Mississippi Valley Conservation Authority

Integrated Monitoring Report: 2024 Season

Clyde River Subwatershed

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1.0 Executive Summary

The purpose of this integrated monitoring report is to present an overview of the environmental monitoring that Mississippi Valley Conservation Authority (MVCA) completed during the 2024 season. The emphasis of this report is on results of the lake monitoring program but also includes water levels and flow, snow pack, and stream monitoring data. MVCA samples each of its 10 subwatersheds on a 5-year rotation. The Clyde River subwatershed was the primary focus for 2024.

The Mississippi River watershed saw one of the earliest/lowest spring peaks on record; followed by above average rainfall from April to August, including remnants of two hurricanes. This allowed lakes and streams to easily sustain normal conditions throughout the summer months with no threat of drought conditions. Refer to Pages 6-16.

Lakes sampled in 2024 include: Palmerston Lake, Canonto Lake, Sunday Lake, Clyde Lake, Flower Round Lake, Widow Lake, Joe's Lake, and Robertson Lake in the Clyde River subwatershed. Additionally, Fawn Lake and Crotch Lake in the Upper Mississippi subwatershed, as well as Dalhousie and Mississippi Lakes were monitored in 2024; representing the water quality sampled within the main Mississippi River. The sampled lakes maintained their typical nutrient profile characteristics as well as typical dissolved oxygen and temperature profiles for the season. Refer to Pages 17-37.

Through the stream monitoring program several sites were selected for thermal habitat assessment in 2024 (14 sites within the Mississippi River watershed, eight sites from the Carp River watershed, and five Ottawa Tributaries within the watershed). Two of these sites were found to support warm water fish habitat, one was classified as having cool-warm water habitat, and 16 were classified as having cool water habitat. Additionally, fish sampling was conducted at nine sites and found cold to cool water indicator species at seven of them. Performing these monitoring programs annually aids in accounting for the impacts of variable climate influences through analysis of long-term datasets. Refer to Pages 38-41.

This report emphasizes the value of the combined monitoring operations conducted through MVCA's Water Management, Lake Monitoring, and Stream Monitoring programs. The information gathered through these efforts supports MVCA's Stewardship program (Page 42) as well as the initiatives within the Planning and Regulations department (Page 43).

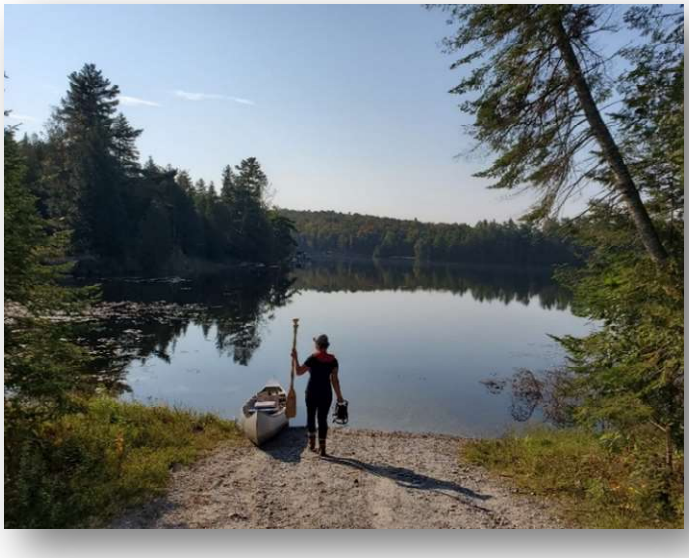
2.0 Introduction

The goal of the Lake Monitoring program is to accumulate reliable environmental data on the lakes within the watershed. Despite various adjustments to the protocol throughout the years, the program has remained a fundamental part of MVCA's environmental monitoring program. It continues to provide valuable baseline data while promoting stewardship within the watershed.

This is achieved by collecting water quality data and monitoring the lakes for changes in trends. Due to the large number of lakes monitored within the MVCA jurisdiction a rotational sampling program is undertaken with the goal of collecting baseline data and monitoring general trends (45 lakes are monitored out of over 300 lakes). MVCA collects data on parameters which are both easy to repeat and are important indicators in water quality assessments. Many of the lakes not sampled on a regular basis by MVCA are sampled/monitored through other programs, such as the Ministry of Environment Conservation and Parks' Lake Partner Program (LPP). Relying on volunteer effort, this program provides both equipment and a valuable framework for yearly data collection. It is also an excellent platform for encouraging and promoting awareness and ownership of lake health within lake communities. If lake stewards are interested in more detailed yearly assessments of their lake, they should consider the LPP which is coordinated through the Dorset Environmental Science Centre.

MVCA's Stream Monitoring program also collects valuable information on stream temperature, fish communities, and benthic communities of the watershed's many tributaries. It follows the Ontario Stream Assessment Protocol (OSAP) methods to conduct stream site identifications, electrofishing, benthic surveys, and temperature monitoring at various sites throughout the year.

The goal of MVCA's fish data collection is to determine the presence or absence of cold or cool water species. These species are indicators of the thermal regime of a stream as they require very specific conditions to thrive, and thus are sensitive to changes caused by climate change or nearby development pressure. Limited fish sampling was carried out in the summer of 2024, with a focus on sites within the City of Ottawa, and cold-water catchments in Lanark County. MVCA also monitored the water temperature at select sites throughout the watershed to confirm the potential thermal habitat available for fish populations. The results are used for tracking thermal trends for longer-term climate analysis.



3.0 Water Quantity Monitoring

3.1 Summary

Three types of water quantity monitoring occurred in the Clyde River subwatershed in 2024: snow pack, water levels and flow, and precipitation. Figure 1 shows the locations of the various gauges used to collect water level and flow data, the locations of snow courses where snow pack water content is measured, and the lakes monitored in 2024. There are 2 flow stations with precipitation gauges, 6 water level gauges, and 4 snow courses in the Clyde River subwatershed. Additionally, the precipitation readings from the Buckshot Creek stream station, and the snow course data from Ardoch were used to give context to lake conditions in the north-western portion of the Clyde River subwatershed.

The watershed experienced one of the earliest/lowest spring freshet and thaw seasons on record, in 2024. In 2023 the watershed saw a dry fall and a late start to winter; leaving lower than normal flows across the watershed going into January 2024. The snow received in January was followed up with rain and warm temperatures. This left most of the snowpack very dense. For historical context, by February our area usually has a snowpack density around 20%; instead, density results were between 30-40%. For this reason, rain and air temperature were the deciding factors in the 2024 freshet. Warm weather received at the end of February triggered an early spring freshet with levels and flows slowly increasing throughout the watershed. MVCA issued a Water Conditions Statement for Water Safety on February 26th due to unsafe ice conditions and increased water levels in creeks and streams, and along roadside ditches. We later issued a Flood Outlook on March 8th. Typically, the peak flow on the Clyde River on April 10th is 62 cms (centimeters per second), and the typical peak flow for Mississippi River at Appleton is close to 150 cms on April 13th. The spring of 2024 was very different with the Clyde River peaking on March 8th at 20.4 cms, and the Mississippi River at Appleton peaking at 79.3 cms on March 12th.

As spring turned to summer, monitoring stations logged above average rainfall from April to August including storms from two hurricanes: Hurricane Beryl on July 10th and Hurricane Debby on Aug 9th. Significant rainfall from Hurricane Beryl resulted in a Flood Watch for the Mississippi watershed and the subsequent above average rain amounts resulted in multiple Water Safety Statements throughout the summer months due to high flows and constant dam operations.

September to December saw normal rain averages leaving water levels and flows at normal conditions by the end of the year.

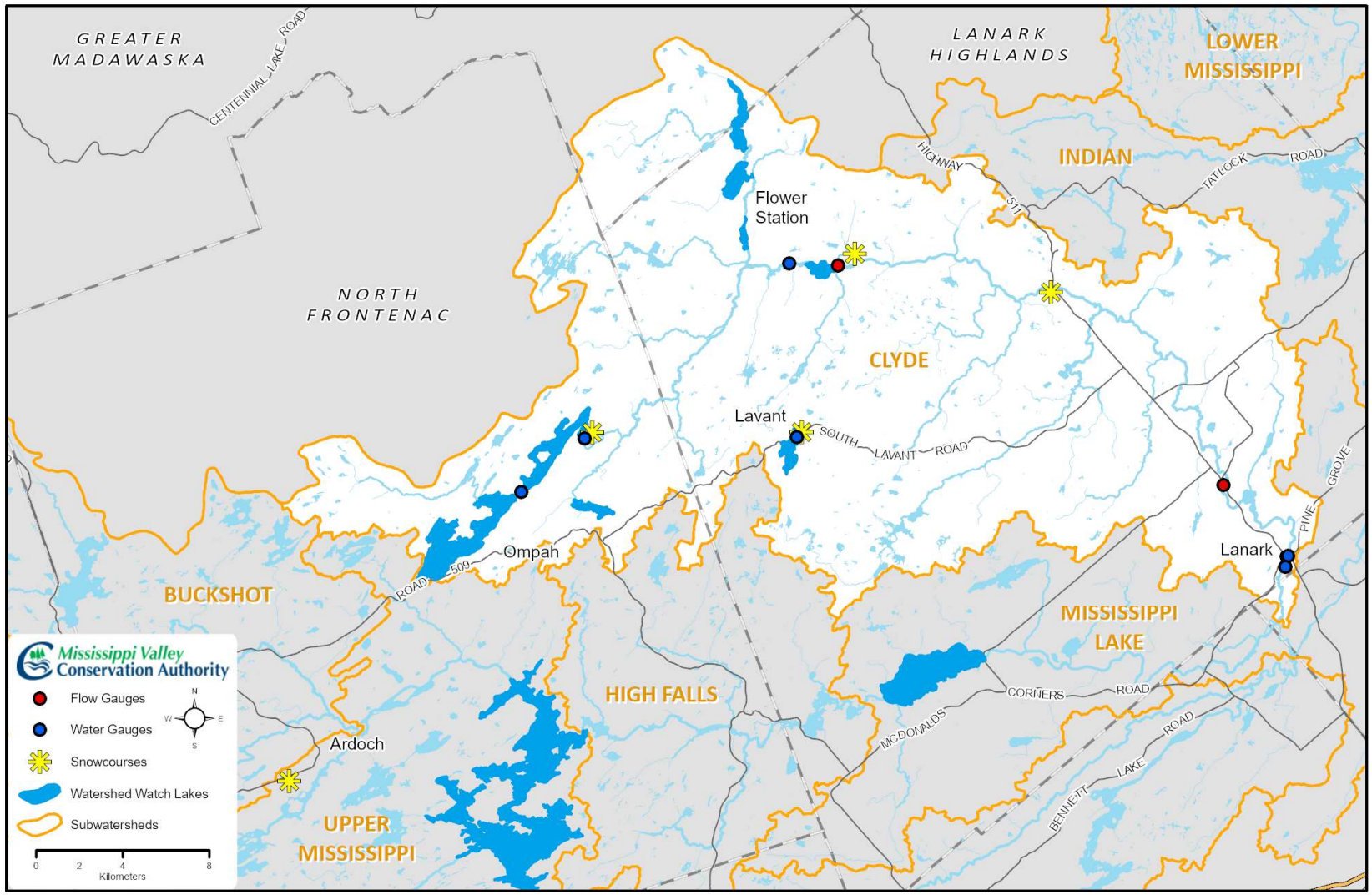


Figure 1: The various water quantity monitoring sites in the Clyde River Subwatershed, plus the lakes within the subwatershed that were monitored in 2024.

3.2 Snow Pack

Measuring snow depth and equivalent water content

Snow pack is measured at 16 sites within MVCA's jurisdiction. This provides MVCA with information on the expected spring runoff for that year; thus, assisting in decisions related to dam operations and flood forecasting. These water management efforts are critical to minimizing flood damage, maintaining flows and water levels for fish and wildlife, and meeting the target levels for summer recreational activities. Results from six snow course stations have been interpreted to describe the diversity of snowpack conditions across the Mississippi Valley watershed which contribute to the observed spring water levels. The six sites were selected for analysis due to their proximity to lakes which were studied in 2024 (Figure 1, Figure 5). Ardoch is upstream of Crotch Lake, Highfalls is upstream of Dalhousie Lake, and Innisville is upstream of Mississippi Lake. Gordon Rapids is near Joe's Lake, Lavant is beside Robertson Lake, and Brightside is near the Clyde River downstream of the sampled lakes. The 2024 results from these stations are compared to their historical average results in Figure 2.

Due to a dry fall and a late start to winter, the 2024 study area was left with lower than normal flows going into January. The snow received in January was followed up with rain and warm temps in the first few weeks. This left most of the snowpack very dense. Historically, by February our snowpack density is around 20%; instead we saw density results between 30-40%. Warm weather received at the end of February triggered runoff flows which developed into an early and low spring peak in water levels.

It can be seen in Figure 2 that the snow pack water levels were fairly consistent across the upper and central watershed. The levels were higher than average in January but melted repeatedly in February due to warm air temperatures and rainfall events. There was no measurable snow left at the survey sites by March.

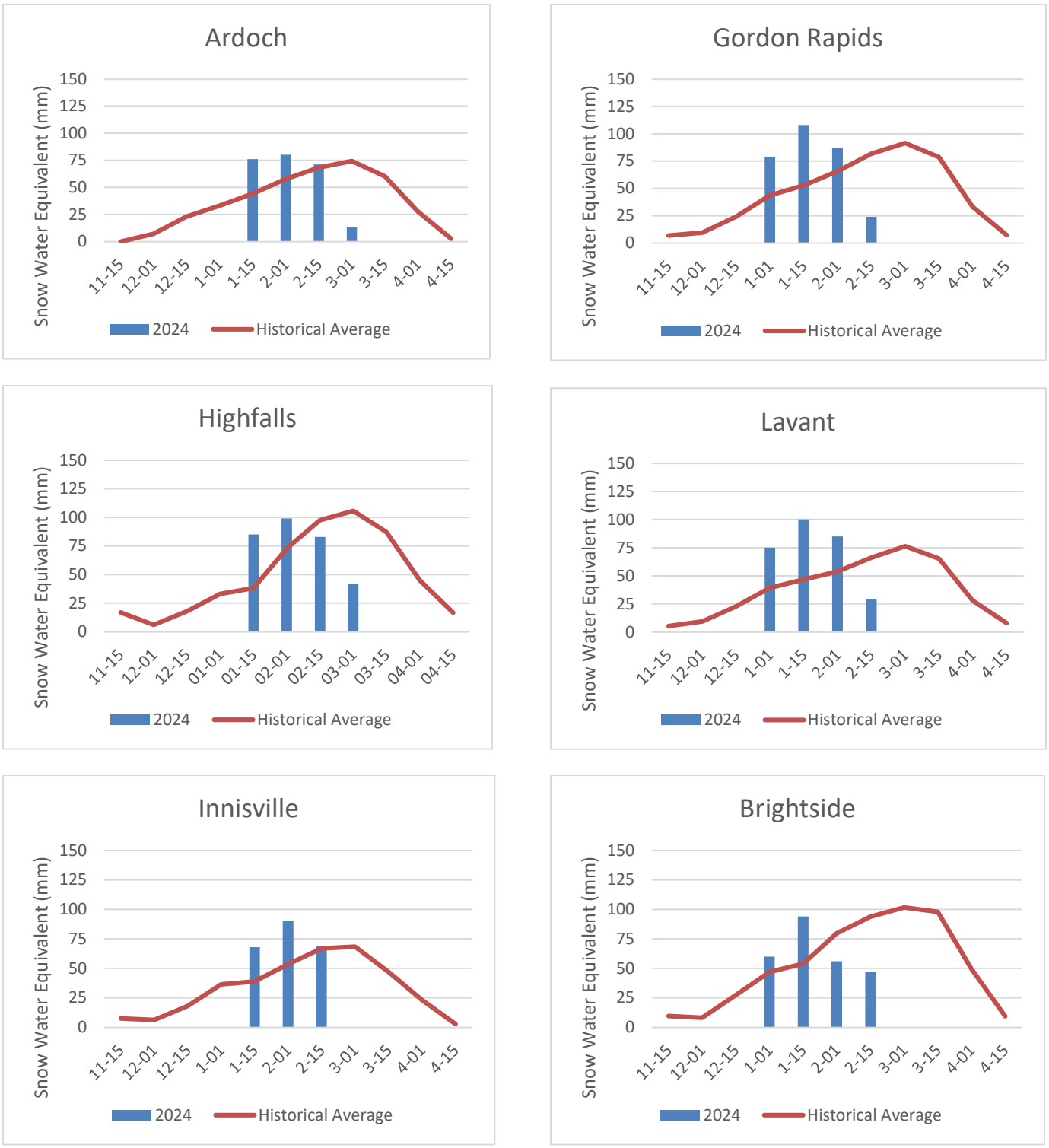


Figure 2: 2024 snow water equivalent levels vs. historical averages sampled near the main Mississippi River lakes (Ardoch, Highfalls, Innisville); and the Clyde River snow courses (Gordon Rapids, Lavant, Brightside).

3.3 Stream Flow and Precipitation

Precipitation gauges are located with streamflow gauge stations across the watershed. These gauges provide information on weather events and climactic conditions which influence water levels in the Mississippi River watershed. This report focuses on 2024 data from the stream flow and rain gauge station at the outlet of Joe's Lake (Gordon's Rapids), on the Clyde River upstream of the village of Lanark, the outlet of Dalhousie Lake, and in the community of Ferguson's Falls (upstream of Mississippi Lakes). The daily total precipitation and the daily mean flows at these stations are included in Figures 3a, 3b, 3c and 3d respectively. Note that gaps in the daily mean flow (green line) represent times when the survey equipment was not functioning properly creating a gap in the data record, they do not represent a zero reading.

The Figures show two peak flows occurring around March 10th and April 15th, resulting from an early/low spring peak followed by substantial rainfall. Significant rainfall forecasted from the remnants of hurricane Beryl in early July resulted in a Flood Watch for the Mississippi watershed as well as another strong peak in the main river system.

Figures 3a, 3b, 3c, and 3d also illustrate above average rainfall which occurred throughout the summer months. The watershed saw several large precipitation events occurring throughout the summer months resulting in flows above historical normals. The normal yearly total amount of precipitation for the Mississippi Valley watershed is around 900 mm per year; whereas the amount of precipitation received in 2024 was around 1315 mm.

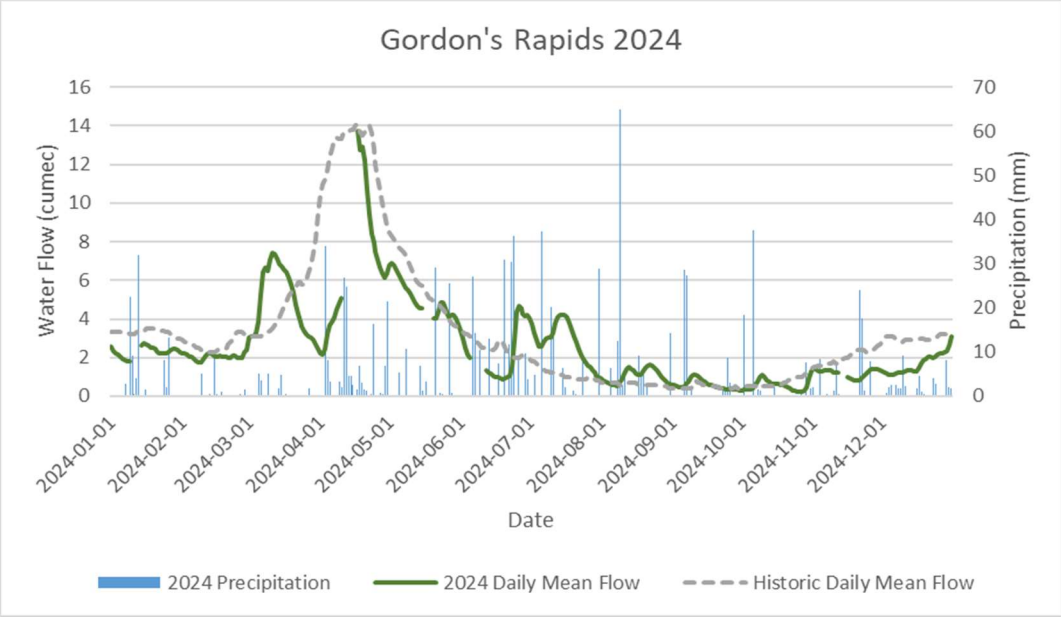


Figure 3a: Daily total precipitation and daily mean water flows at the Joe's Lake-Gordon's Rapids gauge station (at the outlet of the upper Clyde River subwatershed) for 2024 compared to the historic daily mean flows for the site.

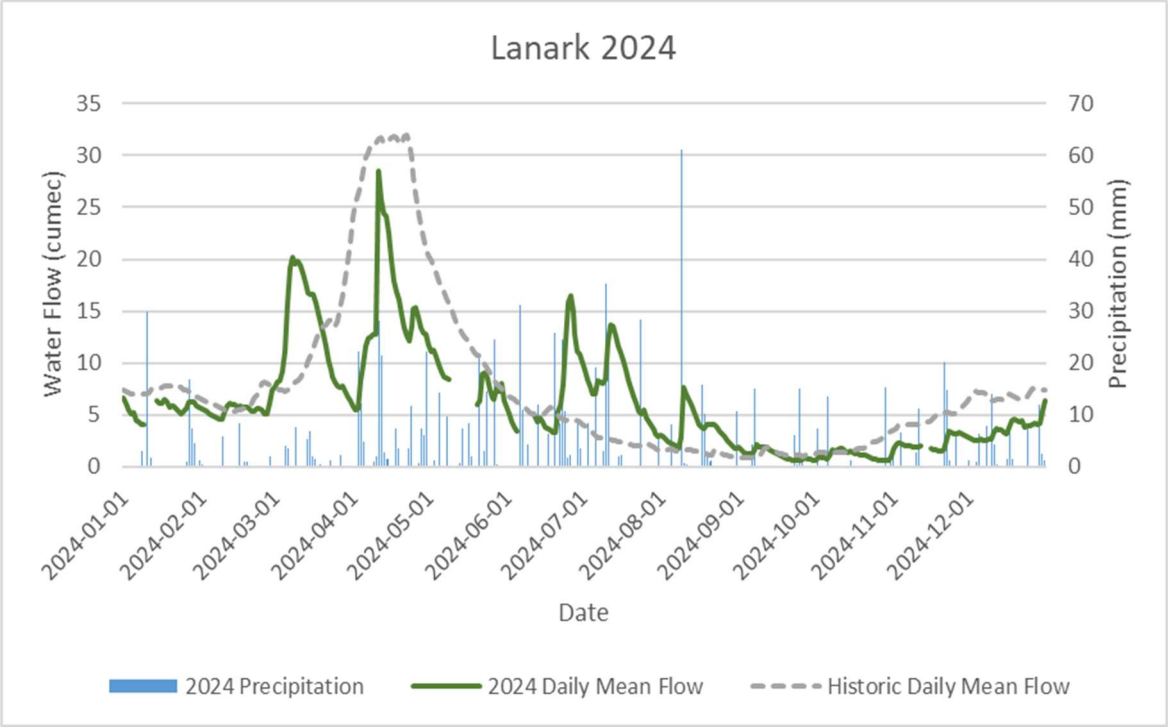


Figure 3b: Daily total precipitation and daily mean water flows at the Lanark gauge station (near Hopetown) for 2024 compared to the historic daily mean flows for the site.

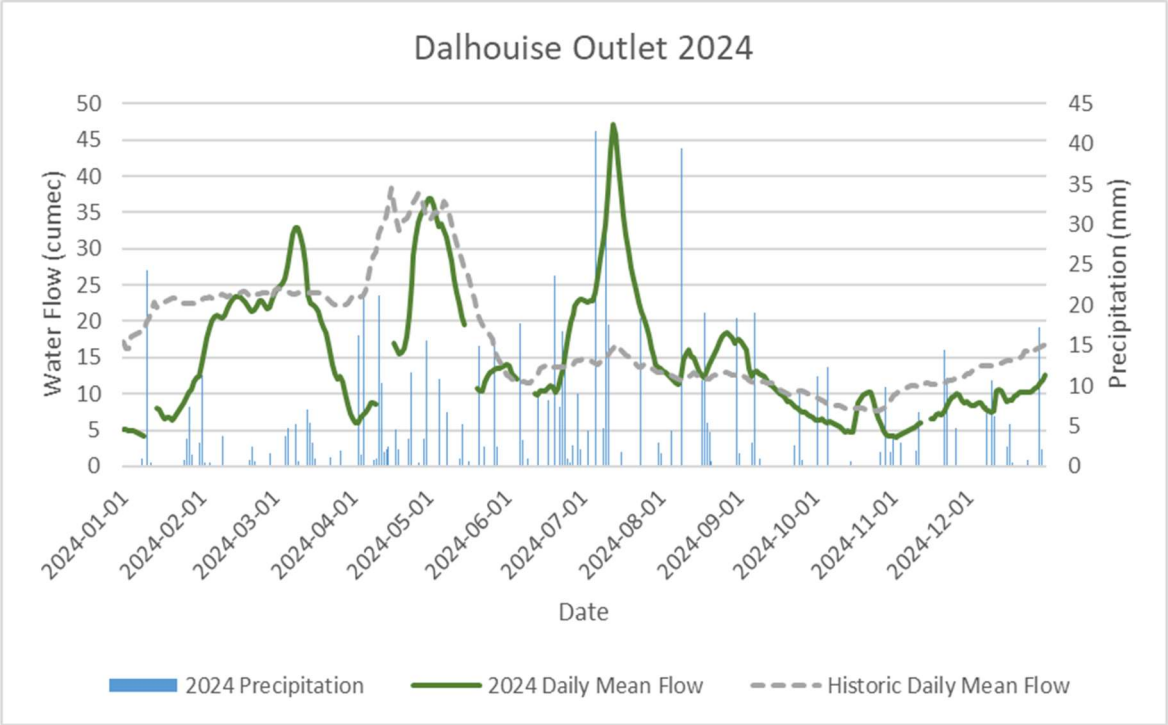


Figure 3c: Daily total precipitation and daily mean water flows at the Dalhousie Lake gauge station for 2024 compared to the historic daily mean flows for the site.

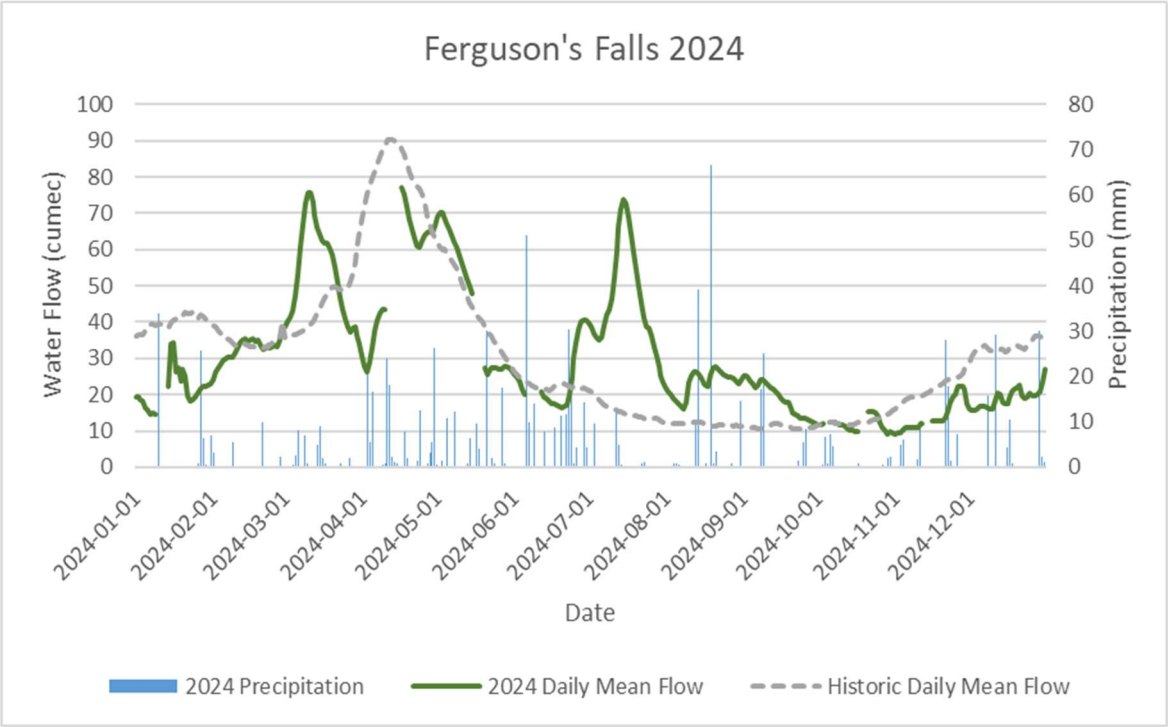


Figure 3d: Daily total precipitation and daily mean water flows at the Ferguson's Falls gauge station for 2024 compared to the historic daily mean flows for the site.

3.4 Lake Water Levels

Water levels are measured from gauges which are installed at several dams and gauge stations throughout the watershed. The following lakes do not have control structures nor gauge stations so they are not discussed further in this section; Sunday, Robertson, Clyde, and Flower Round. While Joe's Lake, Dalhousie Lake, and Mississippi Lake do not have control structures but do have gauge stations.

Water Survey of Canada Gauge Station at Joe's Lake

MVCA operates 19 dams throughout the watershed. Water levels in five of the lakes monitored in 2024 are managed by a dam, including: Crotch Lake (and by association Fawn Lake), Palmerston Lake, Canonto Lake, and Widow Lake (Figures 4a-e). Water levels in Joe's Lake, Dalhousie Lake, and Mississippi Lakes (Figure 4f and 4g) are not controlled by a dam. Note that gaps in the daily mean level (green line) represent times when the survey equipment was not functioning properly creating a gap in the data record, they do not represent a zero reading.

Water Survey of Canada gauge stations installed throughout the watershed contribute data to our flow and water level analysis. For example, Joe's Lake has a Water Survey of Canada gauge station at its outlet which provides us with water flow and precipitation information for the upper part of the Clyde River subwatershed.

Due to the above average rainfall this year, all of the lakes stayed at above average water levels throughout the summer season with no issues of drought.

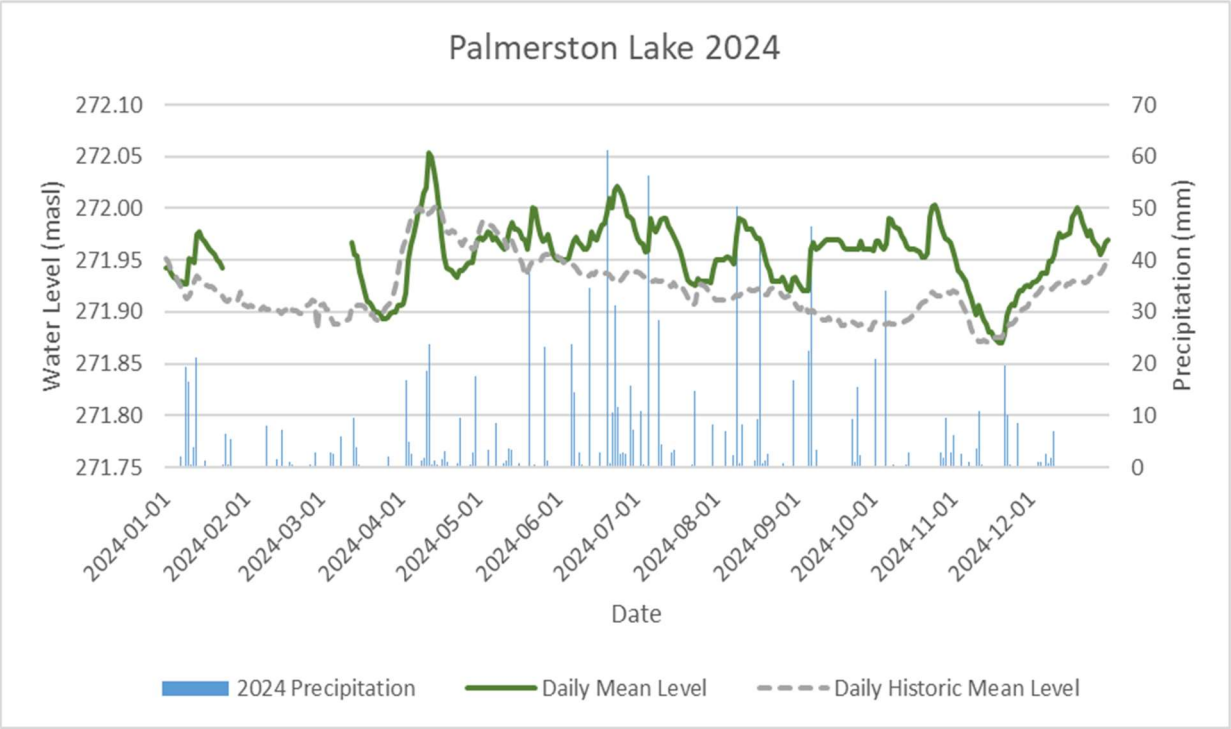


Figure 4a: 2024 and historic daily mean water levels (meters above sea level - MASL) at Palmerston Lake compared to the 2024 daily total precipitation at the Buckshot Creek stream gauge station.

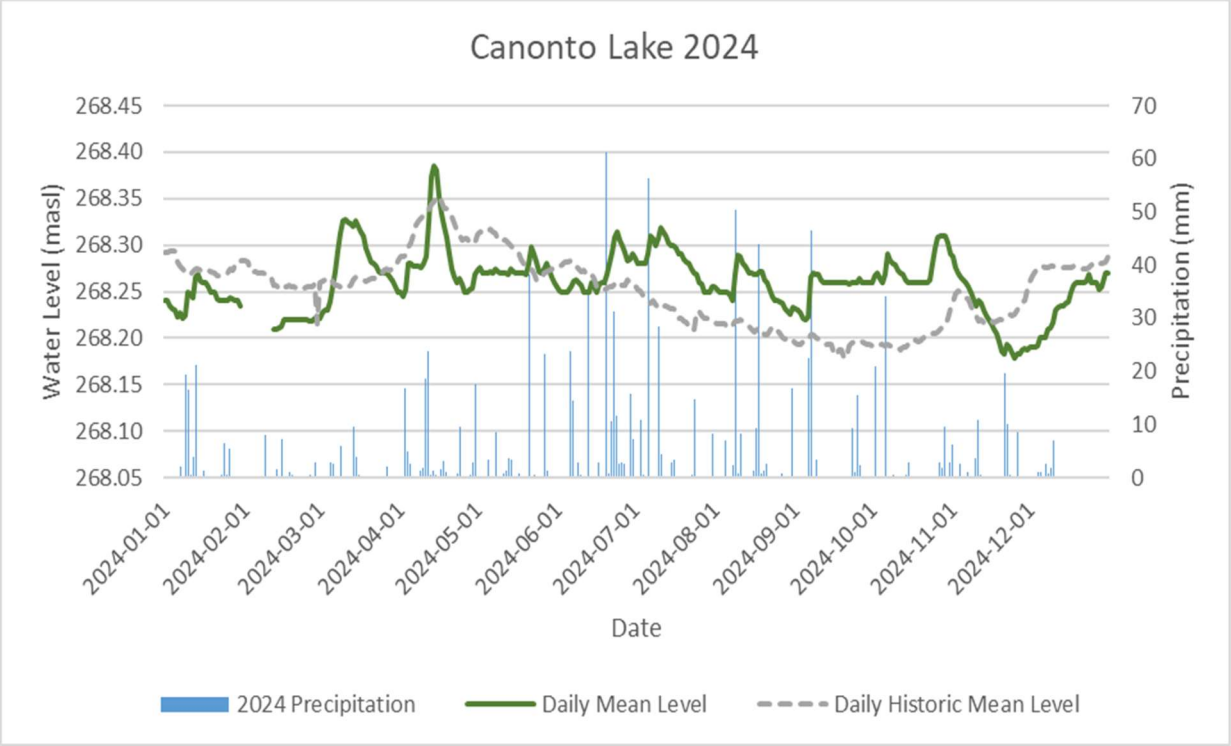


Figure 4b: 2024 and historic daily mean water levels (meters above sea level - MASL) at Canonto Lake compared to the 2024 daily total precipitation at the Buckshot Creek stream gauge station.

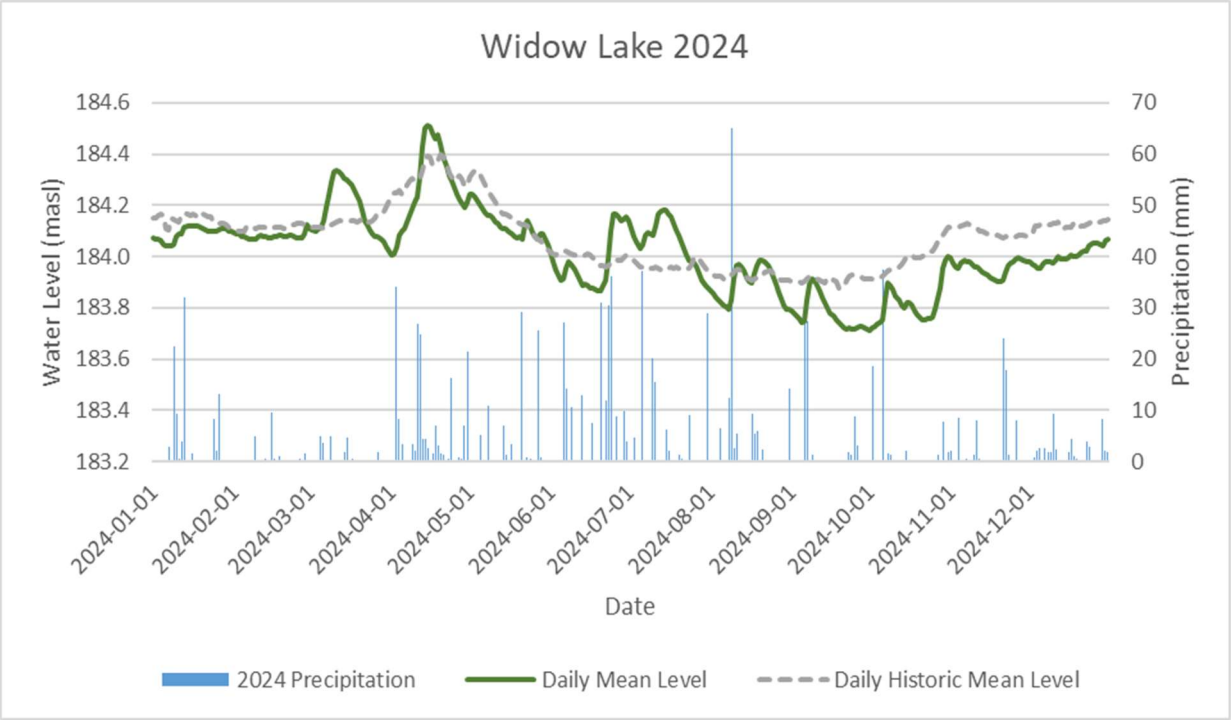


Figure 4c: 2024 and historic daily mean water levels (meters above sea level - MASL) at Widow Lake compared to the 2024 daily total precipitation at the Gordon's Rapids stream gauge station.

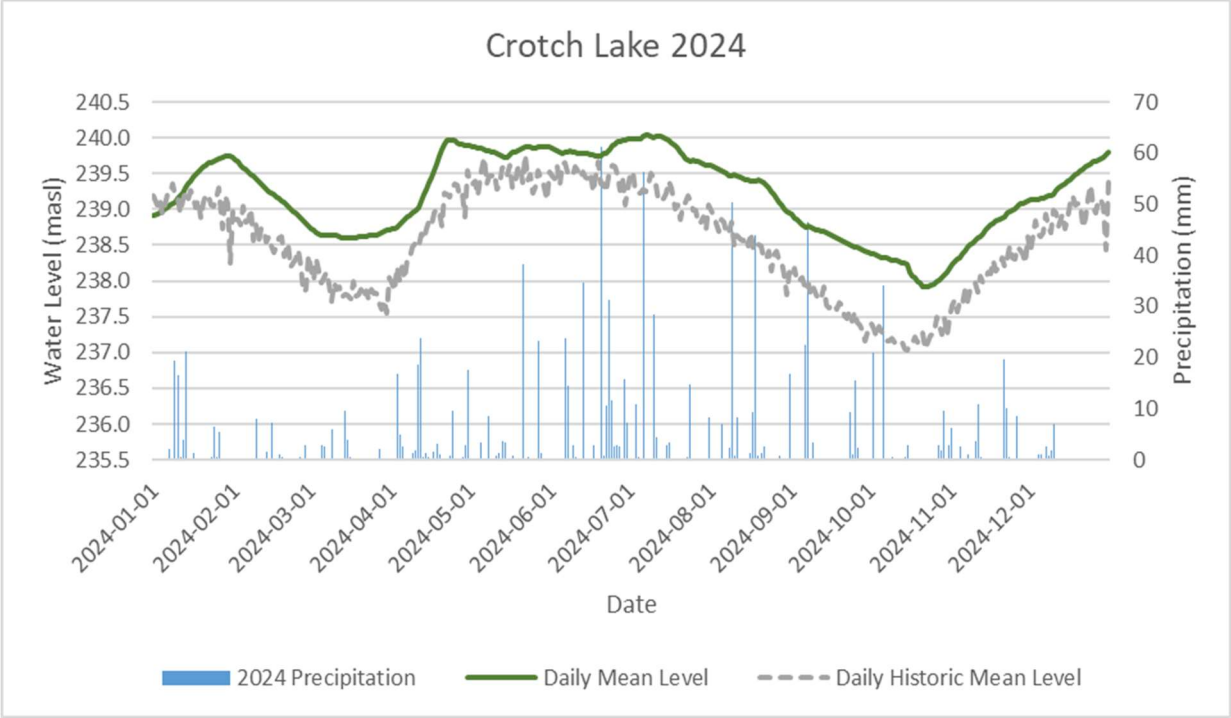


Figure 4d: 2024 and historic daily mean water levels (meters above sea level - MASL) at Crotch Lake compared to the 2024 daily total precipitation at the Buckshot Creek stream gauge station.

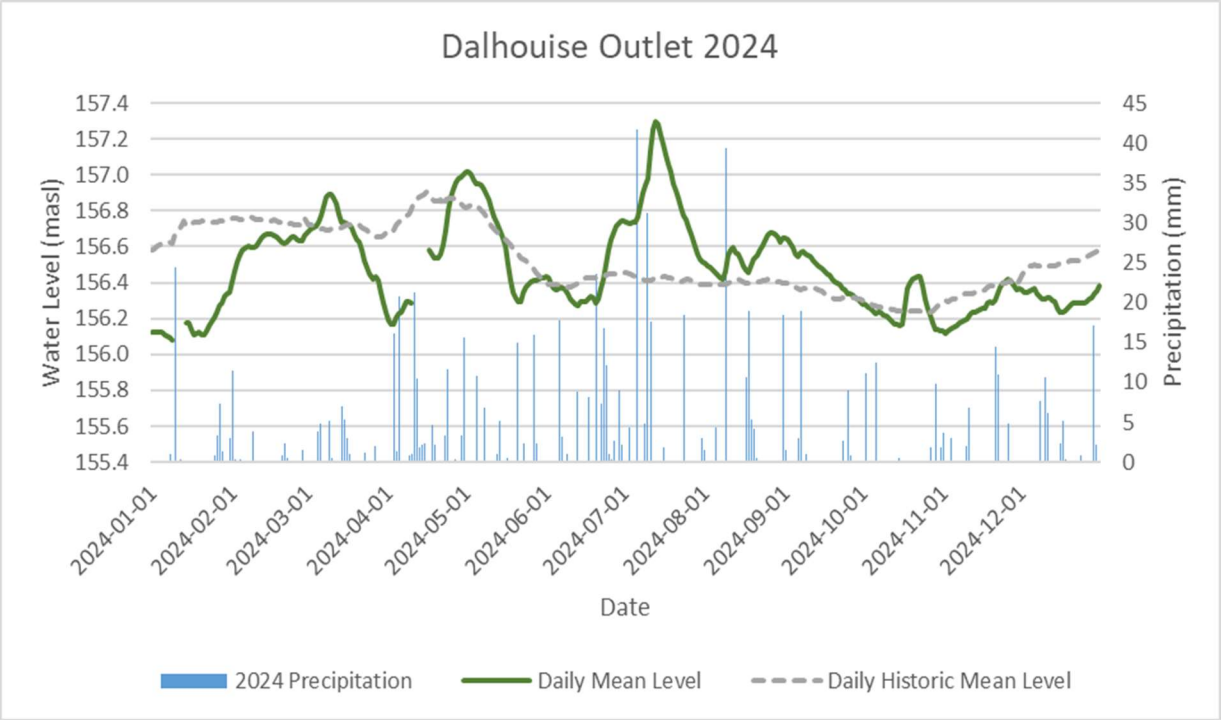


Figure 4e: 2024 and historic daily mean water levels (meters above sea level - MASL) at the Dalhousie Lake gauge compared to the 2024 daily total precipitation at the same location.

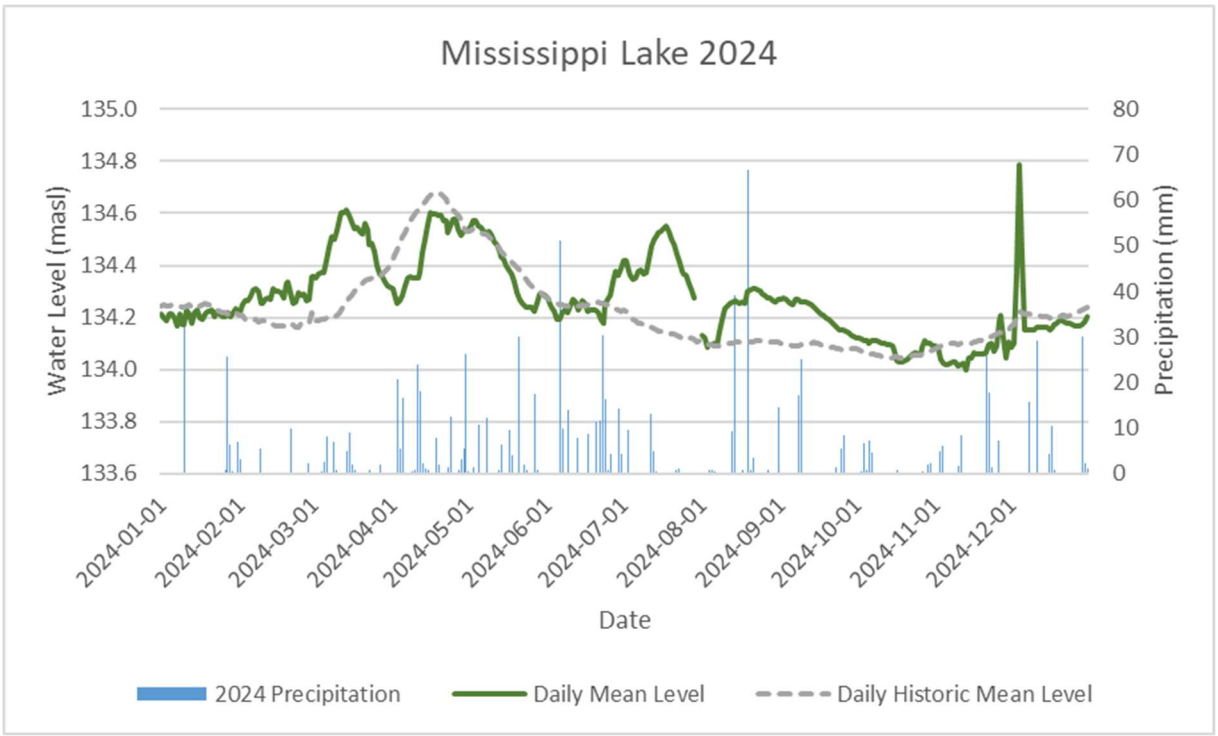


Figure 4f: 2024 and historic daily mean water levels (meters above sea level - MASL) at the Mississippi Lake gauge compared to the 2024 daily total precipitation at the nearby Ferguson's Falls stream gauge.

4.0 Lake Monitoring Program

In 2024, the sampling focus was on the Clyde River subwatershed. Table 1 lists the lakes sampled by subwatershed in order from upstream to downstream. Figure 5 highlights the lake sites where sampling occurred in 2024. Due to modifications in the sampling rotation not all Clyde River lakes on our sampling list were visited this year.

Preparing to filter a lake water sample

- Four lakes were sampled representing the main Mississippi River. Of those, only Mississippi Lake is downstream of the Clyde River's outlet into the Mississippi River.
- Located in the north-central portion of the Mississippi River watershed, the Clyde River subwatershed collects precipitation from the Lanark Highlands as it flows south towards the village of Lanark. This watershed is the largest tributary to the Mississippi River with an area of 667 km^2 and a total river length of 48.5 km. Eight lakes from this subwatershed were sampled in 2024.

Lakes sampled in 2024

Mississippi River Main Stem:

- Fawn Lake
- Crotch Lake
- Dalhousie Lake
- Mississippi Lake

Clyde River Subwatershed:

- Palmerston Lake
- Canonto Lake
- Sunday Lake
- Clyde Lake
- Flower Round Lake
- Widow Lake
- Joe's Lake
- Robertson Lake

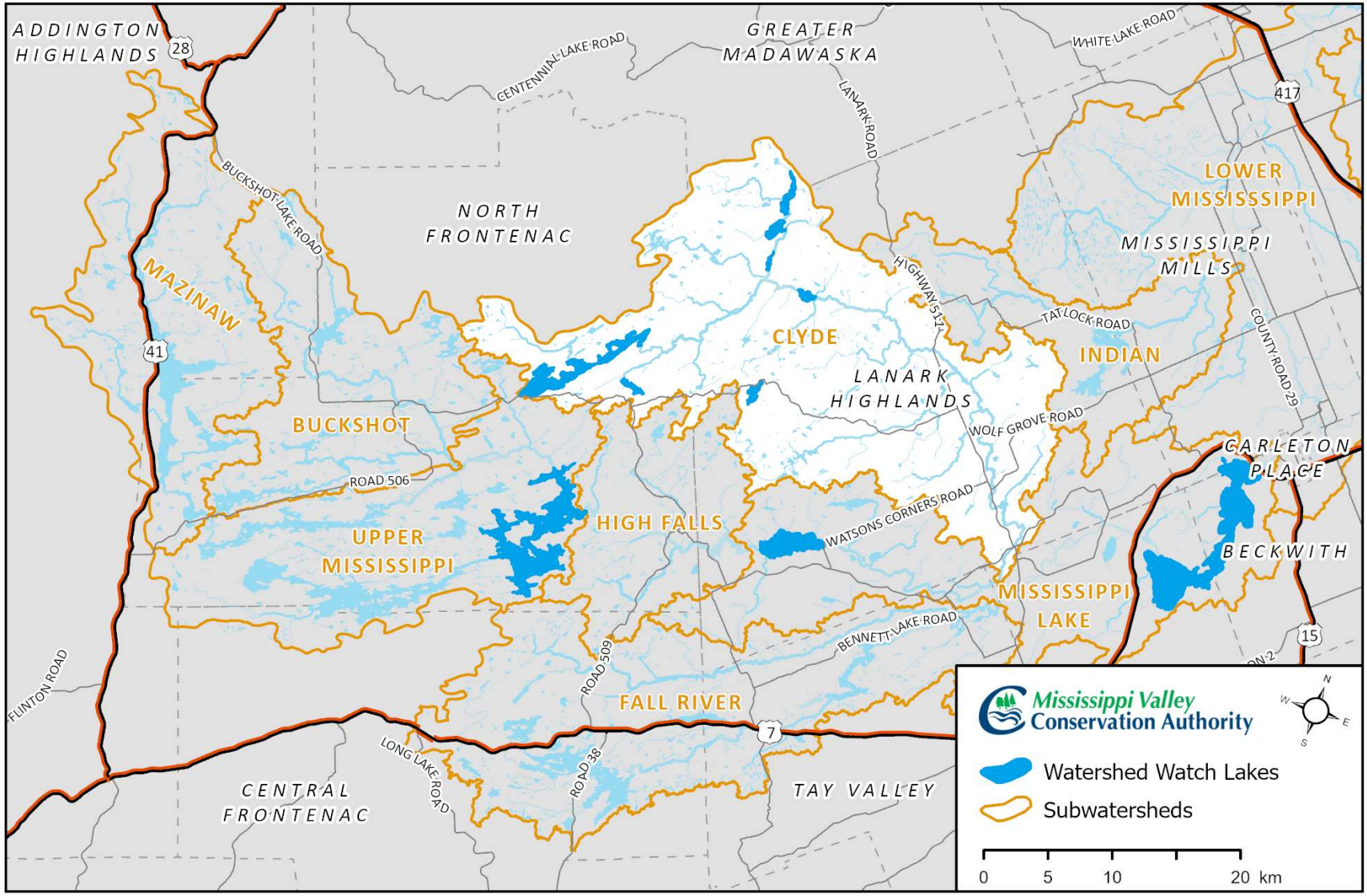


Figure 5: The lakes shown in darker blue represent the 12 lakes monitored in 2024. The Clyde River subwatershed is shown in white.

4.1 Results Summary

Overall, the lakes sampled in 2024 were consistent with historic trends for Total Phosphorus (TP) levels, Secchi depth and trophic status. The lakes continue to be monitored as part of the regular sampling rotation which enhances the robustness of MVCA's long-term data set and improves understanding of yearly results.

To help interpret and display the results of the lake monitoring program, "box and whisker" plots have been used (Figure 6). This type of chart illustrates the middle 50% of all data points within the box. The additional 50% is shown by the lines (whiskers) extending from the top and bottom of the box, representing the upper or lower 25% of the dataset respectively. The median value of the dataset is indicated with a line in the middle of the data spread. Outliers are any data points which fall outside of the reach of the box and whisker area shown as dots above/below the whiskers. An example of the application of this chart type using our lake monitoring data is shown in Figure 7. Note, trophic status definitions are described in the following Secchi depth and total phosphorus methods sections.

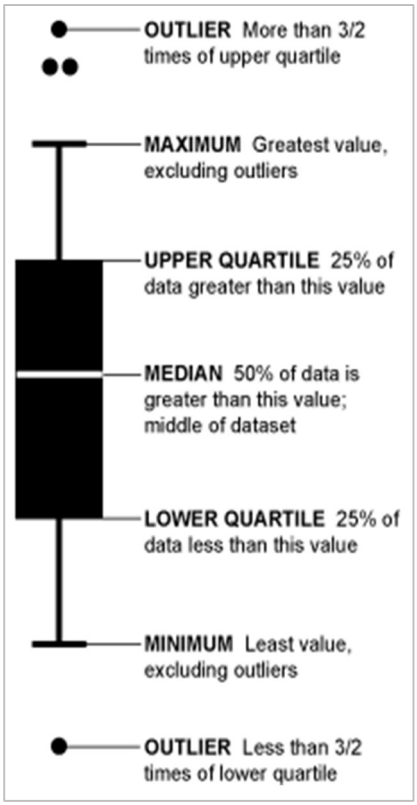


Figure 6: How to interpret a Box and Whisker Plot

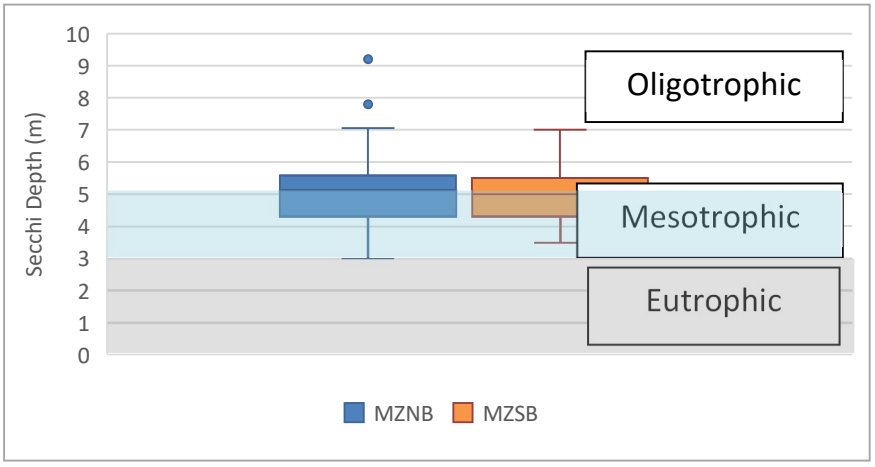


Figure 7: An example of a box and whisker plot from Mazinaw Lake's 2019 Secchi depth results compared to trophic status ranges.

4.2 Lake Monitoring Indicators and Methodology

The Lake Monitoring Program tests for six water quality parameters. These parameters are selected for their relative simplicity of collection, reproducibility, and ability to determine trophic status. The parameters are further described below.

Calcium

Calcium in lakes is a measure of the levels of calcium (Ca^{2+}), magnesium (Mg^{2+}) and bicarbonate (HCO_3^-) ions in the water. Higher levels of these ions classify the water as 'hard' water, and lower levels as 'soft' water.

Testing calcium levels

Sources: Calcium enters a lake largely through the mineral weathering of rocks (such as marbles and limestones). It is then either used by aquatic organisms for bones or shells or as a component in the cell walls of aquatic plants, and eventually deposits into the sediment of the lake.

Measurement: MVCA measures calcium hardness ($CaCO_3$ in mg/L) in the field. The result is then multiplied by 0.4 to determine the concentration of calcium freely available in the water. Calcium in freshwater usually falls within the range of 4 to 100 mg/L. Calcium sampling only occurs as part of the spring sampling protocol.

Significance: Calcium has been shown to influence zooplankton (small planktonic invertebrates) communities, which are an important food source for many baitfish species. Higher calcium levels are also required for zebra mussels to thrive.

pH

Measurement: The pH scale is a logarithmic measure of the concentration of hydrogen ions in solution. It is a measure of the acidity of a solution and ranges from 0 to 14. A pH of 7 is considered neutral, values above 7 are basic, and values below 7 are acidic. The logarithmic scale means that a change from pH 7 to pH 8 is a ten-fold decrease in the concentration of hydrogen ions in solution.

Staff using a PH sensor

Significance: The acidity of a water body affects all chemical reactions within the water. Even small changes in pH can have a large influence on the solubility of some nutrients, including phosphorus, which in turn can influence plant growth. The Provincial Water Quality Objective (PWQO) for pH in lakes is 6.5 – 8.5, which ensures optimal conditions for most aquatic species.

Secchi Depth

Measurement: Secchi depth is a measure of water clarity and is collected by lowering a Secchi disk (a weighted black and white disc), attached to a measured rope, into the water on the shady side of the boat to the point where it can no longer be seen.

A Secchi disc

Interpretation: The greater the Secchi depth, the clearer the lake is. The Secchi depth also helps determine the euphotic zone (the depth of water through which light is able to penetrate). The guideline shown in Table 2 is used to determine a lake's nutrient status according to Secchi depth.

Significance: Secchi depth can be influenced by the concentration of algae or the presence of other suspended materials in the water. Often a decrease in Secchi depth occurs in unison with an increase in phosphorus. However, the presence of zebra mussels can also influence Secchi depth. They filter the water to feed on the algae and zooplankton; making the water clearer and possibly increasing Secchi depths.

Table 2: Interpreting Secchi depth results.

Secchi Depth	Lake Nutrient Status
≥ 5 meters	Oligotrophic – unenriched, few nutrients
3.0 – 4.9 meters	Mesotrophic – moderately enriched, some nutrients
< 3.0 meters	Eutrophic – enriched, higher levels of nutrients

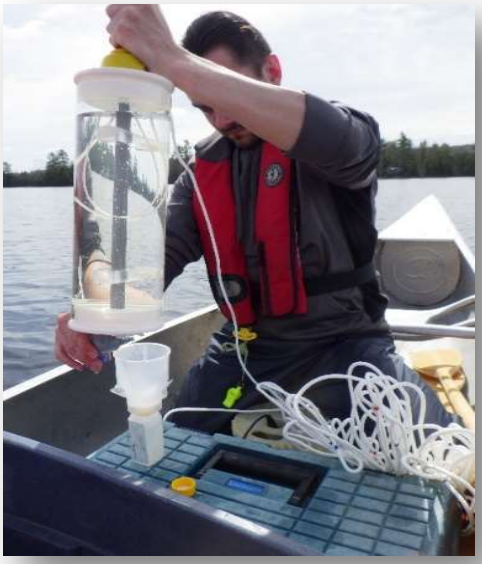
Total Phosphorus

Phosphorus is an essential nutrient for all living organisms as it plays a role in numerous aspects of biological metabolism. It is also the limiting nutrient in biological activity and therefore when phosphorus levels get too high there tend to be adverse effects such as algae blooms.

Sources: Phosphorus can be found naturally in the environment, as well as in many man-made products such as soaps, detergents, fertilizers and septic waste. Total phosphorus (TP) is measured in micrograms per liter (µg/L).

Measurement: As part of the Lake Monitoring program, two types of total phosphorus levels are measured at each sampling location: euphotic zone phosphorus (TPA), and bottom phosphorus (TPB). All TP samples are filtered through an 80-micron mesh to remove zooplankton which could skew results. The euphotic zone is defined as twice the Secchi depth and is the depth to which light can reach and influence plant growth.

The bottom phosphorus sample is collected at sites that have a depth greater than the euphotic zone, using a device called a Kemmerer Bottle. The bottle is sent down to the appropriate depth, approximately 1 meter off the bottom of the lake, with both ends open. A weight on the rope is then dropped, causing both ends to close when the weight hits the bottle, sealing the sample water in the bottle, providing a discrete volume of water from the appropriate depth.



Filtering a sample of water that was taken from near lake bottom with a Kemmerer Bottle

Significance: Total phosphorus levels provide an accepted standard to characterize a lake's trophic status following the general guidelines as seen in Table 3. It should be noted that while these numbers provide an idea of a lake's current trophic status, lakes naturally progress over time from oligotrophic to eutrophic, so an 'ideal' trophic status does not exist. Furthermore, natural variation can cause a great deal of change from year-to-year and even within years, so it is important to look at larger trends rather than one or two exceptional years.

Table 3: Interpreting total phosphorus results.

Total Phosphorus Level	Lake Trophic Status
≤ 10 µg/L	Oligotrophic – unenriched, few nutrients
10.1 – 19.9 µg/L	Mesotrophic – moderately enriched, some nutrients
≥ 20 µg/L*	Eutrophic – enriched, higher levels of nutrients

*The Provincial Water Quality Objective (PWQO) for total phosphorus in lakes is 20 µg/L (*Water Management, Policies and Guidelines, Provincial Water Quality Objectives of the Ministry of the Environment and Energy. MOE. 1994*). The goal is to keep phosphorus below this level in order to maintain aquatic health and the recreational value of watershed lakes.

Dissolved Oxygen and Water Temperature

Dissolved oxygen (D.O.) is essential to all aquatic life, including fish, invertebrates and bacteria. Many factors can influence dissolved oxygen concentrations in a lake, but two key factors are lake stratification (water temperature), and the amount of phytoplankton (microscopic algae) produced in the lake.

Measurement: Dissolved oxygen (D.O.) and water temperature are measured using an Optical Dissolved Oxygen Probe. This instrument (pictured above) is lowered through the water at one-meter intervals, where it takes both water temperature and D.O. readings. This creates a dissolved oxygen profile where changes in temperature and D.O. can be recorded as depth increases. Table 4 shows the

optimal temperature/D.O. combinations for cold, cool, and warm water fish habitat. Results from the D.O. and water temperature profiles for each of the 2024 lake monitoring sites are available in Appendix A.

An Optical Dissolved Oxygen Probe

Significance: Lake stratification is the separation of the water into three layers: the epilimnion (top layer), metalimnion (middle transitional layer also known as the thermocline), and the hypolimnion (bottom layer). Stratification is caused by changes in water density due to temperature at depth, and occurs from late spring to early fall.

Due to stratification, deeper water D.O. concentrations are at their lowest during the late summer and early fall. This is when the water in the hypolimnion cannot recharge its oxygen concentrations because it is isolated from the atmosphere by the epilimnion and the thermocline (the steep temperature gradient between the warm sunlight epilimnion water and the cooler hypolimnion water below). Also, during the late summer and early fall the phytoplankton that have been actively growing and reproducing during the summer months begin to die and sink to the bottom of the lake. The bacteria that decompose organic matter, including the phytoplankton, consume large amounts of dissolved oxygen, further depleting levels in the hypolimnion. The low levels of D.O. in the bottom depths of a lake decrease the amount of critical habitat available for cool water fish species to thrive, as the fish species are also stressed by the warmer temperatures in the oxygen rich epilimnion.

Table 4: Optimal conditions for different fish habitat classes.

	Dissolved Oxygen	Water Temperature
Cold Optimal	>6 mg/L AND	<10 °C
Cool Optimal	>4 mg/L AND	<15.5 °C
Warm Optimal	>4 mg/L AND	<25 °C

Source: Coker, G.A., Portt, C.B., & Minns, C.K. (2001). Morphological and Ecological Characteristics of Canadian Freshwater Fishes. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2554.

5.0 Lake Results: Main Mississippi River

5.1 Fawn Lake

Fawn Lake is a headwater lake (meaning the lake has a small catchment area contributing overland flow to it, and there are no rivers feeding it) connected to Crotch Lake's southern basin in North Frontenac via a shallow marsh wetland. It has a maximum depth of 9 meters.

The 2024 data (Table 5) shows moderate to high levels of total phosphorus and moderate to deep Secchi depth measurements. MVCA has now monitored it through four ice-free seasons and it has maintained moderate (mesotrophic) total phosphorus results and moderate to deep (mesotrophic to oligotrophic) Secchi depth results. Results from 2024 are compared to past data in Figure 8, and show that the lake is maintaining a primarily mesotrophic classification, and there is no indication of a change in trophic classification over time. The September total phosphorus result of 75 µg/L is likely an outlier in the dataset as it is well above the expected dataset range. Continued sampling of this lake will help put this one reading in context of the overall character of the lake.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 5: 2024 sampling summary for Fawn Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 24, 2024	5	10	n/a	24
Main Basin	July 12, 2024	5	30		
Main Basin	Sept 13, 2024	4.5	75		

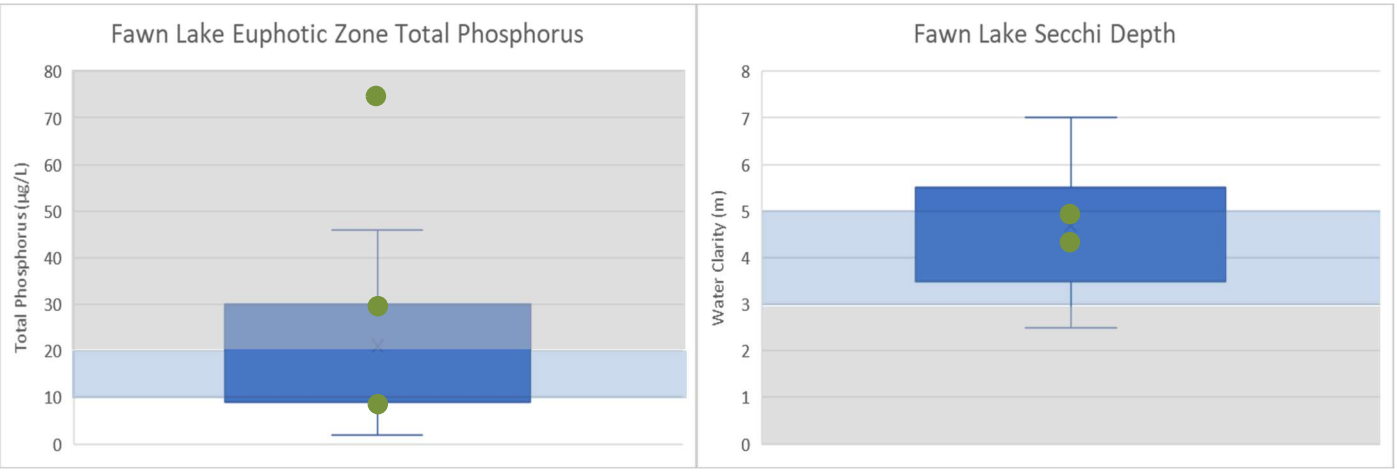


Figure 8: Euphotic Zone Total Phosphorus and Secchi Depth results from four sampling years for the main basin of Fawn Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

5.2 Crotch Lake

Crotch Lake is mid-way along the main Mississippi River in North Frontenac and is the only true reservoir in the watershed. The lake water level is managed to capture spring melt events and augments summer and winter river flows downstream. It has a maximum depth of 25 m; however, the lake surface can drop by 4 m over the summer season due to dam operations.

The 2024 data (Table 6) shows low levels of total phosphorus for most of the season and moderate to deep Secchi depth measurements throughout the lake. MVCA has now monitored it through eight summers and it has maintained a low to moderate total phosphorus result. Results from 2024 are compared to past data in Figure 9 showing the lake maintaining a primarily oligotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 6: 2024 sampling summary for Crotch Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
North Basin	June 4, 2024	5.5	2	<2	16
North Basin	July 12, 2024	4.5	14	12	
North Basin	Sept 13, 2024	4.5	5	10	
South Basin	June 4, 2024	3.0	4	9	16
South Basin	July 12, 2024	4.5	9	15	
South Basin	Sept 13, 2024	5.5	36	19	

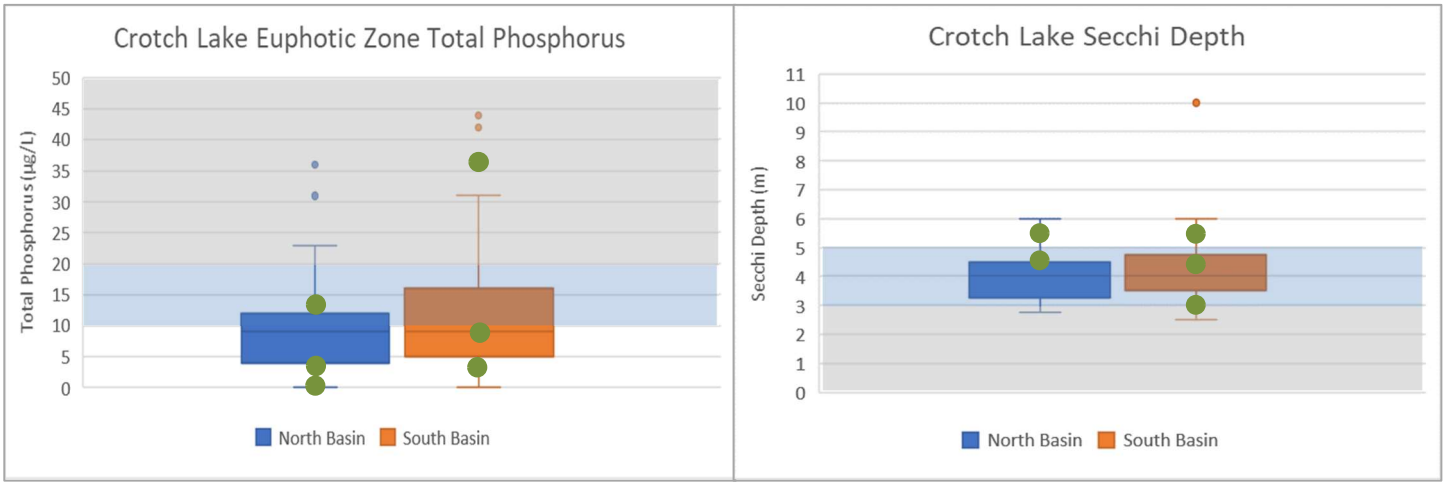


Figure 9: Euphotic Zone Total Phosphorus and Secchi Depth results from eight sampling years for the main basins of Crotch Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

5.3 Dalhousie Lake

Dalhousie Lake is the last main river lake before the Clyde and Fall Rivers join the Mississippi River near Lanark. It is located at the transition between the Canadian Shield and the St. Lawrence lowlands geologic zones. It is a wide and shallow lake with the deepest area measuring 11 meters and located in the western portion of the lake. The lake provides warm water habitat to Northern Pike, Small and Largemouth bass, Walleye and other fish species.

Results from 2024 are summarized in Table 7 and compared to past data in Figure 10, and show that the lake has maintained a mesotrophic status. When compared to prior years, there is no indication of a change in trophic classification over time. As a large main river lake, Dalhousie will continue to be monitored annually to track the lake's condition.

The water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 7: 2024 sampling summary for Dalhousie Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 31, 2024	4.5	<2	7	32
Main Basin	July 29, 2024	3.5	18		
Main Basin	Oct 8, 2024	4	9		

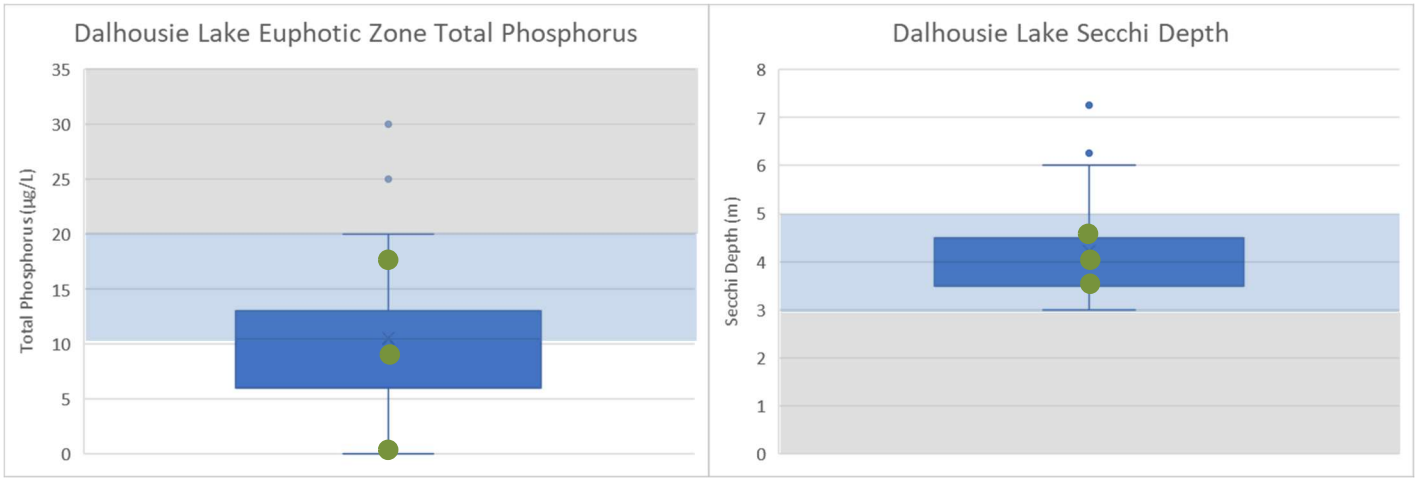


Figure 10: Euphotic Zone Total Phosphorus and Secchi Depth results from ten sampling years for the main basin of Dalhousie Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

5.4 Mississippi Lake

Mississippi Lake is a large and shallow warm-water-lake in Lanark County. It is the furthest downstream lake on the main stem of the Mississippi River system and its outlet is at the town of Carleton Place. It has a maximum depth of 10 meters. MVCA has now monitored it through 20 ice free seasons. A summary of the results from the 2024 survey are presented in Table 8.

Results from 2024 are summarized in Table 8 and compared to past data in Figure 11, showing the lake maintained a mesotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 8: 2024 sampling summary for Mississippi Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)*	Calcium (Ca2+) (mg/L)
Inlet (MLI)	May 6, 2024	4	13	11	40
Inlet	July 2, 2024	3.5	15	16	
Inlet	Sept 12, 2024	3.5	10	9	
Burnt Island (MLB)	May 6, 2024	3.5	7	8	40
Burnt Island	July 2, 2024	3.5	17	14	
Burnt Island	Sept 12, 2024	4	11	10	
Pretties Island (MLP)	May 6, 2024	3.5	6		
Pretties Island	July 2, 2024	3.5	12		
Pretties Island	Sept 12, 2024	3.5	8		
Outlet (MLO)	May 6, 2024	2.2	11		
Outlet	July 2, 2024	2.5	13		
Outlet	Sept 12, 2024	2.5	9		

*Total phosphorus samples are taken from 1 m off of the bottom of the lake, and only if the euphotic zone does not extend to the bottom.

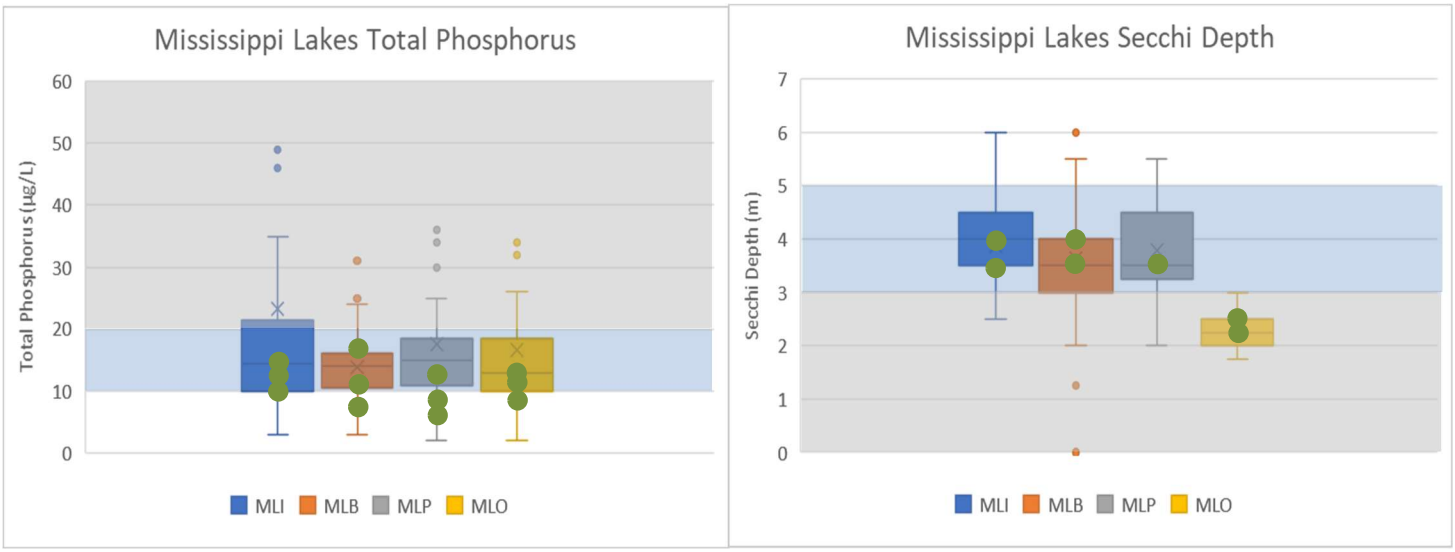


Figure 11: Euphotic Zone Total Phosphorus and Secchi Depth results from 20 sampling years for all four sites. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours. Note: The maximum Secchi depth possible at the outlet site (MLO) is limited by the water depth (3 m), and by a thick bed of aquatic plants inhabiting the area.

Water sampling on Mississippi Lake

6.0 Lake Results: Clyde River Subwatershed

6.1 Palmerston Lake

Palmerston Lake is a deep cold-water Canadian Shield lake in the western headwaters of the Clyde River subwatershed. It is 58 m deep and supports cold-water fish species such as Lake Trout and Lake Whitefish. Warmer water fish such as smallmouth bass can also be found here.

Results from 2024 are summarized in Table 9 and compared to past data in Figure 12, showing the lake maintaining an oligotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

D.O. profiles reveal excellent conditions for cold-water fish, with plenty of suitable habitat in the lower depths of the lake. Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 9: 2024 sampling summary for Palmerston Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
North Basin	May 16, 2024	5	<2	<2	40
North Basin	July 19, 2024	8	8	16	
North Basin	Sept 10, 2024	5.5	5	8	
South Basin	May 16, 2024	5	<2	<2	32
South Basin	July 19, 2024	7	6	10	
South Basin	Sept 10, 2024	6.5	4	12	

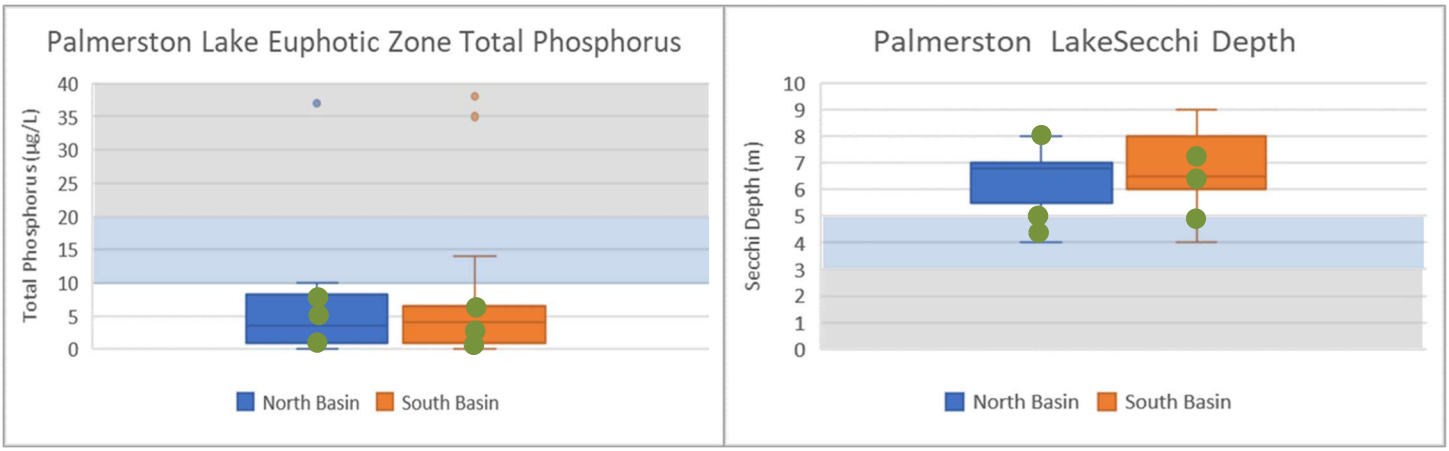


Figure 12: Euphotic Zone Total Phosphorus and Secchi Depth results from five sampling years for the main basin of Palmerston Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.2 Canonto Lake

Canonto Lake is a large Canadian Shield lake in the headwaters of the south branch of the Clyde River. Palmerston Lake is immediately upstream and is only separated by a dam managed by MVCA. It is 21 m deep and is known to support warm water fish such as Northern Pike, Small and Largemouth bass, as well as Walleye.

Results from 2024 are summarized in Table 10 and compared to past data in Figure 13, showing the lake maintaining an oligotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time. While the mid-summer total phosphorus readings were slightly higher than typical in the mesotrophic range, they are within the expected data range, and the levels returned to the lower oligotrophic range by the September sampling event.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 10: 2024 sampling summary for Canonto Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
North Basin	May 30, 2024	8	8	<2	40
North Basin	July 8, 2024	6	16	23	
North Basin	Sept 16, 2024	5.5	9	20	
South Basin	May 30, 2024	9	4	<2	48
South Basin	July 8, 2024	6	13	19	
South Basin	Sept 16, 2024	12	7	9	

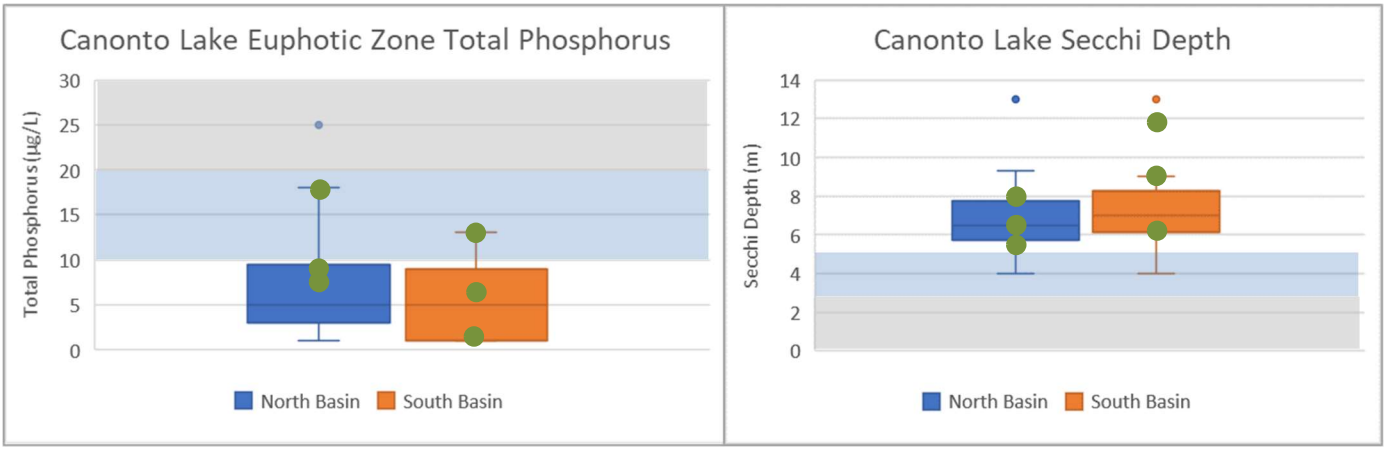
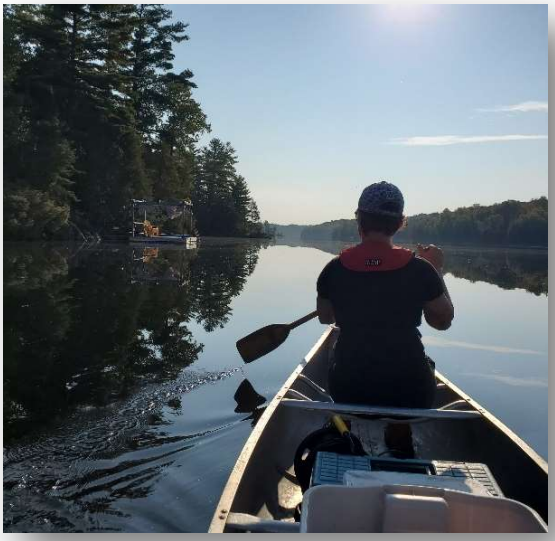


Figure 13: Euphotic Zone Total Phosphorus and Secchi Depth results from six sampling years for the main basin of Canonto Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.3 Sunday Lake



Sunday Lake is a headwaters lake that flows into Sunday Creek, which then joins the south branch of the Clyde River near Folger. It is a narrow 15 m deep lake with wetlands at the inlets and outlet that support northern pike, walleye, bass and other warm-water fish species.

Results from 2024 are summarized in Table 11 and compared to past data in Figure 14, showing the lake maintaining an oligotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

The water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 11: 2024 sampling summary for Sunday Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 7, 2024	3.5	4	6	48
Main Basin	July 4, 2024	3	8	19	
Main Basin	Sept 19, 2024	5.5	8	12	

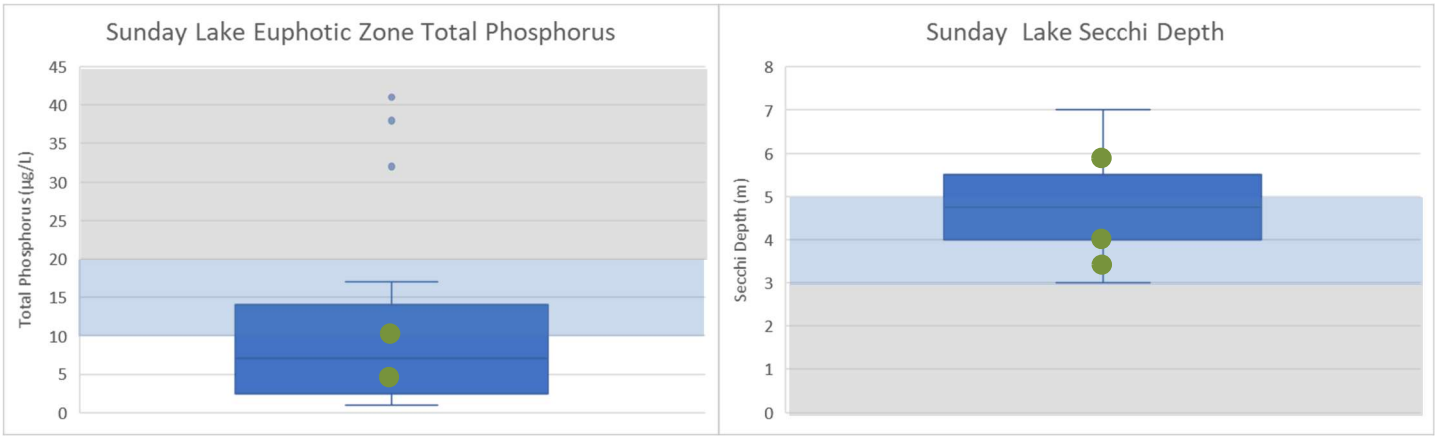


Figure 14: Euphotic Zone Total Phosphorus and Secchi Depth results from six sampling years for Sunday Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.4 Clyde Lake

Clyde Lake is the most northern lake in our watershed that we monitor. It is part of the north branch of the Clyde River and is located beside the K&P Trail. It is 12 m deep and supports a population of northern pike, as well as small and largemouth bass.

Results from 2024 are summarized in Table 12 and compared to past data in Figure 15, showing the lake maintaining a mesotrophic classification. While the mid-summer results are on the threshold for the eutrophic range, they are within the lake's expected range of results, and they decrease into the mesotrophic range by the fall sampling visit. When compared to prior years, there is no indication of a change in trophic classification over time.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 12: 2024 sampling summary for Clyde Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	June 3, 2024	3.5	4	18	32
Main Basin	Aug 7, 2024	2.5	20	104	
Main Basin	Sept 27, 2024	4	15	118	

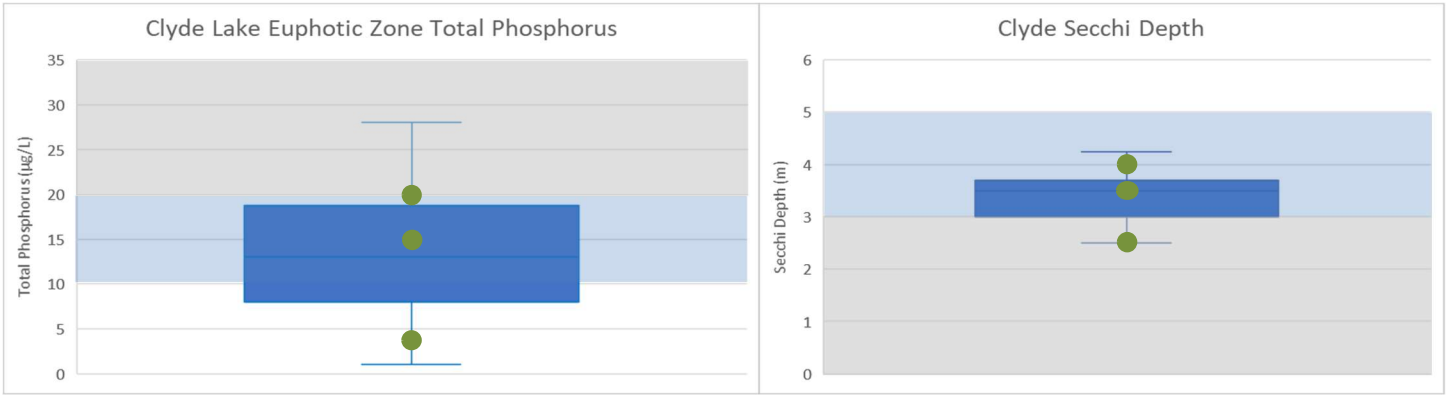
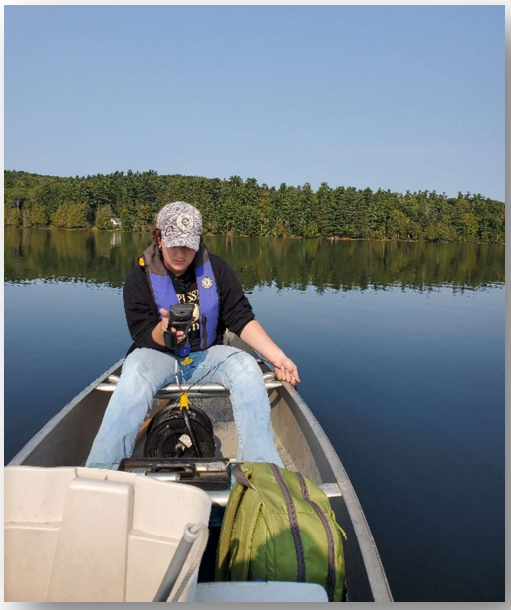


Figure 15: Euphotic Zone Total Phosphorus and Secchi Depth results from five sampling years for the main basin of Clyde Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.5 Flower Round Lake



Flower Round Lake is part of the north branch of the Clyde River downstream of Clyde Lake, at the community of Flower Station. It is 13 m deep and is known to support Northern Pike, Small and Largemouth bass, Walleye, and Burbot. A tributary to the lake's south-west shore flows through a large wetland community providing nutrients and habitat diversity to the lake area.

Results from 2024 are summarized in Table 13 and compared to past data in Figure 16, showing the lake maintaining a mesotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 13: 2024 sampling summary for Flower Round Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 29, 2024	4.5	<2	6	32
Main Basin	Aug 2, 2024	4.5	16	71	
Main Basin	Sept 12, 2024	3.5	11	168	

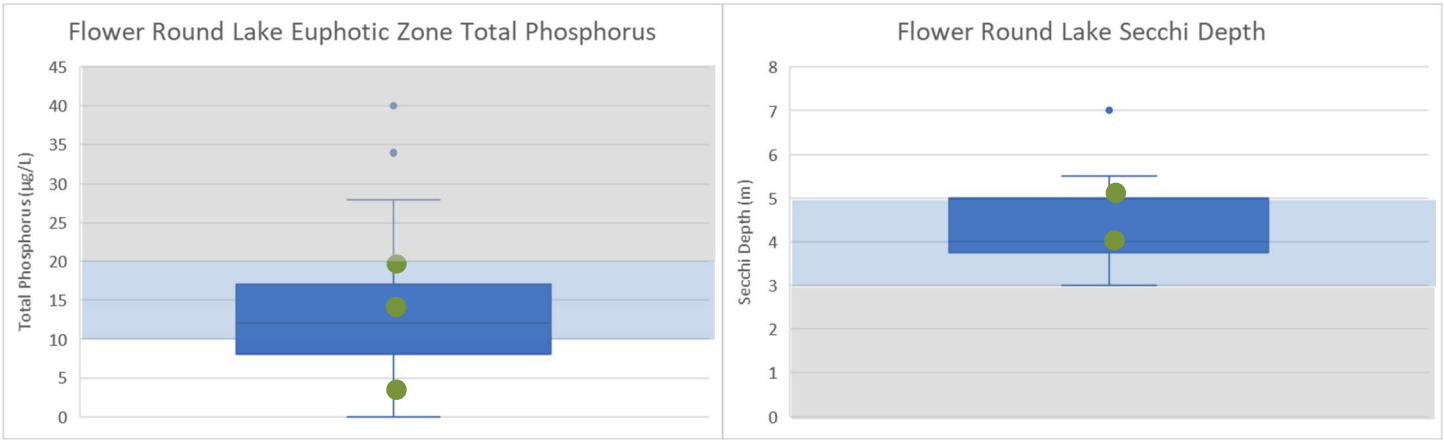


Figure 16: Euphotic Zone Total Phosphorus and Secchi Depth results from six sampling years for both basins in Flower Round Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.6 Widow Lake

Widow Lake a narrow, shallow lake with a depth of 6 meters, south of Flower Station, and the Flower Lake outlet. This lake has both locally and provincially significant wetlands that are a part of this lake's ecosystem which provide habitat and breeding areas for fish (such as Northern Pike, Small and Largemouth Bass, and Walleye) and other wildlife. The outlet of Widow Lake is known as the Clyde Forks where the north, middle and south branches of the Clyde River join and flow east then south to Lanark.

Results from 2024 are summarized in Table 14 and compared to past data in Figure 17, showing the lake maintaining a mesotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

The water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 14: 2024 sampling summary for Widow Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 23, 2024	5.5	7		40
Main Basin	July 17, 2024	3	28		
Main Basin	Sept 30, 2024	1.7	15	20	

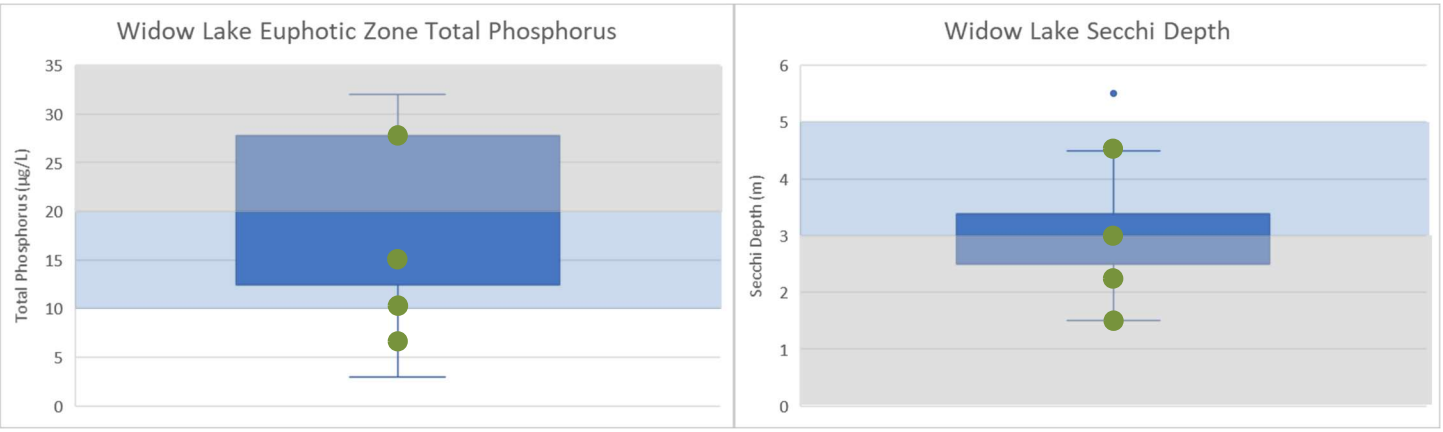
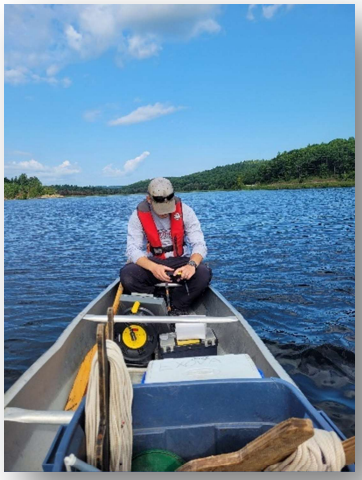


Figure 17: Euphotic Zone Total Phosphorus and Secchi Depth results from five sampling years for the main basin of Widow Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.7 Joe's Lake



The lake is shallow (4 meters) and is found downstream of the Joe's Lake Provincially Significant Wetland which extends from the outlet of Widow Lake to the inlet of Joe's Lake. This wetland habitat supports a warm water fish species such as Northern Pike, Small and Largemouth Bass, and Walleye which will make use of the wetland vegetation at the inlet for breeding habitat and shelter.

MVCA has now monitored this lake through six ice free seasons and it has consistently had a mesotrophic classification. Results from 2024 are summarized in Table 15 and compared to past data in Figure 18, showing the lake maintaining a mesotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 15: 2024 sampling summary for Joe's Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 3, 2024	4	11	n/a	40
Main Basin	July 23, 2024	3	21		
Main Basin	Sept 3, 2024	3.5	15		

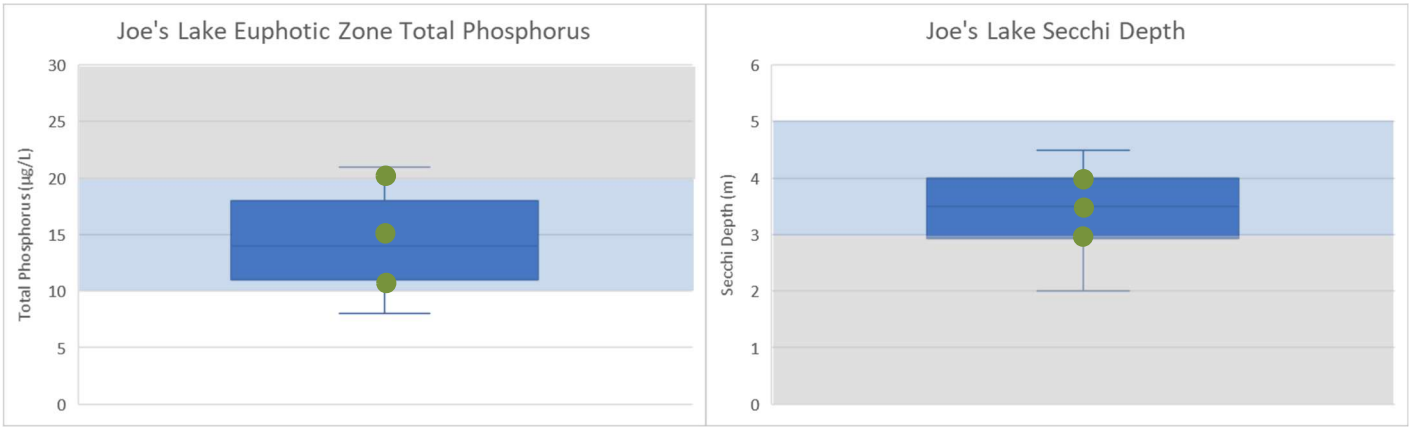


Figure 18: Euphotic Zone Total Phosphorus and Secchi Depth results from six sampling years for the main basin of Joe's Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

6.8 Robertson Lake

Robertson Lake is a deep (30 m) headwater lake, with a relatively small surface area, within the Clyde River subwatershed. The lake supports warm water fish species such as Northern Pike, Small and Largemouth bass, and Walleye. As there is very little drainage area upstream of the lake, nutrient inputs are associated with rain and snow melt surface flows from the surrounding landscape.

Results from 2024 are summarized in Table 16 and compared to past data in Figure 19, showing the lake maintaining an oligotrophic classification. When compared to prior years, there is no indication of a change in trophic classification over time.

Beyond 12-13 m deep the lake experiences low dissolved oxygen levels and anoxic conditions during the summer and fall sampling visits. These low oxygen levels near the sediment layers may contribute to a natural chemical process which causes the phosphorus to dissolve back out of the lake sediment, contributing to the high total phosphorus results in the near-bottom water samples. Past monitoring results have shown similar low dissolved oxygen levels with higher total phosphorus readings near bottom, indicating that these results are consistent and part of the natural character of this lake.

Water temperature and dissolved oxygen profile data from the 2024 sampling events are available in Appendix A.

Table 16: 2024 sampling summary for Robertson Lake.

Site	Date	Secchi Depth (m)	Total P: Euphotic Zone (µg/L)	Total P: Bottom Sample (µg/L)	Calcium (Ca2+) (mg/L)
Main Basin	May 9, 2024	8	6	164	40
Main Basin	July 5, 2024	7	8	158	
Main Basin	Sept 20, 2024	6	6	202	

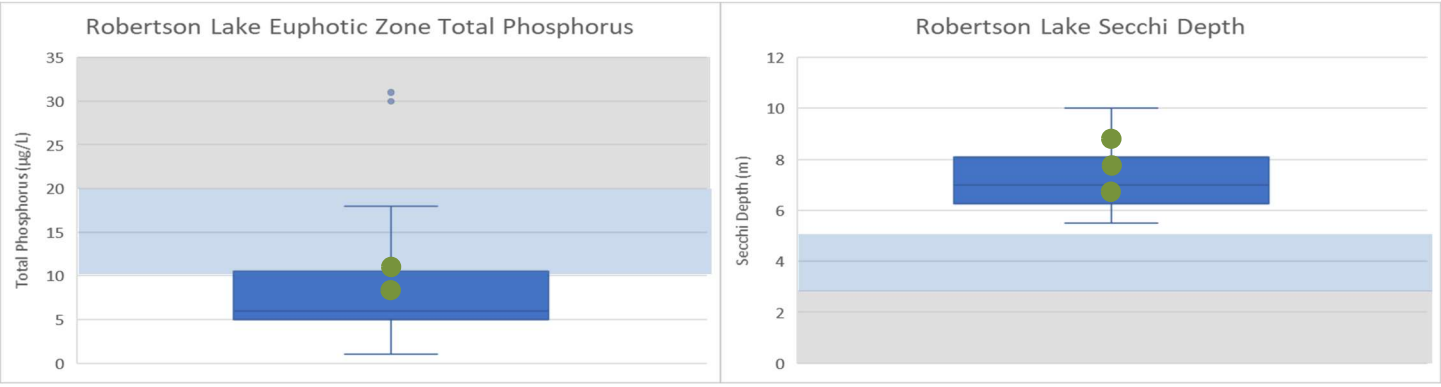


Figure 19: Euphotic Zone Total Phosphorus and Secchi Depth results from six sampling years for the main basin of Robertson Lake. The 2024 results are shown with a green dot, and the trophic level classifications are shown with the white (oligotrophic), blue (mesotrophic), grey (eutrophic) background colours.

7.0 Stream Monitoring Program (Full Watershed)

7.1 Summary

Like the lake monitoring program, the stream program involves visiting sites on a rotational basis and includes sampling within the subwatershed of focus (e.g. Clyde River), as well other sites across the watershed as shown in Figure 20. Of the 28 stream temperature sites, nine sites were also assessed for their fish populations. Table 17 summarizes the stream monitoring locations and their thermal results for 2024.

Brook Trout
(*Salvelinus fontinalis*)

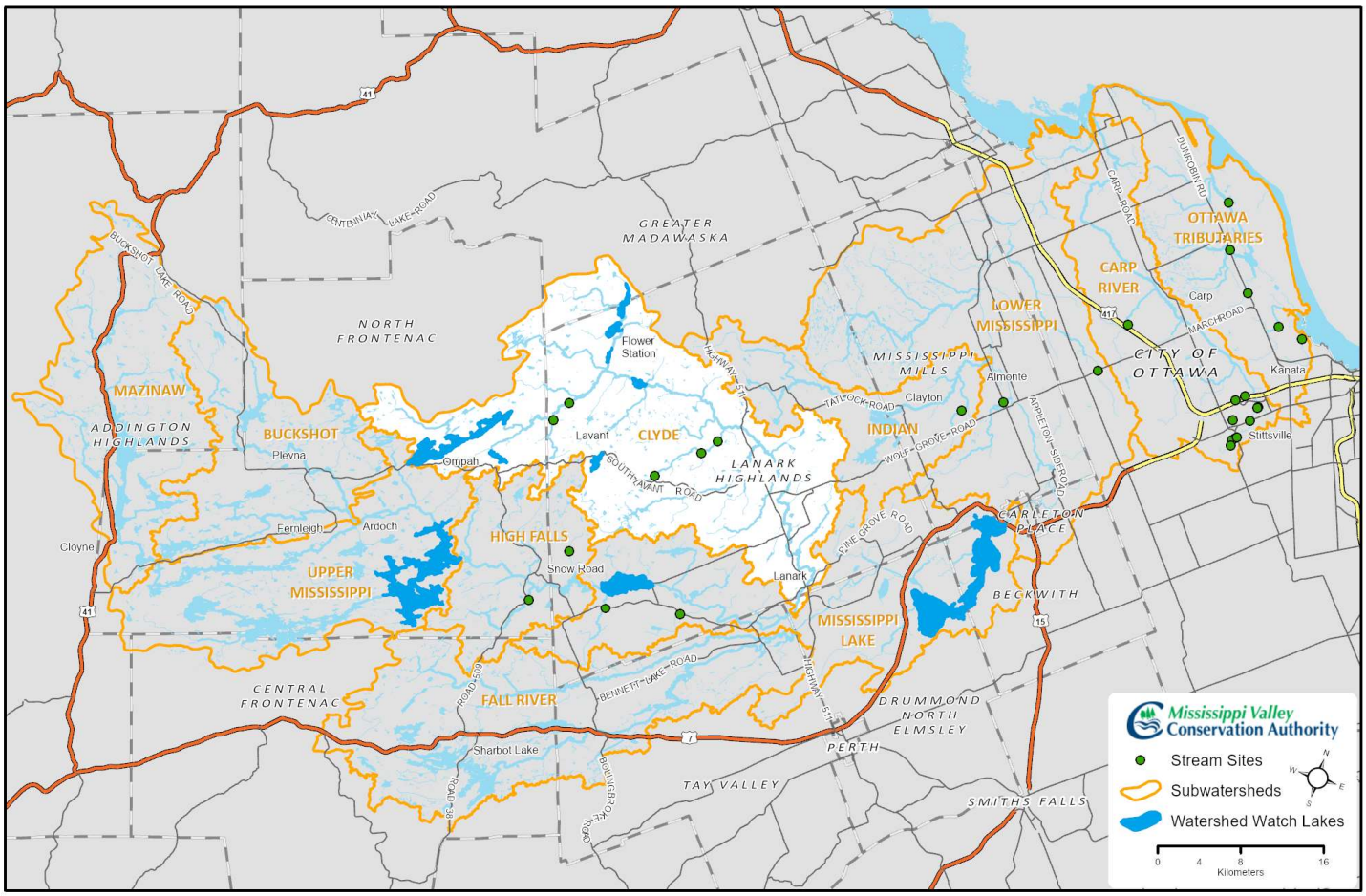


Figure 20: 2024 stream temperature monitoring site locations, nine of which also had their fish community sampled.

7.2 Temperature Monitoring

Many factors can influence fluctuations in stream temperature including springs, tributaries, precipitation runoff, discharge pipes, and stream shading from riparian vegetation. The natural year-to-year variations of water temperatures can be influenced by many factors (duration and frequency of rain events, flow rates from springs, changes in stream shading, etc.) and can have many impacts on the stress levels and success rates of the cold to cool water fish species that are found in the creek. Both water temperature and maximum air temperature are used (using the revised Stoneman and Jones method by Cindy Chu *et al, 2009*) to classify a watercourse as either cold, cold-cool, cool, cool-warm, or warm water.

Deploying a temperature logger

In 2024, temperature loggers were launched at 14 stream sites in the Mississippi River watershed, and at 18 sites within the City of Ottawa catchments of the Carp River and Ottawa River tributaries. These loggers are used to investigate thermal habitat availability and to continue monitoring known cold to cool water streams for potential variations over time. As discussed above in the Water Quantity Summary (Section 3.1), 2024 had no spring flood warning events. However, there was a flood watch event in July due to the rain associated with Hurricane Beryl. Our area experienced average to high rain fall amounts throughout the summer months resulting in a well hydrated system through the hottest part of the year.

Analysis of the temperature logger data indicates that the frequent summer rain events in July and August prevented sites from drying out; resulting in many sites maintaining previous thermal classifications. One site (Mosquito Creek) was slightly warmer than the previous times it has been monitored, while a different site (Poole Creek, downstream) was cooler than previous results. The presence of this variability in the long-term sites shows the short-term sensitivity of each catchment to seasonal weather patterns and the need for long term monitoring to understand the potential for shifts in climate impacts. The overall thermal condition for each 2024 site is summarized in Table 17.

Mosquito Creek has been monitored for six consecutive years now and results have shown it to fluctuate between being a cool and cold-cool habitat, with a longer-term cool habitat dominance. For an unknown reason, the summer of 2024 data has resulted in a warm classification. This site will continue to be revisited to help determine if this is an indicator of a local habitat change, or if it might be due to other factors.

Poole Creek's downstream site is typically warmer than the upstream monitored sites as the logger placed here samples water that has flowed through open sunny wetlands and park spaces. In 2024 the temperature monitoring showed the site to be cooler than it has been in past years. This is

possibly due to the extra rainfall increasing the cool groundwater baseflow contributions to the creek. It is also possible that as vegetation is maturing in the downstream creek valleys there is an increase in stream shading and water temperature mitigation occurring.

There were data collection challenges at some sites in 2024 such as; low water events left equipment out of the water despite the season's rainfall amounts, or equipment failures part way through the summer. These types of incidents reinforce the importance of maintaining a robust long-term monitoring program so that enough data is captured over time to indicate the overall character of the habitat.

Table 17: A summary of the stream sites sampled in 2024 with their thermal classification results and trend summaries. The table also indicates if a site's fish population was sampled (for more details see Section 7.3). *Note, it may take many years of classification analysis to account for annual weather variation influences.

Subwatershed	Stream Name		Thermal Classification	Number of Years Monitored	Thermal Trend Direction*	Fished?
Carp River	Corkery Creek	R010-21	Cool	4	Stable	
Carp River	Feedmill Creek	CK72-84	Cool	2	*	
Carp River	Feedmill Creek	CK72-89	Cool	2	*	
Carp River	Feedmill Creek	FDM020	n/a	4		Yes
Carp River	Poole Creek	CK70-02	Cool	6	Down	Yes
Carp River	Poole Creek	CK70-05	Cool	4	Stable	Yes
Carp River	Poole Creek	CK70-07	Cool	3	Stable	Yes
Carp River	Poole Creek	MVCA-001	n/a	1		Yes
Clyde River	Easton's Creek	MVEC-02	n/a	3		
Clyde River	Easton's Creek	MVEC-004	n/a	4		
Clyde River	Easton's Creek	MVEC-006	n/a	2	*	
Clyde River	Graham Creek	MVCGC-001	Cool-Warm	2	*	
Clyde River	Sunday Creek	MVCCRS-004	n/a	2	*	
Fall River	Bolton Creek	MVCBOC-001	Warm	6	Stable	Yes
High Falls	Mosquito Creek	MV1MQ-1	Warm	6	Up this year	Yes
Lower Mississippi	Cody Creek	CK3-01	Cool	4	Stable	
Lower Mississippi	Cody Creek	CK3-04	Cool	4	Stable	
Lower Mississippi	Union Hall Creek	MVCUHC-001	Cool	3	Stable	
Lower Mississippi	Union Hall Creek	Site19	Cool	2	*	

Subwatershed	Stream Name		Thermal Classification	Number of Years Monitored	Thermal Trend Direction*	Fished?
Lower Mississippi	Wolf Grove Creek	MVCWG-0.95	Cool	2	*	
Mississippi Lakes	Black Creek	MVCBLC-02KF0685	Warm	4	Stable	
Mississippi Lakes	Long Sault Creek	MVCLS-15LS004	n/a	9		Yes
Mississippi Lakes	Paul's Creek	MV1PC-15HF002	Cool	7	Stable	Yes
Ottawa Tribs	Casey Creek	CK64-02	n/a	4	*	
Ottawa Tribs	Constance Creek	CK4-02	Cool	4	Stable	
Ottawa Tribs	Harwood Creek	CK65-04	Cool	5	Stable	
Ottawa Tribs	Shirley's Brook	CK5-SHR050	Cool	5	Stable	
Ottawa Tribs	Watt's Creek	CK06-001	Cool	3	*	

MVCA staff with sampled fish in viewing boxes for identification and documentation

7.3 Fish Sampling

MVCA uses a standardized sampling technique called electrofishing to safely and temporarily stun fish by passing a mild electrical current through the water. This allows the crew to net, then identify and measure the fish. After a fish is documented they are released back into the water.

MVCA staff using a backpack electro-fishing unit with two people prepared to net fish

Nine stream sites were electro-fished in 2024. Sites were chosen to add details to the 2024 City Stream Watch assessments, and to revisit sites known to support cold to cool water fish species. Refer to Table 17 for the complete list of the stream sites sampled.

Coldwater fish species were found at seven sites across four waterbodies. Within the City of Ottawa's Carp River watershed Mottled Sculpin continues to be found in Feedmill Creek and Poole Creek. Within the Mississippi River watershed Brook Trout were found in Long Sault Creek and Mosquito Creek. Temperature monitoring at these sampling locations (Table 17) confirms a minimum of a cool water status at all of these sites with the exception of Mosquito Creek's 2024 data, which entered the warm range for the first time.

These sites will continue to be monitored as part of the sampling rotation to account for annual variations in species abundances and to document habitat characteristics over time.

Sorting and documenting caught fish

MVCA's Tree Planting Programs

Shoreline tree planting is an effective method to protect water quality, combat erosion, clean the water, and create healthy habitat for fish, birds, pollinators and other wildlife.

MVCA administers a shoreline planting program where MVCA staff conduct a site visit, then work with the property owners to design a shoreline planting plan that will suit their property's needs. MVCA orders, delivers and installs the plants according to the property plan. In 2024, this program resulted in over 1400 trees, shrubs, and wildflowers being planted across 10 properties.

Native shoreline tree and shrub orders ready for delivery

For the past several years MVCA has been offering a Lake Tree Day program to lake associations on a rotational basis. Through this program, property owners are offered up to 15 shoreline plants per property in exchange for a donation to the Stewardship program. In 2024, MVCA partnered with the Kashwakamak Lake Association and Sunday Lake Association to distribute 702 plants to 40 properties. Due to the continued success of this program within the lake community, Lake Tree Days will be offered again in 2025 at Mazinaw, Buckshot, and Shawenegog lakes.

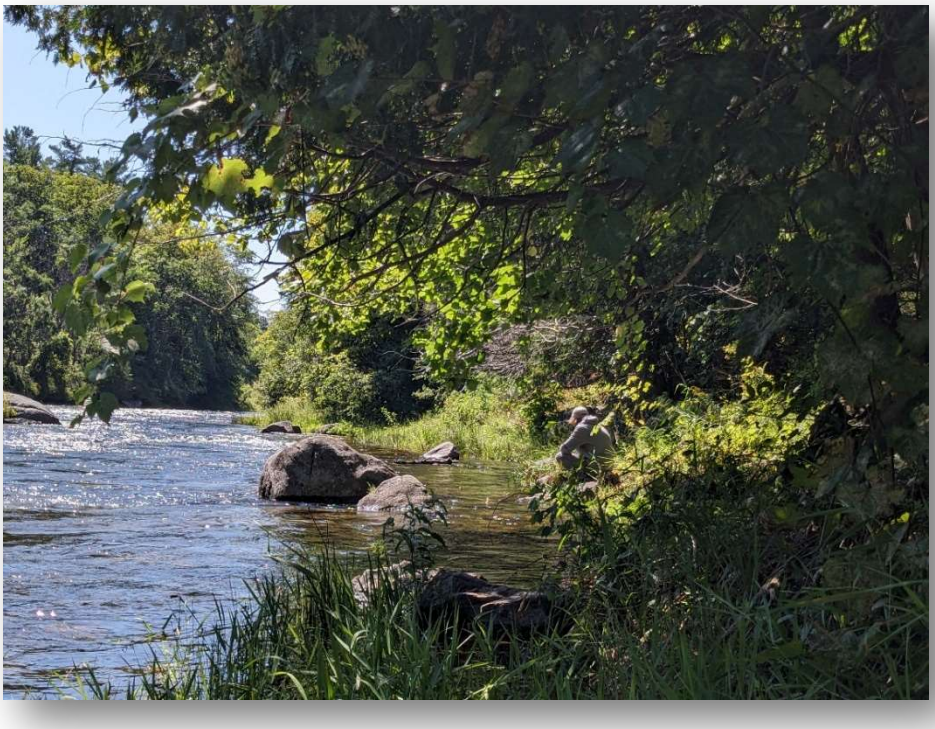
Shoreline restoration plant installation

9.0 Lake Planning

MVCA is mandated to review applications under the *Planning Act* for potential natural hazard issues such as flooding and erosion. MVCA also administers Section 28.1 of the Conservation Authorities Act, and *Ontario Regulation 41/24*. The purpose of the act and regulation is to prevent loss of life and property due to flooding and erosion, and to further support the conservation, restoration, development and management of natural resources in watersheds in Ontario. In MVCA regulated areas (floodplains, shorelines, and wetlands), permission is required from MVCA to develop or interfere with wetlands, and to straighten, change, divert or interfere in any way with shorelines and watercourses.

Having reliable information about the health of a lake is essential for providing appropriate and effective recommendations on development applications. The monitoring information is often used in the review of planning applications and may assist in developing mitigation recommendations, thereby minimizing the impacts of developments.

Monitoring of our lakes also informs shoreline residents, both seasonal and permanent, of the lake health; encouraging them to become caretakers of their lake and engage in an active role to restore and enhance their shoreline. Many stewardship initiatives that protect and enhance water quality are focused around slowing overland runoff after storms; thus, minimizing both the erosion of soils and the washing of extra nutrients into the water. This can be achieved through a variety of strategies including: temporarily storing water (eg. rain barrels), directing runoff away from the lake (e.g. installing properly working eavestroughs), as well as creating or enhancing surfaces that allow more water to infiltrate rather than run off along the surface (e.g. rain gardens, bioswales). Lastly, planting native species of trees, shrubs, and perennials along the shoreline help maintain soils assisting with erosion prevention while also providing food and shelter for wildlife.



Appendix A: Water Temperature and Dissolved Oxygen Profile Details

The results from the 2024 temperature and dissolved oxygen profiles from all lake sampling events are presented below in alphabetical order. For lakes with appropriate cool to cold water conditions, a colour code has been applied to the table representing optimal cold-water habitat conditions (blue) and the fringe vital conditions for survival (orange) as defined in Table A-1. Some of the warm water lakes may be shown to have these conditions periodically but they do not last throughout the season and thus those lakes only support a warm water fishery.

List of cold water and warm water lakes monitored in 2024.

This list summarizes the thermal classifications for the lakes sampled in 2024. Note: Some of the cold-water lakes may no longer support certain cold-water fish species, such as Lake Trout (*Slvelinus namaycush*), due to historical stocking activities or water level management efforts.

Cold Water Lakes:

- Canonto Lake
- Robertson Lake
- Palmerston Lake
- Sunday Lake

Warm Water Lakes:

- Clyde Lake
- Crotch Lake
- Dalhousie Lake
- Fawn Lake
- Flower Round Lake
- Joe's Lake
- Mississippi Lake
- Widow Lake

A juvenile Rainbow Trout (*Oncorhynchus mykiss*)

Table A-1: Optimal and vital habitat conditions for cold water fish species such as Lake Trout.

	Optimal Habitat for Cold Water Fisheries = DO > 6 mg/L at < 10°C
	Vital Habitat for Cold Water Fisheries = DO > 4 mg/L at < 15.5°C

Canonto Lake

North Basin

CLNB	30-May-24		08-Jul-24		16-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	18.5	9.50	24.9	8.41	21.3	9.27
1	18.5	9.49	24.7	8.43	21.3	9.25
2	18.5	9.48	24.5	8.53	20.9	9.33
3	18.4	9.46	23.9	8.73	20.8	9.38
4	18.3	9.45	23.2	8.71	20.2	9.33
5	16.5	10.70	22.2	8.79	19.3	9.13
6	14.4	10.94	20.5	9.25	19.0	8.99
7	12.5	11.06	16.5	10.89	18.6	8.75
8	10.6	11.11	13.2	10.65	18.2	8.56
9	9.7	11.01	11.2	10.26	15.7	8.59
10	9.0	10.57	10.0	9.41	12.7	6.50
11	8.7	10.05	9.5	8.73	10.8	4.04
12	8.5	9.85	9.2	8.62	10.0	1.74
13	8.3	9.55	8.9	7.88	9.6	0.79
14	8.0	8.98	8.5	5.40	8.6	0.65
15	7.8	8.17	8.3	4.60	8.3	0.62
16	7.5	7.19	8.0	3.90	8.0	6.20
17	7.4	6.66	7.7	2.86	8.1	0.61
18	7.3	6.29	7.6	2.26	7.9	0.60
19			7.5	1.80	7.8	0.58
20			7.4	0.77	7.7	0.58

South Basin

CLSB	30-May-24		08-Jul-24		16-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	18.4	9.40	24.5	8.39	20.8	9.16
1	18.4	9.39	24.5	8.41	20.5	9.21
2	18.4	9.39	24.2	8.52	20.3	9.23
3	18.4	9.36	23.8	8.62	20.0	9.28
4	18.3	9.37	22.7	8.75	19.7	9.23
5	17.6	9.41	21.8	8.96	19.3	9.18
6	13.9	10.88	19.6	10.23	19.1	9.10
7	11.3	11.23	15.3	11.12	18.9	9.01
8	10.3	11.42	12.5	11.16	18.2	8.90
9	9.3	11.26	11.2	10.82	14.1	10.12
10	8.8	10.99	10.0	10.21	11.3	8.53
11	8.3	10.53	9.3	9.92	10.2	6.44
12	7.9	10.05	8.7	9.40	9.3	4.45
13	7.7	9.53	8.4	8.62	8.8	3.33
14	7.5	9.21	8.1	7.86	8.2	1.29
15	7.3	8.47	7.8	6.21	8.0	0.78
16	7.2	8.03	7.6	5.23	7.8	0.68
17	7.1	7.43	7.4	4.44	7.6	0.62
18	7.0	7.25	7.4	4.01	7.5	0.50
19	6.9	6.53	7.3	3.70	7.4	0.59
20	6.9	6.27	7.2	2.94	7.4	0.58
21			7.1	2.71	7.3	0.57
22			7.1	0.78	7.2	0.57
23					7.2	0.57
24					7.2	0.56

Clyde Lake

Main Basin

CYMB	03-Jun-24		07-Aug-24		27-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	22.2	8.90	25	8.44	19.9	9.31
1	21.7	8.89	24.8	8.34	19.5	9.34
2	20.8	8.88	24.6	8.21	19.4	9.28
3	19.6	8.80	24.3	6.23	19.3	9.24
4	17.6	7.23	22.2	1.45	18.9	8.87
5	13.4	5.71	17.4	0.73	17.7	7.38
6	11.2	5.96	13.5	0.67	15.7	2.24
7	9.9	4.32	10.8	0.60	12.8	0.75
8	8.9	2.42	9.5	0.58	10.3	0.66
9	8.5	1.58	8.8	0.57	9.1	0.64
10	7.9	0.83	8.1	0.57	8.4	0.65
11	7.6	0.66	7.8	0.58	8.1	0.62
12					7.90	0.62

Crotch Lake

North Basin

CRNB	04-Jun-24		12-Jul-24		13-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	23.2	8.69	24.6	8.47	20.0	9.33
1	21.9	8.79	24.0	8.50	19.5	9.32
2	21.4	8.79	23.8	8.40	19.4	9.27
3	20.1	8.84	23.7	8.33	18.7	8.92
4	19.3	8.57	23.7	8.25	18.4	8.88
5	17.7	8.38	23.3	7.86	18.3	8.70
6	15.7	8.37	20.9	6.67	18.2	8.47
7	12.8	8.74	18.5	5.94	17.9	8.14
8	11.1	8.72	13.3	6.14	16.8	5.39
9	10.2	8.65	11.4	6.37	12.0	1.94
10	9.4	8.61	10.4	6.01	10.6	2.13
11	9.0	8.51	9.6	5.85	9.7	2.15
12	8.7	8.25	9.2	5.83	9.4	2.15
13	8.6	8.25	9.0	5.64	9.1	1.96
14	8.6	8.16	8.8	5.51	8.8	1.57
15	8.5	8.04	8.7	4.99	8.7	1.34
16	8.4	8.01	8.6	4.74	8.5	1.08
17	8.3	7.60	8.5	4.13	8.5	0.89
18	8.2	7.49	8.4	4.02	8.4	0.71
19	8.2	7.16			8.3	0.65
20	8.2	6.91			8.3	0.62

South Basin

CRSB	15-May-24		12-Jul-24		13-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.4	10.23	25.6	8.73	20.5	9.45
1	14.3	10.25	23.9	9.01	19.8	9.47
2	14.2	10.26	23.6	8.92	19.6	9.46
3	14.1	10.27	23.5	8.85	18.7	9.41
4	13.6	10.42	23.4	8.83	18.3	9.12
5	11.9	10.77	22.1	8.34	18.1	8.99
6	11.4	10.91	21.3	8.09	17.9	8.66
7	10.7	10.87	16.0	6.51	17.3	8.11
8	9.2	10.84	13.3	6.81	14.4	3.01
9	8.8	10.74	11.1	6.69	11.1	2.86
10	8.6	10.61	9.9	6.91	9.7	3.05
11	8.3	10.46	9.1	7.38	8.8	3.63
12	8.1	10.37	8.6	7.51	8.5	2.67
13	7.9	10.20	8.3	7.42	8.3	2.66
14	7.9	10.15	8.2	7.28	8.1	2.86
15	7.9	10.08	8.1	7.16	7.9	2.84
16	8.0	10.25	8.0	7.09	7.8	2.64
17	7.9	10.20	7.8	6.00	7.7	2.19
18	7.7	9.97	7.7	5.99	7.6	1.96
19	7.6	9.73	7.6	5.81	7.5	1.66
20	7.5	9.61	7.6	5.49	7.4	1.30
21	7.4	9.47	7.5	5.76	7.4	1.06
22	7.4	9.44	7.5	5.57	7.4	0.87
23	7.3	9.32	7.4	5.29	7.3	0.66
24	7.3	9.24	7.3	4.52	7.3	0.60
25			7.3	4.27	7.2	0.58
26			7.3	3.59		
27			7.2	2.61		

Dalhousie Lake

Main Basin

DLMB	31-May-24		29-Jul-24		08-Oct-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	19.6	9.44	25.1	8.45	17.3	9.77
1	19.5	9.43	24.6	8.49	17.3	9.75
2	19.4	9.38	24.4	8.42	17.4	9.69
3	19.4	9.26	24.3	8.27	17.4	9.66
4	19.3	9.20	24.1	7.89	17.4	9.64
5	19.2	9.06	23.9	7.72	17.4	9.62
6	15.9	8.66	21.5	2.77	17.4	9.61
7	15.2	8.63	19.3	1.07	17.4	9.58
8	13.7	7.89	16.9	0.73	17.1	9.12
9	12.8	7.59	14.9	0.60	16.1	4.45
10	12.2	7.03	13.8	0.58	14.0	0.85
11	11.6	6.46	13.0	0.56	13.1	0.77
12			12.4	0.55	12.6	0.74
13			12.0	0.55	12.4	0.71
14			11.7	0.55	12.1	0.71
15			11.6	0.53	12.0	0.69
16			11.5	0.53	11.9	0.68

Fawn Lake

Main Basin

FLMB	15-May-24		12-Jul-24		13-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	17.0	9.08	26.7	8.26	20.6	9.36
1	17.0	9.06	25.1	8.30	19.8	9.36
2	16.9	9.07	24.7	8.32	18.6	8.98
3	15.8	8.79	23.8	7.36	17.9	8.90
4	11.7	9.23	20.1	5.53	17.4	9.85
5	10.2	8.78	14.5	3.42	15.0	0.96
6	8.8	7.69	11.7	1.32	11.1	0.82
7	7.9	6.34	9.9	0.83	8.8	0.76
8	6.9	3.96	8.2	0.72	8.2	0.71
9	6.4	0.78	7.6	0.67		

Flower Round Lake

Main Basin

FLRMB	29-May-24		02-Aug-24		12-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	19.0	9.23	26.9	8.12	19.3	9.44
1	19.2	917.00	26.9	8.09	19.2	9.44
2	19.2	9.12	26.2	8.31	19.1	9.43
3	19.2	9.09	25.0	7.84	18.6	9.06
4	19.2	9.05	23.8	6.37	18.5	8.79
5	13.9	10.42	21.4	5.74	18.3	8.61
6	11.9	10.15	16.4	7.04	17.8	7.06
7	10.6	9.02	12.8	0.71	13.9	1.43
8	9.9	7.78	11.2	0.60	11.2	0.97
9	9.1	7.10	9.9	0.57	10.1	0.86
10	8.8	6.55	9.3	0.55	9.6	0.79
11	8.7	2.60	9.0	0.55	10.1	0.75
12			8.9	0.52	8.9	0.73
13			8.6	0.51		
14						

Joe's Lake

Main Basin

JLMB	03-May-24		23-Jul-24		03-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	13.3	10.73	24.8	8.49	19.8	9.40
1	13.1	10.71	24.6	8.02	19.8	9.10
2	12.9	10.47	23.2	3.47	19.7	9.00
3	11.6	9.95	21.2	0.65	19.7	9.02
4	10.9	9.97	18.4	0.65	19.6	7.75
5			17.4	0.60		

Mississippi Lake

Inlet

MLI	06-May-24		02-Jul-24		11-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.9	10.25	22.6	8.93	16.8	9.99
1	14.9	10.20	22.3	8.87	16.8	9.97
2	14.9	10.22	22.1	8.83	16.7	9.91
3	14.9	10.25	22.1	8.73	16.7	9.83
4	14.9	10.22	22.0	8.65	16.7	9.81
5	15.0	10.20	21.9	8.31	16.7	9.77
6	15.0	10.22	21.8	8.07	16.7	9.58
7	14.9	10.17	21.6	7.84	16.7	9.49
8	14.9	10.13	21.5	7.58	16.7	9.54
9	14.9	10.13	21.5	7.62	16.6	9.17
10			20.0	4.22		
11			15.8	1.05		

Burnt Island

MLB	06-May-24		02-Jul-24		11-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	15.6	11.90	23.1	9.84	17.9	10.07
1	15.4	11.85	22.3	9.89	17.8	10.11
2	15.1	11.93	22.1	9.86	17.8	10.10
3	14.6	12.05	21.9	9.75	17.8	10.07
4	13.6	12.38	21.9	9.63	17.7	10.05
5	13.3	12.38	21.8	9.46	17.7	10.00
6	12.8	11.97	21.7	9.13	17.7	9.97
7	12.1	11.88	21.4	8.73	17.7	9.87
8	12.0	11.80	21.3	8.67	17.7	9.83
9	12.0	11.74	21.3	8.67	17.7	9.76

Pretties Island

MLP	06-May-24		02-Jul-24		11-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.9	12.40	22.7	9.89	18.3	10.33
1	14.7	12.39	22.5	9.88	18.2	10.32
2	14.2	12.28	22.3	9.69	18.1	10.24
3	14.1	12.33	22.2	9.64	17.9	9.86
4	13.7	12.21	21.8	8.86	17.9	9.76
5	13.4	12.18	21.7	8.64	17.8	9.63
6	13.2	11.85	21.6	8.67	17.8	9.49

Outlet

MLO	06-May-24		02-Jul-24		11-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.8	12.25	23.0	10.02	17.5	10.84
1	14.8	12.24	22.9	10.04	17.5	10.82
2	14.7	12.40	22.3	11.50	17.3	11.24

Palmerston Lake

North Basin

PMNB	16-May-24		18-Jul-24		10-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.3	10.31	24.2	8.50	19.0	9.16
1	14.1	10.32	24.2	8.49	19.1	9.13
2	13.4	10.45	24.2	8.46	19.0	9.12
3	12.5	10.76	24.2	8.43	19.0	9.11
4	11.8	10.99	24.1	8.43	18.9	9.10
5	11.2	11.18	23.9	8.56	18.8	9.08
6	10.2	11.48	22.1	9.11	18.8	9.05
7	9.3	11.61	18.8	10.57	18.7	9.03
8	8.6	11.69	14.6	12.35	18.6	9.00
9	8.2	11.67	11.4	12.46	18.2	9.19
10	7.5	11.58	9.5	12.03	12.4	12.60
11	7.1	11.41	8.5	11.59	10.3	11.72
12	7.0	11.16	8.0	11.20	9.2	10.96
13	6.8	11.12	7.7	10.75	8.6	10.41
14	6.8	10.98	7.5	10.63	7.8	9.60
15	6.6	10.94	7.3	10.37	7.5	9.07
16	6.5	10.81	7.1	10.13	7.3	8.96
17	6.5	10.72	7.0	9.99	7.2	8.94
18	6.4	10.64	6.9	9.85	7.0	8.49
19	6.4	10.66	6.8	9.74	6.9	8.19
20	6.3	10.45	6.8	9.63	6.9	7.99
21	6.2	10.39	6.7	9.48	6.8	7.73
22	6.1	10.25	6.7	9.36	6.8	7.56
23	6.1	10.07	6.6	9.21		
24	6.0	9.64	6.6	9.03		
25	6.0	9.34	6.6	8.65		
26	6.0	9.22	6.5	8.45		
27	6.0	9.19				

South Basin

PMSB	16-May-24		18-Jul-24		10-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.6	103.37	24.9	8.39	19.0	9.38
1	13.7	10.51	24.9	8.36	18.8	9.37
2	13.3	10.57	24.9	8.35	18.6	9.34
3	13.0	10.60	24.9	8.34	18.5	9.28
4	12.9	10.60	24.8	8.31	18.5	9.23
5	12.5	10.74	24.8	8.29	18.5	9.21
6	12.0	10.84	24.5	8.37	18.5	9.19
7	9.6	11.54	21.0	10.12	18.4	9.19
8	8.5	11.74	17.9	11.94	18.4	9.17
9	7.8	11.72	13.4	13.03	17.3	11.22
10	7.4	11.67	10.5	12.76	11.8	12.29
11	7.3	11.63	9.5	12.41	9.9	11.99
12	7.0	11.48	8.6	11.95	8.9	11.72
13	6.8	11.26	8.0	11.57	8.4	11.21
14	6.7	11.16	7.6	11.08	8.0	10.68
15	6.6	11.12	7.3	10.71	7.6	10.23
16	6.5	11.05	7.1	10.44	7.4	9.94
17	6.5	10.97	7.0	10.37	7.2	9.13
18	6.4	10.92	6.9	10.07	7.0	8.76
19	6.3	10.84	6.8	9.73	6.8	8.95
20	6.2	10.80	6.6	9.71	6.7	8.81
21	6.1	10.75	6.5	9.39	6.6	8.66
22	6.1	10.70	6.5	9.44	6.5	8.52
23	6.0	10.66	6.4	9.33	6.4	8.49
24	6.0	10.65	6.3	9.41	6.3	5.58
25	5.9	10.64	6.2	9.29	6.2	8.39
26	5.8	10.62	6.1	8.70	6.1	8.34
27	5.8	10.59	6.0	8.96	6.0	8.32
28	5.8	10.57	5.9	9.07	6.0	8.29
29	5.8	10.55	5.8	9.12	5.9	8.33
30	5.7	10.43	5.8	9.07	5.9	8.29
31	5.7	10.40	5.7	9.02	5.8	8.40
32	5.6	10.34	5.7	8.92	5.8	8.37
33	5.5	10.29	5.6	8.87	5.7	8.34
34	5.5	10.25	5.6	8.71	5.7	8.22
35	5.5	10.20	5.6	8.53	5.6	8.12
36	5.4	10.17	5.5	8.36	5.6	8.02
37	5.4	10.09	5.5	8.29	5.6	7.92
38	5.4	10.06	5.5	8.16	5.5	7.56

39	5.4	10.01	5.5	8.04	5.5	7.21
40	5.4	9.96	5.4	7.85	5.4	6.97
41	5.3	9.92	5.4	7.55	5.4	6.77
42	5.3	9.84	5.4	7.31	5.4	6.44
43	5.3	9.79	5.4	7.14	5.4	6.23
44	5.3	9.74	5.4	6.89	5.4	6.00
45	5.3	9.65	5.4	6.24		
46	5.3	9.57	5.3	5.76		
47	5.3	9.10	5.3	5.01		
48	5.3	8.87	5.3	4.56		
49	5.2	8.75	5.3	3.87		

Robertson Lake

Main Basin

RLMB	09-May-24		05-Jul-24		20-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	14.2	10.29	23.7	8.48	21.6	8.89
1	14.1	10.32	23.7	8.47	21.6	8.87
2	14.1	10.29	23.4	8.45	21.6	8.86
3	13.6	10.51	22.7	8.40	21.0	9.01
4	11.7	11.23	22.3	8.49	20.1	9.01
5	11.1	11.35	21.6	8.35	19.6	8.85
6	10.5	11.37	18.2	10.26	19.2	8.66
7	9.8	11.34	14.2	10.56	18.6	8.45
8	9.2	11.25	12.1	10.51	16.7	8.74
9	8.4	10.91	10.5	9.63	13.6	8.64
10	7.8	10.47	9.5	9.32	11.2	6.60
11	7.6	9.95	8.8	8.37	9.9	4.26
12	7.1	9.16	8.1	7.01	8.9	1.66
13	6.4	8.06	7.4	5.33	7.9	1.02
14	5.9	7.10	6.3	2.70	7.4	2.30
15	5.5	5.75	5.8	1.25	6.8	0.92
16	5.2	4.30	5.6	0.69	5.8	0.66
17	4.9	2.31	5.4	0.66	5.5	0.64
18	4.9	1.86	5.3	0.64	5.3	0.60
19	4.7	0.94	5.0	0.62	5.0	0.59
20	4.6	0.65	4.9	0.61	4.9	0.59
21	4.4	0.63	4.8	0.60	4.8	0.58
22	4.3	0.61	4.7	0.60	4.8	0.57
23	4.3	0.59	4.7	0.58	4.8	0.56
24	4.3	0.58	4.6	0.57	4.7	0.55
25	4.3	0.57	4.6	0.55	4.7	0.55
26	4.3	0.56	4.6	0.55	4.7	0.55
27			4.6	0.55	4.7	0.54
28			4.5	0.54	4.7	0.54
29			4.6	0.53	4.7	0.53
30			4.6	0.53		

Sunday Lake

Main Basin

SDMB	07-May-24		04-Jul-24		19-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	15.8	10.04	23.7	8.52	21.4	9.04
1	15.0	10.20	23.5	8.53	20.6	9.37
2	14.6	10.19	23.0	8.79	19.1	8.97
3	13.1	10.62	21.7	8.47	17.9	8.46
4	11.1	10.56	18.3	9.13	16.5	7.89
5	9.2	10.18	13.0	8.87	13.3	7.40
6	8.2	9.82	9.9	8.47	10.6	9.09
7	6.9	8.73	8.2	8.65	8.8	9.81
8	6.0	7.99	7.0	8.36	7.5	9.73
9	5.5	7.70	6.2	7.75	6.3	4.19
10	5.1	7.68	5.7	6.85	5.7	2.32
11	5.0	7.51	5.3	5.22	5.4	1.35
12	4.9	6.93	5.0	2.66	5.20	1.01
13	4.8	6.16	4.90	1.28	5.10	0.85
14	4.8	5.40	4.90	0.84	5.00	0.80
15	4.8	3.95	4.80	0.69	4.90	0.76
16					4.90	0.74
17					4.90	0.72

Widow Lake

Main Basin

WDMB	23-May-24		17-Jul-24		30-Sep-24	
Depth (m)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)	Temp (°C)	D.O. (mg/L)
0.1	22.9	8.72	25.3	8.29	18.7	9.55
1	22.5	8.62	25.2	8.29	18.7	9.44
2	21.2	9.06	24.4	7.31	18.6	9.98
3	16.9	9.03	22.2	8.11	18.5	6.00
4	14.1	6.50	19.6	3.44	17.7	1.33
5	12.0	3.87	16.6	0.66	16.3	0.76
6			14.8	0.58		

Appendix B: Lake Results Summary

						Trophic Status		Trophic Trend	
Lake Name	Max Depth (m)	Thermal Status	# Years Sampled	2024 Avg. Total Phosphorus (µg/L)	2024 Avg. Secchi Depth (m)	Total Phosphorus	Secchi Depth	Total Phosphorus	Secchi Depth
Canonto	21	Cold	6	9.5	7.8	Oligotrophic	Oligotrophic	Stable	Stable
Clyde	12	Warm	5	13.0	3.3	Mesotrophic	Mesotrophic	Stable	Stable
Crotch	25	Warm	8	11.7	4.6	Mesotrophic	Mesotrophic	Stable	Stable
Dalhousie	11	Warm	12	10.0	4.0	Oligotrophic	Mesotrophic	Stable	Stable
Fawn	9	Warm	4	38.3	4.8	Eutrophic	Mesotrophic	Stable	Stable
Flower Round	13	Warm	6	9.7	4.2	Oligotrophic	Mesotrophic	Stable	Stable
Joe's^	4	Warm	6	15.7	3.3	Mesotrophic	Mesotrophic	Stable	Stable
Mississippi	10	Warm	20	11.0	3.3	Mesotrophic	Mesotrophic	Stable	Stable
Palmerston	56	Cold	6	4.5	6.2	Oligotrophic	Oligotrophic	Stable	Stable
Robertson	31	Cold	6	6.7	7.0	Oligotrophic	Oligotrophic	Stable	Stable
Sunday	16	Cold	6	6.7	4.0	Oligotrophic	Mesotrophic	Stable	Stable
Widow	6	Warm	5	16.7	3.4	Mesotrophic	Mesotrophic	Stable	Stable

^Joe's Lake is not greater than 5 m deep, therefore can't receive an oligotrophic Secchi depth rating.