

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 including 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 2022 and compares it to data collected from 2002 to the present.

The MLA and their volunteers monitored 55 areas within 18 lakes and rivers for a total of 700 samples between May and September in 2022. 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 2022 were minor. Three additional sites were added 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. Ten additional nearshore monitoring sites were also added in 2022, two on Clear Lake (CLR-8 and 9), three on Brandy Lake (BDY-12, 13 and 14), one in Foot's Bay (FTB-6), three in Muskoka Bay (MBA-A, B and C) and one in Skeleton Lake (SKL-6). Additionally, one site on Muskoka Bay (MBA-5) was sampled for the first time since 2014.

Finally, no samples were collected in 2022 at Bass Lake, which has opted out of the MLA WQI Program since 2021. Furthermore, samples were not collected in 2022 at, three stations on Brandy Lake (BDY-3, 5 and 6), all Leonard Lake stations with the exception of LEO-8 (a deep-water stations with limited long-term data), one station on Moon River (MOO-15) and one station on Lake Rosseau (ROS-1).

Detailed summaries of 2022 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 2022 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 2022 we updated the



assessment of the long-term trends in Secchi data. Although no long-term trends were detected in Secchi depth at any of the stations analyzed we believe the assessment of water clarity data would be a valuable annual addition to the MLA WQI Program.

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 lakes¹, 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 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 and we recommend continued training with volunteers to ensure methodological consistency and long-term data compatibility.

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 highest recorded to date in 2021 and resulted in additional sampling of the creek that discharges near Willow Beach in 2022. 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 2023 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.

Cyanobacterial blooms were recorded in 2022 at Leonard Lake and Three Mile Lake and were reported to the MECP. Based on data recorded by the Simcoe Muskoka District Health Unit (SMDHU), additional blooms in the Muskoka region at lakes and embayment’s not sampled by the MLA WQI program included Bass Lake (Muskoka), Farlain Lake, Mary Lake, Lake St. John, Lake St. George, Penetang Harbour, Smith’s Bay and Muldrew Lakes.

In 2021, *E. coli* counts exceeded 50 cfu/100 mL at 41 sampling events and retests were not completed in 28 of those events in 2021. In 2022, 13 events warranted re-sampling which was performed in all but four of those events. Maintaining sampling protocols was improved in 2022 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 2022 include Beaumaris (BMR-10), Bruce Lake (BRU-6), Clear Lake (CLR-8), Minett (MIN-1, and 6), Moon River (MOO-6), Muskoka River

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.



(MRV-2, and 7), Star Lake (STR-4) and Willow Beach (WLB-1 and 3). The nearshore areas which exceeded a geometric mean of 30 cfu/100mL in 2022 were Beaumaris (BMR-4 and 10), Bruce Lake (BRU-6), Indian River (IND-2), Minett (MIN-1 and 6), Muskoka River (MRV-7) and Willow Beach (WLB-3).

In 2022, 55 areas were sampled, 44 of which were assigned green lights, while ten yellow lights and one red light were assigned based on the MLA criteria. Yellow lights at five of the eleven sampling areas were the result of elevated bacteria concentrations, while five sampling areas (Boyd Bay, Bala Bay, Brandy Lake, Silver Lake (Port Carling) and Leonard Lake) experienced cyanobacterial blooms in 2018 - 2022 for which a causation study has not yet been completed. Blooms documented in 2022 did not exceed the MLA threshold for microcystin of 20 µg/L and were therefore assigned a yellow light. Bruce Lake exceeded yellow light triggers for algae blooms and bacteria concentrations.

A single red light was assigned in 2022 to Willow Beach (WLB-3), where we identified a long-term statistically significant increasing trend in phosphorus concentrations despite a marked reduction in TP concentrations in 2022 relative to the peak value observed in 2021.

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, Bruce Lake, and Indian River where elevated levels of bacteria and/or phosphorus were identified in 2022.

