Muskoka Lakes Association Water Quality Initiative:

Summary Report of 2004 Monitoring Programme

including instructions for accessing data via the Internet

Logan Environmental Consulting
1040 Islander Avenue
Port Carling, Ontario
http://www.loganenvironmental.com

Introduction

The Muskoka Lakes Association water quality initiative uses two separate, yet complimentary, methods of reporting on the quality of surface waters in our lakes. These methods reflect the two complimentary *functions* of the initiative: monitoring and research. These functions are differentiated by how the data is used, and therefore, reported.

Most readers will be mainly interested in the monitoring results of the program. The monitoring function is an annual report of the results of a variety of parameters measured at various locations around the lakes that are part of the MLA program. The monitoring function will indicate to the reader how the water quality in a particular location differs from water quality in other areas, and how water quality in a particular area varies through time (from season to season). Remedial measures can be employed in a location with impaired water quality or with water quality that is worsening over time. "Hot spots" can be identified, neighbours may be warned of any serious concerns to public health or the local ecosystem, and the appropriate government authorities can be notified of potential sources of contamination.

Due to the scope of information available and the importance of effectively disseminating it, these results are made available in electronic format to the public via the MLA website (a paper copy of these results would fill several hundred pages). The following short report summarizes the main findings of the monitoring function of the initiative, and offers a detailed explanation of how to fully access the wealth of information in geo-referenced format via the MLA website.

Advanced readers will wish to read the results of the research function of the program. A traditional paper report outlining these results as well as the scientific theory, method, and quality assurance techniques of the program is available either in PDF format from the MLA website or from the MLA office in Port Carling.

Summary of 2004 Results

The following is a simple summary of the results observed during 2004. The reader is able to see how water quality in each area studied compares with water quality objectives and with water quality observed in all other areas studied. The second part of this summary is a composite summary of the results on each lake for all samples taken in 2002, 2003 and 2004. A full explanation of the significance of each parameter as well as a description of the sampling protocol used can be found in the 2004 Annual Report.

Figure 1 - Average Escherichia Coli observed in 2004

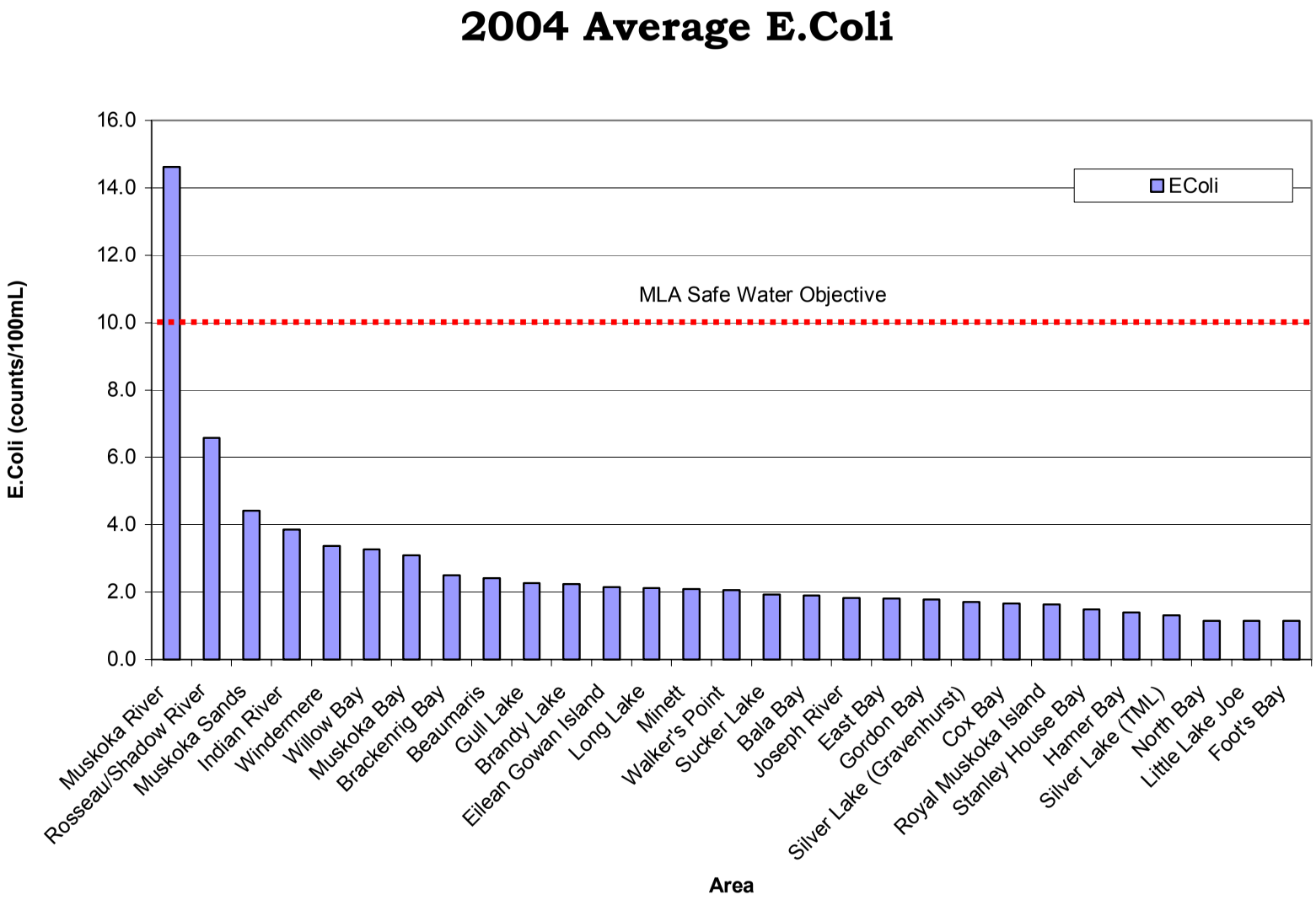


Figure 2 - Average Total Coliform observed in 2004

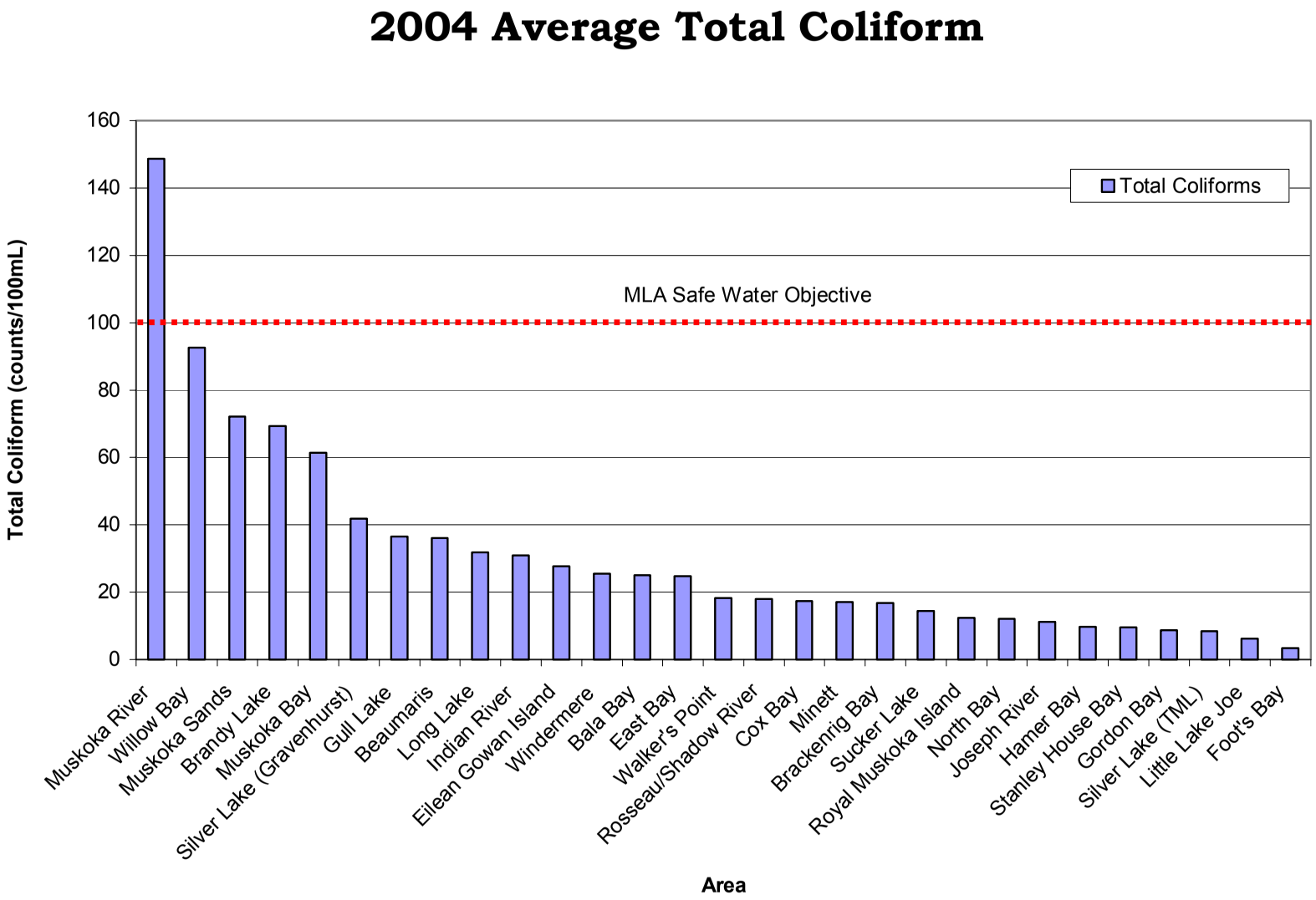


Figure 1 shows *Escherichia Coli* (E.Coli; the bacteria most closely associated with human health risks) results from 2004. Average values shown on the figure are calculated geometric means. The dotted red line represents the MLA safe water objective, first described in Section 5.3 of the 2002 Annual Report. 2004 is the first year in which any area (Muskoka River area) exceeded the safe water objective on average. This should not be interpreted to mean that the water quality is unsafe for recreational purposes (swimming etc.) as the Ontario Ministry of Health's standard for safe recreational water is 100 counts/100mL (10 times as high as the MLA objective). Since water in the Muskoka River originates in a variety of locations throughout a large watershed and passes through several towns and small cities before being monitored in the lower reaches of the Muskoka River, it is very difficult to identify any specific sources of bacteria, however both the MLA and the local community should be aware and wary of the increase in E.Coli between 2003 and 2004.

Average (geometric mean) total coliform in every area studied in 2004 is shown in Figure 2. Again, only the Muskoka River exceeds the MLA safe water objective (while remaining well below the provincial government's standard for safe recreational water quality). Figure 2 also illustrates the fact that total coliform includes many kinds of natural bacteria common in detritus; areas with high total coliform counts receive water from large areas of watershed, most often with large wetlands. On the other hand, areas with low coliform counts generally receive water from very small catchment areas.

Figure 3 shows average total phosphorus concentration in each area where this parameter was measured in 2004. Averages shown are arithmetic means. These average values are slightly higher than in previous years, and slightly higher than the three-year average. Generally, it is considered positive if all readings are in the "oligotrophic" range, however the increase in phosphorus concentration over time is most important. Since it is impossible to know the actual pre-development ("natural") phosphorus concentration, trends over only three years should be interpreted with caution.

None of the results are particularly high, except for Brandy Lake, which does not fall into the eutrophication classification system. Brandy Lake is classified as a dystrophic lake, which is high in dissolved organic carbon and therefore also high in total phosphorus regardless of human impacts. High total phosphorus in this case in not considered unhealthy.

Average turbidity, a measure of water clarity, is shown in Figure 4. While there is no water quality objective associated with turbidity, clearer water is usually considered to be aesthetically more pleasing and implies a healthy oligotrophic aquatic ecosystem. For reference, keep in mind that a commercially available bottle of drinking water (such as Aquafina) has a turbidity of approximately 0.3 NTU and normal black tea has a turbidity of approximately 25 NTU.

Figure 3 - Average Total Phosphorus observed in 2004

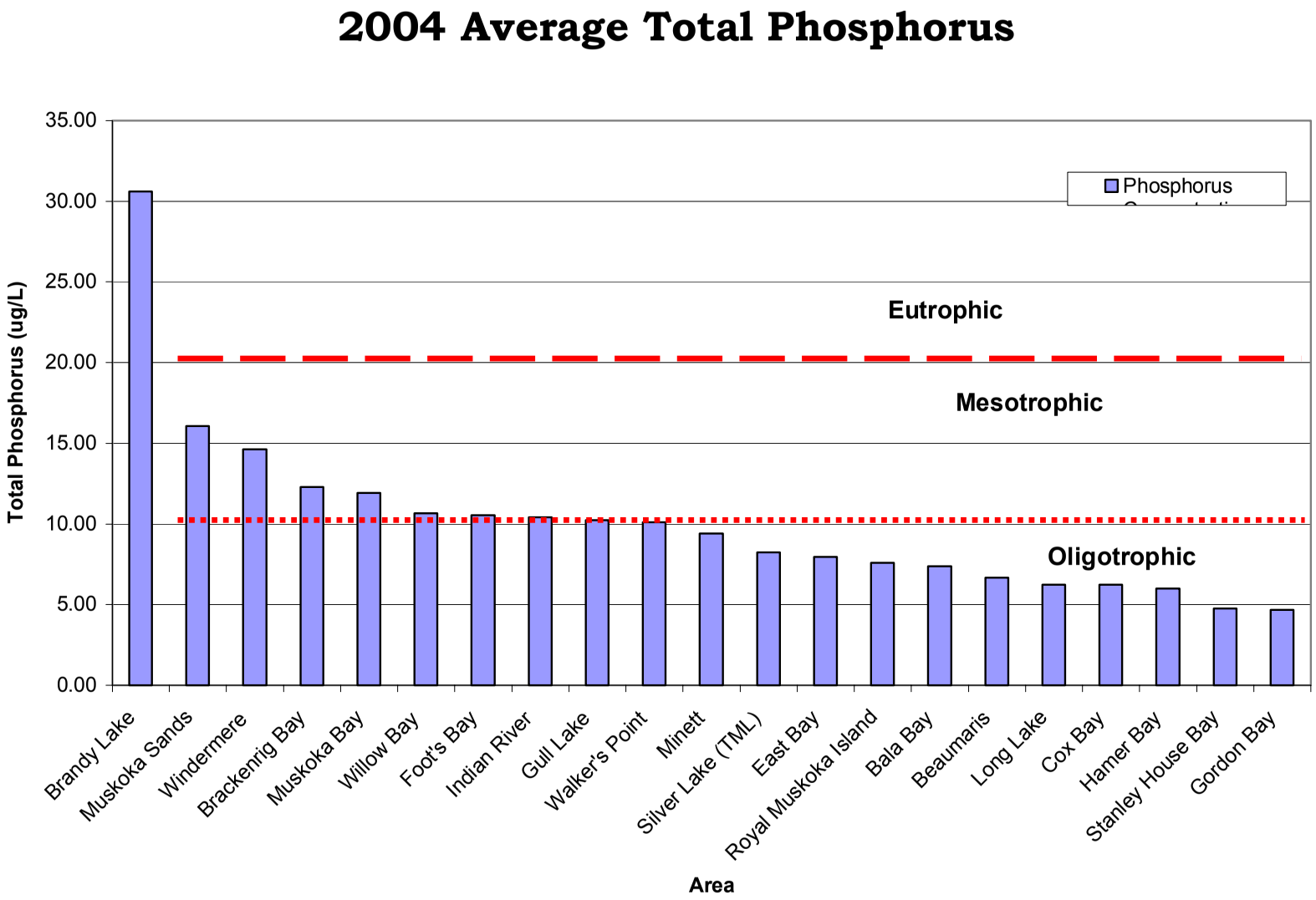


Figure 4 - Average Turbidity observed in 2004

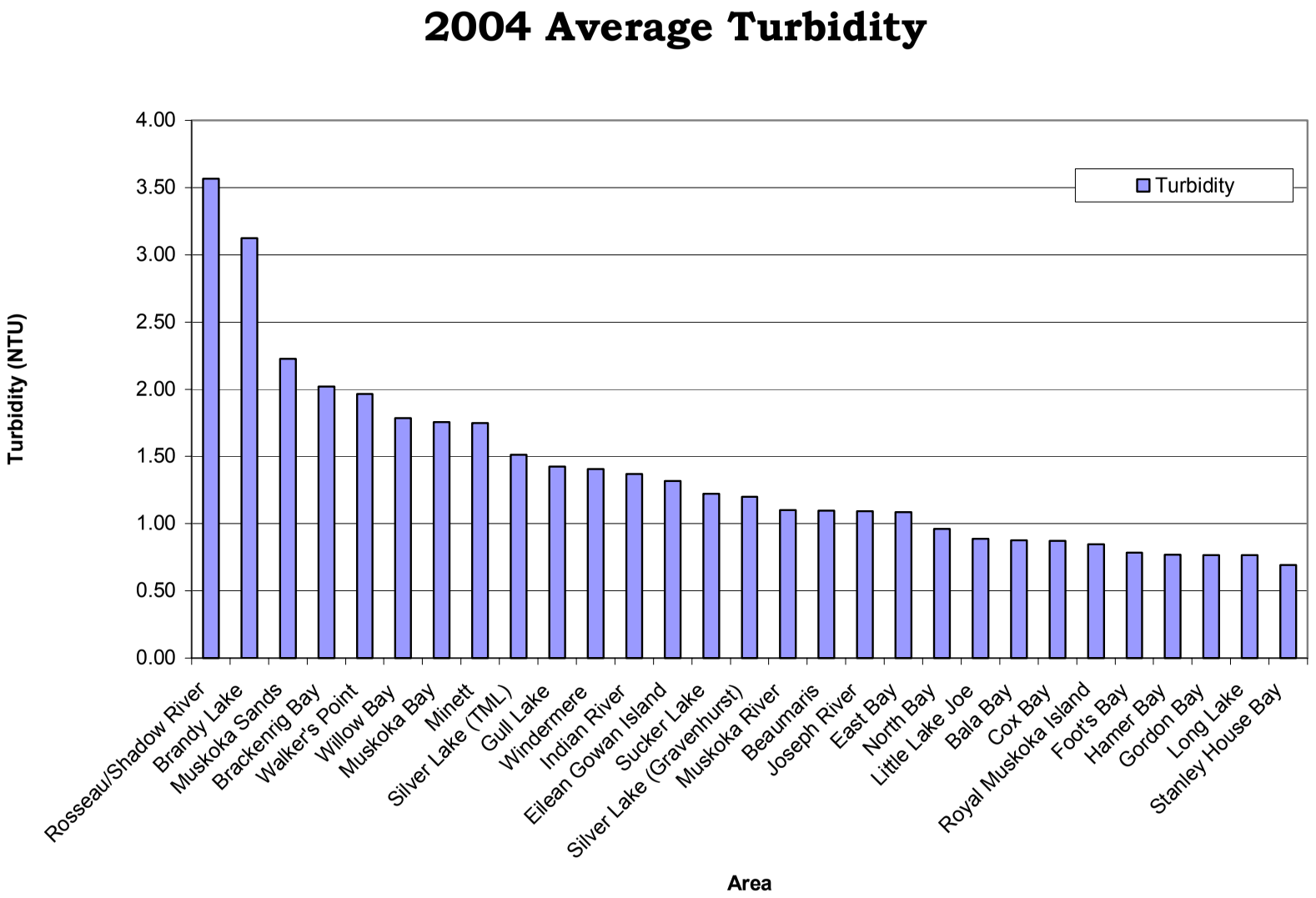


Figure 5 - Average Temperature observed in 2004

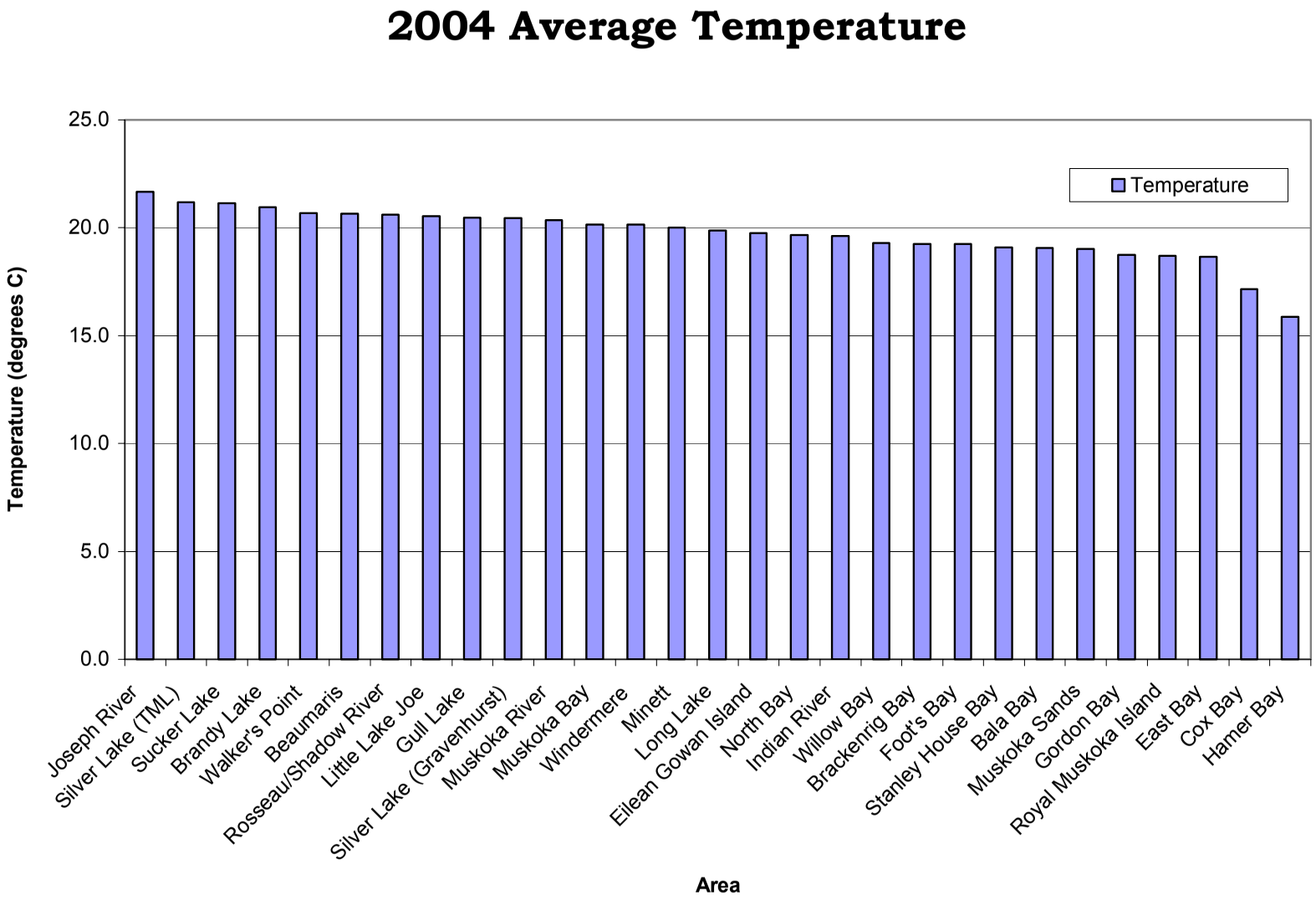


Figure 5 shows average (arithmetic mean) temperature for all areas. Similar to turbidity, there is no water quality objective associated with temperature, and the results should be considered primarily for interest's sake.

Three-year Averages

Graphs describing average readings over the first three years (2002-2004) of the full water quality program are also included. These graphs show how each lake and river that is monitored compares with the other lakes and rivers monitored. These results are most useful for assessing the long-term health of each water body.

It is important to note that the conditions in various lakes and rivers differ drastically. Rivers like the Indian River and the Little Joe River are not unlike the large lakes that they join (and in fact have been blasted and dredged to change their inherent characteristics), whereas rivers like the Hoc Roc River and Shadow River are more traditional, natural water courses that drain large catchment areas. These rivers are expected to have higher concentrations of contaminants, as they collect runoff from large areas and concentrate it in a small area.

Conditions between lakes in Muskoka tend to be more comparable. Nearly all lakes in Muskoka are oligotrophic, which means 'nutrient-poor.' This condition arises from the fact that the lake is carved out of granite, which erodes slowly and is itself nutrient-poor. An increase in biological productivity in these lakes (represented here by total phosphorus concentration, but also observed through the growth of algae and other plants) is typically considered to be a bad thing. Brandy Lake is the program's sole exception to this rule, as previously mentioned.

Figure 6 shows the three-year average (geometric mean) of E.Coli readings. All lakes had a long-term average of below five E.Coli counts/100mL, which is very low. As noted previously, both the Hoc Roc River and Shadow River drain large catchment areas, and are prone to concentrating contaminants from a wide area. As E.Coli can indicate human faecal contamination, it is prudent for Shadow and Hoc Roc River residents to be particularly cognizant of any potential sources of human waste, such as malfunctioning septic facilities, and report them to the MLA or the appropriate authorities.

Average (geometric mean) total coliform observed over the three year period is shown in Figure 7. Total coliform can indicate that a water body is being impaired, but do not have a direct correlation to human health. Typically, total coliform readings are one order of magnitude higher than E.Coli readings (multiply E.Coli by 10).

Figure 7 shows that results are approximately ten times greater than E.Coli measurements. Similar to the discussion about E.Coli, there are no concerns about bacteria in any of the Lakes monitored (although levels in Leonard Lake are higher than expected). Again, the Hoc Roc and Shadow Rivers are high in coliforms. The Muskoka

Figure 6 - Average *E.Coli* observed in 2002-2004

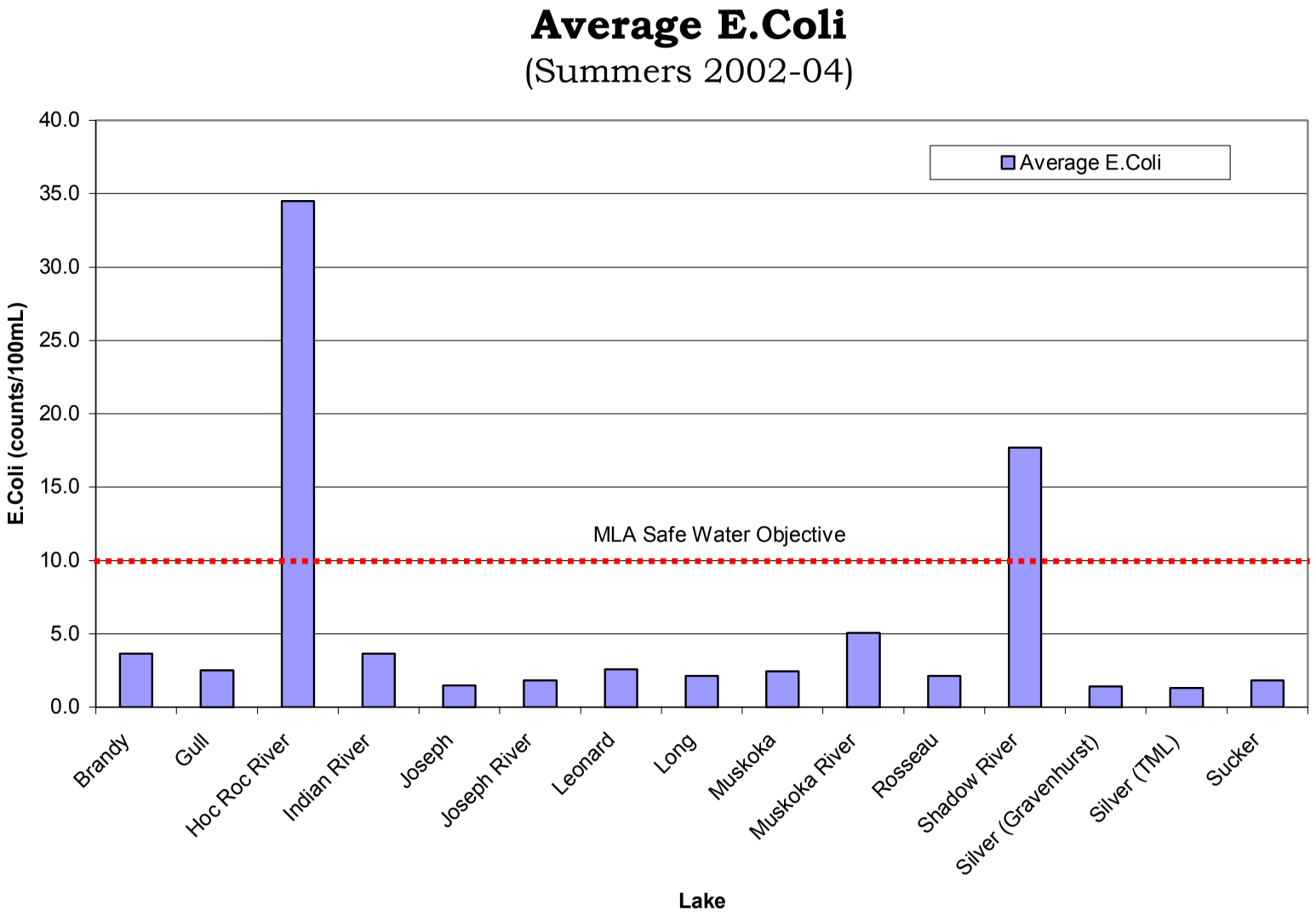


Figure 7 - Average total coliform observed in 2002-2004

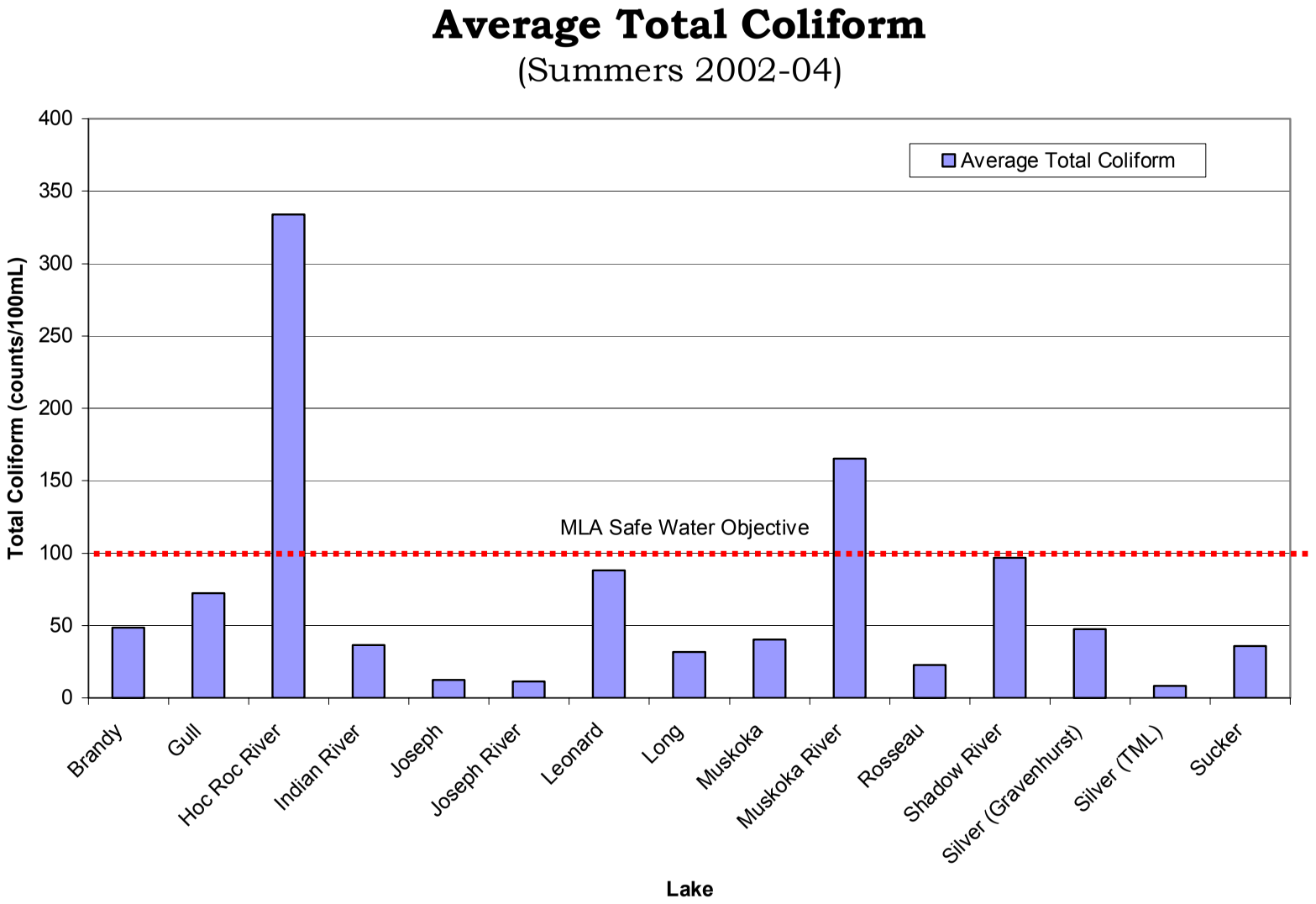


Figure 8 - Average total phosphorus observed in 2002-2004

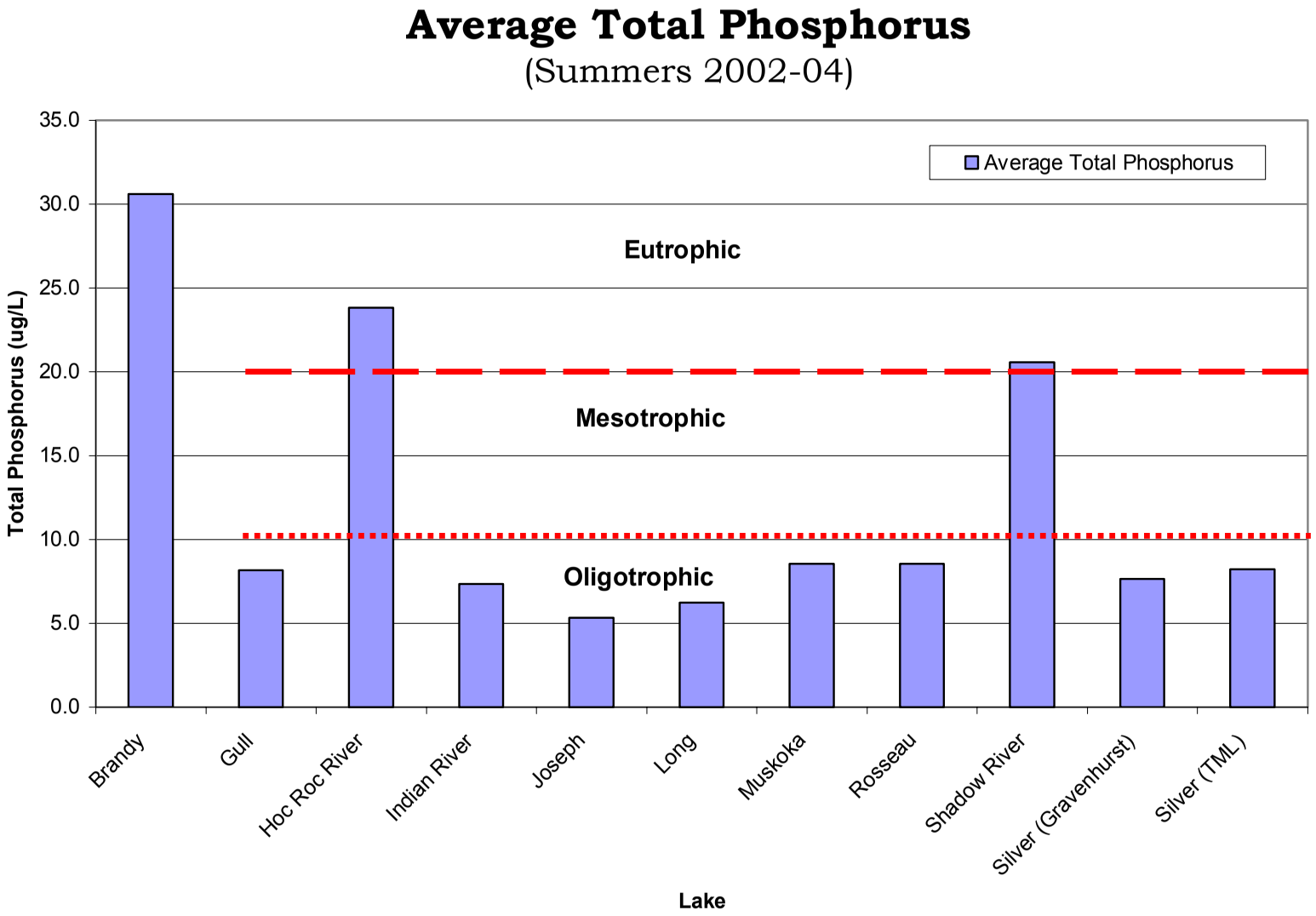


Figure 9 - Average turbidity observed in 2002-2004

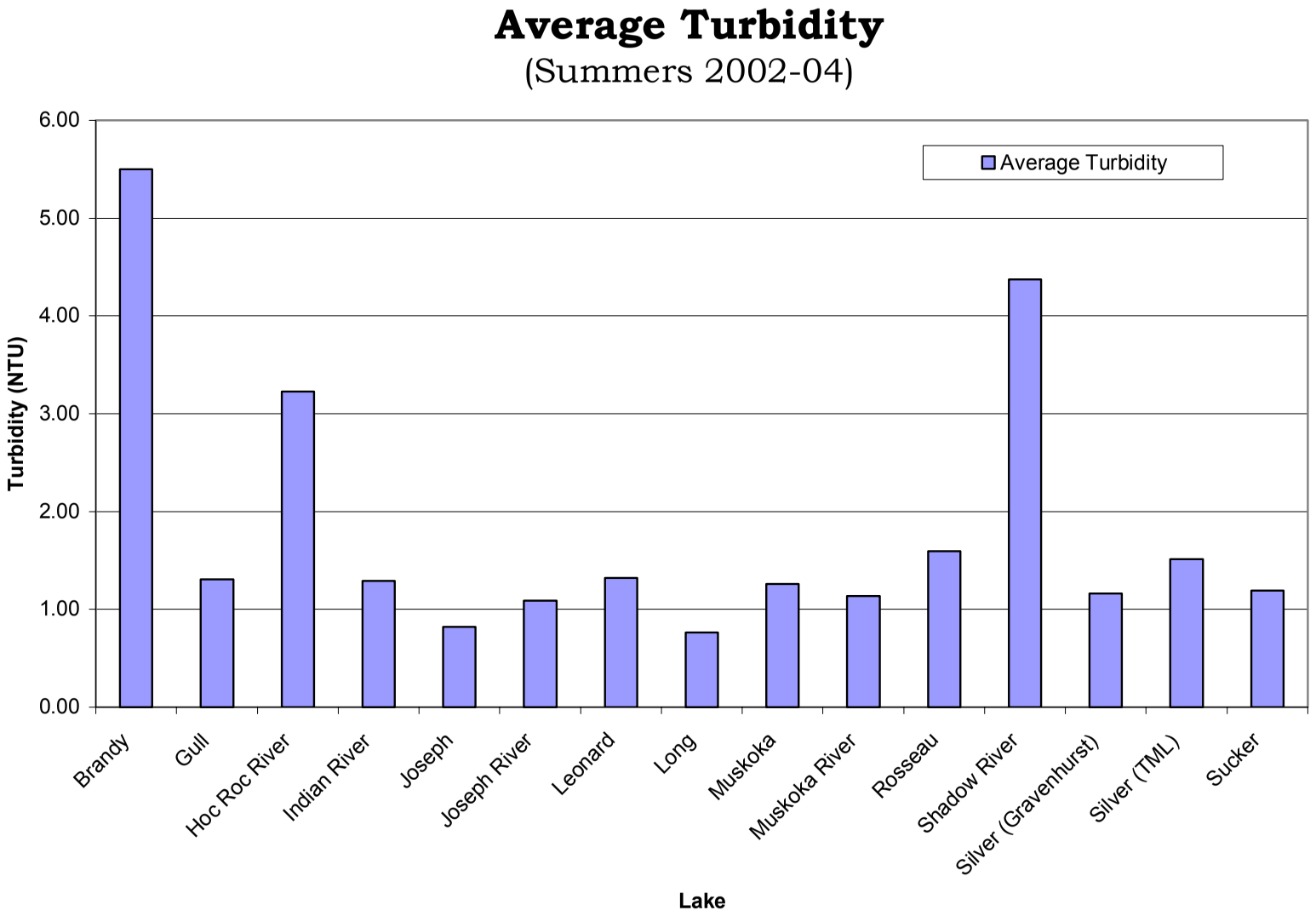
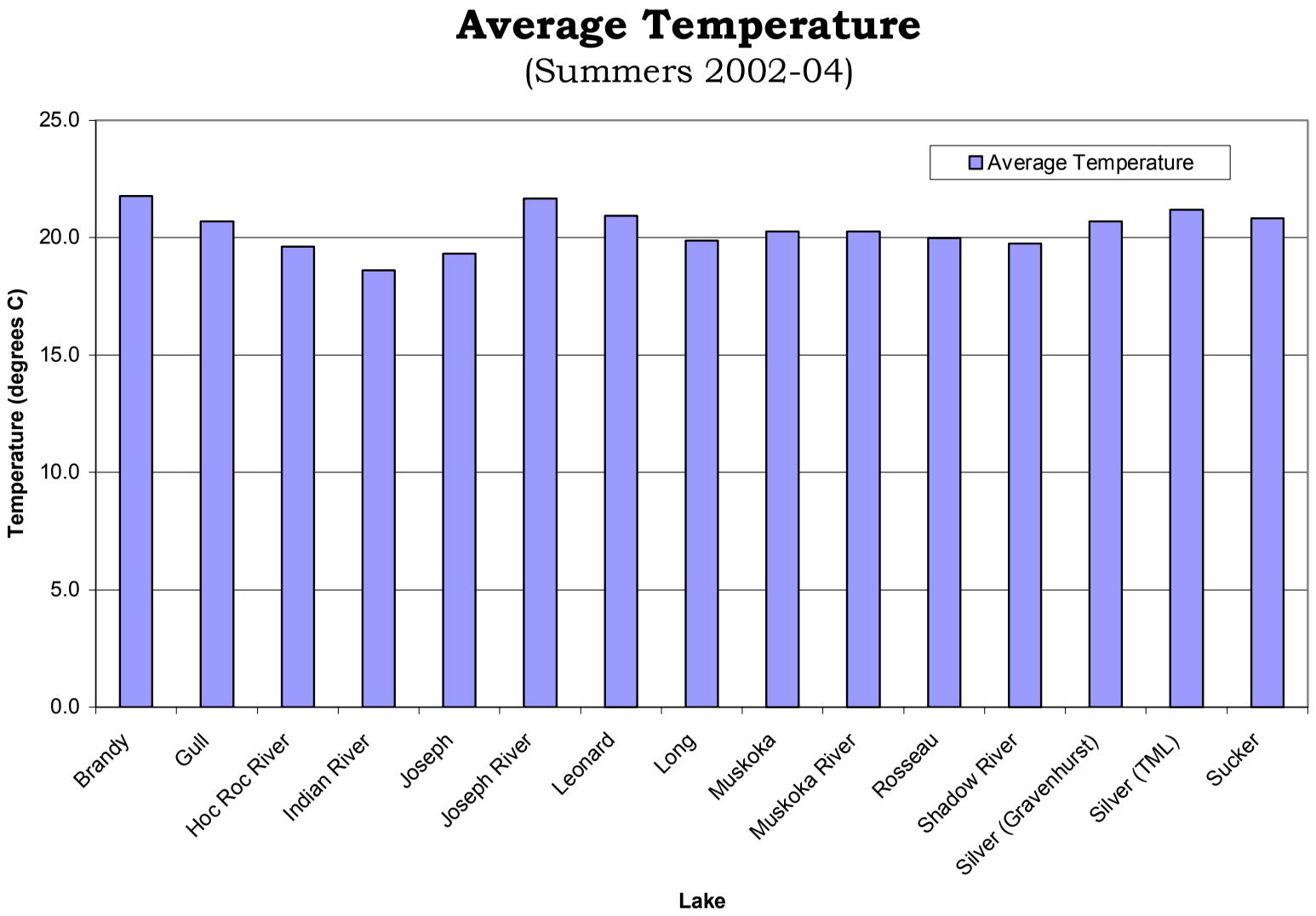


Figure 10 - Average temperature observed in 2002-2004



River is also high in total coliform, again most likely because its catchment is an enormous area including a variety of land uses.

Figure 8 summarizes total phosphorus results for the program between 2002 and 2004. Most lakes in Muskoka are naturally oligotrophic, as discussed in the Summary of 2004 Results. The three-year average phosphorus level reported here gives a very good picture of the true trophic status of lakes, due to the large number of samples averaged. All lakes are oligotrophic except Brandy Lake (Brandy Lake's phosphorus levels are also discussed in the Summary of 2004 Results section.) The rivers monitored are also high in total phosphorus, which is normal in all natural river systems.

As noted previously, there are no objectives associated with either turbidity (Figure 9) or temperature (Figure 10). While lower turbidity is generally indicative of a healthy ecosystem while being more aesthetically pleasing, temperature should be considered for interest's sake.

Conclusions

A review of program results show that between 2002 and 2004, bacteria levels (both E.Coli and total coliform are typically well below the objectives set by the MLA. Exceptions are seen most notably in the Hoc Roc River, but also in the Shadow River and the Muskoka River. Note that these bacteria levels are still well below the safe water standard set by the Province of Ontario, so it is still very safe to swim in these areas.

Total phosphorus results show that most lakes in the area are oligotrophic, with the exception of Brandy Lake with its high levels of dissolved organic carbon. The rivers measured also have higher phosphorus levels than the oligotrophic lakes. Turbidity also shows consistent results, with less clear water found in Brandy Lake, Lake Rosseau and Silver Lake.

There are also important differences in water quality between one area and another on the same lake. Results from specific areas and sites show that some areas tend to have higher readings for all parameters. These include the Muskoka Sands area, the Windermere area and the Willow Bay area. Likewise, specific areas consistently return the lowest readings across all parameters. These areas include Little Lake Joe, Stanley House Bay, Gordon Bay and Hamer Bay.

A thorough examination of all trends in water quality is now warranted and will be carried out over the next year. Even though the water quality is still very safe for swimming etc, the areas that exhibit symptoms of impaired water quality compared to other areas of the lakes will be investigated to find out where bacteriological and nutrient contaminants are coming from.

Using the Website

Detailed results from all sites monitored are accessible in an interactive web-based application. To access the water quality initiative's online results, visit the MLA's website at http://www.mla.on.ca and click "Water Quality" on the main menu. Detailed background information including a glossary and references is included on this page. The results can be directly accessed by following the "Results" link which will take the user to a screen indexing all of the sites. The first link on this index screen is a link to this summary report. You will also see a list of each lake and river from which results are available. For each sampling area there is a map showing each of the sampling locations:

- If the site is identified with a red dot, E.Coli, total coliforms, turbidity and temperature results are available
- If the dot is green, phosphorus concentration, turbidity and temperature are recorded
- A split red and green dot indicates that all five parameters are measured.

On the same page, there is a list of results available. The user can choose to view either a spatial or temporal comparison of results. The spatial comparison for each parameter returns a graph showing the seasonal average reading for the selected parameter at each site in the area selected, along with the five highest average readings recorded during 2004 and the five lowest average readings recorded in 2004. Sites from the area selected are highlighted in purple.

The temporal comparison of results shows all results (beginning in 2002) available for each site in the selected area for the selected parameter. This graph allows the reader to see how specific water quality parameters continue to change through time. Sites may change occasionally from year to year, so there may not always be a direct comparison between years.

A list of all three-letter site codes is available at http://www.mla.on.ca/waterquality/codes.htm so you can more easily read the graphs. If a question mark appears on the graph, you can double-click on it to show a note that will help you interpret the data.

Report Prepared by:

Michael Logan, BSc MASc MURP
Principal

15 November 2004