplectus acutus	Hardstem bulrush	1%
Typha latifolia	Broad-leaved cattail	1%
Ricciocarpus natans	Purple-fringed riccia	1%
Polygonum amphibium,	Water smartweed	Visual Only
Bolboschoenus fluviatilis	River bulrush	Visual Only
Carex comosa	Bottle brush sedge	Visual Only
Nelumbo lutea	American lotus	Visual Only
Leersia oryzoides	Rice cut-grass	Visual Only





Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Since 2013 Northwest Anderson Lake has been experiencing an increasing trend in the number of plant species observed. This is likely due in part to the water quality and ecological improvement projects implemented since 2007.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. In 2024, Northwest Anderson Lake had FQI values that were well above the IBI threshold.

Note: purple bars indicate period following significant infestation of curly-leaf pondweed (CLP) and completion of a whole-lake drawdown (2008) and subsequent spring herbicide treatments (2009–2013) to reduce CLP prevalence.

Aquatic Invasive Plant Species

Four aquatic invasive plant species were found in Northwest Anderson Lake in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

Curly-leaf pondweed was collected on the rake at 3 locations (2.3% occurrence) and visually observed at 2 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.0 during the June survey. During the August survey, curly-leaf pondweed was not collected on a rake, which is typical for the plant's growth cycle.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the western shoreline in August among the cattails. Most purple loosestrife plants are managed naturally by Galerucella, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Reed canary grass (*Phalaris arundinaceae*)

Observed at one location along the southern shore in June and August.

Image source: Endangered Resources Services

Narrow-leaved cattail (*Typha angustifolia*)

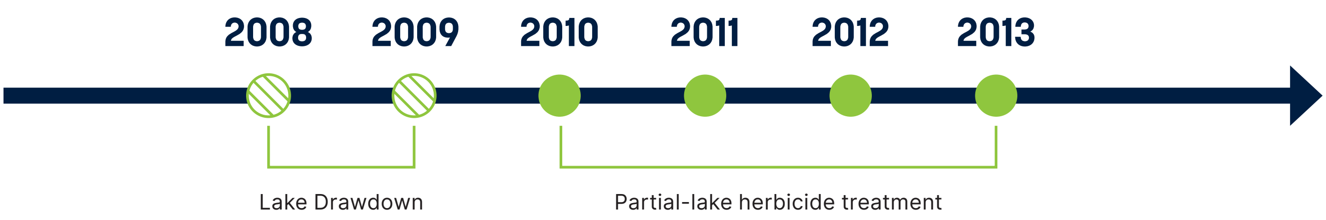
Dominant along the northern, western, and southern shorelines in June and August.

2.3.4 Aquatic Invasive Species (AIS) Plant Management Practices

A whole-lake drawdown was performed on Northwest Anderson Lake between fall 2008 and spring 2009 to manage the aquatic invasive plant species curly-leaf pondweed. The lake was drawn down to allow the lakebed to freeze over the winter. Curly-leaf pondweed primarily propagates through the production of dormant vegetative propagules called turions. Turions are produced in late spring, remain dormant in sediment through the summer, and germinate under cooler water conditions in the fall. A winter freeze can kill the turions, thus disrupting curly-leaf pondweed's reproductive cycle.

Following the lake drawdown, the NMCWD performed plant surveys and applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth. These tended to be lakebed areas that were not exposed to winter freeze conditions during the drawdown. Spot herbicide treatments were completed on Northwest Anderson Lake between 2010–2013.

NMCWD Management



While curly-leaf pondweed was found in Northwest Anderson in 2024, it was found at only a few locations and low densities.

2.3.5 Phytoplankton Observations in Northwest Anderson Lake

The phytoplankton community in Northwest Anderson Lake was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the next page summarizes the number and major groups of phytoplankton observed in Northwest Anderson Lake between June and September 2024. Blue-green algae (cyanobacteria) were the major taxon (or group) observed throughout the monitored period, representing 80% - 96% of the phytoplankton community between June and mid-August and 45% of the community in September. Green algae, golden algae, cryptomonads, haptophytes, and other taxa were also present throughout the monitored period but at notably lower percentages.

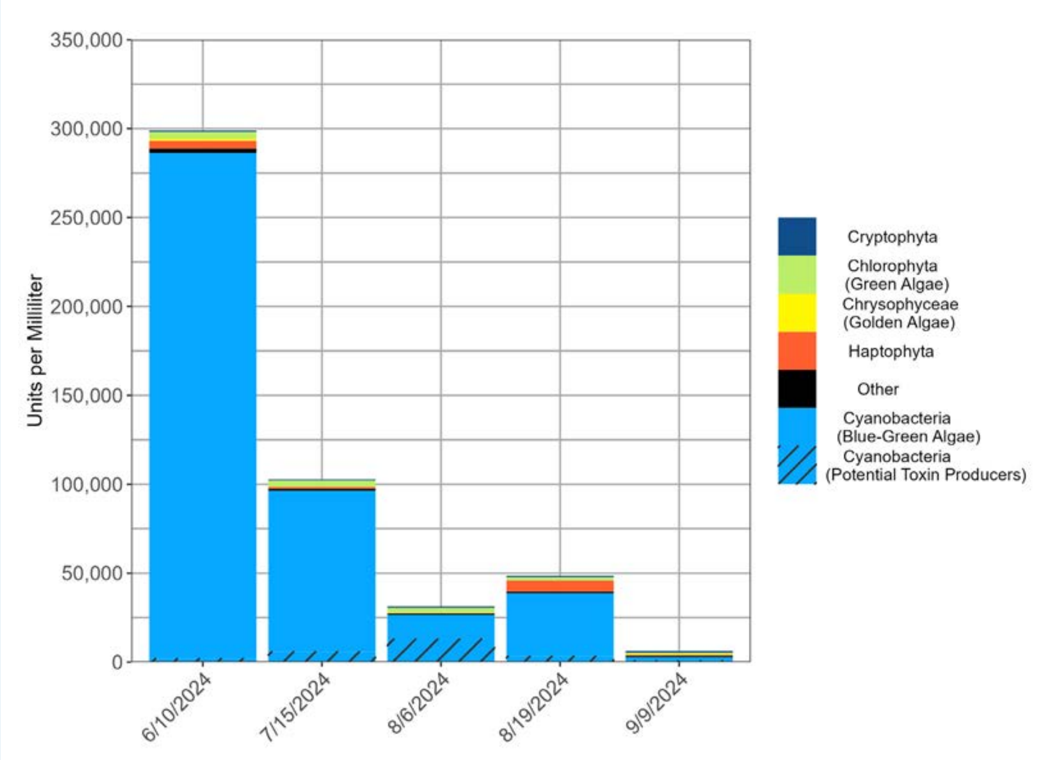
When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful since some species can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure. In 2024, a high abundance of blue-green algae was observed between mid-June and early August. However, only a small percentage of the blue-green algae species were potential toxin producing species. For example, in June less than one percent of the observed blue-green algae were species that have the potential to produce toxins. In June over 92% of the blue-green algae were a non-toxin producing, picoplankton species called Cyanocatena imperfecta. Picoplankton are very small photosynthetic phytoplankton of cell sizes between 0.2 and 2 µm. As such, even if there is a high abundance of picoplankton, the water column may still be noticeably clear. Monitoring in early August observed the highest number of potential toxin producing blue-green algae species at approximately 12,900 units per milliliter.

The abundance of blue-green algae observed in 2024 was notably higher than what has been observed in other monitored years within the last decade. However, this is largely due to the abundance of non-toxin producing picoplankton species. High blue-green algae abundance in 2024 occurred in the early portions of the summer, which was during noteworthy wet climatic conditions. It's possible that increased nutrients from stormwater runoff may have created favorable conditions for enhanced blue-green algae growth.

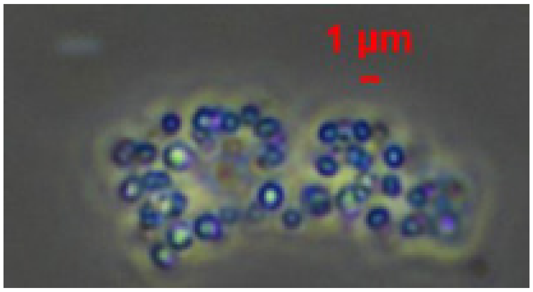
Phytoplankton

Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

Example of cyanobacteria (blue-green) algae scum



Between June and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure above summarizes the number and major groups of phytoplankton observed. Blue-green algae (cyanobacteria) were the most abundant taxon (or group) found in Northwest Anderson Lake throughout the monitored period with notably higher abundances observed in June and July. A large percentage of the blue-green algae species were non-toxic picoplankton, which are very small phytoplankton with cell sizes < 2um (smaller than the thickness of spider silk).



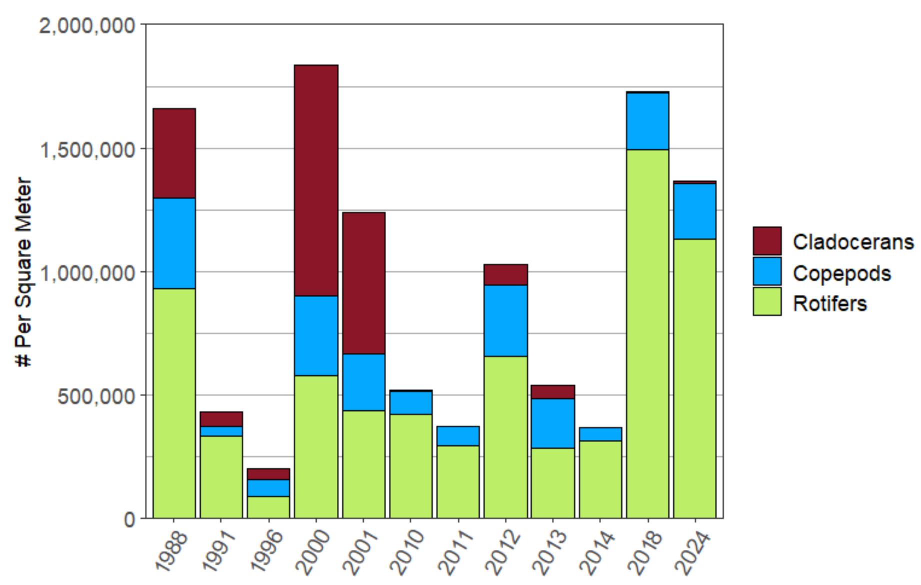
Microscopic image of Cyanocatena imperfecta, a picoplankton blue-green algae species from Northwest Anderson Lake. Picoplankton can be common in urban lakes with moderate to high nutrient concentrations and can seasonally cycle similar to other groups of algae.

(Source GreenWater Laboratories)

2.3.6 Zooplankton observations in Northwest Anderson Lake

Zooplankton are microscopic aquatic animals that drift and move throughout the lake water column. They play major roles in the aquatic food web by consuming algae and are primary food sources for larger organisms such as fish. The zooplankton community in Northwest Anderson Lake was monitored periodically between 1988 and 2024 to help evaluate water quality and the quality of food available to fish. Fish preference for certain groups of zooplankton can vary depending on the fish species, fish age, and the lake habitat. Copepods can have high protein content making them a nutritious option for certain fish species. Cladocerans tend to be larger in size (i.e., a more substantial food source) and can be relatively easy to capture due to their slower movements. Rotifers are generally smaller in size and provide less nutritional value compared to cladocerans and copepods. While adult fish often prefer larger prey that offer more energy and nutrients per capture, rotifers are still consumed by many fish species, particularly when other food sources are scarce. Additionally, the smaller size of rotifiers may be attractive to young, larval fish species.

The figure below summarizes the historical summer averages of the major groups of zooplankton observed in Northwest Anderson Lake. Since 1988, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable. Rotifers have typically been the most abundant. The summer average quantity of rotifers ranges from 32%–86% of the observed species. Copepods have typically been the second most abundant and represent approximately 10%–37% of the observed species based on summer average concentrations. Cladocerans are typically the least abundant group observed in the historical record. Besides 2000 and 2001, the summer average quantity of cladocerans were less than 25% of the observed species, ranging from 0%–23%. Higher abundances of cladocerans were observed in 2000 and 2001, where the summer average abundance of cladocerans represented 46% and 51% of the observed species, respectively.



Water fleas (Daphnia, Cladocera) are a popular prey option for fish in lakes.

2.3.7 Summary for Northwest Anderson Lake

Monitoring between 2011–2024 shows that Northwest Anderson Lake has consistently met the state water quality standards for shallow lakes for all three eutrophication parameters. This is likely the result of water quality improvement projects that were implemented between 2008–2014. In 2024 phosphorus and chlorophyll-*a* concentrations were well below state standards and Secchi disk transparency showed high clarity conditions that were better than state standards. Historical chloride concentrations have never exceeded the MPCA chronic standard. However, the 2024 monitored chloride concentrations in Northwest Anderson Lake were the highest observed on record.

Since 2013 Northwest Anderson Lake has been experiencing an increasing trend in the number of plant species observed. In 2024, a total of 24 and 28 species, either submerged, floating, or emergent, were observed in the June and August plant surveys, respectively. The number of species observed in 2024 were well above the MNDNR Plant IBI threshold of 11 species. The FQI values ranged between 23.1–29.7 and were also well above the MNDNR Plant IBI threshold of 17.8.

Four invasive aquatic plant species were observed in Northwest Anderson Lake in 2024 including the submerged species curly-leaf pondweed and the emergent species narrow-leaved cattail, purple loosestrife, and reed canary grass. A whole-lake drawdown was performed on Northwest Anderson Lake between fall 2008 and spring 2009 to manage curly-leaf pondweed. The lake was drawn down to allow the lakebed to freeze over the winter to reduce the viability of turions and disrupt the plant's reproductive cycle. Following the lake drawdown, the NMCWD applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth between 2010–2013. While curly-leaf pondweed was found in Northwest Anderson in 2024, it was found at only a few locations and low densities.

In 2024, a higher abundance of blue-green algae was observed between mid-June and early August, although only a small percentage of the blue-green algae species were potential toxin producing species. In June over 92% of the blue-green algae were a non-toxin producing, picoplankton species called Cyanocatena imperfecta. Picoplankton are very small photosynthetic phytoplankton of cell sizes between 0.2 and 2 µm. As such, even if there is a high abundance of picoplankton, the water column may still be noticeably clear.

Zooplankton were monitored in 2024, and similar to previous monitored years, rotifers were the most abundant, followed by copepods, and then cladocerans.

The District completed a water quality study of the Anderson Lakes in 2005 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. Several management practices have been implemented since the water quality study was completed, including an alum sediment treatment on Southwest Anderson Lake, upgrades to an existing stormwater pond, aquatic invasive species plant management, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program.

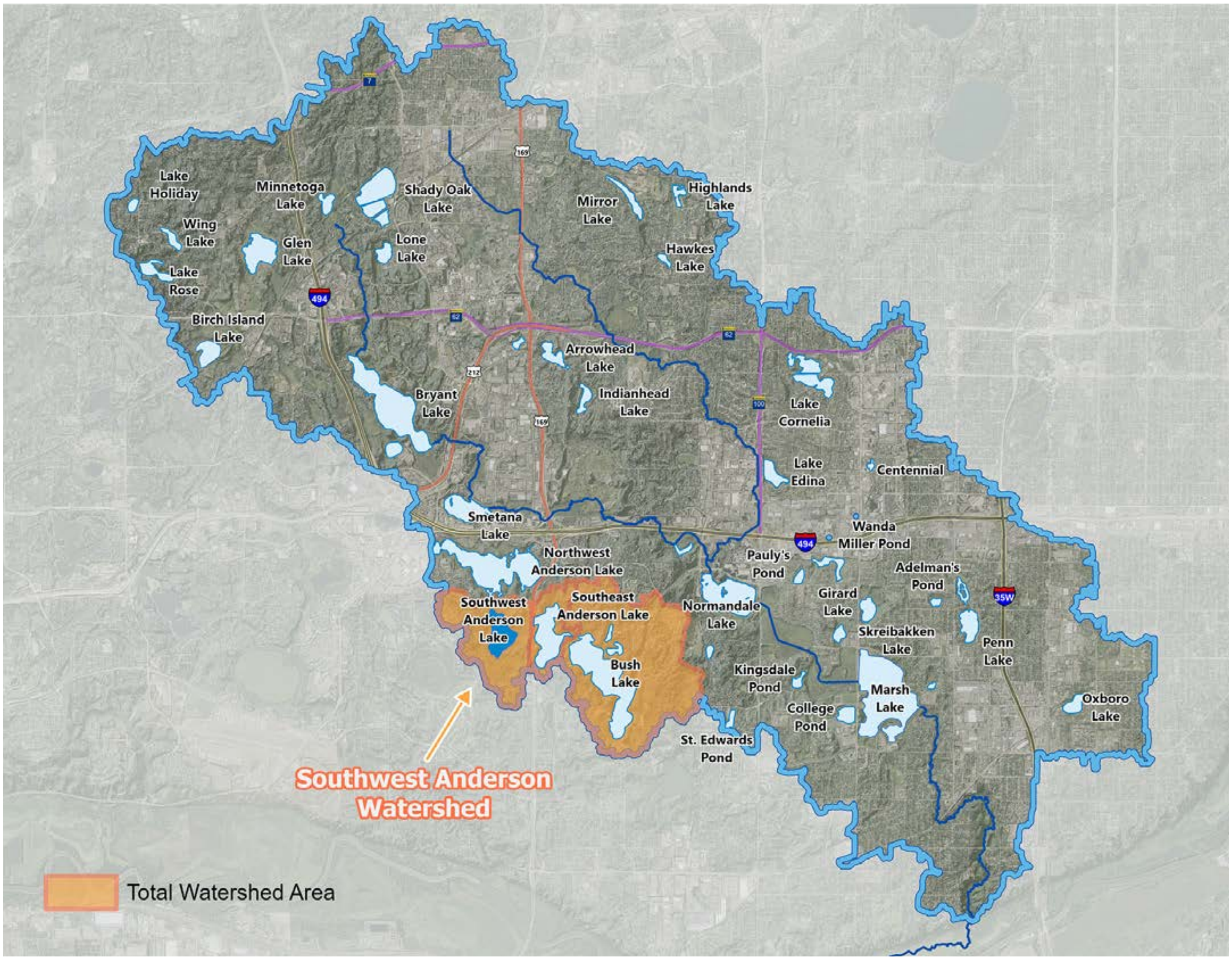
2.4 Southwest Anderson Lake

2024 MONITORED PARAMETERS

- **Water Quality**
- **Aquatic Plants (Macrophytes)**
- **Phytoplankton (Algae)**
- **Zooplankton**

APPENDICES: Maps showing aquatic plant survey results are included in Appendix B. Water quality, phytoplankton, and zooplankton monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Eden Prairie
Surface Area	110 acres
Average/Maximum Depth	4 feet / 8 feet
Direct Watershed Area	453 acres
Total Watershed Area	1,851 acres
Watershed: Surface Area	17:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Upstream Waterbody	Southeast Anderson
Downstream Waterbody	Northwest Anderson



2.4.1 Water Quality Observations in Southwest Anderson Lake

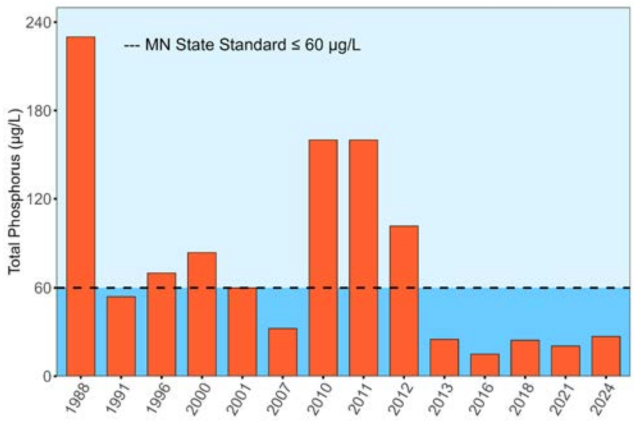
Southwest Anderson Lake is located in the City of Eden Prairie and is used primarily for wildlife viewing. When water levels are high enough, water is pumped from Bush Lake to Southeast Anderson Lake, which discharges to Southwest Anderson Lake via gravity. Southwest Anderson Lake then discharges to Northwest Anderson Lake. Water from Northwest Anderson Lake flows under Interstate 494 through a storm sewer system and discharges to the South Fork of the Nine Mile Creek.

Southwest Anderson Lake has a water surface area of approximately 110 acres, a maximum depth of 8 feet, and a mean depth of approximately 4 feet. Southwest Anderson Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

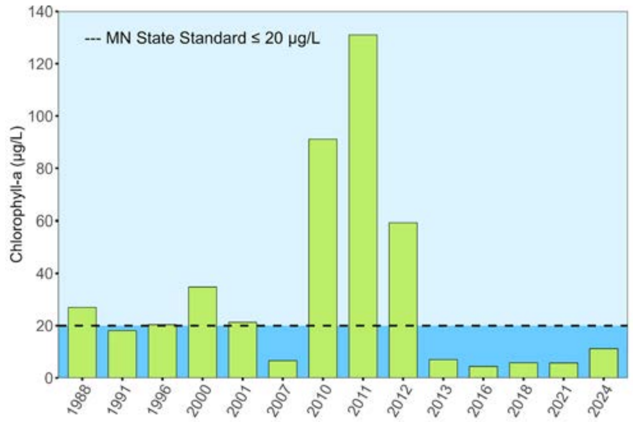
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Southwest Anderson Lake is not on the Minnesota impaired waters list.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Southwest Anderson Lake by the NMCWD during 1988, 1991, 1996, 2000, 2001, 2007, 2010–2014, 2018, 2021, and 2024. Since 2013, the summer average total phosphorus and chlorophyll-*a* concentrations and Secchi depth have been better than the state eutrophication standards for shallow lakes in the North Central Hardwood Forest Ecoregion. This indicates that the management activities completed as part of the Eden Prairie Lakes Water Quality Improvement Project between 2008 and 2014 improved the lake's water quality.

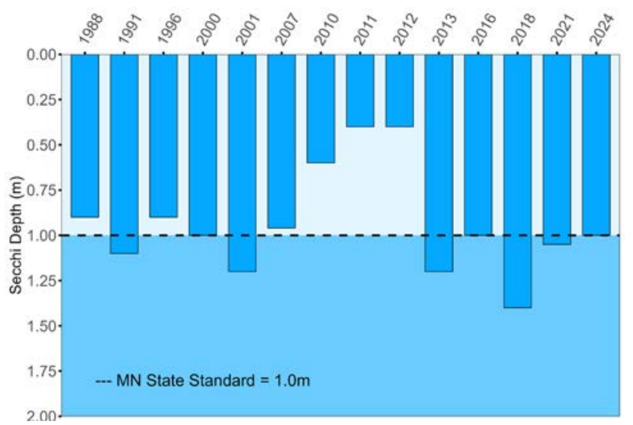
Chloride concentrations were measured by the NMCWD from 2010–2014 and in 2016, 2018, 2021, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. The highest observed chloride concentration was in April 2024 at 68 mg/L. The average chloride concentration between April and September 2024 was 54 mg/L.



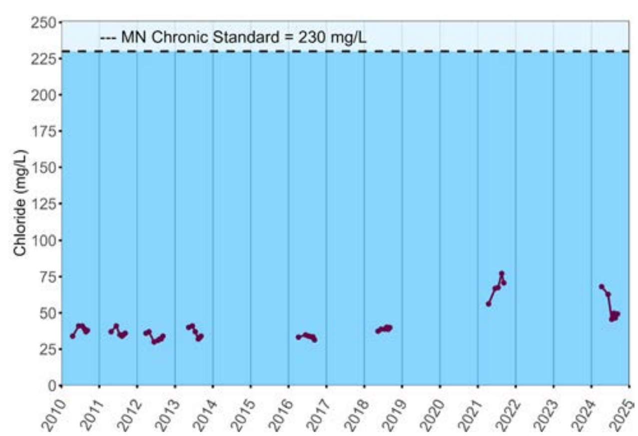
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Southwest Anderson Lake, the summer average total phosphorus concentrations have been better than the shallow lake state standard in 1991, 2001, 2007, and years monitored between 2013–2024. Improved phosphorus concentrations in the last decade are likely the result of water quality improvement projects implemented between 2008–2014. In 2024 the summer average total phosphorus concentration was 27 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Southwest Anderson Lake, the summer average chlorophyll-*a* concentrations have been better than the shallow lake state standard in 1991, 2007, and years monitored between 2013–2024. In 2024 the summer average chlorophyll-*a* concentration was 11 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Southwest Anderson Lake, the summer average Secchi disk transparency has met or been better than the shallow lake state standard in 1991, 2000, 2001, and years monitored between 2013–2024. In 2024 the summer average Secchi disk transparency was 1.0 meter.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Southwest Anderson Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. In 2024, the highest observed chloride concentration was 68 mg/L in April. The average chloride concentration between April and September 2024 was 54 mg/L.

2.4.2 Water Quality Management Practices

The District completed a water quality study for the Anderson Lakes in 2005 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering the Anderson Lakes to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study in all three Anderson Lakes.

Management Practice	Basis	Year Implemented	Lead Agency
Upgrade Existing Stormwater Pond *Northwest Anderson*	Reduce pollutant loads entering Northwest Anderson from watershed runoff	2007	NMCWD
Lake Drawdown *Northwest and Southwest Anderson Lakes*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	Fall 2008 – Spring 2009	NMCWD
Herbicide Treatments *All Anderson Lakes*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions. Whole lake herbicide treatments performed on Southeast Anderson. Spot treatments on Northwest and Southwest Anderon (targeting areas not exposed during drawdown)	2009 – 2014	NMCWD
Alum Sediment Treatment *Southwest Anderson Lake*	Reduce internal sediment phosphorus load to Southwest Anderson Lake, which also reduces phosphorus inflows to Northwest Anderson Lake	2012	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2008 – Ongoing	NMCWD

Lake drawdown to manage curly-leaf pondweed on Northwest and Southwest Anderson Lakes. Herbicide treatments were applied to all Anderson Lakes following the drawdown.

Alum treatment on Southwest Anderson Lake.

2.4.3 Aquatic Plant Observations in Southwest Anderson Lake

A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

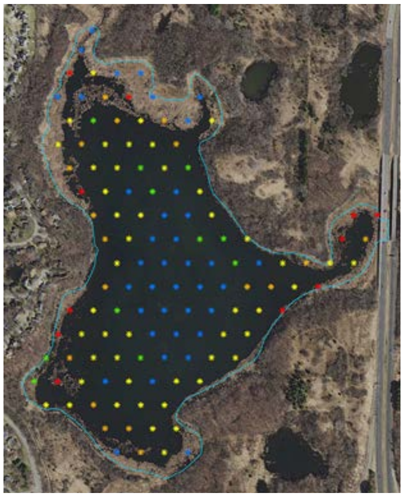
The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

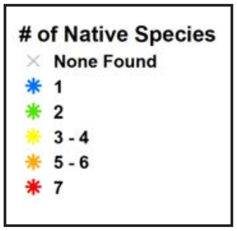
The District conducted point intercept plant surveys of Southwest Anderson Lake in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix B. The following page provides a list of native plant species observed, summarizes their percent occurrence, and shows the locations native plants were found during the August survey. Graphs also summarize the historical plant IBI scores between 1991 and 2024, tracking how the plant health conditions have changed over time.

Bearded stonewort in Southwest Anderson Lake

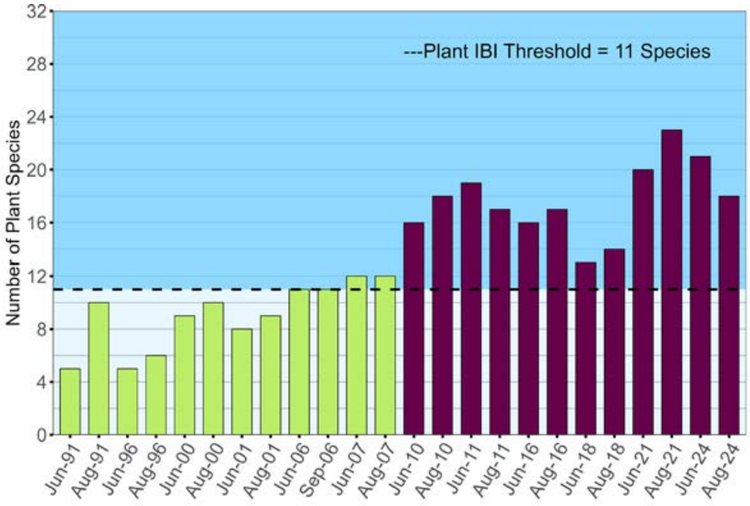
Native Plants	Common Name	% Occurrence in August 2024
All Plants (Combined) — Number of points with native plants: 125/125 sites		100%
Submerged Plants		
Ceratophyllum demersum	Coontail	60%
Lychnothamnus barbatus	Bearded stonewort	37%
Potamogeton zosteriformis	Flat-stem pondweed	26%
Elodea canadensis	Common waterweed	18%
Heteranthera dubia	Water star-grass	4%
Najas flexilis	Slender naiad	1%
Potamogeton foliosus	Leafy pondweed	1%
Stuckenia pectinata	Sago pondweed	1%
Utricularia vulgaris	Common bladderwort	Visual Only
Floating/Emergent Plants		
Lemna trisulca	Forked duckweed	49%
Nymphaea odorata	White water lily	38%
Lemna minor	Small duckweed	17%
Spirodela polyrhiza	Large duckweed	17%
Wolffia columbiana	Common watermeal	17%
—	Filamentous algae	11%
Nelumbo lutea	American lotus	10%
Sagittaria latifolia	Common arrowhead	2%
Riccia fluitans	Slender riccia	1%
Ricciocarpus natans	Purple-fringed riccia	1%
Brasenia schreberi	Watershield	Visual Only
Nuphar variegata	Spatterdock	Visual Only
*Hydrocotyle ranunculoides**	Floating pennywort*	Visual Only

* Floating pennywort is native to the United States, but not to the state of Minnesota. Its growth patterns are being monitored by the MNDNR.

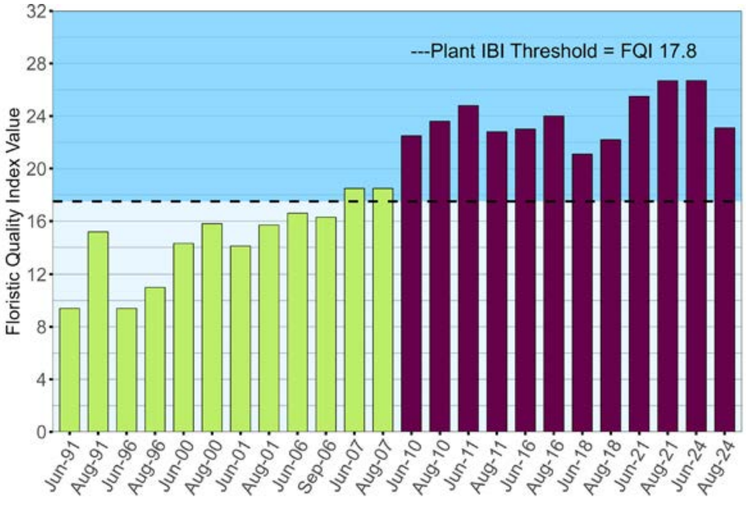




Number of native plant species observed at each observation point in Southwest Anderson Lake in August 2024.



Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Since 2007 the number of plant species observed in Southwest Anderson Lake has exceeded the MNDNR Plant IBI threshold of 11 species. This is likely due in part to the water quality and ecological improvement projects implemented since 2007.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. In 2024, Southwest Anderson Lake had FQI values that were well above the IBI threshold.

Note: purple bars indicate period following significant infestation of curly-leaf pondweed (CLP) and completion of a whole-lake drawdown (2008) and subsequent spring herbicide treatments (2010–2011) to reduce CLP prevalence.

Aquatic Invasive Plant Species

Two aquatic invasive plant species were found in Southwest Anderson Lake in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

Curly-leaf pondweed was collected on the rake at 4 locations (3.2% occurrence) and visually observed at 1 location in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.0 during the June survey. During the August survey, curly-leaf pondweed was not collected on a rake, which is typical for the plant's growth cycle.

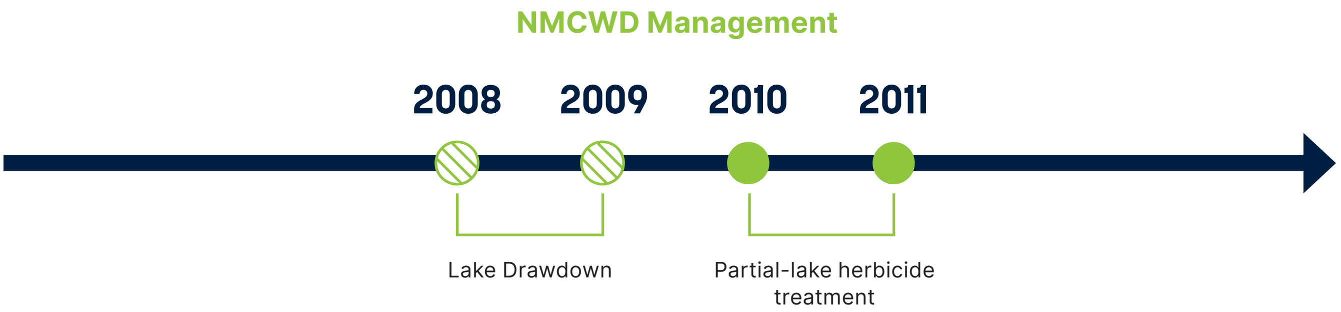
Narrow-leaved cattail (*Typha angustifolia*)

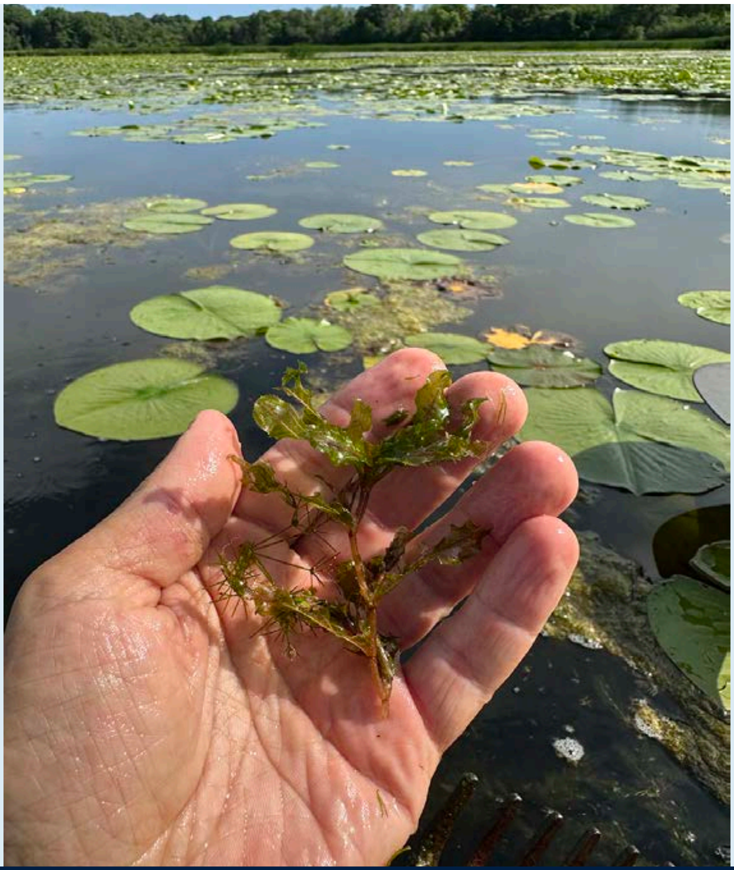
Dominant along the northern, eastern, and southern shorelines in June and August.

2.4.4 Aquatic Invasive Species (AIS) Plant Management Practices

A whole-lake drawdown was performed on Southwest Anderson Lake between fall 2008 and spring 2009 to manage the aquatic invasive plant species curly-leaf pondweed. The lake was drawn down to allow the lakebed to freeze over the winter. Curly-leaf pondweed primarily propagates through the production of dormant vegetative propagules called turions. Turions are produced in late spring, remain dormant in sediment through the summer, and germinate under cooler water conditions in the fall. A winter freeze can kill the turions, thus disrupting curly-leaf pondweed's reproductive cycle.

Following the lake drawdown, the NMCWD performed plant surveys and applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth. These tended to be lakebed areas that were not exposed to winter freeze conditions during the drawdown. Spot herbicide treatments were completed on Southwest Anderson Lake between 2010–2011.





While curly-leaf pondweed was found in Southwest Anderson in 2024, it was found at only a few locations and low densities.

2.4.5 Phytoplankton Observations in Southwest Anderson Lake

The phytoplankton community in Southwest Anderson Lake was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the following page summarizes the number and major groups of phytoplankton observed in Southwest Anderson Lake between June and September 2024. The dominant taxon (or group) was variable throughout the monitoring period. Haptophytes were the major taxon observed in June, while blue-green algae (cyanobacteria) were the major taxon observed in July and early August. Cryptomonads and blue-green algae were both major taxa observed in late August and in mid-September the major taxon observed was the golden algae (chrysophyceae). Green algae and other taxa were also present throughout the monitored period but at notably lower percentages.

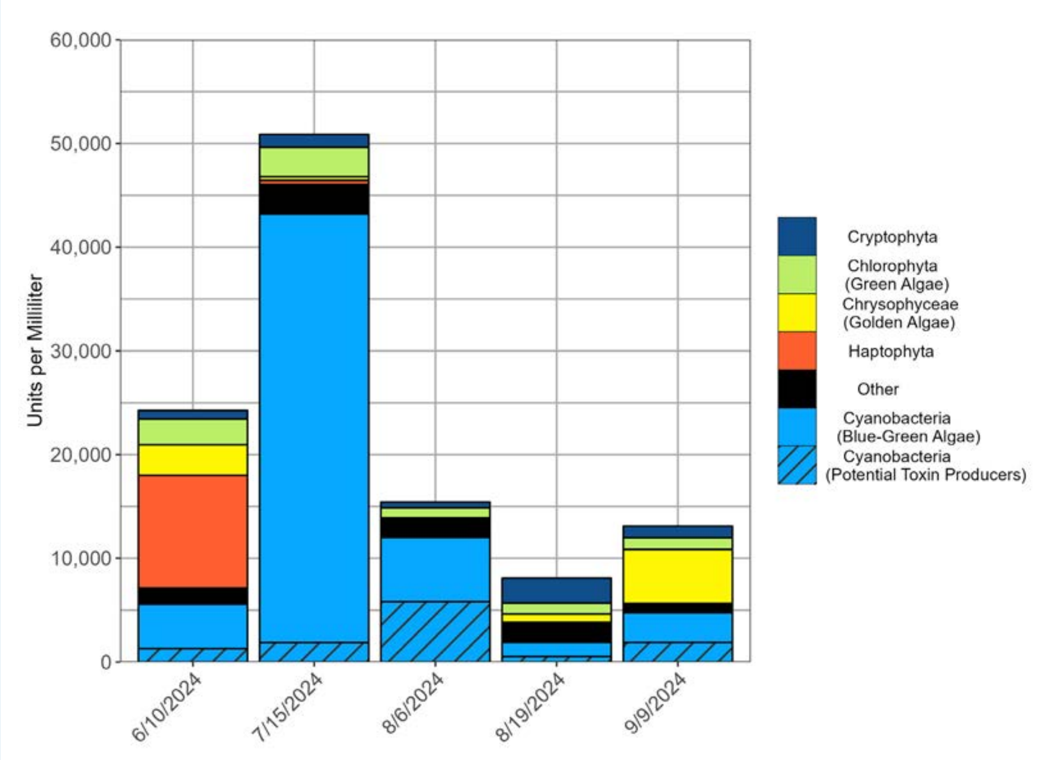
When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful since some species can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure. In 2024, a high abundance of blue-green algae was observed between July and early August. However, only a portion of the blue-green algae species were potential toxin producing species. For example, in June less than five percent of the observed blue-green algae were species that have the potential to produce toxins. In July over 53% of the blue-green algae were a non-toxin producing, picoplankton species called *Cyanogranis irregularis*. Picoplankton are very small photosynthetic phytoplankton of cell sizes between 0.2 and 2 µm. As such, even if there is a high abundance of picoplankton, the water column may still be noticeably clear. Monitoring in early August observed the highest number of potential toxin producing blue-green algae species at approximately 5,800 units per milliliter.

The abundance of blue-green algae observed in 2024 was notably higher than observations from other monitored years within the last decade. However, this is largely due to the abundance of non-toxin producing picoplankton species. High blue-green algae abundance in 2024 occurred in the early portions of the summer, which was during noteworthy wet climatic conditions. It's possible that increased nutrients from stormwater runoff may have created favorable conditions for enhanced blue-green algae growth.

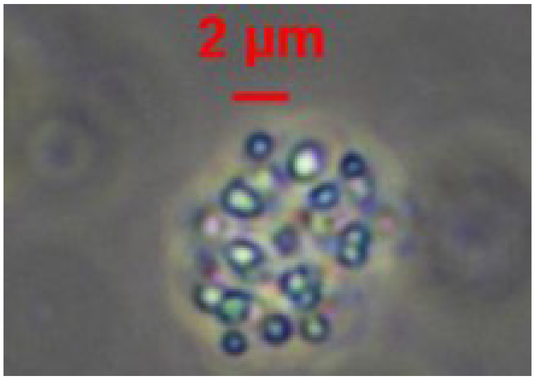
Phytoplankton

Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

Example of cyanobacteria (blue-green) algae scum



Between June and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure above summarizes the number and major groups of phytoplankton observed. Blue-green algae (cyanobacteria) were the most abundant taxon (or group) found in Southwest Anderson Lake in July and early August. A large percentage of the blue-green algae species were non-toxic picoplankton, which are very small phytoplankton with cell sizes < 2um (smaller than the thickness of spider silk).



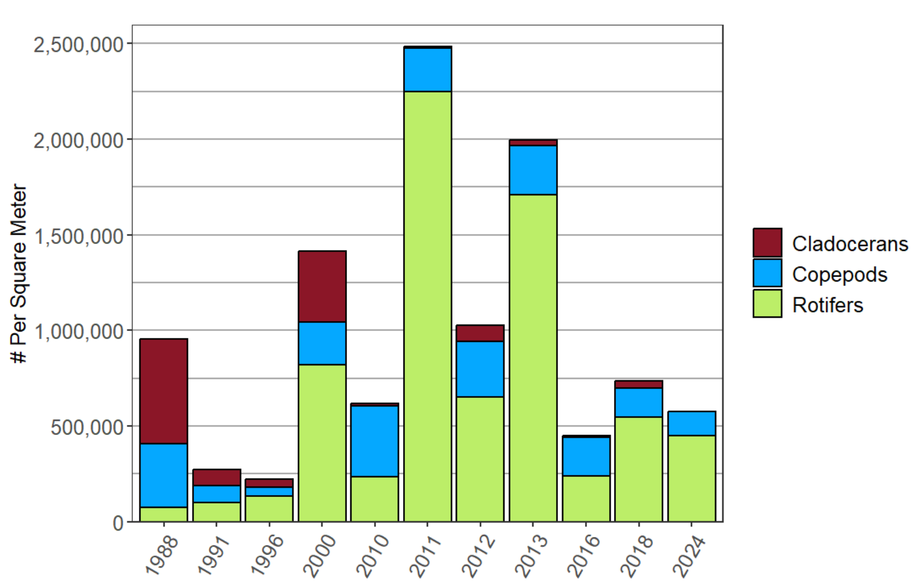
Microscopic image of Cyanogranis irregularis, a picoplankton blue-green algae species from Southwest Anderson Lake. Picoplankton can be common in urban lakes with moderate to high nutrient concentrations and can seasonally cycle similar to other groups of algae.

(Source GreenWater Laboratories)

2.4.6 Zooplankton observations in Southwest Anderson Lake

Zooplankton are microscopic aquatic animals that drift and move throughout the lake water column. They play major roles in the aquatic food web by consuming algae and are primary food sources for larger organisms such as fish. The zooplankton community in Southwest Anderson Lake was monitored periodically between 1988 and 2024 to help evaluate water quality and the quality of food available to fish. Fish preference for certain groups of zooplankton can vary depending on the fish species, fish age, and the lake habitat. Copepods can have high protein content making them a nutritious option for certain fish species. Cladocerans tend to be larger in size (i.e., a more substantial food source) and can be relatively easy to capture due to their slower movements. Rotifers are generally smaller in size and provide less nutritional value compared to cladocerans and copepods. While adult fish often prefer larger prey that offer more energy and nutrients per capture, rotifers are still consumed by many fish species, particularly when other food sources are scarce. Additionally, the smaller size of rotifiers may be attractive to young, larval fish species.

The figure below summarizes the historical summer averages of the major groups of zooplankton observed in Southwest Anderson Lake. Since 1988, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable. Rotifers have typically been the most abundant, especially in the last 20 years. Between 2010–2024 the summer average quantity of rotifers ranged from 38%–91% of the observed species. Copepods have typically been the second most abundant and between 2010–2024 represented approximately 9%–60% of the observed species based on summer average concentrations. Since 2000 cladocerans are typically the least abundant group observed in the historical record. Between 2010–2024, the summer average quantity of cladocerans ranged from 0%–8%. Higher abundances of cladocerans were observed between 1988–2000, where the summer average abundance of cladocerans ranged between 19%–58% of the observed species.



Water fleas (Daphnia, Cladocera) are a popular prey option for fish in lakes.

2.4.7 Summary for Southwest Anderson Lake

Monitoring between 2013–2024 shows that Southwest Anderson Lake has consistently met the state water quality standards for shallow lakes for all three eutrophication parameters. This is likely the result of water quality improvement projects that were implemented between 2008–2014. In 2024 phosphorus and chlorophyll-*a* concentrations were well below state standards and Secchi disk transparency met the state standard. Historical chloride concentrations have never exceeded the MPCA chronic standard.

Since 2007 the number of plant species observed in Southwest Anderson Lake has been above the MNDNR Plant IBI threshold of 11 species. In 2024, a total of 21 and 18 species, either submerged, floating, or emergent, were observed in the June and August plant surveys, respectively. The FQI values ranged between 23.1–26.7 and were well above the MNDNR Plant IBI threshold of 17.8.

Two invasive aquatic plant species were observed in Southwest Anderson Lake in 2024 including the submerged species curly-leaf pondweed and the emergent species narrow-leaved cattail. A whole-lake drawdown was performed on Southwest Anderson Lake between fall 2008 and spring 2009 to manage curly-leaf pondweed. The lake was drawn down to allow the lakebed to freeze over the winter to reduce the viability of turions and disrupt the plant's reproductive cycle. Following the lake drawdown, the NMCWD applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth between 2010–2011. While curly-leaf pondweed was found in Southwest Anderson in 2024, it was found at only a few locations and low densities.

In 2024, a higher abundance of blue-green algae was observed between July and early August, although only a small percentage of the blue-green algae species were potential toxin producing species. In July over 53% of the blue-green algae were a non-toxin producing, picoplankton species called *Cyanogranis irregularis*. Picoplankton are very small photosynthetic phytoplankton of cell sizes between 0.2 and 2 µm. As such, even if there is a high abundance of picoplankton, the water column may still be noticeably clear.

Zooplankton were monitored in 2024, and similar to previous monitored years, rotifers were the most abundant, followed by copepods, and then cladocerans.

The District completed a water quality study of the Anderson Lakes in 2005 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. Several management practices have been implemented since the water quality study was completed, including an alum sediment treatment on Southwest Anderson Lake, upgrades to an existing stormwater pond, aquatic invasive species plant management, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program.

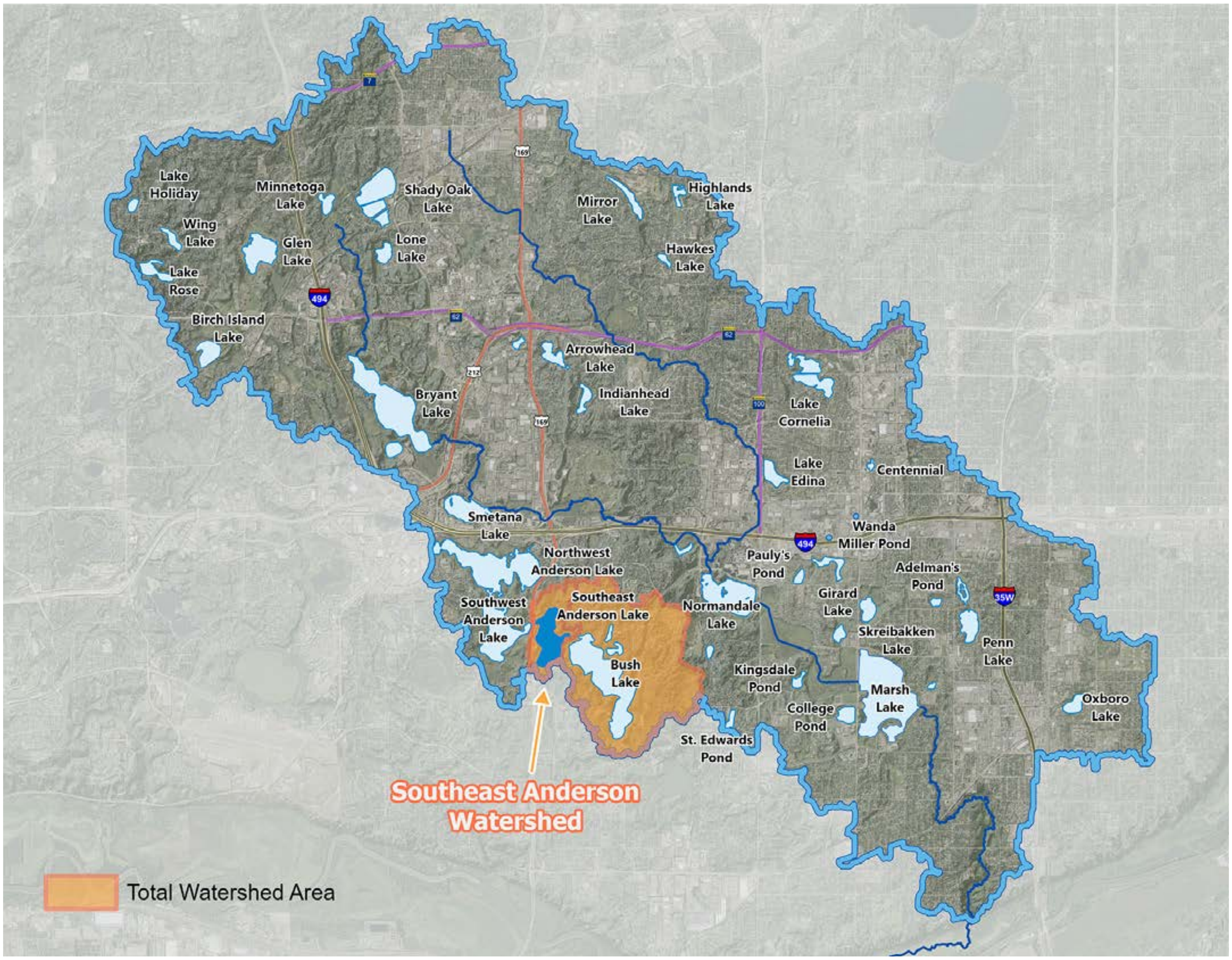
2.5 Southeast Anderson Lake

2024 MONITORED PARAMETERS

- **Water Quality**
- **Aquatic Plants (Macrophytes)**
- **Phytoplankton (Algae)**
- **Zooplankton**

APPENDICES: Maps showing aquatic plant survey results are included in Appendix C. Water quality, phytoplankton, and zooplankton monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Bloomington
Surface Area	81 acres
Average/Maximum Depth	4.7 feet / 9 feet
Direct Watershed Area	206 acres
Total Watershed Area	1,398 acres
Watershed: Surface Area	17:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Upstream Waterbody	Bush Lake (when pumped)
Downstream Waterbody	Southwest Anderson



2.5.1 Water Quality Observations in Southeast Anderson Lake

Southeast Anderson Lake is located in the City of Bloomington and is used primarily for wildlife viewing. When water levels are high enough, water is pumped from Bush Lake to Southeast Anderson Lake, which discharges to Southwest Anderson Lake via gravity. Southwest Anderson Lake then discharges to Northwest Anderson Lake. Water from Northwest Anderson Lake flows under Interstate 494 through a storm sewer system and discharges to the South Fork of the Nine Mile Creek.

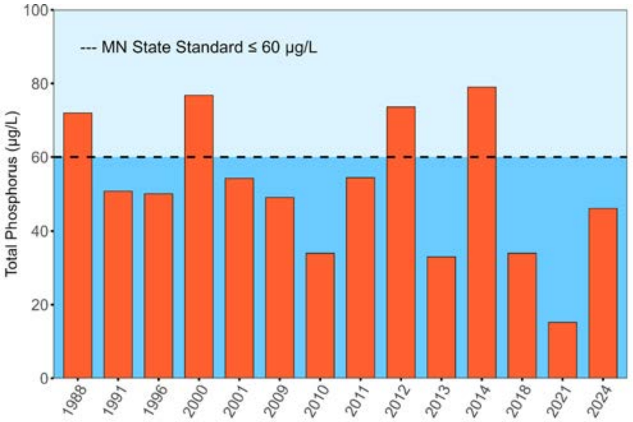
Southeast Anderson Lake has a water surface area of approximately 81 acres, a maximum depth of 9 feet, and a mean depth of approximately 4.7 feet. Southeast Anderson Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Southeast Anderson Lake is not on the Minnesota impaired waters list.

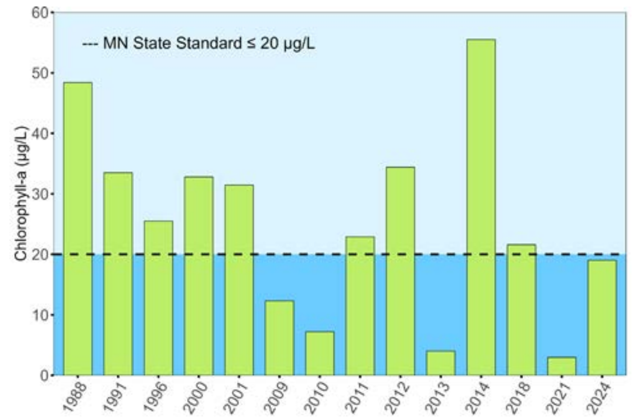
The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Southeast Anderson Lake by the NMCWD during 1988, 1991, 1996, 2000, 2001, 2009–2014, 2018, 2021, and 2024. Throughout the historical record the years that Southeast Anderson Lake met the state eutrophication standards for shallow lakes in the North Central Hardwood Forest Ecoregion was variable. Monitored years between 2018–2024 indicated that total phosphorus concentrations and Secchi disk transparency were better than the state eutrophication standards. Chlorophyll-*a* concentrations were better than the state standards in both 2021 and 2024.

In June and July 2024, total phosphorus concentrations were higher at the bottom of the lake than at the surface. Based on the monitored parameters, higher concentrations at the bottom are due in part to a higher abundance of algae near the lake bottom. It’s also possible that degrading curly-leaf pondweed plants could cause an increase in particulates monitored near the lake bottom during this period.

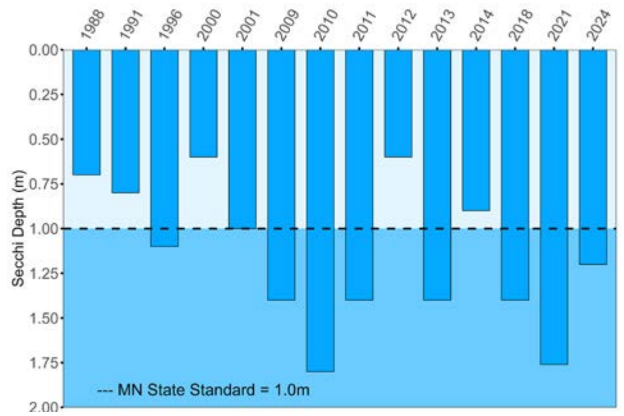
Chloride concentrations were measured by the NMCWD from 2009-2014 and in 2016, 2018, 2021, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. However, the 2024 monitored chloride concentrations in Southeast Anderson Lake were the highest observed on record. The highest observed chloride concentration was in April 2024 at 132 mg/L. The average chloride concentration between April and September 2024 was 116 mg/L.



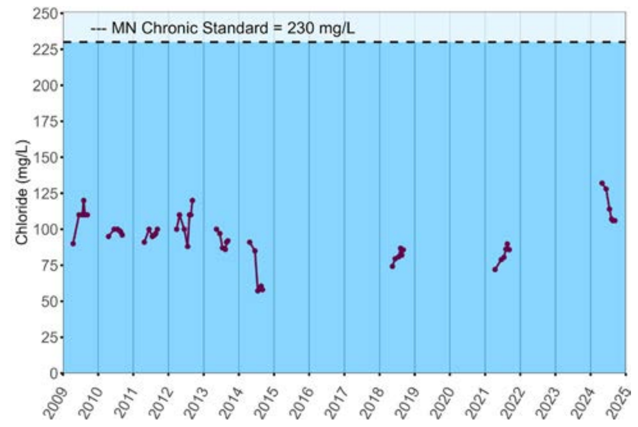
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Southeast Anderson Lake, the summer average total phosphorus concentrations have been better than the shallow lake state standard in 1991, 1996, 2001, 2009–2011, 2013 and years monitored between 2018–2024. In 2024 the summer average total phosphorus concentration was 46 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Southeast Anderson Lake, the summer average chlorophyll-*a* concentrations have been better than the shallow lake state standard in 2009–2011, 2013, 2021, and 2024. In 2024 the summer average chlorophyll-*a* concentration was 19 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Southeast Anderson Lake, the summer average Secchi disk transparency has met or been better than the shallow lake state standard in 1996, 2001,2009–2011, 2013, and years monitored between 2018–2024. In 2024 the summer average Secchi disk transparency was 1.2 meters.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Southeast Anderson Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. However, chloride concentrations in 2024 were the highest observed on record. The highest observed chloride concentration was 132 mg/L in April 2024. The average chloride concentration between April and September 2024 was 116 mg/L.

2.5.2 Water Quality Management Practices

The District completed a water quality study for the Anderson Lakes in 2005 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering the Anderson Lakes to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study in all three Anderson Lakes.

Management Practice	Basis	Year Implemented	Lead Agency
Upgrade Existing Stormwater Pond *Northwest Anderson*	Reduce pollutant loads entering Northwest Anderson from watershed runoff	2007	NMCWD
Lake Drawdown *Northwest and Southwest Anderson Lakes*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	Fall 2008 – Spring 2009	NMCWD
Herbicide Treatments *All Anderson Lakes*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions. Whole lake herbicide treatments performed on Southeast Anderson. Spot treatments on Northwest and Southwest Anderon (targeting areas not exposed during drawdown)	2009 – 2014	NMCWD
Alum Sediment Treatment *Southwest Anderson Lake*	Reduce internal sediment phosphorus load to Southwest Anderson Lake, which also reduces phosphorus inflows to Northwest Anderson Lake	2012	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2022 – Ongoing	NMCWD

Lake drawdown to manage curly-leaf pondweed on Northwest and Southwest Anderson Lakes. Herbicide treatments were applied to all Anderson Lakes following the drawdown.

Alum treatment on Southwest Anderson Lake.

2.5.3 Aquatic Plant Observations in Southeast Anderson Lake

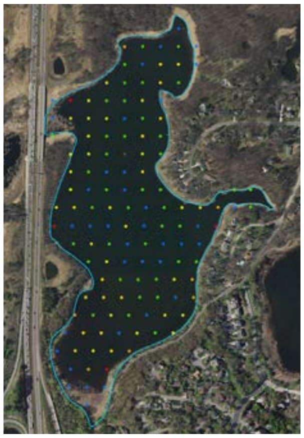
A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

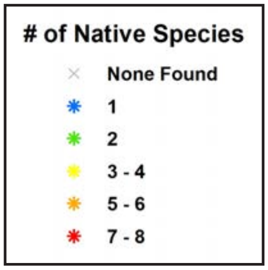
The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

The District conducted point intercept plant surveys of Southeast Anderson Lake in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix C. The following page provides a list of native plant species observed, summarizes their percent occurrence, and shows the locations native plants were found during the August survey. Graphs also summarize the historical plant IBI scores between 1991 and 2024, tracking how the plant health conditions have changed over time.

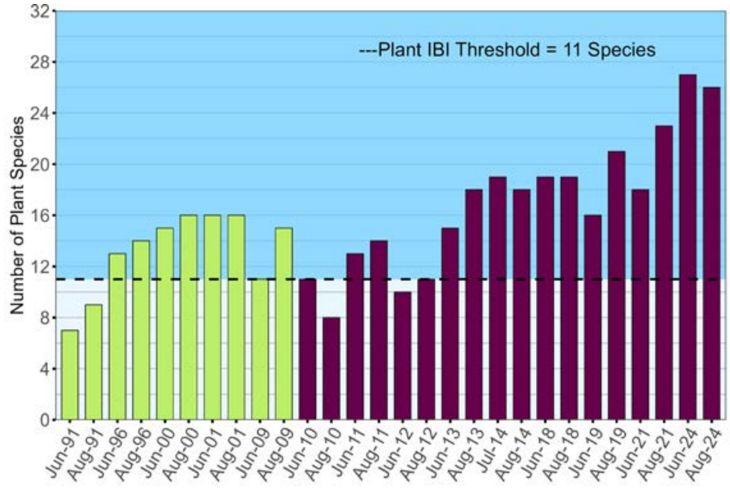
Hooded arrowhead, a state threatened species, was found for the first time in Southeast Anderson in 2024.

Native Plants	Common Name	% Occurrence in August 2024
All Plants (Combined) — Number of points with native plants: 131/132 sites		99%
Submerged Plants		
Ceratophyllum demersum	Coontail	52%
Potamogeton zosteriformis	Flat-stem pondweed	29%
Lychnothamnus barbatus	Bearded stonewort	18%
Elodea canadensis	Common waterweed	17%
Potamogeton amplifolius	Large-leaf pondweed	9%
Chara sp.	Muskgrass	8%
Heteranthera dubia	Water star-grass	8%
Vallisneria americana	Wild celery	5%
Potamogeton foliosus	Leafy pondweed	1%
Potamogeton nodosus	Long-leaf pondweed	1%
Potamogeton pusillus	Small pondweed	1%
Stuckenia pectinata	Sago pondweed	1%
Najas flexilis	Slender naiad	Visual Only
Floating/Emergent Plants		
Nymphaea odorata	White water lily	33%
Schoenoplectus tabernaemontani	Softstem bulrush	9%
Leersia oryzoides	Rice cut-grass	7%
Lemna minor	Small duckweed	6%
Spirodela polyrhiza	Large duckweed	5%
Sagittaria latifolia	Common arrowhead	4%
Lemna trisulca	Forked duckweed	3%
Wolffia columbiana	Common watermeal	3%
Scirpus atrovirens	Black bulrush	2%
Bolboschoenus fluviatilis	River bulrush	2%
Typha latifolia	Broad-leaved cattail	2%
Sagittaria rigida	Sessile-fruited arrowhead	2%
—	Filamentous algae	2%
Schoenoplectus acutus	Hardstem bulrush	2%
Brasenia schreberi	Watershield	1%
Sagittaria calycina	Hooded arrowhead	1%
Sagittaria cristata	Crested arrowhead	1%
Polygonum amphibium	Water smartweed	Visual Only
Carex comosa	Bottle brush sedge	Visual Only

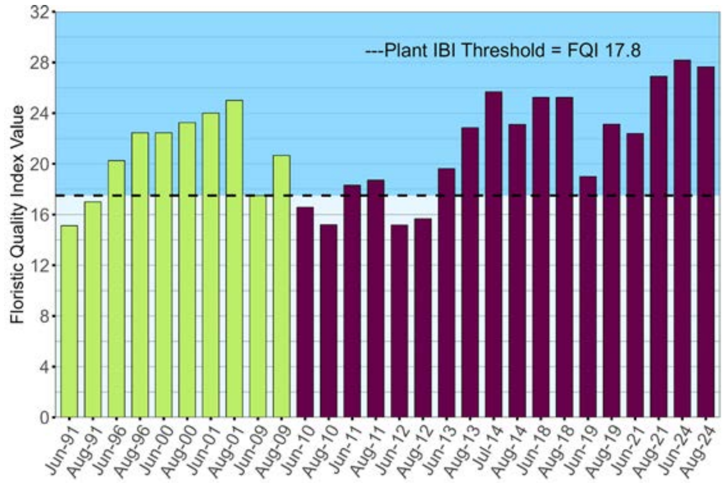




Number of native plant species observed at each observation point in Southeast Anderson Lake in August 2024.



Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Since 2013 Southeast Anderson Lake has been experiencing an increasing trend in the number of plant species observed.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. In 2024, Southeast Anderson Lake had FQI values that were well above the IBI threshold.

Note: purple bars indicate period following significant infestation of curly-leaf pondweed (CLP) and completion of spring herbicide treatments (2009–2014) to reduce CLP prevalence.

Aquatic Invasive Plant Species

Six aquatic invasive plant species were found in Southeast Anderson Lake in 2024.

Eurasian Watermilfoil (EWM) (*Myriophyllum spicatum*)

Eurasian Watermilfoil was widespread throughout the lake in 2024. Eurasian Watermilfoil was collected on the rake at 97 locations (74% occurrence) and visually observed at 8 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 2.0 during the June survey. Eurasian Watermilfoil was collected on the rake at 95 locations (72% occurrence) and visually observed at 7 locations in August with an average rake density of 2.2.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

Curly-leaf pondweed was widespread throughout the lake in 2024. Curly-leaf pondweed was collected on the rake at 84 locations (64% occurrence) and visually observed at 6 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.6 during the June survey. During the August survey, curly-leaf pondweed was collected on the rake at 1 location. Low occurrence in August is typical for the plant's growth cycle.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the western shoreline in August. Most purple loosestrife plants are managed naturally by Galerucella, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Common reed (Phragmites australis)

Observed at one location along the southern shoreline in August.

Reed canary grass (*Phalaris arundinaceae*)

Observed at multiple locations along the eastern and western shorelines in June and August.

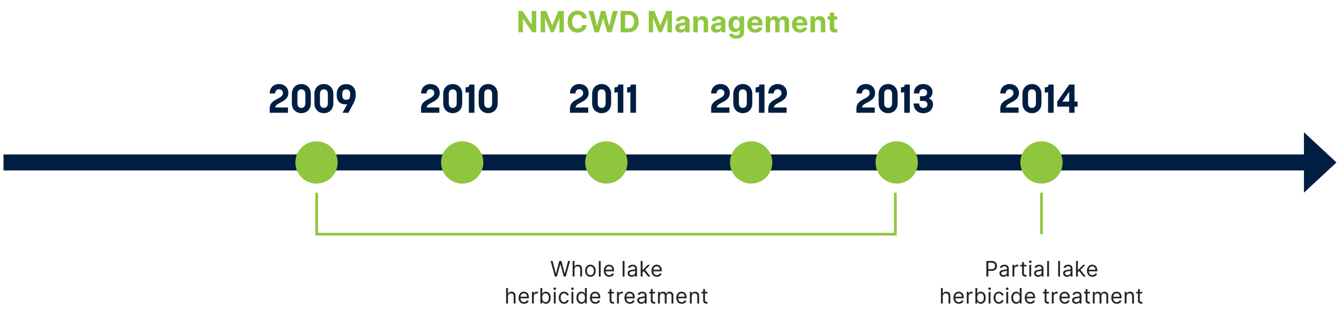
Narrow-leaved cattail (*Typha angustifolia*)

Dominant along the northern, western, and southern shorelines in June and August.

Image source: Endangered Resources Services

2.5.4 Aquatic Invasive Species (AIS) Plant Management Practices

Whole-lake drawdowns were performed on Northwest and Southwest Anderson Lakes between fall 2008 and spring 2009 to manage the aquatic invasive plant species curly-leaf pondweed. However, a whole-lake drawdown was not performed on Southeast Anderson Lake due to low resident support during the project planning process. Instead, the NMCWD conducted herbicide treatments on Southeast Anderson Lake between 2009–2014.



Curly-leaf pondweed (CLP) was widespread throughout Southeast Anderson Lake in 2024. This photo shows a dense CLP rake that was observed at one of the sample locations. CLP was collected on the rake at 84 locations (64% occurrence) and visually observed at 6 locations in June.

2.5.5 Phytoplankton Observations in Southeast Anderson Lake

The phytoplankton community in Southeast Anderson Lake was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the next page summarizes the number and major groups of phytoplankton observed in Southeast Anderson Lake between June and September 2024. Blue-green algae (cyanobacteria) were the major taxon (or group) observed from June through late August, representing 85%–99% of the phytoplankton community. In September, cryptomonads were the major taxon observed. Green algae, golden algae, haptophytes, and other taxa were also present throughout the monitored period but at notably lower percentages.

When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful since some species can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure. In 2024, a high abundance of blue-green algae was observed in the lake during the June sampling event.

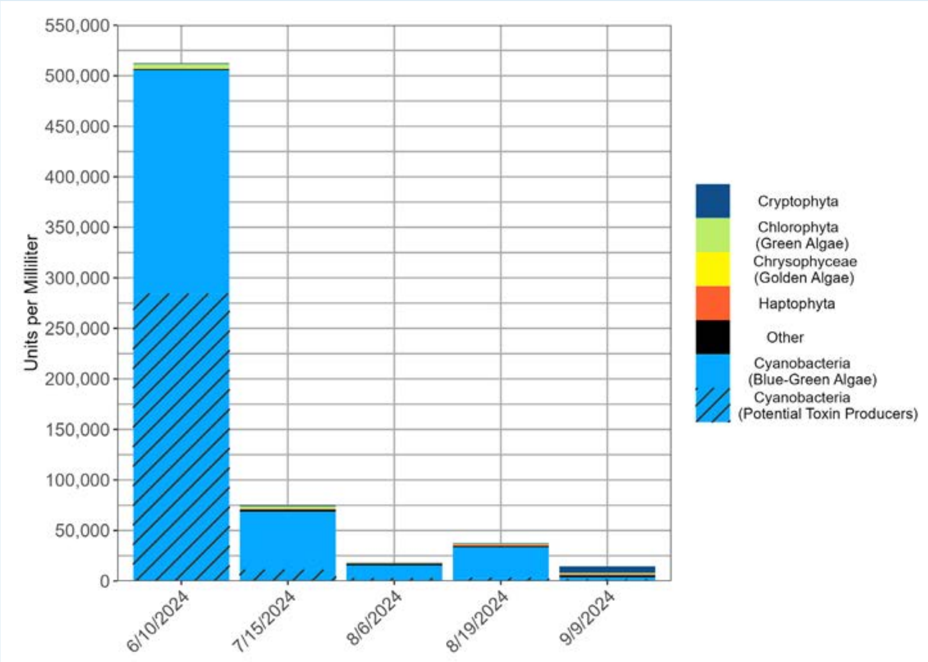
The observed June 2024 blue-green algae abundance was above the WHO threshold of 100,000 units per milliliter for a moderate probability of adverse health effects to recreational users. Of the blue-green algae species observed in June, 56% of the species were potential toxin producing species. While blue-green algae abundance decreased in July, observed cell counts were still above the WHO low probability of adverse health effects threshold (>20,000 units per milliliter). Sixteen percent (16%) of the observed blue-green algae species in July were potential toxin producing species.

The abundance of blue-green algae observed in June and July 2024 was notably higher than what has been observed in other monitored years within the last decade. High blue-green algae abundance in 2024 occurred in the early portions of the summer, which was during noteworthy wet climatic conditions. It’s possible that increased nutrients in runoff created favorable conditions for enhanced blue-green algae growth. Early die-off and degradation of curly-leaf pondweed may have also contributed to high nutrient availability for enhanced blue-green algae growth.

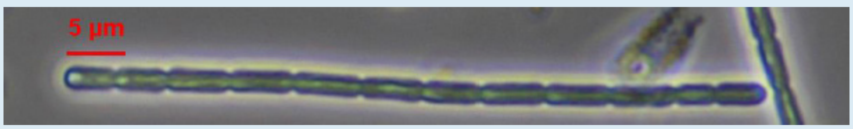
Phytoplankton

Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake’s zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

Example of cyanobacteria (blue-green) algae scum

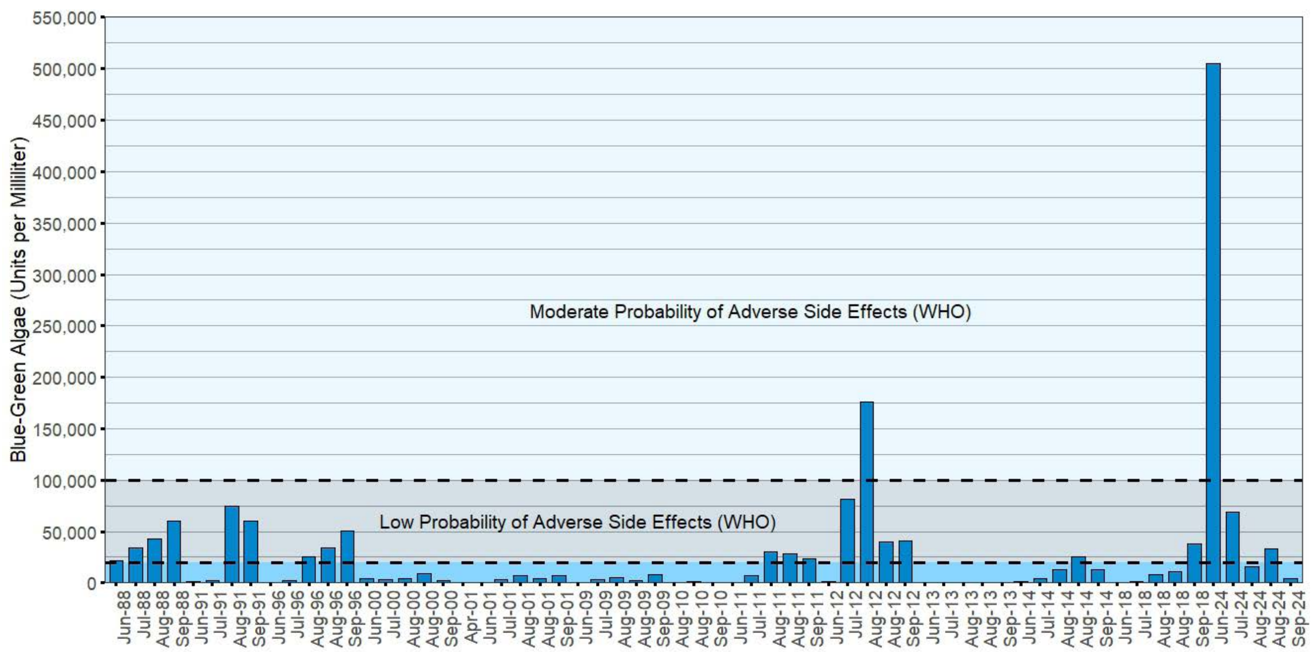


Between June and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure to the left summarizes the number and major groups of phytoplankton observed. Blue-green algae (cyanobacteria) were the most abundant taxon (or group) found in Southeast Anderson Lake from June through late August.



Microscopic image of Pseudanabaena, a potential toxin producing blue-green algae species from Southeast Anderson Lake found during June sampling.

(Source GreenWater Laboratories)

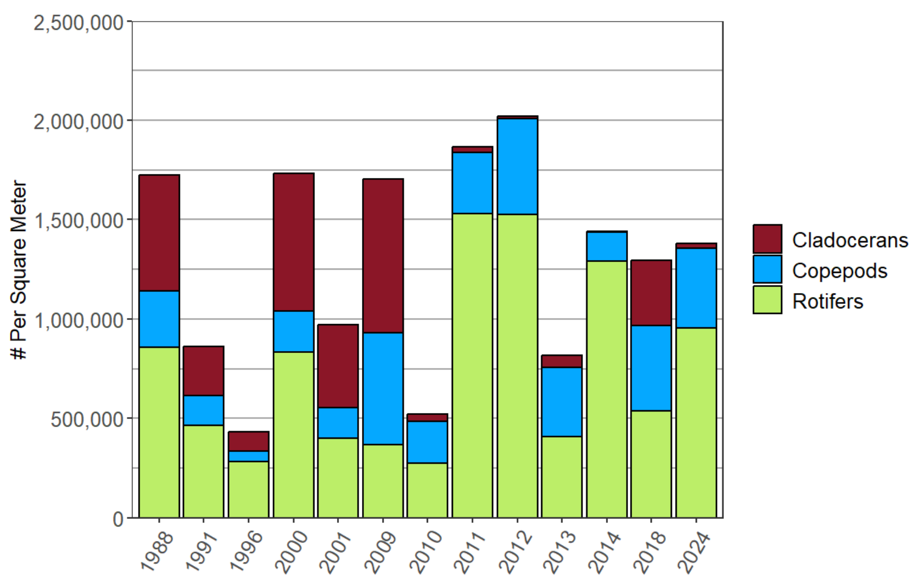


Blue-green algae (cyanobacteria) have historically been found in Southeast Anderson Lake since monitoring began in 1988 as seen above. In June 2024 there was a notable increase in blue-green algae abundance as compared to the historical monitoring record. Blue-green algae are associated with water quality problems and can be a source of health concerns not only for humans, but for wildlife. Blue-green algae numbers in 2024 ranged from approximately 3,900 units per milliliter in September to approximately 505,500 units per milliliter in June. Potential toxin producing species ranged from approximately 1,100 units per milliliter in September to 284,000 units per milliliter in June.

2.5.6 Zooplankton observations in Southeast Anderson Lake

Zooplankton are microscopic aquatic animals that drift and move throughout the lake water column. They play major roles in the aquatic food web by consuming algae and are primary food sources for larger organisms such as fish. The zooplankton community in Southeast Anderson Lake was monitored periodically between 1988 and 2024 to help evaluate water quality and the quality of food available to fish. Fish preference for certain groups of zooplankton can vary depending on the fish species, fish age, and the lake habitat. Copepods can have high protein content making them a nutritious option for certain fish species. Cladocerans tend to be larger in size (i.e., a more substantial food source) and can be relatively easy to capture due to their slower movements. Rotifers are generally smaller in size and provide less nutritional value compared to cladocerans and copepods. While adult fish often prefer larger prey that offer more energy and nutrients per capture, rotifers are still consumed by many fish species, particularly when other food sources are scarce. Additionally, the smaller size of rotifiers may be attractive to young, larval fish species.

The figure below summarizes the historical summer averages of the major groups of zooplankton observed in Southeast Anderson Lake. Since 1988, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable. Rotifers have typically been the most abundant. The summer average quantity of rotifers ranges from 22%–90% of the observed species. Copepods have typically been the second most abundant and represent approximately 10%–43% of the observed species based on summer average concentrations. Cladocerans are typically the least abundant group observed in the historical record with the summer average quantity of cladocerans ranging from <1%–45% of the observed species.



Water fleas (Daphnia, Cladocera) are a popular prey option for fish in lakes.

2.5.7 Summary for Southeast Anderson Lake

Monitoring between 1988–2024 shows that the water quality in Southeast Anderson Lake has been variable. However, all three eutrophication parameters met the state standards for shallow lakes in 2021 and 2024. In 2024 phosphorus and chlorophyll-*a* concentrations were below state standards and Secchi disk transparency met the state standard. Historical chloride concentrations have never exceeded the MPCA chronic standard.

Since 2013 Southeast Anderson Lake has been experiencing an increasing trend in the number of plant species observed. In 2024, a total of 27 and 26 species, either submerged, floating, or emergent, were observed in the June and August plant surveys, respectively. The number of species observed in 2024 were well above the MNDNR Plant IBI threshold of 11 species. The FQI values ranged between 27.7–28.2 and were also well above the MNDNR Plant IBI threshold of 17.8.

Six invasive aquatic plant species were observed in Southeast Anderson Lake in 2024 including the submerged species curly-leaf pondweed and Eurasian watermilfoil and the emergent species narrow-leaved cattail, reed canary grass, purple loosestrife, and common reed. The NMCWD conducted herbicide treatments to areas with curly-leaf pondweed growth between 2009–2014. As of 2024, the June plant survey showed that curly-leaf pondweed growth was widespread throughout the lake.

In 2024, high abundances of blue-green algae were observed during the June and July sampling events. The observed June abundance was above the WHO threshold of 100,000 per milliliter for a moderate probability of adverse health effects to recreational users. The observed July abundance was above the WHO threshold of 20,000 per milliliter for a low probability of adverse health effects to recreational users.

Zooplankton were monitored in 2024, and similar to previous monitored years, rotifers were the most abundant, followed by copepods, and then cladocerans.

The District completed a water quality study of the Anderson Lakes in 2005 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in the Anderson Lakes were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. Several management practices have been implemented since the water quality study was completed, including an alum sediment treatment on Southwest Anderson Lake, upgrades to an existing stormwater pond, aquatic invasive species plant management, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program.

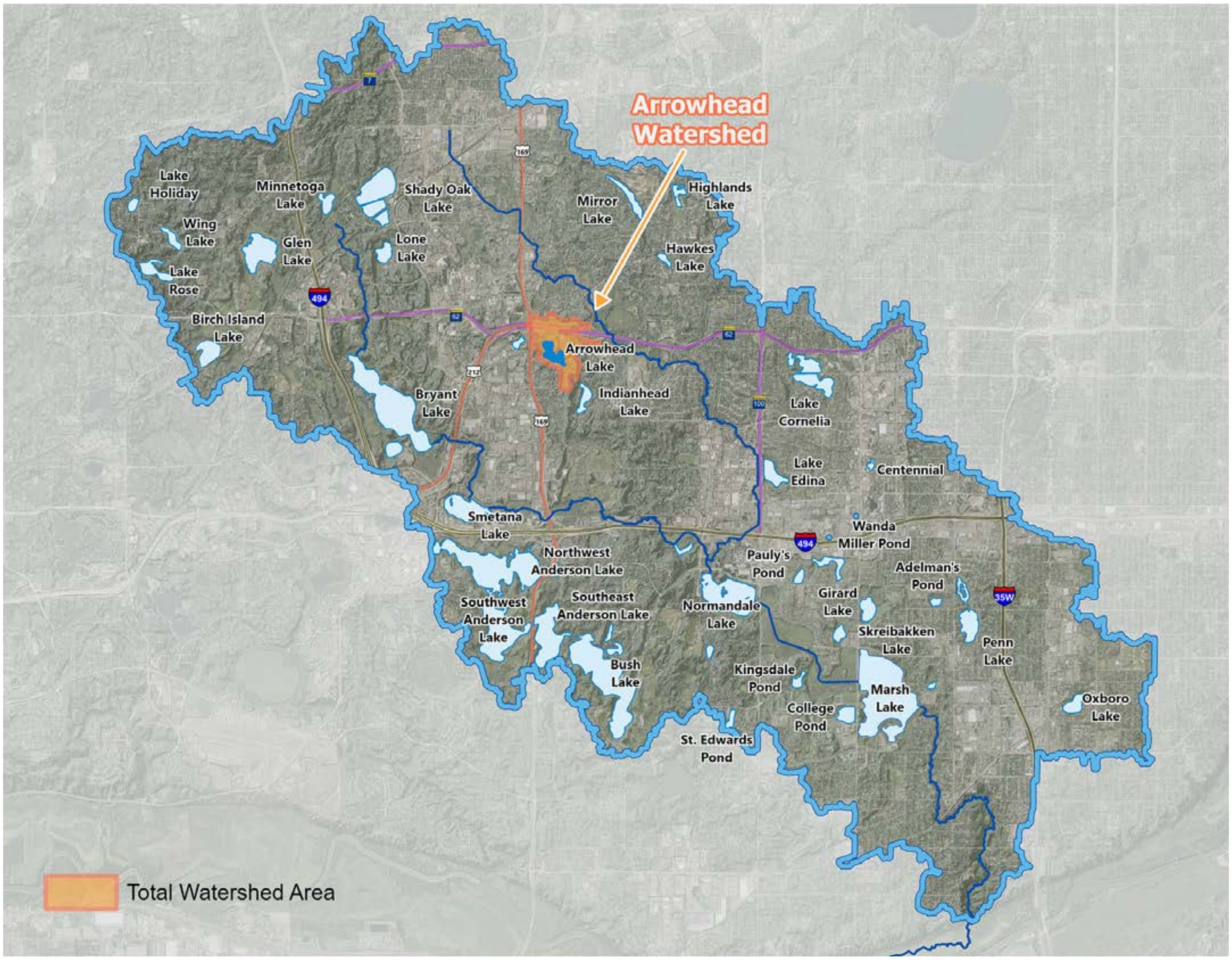
2.6 Arrowhead Lake

2024 MONITORED PARAMETERS

- **Water Quality**

APPENDICES: Water quality monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Edina
Surface Area	22 acres
Average/Maximum Depth	3.2 feet / 8 feet
Watershed Area	178 acres
Watershed:Surface Area	8:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Downstream Waterbody	Landlocked



2.6.1 Water Quality Observations in Arrowhead Lake

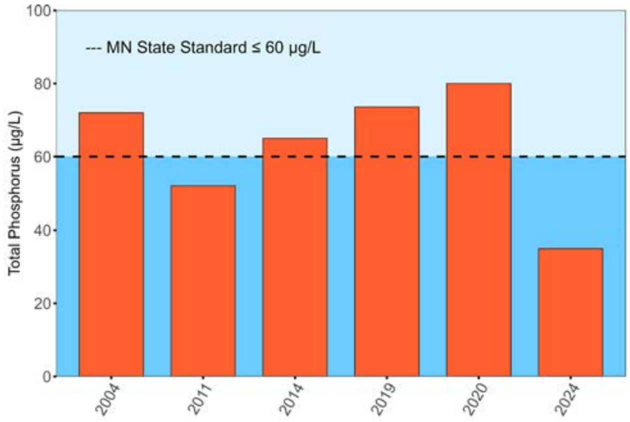
Arrowhead Lake is located in the City of Edina and is used primarily for wildlife viewing. Arrowhead Lake is land-locked with no surface outlet. Thus, the water level in the lake depends on weather conditions (snowmelt, rainfall, evaporation) and groundwater flow.

Arrowhead Lake has a water surface area of approximately 22 acres, a maximum depth of 8 feet, and a mean depth of approximately 3.2 feet. Arrowhead Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

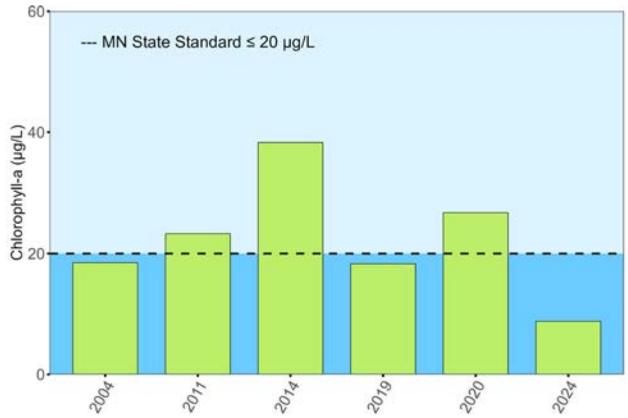
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Arrowhead Lake is not on the Minnesota impaired waters list.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Arrowhead Lake by the NMCWD during 2004, 2011, 2014, 2019, 2020, and 2024. Monitoring data from 2024 indicate that the management activities completed in 2024 as part of the Arrowhead and Indianhead Lakes Water Quality Improvement Project have improved the lake's water quality. The summer average total phosphorus and chlorophyll-*a* concentrations monitored in 2024 were notably lower than concentrations monitored between 2004–2020. Similarly, the 2024 Secchi disk transparency measurements were noticeably improved from measurements between 2004–2020. All three eutrophication parameters were better than the respective state standard.

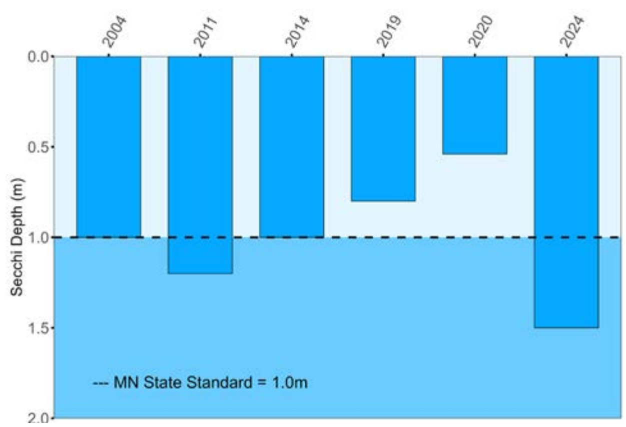
Chloride concentrations were measured by the NMCWD in 2011, 2014, 2019, 2020, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. In 2024, chloride concentrations were monitored between June and September. The highest observed concentration was in June 2024 at 165 mg/L. The average chloride concentration between June and September 2024 was 130 mg/L.



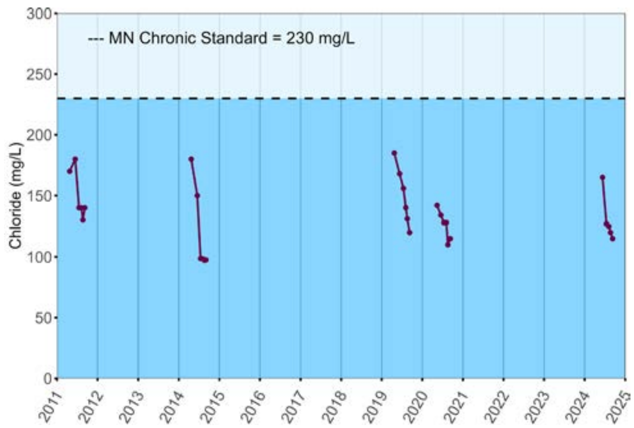
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Arrowhead Lake, the summer average total phosphorus concentrations have been better than the shallow lake state standard in 2011 and 2024. In 2024 the summer average total phosphorus concentration was 35 µg/L, which is notably lower than the summer average concentrations observed between 2014–2020. Improved phosphorus concentrations in 2024 are likely the result of water quality improvement projects that were implemented in 2024.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Arrowhead Lake, the summer average chlorophyll-*a* concentrations have been better than the shallow lake state standard in 2004, 2019, and 2024. In 2024 the summer average chlorophyll-*a* concentration was 9 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Arrowhead Lake, the summer average Secchi disk transparency has met or been better than the shallow lake state standard in 2004, 2011, 2014, and 2024. In 2024 the summer average Secchi disk transparency was 1.5 meters.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Arrowhead Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. In 2024, chloride concentrations were monitored between June and September. The highest observed chloride concentration was 165 mg/L in June 2024. The average chloride concentration between June and September 2024 was 130 mg/L.

2.6.2 Water Quality Management Practices

The District completed a water quality study of Arrowhead Lake in August of 2022 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Arrowhead Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Arrowhead Lake to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study. A few of these practices were already in place before the study, but were identified as being key management efforts for continued improvement of lake health.

Management Practice	Basis	Year Implemented	Lead Agency
Herbicide Treatments	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	2017 - Ongoing	City of Edina
Enhanced Street Sweeping	Reduce pollutant loading from stormwater runoff	2023 – Ongoing	City of Edina
Alum + Iron Treatment	Reduce internal sediment phosphorus load	2024	NMCWD
Modifications to Aeration System	Reduce internal sediment phosphorus load and improve fisheries health	2024 – Ongoing (system operating in fall 2024)	NMCWD & City of Edina
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	Ongoing	NMCWD

Aeration System Improvements

Alum + Iron Treatment

2.7 Bryant Lake

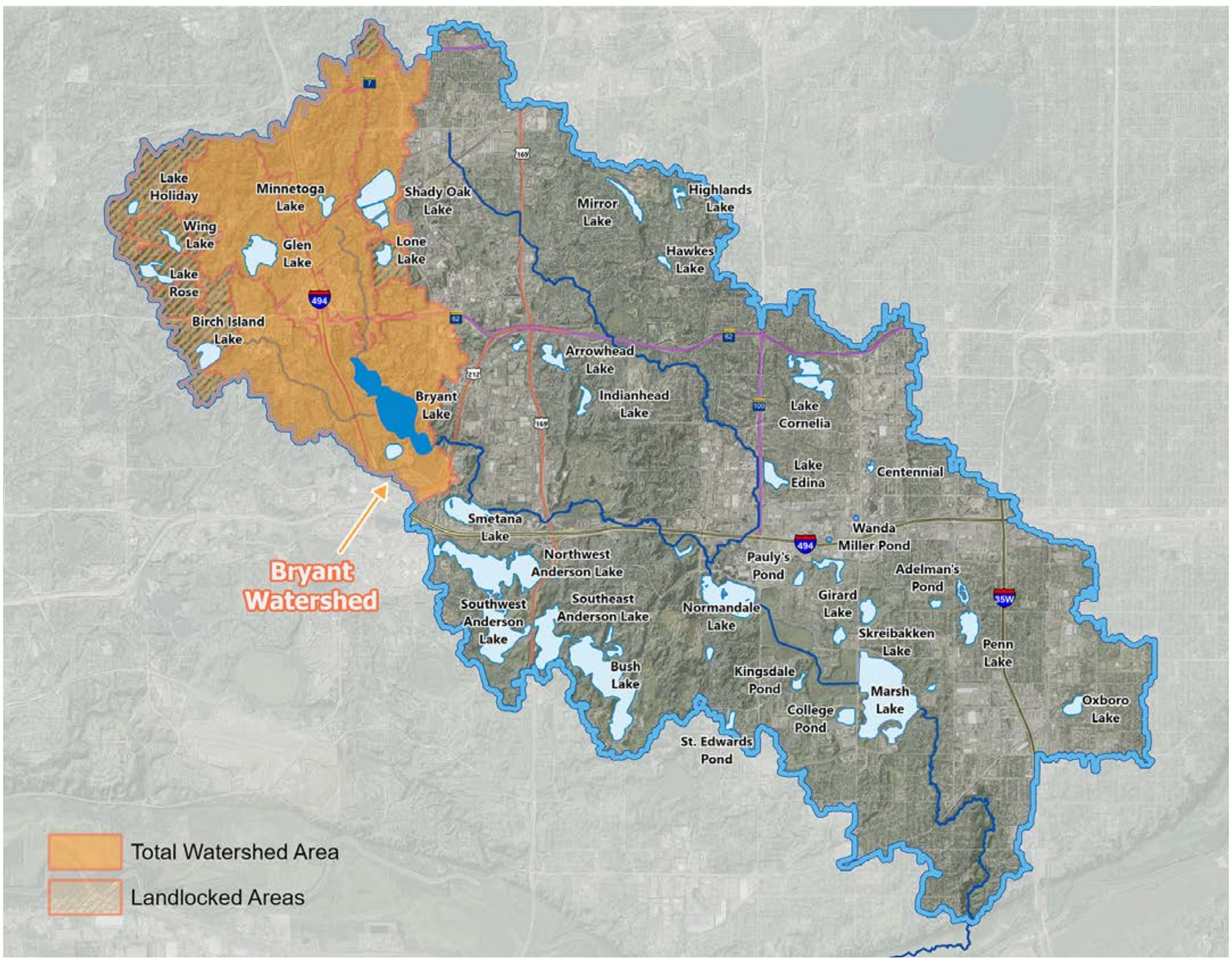
2024 MONITORED PARAMETERS

- **Water Quality**
- **Aquatic Plants (Macrophytes)**
- **Phytoplankton (Algae)**
- **Zooplankton**

APPENDICES: Maps showing aquatic plant survey results are included in Appendix D. Water quality, phytoplankton, and zooplankton monitoring results can be provided upon request.

Shallow/Deep	Deep
Location	Eden Prairie
Surface Area	173 acres
Average/Maximum Depth	15.2 feet / 45 feet
Direct Watershed Area	1,276 acres
Total Watershed Area*	6,274 acres (1,197 landlocked)
Watershed: Surface Area	29:1
Impairment Status	Delisted for nutrient impairment in 2018; Impaired for aquatic consumption (mercury in fish tissue) since 2002; Impaired for aquatic life (fish) since 2018
Upstream Waterbody	South Fork Nine Mile Creek & County Ditch 34
Downstream Waterbody	South Fork Nine Mile Creek

* Includes 1,197 acres that are typically landlocked under average storm events



2.7.1 Water Quality Observations in Bryant Lake

Bryant Lake is located in the City of Eden Prairie and is used for boating, fishing, swimming, and wildlife viewing. Bryant Lake is located on the South Fork of the Nine Mile Creek. As such, when water levels are high enough, water will discharge through Bryant Lake's outlet located in the southeast of the lake directly into the South Fork of the Nine Mile Creek.

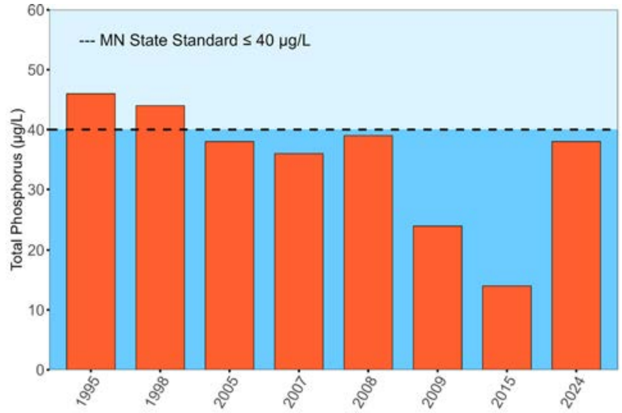
Bryant Lake has a water surface area of approximately 173 acres, a maximum depth of 45 feet, and a mean depth of approximately 15.2 feet. Bryant Lake is a deep lake, so only a portion of the lake bottom is shallow enough for aquatic plants to grow and the lake will generally mix fully only twice per year in the spring and fall (dimictic lake).

As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Bryant Lake was added to the impaired waters list for nutrient impairments in 2008, but was delisted in 2018 due to improved water quality conditions following the implementation of management practices.

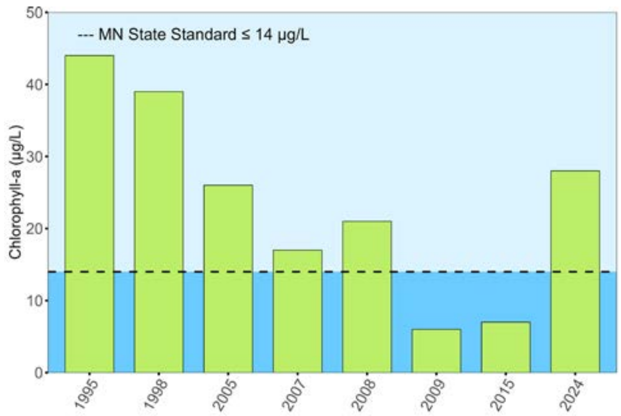
The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measusred in Bryant Lake by the NMCWD in 1995, 1998, 2005, 2007–2009, 2015, and 2024. Since 2007, the summer average total phosphorus concentrations have been better than the state eutrophication standard for deep lakes in the North Central Hardwood Forest Ecoregion. Summer average chlorophyll-*a* concentrations in 2009 and 2015 were better than the state eutrophication standard; however, in 2024 the summer average chlorophyll-*a* concentration exceeded the state standard. Since 2008 observed summer average Secchi disk transparency depths have been better than the state standard.

Between July and September 2024, total phosphorus concentrations were notably higher at the bottom of the lake than at the surface. Based on the monitored parameters, higher concentrations at the bottom are likely due to phosphorus release from lake bottom sediment. Lake stratification in deep lakes can limit the mass of phosphorus that reaches the surface waters during the growing season. However, phosphorus can be mixed into the surface waters from bottom waters during windy days or storm events, which may enhance algal growth.

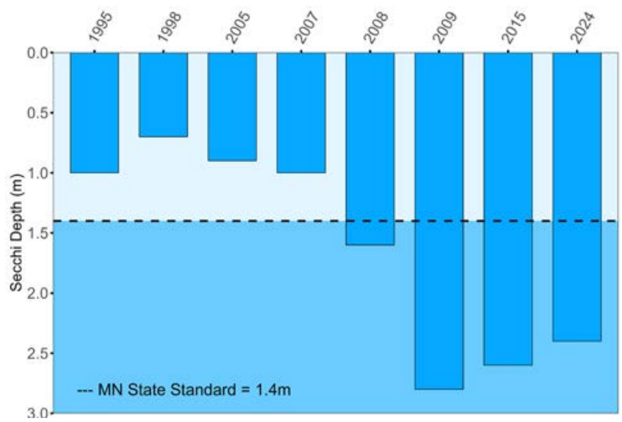
Chloride concentrations were measured by the NMCWD in 2009, 2015 and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. However, the 2024 monitored chloride concentrations in Bryant Lake were the highest observed on record. The highest observed chloride concentration was in April 2024 at 146 mg/L. The average chloride concentration between April and late August 2024 was 128 mg/L.



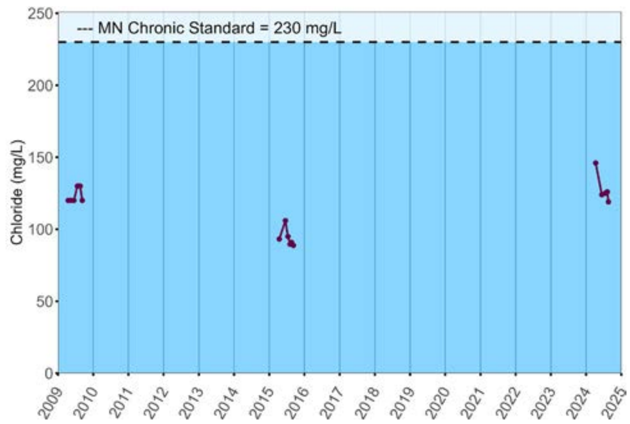
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Bryant Lake, the summer average total phosphorus concentrations have been better than the deep lake state standard since 2005. In 2024 the summer average total phosphorus concentration was 38 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Bryant Lake, the summer average chlorophyll-*a* concentrations have been better than the deep lake state standard in 2009 and 2015. In 2024 the summer average chlorophyll-*a* concentration was 28 µg/L, higher than the standard.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Bryant Lake, the summer average Secchi disk transparency has met or been better than the deep lake state standard in 2008–2009, 2015, and 2024. In 2024 the summer average Secchi disk transparency was 2.4 meters.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Bryant Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. However, chloride concentrations in 2024 were the highest observed on record. The highest observed chloride concentration was 146 mg/L in April 2024. The average chloride concentration between April and late August 2024 was 128 mg/L.

2.7.2 Water Quality Management Practices

The District completed a water quality study for Bryant Lake in 2003 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Bryant Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Bryant Lake to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study.

Management Practice	Basis	Year Implemented	Lead Agency
Wetland Restoration at County Ditch 34 west of I-494 (outlet modification)	Reduce pollutant loads entering Bryant Lake from watershed runoff	2009	NMCWD
Alum Sediment Treatment	Reduce internal sediment phosphorus load	2008, 2013	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2016 – Ongoing	NMCWD

The hydrology for an existing wetland was restored by constructing a new outlet structure

Second Partial Alum Treatment in 2013

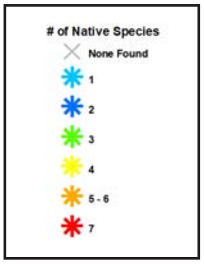
2.7.3 Aquatic Plant Observations in Bryant Lake

A healthy, deep, urban lake will have an abundance of aquatic plants growing throughout the lake's littoral zone (nearshore sediment bottom area). Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

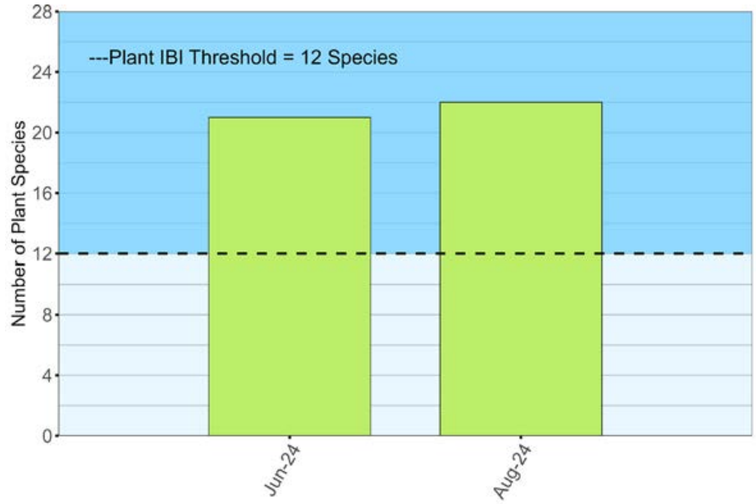
The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

The District conducted point intercept plant surveys on Bryant Lake in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix D. The following page provides a list of native plant species observed, summarizes their percent occurrence, and shows the locations native plants were found during the August survey. Graphs also summarize the plant IBI scores in 2024. NMCWD completed point-intercept surveys for the first time on Bryant Lake in 2024.

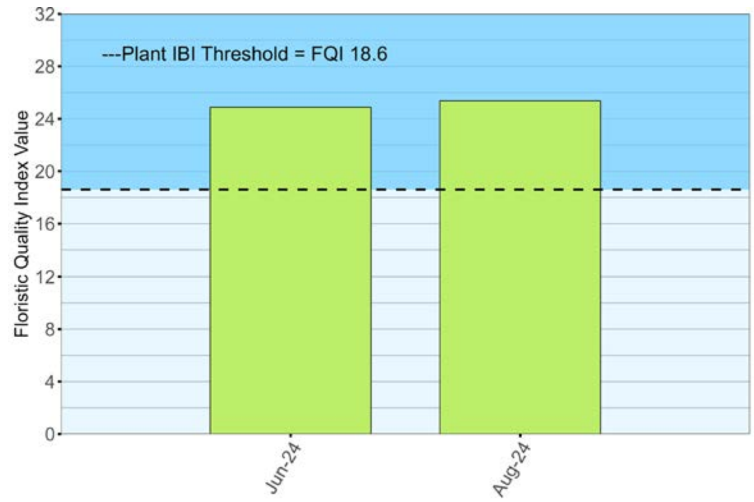
Native Plants	Common Name	% Occurrence in August 2024
All Plants (Combined) — Number of littoral points with native plants: 80/89 sites		90%
Submerged Plants		
Ceratophyllum demersum	Coontail	71%
Heteranthera dubia	Water star-grass	12%
Myriophyllum sibiricum	Northern water-milfoil	8%
Ranunculus aquatilis	White water crowfoot	8%
Potamogeton illinoensis	Illinois pondweed	7%
Utricularia vulgaris	Common bladderwort	3%
Chara sp.	Muskgrass	2%
Elodea canadensis	Common waterweed	1%
Najas flexilis	Slender naiad	1%
Potamogeton nodosus	Long-leaf pondweed	Visual Only
Stuckenia pectinata	Sago pondweed	Visual Only
Floating/Emergent Plants		
Lemna minor	Small duckweed	40%
Wolffia columbiana	Common watermeal	40%
Spirodela polyrhiza	Large duckweed	37%
Lemna trisulca	Forked duckweed	35%
Filamentous algae	Filamentous algae	24%
Nelumbo lutea	American lotus	15%
Nymphaea odorata	White water lily	15%
Nuphar variegata	Spatterdock	Visual Only
Schoenoplectus acutus	Hardstem bulrush	Visual Only
Schoenoplectus pungens	Three-square bulrush	Visual Only



Number of native plant species observed at each observation point in Bryant Lake in August 2024.



Number of species: A deep lake meets the MNDNR Plant IBI threshold when it has greater than 12 species. 2024 was the first year that NMCWD performed point-intercept plant surveys on Bryant Lake. The number of species documented in 2024 through the plant IBI assessment framework was 21 species in June and 22 species in August, which are well above the IBI threshold.



Floristic Quality Index (FQI) values (quality of species): A deep lake meets the MNDNR Plant IBI threshold when the lake has an FQI value greater than 18.6. In 2024, Bryant Lake had FQI values that were well above the IBI threshold and ranged from 24.9 in June to 25.4 in August.

Aquatic Invasive Plant Species

Five aquatic invasive plant species were found in Bryant Lake in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

CLP was observed in numerous locations throughout the littoral area in 2024 with a higher density in the eastern and southern nearshore areas. CLP was collected on the rake at 46 locations (47% occurrence) in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.7 during the June survey. During the August survey, CLP was collected on the rake at 2 locations. Low occurrence in August is typical for the plant's growth cycle.

Eurasian Watermilfoil (EWM) (*Myriophyllum spicatum*)

EWM was widespread throughout the littoral zone in 2024. EWM was collected on the rake at 43 locations (43% occurrence) and visually observed at 10 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.9 during the June survey. EWM was collected on the rake at 23 locations (26% occurrence) and visually observed at 3 locations in August with an average rake density of 1.3. Most of the EWM observed in August was burned and unhealthy looking possibly as a consequence of numerous aquatic plant management efforts carried out by residents along their shorelines.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the northwestern shoreline in August. Most purple loosestrife plants are managed naturally by *Galerucella*, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Reed canary grass (*Phalaris arundinaceae*)

Observed at one location along the eastern shoreline in June and August.

Image source: Endangered Resources Services

Narrow-leaved cattail (*Typha angustifolia*)

Observed at one location along the eastern shoreline in June and August.

2.7.4 Phytoplankton Observations in Bryant Lake

The phytoplankton community in Bryant Lake was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the next page summarizes the number and major groups of phytoplankton observed in Bryant Lake between June and September 2024. Blue-green algae (cyanobacteria) were the major taxon (or group) observed from June through September, representing 44%–93% of the phytoplankton community. Green algae, golden algae, diatoms, cryptomonads, and other taxa were also present throughout the monitored period but at notably lower percentages.

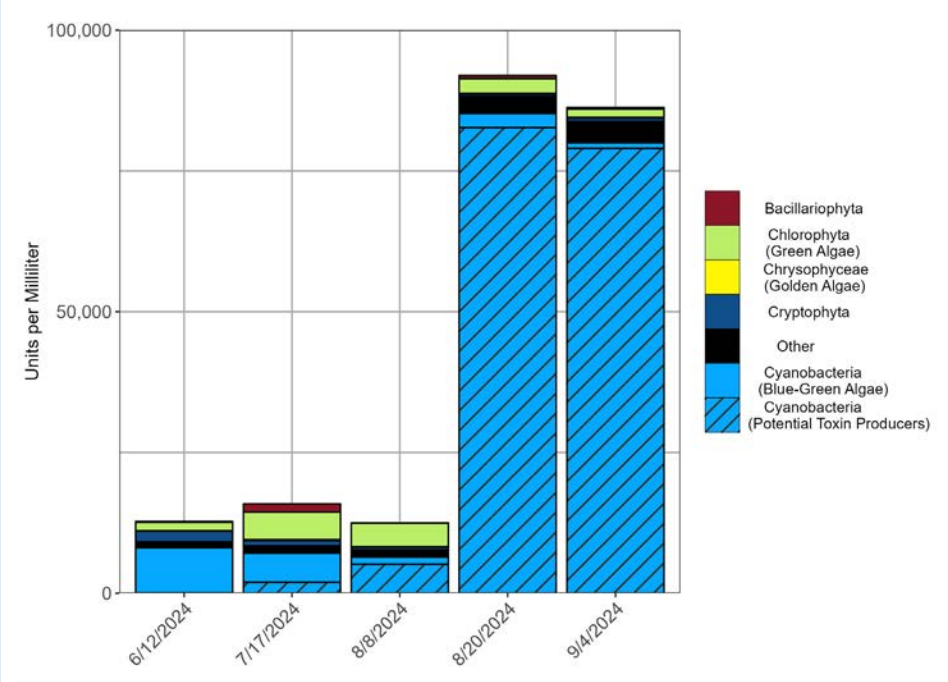
When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful since some species can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure. In 2024, blue-green algal blooms were observed in the lake April through September, with a high abundance observed late August through September. The observed late August and September 2024 blue-green algae abundances (>80,000 units per milliliter) were well above the WHO threshold of 20,000 units per milliliter for a low probability of adverse health effects to recreational users. Of the blue-green algae species observed in both late August and September, 93% of the species were potential toxin producing species. Although there can be many causes of blue-green algal blooms, the high total phosphorus concentrations and hot summer conditions likely contributed to the growth and persistence of the blue-green algal population throughout the late summer months.

The abundance of blue-green algae observed in late August and September 2024 was notably higher than what has been observed in other monitored years since 2009. The blue-green algae abundance was similar to observations in late summer 2005 and 2007. High blue-green algae abundance in 2024 occurred in the later portions of the summer, which was during noteworthy dry climatic conditions. It's possible that increased nutrients from internal loading from lake bottom sediment created favorable conditions for enhanced blue-green algae growth.

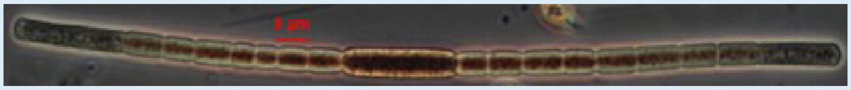
Phytoplankton

Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

Example of cyanobacteria (blue-green) algae scum

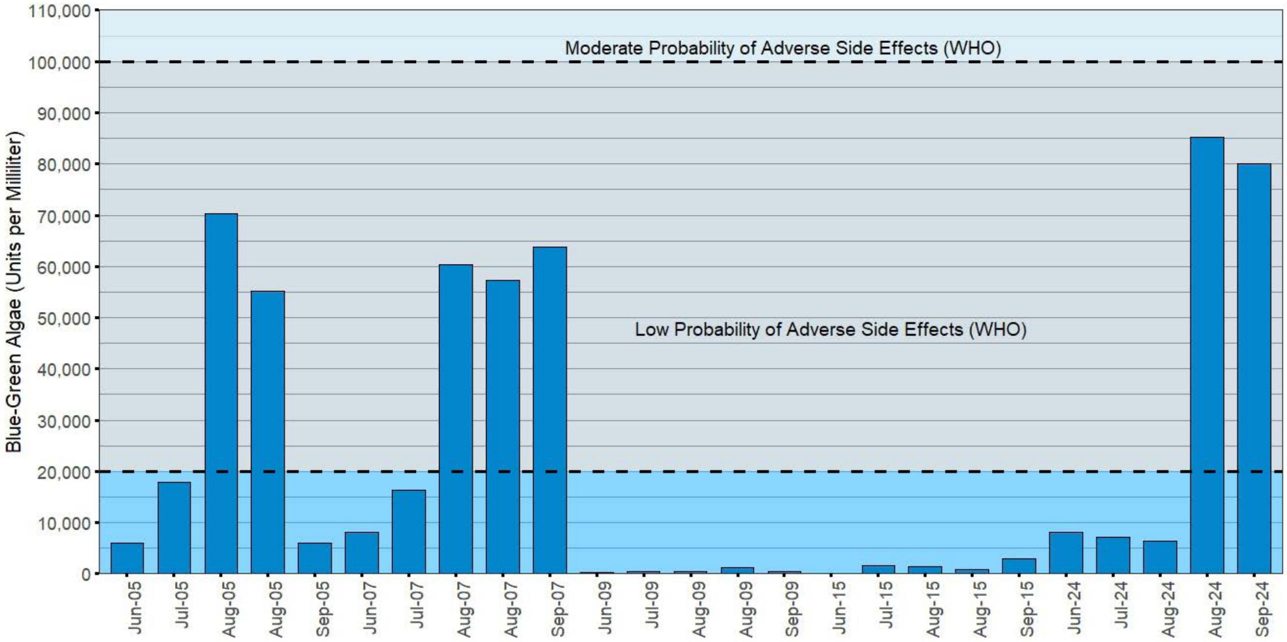


Between June and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure to the left summarizes the number and major groups of phytoplankton observed. Blue-green algae (cyanobacteria) were the most abundant taxon (or group) found in Bryant Lake from June through September.



(Source GreenWater Laboratories)

Microscopic image of Aphanizomenon flos-aquae, a potential toxin producing blue-green algae species observed in Bryant Lake during September monitoring.

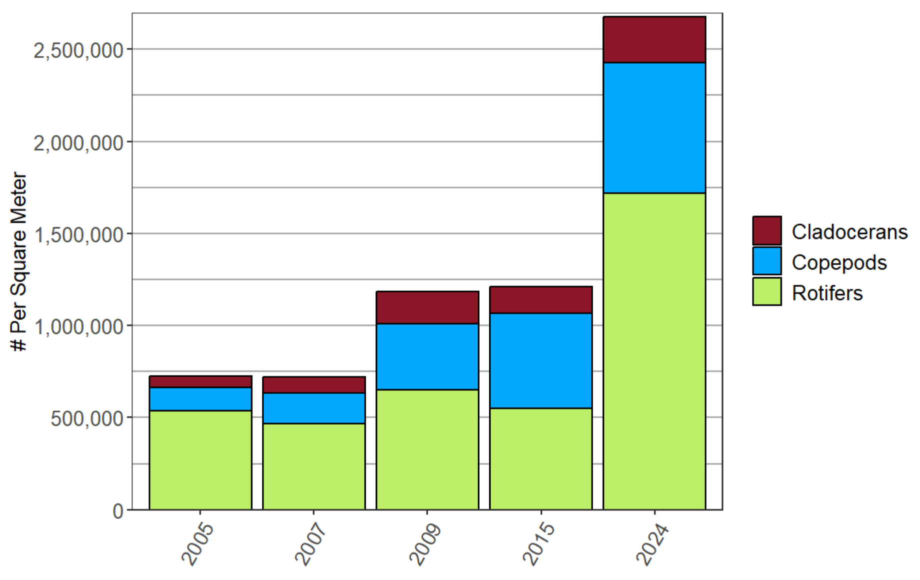


Blue-green algae (cyanobacteria) have historically been found in Bryant Lake since monitoring began in 2005 as seen above. In late August and September 2024 there was a notable increase in blue-green algae abundance as compared to observations in 2009 and 2015. Blue-green algae are associated with water quality problems and can be a source of health concerns not only for humans, but for wildlife. Blue-green algae numbers in 2024 ranged from approximately 6,400 units per milliliter in early August to approximately 85,200 units per milliliter in late August. Potential toxin producing species ranged from approximately 55 units per milliliter in June to 82,700 units per milliliter in late August.

2.7.5 Zooplankton observations in Bryant Lake

Zooplankton are microscopic aquatic animals that drift and move throughout the lake water column. They play major roles in the aquatic food web by consuming algae and are primary food sources for larger organisms such as fish. The zooplankton community in Bryant Lake was monitored periodically between 2005 and 2024 to help evaluate water quality and the quality of food available to fish. Fish preference for certain groups of zooplankton can vary depending on the fish species, fish age, and the lake habitat. Copepods can have high protein content making them a nutritious option for certain fish species. Cladocerans tend to be larger in size (i.e., a more substantial food source) and can be relatively easy to capture due to their slower movements. Rotifers are generally smaller in size and provide less nutritional value compared to cladocerans and copepods. While adult fish often prefer larger prey that offer more energy and nutrients per capture, rotifers are still consumed by many fish species, particularly when other food sources are scarce. Additionally, the smaller size of rotifiers may be attractive to young, larval fish species.

The figure below summarizes the historical summer averages of the major groups of zooplankton observed in Bryant Lake. Since 2005, the observed quantity of zooplankton and the percentages of observed rotifers, copepods, and cladocerans have been variable with a notable increase in all three groups in 2024. Rotifers have typically been the most abundant. The summer average quantity of rotifers ranges from 45%–74% of the observed species. Copepods have typically been the second most abundant and represent approximately 17%–43% of the observed species based on summer average concentrations. Cladocerans are typically the least abundant group observed in the historical record with the summer average quantity of cladocerans ranging from 9%–15% of the observed species.



Water fleas (Daphnia, Cladocera) are a popular prey option for fish in lakes.

2.7.6 Summary for Bryant Lake

In 2024, Bryant Lake's summer average total phosphorus concentration and Secchi disk transparency were better than the State eutrophication water quality standards for deep lakes. The summer average chlorophyll-*a* concentration exceeded State eutrophication standards with a notable increase in concentrations in the late summer months. Historical chloride concentrations have never exceeded the MPCA chronic standard.

Both the number of aquatic plant species in the lake (21–22 species) and FQI values (24.9–25.4) in 2024 were better than the MNDNR Plant IBI thresholds of 12 and 18.6, respectively. Monitoring year 2024 was the first year that the NMCWD performed point-intercept plant surveys on Bryant Lake.

Five invasive aquatic plant species were observed in Bryant Lake in 2024 including the submerged species curly-leaf pondweed and Eurasian watermilfoil, and the emergent species narrow-leaved cattail, purple loosestrife, and reed canary grass.

In 2024, a higher abundance of blue-green algae were observed in the lake during the late August and September monitoring events, with blue-green counts well above the World Health Organization (WHO) threshold of 20,000 per milliliter for a low probability of adverse health effects to recreational users, but below the threshold of 100,000 per milliliter for moderate probability of adverse health effects. Although there can be many causes of blue-green algal blooms, the high total phosphorus concentrations and hot summer conditions likely contributed to the growth and persistence of the blue-green algal population throughout the summer months.

Zooplankton were monitored in 2024—rotifers were the most abundant, followed by copepods, and then cladocerans. Of the years with monitoring data, 2024 observed the highest zooplankton numbers for all three groups.

The District completed a water quality study of Bryant Lake in 2003 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Bryant Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. NMCWD implemented several management practices since the water quality study, including an alum sediment treatment, a wetland restoration project, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program. Due to the water quality improvement projects implemented since the water quality study, Bryant Lake was removed from the MPCA's impaired waters list for nutrient impairment in 2018.

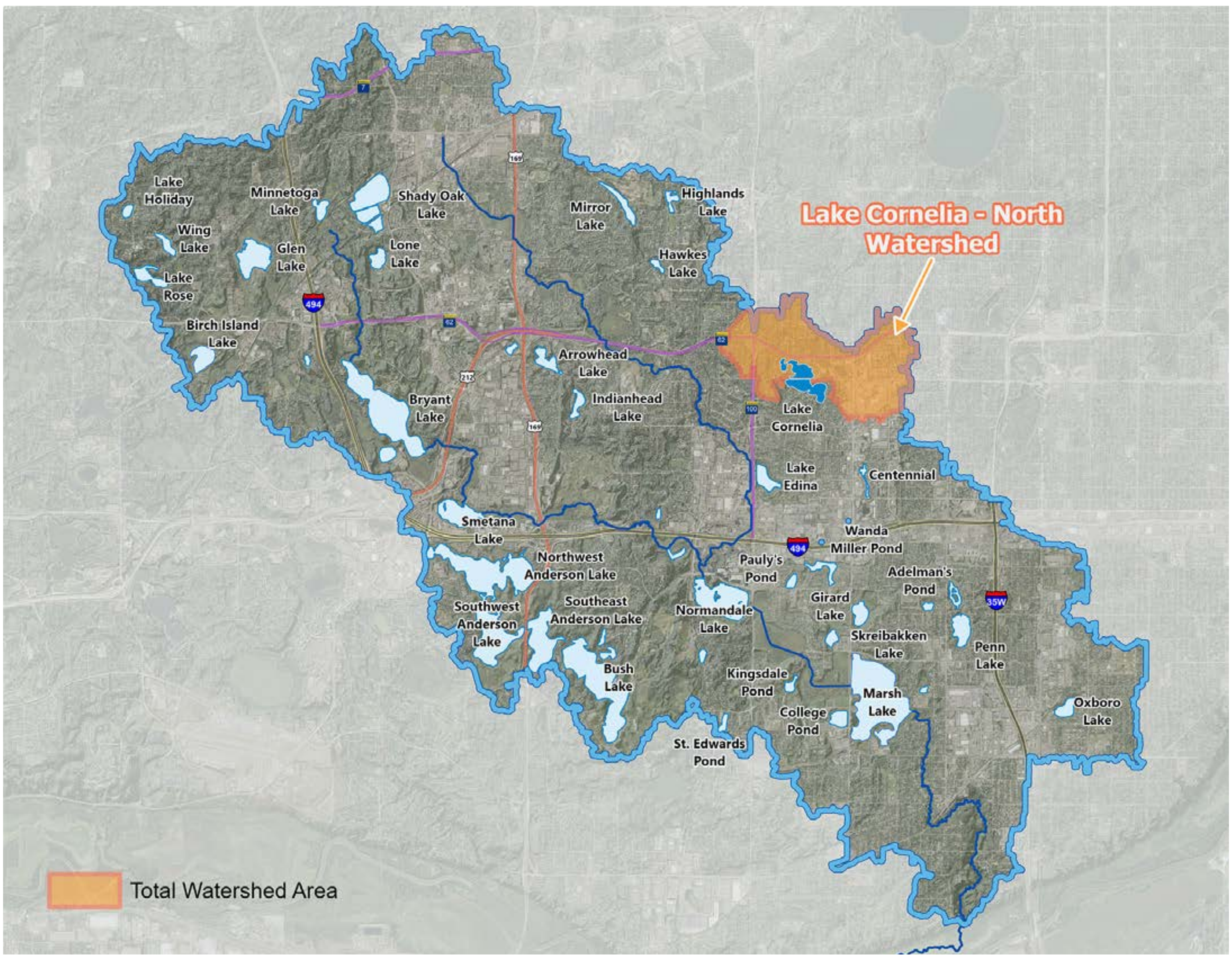
2.8 Lake Cornelia's North Basin

2024 MONITORED PARAMETERS

- Water Quality
- Aquatic Plants (Macrophytes)
- Phytoplankton (Algae)

APPENDICES: Maps showing aquatic plant survey results are included in Appendix E. Water quality and phytoplankton monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Edina
Surface Area	21 acres
Average/Maximum Depth	2.3 feet / 4 feet
Watershed Area	908 acres
Watershed: Surface Area	43:1
Impairment Status	Impaired for nutrients since 2008
Downstream Waterbody	Lake Cornelia's South Basin



2.8.1 Water Quality Observations in Lake Cornelia's North Basin

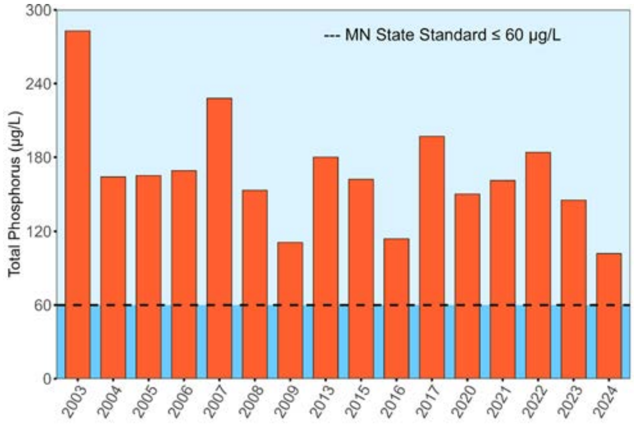
Lake Cornelia is located in the central portion of the City of Edina and is used primarily for fishing and wildlife viewing. Lake Cornelia is comprised of two basins, north and south. The two basins are connected by a small equalizing culvert under 66th Street. The normal water level in both the north and south basins are controlled by the outlet structure in the south basin, which includes a 14 foot long weir structure with a control elevation of 859.1 mean sea level (MSL). Water that discharges from the south basin of Lake Cornelia is conveyed to Lake Edina through an extensive storm sewer network.

Lake Cornelia's North Basin has a water surface area of approximately 21 acres, a maximum depth of 4 feet, and a mean depth of approximately 2.3 feet. The North Basin is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

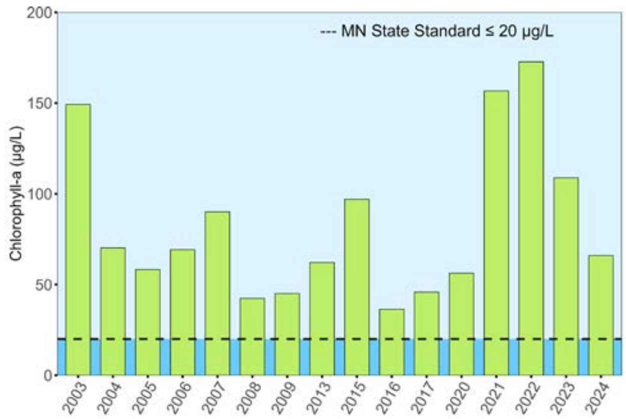
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Lake Cornelia was added to the Minnesota impaired waters list for excess nutrients in 2008.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Lake Cornelia's North Basin by NMCWD during 2004, 2008, 2013, 2015–2017, and 2020-2024 and by the Metropolitan Council Environmental Services (MCES) Community Assisted Monitoring Program (CAMP) during 2003 and 2005–2009. Poor water quality has been observed in the lake during the entire period of record. All summer average total phosphorus and chlorophyll-*a* concentrations and Secchi disk transparency values, including those monitored in 2024, failed to meet the Minnesota State water quality standards for shallow lakes in the North Central Hardwood Forest Ecoregion.

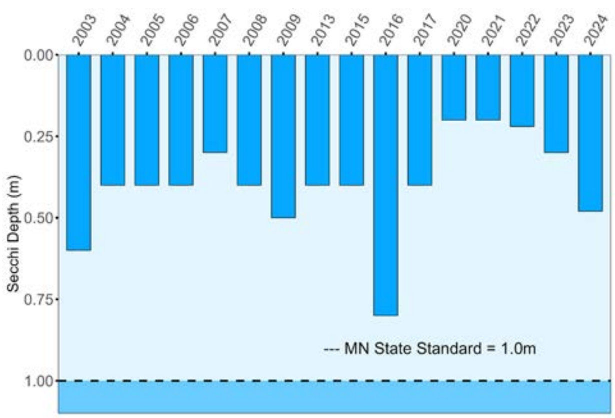
Chloride concentrations were measured by NMCWD in 2013, 2015–2017, and 2020–2024 generally between April and September. For all years with April/May samples, the chloride concentrations exceeded the MPCA chronic standard of 230 mg/L. Between 2021 and 2023 chloride concentrations remained above the chronic standard into later months of the summer likely due to the dry climatic conditions and resulting lack of flushing (i.e., low water levels and less water discharging from the lake). However, in 2024, the chloride concentrations dropped notably due to wetter spring and summer climatic conditions. All monitored chloride concentrations between June–September were below the state chronic standard.



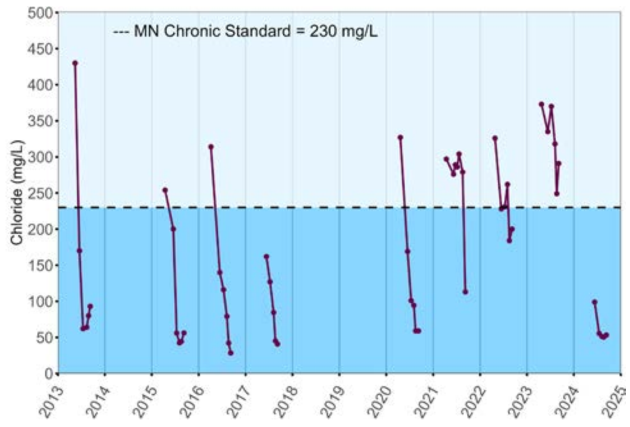
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Lake Cornelia's North Basin, the summer average total phosphorus concentrations have exceeded the shallow lake state standard for all monitored years between 2003–2024. In 2024 the summer average total phosphorus concentration was 102 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Lake Cornelia's North Basin, the summer average chlorophyll-*a* concentrations have exceeded the shallow lake state standard for all monitored years between 2003–2024. In 2024 the summer average chlorophyll-*a* concentration was 66 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Lake Cornelia's North Basin, the summer average Secchi disk transparency did not meet the shallow lake state standard for all monitored years between 2003–2024. In 2024 the summer average Secchi disk transparency was 0.5 meters.



Chloride can accumulate in lakes from road de-icing and water softening salts. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Lake Cornelia's North Basin, observed chloride concentrations have exceeded the state chronic criterion standard for portions of the monitored years between 2013–2023. In 2024, chloride concentrations dropped notably from observations in 2022 and 2023, which were particularly dry summers. A wet spring and early summer in 2024 provided opportunities for increased lake levels and flushing.

2.8.2 Water Quality Management Practices

The District completed a water quality study of Lake Cornelia in July of 2019 to identify water quality and ecological improvement measures. The study concluded that the poor water quality in Lake Cornelia is primarily due to excess phosphorus, which fuels algal production and decreases water clarity. An overabundance of rough fish was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Lake Cornelia to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study. A few of these practices were already in place before the study, but were identified as being key management efforts for continued improvement of lake health.

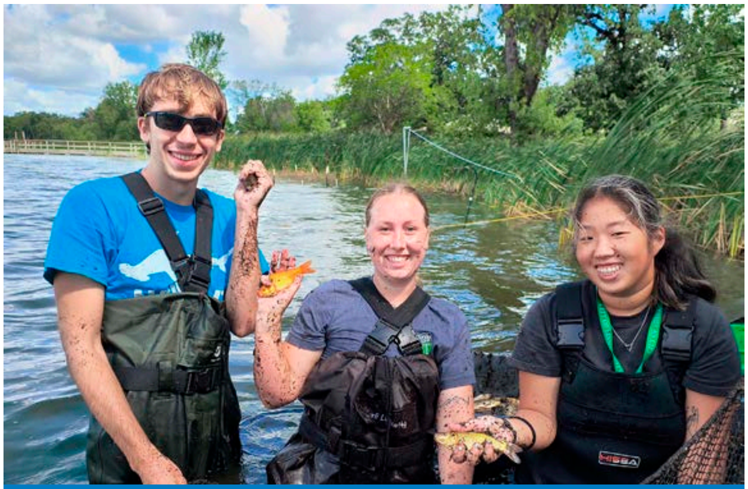
Management Practice	Basis	Year Implemented	Lead Agency
Herbicide Treatments	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	2017- Ongoing	NMCWD & City of Edina
Enhanced Street Sweeping	Reduce pollutant loading from stormwater runoff	2020 – Ongoing	City of Edina
Alum Sediment Treatment	Reduce internal sediment phosphorus load	2020	NMCWD
Rosland Park Stormwater Filtration Vault	Reduce nutrient/pollutant loading from stormwater (following stormwater events) and remove in-lake nutrients/pollutants (during dry weather)	2022 – Ongoing (system operating in July)	NMCWD & City of Edina
Rough Fish Removal	Reduce levels of goldfish to reduce sediment disturbance, reduce sediment phosphorus load, and promote food web balance	2023 – Ongoing	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2011 – Ongoing	NMCWD

Alum Treatment

Rosland Park Stormwater Filtration Vault

2.8.2.1 Fisheries Management

The water quality study completed by the District in 2020 identified goldfish and carp at biovolumes large enough to warrant further assessment as these rough fish species can have negative effects on lake water quality. The *Goldfish Population and Management Feasibility Study in the Lake Cornelia System* was completed by WSB from 2021–2022 to determine the environmental conditions that drive goldfish movements to upstream waterbodies, assess the goldfish population, and to test multiple goldfish removal/management methods. The study concluded that goldfish are likely spawning within their resident lakes near cattails and bullrush fringes rather than in upstream waterbodies and determined that small-mesh baited box nets were effective at removing goldfish (WSB, 2022). Following these conclusions, goldfish removal efforts were expanded in 2023 and 2024. In 2023, two box net traps were deployed and lifted on 12 occasions in the North Basin. In total, 1,829 pounds or approximately 42,133 individual goldfish were removed from the North Basin in 2023. In 2024, two box net traps were deployed and lifted on 13 occasions in the North Basin. In total, 1,420 pounds or approximately 10,420 individual goldfish were removed from the North Basin in 2024. Additionally, field staff noticed evidence of natural recruitment and increases in bluegill, golden shiners, and black crappie. The District plans to continue box netting efforts in 2025.



District staff assist with goldfish removal and fish survey efforts on Lake Cornelia

District staff netting fish on Lake Cornelia

2.8.3 Aquatic Plant Observations in Lake Cornelia's North Basin

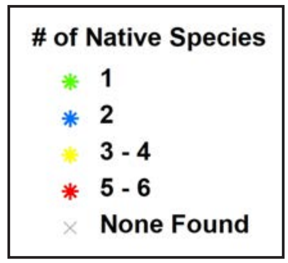
A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

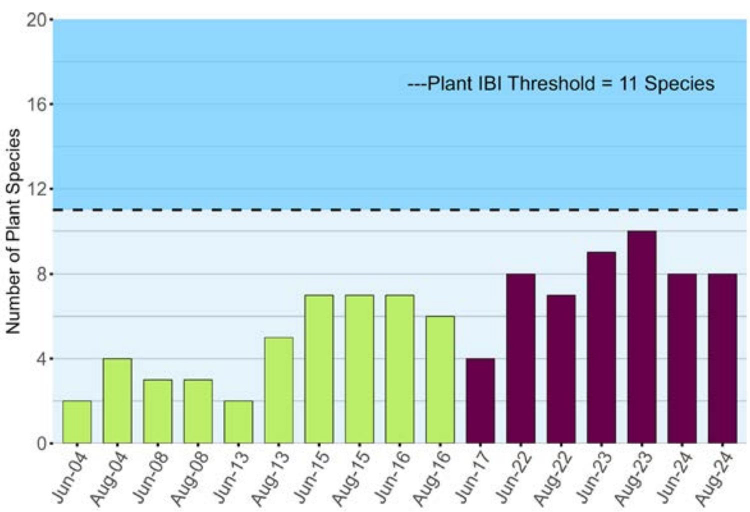
The District conducted point intercept plant surveys of Lake Cornelia's North Basin in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix E. The following page provides a list of the native plant species observed in 2024, their maximum percent occurrence (in either June or August), and the locations native plants were found during the August survey. Graphs also summarize the historical plant IBI scores between 2004 and 2024, tracking how the plant health conditions have changed over time.

Native Plants	Common Name	Maximum % Occurrence in 2024[1]
All Plants (Combined) Number of points with native plants: 17/48 sites		35% (A)
Submerged Plants		
Elodea canadensis	Common waterweed	19% (A)
Stuckenia pectinata	Sago pondweed	17% (A)
Ceratophyllum demersum	Coontail	15% (A)
Potamogeton nodosus	Longleaf pondweed	4% (A)
Floating/Emergent Plants		
Lemna minor	Small duckweed	4% (J)
Wolffia columbiana	Common watermeal	4% (A)
—	Filamentous algae	4% (A)
Spirodela polyrhiza	Large duckweed	Visual Only
Schoenoplectus acutus	Hardstem bullrush	Visual Only
Carex comosa	Bottle Brush sedge	Visual Only

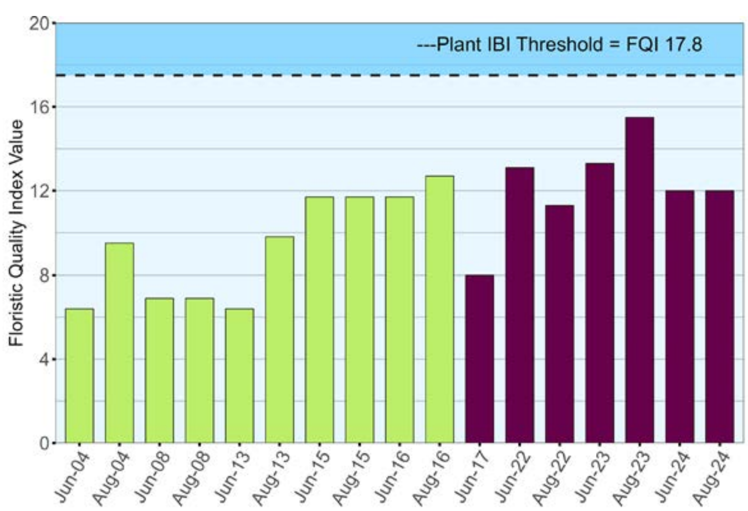
[1] Summarizes the maximum percent occurrence of a plant species from either the June (J) or August (A) 2024 point-intercept survey.



Number of native plant species observed at each observation point in Lake Cornelia's North Basin in August 2024.



Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Between 2004–2024, the number of species in Lake Cornelia's North Basin ranged from 2 to 10 and failed to meet the MNDNR Plant IBI threshold during the entire period. The number of species observed in 2024 was similar to what was observed in 2023.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. Between 2004–2024, FQI values in Lake Cornelia's North Basin ranged from 6.4 to 15.5, failing to meet the MNDNR Plant IBI threshold during this entire period. The FQI values observed in 2024 were slightly less than the values observed in 2023.

Note: purple bars indicate period following significant infestation of curly-leaf pondweed (CLP) and completion of spring herbicide treatments to reduce CLP prevalence.

Aquatic Invasive Plant Species

Five aquatic invasive plant species were found in Lake Cornelia's North Basin in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

A whole-lake herbicide application was completed on Lake Cornelia in spring 2024 to control the growth of curly-leaf pondweed (CLP). A June 2024 point intercept survey was used to assess the effectiveness of the spring treatment and help determine management needs for 2025. CLP was collected on the rake at 16 locations (33% occurrence) and visually observed at 1 additional location in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.5 during the June survey. During the August survey, CLP was not collected on a rake, which is typical for the plant's growth cycle.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the eastern shore in June and August. Most purple loosestrife plants showed damage from *Galerucella*, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Hybrid Eurasian watermilfoil

Observed in one location in mid-September along the north-central shoreline. NMCWD is working with the MNDNR for management options in 2025.

Reed canary grass (*Phalaris arundinaceae*)

Observed at one location along the eastern shore in June and August.

Image source: Endangered Resources Services

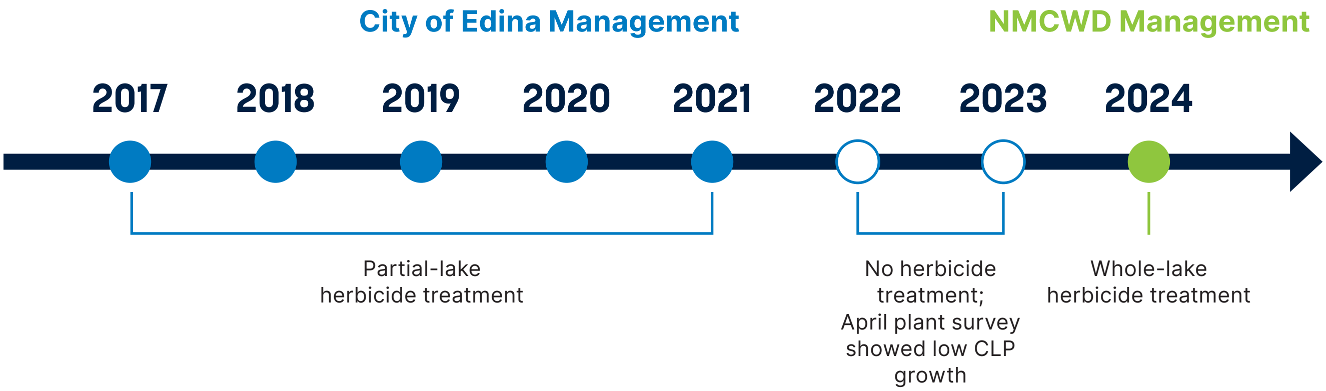
Hybrid cattail (*Typha X glauca*)

Dominant along the shore of the north basin during June and August.

2.8.4 Aquatic Invasive Species (AIS) Plant Management Practices

Since 2017, the City of Edina or NMCWD have been performing plant surveys in Lake Cornelia's North Basin to document the growth of the invasive species curly-leaf pondweed (CLP) and have managed during years with notable growth. The timeline below provides a summary of the management practices completed. The management of CLP in Lake Cornelia has been challenging. Post herbicide treatment surveys have observed small CLP plants regrowing from root masses and from "stick" or "micro" turions, which is atypical as compared to observations in other lakes with similar herbicide management histories.

In April 2024, the NMCWD submitted a lake vegetation management plan (LVMP) to the MNDNR. The LVMP provided a background on the existing AIS conditions, an overview of public participation, and summarized the proposed management goals and actions. The MNDNR approved the LVMP and authorized a 5-year variance to perform herbicide treatments on greater than 15% of the littoral area. NMCWD completed a whole-lake Endothall herbicide treatment in spring 2024. CLP management is expected to continue in Lake Cornelia in the coming years.



Curly-leaf pondweed in Lake Cornelia's North Basin, July 2023.

During an October 2024 turion survey completed by Endangered Resource Services, most turions were of the small "stick" or "micro" varieties, which is an uncommon observation.

During a June 2024 plant survey completed by Endangered Resource Services, small CLP plants were found re-growing from root systems post herbicide treatment.

2.8.5 Phytoplankton Observations in Lake Cornelia's North Basin

The phytoplankton community in Lake Cornelia's North Basin was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the next page summarizes the number and major groups of phytoplankton observed in Lake Cornelia's North Basin between April and September 2024. Blue-green algae (cyanobacteria) were the major taxon (or group) observed throughout the monitored period, representing 64% - 93% of the phytoplankton community. Green algae, diatoms, golden algae, haptophytes, and other taxa were also present throughout the monitored period but at notably lower percentages.

When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful since some species can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure. In 2024, blue-green algal blooms were observed in the lake April through September, with more severe blooms observed August through September. Total blue-green algae numbers between August and September ranged from approximately 863,400 units per milliliter in early August to approximately 1,075,700 units per milliliter in September. Potential toxin producing species between August and September ranged from approximately 171,400 units per milliliter in September to 381,300 units per milliliter in early August. These observed blue-green algae values are well above the WHO threshold of 100,000 per milliliter for a moderate probability of adverse health effects to recreational users. Through a partnership with the Minnesota Department of Health (MDH), it was confirmed that microcystin concentrations sampled within scums located in the North Basin exceeded the MPCA's recreational threshold of 6 µg/L during one monitoring event in early August. Microcystin is a liver toxin, and the level of damage is dependent on the amount ingested and length of exposure. When in doubt, it is best to stay out. Although there can be many causes of blue-green algal blooms, the high total phosphorus concentrations and hot summer conditions likely contributed to the growth and persistence of the blue-green algal population throughout the summer months.

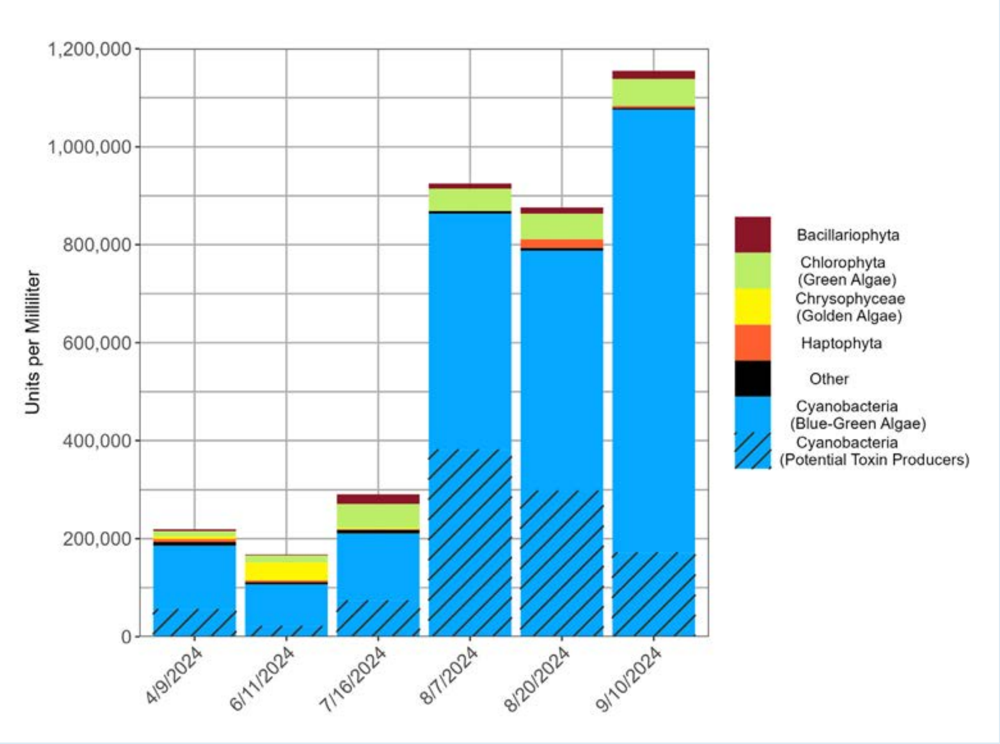
Phytoplankton

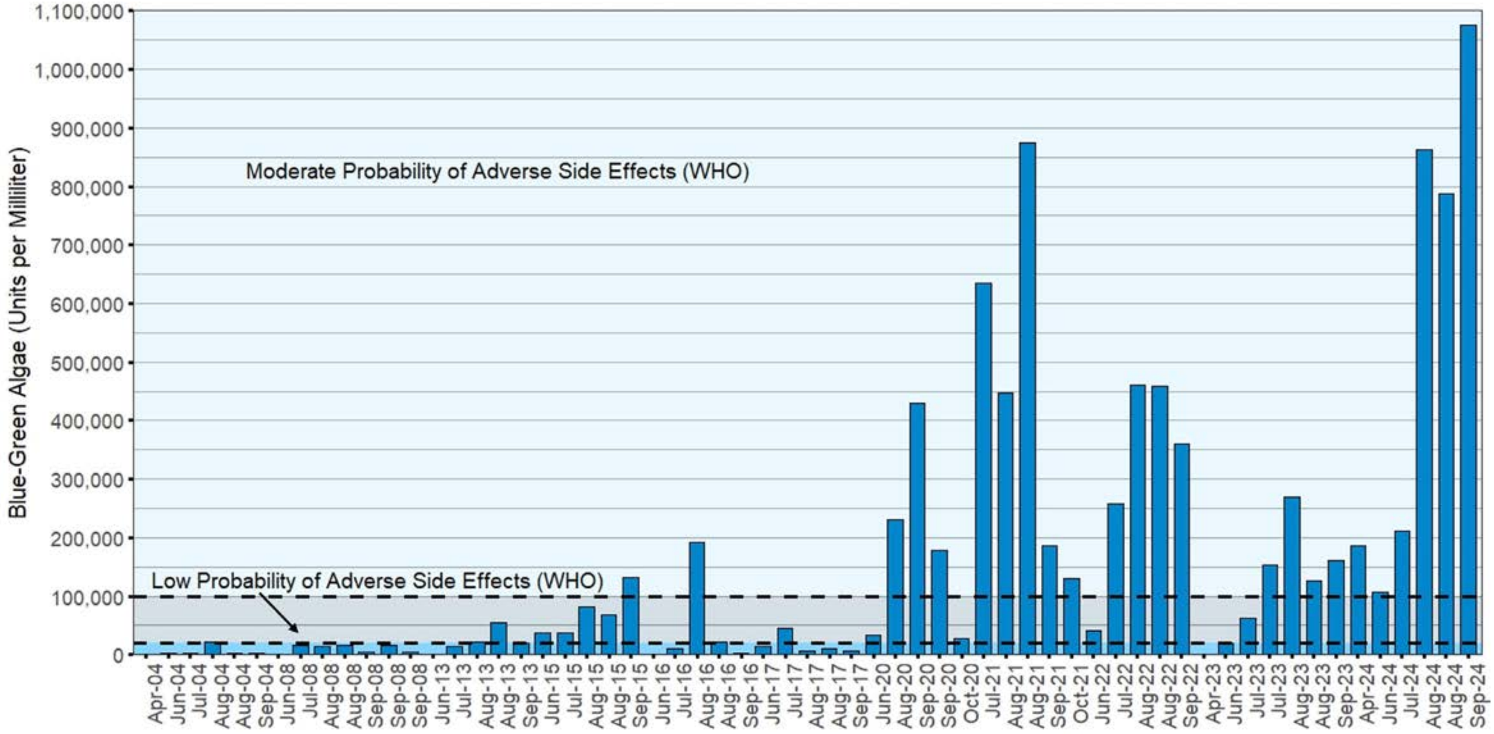
Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

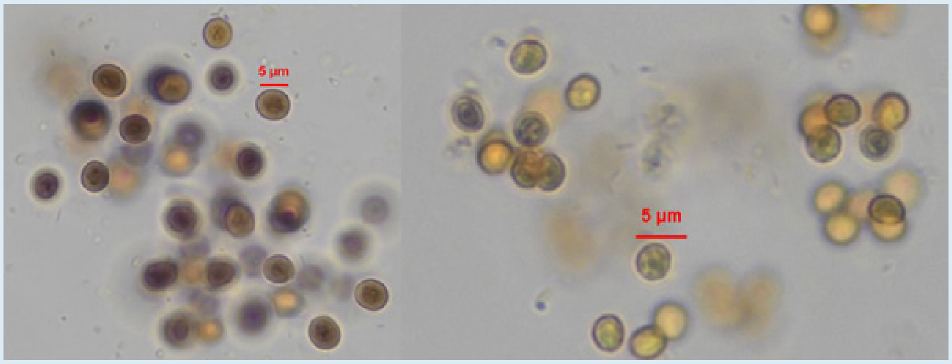
Cyanobacteria (blue-green) algae scum observed in mid-July 2024 in Lake Corenlia's North Basin

Over the past decade blue-green algae have historically been a concern in the Lake Cornelia's North Basin with blue-green algae cell counts observed well above the WHO thresholds for low or moderate probability of adverse health effects to recreational users on multiple occasions. Due to the higher abundance of algae, the City of Edina started treating Lake Cornelia with copper sulfate in 2013 to control algal growth. As such, the reported phytoplankton counts during 2013 – 2018 and 2022 - 2023 were impacted by algaecide treatments. The timeline below shows the approximate dates of the algal treatment efforts based on past records.

Between April and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure to the right summarizes the number and major groups of phytoplankton observed. Blue-green algae (cyanobacteria) were the most abundant taxon (or group) found in the Lake Cornelia's North Basin throughout the monitored period.







Microscopic image of Microcystis, a potential toxin producing blue-green algae species from Lake Cornelia's North Basin.
(Source GreenWater Laboratories)

Blue-green algae (cyanobacteria) have historically been found in Lake Cornelia's North Basin since monitoring began in 2004, with a notable increase in abundance in the last decade as seen above. Blue-green algae are associated with water quality problems and can be a source of health concerns not only for humans, but for wildlife. In 2024, blue-green algae were observed in the lake April through September, with severe blooms observed August through September. Blue-green algae numbers in 2024 ranged from approximately 106,800 units per milliliter in June to approximately 1,075,700 units per milliliter in September. Potential toxin producing species ranged from approximately 21,100 units per milliliter in June to 381,300 units per milliliter in early August.

2.8.6 Summary for Lake Cornelia's North Basin

Water quality of Lake Cornelia's North Basin was poor in 2024 and the lake failed to meet State eutrophication water quality standards for shallow lakes due to excess phosphorus and algae in the lake and poor water clarity. Chloride concentrations in the North Basin were lower than previous years due to wetter climatic conditions in spring and early summer. All 2024 monitoring events between June and September were below the MPCA chronic criteria.

Both the number of aquatic plant species in the lake and FQI values in 2024 failed to meet the MNDNR Plant IBI thresholds of 11 and 17.8, respectively. Both the number of species observed (8 species) and the FQI values (12) were similar to observations in the last two years.

Five invasive aquatic plant species were observed in the Lake Cornelia's North Basin in 2024 including the submerged species curly-leaf pondweed and hybrid Eurasian watermilfoil, and the emergent species hybrid cattail, purple loosestrife, and reed canary grass. The City of Edina conducted spring plant surveys and herbicide treatments from 2017 to 2021 within the North Basin to reduce the presence of curly-leaf pondweed. In April 2024, the NMCWD submitted a lake vegetation management plan (LVMP) to the MNDNR. The MNDNR approved the LVMP and authorized a 5-year variance to perform herbicide treatments greater than 15% of the littoral area. Correspondingly, the NMCWD completed a whole-lake herbicide treatment in spring 2024 to reduce the presence of curly-leaf pondweed. The management of CLP in Lake Cornelia has been challenging. Post herbicide treatment surveys have observed small CLP plants regrowing from root masses and regrowing from "stick" or "micro" turions, which is atypical as compared to observations in other lakes with similar herbicide management histories. CLP management is expected to continue in Lake Cornelia in the coming years.

In 2024, severe blue-green algal blooms were observed in the lake during the early August through September monitoring events, with blue-green counts well above the World Health Organization (WHO) threshold of 100,000 per milliliter for a moderate probability of adverse health effects to recreational users. Although there can be many causes of blue-green algal blooms, the high total phosphorus concentrations and hot summer conditions likely contributed to the growth and persistence of the blue-green algal population throughout the summer months.

The District completed a water quality study of Lake Cornelia in July of 2019 to identify water quality and ecological improvement measures. The study concluded that the poor water quality in Lake Cornelia is primarily due to excess phosphorus, which fuels algal production and decreases water clarity. An overabundance of rough fish was also found to be a water quality concern. Several management practices have been implemented since the water quality study was completed, including an alum sediment treatment, the installation of the Rosland Park Stormwater Filtration Vault, rough fish removals, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program.

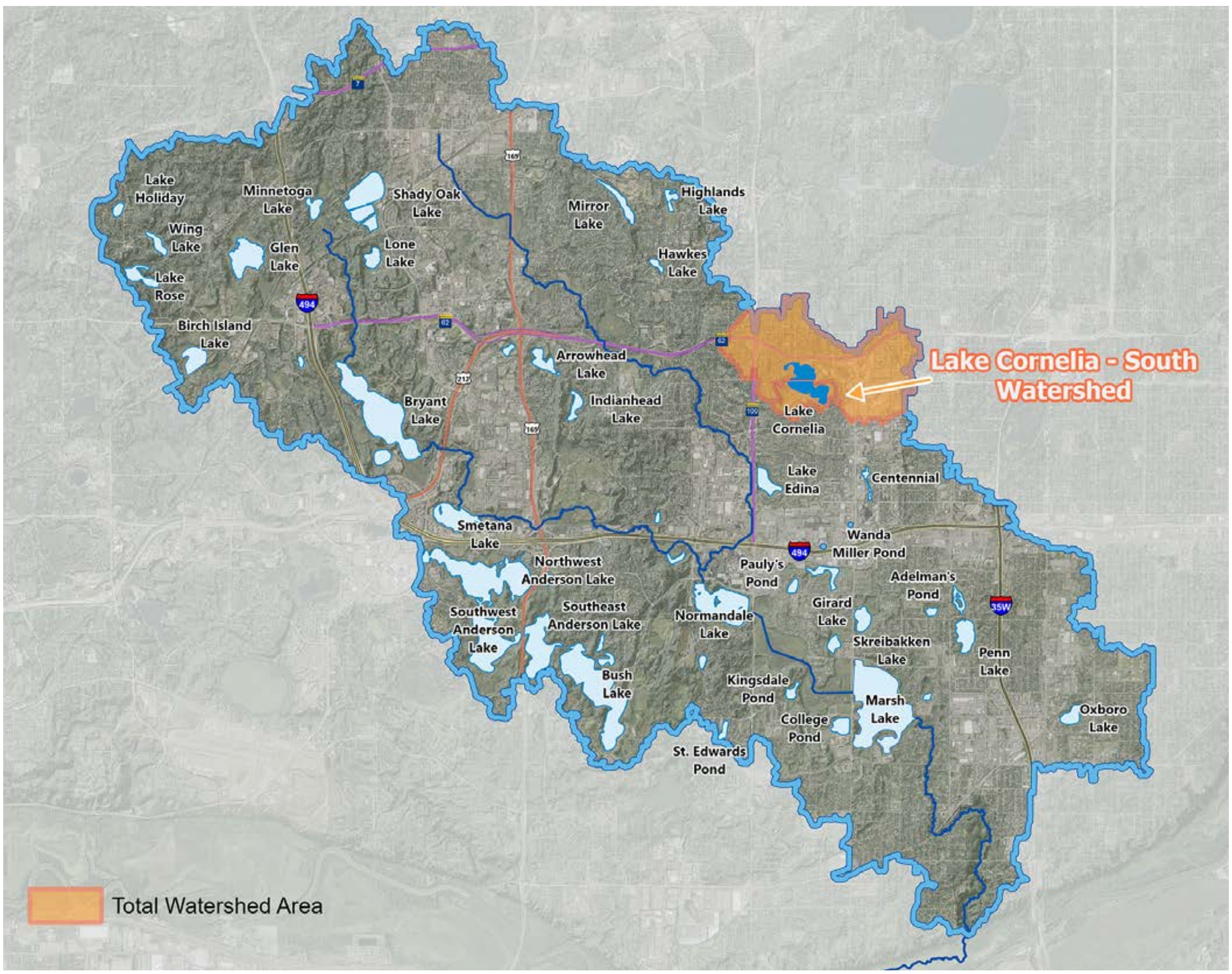
2.9 Lake Cornelia's South Basin

2024 MONITORED PARAMETERS

- **Water Quality**
- **Aquatic Plants (Macrophytes)**
- **Phytoplankton (Algae)**

APPENDICES: Maps showing aquatic plant survey results are included in Appendix E. Water quality and phytoplankton monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Edina
Surface Area	33 acres
Average/Maximum Depth	3.6 feet / 5 feet
Direct Watershed Area	112 acres
Total Watershed Area	1,020 acres
Watershed:Surface Area	31:1
Impairment Status	Impaired for nutrients since 2008
Upstream Waterbody	Lake Cornelia (North Basin)
Downstream Waterbody	Lake Edina



2.9.1 Water Quality Observations in Lake Cornelia's South Basin

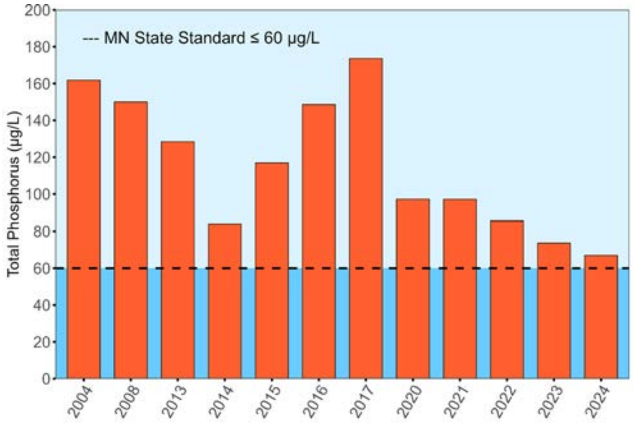
Lake Cornelia is located in the north central portion of the City of Edina and is used primarily for fishing and wildlife viewing. Lake Cornelia is comprised of two basins, north and south. The two basins are connected by a small equalizing culvert under 66th Street. The normal water level in both the north and south basins are controlled by the outlet structure in the south basin, which includes a 14 foot long weir structure with a control elevation of 859.1 mean sea level (MSL). Water that discharges from the south basin of Lake Cornelia is conveyed to Lake Edina through an extensive storm sewer network.

Lake Cornelia's South Basin has a water surface area of approximately 33 acres, a maximum depth of 5 feet, and a mean depth of approximately 3.6 feet. The South Basin is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

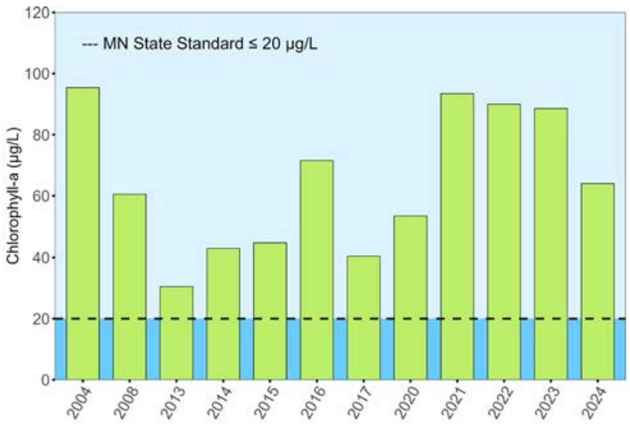
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Lake Cornelia was added to the Minnesota impaired waters list for excess nutrients in 2008.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Lake Cornelia's South Basin by NMCWD during 2004, 2008, 2013, 2015-2017, and 2020-2024. Poor water quality has been observed in the lake during the entire period of record. All summer average total phosphorus and chlorophyll-*a* concentrations and Secchi disk transparency values, including those monitored in 2024, failed to meet the Minnesota State eutrophication standards for shallow lakes in the North Central Hardwood Forest Ecoregion.

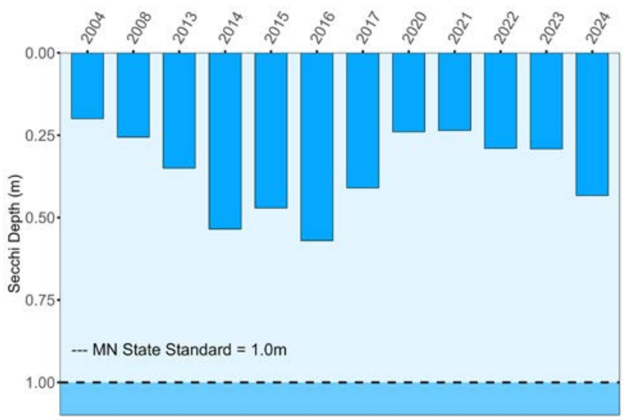
Chloride concentrations were measured by NMCWD in 2013, 2015-2017, and 2020-2024 generally between April and September. Observed chloride concentrations have exceeded the MPCA chronic standard of 230 mg/L for portions of the monitored years in 2013, 2021, 2022, and 2023. Between 2021 and 2023 chloride concentrations remained above the chronic standard into later months of the summer likely due to the dry climatic conditions and resulting lack of flushing (i.e., low water levels and less water discharging from the lake). However, in 2024, the chloride concentrations dropped notably due to wetter spring and summer climatic conditions. All monitored chloride concentrations between June–September were below the state chronic standard.



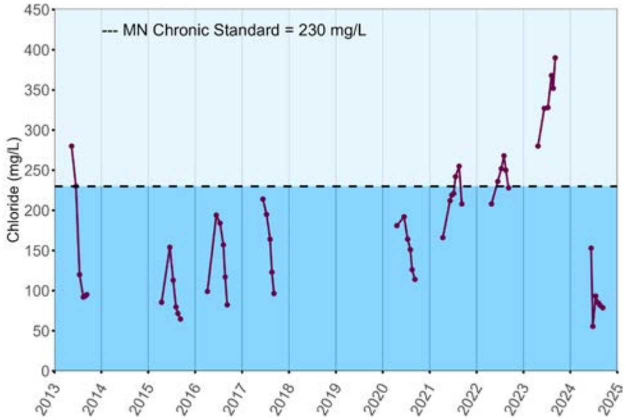
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Lake Cornelia's South Basin, the summer average total phosphorus concentrations have exceeded the shallow lake state standard for all monitored years between 2004–2024. In 2024 the summer average total phosphorus concentration was 67 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Lake Cornelia's South Basin, the summer average chlorophyll-*a* concentrations have exceeded the shallow lake state standard for all monitored years between 2004–2024. In 2024 the summer average chlorophyll-*a* concentration was 64 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Lake Cornelia's South Basin, the summer average Secchi disk transparency has not met the shallow lake state standard for all monitored years between 2004–2024. In 2024 the summer average Secchi disk transparency was 0.4 meters.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Lake Cornelia's South Basin, observed chloride concentrations have exceeded the state chronic criterion standard for portions of the monitored years in 2013, 2021, 2022 and 2023. In 2024, chloride concentrations dropped notably from previous years. A wet spring and early summer in 2024 provided opportunities for increased lake levels and flushing. The highest observed concentration was in June 2024 at 153 mg/L.

2.9.2 Water Quality Management Practices

The District completed a water quality study of Lake Cornelia in July of 2019 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Lake Cornelia were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of rough fish was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Lake Cornelia to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study. A few of these practices were already in place before the study, but were identified as being key management efforts for continued improvement of lake health.

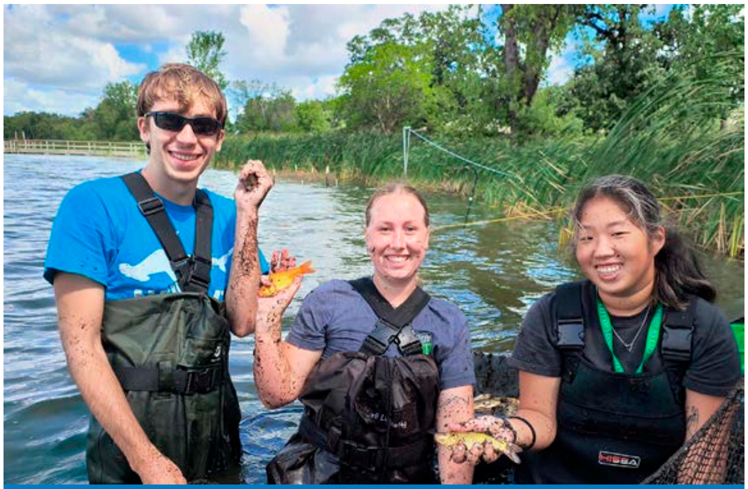
Management Practice	Basis	Year Implemented	Lead Agency
Herbicide Treatments	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions.	2017- Ongoing	NMCWD & City of Edina
Enhanced Street Sweeping	Reduce pollutant loading from stormwater runoff	2020 – Ongoing	City of Edina
Alum Sediment Treatment	Reduce internal sediment phosphorus load	2020	NMCWD
Rosland Park Stormwater Filtration Vault	Reduce nutrient/pollutant loading from stormwater (following stormwater events) and remove in-lake nutrients/pollutants (during dry weather)	2022 – Ongoing (system operating in July)	NMCWD & City of Edina
Rough Fish Removal	Reduce levels of goldfish and carp to reduce sediment disturbance, reduce sediment phosphorus load, and promote food web balance	2023 – Ongoing	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2019 – Ongoing	NMCWD

Alum Treatment

Rosland Park Stormwater Filtration Vault

2.9.2.1 Fisheries Management

The water quality study completed by the District in 2020 identified goldfish and carp at biovolumes large enough to warrant further assessment as these rough fish species can have negative effects on lake water quality. The *Goldfish Population and Management Feasibility Study in the Lake Cornelia System* was completed by WSB from 2021–2022 to determine the environmental conditions that drive goldfish movements to upstream waterbodies, assess the goldfish population, and to test multiple goldfish removal/management methods. The study concluded that goldfish are likely spawning within their resident lakes near cattails and bullrush fringes rather than in upstream waterbodies and determined that small-mesh baited box nets were effective at removing goldfish (WSB, 2022). Following these conclusions, goldfish removal efforts were expanded in 2023 and 2024. In 2023, two box net traps were deployed and lifted on 12 occasions in the South Basin. In total, 1,162 pounds or approximately 12,360 individual goldfish were removed from the South Basin in 2023. In 2024, two box net traps were deployed and lifted on 13 occasions in the South Basin. In total, 491 pounds or approximately 2,370 individual goldfish were removed from the South Basin in 2024. Additionally, field staff noticed evidence of natural recruitment and increases in bluegill, golden shiners, and black crappie. The District plans to continue box netting efforts in 2025.



District staff assist with goldfish removal and fish survey efforts on Lake Cornelia

District staff netting fish on Lake Cornelia

2.9.3 Aquatic Plant Observations in Lake Cornelia's South Basin

A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

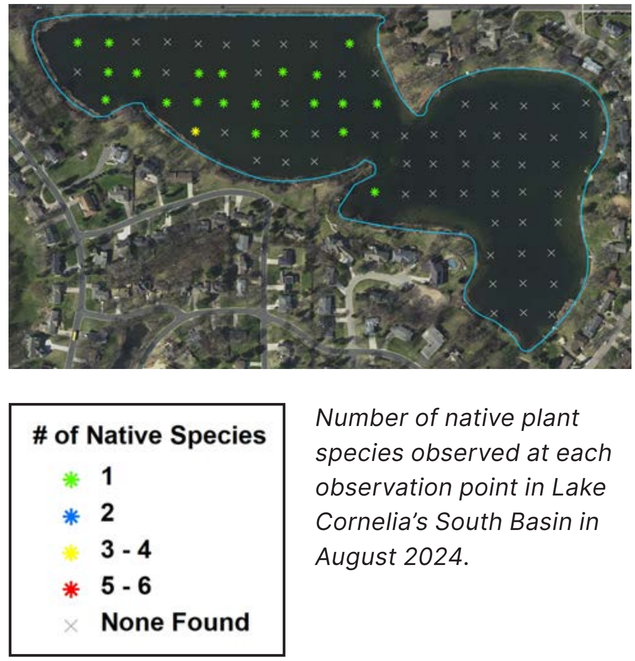
The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

The District conducted point intercept plant surveys of Lake Cornelia's South Basin in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix E. The following page provides a list of the native plant species observed in 2024, their maximum percent occurrence (in either June or August), and the locations native plants were found during the August survey. Graphs also summarize the historical plant IBI scores between 2004 and 2024, tracking how the plant health conditions have changed over time.

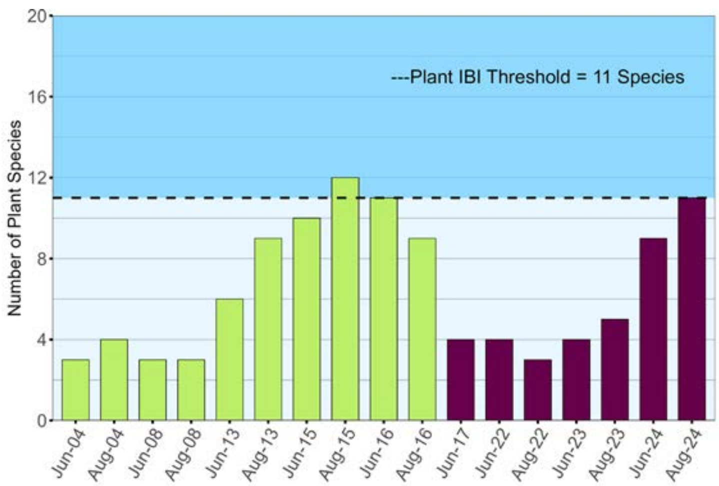
Long-leaf pondweed observed in Lake Cornelia's South Basin

Native Plants	Common Name	Maximum % Occurrence in 2024[1]
All Plants (Combined) Number of points with native plants: 21/77 sites		27% (A)
Submerged Plants		
Elodea canadensis	Common waterweed	23% (A)
Potamogeton nodosus	Long-leaf pondweed	3% (A)
Stuckenia pectinata	Sago pondweed	1% (A)
Chara sp.	Muskgrasses	1% (J)
Floating/Emergent Plants		
—	Filamentous algae	4% (J)
Lemna minor	Small duckweed	1% (A)
Spirodela polyrhiza	Large duckweed	1% (A)
Wolffia columbiana	Common watermeal	1% (A)
Bolboschoenus fluviatilis	River bulrush	Visual Only
Sagittaria latifolia	Common arrowhead	Visual Only
Schoenoplectus acutus	Hardstem bulrush	Visual Only
Schoenoplectus tabernaemontani	Softstem bulrush	Visual Only
Sparganium eurycarpum	Common bur-reed	Visual Only
Iris virginica	Southern blue flag	Visual Only

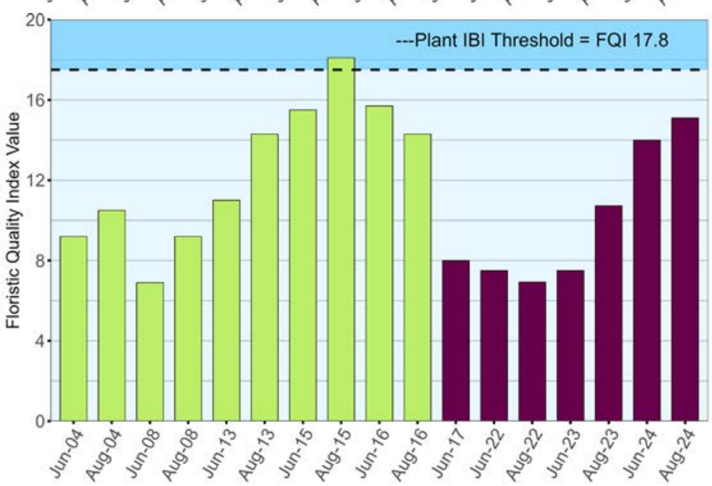
[1] Summarizes the the maximum percent occurrence of a plant species from either the June (J) or August (A) 2024 point-intercept survey.



Number of native plant species observed at each observation point in Lake Cornelia's South Basin in August 2024.



Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Between 2004–2024, the number of species in Lake Cornelia's South Basin ranged from 3 to 12 and met the MNDNR Plant IBI threshold on three occasions in 2015, 2016, and 2024. The number of species observed in 2024 was higher than what was observed in recent years.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. Between 2004–2024, FQI values in Lake Cornelia's South Basin ranged from 6.9 to 18.1, failing to meet the MNDNR Plant IBI threshold except in August 2015. The FQI values observed in 2024 were higher than what was observed in recent years.

Note: purple bars indicate period following significant infestation of curly-leaf pondweed (CLP) and completion of spring herbicide treatments to reduce CLP prevalence.

Aquatic Invasive Plant Species

Four aquatic invasive plant species were found in Lake Cornelia's South Basin in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

A whole-lake herbicide application was completed on Lake Cornelia in spring 2024 to control the growth of curly-leaf pondweed. A June 2024 point intercept survey was used to assess the effectiveness of the spring treatment and help determine management needs for 2025. Curly-leaf pondweed was collected on the rake at 24 locations (59% occurrence) in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.1 during the June survey. During the August survey, curly-leaf pondweed was not collected on a rake, which is typical for the plant's growth cycle.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the western shoreline in June and August. Most purple loosestrife plants are managed naturally by Galerucella, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Reed canary grass (*Phalaris arundinaceae*)

Observed at one location along the western shoreline in June and August.

Image source: Endangered Resources Services

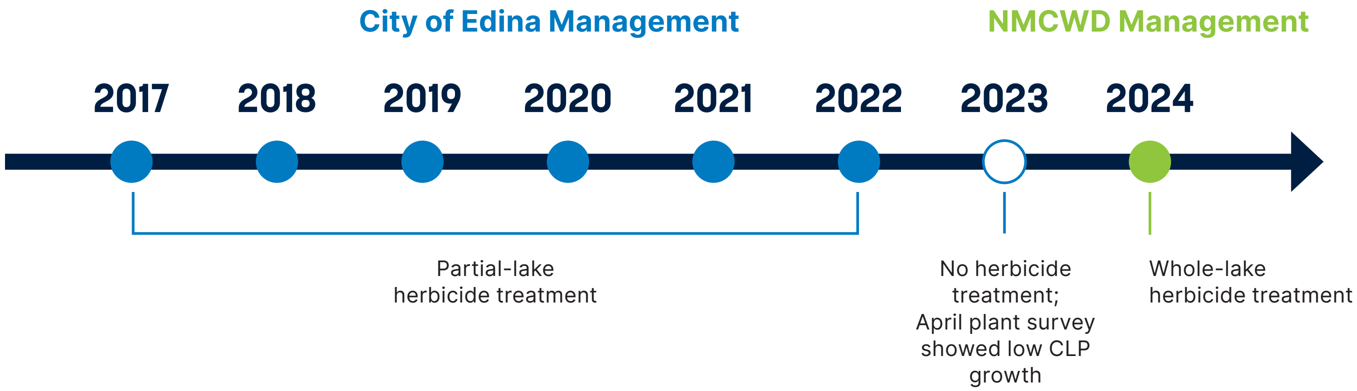
Hybrid cattail (*Typha X glauca*)

Observed scattered around the shoreline in August.

2.9.4 Aquatic Invasive Species (AIS) Plant Management Practices

Since 2017, the City of Edina or NMCWD have been performing plant surveys in the Lake Cornelia's South Basin to document the growth of the invasive species curly-leaf pondweed (CLP) and have managed during years with notable growth. The timeline below provides a summary of the management practices completed. The management of CLP in Lake Cornelia has been challenging. Post herbicide treatment surveys have observed small CLP plants regrowing from root masses and from "stick" or "micro" turions, which is atypical as compared to observations in other lakes with similar herbicide management histories.

In April 2024, the NMCWD submitted a lake vegetation management plan (LVMP) to the MNDNR. The LVMP provided a background on the existing AIS conditions, an overview of public participation, and summarized the proposed management goals and actions. The MNDNR approved the LVMP and authorized a 5-year variance to perform herbicide treatments on greater than 15% of the littoral area. NMCWD completed a whole-lake Endothall herbicide treatment in spring 2024. CLP management is expected to continue in Lake Cornelia in the coming years.



During an October 2024 turion survey completed by Endangered Resource Services, most turions were of the small "stick" or "micro" varieties, which is an uncommon observation.

In Lake Cornelia, small CLP plants were found growing from microturions.

During a June 2024 plant survey completed by Endangered Resource Services, small CLP plants were found re-growing from root systems post herbicide treatment.

2.9.5 Phytoplankton Observations in Lake Cornelia's South Basin

The phytoplankton community in Lake Cornelia's South Basin was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the next page summarizes the number and major groups of phytoplankton observed in Lake Cornelia's South Basin between April and September 2024. Blue-green algae (cyanobacteria) were the major taxon (or group) observed throughout the monitored period, representing 36%–98% of the phytoplankton community. Green algae, diatoms, golden algae, haptophytes, and other taxa were also present throughout the monitored period but at notably lower percentages.

When water is warm and rich in nutrients, cyanobacteria can grow quickly forming blooms. These blooms can be considered harmful since some species can produce cyanotoxins. Human or wildlife exposure to cyanotoxins may cause skin irritations, including rashes, hives, swelling or skin blisters. Ingestion of cyanotoxins can also cause more severe health effects such as liver or kidney damage, seizures, or death, depending on the cyanotoxin and the magnitude, duration and frequency of the exposure. In 2024, blue-green algal blooms were observed in the lake April through September, with more severe blooms observed June through September. Total blue-green algae numbers between June and September ranged from approximately 1,295,000 units per milliliter in June to approximately 3,453,000 units per milliliter in September. Potential toxin producing species between June and September ranged from approximately 204,750 units per milliliter in June to 633,200 units per milliliter in early August. These observed blue-green algae values are well above the WHO threshold of 100,000 per milliliter for a moderate probability of adverse health effects to recreational users. Through a partnership with the Minnesota Department of Health (MDH), it was confirmed that microcystin concentrations sampled within scums located in the South Basin exceeded the MPCA's recreational threshold of 6 µg/L on two monitored occasions in early August and early September. Microcystin is a liver toxin, and the level of damage is dependent on the amount ingested and length of exposure. When in doubt, it is best to stay out. Although there can be many causes of blue-green algal blooms, the high total phosphorus concentrations and hot summer conditions likely contributed to the growth and persistence of the blue-green algal population throughout the summer months.

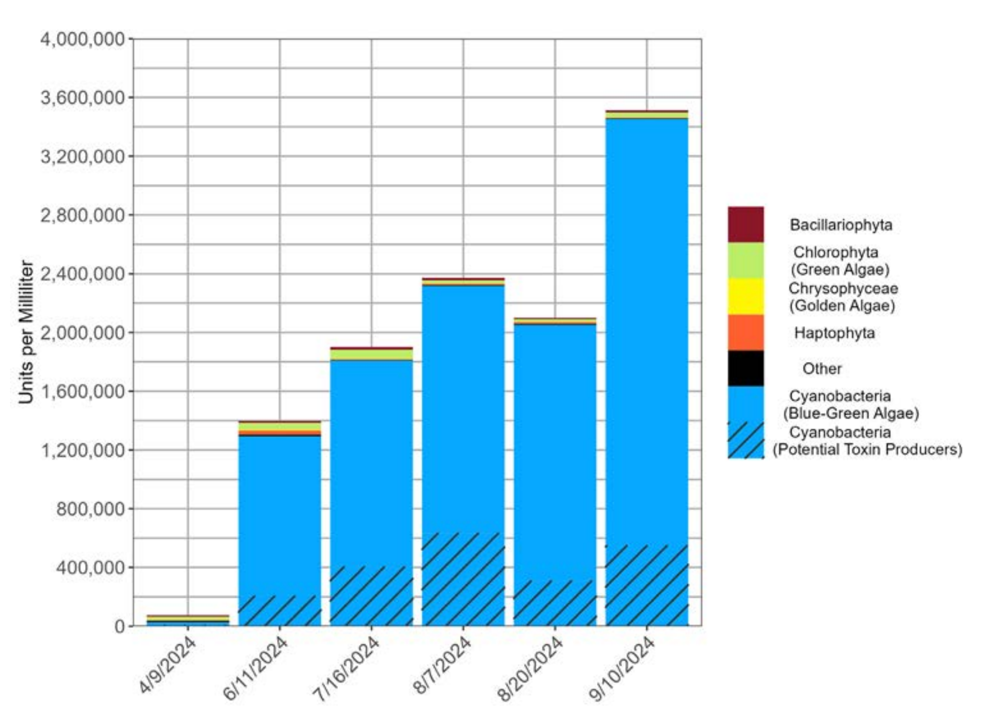
Phytoplankton

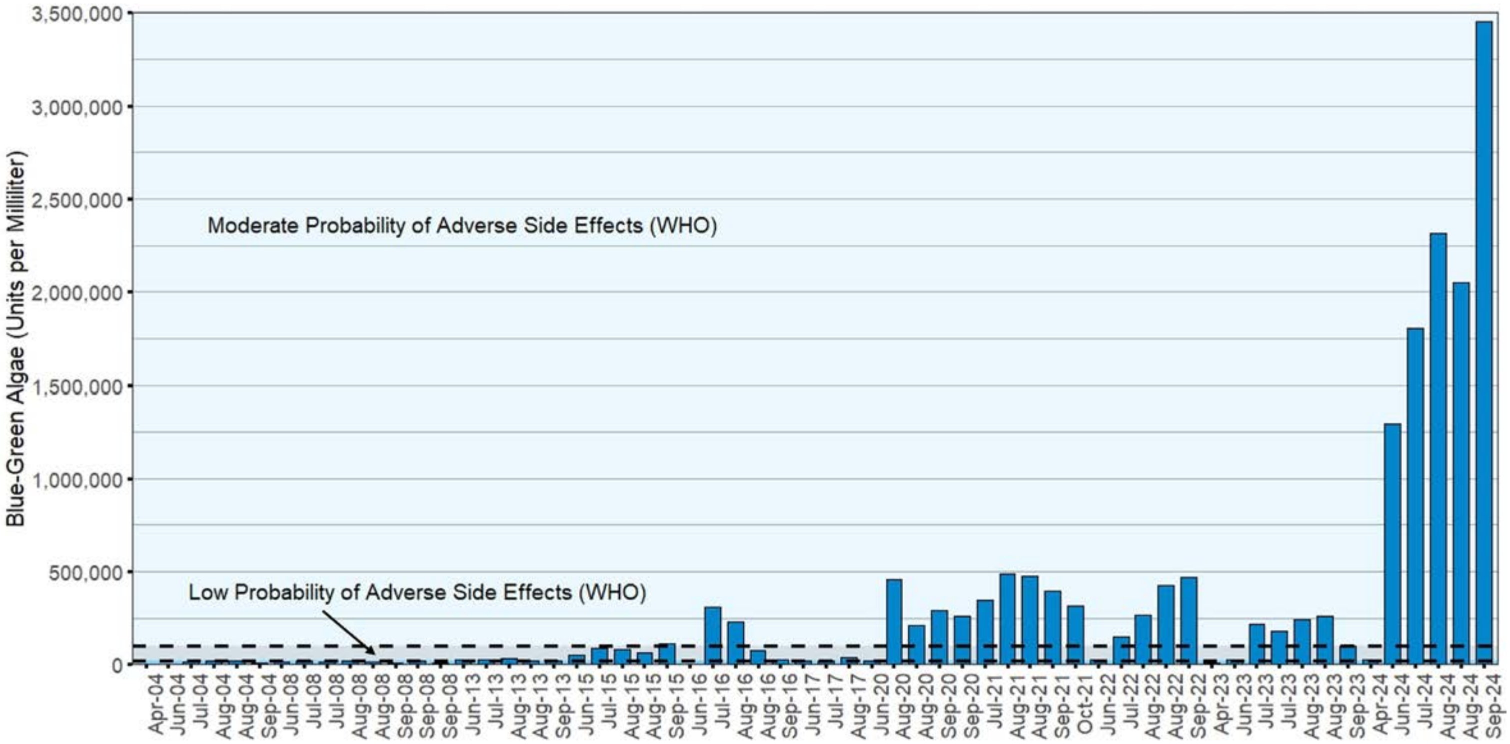
Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

Cyanobacteria (blue-green) algae scum observed in mid-July 2024 in Lake Cornelia's South Basin.

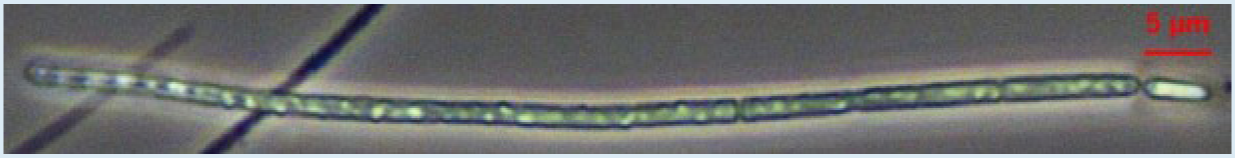
Over the past decade blue-green algae have historically been a concern in the Lake Cornelia's South Basin with blue-green algae cell counts observed well above the WHO thresholds for low or moderate probability of adverse health effects to recreational users on multiple occasions. Due to the higher abundance of algae, the City of Edina started treating Lake Cornelia with copper sulfate in 2013 to control algal growth. As such, the reported phytoplankton counts during 2013–2018 and 2022–2023 were impacted by algaecide treatments. The timeline below shows the approximate dates of the algal treatment efforts based on past records.

Between April and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure to the right summarizes the number and major groups of phytoplankton observed. Blue-green algae (cyanobacteria) were the most abundant taxon (or group) found in the Lake Cornelia's South Basin throughout the monitored period.





Blue-green algae (cyanobacteria) have historically been found in Lake Cornelia's South Basin since monitoring began in 2004, with a notable increase in abundance in the last decade as seen above. Blue-green algae are associated with water quality problems and can be a source of health concerns not only for humans, but for wildlife. In 2024, blue-green algae were observed in the lake April through September, with severe blooms observed June through September. Blue-green algae numbers in 2024 ranged from approximately 27,400 units per milliliter in April to approximately 3,453,000 units per milliliter in September. Potential toxin producing species ranged from approximately 4,900 units per milliliter in April to 633,200 units per milliliter in early August.



Microscopic image of Raphidiopsis raciborskii, a potential toxin producing blue-green algae species from Lake Cornelia's South Basin.

(Source GreenWater Laboratories)

2.9.6 Summary for Lake Cornelia's South Basin

Water quality of Lake Cornelia's South Basin was poor in 2024 and the lake failed to meet State eutrophication water quality standards for shallow lakes due to excess phosphorus and algae in the lake and poor water clarity. Chloride concentrations in the South Basin were lower than previous years due to wetter climatic conditions in spring and early summer. All 2024 monitoring events between June and September were below the MPCA chronic criteria.

Both the number of aquatic plant species in the lake and FQI values in 2024 were higher than what was observed in recent years. A total of 9 and 11 species, either submerged, floating, or emergent, were observed in the June and August plant surveys, respectively. The number of species observed in August met the MNDNR Plant IBI threshold of 11 species, but most species were found at low extents. The FQI values ranged between 14.0–15.1 and failed to meet the MNDNR Plant IBI threshold of 17.8.

Four invasive aquatic plant species were observed in the Lake Cornelia's South Basin in 2024 including the submerged species curly-leaf pondweed and the emergent species hybrid cattail, purple loosestrife, and reed canary grass. The City of Edina conducted spring plant surveys and herbicide treatments from 2017 to 2022 within the South Basin to reduce the presence of curly-leaf pondweed. In April 2024, the NMCWD submitted a lake vegetation management plan (LVMP) to the MNDNR. The MNDNR approved the LVMP and authorized a 5-year variance to perform herbicide treatments greater than 15% of the littoral area. Correspondingly, the NMCWD completed a whole-lake herbicide treatment in spring 2024 to reduce the presence of curly-leaf pondweed. The management of CLP in Lake Cornelia has been challenging. Post herbicide treatment surveys have observed small CLP plants regrowing from root masses and regrowing from "stick" or "micro" turions, which is atypical as compared to observations in other lakes with similar herbicide management histories. CLP management is expected to continue in Lake Cornelia in the coming years.

In 2024, severe blue-green algal blooms were observed in the lake during June through September monitoring events, with blue-green counts well above the World Health Organization (WHO) threshold of 100,000 per milliliter for a moderate probability of adverse health effects to recreational users. Although there can be many causes of blue-green algal blooms, the high total phosphorus concentrations and hot summer conditions likely contributed to the growth and persistence of the blue-green algal population throughout the summer months.

The District completed a water quality study of Lake Cornelia in July of 2019 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Lake Cornelia were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of rough fish was also found to be a water quality concern. Several management practices have been implemented since the water quality study was completed, including an alum sediment treatment, the installation of the Rosland Park Stormwater Filtration Vault, rough fish removals, aquatic invasive species plant management, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program.

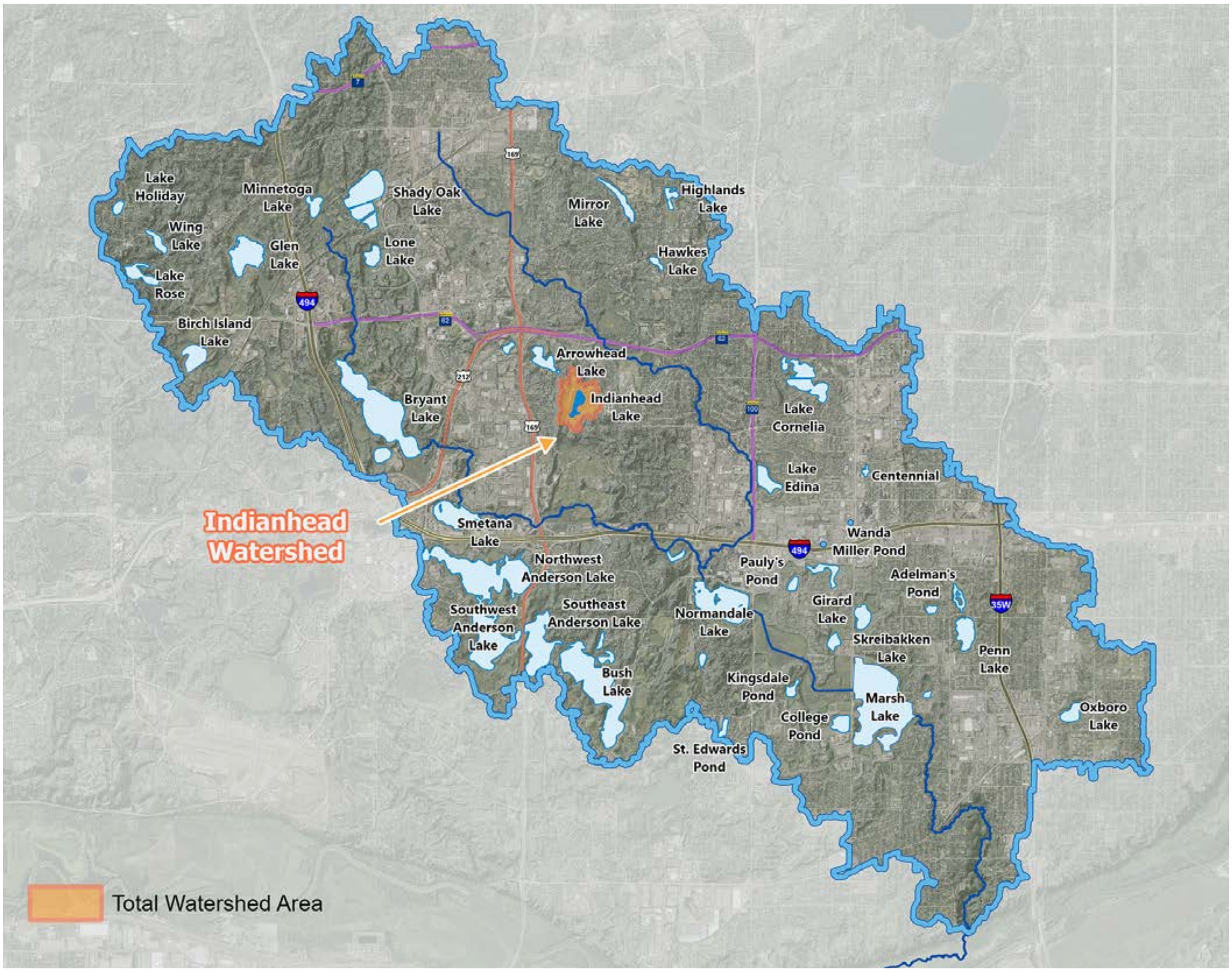
2.10 Indianhead Lake

2024 MONITORED PARAMETERS

- **Water Quality**

APPENDICES: Water quality monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Edina
Surface Area	14 acres
Average/Maximum Depth	3.1 feet / 5.3 feet
Watershed Area	107 acres
Watershed:Surface Area	8:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Downstream Waterbody	Landlocked



2.10.1 Water Quality Observations in Indianhead Lake

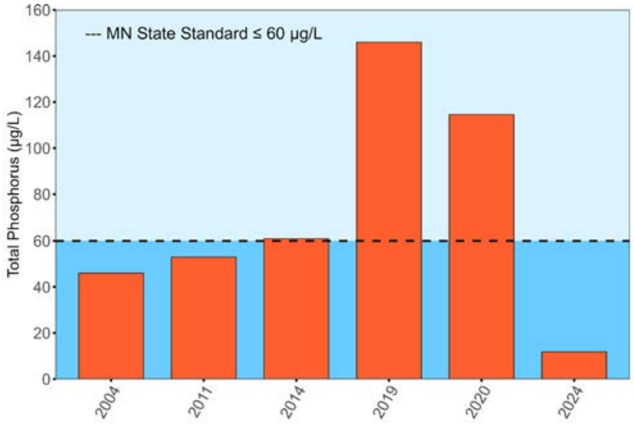
Indianhead Lake is located in the City of Edina and is used primarily for wildlife viewing. Indianhead Lake is land-locked with no surface outlets. Thus, the water level in the lake depends on weather conditions (snowmelt, rainfall, evaporation) and groundwater flow.

Indianhead Lake has a water surface area of approximately 14 acres, a maximum depth of 5.3 feet, and a mean depth of approximately 3.1 feet at the lake's 10-year average water surface elevation between 2015–2024. Indianhead Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

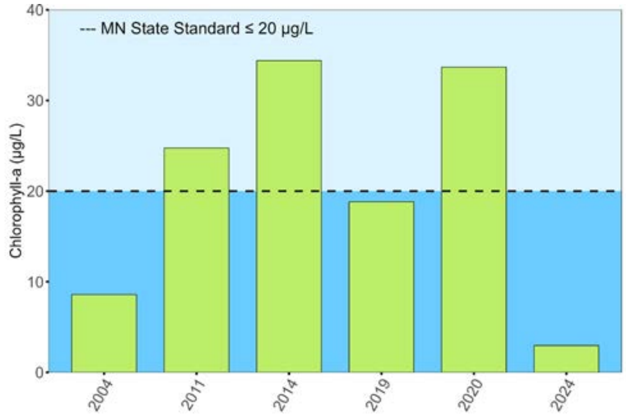
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Indianhead Lake is not on the Minnesota impaired waters list.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Indianhead Lake by the NMCWD during 2004, 2011, 2014, 2019, 2020, and 2024. Monitoring data from 2024 indicate that the management activities completed in 2024 as part of the Arrowhead and Indianhead Lakes Water Quality Improvement Project have improved the lake's water quality. The summer average total phosphorus and chlorophyll-*a* concentrations monitored in 2024 were notably lower than concentrations monitored between 2004–2020. Similarly, the 2024 Secchi disk transparency measurements were noticeably improved from measurements between 2004–2020. All three eutrophication parameters were better than their respective state eutrophication standards.

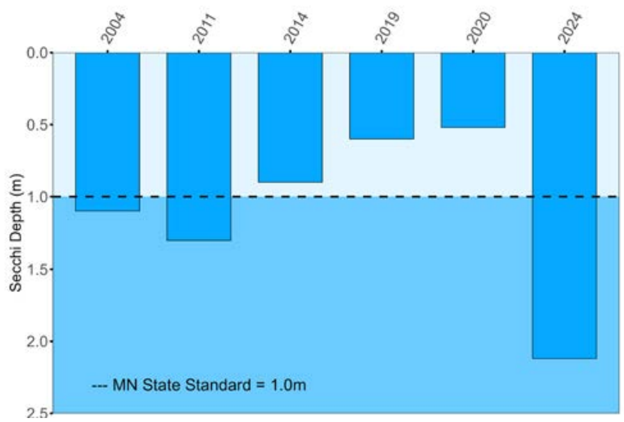
Chloride concentrations were measured by the NMCWD in 2011, 2014, 2019, 2020, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. In 2024, chloride concentrations were monitored between June and September. The highest observed concentration was in June 2024 at 112 mg/L. The average chloride concentration between June and September 2024 was 98 mg/L.



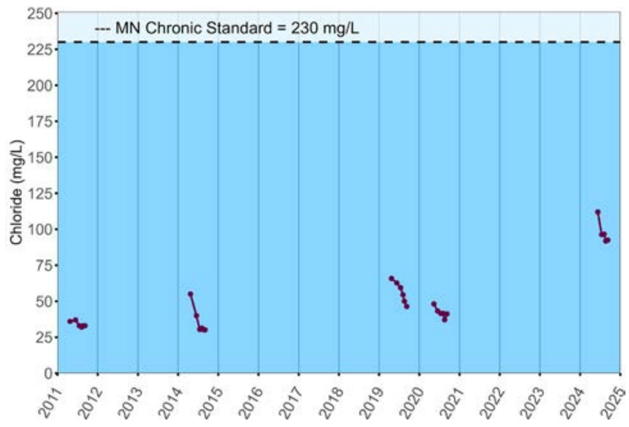
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Indianhead Lake, the summer average total phosphorus concentrations have been better than the shallow lake state standard in 2004, 2011, and 2024. In 2024 the summer average total phosphorus concentration was 12 µg/L, which is notably lower than the summer average concentrations observed between 2014–2020. Improved phosphorus concentrations in 2024 are likely the result of water quality improvement projects that were implemented in 2024.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Indianhead Lake, the summer average chlorophyll-*a* concentrations have been better than the shallow lake state standard in 2004, 2019, and 2024. In 2024 the summer average chlorophyll-*a* concentration was 3 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Indianhead Lake, the summer average Secchi disk transparency has met or been better than the shallow lake state standard in 2004, 2011, and 2024. In 2024 the summer average Secchi disk transparency was 2.1 meters where the Secchi disk could be viewed all the way to the lake bottom for all monitoring events.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Indianhead Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. In 2024, chloride concentrations were monitored between June and September. The highest observed chloride concentration was 112 mg/L in June 2024. The average chloride concentration between June and September 2024 was 98 mg/L.

2.10.2 Water Quality Management Practices

The District completed a water quality study of Indianhead Lake in August of 2022 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Indianhead Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed was also found to be a water quality concern. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Indianhead Lake to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study. A few of these practices were already in place before the study, but were identified as being key management efforts for continued improvement of lake health.

Management Practice	Basis	Year Implemented	Lead Agency
Herbicide Treatments	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	2019 – ongoing	City of Edina
Enhanced Street Sweeping	Reduce pollutant loading from stormwater runoff	2023 – ongoing	City of Edina
Alum + Iron Treatment	Reduce internal sediment phosphorus load	2024	NMCWD
Upgrades to Aeration System	Reduce internal sediment phosphorus load and improve fisheries health	2024 – ongoing (system operating in fall 2024)	NMCWD & City of Edina
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	Ongoing	NMCWD

Aeration System Improvements

Alum + Iron Treatment

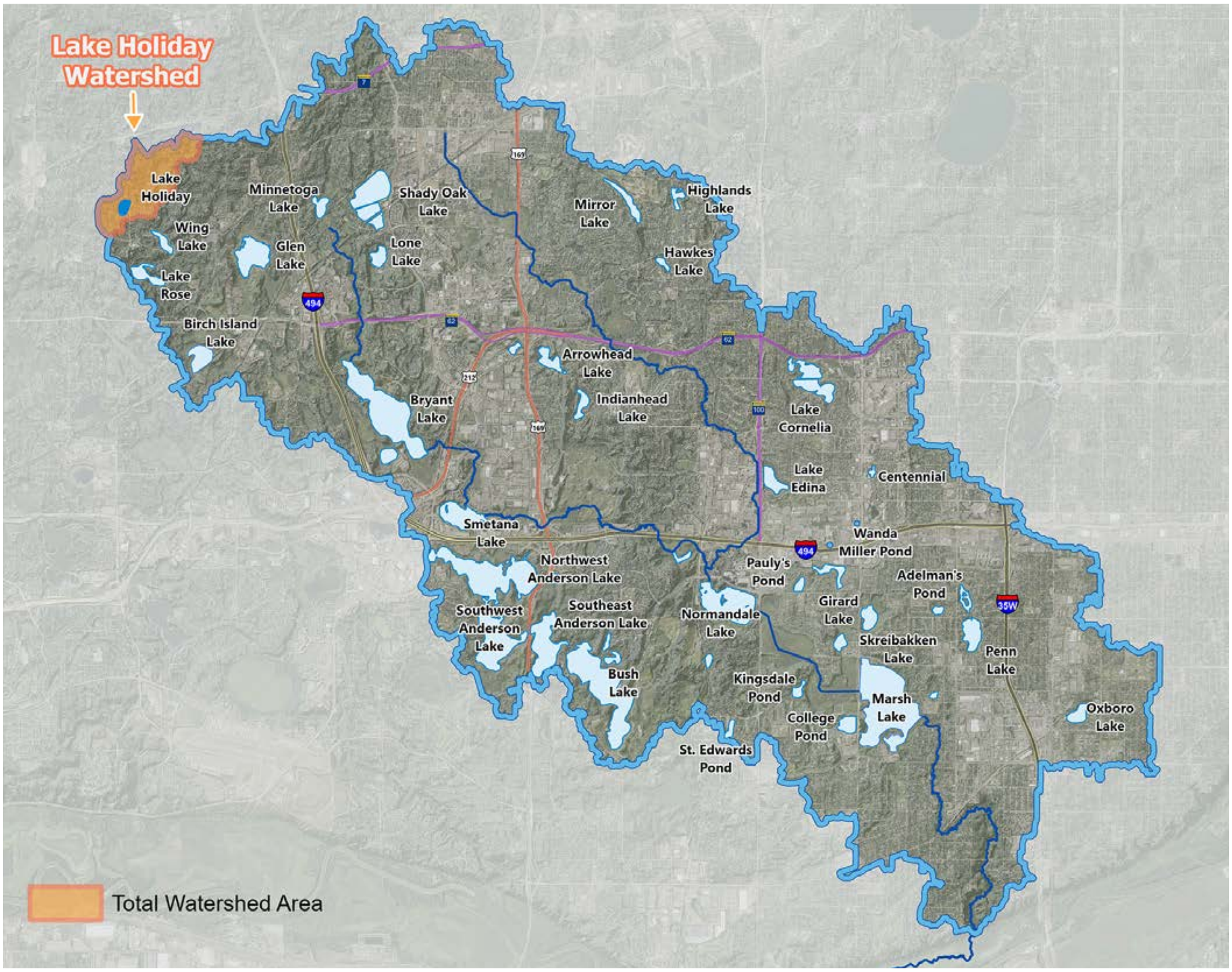
2.11 Lake Holiday

2024 MONITORED PARAMETERS

- **Aquatic Plants (Macrophytes)**

APPENDICES: Maps showing aquatic plant survey results are included in Appendix F.

Shallow/Deep	Shallow
Location	Minnetonka
Surface Area	8 acres
Average/Maximum Depth	3.1 feet / 5 feet
Watershed Area	312 acres
Watershed: Surface Area	39:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Downstream Waterbody	Wing Lake



2.11.1 Aquatic Plant Observations in Lake Holiday

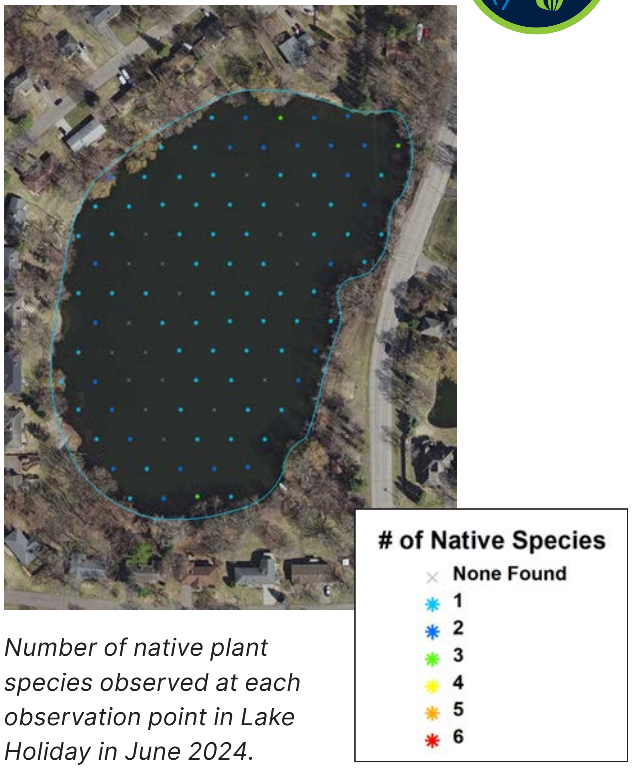
A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

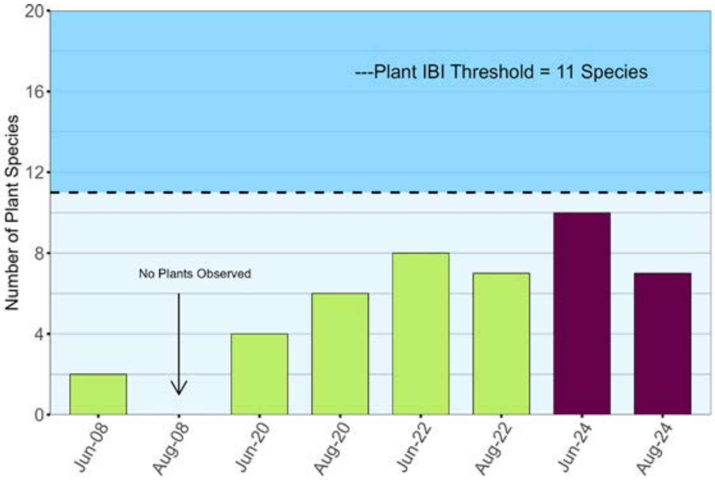
The District conducted point intercept plant surveys of Lake Holiday in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix F. The follwoing page provides a list of the native plant species observed in 2024, their maximum percent occurrence (in either June or August), and the locations native plants were found during the June survey. Graphs also summarize the historical plant IBI scores between 2008 and 2024, tracking how the plant health conditions have changed over time.

Native Plants	Common Name	Maximum % Occurrence in 2024[1]
All Plants (Combined) Number of points with native plants: 17/48 sites		84% (A)
Submerged Plants		
Elodea canadensis	Common waterweed	82% (J)
Ceratophyllum demersum	Coontail	23% (J)
Stuckenia pectinata	Sago pondweed	2% (J)
Potamogeton foliosus	Leafy pondweed	1% (J)
Potamogeton nodosus	Long-leaf pondweed	1% (J)
Potamogeton zosteriformis	Flat-stem pondweed	1% (J)
Nitella sp.	Nitella	1% (A)
Floating/Emergent Plants		
—	Filamentous algae	21% (J)
Lemna minor	Small duckweed	2% (A)
Spirodela polyrhiza	Large duckweed	2% (A)
Eleocharis erythropoda	Bald spikerush	1% (J)
Wolffia columbiana	Common watermeal	Visual Only
Carex comosa	Bottle brush sedge	Visual Only

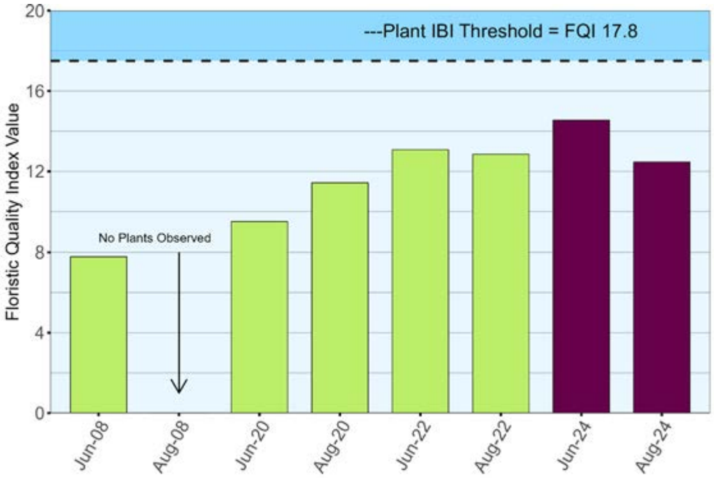
[1] Summarizes the maximum percent occurrence of a plant species from either the June (J) or August (A) 2024 point-intercept survey.



Number of native plant species observed at each observation point in Lake Holiday in June 2024.



Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Between 2008–2024, the number of species in Lake Holiday ranged from 0 to 10 and failed to meet the MNDNR Plant IBI threshold during the entire period. The number of species observed in June 2024 was the highest on record. A total of 10 species, either submerged, floating, or emergent, were observed in the June survey. Less species were observed in August likely due to a high abundance of algae growth.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. Between 2008–2024, FQI values in Lake Holiday ranged from 0 to 14.6, failing to meet the MNDNR Plant IBI threshold during this entire period. The FQI value observed in June 2024 was the highest on record.

Note: purple bars indicate period following significant infestation of curly-leaf pondweed (CLP) and completion of a spring herbicide treatment (2024) to reduce CLP prevalence.

Aquatic Invasive Plant Species

Three aquatic invasive plant species were found in Lake Holiday in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

An herbicide application was completed on Lake Holiday in spring 2024 to control the growth of curly-leaf pondweed. A June 2024 point intercept survey was used to assess the effectiveness of the spring treatment and help determine management needs for 2025. No living curly-leaf pondweed plants were collected on a rake (0% occurrence) during the June or August plant survey. There was clear indication of herbicide treatment control on the curly-leaf pondweed plants found.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the western shoreline in August. Most purple loosestrife plants are managed naturally by *Galerucella*, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Reed canary grass (*Phalaris arundinaceae*)

Observed at a handful of locations scattered throughout the northern, eastern, and western shorelines in June and August.

Image source: Endangered Resources Services

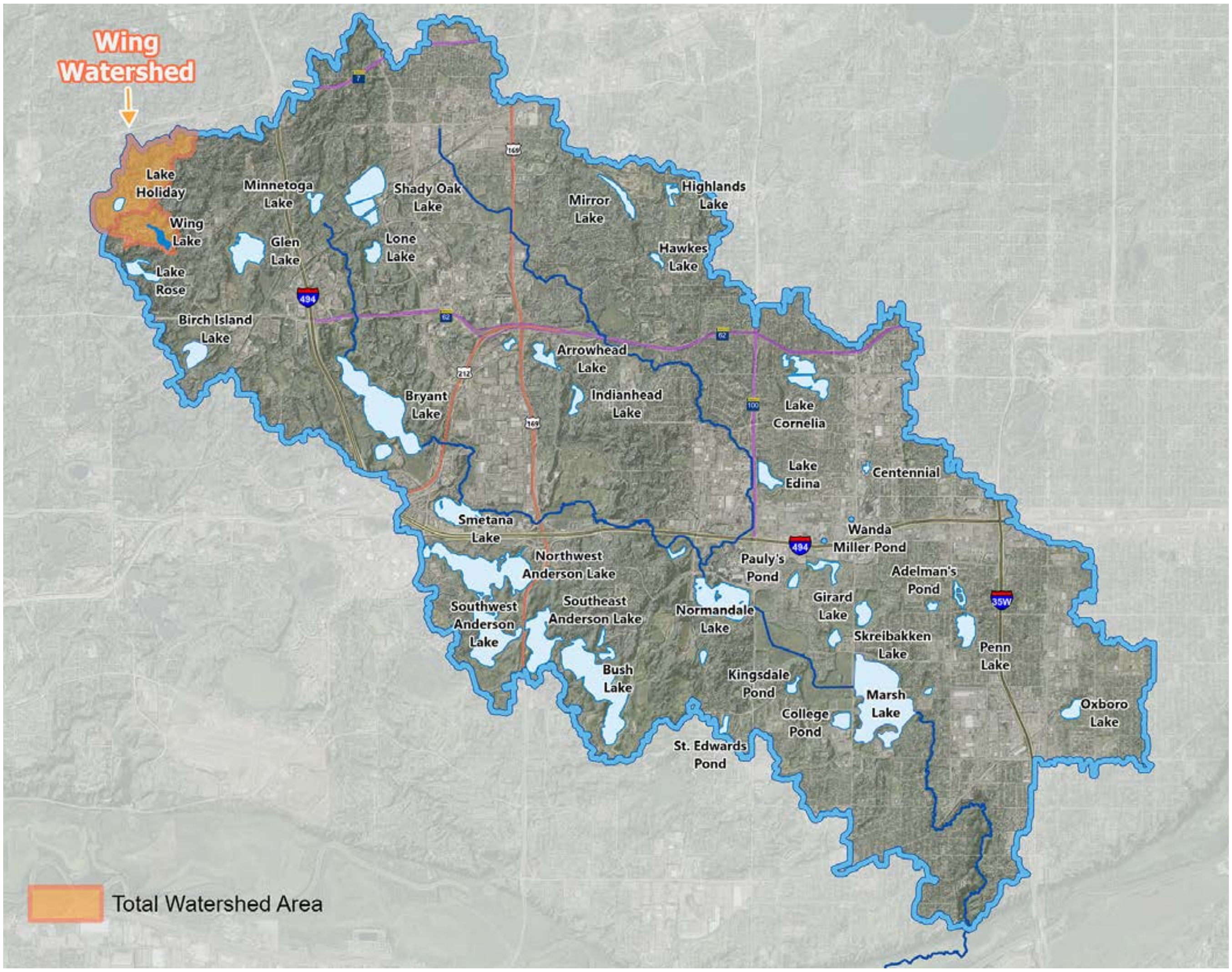
2.12 Wing Lake

2024 MONITORED PARAMETERS

- **Water Quality**

APPENDICES: Water quality monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Minnetonka
Surface Area	14 acres
Average/Maximum Depth	3.1 feet / 7 feet
Direct Watershed Area	131 acres
Total Watershed Area	443 acres
Watershed: Surface Area	32:1
Impairment Status	Impaired for nutrients since 2010
Upstream Waterbody	Lake Holiday (when pumped)
Downstream Waterbody	Lake Rose



2.12.1 Water Quality Observations in Wing Lake

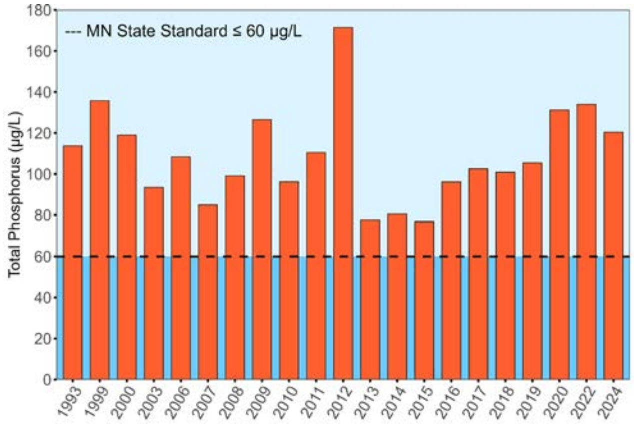
Wing Lake is located in the City of Minnetonka and is used primarily for wildlife viewing. When water levels are high enough, water is pumped from Lake Holiday to Wing Lake, which discharges to Lake Rose via gravity. Water that discharges from Lake Rose via gravity flows through an extensive storm sewer network that ultimately discharges to Birch Island Lake.

Wing Lake has a water surface area of approximately 14 acres, a maximum depth of 7 feet, and a mean depth of approximately 3.1 feet. Wing Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

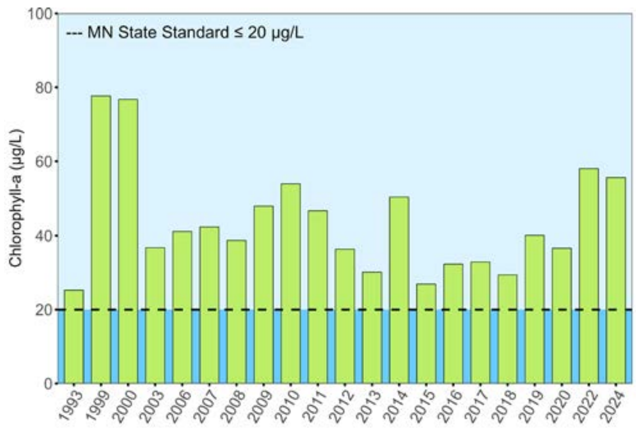
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Wing Lake was added to Minnesota's impaired waters list in 2010 for excess nutrients.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Wing Lake between 1993 and 2024 through NMCWD and City of Minnetonka routine monitoring programs and through the Metropolitan Council Environmental Services (MCES) Community Assisted Monitoring Program (CAMP). Poor water quality has been observed in the lake during the entire period of record. All summer average total phosphorus and chlorophyll-*a* concentrations, including those monitored in 2024, failed to meet the state water quality standards for shallow lakes in the North Central Hardwood Forest Ecoregion. Most Secchi disk transparency measurements in the historical record also failed to meet the State standard (except 2007–2008 and 2022).

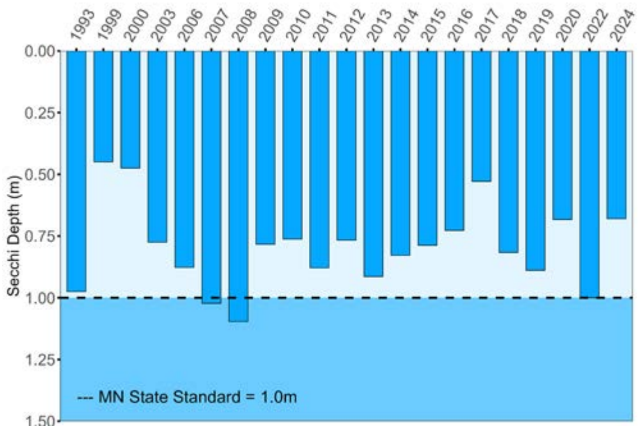
Chloride concentrations were measured by the NMCWD and City of Minnetonka in 2020, 2022, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. However, chloride concentrations in 2024 were the highest observed on record. In 2024, chloride concentrations were monitored between April and September. The highest observed concentration was in June 2024 at 89 mg/L. The average chloride concentration between April and September 2024 was 62 mg/L.



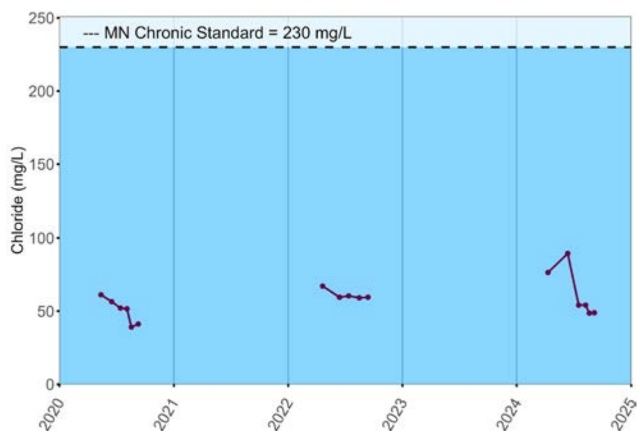
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Wing Lake, the summer average total phosphorus concentrations have exceeded the shallow lake state standard for all monitored years between 1993–2024. In 2024 the summer average total phosphorus concentration was 120 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Wing Lake, the summer average chlorophyll-*a* concentrations have exceeded the shallow lake state standard for all monitored years between 1993–2024. In 2024 the summer average chlorophyll-*a* concentration was 56 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Wing Lake, the summer average Secchi disk transparency did not meet the shallow lake state standard for all monitored years between 1993–2024 except 2007–2008 and 2022. In 2024 the summer average Secchi disk transparency was 0.7 meters.

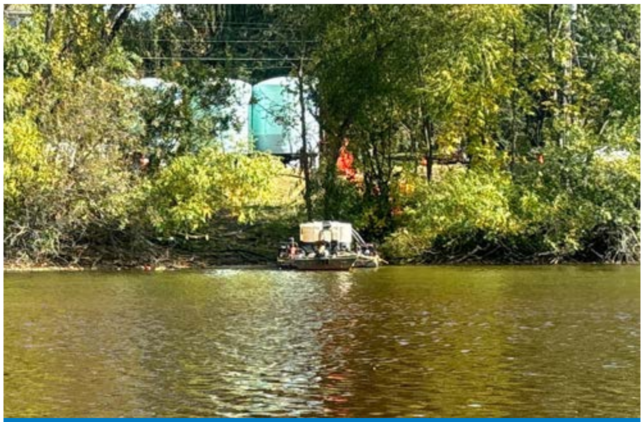


Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Wing Lake, observed chloride concentrations have never exceeded the state chronic criterion standard. However, chloride concentrations in 2024 were the highest observed on record. The highest observed chloride concentration was 89 mg/L in June 2024. The average chloride concentration between April and September 2024 was 62 mg/L.

2.12.2 Water Quality Management Practices

The District completed a water quality study for Holiday, Wing, and Rose Lakes in August of 2022 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Wing Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Wing Lake to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study.

Management Practice	Basis	Year Implemented	Lead Agency
Alum + Iron Treatment *Holiday and Wing Lakes*	Reduce internal sediment phosphorus load.	2024	NMCWD
Herbicide Treatments *Lake Holiday*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions	2024 – Ongoing	NMCWD
Enhanced Street Sweeping *Holiday, Wing, Rose Lakes*	Reduce pollutant loading from stormwater runoff.	2024 – Ongoing	City of Minnetonka
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2008 – Ongoing	NMCWD



Alum + Iron treatment on Lake Holiday. Reductions in nutrients from upstream lakes helps to reduce nutrient loading to downstream Wing Lake & Lake Rose.

Alum + Iron treatment on Wing Lake

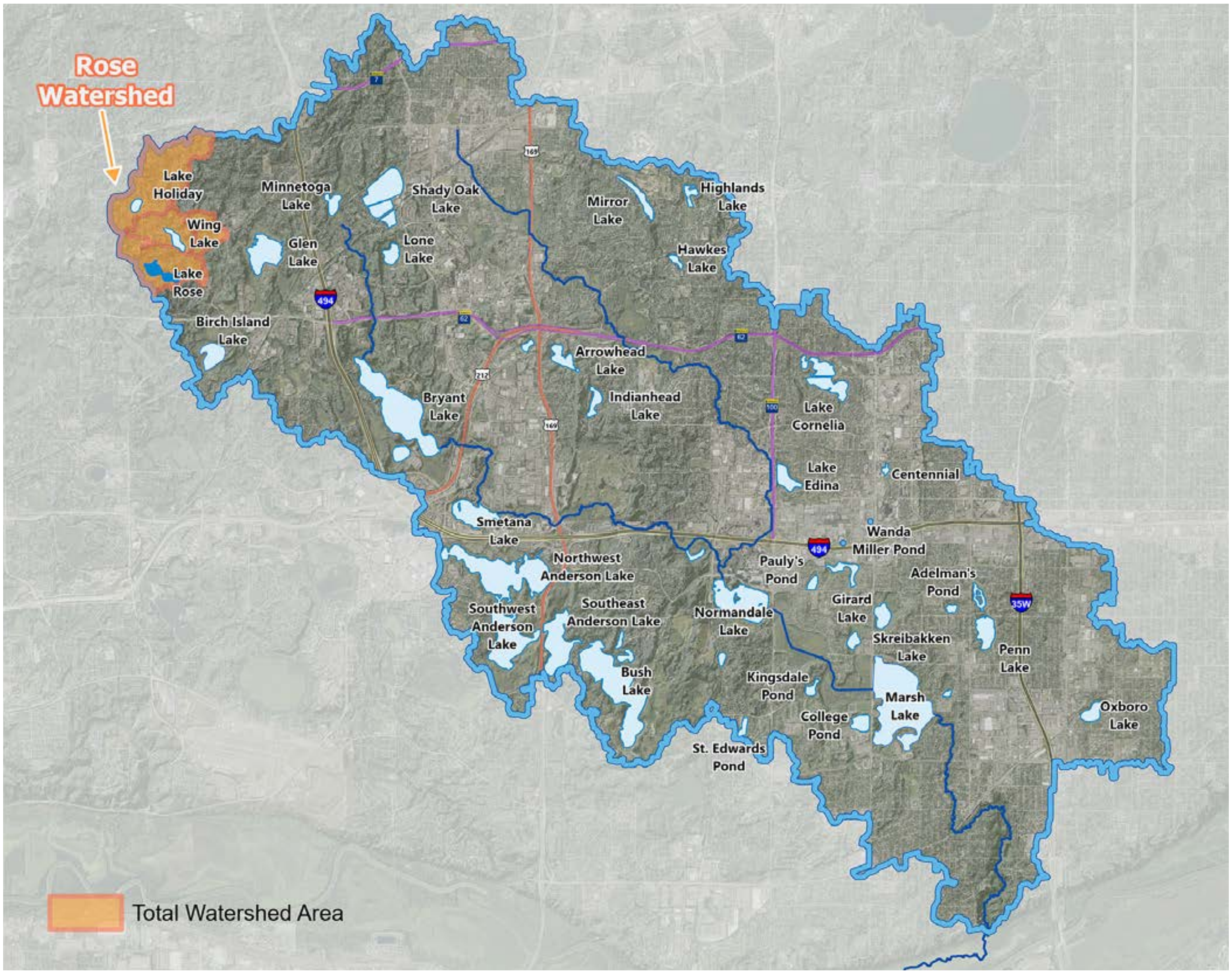
2.13 Lake Rose

2024 MONITORED PARAMETERS

- **Water Quality**

APPENDICES: Water quality monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Minnetonka
Surface Area	30 acres
Average/Maximum Depth	4.6 feet / 14 feet
Direct Watershed Area	259 acres
Total Watershed Area	702 acres
Watershed: Surface Area	23:1
Impairment Status	Impaired for nutrients since 2010
Upstream Waterbody	Wing Lake
Downstream Waterbody	Birch Island Lake



2.13.1 Water Quality Observations in Lake Rose

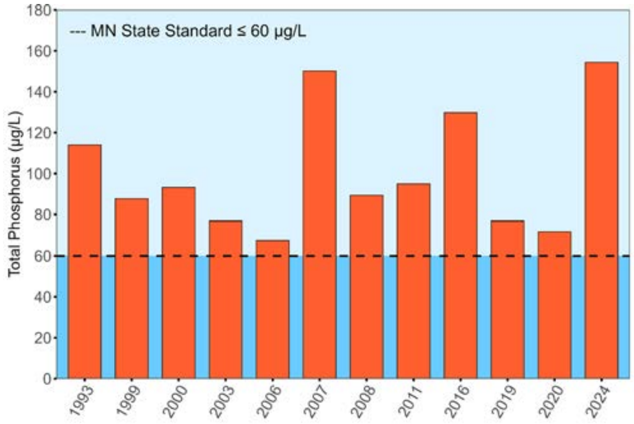
Lake Rose is located in the City of Minnetonka and is used primarily for wildlife viewing. When water levels are high enough, water is pumped from Lake Holiday to Wing Lake, which discharges to Lake Rose via gravity. Water that discharges from Lake Rose via gravity flows through an extensive storm sewer network that ultimately discharges to Birch Island Lake.

Lake Rose has a water surface area of approximately 30 acres, a maximum depth of 14 feet, and a mean depth of approximately 4.6 feet. Lake Rose is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

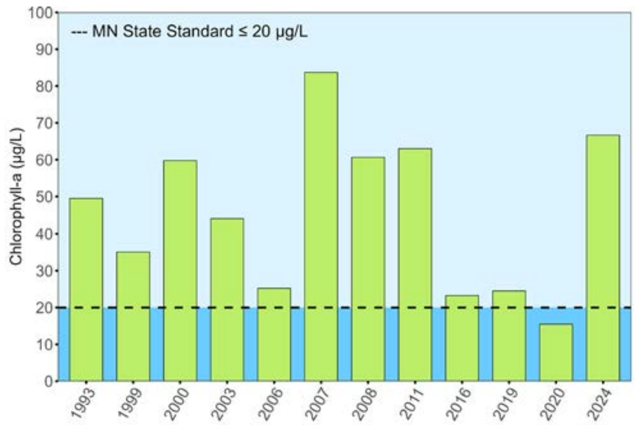
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Lake Rose was added to Minnesota's impaired waters list in 2010 for excess nutrients.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Lake Rose between 1993 and 2024 through NMCWD and City of Minnetonka routine monitoring programs and through the Metropolitan Council Environmental Services (MCES) Community Assisted Monitoring Program (CAMP). Poor water quality has been observed in the lake during the entire period of record. All summer average total phosphorus and chlorophyll-*a* concentrations, except the chlorophyll-*a* concentration in 2020, failed to meet the Minnesota State eutrophication standards for shallow lakes in the North Central Hardwood Forest Ecoregion. Most Secchi disk transparency measurements in the historical record also failed to meet the state eutrophication standard. The exception were the summer average Secchi disk transparency measurements in 2006, 2008, 2016, 2019, and 2020 that just met or were slightly better than the state standard.

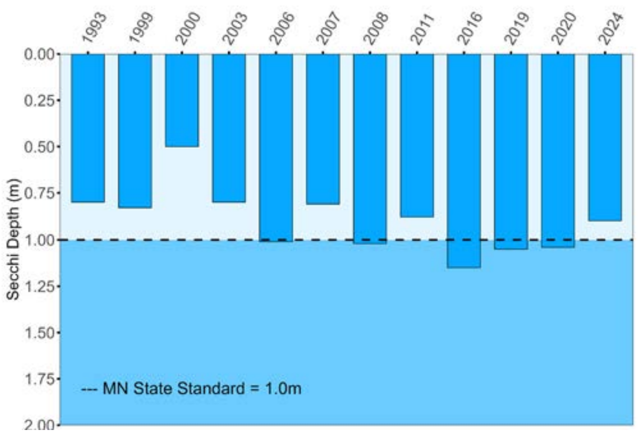
Chloride concentrations were measured by the NMCWD and City of Minnetonka in 2020, 2022, and 2024 (generally between April and September). The chloride concentrations have not exceeded the MPCA chronic standard of 230 mg/L in the historical record. However, chloride concentrations in 2024 were the highest observed on record. In 2024, chloride concentrations were monitored between April and September. The highest observed concentration was in June 2024 at 68 mg/L. The average chloride concentration between April and September 2024 was 58 mg/L.



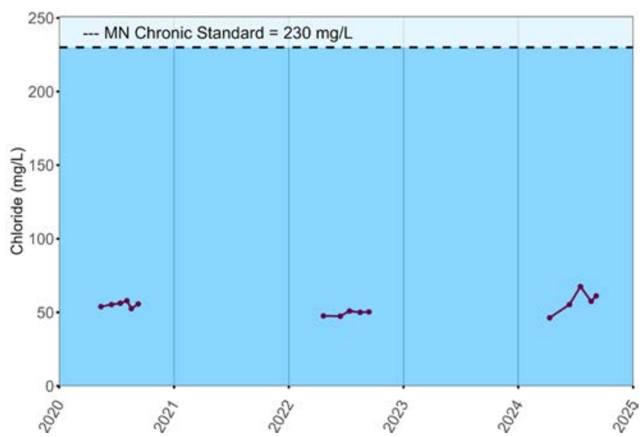
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Lake Rose, the summer average total phosphorus concentrations have exceeded the shallow lake state standard for all monitored years between 1993–2024. In 2024 the summer average total phosphorus concentration was 154 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Lake Rose, the summer average chlorophyll-*a* concentrations have exceeded the shallow lake state standard for all monitored years between 1993–2024 except 2020. In 2024 the summer average chlorophyll-*a* concentration was 67 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Lake Rose, the summer average Secchi disk transparency monitored since 1993 have met or been better than the state standard in 2006, 2008, 2016, 2019, and 2020. In 2024 the summer average Secchi disk transparency was 0.9 meters and failed to meet state standards.

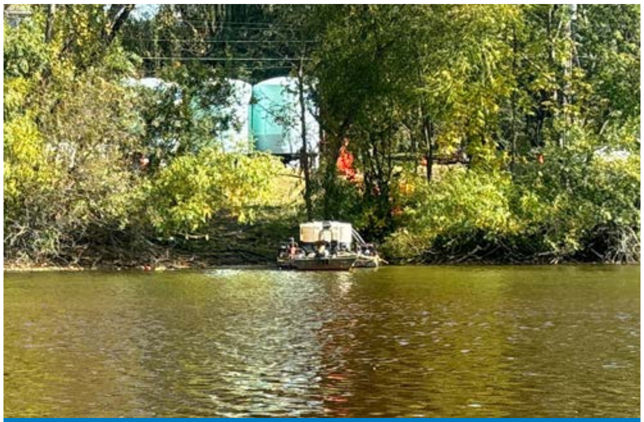


Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Lake Rose, observed chloride concentrations have never exceeded the state chronic criterion standard. However, chloride concentrations in 2024 were the highest observed on record. The highest observed chloride concentration was 68 mg/L in July 2024. The average chloride concentration between April and September 2024 was 58 mg/L.

2.13.2 Water Quality Management Practices

The District completed a water quality study for Holiday, Wing, and Rose Lakes in August of 2022 to identify water quality and ecological improvement measures. The study concluded that water quality concerns in Lake Rose were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Lake Rose to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since the water quality study.

Management Practice	Basis	Year Implemented	Lead Agency
Alum + Iron Treatment *Holiday and Wing Lakes*	Reduce internal sediment phosphorus load.	2024	NMCWD
Herbicide Treatments *Lake Holiday*	Reduce the impacts of curly-leaf pondweed on producing degraded water quality and ecological conditions.	2024 – Ongoing	NMCWD
Enhanced Street Sweeping *Holiday, Wing, Rose Lakes*	Reduce pollutant loading from stormwater runoff.	2024 – Ongoing	City of Minnetonka
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2010 – Ongoing	NMCWD



Alum + Iron treatment on Lake Holiday. Reductions in nutrients from upstream lakes helps to reduce nutrient loading to downstream Wing Lake & Lake Rose.

Alum + Iron treatment Treatment on Wing Lake. Reductions in nutrients from upstream lakes helps to reduce nutrient loading to downstream Lake Rose.

2.14 Normandale Lake

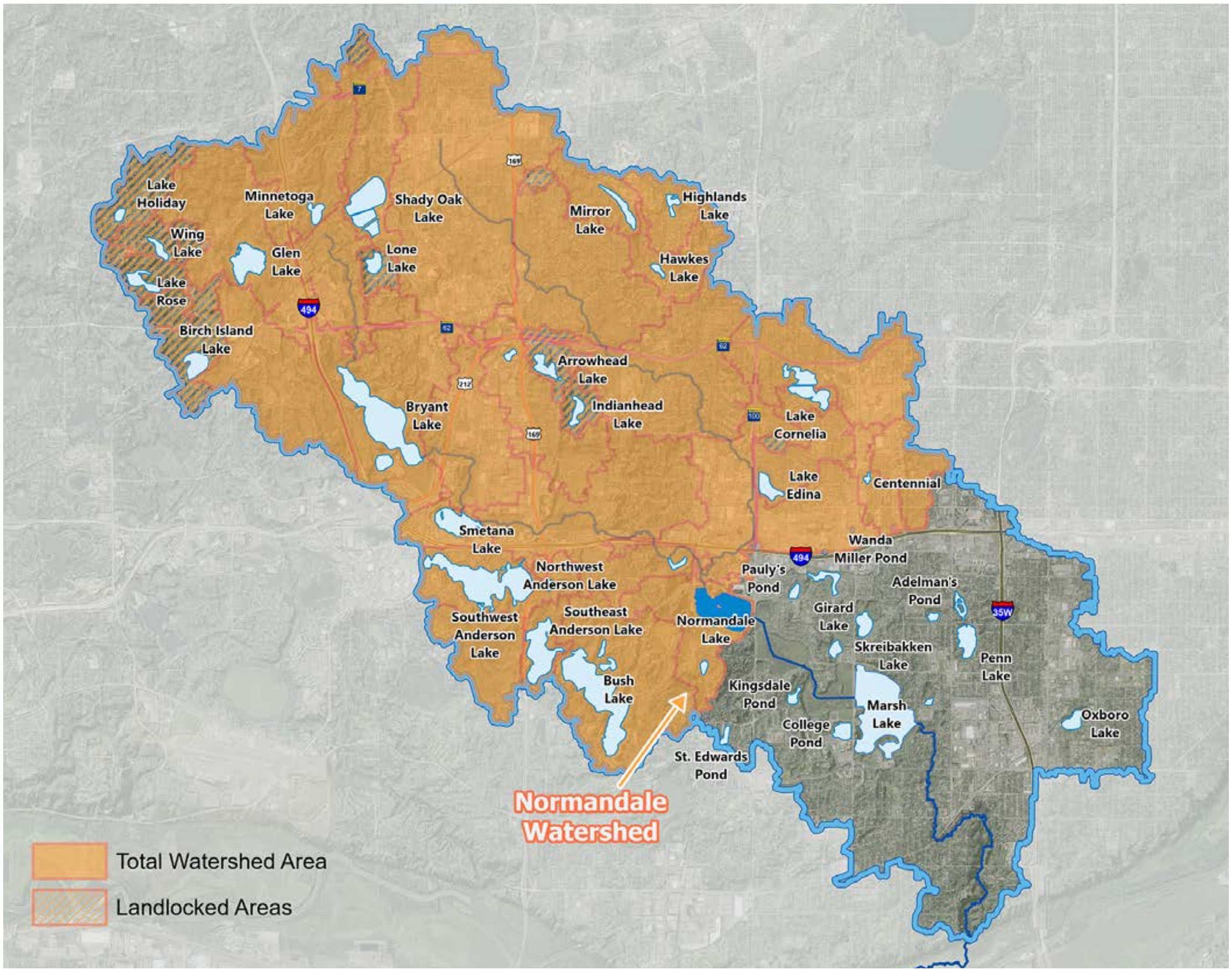
2024 MONITORED PARAMETERS

- Water Quality
- Aquatic Plants (Macrophytes)
- Phytoplankton (Algae)

APPENDICES: Maps showing aquatic plant survey results are included in Appendix G. Water quality and phytoplankton monitoring results can be provided upon request.

Shallow/Deep	Shallow
Location	Bloomington
Surface Area	112 acres
Average/Maximum Depth	3 feet/ 9 feet
Direct Watershed Area	582 acres
Total Watershed Area*	21,603 acres (1,637 landlocked)
Watershed:Surface Area	178:1
Impairment Status	No impairments identified on Minnesota's 2024 impaired waters list
Upstream Waterbody	North & South Forks Nine Mile Creek
Downstream Waterbody	Main Stem Nine Mile Creek

* Includes 1,637 acres that are typically landlocked under average storm events



2.14.1 Water Quality Observations in Normandale Lake

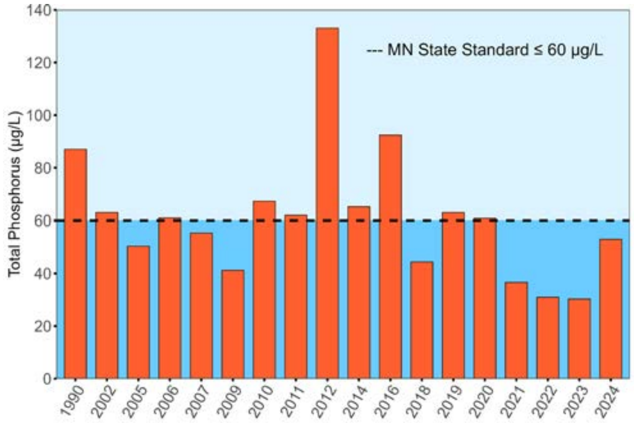
Normandale Lake is located in the City of Bloomington and is used for boating, fishing, and wildlife viewing. Normandale Lake was created along the Nine Mile Creek as a result of the Mount Normandale Lake flood control project, implemented in the late-1970s. The lake water level is controlled by the elevation of the outlet structure located at the east side of Normandale Lake and by weather conditions (snowmelt, rainfall, creek flows, and evaporation). The lake has a large upstream watershed and therefore receives a large amount of flow compared to its size and has a short residence time (i.e., water in the lake is replaced relatively quickly by inflow from the Nine Mile Creek). Flows through the lake, and associated pollutant loading from the upstream watershed, can vary significantly depending on climatic conditions.

Normandale Lake has a water surface area of approximately 112 acres, a maximum depth of 9 feet, and a mean depth of approximately 3 feet. Normandale Lake is shallow enough for aquatic plants to grow over the entire waterbody and to mix many times per year (polymictic lake).

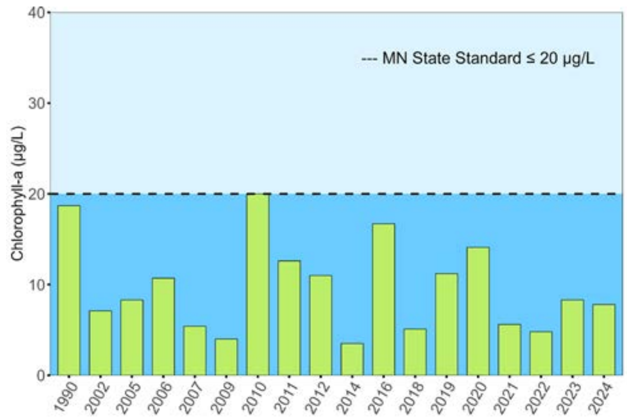
As required by the federal Clean Water Act, the Minnesota Pollution Control Agency (MPCA) assesses water quality data collected for various waters of the state and creates a list of impaired waters every two years. Waterbodies included on the list are those that failed to meet water quality standards based on designated use and ecoregion. Normandale Lake is not on the Minnesota impaired waters list.

The state of Minnesota commonly uses three eutrophication standards—total phosphorus, chlorophyll-*a*, and Secchi disk transparency—to assess lake health and track water quality changes. These three water quality parameters were measured in Normandale Lake by Nine Mile Creek Watershed District during 1990, 2002, 2005, 2007, 2010, 2014, 2016, 2018–2024; by the Metropolitan Council Environmental Services (MCES) Community Assisted Monitoring Program (CAMP) during 2006 and 2009–2012; and by the MPCA Citizen Lake Monitoring Program (CLMP) in 2020–2023 (Secchi depth). Data from these sources has generally been included in computation of the historic summer average values depending on timing of data availability, sampling location, and data quality review. The summer average total phosphorus concentrations have been better than the state eutrophication standard for shallow lakes in the North Central Hardwood Forest Ecoregion in 2005, 2007, 2009, 2018, and 2021–2024. Throughout the entire period of record summer average chlorophyll-*a* concentrations and Secchi disk transparency depths met or were better than state standards.

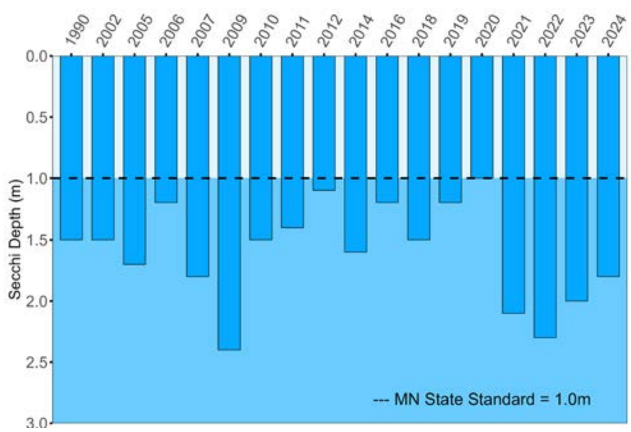
Chloride concentrations were measured by the NMCWD in 2010, 2014, 2016, and 2018–2024 (generally between April and September). Observed chloride concentrations have exceeded the MPCA chronic standard of 230 mg/L for portions of the monitored years in 2014, 2016, 2018, 2022, and 2023. In 2024, chloride concentrations were monitored between June and September. The observed chloride concentrations dropped notably from 2022–2023 due to wetter spring and summer climatic conditions. The highest observed chloride concentration was in July 2024 at 134 mg/L. The average chloride concentration between June and September 2024 was 114 mg/L.



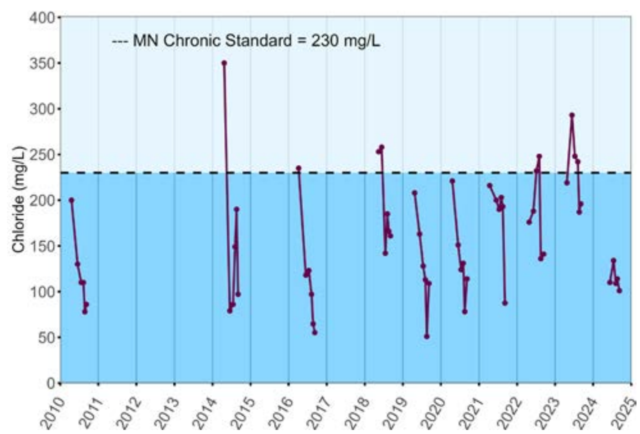
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in a lake can result in nuisance algal blooms and threaten the health of the aquatic plant community. In Normandale Lake, the summer average total phosphorus concentrations at the routine monitoring location on the east side of the lake were better than the shallow lake state standard in 2005, 2007, 2009, 2018, and 2021–2024. In 2024 the summer average total phosphorus concentration was 53 µg/L.



Chlorophyll-*a* is used as a measure of algal abundance since it is a photosynthetic pigment of algae. High amounts of chlorophyll-*a* can indicate degraded lake water quality conditions. In Normandale Lake, the summer average chlorophyll-*a* concentrations have met or been better than the shallow lake state standard throughout the historical record. In 2024 the summer average chlorophyll-*a* concentration was 8 µg/L.



A Secchi disk is a white circular plate that is lowered into the lake to measure the clarity of the water column (transparency). Low clarity can indicate high algal growth and/or increased sediment suspension in the water column. In Normandale Lake, the summer average Secchi disk transparency has met or been better than the shallow lake state standard throughout the historical record. In 2024 the summer average Secchi disk transparency was 1.8 meters.



Chloride can accumulate in lakes from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In Normandale Lake, observed chloride concentrations have exceeded the state chronic criterion standard for portions of the monitored years in 2014, 2016, 2018, 2022, and 2023. In 2024, the highest observed chloride concentration was 134 mg/L in July 2024. The average chloride concentration between June and September 2024 was 114 mg/L.

2.14.2 Water Quality Management Practices

The District completed a water quality study of Normandale Lake in 2005 and a follow-up water quality evaluation in 2017 to identify water quality and ecological improvement measures. The studies concluded that the water quality concerns in Normandale Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. The NMCWD and its partners implemented management practices to reduce pollutants and nutrients entering Normandale Lake to improve water quality and enhance ecological health. The table below provides a description of the management practices implemented since 2018.

Management Practice	Basis	Year Implemented	Lead Agency
Lake Drawdown	Reduce the impacts of curly-leaf pondweed on water quality and the native plant community	Fall 2018 – Spring 2019	NMCWD
Alum Sediment Treatment	Reduce internal sediment phosphorus load	2019	NMCWD
Herbicide Treatments	Spot herbicide treatments applied after drawdown to further reduce the impacts of curly-leaf pondweed on water quality and the native plant community	2020 – Ongoing	NMCWD
Rough Fish Removal	Reduce levels of carp, promote a balanced fishery, and reduce sediment disturbance	2021 – Ongoing	NMCWD
Cost-Share Grants	In a fully developed watershed, opportunities for largescale BMPs can be limited. Grant funds are available to residents, associations, nonprofits, schools, businesses, and cities for stormwater retrofit and native plant restoration projects within the District boundaries.	2013 – Ongoing	NMCWD

Lake drawdown to manage curly-leaf pondweed

Alum treatment

2.14.2.1 Fisheries Management

Fisheries surveys completed by the District between 2019 and 2021 identified carp at biovolumes large enough to warrant further assessment and management planning as carp can have negative effects on lake water quality. The *Integrated Pest Management Plan (IPM Plan) for Common Carp in Normandale Lake* (updated December 2023) was completed by WSB to review the ecological and hydrological conditions of Normandale Lake and its connected water bodies to develop cost-effective ways to reduce carp populations and limit recruitment. Carp removal efforts have occurred annually between 2021–2024. In 2024, three box net traps were deployed and lifted on 5 occasions in Normandale Lake and six upstream creek trapping events took place. In total, 4,580 pounds or approximately 1,280 individual carp were removed from Normandale Lake and upstream Nine Mile Creek locations in 2024. The District plans to continue carp removal efforts in 2025.

District staff lifting one of the box nets on Normandale Lake to manage the carp population.

District staff studied the movement of carp from Normandale Lake to the Nine Mile Creek and conducted creek removal efforts.

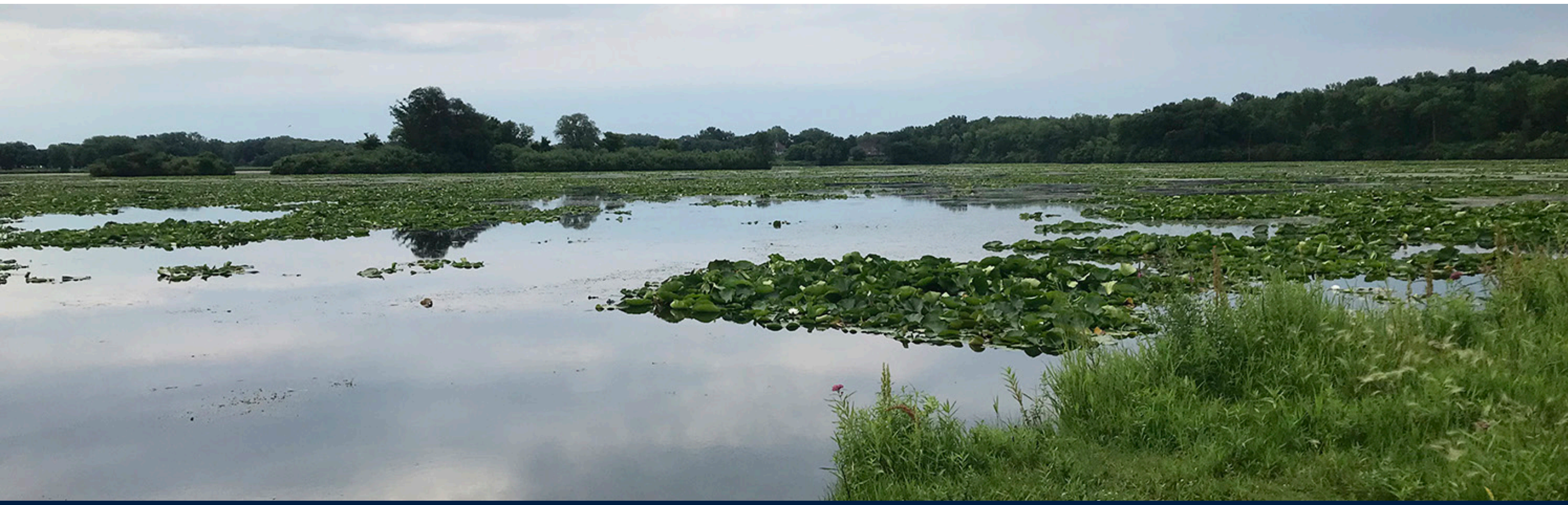
2.14.3 Aquatic Plant Observations in Normandale Lake

A healthy, shallow, urban lake will have an abundance of aquatic plants growing throughout the entire lake due to the shallowness and higher amounts of nutrients. Aquatic plants can provide excellent habitat for insects, zooplankton, fish, waterfowl, and other wildlife. The plants can also help to take phosphorus and nitrogen from the lake water, reducing the amount of nutrients available for algal growth. However, excess nutrients can lead to an overabundance of algal growth that creates turbid (murky-looking, low clarity) water. Lake water with low clarity can limit or prevent aquatic plant growth, which can lead to an unhealthy plant community, including reductions in the quantity and diversity of aquatic plants.

The ability to assess the health of a lake's plant community is a valuable tool in the conservation of Minnesota's lakes. With this objective in mind, the Minnesota Department of Natural Resources (MNDNR) developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The MNDNR Lake Plant Eutrophication IBI includes two metrics: (1) the number of species in a lake; and (2) the "quality" of the species, as measured by the floristic quality index (FQI). The MNDNR has determined a threshold for each metric and lakes that score below the thresholds have degraded plant communities and are likely stressed from cultural eutrophication.

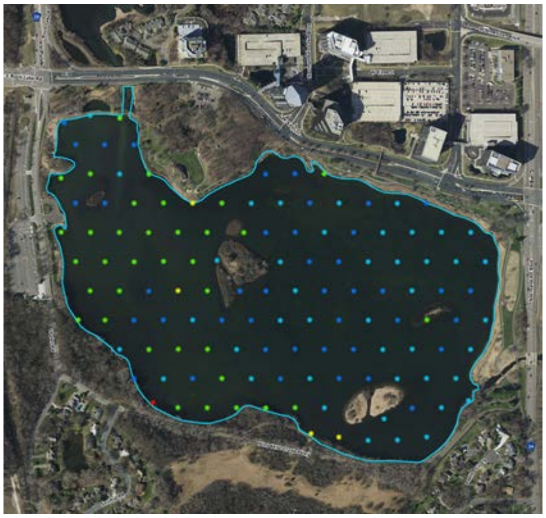
The District conducted point intercept plant surveys of Normandale Lake in June and August of 2024 to assess the health of the plant community. Maps showing survey results are included in Appendix G. The following page provides a list of native plant species observed, summarizes their percent occurrence, and shows the locations native plants were found during the August survey. Graphs also summarize the historical plant IBI scores between 2002 and 2024, tracking how the plant health conditions have changed over time.

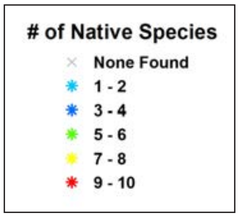
The 2024 plant survey in Normandale Lake showed that the submerged plant species with the highest occurrence included coontail, flat-stem pondweed, and common waterweed. In the last 5 years the occurrence of flat-stem pondweed in Normandale Lake has notably increased from 8% in June 2020 to 52% in August 2024. The species of floating and emergent plants with the highest observed occurrence in 2024 included filamentous algae, common watermeal, duckweed (small/large), and white water lily. In the last 5 years the occurrence of common watermeal has been variable, ranging between 10%–38% occurrence. In the last 5 years the occurrence of white water lily in Normandale Lake has notably increased from 5% in June 2020 to 34% in August 2024.



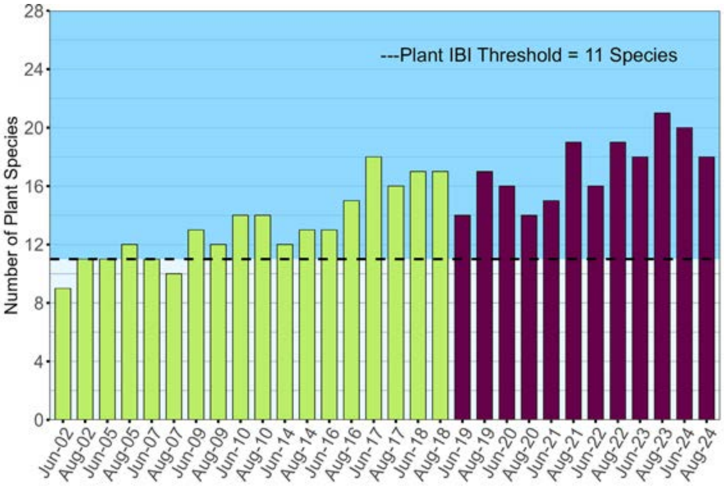
Native Plants	Common Name	% Occurrence in August 2024
All Plants (Combined) — Number of points with native plants: 125/125 sites		100%
Submerged Plants		
Ceratophyllum demersum	Coontail	92%
Potamogeton zosteriformis	Flat-stem pondweed	52%
Elodea canadensis	Common waterweed	41%
Potamogeton nodosus	Long-leaf pondweed	8%
Heteranthera dubia	Water star-grass	6%
Chara sp.	Muskgrasses	3%
Potamogeton foliosus	Leafy pondweed	3%
Stuckenia pectinata	Sago pondweed	3%
Nitella sp.	Nitella	1%
Floating/Emergent Plants		
Filamentous algae	Filamentous algae	67%
Wolffia columbiana	Common watermeal	38%
Lemna minor	Small duckweed	37%
Spirodela polyrhiza	Large duckweed	36%
Nymphaea odorata	White water lily	34%
Lemna trisulca	Forked duckweed	1%
Sparganium eurycarpum	Common bur-reed	1%
Eleocharis erythropoda	Bald spikerush	Visual Only
Polygonum amphibium	Water smartweed	Visual Only
Sagittaria calycina	Hooded arrowhead	Visual Only
*Hydrocotyle ranunculoides**	Floating pennywort*	Visual Only

* Floating pennywort is native to the United States, but not to the state of Minnesota. Its growth patterns are being monitored by the MNDNR.

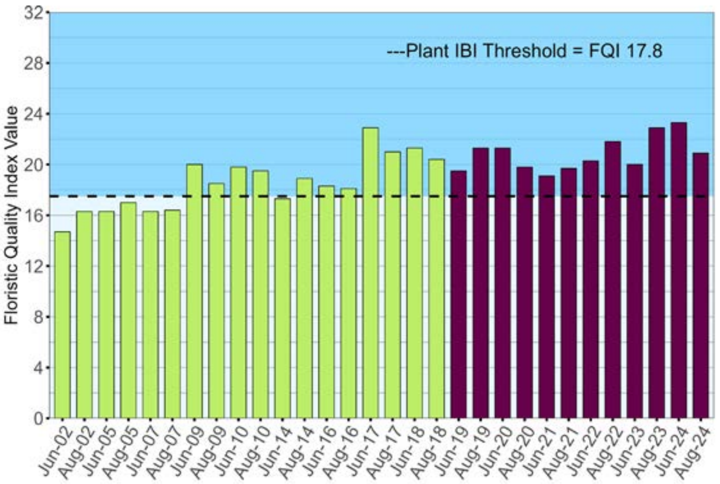




Number of native plant species observed at each observation point in Normandale Lake in August 2024.



Number of species: A shallow lake fails to meet the MNDNR Plant IBI threshold when it has fewer than 11 species. Since 2009 the number of plant species observed in Normandale Lake has been better than the plant IBI threshold.



Floristic Quality Index (FQI) values (quality of species): A shallow lake fails to meet the MNDNR Plant IBI threshold when the lake has an FQI value less than 17.8. In 2024, Normandale Lake had FQI values that were better than the IBI threshold.

** Note: purple bars indicate period following completion of a whole-lake drawdown (2018/2019) and subsequent spring herbicide treatments (2020–2024) to reduce CLP prevalence.*

Aquatic Invasive Plant Species

Five aquatic invasive plant species were found in Normandale Lake in 2024.

Curly-leaf pondweed (CLP) (*Potamogeton crispus*)

A spot herbicide application was completed on Normandale Lake in spring 2024 to manage the growth of curly-leaf pondweed (CLP). A June 2024 point intercept survey was used to assess the effectiveness of the spring treatment and help determine management needs for 2025. CLP was collected on the rake at 13 locations (10% occurrence) and visually observed at 9 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.2 during the June survey. During the August survey, CLP was collected on the rake at 1 location. Minimal CLP growth in August is typical for the plant's growth cycle.

Eurasian Watermilfoil (EWM) (*Myriophyllum spicatum*)

A spot herbicide application was completed on Normandale Lake in fall 2024 to manage the growth of a few Eurasian Watermilfoil (EWM) beds observed during the June plant survey. EWM was collected on the rake at 1 location (<1% occurrence) and visually observed at 2 locations in June. On a scale of 1 (low) to 3 (high), the average rake density was 1.0 during the June survey.

Purple loosestrife (*Lythrum salicaria*)

Observed at one location along the northern shoreline in June and August. Most purple loosestrife plants are managed naturally by *Galerucella*, the purple loosestrife eating beetle. The beetles control purple loosestrife plants by eating the plants. Because they are expected to control the purple loosestrife in the lake, no additional management is needed.

Reed canary grass (*Phalaris arundinaceae*)

Observed at three locations along the northern and southern shorelines.

Image source: Endangered Resources Services

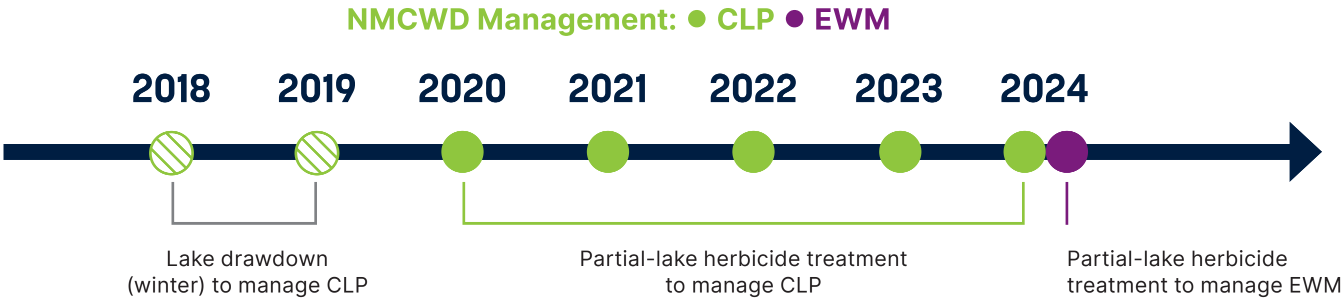
Narrow-leaved cattail (*Typha angustifolia*)

Observed at three locations along the northern and southern shorelines.

2.14.4 Aquatic Invasive Species (AIS) Plant Management Practices

In 2018, the District began implementation of the Normandale Lake Water Quality Improvement Project, in partnership with the City of Bloomington. A whole-lake drawdown was performed on Normandale Lake between fall 2018 and spring 2019 to manage the aquatic invasive plant species curly-leaf pondweed (CLP). The lake was drawn down to allow the lakebed to freeze over the winter. Curly-leaf pondweed primarily propagates through the production of dormant vegetative propagules called turions. Turions are produced in late spring, remain dormant in sediment through the summer, and germinate under cooler water conditions in the fall. A winter freeze can kill the turions, thus disrupting curly-leaf pondweed's reproductive cycle. Following the lake drawdown, the NMCWD performed plant surveys and applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth within Normandale Lake and portions of Nine Mile Creek immediately upstream of the lake. Spot herbicide treatments were completed between 2020–2024. CLP management occurred on Normandale Lake in 2025.

In fall 2024, the District performed a spot herbicide treatment on Normandale Lake to manage the growth of Eurasian watermilfoil (EWM). Established EWM beds were found at three locations during the June plant survey. As such, the District performed a spot herbicide treatment to limit the spread of this aggressive aquatic invasive species.



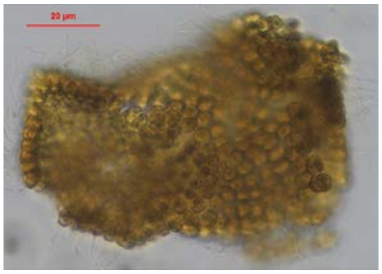
Canopied Eurasian watermilfoil beds were observed during the June plant survey. A spot herbicide treatment was applied in fall 2024 to manage the spread of this aggressive invasive species.

(Photo source: Endangered Resource Services)

2.14.5 Phytoplankton Observations in Normandale Lake

The phytoplankton community in Normandale Lake was monitored in 2024, including identification and enumeration of the phytoplankton species to help evaluate water quality and the quality of food available to zooplankton. The figure on the next page summarizes the number and major groups of phytoplankton observed in Normandale Lake between June and September 2024. In general, the total algal abundance observed in Normandale Lake was low in 2024 and the dominant taxon (or group) was variable throughout the monitoring period. Golden algae were the major taxon observed in June, while blue-green algae (cyanobacteria) and green algae were the major taxon observed in July. From early August through September blue-green algae were the major taxon observed; however, there was still a good balance of other species observed including green algae, golden algae, and cryptomonads. Bacillariophyta (diatoms) and other taxa were also present throughout the monitored period but at notably lower percentages.

The abundance of blue-green algae observed in 2024 was similar to other years in the historical monitoring record. Comparison of the observed blue-green numbers during the monitored period to the World Health Organization (WHO) guideline thresholds for probability of adverse health effects to recreational users indicates all observed values have been below the threshold for low probability of adverse health effects (20,000 units per mL). The highest abundance of blue-green algae in 2024 was observed in late August at approximately 5,900 units per mL. Of the species observed, 55% were potential toxin producing species (<3,300 units per mL). This observed abundance is well below the WHO guideline threshold for low probability of adverse health effects.



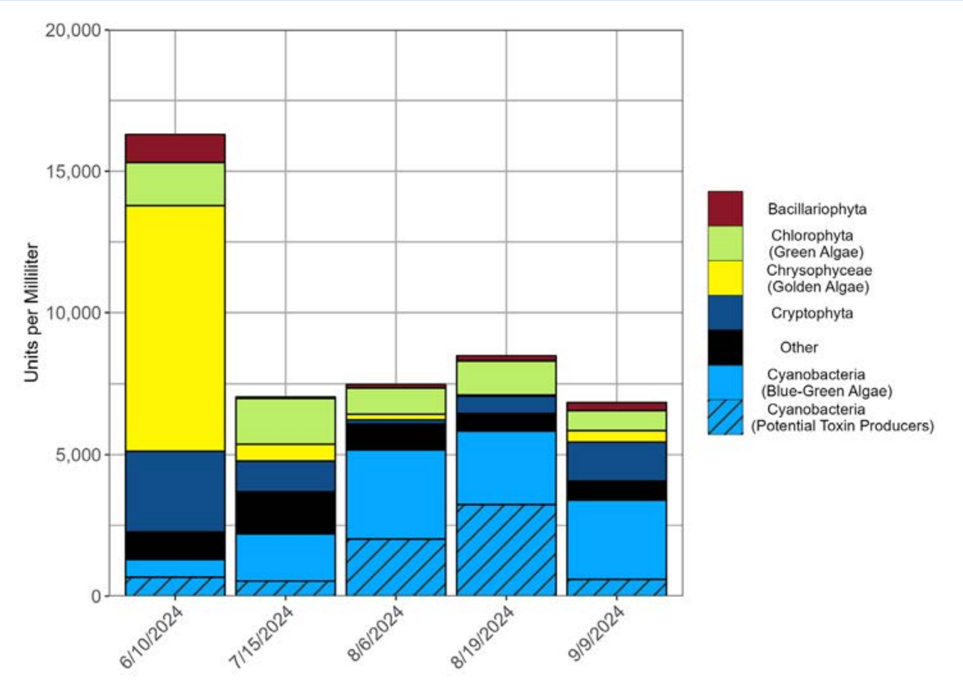
Microscopic image of Uroglenopsis/Urostipulosiphon, a golden algal species from Normandale Lake.

(Source GreenWater Laboratories)

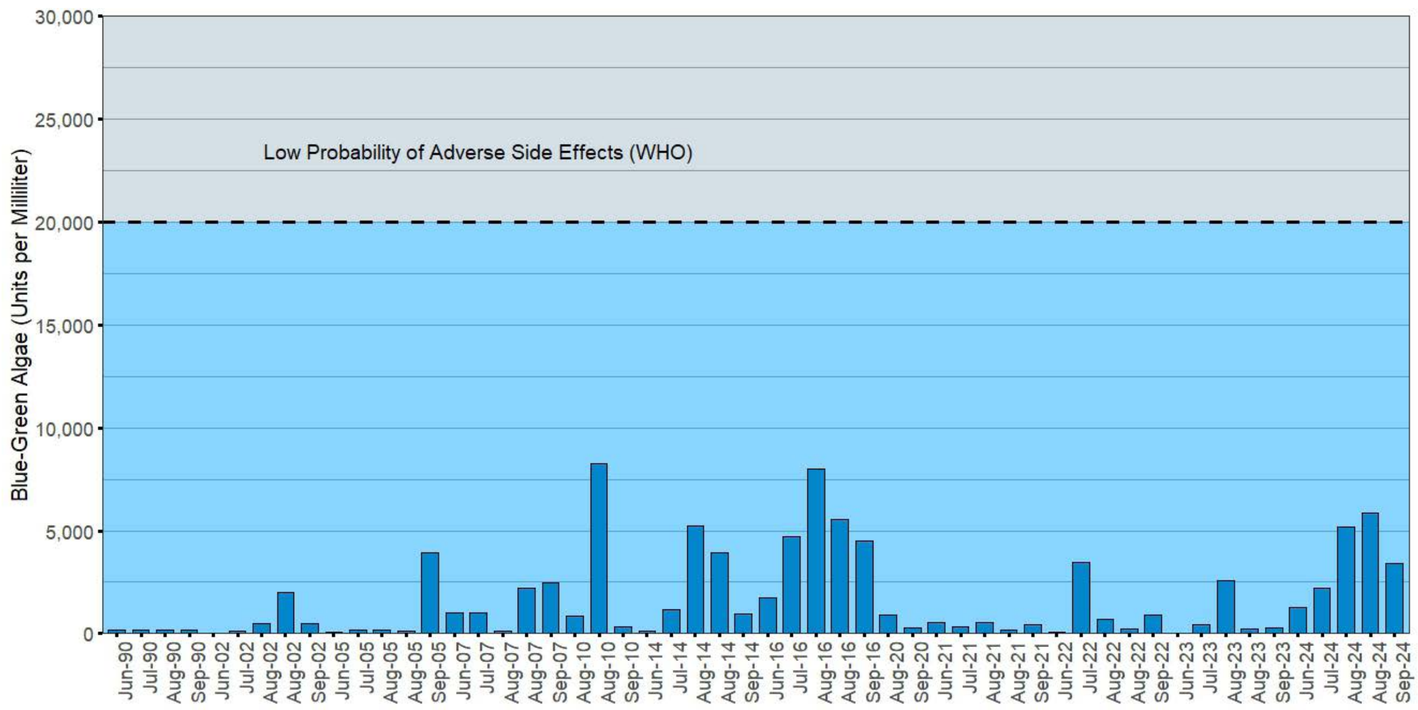
Phytoplankton

Phytoplankton, or algae, are microscopic organisms that are suspended or floating in the water column. Phytoplankton can be single cell, filamentous, or community-based organisms. They derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton, which are in turn eaten by fish. Zooplankton prefer to eat phytoplankton species that have higher nutritional quality, are easily edible, and are non-toxic. Freshwater zooplankton typically prefer certain species of cryptophytes, green algae, and haptophytes. Blue-green algae and diatoms are less desirable. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. However, excess phytoplankton from high amount of nutrients can reduce water clarity, impact aquatic plant growth, and possibly cause human health concerns.

Example of cyanobacteria (blue-green) algae scum



Between June and September 2024 the NMCWD collected phytoplankton (algae) samples for enumeration and identification. The figure to the left summarizes the number and major groups of phytoplankton observed. The total algal abundance observed in Normandale Lake in 2024 was low and the dominant taxon (or group) was variable. Golden algae were dominant in June. Between July and September, blue-green algae were the major taxon observed, but there was still a good abundance of other algal types during those months.



Blue-green algae (cyanobacteria) have historically been found in Normandale Lake since monitoring began in 1990, but at relatively low abundance. Comparison of blue-green numbers during the historical record to the World Health Organization (WHO) guideline thresholds for probability of adverse health effects to recreational users indicates all observed values have been below the threshold for low probability of adverse health effects.

2.14.6 Summary for Normandale Lake

At the eastern routine monitoring location in Normandale Lake, the summer average total phosphorus concentrations have been better than the state eutrophication standard for shallow lakes in 2005, 2007, 2009, 2018, and 2021–2024. Throughout the entire period of record, starting in 1990, summer average chlorophyll-*a* concentrations and Secchi disk transparency depths met or were better than state eutrophication standards. 2024 chloride concentrations in Normandale Lake were lower than previous years due to wetter climatic conditions in spring and early summer. All 2024 monitoring events between June and September were below the MPCA chronic criteria.

Both the number of aquatic plant species in the lake and FQI values in 2024 were similar to what was observed in recent years. In 2024, a total of 20 and 18 species, either submerged, floating, or emergent, were observed in the June and August plant surveys, respectively. The number of species observed in 2024 were well above the MNDNR Plant IBI threshold of 11 species. The FQI values ranged between 21.0–23.3 and were also well above the MNDNR Plant IBI threshold of 17.8.

Five invasive aquatic plant species were observed in Normandale Lake in 2024 including the submerged species curly-leaf pondweed and Eurasian watermilfoil and the emergent species narrow-leaved cattail, purple loosestrife, and reed canary grass. A whole-lake drawdown was performed on Normandale Lake between fall 2018 and spring 2019 to manage curly-leaf pondweed. The lake was drawn down to allow the lakebed to freeze over the winter to reduce the viability of turions and disrupt the plant's reproductive cycle. Following the lake drawdown, the NMCWD performed plant surveys and applied spot herbicide treatments as necessary to areas with continued curly-leaf pondweed growth between 2020–2024. In fall 2024, a spot herbicide treatment was also performed to manage the growth and spread of Eurasian watermilfoil.

In 2024, the total algal abundance observed in Normandale Lake was low and the dominant taxon (or group) was variable throughout the monitoring period. The abundance of blue-green algae observed in 2024 was similar to other years in the historical monitoring record. Comparison of the observed blue-green numbers during the monitored period to the World Health Organization (WHO) guideline thresholds for probability of adverse health effects to recreational users indicates all observed 2024 values were below the threshold for low probability of adverse health effects (20,000 units per mL).

The District completed a water quality study of Normandale Lake in 2005 and a follow-up water quality evaluation in 2017 to identify water quality and ecological improvement measures. The studies concluded that the water quality concerns in Normandale Lake were primarily due to excess phosphorus, which can fuel algal production and decrease water clarity. An overabundance of the aquatic invasive species curly-leaf pondweed as well as an overabundance of rough fish were also found to be water quality concerns. Several management practices have been implemented since the studies were completed, including an alum sediment treatment, aquatic invasive species plant management through a lake drawdown and herbicide treatments, rough fish removals, and continued funding assistance of private stormwater retrofit installations through the NMCWD cost-share grant program.

In 2025, the NMCWD plans to develop a project assessment framework for water quality improvement projects to characterize lake management status and needs following project implementation and identify triggers and timeframes around future monitoring and re-assessment. Normandale Lake will be evaluated as a pilot for the project assessment framework, with anticipated outcomes including recommendations for continuation of water quality and biological monitoring.

3 Nine Mile Creek Stream Monitoring

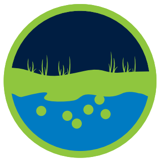
A summary of the 2024 and historical water quality and ecological monitoring data collected at locations along the Nine Mile Creek

North Fork Nine Mile Creek, summer 2024

The Nine Mile Creek Watershed District monitors the water quality and ecological health of the Nine Mile Creek on an annual basis. Because the primary use of Nine Mile Creek is ecological—a place for fish and aquatic life to live—the focus of the Nine Mile Creek monitoring program is the evaluation of the stream's aquatic life community as well as the ecosystem components essential for the survival of aquatic life. The District's stream monitoring program typically consists of the following monitoring:

Water quality monitoring on eight occasions (once a month March through October)

Automated stream pollutant monitoring following the Metropolitan Council's Watershed Outlet Monitoring Program (**WOMP**)—water quality grab samples are collected monthly, composite water quality samples are collected during most storm events larger than 0.5 inches, and stream flow is continuously monitored



Habitat monitoring on one occasion during the summer

Fish community monitoring on one occasion during the summer

Macroinvertebrate community monitoring on one occasion during the fall

Ten locations were monitored for water quality in 2024, including four locations on the North Fork, three locations on the South Fork, and three locations on the Main Stem. Eight locations were monitored for habitat, fish, and macroinvertebrates. Monitoring locations are shown on Figure 1-2. Table 3-1 summarizes the stream monitoring completed by the District in 2024. Stream monitoring locations are listed upstream to downstream for each stream reach. Results of the District's 2024 stream monitoring are summarized in detail in the subsections of this chapter.

APPENDICES

- Fish monitoring results are summarized in Appendix H.
- Flow, water quality, habitat, and macroinvertebrate monitoring results can be provided upon request.

Fish Community Monitoring on Nine Mile Creek in 2021

Table 3-1 Summary of 2024 Stream Monitoring by the Nine Mile Creek Watershed District

Monitoring Location	Location Description	Water Quality	Ecological (Habitat, Fish, Macroinvertebrates)
ECU 1A-1	**North Fork** of Nine Mile Creek, immediately west of Highway 169 in Hopkins	A	C
ECU 2	**North Fork** of Nine Mile Creek, east of Cahill Road and north of Brook Drive (Heights Park) in Edina	A	C
N3	**North Fork** of Nine Mile Creek at Metro Boulevard in Edina. Station N3 is one of the automated stream monitoring stations (WOMP stations)	A, B	
ECU-2A	**North Fork** of Nine Mile Creek, immediately downstream from West 77th Street / West of Highway 100 in Bloomington		C
ECU 2AWQ	**North Fork** of Nine Mile Creek, downstream of Interstate 494 and immediately upstream from 81st Street in Bloomington.	A	
ECU 3A	**South Fork** of Nine Mile Creek, immediately upstream of the Highway 62 crossing and the Bryant Lake Park Reserve and downstream from Bren Road in Minnetonka.	A	C
N2	**South Fork** of Nine Mile Creek at West 78th Street in Edina. Station N2 is an automated WOMP stream monitoring station	A, B	
ECU 5A	**South Fork** of Nine Mile Creek, in Corridor Park immediately downstream of Interstate 494 and west of East Bush Lake Road in Bloomington	A	C
ECU 7A/N1	**Main Stem** of Nine Mile Creek, downstream of Marsh Lake and immediately downstream of 98th Street in Bloomington. Station 7A is also an automated WOMP Station N1.	A, B	C
ECU 7B	**Main Stem** of Nine Mile Creek, downstream of Old Shakopee Road at 103rd Street in Bloomington.	A	C
ECU-7C	**Main Stem** of Nine Mile Creek, downstream of 106th Street in Bloomington.	A	C

A Monitored water quality parameters included specific conductance, dissolved oxygen, pH, temperature, turbidity, and flow on eight occasions (once a month March through October).

B Monitored water quality parameters during monthly grab samples and storm event composite samples include alkalinity, chloride, COD, hardness, ammonia nitrogen, nitrate, nitrite, total Kjeldahl nitrogen, total phosphorus, orthophosphate, sulfate, total organic carbon, total suspended solids, and volatile suspended solids. Chlorophyll-*a* and E. coli is only collected during monthly grab samples.

C Monitored ecological parameters included water depth, flow, depth of fine sediment, percent embeddedness, length of eroded streambank, fish community, and macroinvertebrate community on one occasion.

NOTE: See next page for stream monitoring terms

3.1 Stream Monitoring Terms

Chloride

Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians.

Specific Conductance

Specific conductance is a measure of water's ability to pass an electrical current via ions dissolved in the water such as alkalis, chloride, sulfides, and carbonate compounds. The higher the specific conductance, the more dissolved salts and minerals that are present in the water. For example, high chloride concentrations can lead to high specific conductance impacting species diversity and community structures.

Turbidity (and Total Suspended Solids)

Turbidity is a measurement of the relative clarity of the water by computing the amount of light that is scattered by material floating in the water. As the water gets less clear due to an increase in particles (i.e., total suspended solids including sediment, soils, detritus), the turbidity value increases. High turbidity can affect light penetration and reduce plant growth, and can result in harm to habitat areas for fish and other aquatic life due to increased sedimentation and siltation. Increased turbidity and suspended solids can also increase water temperature, as darker, less clear water will adsorb more radiation from the sun.

pH

pH is the measurement of the acidity or basicity of the water. The scale ranges between 1 (very acidic) to 14 (very basic), with 7 being neutral. Natural freshwaters typically have a pH ranging between 6.5–9.0 depending on water quality and environmental conditions. Aquatic organisms have pH thresholds to maintain healthy growth. Changes in pH, especially sudden changes, can result in stress or fatality to aquatic organisms.

Dissolved Oxygen

Dissolved oxygen is the concentration (or the amount) of oxygen gas incorporated in water. Oxygen can enter the water from the atmosphere, or it can accumulate from the oxygen released by plants or algae during photosynthesis. Sufficient dissolved oxygen is necessary to support the health and reproduction of organisms such as aquatic insects and fish. Major physical properties that can influence the concentration of dissolved oxygen include temperature, flow, turbulence, nutrient levels, and level of decomposition.

Temperature

Temperature is the measurement of the water temperature. Factors that control stream water temperature include air temperature, geology, amount of shading, and water inputs from the tributary watershed and springs. Aquatic organisms are adapted to prefer certain temperature ranges. Increases in temperature due to altered landscapes can cause stress to aquatic organisms.

Phosphorus

Phosphorus is an essential nutrient required for biological production. Phosphorus can enter a stream from stormwater runoff or be produced during the degradation of organic matter. Elevated phosphorus can influence plant species, alter food resources for aquatic organisms, and lead to higher risk of low oxygen conditions (due to increased bacterial decomposition).

Macroinvertebrates

Macroinvertebrates (or aquatic insects) are organisms that lack a spine and are large enough to be seen with the naked eye. They play major roles in recycling nutrients and are primary food sources for fish. Because macroinvertebrates can respond quickly to aquatic environmental changes measurements of their diversity and abundance can be good indicators of stream health.

3.2 Water Quality Goals for the Nine Mile Creek—Minnesota State Standards

The text below and the table on the next page summarizes the stream water quality standards and ecological thresholds used by the NMCWD to assess stream health. These standards and thresholds will be referenced throughout the report and shown on summary plots and figures.

- **Minnesota Stream Water Quality Standards by Class—**The Minnesota Pollution Control Agency (MPCA) specifies standards applicable to Minnesota streams to protect aquatic life. Nine Mile Creek is required to meet the most restrictive water quality standard for Classes 2B, 2C, or 2D; 3A, 3B, 3C, or 3D; 4A, 4B or 4C; and 5. The levels of dissolved oxygen, pH, and temperature in Nine Mile Creek were compared to Minnesota State standards for Class 2B streams and specific conductance was compared with the Minnesota State standard for a Class 4A stream because they are the most restrictive water quality standards for these parameters.

- **Minnesota Chloride Standards—**Because high concentrations of chloride can harm fish and plant life, the MPCA has established acute and chronic exposure chloride standards. The chronic standard for chloride to protect Class 2B streams is 230 mg/L. The acute (maximum) standard to protect Class 2B streams is 860 mg/L. Two or more exceedances of the chronic criterion within a three-year period are considered an impairment. One exceedance of the acute criterion is considered an impairment.

- **Minnesota Eutrophication Standards—**The MPCA has developed standards for river eutrophication designed to protect aquatic life. The eutrophication standards were developed for three geographic regions. The total phosphorus concentrations monitored at the Nine Mile Creek WOMP stations N1, N2, and N3 were compared to the Minnesota State standards for the Central Region.

- **Minnesota Total Suspended Solids (TSS) Standard—**In 2015, the MPCA introduced a total suspended solids (TSS) standard based on geographic region and stream class due to difference in natural background conditions resulting from varied geology and biological sensitivity. The TSS concentrations collected at the Nine Mile Creek WOMP stations N1, N2, and N3 were compared to the Minnesota State standards for the Central Region. Turbidity was a state standard from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids and is measured at the ECU monitoring locations.

- **Minnesota Fish Community Standards—**For fish community monitoring, the NMCWD uses the Fish Index of Biological Integrity (FIBI) standards developed by the MPCA. The MPCA FIBI is on a 0 to 100 scale with increasing scores indicating improving stream health. The MPCA has classified Minnesota streams into nine types corresponding to regional patterns in the composition of stream fishes. Stream type is differentiated by geographic region, contributing drainage area, reach-scale gradient, and thermal classification. A unique FIBI and biocriterion were developed for each stream type. The FIBI standard and confidence limit applicable to the North Fork of Nine Mile Creek (from Metro Boulevard to end of Marsh Lake) are those designated for Class 2Bm Southern Headwaters streams. The FIBI standard and confidence limit applicable to the other reaches of Nine Mile Creek are those designated for Class 2Bg Southern Headwaters streams. The MPCA has determined confidence limits around the standards to account for variability within the aquatic community because of natural spatial and temporal differences and sampling or method errors.

- **Minnesota Macroinvertebrate Community Standards—**For macroinvertebrate community monitoring, the NMCWD uses the Macroinvertebrate Index of Biological Integrity (MIBI) standards developed by the MPCA. The MPCA MIBI is on a 0 to 100 scale with increasing scores indicating improving stream health. The MPCA has classified Minnesota streams into nine types corresponding to regional patterns in the composition of stream macroinvertebrates. Stream type is differentiated by geographic region, contributing drainage area, reach-scale gradient, and thermal classification. A unique MIBI and biocriterion were developed for each stream type. The eight biological monitoring locations of Nine Mile Creek fall under the stream types of either Class 2Bm Southern Stream Riffle Run (RR), Class 2Bg Southern Stream RR, or Class 2Bg Southern Forest Stream Glide Pool (GP).

Table 3-2 Water Quality Standards and Ecological Thresholds used by the NMCWD to assess stream health

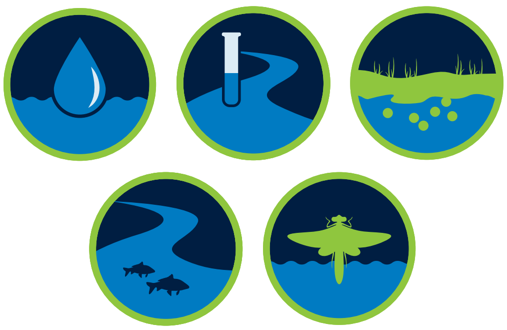
Type	Parameter		Stream Standard/Threshold
Water Quality	Dissolved Oxygen (mg/L)		≥ 5
	pH		6.5 – 9.0
	Temperature (°F)		Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F
	Specific Conductance (µmhos/cm @ 25°C)		< 1,000
	Chloride (mg/L)		≤ 230 (chronic) ≤ 860 (acute)
	Total Phosphorus (µg/L)		≤ 100
	Total Suspended Solids (mg/L)		< 30
	Turbidity (NTU)		< 25[6]
Fish Community (Fish Index of Biological Integrity (FIBI))	Class 2Bg Southern Headwaters[1]	FIBI Standard	≥ 55
		FIBI Lower Confidence Limit	≥ 48
	Class 2Bm Southern Headwaters[2]	FIBI Standard	≥ 33
		FIBI Lower Confidence Limit	≥ 26
Macroinvertebrate Community (Macroinvertebrate Index of Biological Integrity (MIBI))	Class 2Bg Southern Forest Stream GP[3]	MIBI Standard	≥ 43
		MIBI Lower Confidence Limit	≥ 29.4
	Class 2Bg Southern Stream RR[4]	MIBI Standard	≥ 37
		MIBI Lower Confidence Limit	≥ 24.4
	Class 2Bm Southern Stream RR[5]	MIBI Standard	≥ 24
		MIBI Lower Confidence Limit	≥ 11.4

[1] Monitoring stations ECU-1A-1, ECU-2, ECU-3A, ECU-5A, ECU-7A, ECU-7B, ECU-7C
[2] Monitoring station ECU-2A
[3] Monitoring stations ECU-1A-1, ECU-5A
[4] Monitoring stations ECU-2, ECU-3A, ECU-7A, ECU-7B, ECU-7C
[5] Monitoring station ECU-2A
[6] Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

3.3 North Fork Nine Mile Creek

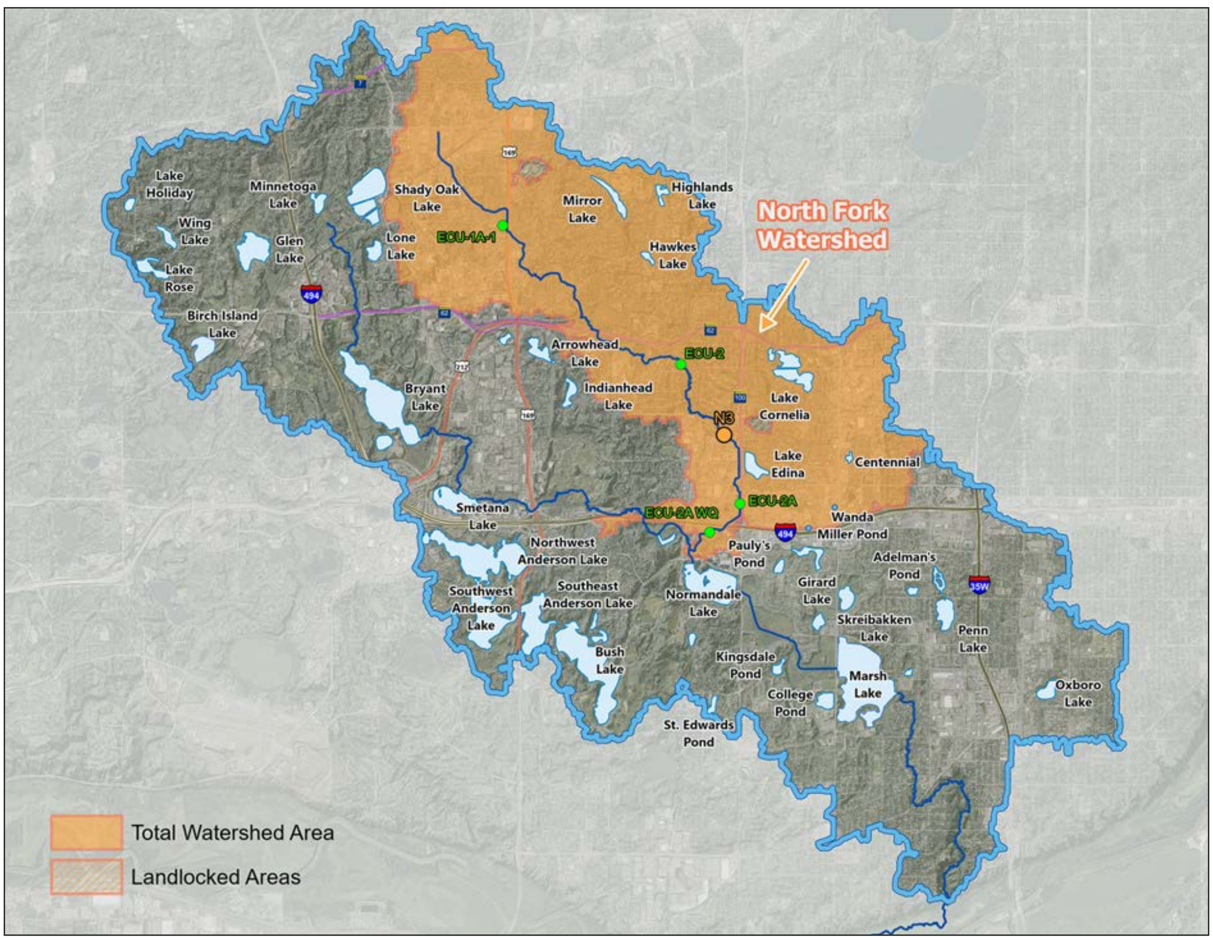
2024 MONITORED PARAMETERS

- **Water Quality**
- **WOMP Stream Flow and Pollutants**
- **Habitat**
- **Fish Index of Biotic Integrity (FIBI)**
- **Macroinvertebrate Index of Biotic Integrity (MIBI)**



Nine Mile Creek Section	North Fork
Tributary Municipalities	Hopkins, Minnetonka, Edina, Richfield, Bloomington
Watershed Area*	8,697 acres (70 landlocked)
Impairment Status (Headwaters to Metro Blvd)	Impaired for aquatic life (fish bioassessment) since 2004
Impairment Status (Metro Blvd to Confluence with South Fork)	Impaired for aquatic life (fish bioassessment) since 2018 Impaired for aquatic life (macroinvertebrate bioassessment) since 2018

** Includes 70 acres that are typically landlocked under average storm conditions.*



3.3.1 Water Quality Monitoring in North Fork Nine Mile Creek

In 2024, four monitoring stations were used to measure the water quality conditions of the North Fork of the Nine Mile Creek, including monitoring locations ECU-1A-1, ECU-2, N3, and ECU-2AWQ (listed upstream to downstream). These monitoring locations are shown in Figure 1-1. Monitored water quality parameters included dissolved oxygen, pH, temperature, specific conductance, turbidity, and flow on eight occasions (once a month March through October). Table 3-3 through Table 3-6 summarize the average, maximum, and minimum observed values for each water quality parameter at each monitoring location on the North Fork. The tables also outline the number of events when the monitored parameter exceeded the state standard or threshold.

Dissolved oxygen measurements observed in the North Fork of the Nine Mile Creek in 2024 met the Minnesota State standard (>5 mg/L) at a higher frequency than 2023—100% of measurements met the State standard in 2024 as compared with 94% in 2023. In 2024, the North Fork met the State standard for dissolved oxygen more frequently than other sampling locations on the Main Steam and South Fork. Time series plots showing the observed dissolved oxygen concentrations can be viewed at the end of this section.

Stream flow and temperature can notably influence the observed dissolved oxygen concentrations in the stream. 2024 was wet in the spring and early summer and dry in the fall. As such, increased flowrates were observed in the North Fork between April and August and notably lower flowrates were observed between September and October. The highest water temperatures were observed in August averaging 72.6ºF in the North Fork. The lowest dissolved oxygen concentrations were generally observed during periods of both reduced stream flow and higher water temperatures.

High **stream flow** can also notably influence the observed **turbidity (clarity)** of the stream due to increased particulates discharging to the stream from watershed runoff as well as amplified sediment resuspension and bank erosion in the stream itself. Generally higher turbidity measurements were noted during increased flowrates observed in the North Fork between April and August. Lower turbidity measurements were observed during low flow conditions between September and October. Higher turbidity measurements were also observed in ECU-1A-1 and ECU-2A in March although lower flowrates were observed.

The **pH** in the North Fork met the state standards throughout the monitored period.

Consistent with previous years, the **specific conductance** criterion (<1,000 μmhos/cm at 25ºC) was met less frequently in 2024 than other Minnesota State standards. As in previous years, the North Fork monitoring locations met the State standard for specific conductance less frequently than other sampling locations on the Main Stem and South Fork—only 47% of the North Fork measurements met the specific conductance standard in 2024. Time series plots showing the observed specific conductance values can be viewed at the end of this section. The exceedance of the Minnesota State specific conductance standard in the North Fork of the Nine Mile Creek in 2024 (and similarly throughout the period of record) has been unfavorable for the aquatic life in the stream. High specific conductance measurements in Nine Mile Creek that fail to meet state standards typically result from the discharge of excess chloride from deicing chemicals (salt) to the creek. Other potential sources include synthetic fertilizers.

Table 3-3 North Fork Nine Mile Creek monitoring location ECU-1A-1 monthly water quality data summary

Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	9.4	12.8	6.2	0/8 (0%)
pH	6.5 – 9.0	7.5	7.8	7.0	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	58.7	72.1	43.9	0/8 (0%)
Specific Conductance (μmhos/cm @ 25°C)	< 1,000	1,127	1,374	779	5/8 (63%)
Turbidity (NTU)	< 25[1]	4.8	7.5	2.7	0/8 (0%)
Flow (cfs)	N/A	2.8	6.1	0.8	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Table 3-4 North Fork Nine Mile Creek monitoring location ECU-2 monthly water quality data summary

Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	8.2	13.1	6.1	0/8 (0%)
pH	6.5 – 9.0	7.6	8.0	7.2	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	59.5	74.8	43.0	0/8 (0%)
Specific Conductance (μmhos/cm @ 25°C)	< 1,000	921	1,342	541	4/8 (50%)
Turbidity (NTU)	< 25[1]	5.2	7.1	2.9	0/8 (0%)
Flow (cfs)	N/A	5.3	17.0	0.8	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Table 3-5 North Fork Nine Mile Creek monitoring location N3 monthly water quality data summary (WOMP Station)

Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	9.6	13.1	7.2	0/8 (0%)
pH	6.5 – 9.0	7.8	8.1	7.3	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	59.3	72.3	39.4	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	889	1,334	481	4/8 (50%)
Turbidity (NTU)	< 25[1]	3.9	5.6	1.9	0/8 (0%)
Flow (cfs)	N/A	4.8	13.2	0.6	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

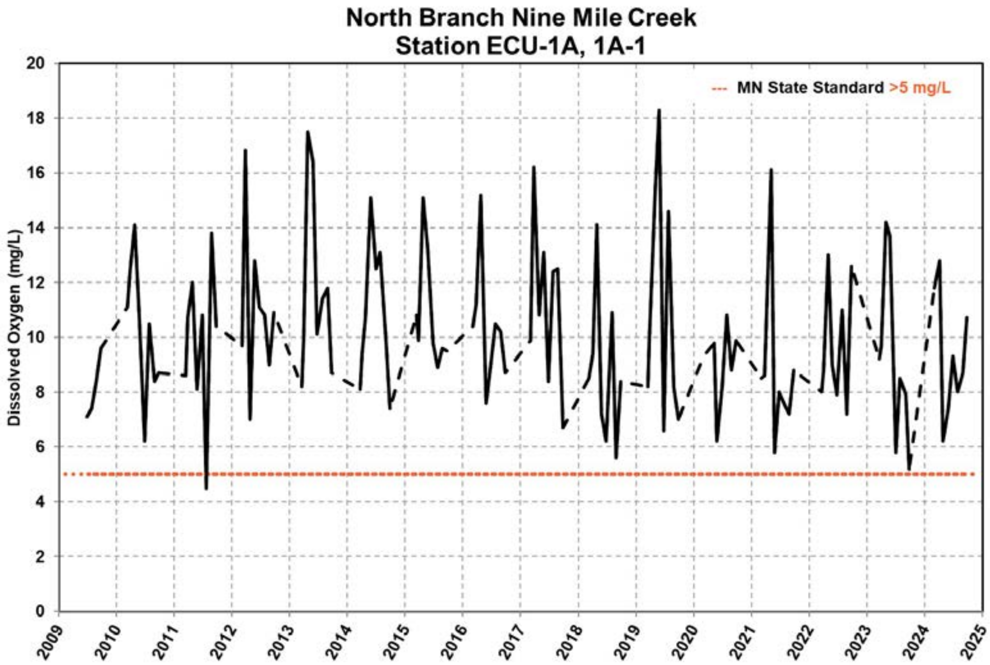
Table 3-6 North Fork Nine Mile Creek monitoring location ECU-2AWQ monthly water quality data summary

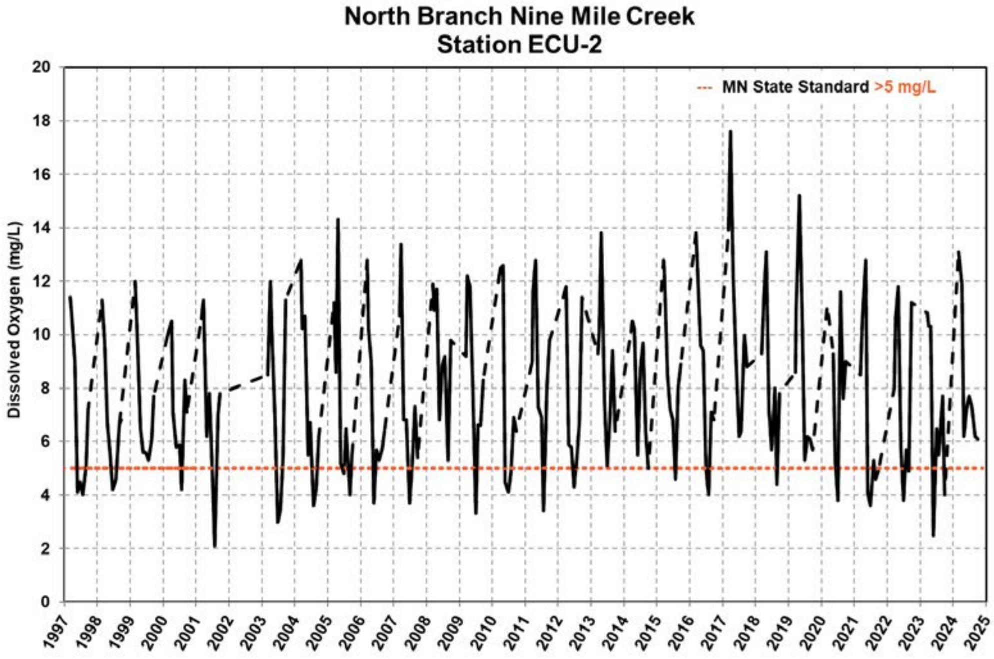
Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	8.2	10.4	6.2	0/8 (0%)
pH	6.5 – 9.0	7.5	7.6	7.3	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	58.3	71.1	40.3	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	1,033	1,573	541	4/8 (50%)
Turbidity (NTU)	< 25[1]	7.4	9.9	5.0	0/8 (0%)
Flow (cfs)	N/A	8.8	22.8	2.2	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Dissolved Oxygen

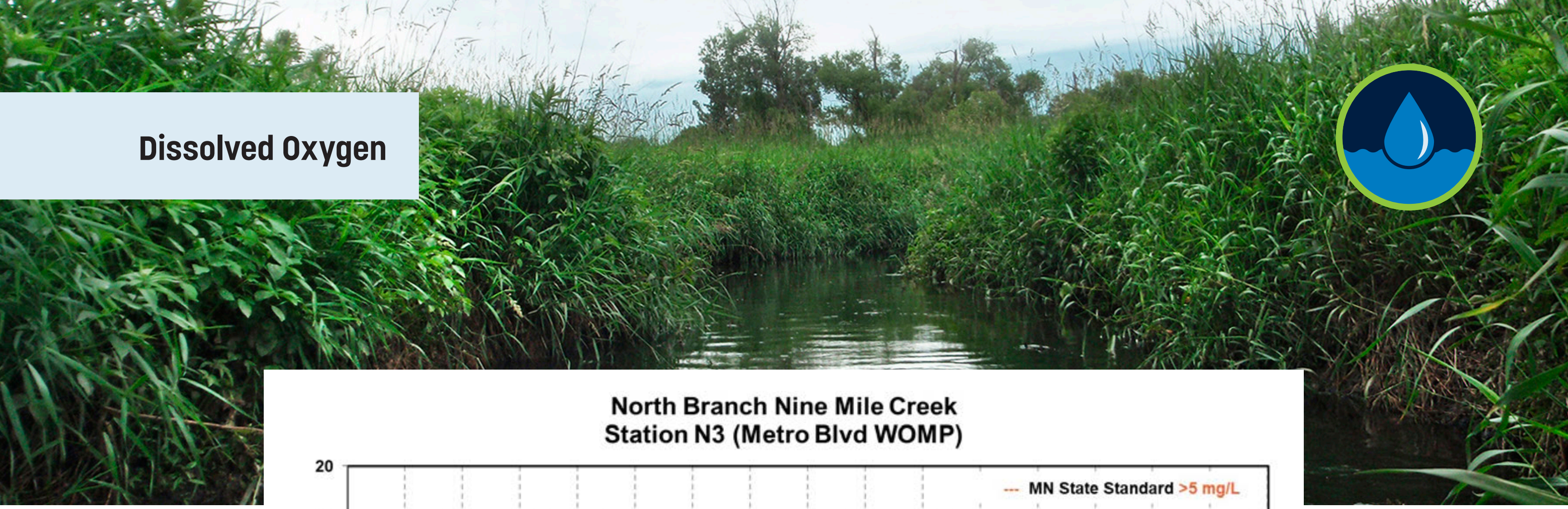
Dissolved oxygen is the concentration (or the amount) of oxygen gas incorporated in water. Oxygen can enter the water from the atmosphere, or it can accumulate from the oxygen released by plants or algae during photosynthesis. Sufficient dissolved oxygen is necessary to support the health and reproduction of organisms such as aquatic insects and fish. Major physical properties that can influence the concentration of dissolved oxygen include temperature, flow, turbulence, nutrient levels, and level of decomposition.

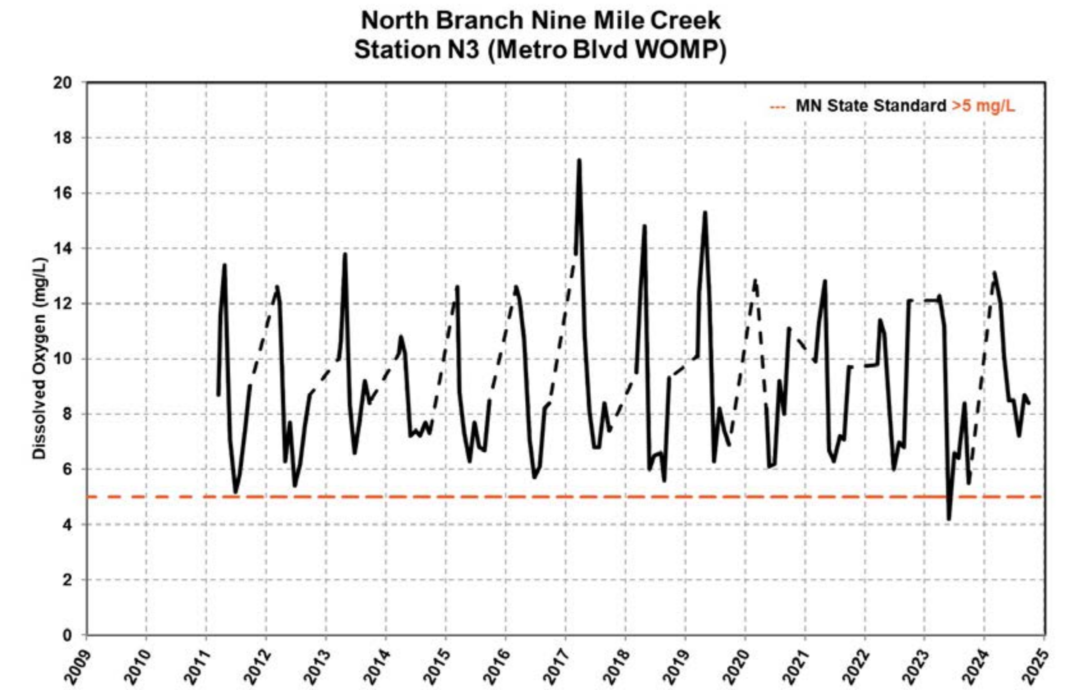


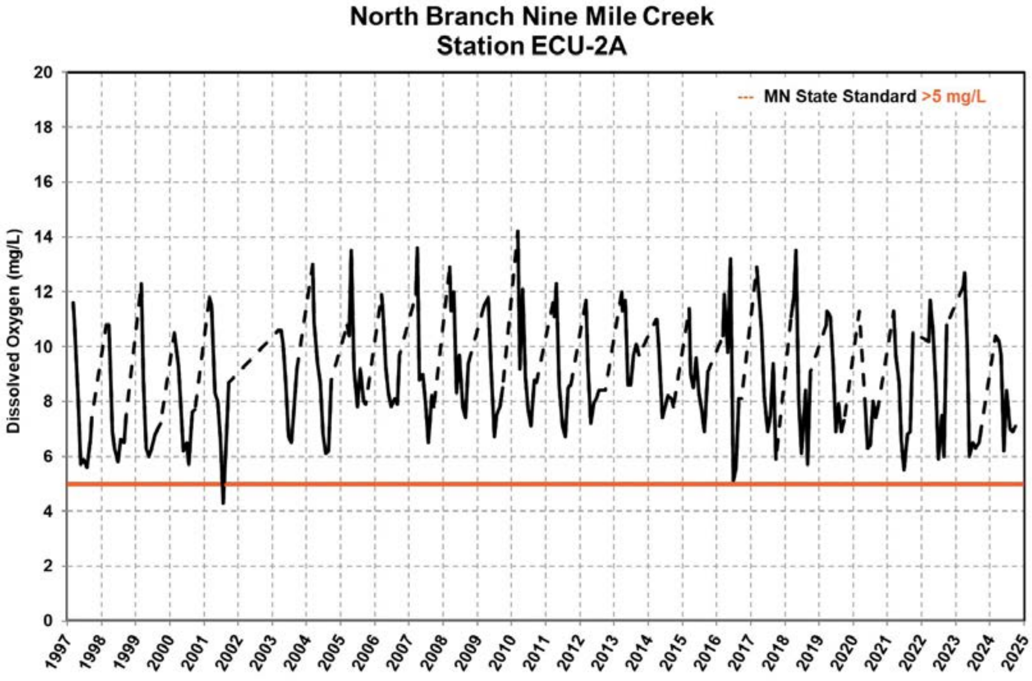


NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

Dissolved Oxygen



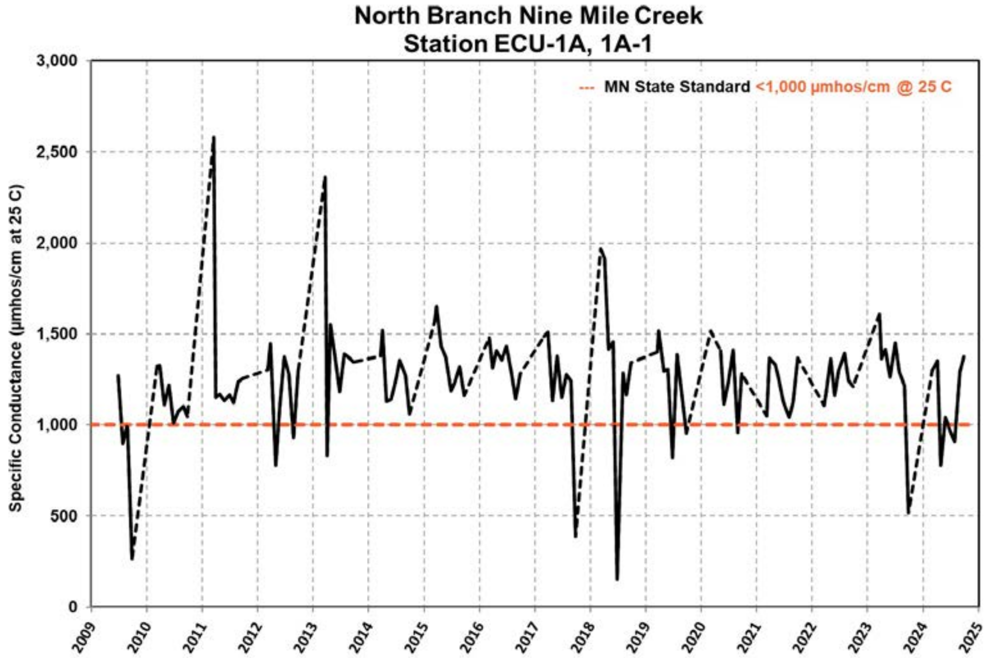


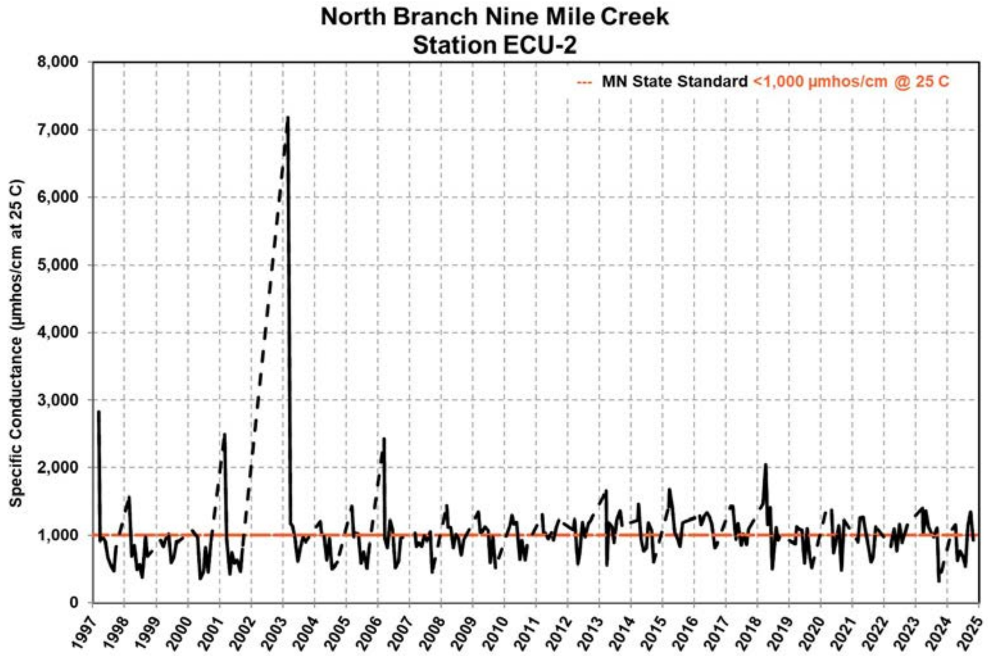


NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

Specific Conductance

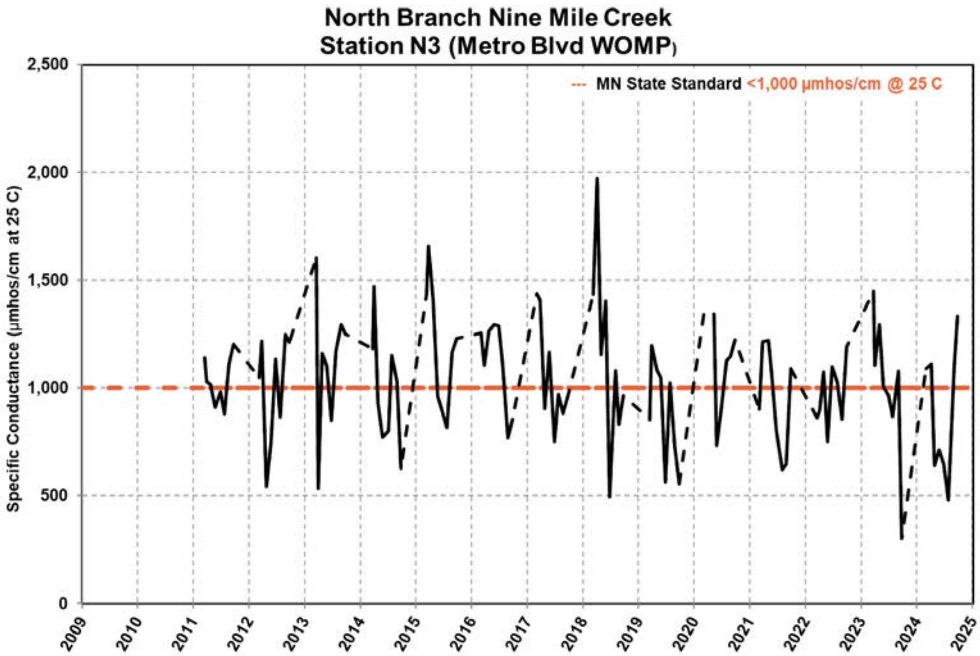
Specific conductance is a measure of water's ability to pass an electrical current via ions dissolved in the water such as alkalis, chloride, sulfides, and carbonate compounds. The higher the specific conductance, the more dissolved salts and minerals that are present in the water. For example, high chloride concentrations can lead to high specific conductance. Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians.

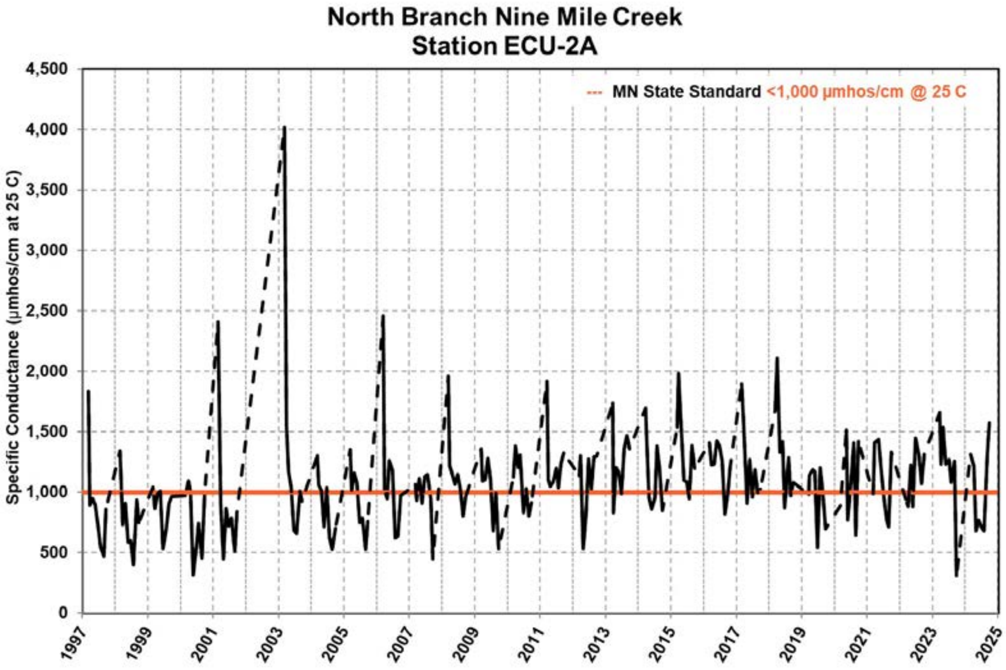




NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

Specific Conductance

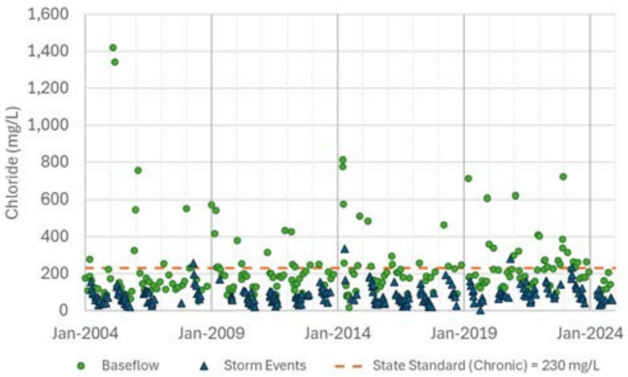




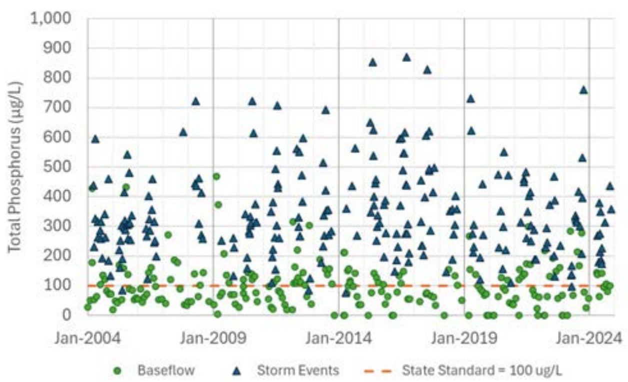
NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

3.3.2 WOMP Stream Pollutant Monitoring in North Fork Nine Mile Creek

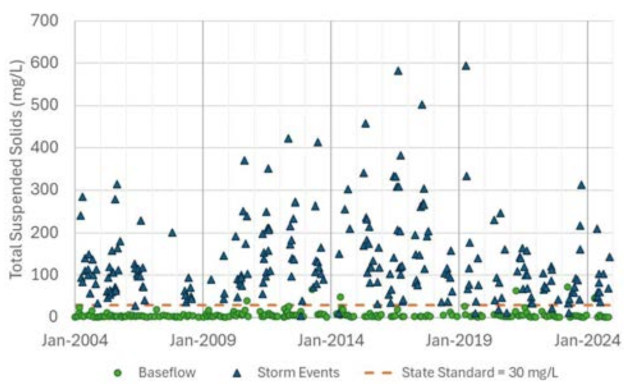
In 2024, one monitoring station was used to measure stream pollutant conditions of the North Fork of the Nine Mile Creek. Monitoring station N3 uses an automated stream pollutant monitoring system similar to the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP). Water quality grab samples were collected bi-weekly to monthly to monitor baseflow conditions and composite samples were collected during most storm events larger than 0.5 inches to monitor stormwater pollutant loads to the North Fork. The plots below summarize the monitored chloride, total phosphorus, and total suspended solids concentrations monitored at station N3 between 2004 and 2024 under baseflow (green) and stormwater pollutant loading (blue) conditions and compares the monitored data to the state standards.



Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In 2024, chloride concentrations at N3 between May and November were higher during baseflow conditions rather than storm events. A maximum concentration of 208 mg/L was observed at the end of September.



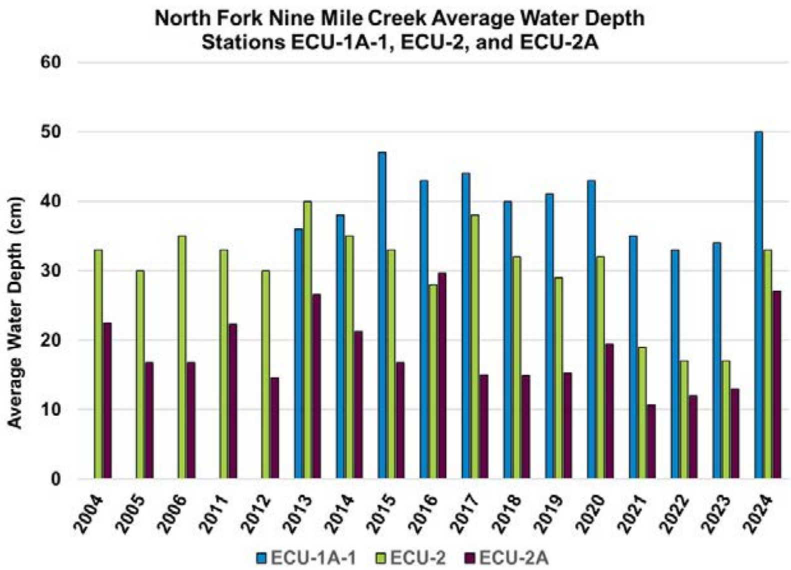
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in streams can influence plant species, alter food resources for aquatic organisms, and lead to higher risk of low oxygen conditions (due to increased bacterial decomposition). In 2024, total phosphorus concentrations at N3 between May and November were higher during storm event conditions. A maximum storm composite concentration of 436 µg/L was observed during a storm event at the end of October.



Suspended solids, including soils, detritus, and algae, in stream water can increase turbidity and decrease clarity. High amounts of suspended solids can affect light penetration and reduce plant growth and can result in harm to habitat areas for fish and other aquatic life due to increased sedimentation and siltation. In 2024, total suspended solids concentrations at N3 between May and November were higher during storm event conditions. A maximum storm composite concentration of 210 mg/L was observed during a storm event at the end of May.

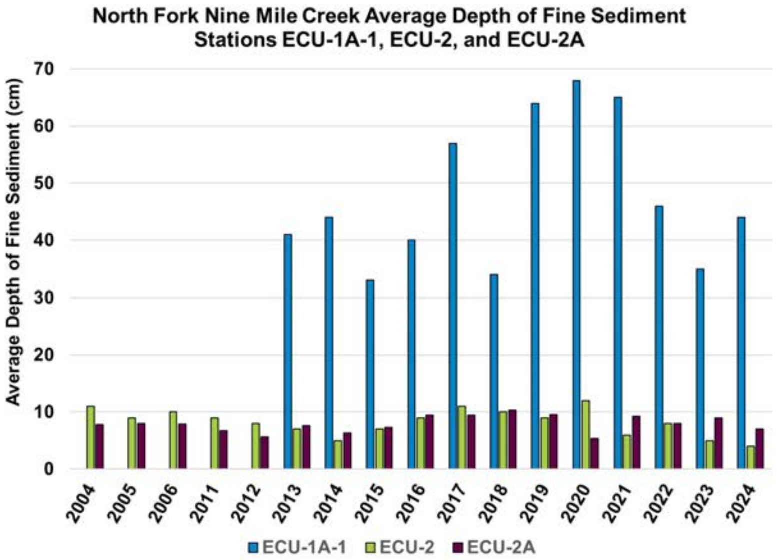
3.3.3 Habitat Monitoring in North Fork Nine Mile Creek

In 2024, three monitoring stations were used to measure the habitat conditions of the North Fork of the Nine Mile Creek, including monitoring locations ECU-1A-1, ECU-2, and ECU-2A (listed upstream to downstream). These monitoring locations are shown in Figure 1-1. Monitored habitat parameters included water depth, flow, depth of fine sediment, percent embeddedness, and length of eroded streambank on one occasion (typically completed during fisheries monitoring). A summary of the water depth, depth of fine sediment, and stream bank erosion observations are provided below.



Water depth is a factor in determining the presence and distribution of fish in streams. Water depths have annually been measured when fish surveys were completed. The average water depths, measured at monitored cross sections, in the North Fork increased in 2024 (since 2023 was a very dry year), providing better fisheries water depths.

Fine sediments like silt, clay, and sand can fill the voids between gravel, rocks, and boulders in the streambed. These voids are critical for fish spawning and providing macroinvertebrates with sheltering and breeding locations. The upstream North Fork monitoring location ECU-1A-1 has been observed to have a notably higher average depths of fine sediments than the downstream North Fork monitoring locations as well as the monitoring locations on the South Fork and Main Stem.



ECU-1A-1 Stream Bank Erosion Observations

Grasses on the upper portions of the banks are preventing some erosion; however notable erosion was observed along bends where exposed soils are present. There are multiple locations along this reach where bank soils are sloughing into the stream. Based on the current erosion observations, it's likely that elevated levels of erosion are occurring during high flow events when water overtops the banks.

ECU-2 Stream Bank Erosion Observations

Erosion is prevalent throughout the entire reach. The most severe erosion is present south of the foot bridge where bank soils at the bends are sloughing off into the stream. It's likely that elevated levels of erosion are occurring during high flow events when water overtops the banks. Grasses on the upper portions of the banks are minimizing erosion in a few areas.

ECU-2A Stream Bank Erosion Observations

Because this reach does not have any appreciable bends, bank erosion has not increased to the same extent as what has been observed in ECU-1A-1 and ECU-2 in the last 5 years. However exposed soils covered by overhanging grasses are still susceptible to erosion, especially during high flow conditions.

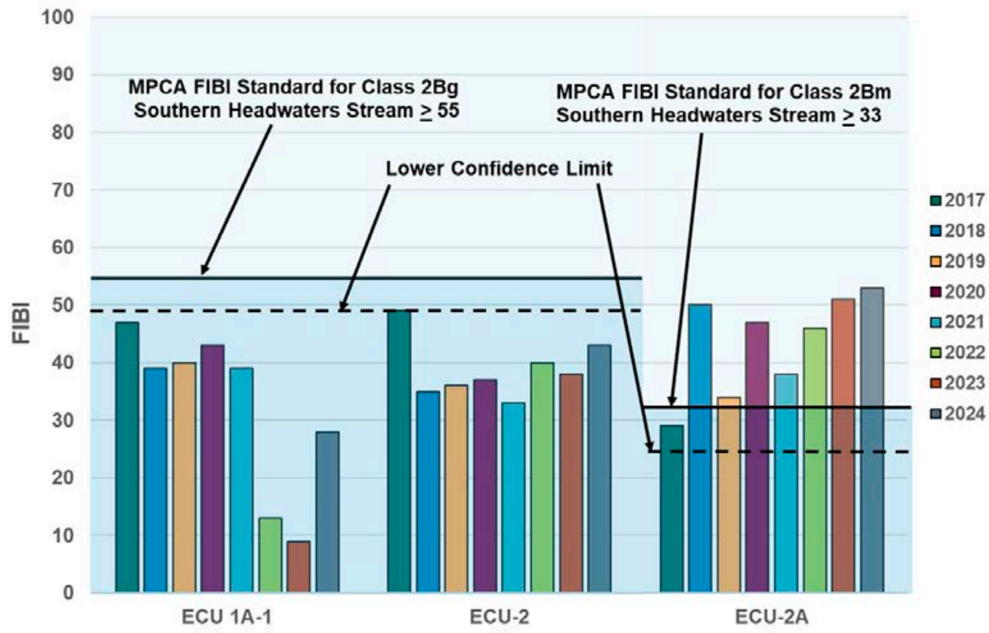
3.3.4 Fish Index of Biotic Integrity (FIBI) in North Fork Nine Mile Creek

Fish were monitored at the three North Fork sample locations during June 20–26, 2024. FIBI scores were computed and compared with the applicable FIBI standards for Nine Mile Creek. FIBI scores from the two upstream North Fork locations, ECU-1A-1 and ECU-2 were below the FIBI standard and the lower confidence limit. The FIBI score from the downstream North Fork location, ECU-2A, met its respective FIBI standard and was the highest score observed in the historical record.

FIBI scores from the two most upstream North Fork locations, ECU 1A 1 and ECU 2, have not met the FIBI standard during the entire period of record (2017 through 2024). The *Nine Mile Creek Biological Stressor Identification* (Barr Engineering Co., 2010) concluded inadequate oxygen was a primary stressor to the North Fork fish community followed by excess sediment and excess ionic strength due to excess chloride in the stream. Water quality observations in 2024 documented excess specific conductivity (chloride) at both ECU-1A-1 and ECU-2 in 2024 indicating a possible biological stressor. Specific conductivity exceeded the state standard at both monitoring locations in April, May, September, and October. Specific conductivity also exceeded the state standard in June at ECU-1A-1.

FIBI scores from the downstream North Fork location, ECU-2A, met the FIBI standard during 2018 through 2024, but not during 2017. However, the 2017 value was within the standard's confidence limits indicating it was close to the standard. The *Nine Mile Creek Biological Stressor Identification* (2010) concluded excess ionic strength due to excess chloride in the stream was a stressor to the North Fork fish community. In 2024, specific conductivity was observed to exceed the state standard in April, May, September, and October, similar to the upstream locations, indicating a possible biological stressor.

The North Fork of the Nine Mile Creek from the stream's headwaters (Hopkins) to Metro Blvd (Edina) has been included on the state's impaired waters list for aquatic life (fish bioassessment) since 2004. The portion of the North Fork downstream of Metro Blvd has been included on the state's impaired waters list for aquatic life (fish bioassessment) since 2018.



2017–2024 North Fork Nine Mile Creek Fish Index of Biotic Integrity (FIBI) values compared with the MPCA FIBI standards and lower confidence limits

3.3.5 Macroinvertebrate Index of Biotic Integrity (MIBI) in North Fork Nine Mile Creek

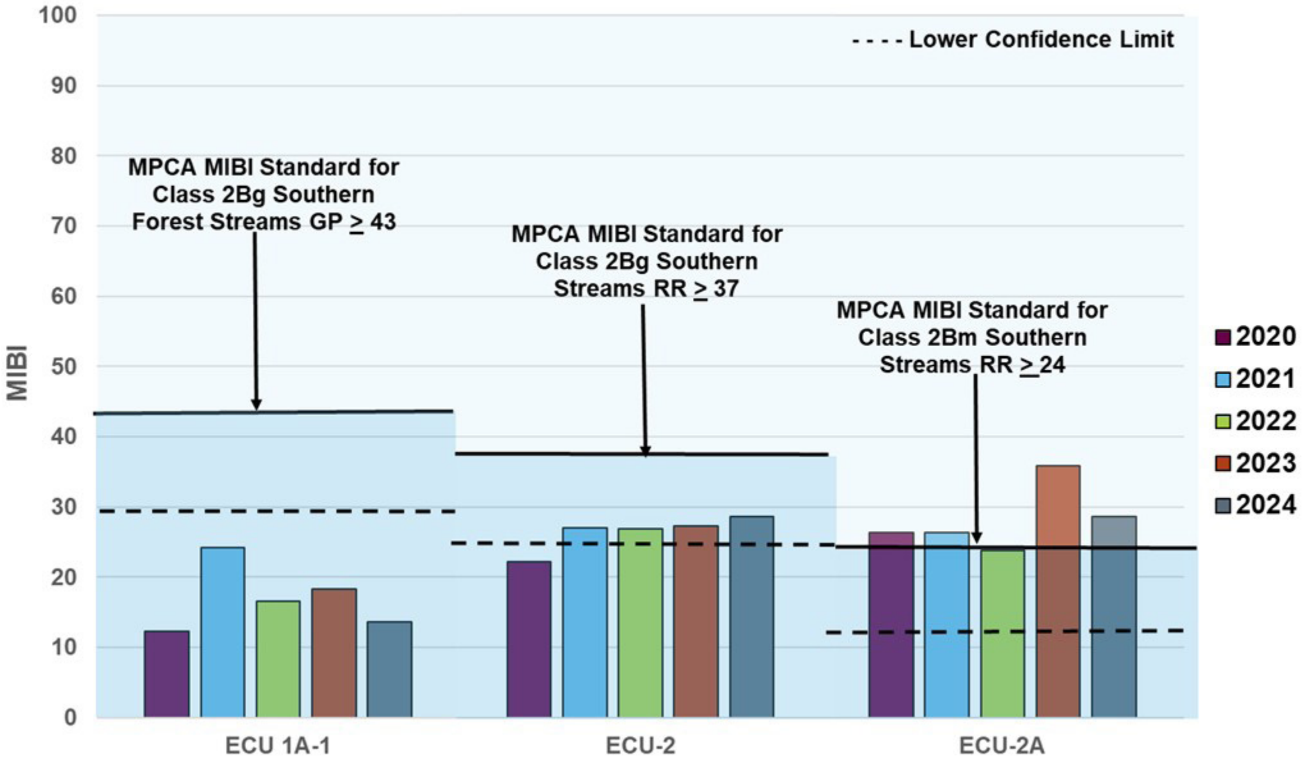
Macroinvertebrates were monitored at the three North Fork sample locations during October 1-2, 2024. MIBI scores were computed and compared with the applicable MIBI standards for the North Fork of the Nine Mile Creek.

In 2024, the downstream North Fork Location, ECU-2A, was the only sample location that met the applicable MPCA standard. The downstream ECU-2A monitoring location has also met the applicable MPCA standard in 2020–2021 and in 2023. The middle North Fork location, ECU-2, had a 2024 MIBI value greater than its respective lower confidence limit indicating the monitoring location was close to its applicable MIBI standard. This observation is consistent with MIBI observations between 2021–2023. The 2024 MIBI value of the most upstream North Fork location, ECU 1A 1, was below the MIBI standard and the lower confidence limit, which is consistent with the MIBI observations since monitoring began in 2020.

The portion of the North Fork Nine Mile Creek that's downstream of Metro Blvd (Edina) has been included on the state's impaired waters list for aquatic life (macroinvertebrate bioassessment) since 2018.

Example photo of a mayfly nymph

Photo credit: Dr. Dean Hansen



2020-2024 North Fork Nine Mile Creek Macroinvertebrate Index of Biotic Integrity (MIBI) values compared with the MPCA MIB standards and lower confidence limits

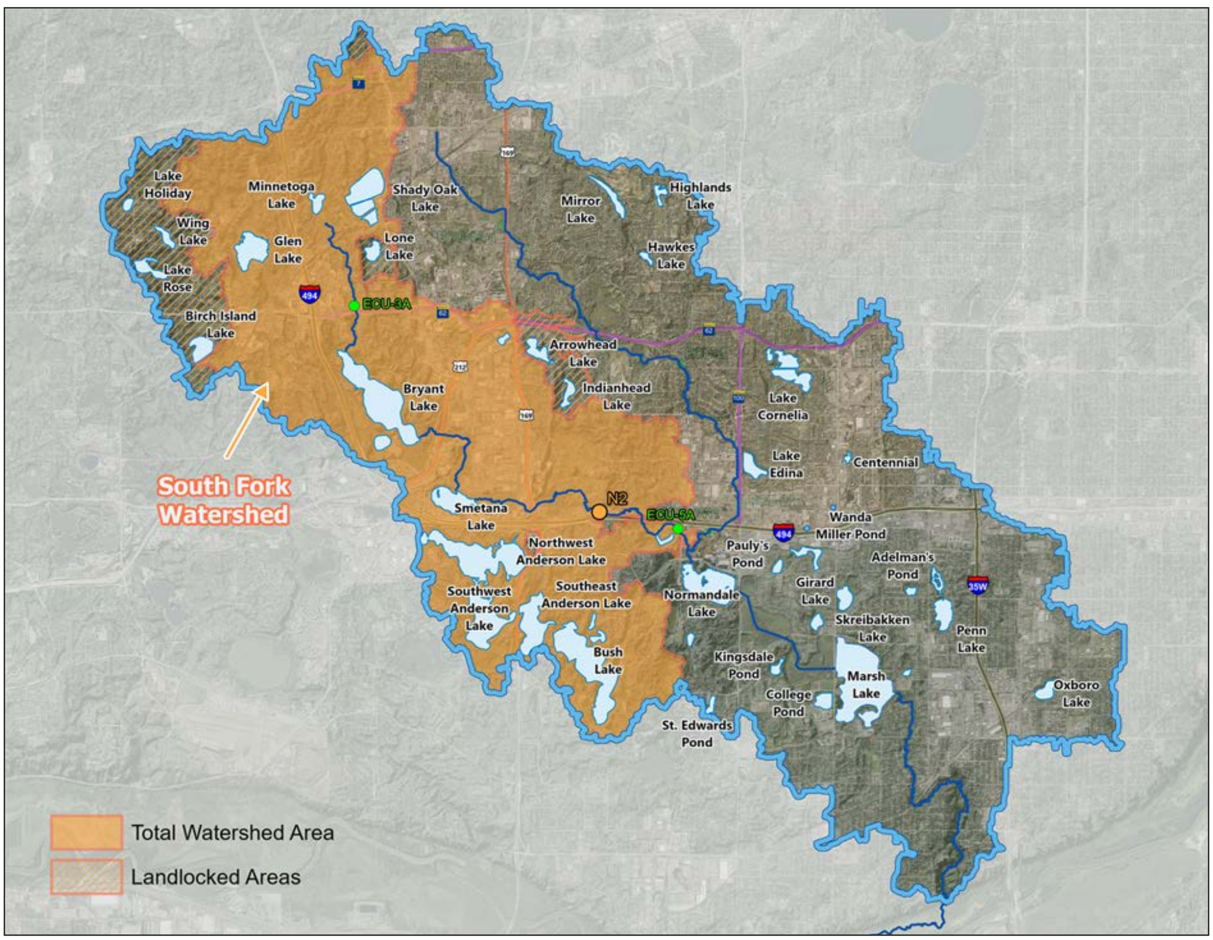
3.4 South Fork Nine Mile Creek

2024 MONITORED PARAMETERS

- **Water Quality**
- **WOMP Stream Flow and Pollutants**
- **Habitat**
- **Fish Index of Biotic Integrity (FIBI)**
- **Macroinvertebrate Index of Biotic Integrity (MIBI)**

Nine Mile Creek Section	South Fork
Tributary Municipalities	Hopkins, Minnetonka, Edina, Eden Prairie, Bloomington
Watershed Area*	12,357 acres (1,640 landlocked)
Impairment Status (Lake Smetana to Confluence with North Fork)	Impaired for aquatic life (fish bioassessment) since 2018 Impaired for aquatic life (macroinvertebrate bioassessment) since 2018

** Includes 1,640 acres that are typically landlocked under average storm conditions.*



3.4.1 Water Quality Monitoring in South Fork Nine Mile Creek

In 2024, three monitoring stations were used to measure the water quality conditions of the South Fork of the Nine Mile Creek, including monitoring locations ECU-3A, N2, and ECU-5A (listed upstream to downstream). These monitoring locations are shown in Figure 1-1. Monitored water quality parameters included dissolved oxygen, pH, temperature, specific conductance, turbidity, and flow on eight occasions (once a month March through October). Table 3-7 through Table 3-9 summarize the average, maximum, and minimum observed values for each water quality parameter at each monitoring location on the South Fork. The tables also outline the number of events when the monitored parameter exceeded the state standard or threshold.

Dissolved oxygen measurements observed in the South Fork of the Nine Mile Creek in 2024 met the Minnesota State standard (>5 mg/L) with the same frequency as 2023—75% met the State standard in 2023 and 2024. In 2024, the South Fork met the State standard for dissolved oxygen less frequently than other sampling locations on the Main Steam and North Fork, which met the standard at a frequency of 95% and 100% respectively. Time series plots showing the observed dissolved oxygen concentrations can be viewed at the end of this section.

Stream flow and temperature can notably influence the observed dissolved oxygen concentrations in the stream. 2024 was wet in the spring and early summer and dry in the fall. As such, increased flowrates were observed in the downstream South Fork monitoring locations (N2, ECU-5a) between April and August and notably lower flowrates were observed between September and October. Upstream monitoring location, ECU-3A, had extensively lower flowrates than the downstream South Fork monitoring locations throughout the 2024 monitored period. Observed flowrates ranged from 0.1–1.1 cfs at ECU-3A. The highest water temperatures at all three South Fork locations were observed in August averaging 73.1°F. The lowest dissolved oxygen concentrations were generally observed during periods of both reduced stream flow and higher water temperatures. At N2 measured dissolved oxygen concentrations in March and July–October were below the Minnesota state standard of 5 mg/L. The lowest observed dissolved oxygen concentration was 3.0 mg/L in August at a temperature of 74.5°F.

The South Fork generally observed higher **turbidity (clarity)** values during lower stream flowrates during monthly monitoring. Higher turbidity during low flows can occur due to increased algal growth or organic matter accumulation and decomposition, particularly during warmer stream temperatures. Low flow rates may also change the conditions under which fine sediment is resuspended, which can result in higher turbidity measurements. Furthermore, with less water flowing, any pollutants or sediments entering the stream are less diluted, leading to higher concentrations of suspended particles. The South Fork also experiences high turbidity and total suspended solids measurements during storm events (see Section 3.4.2).

The **pH** in the South Fork met the state standards throughout the monitored period.

Consistent with previous years, the observed **specific conductance** failed to meet Minnesota State standards (<1,000 µmhos/cm at 25°C) for portions of the monitored period. However, contrary to previous years, the South Fork monitoring locations met the State standard for specific conductance more frequently than other sampling locations on the North Fork and Main Stem— 88% of the South Fork measurements met the specific conductance standard in 2024. This is also an improvement over conditions observed in 2023 where only 29% of the South Fork measurements met the specific conductance standard. Time series plots showing the observed specific conductance values can be viewed at the end of this section. The exceedance of the Minnesota State specific conductance standard in the South Fork of the Nine Mile Creek in 2024 (and similarly throughout the period of record) has been unfavorable for the aquatic life in the stream. High specific conductance measurements in Nine Mile Creek that fail to meet state standards typically result from the discharge of excess chloride from deicing chemicals (salt) to the creek. Other potential sources include synthetic fertilizers.

Table 3-7 South Fork Nine Mile Creek monitoring location ECU-3A monthly water quality data summary

Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	8.2	11.8	6.3	0/8 (0%)
pH	6.5 – 9.0	7.4	7.7	6.8	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	57.1	70.9	43.9	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	704	842	544	0/8 (0%)
Turbidity (NTU)	< 25[1]	3.5	5.7	1.3	0/8 (0%)
Flow (cfs)	N/A	0.3	1.1	0.1	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Table 3-8 South Fork Nine Mile Creek monitoring location N2 monthly water quality data summary (WOMP Station)

Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	5.4	9.4	3.0	5/8 (63%)
pH	6.5 – 9.0	7.3	7.6	7.1	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	60.4	74.5	41.9	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	813	1,100	626	1/8 (13%)
Turbidity (NTU)	< 25[1]	2.2	4.6	0.8	0/8 (0%)
Flow (cfs)	N/A	8.0	25.1	0.2	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

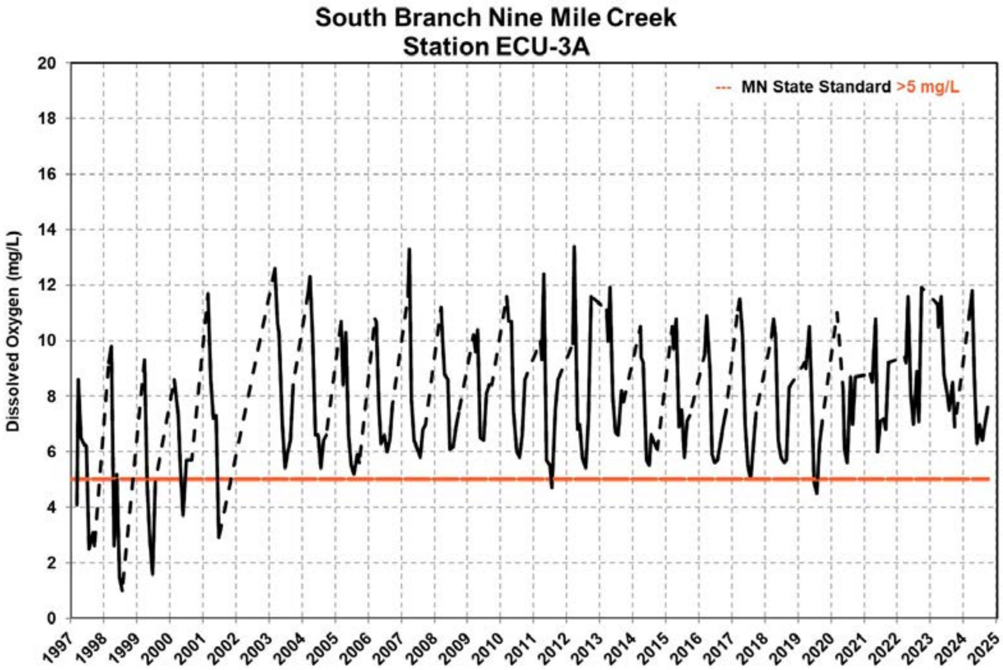
Table 3-9 South Fork Nine Mile Creek monitoring location ECU-5A monthly water quality data summary

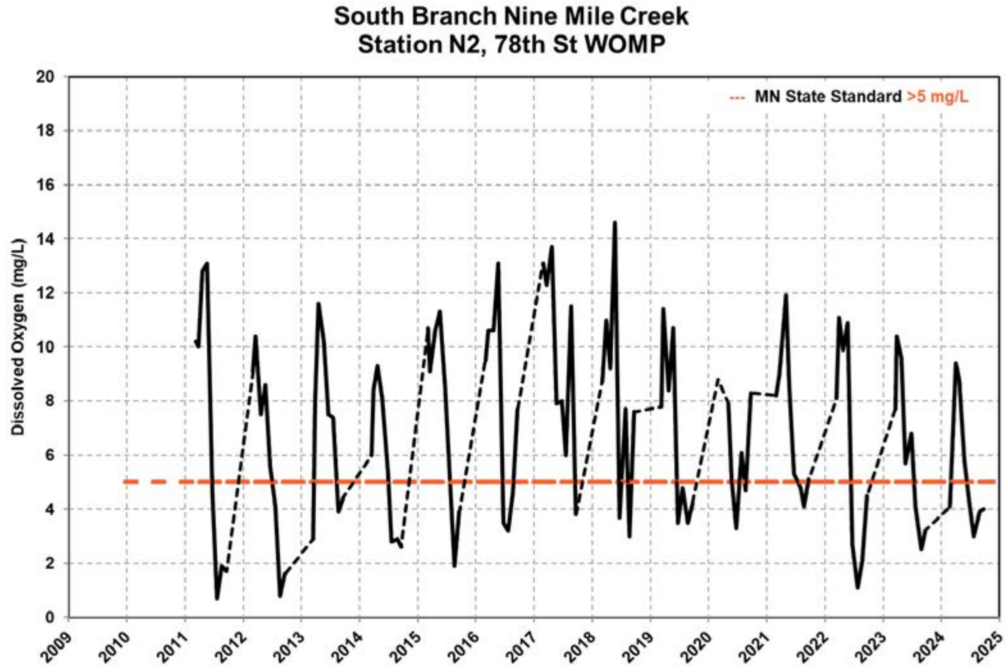
Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	7.1	12.3	4.8	1/8 (13%)
pH	6.5 – 9.0	7.5	7.6	7.3	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	60.1	73.8	40.6	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	823	1,087	621	2/8 (25%)
Turbidity (NTU)	< 25[1]	3.0	6.2	1.3	0/8 (0%)
Flow (cfs)	N/A	9.8	29.5	0.4	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Dissolved Oxygen

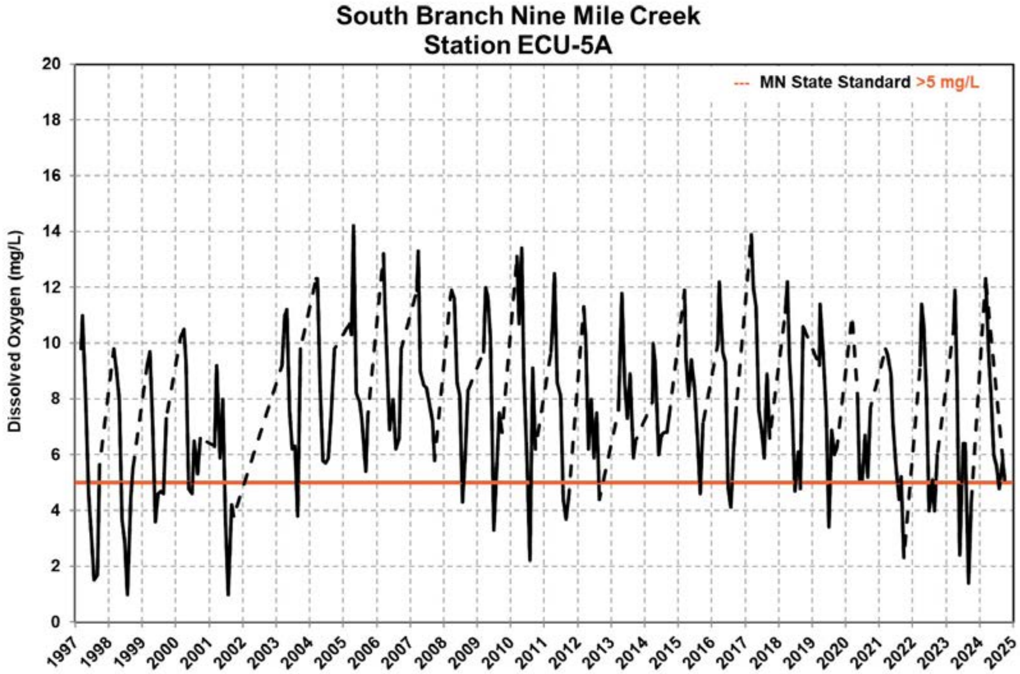
Dissolved oxygen is the concentration (or the amount) of oxygen gas incorporated in water. Oxygen can enter the water from the atmosphere, or it can accumulate from the oxygen released by plants or algae during photosynthesis. Sufficient dissolved oxygen is necessary to support the health and reproduction of organisms such as aquatic insects and fish. Major physical properties that can influence the concentration of dissolved oxygen include temperature, flow, turbulence, nutrient levels, and level of decomposition.





NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

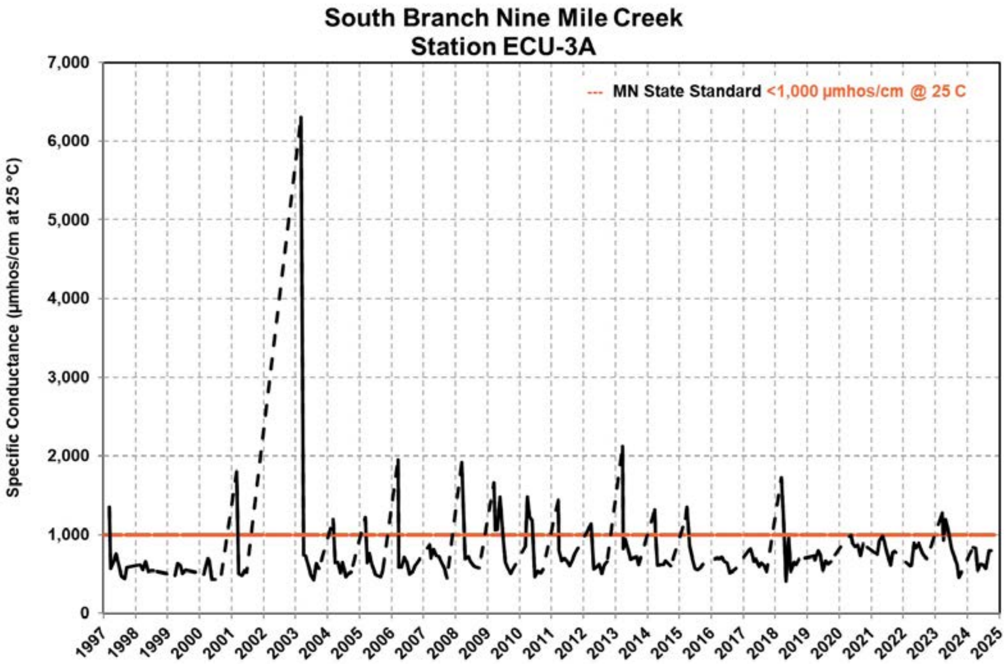
Dissolved Oxygen

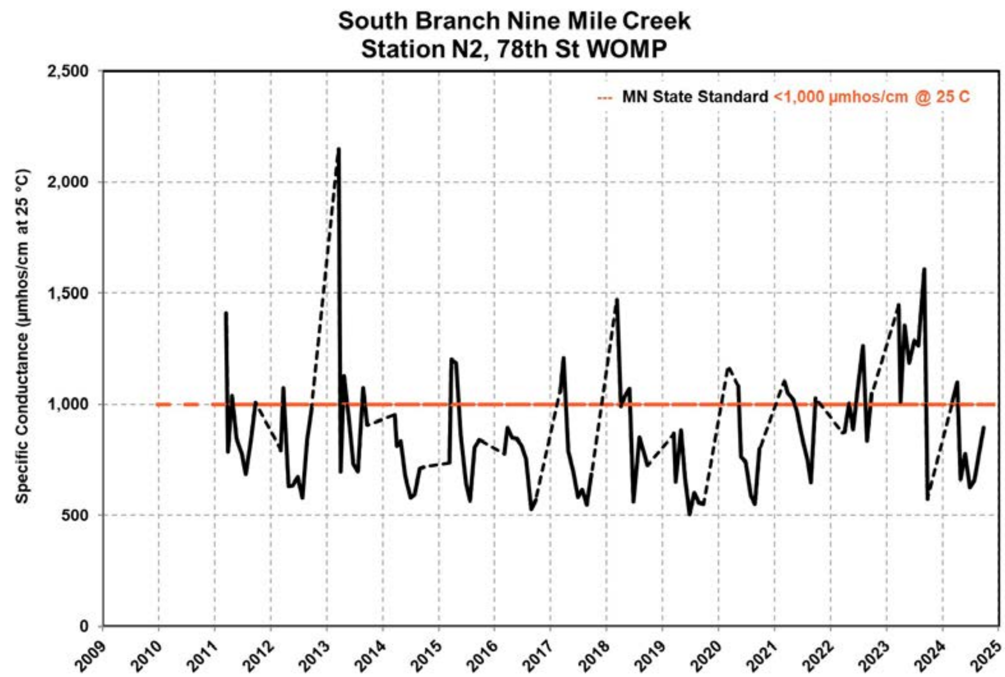


NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

Specific Conductance

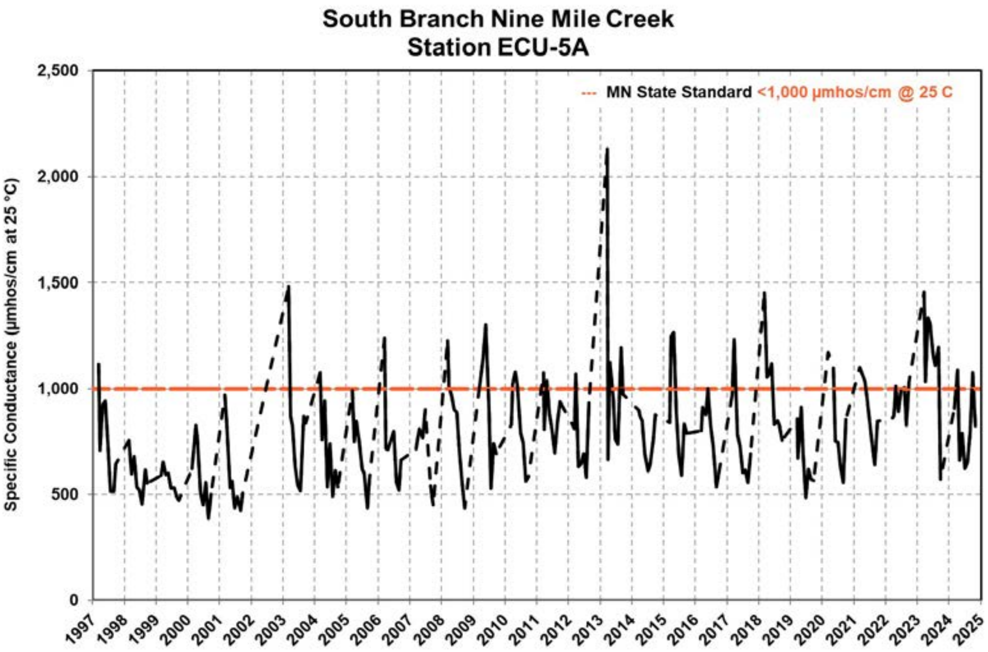
Specific conductance is a measure of water's ability to pass an electrical current via ions dissolved in the water such as alkalis, chloride, sulfides, and carbonate compounds. The higher the specific conductance, the more dissolved salts and minerals that are present in the water. For example, high chloride concentrations can lead to high specific conductance. Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians.





NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

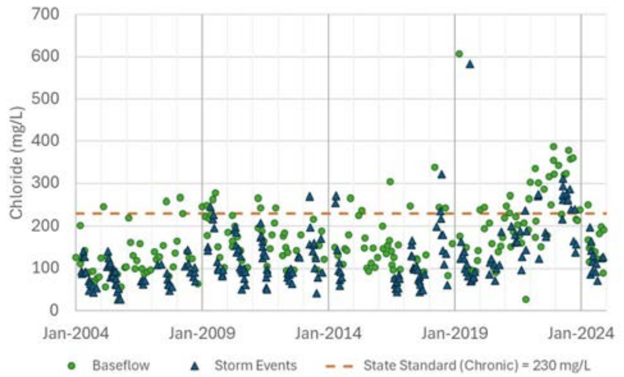
Specific Conductance



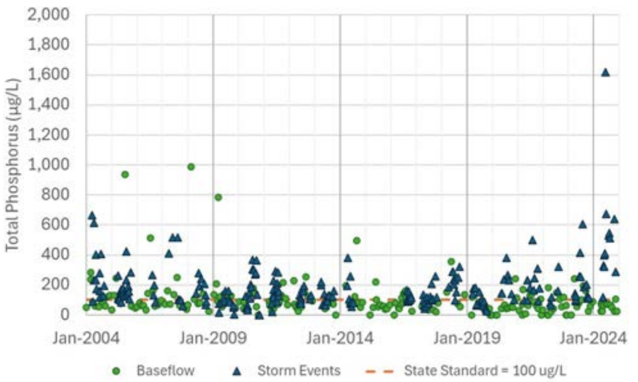
NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

3.4.2 WOMP Stream Pollutant Monitoring in South Fork Nine Mile Creek

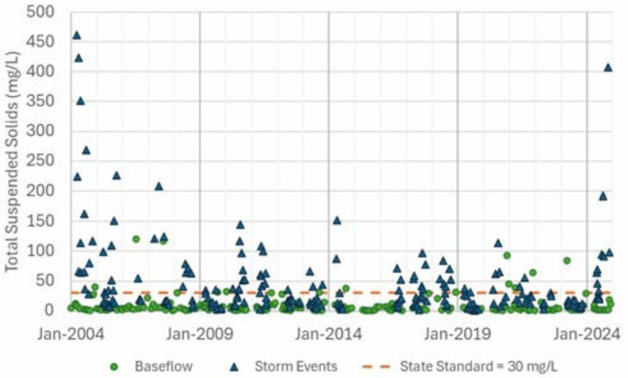
In 2024, one monitoring station was used to measure stream pollutant conditions of the South Fork of the Nine Mile Creek. Monitoring station N2 uses an automated stream pollutant monitoring system similar to the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP). Water quality grab samples were collected bi-weekly to monthly to monitor baseflow conditions and composite samples were collected during most storm events larger than 0.5 inches to monitor stormwater pollutant loads to the South Fork. The plots below summarize the monitored chloride, total phosphorus, and total suspended solids concentrations monitored at station N2 between 2004 and 2024 under baseflow (green) and stormwater pollutant loading (blue) conditions and compares the monitored data to the state standards.



Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In 2024, chloride concentrations at N2 between May and November were similar during baseflow and storm event conditions. Higher chloride concentrations were observed during baseflow conditions in April with a maximum concentration of 251 mg/L.



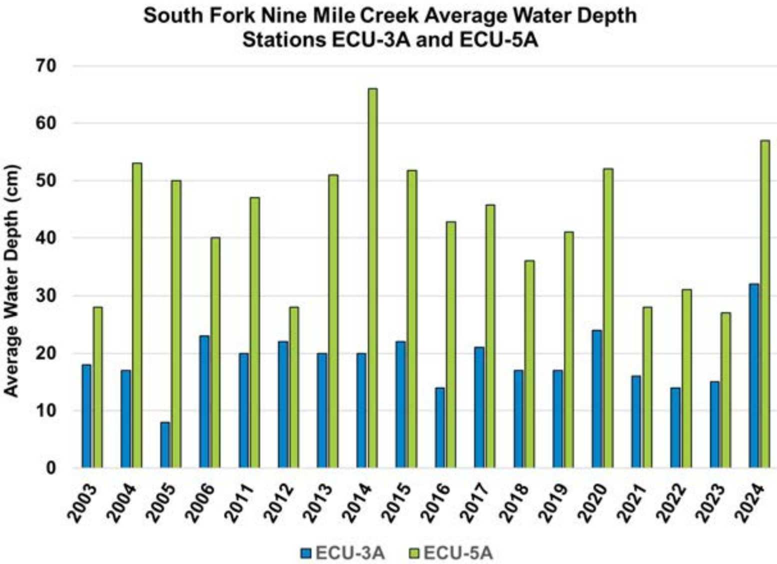
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in streams can influence plant species, alter food resources for aquatic organisms, and lead to higher risk of low oxygen conditions (due to increased bacterial decomposition). In 2024, total phosphorus concentrations at N2 between May and November were higher during storm event conditions. A maximum storm composite concentration of 1,620 µg/L was observed during a storm event at the end of June.



Stream water will get less clear and more turbid from an increase in **total suspended solids** including sediment, soils, detritus, and algae. High amounts of suspended solids can affect light penetration and reduce plant growth and can result in harm to habitat areas for fish and other aquatic life due to increased sedimentation and siltation. In 2024, total suspended solids concentrations at N2 between May and November were higher during storm event conditions. A maximum storm composite concentration of 408 mg/L was observed during a storm event at the beginning of November.

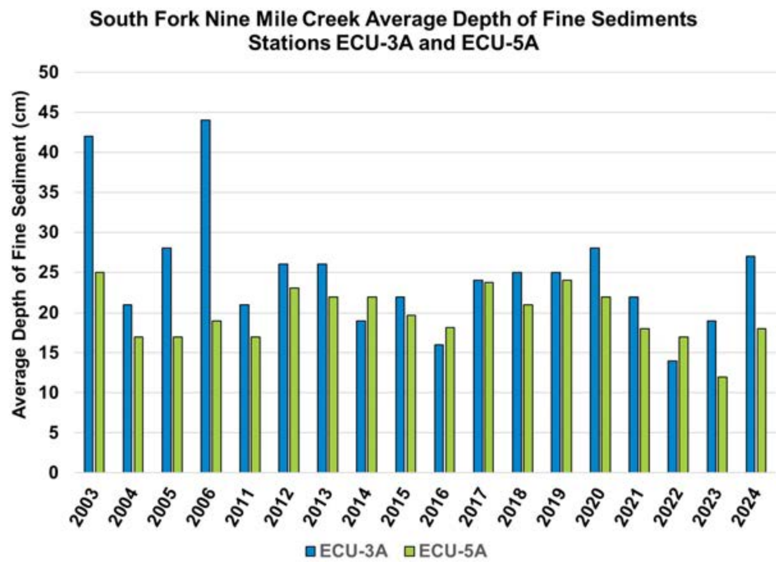
3.4.3 Habitat Monitoring in South Fork Nine Mile Creek

In 2024, two monitoring stations were used to measure the habitat conditions of the South Fork of the Nine Mile Creek. These included monitoring locations ECU-3A and ECU-5A (listed upstream to downstream). These monitoring locations are shown in Figure 1-1. Monitored habitat parameters included water depth, flow, depth of fine sediment, percent embeddedness, and length of eroded streambank on one occasion (typically completed during fisheries monitoring). A summary of the water depth, depth of fine sediment, and stream bank erosion observations are provided below.



Water depth is a factor in determining the presence and distribution of fish in streams. Water depths have annually been measured when fish surveys were completed. The average water depths, measured at monitored cross sections, in the South Fork increased in 2024 (since 2023 was a very dry year), providing better fisheries water depths.

Fine sediments like silt, clay, and sand can fill the voids between gravel, rocks, and boulders in the streambed. These voids are critical for fish spawning and providing macroinvertebrates with sheltering and breeding locations. Within the past decade, both monitoring locations on the South Fork had similar average depths of fine sediment. A slight increase in the depth of fine sediment was observed at both locations in wet years.



ECU-3A Stream Bank Erosion Observations

Considerable erosion was observed at the downstream end of this reach. Exposed soils on the bends are sloughing into the stream. Some areas of bank erosion have caused trees to fall.

While the downstream end of this reach has more notable erosion concerns, the upper and middle portions of the reach have been experiencing a slight increasing trend in erosion in the last 5 years.

ECU-5A Stream Bank Erosion Observations

Grasses on the upper portions of the banks are helping to stabilize the channel along this reach. Annual erosion measurements of this reach tend to fluctuate with water depth, indicating that erosion is more prevalent in the stream channel rather than the upper portions of the banks.

3.4.4 Fish Index of Biotic Integrity (FIBI) in South Fork Nine Mile Creek

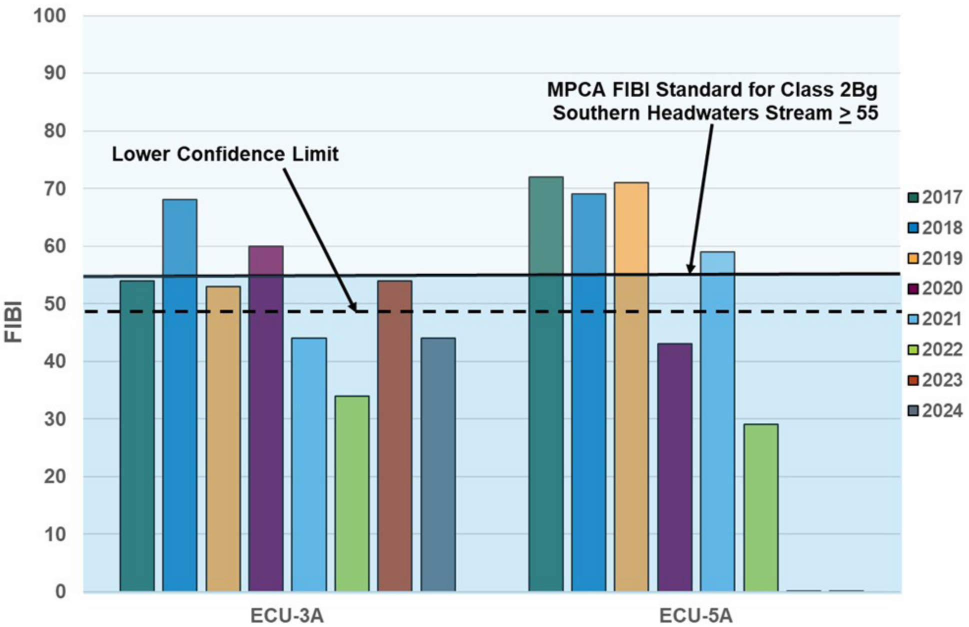
Fish were monitored at the two South Fork sample locations during June 18–26, 2024. FIBI scores were computed and compared with the applicable FIBI standards for the South Fork of the Nine Mile Creek. The FIBI score from both South Fork monitoring locations ECU-3A and ECU-5A did not meet their respective FIBI standard or lower confidence limit.

FIBI values from the upstream South Fork location, ECU-3A, met the FIBI standard during 2018 and 2020, but not during 2017, 2019, and 2021–2024. However, 2017, 2019 and 2023 values were within the standard's confidence limits indicating the values were fairly close to the standard. Low baseflow in 2021 through 2024 likely stressed the fish community. Observed baseflows at ECU-3A between April 2021 through October 2024 ranged between 0.01–2.1 cfs. These flows were noticeably lower than flows measured between April 2017 through October 2020, which ranged from 0.2 cfs to 11.8 cfs. Additionally, dissolved oxygen concentrations monitored at ECU-3A in 2024 failed to meet the state standard in March and between July and October (i.e., dissolved oxygen concentrations below 5 mg/L).

FIBI values from the South Fork downstream location, ECU 5A, met the FIBI standard during 2017 through 2019 and in 2021, but not during 2020 and 2022–2024. The 2023 and 2024 scores of 0 are the lowest to date as compared with FIBI scores of 29 through 72 during 2017 through 2022. Low baseflow in 2023 likely stressed the fish community. In September 2023 no flow was observed at ECU-5A. While the observed flows at ECU-5A were markedly higher in 2024, it's possible that the fish community has not re-established from the extreme low flow conditions in 2023. Additionally, dissolved oxygen concentrations at ECU-5A failed to meet the state standard in August 2024 (i.e., dissolved oxygen concentrations below 5 mg/L).

The biological stressors identified by the *Nine Mile Creek Biological Stressor Identification* (Barr Engineering Co., 2010) for the South Fork of Nine Mile Creek included inadequate dissolved oxygen, excess sediment, and inadequate baseflow. The low flows and low dissolved oxygen levels measured in the South Fork in 2023 and low dissolved oxygen in 2024 indicate inadequate baseflow and low dissolved oxygen as possible biological stressors in recent years.

The South Fork of the Nine Mile Creek from Lake Smetana (Eden Prairie) to the confluence with the North Fork (Bloomington) has been included on the state's impaired waters list for aquatic life (fish bioassessment) since 2018.



2017-2024 South Fork Nine Mile Creek Fish Index of Biotic Integrity (FIBI) values compared with the MPCA FIBI standards and lower confidence limits.

3.4.5 Macroinvertebrate Index of Biotic Integrity (MIBI) in South Fork Nine Mile Creek

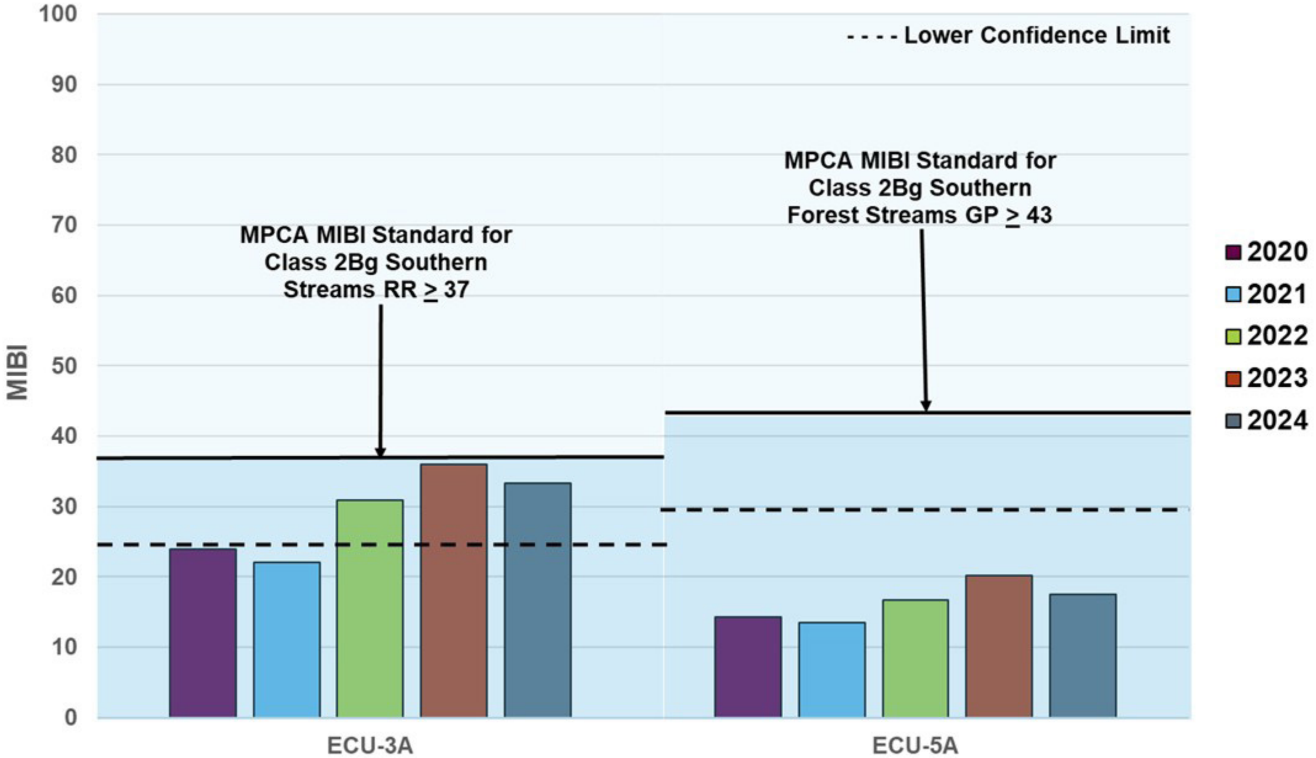
Macroinvertebrates were monitored at the two South Fork sample locations during October 1, 2024. MIBI scores were computed and compared with the applicable MIBI standards for the South Fork of the Nine Mile Creek.

In 2024, upstream South Fork location, ECU-3A, had a MIBI value greater than its respective lower confidence limit indicating the monitoring location was close to its applicable MIBI standard. This observation is consistent with MIBI observations between 2022–2023. The 2024 MIBI value of the downstream South Fork location, ECU-5A, was below the MIBI standard and the lower confidence limit, which is consistent with the MIBI observations since monitoring began in 2020.

The South Fork of the Nine Mile Creek from Lake Smetana (Eden Prairie) to the confluence with the North Fork (Bloomington) has been included on the state's impaired waters list for aquatic life (macroinvertebrate bioassessment) since 2018.

Example photo of a black fly larva

Photo credit: Dr. Dean Hansen

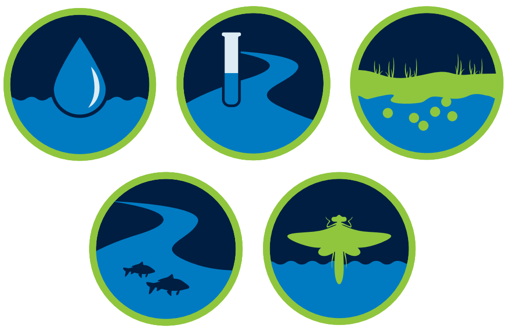


2020-2024 South Fork Nine Mile Creek Macroinvertebrate Index of Biotic Integrity (MIBI) values compared with the MPCA MIBI standards and lower confidence limits.

3.5 Main Stem Nine Mile Creek

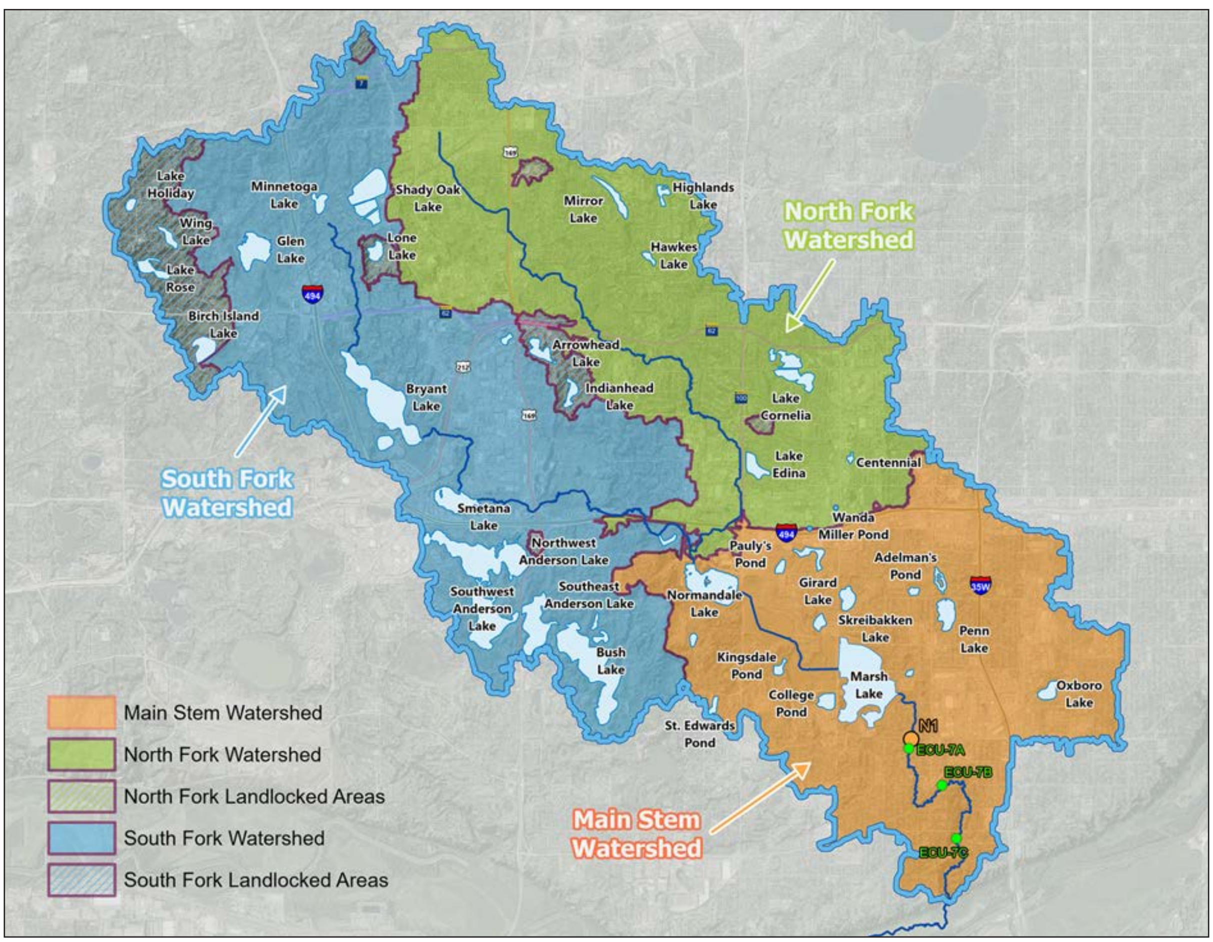
2024 MONITORED PARAMETERS

- **Water Quality**
- **WOMP Stream Flow and Pollutants**
- **Habitat**
- **Fish Index of Biotic Integrity (FIBI)**
- **Macroinvertebrate Index of Biotic Integrity (MIBI)**



Nine Mile Creek Section	Main Stem
Tributary Municipalities	Richfield, Bloomington, Minnetonka, Eden Prairie, Edina, Hopkins
Direct Watershed Area	8,673 acres
Total Watershed Area*	29,727 acres (1,709 landlocked)
Impairment Status (Confluence of North and South Forks to downstream of Marsh Lake)	• Impaired for aquatic life (fish bioassessment) since 2018 • Impaired for aquatic life (macroinvertebrate bioassessment) since 2018
Impairment Status (Downstream of Marsh Lake to the Minnesota River)	• Impaired for chloride since 2004 • Impaired for Escherichia coli (E. coli) since 2018 • Impaired for aquatic life (fish bioassessment) since 2018 • Impaired for aquatic life (macroinvertebrate bioassessment) since 2018

** Includes 1,709 acres that are typically landlocked under average storm conditions.*



3.5.1 Water Quality Monitoring in Main Stem Nine Mile Creek

In 2024, three monitoring stations were used to measure the water quality conditions of the Main Stem of the Nine Mile Creek, including monitoring locations ECU-7A (N1), ECU-7B, and ECU-7C (listed upstream to downstream). These monitoring locations are shown in Figure 1-1. Monitored water quality parameters included dissolved oxygen, pH, temperature, specific conductance, turbidity, and flow on eight occasions (once a month March through October). Table 3-10 through Table 3-12 summarize the average, maximum, and minimum observed values for each water quality parameter at each monitoring location on the Main Stem. The tables also outline the number of events when the monitored parameter exceeded the state standard or threshold.

Dissolved oxygen measurements observed in the Main Stem of the Nine Mile Creek in 2024 met the Minnesota State standard (>5 mg/L) with a similar frequency as 2023—96% met the State standard in 2024 compared with 91% in 2023. Time series plots showing the observed dissolved oxygen concentrations can be viewed at the end of this section. In 2024, the upstream monitoring location ECU-7A (N1) consistently had lower dissolved oxygen concentrations than the downstream monitoring locations, ECU-7B and 7C. Historical records indicate that water discharging from Marsh Lake can notably influence the observed dissolved oxygen concentrations at ECU-7A (N1). Oxygen levels within Marsh Lake fluctuate due to biological activity within the marsh—biological photosynthesis raises oxygen levels and biological decay lowers oxygen levels. Hence, water flowing from the marsh can influence the dissolved oxygen concentration of the Nine Mile Creek for the portions that are immediately downstream. The periods of low dissolved oxygen observed at ECU-7A (N1) occurred during periods of high flow. As such, biological degradation resulting in low dissolved oxygen within Marsh Lake was likely the cause of low dissolved oxygen at ECU-7A (N1) in May and August.

For the downstream Main Stem monitoring locations not as highly influenced by Marsh Lake, **stream flow and temperature** can notably influence the observed dissolved oxygen concentrations. 2024 was wet in the spring and early summer and dry in the fall. As such, increased flowrates were observed in the Main Stem between April and August and notably lower flowrates were observed between September and October. The highest water temperatures were observed in August averaging 72.1°F in the Main Stem. The lowest dissolved oxygen concentrations were generally observed during periods of both reduced stream flow and higher water temperatures at monitoring stations ECU-7B and 7C.

High stream flow can also notably influence the observed **turbidity (clarity)** of the stream due to increased particulates discharging to the stream from watershed runoff as well as amplified sediment resuspension and bank erosion in the stream itself. Generally higher turbidity measurements were noted during increased flowrates observed in the Main Stem between April and August. Lower turbidity measurements were observed during low flow conditions between September and October. Higher turbidity measurements were also observed in March although lower flowrates were observed. This is likely associated with increased particulates from snowmelt.

The **pH** in the Main Stem met the state standards throughout the monitored period.

Consistent with previous years, the 2024 observed **specific conductance** failed to meet Minnesota State standards (<1,000 μmhos/cm at 25°C) for portions of the monitored period. In 2024, 75% of the Main Stem measurements met the specific conductance standard. This is an improvement over conditions observed in 2023 where only 39% of the Main Stem measurements met the specific conductance standard. Time series plots showing the observed specific conductance values can be viewed at the end of this section. The exceedance of the Minnesota State specific conductance standard in the Main Stem of the Nine Mile Creek in 2024 (and similarly throughout the period of record) has been unfavorable for the aquatic life in the stream. High specific conductance measurements in Nine Mile Creek that fail to meet state standards typically result from the discharge of excess chloride from deicing chemicals (salt) to the creek. Other potential sources include synthetic fertilizers. The MPCA has listed the portion of the Main Stem Nine Mile Creek that downstream of Marsh Lake to the Minnesota River as impaired for chloride since 2004.

Table 3-10 Main Stem Nine Mile Creek monitoring location ECU-7A/N1 monthly water quality data summary (WOMP Station)

Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	6.2	10.4	4.3	2/8 (25%)
pH	6.5 – 9.0	7.2	7.7	6.7	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	59.0	72.5	37.9	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	762	1,101	518	2/8 (25%)
Turbidity (NTU)	< 25[1]	2.8	4.1	0.9	0/8 (0%)
Flow (cfs)	N/A	25.4	73.1	2.0	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Table 3-11 Main Stem Nine Mile Creek monitoring location ECU-7B monthly water quality data summary

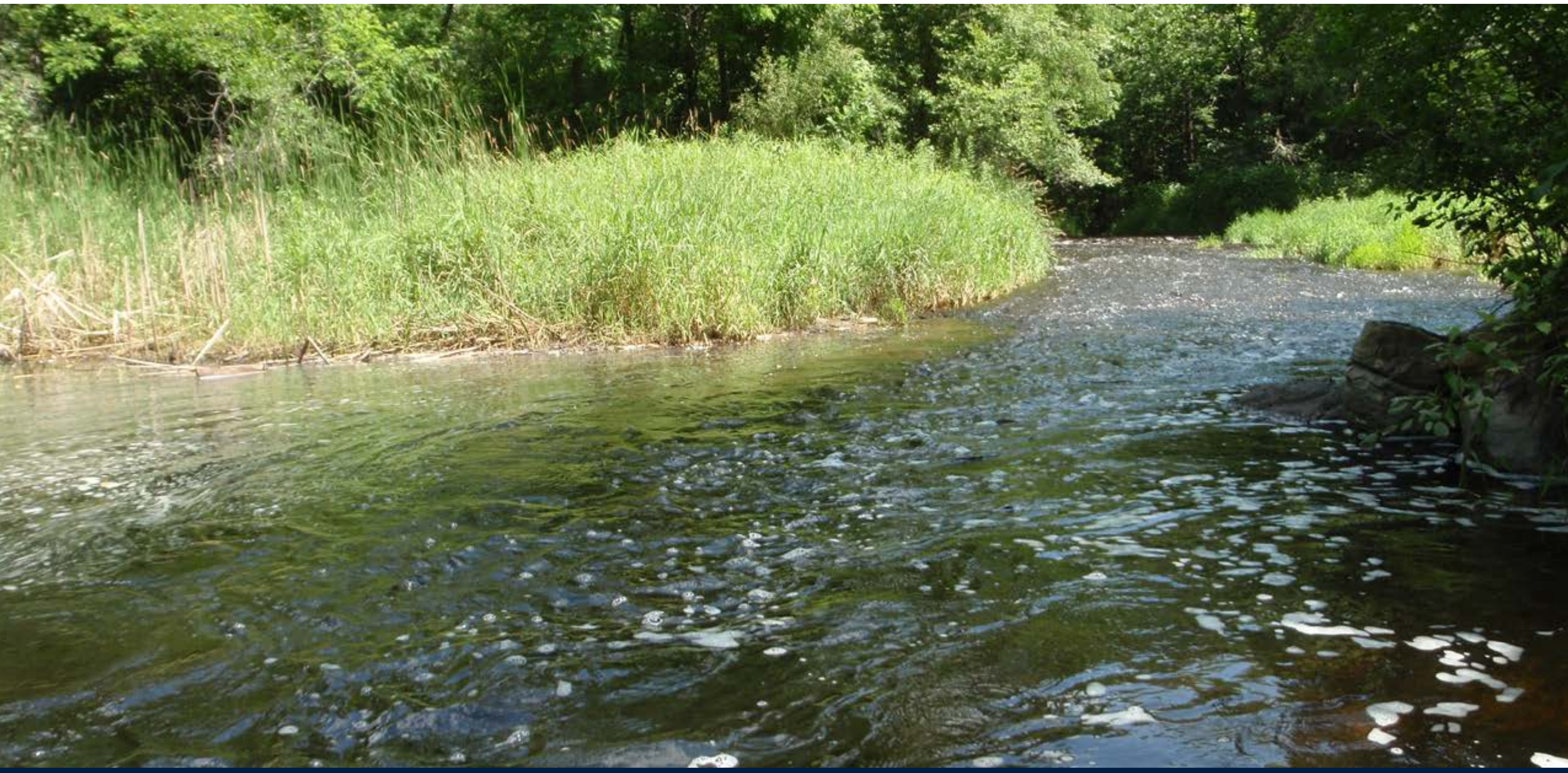
Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	8.0	10.5	6.0	0/8 (0%)
pH	6.5 – 9.0	7.4	7.8	6.8	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	58.8	72.0	38.9	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	765	1,096	524	2/8 (25%)
Turbidity (NTU)	< 25[1]	3.7	5.7	1.7	
Flow (cfs)	N/A	26.5	74.5	2.2	-

[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

Table 3-12 Main Stem Nine Mile Creek monitoring location ECU-7C monthly water quality data summary

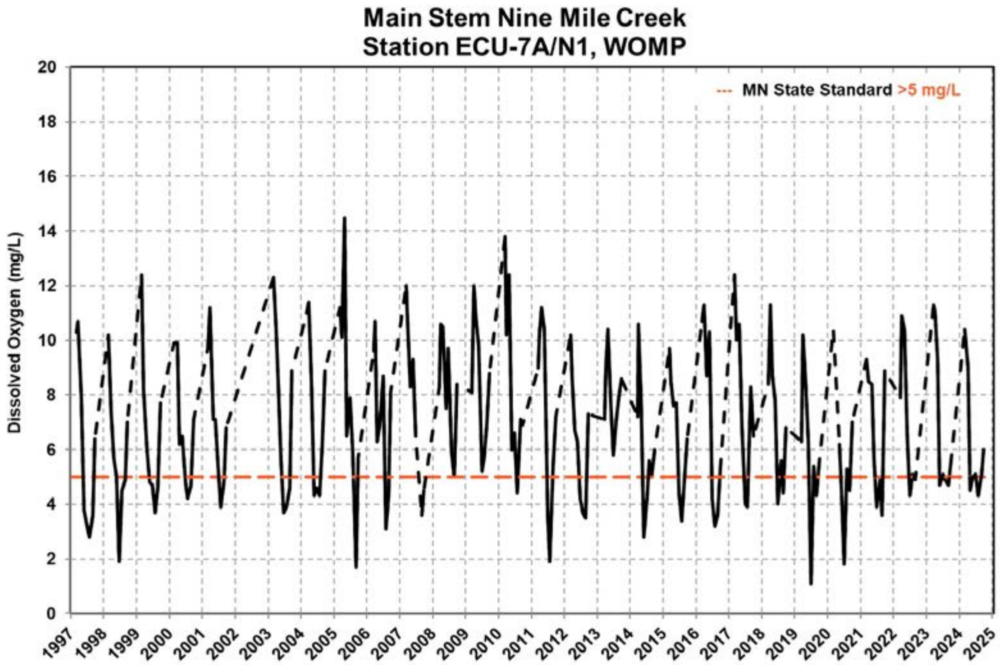
Parameter	Stream Standard/ Threshold	Average	Maximum	Minimum	Number of times standard was exceeded (% of samples)
Dissolved Oxygen (mg/L)	> 5	9.7	12.0	8.0	0/8 (0%)
pH	6.5 – 9.0	7.5	7.9	6.7	0/8 (0%)
Temperature (°F)	Not to exceed 5°F above natural, based on a monthly average of maximum daily water temperature; Not to exceed daily average of 86°F	58.3	71.8	38.9	0/8 (0%)
Specific Conductance (µmhos/cm @ 25°C)	< 1,000	773	1,085	534	2/8 (25%)
Turbidity (NTU)	< 25[1]	3.5	5.3	2.1	0/8 (0%)
Flow (cfs)	N/A	27.6	75.6	2.8	-

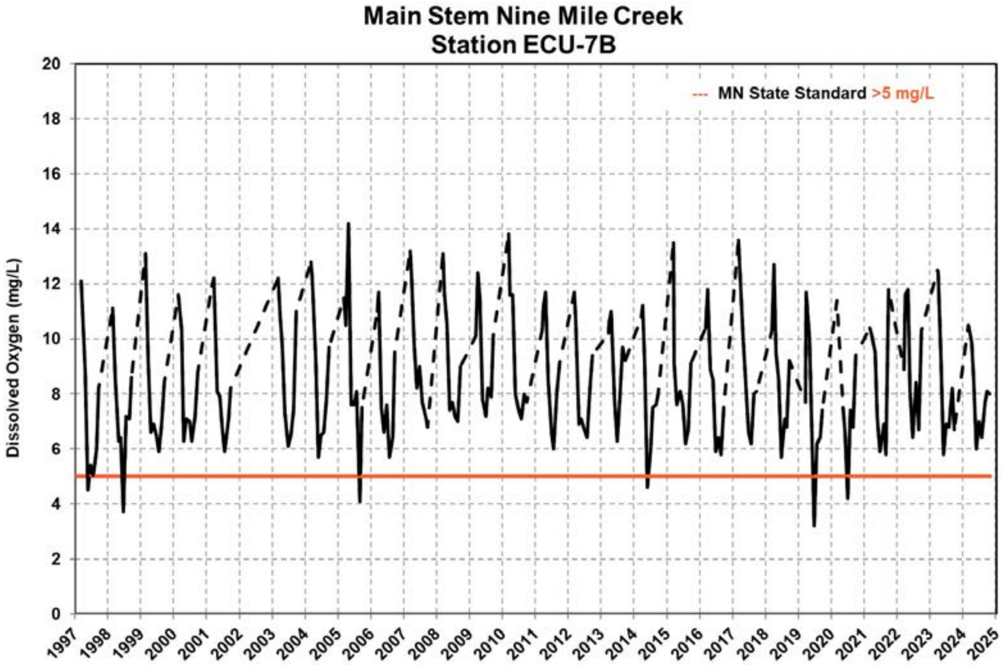
[1]Turbidity was a state standard (< 25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.



Dissolved Oxygen

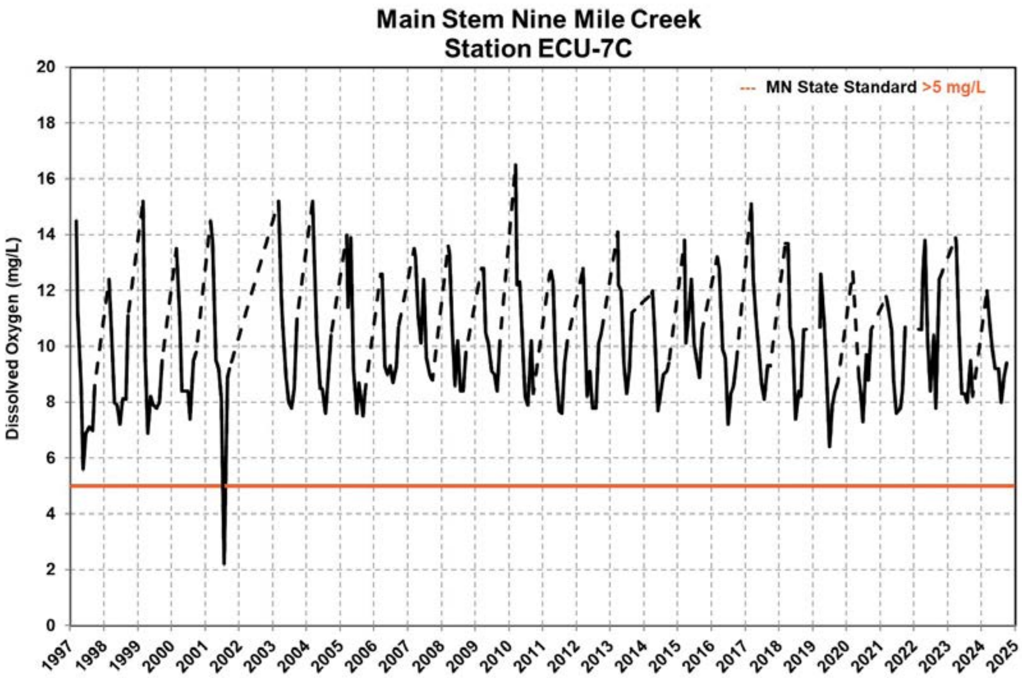
Dissolved oxygen is the concentration (or the amount) of oxygen gas incorporated in water. Oxygen can enter the water from the atmosphere, or it can accumulate from the oxygen released by plants or algae during photosynthesis. Sufficient dissolved oxygen is necessary to support the health and reproduction of organisms such as aquatic insects and fish. Major physical properties that can influence the concentration of dissolved oxygen include temperature, flow, turbulence, nutrient levels, and level of decomposition.





NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

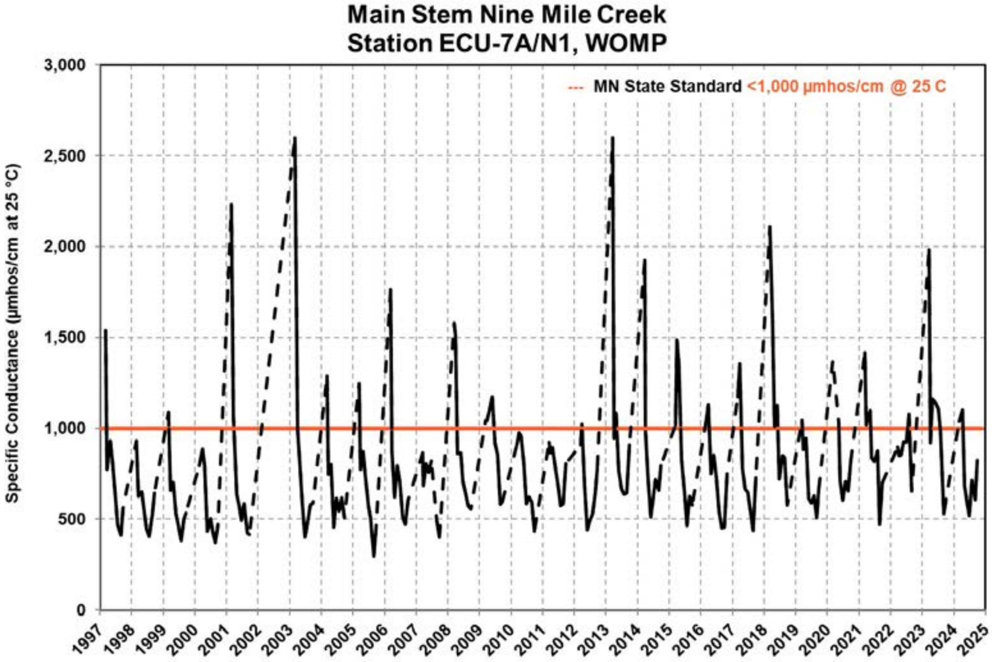
Dissolved Oxygen

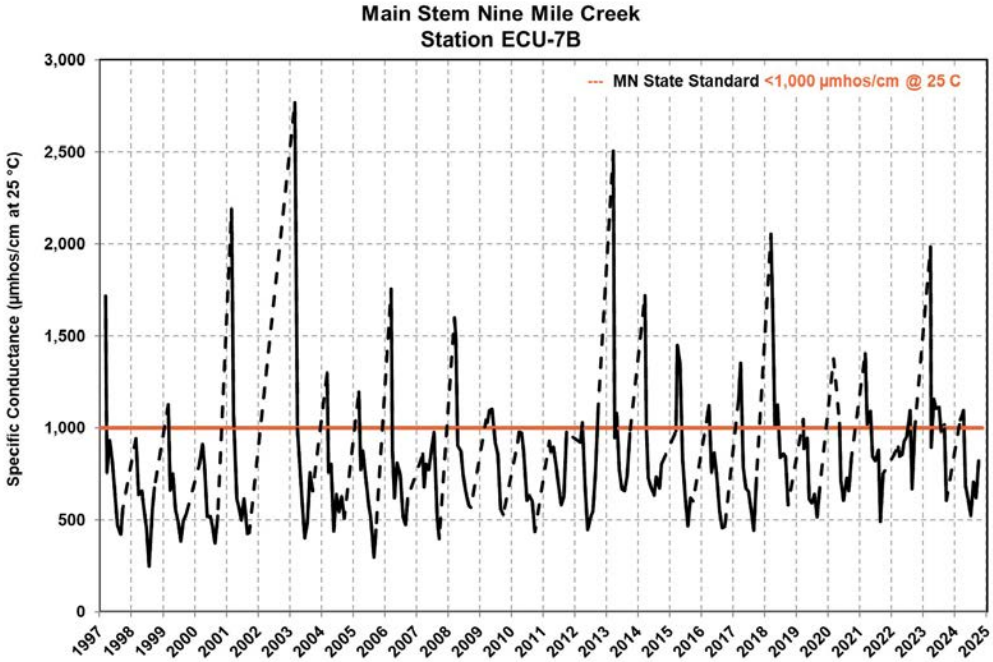


NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

Specific Conductance

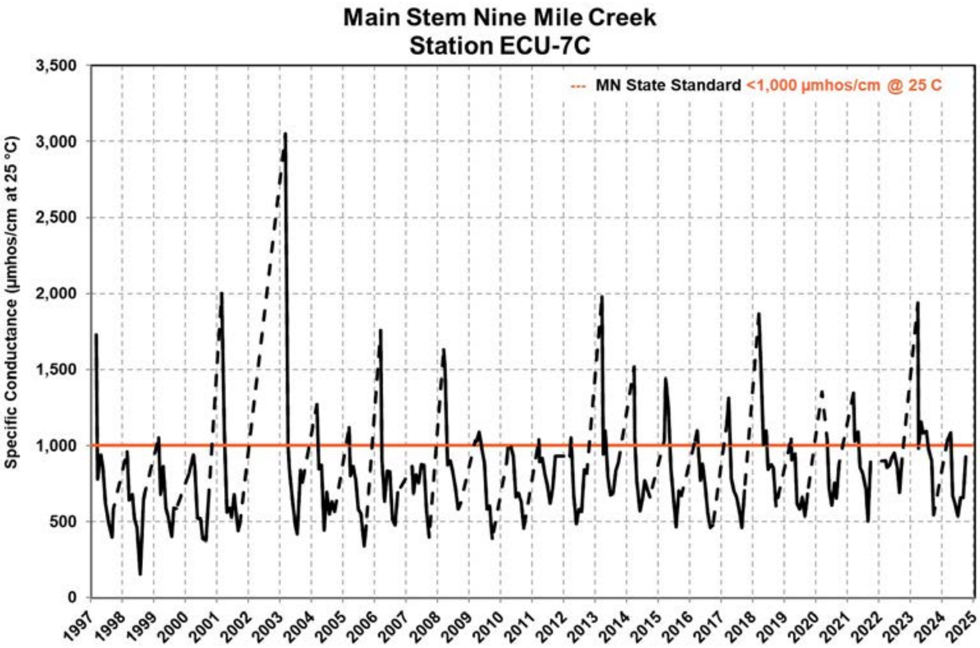
Specific conductance is a measure of water's ability to pass an electrical current via ions dissolved in the water such as alkalis, chloride, sulfides, and carbonate compounds. The higher the specific conductance, the more dissolved salts and minerals that are present in the water. For example, high chloride concentrations can lead to high specific conductance. Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians.





NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

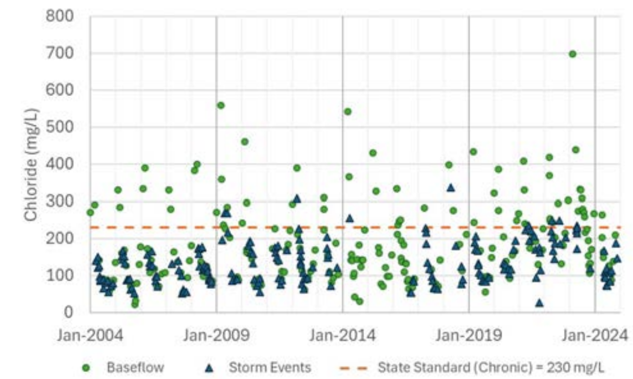
Specific Conductance



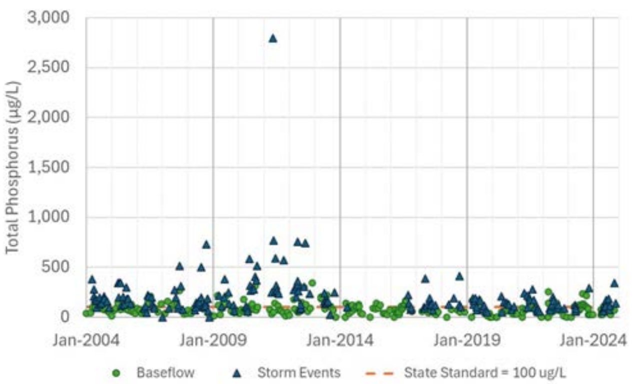
NOTE: Dashed lines indicate periods of no monitoring data (typically in winter)

3.5.2 WOMP Stream Pollutant Monitoring in Main Stem Nine Mile Creek

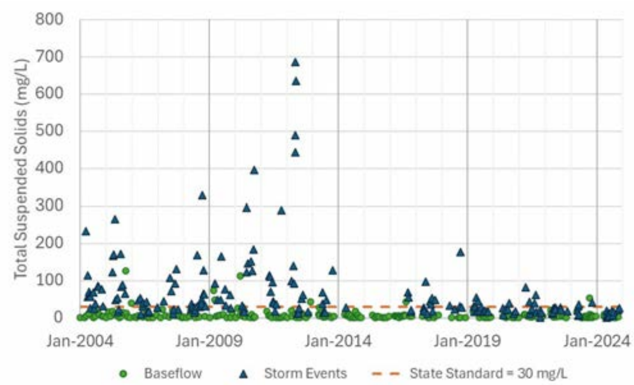
In 2024, one monitoring station was used to measure stream pollutant conditions of the Main Stem of the Nine Mile Creek. Monitoring station N1 uses an automated stream pollutant monitoring system similar to the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP). Water quality grab samples were collected bi-weekly to monthly to monitor baseflow conditions and composite samples were collected during most storm events larger than 0.5 inches to monitor stormwater pollutant loads to the Main Stem. The plots below summarize the monitored chloride, total phosphorus, and total suspended solids concentrations monitored at station N1 between 2004 and 2024 under baseflow (green) and stormwater pollutant loading (blue) conditions and compares the monitored data to the state standards.



Chloride can enter streams and shallow groundwater from road de-icing salts and synthetic fertilizers. High amounts of chloride can influence species diversity and community structure and become toxic to fish, aquatic insects, and amphibians. In 2024, chloride concentrations at N1 between May and November were similar during baseflow and storm event conditions. Higher chloride concentrations were observed during baseflow conditions in April with a maximum concentration of 265 mg/L.



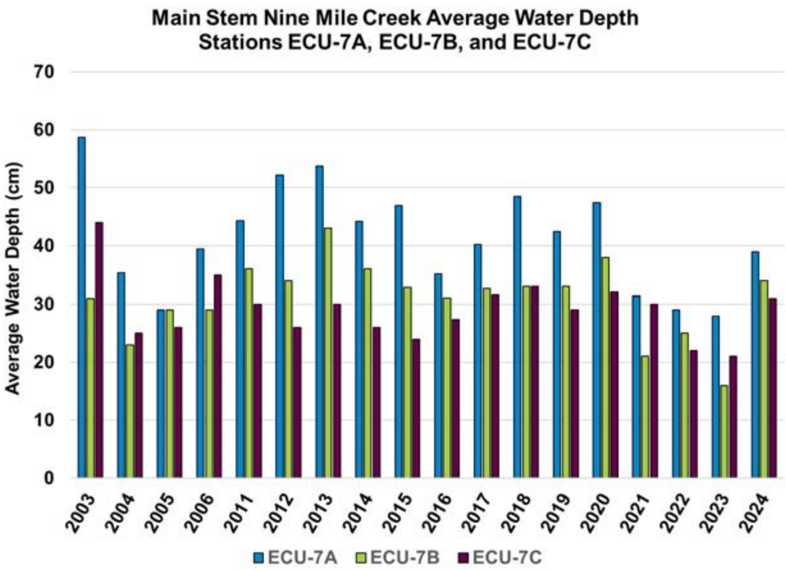
Phosphorus is an essential nutrient required for biological production. An overabundance of phosphorus in streams can influence plant species, alter food resources for aquatic organisms, and lead to higher risk of low oxygen conditions (due to increased bacterial decomposition). In 2024, total phosphorus concentrations at N1 between May and November were higher during storm event conditions. A maximum storm composite concentration of 346 µg/L was observed during a storm event at the end of October.



Stream water will get less clear and more turbid from an increase in **total suspended solids** including sediment, soils, detritus, and algae. High amounts of suspended solids can affect light penetration and reduce plant growth and can result in harm to habitat areas for fish and other aquatic life due to increased sedimentation and siltation. In 2024, total suspended solids concentrations at N1 between May and November were higher during storm event conditions. A maximum storm composite concentration of 26 mg/L was observed during a storm event in mid-November.

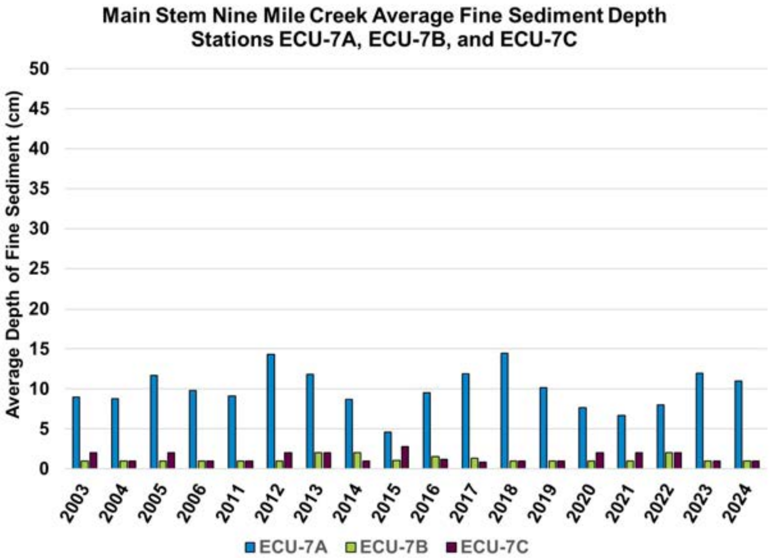
3.5.3 Habitat Monitoring in Main Stem Nine Mile Creek

In 2024, three monitoring stations were used to measure the habitat conditions of the Main Stem of the Nine Mile Creek. These included monitoring locations ECU-7A, ECU-7B, and ECU-7C (listed upstream to downstream). These monitoring locations are shown in Figure 1-1. Monitored habitat parameters included water depth, flow, depth of fine sediment, percent embeddedness, and length of eroded streambank on one occasion (typically completed during fisheries monitoring). A summary of the water depth, depth of fine sediment, and stream bank erosion observations are provided below.



Water depth is a factor in determining the presence and distribution of fish in streams. Water depths have annually been measured when fish surveys were completed. The average water depths, measured at monitored cross sections, in the Main Stem increased in 2024 (since 2023 was a very dry year), providing better fisheries water depths.

Fine sediments like silt, clay, and sand can fill the voids between gravel, rocks, and boulders in the streambed. These voids are critical for fish spawning and providing macroinvertebrates with sheltering and breeding locations. The upstream Main Stem monitoring location ECU-7A has been observed to have notably higher average depths of fine sediments than the downstream monitoring locations.



ECU-7A Stream Bank Erosion Observations

Considerable erosion was observed at the upstream end of this reach. Exposed soils on the bends are sloughing into the stream. Some areas of bank erosion have caused trees to fall. Additionally, as shown in the photo, an existing storm sewer pipe is exposed due to severe erosion and is discharging runoff multiple inches above the stream bed, which creates conditions where the stream bed is susceptible to erosion during storm events.

ECU-7B Stream Bank Erosion Observations

Bank erosion is fairly uniform throughout the reach, but more noticeable at stream bends. Portions of the reach are more susceptible to erosion due to limited vegetation on the banks, especially during high flow conditions.

ECU-7C Stream Bank Erosion Observations

Bank erosion is fairly uniform throughout the reach, but more noticeable at stream bends. Portions of the reach are more susceptible to erosion due to limited vegetation on the banks, especially during high flow conditions.

3.5.4 Fish Index of Biotic Integrity (FIBI) in Main Stem Nine Mile Creek

Fish were monitored at the three Main Stem sample locations during July 18–19, 2024. This is a month later than the North and South Forks due to high June stream flows creating access and safety concerns in the Main Stem. FIBI scores were computed and compared with the applicable FIBI standards for the Main Stem of the Nine Mile Creek (as seen in the graph on the next page). The 2024 FIBI scores from the upstream, ECU-7A, and middle, ECU-7B, Main Stem locations did not meet the respective FIBI standard. The FIBI score from the downstream Main Stem location, ECU-5A, was just below its respective FIBI standard, but was above the lower confidence limit.

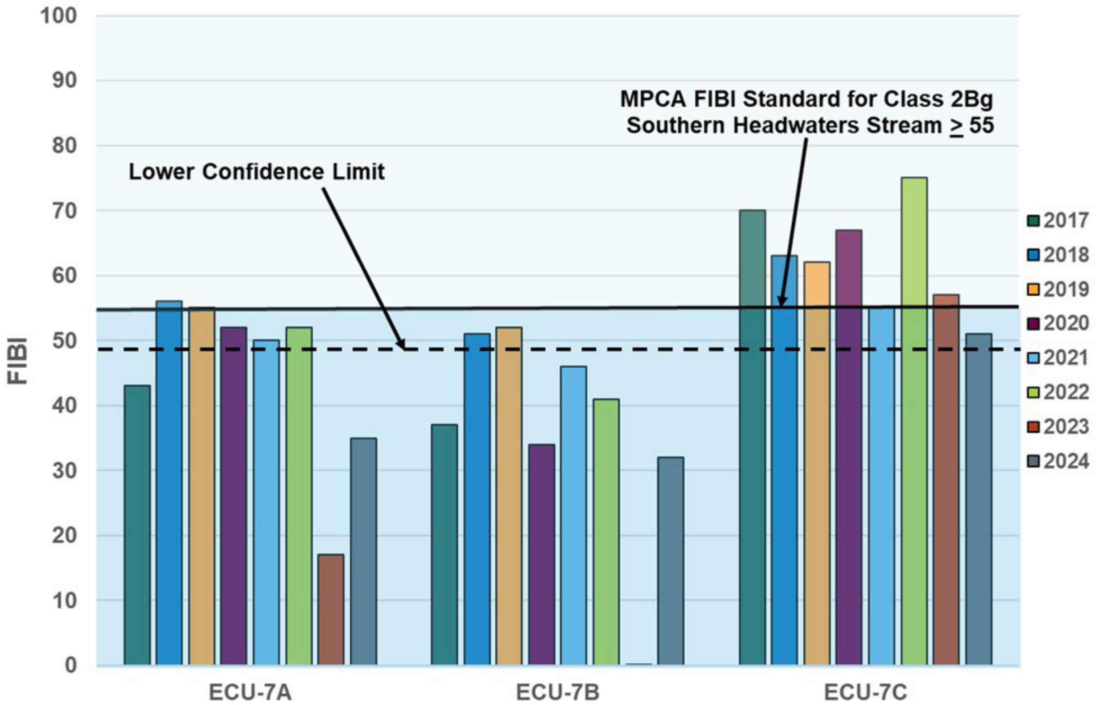
FIBI scores from the upstream Main Stem location, ECU-7A, met the FIBI standard during 2018 and 2019, but not during 2017 and 2020–2024. However, the 2020 through 2022 values were within the standard's confidence limits indicating the scores were relatively close to the standard. The 2023 FIBI score of 17 was the lowest score to date and was likely due to low flow and oxygen levels. In 2024, the FIBI score of 35 increased from the previous year. While the observed flows at ECU-7A were markedly higher in 2024, it's possible that the fish community has not fully re-established from the extreme low flow conditions in 2023. Additionally, dissolved oxygen concentrations at ECU-7A failed to meet the state standard in May and August 2024 (i.e., dissolved oxygen concentrations below 5 mg/L) and were at the standard in June, July, and September.

FIBI scores from the middle Main Stem location, ECU-7B, failed to meet the FIBI standard during all 7 monitored years. The FIBI score of 0 in 2023 was the lowest to date as compared with FIBI scores of 34 to 52 during 2017 through 2022 and was likely due to low flow conditions. In 2024, the FIBI score of 32 increased from the previous year. While the observed flows at ECU-7B were markedly higher in 2024, it's possible that the fish community has not fully re-established from the extreme low flow conditions in 2023. Observed dissolved oxygen concentrations at ECU-7B were above state standards ranging between 6.0–10.5 mg/L.

The 2024 FIBI score of 51 is the lowest score to date for the downstream Main Stem location, ECU 7C. This is the first year on record that the FIBI score at ECU-7C has failed to meet its respective FIBI standard. Nevertheless, the 2024 value is within the standard's confidence limits indicating the score is relatively close to the standard. It's possible that low flows between July and October in 2023 created stressful fisheries conditions. While the observed flows at ECU-7C were markedly higher in 2024, it's possible that the fish community has not fully re-established from the extreme low flow conditions in 2023. Observed dissolved oxygen concentrations at ECU-7C were well above state standards ranging between 8.0–12.0 mg/L.

The biological stressors identified by the *Nine Mile Creek Biological Stressor Identification* (Barr Engineering Co., 2010) for the Main Stem of Nine Mile Creek included low dissolved oxygen, high sediment accumulation, and high ionic strength due to excess chloride. The low flows and low dissolved oxygen levels measured in the Main Stem in 2023 and low dissolved oxygen at ECU-7A (N1) in 2024 document inadequate baseflow and low dissolved oxygen as possible biological stressors in recent years.

The entirety of the Main Stem of the Nine Mile Creek has been included on the state's impaired water list for aquatic life (fish bioassessment) since 2018.



2017-2024 Main Stem Nine Mile Creek Fish Index of Biotic Integrity (FIBI) values compared with the MPCA FIBI standards and lower confidence limits.

3.5.5 Macroinvertebrate Index of Biotic Integrity (MIBI) in Main Stem Nine Mile Creek

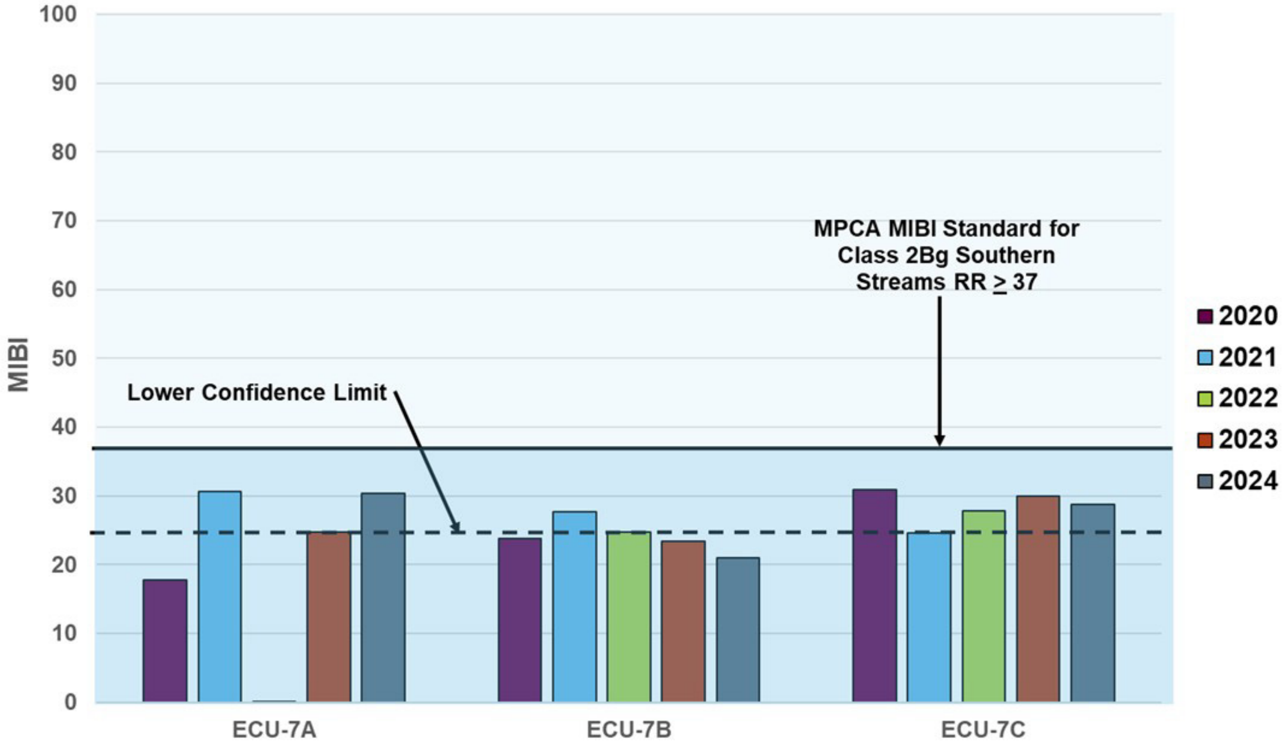
Macroinvertebrates were monitored at the three Main Stem sample locations during October 2, 2024. MIBI scores were computed and compared with the applicable MIBI standards for the Main Stem of the Nine Mile Creek.

In 2024, the upstream Main Stem location, ECU-7A, had a MIBI value greater than its respective lower confidence limit indicating the monitoring location was close to its applicable MIBI standard. This observation is consistent with the MIBI observations in 2021 and 2023. Upstream Main Stem location, ECU-7A was not sampled in 2022 due to a dry stream bed. The 2024 MIBI value from middle Main Stem location, ECU-7B was lower than the lower confidence limit. This is consistent with observations in 2020 and 2023. The MIBI value has been decreasing at ECU-7B since 2021. The 2024 MIBI value from the downstream Main Stem location, ECU-7C, was greater than the lower confidence limit, which is consistent with observations since 2020.

Example photo of a caddisfly larva

Photo credit: Dr. Dean Hansen

The entire length of the Main Stem Nine Mile Creek has been included on the state's impaired waters list for aquatic life (macroinvertebrate bioassessment) since 2018.



2020-2024 Main Stem Nine Mile Creek Macroinvertebrate Index of Biotic Integrity (MIBI) values compared with the MPCA MIBI standards and lower confidence limits.

3.6 Stream Monitoring Summary for the Nine Mile Creek

Table 3-13 summarizes stream monitoring data from 2024. All Nine Mile Creek pH and temperature measurements met the state standards in 2024. 90% of the dissolved oxygen measurements and 68% of the specific conductance measurements met the state standards in 2024.

As in previous years, the North Fork locations failed to meet the Minnesota State standard for specific conductance more frequently than other sampling locations—47% of the North Fork measurements met the state specific conductance standard in 2024 compared with 88% of South Fork and 75% of Main Stem measurements.

In 2024, the North Fork met the state standard for dissolved oxygen more frequently than other sampling locations—100% of the dissolved oxygen measurements from the North Fork were within the state criterion in 2024 compared with 96% of Main Stem and 75% of South Fork measurements.

Because 2024 had a wet spring and summer, the annual monitored water depths and monthly average/maximum flowrates were greater than what was observed in 2023, which was a dry year. Increased water depths and flowrates can allow for improved aquatic habitat conditions.

The downstream North Fork (ECU-2A) monitoring location was the only monitoring location that met the state Fish IBI standard in 2024. The downstream Main Stem location (ECU-7C) did not meet the state Fish IBI standard in 2024, but was greater than the lower confidence limit. All other monitoring locations did not meet the state Fish IBI standard or lower confidence limit.

The downstream North Fork (ECU-2A) monitoring location was the only sample location that met the state Macroinvertebrate IBI standard in 2024. However, four locations (middle North Fork location ECU-2, upstream South Fork location ECU-3A, and upstream and downstream Main Stem locations ECU-7A and ECU-7C) had MIBI values greater than their respective lower confidence limits, indicating they were close to the applicable MIBI standard.

Several biological stressors identified by the *Nine Mile Creek Biological Stressor Identification* (2010) were documented as present in Nine Mile Creek during 2024, including:

- North Fork — excess ionic strength
- South Fork — inadequate dissolved oxygen and excess ionic strength
- Main Stem — inadequate dissolved oxygen and excess ionic strength

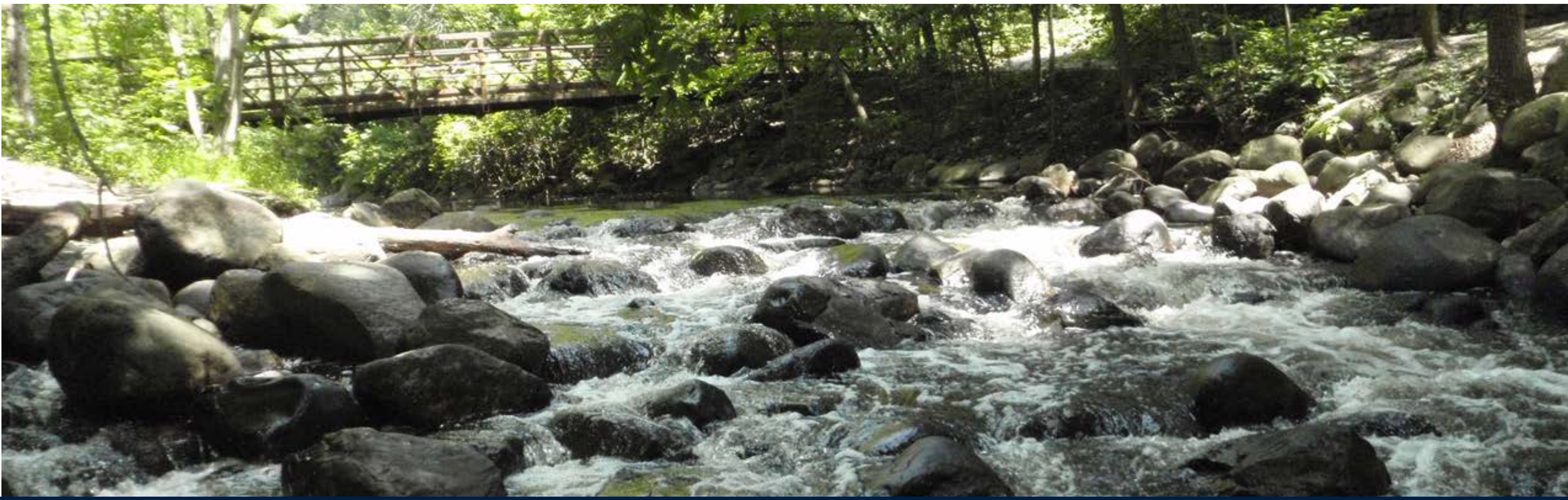


Table 3-13 2024 Nine Mile Creek Stream Data Summary

Stream Section	Station	Specific Conductance		Dissolved Oxygen		pH	Temperature	Turbidity		Minimum Baseflow (March-October)	Average Baseflow (March – October)	Average Water Depth (June 18-26 or July 18-19)[2]	Average Depth of Fine Sediment (June 18-26 or July 18-19)[2]	Fish IBI[2]	Macro-invertebrate IBI[3]
		Failed to Meet Standard (# of monthly events)		Failed to Meet Standard (# of monthly events)		Failed to Meet Standard (# of monthly events)	Failed to Meet Standard (# of monthly events)	Exceeded 25 NTU[1] (# of monthly events)		Cubic feet per second	Cubic feet per second	Centimeters (inches)			
North Fork	ECU-1A 1	5/8	March–April, June, Sept–Oct							0.8	2.8	50	44	did not meet standard or lower confidence limit	did not meet standard or lower confidence limit
	ECU-2	4/8	March–April, Sept–Oct							0.8	5.3	33	4	did not meet standard or lower confidence limit	met lower confidence limit
	N3	4/8	March–April, Sept–Oct							0.6	4.8				
	ECU-2A	4/8	March–April, Sept–Oct							2.2	8.8	27	7	met standard	met standard
South Fork	ECU-3A									0.1	0.3	32	27	did not meet standard or lower confidence limit	met lower confidence limit
	N2	1/8	April	5/8	March, Jul–Oct					0.2	8.0				
	ECU-5A	2/8	April, October	1/8	August					0.4	9.8	57	18	did not meet standard or lower confidence limit	did not meet standard or lower confidence limit
Main Stem	ECU-7A (N1)	2/8	March–April	2/8	May, August					2.0	25.4	39	11	did not meet standard or lower confidence limit	met lower confidence limit
	ECU-7B	2/8	March–April							2.2	26.5	34	1	did not meet standard or lower confidence limit	did not meet standard or lower confidence limit
	ECU-7C	2/8	March–April							2.8	27.6	31	1	met lower confidence limit	met lower confidence limit

1 Turbidity was a state standard (25 NTU) from the 1960s through 2014 when it was replaced with total suspended solids. Although turbidity is not currently a state standard, it is a useful surrogate indicator of total suspended solids.

2 Fish surveys, water depth, and depth of fine sediment measurements were completed for the North and South Fork monitoring locations on one day between June 18–26, 2024 and the Main Stem monitoring locations during July 18–19, 2024.

3 Macroinvertebrate survey was completed October 1–2, 2024.

4 LAKE LEVEL MONITORING

A summary of the 2024 and historical water levels collected for District Lakes

Indianhead Lake, September 2024

The lake level monitoring program was initiated by the Nine Mile Creek Watershed District in 1960. Since inception of the program, the number of lakes being monitored has fluctuated over time in response to specific data needs. In 2024, the Nine Mile Creek Watershed District recorded monthly lake levels at 29 lakes and waterbodies throughout the Nine Mile Creek watershed. The locations of the monitored waterbodies are shown on Figure 1-1. Lake level readings are taken monthly, usually at the same time the groundwater levels are measured. The levels of the lakes are generally measured using an engineering level from permanent structures along the shore.

Lake levels are influenced by groundwater conditions, local precipitation, size of the drainage area, land surface area, outlet elevation and configuration, local land use, and a variety of other factors. The effects of these influences on the lakes differ; there is no general uniformity in the fluctuation of lake levels in the watershed. Table 4-1 summarizes the net change in lake levels between December 2023 and December 2024, as well as the historic high and low water elevations. Graphs showing measured lake levels from January 2000 through December 2024 are included in Appendix I.

During 2024, 16 of the monitored lake levels decreased and 13 of the monitored lake levels increased from December 2023 to December 2024. The fairly equal mix of decreased (16 lakes) and increased (13 lakes) lake levels reflect that 2024 was a more typical climatic year (not extraordinarily wet or dry) as compared with 2023, which was a notably dry year and 27 of the monitored lake levels decreased in the Twin Cities metropolitan area. The recovering lake levels also generally reflected that many groundwater levels in the region were also recovering in 2024. The most notable net increase in lake levels from December 2023 to December 2024 was Lake Rose (+1.9 feet). The most notable net decreases in lake levels from December 2023 to December 2024 were Lake Edina (-1.3 feet) and Oxboro Lake (-1.3 feet). There were no new historical high or low lake water elevation records set in 2024.

Table 4-1 Summary of 2024 Monthly Observed Lake Levels

Lake	Measured Lake Level—December 2023 (12/26/2023)	Measured Lake Level—December 2024 (12/26/2024)	Net Change in Measured Lake Levels (12/26/2023 - 12/26/2024)	Historical High Water Elevation		Historical Low Water Elevation	
	(feet MSL)	(feet MSL)	(feet)	(feet MSL)	Date	(feet MSL)	Date
NW Anderson	838.3	839.1	0.8	841.8	7/24/1987	833.0	1/5/2009
SE Anderson	834.2	834.9	0.7	841.8	7/24/1987	833.1	2/28/2013
SW Anderson	838.5	839.1	0.6	841.8	7/24/1987	835.1	12/8/1964
Arrowhead[1]	872.6	873.8	1.2	878.6	7/24/1987	871.3[2]	1/30/2023[2]
Birch Island[3]	877.9	878.1	0.2	891.2	3/24/1969	875.1	2/28/2013
Bryant	851.5	851.2	-0.3	854.8	7/24/1987	849.3	1/14/1977
Bush[4]	829.5	829.7	0.2	836.9	6/11/1999	826.0	8/8/1964
N Cornelia	859.9	859.1	-0.8	864.1	7/24/1987	858.1	12/8/1967
S Cornelia	859.3	859.1	-0.2	864.1	7/24/1987	858.0	11/28/2022
Edina	822.2	820.9	-1.3	825.4	7/24/1987	817.8	2/9/1982
N Garrison	864.4	863.9	-0.5	864.8	4/10/1965	860.7	2/28/2012
Glen	900.4	901.0	0.6	905.0	8/6/1965	898.2	7/30/2010
Hawkes[4]	885.8	884.9	-0.9	892.2	7/24/1987	881.6	1/14/1977
Indianhead[1]	863.0	863.5	0.5	865.2	5/31/2019	861.0	2/28/2013
Lone[1]	897.5	897.6	0.1	901.6	10/25/2019	895.4	2/6/1990
Minnetoga	896.2	896.1	-0.1	899.1	7/24/1987	894.1	2/6/1990
Mirror[4]	906.6	907.6	1.0	912.1	7/24/1987	901.8	1/14/1977
Nancy (formerly S. Garrison)	863.2	862.8	-0.4	863.3	4/10/1965	860.7	12/30/2011
Normandale	809.2	808.4	-0.8	815.8	7/24/1987	802.0[5]	12/3/2018[5]
Oxboro	805.3	804.0	-1.3	813.3	7/24/1987	797.9	1/15/1991
Pauly's Pond	816.4	815.7	-0.7	821.2	7/24/1987	811.8	7/29/1988
Penn (Lower)	806.5	807.5	1.0	816.6	7/24/1987	802.3	2/28/2013
Rose	921.8	923.7	1.9	928.4	4/4/1966	919.6	1/8/1990
Shady Oak[6]	900.9	901.7	0.8	905.6	5/31/2019	897.8	1/29/1990
Skriebakken	803.5	803.4	-0.1	811.3	7/24/1987	801.2	1/22/1977
Smetana	835.6	835.1	-0.5	840.6	7/24/1987	830.2	11/8/1976
Swimming Pool Pond (formerly Valley View)	863.0	862.1	-0.9	865.4	7/24/1987	860.1	2/28/2012
Wanda Miller	820.5	819.9	-0.6	826.7	7/24/1987	814.8	2/28/2013
Wing	939.1	938.6	-0.5	941.5	7/24/1987	933.5	1/31/1989

[1] Land-locked lake
[2] Previous record was 871.4 ft on 2/18/1981, 11/28/2022, and 12/27/2022.
[3] High surface outlet. Hasn't discharged since 1987.
[4] Pumped outlet
[5] In 2018, the District began implementation of a water quality improvement project for Normandale Lake. A drawdown of the lake was completed in fall of 2018 to expose the lake bed to a winter freeze and freeze out curly-leaf pondweed.
[6] Gated high surface outlet

5 GROUNDWATER WELL MONITORING

A summary of the 2024 and historical groundwater levels collected from District wells.

The groundwater level monitoring program was initiated by the Nine Mile Creek Watershed District in 1962. Since inception of the program, the number of groundwater wells being monitored has fluctuated over time, with wells being added in response to specific information needs and other monitoring wells being lost as land development occurred. In 2024, only 6 of the groundwater observation wells remain active. The active groundwater observation wells are shown in Figure 1-1.

Table 5-1 summarizes the groundwater level observations from 2024. The table includes measured groundwater observations between December 2023 and December 2024, as well as the corresponding net change in groundwater levels during that time period. During this year, the net change in groundwater elevation ranged from a 0.5-foot decrease in Well 35 (east of Braemar Golf Course in Edina) to a 2.0-foot increase in Well 7 (northeast of Bredesen Park in Edina). Table 5-1 also lists the maximum fluctuation of each well between December 2023 through December 2024 (i.e., the difference between the highest and lowest observed water levels in 2024). The maximum fluctuation observed in 2024 ranged from a 1.1-foot decrease in Well 52 (west of Bryant Lake in Eden Prairie) to a 3.4-foot increase in Well 41 (northeast of Hawkes Lake in Edina), with an average maximum fluctuation of a 1.2-foot increase. There were no new historical high or low groundwater elevations in 2024.

Graphs of the observed groundwater levels for each active monitoring site from January 2000 through December 2024 are included in Appendix J.

Table 5-1 Summary of 2024 Monthly Observed Groundwater Levels

Well ID	Measured Groundwater Level—December 2023 (12/27/2023)	Measured Groundwater Level—December 2024 (12/26/2024)	Net Change in Measured Groundwater Levels (12/27/2023 - 12/26/2024)	Maximum 2024 Fluctuation	Historical High Water Elevation		Historical Low Water Elevation	
	(feet MSL)	(feet MSL)	(feet)	(feet)	(feet MSL)	Date	(feet MSL)	Date
7	873.1	875.1	2.0	2.2	894.9	3/25/2004	857.2	10/17/1989
22	796.2	798.0	1.8	2.2	802.3	5/3/1966	791.0	5/31/1990
26	821.0	820.8	-0.2	-0.2	827.9	4/29/2003	813.4	12/1/1964
35	842.6	842.1	-0.5	0.9	848.7	3/15/2005	834.1	1/1/1964
41	879.8	881.5	1.7	3.4	885.8	8/26/2019	871.0	8/10/1977
52	851.4	851.7	0.3	-1.1	855.0	3/17/2003	849.1	9/15/1994

APPENDICES

Appendices in separate PDF

Appendix A	2024 Northwest Anderson Lake Plant Maps
Appendix B	2024 Southwest Anderson Lake Plant Maps
Appendix C	2024 Southeast Anderson Lake Plant Maps
Appendix D	2024 Bryant Lake Plant Maps
Appendix E	2024 Lake Cornelia Plant Maps
Appendix F	2024 Lake Holiday Plant Maps
Appendix G	2024 Normandale Lake Plant Maps
Appendix H	Nine Mile Creek Fisheries Summary
Appendix I	Lake Level Graphs
Appendix J	Groundwater Level Graphs