Item 5Cii.
BCWMC 7-17-25

Parkers Lake

2024 Water Quality Monitoring

The Bassett Creek Watershed Management Commission

Stewardship of the Ȟaȟá Wakpádaŋ/Bassett Creek Watershed
to improve ecosystem health and reduce flood risk

The Bassett Creek Watershed Management Commission (BCWMC) has monitored water quality conditions in the watershed's 10 priority lakes since 1972. This monitoring is performed to detect changes or observe trends in water quality, inform pollution modeling and studies, and target future projects and programs. A summary of 2024 monitoring efforts on Parkers Lake is provided below.

At a glance: 2024 monitoring results

In 2024, the BCWMC monitored Parkers Lake for the following:

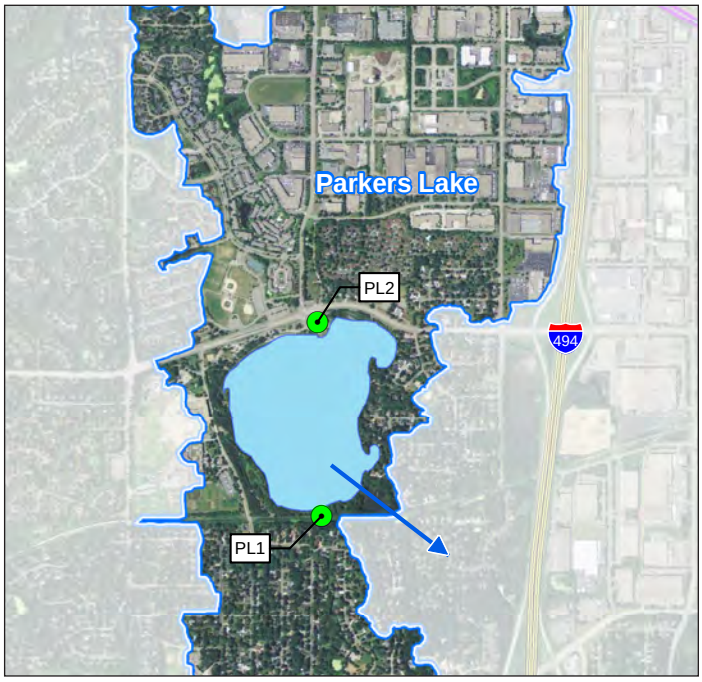
- Water chemistry (nutrients, chlorophyll *a*, chloride)
- Water clarity and dissolved oxygen
- Phytoplankton and zooplankton (microscopic plants and animals)
- Macrophytes (aquatic plants)

Results of 2024 monitoring show Parkers Lake met the applicable Minnesota Pollution Control Agency (MPCA) and Bassett Creek Watershed Management Commission (BCWMC) water quality standards for chlorides, Secchi disc (a measure of clarity), total phosphorus, and chlorophyll *a.* Trend analyses show no statistically significant change in water quality over the last 10 years as measured by an analysis of changes in summer average total phosphorus, chlorophyll *a*, and Secchi disc depth. The 2024 average chloride concentration was lower than average concentrations measured from 2018 through 2023, a positive change for the lake. Other results include the following:

- Both the number and quality of plant species observed in the lake, as measured by the Floristic Quality Index (FQI), were better than the Minnesota Department of Natural Resources (MNDNR) Plant Index of Biotic Integrity (IBI) thresholds.
- Curly-leaf pondweed (CLP) was found more frequently in 2024 than in 2021 (the last time the lake was monitored), but density was similar during the two years.
- Eurasian watermilfoil (EWM) was observed less frequently and at a lower density in 2024 than in 2021.
- The 2024 phytoplankton and zooplankton numbers were within the range observed since 1982.
- An Aquatic Invasive Species (AIS) Suitability Analysis indicates the water quality of Parkers Lake meets the suitability requirements for rusty crayfish, faucet snail, zebra mussels, starry stonewort, and spiny waterflea. However, the sodium and specific conductance levels were too high to be suitable for the Chinese mystery snail. Hence, this species would likely survive but may not thrive in Parkers Lake.

About Parkers Lake

BCWMC classification	Priority-1 deep lake
Watershed area	1,065 acres
Lake size	97 acres
Average depth	12 feet
Maximum depth	37 feet
Ordinary high water level	935.9 feet (NGVD29)
Normal water level	934.2 feet (NAVD88)
Downstream receiving waterbody	Medicine Lake
Location (city)	Plymouth
MPCA impairments	Chloride, mercury in fish tissue
Aquatic invasive species	Eurasian watermilfoil, curly-leaf pondweed
Public access	Yes (boat launch)



Recommendations

- Continue working with cities, businesses, and Hennepin County to improve winter maintenance practices and reduce the chloride load conveyed to Parkers Lake from streets and parking lots in the watershed
- Continue to provide education and information to lake users to reduce the chance of AIS introduction
- Continue water quality and biological monitoring at a 3-year frequency

2024 water chemistry

2024 was a very wet year. According to data from the MNDNR, April through June was the wettest on record for Minnesota. During this period, the Twin Cities received 17.3 inches of precipitation, 5.9 inches above normal. March, July, and August were also wet, with 13.5 inches of precipitation in the Twin Cities—3.4 inches above normal. As shown in the figures to the right:

- Increases in phosphorus concentrations on June 4, July 2, and August 27 were associated with recent rainstorms.
- Increases in chlorophyll *a* concentrations on June 17, July 2, August 13, August 27, and September 3 were associated with recent rainstorms.
- Secchi disc depth declined from June through August when above normal precipitation occurred.

Total phosphorus levels

While phosphorus is necessary for plant and algae growth, excessive phosphorus leads to excessive algae growth, decreased water clarity, and water quality impairment.

- BCWMC/MPCA standard: Summer average of 40 micrograms per liter (µg/L) or less
- Observed range: Low of 22 µg/L in mid-September to a high of 53 µg/L in early June and early July following storm events (see figure at right and on page 3)
- Summer average: 38 µg/L (met BCWMC/MPCA standard)

Chlorophyll *a* levels

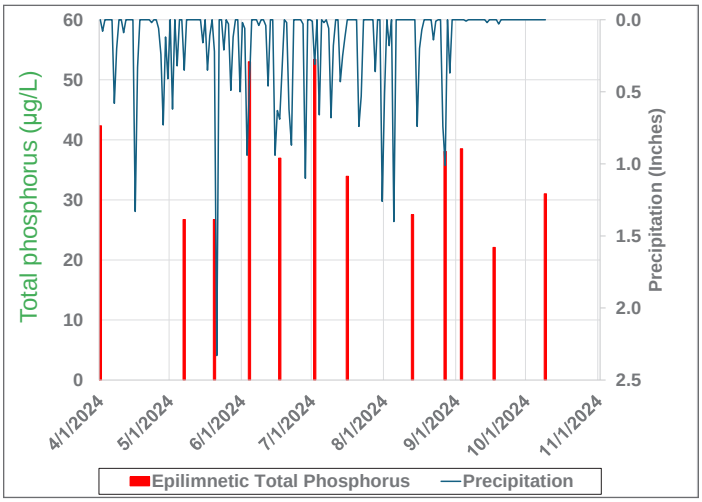
Chlorophyll *a* is a pigment in algae and generally reflects the amount of algae growth in a lake. Lakes that appear clear generally have chlorophyll *a* levels of less than 15 micrograms per liter (µg/L).

- BCWMC/MPCA standard: Summer average of 14 µg/L or less
- Observed range: Low of 0.2 µg/L in late July to a high of 26.5 µg/L in early July (see figure at right and on page 3)
- Summer average: 10.7 µg/L (met BCWMC/MPCA standard)

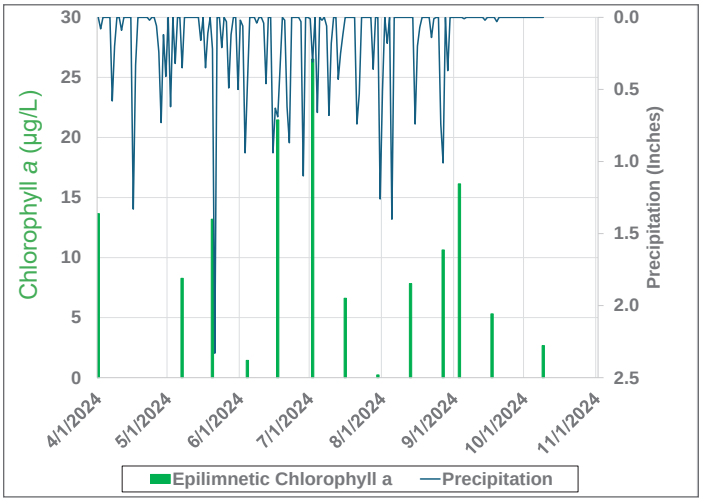
Water clarity

- Water clarity is often affected by the number of algae or other photosynthetic organisms in a lake. It is usually measured by lowering an 8-inch “Secchi” disc into the lake; the depth at which the disc’s alternating black-and-white pattern is no longer visible is considered a measure of the water’s clarity.
- BCWMC/MPCA standard: Summer average of 1.4 meters or more
- Observed range: From 1.5 meters in early September to 4.1 meters in early June (see figure below and on page 3)
- Summer average: 2.5 meters (met BCWMC/MPCA standard)

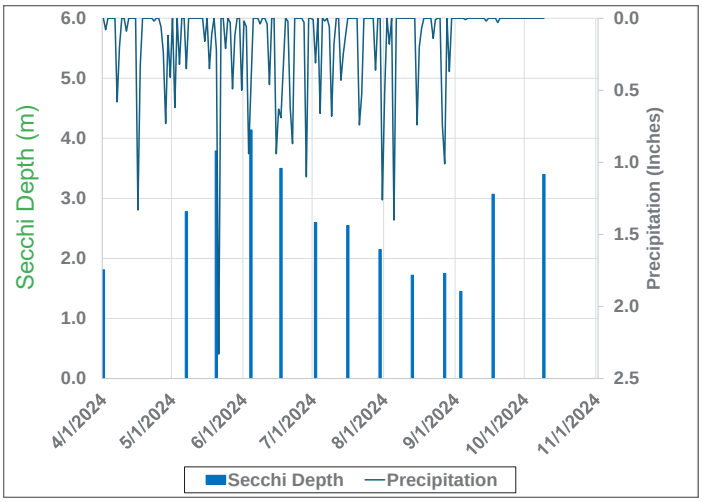
2024 precipitation and total phosphorus



2024 precipitation and chlorophyll *a*



2024 precipitation and water clarity

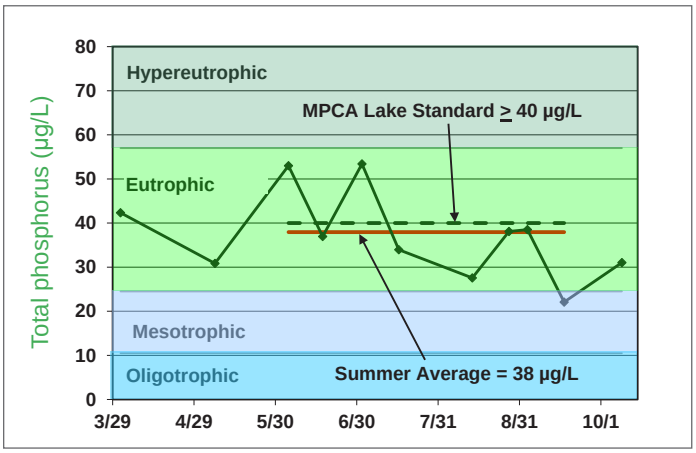


Definitions

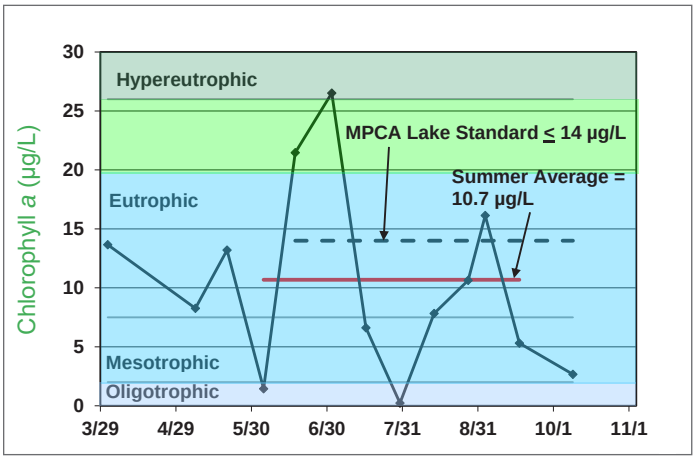
- **Hypereutrophic:** Nutrient-rich lake conditions characterized by frequent and severe algal blooms and low water clarity; excessive algae can significantly reduce lake oxygen levels
- **Eutrophic:** Lake condition characterized by abundant accumulation of nutrients supporting dense growth of algae and other organisms; decay of algae can reduce lake oxygen levels
- **Mesotrophic:** Lake condition characterized by medium levels of nutrients and clear water
- **Oligotrophic:** Lake condition characterized by a low level of dissolved nutrients, high oxygen content, sparse algae growth, and very clear water

Water chemistry monitoring (cont.)

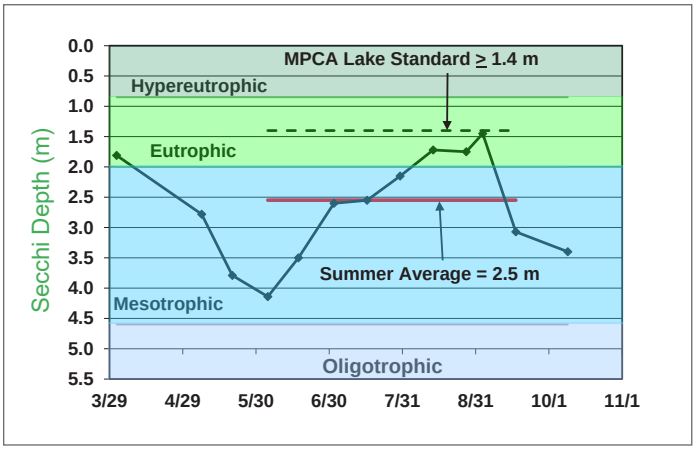
2024 total phosphorus trends



2024 chlorophyll a trends



2024 water clarity (Secchi depth) trends



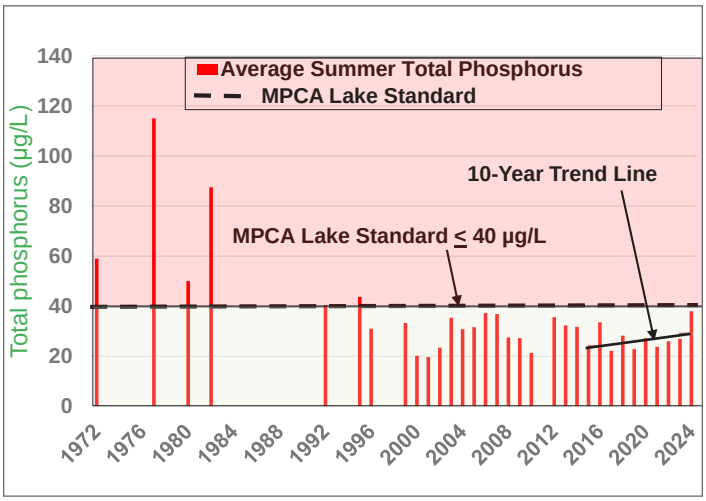
Historical trends: 1972–2024

Water quality in Parkers Lake has been monitored since 1972. Summer averages (June through September) of total phosphorus, chlorophyll *a*, and Secchi disc depth from 1972 through 2024 are shown in the figures at right. Lake water quality has improved since 2000. Prior to 2000, at least one of the three parameters generally failed to meet the BCWMC/MPCA standards. Since 2000, total phosphorus and Secchi disc have met the BCWMC/MPCA standards and chlorophyll *a* has met the standard since 2016.

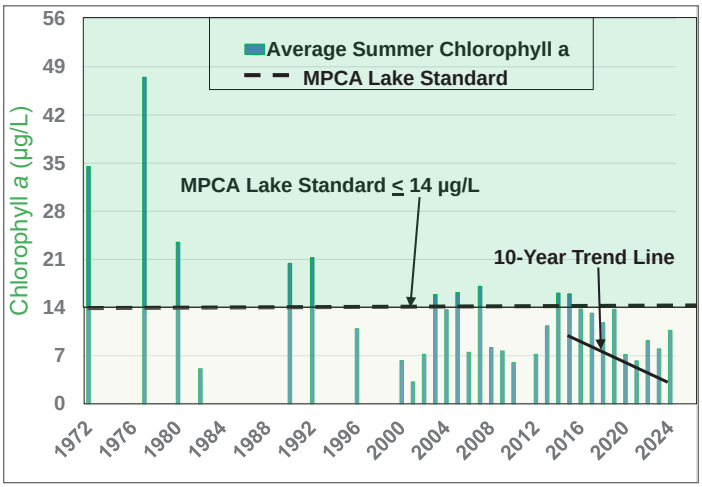
Overall, from 1972 through 2024, 97 percent of summer average Secchi disc depth and 82 percent and 61 percent of total phosphorus and chlorophyll *a* concentrations, respectively, met BCWMC/MPCA standards. In 2024, summer averages of all three parameters met the BCWMC/MPCA standards.

Trend analyses show no statistically significant change in water quality over the last 10 years as measured by changes in summer average total phosphorus, chlorophyll *a*, and Secchi disc depth. While total phosphorus has increased at an annual rate of about 0.5 µg/L and chlorophyll *a* has decreased at an annual rate of about 0.8 µg/L over the past 10 years, these changes are not significant at the 95 percent confidence level. Trend analysis of Secchi disc depth indicates no change occurred over the past 10 years.

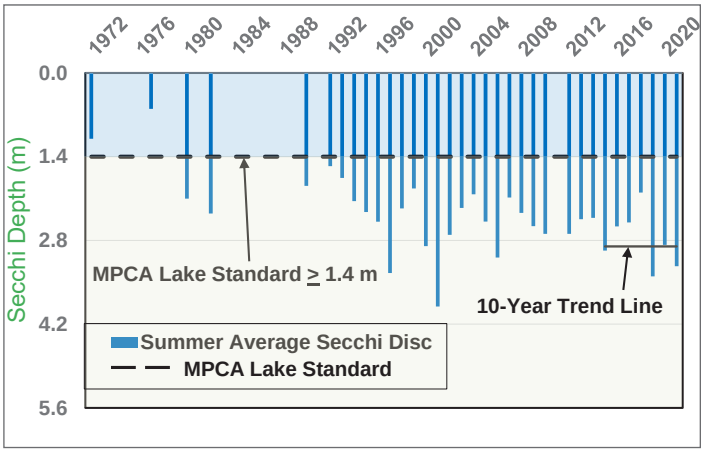
Historical phosphorus trends



Historical chlorophyll *a* trends



Historical Secchi disc trends

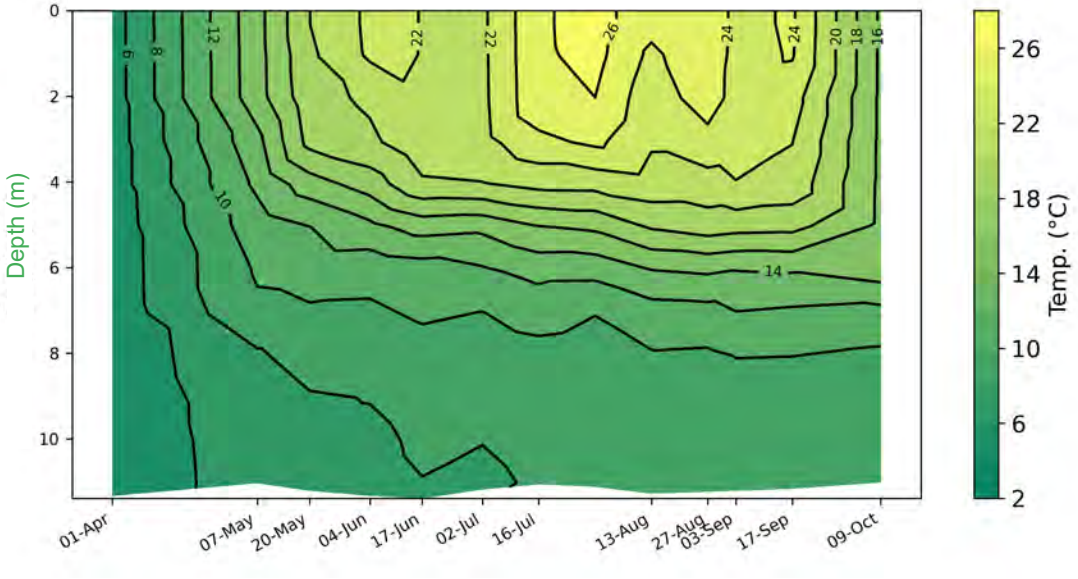


Phosphorus loading from sediment

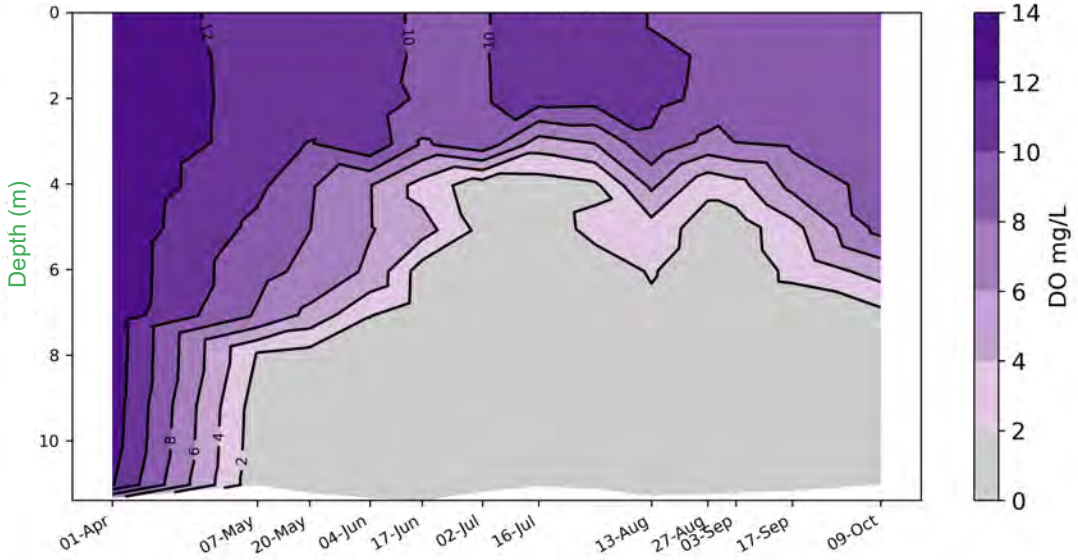
Stratification—the separation of the lake into different temperature layers—resulted in low oxygen levels at the bottom of Parkers Lake in 2024. The lake's thermocline separated warmer water at the surface of the lake from the cooler waters near the bottom. The upper layer of warm water-known as the epilimnion-mixed regularly, while the cooler waters stayed separated due to density differences, only fully mixing with the epilimnion during fall and spring turnover (see temperature isopleth on page 6). Low oxygen levels were observed below the Parker's Lake thermocline from May through October in this year (see dissolved oxygen isopleth on page 6).

The release of phosphorus stored in lake-bottom sediments when oxygen levels are low (<2 mg/L) is described as "internal phosphorus loading from sediment." Lake stratification confined the high phosphorus concentrations from internal sediment loading to the bottom of Parkers Lake in May and June when the thermocline was 6 to 8 meters from the surface. Later in the summer, when the thermocline was closer to the surface (4 meters during July or 5 meters in late August through early September), the high phosphorus from internal sediment loading was mixed into the lake's surface waters during storm events (see total phosphorus isopleth on page 6). Higher wind speeds increased turbulent mixing, also allowing higher phosphorus concentrations from internal loading to mix into the lake's surface water during this time. The added phosphorus increased algal growth in the lake's surface waters and reduced water clarity. Despite phosphorus increases in surface waters from storm event mixing, the summer average surface water phosphorus concentration reflected good water quality and met the MPCA phosphorus standard.

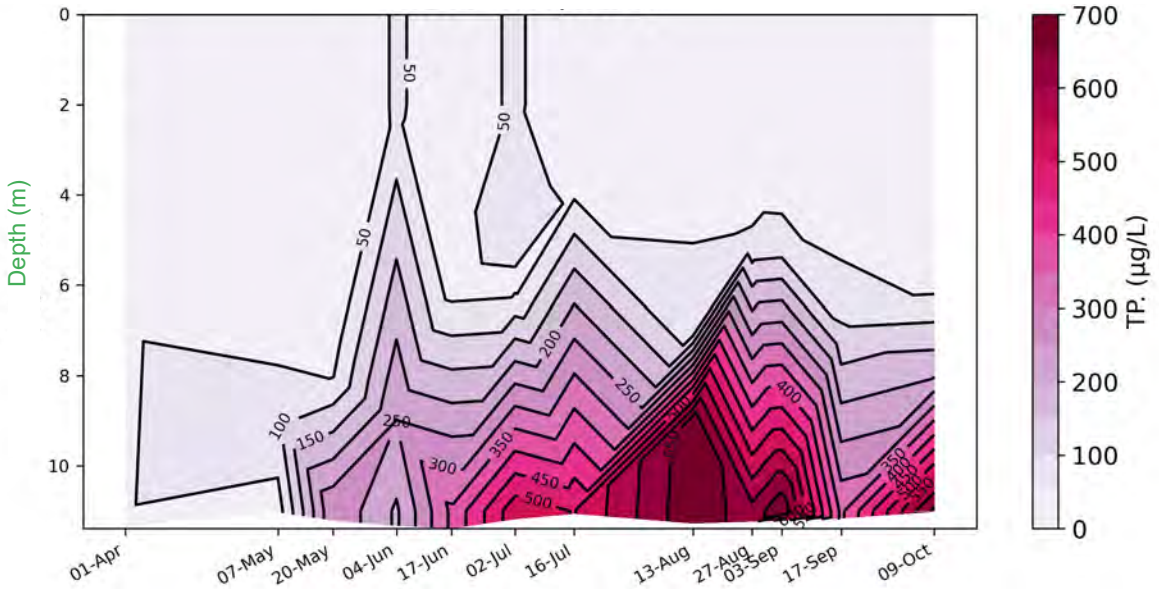
Temperature isopleth



Dissolved oxygen isopleth



Total phosphorus isopleth



Chloride levels from 1980 to 2024

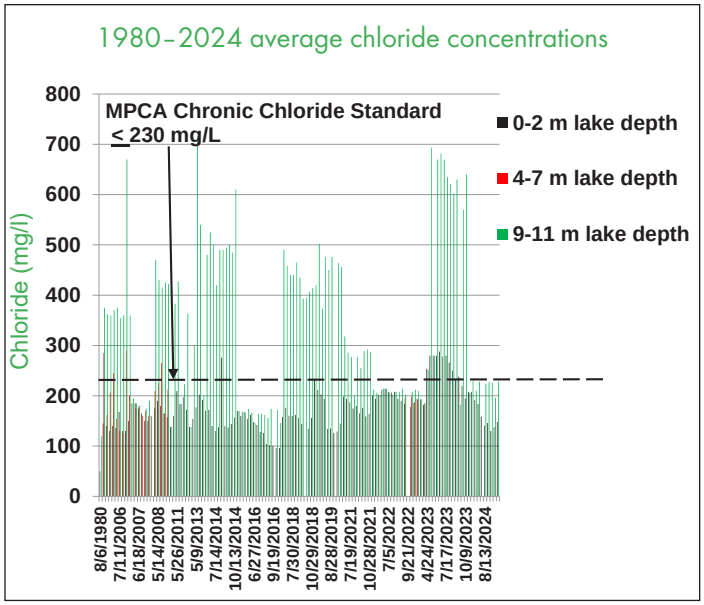
Chloride concentrations in area lakes have increased since the early 1990s, when many government agencies switched from sand or sand/salt mixtures to salt for winter road maintenance. When snow and ice melt, the salt goes with it, washing into lakes, streams, wetlands, and groundwater. It only takes 1 teaspoon of road salt to pollute 5 gallons of water to a point where it can no longer support freshwater life. That pollution is essentially permanent, as there is no easy or affordable way to remove chloride from water.

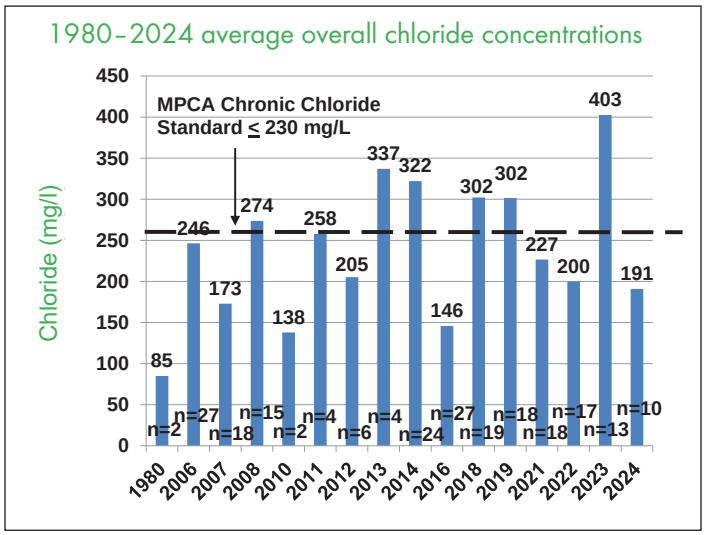
Because high chloride concentrations can harm fish, zooplankton, and plant life, the MPCA has established maximum and chronic chloride standards. The maximum standard is the highest concentration of chloride that aquatic organisms can be exposed to for a brief time with zero-to-slight mortality. The chronic standard is the highest chloride concentration that aquatic life can be exposed to indefinitely without causing chronic toxicity. Chronic toxicity is defined as a stimulus that lingers or continues for a long period, often one-tenth of the life span or more. Chronic effects can be mortality, reduced growth, reproduction impairment, harmful changes in behavior, and other nonlethal effects. A lake is considered impaired for chlorides if two or more measurements exceed the chronic criterion (230 mg/L) within a 3-year period or if one measurement exceeds the maximum criterion (860 mg/L).

Surface chloride measurements in 2024 ranged from a low of 130.0 mg/L in early September to a high of 207.9 mg/L in May. Near-bottom chloride measurements ranged from a low of 195.6 mg/L in late September to a high of 229.9 mg/L in late May. All 2024 measurements met the MPCA chronic and maximum chloride standards.

Parkers Lake has been listed as impaired for chlorides since 2014. As shown in the figure at right, chloride concentrations in the lake's bottom waters (9–11 meter depths) failed to meet the MPCA chronic chloride standard during most years from 2006 through 2021. During this period, annual chloride averages for the entire lake also generally exceeded the MPCA chronic standard. An exception occurred in 2021 when the annual chloride average was slightly below the MPCA chronic standard, despite all but one near-bottom chloride concentration exceeding the MPCA chronic standard. In 2024, chloride concentrations in the lake's surface and bottom waters met the MPCA chronic chloride standard. The 2024 average chloride concentration (including surface and near-bottom) of 191 mg/L was lower than average concentrations from 2018 through 2023, ranging from 200 mg/L to 403 mg/L.

The winter preceding this monitoring had very little snow. The lower quantities of deicing chemicals applied to the lake's watershed during the winter preceding the 2024 monitoring likely contributed to the lower chloride concentrations in the lake during 2024.





Macrophytes (aquatic plants)

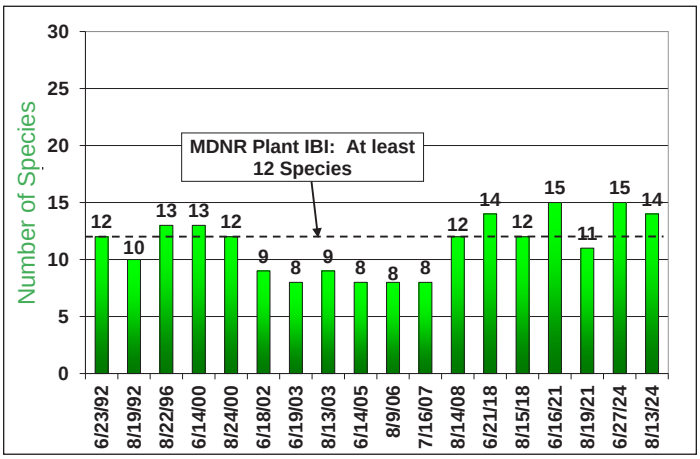
Lake Plant Eutrophication Index of Biological Integrity (IBI)

Eutrophication (excessive nutrients) can have detrimental effects on a lake, including reducing the quantity and diversity of plants. The MNDNR developed a Lake Plant Eutrophication Index of Biological Integrity (IBI) to measure the response of a lake plant community to eutrophication. The 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. Lakes that score below the thresholds contain degraded plant communities and are likely stressed from anthropogenic (human-caused) eutrophication.

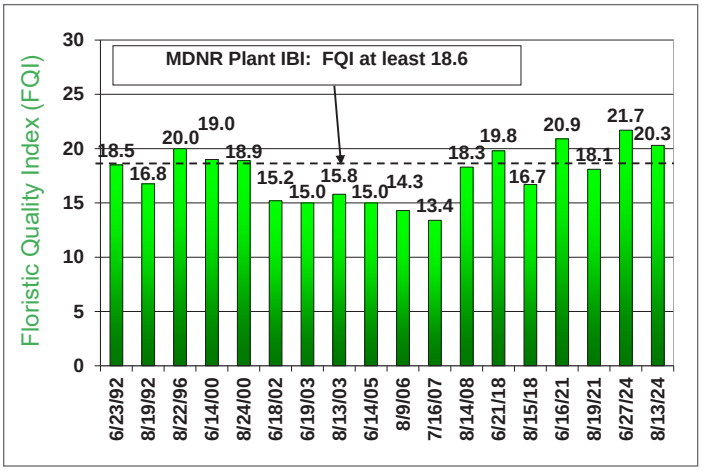
Plant survey data from 1992 to 2024 were assessed to determine Plant IBI trends. The figures at right show Parkers Lake FQI scores and the number of species for that period compared to the MNDNR Plant IBI thresholds.

- **Number of species:** A deeper water lake, such as Parkers Lake, meets the MNDNR Plant IBI threshold when it has 12 species or more species. The number of species in Parkers Lake in 2024 ranged from 14 in August to 15 in June, better than the MNDNR Plant IBI threshold. From 1992 through 2021, the number of species in Parkers Lake ranged from eight to 15 and met the MNDNR Plant IBI threshold on eight of the 16 monitored occasions.
- **FQI values (quality of species):** The MNDNR Plant IBI threshold for deeper water lakes, as measured by FQI, is a minimum of 18.6. In 2024, FQI values for Parkers Lake ranged from a low of 20.3 in August to a high of 21.7 in June, both better than the MNDNR Plant IBI threshold. The June value was the highest FQI value observed in the monitored period. From 1992 through 2021, FQI values ranged from 13.4 to 20.9 and were better than the MNDNR Plant IBI threshold during five of the 16 monitored occasions.

MNDNR plant IBI: number of species



MNDNR plant IBI: floristic quality index (FQI)



Phytoplankton and Zooplankton

Phytoplankton, or algae, are small aquatic plants naturally present in lakes. Phytoplankton derive energy from the sun through photosynthesis and provide food for several types of aquatic organisms, including zooplankton (microscopic animals), which are, in turn, eaten by fish. An inadequate phytoplankton population limits a lake's zooplankton population and indirectly limits fish production in a lake. Excess phytoplankton can reduce water clarity.

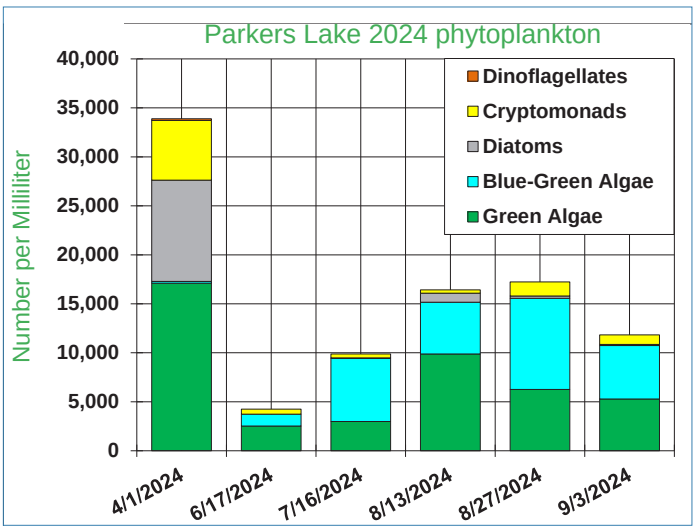
Phytoplankton samples were collected from Parkers Lake to evaluate water quality and the quality of food available to zooplankton. Phytoplankton numbers declined from the April to June sampling, and lower phytoplankton numbers were found from June through September, a reflection of the lake's good water quality. Cryptomonads and green algae, good food sources for the lake's zooplankton, were present throughout the monitored period. Blue-green algae, which are associated with water quality problems and can be a source of health concerns, dominated the phytoplankton community in mid-July and late August and

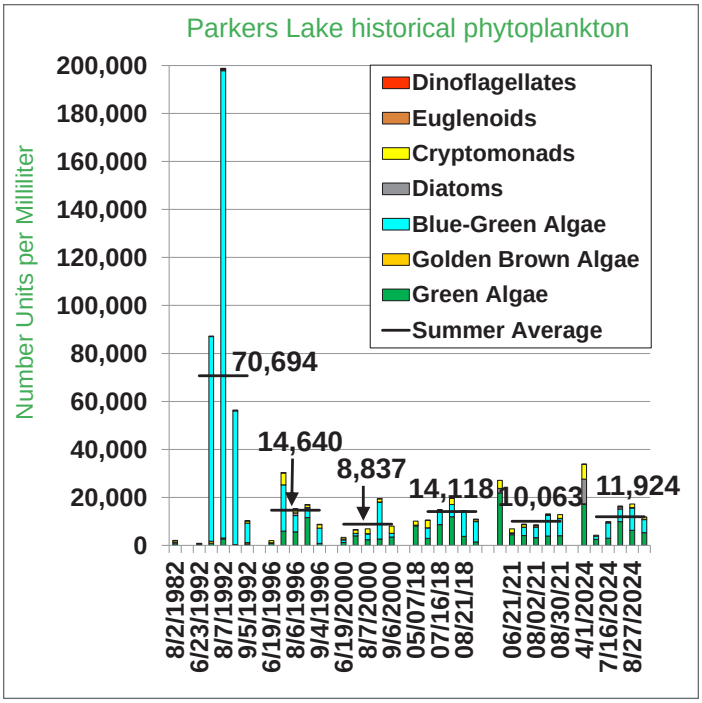
co-dominated the phytoplankton community with green algae in early September. However, the overall number of blue-green algae during 2024 was low and did not cause water quality problems or adverse health concerns (see figure on page 9). In 2024, phytoplankton numbers were within the range observed since 1982 (see figure below).

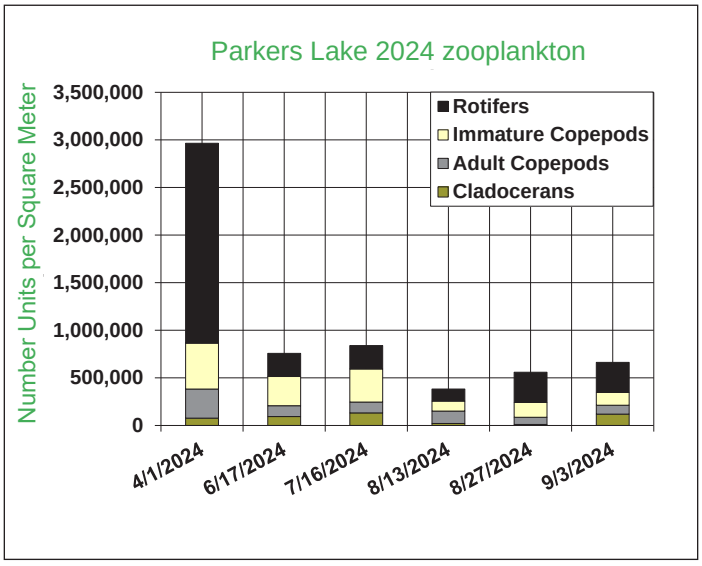
Unlike phytoplankton, zooplankton do not produce their own food. As “filter feeders,” they eat millions of small algae; given the right quantity and species, they can filter the volume of an entire lake in a matter of days. They are also valuable food for planktivorous fish and other organisms.

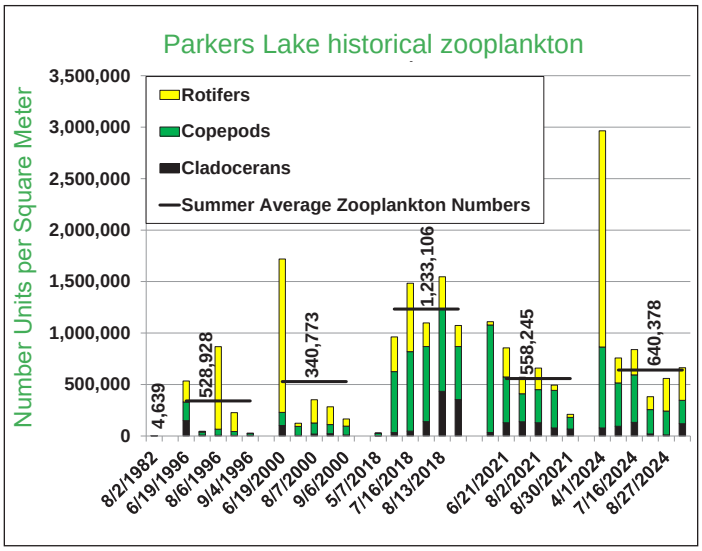
The 2024 zooplankton composition in Parkers Lake reflects the impact of fish predation on the community. Fish generally select the largest zooplankters they see and prefer cladocerans to copepods because they swim slowly and lack the copepods’ ability to escape predation by jerking or jumping out of the way. Rotifers, the least preferred food for fish, dominated the community during April, late August, and early September. Immature copepods, the second least preferred food for fish, dominated the community during June and July. In mid-August, immature and adult copepods co-dominated the community (see figure at right). Because rotifers and copepods do not graze as heavily on algae as the larger cladocerans, they generally have a limited impact on the lake’s water quality. This suggests that future Parkers Lake water quality management efforts should focus on phosphorus management to reduce the nutrients contributing to algae growth.

Zooplankton numbers in 2024 were within the range observed since 1982 (see figure at right).









Aquatic invasive species

In 2024, two aquatic invasive species were present in Parker's Lake.

- **Curly-leaf pondweed (*Potamogeton crispus*):** CLP was found at 33 percent of sample points in June and 5 percent in August 2024. The decline between June and August was due to a natural die-off in late June.

  At the time of June sampling, 44 of the 47 CLP sample points were low density (i.e., a density of 1 on a scale of 1–3); of the remaining three sample points, one had a medium density of CLP (i.e., a density of 2 on a scale of 1-3) and two had a high density (i.e., a density of 3 on a scale of 1–3). In August, six of the seven CLP sample points were low density; the remaining sample point had a medium density of CLP. CLP did not cause problematic conditions for recreational users in 2024, but the late June die-off added phosphorus to the lake.

  Although CLP frequency declined between 2018 and 2021—from 39 percent in June 2018 to 29 percent in June 2021 and from 4 percent in August 2018 to not observed in August 2021—it slightly increased in 2024—to 33 percent in June and 5 percent in August.

  CLP density was similar in 2018, 2021, and 2024. The average June CLP density was 1.2 in June 2018 and 2021, compared with 1.1 in June 2024. The average August CLP density was 1.0 in 2018 compared with 1.1 in 2024. CLP was not observed in August 2021.

  Limited ice and snow cover during the preceding winter, allowing CLP to grow throughout the winter, may have contributed to the increased abundance of CLP in 2024.

- **Eurasian watermilfoil (*Myriophyllum spicatum*):** In 2024, Eurasian watermilfoil (EWM) frequency was similar in June (40%) and August (43%). The average 2024 EWM density in the lake was also similar in June (1.4 on a scale of 1–3) and August (1.3). While a few areas of the lake had high levels of EWM during both June and August, most EWM areas did not cause problematic conditions for recreational lake users in 2024.

  June frequency and density in 2018 (61 percent frequency and 2.2 density) and 2021 (60 percent frequency and 1.9 density) were higher than 2024 (40 percent frequency and 1.4 density). Similarly, August frequency and density were higher in 2018 (71 percent frequency and 2.0 density) and 2021 (76 percent frequency and 1.9 density) than in 2024 (43 percent frequency and 1.3 density). The reduction in EWM frequency and density in 2024 was favorable for the lake.

Suitability of Parkers Lake for other AIS

Many AIS residing in Minnesota have not yet been observed in Parkers Lake but could be introduced. For example, zebra mussels and starry stonewort are in nearby Medicine Lake. To evaluate whether Parkers Lake water quality would support the introduction of six AIS (starry stonewort, zebra mussels, spiny waterflea, faucet snail, Chinese mystery snail, and rusty crayfish), a suitability analysis for each species was performed.

The analysis compared 2024 water quality data in Parkers Lake with the water quality conditions required for each species, specifically evaluating total phosphorus, chlorophyll *a*, Secchi disc depth, trophic state index (TSI), water temperature, dissolved oxygen, specific conductance, pH, calcium, magnesium, sodium, alkalinity, hardness, and calcium carbonate. The results indicate the water quality of Parkers Lake meets the suitability requirements for rusty crayfish, faucet snail, zebra mussels, starry stonewort, and spiny waterflea. However, the sodium and specific conductance levels were too high to be suitable for the Chinese mystery snail. Hence, this species would likely survive but may not thrive in Parkers Lake.