RAMSEY-WASHINGTON
METRO WATERSHED DISTRICT

2025 WATER MONITORING ANNUAL REPORT

Prepared
May 2026

TABLE OF CONTENTS

TERMS

Best management practices (BMPs): Practices that protect water quality.

Chloride: Small amounts of chlorides are required for normal cell functions in plant and animal life, but chloride from de-icing and water-softener salt that gets into lakes and streams can be toxic to some aquatic life. The standard for chloride in Minnesota lakes and streams is 230 mg/L for chronic levels. That is the standard level used in this report.

Chlorophyll-*a*: Chlorophyll-*a* measures the amount of algae in a lake. Large amounts of algae, which cause green scum and odors, are a symptom of degraded water quality.

Eutrophication: Eutrophication describes a situation where a lake or other body of water has excessive nutrients and minerals, frequently due to polluted runoff. The effect of the nutrient excess can be dense plant growth and stress to animal life due to lack of oxygen.

Orthophosphate: The form of phosphorus that is readily available for use by algae and other aquatic plants for growth.

PFAS (perfluoroalkyl substances): Polluting substances used in a variety of industrial, agricultural, military, and commercial product applications.

Phosphorus: Phosphorus is a nutrient that is essential for plant life, but excessive phosphorus degrades water quality. Common sources of phosphorus in lakes are fertilizers and organic wastes from runoff and soil erosion.

Secchi disk: The clarity or transparency of water is measured by lowering a "Secchi disk" (usually black and white) into the water until it is no longer visible from the surface. The greater the "Secchi depth," the more transparent the water.

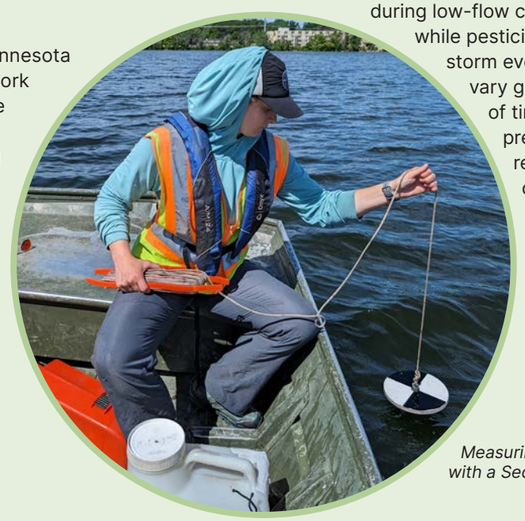
Tiered aquatic life uses (TALU): The Minnesota Pollution Control Agency's TALU framework is a significant revision to the aquatic life use classification in the state's water quality standards and is built on existing water quality standards to improve how water quality in streams and rivers are monitored and managed.

Total suspended solids: Particulate matter, including soils, metals, organic materials, and debris that are suspended in a moving body of water.

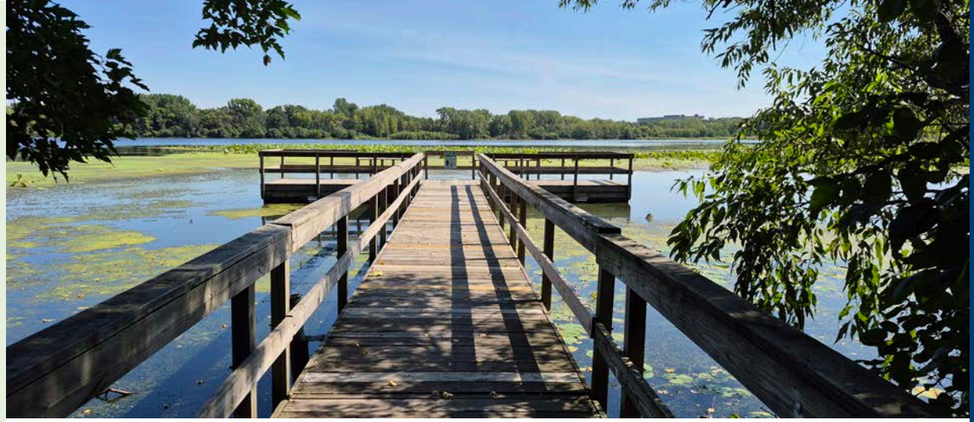
STATE STANDARDS

The following information on how Minnesota standards for water quality are determined is taken from the Minnesota Pollution Control Agency's *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List*.

- **Total phosphorus and chlorophyll-*a* in lakes:** Data used for phosphorus and chlorophyll-*a* calculations are limited to those collected from the upper most 2 meters of the water column (surface). If more than one sample is collected in a lake per day, these values are averaged to yield a daily average value. Following this step, all June to September data for the 10-year assessment window are averaged to determine mean summer values for TP, corrected chlorophyll-*a*, and Secchi depth. These values are then compared to the standards, and the assessment is made.
- **Conventional pollutants (total suspended solids [TSS]):** A stream exceeds the standard for TSS if (1) the standard is exceeded more than 10% of the days of the assessment season (April through September) as determined from a data set that gives an unbiased representation of conditions over the assessment season, and (2) at least three such measurements exceed the standard.
- **Aquatic life toxicity-based standards (chlorides):** Aquatic life toxicity-based chronic water quality standards are written as four-day average concentrations. In some cases, pollutant concentrations can be quite variable over such periods, depending on factors such as the type and size of the water body, weather and flow conditions, and the source and nature of the pollutant. For example, chloride concentrations in lakes, streams, and wetlands are relatively stable during low-flow conditions over 4 days, while pesticide concentrations during storm events in small streams can vary greatly in that same amount of time. The chloride values presented in this report represent average water column concentrations.



Measuring water clarity with a Secchi disk



This report presents annual historical monitoring data, providing an overall water quality assessment of lakes and streams within the Ramsey-Washington Metro Watershed District (RWMWD or the District). It includes an assessment of 16 lakes and ponds and five streams or conveyances, with a primary focus on total phosphorus, ortho-phosphorus, chlorophyll-*a*, Secchi disk depth (lakes only), total suspended solids, and chloride. Data also includes nitrogen in streams. Nitrogen loads contributed by streams may influence the ecological status of aquatic-plant-dominated shallow lakes, and there are many shallow lakes in the District. Chloride is also a pollutant of increasing concern as deicing salt used on impervious areas has the potential to lead to high chloride concentrations in ponds, lakes, and streams, particularly during winter and spring months.

This report includes a section on best-management practices (BMPs) constructed at various locations in the watershed. BMPs are also discussed with lake and stream assessments. Unlike ponds, which settle phosphorus attached to particulate sediment, these BMPs are designed to remove both particulate and dissolved phosphorus. While ponds are still a dominant feature in the District and remove high fractions of particulate pollutants, their phosphorus-removal performance is limited. For this reason, one of the primary BMPs installed to meet total maximum daily load (TMDL) requirements is filtration-type BMPs. Many of the filtration-type BMPs with media designed to bind dissolved phosphorus are still considered somewhat experimental; hence, an assessment of the lifespan, performance, and effectiveness of these systems is warranted. The BMP section will also cover other unique BMPs within the District, such as the Tanners alum treatment plant. The District also constructs infiltration BMPs, but due to a lack of monitoring data, they are not discussed in this report.

- **Chapter 2** contains the conclusions and recommendations of the report, providing a high level look at monitoring findings and proposed next steps. The rest of the report is organized by resource type or subject.
- **Chapter 3** includes the most recent and historical lake data, water quality trends, a discussion of in-lake management actions and actions in the tributary watershed, and an overall assessment.
- **Chapter 4** includes recent and historical monitoring data for streams and conveyances, an overall assessment, a discussion of water quality trends, and a description of relevant management actions.
- **Chapter 5** provides the results of various monitored BMPs throughout the District.
- **Chapter 6** discusses contaminants of emerging concern in the District, including PFAS (perfluoroalkyl), chloride, and mercury.
- **Chapters 7 and 8** describe fisheries and aquatic vegetation management strategies the District has used to help improve water quality.
- **Chapter 9** describes preliminary data analysis for the synoptic water quality sampling of Battle Creek and Fish Creek.

1. INTRODUCTION

2. CONCLUSIONS AND RECOMMENDATIONS

Overall, eutrophication parameters in the District lakes have improved throughout the reported monitoring period spanning decades. More recent data, however, suggests that water quality has worsened. Monitoring data indicates that over the past 10 years, water quality (phosphorus, chlorophyll-*a*, Secchi disk transparency, and chloride) significantly improved in Wakefield Lake, while at least one water quality parameter significantly worsened for Battle Creek, Bennett, Carver, Gervais, Keller, Kohlman, Owasso, Phalen, Wabasso, Snail, Tanners and Twin lakes. However, in all instances of worsening phosphorus, chlorophyll-*a*, and Secchi disk transparency trends, data within these 10 years were similar or better than historical data.

Likewise, water quality parameters (phosphorus, total suspended solids, nitrate and nitrite, or chloride) at the District streams have improved since monitoring began, but more recent data suggests that water quality has worsened. Water quality did not improve at any sites while at least one water quality parameter significantly worsened for Battle Creek, Beltline Interceptor, Fish Creek, and Kohlman Creek. However, as with the lakes, in all instances of worsening phosphorus, chlorophyll-*a*, and Secchi disk transparency trends, data were similar or better than historical data.

Long-term water quality improvements in District lakes and streams suggest that the implementation of numerous BMPs have helped to improve water quality. However, BMPs in select locations may need to be serviced or upgraded based on worsening recent data. A summary of these BMPs implemented over the past two decades is below.

- **The Woodlyn Rain Garden Iron-Enhanced Sand Filter** has been monitored from 2012 to 2025. Phosphorus removal was variable in the first three years of monitoring and ranged from 3% to 68%. However, removal then increased to 92% in 2022. Since then, removal has been variable and decreased in 2025 to 43%. Orthophosphate removal has been highly variable over the years ranging from a minimum in 2018 of 0% and a maximum in 2015 of 93%. Removal in 2025 was 50%. Total suspended solid removal was 48% in 2012 but ranged between 73% and 98% in the years following. In 2025, the basin was disturbed due to mowing, so District staff plan to let the basin re-establish for a year before monitoring again. Vegetation replacement and media replacement may be required in the future.
- **The Frost and Kennard Spent Lime Filter** was constructed in 2018 and has been monitored every year since. Influent total phosphorus, orthophosphate, and total suspended solids removal at the Frost Kennard Filter decreased from 2018 to 2021, but then removal increased in 2022 (potentially due to drought conditions). From 2023 and 2025, the filter had consistent high total phosphorus removal (50%-65%) and total suspended solids removal (over 90%), while orthophosphate has removals have been consistently lower (Below 20%). Monitoring will continue in 2026.
- An additional spent-lime BMP, the **Willow Pond Continuous Monitoring and Adaptive Control (CMAC) spent lime filter** was first monitored in 2024. In 2024, the CMAC filter was filled three times to test its pollutant removal performance. The average removals during the three test events in 2024 was 26% for total phosphorus, 13% for orthophosphate, and 36% for total suspended solids. In 2025, the CMAC filter was filled once for testing. The removal for the testing event in 2025 was 56% for total phosphorus, 44% for orthophosphate, and 42% for total suspended solids. Monitoring will continue in 2026.
- Media in the **Wakefield Lake Experimental Iron and Granite Sand Filter** was replaced with iron and granite sand in 2022. The performance of the filter with respect to phosphorus and orthophosphate removals was mixed, with an average removal of 9% and 19%, respectively. Total suspended solids performance improved over the year, but the filter still had minimal removals, with two events actually releasing suspended solids. From 2023 and 2025, performance was consistently high at over 67% removal of total phosphorus, orthophosphate, and total suspended solids removal except for total phosphorus in 2025 which was 36%. One potential reason for the relatively poor initial performance of the filter's solids removal is that the new media was not washed properly and contained additional solids at the time of installation. Monitoring will continue in 2026.

- **Arbogast CC17 Filter** monitoring began in 2024. Total phosphorus removal decreased from 59% in 2024 to 21% in 2025, orthophosphate removal increased from 9% to 26%, and total suspended solids removal remained roughly the same (94% to 91%). The filter needs more monitoring to understand the average annual removals, and some adjustments to the inlet are expected in 2026.
- **The Tanners Lake Alum Treatment system** has performed very reliably and is likely the primary reason that Tanners Lake has stayed off the impaired waters list. Since the beginning of operation in 1998, the average annual total phosphorus removal has ranged from 48 to 91%, with the removals from 2015 to 2019 ranging from 78–89%. Total phosphorus removal declined to 30% from 2019 to 2023. From 2024 to 2025, total phosphorus removal increased to 60% and 68% respectively. The total phosphorus removal increase in 2025 may be due to the alum dosage change in May 2025.

In addition to continuing the typical lake monitoring activities in 2026, the following are recommendations for future annual monitoring.

1. Chloride

a. Continue to incorporate chloride monitoring into all routine water quality monitoring.

b. Continue annual monitoring of water bodies, including ponds, ditches, and creeks, on a rotating basis to better understand where the chloride hotspots are within the RWMWD. In 2025, ice out chloride monitoring was continued (see Chapter 6), and monitoring in water bodies is planned to continue in 2026.

c. Measure specific conductance when measuring chloride to develop a relationship between chloride and specific conductance. In the future, specific conductance may be used as a surrogate for chloride by developing a regression between the two parameters.

d. In 2026, RWMWD is creating a District-wide Chloride Reduction Strategy. Goals include assessing chloride levels across the watershed, identifying areas for targeted chloride reduction and monitoring, and developing a district-wide strategy for chloride reduction. Monitoring may be used to inform implementation strategies for chloride reduction.

2. Streams

a. Continue monitoring the water quality of streams (at minimum, total phosphorus, total dissolved phosphorus, ortho-phosphorus, total Kjeldahl nitrogen, nitrate plus nitrite, total suspended solids, chloride, and chlorophyll-*a*). Water quality monitoring will have value even if the flow cannot be monitored.

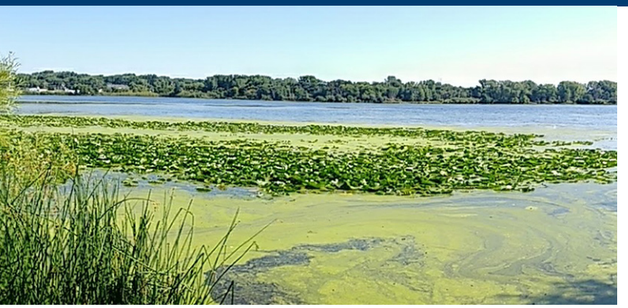
3. BMPs

a. A rotating monitoring schedule for the filtration-type BMPs constructed in the District has been developed to document their performance. A rotating schedule will allow for a more widespread monitoring effort when new BMPs come online. It is important to reevaluate the BMP monitoring schedule annually.

b. The media of the following BMPs needs further evaluation in 2026 or later to confirm whether these filters are performing as designed:

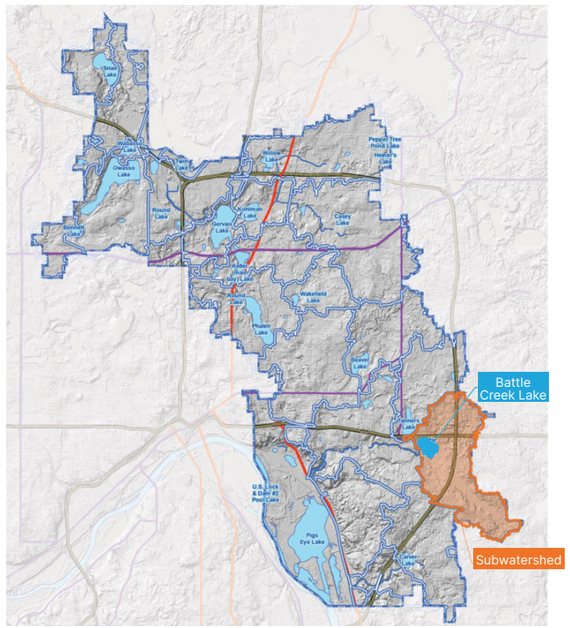
   i. Beam Avenue iron-enhanced sand filter
   ii. Woodlyn Avenue iron-enhanced sand filter
   iii. Willow Pond CMAC spent-lime filter
   iv. Wakefield Lake experimental iron and granite sand filter
   v. Arbogast CC17 filter
   vi. Frost Kennard spent lime filter

BATTLE CREEK LAKE



Attribute	Description
MPCA designation	Shallow lake; “non-support” of aquatic life (chloride)
Tributary area	2,638 acres
Surface area	103 acres
Average/maximum depth	4 feet/15 feet
RWMWD nutrient classification[1]	At risk
Accountable municipalities	Landfall, Oakdale, Woodbury, Washington County
Downstream water body	Battle Creek

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Battle Creek Lake is a shallow lake in Washington County that receives flows from Tanners Lake and outlets to Battle Creek. The lake is used for a variety of recreational purposes, including motor boating, canoeing, fishing, picnicking, and aesthetic viewing. A public boat access is located at the lake’s southeast corner in Shawnee Park.

Battle Creek Lake is on the MPCA’s impaired waters list for mercury (aquatic consumption) and chloride (aquatic life). A statewide mercury TMDL was completed in 2007, and the Twin Cities Metro Area Chloride TMDL was completed in 2016. The lake was removed from the MPCA’s Impaired Waters List for excess nutrients in 2014.

Battle Creek Lake has been monitored annually for phosphorus, chlorophyll-*a*, and Secchi disk depth from 1997 to 2025; it has been monitored annually for chloride since 2015. In 2025, the lake met Minnesota state standards for summer averages for all four parameters (see table and graphs at right). The 10-year data shows a statistically significant trend of worsening total chlorophyll-*a* concentration.

According to the 2017 *Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 68% of the phosphorus in Battle Creek Lake comes from stormwater. Strategies to address stormwater management include implementing water-quality projects that reduce external loading to the lake and BMP cost-share programs. Plans to address chloride include improving road salt management by promoting and adopting strategies outlined in the *Twin Cities Metro Area Chloride Management Plan* and the RWMWD’s upcoming Chloride Reduction Strategy.

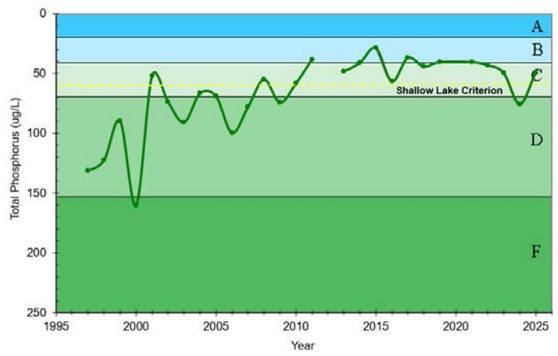
Since first establishing water quality goals for Battle Creek Lake, RWMWD has completed several projects that have contributed to improvements in water quality. Recent projects include:

- **Woodbury Elementary and Middle School rain gardens (2017):** This was one of six school rain garden projects funded, in part, by a $150,000 Clean Water Fund grant. Two gardens were planted at the site, providing needed pollinator habitat and reducing the volume of polluted runoff that drains to Battle Creek Lake.
- **Trinity Presbyterian Church (2017):** Two rain gardens were installed at this site to manage runoff from the church’s parking lot. This reduces the volume of polluted rainwater draining to Battle Creek Lake.
- **Woodbury Target (2024):** Two biofiltration basins were installed at the Target store located in the Valley Creek Plaza in Woodbury. Water is captured from the store’s parking lot via trench drains that discharge into the basins. The basins reduce the pollutants that drain to Battle Creek Lake, and include native vegetation for pollinator, bird, and insect habitat.

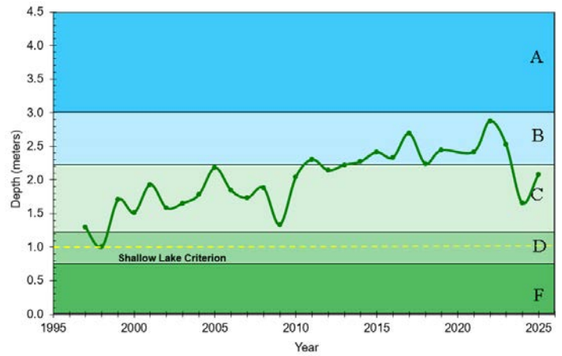
Parameter	State Standard	2025 Battle Creek Lake	10-Year Average	10-Year Trend
Phosphorus	≤ 60 µg/l	49.2 µg/l	47 µg/l	None
Chlorophyll-*a*	≤ 20 µg/l	10.8 µg/l	9 µg/l	Worsening
Secchi disk transparency	> 1 meter	2.1 meters	2 meters	None
Chloride	≤ 230 mg/L [2]	147 mg/L	192 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

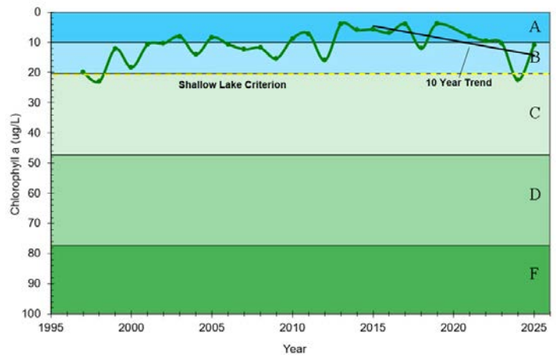
Total phosphorus (µg/l)



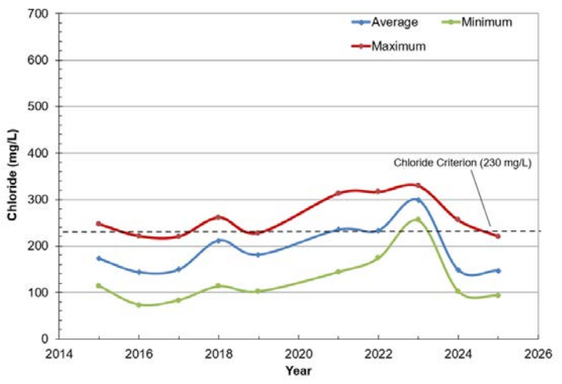
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



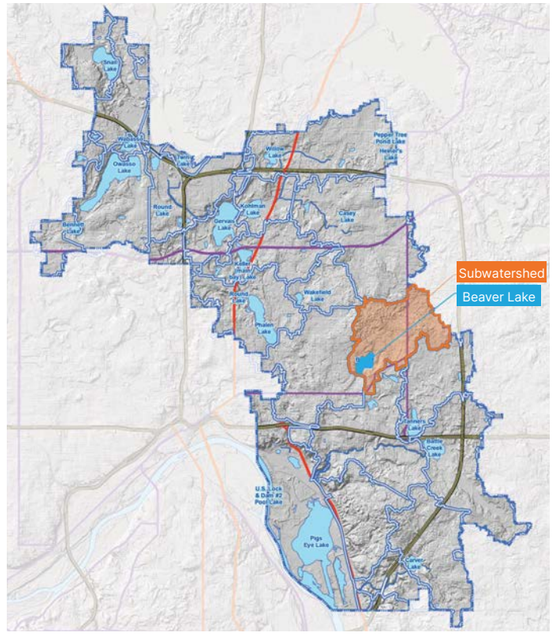
Chloride (mg/L)



BEAVER LAKE

Attribute	Description
MPCA designation	Shallow
Tributary area	1,935 acres
Surface area	87 acres
Average/maximum depth	4/11 feet
RWMWD nutrient classification[1]	At risk
Accountable municipalities	Maplewood, St. Paul, Ramsey County, Washington County
Downstream water body	Beltline Storm Sewer and Mississippi River

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Beaver Lake is a small, shallow lake in Maplewood that drains to the Beltline storm sewer and on to the Mississippi River. A Ramsey County park occupies most of the north and west shoreline. The lake has some wildlife habitat and is primarily used for canoeing, fishing, picnicking, and aesthetic viewing. It is impaired for mercury (aquatic consumption), at risk for chlorides, and listed by the Minnesota DNR as infested with Eurasian watermilfoil. In 2014, the lake was removed from the MPCA's Impaired Waters List for excess nutrients.

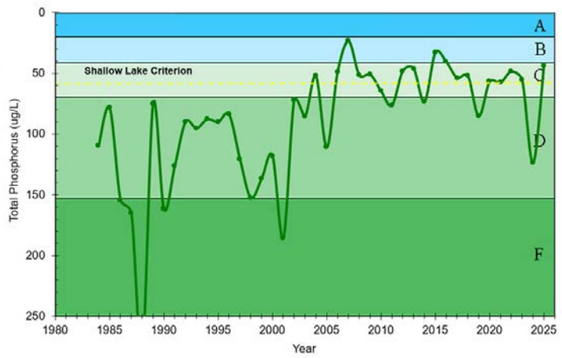
Beaver Lake has been monitored annually for phosphorus, chlorophyll-*a*, and Secchi disk depth since 1984; chloride monitoring started in 2015. In 2025, the lake met summer-average state standards for all parameters (see table and graphs at right). The 10-year data shows no statistically significant trends.

According to the 2017 *Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 51% of the phosphorus in Beaver Lake comes from stormwater, and 47% comes from internal loading. Strategies to address stormwater management include implementing water-quality projects to reduce the total phosphorus load to the lake and BMP cost-share programs. Plans to reduce in-lake loading include assessing options for the inactivation of sediment release of phosphorus.

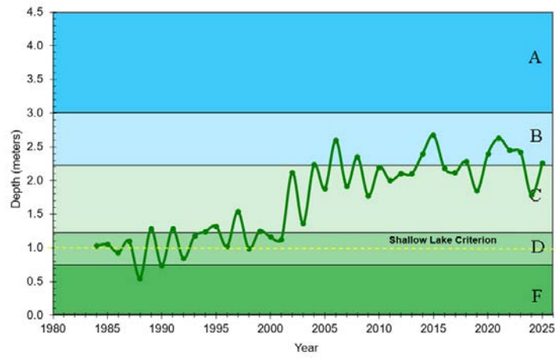
Parameter	State Standard	2025 Beaver Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 60 µg/l	44.0 µg/l	62 µg/l	None
Chlorophyll-*a*	≤ 20 µg/l	15.3 µg/l	19 µg/l	None
Secchi disk transparency	> 1 meter	2.3 meters	2.2 meters	None
Chloride	≤ 230 mg/L [2]	92.0 mg/L	109 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

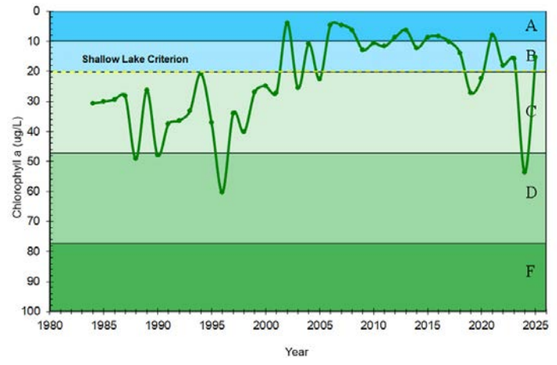
Total phosphorus (µg/l)



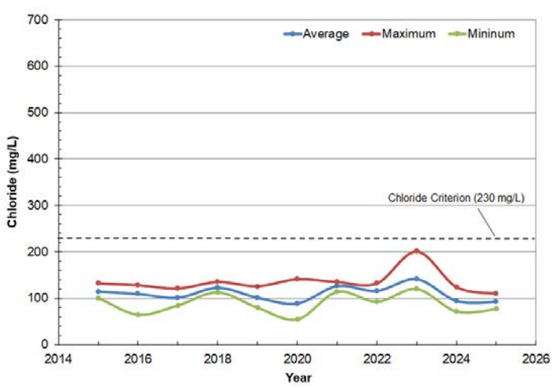
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



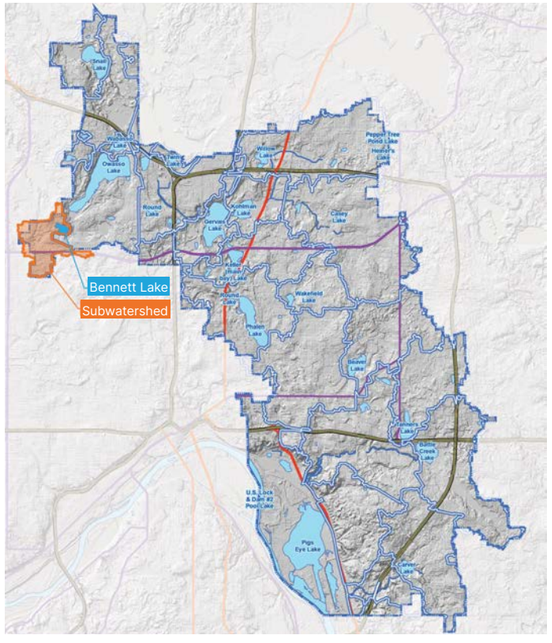
Chloride (mg/L)



BENNETT LAKE

Attribute	Description
MPCA designation	Shallow
Tributary area	721 acres
Surface area	25 acres
Average/maximum depth	9 feet
RWMWD nutrient classification[1]	Impaired
Accountable municipalities	Roseville, Ramsey County
Downstream water body	Lake Owasso

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Bennett Lake is the start of a chain of lakes that ultimately drains to Grass Lake. The City of Roseville's Central Park surrounds the lake, which has a fishing pier and provides canoeing opportunities. The Minnesota Department of Natural Resources uses Bennett Lake as a fish nursery.

Bennett Lake is considered by the MPCA to be impaired for mercury (aquatic consumption) and excess nutrients. A statewide mercury TMDL was completed in 2007, and a nutrient TMDL was completed in 2017.

Bennett Lake has been monitored annually for chlorophyll-*a* from 1984 to 2025 and for phosphorus and Secchi disk depth from 2003 to 2025. Annual chloride monitoring began in 2015. In 2025, the lake met summer-average state standards for only Secchi disk transparency and chloride (see table and graphs at right). The 10-year data shows a statistically significant trend of worsening total phosphorus concentration.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 56% of the phosphorus in Bennett Lake comes from internal loading, and 43% comes from stormwater. In 2022, a shallow lake aeration study began. The study consisted of monthly monitoring for water quality and sediment coring, as well as continuous dissolved oxygen monitoring. The objective of the study was to determine if shallow aeration could reduce phosphorus loading and improve dissolved oxygen throughout the lake. The benefits of aeration for Bennett Lake were primarily seen close to the aeration system and may have been limited due to the lack of iron. The shallow lake aeration study monitoring was continued in 2023, and report was provided to RWMWD staff and the board of managers in 2024. At this time, an aeration project is not planned for Bennett Lake.

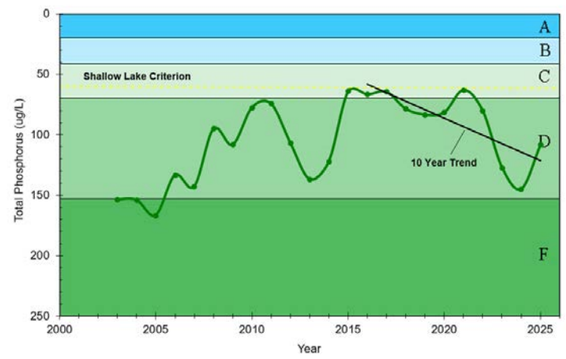
RWMWD has completed three recent projects that have contributed to improving the water quality of this lake:

- **Grace Church retrofit (2015):** This project involved the installation of two rain gardens and three native planting areas to intercept and filter runoff from the Grace Church parking lot, reducing the volume of polluted rainwater draining to Bennett Lake.
- **Carp management (ongoing since 2017):** Carp management in the Lake Owasso system of lakes (Owasso, Wabasso, Bennett, and Grass) helps control phosphorus loading in these waters. Foraging carp stir up nutrient-rich sediment on the lake bottom, which, in turn, contributes to turbid water and algae blooms. Management efforts include counting carp to understand the extent of the population, tracking them with radio tags to allow efficient harvesting and identification of carp nurseries, and installing barriers.
- **Willow Pond spent-lime filter (2018):** This project involved the installation of a spent lime filter that draws water above the pond's outlet elevation off of Willow Pond. The pipe that draws water from Willow Pond can be opened and closed automatically to control the volume of water in the filter and the length of time between filling events.

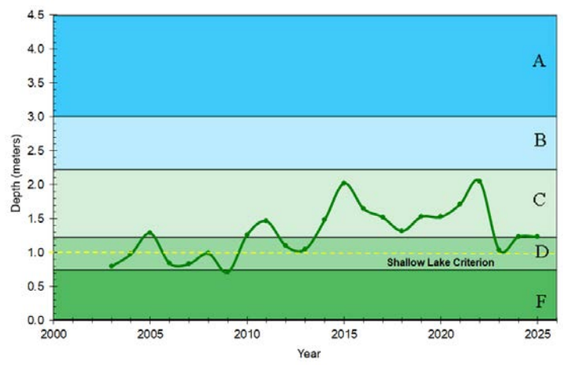
Parameter	State Standard	2025 Bennett Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 60 µg/l	108.3 µg/l	90 µg/l	Worsening
Chlorophyll-*a*	≤ 20 µg/l	55.0 µg/l	22 µg/l	None
Secchi disk transparency	> 1 meter	1.2 meters	1.6 meters	None
Chloride	≤ 230 mg/L [2]	59.7 mg/L	113 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

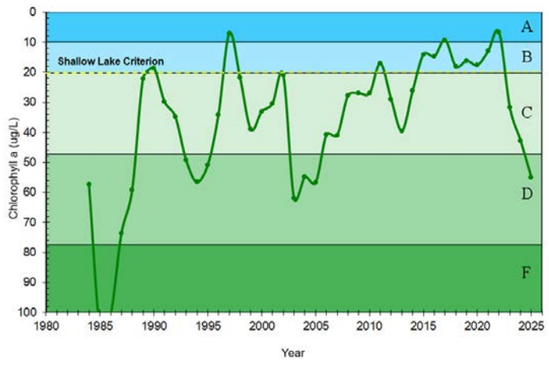
Total phosphorus (µg/l)



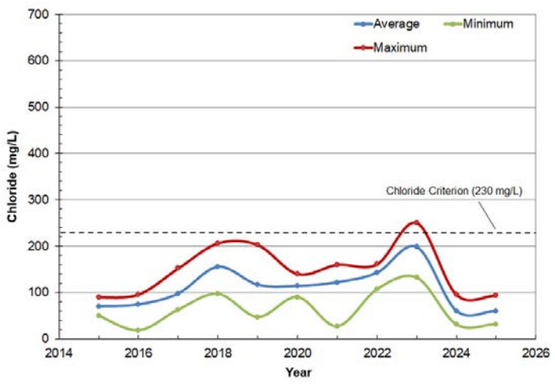
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



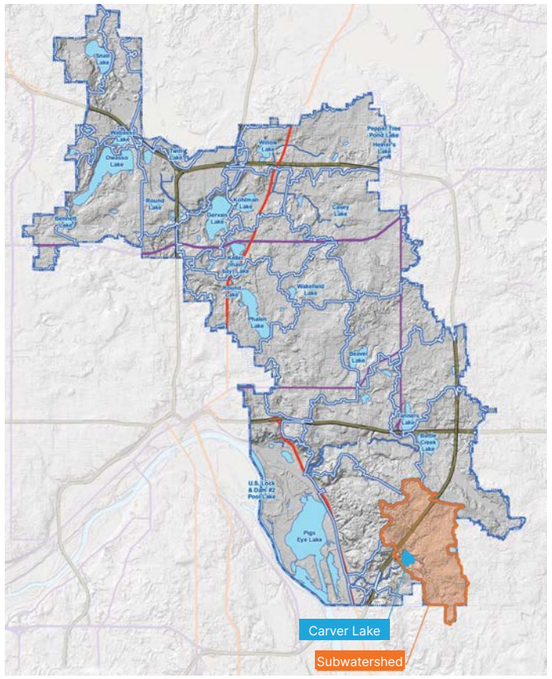
Chloride (mg/L)



CARVER LAKE

Attribute	Description
MPCA designations	Deep lake; "non-support" of aquatic life (chloride)
Tributary area	2,274 acres
Surface area	49 acres
Average/maximum depth	16/36 feet
RWMWD nutrient classification[1]	At risk
Accountable municipalities	Maplewood, Woodbury, Ramsey County, Washington County
Downstream water body	Fish Creek

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Carver Lake, which borders the popular Carver Lake Park, is used primarily for swimming and canoeing. There is a public beach located on the southeast side, along with canoe access.

Carver Lake was removed from the MPCA's impaired list for nutrients in 2014. However, it is still considered to be impaired for mercury (aquatic consumption) and chloride (aquatic life). A statewide mercury TMDL was completed in 2007, and the Twin Cities Metro Area Chloride TMDL was completed in 2016.

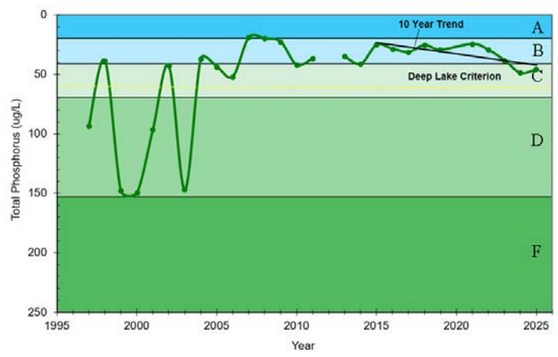
Carver Lake has been monitored annually for phosphorus, chlorophyll-*a*, and Secchi disk depth from 1997 to 2025. Annual chloride monitoring began in 2016. In 2025, the lake did not meet MPCA summer-average state standards for any monitored parameter. The 10-year trend shows a statistically significant worsening of total phosphorus concentrations (see table and graphs at right).

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 79% of the phosphorus in Carver Lake comes from stormwater, and 19% comes from internal loading. Goals for the lake include improving stormwater management by implementing a BMP cost-share program and water quality projects that decrease the phosphorus load to Carver Lake.

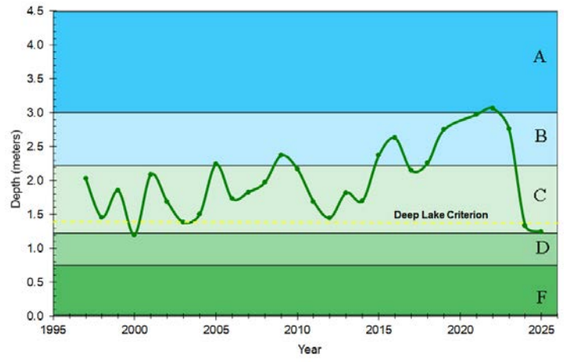
Parameter	State Standard	2025 Carver Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	46.0 µg/l	33 µg/l	Worsening
Chlorophyll-*a*	≤ 14 µg/l	35.2 µg/l	17 µg/l	None
Secchi disk transparency	> 1.4 meters	1.2 meters	2.4 meters	None
Chloride	≤ 230 mg/L [2]	243.3 mg/L	303 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

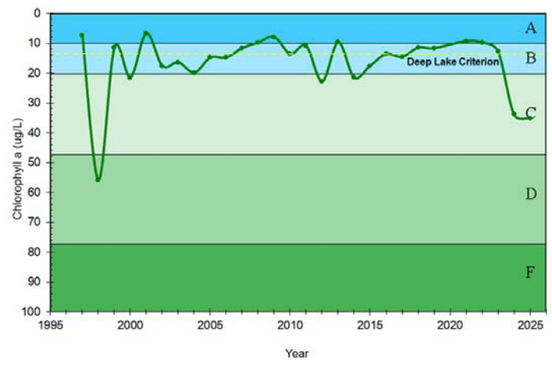
Total phosphorus (µg/l)



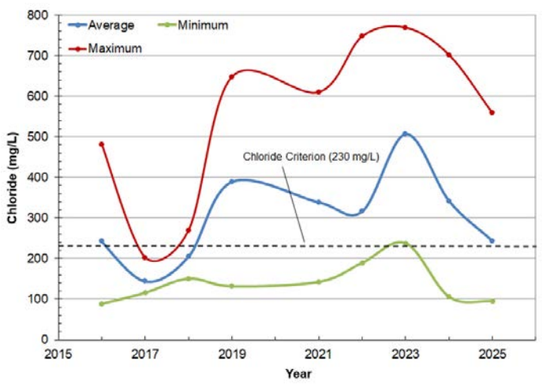
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



Chloride (mg/L)



CASEY LAKE

Casey Lake is actually a large wetland. Located in North St. Paul, it is the headwaters of Kohlman Creek.

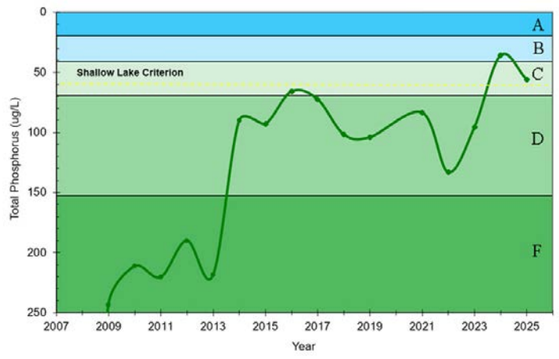
Casey Lake has been monitored annually for phosphorus, chlorophyll-*a*, and Secchi disk depth since 2008; however, as a wetland, state eutrophication standards do not apply. The 10-year data does not show a statistically significant trend in any of the monitored parameters.

In the winter of 2012–2013, a draw-down of Casey Lake was done to kill invasive carp, which used the lake as a nursery. Foraging carp stir up nutrient-rich sediment on the lake bottom, which, in turn, contributes to turbid water and algae blooms. The draw-down dramatically improved the lake's water clarity (from 0.26 meters to 0.88 meters). In the spring of 2013, the DNR stocked bluegills and bass in Casey Lake to keep carp levels low.

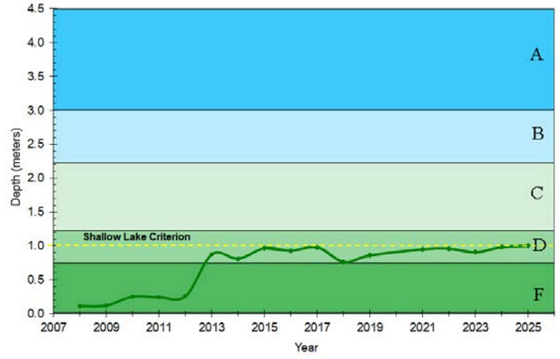
Parameter	State Standard	2025 Casey Lake	10-Year Average[1]	10-Year Trend
Phosphorus	N/A	56.0 µg/l	84 µg/l	None
Chlorophyll-*a*	N/A	18.7 µg/l	18 µg/l	None
Secchi disk transparency	N/A	1.00 meters	0.9 meters	None
Chloride	N/A	50.0 mg/L	N/A	N/A

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.

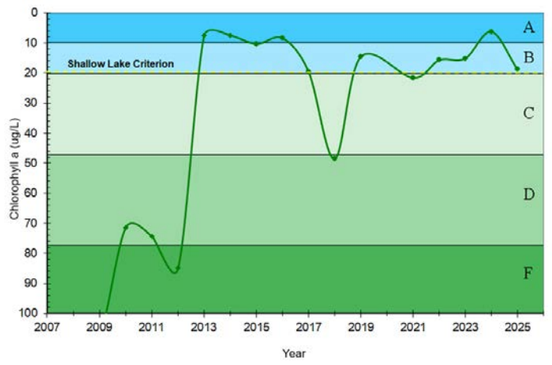
Total phosphorus (µg/l)



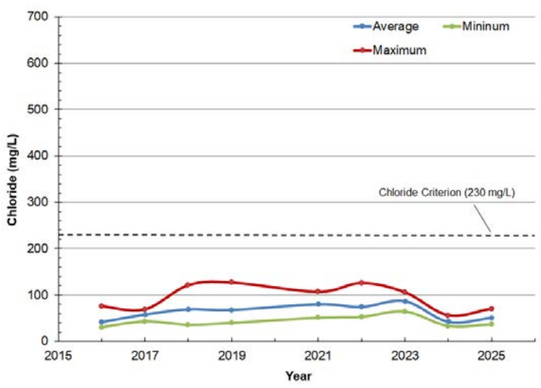
Secchi transparency (m)



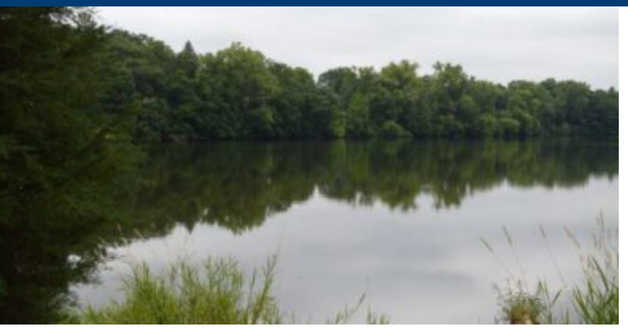
Chlorophyll-*a* (µg/l)



Chloride (mg/L)

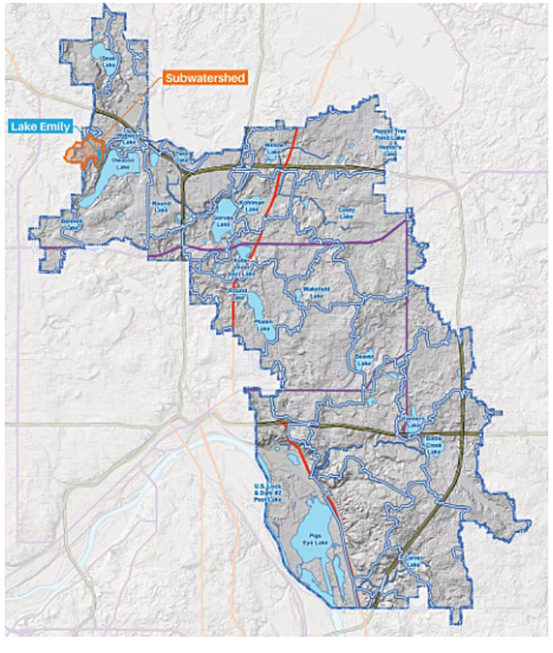


LAKE EMILY



Attribute	Description
MPCA designation	Shallow
Tributary area	244 acres
Surface area	13 acres
Average/maximum depth	7/15 feet
MPCA Designations	N/A
RWMWD nutrient classification[1]	At-risk
Accountable municipalities	Shoreview
Downstream water body	Lake Owasso

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Lake Emily is a small, shallow lake in Shoreview, within Ramsey County. The lake is part of the larger Lake Owasso watershed. Lake Emily is completely surrounded by private land, and there is no public access. Residents use the lake for fishing, canoeing, and aesthetic enjoyment.

The Lake Emily subwatershed is fully developed. Land use is predominantly single-family residential, with some areas of park, recreational, or preserve land use and institutional land uses. Based on water quality modeling, approximately 42% of the nutrient load to Lake Emily comes from the lake sediments, approximately 37% comes from the direct watershed, and approximately 20% comes from the upstream Lake Judy wetland.

The RWMWD has assigned a water quality classification of "At Risk" to Lake Emily based on water quality data that exceed the MPCA standards and RWMWD goals. RWMWD monitored Lake Emily in 2005 and 2013 and the data is included in the table below. In 2024, Lake Emily was monitored for the first time since 2013 due to the installation of the Arbogast CC17 filter. In 2025, the lake did not meet MPCA summer-average state standards for all parameters but chloride.

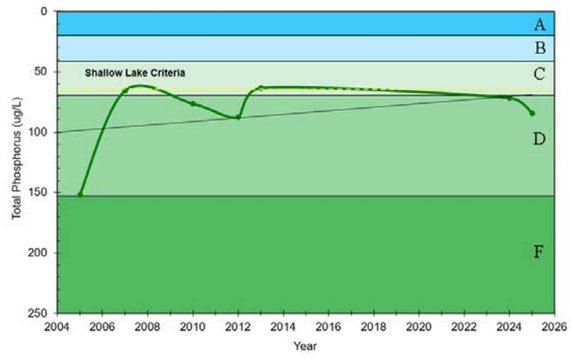
RWMWD has completed one recent project that has contributed to improving the water quality of this lake:

- **Arbogast Filter (2023):** The Arbogast Filter is a regional underground stormwater filter that diverts stormwater runoff from the storm sewer trunkline along Arbogast Street in Shoreview, filters the stormwater through a crushed limestone (CC17) media, and sends the treated water back to the Arbogast storm sewer, which discharges to Lake Emily. The filter is expected to remove approximately 7 pounds of total phosphorus each year. Performance results of the Arbogast Filter is included in Chapter 5.

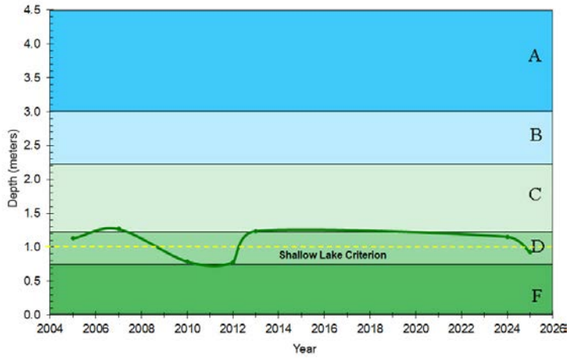
Parameter	State Standard	2025 Lake Emily	Lake Emily (2005-2013) Growing Season Average	Trend (2005-2013)
Phosphorus	≤ 60 µg/l	84.3 µg/l	98 µg/l	Worsening
Chlorophyll-*a*	≤ 20 µg/l	90.2 µg/l	34 µg/l	No Trend
Secchi disk transparency	> 1 meter	0.9 meters	1.4 meters	No Trend
Chloride	≤ 230 mg/L [1]	45.2 mg/L	N/A	N/A

[1] State standard for chronic chloride exposure

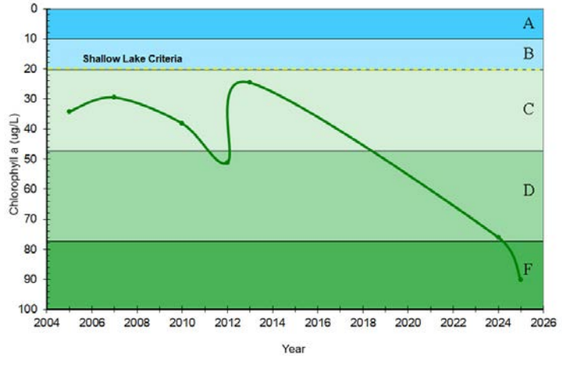
Total phosphorus (µg/l)



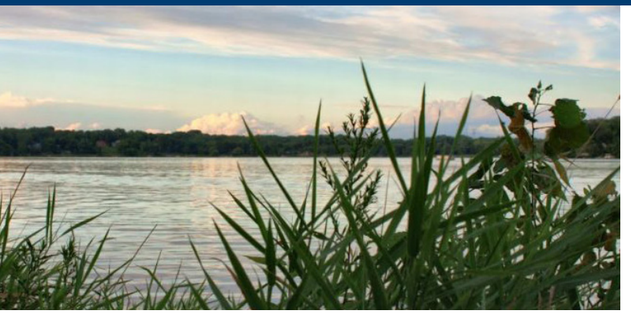
Secchi transparency (m)



Chlorophyll-*a* (µg/l)

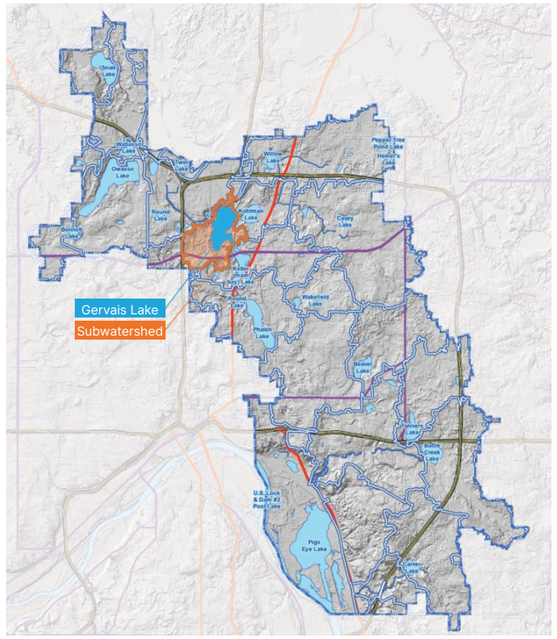


GERVAIS LAKE



Attribute	Description
MPCA designations	Deep; "non-support of aquatic life (fish and chloride)
Tributary area	893 acres
Surface area	234 acres
Average/maximum depth	22/41 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Little Canada, Maplewood, Ramsey County
Downstream water body	Keller Lake

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Gervais Lake is the second and largest lake in the Phalen Chain of Lakes. It is used primarily for swimming, skiing, and boating. There is public boat access from Spoon Lake and a Ramsey County swimming beach and park adjacent to the lake. The lake receives flows from Gervais Creek, Kohlman Lake, and runoff from its direct tributary area.

Gervais Lake is on the MPCA's impaired waters list as impaired for mercury (aquatic consumption), PFOS (perfluorooctane sulfonate, aquatic consumption), fish bioassessment, and chloride. The lake is also listed by the Minnesota DNR as infested with Eurasian watermilfoil and zebra mussels (veligers). A statewide mercury TMDL was completed in 2007.

Annual monitoring for phosphorus, chlorophyll-*a*, and Secchi disk depth started in 1981. Annual monitoring for chloride began in 1998. In 2025, the lake met summer-average state standards for total phosphorus and chloride. The 10-year trend shows a statistically significant worsening of Secchi disk transparency (see table and graphs at right).

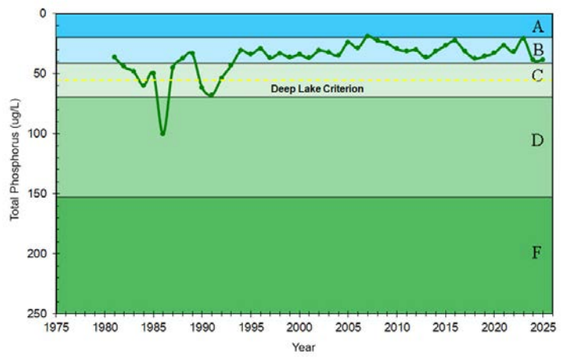
According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 24% of the phosphorus in Gervais Lake comes from stormwater, and 76% comes from upstream water bodies. Plans to address these conditions include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake.

One project that helps control phosphorus loading in the Phalen Chain of Lakes (Gervais, Lake Phalen, Lake Keller, Kohlman Lake) is carp management (ongoing since 2009). Foraging carp stir up nutrient-rich sediment on the lake bottom, which, in turn, contributes to turbid water and algae blooms. Management efforts include counting carp to understand the extent of the population, tracking them with radio tags to allow efficient harvesting and identification of nurseries, and installing barriers. Efforts have reduced carp in the Phalen Chain by over 60%.

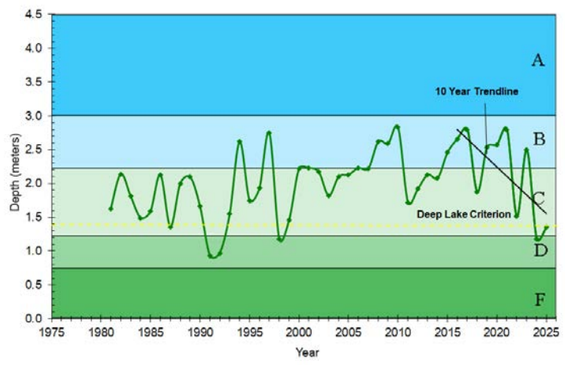
Parameter	State Standard	2025 Gervais Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	38.5 µg/l	32 µg/l	None
Chlorophyll-*a*	≤ 14 µg/l	27.7 µg/l	18 µg/l	None
Secchi disk transparency	> 1.4 meter	1.4 meters	2.2 meters	Worsening
Chloride	≤ 230 mg/L [2]	147 mg/L	186 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

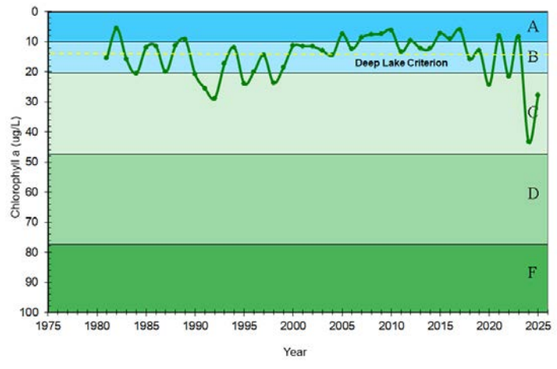
Total phosphorus (µg/l)



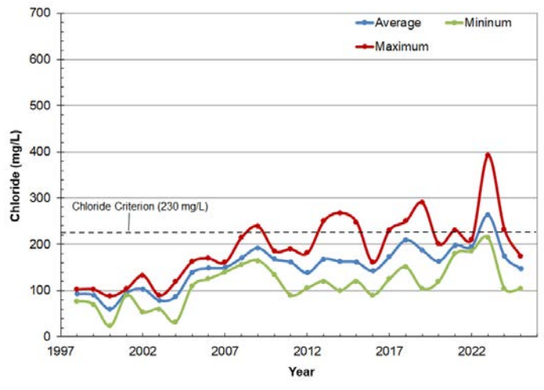
Secchi transparency (m)



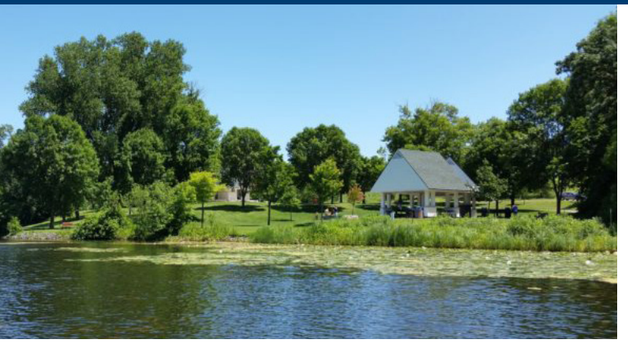
Chlorophyll-*a* (µg/l)



Chloride (mg/L)

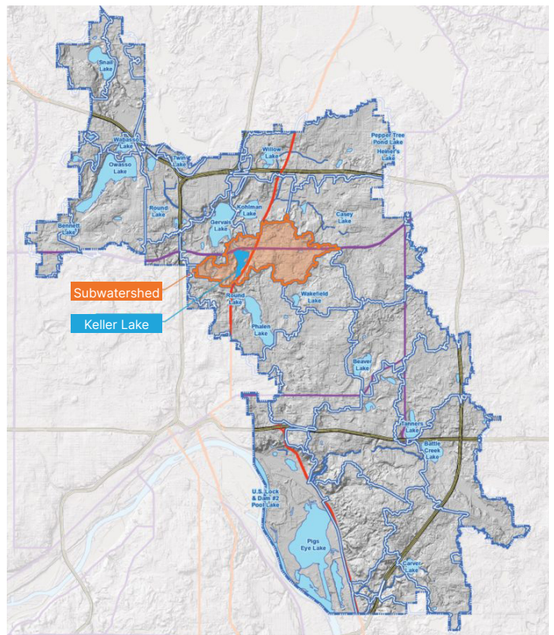


KELLER LAKE



Attribute	Description
MPCA designation	Shallow
Tributary area	1,577 acres
Surface area	72 acres
Average/maximum depth	4/8 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Little Canada, Maplewood, Ramsey County
Downstream water body	Lake Phalen

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Keller Lake is the third lake in the Phalen Chain of Lakes and is used for motor boating, canoeing, fishing, picnicking, and aesthetic viewing. There is a Ramsey County park on the lake's east shoreline. Flows to the lake are received from Gervais Lake (through Spoon Lake) and runoff from its direct tributary area.

Keller Lake is listed as impaired for PFOS (aquatic consumption) and was listed as impaired for excess nutrients in 2002 but was removed from the list in 2014 after meeting state standards (for shallow lakes). The lake is still at risk of impairment for chlorides. In addition, Keller Lake is listed by the Minnesota DNR as infested with Eurasian watermilfoil and exposed to zebra mussels due to its connection with Gervais Lake.

Annual monitoring for phosphorus, chlorophyll-*a*, and Secchi disk depth began in 1981; monitoring for chlorides started in 2015. In 2025, Keller Lake met summer-average state standards for all parameters except for chlorophyll-*a* (see table and graphs at right). The 10-year data shows a statistically significant trend of worsening chlorophyll-*a* concentration and Secchi disk depth.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 42% of the phosphorus in Lake Keller comes from stormwater, 8% comes from internal loading, and 49% comes from upstream water bodies. Strategies to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake. Internal loading is being addressed by managing carp.

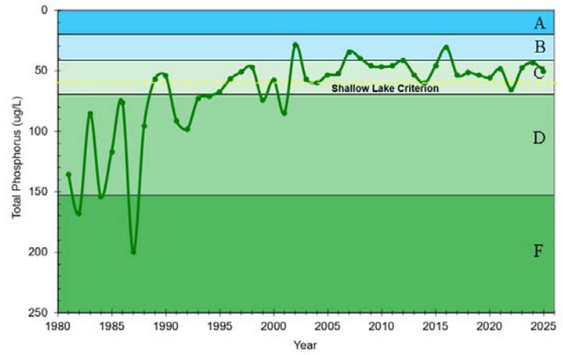
Several recent projects have helped Keller Lake meet state water-quality standards. These include:

- **Carp management (ongoing since 2009):** Carp management helps control phosphorus loading in the Phalen Chain of Lakes (Keller Lake, Gervais Lake, Lake Phalen, and Kohlman Lake). Foraging carp stir up nutrient-rich sediment on the lake bottom, which, in turn, contributes to turbid water and algae blooms. Management efforts include counting carp to understand the extent of the population, tracking them with radio tags to allow efficient harvesting and identification of nurseries, and installing barriers. Efforts have reduced carp in the Phalen Chain by over 60%.
- **Keller Lake Shoreline (2012):** This ecological restoration project treated over 2,000 feet of shoreline, helping to reduce the volume of polluted stormwater that reaches the lake. The restoration areas now support more than 75 species of native plants.
- **Lakeview Lutheran (2013)** is one of 12 projects to manage rainwater runoff at churches with large amounts of impervious surface. Three rain gardens were installed, as well as a native planting area that provides pollinator habitat. The gardens and planting area filter runoff from the church parking lot.

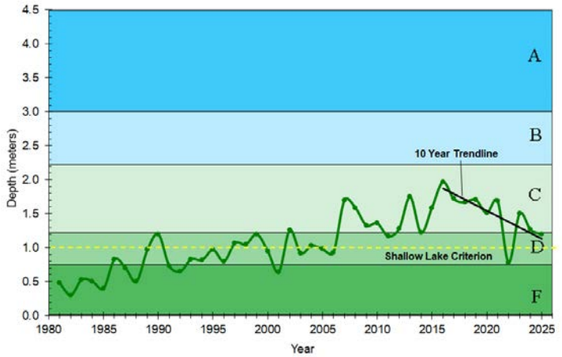
Parameter	State Standard	2025 Keller Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 60 µg/l	50.1 µg/l	50 µg/l	None
Chlorophyll-*a*	≤ 20 µg/l	24.7 µg/l	16 µg/l	Worsening
Secchi disk transparency	> 1 meter	1.2 meters	1.5 meters	Worsening
Chloride	≤ 230 mg/L [2]	125.4 mg/L	166 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

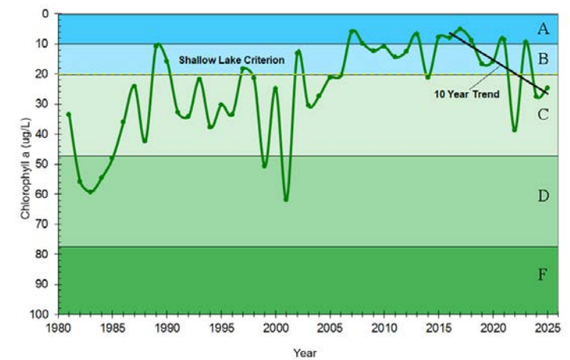
Total phosphorus (µg/l)



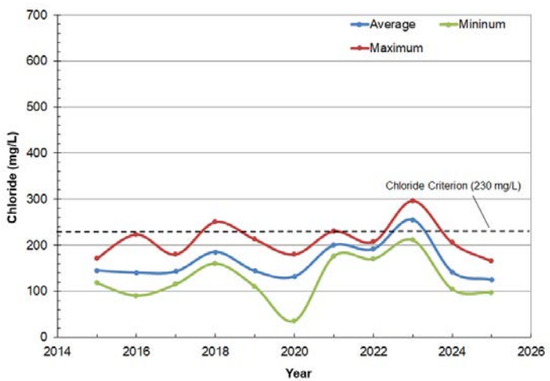
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



Chloride (mg/L)

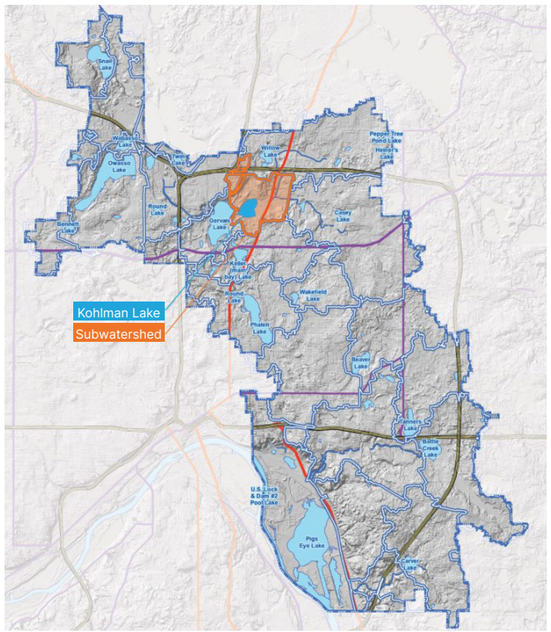


- **The Highway 36/61 project (2014):** This project was constructed as part of the overall Trunk Highway 36 and English Street interchange effort. It included the installation of a stormwater treatment system to prevent polluted stormwater runoff from entering Keller Lake and downstream Lake Phalen. The project treats stormwater from approximately 70 acres of commercial, residential, and highway areas by channeling it through an enhanced sand filter cell and two wetland treatment basins designed to remove phosphorus-rich sediment and other contaminants.
- **Weaver Elementary School (2016)** is one of six school rain garden projects to manage polluted runoff at schools in priority areas of the watershed. This project also provides needed pollinator habitat.

KOHLMAN LAKE

Attribute	Description
MPCA designations	Shallow; "non-support" of aquatic life (chloride)
Tributary area	1,009 acres
Surface area	84 acres
Average/maximum depth	4/12 feet
RWMWD nutrient classification[1]	At-risk (changed from "impaired" in 2022 MPCA assessment)
Accountable municipalities	Little Canada, Maplewood, Vadnais Heights, Ramsey County
Downstream water body	Gervais Lake

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Kohlman Lake is the first lake in the Phalen Chain of Lakes. It is used for a variety of recreational purposes, including motor boating, canoeing, fishing, picnicking, and aesthetic viewing. While the drainage area that directly reaches the lake is just over 1,000 acres, the total area connected to the lake through Kohlman and Willow Creeks is about 7,500 acres. There is no direct public boat access to Kohlman Lake, but it can be accessed from Gervais Lake.

Kohlman Lake is listed as impaired for chloride (aquatic life). It was also listed for excess nutrients in 2002 but delisted in 2024. In addition, Kohlman is listed by the Minnesota DNR as infested with Eurasian watermilfoil (although none was observed in a 2025 macrophyte survey by the county), and exposed to zebra mussels due to its connection to Gervais Lake. A nutrient TMDL was completed in 2010, and the Twin Cities Metro Area Chloride TMDL was completed in 2016.

Annual monitoring for phosphorus, chlorophyll-*a*, and Secchi disk depth has occurred since 1981. Annual monitoring for chlorides began in 2021. In 2025, Kohlman Lake met the summer-average state standards for Secchi disk depth and chloride. The 10-year trend shows a statistically significant trend of worsening total phosphorus concentration, chlorophyll-*a* concentration, and Secchi disk depth. These parameters are expected to improve in 2026 after a planned alum treatment in the spring.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 76% of the phosphorus in Kohlman Lake comes from stormwater, and 23% comes from internal loading. Strategies to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake. An initial alum treatment was completed on the lake in 2010; another alum treatment is planned for early 2026.

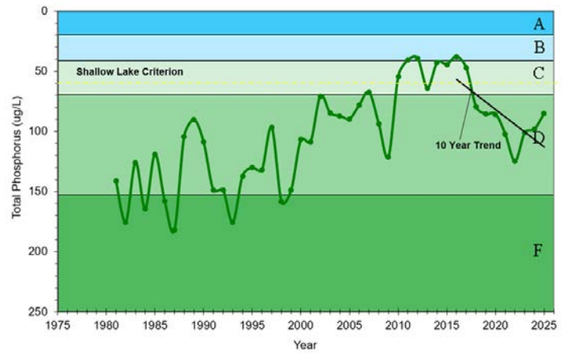
A few projects have helped improve water quality in Kohlman Lake:

- **Beam Avenue iron-enhanced sand filter (2009):** During construction of the new Country View Lane in Maplewood, RWMWD constructed a sand filter to remove dissolved phosphorus from stormwater. Sand filters have been used for years to remove solids and some pollutants from stormwater, but elemental iron (often called zero-valent iron) was added to the sand to remove dissolved phosphorus by forming iron-phosphate complexes. RWMWD monitoring indicates this practice effectively removes about 90 percent of dissolved phosphorus in the tributary stormwater. This filter is evaluated in Chapter 5.
- **Carp management (ongoing since 2009):** Carp management helps control phosphorus loading in the Phalen Chain of Lakes (Kohlman Lake, Lake Phalen, Gervais Lake, Lake Keller). Foraging carp stir up nutrient-rich sediment on the lake bottom, which, in turn, contributes to turbid water and algae blooms. Management efforts include counting carp to understand the extent of the population, tracking them with radio tags to allow efficient harvesting and identification of nurseries, and installing barriers. These efforts have reduced carp in the Phalen Chain by over 60%.
- **Alum Treatment (2010):** An in-lake alum treatment was performed on the lake in 2010.
- **Maplewood Mall (2012):** With 35 acres of asphalt pavement and concrete surfaces surrounding it, Maplewood Mall was a major source of phosphorus runoff to Kohlman Lake. But, over 4 years, the RWMWD installed a variety of stormwater management features that capture and filter 67 percent of rainwater at the mall—up from just 3 percent before the project. These features include innovative tree trenches, rain gardens, permeable pavers, and a 5,700-gallon cistern that receives runoff from the mall roof. Interpretive signage educates the public about these improvements, and a large watershed map in the entry vestibule shows how water travels from the mall all the way to the Mississippi River.
- **Maplewood Toyota (2025):** Maplewood Toyota's BMP is a pretreatment structure to reduce pollutants being deposited directly into the wetland that flows into Kohlman Lake.

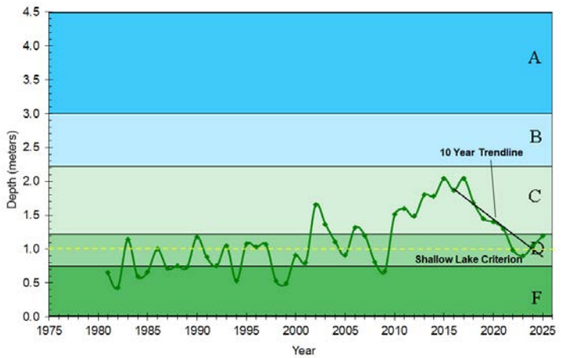
Parameter	State Standard	2025 Kohlman Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 60 µg/l	85.2 µg/l	85 µg/l	Worsening
Chlorophyll-*a*	≤ 20 µg/l	22.7 µg/l	22 µg/	Worsening
Secchi disk transparency	> 1 meter	1.2 meters	1.4 meters	Worsening
Chloride	≤ 230 mg/L [2]	104 mg/L	152 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

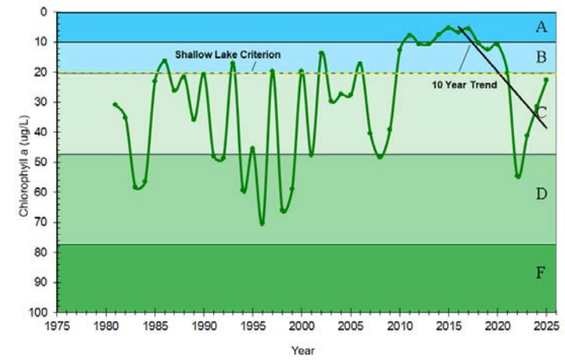
Total phosphorus (µg/l)



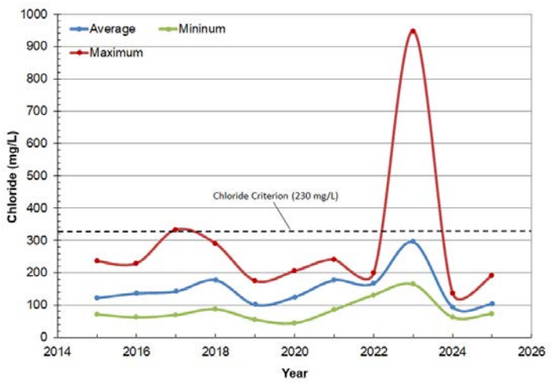
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



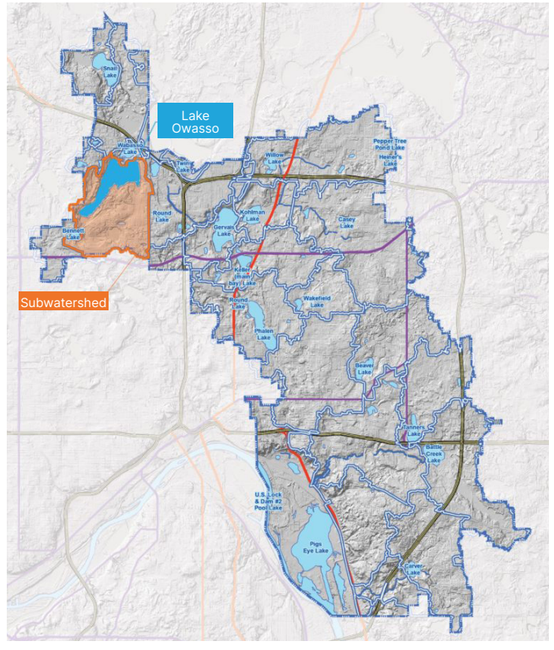
Chloride (mg/L)



LAKE OWASSO

Attribute	Description
MPCA designation	Deep
Tributary area	2,175 acres
Surface area	375 acres
Average/maximum depth	11/37 feet
RWMWD nutrient classification[1]	At risk
Accountable municipalities	Roseville, Shoreview, Ramsey County
Downstream waterbody	Lake Wabasso

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Lake Owasso is the largest lake in the RWMWD and a major regional recreational resource for fishing, boating, waterskiing, and swimming. Roseville's Central Park North (along the south shore of the lake) and Owasso County Park in the city of Shoreview (on the north side) provide two public access points, including a boat launch and a public swimming beach. Lake Owasso receives water from Bennett Lake and Lake Emily.

Lake Owasso was delisted for mercury (aquatic consumption) impairment in 2020. The lake is also listed by the Minnesota DNR as infested with Eurasian watermilfoil and zebra mussels. A statewide mercury TMDL was completed in 2007.

Phosphorus and Secchi disk depth have been monitored annually at Lake Owasso from 2003 to 2025. Chlorophyll-*a* has been monitored annually since 1984, and chlorides have been monitored since 2015. 2025 monitoring shows that the lake meets summer-average state standards for all parameters but chlorophyll-*a*. The 10-year data shows a statistical significant worsening of chloride concentrations.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 31% of the phosphorus in Lake Owasso comes from stormwater, and 63% comes from internal loading. Plans to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake. Internal loading will be addressed by managing carp as needed.

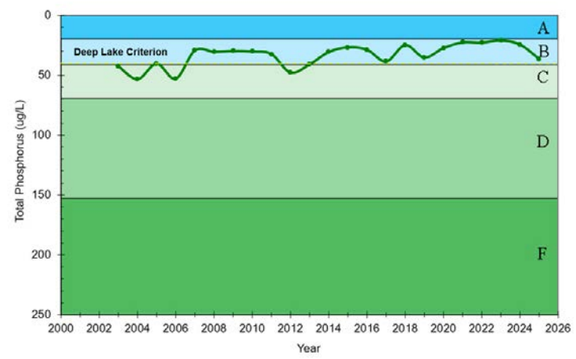
Several projects have been completed to improve water quality in Lake Owasso:

- **Central Park Elementary (2017)** is one of six school rain garden projects that provide needed pollinator habitats and reduce the volume of polluted runoff. RWMWD's goal was to manage rainwater runoff at schools in priority areas of the watershed while engaging local communities in a shared learning experience.
- **Prince of Peace Lutheran Church (2015) and North Heights Christian Academy (2017)** are two of 12 projects to manage rainwater runoff at churches with large amounts of impervious surfaces. The goal of these projects was to install rain gardens to intercept and filter polluted runoff from the church parking lots.
- **Carp management (ongoing since 2017):** With four interconnected lakes (Owasso, Wabasso, Bennett, and Grass) and 12 shallow ponds, the Lake Owasso system offers prime habitat for carp to potentially out-compete native game fish. As carp root for food along the lake bottom, they stir up nutrient-rich sediment, which, in turn, contributes to turbid water and algae blooms. Management efforts include counting carp to understand the extent of the population, tracking them with radio tags to allow efficient harvesting and identification of nurseries, and installing barriers.

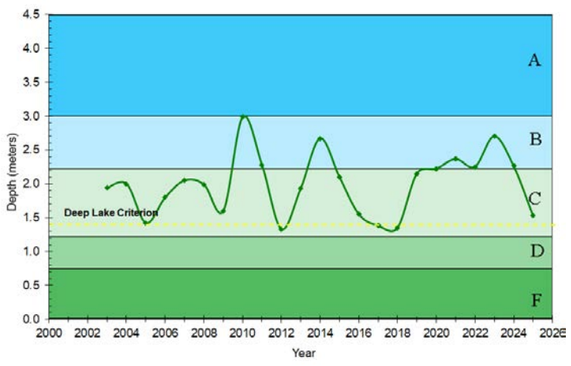
Parameter	State Standard	2025 Lake Owasso	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	36.3 µg/l	28 µg/l	None
Chlorophyll-*a*	≤ 14 µg/l	28.9 µg/l	14 µg/l	None
Secchi disk transparency	> 1.4 meter	1.5 meters	2.0 meters	None
Chloride	≤ 230 mg/L [2]	71.3 mg/L	65 mg/L	Worsening

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

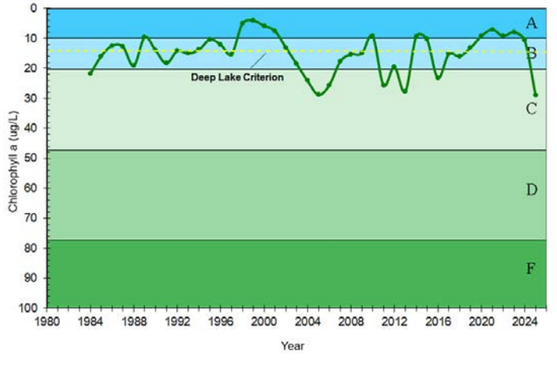
Total phosphorus (µg/l)



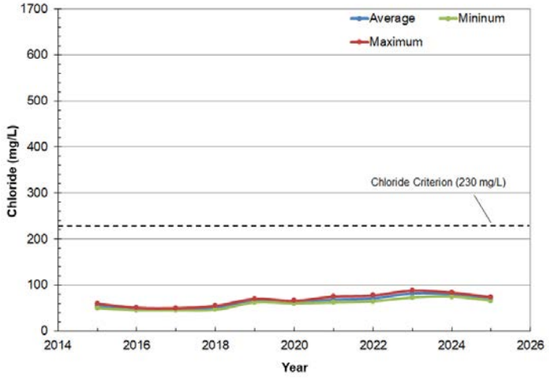
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



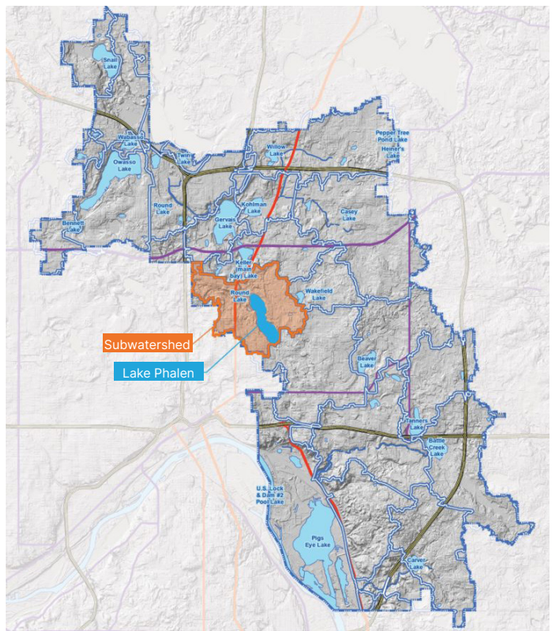
Chloride (mg/L)



LAKE PHALEN

Attribute	Description
MPCA designation	Deep
Tributary area	1,995 acres
Surface area	200 acres
Average/maximum depth	22/95 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Maplewood, St. Paul, Ramsey County
Downstream water body	Mississippi River via the Beltline Interceptor storm sewer

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Lake Phalen, the downstream-most lake in the Phalen Chain of Lakes, is surrounded by park land that has 2 miles of restored shoreline. The lake is used primarily for swimming, fishing, paddling, picnicking, and aesthetic viewing. It has public boating access and a swimming beach. While the direct tributary area to the lake is close to 2,000 acres, the total land area that ultimately drains through Lake Phalen is closer to 15,000 acres, including the Keller Lake and Wakefield Lake subwatersheds.

Lake Phalen is impaired for mercury (aquatic consumption) and PFOS (aquatic consumption) and is listed by the Minnesota DNR as infested with Eurasian watermilfoil. A statewide mercury TMDL was completed in 2007.

Phosphorus, chlorophyll-*a*, and Secchi disk depth have been monitored annually since 1981. Annual chloride monitoring began in 2015. In 2025 the lakes met summer-average state standards for all parameters. The 10-year data shows a statistically worsening of chloride concentration.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 68% of the phosphorus in Lake Phalen comes from stormwater, and 32% comes from internal loading. Plans to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake.

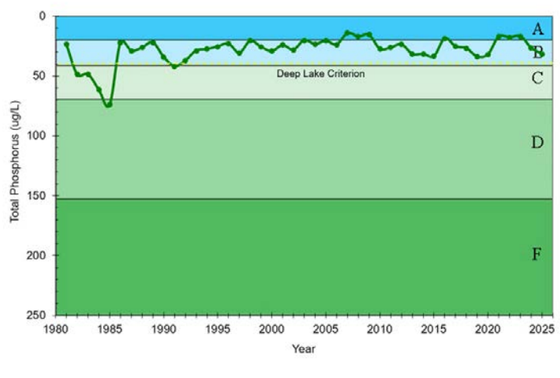
Projects that have improved water quality in Lake Phalen include:

- **Carp management (ongoing since 2009):** Carp management helps control phosphorus loading in the Phalen Chain of Lakes (Lake Phalen, Gervais Lake, Lake Keller, Kohlman Lake). Foraging carp stir up nutrient-rich sediment on the lake bottom, which, in turn, contributes to turbid water and algae blooms. Management efforts include counting carp to understand the extent of the population, tracking them with radio tags to allow efficient harvesting and identification of nurseries, and installing barriers. These efforts have reduced carp in the Phalen Chain by over 60%.
- **Phalen shoreline restoration (2010):** This project has become one of the largest lakeshore restoration efforts in Minnesota. The long-term effort involved restoring deep-rooted native plants to filter stormwater, prevent erosion, and create needed urban wildlife habitat. More than 100 native plant species have become established along the shore.
- **Keller Golf Course (2014):** Keller is a beautiful public course located just east of Lake Keller. The no-play areas on this course comprise part of the Phalen Chain of Lakes natural areas corridor, providing critical wildlife habitat and improving infiltration. This improvement project restored more than seven acres of no-play area.

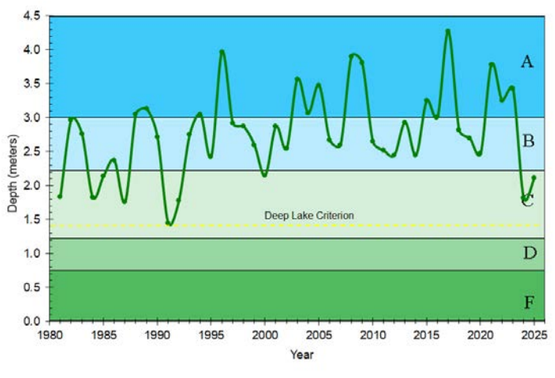
Parameter	State Standard	2025 Lake Phalen	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	31.6 µg/l	25 µg/l	None
Chlorophyll-*a*	≤ 14 µg/l	12.2 µg/l	9 µg/l	None
Secchi disk transparency	> 1.4 meters	2.1 meters	3.0 meters	None
Chloride	≤ 230 mg/L [2]	138.1 mg/L	153 mg/L	Worsening

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

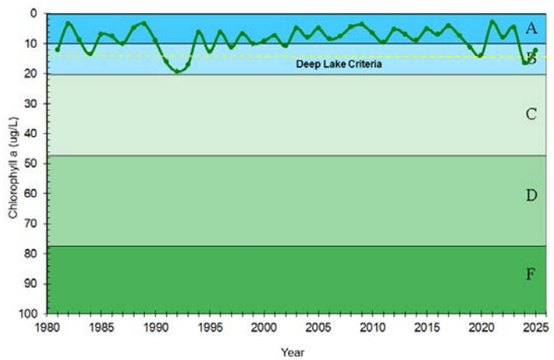
Total phosphorus (µg/l)



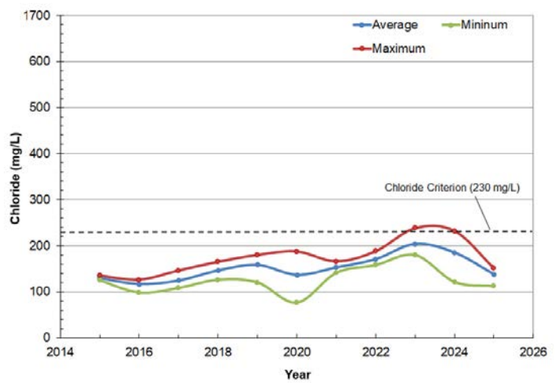
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



Chloride (mg/L)

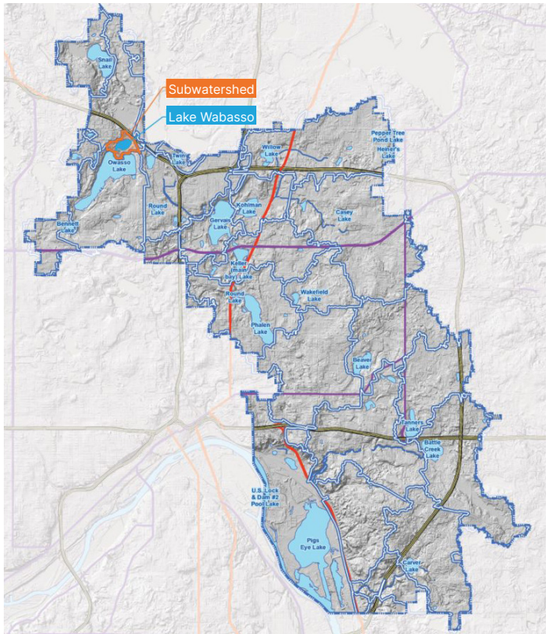


- **Keller Creek buffer (2018):** The Keller Creek restoration effort restored native plant communities, removed invasive vegetation, reduced erosion, and brought significant improvements to wildlife habitat and recreation along nearly a mile of the creek.

LAKE WABASSO

Attribute	Description
MPCA designation	Deep
Tributary area	147 acres
Surface area	52 acres
Average/maximum depth	16/66 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Shoreview, Ramsey County
Downstream waterbody	Grass Lake

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Lake Wabasso is a deep lake in Shoreview that supports a healthy fish population. In addition to fishing, it is used for boating and swimming. Boat access is provided in Lake Owasso County Park on the south side. Lake Wabasso was delisted for mercury (aquatic consumption) by the MPCA in 2020. It is also listed by the Minnesota DNR as infested with Eurasian watermilfoil.

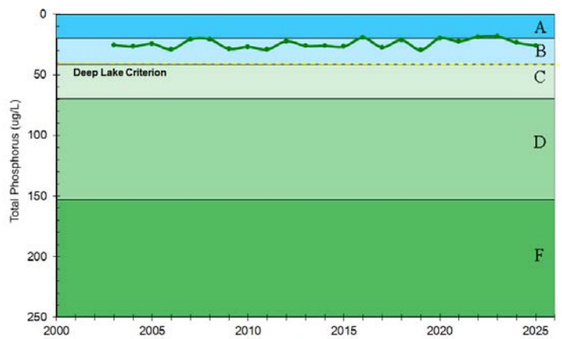
Chlorophyll-*a* has been monitored annually at Lake Wabasso since 1984. Phosphorus and Secchi disk depths have been monitored annually since 2003. Annual chloride monitoring began in 2015. In 2025, Lake Wabasso met summer-average state standards for all four parameters. The 10-year data shows a statistically significant trend of chloride concentrations worsening.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 13% of the phosphorus in Lake Wabasso comes from stormwater, 62% comes from internal loading, and 22% comes from atmospheric deposition. Plans to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake.

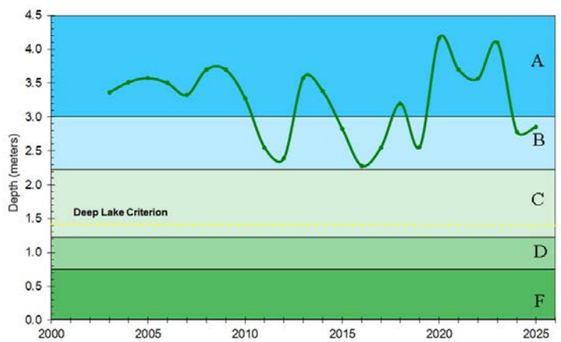
Parameter	State Standard	2025 Lake Wabasso	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	25.9 µg/l	23 µg/	None
Chlorophyll-*a*	≤ 14 µg/l	10.0 µg/L	7 µg/	None
Secchi disk transparency	> 1.4 meters	2.9 meters	3.2 meters	None
Chloride	≤ 230 mg/L [2]	72.2 mg/L	62 mg/L	Worsening

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

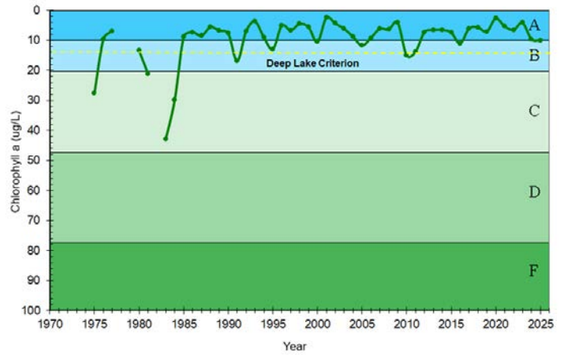
Total phosphorus (µg/l)



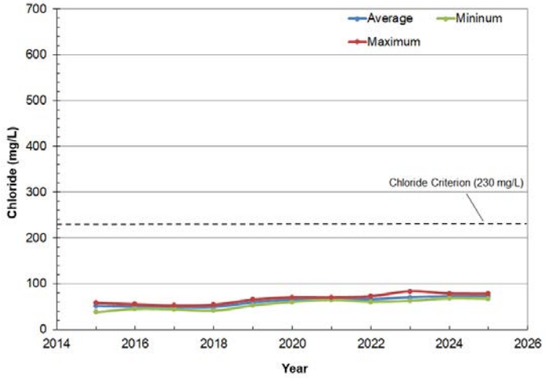
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



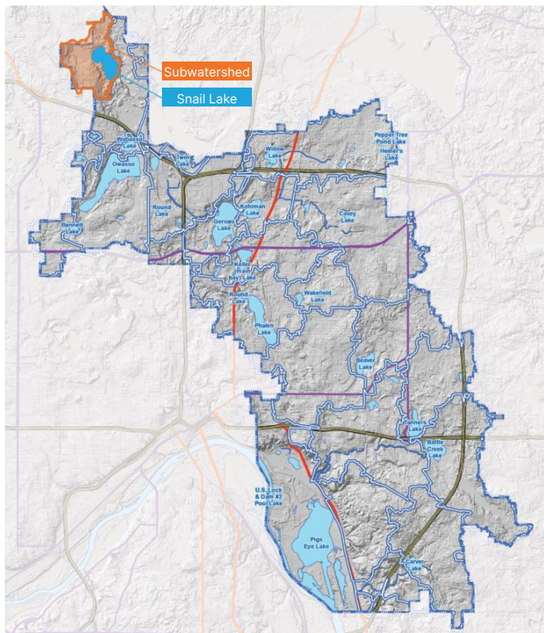
Chloride (mg/L)



SNAIL LAKE

Attribute	Description
MPCA designation	Deep
Tributary area	961 acres
Surface area	190 acres
Average/maximum depth	28 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Shoreview, Ramsey County
Downstream waterbody	Landlocked

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Snail Lake is a 190-acre landlocked lake in the city of Shoreview; a 35 acre wetland can be found on the northwest side of the lake. The lake, used for fishing, boating, and swimming, is bordered by Snail Lake Regional Park to the south. The park includes public access and a swimming beach.

Snail Lake is impaired for mercury (aquatic consumption); a statewide mercury TMDL was completed in 2007. The lake is also listed by the Minnesota DNR as infested with Eurasian watermilfoil.

Phosphorus, chlorophyll-*a*, and Secchi disk depth have been monitored annually since 2005. Annual monitoring of chloride began in 2015. In 2025, the lake met summer-average state standards for all four water-quality parameters. The 10-year data shows a statistically significant trend of chloride concentrations worsening.

According to the *2017 Ramsey Washington Metro Watershed District Watershed Restoration and Protection Strategies Report*, 30% of the phosphorus in Snail Lake comes from stormwater, 11% comes from internal loading, and 51% from upstream water bodies. Strategies to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake.

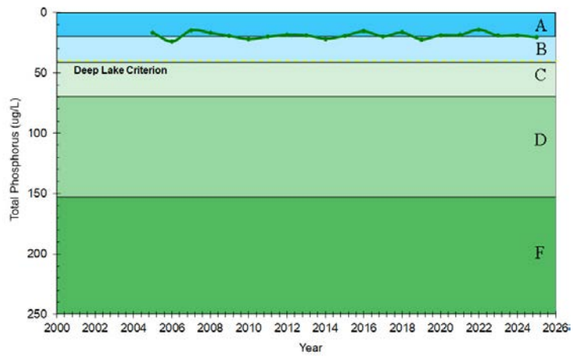
One project that has improved water quality in Snail Lake is:

- **Wetland A ecological restoration (2020 and 2021):** RWMWD partnered with Ramsey County and other organizations to conduct a 3-year ecological restoration project in the area. Between 2020 and 2021, RWMWD staff and volunteers restored 4.8 acres of shoreline that stretched approximately 4,500 feet long. Over 80 species of native plants were installed as natural buffers in place of invasive species like common buckthorn.

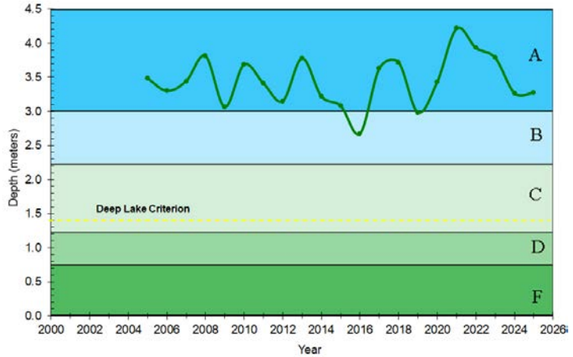
Parameter	State Standard	2025 Snail Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	20.7 µg/l	18 µg/l	None
Chlorophyll-*a*	≤ 14 µg/l	6.1 µg/l	5 µg/l	None
Secchi disk transparency	> 1.4 meters	3.3 meters	4 meters	None
Chloride	≤ 230 mg/L [2]	92.2 mg/L	93 mg/L	Worsening

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

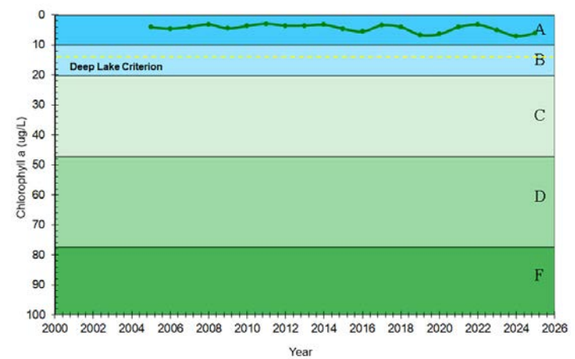
Total phosphorus (µg/l)



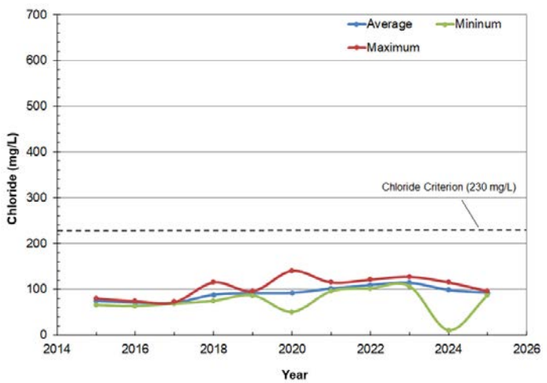
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



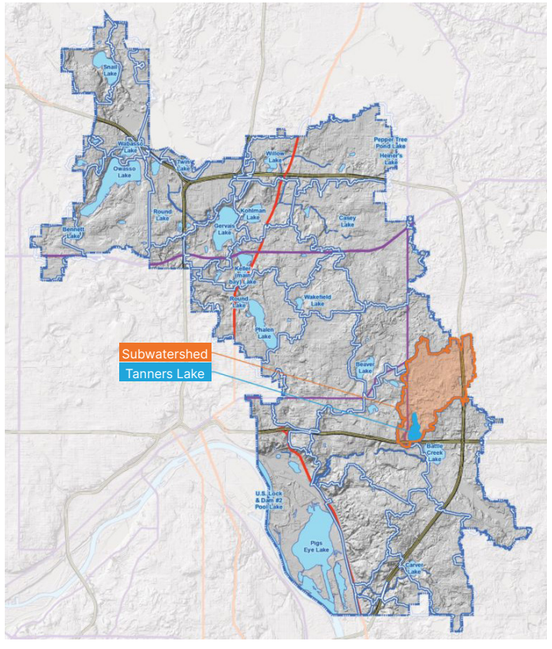
Chloride (mg/L)



TANNERS LAKE

Attribute	Description
MPCA designations	Deep; "non-support" of aquatic life (chloride)
Tributary area	1,707 acres
Surface area	74 acres
Average/maximum depth	20/46 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Landfall, Maplewood, Oakdale, Woodbury, Ramsey County, Washington County
Downstream water body	Battle Creek Lake

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Located almost entirely within the cities of Oakdale and Landfall, Tanners Lake discharges into the headwaters of Battle Creek—a tributary of the Mississippi River. The lake is used primarily for swimming, skiing, motor boating, fishing, canoeing, picnicking, and aesthetic viewing. Tanners Lake Park, which includes a beach for swimming and boat access for fishing, is located on the east shore of the lake. Facilities are also present for softball and volleyball.

Tanners Lake was listed as impaired for excess nutrients in 2002, but after meeting state standards, it was removed from the impaired waters list in 2004. It is was also delisted for mercury (aquatic consumption) in 2020. The lake is listed as impaired for chloride (aquatic life) and PFOS (aquatic consumption). A statewide mercury TMDL was completed in 2007, and the Twin Cities Metro Area Chloride TMDL was completed in 2016.

RWMWD currently operates an aluminum sulfate (alum) treatment facility on the north end of Tanners Lake that treats a significant portion of watershed runoff before it enters the lake. Alum is injected into the stormwater runoff, which causes phosphorus to precipitate out and settle into a sedimentation pond.

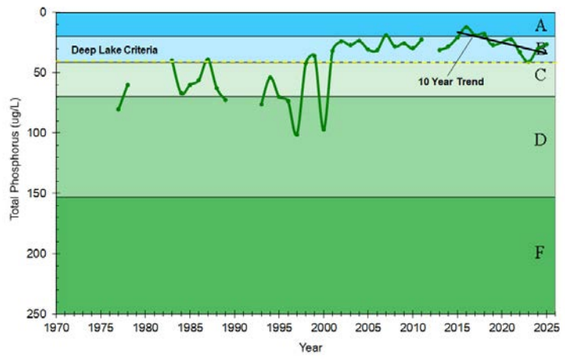
Phosphorus, chlorophyll-*a*, and Secchi disk depth have been monitored annually since 1993. Annual chloride monitoring began in 2017. In 2025, the lake met summer-average state standards for all parameters but chlorophyll-*a*. The 10-year data shows a statistically significant trend of worsening phosphorus concentration, chlorophyll-*a* concentration, and Secchi disk depth.

Strategies to address stormwater pollution include implementing the BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake. Plans to address chloride include improving road salt management by promoting and adopting strategies in the Twin Cities Metro Area Chloride Management Plan.

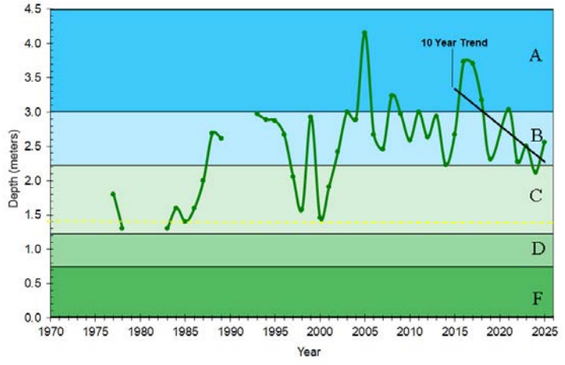
Parameter	State Standard	2025 Tanners Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	26.4 µg/l	25 µg/l	Worsening
Chlorophyll-*a*	≤ 14 µg/l	14.2 µg/l	10 µg/l	Worsening
Secchi disk transparency	> 1.4 meters	2.6 meters	2.8 meters	Worsening
Chloride	≤ 230 mg/L [2]	132 mg/L	205 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

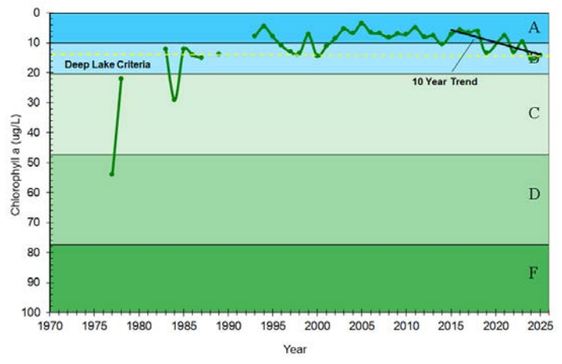
Total phosphorus (µg/l)



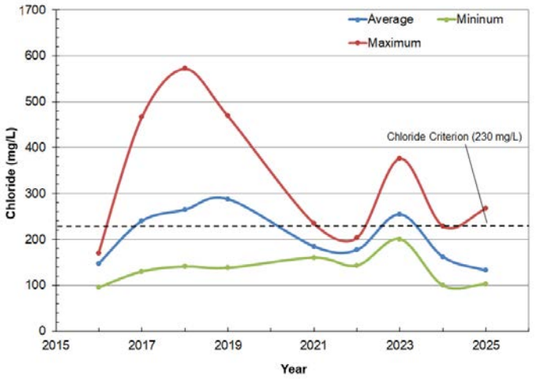
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



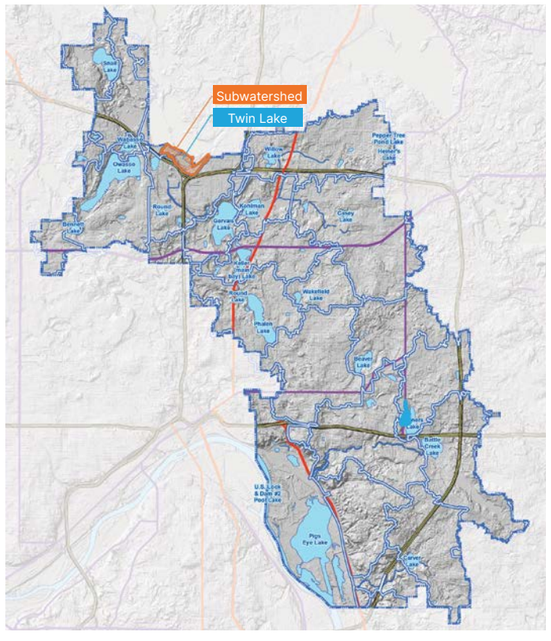
Chloride (mg/L)



TWIN LAKE

Attribute	Description
MPCA designation	Deep
Tributary area	192 acres
Surface area	35.5 acres
Average/maximum depth	33 feet
RWMWD nutrient classification[1]	Stable
Accountable municipalities	Little Canada, Vadnais Heights, Ramsey County
Downstream waterbody	Gervais Creek

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Twin Lake lies in Little Canada and Vadnais Heights. It is a small and relatively deep lake, mainly surrounded by homes. Formerly landlocked, an outlet was installed in the lake in 2020 to allow water to discharge to Gervais Creek during high water periods. Twin Lake has some wildlife habitat and is primarily used for canoeing, aesthetic viewing, fishing, and occasional jet skiing; there is no public access. The lake is not impaired.

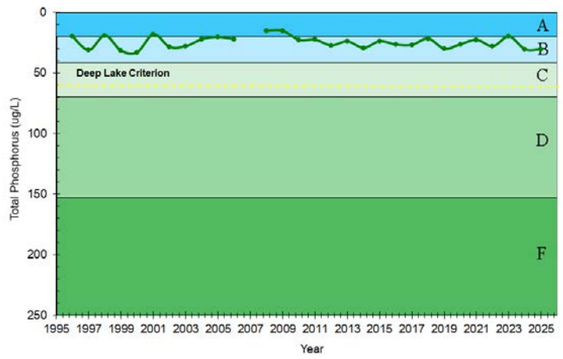
With the exception of 2007, phosphorus, chlorophyll-*a*, and Secchi disk depth have been monitored annually on Twin Lake since 1996. Annual monitoring of chloride began in 2015. In 2025, the lake did not meet the summer-average state standards for chlorophyll-*a*. The 10-year data shows a statistically significant trend of worsening chloride concentration.

Strategies to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake.

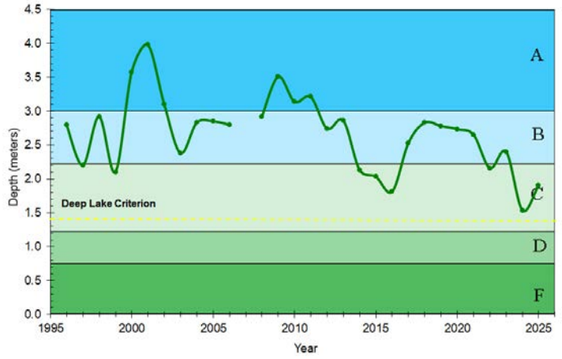
Parameter	State Standard	2025 Twin Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 40 µg/l	30.5 µg/l	26 µg/l	None
Chlorophyll-*a*	≤ 14 µg/l	14.3 µg/l	12.0 µg/l	None
Secchi disk transparency	> 1.4 meters	1.9 meters	2.3 meters	None
Chloride	≤ 230 mg/L [2]	59.9 mg/L	58 mg/L	Worsening

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

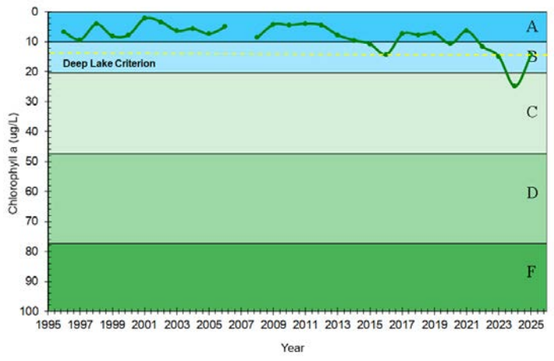
Total phosphorus (µg/l)



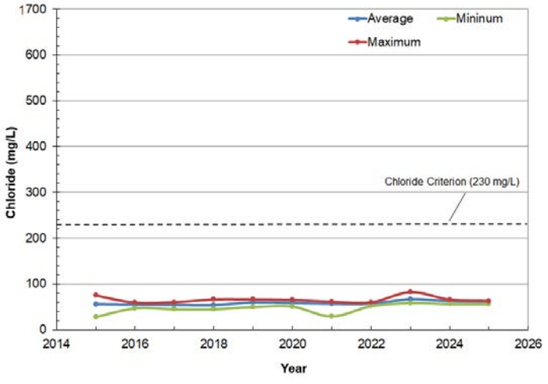
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



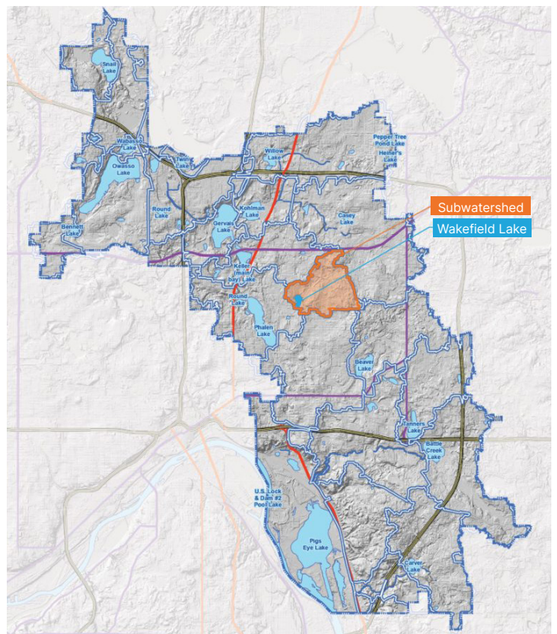
Chloride (mg/L)



WAKEFIELD LAKE

Attribute	Description
MPCA designation	Shallow
Tributary area	948 acres
Surface area	23 acres
Average/maximum depth	4.6/9 feet
RWMWD nutrient classification[1]	Impaired
Accountable municipalities	Maplewood, North St. Paul, St. Paul, Ramsey County
Downstream water body	Lake Phalen

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Wakefield Lake is located in Maplewood and is primarily used for shoreline fishing, picnicking, and aesthetic viewing. It is bordered by park land on the north and east sides of the lake. Public access is available in Wakefield Park, although there is no boat launch.

Wakefield Lake was added to the MPCA's impaired waters list for excess nutrients in 2002; a nutrient TMDL was completed in 2017. Wakefield is also at risk for chloride impairment.

Phosphorus, chlorophyll-*a*, and Secchi disk depth have been monitored annually since 1984. Chloride has been measured annually since 1992. In 2025, Wakefield Lake did not meet summer-average state standards for phosphorus and chlorophyll-*a*. The 10-year data shows a statistically significant trend of Secchi disk transparency improving.

Strategies to address stormwater pollution include implementing a BMP cost-share program and water-quality projects that decrease the total phosphorus load to the lake. Plans to reduce in-lake loading by 80% include developing a plan for macrophyte management (including curlyleaf pondweed) and a whole-lake oxygenation system, which is being evaluated in 2026.

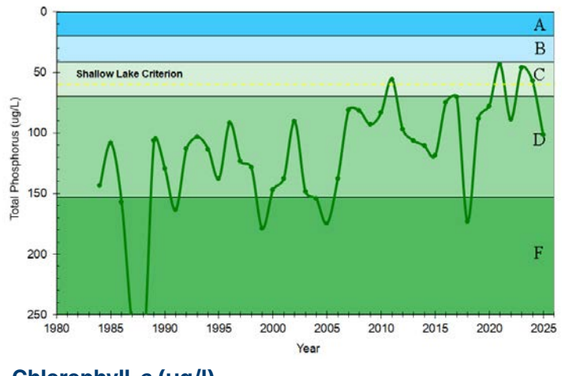
Recent projects to improve the water quality of Wakefield Lake are:

- **Presentation Catholic Church (2015):** Is one of 12 projects managing rainwater runoff at churches with large amounts of impervious surfaces. The goal was to install six rain gardens and one infiltration trench that intercept and filter runoff from the church parking lot. This reduces the volume of polluted rainwater draining to Wakefield Lake.
- **The Wakefield spent-lime filter (2018):** This project involves piping stormwater from a large portion of the 944-acre Wakefield Lake subwatershed into a large underground chamber where it interacts with spent lime. The lime material is a repurposed byproduct of municipal drinking water treatment, and it binds to phosphorus in the stormwater. Water leaving the spent lime chamber was projected to contain about 70 percent less dissolved phosphorus than when it entered. This treatment system is evaluated in Section 5.
- **Wakefield Park stormwater improvements (2020):** The goal of this project was to install two large rain gardens that intercept and filter rainwater runoff from the streets. This reduces the volume of rainwater runoff and increases the quality of runoff that drains into Wakefield Lake. This project was completed in conjunction with a City of Maplewood project to narrow Frost Avenue, which also improves the quality of runoff going into Wakefield Lake.

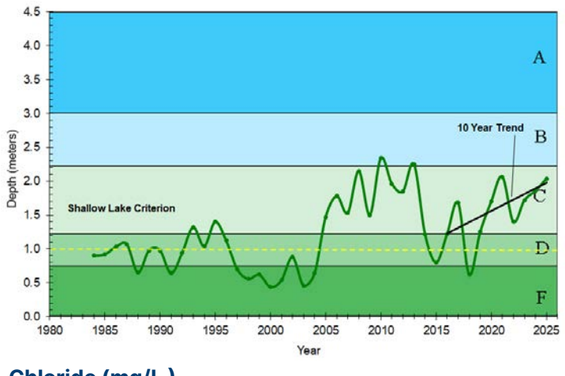
Parameter	State Standard	2025 Wakefield Lake	10-Year Average[1]	10-Year Trend
Phosphorus	≤ 60 µg/l	101.6 µg/l	82 µg/l	None
Chlorophyll-*a*	≤ 20 µg/l	46.5 µg/l	30 µg/l	None
Secchi disk transparency	> 1 meter	2.0 meters	1.6 meters	Improving
Chloride	≤ 230 mg/L [2]	92.6 mg/L	131 mg/L	None

[1] A minimum of 10 years of data were analyzed. If a year was missing within the most recent 10-year period, the period of record was extended.
[2] State standard for chronic chloride exposure

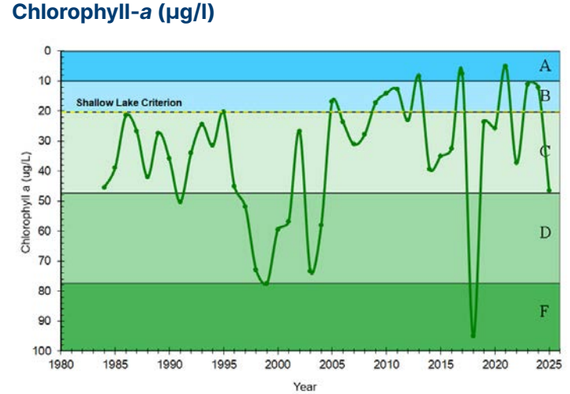
Total phosphorus (µg/l)



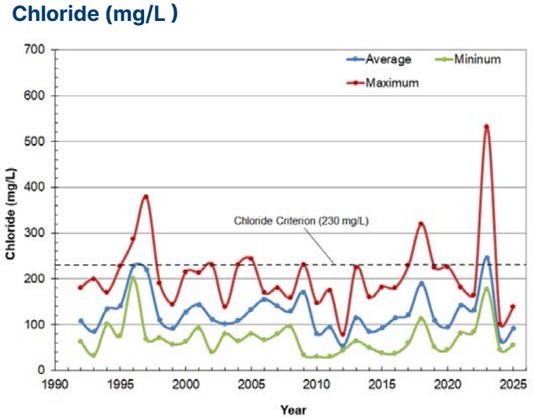
Secchi transparency (m)



Chlorophyll-*a* (µg/l)



Chloride (mg/L)



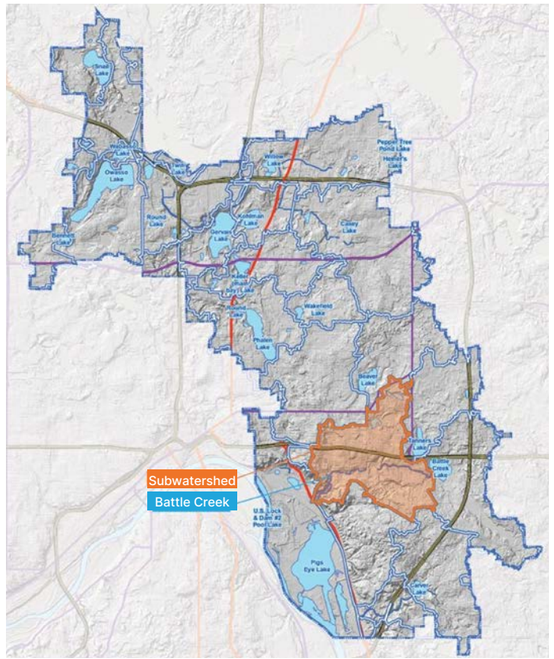
- **Aldrich Ice Arena (2020):** The goal of this project was to remove the asphalt parking lot and install 15 rain gardens. The rain gardens reduce the volume of stormwater runoff and remove pollutants from the runoff before reaching Wakefield Lake.
- **Mounds Park Academy (2022):** The goal of this project was to remove a section of unused parking lot to build a rain garden that could treat runoff before it enters the school's pond. The school is interested in funding an outdoor learning space alongside the rain garden.
- **Woodland Hills (2024):** The goal of this project was to install four rain gardens that intercept and filter runoff from the church parking lot.
- **Cochran Recovery Services (2025):** The goal of this project was to retrofit raingardens in the Cochran Recovery Services parking lot in places where water was already collecting, to improve drainage and convert turf to native plantings.

4. STREAMS

BATTLE CREEK

Attribute	Description
Tributary area	2,972 acres
Creek length	3.8 miles
Downstream waterbody	Mississippi River
MPCA designations	"Non-Support" of aquatic life (chloride, fish, macroinvertebrates, TSS); "Non-Support" of aquatic recreation (*E. coli*)
Accountable municipalities	Maplewood, St. Paul, Woodbury, Ramsey County, Washington County
RWMWD nutrient classification[1]	Impaired (TSS)

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Battle Creek is a perennial, urban stream that originates at the outlet from Battle Creek Lake in Woodbury. The creek then flows west and ultimately discharges to Pigs Eye Lake and the Mississippi River. A well-maintained regional park with trails for hiking, cross-country skiing, and cycling is situated along the creek in St. Paul.

Historically, Battle was plagued by frequent and devastating floods that caused loss of life, substantial property damage, and heavy stream erosion. The District completed a significant restoration project in 1982 and continues to conduct maintenance on the creek to sustain that project.

As a part of the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP), Battle Creek has been monitored annually for phosphorus and total suspended solids since 1996. Annual monitoring for nitrate began in 2000 and for chloride in 2002. The creek is currently impaired for chloride and was also listed in 2014 as impaired for degraded fish and macroinvertebrate biological community health. Battle Creek was placed on the 2024 303(d) impaired waters list for *E. coli* and TSS. A stressor identification report was completed in 2015; chloride and TSS were found to be the primary stressors for fish and macroinvertebrates in the creek. The study identified total phosphorus as a probable secondary stressor. For that reason, the District has assigned Battle Creek a RWMWD nutrient water quality classification of "Impaired."

As seen in the chart (above right), the creek failed to meet state standards for phosphorus and total suspended solids in 2025. The 10-year data shows a statistically significant worsening trend for all parameters but chloride.

Section 9 of this report describes the results of a synoptic surveying effort that District staff completed for Battle Creek in 2025, assessing the water quality at several points along the creek, during a series of storm events.

Recent projects to improve the water quality of Battle Creek include:

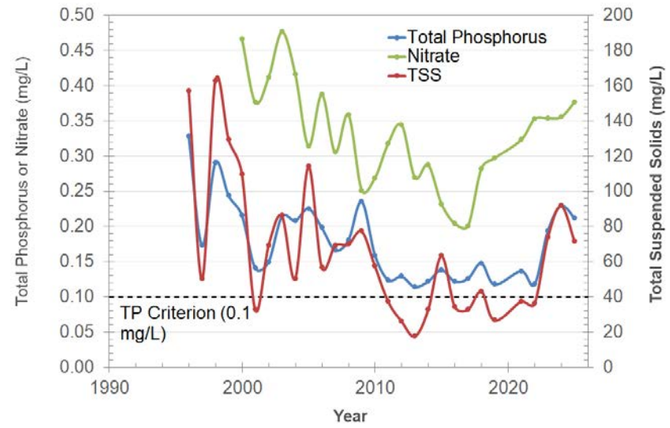
- Maplewood Living Streets (2012): The Maplewood street reconstruction project included 32 new rainwater gardens throughout the neighborhood, the addition of 120 drought-tolerant trees, and the creation of a regional infiltration basin. The rainwater gardens, trees, and infiltration basin sequester 40 tons of CO_2 per year, as well as filter and infiltrate 50 percent of the stormwater runoff.
- Christ United Methodist Church (2016): Two rain gardens were installed to intercept and filter runoff from the church's parking lot—reducing the volume of polluted runoff that drains to Battle Creek.

Parameter	State Standard	2025 Battle Creek	10-Year Average	10-Year Trend
Phosphorus	≤ 100 µg/l	212 µg/l	156 µg/l	Worsening
Total suspended solids	<15 mg/L	72 mg/L	51 mg/L	Worsening
Nitrate	N/A	0.38 mg/L	0.30 mg/L	Worsening
Chloride	≤ 230 mg/L[1]	167 mg/L	193 mg/L	None

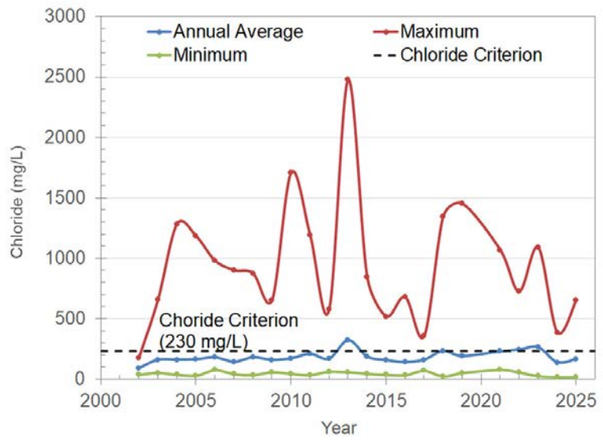
[1] State standard for chronic chloride exposure

- Slumberland Clearance Outlet Store (2016): A native planting area replacing 20,000 square feet of parking lot surface provides pollinator habitat and filters rainwater runoff before it drains to Battle Creek.
- Target—Suburban Avenue (2020): The project included the removal of an impervious parking lot to install 7 rain gardens and a linear tree trench. The installed best management practices can reduce the volume of polluted runoff that drains to Battle Creek, as well as remove pollutants such as total suspended solids and total phosphorus.
- St. Pascal Baylon Church (2022): The project included retrofitting the existing parking lot to maintain the existing grading, adding a tree trench and a small rain garden. The tree trench and rain garden will remove phosphorus and sediment from stormwater that travels to Battle Creek.

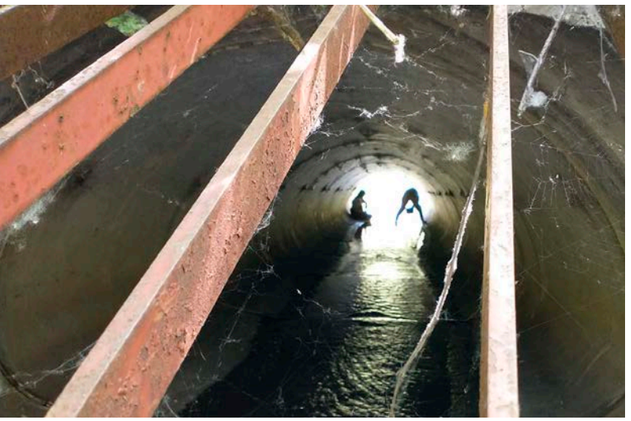
Nutrients and solids (mg/L)



Chlorides (mg/L)



BELTLINE INTERCEPTOR



The Beltline Interceptor is a large storm sewer pipe system constructed in 1920 and maintained by the RWMWD. The system is approximately 5 miles long, extending from the outlets of Lake Phalen and Beaver Lake to the Mississippi River. It collects a large percentage of stormwater runoff from St. Paul's east side and also conveys runoff from the entire Phalen Chain of Lakes subwatershed and the Beaver Lake subwatershed to the Mississippi River. The total drainage area to the Beltline Interceptor is 27.8 square miles)—over half of the District's water.

As a part of the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP), the Beltline Interceptor has been monitored annually for phosphorus and total suspended solids since 1995. Annual monitoring for nitrates began in 2000 and for chloride in 2002. As seen in the chart below, the Beltline Interceptor met state standards for only chlorides in 2025. The 10-year data shows a statistically significant trend of worsening nitrate and nitrite concentration.

Recent projects to improve the water quality of Beltline Interceptor include:

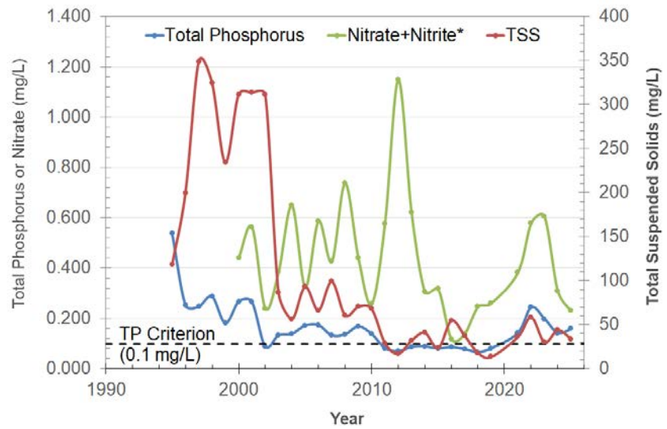
- Saint Paul Urban Tennis Center (2020): A new infiltration basin was installed to reduce the volume of runoff to the Beltline Interceptor and remove pollutants from stormwater runoff.

Parameter	State Standard	2025 Beltline Interceptor	10-Year Average	10-Year Trend
Phosphorus	≤ 100 µg/l	159 µg/l	132 µg/l	None
Total suspended solids	<15 mg/L	34 mg/L	36 mg/L	None
Nitrate and Nitrate[1]	N/A	0.23 mg/L	0.32 mg/L	Worsening
Chloride	≤ 230 mg/L[2]	84 mg/L	134 mg/L	None

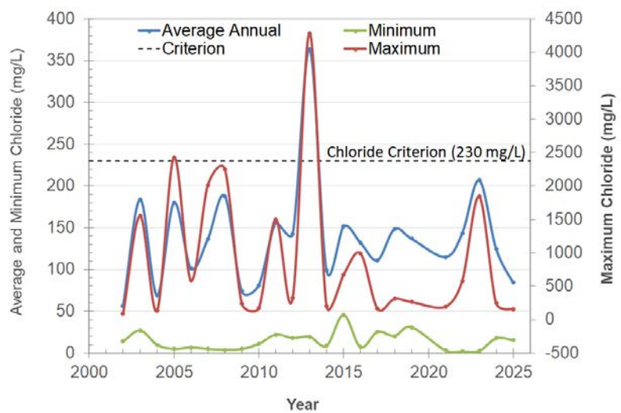
[1] Before 2021, nitrate was the measured parameter. Starting in 2021 Nitrate and Nitrite were measured.

[2] State standard for chronic chloride exposure

Nutrients and solids (mg/L)



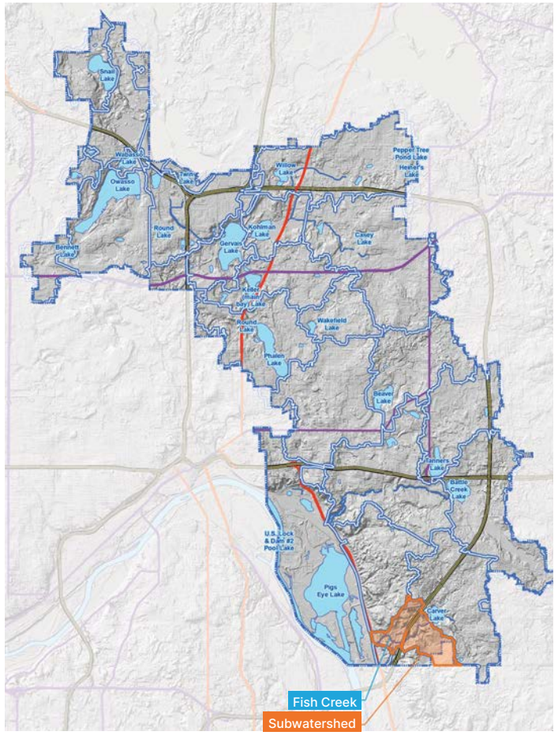
Chlorides (mg/L)



FISH CREEK

Attribute	Description
Tributary area	783 acres
Creek length	1.8 miles
Downstream waterbody	Eagle Lake
MPCA designations	"Non-support" of aquatic life (benthic macroinvertebrates); at risk for chloride; "non-support" of aquatic recreation (*E. coli*; and total suspended solids)
Accountable municipalities	Maplewood, St. Paul, Woodbury, Ramsey County, Washington County
RWMWD nutrient classification[1]	Impaired (TSS)

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Fish Creek is a perennial, urban stream that originates at Carver Lake and ultimately discharges to Eagle Lake and the Mississippi River. The majority of the Fish Creek subwatershed is located in Ramsey County and the southeastern portion of Washington County.

Fish Creek was placed on the 2014 303(d) impaired waters list due to elevated levels of *E. coli* bacteria. *E. coli* is used in water quality monitoring as an indicator of water that is contaminated with human or animal waste and accompanying disease-causing organisms. Bacterial abundance in excess of the water quality standards can pose a risk to human health. Fish Creek was placed on the 2024 303(d) impaired waters list due to TSS and benthic macroinvertebrates bioassessments.

As a part of the Metropolitan Council's Watershed Outlet Monitoring Program (WOMP), Fish Creek has been monitored annually for phosphorus and total suspended solids since 1995. Annual monitoring for nitrates began in 2000 and for chlorides in 2002. In 2025, Fish Creek failed to meet state standards for phosphorus and total suspended solids. The 10-year data shows a statistically significant trend of worsening chloride concentrations.

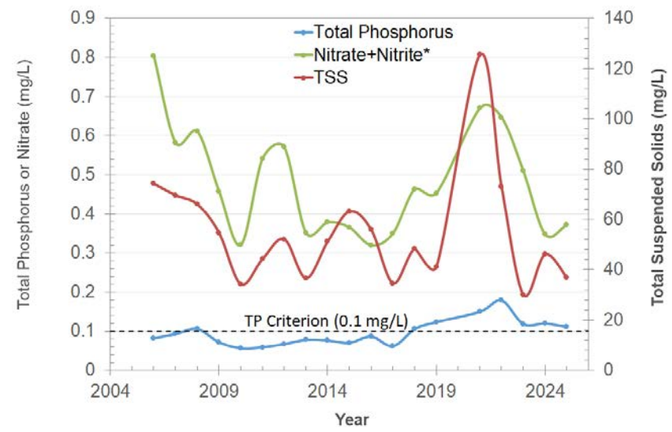
Section 9 of this report describes the results of a synoptic surveying effort that District staff completed for Fish Creek in 2025, assessing the water quality at several points along the creek, during a series of storm events.

Parameter	State Standard	2025 Fish Creek	10-Year Average	10-Year Trend
Phosphorus	≤ 100 µg/l	111 µg/l	117 µg/L	None
Total suspended solids	<15 mg/L	37 mg/L	55 mg/L	None
Nitrate and Nitrate[1]	N/A	0.37 mg/L	0.47 mg/L	None
Chloride	≤ 230 mg/L[2]	119 mg/L	161 mg/L	Worsening

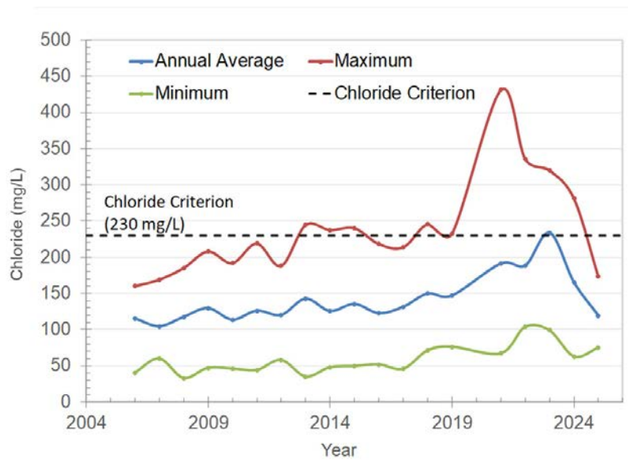
[1] Prior to 2024, only nitrate was the measured parameter.

[2] State standard for chronic chloride exposure

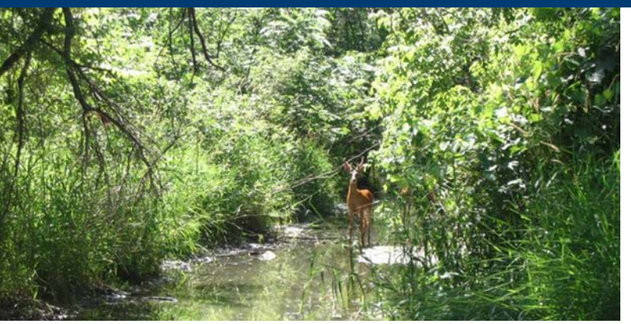
Nutrients and solids (mg/L)



Chlorides (mg/L)

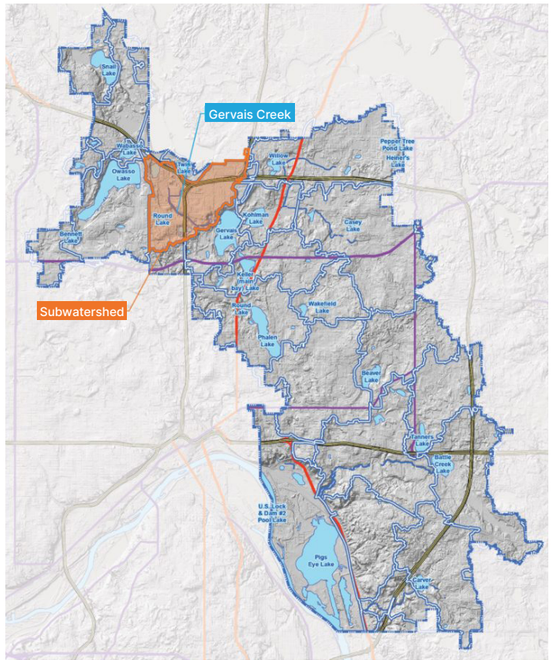


GERVAIS CREEK



Attribute	Description
Tributary area	1,847 acres
Creek length	2.2 miles
Downstream waterbody	Gervais Lake
MPCA designations	"Non-support" of aquatic life (benthic macroinvertebrates)
Accountable municipalities	Little Canada, Vadnais Heights, Ramsey County
RWMWD nutrient classification[1]	At risk

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Gervais Creek is an intermittent stream that was previously managed as a county ditch (County Ditch 16). It is now managed by the RWMWD as a stormwater system.

Gervais Creek has been monitored annually for phosphorus and total suspended solids since 2010. Annual monitoring for chlorides began in 2010 and for nitrates in 2016. In 2025, the creek did not meet the state standard for phosphorus. The 10-year averages show no statistically significant trend for any parameter.

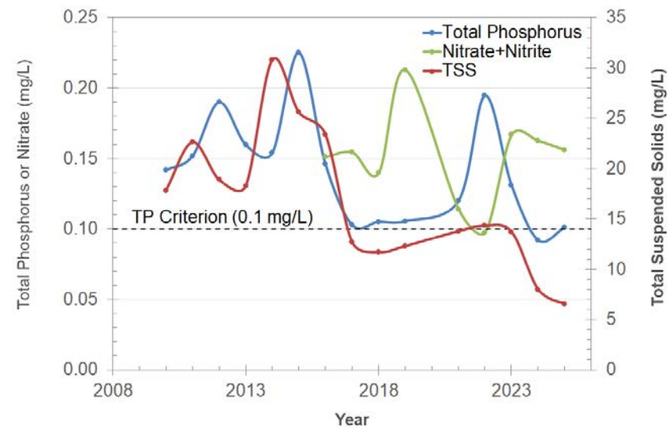
Recent projects to improve the water quality in Gervais Creek include:

- Pioneer Park (2024): At Pioneer Park in Little Canada, RWMWD installed a stormwater reuse system that utilizes the top one foot of water in the two existing ponds. Assuming this water is used for irrigation, is estimated that stormwater could meet 88% of the annual irrigation demand for Pioneer Park. It is estimated that this project could reduce annual TSS loads by 1,393 pounds per year and annual TP loads by 7.7 pounds per year. The stormwater reuse system includes pumping, particulate filtration and disinfection (UV). The system also utilizes the existing well system for irrigation back-up supply.

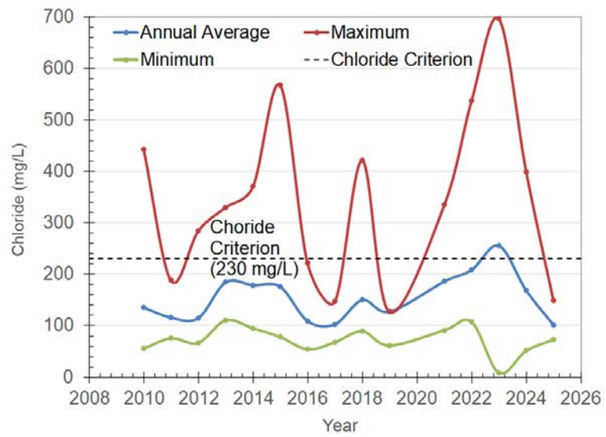
Parameter	State Standard	2025 Gervais Creek	Average	10-Year Trend
Phosphorus	≤ 100 µg/l	101 µg/l	122 µg/l (10-year average)	None
Total suspended solids	<15 mg/L	7 mg/L	13 mg/L (10-year average)	None
Nitrate	N/A	0.16 mg/L	0.15 mg/L (6-year average)	None
Chloride	≤ 230 mg/L[1]	101 mg/L	156 mg/L (10-year average)	None

[1] State standard for chronic chloride exposure

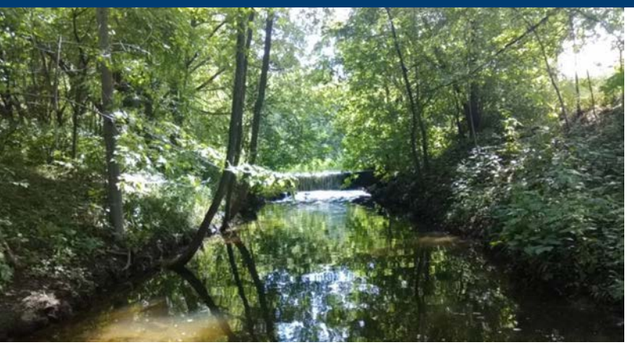
Nutrients and solids (mg/L)



Chlorides (mg/L)

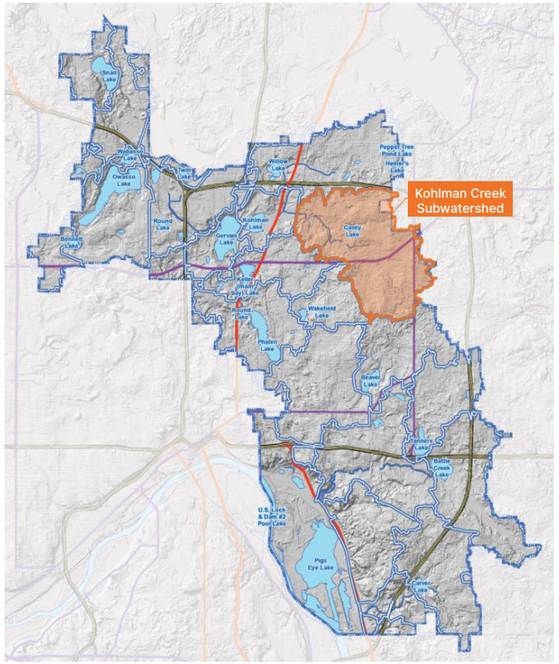


KOHLMAN CREEK



Attribute	Description
Tributary area	3,653 acres
Creek length	2.8 miles
Downstream waterbody	Kohlman Lake
Accountable municipalities	Maplewood, North St. Paul, Oakdale, Ramsey County, Washington County
RWMWD nutrient classification[1]	At risk

[1]RWMWD nutrient classifications are based on the relationship between the historical average water quality (based on phosphorus concentration alone) and the MPCA water quality (phosphorus) standards.



Kohlman Creek is an intermittent stream that was previously considered a county ditch (County Ditch 18 South). The stream generally flows from southeast to northwest and eventually discharges to the Kohlman Basin in the Kohlman Lake subwatershed. The District has managed the creek as a stormwater conveyance system. Most of the creek remains in its natural state.

Kohlman Creek has been monitored annually for phosphorus, total suspended solids, and chlorides since 2008. Annual monitoring for chlorides began in 2015. In 2025, Kohlman Creek did not meet the state standard for phosphorus and total suspended solids. The 10-year data show a statistically significant worsening of chloride concentrations.

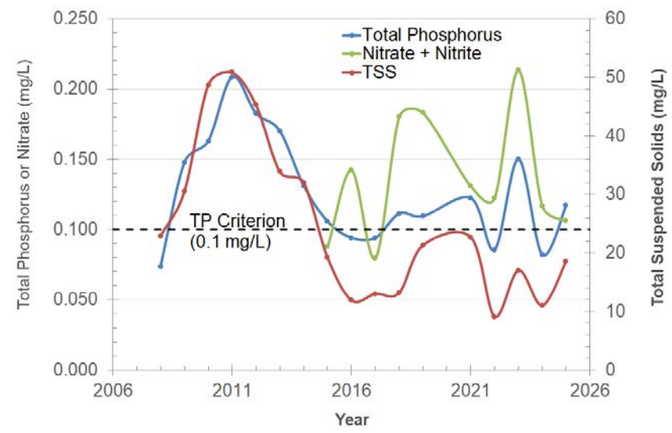
Recent projects to improve the water quality in Kohlman Creek include:

- Maplewood Mall (2012): With 35 acres of asphalt pavement and concrete surfaces surrounding it, Maplewood Mall was a major source of phosphorus runoff to Kohlman Lake and Kohlman Creek. But, over 4 years, the RWMWD installed a variety of stormwater management features that capture and filter 67 percent of rainwater at the mall—up from just 3 percent before the project. These features include innovative tree trenches, rain gardens, permeable pavers, and a 5,700-gallon cistern that receives runoff from the mall roof. Interpretive signage educates the public about these improvements, and a large watershed map in the entry vestibule shows how water travels from the mall all the way to the Mississippi River.
- Harmony Learning Center and Maplewood Middle School (2016): These school rain garden projects provide pollinator habitat and reduce the volume of polluted runoff that drains to Kohlman Creek.
- North Presbyterian Church (2017): This rain garden intercepts and filters runoff from the church parking lot, reducing the volume of polluted rainwater draining to Kohlman Creek.
- Target—North Saint Paul (2021): The project included the removal of an impervious parking lot to install 4 rain gardens and 2 linear tree trenches. The installed best management practices can reduce the volume of polluted runoff that drains to Kohlman Creek, as well as remove pollutants such as total suspended solids and total phosphorus.

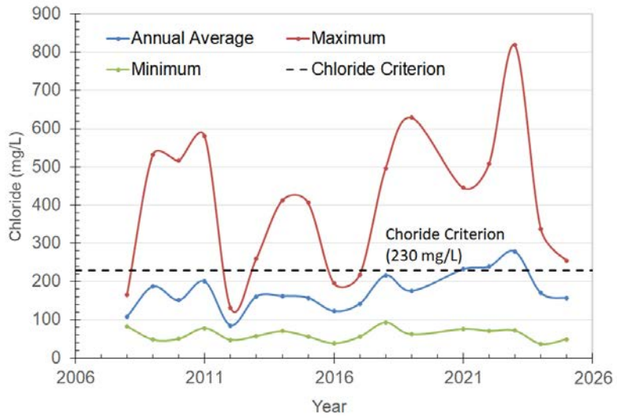
Parameter	State Standard	2025 Kohlman Creek	10-Year Average	10-Year Trend
Phosphorus	≤ 100 µg/l	117 µg/l	107 µg/l	None
Total suspended solids	<15 mg/L	19 mg/L	15 mg/L	None
Nitrate	N/A	0.11 mg/L	0.14 mg/L	None
Chloride	≤ 230 mg/L[1]	177 mg/L	193 mg/L	Worsening

[1] State standard for chronic chloride exposure

Nutrients and solids (mg/L)



Chlorides (mg/L)



5. BEST MANAGEMENT PRACTICE (BMP) WATER QUALITY REPORTS

IRON-ENHANCED SAND FILTERS

Attribute	Description
City	Maplewood
Subwatershed	Kohlman Creek
Completed	2009
Cost	$235,000
Funding Sources	District Levy Fund, Stormwater Impact Fund
Partners	City of Maplewood, University of Minnesota—St. Anthony Falls Laboratory

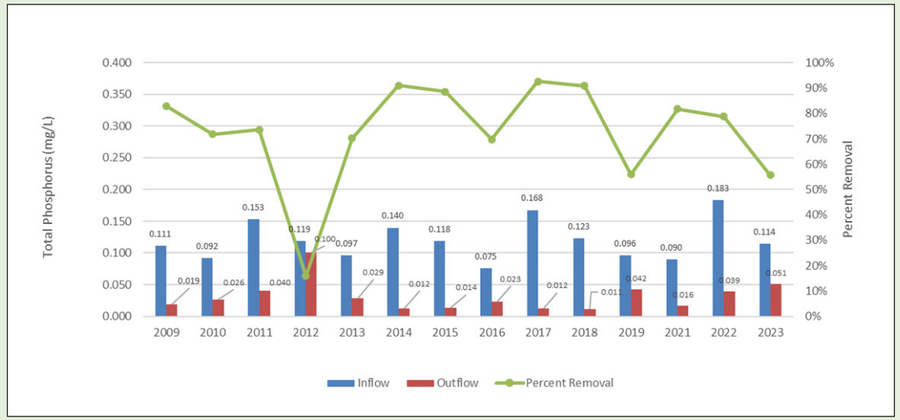
Beam Avenue Iron-Enhanced Sand Filter

RWMWD's iron-enhanced sand filter on Beam Avenue was installed in 2009 to improve the water quality of Kohlman Lake. It was the first filter of its kind in Minnesota.

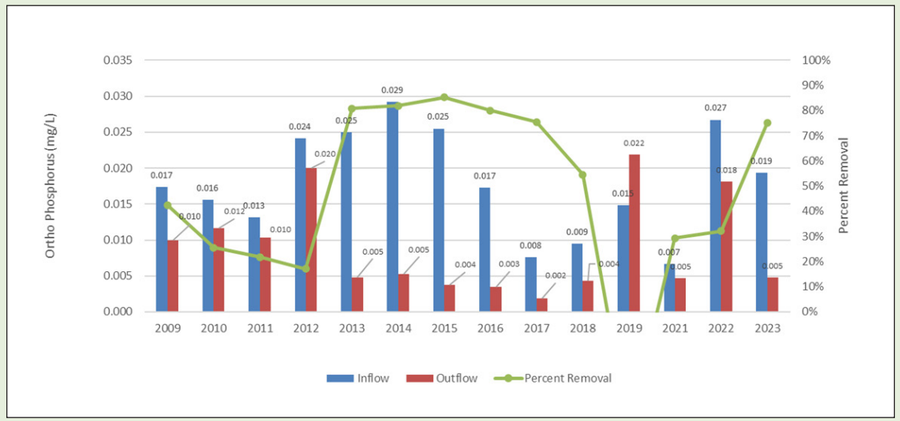
Sand filters have been used for years to remove solids and pollutants from stormwater. Newer, iron-enhanced sand filters (sand mixed with iron filings) are now being used as an efficient and cost-effective means of removing phosphorus. The filter works through a chemical process in which phosphorus molecules bind to the iron particles in the sand filter as water passes through.

The RWMWD has monitored its iron-enhanced sand filter since 2009. Between 2009–2018, total phosphorus removal ranged from 70–93%. But, in 2019, it declined significantly (56%). For 2021 and 2022, the TP removal improved to 82% and 79%, respectively. However, in 2023, there was again a performance decrease to 56% removal. Removal of orthophosphate has declined, dropping from 70% removal in 2016 to -47% in 2019 (perhaps an indication that the filter is releasing dissolved phosphorus). In 2021 and 2022, orthophosphate removal rates increased slightly to approximately 30%. In 2023, the removal of orthophosphate increased to roughly 75%. The increased removals between 2021 and 2023 could be because of drought conditions in the watershed but could also be attributed to the replacement of the media closest to the system's inlet in 2022. Removal of total suspended solids remains relatively steady, with average yearly removal consistently exceeding 85% for almost all monitored years. The average percent removal for the period of monitoring (2009–2023) is 73% for total phosphorus, 40% for orthophosphate, and 89% for total suspended solids. The filter was not monitored in 2024 and 2025, but will be monitored in 2026.

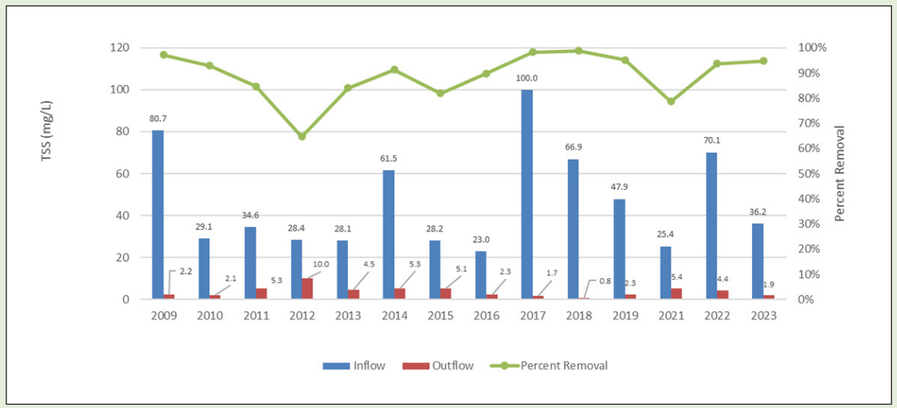
Total phosphorus removal performance



Orthophosphate removal performance



TSS removal performance



Woodlyn Rain Garden Iron-Enhanced Sand Filter

The Woodlyn iron-enhanced sand filter is part of the larger Maplewood Mall stormwater retrofit effort. The goal of that project—designed to capture and filter 67% of rainwater at the mall site—was to decrease the phosphorus runoff to nearby Kohlman Lake. Prior to the project, only 3% of the stormwater runoff from the mall was captured and filtered.

The Woodlyn iron-enhanced sand filter is a narrow strip of iron-enhanced sand beneath a rain garden. Runoff is intercepted from a parking lot and directed to the rain garden. There, the stormwater filters through the iron-enhanced sand for a period until it is treated. The average annual phosphorus removal with the filter has ranged from 3% during the first year of operation to 92% in 2022. The average annual removal of orthophosphate ranged from 0% in 2018 to 93% in 2015. The average removal for the 2012 to 2018 monitoring period was 58% for total phosphorus, 73% for orthophosphate, and 94% for total suspended solids.

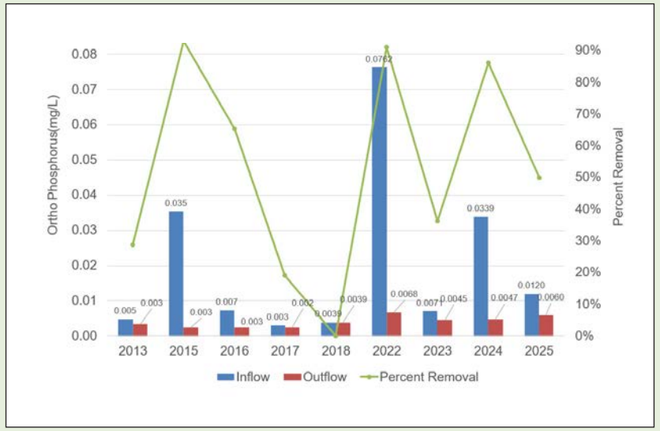
In 2022, over ten years after the construction of the filter, total phosphorus, orthophosphate, and total suspended solids removal were all over 90%—the highest yearly removal rates since monitoring began. The infrequent and small rainfall events in 2022 may account for this increased performance, as the rain washed down impervious surfaces laden with atypically high levels of accumulated sediment. Due to the improved performance in 2022, Barr recommended monitoring of Woodlyn before deciding whether filter media replacement was required. In 2023, the filter was sampled more frequently. Total phosphorus removal dropped to 61%. Orthophosphate removal dropped to 36%, and total suspended solids removal dropped to 83%. In 2024, the filter was sampled frequently and performed similar to 2022 with removals above 85% for the three monitored parameters. Total phosphorus and orthophosphate removed decreased again in 2025 to roughly 45% while TSS removal improved to 96%.

In 2025, the basin was mowed and the lawn clippings were left within the basin, which could have impacted filter performance in 2025. Barr determined that vegetation replacement may be required after the mowing. In 2026, the basin will not be monitored and will be allowed to re-establish after the mowing and disturbance in 2025. In the future if vegetation replacement is required, it is recommended to evaluate if media replacement should be done in combination with the future vegetation maintenance.

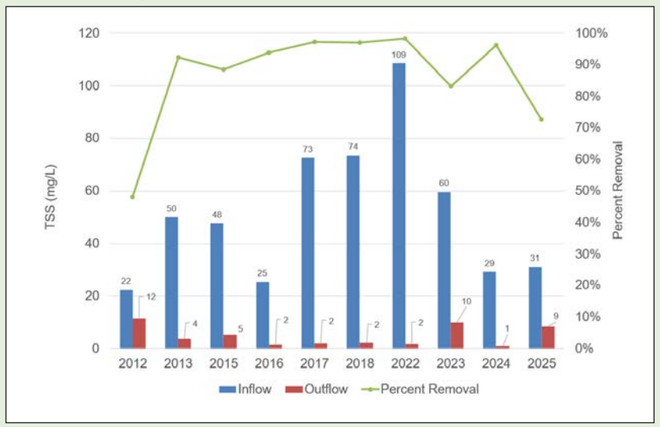
Attribute	Description
City	Maplewood
Subwatershed	Kohlman Lake
Completed	2009
Cost	$72,900
Funding Sources	District funds
Partner	Simon Property Group, Minnesota Pollution Control Agency (monitoring)

Total phosphorus removal performance

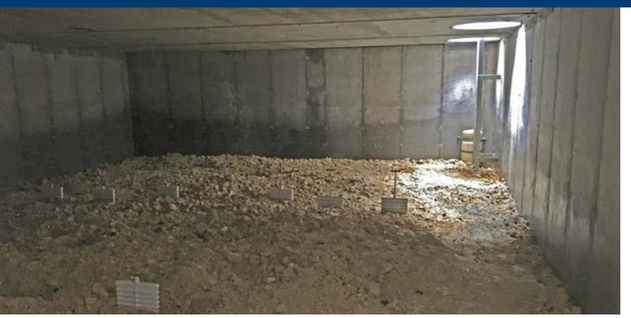
Orthophosphate removal performance



TSS removal performance



SPENT-LIME FILTERS



Attribute	Description
City	Maplewood
Subwatershed	Wakefield Lake
Completed	2018
Cost	$390,000
Funding Sources	Clean Water Fund ($300,000) and District funds
Partner	City of Maplewood

Frost and Kennard Spent-Lime Filter

This innovative stormwater filter is at the corner of Frost Avenue and Kennard Street in Maplewood, a few blocks upstream from Wakefield Lake. It is designed to capture and filter stormwater runoff from a large portion of the lake's 944-acre subwatershed.

The filter intercepts water from the storm sewer and routes it into a 20- by 36-foot underground chamber. There, the water interacts with spent lime—a chalky clay-like material consisting of calcium carbonate, which is a waste product of municipal drinking water treatment. Phosphorus in the water binds to calcium in the spent lime material, decreasing the amount of phosphorus in the water leaving the chamber.

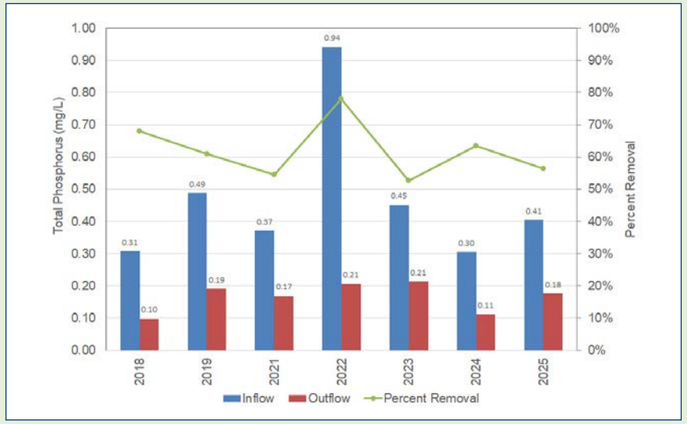
Spent lime is particularly effective in removing a form of phosphorus called orthophosphate, often found in stormwater runoff. While orthophosphate is a vital nutrient for bacteria and plants in surface waters, too much orthophosphate can promote algae growth and decrease water clarity.

Sampling equipment monitors phosphorus levels and total suspended solids as water enters and leaves the filter on its way to Wakefield Lake, which is impaired for phosphorus. The goal is to help the lake meet the state standard for phosphorus (60 micrograms per liter).

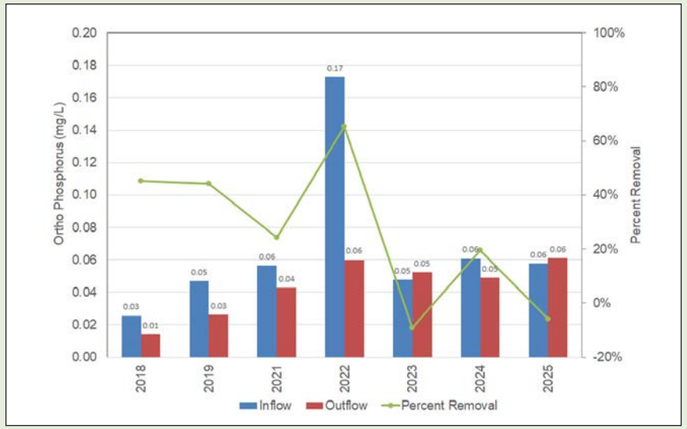
The removal performance of total phosphorus, orthophosphate, and total suspended solids all show a similar pattern. From 2018 to 2021, there was a slight decrease in removals for all parameters. For example, total phosphorus performance was 68% in 2018, 61% in 2019, and 55% in 2021. This decreasing trend would indicate that the media may need to be replaced. However, in 2022, the filter had its best removal performance, with removals of 78% for total phosphorus, 65% for orthophosphate, and 93% for total suspended solids. One potential reason for the increased performance in 2022 could be that 2022 was a drought year with typically small rainfall events. Monitoring from 2023 to 2025 indicates that total phosphorus removal is relatively constant with annual removal percentage ranging from 50 to 65%. Similarly, the annual total suspended solids removal was above 90% for those years. These results indicate that the filter has stabilized for total phosphorus and total suspended solids removals. However, orthophosphate removal remains an all-time low with the 2023 and 2025 average annual removal being negative and the 2024 average annual removal being approximately 20%. Declining orthophosphate removals indicate the filter material may need to be replaced in the near future.

In July 2024, RWMWD staff entered the underground chamber to inspect the filter and potential sediment buildup. The motivation for the inspection was the mixed performance of the filter over the years. The inspection found that sediment was covering the spent lime material throughout the system. The depth of sediment ranged from 0.05 feet to 0.4 feet in various locations. In addition, the forebay was approximately 50% full of sediment. In September of 2025, sediment removal was performed. Sediment was removed from the forebay and debris was removed from the top of the spent lime near the inlet.

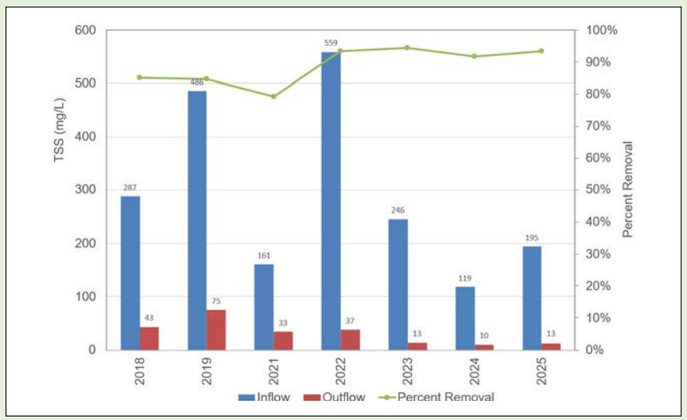
Total phosphorus removal performance



Orthophosphate removal performance



TSS removal performance



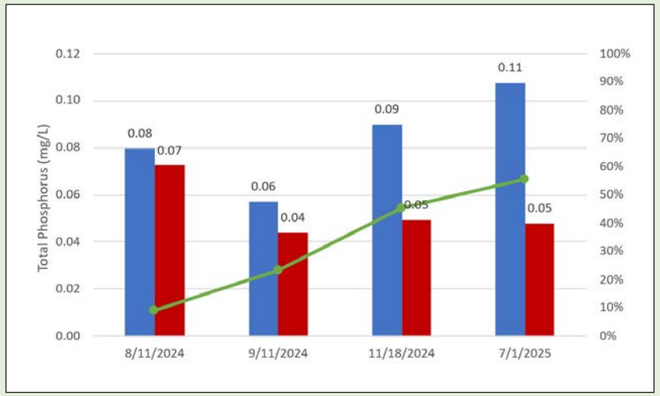
Willow Pond Continuous Monitoring and Adaptive Control (CMAC)

This innovative filter is located adjacent to Willow Pond, off Hamline Avenue and County Road B2 West in Roseville. The filter was designed to receive intermittent flow from Willow Pond before the water travels downstream to Bennett Lake, which is impaired for excess nutrients. The system has multiple sensors that give real-time feedback to stop pumping if the water level drops below a threshold in Willow Pond. The intermittent flows pumped into the filter are treated with spent lime material. Although the system was constructed in 2019, 2024 was the first year the system was monitored. The system was not monitored until 2024 due to low water levels in Willow Pond.

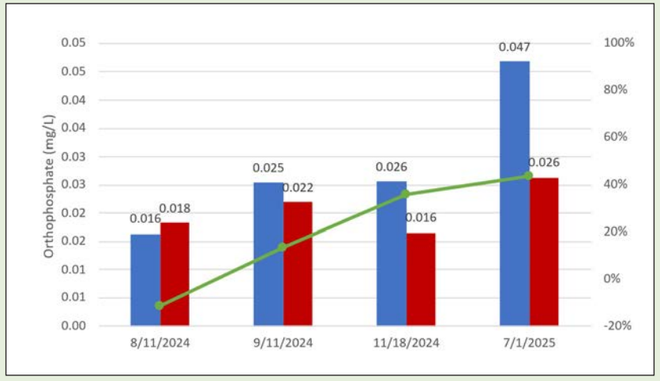
The sampling for the CMAC utilizes sequential/discrete sampling by collecting nine samples. The results in the figures are based on taking the average inlet and outlet sample from the nine discrete samples taken. In 2024, the CMAC was tested three times by manually opening the valve to the system. The average removal for the 2024 monitoring events was 26% for total phosphorus, 13% for orthophosphate, and 36% for total suspended solids. In 2025, the CMAC was manually tested once and had a removal of 56% for total phosphorus, 44% for orthophosphate, and 42% for total suspended solids. In 2026, the goal is to have the system online with automatic controls (instead of manual valve operation) and collect corresponding water quality results.

Attribute	Description
City	Roseville
Subwatershed	Bennett Lake
Completed	2019
Cost	$220,000
Funding Source	District funds
Partner	Roseville

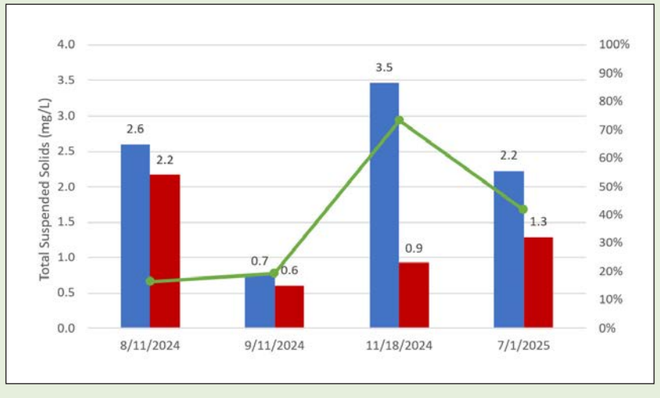
Total phosphorus removal performance



Orthophosphate removal performance



TSS removal performance



Attribute	Description
City	Maplewood
Subwatershed	Wakefield Lake
Completed	Fall 2011; filter media changed in 2022
Cost	$40,000
Funding Source	MPCA 319 Grant
Partner	City of Maplewood

Wakefield Lake Experimental Iron and Granite Sand Filter

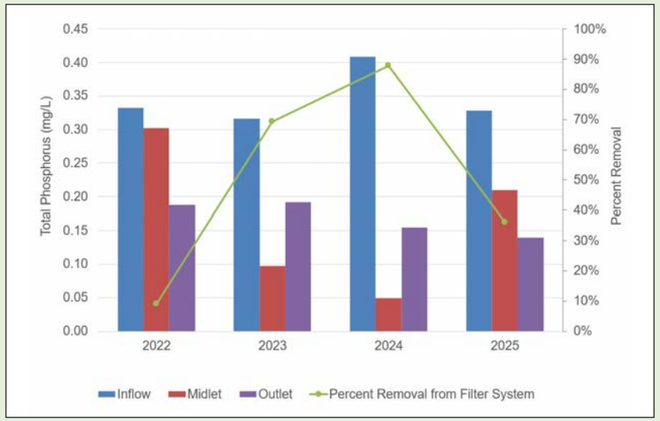
In 2022, the media in the Wakefield Lake experimental filter was replaced with iron and granite sand. Iron and granite sand were selected due to granite sand's high infiltration rate and iron's ability to remove dissolved phosphorus. The system was monitored from 2022 to 2025 in three locations: inlet, "midlet," and outlet. The inlet is the inflow location, the "midlet" is where water leaves the filter media system, and the outlet is the outflow of the pond downstream of the filter (before Wakefield Lake).

In 2022, the filter system had mixed total phosphorus removal performance. The filter removed phosphorus during some events but released it during others. From inlet to outlet, almost all events had a reduction in total phosphorus, but the majority of removals came from the downstream pond. The filter had an average total phosphorus removal (between the inlet and the "midlet") of 9%, while the pond's average removal (between the midlet and the outlet) was 38%. A similar trend was apparent for orthophosphate and total suspended solids. The average orthophosphate removal from the filter was 19%, while the average removal from the pond was 61%. The average total suspended solids removal from the filter was negative, while the pond was 91%.

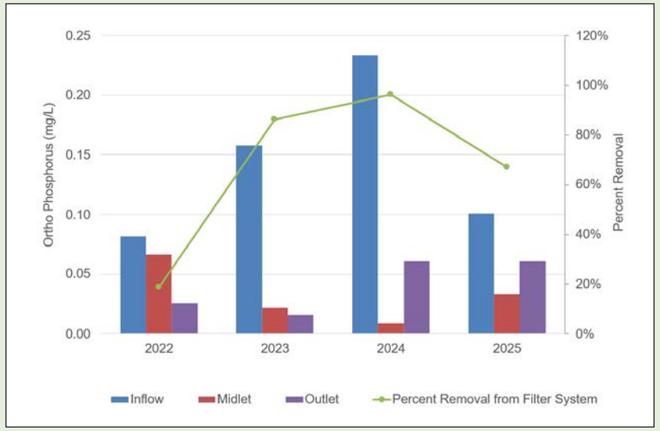
From 2023 to 2025, phosphorus, orthophosphate, and total suspended solids concentrations were consistently decreased through the system, but the removal came from passing through the filter and not the pond. In fact, removal between the inlet and the midlet was always greater than removal between the midlet and pond for each parameter and year. It is noteworthy that the removal of total phosphorus and orthophosphate by the filter was greater in 2023 and 2024 than in 2025.

In February 2026, the filter was maintained by removing accumulated sediment from the filter. The filter will be monitored in 2026 to determine the impact of cleaning and if media replacement is required.

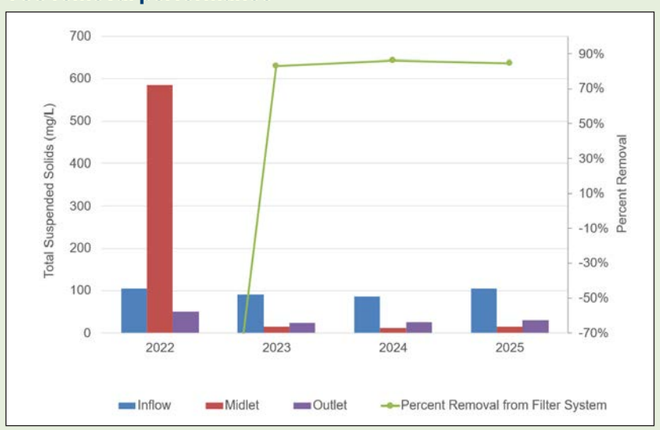
Total phosphorus removal performance



Orthophosphate removal performance



TSS removal performance



Arbogast CC17 Filter

This stormwater filter is located below a paved biking/ walking path north of the intersection of Arbogast Street and Emmert Street in Shoreview. The goal of the underground filtration system is to divert low flows from the storm sewer along Arbogast Street (which conveys outflow from Lake Judy, as well as stormwater runoff from the residential drainage area to the northwest) to a subsurface treatment system before discharging back to the storm sewer and ultimately into Lake Emily.

CC17 is a form of crushed limestone used for a variety of infrastructure and agricultural purposes. In recent years, RWMWD has been experimenting with using it as a filtration media, with the aim of removing phosphorus and other pollutants. When stormwater containing phosphorus enters the CC17 filter media, the phosphorus molecules are attracted to calcium in the CC17 through a bond that is not dependent on the oxygenated state of the media (unlike a phosphorus-iron bond which can only happen in oxygenated environments). However, CC17 has a lower phosphorus removal efficiency when compared to that of iron enhanced sand. CC17 has a relatively high hydraulic conductivity rate (2264 inches per hour) and can therefore filter much higher volumes of stormwater, which makes it a viable filtration media choice in areas that receive continuous flows of stormwater.

Total phosphorus removal was highly variable throughout the two years of sampling and removal exceeded 50% for only three sampling dates. Removal of total phosphorus in 2025 ranged from negative percent removal to 50% removal. Orthophosphate removal was also highly variable with removal exceeding 32% on only one sampling date. Removal in 2025 ranged from negative to 65%. Removal of total suspended solids was above 88% through 2024 and the first sampling sate of 2025. Removal was 62% on the second sampling date of 2025.

Since the installation of the Arbogast filter, it has been discovered that the filter will require consistent maintenance. The Arbogast filter is located downstream of Lake Judy, a large wetland. During the first year of monitoring, staff noticed slow outflow of the filter and had difficulties collecting samples. The slow outflow was due to the top of the filter accumulating organic material from Lake Judy. To keep the high hydraulic conductivity of the filter, consistent maintenance removing organic material is required. The Arbogast filter was maintained by removing sediment before the 2025 monitoring season.

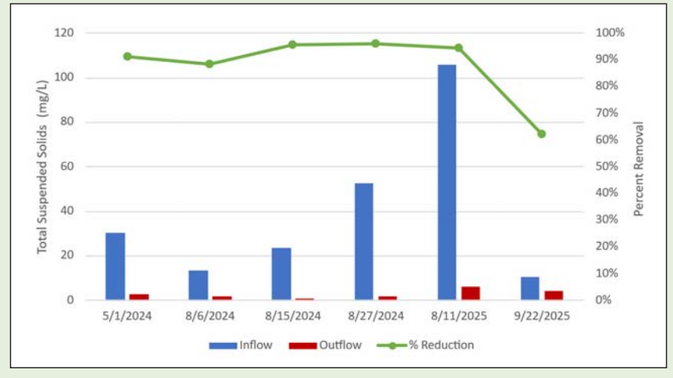
In early 2026, Barr will evaluate options to reduce organic loading by adding a screen to the inlet or altering flows that enter the filter. The filter will be monitored in 2026 to determine the impact of the method selected to reduce organics entering the filter.

Attribute	Description
City	Shoreview
Subwatershed	Lake Emily/Owasso Lake
Completed	2023
Cost	$775,000
Funding Source	District funds
Partner	City of Shoreview

Phosphorus removal performance (mg/L)

Orthophosphate removal performance (mg/L)

Total suspended solids removal performance (mg/L)



ALUM TREATMENT SYSTEM

Attribute	Description
City	Oakdale
Subwatershed	Tanners Lake
Completed	1998
Cost	$1.9 million[1]
Funding Sources	District funds, Minnesota Pollution Control Agency State Revolving Fund Loan

[1] This cost reflects the alum facility as well as other related water quality improvements: Tanners Lake 5th Street Basin, Tanners Lake Berm, Tanners Lake Tartan High School Pond

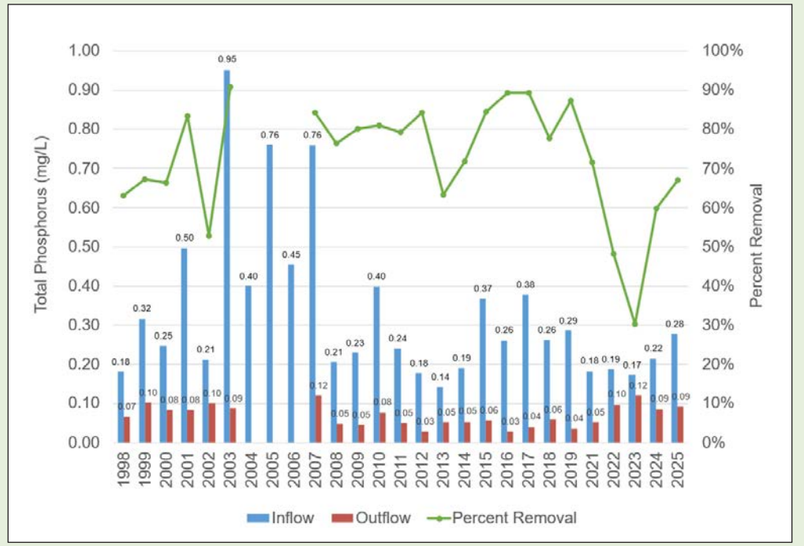
Tanners Lake Alum Treatment Facility

The Tanners Lake alum treatment facility was constructed in 1998 to reduce the amount of phosphorus reaching Tanners Lake. The facility receives stormwater runoff from a 1,246-acre watershed and injects it with aluminum sulfate (known as alum). The alum then binds with the phosphorus in the water and forms a floc that settles to the bottom of a pond upstream of Tanners Lake. The water that ultimately drains out of the pond to Tanners Lake has significantly lower phosphorus content.

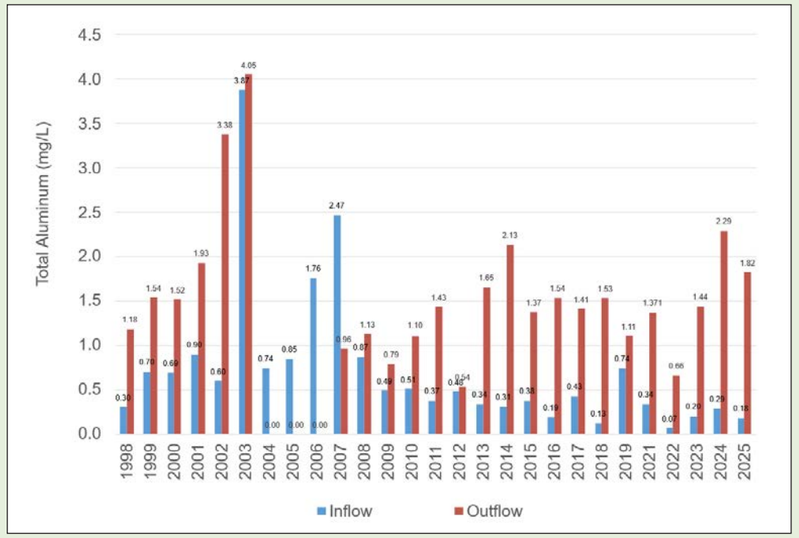
The graphs to the right show the effectiveness of the alum treatment system in reducing total phosphorus over the last 20-plus years of monitoring. Peak performance for phosphorus removal occurred in 2003 (91%) after improvements to the system in 2002. From 2007 to 2021, total phosphorus removal would consistently range from 63% to 89%. From 2019 to 2023, there was a downward trend in total phosphorus removal to 30%. One potential explanation for the decrease from 2021 to 2023, is the low-flow conditions and dry period that was experienced. In addition, removals in 2023 may have been poor due to the treatment plant being shut down temporarily and flushing the inlet of the system. In 2024, total phosphorus removal increased to 60% and then in 2025 to 67% which is more than the total phosphorus removal in 2022 and 2023, but not as high as prior periods. In 2025, the dosing rate was changed once at the end of April and again in mid-May. Based on the review of the data, the dosage change mid-May 2025 appeared to have increased the total phosphorus removal. It will be important to monitor in 2026 to see if total phosphorus removal rates continue to increase.

Unbound aluminum has been monitored over the years, with downstream concentrations from the alum treatment facility typically more than double those upstream. This increase is expected since not all aluminum binds with phosphorus before sampling. The unbound aluminum then enters Tanners Lake and binds with phosphorus there.

Total phosphorus removal performance



Total aluminum

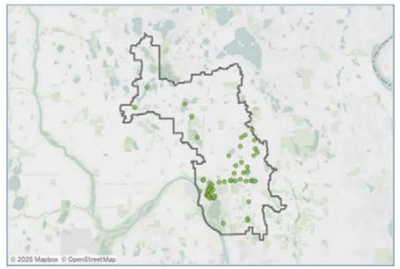


Perfluoroalkyl substances (PFAS)

Perfluoroalkyl substances (PFAS) are also referred to as Perfluorochemicals (PFCs). PFAS are a family of man-made chemicals that have been widely used for decades. PFAS are extremely stable and do not break down in the environment. Common uses of PFAS include:

- Nonstick cookware, stain-resistant carpets, and fabrics
- Coatings on some food packaging (especially microwave popcorn bags and fast food wrappers)
- Components of fire-fighting foam
- Many industrial applications

PFAS have been found in the groundwater in certain parts of Minnesota and are considered "emerging contaminants." Traditional pathways of PFAS are shown in the graphic on this page. Emerging contaminants are contaminants about which the MPCA has a new awareness or understanding of how they move in the environment or affect public health. PFAS, like other emerging contaminants, are the focus of active research and study, which means that new information is released occasionally. In recent years, various forms of PFAS (PFOS, PFOA, PFBA, PFPeA, PFPxA, PFBS, and PFHxS) were detected in surface water from both Battle Creek and Battle Creek Lake through monitoring by the MPCA. Concentrations were low, especially in Battle Creek Lake. High concentrations of PFAS (PFOS, PFOA, PFBA, PFPeA, PFPxA, PFBS, and PFHxS) were detected in samples from the surface foam on Battle Creek. Other areas in the District impacted by the 3M PFAS contamination include the eastern portion of Maplewood, North St. Paul, St. Paul, Oakdale, Landfall, and Woodbury.



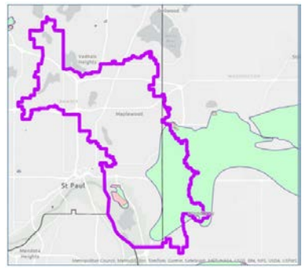
PFAS in the RWMWD: Surface Water

Detectable PFAS across the District

- Detections in 23 lakes, Mississippi River, Battle Creek
- Highest concentrations: Pigs Eye Lake (5,500 ng/L PFBA)
- Lowest: Owasso (1.9 ng/L PFHpA)

Surface water quality standards for PFAS

- Class 1: drinking water
- Class 2: "aquatic life and recreation"



Groundwater area(s) of concern

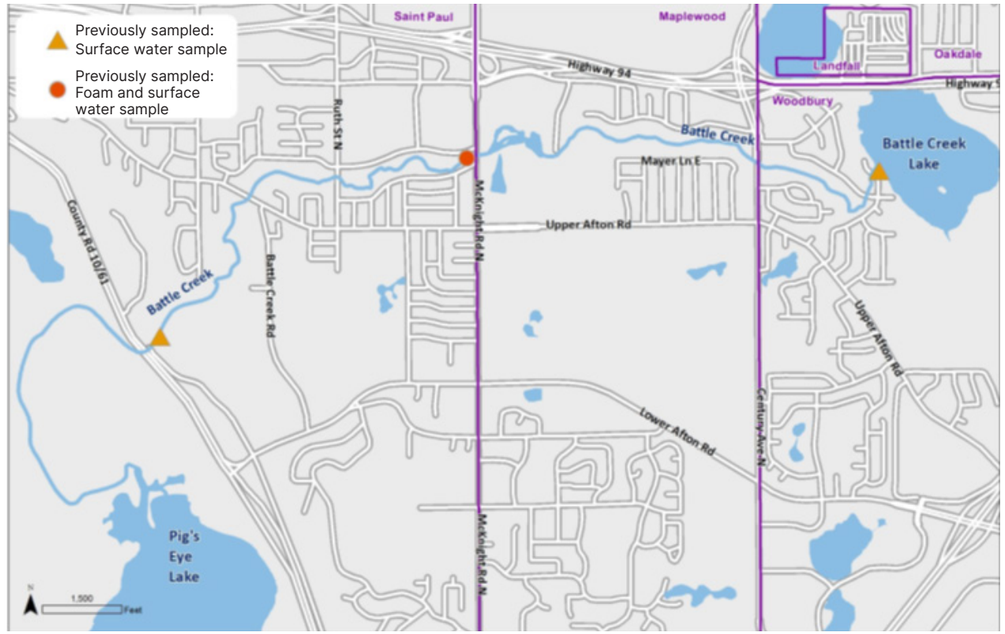
Detectable PFAS across the District

- Based on areas where health risk-based values were exceeded
- Exact boundaries uncertain
- All groundwater in Minnesota is protected as drinking water per Minn. R. 7060.0200
- = all groundwater is Class 1

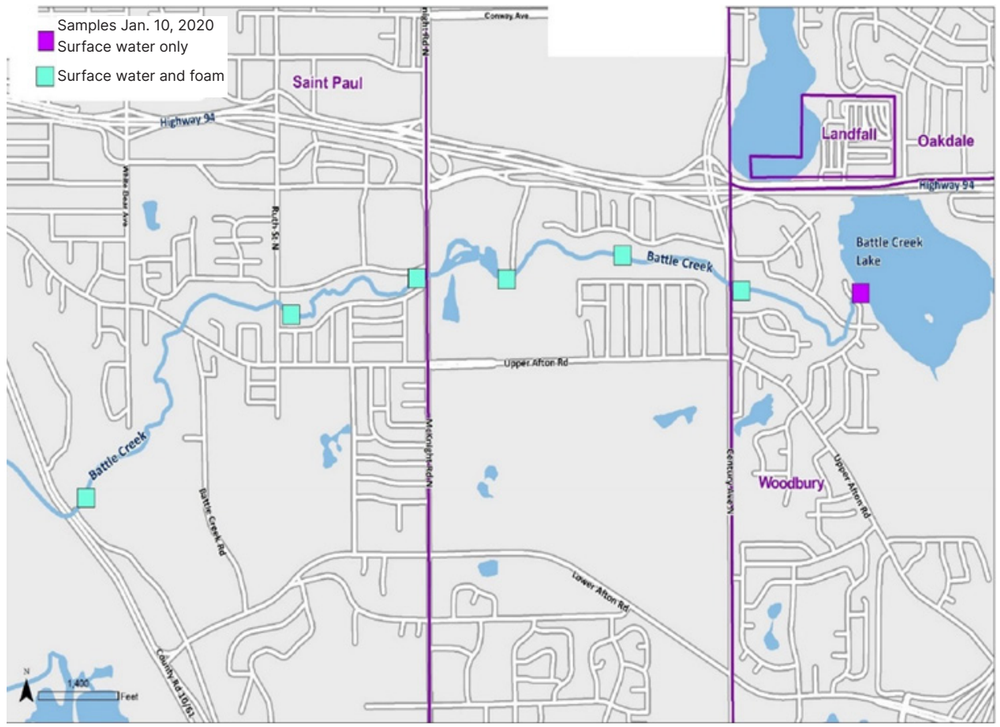
Generally, surface water foam on natural water bodies naturally occurs and does not contain PFAS. However, if PFAS-containing foam is found on surface water, MDH states that it does not pose a risk to human health if skin contact with the foam is minor and infrequent. Overall, with respect to contact with water bodies containing PFAS, MPCA recommends "when in doubt, stay out."

The Minnesota Department of Health (MDH) has guidelines for the recommended consumption of fish based on species type. The MDH has also tested fish for contaminants throughout the state to determine if guidelines should be more stringent based on contaminant concentration results and potential impacts to humans. For example, should the frequency of eating bass be reduced from once a week to once a month because bass in a given lake have a higher concentration of PFAS or mercury? The MDH has determined that the following lakes in the District should have more strict guidelines for fish consumption based on PFAS/PFOS results:

- Battle Creek Lake
- Gervais Lake
- Keller Lake
- Lake Phalen
- Tanners Lake



MPCA's 2019 PFAS sampling locations



MPCA's 2020 PFAS sampling locations

Chloride

Chloride is a commonly monitored water-quality parameter that contributes to total dissolved solids and can affect aquatic life when present at elevated concentrations. The Minnesota Pollution Control Agency's chronic chloride criterion is 230 mg/L.

Most aquatic life criteria are based on testing with sensitive species; hence, the cumulative ecological impact of short-term or persistently high chloride is challenging to identify. Clearly, maintaining chloride below the 230 mg/L criterion will have ecological benefits by reducing overall stress on aquatic life. However, the potential ecological effect can be expected to be a function of the degree to which a given water sample exceeds criteria (e.g., how much greater than 230 mg/L), the frequency of exceedance, and the persistence. The first step towards managing chloride in the District is to examine which water bodies have high chloride concentrations and consider if there are areas within the District with high concentrations ("hot spots").

Chloride monitoring in the District has been completed through two programs: routine lake/stream sampling and ice-out monitoring. Routine lake and stream monitoring refers to sampling that occurs throughout the year (with a focus on summer monitoring), as presented in earlier sections of this report. Chloride monitoring for most of the lakes in this report began in 2015. Figure 6-1 shows the 2025 average summer chloride concentration and 10-year trend of chloride for all RWMWD lakes and streams.

The second chloride monitoring program is chloride ice-out monitoring. Starting in 2021, the District began sampling chlorides after ice-out, where District staff sample a selection of waterbodies (lakes and ponds) a single time between late March to early April. The goal this sampling is to understand the potential worst-case chloride concentrations that are a result of road salt application over winter.

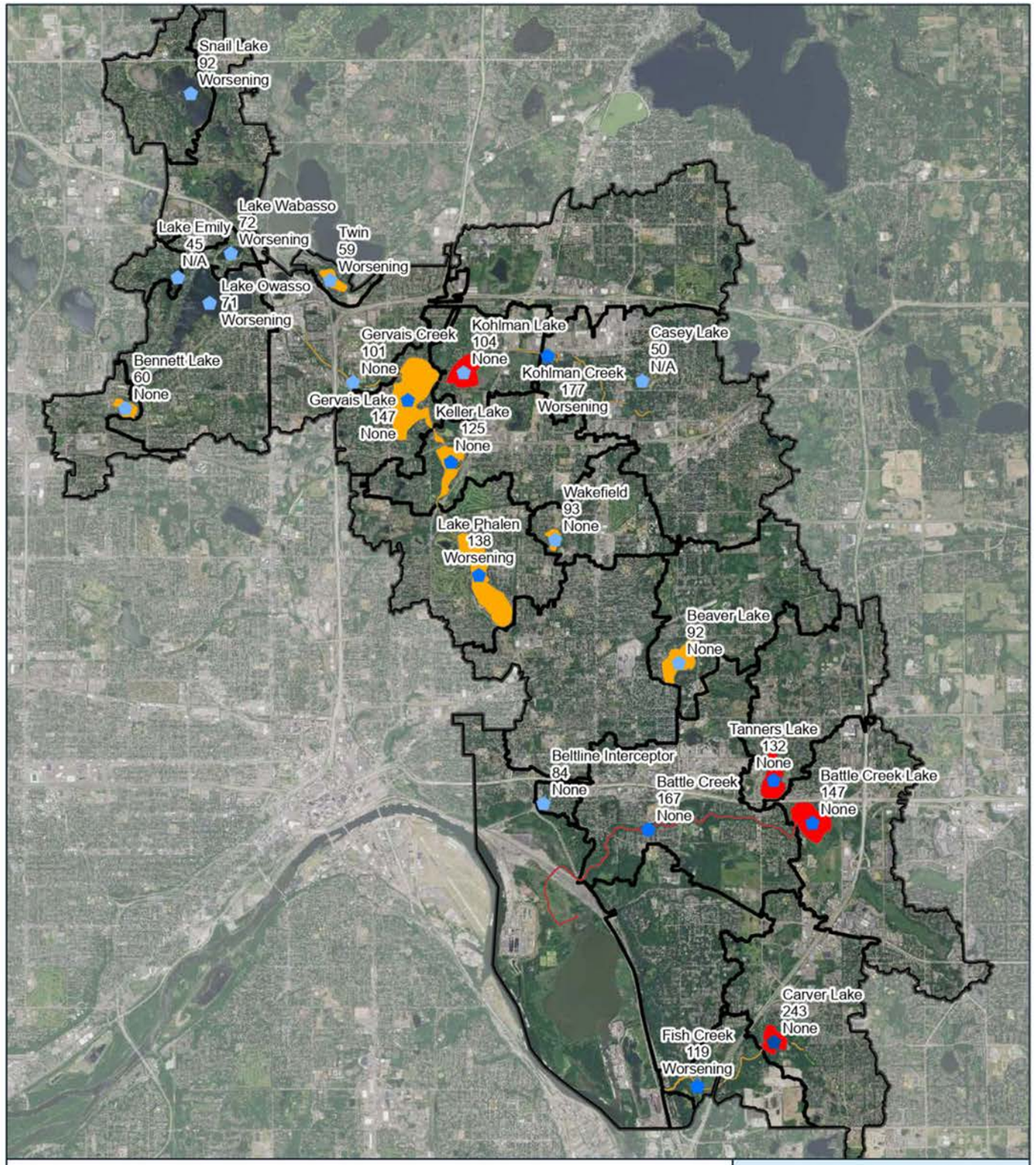
From 2023 to 2025, thirty pond sampling locations were selected for ice-out monitoring; half were selected because they were in the top 50th percentile of chloride concentrations between 2021 and 2022. The remainder of the sample locations were chosen because they are in the Tanners Lake, Battle Creek Lake, Carver Lake, or Kohlman Lake subwatershed—all of which are listed by the MPCA as impaired for chlorides. The primary goal of collecting samples at these locations was to understand potential annual fluctuation in chloride concentrations. Another goal of collecting samples at these locations was to understand local hot spots in chloride-impaired subwatersheds. RWMWD and Ramsey County also conduct ice-out monitoring on the District's major lakes. Results for 2025 are shown in Figure 6-2.

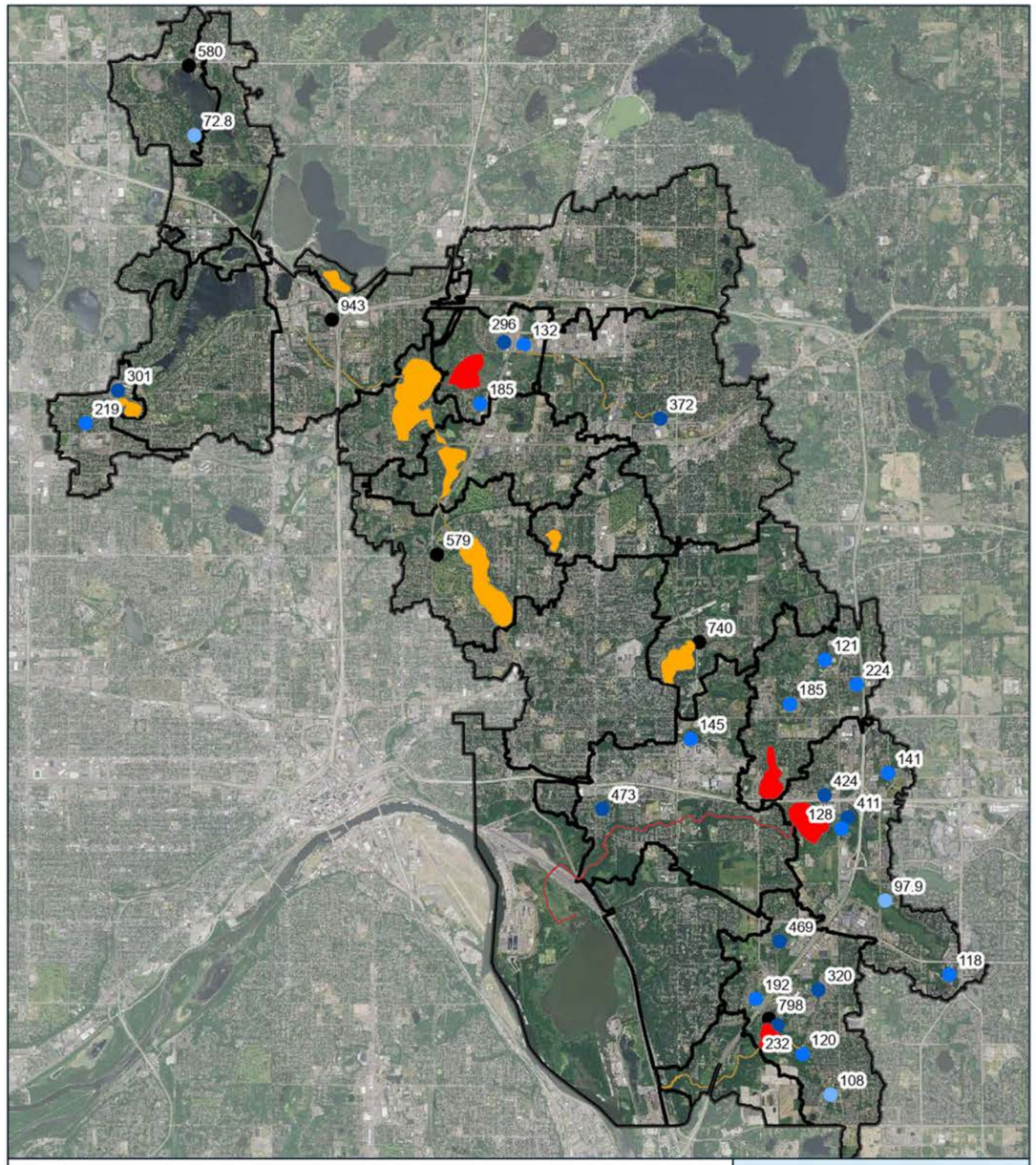
The 2025 ice-out sampling marks the fifth year of ice-out monitoring. In 2026, the ice-out monitoring will continue. In 2026, District staff will add a secondary monitoring event in June at half of the pond sampling locations. The objective of the second monitoring event is to understand if chloride is flushed out of ponds (i.e. moving downstream) or if the elevated chloride concentrations persist throughout the year.

In 2026, RWMWD is developing a Chloride Reduction Strategy. The objective of the Chloride Reduction Strategy is to:

1. Perform an inventory and assessment of chlorides throughout the watershed by using monitoring results and modeling tools
2. Define priority areas to help the District and partners to focus chloride reduction and monitoring
3. Develop an implementation strategy for chloride reduction across district programs including: communications and engagement, monitoring, stewardship grant, regulatory, and research

Chloride monitoring results will directly support the Chloride Reduction Strategy by informing priority areas, guiding modeling efforts, and providing a baseline for evaluating the effectiveness of future chloride reduction actions across the watershed.


Snail Lake
92
Worsening
Lake Wabasso
72
Worsening
Lake Emily
45
N/A
Twin
59
Worsening
Lake Owasso
71
Worsening
Gervais Creek
101
None
Kohlman Lake
104
None
Casey Lake
50
N/A
Bennett Lake
60
None
Kohlman Creek
177
Worsening
Gervais Lake
147
None
Keller Lake
125
None
Wakefield
93
None
Lake Phalen
138
Worsening
Beaver Lake
92
None
Tanners Lake
132
None
Beltline Interceptor
84
None
Battle Creek
167
None
Battle Creek Lake
147
None
Carver Lake
243
None
Fish Creek
119
Worsening
Subwatersheds
2025 Lakes and Creeks Concentration
High, 230 mg/L to 499 mg/L
Medium, 116 mg/L to 229 mg/L
Low, under 115 mg/L
Chloride Impaired Waters
Impaired
At Risk
0
1
2
Miles
2025 RWMWD
Lakes and Streams
Chloride Results
RWMWD 2025 Annual
Monitoring Report
FIGURE 6-1
BARR


580
72.8
943
296
132
301
219
185
372
579
740
121
224
185
145
141
424
411
473
128
97.9
469
118
320
192
798
232
120
108
Subwatersheds
Chloride Impaired Waters
Impaired
At Risk
2025 Chloride Ice Out Concentration
Very High, above 500 mg/L
High, 230 mg/L to 499 mg/L
Medium, 166 mg/L to 229 mg/L
Low, below 115 mg/L
0
1
2
Miles
2025 Chloride
Ice Out
Monitoring Results
RWMWD 2025 Annual
Monitoring Report
FIGURE 6-2
BARR

Mercury

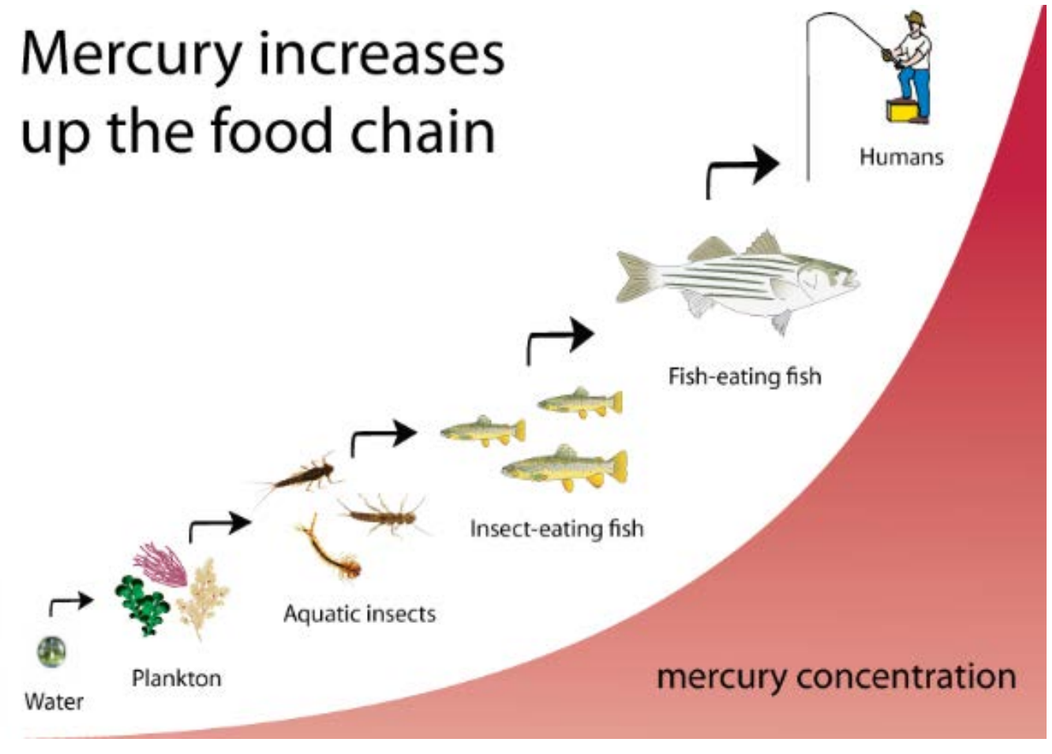
In Minnesota, numerous lakes have aquatic consumption impairments due to mercury in fish tissue. These lakes are considered impaired by mercury. Mercury contamination in Minnesota is primarily due to air deposition and not from point sources. Therefore, the MPCA developed a statewide TMDL to address mercury impairment in its lakes.

Mercury in fish tissue is problematic and dangerous for two primary reasons. First, there is no method for cooking or cleaning fish to reduce the concentration of mercury in the fish before consumption. Secondly, mercury is a compound that is prone to bioaccumulation and biomagnification in fish tissue. Bioaccumulation is the process of chemical concentrations increasing in a single fish over its life span because it consumes a chemical, and the chemical will not degrade via ingestion or other biological processes. Biomagnification is the process of chemical concentrations increasing from lower to higher on the food pyramid by animals high on the food pyramid consuming animals lower on the food pyramid. The combination of bioaccumulation and biomagnification of mercury results in larger fish being more likely to have a high concentration of mercury in their fish tissue. Given the issues with bioaccumulation and biomagnification, the Minnesota Department of Health (MDH) has guidance on which fish can be eaten and at what frequency (i.e., if a sunfish from a give lake can be eaten as one meal a week or one meal a month, depending on the contamination levels). In addition, guidance from the MDH can be more stringent if the lake is impaired by mercury.

Currently, RWMWD has nine lakes that are designated as impaired by the MPCA for aquatic consumption due to mercury in fish tissue:

- Battle Creek Lake, listed in 2012
- Beaver Lake, listed in 2002
- Bennett Lake, listed in 2012
- Carver Lake, listed in 1998
- Eagle Lake, listed in 2008
- Gervais Lake, listed in 1998
- Lake Owasso, listed in 1998
- Lake Phalen, listed in 2012
- Snail Lake, listed in 2002
- Tanners Lake, listed in 2002

Currently, the District does not monitor for mercury in surface water or fish tissue. However, the Minnesota DNR has tested fish in all nine lakes listed above. More information on fish contamination testing and results can be found for each specific lake on the Minnesota DNR LakeFinder Database.



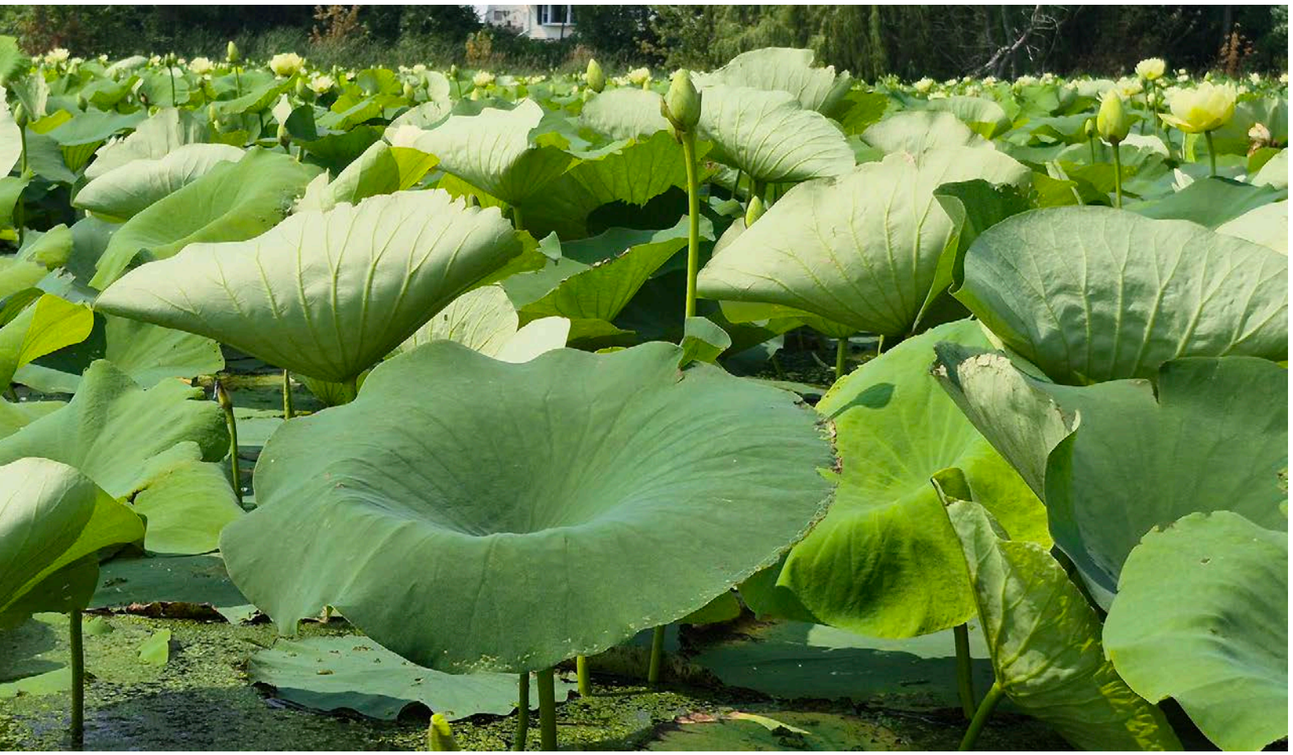
7. FISHERIES

This section describes the work the District has done managing fisheries in its water bodies to improve the water quality of its lakes. To date, efforts have been focused on carp management due to their ability to decrease water quality. Below is a summary of the carp management projects that the District has implemented.

Carp are notorious for deteriorating the water quality of lakes because they stir up sediment and sediment-bound phosphorus while searching for food in the lake bottom. Carp also tend to uproot and disturb submerged aquatic vegetation. They reproduce quickly, have long life cycles, and lack natural predators—increasing the longevity of their impact on water quality. Studies have indicated that carp biomass over 90 pounds per acre can lead to reduced lake water quality (Bajer et al., 2009). Over the past several years, RWMWD has completed significant work to quantify, track, remove, and limit the movement of carp in various waterbodies in the District. Since 2009, the District has worked to reduce carp in the Phalen Chain of Lakes with the use of fish surveys, capture events, the drawdown of Casey Lake (a major carp nursery), and the installation of carp barriers. Due to the success of this program, a similar effort was initiated on the Owasso chain of lakes and is detailed below:

- In 2017, electrofishing surveys for carp were completed on Lake Owasso, Bennett Lake, Lake Wabasso, Lake Emily, Grass Lake, and West Vadnais. Due to high catch rates, a recapture study was completed on Lake Owasso. The Lake Owasso recapture study was completed by marking over 200 carp and releasing them back to the lake, then recapturing them again later in the summer. Results of the recapture study predicted that the population of carp was roughly 15,500 adult carp with a biomass of 195 pounds per acre (double the water quality management threshold).
- From August 2017 to February 2018, 20 carp in Lake Owasso were monitored with radios to record their movements. Tracking the movement of carp can be a beneficial tool for understanding where carp spawn and potential locations to try to capture and remove them. Tracking showed that during the winter, carp move to and typically stay in the northwest bay of Lake Owasso. In February 2018, a commercial carp fishing company was hired to assist with catching the carp in the northwest bay. Unfortunately, the event was unsuccessful due to the nets breaking on submerged objects.
- In May 2018, carp barriers were installed in five locations on the Owasso chain. The barriers prevent carp from migrating in shallow channels to smaller ponds and wetlands where the carp prefer to spawn. If carp spawn in larger lakes, the spawn rate is lower due to eggs and young being eaten by native fish. To date, the carp barriers have been successful—they are seen at the barriers during checks and unable to access the small channels. Any carp found during carp barrier checks are removed. Success can also be seen by fewer young carp in the main lakes and decreasing carp biomass.
- In 2024, RWMWD staff and its hired contractor continued efforts to monitor and control the common carp population in the District. Electrofishing, Passive Integrated Equipment, temporary barriers, trap netting, and other methods were used to both remove carp and estimate carp populations from the Owasso chain of lakes and the Phalen chain of lakes. A total of 735 carp were removed from District waters, and all monitored lakes had carp population densities less than the critical threshold of 100 kg/ha.

In 2025, RWMWD staff and its hired contractor continued efforts to monitor and control the common carp population in the District. Electrofishing, Passive Integrated Equipment, temporary barriers, trap netting, and other methods were used to both remove carp and estimate carp populations from the Owasso chain of lakes and the Phalen chain of lakes. A total of 184 carp were removed from Gervais Mill Pond and Lake Owasso. Carp nursery surveys were conducted on Casey Lake and Wetland A via trap netting. The trap netting yielded no young of year or juvenile carp on Casey and only four in Wetland A. In 2025, 10 carp in Gervais Lake and 31 carp in Kohlman Lake were implanted with passive integrated transponder tags to track spawning migrations and provide future mark-recapture estimates. Given the success on the Phalen Chain and Owasso Chain, an electric carp barrier was installed at the West Vadnais Lake Outlet in 2021. The barrier also has passive integrated transponder (PIT) technology. Over the years, hundreds of carp have been tagged with PIT. If a carp with a PIT sensor hits the barrier, the PIT technology will track the hit and record it. This information can be used to determine if the barrier is preventing tagged fish from traveling elsewhere. The District's management approach will be similar for future years, while also integrating goldfish monitoring and control in several waterbodies.



8. AQUATIC VEGETATION

Over the years, the District has pursued aquatic vegetation projects to help improve lake health and water quality. Below is a summary of the aquatic vegetation management projects the District has conducted over the last decade.

A healthy lake should have aquatic vegetation. In addition to providing food and shelter for many aquatic animals, aquatic plants produce oxygen and can improve water quality by taking up nutrients, stabilizing bottom sediments, and helping keep the water clear. Near shore, emergent plants can also help protect shorelines by reducing wave energy and erosion. However, too much aquatic vegetation can be detrimental to water quality. Excess aquatic vegetation can store phosphorus and then release it to the water column when it dies and decays. In addition, invasive species such as Eurasian watermilfoil or curly leaf pondweed can grow densely, limiting the growth of native plants and the ability of the lake water to mix oxygen throughout the water column. In such cases, aquatic vegetation management (i.e., harvesting) may be required. The District has, on occasion, selectively employed aquatic vegetation harvesting in District lakes.

Ramsey County performed aquatic vegetation point-intercept surveys on ten lakes in 2025, including Battle Creek, Bennett, Casey, Emily, Keller, Kohlman, Wabasso, and Wakefield. Across the lakes surveyed, two non-native species were observed: curly-leaf pondweed (CLP) and Eurasian watermilfoil (EWM). CLP and EWM were present at varying levels across the district, with higher relative abundance observed in select lakes. Several native species were observed in all lakes, with species composition and occurrence varying by lake. More information on aquatic vegetation can be obtained by contacting District staff.

Additionally, RWMWD treated Kohlman Lake with an herbicide, targeting curly-leaf pondweed in April 2025. In a follow-up to the herbicide treatment, Ramsey County performed a turion survey in late September 2025, that counts the viable seedbank of curly-leaf pondweed that may contribute to future growth. The turion survey showed moderate density in the upper-middle portion of the lake, as well as the southern edge. RWMWD and Ramsey County will continue monitoring for curly-leaf pondweed as part of a long-term management strategy for Kohlman Lake. The management of curly-leaf pondweed is in preparation for an alum treatment planned in the Spring of 2026.

9. BATTLE CREEK AND FISH CREEK SYNOPTIC MONITORING

In 2025, the District staff undertook a synoptic surveying effort along both Battle Creek and Fish Creek to better understand how water quality in the creeks changes at various points along the creeks under a variety of flow rates and seasonal conditions. The District staff collected samples on 12 different dates between May 20th and October 29th at 14 different locations: 10 along Battle Creek and 4 along Fish Creek. The sampling dates are summarized in the table below and the sampling locations and names are shown in Figures 9-1 and 9-2. All the sampling locations are directly on the creeks except for Battle Crk 08 and Fish Crk 03. Battle Crk 08 is at a storm sewer manhole just upstream of the outlet to Battle Creek and was included to understand the water quality outflowing from Suburban Pond and the surrounding neighborhoods. Fish Crk 03 is located on the outflow from the Double Driveway Pond and was included to assess the water quality of the outflows from this pond relative to the water quality in Fish Creek. The sampling efforts included taking grab samples and staff gage readings at each of the locations so that the pollutant concentrations could be correlated with flow rates in the creeks.

Sample Date	Event Description
5/20/2025	1.53” (2-day Total: 2.15”)
6/3/2025	0.69" (2-day Total: 0.73")
6/18/2025	Baseflow
6/26/2025	0.85" (2-day Total: 3.01")
7/10/2025	Baseflow
7/16/2025	1.66"
7/29/2025	0.65" (36-hour Total: 1.54")
8/8/2025	Baseflow
8/18/2025	1.23” (3-day Total: 3.92”)
9/12/2025	Baseflow
10/9/2025	Baseflow
10/29/2025	Baseflow

The sampling data will be analyzed in 2026 to better understand how the water quality changes longitudinally along the creeks under various flow regimes and seasons. At the time of writing this report, the analysis is still in its preliminary stages but we are starting to see some interesting trends and observations including:

- The baseflow samples have lower pollutant concentrations than the event samples for *E. coli*, Chlorophyll-*a*, Total Phosphorus and Total Suspended Solids but have higher concentrations for Chloride.
- The average baseflow concentrations for Chlorophyll-*a*, Total Phosphorus and Total Suspended Solids meet the state standards at most locations along the creeks.
- The *E. coli* event concentrations are significantly higher than the baseflow concentrations and both the event and baseflow concentrations are generally well above the state standard.

See table next page

Parameter	State Standard	Sample Type	Battle Creek Average Concentrations	Fish Creek Average Concentrations
E. coli (MPN/100mL)	<=126 MPN/100mL	Baseflow	217	238
		Event	1,515	854
		All	866	541
Chloride (mg/L)	<=230 mg/L	Baseflow	153	96
		Event	110	88
		All	131	92
Chlorophyll-*a* (µg/L)	<=20 µg/L	Baseflow	2	13
		Event	7	24
		All	5	19
Total Phosphorus (mg/L)	<=0.10 mg/L	Baseflow	0.05	0.07
		Event	0.10	0.15
		All	0.08	0.11
Total Suspended Solids (mg/L)	<=15 mg/L	Baseflow	5	7
		Event	22	34
		All	13	21

- The McKnight Basin (location Battle Crk 05) outflow concentrations for Chlorophyll-*a*, Total Phosphorus and Total Suspended Solids meet the state standards for both the baseflow and event samples and are generally better than the concentrations in Battle Creek upstream of the basin (Battle Crk 04).
- The Double Driveway Pond (location Fish Crk 03) outflow concentrations for Chlorophyll-*a*, Total Phosphorus and Total Suspended Solids meet the state standards for both the baseflow and event samples and are better than the concentrations in Fish Creek upstream of this inflow point (Fish Crk 02).

Parameter	State Standard	Sample Type	McKnight Basin Average Concentrations	Battle Crk 04 Average Concentrations	Double Driveway Pond Average Concentrations	Fish Crk 02 Average Concentrations
Chlorophyll-*a* (µg/L)	<=20 µg/L	Baseflow	2	3	4	12
		Event	8	7	9	33
		All	5	5	7	22
Total Phosphorus (mg/L)	<=0.10 mg/L	Baseflow	0.05	0.05	0.04	0.13
		Event	0.09	0.11	0.07	0.27
		All	0.07	0.08	0.05	0.20
Total Suspended Solids (mg/L)	<=15 mg/L	Baseflow	2	4	3	10
		Event	7	37	15	44
		All	4	21	9	27

The final results of this analysis will be used to develop potential BMPs and management recommendations for improving the water quality in these two creeks.

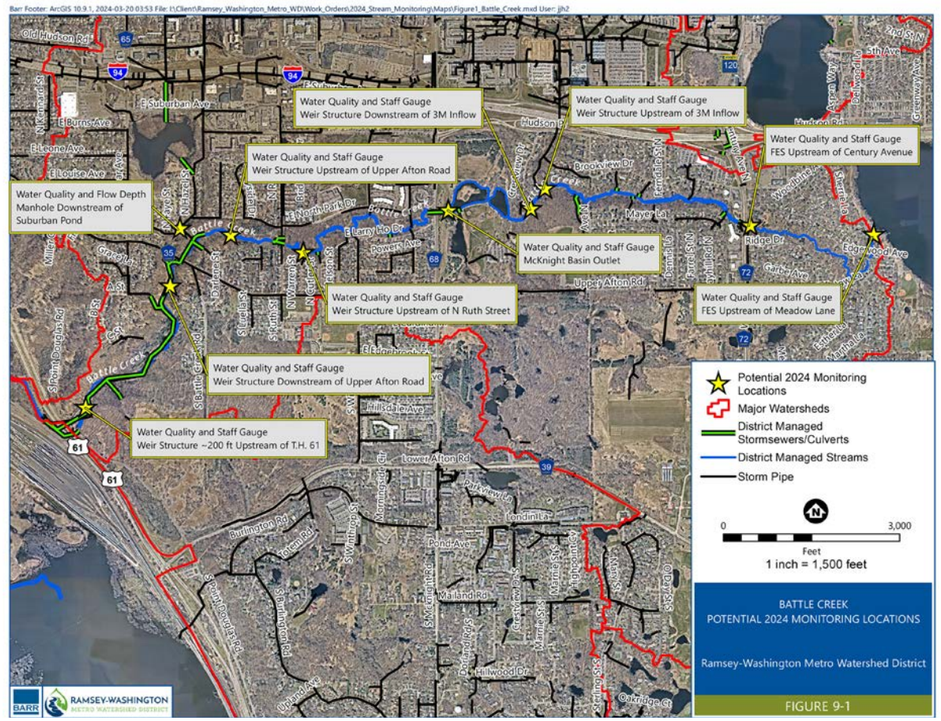


Figure 9.1 Battle Creek Sampling Locations

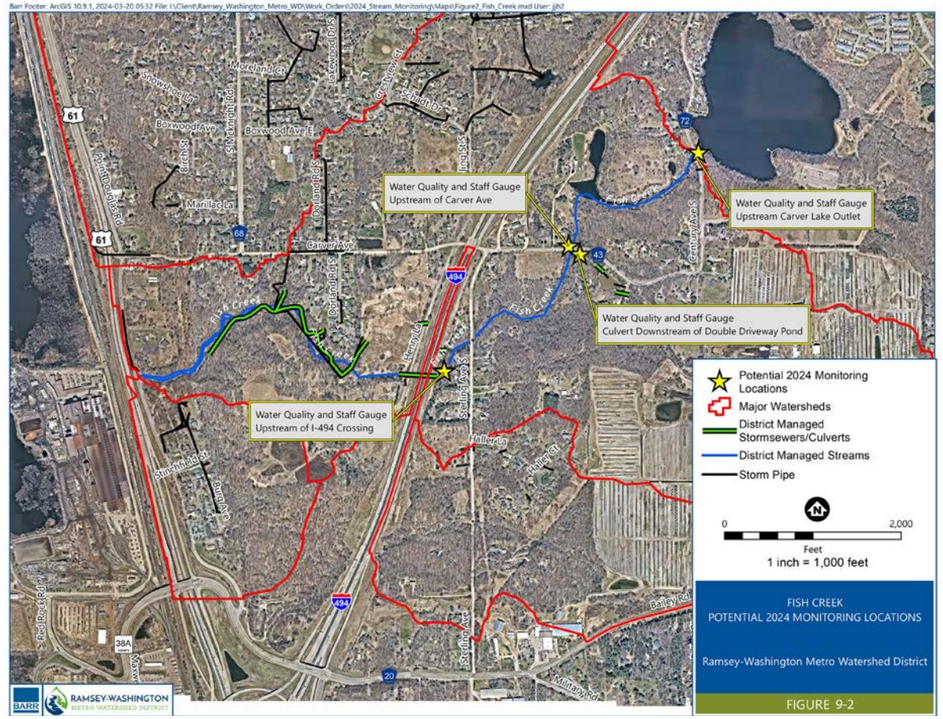


Figure 9.2 Fish Creek Sampling Locations

RAMSEY-WASHINGTON
METRO WATERSHED DISTRICT

2665 Noel Drive
Little Canada, MN 55117
P: 651-792-7950
E: office@rwmwd.org