



**The Township of the Archipelago**  
**Water Quality Monitoring Program Outline**  
**FINAL – December 2016**

**Background**

In the spring of 2016 the Township of the Archipelago (TOA) recommended changes to its water quality (WQ) monitoring program, with the main recommendation being a shift from bacteria to phosphorus monitoring (see Appendix A for further information). Recommended changes (to the WQ monitoring program) were made following discussion amongst TOA's Environment Committee and as a result of partnership with the Georgian Bay Biosphere Reserve (GBBR). For the past three years, GBBR's "Coordinated Nutrient Monitoring Program" has reviewed existing nutrient monitoring efforts (along eastern Georgian Bay) and developed a new set of guidelines and recommendations (see Appendix B for further information). Among these recommendations are:

1. Townships, ratepayer associations and volunteers should join the Lake Partner Program (LPP) administered by the Ontario Ministry of Environment and Climate Change (MOECC). This includes shifting existing water quality monitoring programs from bacteria monitoring to phosphorus monitoring (see Appendix C for further information).
2. Current Lake Partner Program (LPP) sampling locations should continue to be monitored in order to establish long-term records and trends.
3. New LPP monitoring locations are proposed for enclosed bays and in-land lakes (and are shown on maps and listed in tables) as opportunities to be addressed by townships, ratepayer associations and volunteers (see Appendix D for further information).
4. Spring sampling (following LPP protocols) will be sufficient for most locations in the GBBR, as there are few areas that experience fall algal blooms (Clark et al., 2015). However, in some locations 'enhanced' monitoring (beyond LPP) may be required. Generally, the 'trigger' to consider additional monitoring relates to high TP and/or algal blooms (see Appendix E for further information).

The purpose of this document is to outline the revised TOA Water Quality Monitoring Program (in light of these recommended changes).



## **2016 WQ Monitoring Program Results**

### ***LPP Monitoring in the TOA***

As mentioned above, recommended changes to the TOA's water quality program were communicated to volunteers and/or ratepayer associations in the spring of 2016. GBBR is currently in communication with the LPP Coordinator to obtain 2016 participation results. Following receipt of these results, GBBR will identify recommended locations that still require monitoring and will work with ratepayer associations and/or community groups to find volunteers. Locations that were already part of the LPP were encouraged to continue participation in order to collect long-term data and track changes over time. Bacteria monitoring was optional in 2016 and, to date, two ratepayer associations have provided bacteria monitoring results.

### ***Enhanced Monitoring in the TOA***

During the summer of 2016, GBBR and the TOA partnered with Pointe au Baril Islanders Association and Woods Bay Community Association to conduct enhanced nutrient monitoring. This partnership involved training and loaning of equipment (with funding from Environment and Climate Change Canada). The objectives of enhanced nutrient monitoring are: 1) to map areas that 'stratify', 2) to collect vertical profiles, and 3) to collect late summer total phosphorus samples to confirm internal loads. This water quality information will help us to better understand what areas of Sturgeon Bay and Woods Bay are contributing to high phosphorus levels.

### **WQ Monitoring Program Objectives**

Nutrient (phosphorus) monitoring requirements along eastern Georgian Bay are complex. In the past, phosphorus monitoring meant measuring concentration over time to detect any increases due to anthropogenic inputs which could lead to eutrophication and the increased likelihood of nuisance algal blooms. In recent decades there is evidence that phosphorus concentrations in inland lakes have been declining for reasons other than a reduction in anthropogenic loads (Eimers, 2009) and it has been shown by Environment Canada that this is occurring in the open waters throughout the GBBR. In addition, the invasion of Dreissenid Mussels in the Great Lakes has led to the removal of nutrients in offshore areas, which is a result of the filter feeding process of the mussels. In turn, there has been an increase in the nutrients in nearshore areas as the mussels concentrate nutrients as both biomass and waste products in some areas. These multiple stressors require nutrient monitoring for many reasons other than straightforward vigilance with respect to eutrophication. There is now the need to



understand complex patterns in nutrient flux and the way these changes in phosphorus concentrations affect ecosystem function. Therefore nutrient monitoring objectives for eastern Georgian Bay are:

1. Mitigating localised water quality issues.
2. Regional characterisation of water quality.
3. Spatial and temporal trend detection.
4. Identifying the effects of regional drivers and multiple stressors to protect ecosystem function.

While the focus of TOA's water quality program is on nutrients (i.e. phosphorus), it is understood that other contaminants of concern and emerging issues exist, such as: pesticides, herbicides, pharmaceuticals, microplastics, invasive species, etc. The "Coordinated Nutrient Monitoring Program" has started with Total Phosphorus and is building capacity to expand and respond to other water quality monitoring needs and concerns. It is therefore recommended that the TOA's water quality program follow a similar approach and that GBBR staff, via the Environment Program MOU, act as a point of contact for ratepayers on water quality issues, concerns and comments.

### **Program Components**

As discussed with the TOA's Environment Committee, the water quality program is best divided into four components and is summarized in the subsequent table:

1. Monitoring
2. Research
3. Education and Outreach
4. Stewardship and Best Practices



<b>1) Monitoring – Summary of water quality monitoring programs in and/or near the TOA</b>		
<b>Agency / Organization</b>	<b>Program Title</b>	<b>Program Summary</b>
Environment and Climate Change Canada	Great Lakes Surveillance Program (GLSP)	This program conducts offshore monitoring every two years on a variety of water quality parameters (physical, major ions, nutrients, biological, metals and organics). While no GLSP locations are directly in TOA boundaries, monitoring location 122 provides regional characterization.
Ministry of Environment and Climate Change	Lake Partner Program	The Lake Partner Program (LPP) is Ontario’s volunteer-based, water-quality monitoring program. Lakes on the Canadian Shield are sampled for total phosphorus once per year during May, and Secchi disk observations are made, ideally, twice per month from May to October.
Ministry of Environment and Climate Change	Environment Index Station Program (EISP)	This program conducts nearshore monitoring every six years on a variety of water quality parameters (physical, major ions, nutrients, biological, metals and organics). EISP locations 84 and 614 are in TOA boundaries, and another two locations provide regional characterization.
Ministry of Environment and Climate Change	Great Lakes Nearshore Assessment (GLNA)	This program conducts thorough nearshore monitoring roughly every ten years on a variety of water quality parameters (physical, major ions, nutrients, biological, metals and organics). There are numerous GLNA locations in TOA boundaries and the reader is referred to GBBR’s report “Water Quality Monitoring Along Eastern Georgian Bay”, available online: <a href="http://www.gbb.ca/our-environment/state-of-the-bay-report/">www.gbb.ca/our-environment/state-of-the-bay-report/</a>
Georgian Bay Biosphere Reserve	Enhanced Nutrient Monitoring	As mentioned above, GBBR and the TOA have partnered with Pointe au Baril Islanders Association and Woods Bay Community Association to conduct enhanced nutrient monitoring. The objectives of enhanced nutrient monitoring are: 1) to map areas that ‘stratify’, 2) to collect vertical profiles, and 3) to collect late summer total phosphorus



<b>1) Monitoring – Summary of water quality monitoring programs in and/or near the TOA</b>		
<b>Agency / Organization</b>	<b>Program Title</b>	<b>Program Summary</b>
		<p>samples to confirm internal loads. This water quality information will help us to better understand what areas of Sturgeon Bay and Woods Bay are contributing to high phosphorus levels.</p> <p>GBBR has also developed a searchable map to show the major nutrient monitoring programs and activities in each area of the Biosphere Reserve. Start at this link and make sure to select the 'WATER QUALITY' tab from the top left menu: <a href="http://ow.ly/10B5n2">http://ow.ly/10B5n2</a></p>

<b>2) Research – Summary of water quality research programs and reports in and/or near the TOA</b>		
<b>Agency/Authors/Organization</b>	<b>Program / Report Title</b>	<b>Program Summary</b>
LimnoTech, Oct 2015	<p>Draft Lake Huron Science and Monitoring Synthesis</p> <p>Available online:  <a href="http://www.lakehuroncommunityaction.ca/2016/03/07/state-of-lake-huron-conference/">http://www.lakehuroncommunityaction.ca/2016/03/07/state-of-lake-huron-conference/</a></p>	The purpose of this report is to synthesize the scientific understanding and monitoring/research data on Lake Huron in preparation for the 2017 the Cooperative Science and Monitoring Initiative (CSMI) intensive study. It covers the main issues that have been highlighted over the past 10-15 years, so that decisions can be made regarding how to design the 2017 CSMI program to advance or knowledge on these issues.
Charlton and Mayne, 2013	<p>Science and Monitoring Synthesis for South-Eastern Georgian Bay</p> <p>Available online: <a href="http://goo.gl/ruaxLb">goo.gl/ruaxLb</a></p>	This report synthesizes science and monitoring information for south-eastern Georgian Bay with particular emphasis on phosphorus, causes of cyanobacteria and harmful algae blooms and the general condition of aquatic resources within this region.
Georgian Bay Forever	Water Quality Research	<a href="http://georgianbayforever.org/water-quality/research-and-projects/">http://georgianbayforever.org/water-quality/research-and-projects/</a>



<b>2) Research – Summary of water quality research programs and reports in and/or near the TOA</b>		
<b>Agency/Authors/Organization</b>	<b>Program / Report Title</b>	<b>Program Summary</b>
Environment and Climate Change Canada	Lake Simcoe and South-Eastern Georgian Bay Clean Up Fund	<p>From 2012-2017 this fund supports science and monitoring activities:</p> <ul style="list-style-type: none"> <li>• Fish community assessment and development of indicator for fish community;</li> <li>• Coastal wetland assessment of fish, plants and water quality; and</li> <li>• Research and monitoring to assess conditions contributing to phosphorus inputs into SEGB and nuisance and toxic algae growth to fill information gaps and aid in restoration and protection efforts.</li> </ul>

<b>3) Education and Outreach – Water quality outreach and education are achieved via a number of organizations</b>		
<b>Organization</b>	<b>Program</b>	<b>Comments / Links</b>
Georgian Bay Biosphere Reserve	Explore Our Shores	Explore Our Shores is held three times a summer hosted by ratepayer associations in the Township of the Archipelago and typically include water quality related content. Hosts are rotated every year in order to visit all ratepayer associations.
Georgian Bay Biosphere Reserve	State of the Bay	Total phosphorus as an indicator of water quality: <a href="http://www.stateofthebay.ca">www.stateofthebay.ca</a>
Georgian Bay Biosphere Reserve	Kids in the Biosphere	Activity booklet includes water quality related material: <a href="http://www.gbbr.ca/education/kids">www.gbbr.ca/education/kids</a>
Georgian Bay Biosphere Reserve	Water festival	Held annually in May for 120 junior grade students: <a href="http://www.gbbr.ca/education/water-festival/">www.gbbr.ca/education/water-festival/</a>
Georgian Bay Association	Water Quality Committee	<a href="http://www.georgianbayassociation.com/water-quality/">http://www.georgianbayassociation.com/water-quality/</a>



<b>4) Stewardship and Best Practices – Water quality stewardship and best practices are achieved via a number of organizations</b>		
<b>Organization</b>	<b>Program</b>	<b>Comments / Links</b>
Georgian Bay Biosphere Reserve	Life on the Bay	Life on the Bay is a self-assessment of environmental impacts and practices for landowners, which contains several chapters relating to water content. <a href="http://www.gbbr.ca/our-environment/life-on-the-bay-guide">www.gbbr.ca/our-environment/life-on-the-bay-guide</a>
Georgian Bay Forever	Phragmites Removal	GBF facilitates community programs to remove invasive phragmites, thereby improving water quality and wetlands: <a href="http://www.georgianbayforever.org">www.georgianbayforever.org</a>
Georgian Bay Land Trust	Educational Programs	GBLT's educational programs: <a href="https://www.gbtl.org/protecting-land/caring-land-2/education-and-research/">https://www.gbtl.org/protecting-land/caring-land-2/education-and-research/</a>
White Squall	Outer Islands Project	White Squall works with partners to run the Outer Islands Project that involves stewardship and restoration of Crown land: <a href="http://www.whitesquall.com/about-us/whats-new/franklin-island-news/297-outer-islands-sod-project.html">http://www.whitesquall.com/about-us/whats-new/franklin-island-news/297-outer-islands-sod-project.html</a>
Ratepayer Associations	Environment Days	Many ratepayer associations have 'Environment Days' or similar educational events. GBBR (and other GB5 organizations) often attend these events to present about relevant programs.



## **Appendix A – TOA communications to WQ monitoring volunteers in spring of 2016**

Provided below is a copy of an email sent to the TOA's WQ monitoring volunteers in the spring of 2016.

### **Subject: ToA's Volunteer Water Quality Monitoring Program – Spring 2016 Update**

Thank you for your interest in the TOA's Volunteer Water Quality Monitoring Program. We have several information items to share with you, as listed below.

1. We are happy to announce that the "2015 Report on Sampling Data" is available online:

<http://www.thearchipelago.on.ca/index.php/environment/water>

2. For the past two years, the Township has participated in an eastern Georgian Bay "Coordinated Nutrient Monitoring Program" to improve effectiveness and efficiency of the collective efforts of volunteers, associations, agencies and other organizations. Under an Environment and Climate Change Canada grant, the Georgian Bay Biosphere Reserve team has reviewed past water quality monitoring efforts and with a technical team developed a new set of guidelines and recommendations, called the "Enclosed Bays and Inland Lakes Phosphorus Monitoring Guideline".

3. The Guideline makes several recommendations, including that water quality monitoring programs make a simple shift from a focus on bacteria to monitoring phosphorus. The rationale for shifting away from bacteria monitoring is based on a Hutchinson Environmental Sciences report (available here: <https://georgianbay.civicweb.net/document/147227/2011%20Coastal%20Program%20Review%20Final%20Report%20%28HESL%29%20Oc.pdf>) which concluded that single samples taken at one point in time do not indicate either the spatial or temporal extent of the levels of bacteria observed. It recommended that should organizations wish to continue with bacteria testing, it should happen in the framework of a scientific investigation focused on testing specific hypotheses on potential sources of contamination through a focused sampling program. For example, recreational sites (e.g. beaches) could be considered for bacteria monitoring as per the province's Beach Management Guidance Document. Please get in touch if you require assistance setting up a revised bacteria monitoring program.

4. The Guideline aims to help volunteers and townships transition to phosphorus monitoring by joining the Lake Partner Program (LPP). The LPP is an Ontario-wide, publically funded, free program that collects data about phosphorus, water clarity, calcium and temperature from volunteers. The simple tests for Total Phosphorus (TP) and water clarity provide a strong basis for assessing the health of the ecosystem, and whether there is too much or too little TP. Advantages to the LPP are that it facilitates comparisons with other organizations monitoring on the Bay, as well as Ontario Ministry of Environment



and Climate Change (MOECC) and Environment and Climate Change Canada monitoring programs. Data collected by volunteers is analyzed by the Dorset Environmental Science Centre which makes all data and reports available online. The 'Guideline' document includes monitoring protocols and suggested sampling locations.

To learn more about this program and to download a copy of the 'Guideline', please visit:

[www.gbbbr.ca/our-environment/state-of-the-bay-report/](http://www.gbbbr.ca/our-environment/state-of-the-bay-report/)

4. What does this mean to our volunteers? For this year (2016), participation in bacteria monitoring is optional. Please contact Elke Dyck ([edyck@thearchipelago.on.ca](mailto:edyck@thearchipelago.on.ca) or 705-746-4243, ext 317) if your association plans on conducting bacteria monitoring this year, so she can order the necessary supplies.

The TOA will continue to offer water quality training to ratepayer associations. Please contact David Bywater (GBBR, [conservation@gbbbr.ca](mailto:conservation@gbbbr.ca) or 705-774-0978) if you require training or have any questions about the Volunteer Water Quality Monitoring Program. For ratepayer associations that are new to the Lake Partner Program, here is a link to an online training video:

<https://www.youtube.com/watch?v=8NUFVK8eQ6Q>

5. If you want to learn more about water quality along eastern Georgian Bay or see who monitors the water around your house or cottage, visit a new website that summarizes the major water quality programs (including LPP) using a searchable map. The website was developed as part of GBBR's program and has several different features and tools, allowing the user to explore nutrient conditions along the Bay. The 'Summary' webpage allows the user to review the MOECC's Lake Partner Program data. While the 'Advanced' allows the user to review and compare three different nutrient monitoring programs. You can simply view the total phosphorus results for your area, or use the "Query" and/or "Chart" tools to screen and analyze the data. To visit this website follow the link below (make sure to click on the 'Water Quality' tab):

<http://ow.ly/10B5n2>

The Township of the Archipelago partnered with GBBR on this program and is currently reviewing the long term objectives of our Volunteer Water Quality Monitoring Program. We welcome feedback about your experiences, concerns and thoughts about the future direction of the Volunteer Water Quality Monitoring Program.



## **Appendix B – Background about the “Coordinated Nutrient Monitoring Program”**

Since 2014, the Georgian Bay Biosphere Reserve (GBBR) has worked with partners to develop a nutrient monitoring strategy for eastern Georgian Bay, recognizing the efforts of volunteers, townships, organizations, and agencies. The overall objective is to improve the coordination and collection of nutrient information in eastern Georgian Bay. The strategy also aims to ensure consistency in terms of what and how nutrients are measured, in light of current federal, provincial and regional government monitoring programs. Nutrient monitoring refers to total phosphorus (TP) monitoring, as it is the nutrient that controls the growth of algae and most living biota in the aquatic environment.

The project is funded by Environment Canada’s Lake Simcoe South Eastern Georgian Bay Clean Up Fund and the Lake Huron Framework for Community Action, with partner support from townships, organizations, volunteers and research agencies.

In 2015, GBBR conducted a review of the 15 nutrient monitoring programs within its boundaries. It determined that current Federal and Provincial monitoring programs are well established and effectively collect water quality data needed for open water and nearshore areas of eastern Georgian Bay.

The review found that monitoring conducted by volunteers, ratepayer associations and townships plays an important and complementary role, and would benefit from standardized guidelines and training, where necessary.

Recommendations from that review identified the need for increased monitoring in enclosed bays and inland lakes where there are no long-term programs in place. GBBR facilitated the preparation of an “Enclosed Bays and Inland Lakes Phosphorus Monitoring Guideline” for use by townships, ratepayer associations, and volunteers to facilitate their participation in nutrient monitoring in these areas, to help fill this gap.

A key recommendation from the ‘Guideline’ is for organizations and volunteers to continue and/or join the Ministry of Environment and Climate Change’s (MOECC) Lake Partner Program (LPP). The LPP is an Ontario-wide, publically funded, free program that collects data about phosphorus, water clarity, calcium and temperature from volunteers. Advantages of the LPP are that it facilitates comparisons with other organizations monitoring on the Bay, as well as MOECC and Environment Canada monitoring programs.

The ‘Guideline’ presents a targeted number of recommended monitoring locations for organizations and/or volunteers to fulfill. However, if there is greater capacity to add locations, the guideline presents a protocol for selecting and monitoring these sites.



Where there are additional concerns relating to algal blooms, the collection of additional water quality data should be determined on a case-by-case basis following a review of existing data. The 'Guideline' includes a decision tree to help facilitate how further monitoring could occur under several different scenarios. If participants in monitoring decide to expand their activities beyond the Lake Partner Program, the 'Guideline' ensures that information is collected in standardized fashion.

### **Appendix C – Shifting Water Quality Programs from Bacteria Monitoring to Phosphorus Monitoring**

Currently, several organizations and volunteers along eastern Georgian Bay are participating in bacteria monitoring. It is recommended that these organizations consider shifting to phosphorus monitoring to ensure consistency with other monitoring programs. For example, the Township of Georgian Bay recently shifted their monitoring from bacteria to phosphorus based on a scientific review by Hutchinson Environmental Services Limited. This review determined that single samples taken at one point in time do not indicate either the spatial or temporal extent of the levels of bacteria observed. This is based on the fact that survival of *E. coli* in the recreational water environment is dependent on many factors, including temperature, exposure to sunlight, available nutrients, water conditions (e.g. pH and salinity), and competition from, and predation by, other micro-organisms.

The review recommended that should organizations wish to continue with bacteria testing, it should happen in the framework of a scientific investigation focused on testing specific hypotheses on potential sources of contamination through a focused sampling program. In addition, the examination of geometric means (i.e. statistical analysis) should be adopted rather than the interpretation of individual results. For example, recreational sites (e.g. beaches) could be considered for bacteria monitoring as per the province's Beach Management Guidance Document.

### **Appendix D – Why Monitor Enclosed Bays and Inland Lakes?**

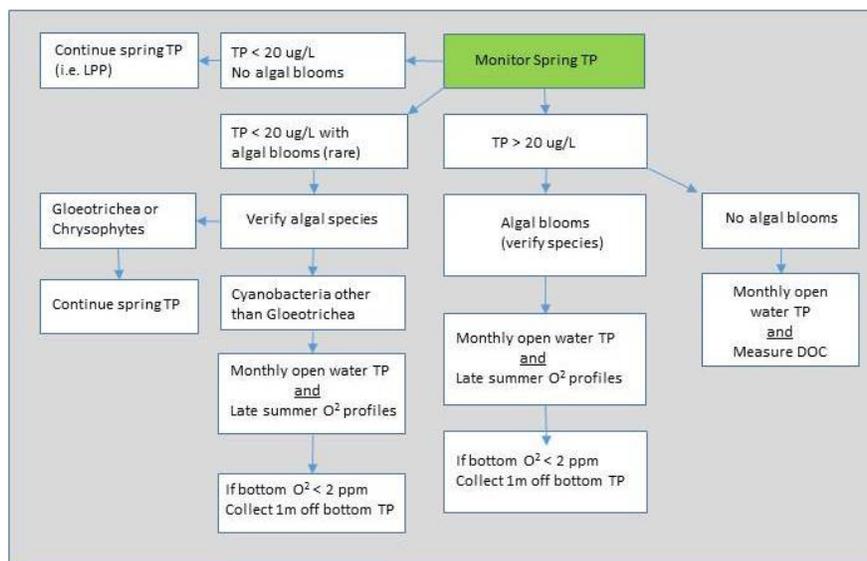
1. Enclosed bays and inland lakes have different environmental conditions than open areas. They may be connected to Georgian Bay with limited exchange of water due to convoluted channels or constricted openings and will have water chemistry characteristics that are more subject to upstream watershed influences. This will be especially true if there are major inflows (streams) or shoreline development within the enclosed bay.



2. Inland lakes require total phosphorus data to help assess background concentrations relative to present day concentrations, which helps to show changes over time, and may help to identify conditions leading to algal blooms.
3. Even in cases where the bay is considered to be ‘natural’ and relatively undeveloped, there are multiple stressors associated with all ecosystems that occur as a result of climate change, long-range transport of pollutants and the influx of invading species.
4. Monitoring in these areas will help to understand the impacts of these stressors and complement upper tier monitoring (by provincial agencies) in nearshore areas.

### Appendix E – Enhanced Water Quality Monitoring

Spring sampling (following LPP protocols) will be sufficient for most locations in the GBBR, as there are few areas that experience fall algal blooms (Clark et al., 2015). However, in some locations ‘enhanced’ monitoring (beyond LPP) may be required. Generally, the ‘trigger’ to consider additional monitoring relates to high TP and/or algal blooms. A decision tree shown in **Figure 1** outlines how additional monitoring would occur under several scenarios. In these scenarios, further water quality parameters can be obtained with only a few additional pieces of equipment, most notably oxygen meters and specialized bottles to collect samples at distinct depths. It is important to bear in mind that the scenarios outlined in the decision tree pertain only to aspects of total phosphorus monitoring.



**Figure 1 – Simplified Decision Tree to Assess the Need for Additional Monitoring**



Additional water quality data are often collected to help interpret any results from a spring nutrient monitoring program that prove difficult to interpret. Tests such as dissolved organic carbon (DOC) can help to determine whether or not high TP concentrations are from natural sources. The collection of additional water quality data should be recommended on a case by case basis following a review of existing data. Additional costs are associated with analysis which must be outsourced to a private lab. General water chemistry suites are available from most private labs and these often include: pH, alkalinity, conductivity, nitrogen (specifically nitrate, NO<sub>3</sub>), phosphorus, dissolved organic carbon (DOC), chloride, sulphate, silica and sometimes cations and anions.

Several municipalities undertake additional water quality monitoring by partnering with the MOECC's LPP. Municipalities typically collect samples using their own equipment and staff, with sample analysis provided by the LPP. These types of science partner programs must be pre-arranged with MOECC. Factors influencing data collection requirements include, but are not limited to: planning (e.g. lake capacity model), by-laws, and local water quality conditions. Other groups use volunteers to collect samples which are submitted to the Trent University Lab (fee for service) at the Dorset Environmental Science Centre. In some cases consultants are used to complete the sampling each year.