2014 Kahshe Lake Steward Report

Kahshe Lake Ratepayers' Association

April 2015

2014 KAHSHE LAKE STEWARD REPORT

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2014 Executive Summary

In accordance with the goals and objectives which have been set for the Kahshe Lake Steward by the KLRA, a comprehensive review and analysis of all historical environmental monitoring on Kahshe and Bass Lakes was completed in Lake Steward Reports for 2012 and 2013. These documents are posted on the KLRA web-site (**http://www.kahshelake.ca/ne/ls**).

This report captures the findings from a limited program of water quality, water clarity and benthic invertebrate sampling in 2014 under the Ministry of Environment and Climate Change's (MOECC) Lake Partner Program. The report also summarizes the findings of the Muskoka Watershed Council's (MWC) recent Watershed Report Card and other environmental issues which have been identified in lecture series seminars hosted by the MWC in 2014 and attended by the Lake Steward.

What do the sampling and analysis results tell us?

- The sampling of water from Kahshe Lake in mid-May under the MOECC's Lake Partner Program confirmed the continued below threshold level of total phosphorus at all four monitoring locations, including a new site established to evaluate water quality in the more shallow, southwestern part of the lake.
- Similarly, water clarity was essentially unchanged from previous years and at a reasonable level considering the tea-coloured waters of Kahshe Lake.
- The benthic sampling carried out with the assistance of the District Municipality of Muskoka (DMM) at Site 2 in 2014 confirmed that the aquatic invertebrates of Kahshe Lake are well within the normal range for species richness and all other indicators of potential water impairment.

What's happening in the field of water quality research and trends in environmental quality?

- The MWC's watershed report card for the Kahshe River Sub-Watershed was published in 2014 and for the first time identified a potential vulnerability for fish habitat in lakes located within this watershed area. This was based on air photo observations showing a decline in the percent of the shoreline and shallow water zone in lakes that has been left in a natural condition. While this information covers all lakes within the Kahshe River sub-watershed and is therefore, not specific to Kahshe or Bass Lakes, any loss of near shore fish habitat has the potential to impact fish survival rates and the ecological health of the aquatic environment.
- The scientific research on interrelationships between water chemistry and the growth and survival of aquatic organisms within the aquatic food web continues to explore how long-term changes in water chemistry, temperature and other factors are being driven or at least influenced by our changing climate. While it is premature to speculate on the outcome of these long term studies, it is nevertheless important to track these findings and to be cognizant of their potential impact on the waters of our lakes.
- It is also important for us to be vigilant in our development activities to minimize shoreline disturbance and to guard against the introduction of invasive species.

Based on the above summary, we need to continue with our sampling efforts and practice overall lake stewardship to delay the onset of nutrient enrichment and its impact on lake health. As such, each of us needs to do our part to maintain the quality of the water by:

- managing our septic systems properly and having tanks pumped out regularly;
- avoiding the use of products containing phosphorus (detergents and cleaners);
- disposing of toxic wastes (batteries, paint, oil, old gas, pressure-treated lumber and other construction waste) at approved land fill sites;
- minimizing near-shore removal or management of vegetation and ensuring that any shoreline disturbance is conducted in strict compliance with permitted uses;
- avoiding the use of any chemical fertilizers and pesticides in areas close to the shore; and,
- taking precautions to minimize the potential for introducing both terrestrial and aquatic invasive species.

1.0 Kahshe Lake Stewardship Mandate

In 2013, the Kahshe Lake Steward Committee was dissolved, with the role of the Lake Steward being assigned to a newly created Conservation Committee which reports directly to the Kahshe Lake Ratepayers' Association (KLRA). The Lake Steward has been made a permanent sitting member of this new committee. This change in reporting structure has not altered the roles and responsibilities of the Lake Steward, and these remain as:

- Educating the residents and other users of the lake on how to **preserve** and **improve** the quality of the lake and its shoreline.
- Monitoring the environmental quality of the lake and keeping the association members up to date on the results of the testing programs.

As this is the third Annual Lake Steward Report, much of the historical and background information presented in the 2012 Lake Steward Report has not changed, and as such, this 2014 report will only briefly summarize the history of environmental monitoring on Kahshe and Bass Lakes and focus more on the chemical testing and biological monitoring that has taken place in 2014.

Another important water quality parameter that is not being routinely monitored in either lake or at the public beaches by any organization is coliform contamination. If you are drinking water from the lake – **which is strongly not recommended** - and want to ensure that your filtering system is functioning properly, you can submit a sample of water to the Simcoe Muskoka Health Unit for coliform analysis. The contact info is:

- 2-5 Pineridge Gate, Gravenhurst, ON, P1P 1Z3. PHONE: 705-684-9090, FAX: 705-684-9887.

Anyone who suspects that a neighbouring septic system is in need of pumping or improved management can also take a sample from the lake and submit it to the Simcoe Muskoka Health Unit.

Given the importance of maintaining fully functional septic systems, the following information has been extracted from a Good Neighbour Resource Hand book article by Rob Abbott which was updated for 2014 by the Conservation Committee.

> Your septic system is a sewage treatment facility that requires careful attention to design, construction, operation and maintenance. **As a property owner, this is your responsibility.** In Ontario, the specifications for construction and maintenance of sewage systems with a flow of less than 10,000 litres per day are regulated under the *Ontario Building Code*, and municipalities are responsible for the inspection and approval of all septic installations. In the case of Kahshe Lake, the Building Department of the Town of Gravenhurst is the department with this responsibility. In addition to permitting the installation of septic systems, the Town of Gravenhurst also operates a septic re-inspection program which is briefly summarized below:

- the re-inspection on Kahshe Lake is carried out every 5 years (2008… 2013….);
- it consists of a trained student visiting most (but not always all) properties and carrying out a visual inspection of the tank and bed;
- if the visual inspection finds the tank and bed in good condition, they leave a note to inform the property owner and send a follow-up letter;
- if there are visual signs of failure of the leaching bed, they leave a notice and the Building Department follows up with a letter requiring a pump-out and system inspection with a receipt from a licensed pumper to confirm that it has been carried out;
- if the visual signs point to a serious failure, the Building Department issues a stop order until evidence is provided that the problem has been corrected.

Unfortunately, there is no systematic process for re-inspections based on permits or on re-inspection findings. However, cottage owners are encouraged to report any suspected problems to the Building Department so they can follow up with an inspection of the system. Another way neighbouring property owners can support a concern regarding possible septic system failure is to submit a sample of lake water from a location close to the suspect property. The sample should go to the Simcoe Muskoka Health Unit for coliform analysis at the address noted on the previous page.

2.0 Environmental Monitoring on Kahshe and Other Muskoka Lakes

Kahshe Lake is being monitored for water quality and biological functioning parameters under two main initiatives as outlined below:

Lake Partner Program (LPP)

This program is operated by the Ontario Ministry of the Environment and Climate Change (MOECC) through the Dorset Environmental Science Centre. Under this program, water sampling and measurement of water clarity is conducted by the Kahshe Lake Steward every year.

The program has consisted of the following activities:

- **Water clarity measurements**
  - Clarity of the water is measured every two weeks during the ice-free period at three (now four) locations using a Secchi disc, and these findings are forwarded to the MOECC for compilation and comparison with other lakes in Ontario.
- **Water quality testing**
  - Water is sampled from three (now four) locations in May each year and sent to the MOE where it is analyzed for total phosphorous.

Given the location of the three sampling sites, which provide coverage of the eastern and northern areas of the lake, a request was made to the MOECC in the fall of 2013 to add an additional sampling

location in the southwest part of Kahshe Lake, where water is generally more shallow and potentially more susceptible to phosphorus-induced algal blooms given the likelihood of warmer water temperatures during the summer months. The MOECC responded favourably, and a new sampling location was added to the south of Cranberry Is.

Lake System Health Program (DMM)

This program is one of several components of a larger **Muskoka Water Strategy** which is operated by The District Municipality of Muskoka (DMM), with support from the Muskoka Watershed Council (MWC), the MOECC and several other participating agencies.

The monitoring program consists of 193 sampling sites on 164 lakes on a rotational basis. The program was designed to deliver a monitoring program which would establish a long-term record of key water quality parameters so that trends in water quality and lake system health could be identified and appropriate management decisions taken to protect lake water quality.

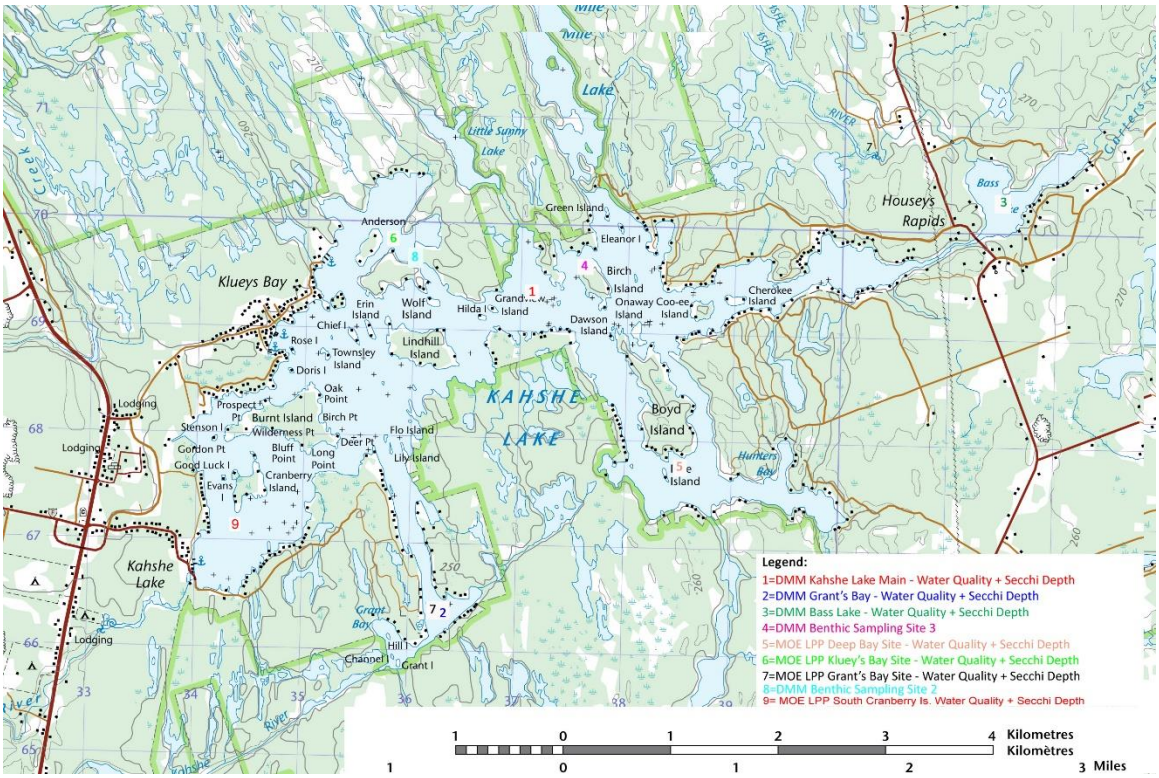
For Kahshe and Bass Lakes, the DMM program consists of the following activities which have been conducted every second year for Kahshe L and every third year for Bass L:

- Spring phosphorus sampling conducted in May (2 sites in Kahshe L and 1 in Bass L);
- Water sample collection for a suite of physical and chemical parameters in May (2 sites in Kahshe L and 1 in Bass L);
- Secchi depth measurements collected in May and August (2 sites in Kahshe L and one in Bass L);
- Temperature and dissolved oxygen at increasing water depths taken in May and August (2 sites in Kahshe L and 1 in Bass L);
- Benthic invertebrate sampling in August (1 of 2 established sites in Kahshe Lake only).

Based on their stated program timing, the DMM did not sample from either Kahshe or Bass Lakes in 2014.

To give a better perspective on where the sampling for both the MOE Lake Partner Program and the DMM Lake System Health Program is conducted on Kahshe and Bass Lakes, the locations of water sampling and measurement have been shown on Figure 1 below.

Figure 1: Map Showing MOECC and DMM Sampling Locations on Kahshe and Bass Lakes



3.0 Results of Monitoring on Kahshe and Bass Lakes

3.1 DMM Lake System Health Monitoring

As noted earlier, there was no sampling or analysis of Kahshe or Bass Lakes by DMM in 2014. However, the most recent Watershed Report Card was released by the Muskoka Watershed Council in 2014, and has been included here.

3.2 MWC Watershed Reports

The MWC's Watershed Report Cards are published every four years, with the most recent one being released in 2014. The Report Cards focus *on Indicators of Watershed Health* which were developed in 2002 through a Water Strategy public consultation process.

Based on information provided in the MWC's Report Cards, the Kahshe River sub-watershed is 24,619 hectares (ha) in size, and is located within the Severn River Watershed. Kahshe Lake itself is 8.3 km^2 in area, while Bass Lake has an area of 0.4 km^2. In total there are 20 lakes over 8 hectares in size in the sub-watershed.

Approximately 5% the sub-watershed is developed with 28% of the land in the sub-watershed being Crown land. There are no major urban areas within the sub-watershed and rural and shoreline

residential development comprises most of the land use. About 16% of the sub-watershed is protected through provincial parks, crown nature reserves, or local land trusts.

In the most recent 2014 Report Card, the MWC grades assigned to the four sub-categories in the Kahshe River Sub-Watershed were:

Land:	Vulnerable
Water:	Not Stressed (see below)
Wetlands:	Not Stressed
Biodiversity:	Not Stressed

However, in a more detailed breakdown of these four sub-categories of watershed health, fish habitat (within the water sub-category) also was determined to be vulnerable. Fish Habitat is indirectly determined by MWC based on shoreline condition as shown below:

- the percent of the shoreline and shallow water zone in a lake that has been left in a natural condition. Loss of near shore fish habitat will significantly impact fish survival rates and the ecological health of the aquatic environment.

Members of the Conservation Committee asked MWC for clarification on exactly how this fish habitat vulnerability was determined, and were informed that:

- In 2014, MWC went to a 3-level grading system over a 5-level grading system used in previous report cards. In the change, they identified anything that was a D, C, or B grade in the 2010 report card as equivalent to 'Vulnerable' in the 2014 report card.

- Second, they used the new air photos to enlarge the shoreline survey. Previously only Sunny and Prospect lakes were surveyed and included in the grading for the 20110 report card. In 2014, new air photos allowed them to look more closely at most of the lakes.

For those interested in more detail regarding the scoring system used by the MWC, the Kahshe River Sub-Watershed Report showing the scoring system and the results for each category (land, water and wetland) have been attached.

3.3 MOECC Lake Partner Program

The MOECC does not generate a year-end report on their Lake Partner Program. Instead, they provide a web-based link to all of the data generated via this program for use by Lake Stewards and other interested parties.

As in previous Lake Steward reports, I've shown the results of the 2014 sampling of Kahshe Lake in May for total phosphorus and water clarity based on Secchi disk measurements every two weeks from May

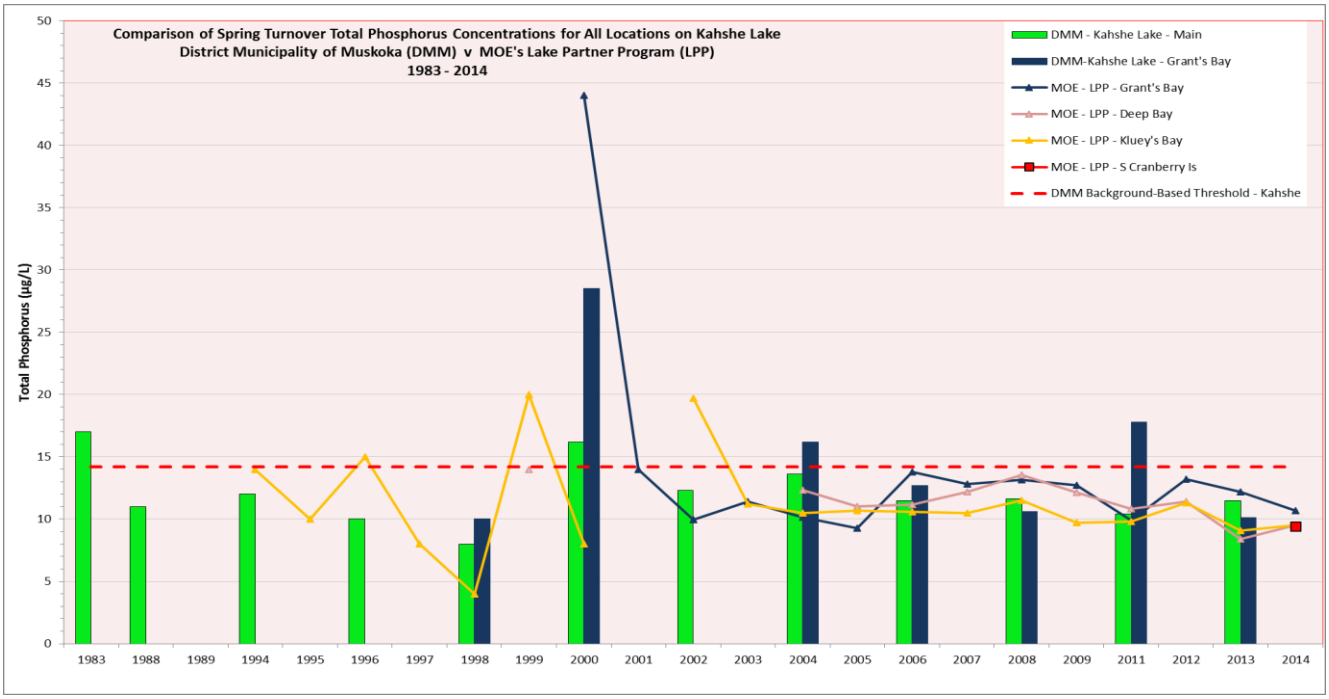
through October. It should be noted here, that 2014 was a fairly normal year in terms of temperature, rainfall and water levels, with the exception of a fairly late 'ice out' condition. The late ice out timing has the potential to interrupt normal spring turnover conditions, but it is not known exactly how this would impact the total phosphorus and water clarity measurements.

In the first chart (Figure 2), the green and blue columns represent the total phosphorus levels as measured by DMM from 1983 up to 2013. The data shown as lines represent the findings from the MOECC's Lake Partner Program over the same time period. The new total phosphorus levels for 2014 are shown for all of the existing monitoring locations as well as for the new sampling site to the south of Cranberry Is.

What's important to note here is that we continue to hold the line on total phosphorus and are well below the DMM's background-based threshold of 14.2 μ/L. While there appears to be a general trend towards slightly higher total phosphorus levels in Grant's Bay versus the Main Site (near Hens and Chickens), this is most likely due to differences in the stage of lake turnover when the samples are taken in the spring. As the spring samples are taken to capture the water quality following spring turnover, the most likely reason for this difference is related to the more shallow depth of the sampling location in Grant's Bay (about 9 m) compared to the much greater depths for the Kahshe Main site. This difference in depth along with other differences in water current and geographical contours is likely to have had an impact on the water turnover that takes place as we cycle through the seasons.

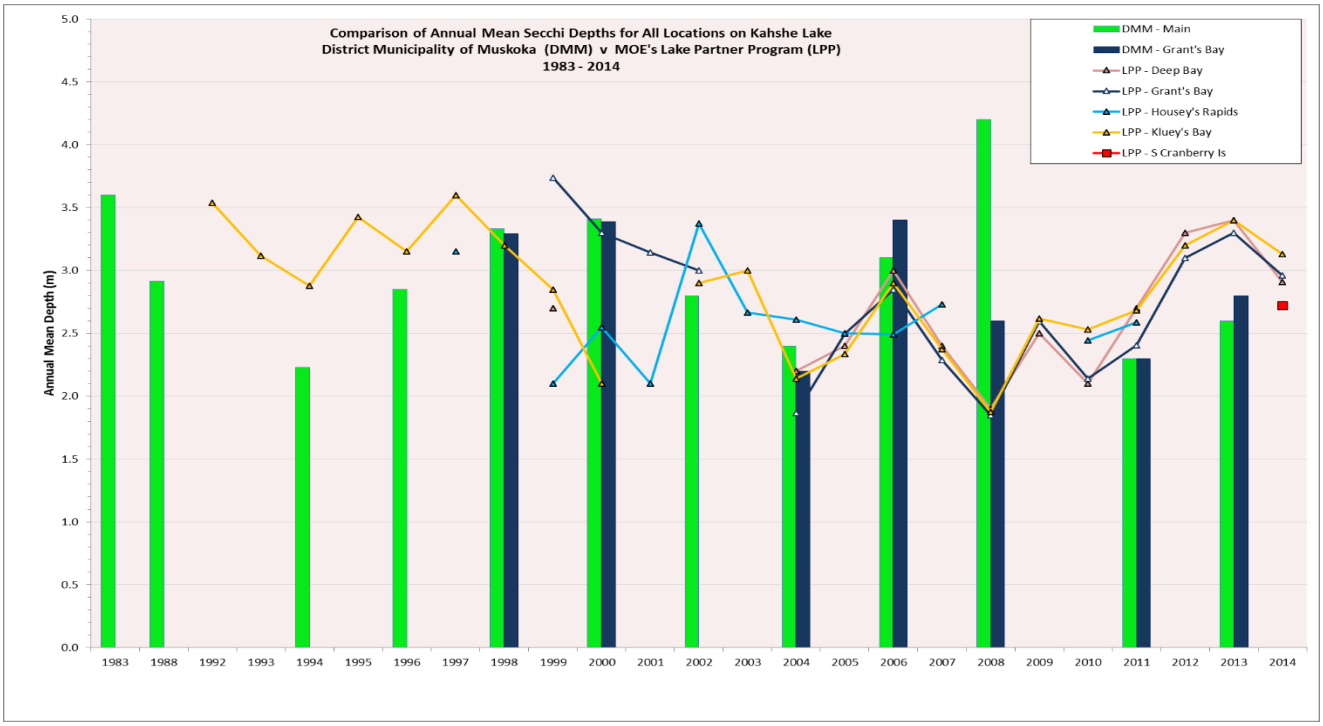
It is also apparent that the new sampling location in the more shallow waters of the southwest area of the lake has demonstrated that water quality for total phosphorus is virtually the same as in other deep water locations.

Figure 2: Total Phosphorus Concentrations in Kahshe Lake from Sampling by DMM and MOECC: 1983-2014



In the second chart (Figure 3), the water clarity measurements for both the DMM and MOECC programs are shown for the period from 1983-2014. As in the first chart, the green and blue columns represent the water clarity as measured by DMM from 1983 up to 2013. The data shown as lines represent the findings from the MOECC's Lake Partner Program over the same time period. The new water clarity measurements for 2014 are shown for all of the existing monitoring locations as well as for the new sampling site to the south of Cranberry Is.

Figure 3: **Water Clarity Measurements in Kahshe Lake from Secchi Depth Monitoring by DMM and MOECC: 1983-2014**



What's important to note here is that water clarity measurements under the two programs continue to demonstrate a reasonable level of water clarity – especially for a tea coloured lake, and that while there is some variability among the different locations on the lake, the data are reasonably similar and do not point to any trend in reduced water clarity. It is also apparent that the new sampling location in the more shallow waters of the southwest area of the lake has demonstrated that water clarity is virtually the same as in other deep water locations. In this case, the depth of the water is the limiting factor in the measurements, as in many cases, the Secchi disk hit the bottom before disappearing from view.

For those who would like to see the actual values for 2014, please refer to Table 1 below.

Table 1: **Total Phosphorus and Secchi Depth Measurements from the MOECC's Lake Partner Program: 2014**

Sampling Location	Total Phosphorus Replicate 1 (µg/L)	Total Phosphorus Replicate 2 (µg/L)	Average Total Phosphorus (µg/L)	Average Secchi Depth (Water Clarity) in metres
Grant's Bay	10.6	10.8	10.7	3.0
Deep Bay	9.2	9.8	9.5	2.9
Kluey's Bay	9.6	9.4	9.5	3.1
S Cranberry Is	9.2	9.6	9.4	2.7

3.4 Other Initiatives of Importance

In addition to the sampling and water clarity measurements over the year, I attended a couple of seminars where information that could be of interest to KLRA members was presented. I've briefly described them below and have also provided links to some of the presentations which are available on-line.

July 26, 2014 : Invasive Species Workshop – Gravenhurst

This was an interactive workshop given by Tracy Logan, FOCA Program Coordinator and David Ryrie, Ontario Federation of Hunters and Anglers. I've inserted some general information from Ontario's Invading Species Awareness Program below to capture some of the material presented in the workshop.

Invasive species are one of the greatest threats to Ontario's biodiversity and the health of our lakes, forests, and wetlands. In 1992, the Ontario Federation of Anglers and Hunters (OFAH), in partnership with the Ontario Ministry of Natural Resources and Forestry, established the Invading Species Awareness Program to address the critical threat that invasive species pose to Ontario's biodiversity.

Since 1992, the program has worked cooperatively to prevent the introduction of invasive species through multiple pathways, including recreational watercraft, use of live bait, and the aquarium, water garden, live food fish, and horticulture industries.

These efforts have resulted in the following successes:

- Engagement of hundreds of community groups and like-minded agencies in invasive species outreach, monitoring, and stewardship activities annually;
- Participation in hundreds of provincial and regionally based events and workshops annually;
- Monitoring of hundreds of water bodies annually by volunteers engaged in Invading Species Watch;
- Early detection of new species invasions through citizen reports to the Invading Species Hotline and Invasive Tracking System within North America, the Great Lakes, and Ontario's inland waters;
- Development of educational materials for invasive species preventions for targeted pathways;
- Distribution of hundreds of thousands of invasive species educational materials annually;
- Training of over 200 technical professionals in invasive species identification and reporting;
- Hiring of over 20 summer staff annually for the Invading Species Hit Squad to deliver on the ground, community-based invasive species education, awareness, and monitoring initiatives;

- Installation of invasive species awareness billboards across the province

The Invading Species Awareness Program answers the Invading Species Hotline (1-800-563-7711) to give the public an avenue to report sightings, seek information, and to request educational material on invasive species.

While there were no specific threats identified for Kahshe Lake, it was apparent that invasive species of aquatic plants, invertebrates, fish and terrestrial plants are gaining a foothold on many areas. For additional information, please follow the link to their web site http://www.invadingspecies.com/

August 28, 2014: Long Term Changes in Surface Water Phosphorus in the Muskoka Haliburton Region – Possible Drivers – Dr. Catherine Eimers – Bracebridge

This was a very technical presentation of Dr. Eimer's PhD research over the past few years. She and her team are trying to understand the reasons (drivers) for some decreasing concentrations of phosphorus in some water bodies. Calcium also is decreasing in some waterbodies. As there was no general conclusion reached at the end of the seminar, it appears that additional research will need to be carried out to determine how watersheds and lakes within them are budgeting total phosphorus and reacting to the changing climate.

However, one possible outcome from changes in lake chemistry involving calcium and phosphorus was recently in the headlines. An article in the Toronto Star referred to jellification by jelly-clad zooplankton on lakes in Muskoka and Haliburton. Dr. Norman Yan (Chair of the Friends of the Muskoka Watershed) responded to say he was taken back as to how alarming jellification was made to sound when it made headlines this week. I've inserted Dr. Yan's response to give this the perspective it warrants.

"I was surprised that some bloggers and journalists have called the jelly-clad Holopedium "Ugly", and one commentator actually called it a fish "parasite". I don't believe any of the paper's co-authors used these words. It is true we called the paper "Jellification…" to highlight a fairly fundamental shift from crusty to jelly-clad species as dominants in the plankton, as we move from a higher calcium (Ca), phosphorus world in our lakes to a lower calcium, lower phosphorus world, but Holopedium is quite lovely to me," says Yan. "It was the study animal in my PhD, and given it needs 20 times less calcium, and 2 times less phosphorus than Daphnia, and survives attacks from invertebrate predators better, it was already widespread in our lakes. Arguably it is a dominant zooplankton species on the Shield. The point of the paper was that it has become more dominant over the last 20-30 years at the expense of its more Ca-needy competitors."

There are indeed a few possible ecological concerns of the change. Yan explains:

"1) We are losing biodiversity here, as several species of Daphnia are losing out to only one Holopedium species;

2) the nutritional value of the large animal plankton is reduced, as Holopedium has a much lower mineral content than Daphnia. The implications of this should be explored, but are not yet known; and,

3) there may well be less food passed up the food chain to fish in our small lakes where invertebrate predators are actually key steps between plankton and fish, because Holopedium is pretty well protected from most invertebrate predators by its jelly coat. When it is eaten, it has lower mineral content."

As of yet, says Yan, there is only one example of a potential direct impact on water takers: that's in Colorado, where one water filtration plant's sand filters are now being clogged by Holopedium and they're spending quite a bit of money to alter their intakes to try to reduce this problem.

In our Muskoka lakes, the absolute abundance of Holopedium has increased by an average of about two fold over the last 20 years, and the relative abundance has increased more, says Yan, while the abundance of 5 species of Daphnia has declined. There are two other, smaller species of Daphnia that need less Ca than their congeners, and they are still doing well, but this won't last if Ca continues to fall, he says.

Still, jellification doesn't mean the end to fish in our lakes. The thing to understand, says Yan, is that "the sky is not falling, but it's not quite the same sky as it once was." No doubt ongoing research and monitoring is critical to the health of our lakes. The upside to the attention raised by The Toronto Star's article this week, says Yan is that it highlights how "research in Muskoka is alerting the world to intriguing and fundamental changes that accompany human interventions in the natural world."

4.0 Evaluation Benthic Monitoring Results for Kahshe Lake

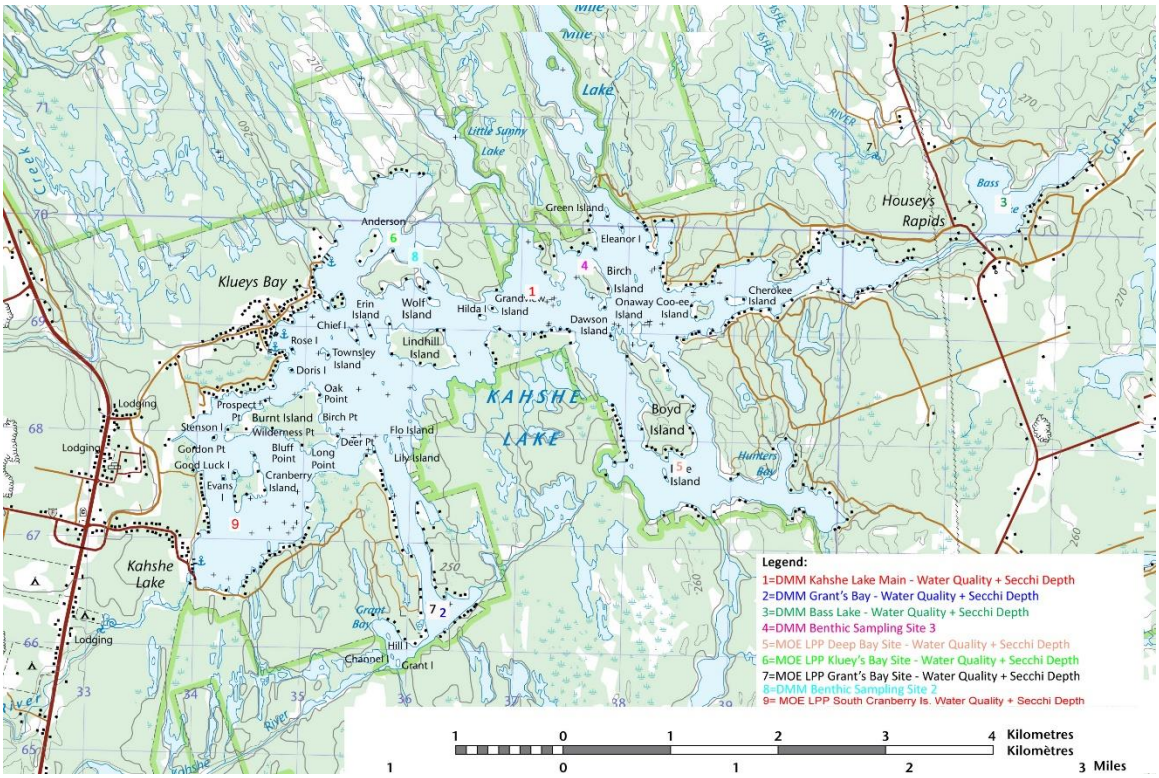
Monitoring bottom-dwelling aquatic invertebrate communities has been carried out by the DMM since 2003. This type of monitoring provides an indirect measure of water quality and habitat disturbance, as the composition of the aquatic-invertebrate community and the relative abundances of different species can be used to evaluate the health of the ecosystem.

Aquatic invertebrates include worms, mollusks, insects, crustaceans, and mites. These animals are sensitive indicators of the health, or condition of lakes and streams, as different species have different sensitivities to environmental changes such as pollution or habitat alteration.

Aquatic invertebrates live from one to three years and are in constant contact with lake sediments.

Monitoring on Kahshe Lake is carried out at two locations as shown on Figure 4 below:

Figure 4: Map Showing Location of Benthic Monitoring Sites on Kahshe Lake



In 2014, the sampling was carried out on August 21 at Site 2 (shown in Figure 4 above as #8). Once three replicates of sediment from the shoreline area were collected by DMM staff member Dylan Moesker, volunteers from Kahshe Lake (Clare Henderson and his son and grandson, Scott and Alex, Paul Henderson, Toby Fletcher, Alex and Joan Milburn, Nancy Purkis and her grandson Finn as well as from the Georgian Bay Turtle Hospital – Miranda Virtanen- got to work in counting the little critters. My wife Gail, kept the coffee flowing and made sure that lunch was ready when the counting was finished.

Kahshe Lake and Scales Nature Park Volunteers on Benthic Counting Day – August 21, 2014

DMM Biotechnician Dylan Moesker Identifying Benthic Invertebrates from Site 2 – August 21, 2014

The results of the sampling from both Site 2 and 3 have been combined and compared to the Muskoka average, which is based on 147 samples from 76 reference lakes between 2004 and 2011. These findings have been presented in a chart on Figure 4. To understand how the sample findings are compared in Figure 4, it is necessary to understand the scoring system which uses indices of organism groupings. This is shown in Table 2 below.

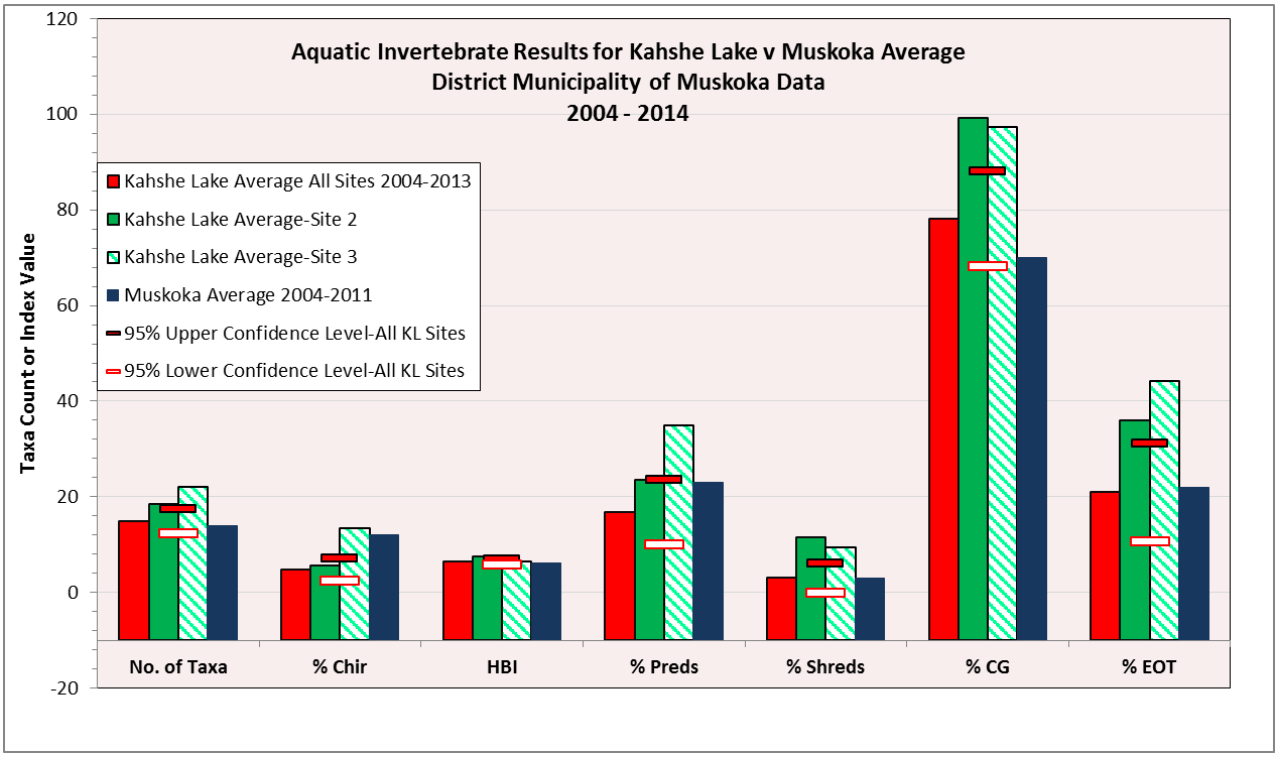
Table 2: Indices Used to Summarize Aquatic Invertebrate Composition in Muskoka

Indicator	What it tells us
Number of taxa collected (Richness)	The number of taxa is a measure of biological diversity. Richness increases with increasing habitat diversity, suitability, and water quality; therefore, the healthier a site's community, the greater its number of taxa.
Percent of collection made-up of midges (% Chironomidae)	Midges (true flies in the family Chironomidae) are tolerant of pollution and habitat changes so their dominance indicates water quality problems.
Organic pollution score (Hilsenhoff index value)	The Hilsenhoff index combines information about the abundances of different types of animals collected at a site with information about those animals' sensitivities to sewage pollution, farm wastes, and other sources of nutrients like phosphorus, nitrogen, and carbon. High values of this index indicate pollution; low values indicate good water quality.
Percent of collected animals that are predators (% Predators)*	In a healthy ecosystem, the numbers of predators and prey are maintained within a narrow range. Extreme fluctuations in this balance signify that the ecosystem is sick.
Percent of collected animals that are adapted to feeding on coarse plant matter (% shredders)*	Shredders are a group of plant eaters adapted to breaking down leaves, wood, and other plant matter that originates on land but gets transported into waterbodies. Such animals should be abundant if there is a good connection between a lake and its watershed. In addition to recycling nutrients, shredders are food for other animals.
Percent of collected animals that are adapted to feeding by collecting small pieces of organic matter (% collector/gatherers)*	Collector-gatherers feed on small pieces of organic matter that arise from the processing activities of shredders (described above). Their presence indicates a good population of shredders, which provide them with food. Like shredders, these animals perform a vital role in energy cycling, and are prey for other animals.
Percent of collection made-up of mayflies, dragonflies, damselflies, and caddisflies (% EOT)	Ephemeroptera (mayflies), Odonata (dragonflies and damselflies), and Trichoptera (caddisflies) are very sensitive to pollution and habitat alteration. They should be prominent in healthy ecosystems, but their numbers will decline in response to stress imposed by human activities.

∗ In healthy ecosystems, the proportion of the aquatic-invertebrate community that is made-up of predators, shredders, collector/gatherers, and other animals is maintained within a narrow range. Marked divergences in abundances of any type of animal signifies a stressed ecosystem.

Using these benthic indices, the results for Kahshe Lake have been plotted against the Muskoka average values in Figure 4 below.

Figure 4: Benthic Monitoring Results for Kahshe Lake – 2004-2014



As shown in the comparison chart above, the average benthic index values from both sites on Kahshe Lake (solid red bars) are, in all but one case, similar to those of Muskoka lakes chosen by the DMM as reference values (solid blue bars). This makes sense, as both sites on Kahshe Lake have been identified by DMM as components of the Muskoka reference site database.

- When the variability in the Kahshe Lake data (based on the average of both sites [solid red bars]) are considered by showing the upper and lower confidence levels (to represent the expected range in mean concentrations at the 95% level of confidence), all the indices except one are further shown to be within the expected range based on the Muskoka reference site comparisons.

- The exception to these findings is for the % Chironomidae (% Chir), where the average Muskoka value is higher than the corresponding average value for Kahshe Lake. However, as shown in Table 2 above, Chironomidae are considered tolerant of pollution and habitat changes, so the marginally lower value for the Kahshe Lake data is actually desirable.

- Based on these findings, the benthic monitoring results from sampling on Kahshe Lake over the period from 2004 to 2014 have not identified any problems in the growth and survival of aquatic invertebrate which can be related to contamination or habitat disturbance.

5.0 Summary and Conclusions

In accordance with the goals and objectives which have been set for the Kahshe Lake Steward by the KLRA, a comprehensive review and analysis of all historical environmental monitoring on Kahshe and Bass Lakes has now been completed and presented within Lake Steward Reports for 2012 and 2013. These documents are posted on the KLRA web-site (**http://www.kahshelake.ca/ne/ls**). This report captures the findings from a limited program of water quality, water clarity and benthic invertebrate sampling in 2014. In addition, discussion is included regarding the MWC's recent Watershed Report Card and on other environmental issues which have been identified in lecture series seminars hosted by the Muskoka Watershed Council in 2014 and attended by the Lake Steward.

What do the sampling and analysis results tell us?

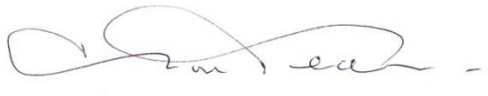
- The sampling of water from Kahshe Lake in mid-May under the MOECC's Lake Partner Program confirmed the continued below threshold level of total phosphorus at all four monitoring locations, including a new site established to evaluate water quality in the more shallow, southwestern part of the lake.
- Similarly, water clarity was essentially unchanged from previous years and at a reasonable level considering the tea-coloured waters of Kahshe Lake.
- The benthic sampling carried out with the assistance of the District Municipality of Muskoka (DMM) at Site 2 in 2014 confirmed that the aquatic invertebrates of Kahshe Lake are well within the normal range for species richness and all other indicators of potential water impairment.

What's happening in the field of water quality research and trends in environmental quality?

- The MWC's watershed report card for the Kahshe River Sub-Watershed was published in 2014 and for the first time identified a potential vulnerability for fish habitat in lakes located within this watershed area. This was based on air photo observations showing a decline in the percent of the shoreline and shallow water zones in lakes that have been left in a natural condition. While this information covers all lakes within the Kahshe River sub-watershed and is therefore, not specific to Kahshe or Bass Lakes, any loss of near shore fish habitat has the potential to impact fish survival rates and the ecological health of the aquatic environment.
- The study of interrelationships between water chemistry and the growth and survival of aquatic organisms within the aquatic food web continues to explore how long-term changes in water chemistry, temperature and other factors are being driven by our changing climate. While it is premature to speculate on the outcome of these long term studies, it is nevertheless important to track these findings and to be cognizant of their potential impact on the waters of our lakes.
- It is also important for us to be vigilant in our development activities to minimize shoreline disturbance and to guard against the introduction of invasive species.

Based on the above summary, we need to continue with our sampling efforts and practice overall lake stewardship to delay the onset of nutrient enrichment and its impact on lake health. As such, each of us needs to do our part to maintain the quality of the water by:

- managing our septic systems properly and having tanks pumped out regularly;
- avoiding the use of products containing phosphorus (detergents and cleaners);
- disposing of toxic wastes (batteries, paint, oil, old gas, pressure-treated lumber and other construction waste) at approved land fill sites;
- minimizing near-shore removal or management of vegetation and ensuring that any shoreline disturbance is conducted in strict compliance with permitted uses;
- avoiding the use of any chemical fertilizers and pesticides in areas close to the shore; and,
- taking precautions to minimize the potential for introducing both terrestrial and aquatic invasive species.



Ron Pearson

Kahshe Lake Steward

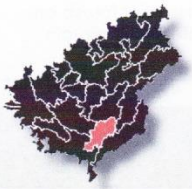
Attachment

2014 Muskoka Watershed Report Card for the Kahshe Lake Sub-Watershed.

2014 MUSKOKA WATERSHED
REPORT CARD

KAHSHE RIVER
SUBWATERSHED

GRADES	
Land	Vulnerable
Water	Not Stressed
Wetlands	Not Stressed
Biodiversity	Not Stressed



The Kahshe River Subwatershed is 24,619 hectares in size. Kahshe Lake itself is 8.3 km² in area and there are 20 additional lakes over 8 hectares in the subwatershed.

The Kahshe River Subwatershed is located in the southeastern portion of The District Municipality of Muskoka in the Town of Gravenhurst. Approximately 5% the subwatershed is developed and 28% of the subwatershed is Crown land.

There are no major urban areas within the subwatershed and rural and shoreline residential development comprises most of the land use. 16% of the subwatershed is protected through provincial parks, crown nature reserves, or local land trusts.

*This report card describes the health of the land, water, wetlands and biodiversity of the Kahshe River Subwatershed and is part of the **2014 Muskoka Watershed Report Card** available at www.muskokawatershed.org.*

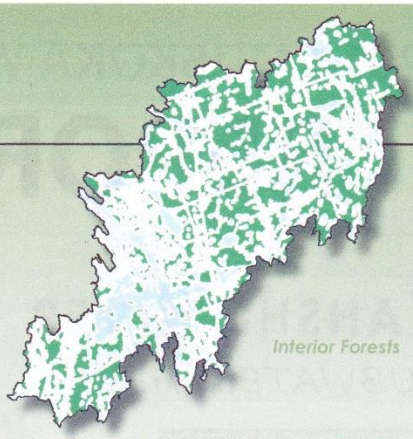
Stewardship Works!

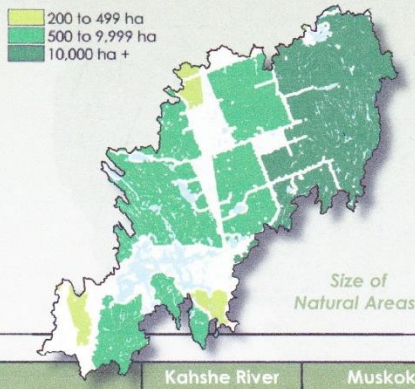
Muskoka WATERSHED COUNCIL

Land:

- Not Stressed
- ✓ Vulnerable
- Stressed

The Kahshe River Subwatershed is located south of the urban area of Gravenhurst and flows in a south-westerly direction into Sparrow Lake. The subwatershed is moderately sized and Kahshe Lake is the largest lake in the catchment. Mixed forest dominates the subwatershed with development focused along the shoreline, the Highway 11 corridor, and in the rural area along existing roads. The development pattern has resulted in a fragmented landscape with reduced interior forest habitat, which is an important landscape feature that supports local biodiversity. Natural areas are also important to help support local biodiversity, purify the air, maintain good water quality and provide a carbon sink.





78% of the subwatershed is privately owned and it is important to encourage a strong private land stewardship program to ensure that the long-term health of the subwatershed is maintained as development occurs. Private land stewardship activities such as participation in MFTIP, CLTIP, and donations to land trusts are encouraged to maintain the values enjoyed in this subwatershed.

Both healthy riparian areas and interior forests are important to support local wildlife and maintain good water quality.

Indicator	Kahshe River Subwatershed		Muskoka Watershed		Description
	Value	Grade	Value	Grade	
Size of Natural Areas	72%	Vulnerable	79%	Vulnerable	Areas of natural cover that are 200 ha or greater. Natural cover includes forest, lakes, rock barrens and wetlands.
200 - 499 ha	4%		7%		
500 - 9,999 ha	38%		52%		
10,000 ha +	30%		20%		
Interior Forest	34%	Vulnerable	58%	Not Stressed	Interior forest is a forested area with a 100-metre forested buffer surrounding it.
Road Density	0.43 km/km^2	Not Stressed	0.51 km/km^2	Vulnerable	Road density is a measure of the degree of fragmentation of the landscape. Roads are a primary cause of death of many species, especially turtles and snakes.
Level of Development	5%	Vulnerable	5.4%	Vulnerable	Level of development is the percent of the watershed in urban or rural development. When more than 10% of a watershed is developed, lake and stream health may be impacted.
Shoreline Density	<13 lots/km	Not Stressed	N/A	N/A	Shoreline density is an indicator of the human stress on a water body. This stress includes nutrient loading, crowding, aesthetic appeal, and habitat impacts.
Shoreline Buffer	75-85%	Vulnerable	75%	Vulnerable	Shoreline buffer is the percent of unaltered lot area from the water's edge 20 metres inland. The shoreline buffer is the last line of defense against the forces that may otherwise damage a healthy lake.

Water:

- ✓ Not Stressed
- ○ Vulnerable
- ○ Stressed

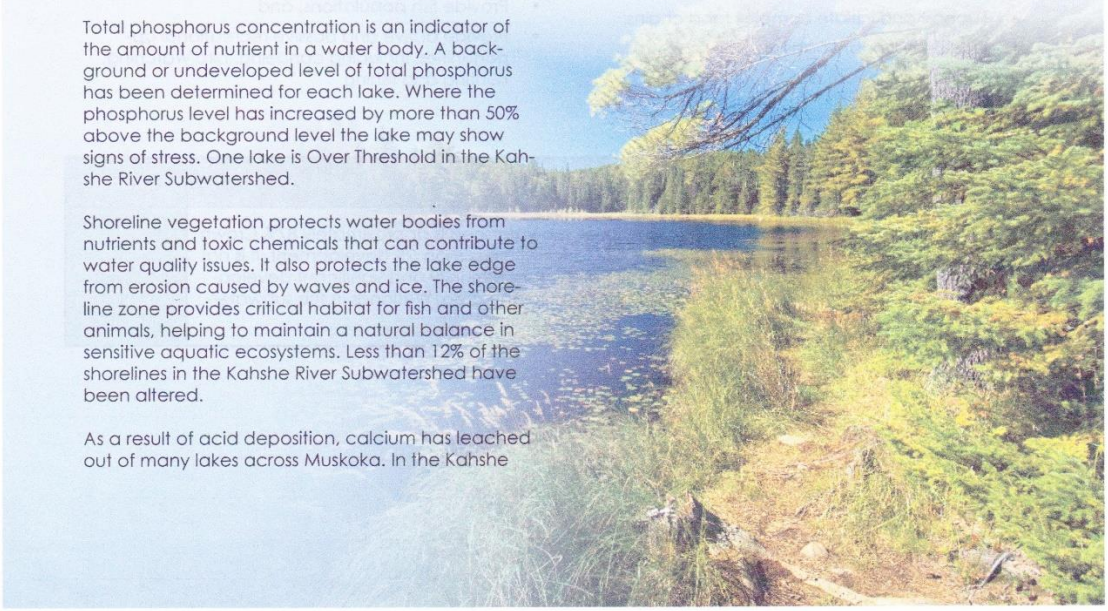
Indicator	Kahshe River Subwatershed		Muskoka Watershed		Description
	# Lakes	Grade	# Lakes	Grade	
Total Phosphorus Concentration	11	Not Stressed	129	Vulnerable	The amount of total phosphorus in a lake is a measure of recreational water quality as phosphorus is generally the limiting nutrient in algae production.
< BG + 30%	9		73		
BG + 30% to BG + 50%	1		27		
> BG + 50%	1		29		
Algae		Not Stressed		Not Stressed	The propensity for algal blooms is the percentage of lakes with TP greater than 15 µg/L and are over threshold.
Fish Habitat (% Unaltered)	75-90%	Vulnerable	91	Not Stressed	This is a measure of fish habitat. Many fish species require the overhanging vegetation, rock shoals, and aquatic vegetation generally found in undisturbed sites.
Calcium Levels	11	Not Stressed	377	Vulnerable	Calcium is an important nutrient for the development of bones and exoskeletons. As a result of acid precipitation, calcium has been leeched out of the forest soils and is now also in decline in many of the lakes in the watershed threatening the continued presence of important lake species.
< 1.5 mg/L	2		161		
1.5 - 2.0 mg/L	3		138		
> 2.0 mg/L	6		78		

The Kahshe River is located in the south of Muskoka. Access to the area was available earlier than other areas of the District and many of the lakes were developed as early as late 1800's and early 1900's.

Total phosphorus concentration is an indicator of the amount of nutrient in a water body. A background or undeveloped level of total phosphorus has been determined for each lake. Where the phosphorus level has increased by more than 50% above the background level the lake may show signs of stress. One lake is Over Threshold in the Kahshe River Subwatershed.

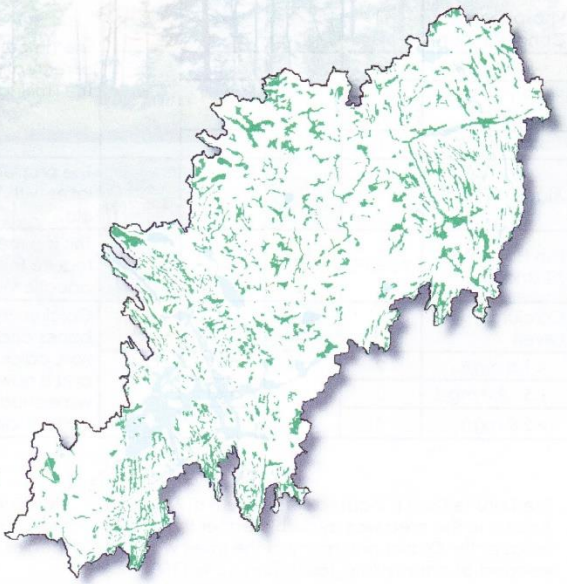
Shoreline vegetation protects water bodies from nutrients and toxic chemicals that can contribute to water quality issues. It also protects the lake edge from erosion caused by waves and ice. The shoreline zone provides critical habitat for fish and other animals, helping to maintain a natural balance in sensitive aquatic ecosystems. Less than 12% of the shorelines in the Kahshe River Subwatershed have been altered.

As a result of acid deposition, calcium has leached out of many lakes across Muskoka. In the Kahshe River Subwatershed, two lakes have less than 1.5 mg/L, which is the critical level for survival for several species.



Wetlands:

- ✓ Not Stressed
- Vulnerable
- Stressed



The Kahshe River Subwatershed is comprised of almost 12% wetland area. Wetlands are recognized by all levels of government as important components of a healthy environment. Wetlands and the area that surrounds them provide continuous, sustainable environmental, economic and social benefits that contribute to the high quality of life in Muskoka. Most species at risk native to Muskoka rely on wetlands for all or a portion of their life cycles.

Wetland Values

- Control and storage of surface water and recharge groundwater;
- Maintain and improve water quality, aid in flood control, and protect shorelines from erosion;
- Trap sediments which would otherwise fill watercourses;
- Support and initiate complex food chains;
- Provide important habitat;
- Support species at risk;
- Provide fish populations; and
- Provide active and passive recreational opportunities, including canoeing, bird watching, hunting and fishing

Subwatershed Name	% Wetlands	Comment	Grade
Kahshe River	11.81	The Kahshe River Subwatershed is approximately 87% Crown and protected lands with less than 5% development. It is not close to a developing community and significant development is not planned for the area. Wetlands in this subwatershed are in good condition.	*Not Stressed*

Biodiversity:

- ✓ Not Stressed
- ○ Vulnerable
- ○ Stressed

Biodiversity refers to the richness of life in the environment – the number of different species, their genetic variability, and the extent to which different groups of species occur from one place to another within the region.

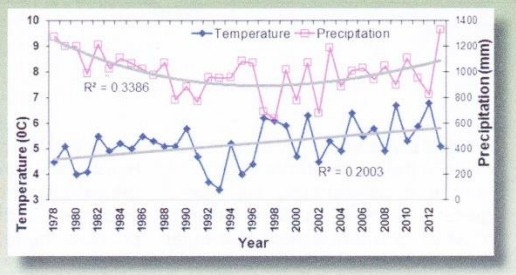
Muskoka is blessed with a rich biodiversity primarily because of the extensiveness of its natural ecosystems. This biodiversity provides the resilience necessary to withstand environmental change and to continue to function normally and provide the environmental goods and services on which we and other species depend.

Indicator	Kahshe River Subwatershed		Muskoka Watershed		Description
	# Species	Grade	# Species	Grade	
Species at Risk Habitat	19	*Not Stressed*	22	*Vulnerable*	The number of different types of species at risk habitat in the subwatershed. Subwatersheds with habitat for more types of species at risk are more vulnerable to development or other stressors.
Endangered	3		5		
Threatened	6		7		
Species Concern	10		10		
Alien Invasive Species*	No Observations	*Not Stressed*	10	*Stressed*	Maintaining the diversity of native species is important to a healthy watershed. Invasive species often out-compete native species and significantly reduce the biodiversity of an area.

* Includes the Spiny Water Flea in the large recreational lakes. Spiny Water Flea will collapse the biodiversity of a lake.

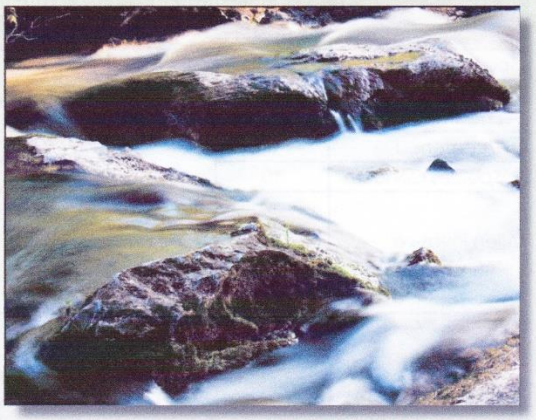
Changing climate: temperatures continue to rise

The mean temperature showed a clear and moderate increase or warming over 1978 to 2013, about 0.35 degree increase per 10 years, or a warming of 1 degree within 30 years. The annual precipitation had a significant decrease during 1978-1998 and then a weak increase during 1999-2013.
(Dorset Environmental Science Centre)



Stewardship Works: help protect the watershed

When all is said and done, the fate of sustainable management of Muskoka's watersheds lies in large part in the hands of local residents as they go about their day-to-day lives. It is the citizens of Muskoka who must generate the interest and enthusiasm to create, continue and expand local projects which lead to positive actions and results.



Stop the spread of invasive species

- Purchase non-invasive or native plants from a reputable dealer.
- Never dispose of domestic plants or animals into the wild.
- Inspect and wash your boat, ATV and other equipment and let dry for at least 6 hours before moving to a new lake or area.
- Do not move species from one area to another.

Retain buffers and leave shorelines in a natural state

- Maintain a wide buffer of native plants and trees around shorelines of lakes and rivers.
- Minimize boat speed (eliminate wake) in all near-shore areas and particularly in areas with known loon nests.
- Avoid grassed lawns in the waterfront area and mini- mize use of fertilizers.

Protect wetlands

- Leave wetlands alone.
- Keep recreational vehicles out of wetlands. Explore by kayak or canoe instead.

Maintain natural areas

- Limit cleared areas in the rural and waterfront area.
- Do not create new roads.

Reduce your personal impact

- Reduce your use of electricity and fossil fuels.
- Maintain your septic system.
- Improve the energy efficiency of your home and vehicle. Treat electricity as a luxury.
- Reduce waste by reusing, reducing, composting and refusing to buy items with excess packaging.