# Executive Summary

The Muskoka Lakes Association (MLA), Canada's oldest lake association, was founded in 1894 to represent the waterfront residents in the Muskoka Region. It has operated "The MLA Water Quality Initiative" (WQI), a monitoring program focussed on Lakes Rosseau, Joseph and Muskoka and many smaller surrounding lakes, since 2002. The MLA's water quality efforts are concentrated on:

- Protecting and promoting water quality through their monitoring program and
- Promoting responsible land use

The MLA Environment Committee manages over a hundred volunteers to collect annual water quality data and retained Hutchinson Environmental Sciences Limited (HESL) in 2021 to analyze their data and to provide recommendations and program modification/development options. This Water Quality Report presents the most recent data collected in 2023 and compares it to data collected from 2002 to the present.

The MLA and their volunteers monitored 52 areas within 17 lakes and rivers for a total of 534 samples between May and September in 2023. Each sampling area represents a geographic location encompassing a group of WQI monitoring sites, usually focussed on a river, lake or embayment of interest to the MLA. Samples were collected for analysis of total phosphorus (TP) and bacteria (*E. coli* and total coliform), with water and air temperature and Secchi depths recorded at each site.

Changes to the areas and sites monitored by the MLA WQI Program in 2023 were minor. Three additional sites were re-sampled near Willow Beach (WLB) in response to the elevated TP concentrations and long-term increasing trend identified during 2021, to investigate potential sources of phosphorus to WLB-3. No additional nearshore monitoring sites were added in 2023.

Finally, no samples were collected in 2023 at Leonard Lake, East Portage Bay and Browning Island which opted out of the MLA WQI Program.

Detailed summaries of 2023 data for mean Secchi depth, spring and annual average TP and annual geometric mean of *E. coli* and total coliform bacteria counts are included in the Area Reports (Appendix A). Long-term trend analyses for TP concentrations at all monitoring sites were included at sites where more than 5 years of data were available. Significant increasing trends were detected at one site which has been discussed in Section 3.6 and within the area report for Willow Beach. All trend analysis plots have been provided in Appendix B.

Without exception, Secchi depths recorded in 2023 remained within the range of variability of the long-term dataset. We noted that the Secchi depth data analysis methodology currently only includes comparison of the current years data against the long-term range of values collected at a sampling site. Trends in Secchi data were last assessed by HESL in 2017 at a limited number of sampling sites, in 2023 we updated the assessment of the long-term trends in Secchi data. A single significant trend in the Secchi depth data was recorded at Allport Bay (ALL-0) in 2023. We observed a small but statistically significant decline in Secchi depth from 2.5 to 2.0 m. The overall change in clarity at ALL-0 is small and ongoing monitoring will continue to inform this change.

Deep-water phosphorus concentrations at all sampling areas within the Lake Joseph, Lake Muskoka and Lake Rosseau were below the Ministry of the Environment, Conservation and Parks (MECP) Interim Provincial Water Quality Objectives (PWQO) of 10 and 20 µg/L for inland lakes[1], however nearshore phosphorus concentrations were elevated at sites within several sampling areas following rain events. We noted in 2021 that the majority of cases of elevated nearshore phosphorus were the result of samples collected during "Moderate" or "Heavy" storm events which, in some cases, we found storm sampling accounted for three or more of the phosphorus samples collected. Storm sampling can be useful to identify sources of phosphorus and therefore should be collected, however HESL recommended that the number of storm events be limited. In 2022, storm event sampling was generally reduced compared to 2021. In 2023, 53% of the samples were collected during documented rain events. To track consistency in sampling, we have documented the number of samples collected during storm events annually since 2018 and will continue to expand this information moving forward.

Trend assessment of spring phosphorus concentrations found a significant increasing trend at Willow Beach – Lake Muskoka, specifically the WLB-3 station, despite a marked reduction in TP concentration in 2022. Concentrations at this location were the elevated in 2021 and resulted in additional sampling of the creek that discharges near Willow Beach in 2022 and 2023. We found substantially elevated total phosphorus concentrations at WLB-6, in a small watercourse adjacent to a horse farm, and recommend sampling at these locations continue in 2024 to gather additional information. Elevated concentrations of phosphorus near agricultural lands suggest that there may be an opportunity to reduce phosphorus export to the watercourse and ultimately to Willow Beach by working with local stakeholders to implement best management practices of fertilizer use and manure management.

No cyanobacterial blooms were recorded in MLA Program lakes in 2023. Based on data recorded by the Simcoe Muskoka District Health Unit (SMDHU), blooms in the Muskoka region at lakes and embayment's not sampled by the MLA WQI program included Bass Lake (Muskoka), Mary Lake, Leonard Lake, Stewart Lake and Three Mile Lake.

Quality Assurance protocols followed during bacteria sampling in some cases. When bacteria counts exceed 50 cfu/100mL the protocol states that an additional sample is collected. The purpose of this additional sample is to determine if contamination may have been a factor in the high bacteria count. In 2023 bacteria were not properly re-sampled in 14 of the 19 events where counts exceeded 50 cfu/100mL. Maintaining sampling protocols should be a focus of 2024 training and continued vigilance is recommended to ensure anomalous data can be confirmed and to maintain consistency, as much as is possible, between current and historical samples.

Sampling areas where *E. coli* counts were elevated (>50 cfu/100ml) in 2023 include Bala Bay (BAL-2), Beaumaris (BMR-10), Clear Lake (CLR-5 and 8), Gull Lake (GUL-2), Minett (MIN-1, 6 and 9), Muskoka River (MRV-7), Star Lake (STR-1 and 4), Windermere (WIN-5 and 7) and Willow Beach (WLB-3 and 4). The nearshore areas which exceeded a geometric mean of 30 cfu/100mL in 2023 were Beaumaris (BMR-

[1] *To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 µg/L; A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 µg/L or less. This should apply to all lakes naturally below this value; Excessive plant growth in rivers and streams should be eliminated at a total phosphorus concentration below 30 µg/L.*

10), Cox Bay (COX-7), Minett (MIN-1, 6 and 9), Muskoka River (MRV-7), Windermere (WIN-5) and Willow Beach (WLB-3).

In 2023, 52 areas were sampled, 47 of which were assigned green lights, while four yellow lights and one red light were assigned based on the MLA criteria. Yellow lights at all four sampling areas were the result of elevated bacteria concentrations. No blooms were documented in MLA Program lakes or sampling areas in 2023.

A single red light was assigned in 2023 to Willow Beach (WLB-3), where we identified an ongoing long-term statistically significant increasing trend in phosphorus concentrations. Concentrations at this location were the highest recorded to date in 2023, likely as a result of increased runoff from the local catchment area with increased precipitation.

HESL has formulated several recommendations which we believe will improve the program moving forward. These include:

1. maintaining consistent sampling at long-term sites whenever possible.

2. continued training with volunteers to ensure methodological consistency and long-term data compatibility.

3. Ongoing analysis of water clarity (Secchi data) as part of future annual monitoring assessments and

4. Focussed sampling at Willow Beach, Minett, and Windermere, where elevated levels of bacteria and/or phosphorus were identified in 2023.