

A Comparative Report of Conservation Authorities and Grassroots Watershed Management Approaches in Ontario

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Abstract

Watershed management plays a key role in the environmental health of a region. Watershed management in Ontario, Canada has been established in two different management types, conservation authorities and grassroots organizations. Conservation authorities were introduced in 1946 through legislation, while grass roots organizations have developed in recent decades through community desire. Four case studies were performed to analyze these watershed management types. Two Conservation Authorities were examined, the Rideau Valley Conservation Authority and the Mississippi Valley Conservation, as well as two grassroots organizations, the Muskoka Watershed Council and the Ottawa Riverkeeper. Through these case studies, the advantages and disadvantages of both types of management approaches were determined. These different approaches to watershed management were found to be beneficial through different means with one a regulatory body and the other an educational body. It was concluded that the watershed management type is dependent on the community and watershed in question.

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“Helping Ourselves to a Healthy Environment”

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Introduction

Water management is a key issue in countries across the world, as water is a vital resource used in everyday life. Water is required for all living organisms on Earth, influencing their distributions and populations, as well as biodiversity and nutrient cycling (Heathcote, 2009). There is a variety of forces affecting water management, as well as a variety of needs that have to be met to ensure the thriving of natural communities and human populations. Table 1 illustrates the issues faced in terms of water use and covers issues such as quality, conservation, and responsibilities.

Table 1.1 List of issues related to water use throughout the world in terms of water availability, quality, and management. (Adapted from Heathcote, 2009).

Water Requirements, Use, Availability	Water Quality	Water Management
Protection of aquatic and wetland habitats	Lake protection and restoration	Roles of projects and programs
Safe drinking supply	Health risks	Roles and duties of different government levels
Waterborne toxins	Impact on land/air/water relationships	Financial costs and funding
Excessive groundwater extraction	Water quality protection	Roles and duties of the public and private sector
Climate change	Management of point and non-point source pollution	Sustainability with increase population and infrastructure

The classification of land into watersheds is one way to manage water bodies as well as their surrounding landscapes (Randhir, 2007). Watersheds are defined by drainage areas, and there is no political or social aspect as to determining their boundaries (Randhir, 2007). Within a watershed, all components are linked by their dependence on the water in the area – these components may vary, such as being an agricultural patch, forest patch, or human

urban areas (Randhir, 2007). Despite the variations in structure, the organisms within all depend on water.

A watershed is defined as the area of land which collects precipitation and drains into a body of water, whether it is a stream, marsh, or lake (RVCA, 2012; Rindhir, 2007).

Watersheds are made up of natural boundaries, and as a result may cross political borders, through busy cities and may expand into more rural areas. A watershed not only includes the water, but also the resources within the watershed, aquatic life, riparian vegetation, and land/water interactions. This not only encompasses environmental interactions, but includes human interactions (Rindhir, 2007).

Watersheds have three primary purposes: to capture water, to filter and store water in soils, and to release water into a waterbody. As described previously, all living things depend on the flow of water through ecosystems. The effects of agriculture, forestry, industry and urbanization are all recorded in the very water on which humans and other organisms depend. Within the watershed, everything is connected, and as a result, the management of the watershed is critical (Muskoka Watershed Council, 2012).

Watersheds can be managed through watershed plans, which are based on an “integrated watershed approach”. The integrated watershed approach incorporates all stakeholders, which includes residents, the government, landowners, as well as the private sector for the management of environmental and natural resources of the watershed (RVCA, 2012a; Rindhir, 2007). A watershed plan is used to manage human activities that will have an impact on the watershed by considering the roles and responsibility of all stakeholders in the watershed (RVCA, 2012a). The watershed plan outlines which areas of the watershed

should be preserved or rehabilitated and areas which are suitable for development (RVCA, 2012a).

Managing land in terms of watersheds and applying an integrated watershed approach to the land has many advantages ranging from environmental to social. Watersheds allow the land to be divided naturally and managed into “units” in terms of their resources and the ecological components which compose the watershed as a whole. Better results can be anticipated by using the watershed approach to land management, as watersheds are based on natural processes which are both ecological and hydrological – this allows an increased understanding of underlying problems within a watershed, and how to best go about a solution. Additionally, all environmental factors within a watershed are considered – ranging from soil to water quality and air, as well as biotic factors such as animals, plants, and human interactions. In terms of socioeconomic advantages to this approach, interaction and communication between the government, businesses, and citizens promotes savings in terms of time and resources. Not only are resources saved, but the communication between parties allows for the assessment of what potential actions may have on the environment and avoids the dreadful mistakes and economic consequences of fixing them. The public is able to become actively involved in the management of watersheds by joining the councils that oversee the watersheds or by becoming involved in the programs, such as tree planting or water sampling. The aim is to get the public involved and concerned about resource use and land management within the watershed, in order to better protect the area.

There are two different methods to managing a watershed – through a governmental Conservation Authority or through a not-for-profit grassroots organization.

The Conservation Authorities Act was implemented in 1946 as a result of observations by agricultural, naturalist and sportsmen's groups that much of the natural resources of Ontario were "unhealthy" due to poor land, water and forestry practices in the 1930s and 1940s. Conservation Authorities focus on managing and delivering watershed-based ecosystem resources and services, while creating awareness of the importance of healthy watersheds. Conservation Authorities are based around watersheds – meaning they are established around watersheds, not the city. As well, the Conservation Authority Act has a major focus on dealing with flooding and the damages that result from it, especially in flood prone areas (Conservation Ontario, 2009). There are 36 Conservation Authorities in Ontario, which together form an organization known as Conservation Ontario. Within Ontario, 90% of its population resides in areas governed by Conservation Authorities, thus they play a critical role in resource management (Conservation Ontario, 2009). Conservation Ontario is dedicated to conserving, restoring, and managing Ontario's natural resources within watersheds.

Not-for-profit watershed management organizations, also known as grassroots, are based on a movement within a local community. Grassroots organizations are managed by the politics of the community where they exist. As a result each grassroots organization may be slightly different. The focus of these organizations is to encourage public engagement in improving the health of the watershed. A grassroots approach is advantageous when managing watersheds as it encourages active public participation and decision making on a more local level (Rindhir, 2007). Grassroots approaches are designed to encourage and facilitate cooperation among the various stakeholders in the watershed region. Grassroots programs can be designed to meet community specific needs, and can therefore be very

successful in providing solutions that work for their area. Since grassroots organizations are local, they combine local knowledge and motivated engagement. Community involvement in participation can go a long way in addressing environmental issues, and grassroots organizations are known to play important roles in environmental protection (Kressley, 2012).

These two types of watershed management approaches in Ontario will be explored using four case studies. Two conservation authorities, the Rideau Valley Conservation Authority and the Mississippi Valley Conservation will be assessed, followed by two grassroots organizations, being the Muskoka Watershed Council and the Ottawa Riverkeeper. Seven main points will be used to compare the two approaches using the four organizations. These include: the mandate, funding, environmental monitoring, projects, credibility and use of third party information, use of information and decision making, as well as community outreach. These points will be discussed in detail for each organization, allowing the differences between the two types of management approaches to be explored.

Rideau Valley Conservation Authority

Overview

The Rideau Valley Conservation Authority (RVCA) is one of Ontario's 36 Conservation Authorities which acts as an environmental protection agency and was formed in 1966 (Rideau Valley Conservation Authority, 1992). The RVCA works with government partners on municipal, provincial, and federal levels as well as with landowners and community groups to maintain the natural resources located in the Rideau watershed. The RVCA implements a variety of programs to benefit the watershed, as well as those who live there.

The RVCA is governed by a Board of Directors which was restructured in 2011 to include representatives from each member municipality. In total, there are eighteen municipalities represented on the Board of Directions.

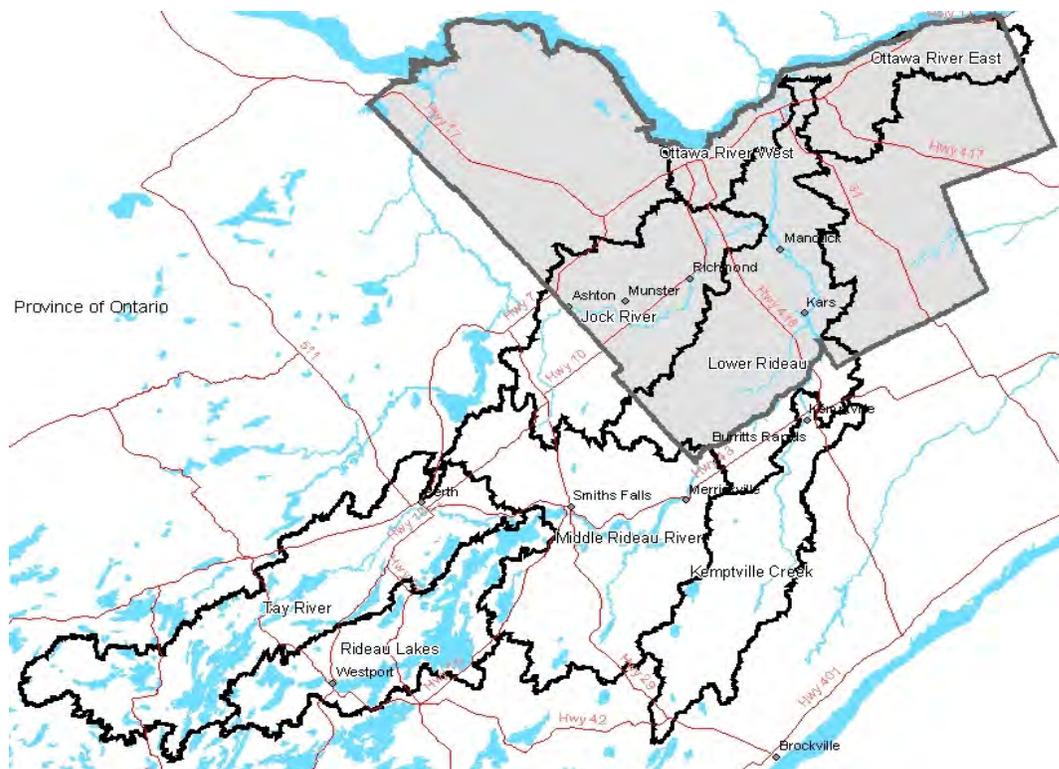


Figure 2.1. Map of the area Rideau River Watershed and its major subwatersheds (RVCA, 2012a)

Each municipality has one representative except for the City of Ottawa, which is represented by six individuals. There is a Chair and Vice-Chair, both which sit on the Board of Directors. There is also a subcommittee of the Board of Directions, known as the Executive Committee, which deals any applications for permits associated with Ontario Regulation 174/06 entitled Rideau Valley Conservation Authority: Regulation of Development, Interference with Wetlands, and Alterations to Shoreline and Watercourses. The Executive Committee is made up of five members: The Chair, Vice-Chair, and three other members from the Board of Directors.

Within the Rideau River, there are six major “subwatersheds”. These include the Kemptville Creek, Jock River, Tay River, Lower Rideau, Middle Rideau, and the Rideau Lakes (RVCA, 2012a). The Rideau River Watershed is vast – it has a drainage area of 4,094km² and the length of the river is 136km (RVCA, 2012a).

To fully understand the Rideau River Watershed, as well as the RVCA, many aspects of the watershed and organization will be looked at, including: funding, programs, credibility, and community outreach.

Mandate/Mission

The RVCA has a mission which is two-fold. Their main mission statement is: “To be the best source of reliable information, experienced advice, and cost-effective services in water and land conservation delivered to all in the Rideau Valley watershed” (RVCA, 2012b). Additionally, another statement was found which states their mission to be to “undertake environmental protection programs that will leave a legacy of clean water, natural shorelines, and sustainable landuse for future generations” (RVCA, 2012c). As well, their vision is one of a healthy and sustainable watershed (RVCA, 2012c).

Their mandate is drawn from the Conservation Authorities Act, which was established in 1946. Under section 20 of the Conservation Authorities Act, the purpose of conservation authority is to design and implement a program which will result in the further conservation, restoration, development, and management of natural resources excluding gas, oil, coal, and minerals while focusing on the prevention of flooding (Conservation Authorities Act, 1990).

Funding

As a Conservation Authority, the RVCA gets its main source of revenues from the municipalities in which it covers. Other sources of funding include provincial grants, levies, and through program revenues. In 2011, the total funding was approximately \$8.6 million (RVCA, 2011a). However, the funding varies year to year and therefore plays a role in the distribution of the funds. For example, in 2010, the funding was almost \$9.6 million (RVCA, 2010). The difference in funding is due to a decrease in special levies in 2011, as well as a decrease in provincial grants. This drop in funding, of almost \$1,000,000 means there will be a decrease in the number of programs, the duration of programs, and potentially the jobs within the RVCA.

2011 Revenue

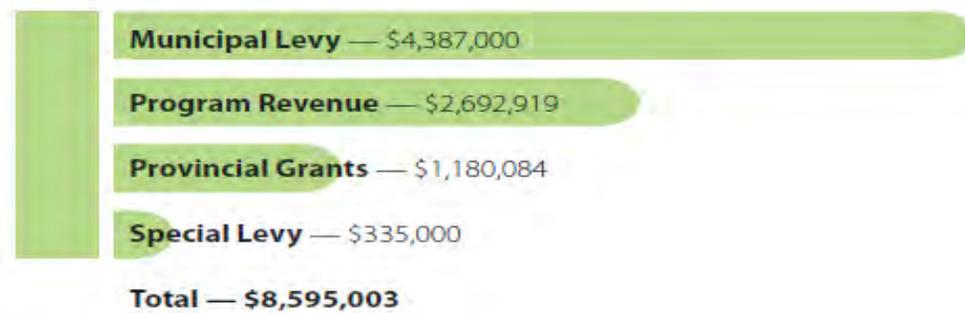


Figure 2.2. Sources of funding for the RVCA in 2011 (RVCA, 2011a).

Environmental Monitoring

The RVCA surveys a diverse array of environmental information – ranging from taking water samples to monitoring flooding, doing stream assessments of invertebrates, and looking at invasive species and the suitability of habitats.

In terms of watershed science, information is collected in areas such as water quality. Various water quality data collected includes temperature profiling of municipal drains, collection of geo-chemistry data, analyzing groundwater samples, measuring water levels, collecting data for flood mapping, as well as surveying the physical and biological attributes of various streams. In 2011, 13 water temperature probes were installed on Pinecrest, Stevens, and Becketts Creeks to increase the ease of data collection. (RVCA, 2011a)

In addition to water quality collection, data is also collected to look at habitat quality and species at risk research. In 2010, 123 fish habitat reviews were completed, as well as data being collected in the Kemptville Creek as part of a species at risk fish mapping project (RVCA, 2010). Additionally, invasive species are being removed from creeks, with three species being removed and monitored in 2011 in Graham, Stillwater, and Greens Creeks. In the summer of 2011, aquatic species at risk research was done in 20 sites across the watershed through stream surveys to collect data on the habitat, inventory mussels, fish, and various invertebrates, as well as analyze possible threats to these species (RVCA, 2011b). As well, 12 turtle platforms were installed at various conservation areas within the watershed to do research for at risk turtle species (RVCA, 2010).

The RVCA collects a diverse amount of data in terms of water quality, habitat quality, and also looks at species at risk, conservation, and invasive species. While the data

is not collected every year, it is surveyed and analyzed, with appropriate action being taken once long-term studies have been completed.

Projects

The RVCA has a variety of priorities that guide the organization when deciding which programs to implement in varying areas (RVCA, 2008). In total, there are six priorities the RVCA uses to implement programs.

- Better the water quality in streams, lakes, rivers, and groundwater reserves. This is done through a variety of different methods including the elimination of faulty septic systems, expanding monitoring systems, utilizing incentive grant programs for rural residents, and providing information to landowners.
- Provide a good water supply that is both safe and sustainable that includes both groundwater and surface water.
- Reducing flood risk makes up another priority of the RVCA – the goal is to improve protection from potential damages caused by floods and erosion through programs which will protect the natural flood plain. An additional goal is to ensure that no unneeded costs and risks are incurred due to unnecessary development. Awareness of flood risks and the improvement of the flood warning system are key aspects of this priority, which will ensure an increased quality of life for those in the watershed.
- Improve watershed habitats. These habitats will be restored if they are damaged, and threatened habitats will be protected. If the habitat is owned on private land within the watershed, the RVCA will aim to encourage stewardship on the land, especially if it is adjacent to nearby shorelines. This will enhance and promote sustainability and biodiversity within the watershed.

- Increase programming within conservation areas. The RVCA will manage conservation areas throughout the watershed while utilizing these areas with a variety of programs providing recreation and education.
- Improve watershed information. The RVCA aims to continue to improve methods to report watershed conditions, changes, and trends to the people within the watershed. This will be accomplished through the use of their website, the Watershed Information System, and by utilizing newsletters and reports. The RVCA will provide supportive and experienced opinions to municipalities, community members, and conservation groups in regards to issues with water management.

Overall, the goal of these programs is to improve the quality of life of all those in the watershed in the most efficient manner, while also prioritizing and protecting the watershed and its natural abundance in diversity and resources. A major portion of the funding to the RVCA went towards programs that are implemented throughout the watershed, ranging from land management and regulation to engineering services. In 2011, just over \$1 million out of \$8.5 million of funding was used for corporate reasons, while the rest was used towards watershed services (Figure 2.3).

2011 Expenses



Figure 2.3. Expenses for the RVCA in 2011 (RVCA, 2011a).

As seen in Figure 2.3, the RVCA has a vast amount of funding to utilize in different areas and therefore improves the duration and amount of programs that can occur in a single year.

The forest management and tree planting program has been going for over forty years and has been expanded over time (RVCA, 2007). The tree planting program started in the 1970s when conservation lands were acquired, and then expanded it by introducing the Private Land Forestry Program which offers advice and tree planting to private land owners. Both of these programs are continuing to this day with over three million trees planted (Figure 2.4).

RVCA Trees Planted by Municipality 1970 to 2007	
Cumberland	.650
Smiths Falls	1,500
Central Frontenac	1,800
Augusta	3,000
Merrickville-Wolford	7,600
North Grenville	18,050
South Frontenac	31,930
Beckwith	36,750
Rideau Lakes	158,050
Elizabethtown-Kitley	208,160
Drummond/North Elmsley	232,850
Tay Valley	281,260
Montague	452,235
Other	116,745
Ottawa	2,226,665
• Urban Ottawa	5,1500
• Gloucester	11,850
• Nepean	27,450
• Osgoode	50,280
• March	153,550
• West Carleton	304,585
• Goulbourn	834,990
• Rideau	838,160
Total	.3.7 Million

Figure 2.4. The amount of trees planted in fifteen municipalities within the RVCA from 1970 to 2007 (RVCA, 2007).

Additionally, flood risk mapping for a variety of rivers and streams within the watershed have been done. These studies are based on identifying areas of land which border

streams and rivers which may be prone to higher than average flood conditions. The mapping process has been done for areas which have a high development, and hence are at risk for greater damage should a flood occur. Some examples of water bodies that have been mapped include Kemptville Creek, Jock River, Blueberry River, and Rideau River. These mapping projects are fairly long – for example, the Kemptville Creek mapping project took three years to complete. Despite the length of these projects, flood maps have been produced for ten water bodies within the watershed, with more than one mapping project occurring in a given year (RVCA, 2012d).

The programs implemented by the RVCA are cumulative and build upon the work of other previous projects to further enhance the diversity and sustainability of the watershed (RVCA, 2008). Not only are programs implemented due to priorities, but the RVCA uses the ecosystem approach as a guiding principle which the programs are based on (Rideau Valley Conservation Authority, 1992). This approach views people as an integral part of ecosystems, who cause change to natural systems. The ecosystem approach acknowledges that natural and human disturbances cannot be continually absorbed by an ecosystem and even small actions will accumulate (Rideau Valley Conservation Authority, 1992). Using this approach and understanding, the RVCA will do monitoring and evaluation work before an action is undertaken within the watershed (Rideau Valley Conservation Authority, 1992).

Credibility and Use of Third Party Information

The RVCA has a diverse array of professional staff, who aim to provide creditable information and interpret the collected data. In total, the RVCA has 65 staff, including professional engineers, planners, forestry specialists, biologists, field technicians, interpreters (RVCA, 2012b). A more concise breakdown of these broad titles includes GIS specialists

and technicians, resource specialists, aquatic and fish habitat biologist, septic inspectors, and groundwater scientists (RVCA, 2012e). This array of professional staff ensures the data collected and interpreted is creditable and is being utilized correctly.

Use of Information and Decision Making

The RVCA collects a great deal of information from the watershed through a variety of projects. The information is fairly important and is used to diagnose what needs to be done to improve the watershed and to classify and organize the watershed into smaller, more manageable units.

Ecological Land Classification is one example of how the information gathered about the watershed is being put to use. The Ecological Land Classification looks at the distribution and assemblages of plant species and tries to understand these distributions by analyzing environmental patterns in the area (RVCA, 2012f). Environmental conditions that may influence the distribution of plant assemblages can include soils, geology, climate, physiography, and existing vegetation. Not only will the Ecological Land Classification help understand the distributions of plant assemblages, but it can also help determine patterns for factors influencing plant distributions as well. The overall goal of the Ecological Land Classification is to organize, categorize, and name ecosystems in a manner similar to how characteristics of plants can distinguish one species from another (RVCA, 2012f).

Geology <ul style="list-style-type: none">• bedrock, parent material type (carbonate, acidic, basic)	Soils <ul style="list-style-type: none">• depth, texture, nutrient status, moisture regime
Physiography <ul style="list-style-type: none">• landform, modes of deposition• topographic position (slope, shape)	Vegetation <ul style="list-style-type: none">• deciduous, conifer, mixed species composition

Figure 2.5. Factors used by the Ecological Land Classification to organize and classify ecosystems. Additionally, these factors are used to map vegetation communities within the watershed (RVCA, 2012f).

The RVCA will use the collected information to create a map of the terrestrial resources distributed throughout the watershed (RVCA, 2012f). Not only will this map provide a collection of information for the distributions of terrestrial resources, but it will be available for use in watershed and municipal planning (RVCA, 2012f). The collected data will eventually become more fine and specific, and can be used in the facilitation of planning, ecosystem management, as well for the establishment of conservation goals (RVCA, 2012f). In conjunction with other collected data, such as aquatic information, the state of the watershed can be gauged and monitoring programs can be established, if needed.

In 2007, the RVCA mapped municipal drains within the watershed, as well as evaluated and classified them (RVCA, 2007). The evaluation creates six categories of drains, A through F, and looks at factors such as flow, water temperature, and fish species present. Only types “D” and “E” are classified as sensitive, and make up 15 of the Rideau’s 410 municipal drains (RVCA, 2007). Municipal drains are subject to regular maintenance, and those classified as “sensitive” require reviews of the maintenance activity to ensure that nothing harmful will occur to the drainage site as a result of maintenance (RVCA, 2007).

Finally, floodplain mapping has been done on a variety of water bodies within the RVCA (RVCA, 2012d). These mapping reports are used not only by the RVCA, but also by the municipalities to plan land use. Areas which are prone to floods are monitored and development of the land is usually not permitted (RVCA, 2012d). In the Rideau Valley, areas within the range of a 1:100 year flood are usually not permitted to be developed for safety reasons (RVCA, 2012d). The collected data from mapping studies for the various water bodies within the Rideau Valley is an integral component on decided where to develop land and to ensure the safety of those living near bodies of water.

Community Outreach

The RVCA makes use of its website to provide detailed information on what has happened during meetings, a list of current members of the board, as well as programs and ways to get involved. Annual reports are published by the authority, which list what has been done throughout the watershed that year. As well, informational pamphlets are available which provide information on who the RVCA is and what they do. A staff list is supplied as well and indicates the titles of each employee and contact information so community members can contact them.

The RVCA has nine conservations areas which can be used for outdoor recreation and provide educational programs. A variety of beaches and trails are available for the public as well. Members of the community can also get involved through a variety of programs, such as tree planting or through the City of Ottawa's Stream Watch program (RVCA, 2010). Volunteers are also an integral part of the RVCA, which is illustrated by how they restored sections of Graham Creek in 2010 (RVCA, 2010).

Summary

The Rideau Valley Conservation Authority is one of Ontario's 36 Conservation Authorities. The Rideau Valley Watershed, which the RVCA has jurisdiction over, encompasses all the municipalities in Eastern Ontario (RVCA, 2007). Through yearly funding of over eight million dollars, the RVCA is able to implement a wide variety of programs, which involves the surveying of environmental information ranging from water quality to monitoring species at risk. The RVCA has nine conservation areas which it manages that the community is able to enjoy and relax in. The community is able to get

involved with the watershed through volunteer activities such as tree planting and stream monitoring, and the RVCA makes all information readily available via its website.

The RVCA manages the watershed with a high degree of success, and its goal of a sustainable watershed that can be enjoyed far into the future has promise.

Mississippi Valley Conservation

Overview

Mississippi Valley Conservation is one of the three Conservation Authorities in the City of Ottawa; it is a local, watershed management agency dedicated to protecting the Mississippi Valley watershed (Mississippi Valley Conservation, 2012a). The Mississippi Valley watershed is located in eastern Ontario, stretching from Mazinaw Lake in the west to the Ottawa River in the east and covers an area of 4,450 km² (Figure 3.1). MVC was established in May of 1968 as a result of recurring environmental concerns in the watershed and the realization that the management practices at the time were insufficient (Mississippi Valley Conservation Authority, 1991). It employs summer students and 30 permanent employees and is overseen by a council of appointed members, representing each of the 11 municipalities that make up the watershed: Ottawa, Carleton Place, Mississippi Mills, Addington Highlands, North Frontenac, Lanark Highlands, Carleton Place, Beckwith, Drimmond / North Elmsley, Perth, and Tay Valley.

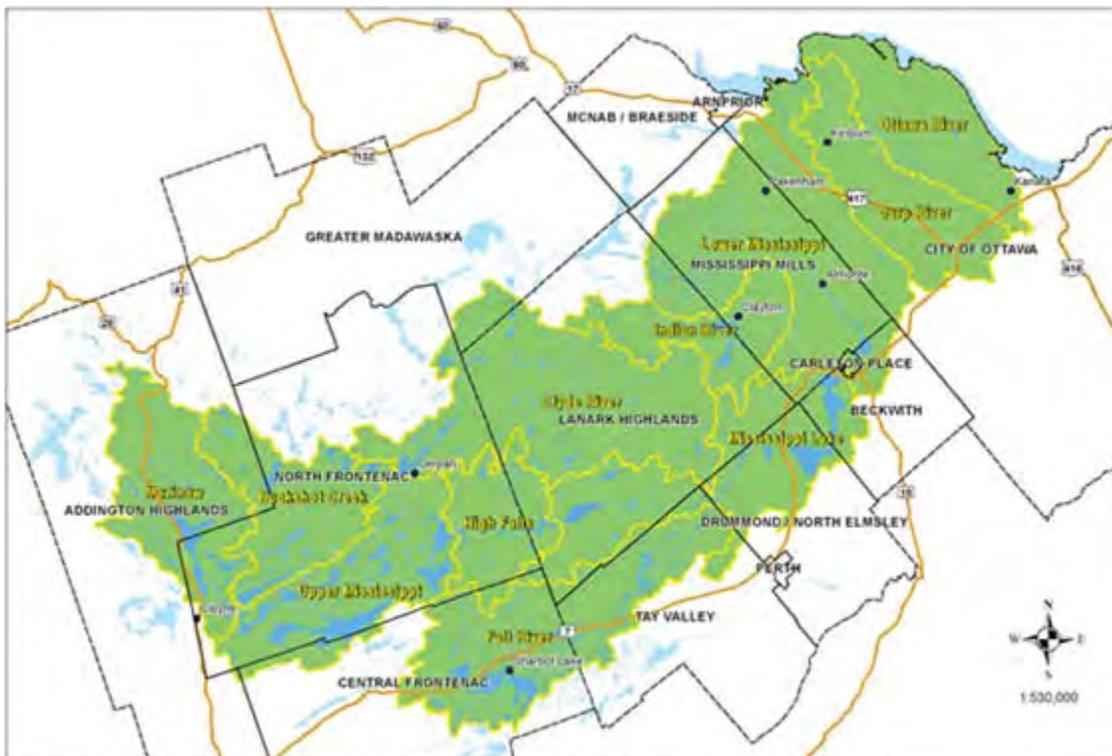


Figure 3.1. Map of the Mississippi Valley Watershed and surrounding region (Mississippi Valley Conservation, 2012a)

Addington Highlands, Tay Valley, Beckwith, Central Frontenac, Drummond, Greater Madawaska, Lanark Highlands and North Frontenac (MVC, 2012a).

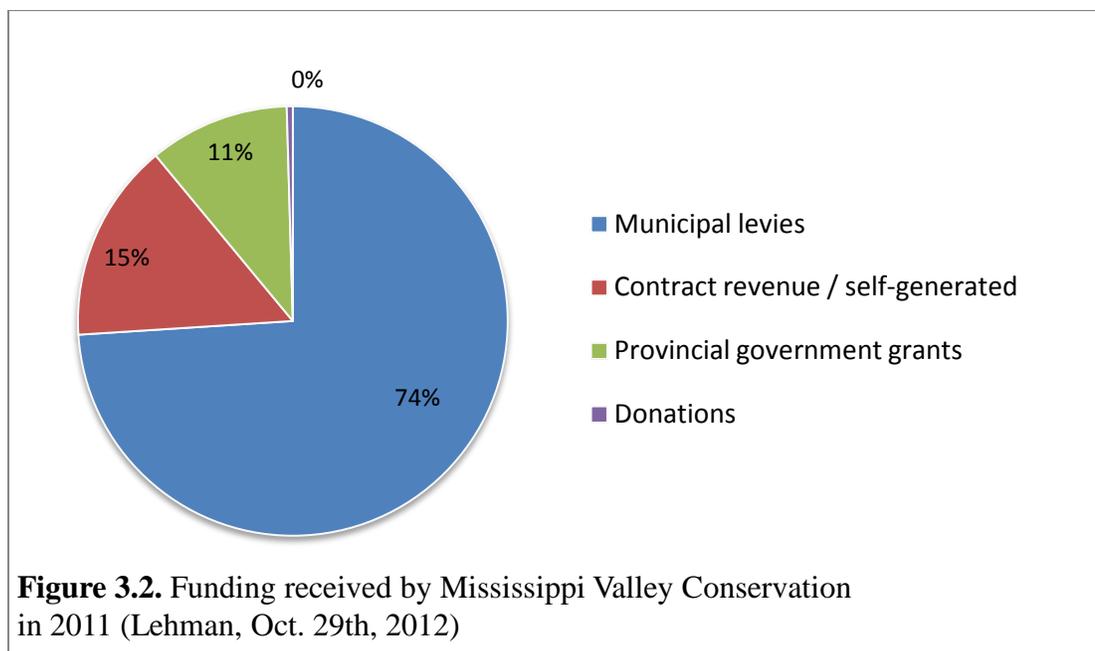
Mandate / Mission

Mississippi Valley Conservation is a part of Conservation Ontario and functions under the Conservation Authorities Act. The MVC uses an integrated management technique in cooperation with the eleven watershed municipalities in the area and other stakeholders; this means that both human activities and the natural resources associated with the watershed are managed equally (Conservation Ontario, 2009a). An integrated approach allows watershed managers to manage multiple stressors impacting the watershed such as climate change, urbanization, pollution and invasive species. This approach balances the needs of local businesses and citizens with the protection and ecological needs of the environment. (Conservation Ontario, 2009a)

Mississippi Valley Conservation recognizes that there is a limit to the amount of land use stress that can occur within an ecosystem without causing permanent damage to the natural environment (Ministry of Natural Resources, 2012). MVC works toward a watershed in which “ecological integrity is maintained and human needs are met, now and in the future, in balance with the needs of the natural environment” (MVC, 2012b). MVC creates programs in watershed planning, resource management and conservation awareness with the end goal of conserving, enhancing and developing the Mississippi Valley area (MVC, 2012b). MVC manages 410 hectares of conservation area lands including the Mill of Kintail, Purdon Conservation Area and Morris Island Conservation Area for residents and visitors to enjoy while preserving the natural ecosystem of the region and protecting the watershed (MVC, 2012c).

Funding

The annual budget of Mississippi Valley Conservation is approximately 2.9 Million dollars, as of 2011 (Lehman, Oct. 29th, 2012). As a Conservation Authority, MVC is funded primarily by government allowances. Approximately 74% of their funding comes from municipal levies, 11% from government grants, 15% from contracts and self-generated funds and 0.5% from individual donations (Figure 3.2). In 2011, MVC received over 2 million dollars' worth of funding from municipal levies (Lehman, Oct. 29th, 2012).



Mississippi Valley Conservation receives outside income through visitors to its conservation areas and educational programs (MVC, 2012c). The Mill of Kintail offers a museum tour and gift shops for visitors to buy souvenirs. The Mill is a beautiful site for weddings, retreats and picnics and can be rented for a low fee (MVC, 2012c). Admission to the Purdon Conservation Area is available by donations that go to the upkeep of the conservation area. MVC offers Conservation Education Programs and Nature Camps; MVC

even offers to come to the school for a fee of \$125 for a half day program and \$220 for a full day program (MVC, 2012d).

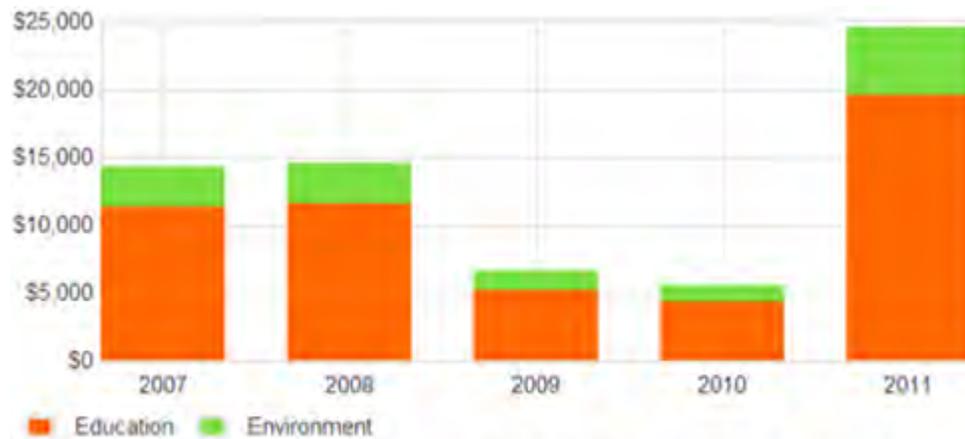


Figure 3.3. History of donations from the Mississippi Valley Conservation Foundation to MVC (Ajah Fundtracker, 2012)

The Mississippi Valley Conservation Foundation was founded in 1996 as a system to raise funds for the MVC and provide volunteers for the programs of Mississippi Valley Conservation (MVC, 2012e). The foundation organizes events, individual donations, corporate partnerships and sponsorships to secure grants and funding on behalf of the Conservation Authority (MVC, 2012e). The income from the Mississippi Valley Conservation Foundation is primarily invested in the educational programs available at the conservation areas within the watershed and secondarily invested in environmental conservation programs (Figure 3.3).

Environmental Monitoring

Mississippi Valley Conservation has been dedicated to monitoring and maintaining the health of the Mississippi Valley watershed for close to forty years. Currently, the MVC monitors stream water levels and flow, ground and surface water quality, and forest cover within the watershed to determine the overall health of the watershed (Mississippi Valley Conservation, 2007). The information collected from these monitoring programs is displayed

and graded in a Watershed Report Card that is completed every five years by the conservation authority (MVC, 2012f).

Water levels and flow rates are monitored at several areas in the watershed. The MVC monitors 15 stream gauges that send up-to-the-minute recordings of water levels and the flow rate of the stream is then calculated based on this information (MVC, 2012f). MVC also uses staff gauges, which are secured to bridges or retaining walls, to measure the water levels. These staff gauges are read and the data is reported to MVC by area volunteers and hired staff (MVC, 2012f). The information received from these gauges, along with weather forecasts and historical data are used in flood forecasting and flood warning programs done by MVC (MVC, 2012f).

The groundwater quality of the Mississippi Valley watershed is monitored by nine established wells throughout the watershed. The monitoring of these wells began in the fall of 2006 and more data must be collected in order to assess the quality of the groundwater. The groundwater quality will be assessed in the 2013 watershed report card produced by MVC (MVC, 2007).

The surface water quality of the Mississippi Valley watershed is mainly monitored through MVC's Watershed Watch program. MVC samples water quality at 59 lake sites across the watershed, on five year cycles (MVC, 2007). The pH, temperature, dissolved oxygen content, clarity, and phosphorus concentrations of the water are monitored three times during the year and a "State of the Lake" report is created for residents and lake associations (MVC, 2007). The water quality is graded based on the total phosphorus concentration and the composition of benthic invertebrates inhabiting the sediment of the lake (MVC, 2007). Phosphorus occurs naturally and anthropogenically in lakes. Sewage

systems, clearing of shorelines, fertilizers, pesticides and detergents can increase the phosphorus concentration within the lake to unhealthy levels (MVC, 2007). The Mississippi Valley watershed contains 16 sites where the phosphorus concentration of the water is regularly monitored as a part of the Provincial Water Quality Monitoring Network (MVC, 2007). Aquatic (benthic) invertebrates are sampled at 17 sites across the watershed as a part of the Ontario Benthos Biomonitoring Network (MVC, 2007). Each sub-watershed in the larger Mississippi Valley watershed is graded based on their surface water quality every five years (Figure 3.4). MVC has recently begun an invasive species monitoring program to insure that non-native species, such as zebra mussel, are not transferred and established to other lakes within the watershed (MVC, 2012f).

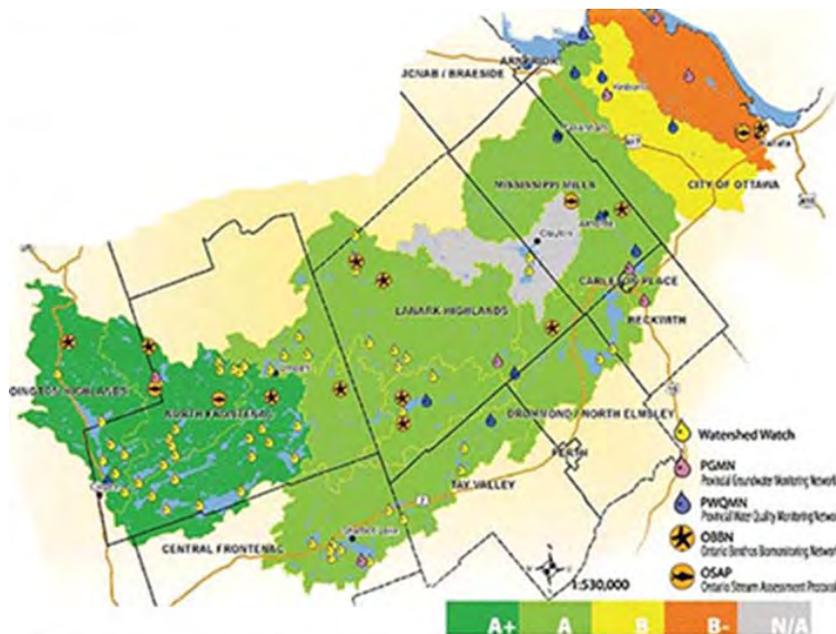


Figure 3.4. Surface Water Quality in the Mississippi Valley watershed in 2007 (Mississippi Valley Conservation. 2007)

Forests and tree cover are crucial to providing habitat, shade, clean air and preventing erosion of the soil within the watershed. MVC evaluates the forest cover within the

watershed based on the total cover and the total forest interior (100 m from the forest edge). (MVC, 2007)

Projects

The budget of Mississippi Valley Conservation allows them to be involved in many different projects to support the healthy maintenance of the watershed. MVC is in the midst of projects involving flood forecasting and warning programs, water and water quality management, climate change, watershed turtles, and even invasive species.

Flooding is major concern for Conservation Authorities, especially those in highly developed areas with lots of infrastructure (Conservation Ontario, 2009b). The combination of snowmelt and increased rain in springtime can cause serious flooding and damage from the flood waters. One of the key responsibilities of Mississippi Valley Conservation is to forecast possible floods and warn residents within the watershed, especially along the Mississippi and Carp River systems (MVC, 2012g). Flood forecasting can decrease the hazard to human life and property damage if residents are warned of the danger early enough. This is done by measuring the water levels and flow information at different locations using stream gauges, staff gauges and snow course sites (MVC, 2012g). The monitored information, combined with weather forecasts, temperature and rainfall predictions, and historical data is used to forecast spring flooding within the watershed. The water content of the snow is the main factor that affects the amount of flooding experienced in the region and can be calculated from the weight of the snow obtained from a core sample (MVC, 2012g). MVC attempts to warn the municipalities in which the flooding will occur 48 hours before a potential flood occurs. Dams are water-control structures used for flood protection, low flow augmentation, ice management, erosion control, and recreation within

the watershed. There are more than 30 active dams on the main Mississippi River and its tributaries, 19 of them are owned by MVC (MVC, 2012g). MVC uses these dams to ensure that a stable water flow and level is maintained for fish, loons, frogs, muskrats and beavers and to allow hydro producers to function and turn a profit (MVC, 2012g). Water levels are altered by weather patterns such as storms or drought; MVC compensates for this change using dams. Lakes in the Mississippi Watershed are used as storage reservoirs to contain flood damages (MVC, 2012g). The lakes are controlled so that the water levels are low in the fall and fill up gradually in the spring with snowmelt and the heavy spring rain. This control of the lakes and rivers reduces the risk and extent of flooding and associated damages in the region; they also allow a relatively stable water level for summer recreational activities on the water (MVC, 2012g).

MVC is committed to protecting the quality of local drinking water by insuring that water connected with the watershed does not become contaminated or depleted. The Mississippi-Rideau Source Protection Plan is proposed water quality management plan developed by a committee made up of members of MVC and the Rideau Valley Conservation Authority under Ontario's Clean Water Act (Mississippi-Rideau Source Water Protection, 2012). The Source Protection Plan uses multiple layers of protection, including



Figure 3.5. Multi-barrier approach to protecting drinking water proposed by MVC and the Rideau Valley Conservation Authority (Mississippi-Rideau Source Water Protection, 2012)

water treatment and testing before it is distributed, to ensure the safety and purity of drinking water in the Ottawa area (Figure 3.5). The Mississippi-Rideau Source Protection Committee is responsible for writing the policies that will protect source water; this includes policies about potential threats near drinking water sources, such as waste disposal sites, stormwater, and sewage system (Mississippi-Rideau Source Water Protection, 2012).

MVC has recently completed a new water management plan in collaboration with the Ontario Ministry of Natural Resources that will allow them to regulate water flows and levels for five waterpower facilities of the Mississippi River system (MVC, 2012g). This is a multi-year project that attempts to balance the economic, social and environmental aspects of the watershed to the benefit of waterpower, flood control, low flow augmentation, fish and wildlife, tourism and recreation within the watershed (MVC, 2012g).

Currently, the Mississippi Valley watershed is experiencing climate change through increases in average temperature (MVC, 2007). This temperature increase causes the snowpack to melt earlier, more droughts in the area, and more frequent extreme weather events. In 2007, the Climate Change Adaptation Strategy was initiated by the MVC as a multi-year project to determine the challenges associated with climate change and where they will most affect the watershed (MVC, 2007). The goal of the program is to make the watershed more resilient to the climate change by monitoring changes in forest cover, surface water quality and groundwater quality. (MVC, 2007)

Mississippi Valley Conservation is involved in a turtle watch program which is now in its third year (MVC, 2012f). The goal of this project is to determine where turtles are located in the watershed, what species they are, and to increase public awareness. The turtle watch program promotes the protection of the turtles and their habitat by engaging the public

to report sightings to MVC so they can be added to the database (MVC, 2012f). Through the turtle watch program, sightings of Blanding Turtles, Common Snapping Turtles, Painted Turtles and Stinkpot Turtles have been reported and added to the MVC database (MVC, 2012f).

Invasive species, such as zebra mussels, rusty crayfish, and spiny water fleas, are harmful to the watershed because they alter the natural balance of the ecosystem by causing a decline in the population of native species (MVC, 2012f). To prevent this, MVC works in partnership with the Ontario Federation of Anglers and Hunters to sample the lakes in the area for invasive species (MVC, 2012f). MVC sets traps in lakes and at locations along the Mississippi River, the Ottawa River and Clyde River; this is mostly done by volunteers, lake stewards and summer students (MVC, 2012f). In 2011, MVC sampled for Zebra Mussels and Spiny Water Flea in 22 lakes, and sampled for Rusty Crayfish in 25 lakes, rivers and creeks in the watershed (Mississippi Valley Shorelines, 2012).

Credibility and Third-Party Information

Mississippi Valley Conservation employs a large range of engineers, scientists and environmental specialists on its staff (MVC, 2012b). Their staff is highly trained and qualified to provide reliable monitoring data which can then be used to implement effective watershed management plans. MVC encourages community involvement in their monitoring programs using volunteers. These volunteers undergo extensive training programs that teach them effective and reliable techniques for monitoring and sampling water quality, invasive species and other environmental factors (Sargeant, 2011). This training program and the educated staff ensure that the collected watershed data is credible and can be used to make informed decisions (Sargeant, 2011).

Mississippi Valley Conservation does most of its own monitoring and data collection using their paid staff, summer students and community volunteers. MVC monitors stream water levels and flow, ground and surface water quality, and forest cover within the watershed, and therefore do not require much third party information. Summer students are used to collect data about invasive species and turtle species found in the Mississippi Valley Watershed (Sargeant, 2011). MVC works in partnership with the Mississippi Valley Lake Stewardship Network to gather environmental data about the health of the lakes within the Mississippi Valley watershed (Mississippi Valley Shorelines, 2012). MVC has just begun a groundwater monitoring program and they receive some information from the Province of Ontario which monitored groundwater between 1946 and 1979 using site specific assessments (MVC, 2012f).

Use of Information and Decision Making

MVC uses the information obtained from their monitoring efforts to improve the management of the river. The information obtained by MVC is used by provincial and federal government departments, along with data obtained from other Conservation Authorities across the province, to implement broad range watershed management programs for the province (Conservation Ontario, 2009b). Monitoring data is used to better understand the effects of urbanization and land use changes on the water quality within the watershed (Mississippi Valley Shorelines, 2012). A better understanding helps staff to make more informed decisions for managing and protecting water resources. Monitoring the progress and success of implemented programs allows MVC to determine the effectiveness of their programs and select future actions that should be taken (Mississippi Valley Shorelines, 2012). Monitoring data is used to characterize water quality conditions in different parts of

the watershed and to identify problem areas (MVC, 2007). These problem areas can then be further examined by MVC and plans can be made to improve the water quality. Monitoring data is used as background data for locations within the watershed that are currently undeveloped but may undergo land use change in the future (MVC, 2012f).

Community Outreach

Mississippi Valley Conservation seeks to educate the public about the importance of the environment and maintaining a healthy watershed. This is done mainly through Conservation Areas and educational programs lead by MVC. Conservation Areas are locations within the watershed dedicated to the protection of forests, wetlands, plant life and wildlife. They act as “living classrooms” for visitors with Interpretive Centres, Seasonal Centres and environmental education programs (MVC, 2012c). MVC owns approximately 410 hectares of land used for conservation areas within the watershed. The three main conservation areas within the watershed are the Mill of Kintail, Purdon Conservation Area and Morris Island Conservation Area (MVC, 2012c). At the Mill of Kintail, MVC uses comprehensive educational programs as an outreach to the community where students and visitors can visit the museum or participate in stream studies, soil profiling and wildlife habitat studies. The Mill of Kintail is also home to many hiking trails where watershed residents and tourists are encouraged to enjoy the natural beauty of the Mississippi Valley watershed (MVC, 2012c). Purdon Conservation Area is a wetland that is home to the largest native colony of Showy Lady’s Slipper Orchids in Canada. Purdon also contains many other plant and wildlife species unique to the Mississippi Valley watershed region. It offers boardwalk hikes and picnic areas where members of the community and tourists are encouraged to enjoy and experience nature (MVC, 2012c). The Morris Island Conservation

Area consists of forested woodlands and wetlands available to the community for hiking, picnicking, canoeing, fishing and natural interpretation. MVC uses the Morris Island Conservation Area as an outlet to educate the public about the value watersheds and of sustainable management (MVC, 2012c).

MVC offers Conservation Education Programs and Nature Camps which promote stewardship and awareness of the environment (MVC, 2012d). These programs are based on the Ontario curriculum and available to students from kindergarten to grade 8, but can be adapted for non-school groups. They are offered on-site at the Mill of Kintail or can be conducted at any school with access to a pond, forest, park or creek (MVC, 2012d). MVC offers a Spring Water Awareness Program directed at elementary school children to educate the public about the dangers of spring run-off and flooding (MVC, 2012d). MVC also offers a Wildlife Watchers Summer Day Camp at the Mill of Kintail where children learn nature appreciation, conservation and stewardship (MVC, 2012d). MVC also offers general astronomy courses at the Mill of Kintail to educate the public about the harmful effects of light pollution on the enjoyment of the night sky and the negative effects on humans and animals (MVC, 2012d).

MVC aims to keep the community involved and informed in their events by issuing State of the Lake Reports, Watershed Report Cards and Monthly Newsletters. Each lake within the watershed is evaluated every five years and a State of the Lake Report of the collected data is available to residents and other interested to keep the community informed about the lakes in the area and the activities of MVC (MVC, 2012f). The Watershed Report Card is based on standard guidelines for all Conservation Authorities to determine watershed “grades”. This is released every five years to keep the community informed about what

MVC is doing in the watershed (MVC, 2012f). Monthly Newsletters are published and available through the MVC's website to communicate with residents about events and activities organized by MVC (Mississippi Valley Shorelines, 2012).

Mississippi Valley Conservation offers many ways for the community to become involved in protecting the watershed, such as volunteering and lake stewardship programs. Residents are offered training programs and encouraged to participate in monitoring of water levels, and invasive species (MVC, 2007). Tree planting and stream assessments are sponsored by MVC to promote watershed protection and nature appreciation at a community level (MVC, 2007).

Summary

Mississippi Valley Conservation is a local, watershed management agency which has the end goal of enhancing and protecting the environment through the Mississippi Valley Watershed. MVC attempts to balance the needs of the community and other watershed stakeholders with the needs of the natural environment. In the coming years, MVC intends to continue expanding its monitoring programs; this will allow them to get a more accurate view of the health of the watershed (MVC, 2007). MVC aims to increase the amount of benthic sampling done in the watershed area in the future to represent all of the unique sub-watersheds within the Mississippi Valley Watershed (MVC, 2007). Mississippi Valley Conservation will continue enforcing the regulations that ensure the maintained health of lakes, river and streams which will ultimately protecting the health of the Mississippi Valley watershed well into the future (MVC, 2007).

The Muskoka Watershed Council

Overview

The Muskoka Watershed Council (MWC) is a volunteer, non-profit (grassroots) organization in the district of Muskoka. The Council is managed by the politics of the community in the absence of a Conservation Authority, bringing together local governments, businesses, lake-based associations, provincial experts and the general public to work on environmental issues (MWC, 2011a). It is driven by volunteer and community beliefs, with huge input from the local public.

The area of Muskoka has beautiful scenery and many lakes provided by the watershed. As a result, it is a destination location for tourism, and one of Ontario's most vacationed areas. Tourism is the most prominent industry in the watershed, and this drives the local economy. The health of the watershed is therefore very important for the functioning and well-being of the Muskoka area (MWC, 2012b), and in the late 1990s, the Muskoka Heritage Foundation (MHF) identified the need to take interest in the watershed. As a result, the MWC was founded in October of 2001, by the MHF and the District Municipality of Muskoka (MWC, 2011a). The formation came out of the local understanding of the importance of the watershed for tourism and recreational purposes (Brouse, 2012).

The Muskoka Watershed Council's areas of interest are the Muskoka River Watershed and portions of the Black River and Severn River Watersheds, as seen in figure 4.1. This results in 20 subwatersheds which all drain into Georgian Bay (MWC, 2012c). "Muskoka watershed" refers to the watersheds within the District of Muskoka, which includes areas in Algonquin Park, the Township of Seguin and the Township of Algonquin Highlands. The Muskoka Watershed is over 62 kilometres at its widest point, and is about

120 kilometres long, covering an area of about 4,660 square kilometres. The entire watershed is on the Canadian Shield. The Black and Severn River watersheds encompass an additional 2,538 square kilometres for the MWC's area of interest (Muskoka Watershed Council, 2012b). More than 50 percent of the natural areas of the MWC watersheds are protected in some way (Muskoka Watershed Council, 2011b).

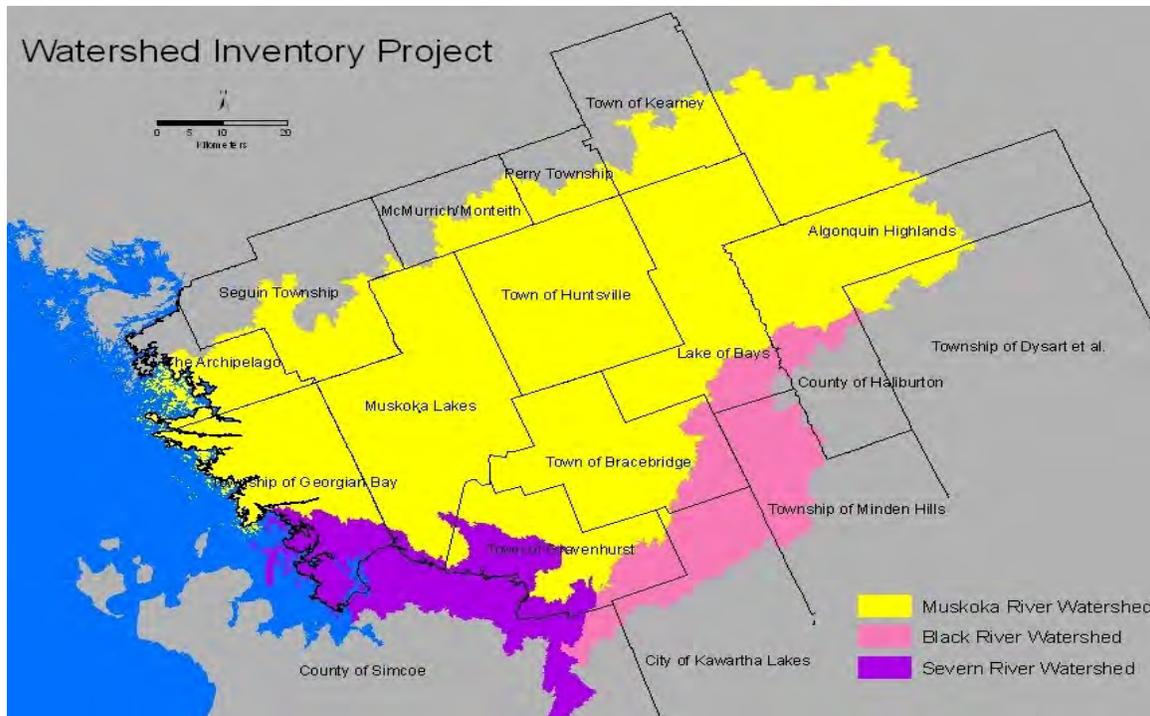


Figure 4.1. The watershed areas of which the MWC encompasses (MWC, 2012b).

The MWC consists of 2 staff members – a director of watershed programs and a watershed technician. The general council and the other committees are composed of volunteers. Membership to the various committees is open to all members of the council as well as the general public. The council aims to have members from various stakeholder groups to encompass many differing views. Examples of these stakeholder groups include businesses, tourism, cottage associations, as well as the forest industry, the education community, and the environmental community (MWC, 2012d).

Mandate/Mission

The Muskoka Watershed Council's mission is to "champion watershed health". The goal of the organization is to sustain the air, water and terrestrial ecosystems of the watershed for reasons such as the environmental, economic and intrinsic value they provide, as well as for health reasons. The MWC accomplishes their goal through four objectives:

1. Evaluating the Watersheds. This is done by developing science based programs to monitor and evaluate the watersheds.
2. Advocating for the watersheds. This is accomplished by encouraging the use of management practices and policies that will sustain or/and improve the health of the watersheds.
3. Communicate and educate. This is done through public programs that promote understanding of the impact the human population has on the watersheds, and by giving information about choices that will demonstrate stewardship for the watersheds.
4. Promote and demonstrate. Promoting activities and demonstrations supporting an environmentally friendly community (MWC, 2012e).

Funding

The Muskoka Watershed Council is financially supported through the District Municipality of Muskoka and the Muskoka Heritage Foundation (MWC, 2012f), which is a non-profit organization that aids in conservation (MHF, 2012). The District pays the salary of the two staff (Brouse, 2012), while the MHF provides the office space, computers and other office supplies for the running of the organization (Brouse, 2012).

Program and project funding is done through sponsors and grants. With respect to donations, the MWC does not directly do any local fundraising, though supports the fundraising of the Muskoka Heritage Foundation (Brouse, 2012). There are programs established to collect donations, with one of these being the Muskoka Envirocredits program. The MWC is one of several non-profit organizations that deliver this program. It gives individuals, businesses and corporations the opportunity to donate to local watershed initiatives, with the donations being used for watershed health initiatives, such as the planting and tending of trees and protection of areas (Muskoka Envirocredits, 2012). The MWC also asks for a \$500 donation from each watershed municipality, but the donation is voluntary (Brouse, 2012). For grant-makers, there have been several for past projects. This includes the Ontario Trillium Foundation, the Environmental Systems Research Institute Conservation Program, the Federal Economic Initiative for Northern Ontario, the Federation of Ontario Cottage Association, and the Ministry of Natural Resources (MWC, 2011a).

The operating budget of the MWC is typically between \$6,000 and \$10,000, which allows the Council to collect resources to publish their watershed report cards (Brouse, 2012). Grants for projects undertaken in collaboration with other organizations are not included in this and has totalled just over \$400,000 from 2001-2011 (MWC, 2011a).

Environmental Monitoring

Many environmental factors are monitored to ensure the health of the watershed. For the water itself, these include water clarity, nutrient availability, bacteria counts, pH and many others, such as water height. There are 42 control structures along the Muskoka River for maintaining water levels throughout the watershed (Muskoka waterweb, 2011). Many land areas are monitored as well, with an important one being the shoreline – the MWC

keeps track of shoreline erosion and shoreline development in the area. Wetlands and forested areas are also monitored, in terms of their presence, dominant vegetation, soil quality, age, overall health and impacts of human development, such as influences of trails and roads. Wildlife is also monitored, in order to protect important habitat and maintain species richness and diversity. Species at risk are monitored, and their profiles (including threats and how you can help) can be found on the MWC website. Protected areas are also monitored as possible starting points for development of natural reserves (MWC, 2011c).

In 2002, the Muskoka Watershed Council came up with a set on indicators that would be used to assess the health of the watershed, and these indicators form the basis of the report cards. This way, changes can be monitored and programs can be developed to increase the health of certain areas if needed. These indicators include (adapted from the MWC's indicators of watershed Health) (MWC, 2001c):

- Water that is swimmable.

To determine if the water is swimmable, the MWC uses indicators such as the number and duration of beach closures and the number of occurrences of bacteria counts that are above provincial standards. Phosphorus concentrations are also considered, as well as algal blooms, and overall changes in water quality (from measurements by a secchi disc).

- Water that is fishable

Fishable water means that there are no restrictions on fish consumption due to toxins in the water. Therefore, the MWC uses fish consumption advisors to assess this indicator.

- Water that is drinkable

To assess if the water is drinkable, the MWC uses the number of unacceptable bacteria counts in drinking water, incidents of malfunctioning septic systems, the number of boil

water advisors, report of spills releasing chemicals into the water supply and the concentration of chemicals in the water due to human activity (determined through various records).

- Air that is breathable.

Air that is breathable is defined as no incidences of respiratory problems due to the air.

This is assessed by the number of smog alerts and the number of lakes with pH lower than 6.

- Ecosystems which are healthy.

The MWC wants to ensure that the ecosystems can function normally without environmental stress. This is assessed by studying the presence and abundance of key species in the food web, species diversity, the quantity and quality of habitat types, the quality of shoreline and buffer areas, and the number and abundance of endangered species. Stresses on the environment are also monitored, such as changes in pH, changes in nutrient availability, and introduced species.

- A physical environment that is sustainable.

The MWC wants to ensure that the watershed has land use that maintains habitat of good quality and sufficient resources to sustain a diversity of species. This is measured by considering the long term protection of habitat (for example conserved land), changes in land use and cover, the quantity and quality of stream base flow, the quantity of ground water consumption, and the extent of shoreline alteration.

- Community values which are environmentally sustainable.

A sustainable watershed will have an economy that is viable but also sustainable, and a community with a strong environmental ethic. The MWC therefore considers employment

in key resource activities and the watershed, and counting the number of schools, businesses and lake associations recognized as practicing environmental stewardship.

The Watershed Inventory Project, which will be discussed further in the next section, used some of these indicators and ones more specific to assess the overall health of the watershed.

A summary of the indicators in this project are shown below.

Table 4.1. Indicators used to assess the watershed in the Watershed Inventory Project (Adapted from the Terrestrial and Aquatic Ecosystem Components of the MWC Watershed Inventory Project) (MWC, 2011b):

Goal	Objective	Indicator
Identify ecosystems and protected areas	Identify all ecosystems within the watershed and their protection status	i) landform and vegetation Association ii) existing protected areas
Identify areas of high ecological importance	Identify natural areas that exhibit high degree of integrity and resiliency	i) Size of discrete ecosystems ii) presence of old growth forests iii) interior size of discrete ecosystems
	Identify Wetlands	Presence of Wetlands
	Identify Riparian areas	Riparian stream/rivers, including lakes and shorelines
	Identify recharge areas	Highly permeable areas
	Identify habitat diversity	Habitat diversity
	Identify species element occurrences, vegetation communities, and other significant wildlife habitat	i) Species and vegetation community occurrences ii) important habitat areas
Identify stresses on ecosystems and processes	Identify condition/quality of watershed	i) percentage natural cover ii) influence of settled areas iii) influence of open cleared areas such as agricultural lands and golf courses iv) influences of pits and quarries v) influence of hydro lines vi) influence of railways vii) influence of roads viii) influence of trails ix) influence of dams x) invasive species x) indicator species

Projects

Projects undertaken by the MWC are completely driven by volunteers. The ideas for projects and their duration are dependent on the time availability and interest of these volunteers. The only exception is the watershed report card. This is the main project done by the MWC, done every four years. These reports are produced by the staff as science-based evaluations of the individual components of the watershed. These report cards contain reports for all 20 subwatersheds (Brouse, 2012).

The projects selected by the MWC must meet the goal of championing watershed health. Since this is so broad, there are many types of projects undertaken by the Council, from assessing parts of the watersheds to developing programs to educate the public. The volunteers of the council will voice areas of concern and a potential project for the area. After a project is selected and volunteer interest is confirmed, funding is searched for through grants and donations. Funding is not usually the limiting factor for projects and other programs– it is mostly volunteer time (Brouse, 2012). There are also many programs established in order to give the public knowledge about the watershed and stewardship, and will be discussed in the community outreach section.

An example of a large project carried out by the Council is the Watershed Inventory Project. This project assessed the Muskoka River and the northern part of the Black-Simcoe watersheds. The project had two parts – a terrestrial component (completed in 2007) and an aquatic component (completed in 2009). It was funded by the Ontario Trillium foundation, and was done in partnership with the MHF, Ministry of Natural Resources, the District Municipality of Muskoka, and Fisheries and Oceans Canada. The project identified significant natural areas of the watershed, as well as areas that were degraded. The Inventory

Project aimed to identify important areas in the watershed where a lack of protection existed (MWC, 2012g).

Credibility and Use of Third Party Information

Although no science background is needed to partake in the council, there are members with science backgrounds to serve a role of academia. This includes individuals with degrees in environmental sciences, environmental engineering, aquatic biology and backgrounds in environmental health. There is also a watershed planning technician on staff. Unlike Conservation Authorities where the staff are qualified, these volunteers may not understand the scientific basis of the watersheds. Even so, their input is important in driving local science. There are also plenty of opportunities to give the volunteers knowledge about the watersheds in a more scientific manner. Every Council meeting (about once a month) has a presentation on some aspect of the watershed. There are also stewardship conferences and summits twice a year presenting science issues in a way for everybody to understand, as well as public conferences offering technical watershed information (Brouse, 2012).

The indicators the MWC uses to assess the watershed were developed by the Council, but with outside expert help. In 2002, twenty-nine technical experts came together to give advice to the council and the public on how to choose the indicators (MWC, 2011c). However, the data used when for these indicators when assessing the health of the watershed mostly comes from third party sources.

The Muskoka Watershed Council does very little of their own monitoring. The MWC has just started monitoring the loss of wetlands to development, but besides this, the rest of the monitoring data comes from elsewhere. There are other credible and competent organizations in the region that are willing to share their data from monitoring with the

Council. Therefore, the majority of the data used by the MWC comes from third party sources. The information shared is used in production of the watershed report cards, as well as for some projects undertaken. Most of the information comes from the District of Muskoka and the Ministry of Natural Resources. Various lake associations and the Dorset Environmental Science Centre also provide data to the MWC (Brouse, 2012).

The water quality data is provided by both the district of Muskoka (for one hundred and sixty-three lakes), as well as various lake associations in the area. The District's sampling program for water quality includes Secchi depth (water clarity), phosphorus concentrations (as a measure of nutrient enrichment), as well as dissolved oxygen and water temperature. A full chemical analysis is also performed on the water (Brouse, 2012). This analysis includes dissolved carbon, pH, conductivity, nitrates, sulphuric acid, iron and chlorine content (Muskoka Waterweb, 2012a). E.coli counts from various lake associations are also considered by the MWC for water quality (Brouse, 2012).

The District of Muskoka also provides information about shoreline development to the MWC. The Lake Systems Health Monitoring program of the District not only looks at water quality, but also assesses shorelines and does biological monitoring. Surveys are done by the District on shoreline vegetation and structures, as well as the first twenty metres of land surrounding the water (Muskoka Waterweb, 2012b). As part of the Lake Systems Health Monitoring, benthic macroinvertebrates are sampled and identified. The council also uses information pertaining to benthic macroinvertebrates collected by the Dorset Environmental Science Centre (DESC), an environmental science facility consisting of government, university and non-government persons that studies Ontario's inland aquatic ecosystems (Dorset Environmental Science Centre, 2012). The MWC also uses calcium

measurements in the water taken by the DESC (Brouse, 2012).

The Parry Sound District of the Ministry of Natural Resources encompasses the area of Muskoka, and much of their data is used by the Muskoka Watershed Council. Information about species at risk and large mammals is collected by the Ministry and used by the MWC. For example in the Watershed Inventory Project, a map of different habitat types for various species was developed. They also develop species at risk factsheets online so the public can be aware of what they can do to help the species. The Ministry of Natural Resources also collects information on forestry used by the MWC. Landscape scale land use, such as developments and mining pits are monitored by both the Ministry and the District, and MWC uses information from both parties pertaining to this (Brouse, 2012).

Even though the data is collected from other sources, the volunteers of the Council use the information to develop their own reports and form the basis of their projects. Since the majority of data is from reputable third party sources, such as lake associations and governmental agencies, the data and reports would be considered credible.

Use of information and Decision Making

The MWC uses the collected information to develop their report cards every four years, to evaluate projects, as well as to communicate issues to the public and decision-makers. Community outreach is perhaps the biggest use of their information, and will be discussed in the next section. The information is made available to increase public awareness of watershed issues. In local organizations, community input is invaluable and the MWC gives knowledge to their community in ways that they can help. The Council uses information gathered from projects to determine future projects of focus and to establish areas of concern. For example, the data resulting from the Watershed Inventory Project is of

huge value and use. This data is being used for natural heritage planning, conservation efforts and restoration. All collaborative members use the resulting project data. The Muskoka Heritage Foundation uses the information to establish priority areas for acquisition; the District uses the data to develop a natural heritage strategy to identify important natural areas; the Ministry of Natural Resources uses the data to for natural heritage planning on watershed land, and also added the data to the provincial database; the MWC reports the data and changes on their report cards, and also uses it to develop stewardship and other education programs; and Fisheries and Oceans Canada will use the findings for fish management activities (MWC, 2012g).

Even with all their information, the Muskoka Watershed Council is not a decision-making body. The MWC works and talks with decision makers regarding watershed health and and management, but does not directly make decisions regarding what is to be done in the area. The Council provides their collected information to decision-makers in both presentations and written format, in hopes of shaping their opinions and ultimately their decisions in matters regarding the watershed. These decision makers include the District, lake associations and the general public. The Council comments on local, provincial and federal legislation through public engagement processes, and has a “best practices” series aimed at lake associations and individuals. MWC also works with real estate agencies to provide information to new residents, and talk with developers and industry if the opportunity arises (Brouse, 2012). There are many written papers on the MWC website regarding watershed health, and hopefully these are read and understood by decision makers and result in decisions in favour of activities that promote watershed health.

Community Outreach

The Muskoka Watershed Council takes on many different community outreach programs. All of these outreach programs are volunteer-based. They get the information regarding watershed health out to the general public in various ways, as well as get the information to decision-making bodies. The major outreach is the watershed report card, which is available online and is distributed to the public via the media (Brouse, 2012).

The MWC has various programs established in order to promote environmental stewardship amongst the public. One of these is the “Best Practices Program” which is aimed at local businesses as well as the general public. The aim of the program is to provide advice on how to live, work and develop land in ways that protect the natural environment. A part of this program is the development of best practices brochures, as well as newspaper articles, public service announcements, and displays at community events (MWC, 2012h). Another program is the “Clean and Green 13”, a program aimed at giving people tips on how to lower their impact on the watersheds during daily activities and how this improvement would help (MWC, 2012i).

The MWC also has various ways in which they get their information about the health of the watersheds out to the community. These include

- “Welcome to the Wetlands”, a presentation given to grade four students in local schools
- Presentations to other community groups
- Activities at the Haliburton-Muskoka Children’s Water Festival, a festival which encourages children to be water stewards
- Displays at local events

- Environmental Lecture Series, which are lectures open to the public about different watershed topics (MWC, 2012j).

The council also publishes papers on the website. These papers may voice their opinions regarding issues on watershed health, or may be literature reviews. The Council also produces e-bulletins a few times a year to promote upcoming events, talk about issues, and related publications. The MWC is also on Facebook and Twitter, and very importantly, all meetings are open to the public (Brouse, 2012).

Summary

The Muskoka Watershed Council is a grassroots organization in the District of Muskoka, formed in 2001 due to the importance of the watershed for tourism purposes. The Council is composed almost completely of volunteers, dedicating their time and ideas to environmental initiatives. With a mission to “champion watershed health” the MWC takes on a wide variety of programs and projects, from watershed monitoring to distributing the information to the public and decision makers. Using data mainly from third party sources, the MWC is able to effectively educate the public on watershed health issues and get the community actively involved and caring about environmental stewardship. The Council has been quite successful so far, in terms of giving the community knowledge, and developing strong networks with volunteers who are active and interested. The Muskoka Watershed Council has also succeeded in meeting many of the needs of their watershed, and is making a big difference in the Muskoka area.

Ottawa Riverkeeper

Overview

The second largest river in eastern Canada stretches 1,271 km through both Ontario and Quebec. This water source moves along its path at an average rate of 1,950 m³/s (Bouza *et al*, 2006). The river is significant because of its great length, the energy potential of the water flow while the watershed associated with the Ottawa River is equally important as it covers a 146,300 km² area. The influence of this watershed affects over 1,670,000 people in more than 250 communities (Bouza *et al*, 2006).



Figure 5.1. The Ottawa River watershed outlined in black from Ottawa Riverkeeper report 2006.

Water sources in a city are important and have a variety of uses. The Ottawa River watershed provides drinking water, a source of food through fishing, a place for recreation, economic value through tourism and activities, a source of energy from dams and generating stations. These are ways only humans benefit from the river, when it is also creating ideal

ecosystems for many species specific to the area. The Ottawa River watershed may have value to people in the area, but truly the beauty of the river is the ecological importance it has. The Ottawa Riverkeeper is an organization dedicated to increasing water quality and the overall ecological health of the Ottawa River Watershed (Ottawa Riverkeeper, 2012a).

The organization was first suggested in 2000 by a group of concerned citizens. In 2001 the group developed a board and became established as an organization (Ottawa Riverkeeper, 2012b). Today, almost 10 years after becoming a registered charity in 2003, the Ottawa Riverkeeper has three full time staff - the Riverkeeper/executive director, communications director and officer manager along with one seasonal staff member who in the summer of 2012 was in charge of the Ottawa swim guide and a board of nine elected directors who are volunteers (Ottawa Riverkeeper, 2012c). Although these thirteen people are directly associated with the Ottawa Riverkeeper, the organization would not function without its many volunteers in the community.

The Ottawa Riverkeeper is a community based not for profit organizations which works with a small staff to educate the general public on the importance of the Ottawa River Watershed.

Mandate /Mission

The Ottawa Riverkeeper is an organization based on believes that the river needs to be protected. They were founded based on common interest of the Ottawa River environment and the hope of maintaining its ecological value. The mission stated on the organizations official website is as follows:

“Ottawa Riverkeeper is an independent voice for the Ottawa River, providing leadership and inspiration to protect, promote and improve its ecological health and future.”

-Ottawa Riverkeeper

The Ottawa Riverkeeper focus on the natural state of the river and minimizing negative human impact of the ecosystems, which it makes up. The Riverkeeper are focused on raising awareness of the importance of water quality and enlightening the general population on ways they way positively influence the Ottawa River (Ottawa Riverkeeper. 2012a). Rather than making legislation, Ottawa Riverkeeper educates all ages and stages of people on the beauty of the river and its surrounding ecosystem hoping to spark peoples interest in being involved or making small changes in their lives to make positive impacts.

Funding

The Ottawa Riverkeeper are a not for profit organization and therefore receive most funding from provincial and municipal grants as well as corporation and individual donations. Unlike Conservation Authorities, this grassroots organization is very dependent on outside sources for financial support. The Ottawa Riverkeeper acknowledges 26 partners and donors as well as 13 individual donors (Ottawa Riverkeeper, 2012d). The annual operating budget is approximately 320, 000 according to Riverkeeper Meredith Brown. The funding received goes into the Ottawa Riverkeepers many programs and projects as well as staff salaries.

Environmental Monitoring

Environmental analysis of the Ottawa River and its surrounding ecosystems is a great task. The river is 1, 271 km long, this is a large length to stretch. The task becomes increasingly difficult as the river runs through both Ontario and Quebec.

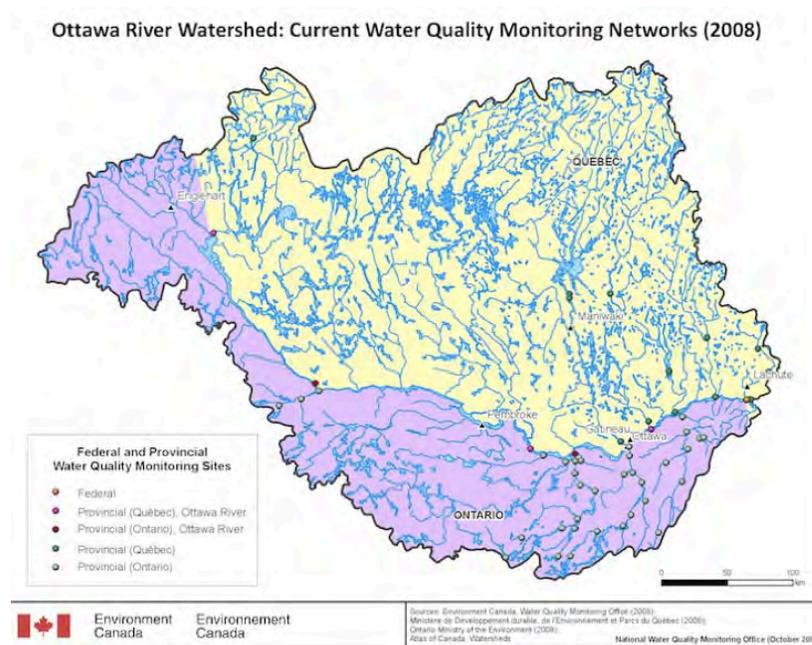


Figure 5.2. Environmental monitoring sites of the Ontario and Quebec Provincial Governments and the Federal Government in the Ottawa River Watershed (Environment Canada, 2008).

There are 6 monitoring stations along the Ottawa River; government municipal, provincial or federal, controls these stations. Although the Riverkeeper do not hire scientists to do research, they do use the results of others research. Aspects of environmental impact on the Ottawa River are often blatant enough in depth research is not needed. The River Watch program of Ottawa Riverkeeper allows the river to be monitored at approximately 16 specific locations however River Watchers are able to monitor other areas of the river as well. Not only are there Riverwatchers at specific locations there is also watershed wide monitoring.

A Riverwatcher is a volunteer from the community who has a desire to influence people's attitude towards the Ottawa River and its watershed. These volunteers have a specific area to over look and go through steps to ensure they are managing this area. First the volunteer must research the area so they have a basis to make observations such as knowing the history of the area, the ecology, geology and geography. They must then

monitor the area; this involves observations of water quality, looking for spills and algae blooms as well ecological factors such as an excess of certain species or a decline in a species. They must then inform fellow Riverwatchers as well as Ottawa Riverkeeper on issues or potential issues observed. The final and arguably most important step is developing a solution to the source problem and assessing how significant the issue is in order to protect the river (Ottawa Riverkeeper, 2012h).

Monitoring is done at a large scale by the Riverwatchers, which is not completed by any government or other outside source. This is important in understanding how different ecosystems of the watershed relate and how one area may affect another. The overall monitoring is accomplished in three different modes. Firstly, paddlers are able to analyze the river qualitatively. By moving down the river at a slow pace, it is easy to observe changes in the ecosystems, therefore impacts can be observed through both space and time (Ottawa Riverkeeper, 2012e). A second source of information of the overall condition of the Ottawa River is through Ottawa Riverkeeper divers. These volunteers are able to observe effects of pollution in the water first hand. They too are able to observe changes in the water quality in different areas of the river, as well as notice changes of the water over time. The divers produce reports on any significant observations, however the results to issues observed are not clear in the reports (Ottawa Riverkeeper, 2012f). The last means of monitoring of the overall watershed is through the Ottawa Riverkeeper air force. These volunteers are able to take aerial photographs of any issues reported giving an overall view of impact, GPS coordinates as well as images to document (Ottawa Riverkeeper, 2012g).

Projects

Ottawa Riverkeeper is an organization based on sharing passion for preserving natural ecosystems with the general population. Programs offered by the organization reflect this and are focused on raising awareness. Some of the programs advocated by the Riverkeeper are specific to Ottawa, while others are in collaboration with other organizations.

The Waterkeeper Swim Guide is an initiative, which was developed by the Lake Ontario Waterkeeper and now supplies information for the Ottawa River area. This swim guide is available online and as an application for mobile devices. The program gives an overview of potential swimming areas, often including picture, beach conditions, E. coli levels and an option to report any pollution or other environmental problems observed in the area. Ottawa Riverkeeper also joins Lake Ontario Waterkeeper and Fraser Riverkeeper in a fundraising project called Swim Drink Fish Music Club. This allows people to make donations for a membership to an exclusive website to download music as well as access to local Waterkeeper news (Ottawa Riverkeeper, 2012i).

Ottawa Riverkeeper has developed solo projects/programs focused on the Ottawa River watershed and its needs. The arguably most important program offered by the Ottawa Riverkeeper is the river watch program; the basis of the organization. As described in environmental monitoring, without volunteers keen to keep tabs on the river, there would be no organization. Any individual may become a river watcher and a workshop is offered to learn what to look for and other specific guidelines (Ottawa Riverkeeper, 2012h).

The great river project was a project that occurred on July. 4th, 2011. This was an initiative to gain knowledge of the river from both observation and communication with

local people. The Riverkeeper paddled the river with publicity in order to raise awareness. Along the way she interviewed people who have influence on the river such as fishermen, farmers, scientists, First Nations Chiefs, river guides and scientists for insight on how the river is doing at the current time and why it is worth learning more about it (Ottawa Riverkeeper, 2012i).

Similar to The Great River Project is the River Patrol. This is an initiative to learn about the river while being on the river. Similar to the Great River Project the Riverkeeper asks citizens their opinion on the river, any current issues on the area, why the value the river and if they have any impact on the river. The Riverkeeper also makes observations on pollution and monitors water quality. This is an important program in that it tracks changes of the ecosystems over time and information can be shared with the public. This program runs from June to September and is a way to encourage media coverage of the river and show the general public the Ottawa Riverkeeper is out there (Ottawa Riverkeeper, 2012i).

Credibility and Use of Third Party Information

The Ottawa Riverkeeper has no hired scientist; therefore volunteers perform all water analysis. Most information is from government sources, such as information from Conservation Authorities, which are credible. The issues the Ottawa Riverkeeper deals with are more qualitative than quantitative, therefore simple observation is used to obtain information through programs such as Riverwatchers. Environment Canada does annual reviews of areas within the Ottawa River watershed and this information is useful to Riverwatchers. An example of information used by Ottawa Riverkeeper from Environment Canada, which is beneficial to the river, is the tabulated species at risk list seen below.

Endangered	Threatened	Special Concern
<p>Plants: American ginseng <i>(Panax quinquefolium)</i> Blunt-lobed woodsia <i>(Woodsia obtusa)</i> Butternut <i>(Juglans cinerea)</i> Eastern Prairie Fringed-orchid <i>(Platanthera leucophaea)</i> False hop sedge <i>(Carex lupuliniformis)</i></p> <p>Fish: Copper redhorse <i>(Moxostoma hubbsi)</i></p> <p>Birds: Henslow's sparrow <i>(Ammodramus henslowii)</i> Barn Owl <i>(Tyto alba)</i> Kirtland's warbler <i>(Dendroica kirtlandii)</i> Loggerhead shrike <i>(Lanius ludovicianus migrans)</i></p> <p>Reptiles: Spotted turtle <i>(Clemmys guttata)</i></p>	<p>Plants: Flooded jellyskin lichen <i>(Leptogium rivulare)</i></p> <p>Fish: Channel darter <i>(Percina copelandi)</i></p> <p>Birds: Least bittern <i>(Ixobrychus exilis)</i> Peregrine falcon <i>(Falco peregrinus anatum)</i></p> <p>Mammals: Grey fox <i>(Urocyon cinereoargenteus)</i></p> <p>Reptiles: Eastern hog-nosed snake <i>(Heterodon platirhinos)</i> Eastern ratsnake <i>(Elaphe obsoleta)</i> Blanding's turtle <i>(Emydoidea blandingii)</i> Spiny softshell turtle <i>(Apalone spinifera)</i></p>	<p>Plants: Pygmy pocket-moss <i>(Fissidens exilis)</i></p> <p>Fish: Bridle shiner <i>(Notropis bifrenatus)</i> Grass pickerel <i>(Esox americanus vermiculatus)</i> Lake sturgeon <i>(Acipenser fulvescens)</i></p> <p>Birds: Barrow's goldeneye <i>(Bucephala islandica)</i> Cerulean warbler <i>(Dendroica cerulean)</i> Harlequin duck <i>(Histrionicus histrionicus)</i> Red-headed woodpecker <i>(Melanerpes erythrocephalus)</i> Red-shouldered hawk <i>(Buteo lineatus)</i> Short-eared owl <i>(Asio flammeus)</i> Yellow rail <i>(Coturnicops noveboracensis)</i></p> <p>Mammals: Eastern wolf <i>(Canis lupus lycaon)</i> Southern flying squirrel <i>(Glaucomyz volans)</i></p> <p>Reptiles: Eastern ribbonsnake <i>(Thamnophis sauritus)</i> Eastern milksnake <i>(Lampropeltis triangulum)</i> Northern map turtle <i>(Graptemys geographica)</i> Wood turtle <i>(Glyptemys insculpta)</i></p> <p>Insects: Monarch <i>(Danaus plexippus)</i></p>

Figure 5.3. Species at Risk Currently or Formerly Associated with the Ottawa River Watershed (Riverkeeper Report, 2006)

This information can be used to highlight areas to protect when a species at risk is present. Other information such as maps and water quality analysis can also be used. Information is also used from industry publications.

Use of Information and Decision Making

Information is necessary to determine action needed to positively influence the watershed. Decision making is made based on the issue in the area looking at the cause of the issues and the affect it has. This method is successful because it means the area which needs assistance will receive it. Decisions made by the Ottawa Riverkeeper are not political and there are no bills past or laws made. However the Ottawa Riverkeeper can influence decision makers and this is a focus of the organization. The purpose is not solely to alert to public but

to draw attention to the importance of the river to the government. The more people who are involved and passionate the more influence they will have. The decisions made by this organization based on information are focused on, what is the issue? Where is the issue? How can the issue be dealt with? Who is willing to help with the issue? These questions are essential to determine action to be taken by the Riverkeeper and show the action is a direct result of an issue.

Community Outreach

The Ottawa Riverkeepers are focused on informing people about the issues surrounding the Ottawa River watershed, and inspiring people to make changes in their lives and promoting others to make positive changes. Community outreach is a major aspect of the organization and the majority of Riverkeeper events are open to the public. The Ottawa Riverkeeper offer community presentations and are willing to speak at events about the Ottawa River, its issues, history, the work Ottawa Riverkeeper does and how each citizen can be involved. The target audience of these community presentations is both adults and youth. The fate of the Ottawa River is not only in the hands of leaders today, but also in the hands of generations to come. Therefore educating youth about the history, benefits and stresses on the river is an important task. River Friends is a program developed by the Ottawa Riverkeeper to inform youth about the importance of the Ottawa River. The River Friends program has eight main steps:

1. Lights, Camera, Action! – this involves watching an Ottawa Riverkeeper movie and encourage it being passed on.
2. Don't snooze: Get Out and Use – this encourages youth to use local natural water sources and encourage respect for them.

3. Have Any Web-Footed Friends? – this asks youth to spread the word about the Ottawa Riverkeeper through getting involved and keeping in the loop of Ottawa Riverkeeper activities.
4. Lap from the Tap – this encourages drinking tap water instead of bottles water.
5. Spot the Water Hog – this encourages saving water in simple ways.
6. Crash Shoreline Trash – this encourages cleaning up the area around the river by individuals and inspiring others to also help.
7. Turn Money Blue – this asks youth to encourage donations to Ottawa Riverkeeper through family, friends and school.
8. Be a Water Hero – this encourages youth to write, promote, take action and help influence the health of the Ottawa River.

The River Friends of Ottawa Riverkeeper is the youth outreach and only one example of how the Ottawa Riverkeeper is involved with the community.

Summary

The Ottawa Riverkeeper is a successful not for profit/ grass roots organization focused on increasing water quality and assisting the surrounding ecosystems. There are no laws created, or bills passed by the organization, however there is action taken. The Ottawa Riverkeeper has many programs and projects which are all open to the general public; these initiatives help promote the importance of the Ottawa River and its watershed which in turn hope to encourage positive ecological health of the area.

Conclusion

From our four case studies of the Rideau Valley Conservation Authority, Mississippi Valley Conservation, the Muskoka Watershed Council, and the Ottawa Riverkeeper, differences were found in their management techniques. A summary of the research questions in this report contrasting Conservation Authorities and grassroots organizations are shown in Table 6.1.

Table 6.1. Summary table of six research questions examined for each case study.

	Conservation Authorities	Grassroots Approach
Funding	Millions of dollars. Mostly through municipal levies.	Thousands of dollars. Range of sources, mostly through donations, and grants.
Environmental Monitoring	Major focus and mostly done by the Conservation Authority.	Limited scope of monitoring.
Programs/projects	Focused on environmental monitoring and restoration. Large focus on flooding.	Focused on volunteer ideas and community specific issues.
Decision Making	Have jurisdiction in the area, and can make decisions.	Provides information to decision makers but does not make decisions.
Credibility and Third Party Information	Credible information obtained from the Conservation Authority itself through specialized staff.	Use of information from creditable third party sources.
Community Outreach	Information available to the community, but has to be searched for.	Major focus of the organization, very easy to find information.

The main question asked in this report is: Which approach is better? By looking at the pros and cons associated with each approach, we can identify the benefits and faults of each method. Some of the main differences between Conservation Authorities and grassroots approaches include differences in funding, community involvement, third party

information, and decision making. The pros and cons of each approach are summarized below in Table 6.2.

Table 6.2. Summary of pros and cons of Conservation Authorities and Grassroots Approaches to watershed management.

	Conservation Authority	Grassroots Approach
Pros	<p>Lots of funding, which results in professional staff and large of projects being ran each year in different areas of watershed science. Funds lead to the acquisition of conservation land and incentive programs.</p> <p>Have jurisdiction in their area, and can make informed choices and active decisions based on their collected data.</p> <p>Collect their own data instead of being dependant on third parties.</p>	<p>The community is very involved within the organization, and has a say in what goes on in terms of projects and programs, which are tailored to the community's need.</p> <p>There is a sense of enthusiasm and achievement within the community.</p> <p>These organizations can be created in areas where Conservation Authorities are not established due to a lack of flooding.</p> <p>Less bureaucracy for these organizations.</p>
Cons	<p>The community is not as well involved and have less input. The information is available to the community, but has to be sought out.</p> <p>Focus of projects is geared towards flood prevention, at the expense of other programs that may be considered more important. Projects are focused more in urban areas.</p> <p>Conservation Authorities add an additional layer of bureaucracy since they are affiliated with governments.</p>	<p>Less funding, resulting in less resources for projects and inability to hire professional, specialized staff.</p> <p>No political decision making, resulting in an inability to make decisions based on collected data.</p> <p>Dependant on third party information.</p>

While both Conservation Authorities and grassroots approaches have a variety of pros and cons, these points do not dictate which approach is better. Based on our report, we conclude that the most important factor in determining which management approach should be implemented is based on the area and watershed in question. For instance, a larger

watershed area may require more resources to manage and a Conservation Authority may be necessary to secure the funding required to properly conserve the watershed area. The human population of the watershed may also play a role – bigger, more urbanized cities within watersheds may cause more damage to the environment in terms of pollution, resource exploitation, and habitat destruction, while also having a potential for more flood damage. Conservation Authorities were originally established to deal with flooding, and this is still a major focus today. In regions with low risk of flooding, Conservation Authorities are established less frequently and grassroots organizations are often developed. These grassroots organizations play a critical role in environmental protection and relaying the status of the watershed to decision makers. Additionally, in areas that are less flood prone, municipalities may not see the need to put a great amount of funding into a Conservation Authority. Financial support also plays a role in the establishment of a Conservation Authority or a grassroots organization, as some areas may not have funds available for a Conservation Authority, or may not be willing to spend such a great deal of money on watershed management. Rural versus urban areas may also play a role in which approach is established – rural regions may feel a greater sense of community and citizens may want to get involved in local issues, which will lead to the creation of grassroots organizations. As well, rural areas may advocate for less governmental influence on what they can and cannot do, whereas urban centres may be more open to government bodies dealing with issues. Finally, the community attitude towards watershed management may also play a critical role in the choice of which organization is established. For example, if the community does not want to get involved, then a grassroots organization will not work, as they cannot function

without the support of volunteers. All of these factors come together to influence the choice of management for the watershed in question.

This report was a comparative study between grassroots organizations and Conservation Authorities. To further expand on this idea, we can compare governmental authorities which monitor watersheds across different provinces. While Conservation Authorities themselves are only within Ontario, other provinces and territories within Canada likely have a governmental legislation for overseeing watersheds. The benefits of each can be examined to find an approach that is the most suitable, if such an approach exists. As well, grassroots organizations are able to exist almost anywhere in the world, and so a comparison can be done by looking at these grassroots organizations to find an approach that is the most effective.

There are a plethora of factors impacting watershed management; therefore Ontario does not have one management strategy for perfectly dealing with watersheds. Both management strategies discussed in this report have benefits, but the challenges associated with them keep them from being perfect. Overall, the watershed management body for the region is dependent on the needs and views of the communities within the watershed, rather than simply the pros and cons of Conservation Authorities and grassroots organizations.

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