# Middle St. Croix Watershed Management Organization 2025 Water Monitoring Summary

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MIDDLE ST. CROIX WATERSHED MANAGEMENT ORGANIZATION

Prepared by:

WASHINGTON CONSERVATION DISTRICT

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## ACKNOWLEDGEMENTS

Multiple agencies and individuals were directly involved in many aspects of this project, such as data collection and data analysis, as well as technical and administrative assistance.

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## ABBREVIATIONS, DEFINITIONS, ACRONYMS, AND SYMBOLS

| | |
|---|---|
| Anoxic | Lacking oxygen |
| BCWD | Brown's Creek Watershed District |
| Benthic | The area nearest lake bed |
| Biweekly | Every two weeks |
| BMP | Best management practice |
| cf | cubic feet |
| cfs | cubic feet per second |
| Chl-α | Chlorophyll-α |
| DO | Dissolved oxygen |
| *E. coli* | *Escherichia coli* |
| Littoral zone | The area of a body of water where sunlight penetrates to the sediment and allows aquatic plants (macrophytes) to grow |
| m | meters |
| MCES | Metropolitan Council Environmental Services |
| mg/L | milligram per liter |
| mL | milliliter |
| MN DNR | Minnesota Department of Natural Resources |
| MPCA | Minnesota Pollution Control Agency |
| MPN | Most probable number |
| MSCWMO | Middle St. Croix Watershed Management Organization |
| NAVD 88 | North American Vertical Datum of 1988, used for determining lake elevations |
| NGVD 29 | National Geodetic Vertical Datum of 1929, used for determining lake elevations |
| OHW | Ordinary high water level |
| SOP | Standard operating procedure |
| TKN | Total Kjeldahl nitrogen |
| TP | Total phosphorus |
| TSI | Trophic State Index |
| TSMP | Trout Stream Mitigation Project |
| TSS | Total suspended solids |
| µg/L | micrograms per liter |
| µmhos/cm | micromhos per centimeter |
| VSS | Volatile suspended solids |
| WCD | Washington Conservation District |

# EXECUTIVE SUMMARY

This report focuses on the summary and comparison of lake and stream water quality data collected by the Washington Conservation District (WCD) in 2025, as well as previous years. In 2025 the Middle St. Croix Watershed Management Organization (MSCWMO) monitored water quality and water surface elevation on McKusick Lake and Lily Lake, water surface elevation on Brick Pond, and flow and water quality at Perro Creek at the Diversion Structure (Figure 1). The purpose of this monitoring is to assess and document current water quality conditions of the lakes and streams, as well as continuation of a long-term monitoring program that will enable the MSCWMO to identify trends associated with best management practice (BMP) implementation and land use changes in the watershed. Also included in this report is data collected at the Brown's Creek Diversion Structure, which is a tributary to McKusick Lake that is monitored by the WCD for the Brown's Creek Watershed District (BCWD). A period of record for historical water monitoring in MSCWMO is found in Table 1.

## Lake Monitoring

Lily Lake was classified as mesotrophic and received an A grade in 2025 (APPENDIX 1). All samples collected June – September met the Minnesota Pollution Control Agency's (MPCA) standards for total phosphorus (TP) and for chlorophyll-α (chl-α) corrected for pheophytin. All Secchi disk transparency measurements also met the MPCA standard (APPENDIX 1).

In 2025 McKusick Lake was classified as eutrophic and received a grade of C+ (APPENDIX 1). Five of the nine samples collected June – September did not meet the Minnesota Pollution Control Agency's standard for total phosphorus and one sample did not meet the standard for chlorophyll-α corrected for pheophytin. All Secchi disk transparency measurements met the MPCA shallow lake standard (APPENDIX 1).

## Stream Monitoring

In 2025 the total recorded discharge from Perro Creek at the Diversion Structure to the St. Croix River was 26,453,270 cubic feet (similar to 2024), which included discharge through the

overflow structure. The average baseflow TP concentration was 0.032 mg/L (similar to 2018-2021 and 2024) and the average baseflow TSS concentration was 3 mg/L (consistent since 2018). The average TP concentration from storm samples was 0.226 mg/L (second lowest since 2018) and the average TSS concentration from storm samples was 222 mg/L (highest since 2016). TP and TSS loads to the St. Croix River were calculated only during monitored periods, and in 2025 the TP load was 75.7 lbs. and the TSS load was 29,152 lbs.

Discharge at the Brown's Creek Diversion Structure in 2025 was 60,305,225 cubic feet (fifth highest since 2006). The total annual TP load was 416 lbs. (sixth lowest since 2006) and the TSS load was 73,469 lbs. (second lowest since 2006). Concentrations of metals were again low in 2025 with only one lead result exceeding the MPCA chronic standard.

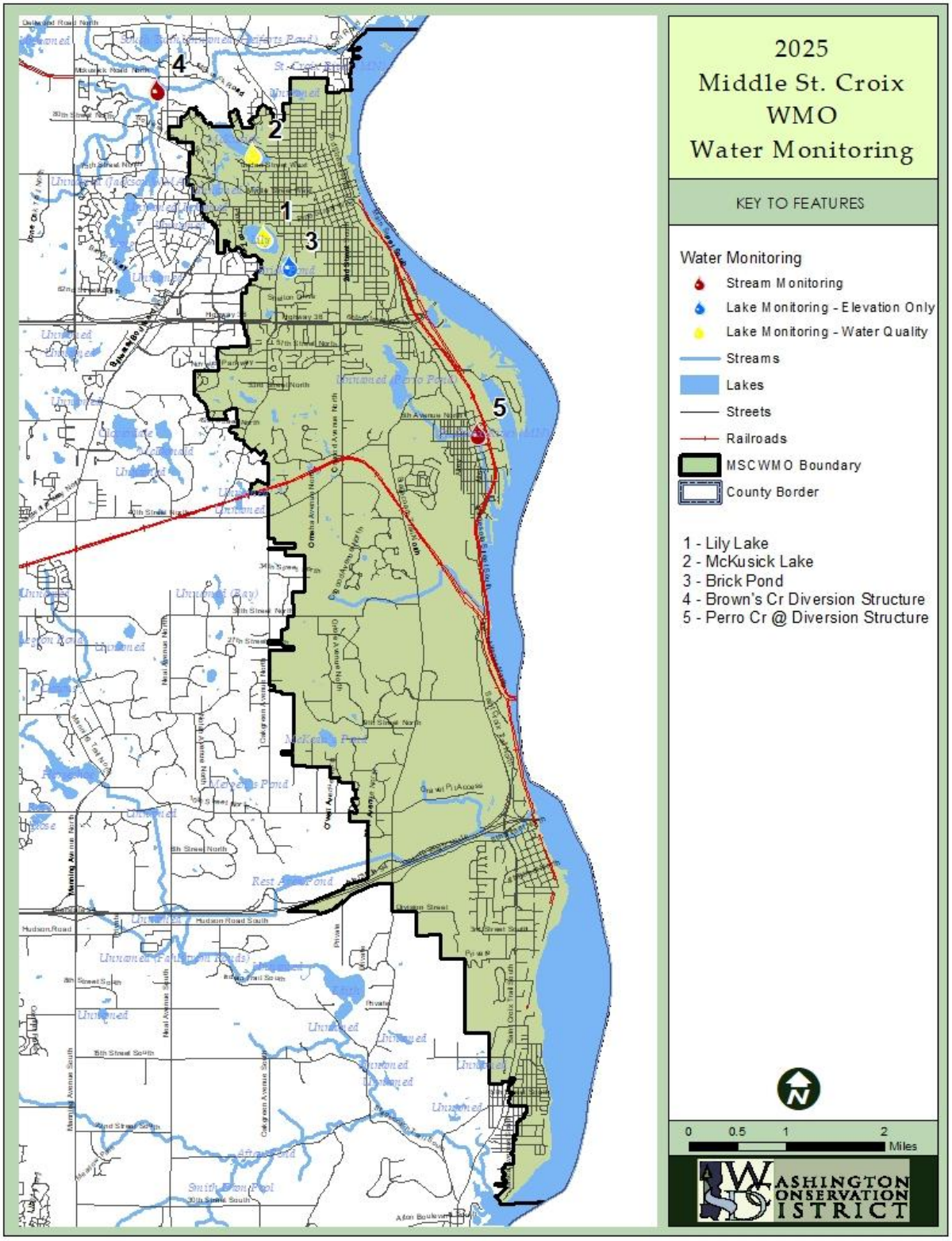


**Figure 1. MSCWMO 2025 Water Monitoring Locations**

**Table 1. Water Monitoring Period of Record in MSCWMO**

| Monitoring Type | Location | Monitored Years | Monitored Parameters |
|---|---|---|---|
| Lake Monitoring | Lily Lake (82-0023) | 1995-2025 | Water Quality Samples, Elevation |
| Lake Monitoring | McKusick Lake (82-0020) | 1994-2025 | Water Quality Samples, Elevation |
| Lake Monitoring | Brick Pond (82-0308w ) | 2008-2013, 2022-2025 | Water Quality Samples, Elevation |
| Stream/Stormw ater | Perro Creek at Diversion Structure | 2016-2025 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Perro Creek Diversion Overflow | 2016-2025 | Stage and Discharge |
| Stream/Stormw ater | Perro Creek @ 3rd Ave. | 2018-2020 | Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ 4th St. | 2018-2019 | Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ 5th Ave. | 2018-2019 | Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ 6th St. | 2006-2013, 2016-2020 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ 8th St. | 2018-2019 | Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ 9th St. | 2018-2020 | Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ Central Ave. | 2018-2019 | Water Quality Samples |
| Stream/Stormw ater | Perro Creek @ St. Croix Trl. | 2018-2019 | Water Quality Samples |
| Stream/Stormw ater | Perro Pond Outlet (Direct to the St. Croix) | 2016-2017 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Perro Pond Outlet (To Perro Creek) | 2016-2019 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Greeley St (Tributary to Lily Lake) | 2015-2023 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Grove St. (Tributary to Lily Lake) | 2015 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Lake St. (Tributary to Lily Lake) | 2015-2016 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Pine Tree (Tributary to Lily Lake) | 2015-2016 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Pump Station (Tributary to Lily Lake) | 2015-2016 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Willard St. (Tributary to Lily Lake) | 2015 | Stage, Discharge, and Water Quality Samples |
| Stream/Stormw ater | Meadow lark Dr. (Trib. to McKusick Lake) | 2009-2011 | Water Quality Samples |
| Stream/Stormw ater | Myrtle St. (Trib. to McKusick Lake) | 2009-2011 | Water Quality Samples |
| Stream/Stormw ater | Brow n's Creek Diversion Structure (BCWD) | 2006-2025 | Stage, Discharge, and Water Quality Samples |

## LAKE MONITORING

### A. METHODS, RESULTS AND DISCUSSION

In 2025 the WCD collected water quality data biweekly on Lily Lake and McKusick Lake, over seven consecutive months (April–October). Measurements obtained during the summer sampling season (June–September) are averaged for a comparison of individual lake dynamics from year to year between lakes within the watershed and to the Minnesota Pollution Control Agency's (MPCA) impairment standards. Lake grades are based on the averages of samples collected May–September. Average values for all parameters are presented in APPENDIX 1 and Figure 2 through Figure 5, which show the current and historic summer averages for each parameter. Water quality samples were collected by the WCD with a two-meter (6.56 feet) integrated surface water column sampler. A full description of WCD Standard Operating Procedures (SOP) is available on the Washington Conservation District website at http://www.mnwcd.org/water-

monitoring. The Metropolitan Council Environmental Services (MCES) Laboratory analyzed the surface water samples for TP, chl-α, and total Kjeldahl nitrogen (TKN).

Total phosphorus is analyzed because it is a major nutrient involved in the eutrophication of lakes and is generally associated with the growth of aquatic plants and/or algal blooms. Common sources of phosphorus include runoff from agricultural fields, livestock areas, urban areas, lakeshore lawns, and improperly operating septic systems. With most lakes in this region, phosphorus is the least available nutrient; therefore, its abundance or scarcity controls the extent of algal growth. Excess algal growth, in turn, negatively affects the clarity, or transparency, and ability of light to penetrate the water. The MPCA sets lake eutrophication standards for aquatic life and recreation. The standard for TP is 0.040 mg/L for deep lakes and 0.060 mg/L for shallow lakes. In general, shallow lakes are defined as less than 15 feet deep, with greater than 80% littoral area, and less than 10 acres. The 2025 summer average TP concentrations of MSCWMO lakes are found in Figure 2.

Chlorophyll-α is measured because it's the photosynthetic component found in algae and aquatic plants and is an indicator of algal productivity. The MPCA standard for pheophytin-corrected chl-α is 14 µg/L for deep lakes and 20 µg/L for shallow lakes. The 2025 summer average chl-α concentrations of MSCWMO lakes are found in Figure 3.

Total Kjeldahl nitrogen, which is the sum of organic nitrogen and ammonia, was analyzed in MSCWMO lakes. While no standard exists for TKN because TP is often the limiting nutrient, TKN can contribute to eutrophication. The 2025 summer average TKN concentrations of MSCWMO lakes are found in Figure 4.

Field measurements are recorded while collecting lake samples, including Secchi disk transparency. The measurement of light penetration using a Secchi disk gives a simple measure of water transparency, or clarity. A reduction in water transparency is typically the result of turbidity composed of suspended sediments, organic matter and/or phytoplankton (algae). The MPCA standard for Secchi disk transparency is 1.4 meters for deep lakes and 1.0 meter for shallow lakes. The 2025 summer average transparency of MSCWMO lakes are found in Figure 5.

User perception and physical/recreational suitability of lakes were recorded, along with temperature and dissolved oxygen (DO) profile measurements taken by the WCD during each sampling event. Profiles are recorded at one-meter increments from the water surface to the lake bottom. The data show the extent of summer stratification and are useful in identifying the development of a thermocline (the layer of water in which the temperature rapidly declines). As a lake stratifies, the water column becomes more stable and mixing is less likely to occur. If mixing occurs during the growing season, nutrients from the lake bottom become available and can result in increased algal production. Lake DO profile data is useful in determining excessive production (algae/plants) in a lake. Increased production creates more DO, for a time, but as plants and algae die off and decay, the bacteria that decompose them consume DO. Low DO conditions may stress fish populations and under anoxic conditions, nutrients may be released from the sediment. Data collected by the WCD can be found on the MPCA website at https://webapp.pca.state.mn.us/surface-water/search and can be obtained from the WCD by request.

A lake grading system is used in this summary, to allow for a better understanding of lake water quality data and to aid in the comparison of lakes. The lake water quality grading system was developed by MCES following the 1989 sampling season. The concept of the lake grading system is a ranking of water quality characteristics by comparing measured values to those of other metro area lakes. The grading system represents percentile ranges for three water quality indicators: the May through September average values of TP, uncorrected trichromatic chl-α, and Secchi disk transparency. These percentiles use ranked data from 119 lakes sampled from 1980-1988 and are shown in Table 2. This method has since been replicated and the grading system has been verified with more recent data. The variables used in the grading system strongly correlate to open-water nuisance aspects of a lake (i.e. algal blooms), which can indicate accelerated aging (cultural eutrophication). There is a strong correlation when comparing trophic status to the lake grade. Summaries of all lake results are presented in APPENDIX 1.

**Table 2. Lake Grade Ranges**

| Grade | Percentile | TP (µg/L) | Chl-α (µg/L) | SD (m) |
|---|---|---|---|---|
| A | <10 | <23 | <10 | >3.0 |
| B | 10-30 | 23-32 | 10-20 | 2.2-3.0 |
| C | 30-70 | 32-68 | 20-48 | 1.2-2.2 |
| D | 70-90 | 68-152 | 48-77 | 0.70-1.2 |
| F | >90 | >152 | >77 | <0.70 |

There are several metrics and systems that can be used to assess lakes, including the Carlson Trophic State Index (TSI) and ecoregion values. The Carlson Trophic State Index is used to quantify the relationship between water quality data and trophic status. Trophic states vary from oligotrophic (low biological activity and high clarity) to hypereutrophic (highly productive with very low clarity). The MSCWMO is located in the North Central Hardwood Forest Ecoregion where lakes are often mesotrophic. Ecoregion values are assigned for TP, TKN, chl- α, and Secchi disk transparency. This report will focus on the methods used by the MPCA and the Metropolitan Council, as previously discussed.

Water elevation monitoring was conducted on two lakes, McKusick and Lily, from March to October 2025. Lake elevation readings are compared to the lake's Ordinary High Water level (OHW)[1]. The OHW for Lily and McKusick Lakes are 844.8 ft. and 851.7 ft., respectively (NGVD 29). Changes in lake water elevation are often attributed to the changes in precipitation. Complete lake elevation data for 2025 are found in APPENDIX 1. For historical lake elevations, visit the MN DNR Lake Finder webpage at http://www.dnr.state.mn.us/lakefind/index.html.

[1] Minnesota State Statutes defines the ordinary high water level (OHW) as follows: Minnesota Statutes 103G.005 Subd. 14. Ordinary High Water Level. "Ordinary high water level" means the boundary of water basins, watercourses, public waters and public waters wetlands, and: The ordinary high water level is an elevation delineating the highest water level that has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial;

1) For watercourses, the ordinary high water level is the elevation of the top of the bank of the channel; and
2) For reservoirs and flowages, the ordinary high water level is the operating elevation of the normal summer pool.

Water elevation monitoring also occurred on Brick Pond by a citizen volunteer, April to November. The lowest recorded elevation was 847.47 ft. (NAVD 88) on 11/10/2025 and the highest was 848.84 ft. on 8/19/2025.

## 1. LILY LAKE

In 2025 WCD staff conducted two-tailed Kendall's Tau statistical analysis based on data collected by professional agencies for both lakes monitored in MSCWMO to determine trends for TP, Secchi, and chl-α ($p<0.05$). Lily Lake had a statistically significant improving trend for TP, average Secchi disk transparency, and chl-α. Lily Lake had an average summertime TP concentration of 0.021 mg/L, which is higher than 2024 average of 0.017 (Figure 2). All nine summertime results met the MPCA lake nutrient impairment standard for TP. The 2025 average summertime concentration of chl-α was 3.8 μg/L, lower than the 4.5 μg/L measured in 2024 (Figure 3). All nine summertime water quality results for chl-α met the MPCA lake impairment standard (APPENDIX 1). Lily Lake had an average summertime TKN concentration of 0.56 mg/L in 2025, which is higher than the average of 0.53 mg/L in 2024 (Figure 4). Secchi disk readings were measured in 2025 with a summertime average of 3.91 meters (Figure 5), with all nine summertime water quality readings meeting the MPCA lake standard for Secchi disk transparency (APPENDIX 1). Lily Lake received an A grade in 2025, matching the A it received in 2024. Temperature and DO profiles indicate that Lily Lake exhibited thermal stratification during the summer months with the thermocline between 4 and 5 meters; therefore, the lake was less likely to completely mix throughout the summer. The elevation was above the OHW for the entire monitoring season, with the highest recorded level of 846.23 ft. occurring on 6/30/2025 and the lowest recorded level of 845.37 ft. occurring on 5/19/2025. A summary of all lake results is presented in APPENDIX 1.

## 2. MCKUSICK LAKE

A two-tailed Kendall's Tau analysis based on data collected by professional agencies showed that McKusick Lake has statistically significant ($p<0.05$) improving trends for TP and average Secchi transparency, and no trend for chl-α. The McKusick Lake summertime average TP concentration in 2025 was 0.074 mg/L, which is higher than the 0.064 mg/L observed in 2024

(Figure 2). Five of the nine summertime samples collected in 2025 did not meet the MPCA shallow lake standard for TP (APPENDIX 1). McKusick Lake had a summertime average chl-α concentration of 10.8 µg/L, which is lower than the chl-α average of 15.6 µg/L from 2024 (Figure 3). One of the nine summertime samples collected in 2025 did not meet the MPCA shallow lake standard for chl-α. The average summertime TKN concentration in 2025 was 0.76 mg/L, lower than the 0.79 mg/L in 2024 (Figure 4). The 2025 summertime average water transparency measured by Secchi disk was 1.93 meters (Figure 5). All nine summertime Secchi disk readings in 2025 met the MPCA shallow lake impairment standard. McKusick Lake received a grade of a C+ in 2025, the same grade it received in 2024. No temperature and DO profiles were collected, so the occurrence of thermal stratification in the deepest part of the lake cannot be determined. A majority of McKusick Lake is very shallow and does not stratify, and therefore is likely to have mixed throughout the summer. The elevation of McKusick Lake remained above the OHW for the entire monitoring season, reaching its highest recorded level of 855.43 ft. on 6/30/2025 and the lowest recorded level of 854.43 ft. on 9/8/2025. A summary of all lake results is presented in APPENDIX 1.

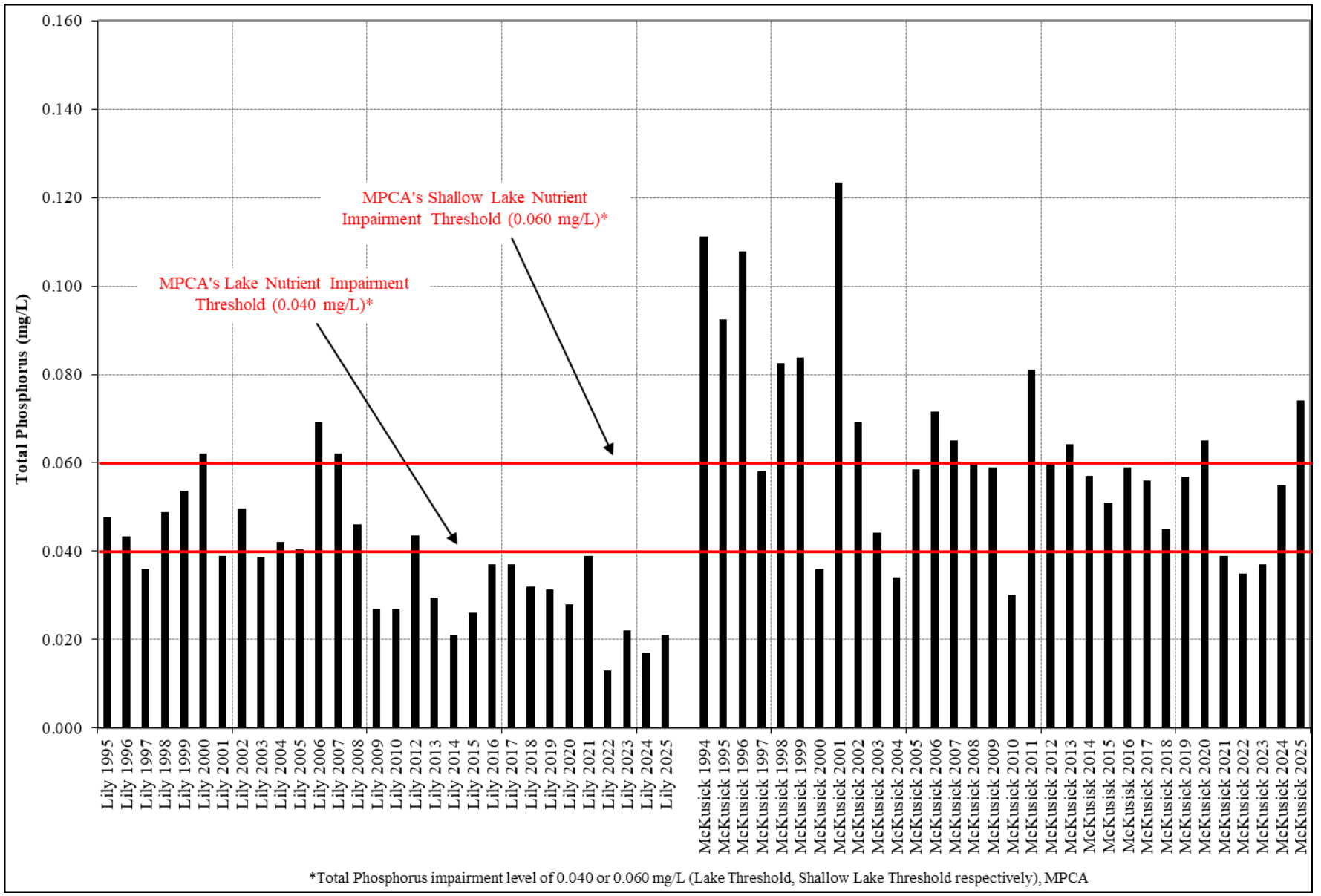


**Figure 2. MSCWMO Historic Summer Average Total Phosphorus**

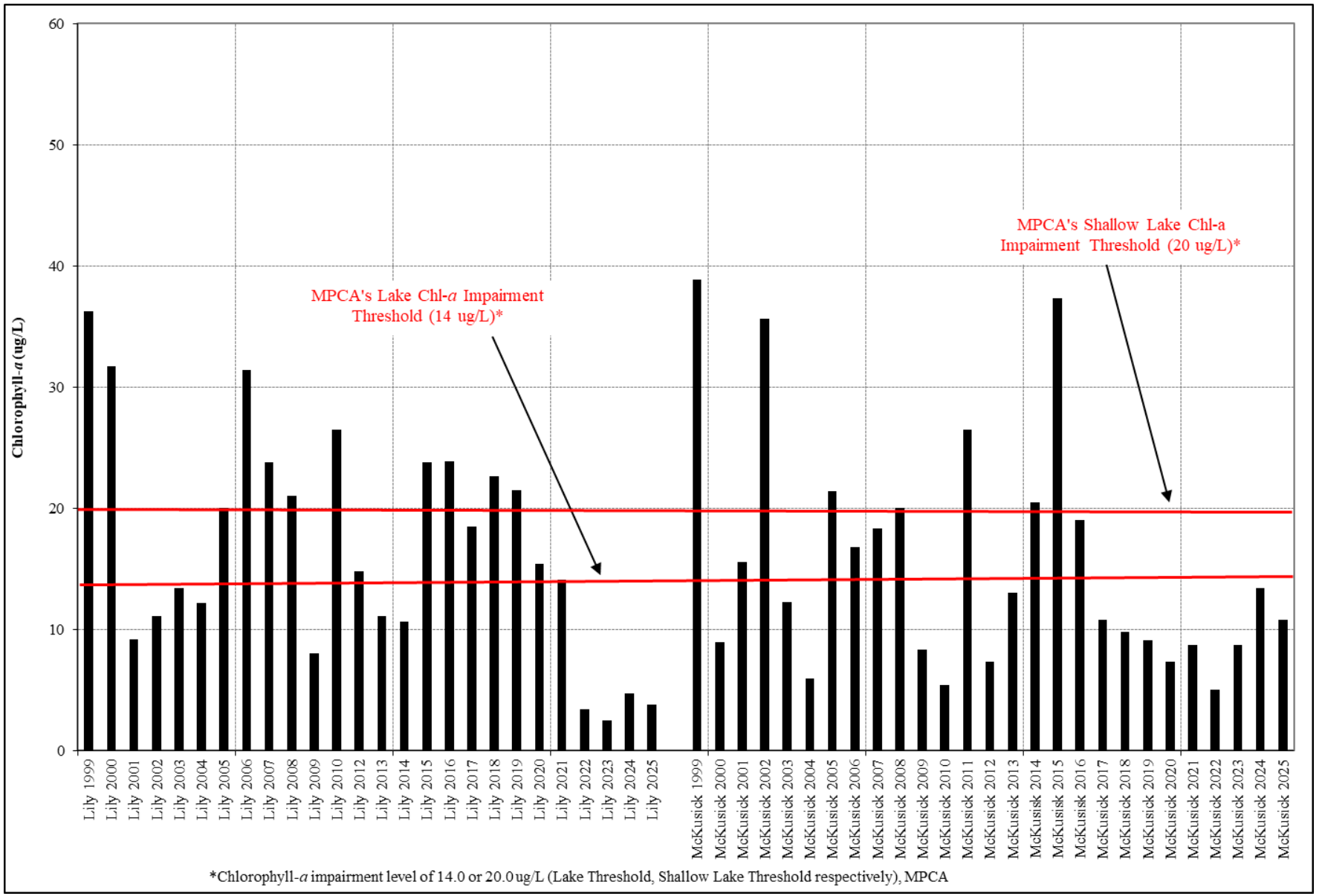


**Figure 3. MSCWMO Historic Summer Average Chlorophyll-α**

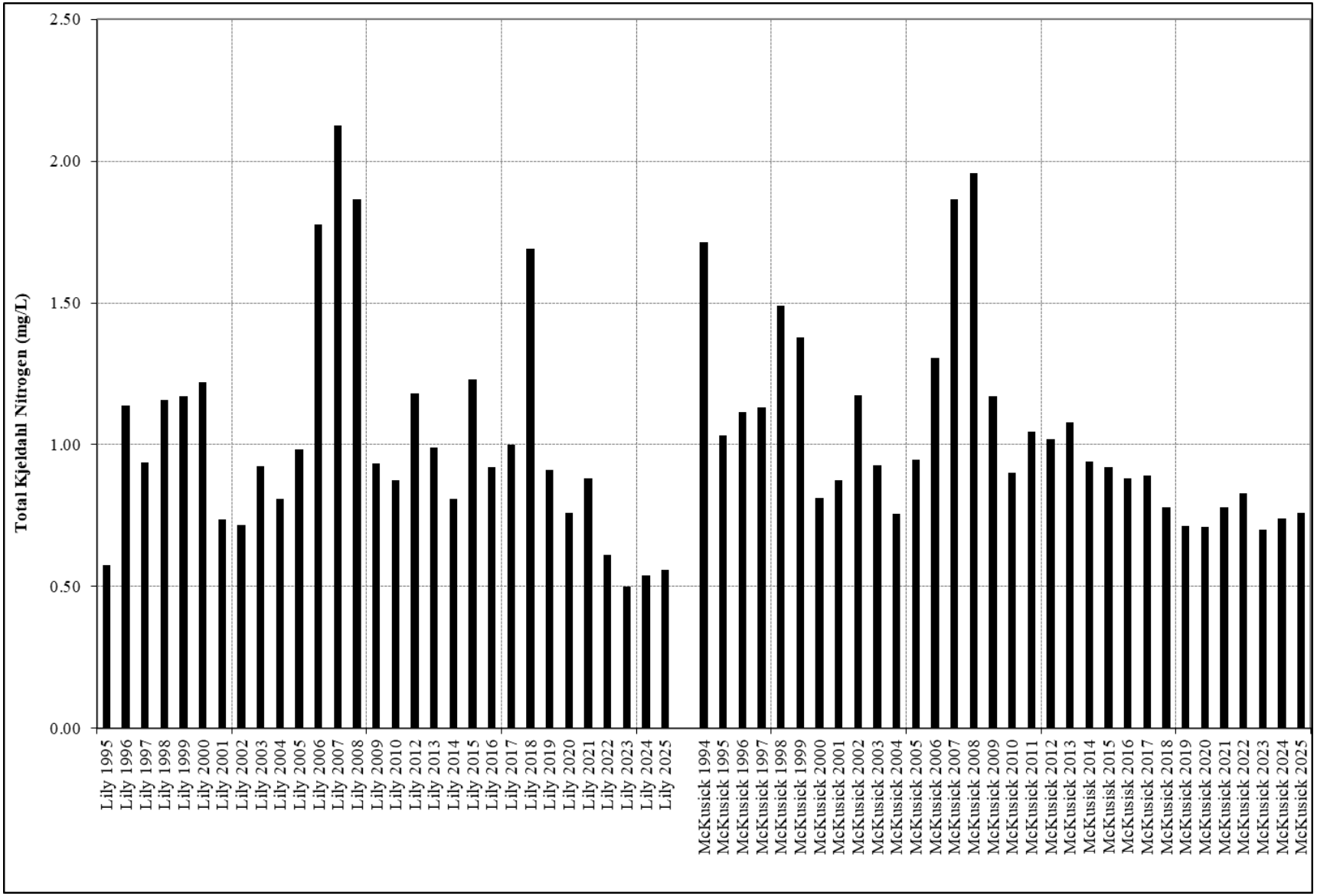


**Figure 4. MSCWMO Historic Summer Average Total Kjeldahl Nitrogen**

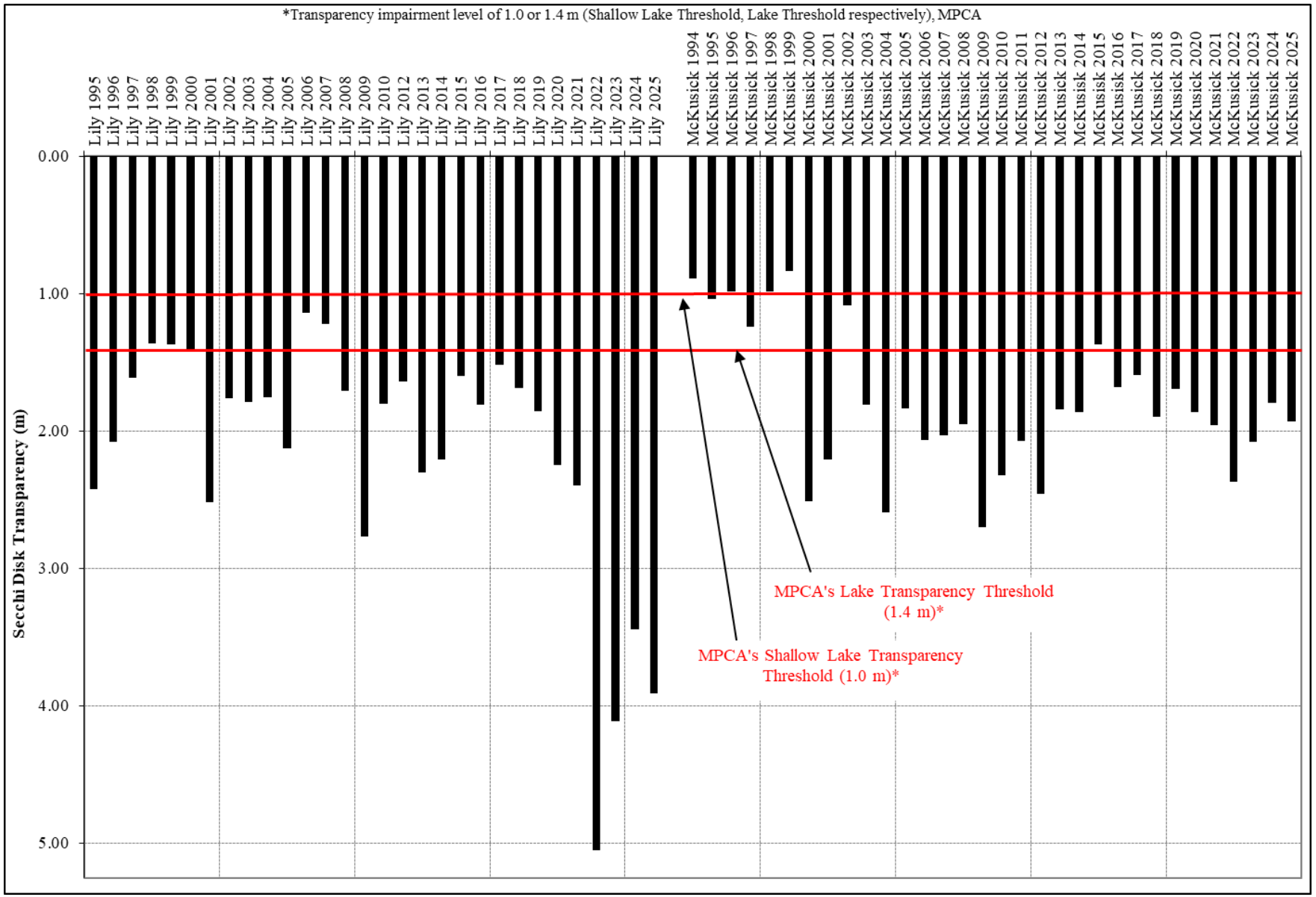


**Figure 5. MSCWMO Historic Summer Average Secchi Disk Transparency**

# STREAM MONITORING

## A. PERRO CREEK MONITORING

The goal of monitoring Perro Creek in 2016-2017 was to identify where the greatest contribution of nutrients and sediment to the St. Croix River was occurring. Monitoring continued in 2018 and 2019 to further refine previous observations. In 2020 water monitoring activities were reduced on Perro Creek and no traditional water quality samples were collected. Beginning in 2021, and continuing through 2025, water quality sampling was conducted on Perro Creek at the Diversion Structure site by collecting in-stream grab samples during baseflow periods and using an automated sampler to collect flow-weighted composite storm samples. The automated sampler allowed for multiple samples to be collected during storm events, which were then combined into one sample representing the storm event. This methodology can provide more accurate data for calculating nutrient loads during storm events than grab samples alone. Continuous 15-minute stage and velocity data were collected at the site and in the Diversion Structure Overflow from 5/8/25 – 10/28/25. Discharge was calculated using an area/velocity relationship, and the recorded discharge in 2025 to the St. Croix River was 26,453,270 cubic feet (Table 3).

Thirteen water quality samples were collected in 2025 and analyzed for total phosphorus, dissolved phosphorus, and total suspended solids (Table 4). Six baseflow grab samples were collected May – October, along with field measurements for temperature, dissolved oxygen, pH, and specific conductivity. Seven storm composite samples were collected May – August. The 2025 baseflow average TP concentration was 0.032 mg/L, which is similar to the baseflow averages for 2018-2021 and 2024 (Table 5). The baseflow average TSS concentration was 3 mg/L, which is similar to the baseflow averages since 2018. The average TP concentration from storm samples collected in 2025 was 0.226 mg/L, which is similar to 2023 and is lower than 2024 (Table 5). The average TSS concentration from storm samples was 222 mg/L, which is similar to 2021 and the highest since monitoring began in 2016. TP and TSS loads to the St. Croix River were calculated for both the creek and the Diversion Structure Overflow during

monitored periods. The TP load in 2025 was 75.7 lbs. (Table 3 and Figure 6) and the TSS load was 29,152 lbs. (Table 3 and Figure 7).

Perro Creek is listed as impaired for TSS on the MPCA's 303(d) Impaired Waters List. The stream is in the Central River Nutrient Region and the MPCA standard is 30 mg/L for class 2B waters. The MPCA's protocols for assessments are as follows:

*"A stream is considered to exceed the standard for TSS if 1) the standard is violated 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 measurements violate the standard. A stream is considered to meet the standard for TSS if the standard is met at least 90% of the days of the assessment season. A designation of meeting the standard for TSS generally requires at least 20 suitable measurements from a data set that gives an unbiased representation of conditions over at least two different years. However, if it is determined that the data set adequately targets periods and conditions when exceedances are most likely to occur, a smaller number of measurements may suffice."*

Perro Creek is also listed as impaired for *E. coli* bacteria on the MPCA's 303(d) Impaired Waters List. *E.* coli is used as an indicator in waterbodies for the possible presence of fecal contamination, including pathogens. The primary source of *E. coli* is human and animal waste, making high *E. coli* presence a concern for human health. A summary by month is found in Table 6. The MPCA standard is defined as follows, and is based on the latest ten years of data as per MPCA protocol:

"*Not to exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples representative of conditions within any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies only between April 1 and October 31*."

**Table 3. Perro Creek 2025 Monitored Discharge and TP & TSS Loading**

| Site | Date range | Discharge (cf) | Discharge (ac-ft) | Percent of Total Discharge | TP Load (lbs) | Percent of TP Load | TSS Load (lbs) | Percent of TSS Load |
|---|---|---|---|---|---|---|---|---|
| Perro at Diversion Structure Baseflow [1] | 5/8/25 - 10/28/25 | 22,167,406 | 509.16 | 84% | 44.0 | 58% | 4,151 | 14% |
| Perro at Diversion Structure Stormflow | 5/8/25 - 10/28/25 | 1,167,110 | 26.81 | 4% | 15.9 | 21% | 14,627 | 50% |
| Perro at Diversion Overflow Baseflow [1 2] | 5/8/25 - 10/28/25 | 2,389,234 | 54.88 | 9% | 4.7 | 6% | 447 | 2% |
| Perro at Diversion Overflow Stormflow [2] | 5/8/25 - 10/28/25 | 729,520 | 16.76 | 3% | 11.0 | 15% | 9,926 | 34% |
| Total to the St. Croix River | | 26,453,270 | 607.60 | 100% | 75.7 | 100% | 29,152 | 100% |

[1] *7/9/25 results were excluded from averages used for load calculations*

[2] *Result averages from samples collected in-stream at the Diversion Structure were used for Diversion Overflow loading calculations*

**Table 4. Perro Creek at Diversion Structure 2025 Water Quality Results**

| Sample Type | Start | End | TP (mg/L) | Dissolved P (mg/L) | TSS (mg/L) | E. coli (mpn/100 mL) | Temperature (°C) | DO (mg/L) | pH | Specific Conductivity (umhos/cm) |
|---|---|---|---|---|---|---|---|---|---|---|
| Base Grab [1] | 5/12/25 15:07 | 5/12/25 15:07 | 0.046 | 0.017 | <3 | 105 | 23.8 | 7.45 | 8.52 | 418 |
| Base Grab | 6/11/25 9:15 | 6/11/25 9:15 | 0.046 | 0.018 | 6 | 201 | 20.5 | 8.10 | 8.45 | 409 |
| Base Grab [2] | 7/9/25 10:19 | 7/9/25 10:19 | 0.058 | 0.032 | 9 | 1733 | 24.2 | 7.34 | 8.14 | 425 |
| Base Grab | 8/12/25 9:38 | 8/12/25 9:38 | 0.026 | 0.014 | 3 | 276 | 22.9 | 6.71 | 8.10 | 404 |
| Base Grab [1] | 9/4/25 13:04 | 9/4/25 13:04 | 0.021 | 0.014 | <3 | 178 | 16.5 | 9.23 | 8.31 | 472 |
| Base Grab | 10/8/25 11:01 | 10/8/25 11:01 | 0.020 | 0.012 | 3 | 76 | 13.8 | 10.01 | 8.32 | 508 |
| | | | | | | | | | | |
| Storm Composite | 5/19/25 20:03 | 5/20/25 23:41 | 0.094 | 0.019 | 28 | | | | | |
| Storm Composite | 6/25/25 14:45 | 6/25/25 15:44 | 0.311 | 0.057 | 275 | | | | | |
| Storm Composite | 7/16/25 2:26 | 7/16/25 3:46 | 0.093 | 0.035 | 137 | | | | | |
| Storm Composite | 7/23/25 14:23 | 7/23/25 14:59 | 0.327 | 0.045 | 575 | | | | | |
| Storm Composite | 7/27/25 20:40 | 7/27/25 21:25 | 0.304 | 0.074 | 189 | | | | | |
| Storm Composite | 8/9/25 4:51 | 8/9/25 7:05 | 0.323 | 0.155 | 266 | | | | | |
| Storm Composite | 8/16/25 7:32 | 8/16/25 9:14 | 0.130 | 0.032 | 81 | | | | | |

[1] *TSS results that are less than the Reporting Limit were divided in half for calculating averages.*

[2] *Results excluded from averages. Sample was collected shortly after a spike in stream stage.*

## Table 5. Perro Creek Historical TP and TSS Averages and Ranges

| Perro @ Diversion Sample Type | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 [b] | 2022 [b] | 2023 [c] | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|
| Baseflow Samples | **8** | **6** | **8** | **6** | **No Samples** | **6** | **5** | **6** | **7** | **6** |
| Stormflow Samples | **5** | **5** | **4** | **3** | | **8** | **9** | **5** | **5** | **7** |
| TP (mg/L) - Baseflow Average | 0.051 | 0.046 | 0.036 | 0.034 | | 0.035 | 0.015 | NA | 0.034 | 0.032 |
| *Baseflow Range* | *~0.023 - 0.090* | *<0.020 - 0.120* | *0.020 - 0.058* | *0.021 - 0.065* | | *0.024 - 0.210* | *<0.020 - 0.065* | *<0.05* | *0.022 - 0.054* | *0.020 - 0.058* |
| TP (mg/L) - Stormflow Average | 0.435 | 0.108 | 0.124 | 0.372 | | 0.427 | 0.279 | 0.216 | 0.283 | 0.226 |
| *Stormflow Range* | *0.126 - 1.330* | *~0.023 - 0.218* | *0.047 - 0.252* | *0.133 - 0.597* | | *0.185 - 0.862* | *<0.020 - 0.524* | *0.089 - 0.370* | *0.040 - 0.396* | *0.093 - 0.327* |
| TSS (mg/L) - Baseflow Average | 16 | 12 | 4 | 2 | | 2 | 3 | 2 | 3 | 3 |
| *Baseflow Range* [a] | *<1 - 77* | *~1 - 60* | *1 - 16* | *1 - 3* | | *1 - 33* | *<3 - 18* | *<3 - 18* | *<3 - 6* | *<3 - 9* |
| TSS (mg/L) - Stormflow Average | 118 | 36 | 20 | 58 | | 217 | 86 | 102 | 208 | 222 |
| *Stormflow Range* | *32 - 308* | *12 - 76* | *8 - 31* | *21 - 97* | | *75 - 429* | *3 - 154* | *10 - 243* | *5 - 327* | *28 - 575* |

[a] *Beginning in 2022 the laboratory changed TSS reporting to as low as the Reporting Limit (3 mg/L) rather than the Method Detection Limit (1 mg/L)*

[b] *Results from base composite sample excluded from averages (Sampled during initial opening of Perro Pond outlet)*

[c] *In 2023 the laboratory reported TP results to as low as the Reporting Limit (0.05 mg/L) rather than the Method Detection Limit (0.02 mg/L). All baseflow results were <0.05 mg/L*

## Table 6. Monthly Geometric Means of *E. coli*- Latest Ten Years

| Site | April | May | June | July | August | September | October |
|---|---|---|---|---|---|---|---|
| **Perro at Diversion Structure** [1] | Insufficient Data | 108 | 297 | 266 | 168 | 405 | 145 |

*Exceeds geometric mean of 126 #/100mL from not less than 5 samples in a calendar month, collected in last 10 yrs*

[1] *>10% of samples collected in the last 10 years exceeded 1,260 #/100mL*

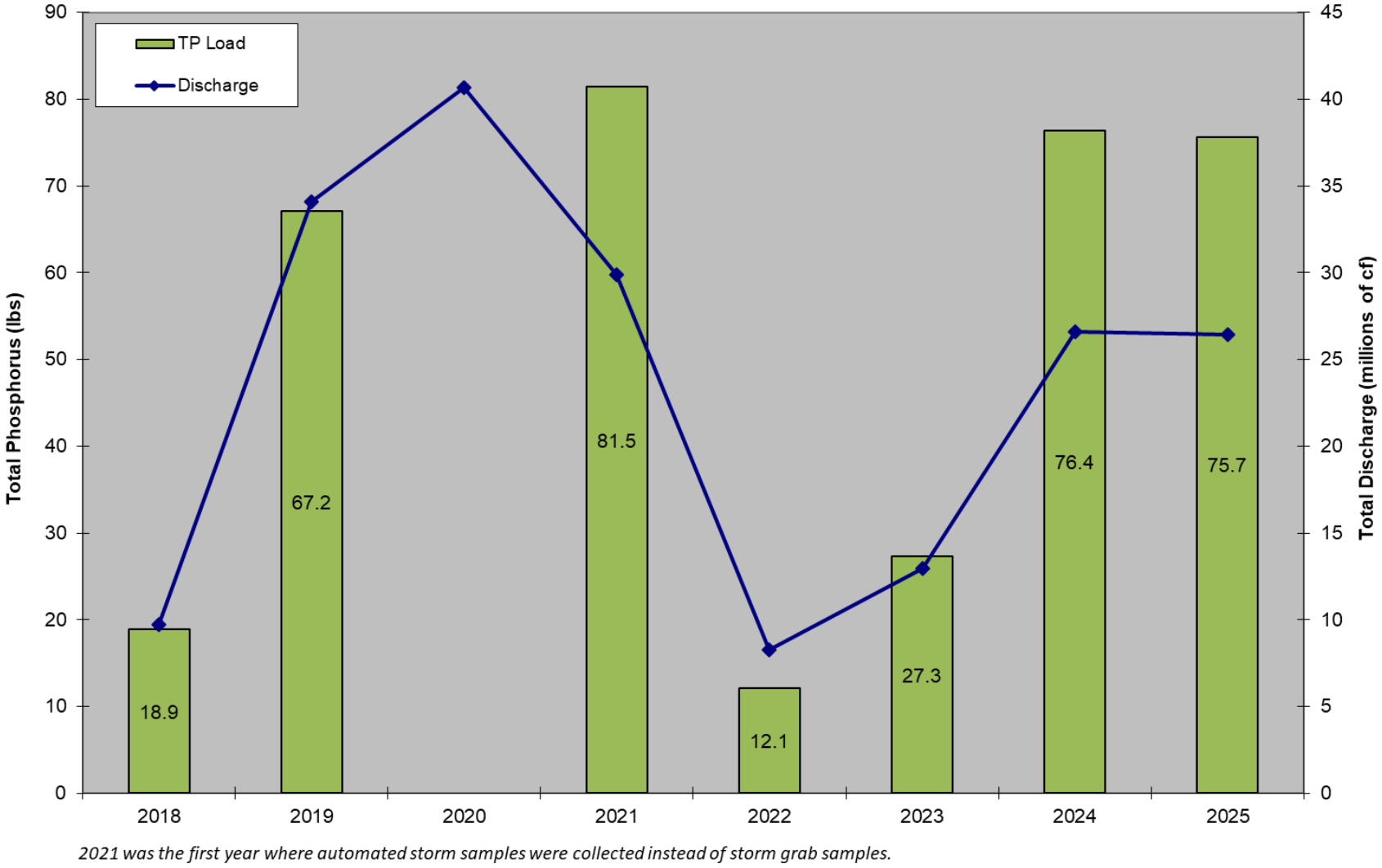


**Figure 6. Perro Creek at Diversion Structure Monitored Discharge and Total Phosphorus Load**

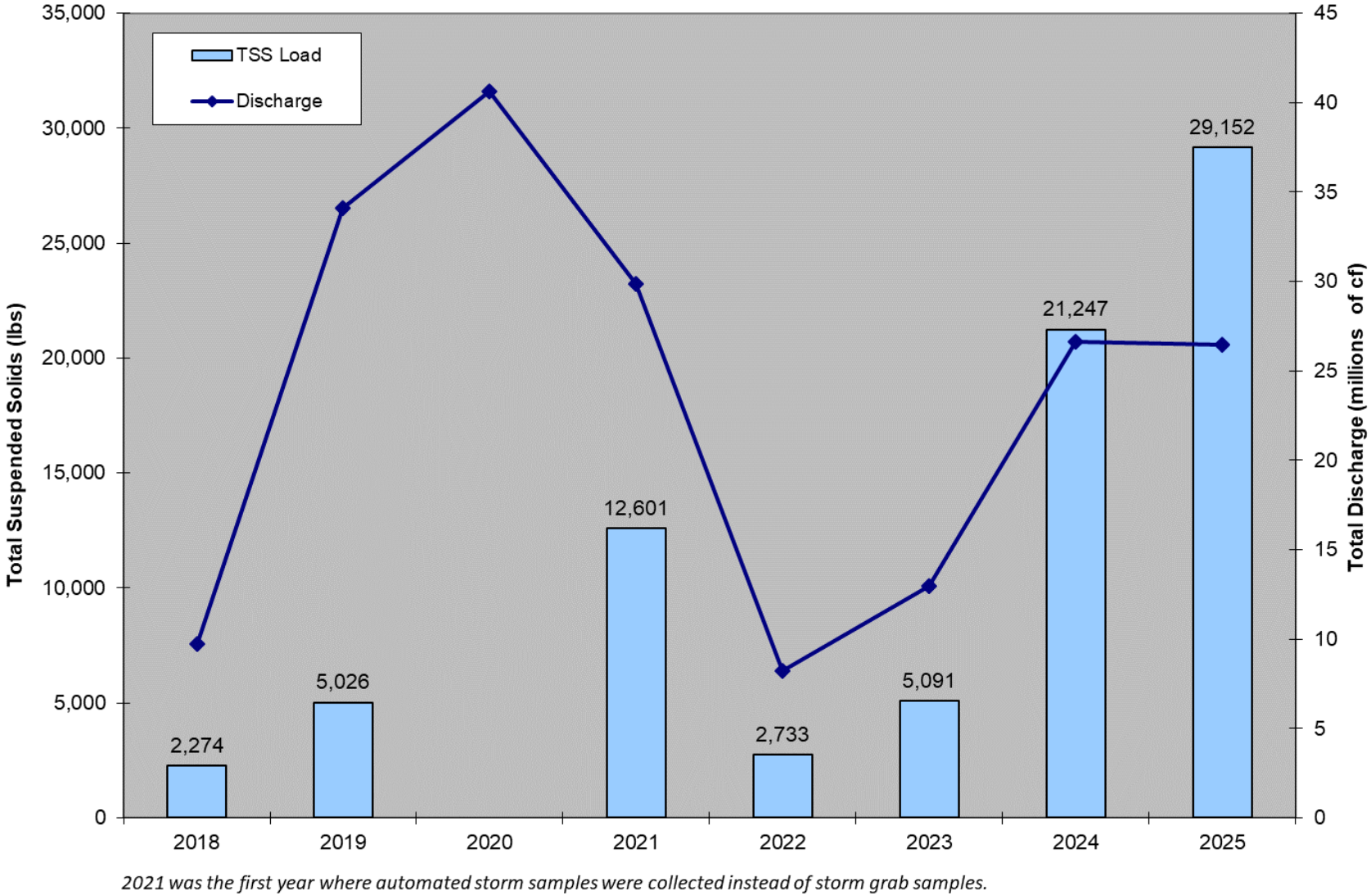


**Figure 7. Perro Creek at Diversion Structure Monitored Discharge and Total Suspended Solids Load**

## B. BROWN'S CREEK DIVERSION STRUCTURE

As part of Brown's Creek Watershed District's long-term monitoring, the WCD collected grab samples and automated flow-weighted samples during both baseflow and storm event conditions at the Brown's Creek Diversion Structure in 2025. The City of Stillwater constructed the diversion structure in June of 2003, as part of the completion of the Trout Stream Mitigation Project (TSMP). It has been functioning to divert water from the 1,800-acre annexation area away from Brown's Creek through McKusick Lake, and ultimately to the St. Croix River. While this diversion structure keeps the warmer urban stormwater runoff from the southern tributary out of the temperature and nutrient sensitive Brown's Creek Ravine, it means that this is discharged to McKusick Lake and can affect the lake water quality. Data collected at this site by the WCD includes continuous stage and total discharge, and water quality samples analyzed for nutrients, sediment, and metals. Discharge in 2025 was 60,305,225 cubic feet, which is the fifth highest recorded since monitoring began in 2006 and was a decrease from 2024 (Table 7). Stream flow and chemistry data from 2025 are found in Table 7 and Table 8.

The TP load to McKusick Lake was 416 lbs., or 0.108 lbs. of phosphorus per acre of watershed land, and the TSS load was 73,469 lbs. of sediment, or 19.06 lbs. per acre (Table 7). In spite of wetter than average conditions, the TP and TSS loads were the sixth and second lowest, respectively, since monitoring began in 2006. BCWD identified erosional head cuts in the drainage tributaries as the source of the excessive loading rates. Rock vanes and stabilization projects have since been implemented to reduce erosion and restore floodplain connectivity. Beginning in 2024 beavers also constructed a series of dams upstream of the site, further trapping sediment and phosphorus by reducing flow rate, allowing settling of sediments, and improving floodplain connectivity. The high total discharge and low nutrient loads provide evidence the restoration projects and natural processes resulting from beaver activity may be improving water quality conditions.

The calculation of MPCA metal standards is described in the Minnesota Administrative Rules Part 7050.0222 and are divided into three categories of toxicity; chronic, maximum, and final acute value (FAV). The chronic standard protects organisms from long-term exposure to a pollutant with minimal effects, the maximum standard from short-term exposure with no or little

mortality, and the FAV is the concentration at which mortality can be expected. In 2025 one sample result from the Brown's Creek Diversion Structure exceeded the chronic standard for lead and no other samples exceeded any metals standards. The number and severity of exceedances of metals standards were tied with two other years, 2022 and 2014, for the lowest number observed since metals analysis began at this site in 2007. Improvements made to reduce erosion and allow the natural settling of sediments that may have metals bound to them in beaver impoundments are the most likely drivers of this. In most cases, severe exceedances of metals are associated with extreme TSS concentrations.

## Table 7. Brown's Creek Diversion Historic Annual Discharge and Loading- Latest Ten Years

| | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Brown's Creek Diversion Structure** | | | | | | | | | | |
| Discharge (cf) | 70,780,581 | 39,625,672 | 45,453,990 | 112,468,888 | 68,165,935 | 46,792,341 | 41,610,620 | 35,622,586 | 72,832,083 | 60,305,225 |
| Total pounds of Phosphorus exported | 1,574 | 784 | 964 | 3,598 | 760 | 446 | 389 | 367 | 573 | 416 |
| TP (lbs/ac/yr) | 0.408 | 0.203 | 0.250 | 0.933 | 0.197 | 0.116 | 0.101 | 0.095 | 0.149 | 0.108 |
| Total pounds of TSS exported | 1,533,496 | 596,382 | 505,314 | 2,707,186 | 246,238 | 401,069 | 75,429 | 74,875 | 230,855 | 73,469 |
| TSS (lbs/ac/yr) | 397.79 | 154.70 | 131.08 | 702.25 | 63.87 | 104.01 | 19.57 | 19.42 | 59.88 | 19.06 |

## Table 8. Brown's Creek Diversion 2025 Chemistry Results

| Sample Type | Start | End | TSS (mg/L) | VSS (mg/L) | TKN (mg/L) | TP (mg/L) | Dissolved P (mg/L) | Copper (ug/L) | Nickel (ug/L) | Lead (ug/L) | Zinc (ug/L) | Cadmium (ug/L) | Chromium (ug/L) | Chloride (mg/L) | Nitrite + Nitrate N (mg/L) | Ammonia Nitrogen (mg/L) | Hardness (mg/L _CaCO3) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Storm Composite | 5/20/2025 6:52 | 5/21/2025 0:40 | 94 | 24 | 1.64 | 0.280 | 0.061 | 3.640 | 2.910 | 1.570 | 10.100 | 0.130 | <2.500 | 31.4 | 0.31 | <0.06 | 121 |
| Storm Composite | 6/13/2025 0:52 | 6/13/2025 8:32 | 30 | 8 | 1.10 | 0.176 | 0.041 | 1.800 | 1.710 | 0.774 | 5.450 | 0.117 | <2.500 | 39.8 | 0.28 | <0.06 | 147 |
| Storm Composite | 6/25/2025 13:29 | 6/25/2025 22:20 | 70 | 24 | 1.47 | 0.281 | 0.076 | 2.820 | 2.300 | 1.130 | 7.840 | 0.117 | <2.500 | 26.0 | 0.34 | <0.06 | 94 |
| Storm Composite | 7/27/2025 20:46 | 7/28/2025 4:47 | 161 | 41 | 2.11 | 0.470 | 0.074 | 3.850 | 3.580 | 2.270 | 14.700 | 0.128 | 3.270 | 24.8 | 0.37 | <0.06 | 92 |
| Storm Composite | 8/9/2025 5:30 | 8/9/2025 9:20 | 283 | 68 | 3.00 | 0.546 | 0.065 | 5.520 | 5.020 | 5.000 | 22.100 | 0.166 | 4.590 | 37.9 | 0.40 | <0.06 | 132 |
| Storm Composite | 8/16/2025 7:29 | 8/17/2025 23:58 | 166 | 61 | 2.11 | 0.361 | 0.067 | 3.970 | 3.660 | 2.310 | 12.900 | 0.148 | 2.920 | 36.6 | <0.20 | <0.06 | 98 |
| | | | | | | | | | | | | | | | | | |
| Base Grab | 5/1/2025 14:09 | 5/1/2025 14:09 | <3 | <3 | 0.47 | 0.051 | 0.023 | <1.000 | 0.715 | <0.500 | 6.040 | <0.100 | <2.500 | 46.4 | <0.20 | <0.06 | 155 |
| Base Grab | 5/12/2025 14:28 | 5/12/2025 14:28 | <3 | <3 | 0.60 | 0.074 | 0.032 | 1.840 | 1.890 | <0.500 | <5.000 | <0.100 | <2.500 | 52.8 | <0.20 | 0.06 | 210 |
| Base Grab | 6/10/2025 13:32 | 6/10/2025 13:32 | 10 | 5 | 0.65 | 0.128 | 0.059 | <1.000 | 0.642 | <0.500 | <5.000 | <0.100 | <2.500 | 24.4 | 0.28 | 0.07 | 209 |
| Base Grab | 7/10/2025 10:03 | 7/10/2025 10:03 | 3 | <3 | 0.53 | 0.084 | 0.054 | <1.000 | 0.573 | <0.500 | <5.000 | <0.100 | <2.500 | 70.6 | <0.20 | 0.08 | 107 |
| Base Grab | 8/4/2025 14:36 | 8/4/2025 14:36 | <3 | <3 | 0.58 | 0.064 | 0.040 | <1.000 | 0.540 | <0.500 | <5.000 | <0.100 | <2.500 | 62.4 | <0.20 | 0.06 | 108 |
| Base Grab | 9/4/2025 10:38 | 9/4/2025 10:38 | 3 | <3 | 0.47 | 0.057 | 0.026 | <1.000 | 0.505 | <0.500 | <5.000 | <0.100 | <2.500 | 47.8 | 0.24 | <0.06 | 152 |
| Base Grab | 10/8/2025 9:33 | 10/8/2025 9:33 | 5 | 3 | 0.54 | 0.078 | 0.018 | <1.000 | 0.708 | <0.500 | <5.000 | <0.100 | <2.500 | 48.2 | 0.31 | <0.06 | 205 |

Exceeds Water Quality Standard
No Exceedance Determinable
Exceeds Chronic Standard
Exceeds Max Standard
Exceeds Final Acute Standard

# MSCWMO: CONCLUSIONS AND RECOMMENDATIONS

## A. LAKES

Lake monitoring in MSCWMO continues to provide valuable baseline water quality information. To determine the health of the lakes in MSCWMO, physical and chemical parameters are compared on a year-to-year basis and to other lakes in the region. Water quality in a lake depends on a number of different variables such as size of the contributing watershed, external nutrient sources, depth of the lake, and the current amount of nutrients available to be periodically released from the lake bottom. Low water quality ratings of MSCWMO lakes are most likely due to long-term contribution of urban runoff (Lily Lake) or due to the sensitivity of shallow lakes being prone to summertime mixing (McKusick Lake). Shallow lakes typically exist in a low algal production, clear-water state with abundant aquatic macrophytes or in a high-algal production, turbid water state. Shallow lakes may not completely stratify in the summer, and therefore have the capability to continually mix throughout the summer. That mixing causes phosphorus to be distributed throughout the water column, causing more frequent and heavy algal blooms. This is unlike deeper, stratified lakes where phosphorus below the thermocline is not available for primary production.

The MPCA previously listed both Lily and McKusick Lake on the 303(d) Impaired Waters list for nutrient/eutrophication impairment. McKusick Lake was delisted in 2012 and Lily Lake was delisted in 2022, because both lakes were meeting water quality standards due to restoration activities within their watersheds.

Summertime (June-September) TP, chlorophyll-α, and Secchi disk transparency averages have remained relatively consistent over the last thirty years in Lily Lake with the exceptions of 1995, 2001, 2009, 2013, and 2014 where overall water quality dramatically improved (Figure 2, Figure 3, and Figure 5). In 2001 phosphorus and chl-α levels dropped and the lake grade improved significantly. In 2006-2008, summer average TP, chl-α, and Secchi disk transparency deteriorated when compared to the averages seen from 2001 to 2005. In 2025 Lily Lake received a grade of an A, matching the grade from 2023-2024 and well above the long-term average lake grade of a C+.

The cause of these one-year increases (1995, 2001, 2009, 2013, and 2014) in water quality is presently unknown, and there may be several possible explanations, which could be investigated further in the future. Lily Lake has received herbicide and algaecide treatments from 1995-2011 and 2016-2018. In 2018-2021, the City of Stillwater and the Lily Lake Association did not request any large-scale herbicide and algaecide treatments but individual landowner treatments have occurred. In 2010, a native buffer planting was installed at the public access and the Lily Lake watershed underwent a subwatershed assessment. As a result, fifteen raingardens were constructed in the Lily Lake watershed from 2011-2012, six large raingardens were installed in 2014, a gully stabilization project installed at Lakeview Hospital discharging to Brick Pond in 2017, and a large gully stabilization and stormwater treatment system discharging to Brick Pond in 2018. Another raingarden was installed in 2019. Construction of a large infiltration basin in the Greeley storm sewer catchment subwatershed was completed in 2022 and the lake was treated with alum on May 24, 2022. The effects of these BMPs may have been seen from 2012 to 2025 monitoring seasons with the 2016-2025 seasons having a statistically significant ($p<0.05$) improving trend for total phosphorus. Continued monitoring is needed to show changes to long-term trends due to the implementation of these BMPs. In 2019, the Lily Lake Phosphorus Reductions for Delisting grant was secured. More information about the Lily Lake Impaired Waters Delisting Road Map can be found at http://www.mscwmo.org/subwatershed-assessments.

A subwatershed assessment was conducted on the McKusick Lake watershed in 2010. In 2011, six raingardens were constructed as a result of the subwatershed assessment. With renewed funding, seven additional raingardens were planned to be installed in the McKusick Lake watershed in 2013 but were not constructed due to issues with utilities; instead, six larger raingardens were installed in 2014. The impacts of previously installed raingardens may have been seen in 2017-2025 with statistically significant ($p<0.05$) improving trends for average TP and average Secchi disk transparency. For more information on the McKusick Lake subwatershed assessment refer to the McKusick Lake Stormwater Retrofit Assessment found at http://www.mscwmo.org/subwatershed-assessments.

## B. STREAMS

Water quality sampling continued on Perro Creek at the Diversion Structure in 2025. The wet summer led to a similar total discharge and TP load, and an increase in TSS load, when compared to 2024. Stormflow periods accounted for only 7% of the monitored discharge to the St. Croix River but 36% of the TP load and 84% of the TSS load occurred during these periods in 2025. For comparison, stormflow periods accounted for a little less in 2024: 5% of the monitored discharge, 30% of the TP load, and 80% of the TSS load. Flow-weighted composite samples should continue to be collected to more accurately calculate TP and TSS loads during storm events. As in 2024, sediment and debris was present in the diversion structure channel for the majority of the monitoring season, which made the streambed within the structure artificially high. This may have affected the automated storm sampling because it allowed more stormwater to flow through the overflow pipe rather than the open channel stream, which is where the sampling equipment is located. The diversion structure should be kept clear of excessive sediment and debris to ensure this doesn't become a problem.

Perro Creek is listed as impaired for TSS on the MPCA's 303(d) Impaired Waters List and is assessed using an unbiased dataset. Flow-weighted composite samples are considered biased towards higher flow periods because more samples are collected during the higher flows, and these samples are therefore not used for TSS assessments. In 2025 there were no TSS results from grab samples collected April – September that exceeded the MPCA standard of 30 mg/L for class 2B waters. Water quality grab samples could be collected at Perro Creek during different levels of flow to provide an unbiased dataset for assessing the stream for TSS impairment.

Perro Creek is listed as impaired for *E. coli* bacteria on the MPCA's 303(d) Impaired Waters List. The 10-year geometric means in June – October exceed the MPCA standard, while the May geometric mean meets the standard. Samples collected in 2025 in July and August were the only samples higher than the monthly geometric means. In 2024, August and September samples were the only ones higher than the monthly geometric means. Monthly *E. coli* samples should continue to be collected from May through October at Perro Creek to expand the dataset for calculating monthly geometric means.

# APPENDIX 1 – LILY LAKE AND MCKUSICK LAKE WATER QUALITY DATA

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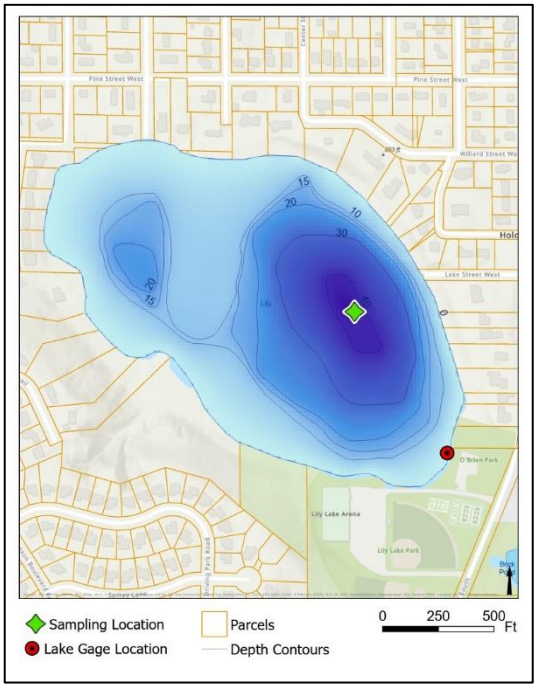
# LILY LAKE

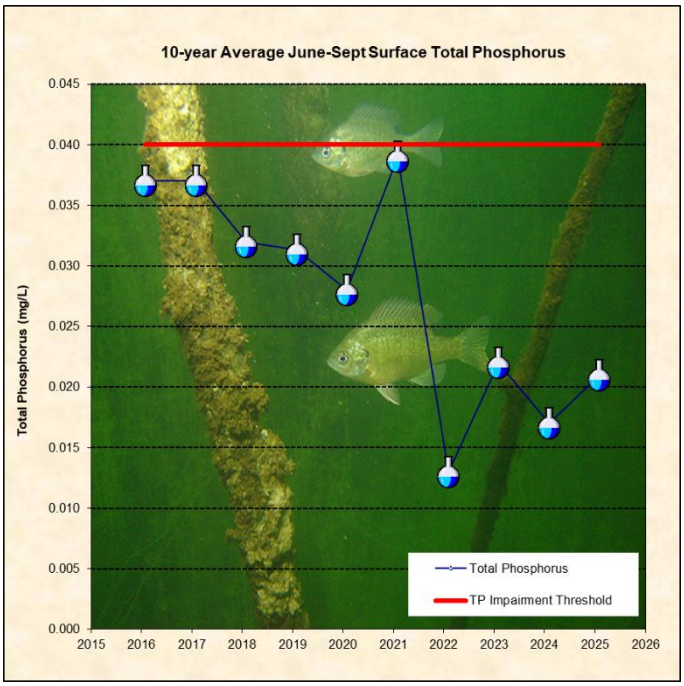
## 2025 Lake Grade: A

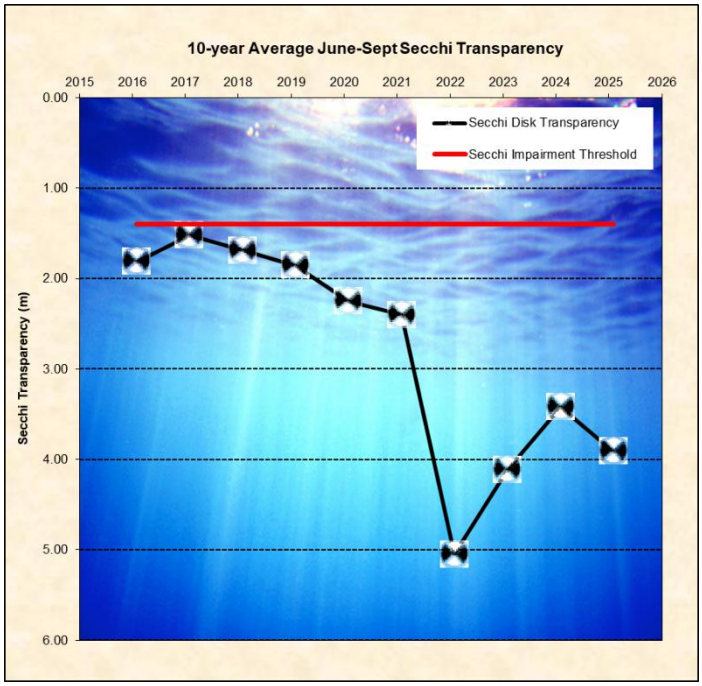
- DNR ID #: 820023
- Municipality: City of Stillwater
- Location: NE ¼ Section 32, T30N-R20W
- Lake Size: 35.90 Acres
- Maximum Depth (2025): 47 ft.
- Ordinary High Water Mark: 844.8 ft.
- 55%Littoral
  Note: Littoral area is the portion of the lake <15 ft. and dominated by aquatic vegetation.
- Publicly accessible




## Summary Points

- Based on the chlorophyll-α results Lily Lake was considered mesotrophic in 2025, according to the Carlson Trophic State Index.
- Using a Kendall's Tau correlation test ($p<0.05$) there is a statistically significant **improving** trend for average total phosphorus, average Secchi transparency, and average chlorophyll-α.
- The major land use is urban/residential.
- The lake stratified in 2025 with the thermocline around 4-5 meters deep.
- The lake was treated with alum on May 24, 2022.
- Lily Lake was delisted in 2022 for its impairment for nutrients on the Minnesota Pollution Control Agency's Impaired Waters List.
- Lab methodology was changed for 2023 total phosphorus sample analysis, as such no results were reported <0.022 mg/L (April-mid September).



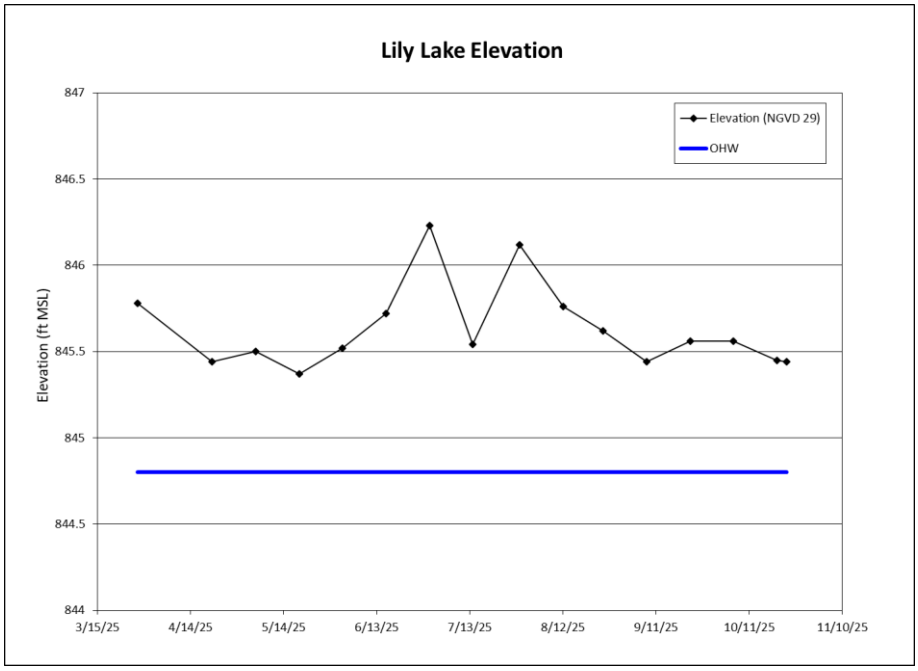
| Date/Time | Total Phosphorus (mg/L) | Uncorrected Trichromatic Chlorophyll-*a* (ug/L) | Pheophytin-Corrected Chlorophyll-*a* (ug/L) | Total Kjeldahl Nitrogen (mg/L) | Secchi Disk Depth (m) | Surface Temperature (Celsius) | Surface Dissolved Oxygen (mg/L) | Chloride (mg/L) |
|---|---|---|---|---|---|---|---|---|
| 4/21/2025 14:30 | 0.016 | 2.5 | 2.4 | 0.52 | 4.11 | 10.8 | 10.81 | |
| 5/5/2025 8:42 | 0.021 | 1.9 | 1.6 | 0.52 | 5.79 | 16.5 | 10.17 | |
| 5/19/2025 13:03 | 0.017 | 2.2 | 1.9 | 0.50 | 3.96 | 16.7 | 8.19 | |
| 6/2/2025 8:46 | 0.014 | 2.9 | 2.4 | 0.58 | 4.88 | 20.1 | NA | |
| 6/16/2025 8:42 | 0.028 | 2.7 | 1.3 | 0.72 | 3.96 | 19.7 | 7.82 | |
| 6/30/2025 8:52 | 0.021 | 4.7 | 3.5 | 0.50 | 3.66 | 24.1 | 8.29 | |
| 7/14/2025 8:47 | 0.020 | 4.7 | 3.7 | 0.53 | 3.66 | 26.4 | 7.62 | |
| 7/29/2025 8:04 | 0.017 | 2.8 | 2.4 | 0.51 | 3.66 | 27.0 | 6.46 | 96.0 |
| 8/12/2025 11:12 | 0.019 | 5.4 | 4.8 | 0.50 | 3.51 | 25.7 | 7.35 | |
| 8/25/2025 8:47 | 0.024 | 7.7 | 6.9 | 0.55 | 3.51 | 22.4 | 6.76 | |
| 9/8/2025 12:32 | 0.023 | 4.7 | 4.5 | 0.61 | 4.57 | 18.7 | 7.40 | 78.5 |
| 9/22/2025 8:41 | 0.019 | 5.9 | 5.1 | 0.56 | 3.81 | 22.1 | 8.10 | |
| 10/6/2025 11:23 | 0.017 | 6.5 | 6.1 | 0.50 | 3.66 | 20.1 | 7.12 | |
| 10/20/2025 8:53 | 0.016 | 5.9 | 5.1 | 0.50 | 4.11 | 14.4 | 7.46 | |
| **2025 Average** | 0.019 | 4.3 | 3.7 | 0.54 | 4.06 | 20.3 | 7.97 | NA |
| **2025 Summer Average** | 0.021 | 4.6 | 3.8 | 0.56 | 3.91 | 22.9 | 7.48 | NA |

Water quality thresholds are 0.04 mg/L TP, 14 µg/L CL-a, 1.4 m Secchi depth*

Shallow lake water quality thresholds are 0.06 mg/L TP, 20 µg/L CL-a, 1.0 m Secchi depth*

| | High | High Date | Low | Low Date | Average |
|---|---|---|---|---|---|
| **2025 Elevation (ft)** | 846.23 | 6/30/2025 | 845.37 | 5/19/2025 | 845.63 |

*Data requirements and determinations of use assessment according to the MPCA's Guidance Manual for Assessing the Quality of Minnesota Surface Waters: "Samples must be collected over a minimum of 2 years and data used for assessments must be collected from June to September. Typically, a minimum of 8 individual data points for TP, corrected chlorophyll-a (chl-a corrected for pheophytin), and Secchi are required. Data used for phosphorus and chlorophyll-a calculations are limited to those collected from the upper most 3 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 summer-mean values for TP, corrected chl-a, and Secchi depth. These values are then compared to the standards and the assessment is made."



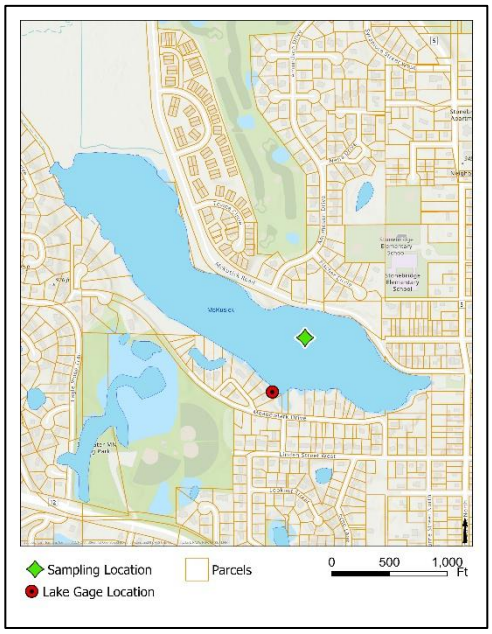

| Lake Water Quality Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summertime Lake Grades (May-Sept) | | | | | | | | | |
| | **2025** | 2024 | 2023 | 2022 | 2021 | 2020 | 2019 | 2018 | 2017 | 2016 |
| Total Phosphorus (mg/L) | A | A | A | A | C | B | B | B | C | C |
| Chlorophyll-*a* (ug/L) | A | A | A | A | C | B | B | B | B | C |
| Secchi depth (ft) | A | A | A | A | B | B | C | C | C | B |
| **Overall** | **A** | **A** | **A** | **A** | **C+** | **B** | **B-** | **B-** | **C+** | **C+** |

# MCKUSICK LAKE

## 2025 Lake Grade: C+

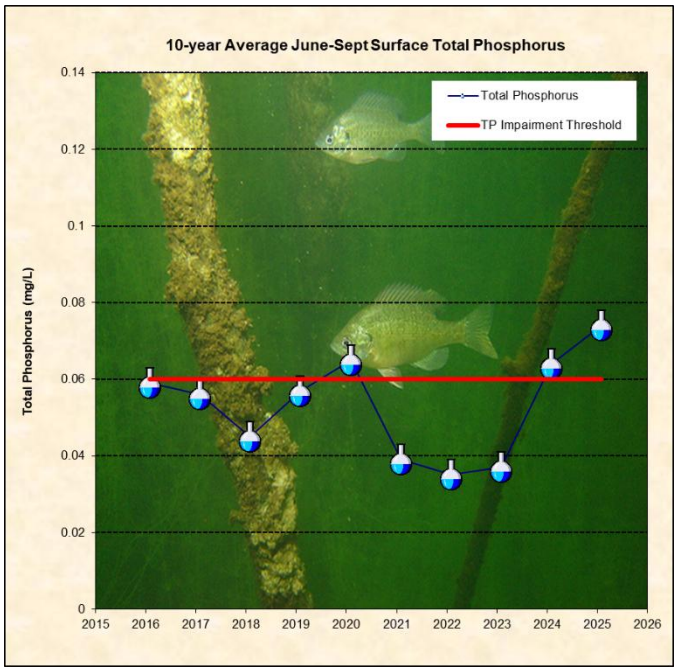
DNR ID #: 820020

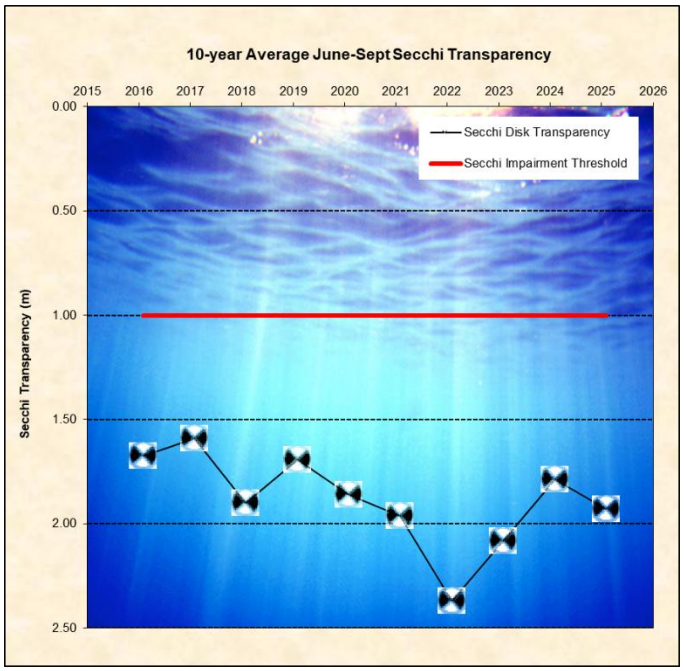
- Municipality: City of Stillwater
- Location: NE ¼ Section 29, T30N-R20W
- Lake Size: 46 Acres
- Maximum Depth (2025): 14 ft.
- Ordinary High Water Mark: 851.7 ft.
- 100% Littoral
  Note: Littoral area is the portion of the lake <15 ft. and dominated by aquatic vegetation.




## Summary Points

- Based on the chlorophyll-α results McKusick Lake was considered eutrophic in 2025, according to the Carlson Trophic State Index.
- Using a Kendall's Tau correlation test ($p<0.05$) there is a statistically significant **improving** trend for average Secchi transparency, average total phosphorus, and no trend for the average chlorophyll-α.
- The major land use is urban/residential.
- Temperature and dissolved oxygen profiles were not collected in 2025 so stratification cannot be determined.
- McKusick Lake was delisted in 2012 for its impairment for nutrients on the Minnesota Pollution Control Agency's Impaired Waters List.



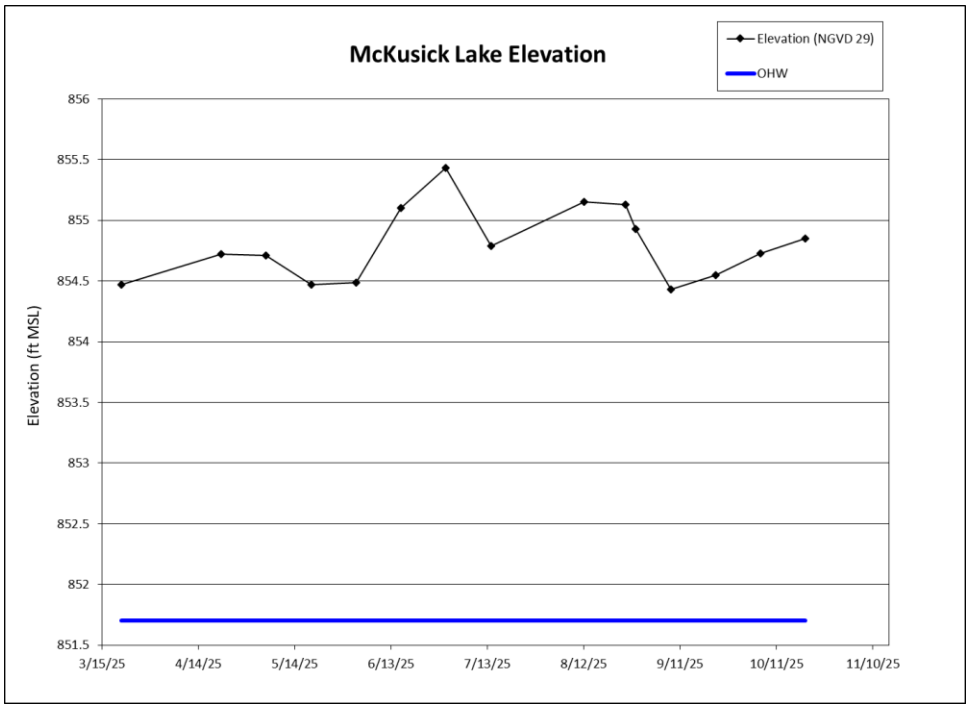
| Date/Time | Total Phosphorus (mg/L) | Uncorrected Trichromatic Chlorophyll-*a* (ug/L) | Pheophytin-Corrected Chlorophyll-*a* (ug/L) | Total Kjeldahl Nitrogen (mg/L) | Secchi Disk Depth (m) | Surface Temperature (Celsius) | Surface Dissolved Oxygen (mg/L) | Chloride (mg/L) |
|---|---|---|---|---|---|---|---|---|
| 4/21/2025 15:13 | 0.052 | 6.2 | 5.6 | 0.64 | 1.98 | 11.8 | 10.03 | |
| 5/5/2025 9:21 | 0.032 | 5.0 | 4.5 | 0.60 | 2.59 | 17.8 | 10.08 | |
| 5/19/2025 13:39 | 0.033 | 5.8 | 4.8 | 0.59 | 2.44 | 15.7 | 9.37 | |
| 6/2/2025 9:22 | 0.032 | 4.3 | 3.7 | 0.64 | 2.74 | 20.6 | 11.38 | |
| 6/16/2025 9:33 | 0.031 | 3.7 | 2.7 | 0.60 | 2.59 | 20.0 | 8.83 | |
| 6/30/2025 9:34 | 0.044 | 5.8 | 4.5 | 0.65 | 2.13 | 23.6 | 8.24 | |
| 7/14/2025 9:27 | 0.169 | 28.0 | 24.0 | 0.97 | 1.52 | 25.9 | 5.41 | |
| 7/29/2025 8:48 | 0.101 | 19.0 | 17.0 | 0.88 | 1.52 | 24.8 | 2.99 | 63.7 |
| 8/12/2025 12:26 | 0.110 | 21.0 | 18.0 | 0.91 | 1.68 | 24.8 | 3.72 | |
| 8/25/2025 9:36 | 0.067 | 14.0 | 12.0 | 0.76 | 1.52 | 20.1 | 1.15 | |
| 9/8/2025 13:12 | 0.066 | 8.4 | 7.7 | 0.72 | 2.13 | 17.2 | 5.03 | 54.3 |
| 9/22/2025 9:23 | 0.042 | 8.1 | 7.5 | 0.73 | 1.52 | 21.1 | 6.25 | |
| 10/6/2025 12:44 | 0.050 | 5.7 | 4.3 | 0.81 | 2.07 | 19.7 | 5.74 | |
| 10/20/2025 9:32 | 0.041 | 4.2 | 3.7 | 0.64 | 1.98 | 12.8 | 7.21 | |
| **2025 Average** | 0.062 | 9.9 | 8.6 | 0.72 | 2.03 | 19.7 | 6.82 | NA |
| **2025 Summer Average** | 0.074 | 12.5 | 10.8 | 0.76 | 1.93 | 22.0 | 5.89 | NA |

Water quality thresholds are 0.04 mg/L TP, 14 µg/L CL-a, 1.4 m Secchi depth*

Shallow lake water quality thresholds are 0.06 mg/L TP, 20 µg/L CL-a, 1.0 m Secchi depth*

| | High | High Date | Low | Low Date | Average |
|---|---|---|---|---|---|
| **2025 Elevation (ft)** | 855.43 | 6/30/2025 | 854.43 | 9/8/2025 | 854.80 |

*Data requirements and determinations of use assessment according to the MPCA's Guidance Manual for Assessing the Quality of Minnesota Surface Waters: "Samples must be collected over a minimum of 2 years and data used for assessments must be collected from June to September. Typically, a minimum of 8 individual data points for TP, corrected chlorophyll-a (chl-a corrected for pheophytin), and Secchi are required. Data used for phosphorus and chlorophyll-a calculations are limited to those collected from the upper most 3 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 summer-mean values for TP, corrected chl-a, and Secchi depth. These values are then compared to the standards and the assessment is made."




| Lake Water Quality Summary | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Summertime Lake Grades (May-Sept) | | | | | | | | | |
| | **2025** | 2024 | 2023 | 2022 | 2021 | 2020 | 2019 | 2018 | 2017 | 2016 |
| Total Phosphorus (mg/L) | C | C | C | C | C | C | C | C | C | C |
| Chlorophyll-*a* (ug/L) | B | B | A | A | A | A | A | B | B | B |
| Secchi depth (ft) | C | C | C | B | C | C | C | C | C | C |
| **Overall** | **C+** | **C+** | **B-** | **B** | **B-** | **B-** | **B-** | **C+** | **C+** | **C+** |