WATER

Recreational water quality, drinking water quality, and water within the natural system, including the health of aquatic species such as fish are the fundamental base of a healthy watershed. As people live and work around lakes, they impact and change the lake ecosystem. Some of these changes may be beneficial and others may degrade the natural systems upon which both humans and other species rely. The report card uses a variety of indicators to identify present and potential stresses on lake systems and to evaluate the health of our water resources.

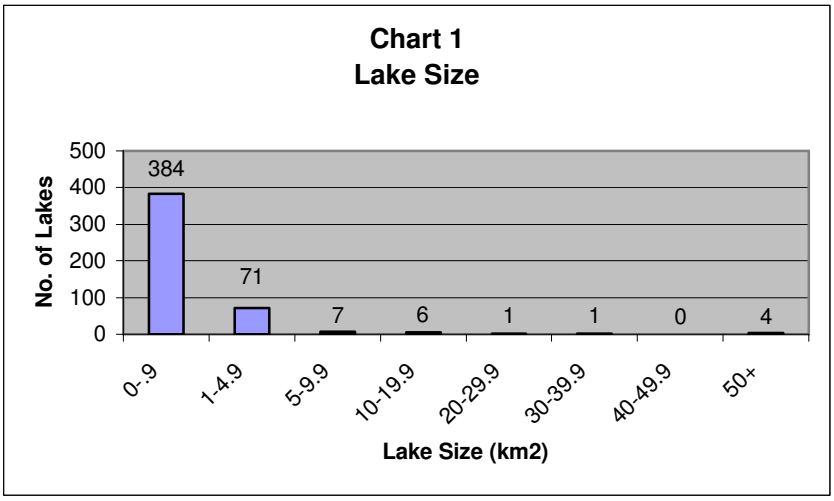
Indicators of the health of the water in Muskoka include:

1. Recreational Water Quality
    a. Nutrient enrichment
    b. Lake sensitivity
    c. Changes in lake clarity
    d. Bacteria levels in surface water
    e. Changes in algal communities
    f. Impact of acid deposition
2. Drinking Water Quality
    a. Municipal drinking water systems
    b. Private drinking water systems
    c. Source Water Protection
3. Aquatic Habitat
    a. Fish habitat
    b. Impact of shoreline development
4. Stewardship activities
    a. Lake Associations
    b. Municipal action

Background

Lake Size

There are over 500 lakes in this geographic area that range in size from very large and deep to very small and shallow. Chart 1 illustrates the range in lake size across the watersheds. Each lake has its own characteristics and natural healthy equilibrium; therefore, in evaluating the health of a lake it can only be compared to itself as it changes over time and should not be compared to other lakes.



Recreational Water Quality

Recreational water quality is the quality of the water in lakes and rivers used by people to enhance recreational pursuits such as swimming, boating, fishing and aesthetic enjoyment. The standard indicators of good recreational water quality used across Ontario have been adopted as reliable indices for the Muskoka Watersheds Report Card and include phosphorus levels, water clarity, bacteria levels and acid deposition.

Lakes in Muskoka are generally in good to very good condition for recreational use as defined by the number of algae blooms and background bacteria levels. It is important to note, however, that lakes are

changing and that scientists do not completely understand the processes that are currently occurring. In general, data are becoming more chaotic and long-term trends are not as predictable as previously observed. As noted below, some indices suggest signs of improvement while others indicate deterioration. It is generally agreed that climate change is affecting natural processes, therefore, intact natural systems, as we enjoy in Muskoka, will be critical in adapting to the projected changes in climate for this area.

Nutrient Enrichment

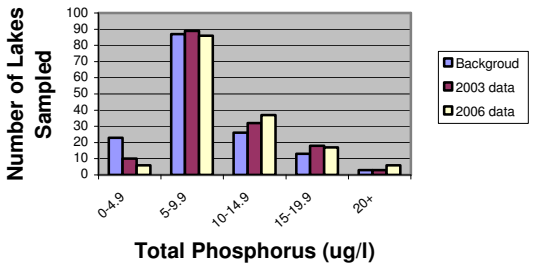
Phosphorus is the nutrient that controls the growth of algae in most Ontario lakes. For this reason, a change in phosphorus concentration in a lake impacts the types of algae that live in the lake and the potential for algae blooms. Algae blooms detract from recreational water quality and in some cases affect the habitat of coldwater fish species such as lake trout.

The District Municipality of Muskoka has monitored over 180 lakes across the District for over twenty-five (25) years for Secchi depth and phosphorus levels. Even with this long-term data set, it is difficult to understand changes and trends that might be occurring. Phosphorus levels in a lake will naturally vary between years as a result of such factors as precipitation, wind, and levels of sunlight. Scientists are also starting to understand that climate change is also affecting phosphorus levels. In order to understand trends in phosphorus concentration detailed studies that relate all these factors to variables such as development, invasive species and other human impacts would be necessary.

In any watershed, there is also a natural variation in phosphorus concentration from lake to lake as a result of such variables as lake size, amount of wetlands, and flow characteristics. This variation should be maintained over time as development and other changes occur. Chart 2, graphs the variance in phosphorus concentration across the watershed. The long-term objective is to maintain the same number of lakes with 3, 9, 15 and 20ug/l[2] of phosphorus, as there would be without development. As the bars on the graph move to the right the lakes are experiencing higher phosphorus concentrations, which might result in more algae blooms. As the bars shift to the left the lakes are experiencing lower phosphorus concentration, which might result in a loss of lake productivity and lead to stress in aquatic animals. Neither situation is desirable or healthy for the long-term life of the lake.

Chart 2 illustrates that there has been a gradual shift in long-term phosphorus levels to the right, which indicates a slight increase in phosphorus concentrations over the undeveloped standard. However, improvement is occurring and over the last twenty years, phosphorus in over 60% of the lakes in Muskoka has remained constant or has decreased.

Chart 2
Total Phosphorus Comparison
Pre-development to 2006 Monitored Data



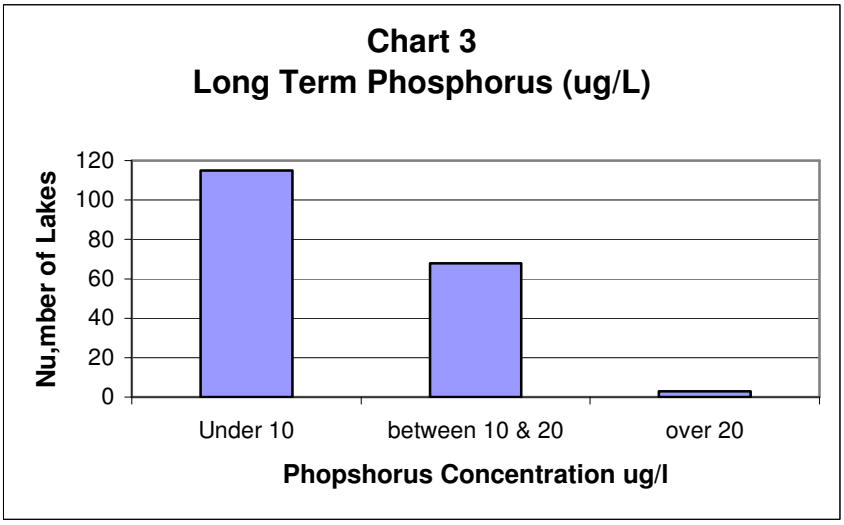
[2] ug/l means micrograms per litre and is equivalent to parts per billion (ppb). This would represent one grain of sand in one billion grains of sand.

Data collected by the Ministry of Environment over a wide series of lakes across all of Ontario indicate that many lakes are experiencing a decrease in phosphorus. The mechanism for this decrease is not completely understood but the multiple stresses of climate change and acid deposition are considered to be a contributing factor. Long-term studies are required to truly understand the complex nature of such trends.

Paleo core samples indicate that in some cases, the present day concentration of phosphorus on some lakes in Muskoka is below that experienced before European development on the lake.[3] The data collected by the District of Muskoka over the last twenty years also indicates that some lakes are decreasing in phosphorus concentration. In fact, forty-seven lakes in Muskoka have a long-term phosphorus average of less than the predicted background or undevelopment value for that lake.

This apparent contradiction in data makes it hard for lake managers to develop effective programs and predict the impact of management decisions. Further monitoring of lake system changes is required to fully understand many of these trends.

Chart 3 illustrates that sixty-two percent (62%) of lakes in the watershed are considered oligotrophic, or nutrient poor, and have phosphorus concentrations of less than 10 ug/l[4]. These lakes are considered excellent recreational lakes and are highly valued for cottage development. Thirty-five percent (35%) of the lakes are considered mesotrophic, or moderately enriched, and have phosphorus concentrations between 10 and 20ug/l. These lakes tend to be smaller and support warm water fish species and more diverse shoreline habitat. Three percent (3%) are considered eutrophic, or enriched, and have phosphorus concentrations over 20ug/l. These lakes naturally have elevated levels of phosphorus based on natural watershed inputs.



Lake Sensitivity

The single most significant impact on water quality on most recreational lakes and rivers in Ontario is the increased levels of phosphorus that are entering surface waterbodies. Sources of phosphorus are both natural and man-made. Natural sources of phosphorus include such things as precipitation and natural drainage from the watershed. Man made sources of phosphorus include increases in overland flow as a result of disruption in the natural vegetation (leading to erosion) in and beyond the riparian zone, use of

[3] Cornelisse, K.J. and Evans, D.O. The Fairy and Peninsula Lakes Study, 1994-1998: Effects of Land Use on the Aquatic Ecosystem.
[4] ug/l means micrograms per litre and is equivalent to parts per billion (ppb)

fertilizers, increased stormwater run-off from impervious surfaces and effluent from septic systems and sewage treatment plants.

The province of Ontario takes a strategic approach to managing the recreational water quality of lakes. The Provincial Water Management Guidelines state that to avoid nuisance concentrations of algae in lakes, total phosphorus concentrations should not exceed 20 ug/l. The guideline goes on to state that a high degree of protection against aesthetic deterioration will be provided by a phosphorus concentration of 10 ug/l. It is recommended that this lower standard should apply to all lakes that are naturally below 10 ug/l.[5]

The District of Muskoka has taken a more pro-active approach to protecting recreational water quality and has established lake specific water quality standards that will protect the long-term health of the water resources in the watershed.

Based on the recreational water quality model as detailed in the report prepared by Gartner Lee Limited in 2005 entitled *Recreational Water Quality Management in Muskoka*, the lakes and rivers in Muskoka have been classified as having high, moderate or low sensitivity to phosphorus. This classification is based on the responsiveness of a waterbody to phosphorus and the mobility of phosphorus within the watershed. A lake's classification will not change.

Lakes of low sensitivity respond only minimally to the input of phosphorus and it is unlikely that development related phosphorus will increase concentrations by more than 50% of the undeveloped phosphorus load. Where shoreline vegetation is maintained, lakes of moderate sensitivity have some ability to receive phosphorus without a significant decrease in water quality. Where a lake is classified as being of high sensitivity, there is the potential for development to input more phosphorus into a lake than it can sustain, causing the measured phosphorus levels to increase beyond the acceptable threshold.

Where the phosphorus loading to a waterbody exceeds 50% of the undeveloped phosphorus load, the lake or river is considered as being "Over Threshold" for phosphorus loading. "Over Threshold" lakes require a higher level of development control as a precautionary action to protect the long-term health of the lake.

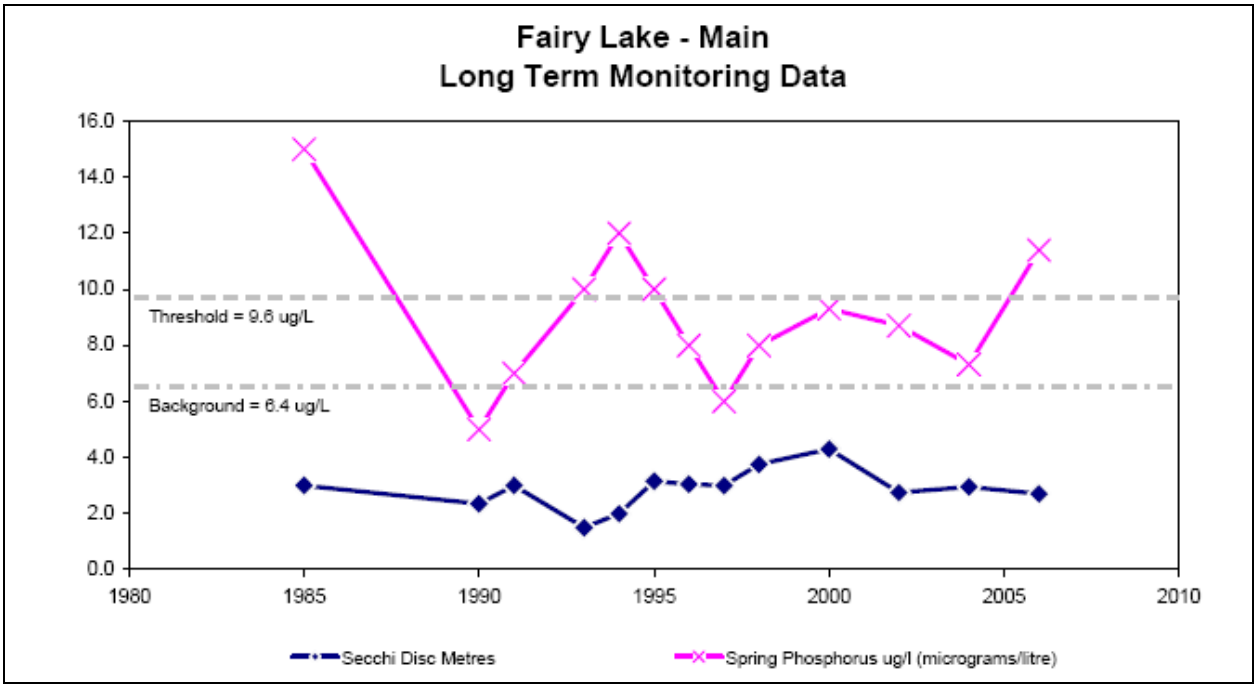
Figure 1: Fairy Lake Data, illustrates both the background, or undeveloped phosphorus level and the threshold level of phosphorus that should not be surpassed for the lake. As is typical with most lakes, the Fairy Lake data has a high degree of variability from year to year. However, it is the long-term average of those annual data that is important. For Fairy Lake, the background level of 6.4 ug/l and the threshold level of 9.6 ug/l define the healthy zone. The long-term phosphorus average for Fairy Lake is 9 ug/l and falls within that healthy zone. This lake specific standard is below the provincial standard of 10 ug/l.

Muskoka has long-term monitoring data for approximately 183 lakes. Of those lakes, 142 lakes meet the stringent local water quality standard or threshold. As noted above, this standard is considerably more restrictive than current provincial standards and is used in a pro-active fashion to 'red flag' potential water quality concerns. When a lake is identified as exceeding its threshold value, a higher level of care is exercised during development and redevelopment, as a precautionary action, to protect the long-term health of the lake. The Province would not consider any of the forty-one (41) lakes that do not meet this local standard to be a water quality concern.

Where a lake has been identified as exceeding its threshold for phosphorus, Muskoka recommends that remedial action plans be prepared to address significant sources of human phosphorus. Currently remedial action plans are being developed for several lakes.

[5] Ontario Ministry of the Environment, Water Management: Policies, Guidelines and Provincial Water Quality Objectives, July 1994.

Figure 1: Fairy Lake Data



Programs have also been undertaken in Muskoka Bay in Gravenhurst and Long Lake in Muskoka Lakes where the municipal sewage treatment systems have been removed from those waterbodies and they are now beginning to recover. Several other lake associations have expressed an interest in developing stewardship programs and understanding the dynamics of their lakes in order to reduce human sources of phosphorus.

In summary, the water quality in area lakes is very good and the planning controls in place in each municipality should maintain that quality as development occurs. A comparison of the amount of development around a lake and the change in phosphorus concentration can provide some insight into this relationship. If the change in total phosphorus increases as development increases, it would indicate that development might be driving the phosphorus change: this is not the case.

A statistical comparison of development on the monitored lakes in Muskoka and the change in total phosphorus levels for those lakes demonstrates that there does not appear to be a significant relationship between the two. In other words, both the positive and negative changes in phosphorus levels in the lakes in Muskoka do not appear to be directly related to increases in development.

In summary, the above charts indicate the following:

1. Over 50% of lakes in Muskoka naturally have less that 10 ug/l total phosphorus and will generally not support excessive algae growth.

2. On average, lakes have slightly more phosphorus today than pre-development levels. However, over the last twenty years, phosphorus in over 60% of lakes has remained constant or has decreased.

3. Of a total of 183 lakes in Muskoka with data, 142 lakes meet the stringent local water quality standard. Of the 41 lakes that do not meet this standards:
   - 21 lakes have long-term phosphorus concentrations of less than the provincial standard of 10 ug/l.

- 16 lakes have a decreasing trend in phosphorus levels

4. Development does not appear to be the sole driver in increases in phosphorus levels.

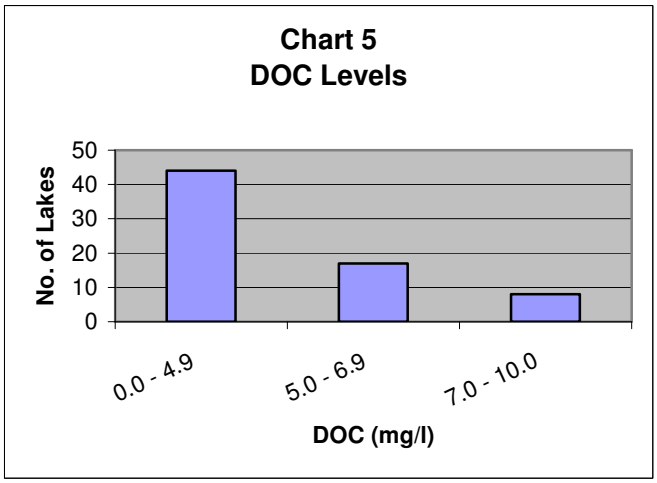
5. 47 lakes (26%) have a long-term phosphorus average of less than the predicted phosphorus level if the lake was undeveloped.

It is recommended that the watersheds be left as natural as possible in order to be able to buffer any stress in the future.

Lake Clarity (Secchi Depth) and Colour (DOC)

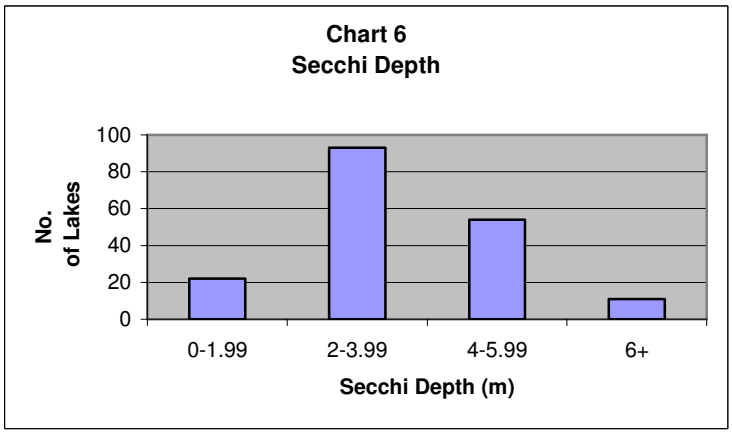
Secchi depth is a measurement of water clarity. In Muskoka, the major determinant of water clarity may be either natural colour, determined by dissolved organic compounds (DOC) or an increase in nutrient input from the surrounding watershed.

A lake may naturally be a brown colour due to high levels of DOC that comes from wetlands in a watershed. DOC colours lakes brown and reduces water clarity, but is not an indication of nutrient enrichment. Examples of lakes with naturally low clarity because of high DOC content include Brandy Lake and Tea Lake. These lakes tend to be smaller and have Secchi depth readings of less than two (2) metres. Chart 5 illustrates that thirty-seven percent (37%) of lakes in Muskoka have a reading of 5 ug/l or higher DOC, which indicates that they are moderately to significantly coloured.

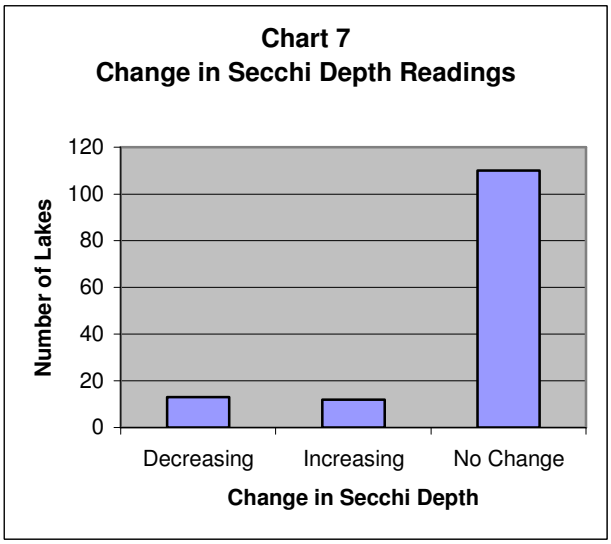


Water clarity can also decrease as nutrients from the surrounding watershed enter and enrich the lake, resulting in high levels of suspended sediments or algal growth.

Water clarity can change weekly or yearly as a result of weather, length of winter ice cover, shoreline development, natural seasonal trends or other impacts. However, when the primary determinant of water clarity is a function of nutrient enrichment, a long-term trend that indicates a reduction in water clarity is an indication of reduced water quality. Charts 6, indicates that lakes in Muskoka that are not influenced by DOC tend to be clear with Secchi depths of more than four (4) metres. Thirty-six percent (36%) of lakes have a sechhi depth of four (4) metres or greater.



Muskoka has monitored lake clarity for over twenty-five years. These data (Chart 7) show that the clarity on ninety percent (90%) of lakes has either stayed the same or improved over that time period. Specifically, eighty percent (80%) of the lakes have not had a significant change in their Secchi depth reading, while nine percent (9%) have increasing water clarity. Nine percent (9%) have seen a decrease in water clarity. Several lakes in this third category are small and have high DOC readings and higher natural levels of enrichment. The constant level of water clarity reflects the excellent recreational water quality experienced across the watershed and the naturally low levels of phosphorus in lakes.
In reviewing the District of Muskoka Secchi depth data, only one lake stands out as an anomaly having low DOC and a low Secchi depth reading.[6] A remedial action program is already being implemented on this lake to address the issue of increases in phosphorus loading as a result of development and other human activity.



Bacteria Levels

Since the *E.coli* outbreak in Walkerton in the spring of 2000, there has been an increased interest in bacteria levels in lakes. The term bacteria refers to a wide range of microorganisms, many of which cause disease. Groups of bacteria, called indicators (total coliform, *E.coli*) occur at higher concentrations in the intestinal tract of both people and animals and can be used to identify possible areas of contamination.

From a health perspective, there is an interest in bacteria levels because of the possible illness or diseases that may result from drinking or swimming in contaminated areas. Recently, there has been an increase in the interest in using the trends in bacteria levels to understand the long-term impact of shoreline development and other human activities on recreational water quality. The Provincial standard for *E.coli* for full-body contact recreational use is 100cfu/100ml and is an indicator of the level at which there is a significant human health risk.

Several lake associations across Muskoka have identified a local standard of 10cfu/100ml as a more appropriate indicator of a change in water quality. This lower standard is based on several years of local testing that confirms that the background levels of *E.coli* in the recreational waters of Muskoka are consistent with undeveloped areas (<5cfu/100ml). Monitoring results from over 70 sites across Muskoka confirm that bacteria levels in shoreline residential areas are less than 10cfu/100ml and are generally less than 5cfu/100ml. Higher *E.coli* readings are more probable near marinas and in more densely developed areas like Honey Harbour and adjacent to some trailer parks.[7] Municipalities should be encouraged to explore programs to address these areas of higher bacteria concentrations.

[6] The District of Muskoka Planning and Economic Development Department, 2006 Lake System Health Monitoring Program, Year End Report and Data Report, October 2006.

[7] Schiefer, K. and Schiefer, K, Water Quality Report 2005, Township of Georgian Bay, GBA Foundation, December 2005. and LURA consulting, Muskoka Lakes Association, Water Quality Initiative, Summary report 2005, Monitoring Program, 2005. and Cumming D, Lake of Bays Association 2004-2005 Data, unpublished data and Jim Marshall Peninsula Lake Data, 2004 –2005 unpublished.

Very preliminary testing of stormwater in urban areas indicates that very high bacteria counts can also be expected in near shore areas after storm events where the stormwater drains off parking lots or other hardened surfaces.

By monitoring lakes using this more stringent standard, areas that have consistently higher *E.coli* readings or have an increasing trend in *E.coli* levels can be identified.

There are several limitations to using bacteria as an indicator of water quality. In order to understand the data collected these need to be understood.

1. The level of indicator bacteria detected in water will usually decrease with time and distance from the pollution source. This means that any results are both site and time specific. If the discharge is stopped, the problem will disappear over a short period of time.
2. As with any data collection, one high reading does not necessarily constitute a significant concern. Data must be analyzed over time and with a series of results in order to understand the long-term trend and any management implications.
3. Volunteer-based monitoring that uses a home-test kit approach is a good method to identify possible areas of higher bacteria concentration, however, a scientific level study would be required to truly determine the cause of any specific hotspot and develop a reasonable remedial action plan.
4. Certain areas such as creeks and wetlands have a naturally higher level of bacteria that may not be a result of human activity.

Algae

Algal communities are changing in Canadian Shield lakes although scientists do not have a good understanding of the mechanisms behind these changes. Long-term trends are not evident at this time and this is an area that requires further study.

There is no question that there is a relationship between changes in phosphorus concentration and changes in algal production. However, there have been an increasing number of episodes of algae that thrive in low alkalinity, nutrient-poor lakes like lakes on the Canadian Shield.[8] Detailed study of a series of lakes in the Muskoka/Haliburton area show a marked increase in this type of algae, known as chrysophytes, in more than 90% of the lakes examined. The increase in chrysophytes is a change from the algae blooms that have historically been experienced in the area which would have had a higher percent of diatoms. Chrysophytes result in taste and odour problems that were not traditionally experienced in these lakes.

Rapid increase over the past two decades indicates that these trends are the result of one or more human based stressors that are operating at a broad, regional scale. After studying various factors that might explain this change, the recent studies determined that there was no correlation between lake water pH or increases in total phosphorus and the increase in chrysophytes. The data appeared to indicate that a regional stressor that may be induced through climate change might have more impact on the changes that are being experienced.[9]

Acidic Deposition

The impact that acidic deposition will have on a waterbody is dependant on the buffering ability of the waterbody. Alkalinity is a measure of a lake's ability to buffer the impacts of acid precipitation. The alkalinity of lake water is mostly determined by the geology of the soils and rocks surrounding the lake.

[8] Paterson, A.M., Cumming, B.F., Smol, J.P., Hall, R.I. Marked Recent Increases of Colonial Scaled Chrysophytes in Boreal Lakes: Implications for the Management of Taste and Odour Events. In *Freshwater Biology,* 2004, **49**, 199-207

[9] ibid

Rocks that contain carbonate, bicarbonate, and hydroxide compounds contribute to alkalinity. In addition, other chemical compounds may add to the buffering capacity of water. Limestone, as found in southern Ontario, is an example of a rock that is rich in carbonates, and contributes to alkalinity in lake water. Granite is the opposite in that it does not contain any minerals that contribute to alkalinity, so lakes with granite geology have low alkalinity, and poor buffering capacity. Table 8 indicates that ninety-two percent (92%) of the lakes in Muskoka have an alkalinity reading of less than 20 ug/l, which means that they are susceptible to acid deposition.

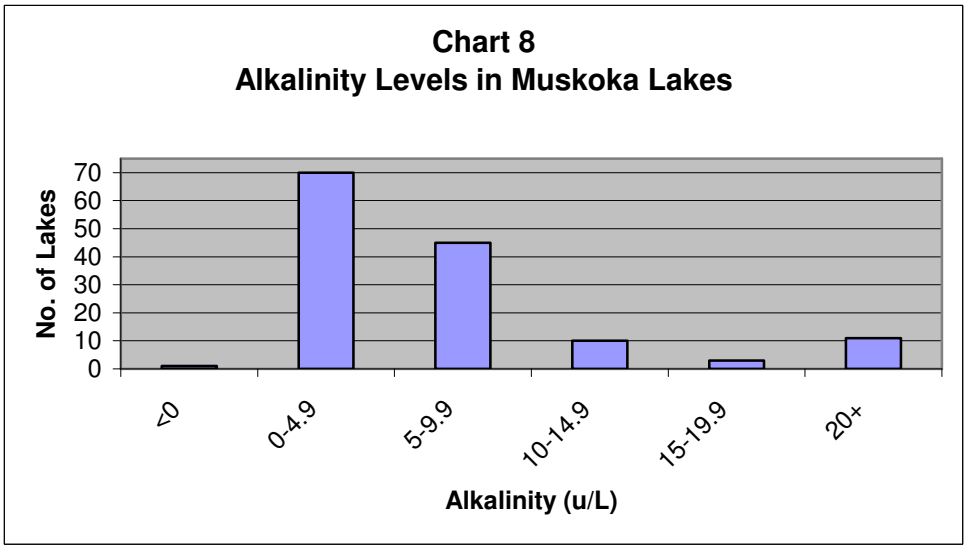
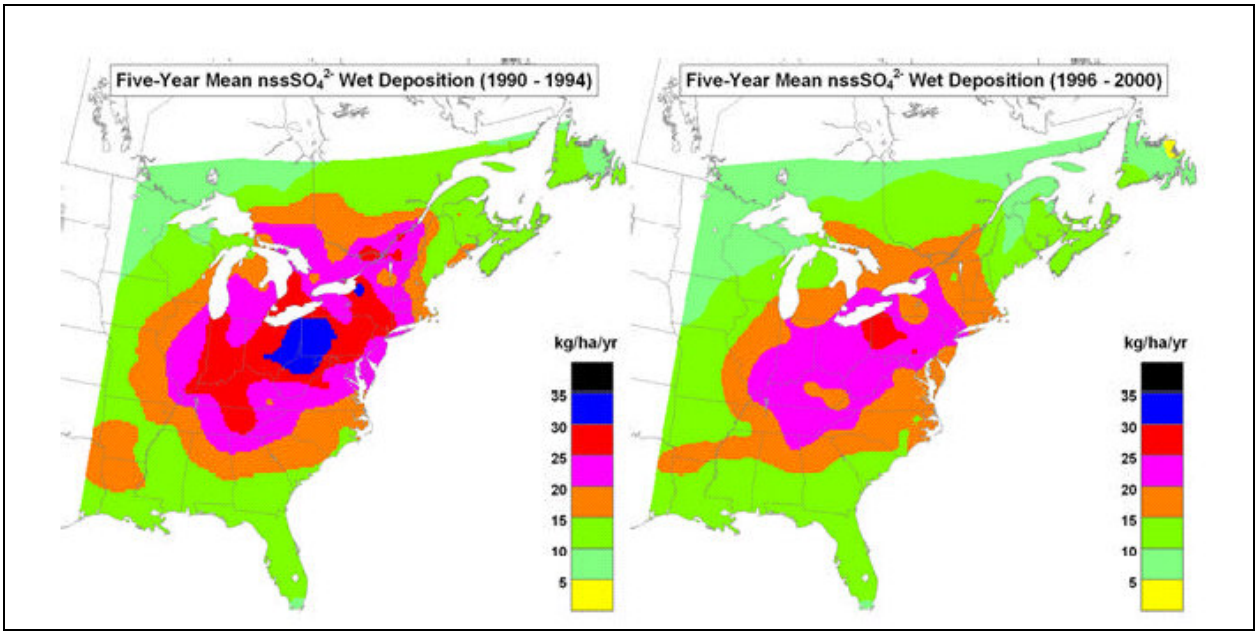


Figure 2: Changes in Wet $S0_4$ Deposition illustrates that significant gains have been made in the reduction of SO_4 across eastern Canada, including in Muskoka/Haliburton/Parry Sound. However, recent studies undertaken in central Ontario indicate that given the current targets (after full implementation of reduction strategies in Canada and United States by the year 2010), the total area of eastern Canada where deposition is expected to continue to exceed the critical load covers almost 800,000 square kilometres, including about 95,000 lakes, and extends from central Ontario through southern Quebec and across much of the Atlantic provinces. Within these areas, many species of fish and other aquatic organisms will disappear entirely from some lakes and be severely reduced in others. The resulting decline in species richness, which is defined as the number of species per lake, is estimated to be between 6% and 15% for fish. Altogether, it is estimated that continuing acidification of these lakes will result in a net loss of nearly 162,000 fish populations alone.[10]

In December 2005, the Canadian Council of Ministers of the Environment (CCME) produced a five-year review of the Canada-Wide Acid Rain Strategy. In it, they indicate that even after all strategies are implemented after 2010, Muskoka will still be receiving 15 to 20 kg/ha/yr of acid deposition. It is estimated that the 'critical load' or the maximum yearly amount of acid deposition that will allow 95% of the lakes within a region to maintain a pH of 6 (acceptable measure of acidity) or more is less than 8 kg/ha/yr for the more sensitive lakes of our watersheds.[11]

[10] Canadian Wildlife Service, Ontario Region, Acid Rain, Effects on Lakes and Birds and Beyond. http://www.on.ec.gc.ca/wildlife_e.html
[11] Environment Canada, State of the Environment Report website, http://www.ec.gc.ca/soer-ree/English

Figure 2: Changes in Sulphate Deposition 1990-1994 to 1996-2000
(Source Ministry of the Environment)



Drinking Water

Municipal Systems

The Sierra Legal Defence Fund recently published its evaluation of municipal drinking water systems in Canada entitled *Waterproof II – Canada's Drinking Water Report Card.* This report gave Ontario an A[-] stating that the province had Canada's best drinking water legislation. Ontario was lauded for its rigorous standards, public transparency and accountability. The only concern expressed was for the slow adoption of source water protection legislation, which was subsequently passed by the legislature in October 2006 and came into force on July 3, 2007.[12]

Provincial regulation requires all municipal plants to maintain this high standard of municipal drinking water. There are nine (9) municipal drinking water systems in the watershed, all located in the District of Muskoka.

As required by provincial legislation, Muskoka annually monitors twelve (12) inorganic parameters, such as mercury and cadmium, and over 55 organic parameters, such as pesticides and fertilizers. There have been no exceedances at any of the plants of either organic or inorganic parameters in the period of review. In addition, Muskoka monitors the raw water, treated water and water in the distribution lines for both e-coli and total coliform. As expected, the raw water will have bacteria counts from time to time, but there have been no adverse readings for bacteria in treated water and distribution system.

Private Systems

Over 50% of the residents in the watershed rely on private, individual sources of drinking water. These sources may either be surface water sources such as a lake or river, or they can be groundwater sources. If the water source is a drilled well, then the Health Unit recommends routine monitoring but does not

[12] Sierra Legal Defence Fund, Waterproof II – Canada's Drinking Water Report Card, October 2006

indicate that a treatment system is necessary. Where the drinking water source is a shallow dug well or a surface water source the Health Unit recommends either a chlorine system or a UV filter to ensure safe water supplies.

Where a drinking water source is private, it is the responsibility of the private owner to ensure that the water is protected and potable. In Ontario, the Health Unit will test drinking water for bacteria contamination but no other water quality monitoring is undertaken on a routine basis. Through the *Well Aware* program[13], individuals can learn how to care for their well and drinking water supply.

Muskoka has some of the most restrictive shoreline development policies in the province with the objective of protecting lake system health for both recreational and drinking water purposes. Recent policy amendments require increased set backs from waterbodies for both buildings and septic systems, property owners are encouraged to maintain or re-establish vegetation, and shoreline development is monitored in order to evaluate the implementation success of municipal policy and objectives.

Source Water Protection

In both private and municipal systems, the protection of the water source is key to maintaining good drinking water supplies. In order to have a drinking water problem, there must be a source of contamination. With few exceptions, neither public nor private drinking water sources are subject to significant threats or possible sources of contamination. In general, the major threats to either ground or surface water sources include municipal and private waste disposal systems, historic and existing landfill sites, agriculture, historic and existing industrial sites, like tanneries, and old buried gasoline storage tanks. Unlike major urban areas to the south, there are limited current or historic industries in the watershed that have contaminated drinking water sources. In addition, the District of Municipality of Muskoka has rigorous municipal programs to address waste treatment and landfill sites; these threats have been minimized over the years.

Waste Disposal Systems - Based on the standards established by the Sierra Legal Defence Fund, Muskoka's Sewage Treatment Plants would receive a grade of A^+ similar to the grade given to Calgary because all the sewage treatment plants have UV disinfection, or equivalent, added to the 100% tertiary treatment.[14] Private waste disposal systems also meet a relatively high standard with all municipalities undertaking septic system re-inspection programs.

Solid Waste Disposal – There are groundwater monitoring program around waste transfer sites, landfill sites, and septage lagoons to ensure groundwater sources are not contaminated from these facilities. Where groundwater has been contaminated due to historic activities, Muskoka has acquired the groundwater rights have been acquired by the municipality.

Land Use Controls -Through the development process, sites that might have contaminated soils have been identified and are required to be cleaned before new development can proceed. Several sites have already been rehabilitated and include such historic uses as old tannery sites, saw mills and gas stations.

Several municipalities have begun to develop Source Protection Plans to protect municipal drinking water sources as required under the new Clean Water Act. As threats are identified or verified, action will be taken to reduce any threat on drinking water source.

There is no regulated approach to the protection of private drinking water sources.

Georgian Bay Drinking Water Sources – Binational.net is a collaboration between the United States Environmental Protection Agency and Environment Canada, to provide a single window on joint Great

[13] *Well Aware* is a provincially sponsored program that provides individuals information, tools and resources about installing, operating and maintaining private well-based water sources.
[14] Sierra Legal Defence Fund, National Sewage Report Card III, September 2004

Lakes programs. This initiative is underway, with postings of several binational programs and reports. The State of the Great Lakes Ecosystem Conference (SOLEC) is a forum at which reports on binational programs are presented and discussed. The State of the Great Lakes 2005 was released at the 2006 conference. The State of the Great Lakes 2005 Report indicates that municipal systems are in good shape stating that the current municipal water treatment technologies ensure the high quality of the drinking water.[15]

Aquatic Habitat

Fish Habitat

There is a belief that key fish populations across Ontario, like lake trout, have been degraded. The extent of the damage, however, cannot be assessed objectively because the required data are not available. Much of these data come from case studies instigated in response to a perceived problem. Such data have enhanced the understanding of the stressors that impact fish populations, but they are not very useful in addressing questions about the overall condition of the fish resource.[16] For this reason, the discussion below is primarily qualitative.

Inland lakes - In 2005-06, Stanley Sutey of Accipiter Fish & Wildlife Services undertook a series of studies on fish species in Lake of Bays. From November 2005 to May 2006, he studied the spawning behaviour of the native species of brook trout and rainbow smelt, and the introduced species of northern pike. His results indicated that the native species had likely declined while the introduced species appeared to be reproducing and increasing in numbers.

The decline in both brook trout and rainbow smelt is likely a result of the destruction to spawning habitat by such activities as poor logging practices and gravel extraction near streams, dredging and filling within watercourses and a general reduction of ground water feeding streams.[17] These stresses are general in nature and can be assumed to impact fish resources in other inland lakes.

Lake Trout – Lake trout are a top predator in many of the lakes in Muskoka/Haliburton/Parry Sound. As a top predator, they are an important component of the food web and act as an indicator of the health of the aquatic system. It is widely held that if the top of the food chain (or web) is healthy then all the components leading to that top predator must also be in a healthy condition.

In total, thirty-two (32) lakes in the watershed are managed for lake trout. Lake trout are found in lakes as shallow as Pine and Tasso Lakes, which are less than 20 metres in depth, to very deep lakes like Lake Joseph, which has a 90 metre deep hole in the northern part of the lake. More commonly, lake trout lakes in Muskoka range in depth from 30 to 60 metres.

An indicator of the health of the lake trout resource is the number of lakes that are stocked. Stocking is done when a lake does not supply enough natural reproduction to support a healthy population. Currently twelve lakes in the Muskoka River Watershed are being stocked on a put-grow-take basis; meaning that little or no natural reproduction is occurring. One lake (Lake Muskoka) is stocked supplementally, meaning that some natural reproduction is occurring. When calculated by surface area, the majority of the lake trout fishery in the watershed is supported entirely (56%) or partly (31%, Lake Muskoka) by natural reproduction.[18]

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[15] Binational.net, State of the Great Lakes 2005 – Drinking Water Report. ISBN 0-662-41480-2, September 2006.

[16] Lest, N.P., Dunlop, W.I. *Monitoring the State of the Lake Trout Resource: A Landscape Approach.* In Boreal Shield Watersheds: Lake Trout Ecosytems in a Changing Environment ed. By. J.M. Gunn, R.J. Steedman, and R.A. Ryder. Lewis Publishers, 2004.

[17] Sutey, Stanley, Lake of Bays Brook Trout Spawning Observations, 2005.

[18] Steve Scholten, Fisheries Biologist – Parry Sound District, Bracebridge Area Office, pers. com.

On the other hand, Mary, Fairy and Vernon lakes that have supported healthy lake trout populations in the past, are now stocked because they do not currently support significant natural reproduction despite most aspects of their habitat being good to excellent for lake trout. Ecosystem changes caused by the introduction of exotic species such as smelt and the spiny water flea (*Bythrotrephes)* may be a reason for this decline.[19]

The nine other lakes currently stocked are generally small lakes with naturally limited areas of suitable juvenile habitat. Five are believed to have had natural populations that have been lost. Two have introduced populations. The origin of two populations is unknown. Without stocking, these lakes would only be able to sustain very limited fishing effort.[20]

Georgian Bay fishery – As with many of the inland lake situations, Georgian Bay is experiencing multiple ecological stressors and is in a state of change. Georgian Bay has more extensive shallow water fish communities as compared to Lake Huron proper. This means that there tend to be more warm and cool water species.

Over the past few decades, there have been some improvements in the Georgian Bay fishery along with some negative trends. The abundance of large and small mouth bass is improving with warmer water, which can be directly linked to climate change. Northern pike, however, is in decline as a result of lower water levels and the subsequent drying of coastal wetlands. Round Gobi, an invasive species that may pose a serious threat to aquatic ecosystems displacing native fish and destroying local fisheries is now proliferating in the Severn Sound area. However, there is now a naturally reproducing population of lake trout in the Bay, which is a good news story.

Biologist on Georgian Bay are starting to see a shift in nutrients from the open water to the shore area as zebra and quagga mussels access the offshore nutrient and bring it to the near shore area. This transfer of nutrients results in higher phosphorus levels in the shallow near shore area and may lead to increases in algae blooms and further negatively impact both the near-shore and off-shore fishery.

With all these changes, it is unclear as to the change in biodiversity on the Bay. There is no existing baseline, as biodiversity was not monitored in the past. It appears that some areas have seen an increase in biodiversity while, where species like the round gobi have been introduced, biodiversity has probably decreased.[21]

Shoreline Habitat

Shoreline vegetation protects waterbodies from nutrients and toxic chemicals that can be carried into the lake and contribute to water quality issues. Native vegetation is an important component of a lake system and provides habitat (for both aquatic and terrestrial animals), stormwater management, water purification and visual beauty.

The District of Muskoka has undertaken shoreline land use surveys on thirty-three (33) lakes across Muskoka. These surveys indicate that the natural shoreline buffer is often very narrow with significantly altered vegetative areas behind. Natural shoreline areas include wetlands, deciduous or coniferous forests and natural beaches, amongst others. Altered shoreline areas include man-made beaches, lawns, and hardened shorelines, amongst others.

Based on five (5) years of data, the average amount of shoreline left in a natural state around a lake is between 81 and 100%. However, behind that narrow vegetated area and within sixty-six feet (66') of the water, the vegetation in the yard area is often significantly altered. On average about 45% of the yard-

[19] Ibid
[20] Ibid
[21] Liskauskas, Arunus Lake Huron Fish Assessment Unit, Ministry of Natural Resources, Owen Sound. Pers. Com.

area is made up of such features as a thinned forest with little shrub or undergrowth, lawn, road or other types of landscaping. The overall weighted average is 31% altered and 69% left naturally vegetated. The level of disturbance, however, ranges from 5% to 75% altered, which means that 95% to 25% of the area has been left in a natural state.

In order to provide the highest level of protection for our waterbodies, as ecological and development pressures increase, wider and more robust shoreline buffers should be encourage. Over time, yard-areas between the residence and the water should be re-vegetated providing more opportunity for nature to adjust.

Stewardship Activities

Lake Associations

Stewardship is key to protecting the health and natural attributes of our water resources. Only when the people that live on the lake take responsibility for their lake will the natural systems of the area be afforded appropriate levels of respect and protection. Lake stewardship can consist of many activities such as the development of lake plans, local education programs, monitoring, and remedial programs.

Lake Plans - Lake planning is a process, undertaken by lake residents, to identify the special character of their lake and to put in place a strategy to protect the high quality of life they currently enjoy.

People are now realizing that lakes, like all ecosystems, have limits and that if a lake's capacity is exceeded because of overdevelopment, the combined effects of pollutants and other pressures will cause a degraded environment from both an ecological and aesthetic point of view. In general, the way a site is developed and managed will have a significant influence on the health of the lake and watershed.

Lakes have their own unique physical, biological, chemical and geographical landscape characteristics, which are reflected in local communities. The goal of lake planning is to identify, protect and restore the natural (chemical and biological), physical and social integrity of the lake's ecosystem. Lake management is not so much about managing natural resources, as it is about managing the human activity that affects these resources.[22]

Currently, in the watersheds over fifteen (15) lakes have or are currently developing lake plans. This is a significant increase in lake level planning since the 2004 report card. Once a lake has developed a lake plan, stewardship programs and other implementation activities generally follow as associations work at achieving their stated goals and objectives.

Stewardship Programs - Stewardship programs are lake specific, action-oriented programs that target specific issues. They may include education programs such as a dock-to-dock programs or a series of community lectures that address local concerns. The objective is to educate lake residents on topics of interest to the lake and to encourage behavioural change to lessen the human impact on the lake system.

A stewardship program may also involve lake monitoring. A monitoring program can include sampling for water chemistry, bacteria, benthic macroinvertebrates, or a host of terrestrial indicators like tree health, salamanders or lichens. By getting to know the lake and shore area first hand, many people gain a new and deeper understanding of the importance and value of the resource they own and share with both other people and the rest of nature. In the watershed, all large lakes and many of the medium and small lakes carry out annual stewardship programs. The District of Muskoka now assists 20 lake associations with an ecosystem monitoring program.

[22] For more information on lake planning visit http://www.lakeplan.com/ or contact the Huntsville Lakes Council for a copy of their document entitled A Template & Manual – Developing a Lake Plan for Your Lake.

Municipal Action

To be successful, stewardship has to be lake based; however, municipalities can play a significant role through the many powers and responsibilities they have under the municipal act, planning act, building code act and others. Specifically, all municipalities within the watersheds implement a septic re-inspection program, ensuring that private systems meet current standards and function properly. New planning policy that incorporates restrictive development policy around lakes for both new development and redevelopment has also recently been approved in Muskoka.

All municipalities participate in the Muskoka Watershed Council and work cooperatively to identify watershed issues and develop coordinated remedial strategies, where appropriate. Recently, several municipalities have renaturalized urban park shorelines providing a local example of a remedial action that can be implemented on private property.

Areas where additional municipal action could be focused include urban stormwater management and greater emphasis on lake specific management concerns.

Our Water – Summary (B+)

Activity	Comment	Grade
Recreational Water Quality		**A-**
• Nutrient Enrichment	1. Over 50% of lakes have naturally low total phosphorus levels and will generally not support excessive algae growth. 2. On average, lakes have slightly more phosphorus today than undeveloped levels. However, over the last twenty years, phosphorus in over 60% of lakes has remained constant or has decreased. 3. Development does not appear to be the driver in increases in phosphorus levels. 4. Of a total of 183 lakes in Muskoka with data, 142 lakes meet the stringent local water quality standard. Of the 41 lakes that do not meet this standard: a. 21 lakes have phosphorus levels that will not generally support algae blooms. b. 16 lakes have a decreasing trend in phosphorus levels. 5. 47 lakes (26%) have a long-term phosphorus average of less than the predicted phosphorus level if the lake was undeveloped.	*A-*
• Water Clarity	1. Water clarity has remained the same or improved on 90% of lakes. 2. Only one lake is an anomaly having low DOC and low Secchi depth readings.	*A*
• Algae	1. Insufficient data.	-
• Bacteria	1. Generally at natural background levels. 2. Some highly developed areas may experience higher concentrations.	*A-*
• Acid Deposition	1. Real improvement has been realized over the last decade. 2. Annual load has not been reduced enough that all lakes in the watershed will recover.	*B*
Drinking Water		**A-**
• Municipal Water	1. Rigorous training of staff. 2. Extensive monitoring of contaminants. 3. No exceedances of contaminants.	*A*
• Private Systems	1. Shoreline policy protects surface water sources. 2. Septic re-inspection program protects wells and surface water. 3. A 'Well Aware' program would help private homeowners.	*A-*

Activity	Comment	Grade
• Municipal Source Water Protection	1. Existing policy in Muskoka Official Plan protects municipal intakes from incompatible uses. 2. All waste disposal plants have tertiary treatment and most have UV disinfectant. 3. Source protection plans are to be developed**.**	A-
• Private Source Water Protection	1. There is no comprehensive program to address source water protection for private systems. 2. Municipalities have implemented septic re-inspection programs. 3. Significant areas of Crown land provide watershed level protection for sources of drinking water. 4. Regulation requires rehabilitation of contaminated sites prior to redevelopment.	*B*
Aquatic Habitat		**B**
• Fish Populations and Habitat	1. Significant human related damage has occurred to various fish habitats on inland lakes. 2. Increased human stress is impacting lake trout habitat including stocking practices, fishing pressures and development. 3. The Georgian Bay ecosystem is under change and not stable. The introduction of invasive species has stressed the Severn Sound Area.	*C*
• Shoreline Habitat	1. On average 31% of the area between the lake and the cottage is altered. 2. Still experiencing dramatic loss of shoreline vegetation on individual lots although some landowners are starting to re-naturalize shorelines.	*A-*
Stewardship Activities		**A-**
• Lake Associations	1. Over 15 lakes have or are developing lake plans. 2. All large and many moderate and small lake associations undertake monitoring programs. 3. The District of Muskoka assists over 20 lake associations with ecosystem monitoring.	*B+*
• Municipal Action	1. Planning documents encourage large setbacks and maintenance of vegetation. 2. Policy to address the impact of urban areas on surface water resources is required. 3. All municipalities participate in local stewardship programs and sit on the Muskoka Watershed Council. 4. Several municipalities have taken action to improve urban shorelines.	*A-*

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