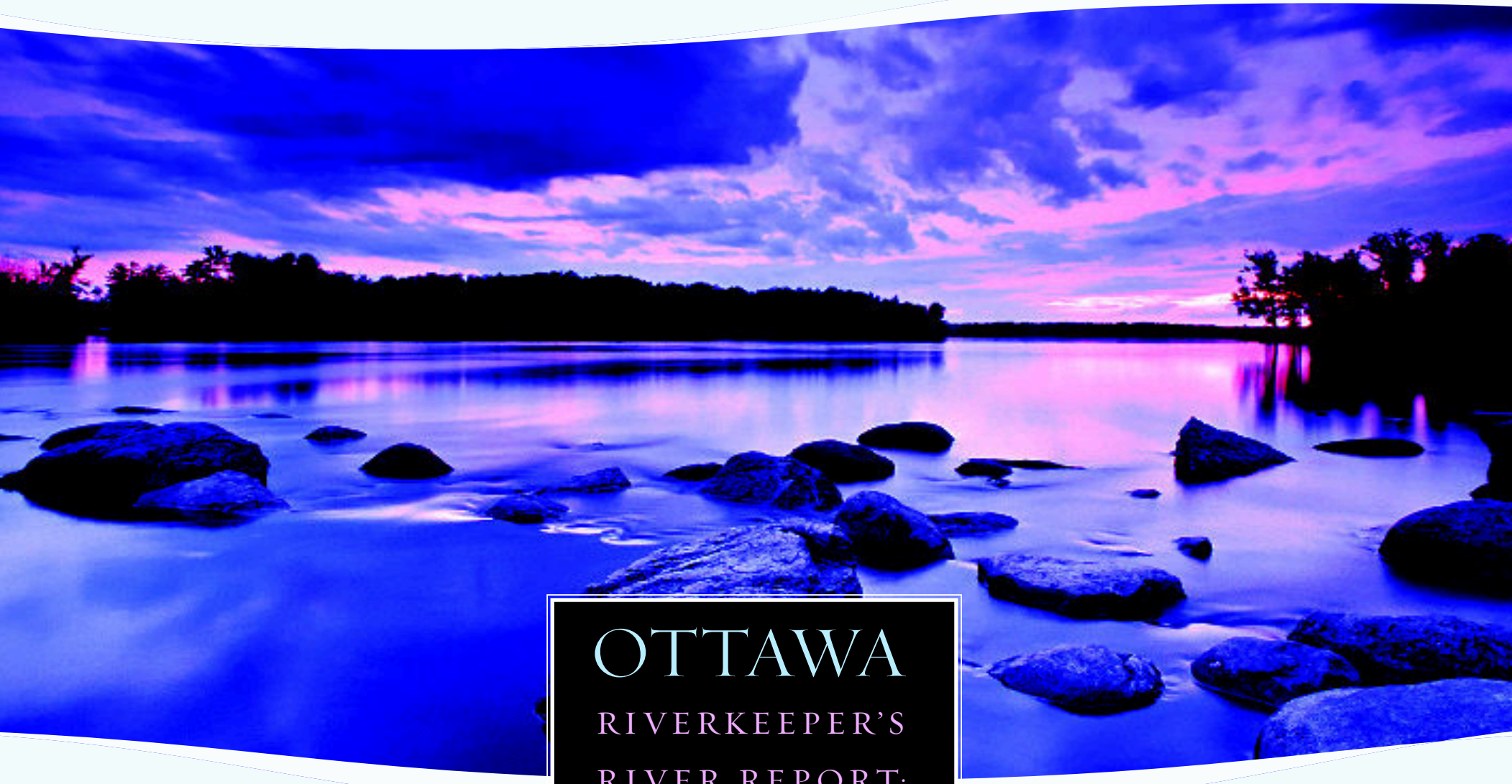
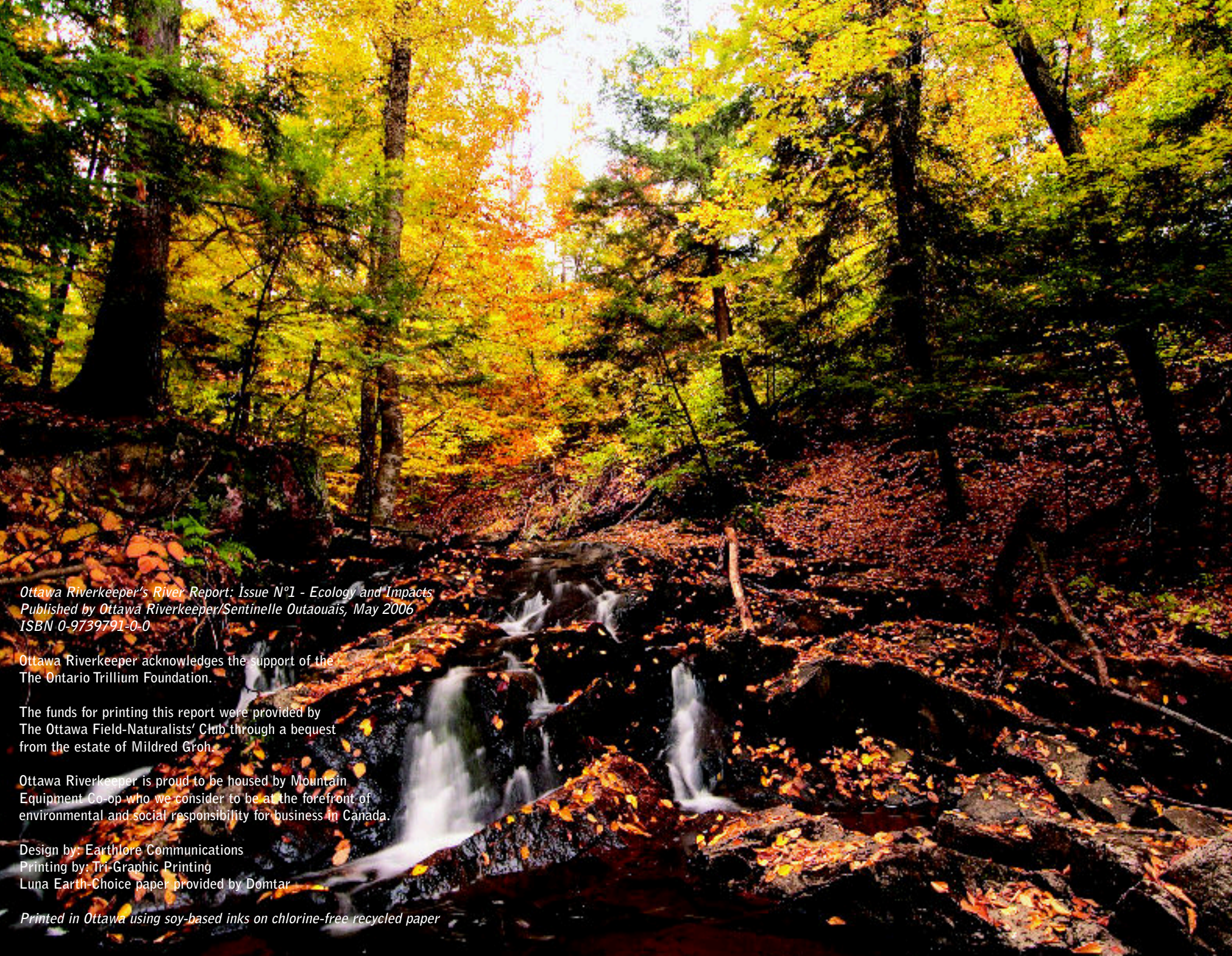
Ottawa RIVERKEEPER®
SENTINELLE Outaouais



OTTAWA RIVERKEEPER'S RIVER REPORT:

ISSUE N°1 | ECOLOGY AND IMPACTS | MAY 2006



Ottawa Riverkeeper's River Report: Issue N°1 - Ecology and Impacts
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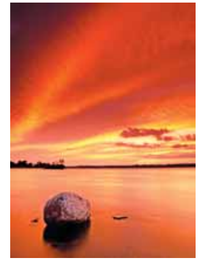
This report is the result of contributions by many people. The board of directors of Ottawa Riverkeeper identified the need for the report and contributed ideas and content. Dan Brunton has been an exceptional source of ecological knowledge and a consistent beam of positive energy. Directors Ole Hendrickson, Nicole DesRoches, Colin Rennie, and John Almstedt provided excellent research and writing. Science Committee member Mary Trudeau also provided guidance and technical contribution. Jennifer Shepherd, Amy Williams and Jim Reid helped with research and report scoping. Many thanks to Ronnie Drever, André Martel, Tim Haxton and Max Finkelstein for providing valuable content that relates to their fields of research and expertise. Maps for the report were generated with the exceptional help of Eric Schwartz who spent countless hours finding data in digital form and turning our ideas into pictures. Software used to generate the maps was donated by Map Info. Photographs for this report were provided by Robert Williams, Andrew Buzzell, Dan Brunton, Alan Todd, Ronnie Drever, Delphine Hasle, and Meredith Brown. The cover photograph is by Andrew Buzzell. All full-page photographs are by Robert Williams, with the exception of those on pages 67 and 68 by Dan Brunton. Thanks to our volunteer editors Diane Vist and Barb Wilson and our team of translators: Chloé Black, Marie-Josée Cusson, Amy Emerson, Gilles Hoppenbrouwers, Jacynthe Lanthis, Sharon Locke, Marieve Sabourin, Spencer Sloan, Isabelle Richard, Mary Varcoe. Earthlore Communications graciously provided their professional services for the design and layout of this report and have been a pleasure to work with. We are especially thankful to Alan Todd for coordinating the production of this report and appearing like an angel at the right time and place. Thanks also to Tim Llyod. Biggest thanks go out to Delphine Hasle for everything – we couldn't have done it without you! This report is dedicated to Charlie who gestated throughout the research and writing of the report and as a newborn spent hours sleeping on Meredith's lap as she typed on her laptop.

The Ottawa Field-Naturalists' Club was founded in 1879. Its objectives are to promote the appreciation, preservation and conservation of Canada's natural heritage; to encourage investigation and publish the results of research in all fields of natural history and to diffuse the information of these fields as widely as possible; to support and co-operate with organizations engaged in preserving, maintaining or restoring environments of high quality for living things. More information can be found at www.ofnc.ca or by calling (613)722-3050. Mildred and Herbert Groh were active in The Ottawa Field-Naturalists' Club for many years. Herb Groh served a term as President and was particularly instrumental in the creation of the Macoun Club for junior naturalists which celebrated its 50th birthday recently.



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Origins

In 2001, a group of concerned citizens formed a board of directors and started Ottawa Riverkeeper to respond to the increasing pressures facing the Ottawa River system. Two years later, Ottawa Riverkeeper became a registered charity and secured funding for a full time employee, called the "Riverkeeper."

Ottawa Riverkeeper is a licensed member of Waterkeeper Alliance, an international grass roots advocacy organization founded by Robert F. Kennedy Jr. Robert Kennedy has a reputation as a resolute defender of the environment and currently serves as President of the organization. Waterkeeper Alliance connects and supports over 157 local Waterkeeper programs to provide a voice for waterways and their communities worldwide.

Goals

The organization is working to achieve a healthy, ecologically sustainable Ottawa River for the enjoyment and benefit of its Ontario and Québec communities. We work independently as well as cooperatively with individuals, businesses, community groups, and all levels of government on both sides of the river to achieve our mission.

Mission Statement

Citizen-based Ottawa Riverkeeper is the voice that works to protect and enhance the ecological health and integrity of the Ottawa River system. Through expert and independent action, Ottawa Riverkeeper encourages responsible decision-making, public education and participation, and compliance with existing protection regulations throughout the watershed.

The Riverkeeper is a full-time, non-governmental ombudsman whose responsibilities are to:

- Develop and maintain an expert understanding of the river's ecological values, processes and special features, and the protective framework offered by various federal, provincial and municipal jurisdiction
- Identify breaches of the law and report them to the appropriate authorities and to the public
- Develop educational programs and outreach to the public and to key decision-makers to increase stewardship and awareness of issues that jeopardize the ecological integrity of the Ottawa River
- Encourage individuals, organizations and businesses to become stewards of the river
- Patrol the river to identify or investigate public concerns
- Conduct ecological monitoring and original research
- Identify and establish partnerships with individuals, communities or organizations working toward a shared vision for the river system

Canadian Waterkeepers in Ottawa

Ottawa Riverkeeper hosted a meeting of Canadian Waterkeepers in November 2005. Waterkeepers from the Fraser River in BC to the Petitcodiac River in NB travelled to Ottawa for a yearly meeting. Robert F. Kennedy Jr., President of the international Waterkeeper Alliance was at the meeting and gave a passionate talk to Ottawa Riverkeeper's invited guests. There are currently 10 Waterkeeper programs in Canada and 157 worldwide. The 2006 meeting for all Waterkeeper programs will take place in San Francisco from June 21-25.

Meredith Brown (Riverkeeper), Bobby Kennedy & John Bouza (President, Ottawa Riverkeeper)

OTTAWA RIVERKEEPER – THE ORGANIZATION

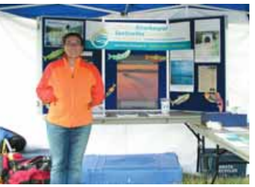
Overview of Ottawa Riverkeeper

The People Behind Ottawa Riverkeeper

Ottawa Riverkeeper is still a very small organization, now with two full-time staff and a volunteer board of directors. Ottawa Riverkeeper relies heavily on volunteers. The strength of our programs depends on them. Some of the programs they play an integral role in include:

- River Watch: A program designed to build a network of citizens and stewardship groups interested in the health of the Ottawa River who work cooperatively with Ottawa Riverkeeper.
- Pollution Hotline (1-888-9KEEPER): A resource for people who have questions or concerns about the Ottawa River and its tributaries.
- River Patrol: During the months of June through September, the Riverkeeper patrols the Ottawa River. There is no substitute for being on the river to learn about the river and understand the pressures the river is currently facing.

Ottawa Riverkeeper participates in many interesting initiatives, organizes events and gives presentations throughout the watershed. To keep up with our activities and issues please consider visiting our website and subscribing to our electronic newsletter.



Delphine Hasle

Ottawa Riverkeeper contact information

Our office is located in Ottawa, Ontario. However, our initiatives extend throughout the Ottawa River Watershed, including Québec.

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A MESSAGE FROM THE PRESIDENT

Beneath Parliament Hill flows more fresh water than in all the rivers of Europe combined. With 20% of the globe's fresh water but only 0.5 per cent of the world's population, we Canadians owe it to ourselves and to humanity to study, understand, and preserve this most precious of all resources.

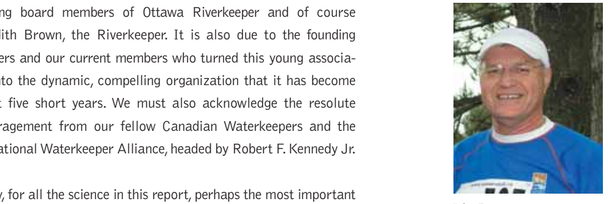
What do we really know about the Ottawa River? We know it has played a central role in the development of this country. We know that the First Nations used this water route as a major highway of trade; that Samuel de Champlain travelled directly below what we now call Parliament Hill during his explorations of this great land; that the lumber trade on the river was vital to the development of this region; and that today the Ottawa is the source of both our recreation and our survival – as we drink its water every day. But, we don't know enough about its current condition, its ecological integrity, its true nature. That is the purpose of this report.

For all its importance, no single public entity has fully measured, quantified and documented the state of the Ottawa River. Federal regulatory bodies, numerous provincial agencies, and a multitude of municipalities study and monitor various aspects of the river, but this inaugural River Report is the first to take a holistic, multi-sectoral approach to the entire watershed.

Noted architect and visionary Buckminster Fuller said, "There is one outstandingly important fact regarding Spaceship Earth, and that is that no instruction book came with it." This report is the first step toward better understanding the state of the Ottawa River. It has come to fruition due to the unwavering dedication of a number of people: George Brown, Dan Brunton, and John Almstedt founding board members of Ottawa Riverkeeper and of course Meredith Brown, the Riverkeeper. It is also due to the founding members and our current members who turned this young association into the dynamic, compelling organization that it has become in just five short years. We must also acknowledge the resolute encouragement from our fellow Canadian Waterkeepers and the international Waterkeeper Alliance, headed by Robert F. Kennedy Jr.

Finally, for all the science in this report, perhaps the most important reasons for studying the Ottawa River can be found in art; as in a poem by fourteen year old Chanel Roberts entitled *The River Flows*, parts of which read:

The river flows…
Passing by followers and listening to their tales
In turn, speaking out to those who will listen…
And when the end is reached and known
It's not an ending but a new beginning
For the river never stops, always flowing
For its people and its friends
Its family and its borrowers
Its givers and its followers
The river thanks them all
And gratitude shows
As the river flows



John Bouza

John Bouza
President
Ottawa Riverkeeper

A MESSAGE FROM THE RIVERKEEPER

The Ottawa River is one of the world's richest river systems and we are fortunate to live within its drainage basin, or watershed. Rivers are the lifeblood of our natural environment and serve as the foundation of a healthy ecosystem. It is easy to give reasons why healthy rivers matter: rivers provide drinking water, rivers are part of our heritage, rivers sustain wildlife, rivers are living classrooms, rivers give us a place to play, relax and reflect, rivers are beautiful, rivers contribute to the local economy, rivers act as migration corridors and rivers sustain people.

Defining what makes a river healthy is challenging. Ottawa Riverkeeper is striving to assess the health of the Ottawa River by studying the long-term trends affecting the river. We are in the first stages of gathering information and this is a feat in itself. Information is spread across municipalities, agencies, provinces, organizations and industries.

As a first step, we are raising awareness about the numerous changes we see throughout the watershed today. As a society, we are currently having a negative effect on the ecological health of our river system. The river is resilient and has an impressive flow, but how much pollution and development can the river handle? We dump our wastes into the river, yet at the same time draw our drinking water from the river. Today we have fish consumption advisories, beach closures, boil water advisories, species at risk and highly altered shorelines – proof that we cannot blindly dump our wastes, fill our wetlands and develop our floodplains.

Ottawa Riverkeeper is one of 157 WATERKEEPER® programs throughout the world. Each year when all the Waterkeepers meet, I consider myself lucky to live on the Ottawa River. Many Waterkeepers are fighting for a heavily polluted river or lake that you wouldn't dip your toes into, let alone eat the fish from. I swim and paddle on the Ottawa River system regularly and marvel at its beauty throughout the seasons.

Protecting the ecological health of the river is in the best interest of all people living within the watershed. Our health, recreation and economy depend on a healthy river system. I would like to ensure that my children and their children enjoy the same benefits from the river as I do today.

As the Ottawa Riverkeeper I have my hands full. The watershed is huge and the pressures are great and varied. Everywhere I travel in the watershed I meet people with a passion for the river. Together we must act to harness the passion and protect the river. We have municipal, federal and provincial legislation in place to protect the river; we must constantly remind our governments to enforce it. We can also act individually to care for the river; as you read this report, please think about how you can help protect our river.

Meredith Brown
Riverkeeper

Meredith Brown

PURPOSE OF THIS REPORT

The purpose of this River Report is to inform a broad audience of the current physical and biological conditions of the Ottawa River watershed and the impacts of human activities on the watershed. This document is intended to be the first of a series of River Reports; as such, it communicates the ecological state of our watershed knowledge to date. Future reports will focus on specific themes and will also attempt to depict watershed trends as more data are gathered and analyzed.

The River Report reflects Ottawa Riverkeeper's mandate which specifies protection of the ecological integrity of the Ottawa River watershed using a science-based perspective and the identification of important issues and priorities.

The report summarizes watershed characteristics, with emphasis on highlighting ecological values. It develops a picture of the Ottawa River watershed for the reader, and explores some of the major watershed-scale impacts and pressures that threaten the ecological integrity of the watershed. The effects of such large-scale activities are put into perspective through an analysis of identifiable indicators that demonstrate ecological changes. The report then completes the picture by examining the human dimension – the social and political context within which watershed management decisions are made and how individuals and stewardship groups can make a difference.

Lavergne Bay

Kipawa River

"Protecting the ecological health of the river is in the best interest of all people living within the watershed."

Meredith Brown, Riverkeeper

Map 1 – Ottawa River Watershed

WATERSHED CHARACTERISTICS

Overview of the Ottawa River Watershed

A glance at a satellite image of North America will immediately illustrate that the Ottawa River is one of the great rivers of the continent, and the second largest in eastern Canada, extending 1,271km. The drainage basin or watershed is enormous as it covers an area of 140,000km^2. Approximately 35% of the watershed is located in Ontario and 65% in Québec. The Ottawa River is the largest tributary of the St. Lawrence River and part of the Great Lakes St. Lawrence drainage basin (Map 1).

The watershed extends from Shining Tree, Ontario in the west to St. Jérôme, Québec in the east; from Westport, Ontario in the south to Launay, Québec in the north; from Algonquin to Aiquebelle, from Témiscaming to Tremblay. From Lake Capimitchigama, the River flows west through lakes and reservoirs, turns south into Lake Témiscaming and southeast toward its St. Lawrence confluence above the island of Montréal.

Legendary explorers, countless first nation peoples, *Coureurs de bois,* loggers, and Old World settlers travelled, lived and frequently died along this original Trans Canada Highway. Initially used as a transportation corridor to move people and goods, today the Ottawa River is not only a source of drinking water and hydroelectricity for the communities that thrive along its shores, but also a world class recreation destination.

The population distribution based on the 2001 census of Canada in the watershed is shown on Map 2. Over 1,670,000 people live in the watershed in more than 250 communities. The population distribution is not evenly spread across the watershed. The most populous sub-watersheds are located in the lower valley of the Ottawa River, while the headwaters are in remote wilderness with few inhabitants. Consequently, large amounts of clean and relatively pristine water from the headwaters flush out the system each year. The most populated region of the watershed is Ottawa/Gatineau, where over 1 million people live. Otherwise, only 18 communities have a population over 10,000 – these communities are identified on Map 2. The only other large community located in the upper watershed is Rouyn-Noranda, Québec (pop. 28,000). The lower valley is where the human footprint is the most observed.

Seventeen of the 18 most populated communities are located downstream of Petawawa, Ontario, on the main stem of the river and in the lower valley of the Nord/Rouge River. The most polluted water is observed in the lower 150 kilometres of the river from Ottawa/Gatineau to the confluence with the St. Lawrence River.

Did you know?

The source of the Ottawa River is Lake Capimitchigama (Québec), located at 250km north from Ottawa and 290 km northwest from Montréal, in the administrative region of Outaouais. The nearest facility is Clova, a former forestry village, now serving several outfitters' lodges. Clova is also a station of the Abitibi railway (Via Rail).

Old Ottawa City Hall: Rideau River and Falls
Photo by: Alan Todd

Paddling the Ottawa River

By Max Finkelstein

No river in Canada reverberates as strongly within my heart as the Ottawa. To paddle its waters is a true journey. It is a journey into the world of nature. Although the ecosystem of the Ottawa has been drastically altered by dams and development, it is still a vibrant river, burgeoning with life. Its wetlands reverberate with the honking of thousands of geese and ducks, herons and bitterns. And you never know what you might see swimming beneath your canoe, from canoe-sized gar and muskellunge to otters and snapping turtles!

A canoe trip on the Ottawa is a journey through time, from the ancient fossils exposed at summer's low water levels to the massive iron rings left over from log driving days. No river in Canada hearkens back to the fur trade days as does the Ottawa. Right in the city of Ottawa, traces of the original portage trail used for over two centuries by the Voyageurs, and for millennia before that by First Nations paddlers, can still be found — steps cut into limestone and worn smooth by the passage of thousands of moccasined feet. For the First Nations people, for the Voyageurs, and for me, the Ottawa is the road to the interior. A difficult road – there were eighteen portages on the route from Montréal to the Mattawa River, where the trail turned west to follow that little river to its source. The route is easier today. With many of the rapids drowned by hydroelectric power dams, there can be as few as seven portages, depending on the water level. But those same dams have hidden much of the historic relics of the river beneath the surface of their reservoirs.

A canoe trip on the Ottawa is a journey through a landscape that is, in a word often overused, but entirely appropriate in this case, majestic. No snow-capped mountains frame its course, but the sheer cliffs of 475-foot high Oiseau Rock, the flotillas of granite-rimmed isles, and the surging rapids (one of the world's highest standing waves can be seen, or run, if you're brave), on Coliseum Rapid in the Rocher Fendu, cannot fail to inspire.

But mostly, a canoe trip on the Ottawa is a journey of the spirit. The Ottawa is a powerful river. One of my favourite places to experience its power is beneath the Parliament Buildings, right in the centre of Canada's capital city. Looking upstream, standing waves that in the spring flood lick the bottom of the bridge that links Ottawa to Gatineau, leap below the industrial complex of mills and dams. Ring-billed gulls and jet black cormorants swirl overhead, the waters of the Ottawa swirl below, the canoe spins and twists like a floating leaf. Here, in the midst of industry, commerce, and politics, the power of the river still comes through and reaches down into your bones.

This river is priceless and precarious. It has given us many gifts. I think from those to whom much has been given, there is much expected. It is time for us to give back to the river. Only then will life continue to burgeon in its waters and its storied past be celebrated, so that all who touch its waters will be touched by its power and beauty. To paddle the Ottawa is to paddle a sacred river, a journey that will touch your soul.

Max Finkelstein is a paddler, author, environmentalist and raconteur, and works by day as the Communications Officer for the Canadian Heritage Rivers System. When he is not speaking about, writing about, or otherwise promoting Canada's river heritage, Max can usually be found paddling on a river.

WATERSHED CHARACTERISTICS

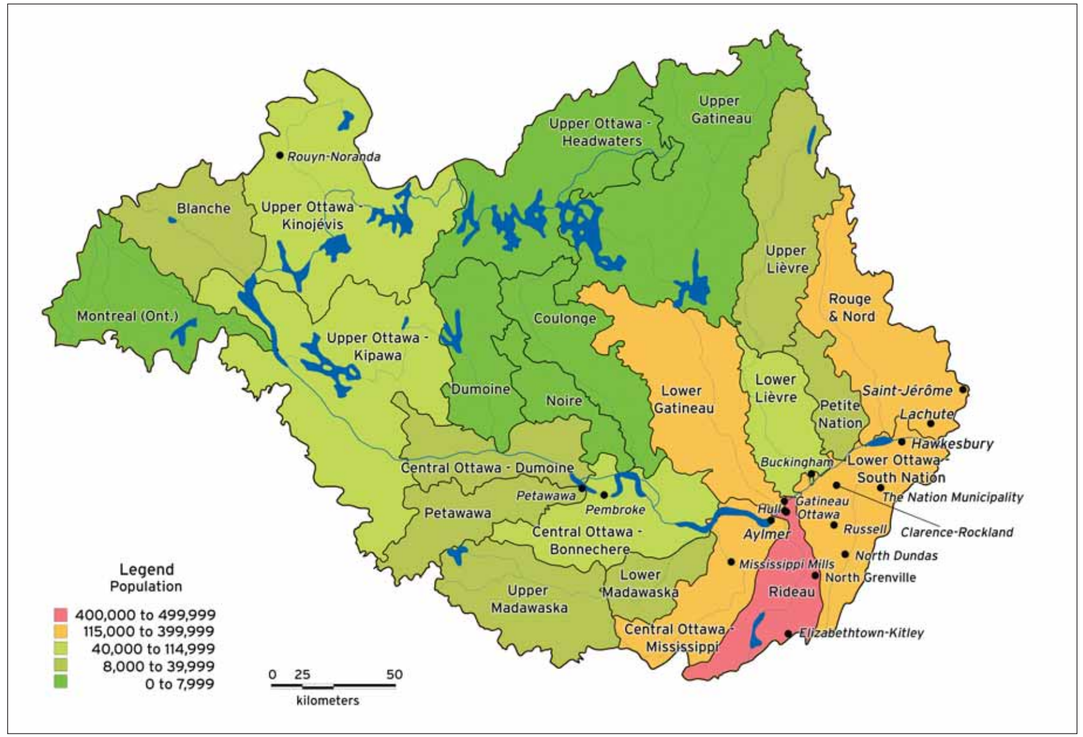
Landform

On the time scale that marks the passage of rivers, this is a youthful watershed, though set upon an ageless foundation. It is also a land of remarkable natural diversity, extraordinary beauty, and of global ecological importance. The foundation of the Ottawa River landscape is established upon one of the most ancient parts of the planet's crust. It is the roots of ancient mountains that once would have rivalled today's Himalayas, and is composed of incredibly hard, one to two billion year old bedrock. These tough granitic, gneissic, and marble hills of the Canadian Shield yield only grudgingly to the insistence of water. Despite the passage of eons of erosion and weathering, the durable bedrock still forces the Ottawa River to weave a torturous path with innumerable turns, falls, and tributaries. Only in the final, lower quarter of the watershed does the river leave the Shield behind and flow across the softer, more impressionable bedrock of the younger sedimentary plain that dominates the Great Lakes and the upper St. Lawrence. Here the river can stretch out, flow more widely and more calmly, gathering in vast contributions from important tributaries like the Gatineau, the Rideau, the South Nation, the Rouge and the Lièvre, to represent one of the world's major sources of fresh water.

Many times in the past these lands and indeed all of Canada have been covered, for millennia at a time, by kilometre-deep layers of ice. These continental glaciers have had a dramatic effect on the Ottawa River watershed, grinding landscapes here, depositing material there, pressing down the very crust of the earth for hundreds of metres and changing the direction of waterways. All of that has occurred 'recently', with the southern portions of Ottawa River watershed first emerging from beneath the last (Wisconsinan) ice sheets only about 12,000 years ago. Atlantic Ocean waters then lapping directly upon the retreating ice walls flowed into the resulting depression in the lower Ottawa Valley, forming the Champlain Sea marine embayment that lasted for more than thousand years. It is bizarre to image Beluga and Bowhead Whales swimming above what is now the Peace Tower on Parliament Hill, but that was the case some 11,000 years ago.

The valley was the focus of much that was not ice covered in eastern Canada in the waning centuries of the Wisconsinan glacial period. With the continental glacier retreated northward, and before those northern lands recovered from the crustal depression of the ice sheets, all of what to become the Great Lakes and even lands extending into present day western Canada drained not through the St. Lawrence but into the Champlain Sea through what was then the mightiest water course river in northeastern North America... our Ottawa River. Indeed, the huge social and economic contribution of the river and its watershed flow directly from these connections.

Ottawa River Shoreline: northshore, Québec
Photo by: Alan Todd



Map 2 – Population in the Ottawa River Watershed

WATERSHED CHARACTERISTICS

Hydrology

Ottawa River at Mattawa

The hydrology of the Ottawa River is largely driven by snowmelt processes. Dam operations, particularly the large reservoirs in the upper watershed, regulate flows in the river to some extent. However, the general monthly trends in flow remain similar to natural conditions.

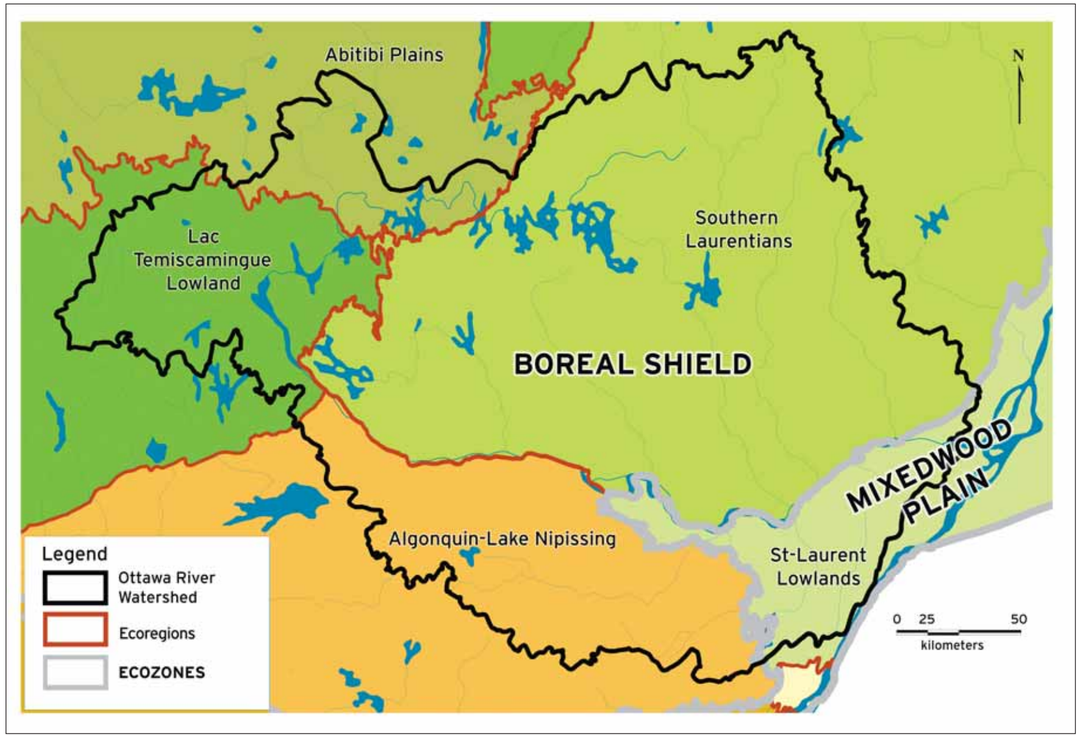
The largest flows occur during spring freshet, which happens between April and June. In a typical year multiple freshet flood peaks occur, as different parts of the watershed melt. The first and smaller peak occurs in April as snow melts in the southern portion of the watershed. A second peak occurs in the beginning of May as melt occurs in the northern part of the watershed. The maximum recorded annual flood (largest flow of the year) in the lower reach near the City of Ottawa was 5800m^3/s, based on data from 1912 to 2001. The mean or average flow near the City of Ottawa is 1200m^3/s.

Flows decrease during the summer, with the lowest flows typically occurring in September. Mean and minimum annual low flows recorded near the City of Ottawa are 470m^3/s and 140m^3/s. Flows are usually moderate during the fall and winter, although large flows have occurred in the fall as a result of large-scale cyclonic storms that cause rainfall throughout the watershed. Cyclonic and convective rainfall cause large flows more frequently in southern tributaries during the summer and fall.

Ecosystem Classification

The ecological diversity of the Ottawa River watershed is classified at several scales. The coarsest scale is represented by "ecozones" which are areas where organisms and their physical environment endure as a discrete system as a result of intimate interconnections of its biotic and abiotic components[1]. These are large units (i.e., greater than 200,000 km^2) delineated by broad, common yet diagnostic natural and human features such as landforms, soils, water features, vegetation, climate, and dominant land uses. As shown in Map 3, two ecozones exist in the Ottawa River watershed: Boreal Shield and Mixedwood Plains[2].

Ecoregions, a subset of the ecozone framework, represent a finer scale of ecosystem classification. Ecoregions are characterized by distinctive regional landforms or assemblages of smaller landforms, as well as vegetation, soils, water, and regional human uses. There are four ecoregions within the Boreal Shield ecozone of the Ottawa River watershed, whereas the Mixedwood Plains are made up entirely of the St. Laurent Lowlands ecoregion (Map 3).



Map 3- Ecosystem Classification in the Ottawa River Watershed

Winter Forest Val Morin
Photo by: Ronnie Drever

Boreal Shield Ecozone

Delineated principally by the overlap of the Canadian Shield and boreal forest, the Boreal Shield is the largest of Canada's 15 terrestrial ecozones. The rocks — mostly metamorphic gneiss — that form the substrate for life in this ecozone are well over a billion years old, formed during the Precambrian era. Glaciers, in some cases over 3-km thick, scoured and carved this substrate and, upon their last retreat about 10,000 years ago, set down blankets of gravel, sand and other glacial deposits. The many lakes, bogs, marshes and wetlands of the Boreal Shield originated in poorly drained depressions left behind by the glaciers.

The climate is cold continental with long winters and short warm summers. Mean annual temperature is about 4°C, with average midwinter and midsummer temperatures hovering around -15°C and 17°C, respectively. Average precipitation is about 1000mm, with roughly 20% falling as snow.

Vegetation in this ecozone is adapted to its cool temperatures, short growing seasons, frequent forest fires, and acidic soils. Black spruce *(Picea mariana)* is the most common tree species, along with other conifers such as white spruce *(Picea glauca),* jack pine *(Pinus banksiana)* and balsam fir *(Abies balsamea).* Common deciduous trees include white birch (Betula papyrifera) and aspen *(Populus sp.).* To the south, yellow birch *(Betula alleghaniensis),* red maple *(Acer rubrum),* sugar maple *(Acer saccharum)* and eastern white cedar *(Thuja occidentalis)* increase in extent and abundance.

The Boreal Shield is home to abundant wildlife. Characteristic mammals include woodland caribou, white-tailed deer, moose, black bear, wolf, lynx, snowshoe hare, fisher, marten, and striped skunk. Beaver, muskrat and mink as well as ducks, loons, geese and swans inhabit its wetlands, rivers, and lakes.

Mixedwood Plains Ecozone

At the southern end of the watershed, near the Ottawa River's mouth, lie the Mixedwood Plains. This ecozone is characterized by abundant rivers and lakes as well as widespread agricultural and urban development. The area remained covered by the now extinct Champlain Sea for about 1,200 years after the last glacial retreat, depositing the thick marine clay deposits that provide the ecozone's characteristically rich and fertile soils.

Climatically, the Mixedwood Plains experience relatively warm summers and cool winters. Mean temperatures in January are typically between -3°C to -12°C, while mean temperatures in July are 18°C to 22°C. The ecozone receives 720 to 1000mm of precipitation annually.

Little remains of the vast temperate forest that once covered the Mixedwood Plains. The forests are composed of species characteristic of the Great Lakes-St. Lawrence forest region such as eastern white pine *(Pinus strobus),* eastern hemlock *(Tsuga canadensis),* yellow birch, red pine *(Pinus resinosa),* sugar maple, red oak *(Quercus rubra)* and basswood *(Tilia americana).* In terms of fauna, birds like the cardinal, green heron, and Carolina wren are unique to the Mixedwood Plains ecozone. Characteristic mammals include white-tailed deer, black bear, eastern cottontail, and grey and black squirrels.

Ecosystem Diversity

It is more than intellectual interest that has inspired scientists and researchers of many stripes to study and record the extraordinary natural and ecological diversity of the Ottawa River. A selection of some of these most special places along the river are described on our website[3]. There are about twenty sites described — an impossibly small number for so vast and complex a natural wonder as the Ottawa River. And even then, we are focusing closely on the main course of the river and giving short shrift to the marvels that are found up many tributaries — major waterways in their own rights — and in turn, in the lesser tributaries of those stream. Still, it is a taste of some of the places that make this such a unique and important landscape. Here are several places to pique your interest:

Réserve Faunique La Vérendrye - Possibly the wildest, most wilderness-like area in the Ottawa River system, La Vérendrye is a rugged, virtually undeveloped Canadian Shield landscape at the very height of the watershed. With some 4,000 lakes and uncountable small streams in this Boreal Region setting, the partially protected natural values of the reserve provide a window into earlier, post-glacial times in the watershed. More importantly, the natural features and processes maintained here constitute an immense ecological reservoir that sustains the ecological integrity of a much larger area of this northern landscape.

Devils Rock, Lake Témiscaming - Spectacular 200m high cliffs of two billion year old bedrock drop straight down into huge (17,000 ha) Lake Témiscaming, and are a dramatic element of the complex geology of the Témiscaming rift valley. Such rock faces are famous for their ability to support plant life from earlier times as well as providing nesting sites for rare raptors. The geological events of which the cliffs are a part are the basis for the immense mineral wealth of this part of the Ottawa River watershed, including even the potential for deposits of gem quality diamonds. Such sites are often assigned considerable cultural or social value too. Devils Rock, for example, is celebrated as the key location for one of the famous 'Hardy Boys' novels.

Oiseau Rock, Pontiac - So named for the Peregrine falcons which nested long ago on the cliffs here which drop precipitously into the river, Oiseau Rock is not only a spectacular lookout over the middle Ottawa Valley but is a haven for rare and out-of-range species. An unusually large number of these have tenaciously clung to the massive granite cliff face for millennia. Some are western species, time travellers from when the Great Lakes and waterways in parts of western Canada drained through the giant Ottawa River across the bottom of the cliff. Happily, its namesake oiseau is once again being seen riding the thermals high above the cliff face.

Petawawa Terrace Provincial Nature Reserve - The steep sand bluff along the western side of the former provincial fish hatchery site at Petawawa is actually the abandoned shoreline of the much larger, post-glacial Ottawa River. The massive sand deposits that characterize the landscape on both sides of the river here were deposited when the Great Lakes drainage burst through ice dams into the upper Champlain Sea, forming a huge submarine delta. This may have been a cataclysmic event — occurring in days or

Lakes and Forest
Photo by: Ronnie Drever

weeks, not years — but regardless, it directly affected the nature of these lands for thousands of years thereafter. The vast pine forests that have characterized much of the Ottawa Valley are perhaps best expressed along the Petawawa-Pontiac sand plain. A remarkable diversity of provincially rare plants and animals are found throughout the sand barrens, dunes and forests of the pristine beach and coniferous woodlands of CFB Petawawa area, including such rarities as nationally significant Wood Turtle and (formerly) the only Canadian breeding population of the globally endangered Kirtland's (Jack Pine) Warbler.

Westmeath-Calumet White Water - Some would argue that this is the most spectacular and aesthetically appealing section of the entire Ottawa River. This area certainly will figure high on any list of top sites, however. Here, the river narrows and tumbles through a seemingly endless series of torturous, rocky channels. The awesome and intimidating rapids and falls that result from this rush of fast water generate kilometres of spectacular white water. The major rafting and kayaking eco-recreation industry that has developed in Ontario's Ottawa River Provincial Park and adjacent Québec-side river channels is completely dependent on the maintenance of high water quality standards and unmanaged natural river flow.

Eardley Escarpment – Ottawa River Valley southward, Gatineau Park
Photo by: Dan Brunton

Lac des Chats Island and Shores - Finally leaving the Canadian Shield landscape of the upper and middle Ottawa Valley, the river forms the broad Lac des Chats at its confluence with the Madawaska River. Although much has been lost to flooding behind the Lac des Chats dam, remaining shoreline areas on the mainland and numerous islands between Sandy Point in Renfrew County and Morris Island in the City of Ottawa are ecologically remarkable. One island and shore area of only a few hectares in size in Lavergne Bay – Morris Island, for example – is known to support several provincially rare and over a dozen regionally rare plant and animal species. Most of these special Lac des Chats elements are aquatic or shoreline species such as the Endangered Musk Turtle and provincially significant Map Turtle. They are dependent on the maintenance of natural conditions along these shores. Most significant of the habitats is the globally rare Shore Alvar vegetation. These bizarre natural meadows supporting many rare and even unique plant and animal species, are found on marble deposits on the Québec shore and limestone bedrock on the Ontario side, have successfully endured millennia of natural flooding, ice scouring, fire and predation. Most examples, however, have been damaged or in some cases, eliminated by recent human activities.

Innis Point-Shirleys Bay - This area protects what is likely the best example of globally rare Shore Alvar vegetation in the Ottawa Valley, as well as a remarkable diversity of riparian, swamp forest and marsh habitats. These include ancient, primary growth Red Maple swamps (perhaps the oldest such habitats in the Ottawa Valley), a long-established Wild Rice marsh and one of the most important migratory bird staging and feeding areas away from the Great Lakes in southern Ontario. It is also an important wintering area for raptors, including unusually large numbers of Great Gray Owls in some years (over 25 in 2005). Most of the site is managed by the Department of National Defence (Connaught Ranges) which has worked co-operatively with the City of Ottawa, the Ottawa Duck Club and others to successfully enhance wildlife populations and protect particularly significant habitats.

Eardley Escarpment - Although five to six kilometres away from the present shoreline, this bedrock escarpment forming the southern

boundary of Gatineau Park is directly connected to the Ottawa River in various ways. Forming the shoreline in Champlain Sea times, its cliffs sustain relict populations of both northern and southern species that are well out of contemporary normal range, some of which are provincially and nationally rare. It also forms an important migration route for raptors migrating up and down the Ottawa River corridor. There is likely no better place from which to view and appreciate the two significantly different Ottawa River landscapes — the rugged Shield-based landscape to the north and the modulated, lowland-based landscape to the south — than from the spectacular vantage points along the Escarpment within Gatineau Park.

Deschênes Rapids - Only one large rapid remains intact along the entire length of the Ottawa River without the negative impact of a bridge crossing, a hydro dam and/or industrial development. The Deschênes Rapids descend from Lac Deschênes across a sandstone sill, producing a broad, boiling white water area that is open and flowing year round. Not coincidentally, the rapids retain the only substantial Ottawa River population of the nationally rare Riverweed — once found commonly in other now-compromised fast water sections of the water course. This oxygenating "lungs-of-the-river" also provide habitat for large numbers of wintering waterfowl as well as rare raptors (including Gyrfalcons in some winters) which prey upon them. These last natural Ottawa River rapids have been threatened with destruction by inter-provincial bridge and/or industrial development for almost 100 years, protected from destruction on several occasions only by the diligence and actions of various private groups of Ottawa River citizens.

Lac Leamy Ecological Park - This is the meeting place between the Ottawa River and the Gatineau River, arguably its most important tributary. The magnificent primary growth maple swamps that have developed here support a wide variety of provincially rare plants and regionally rare animals. Like Britannia upstream, Lac Leamy is well situated to offer shelter and sustenance to migratory birds and in consequence, is likely the most popular birding site in the Outaouais.

Ottawa-Gatineau Alluvial Islands - Over the centuries, river currents have deposited massive amounts of sand and silt in particular areas, first forming bars and eventually islands upon which flood dependent habitats have developed. A string of such virtually unique, constantly shifting creatures of the river have evolved with upstream Kettle Island being the largest and the Petrie Islands being most ecologically diverse. One of the flood-tolerant habitats that has established on these islands in the Hackberry - Ostrich Fern swamp, believed to occur nowhere else in Canada but the lower Ottawa and perhaps adjacent St. Lawrence River. Demanding site conditions have traditionally reduced but not eliminated development pressure on these aesthetically appealing sites and several are now in one form or another of protective status. All have been negatively impacted, however, by head pond flooding from the Carillon Dam some 150 km downstream.

Parc National de Plaisance - Rather like the upstream alluvial islands, massive sediment deposits have been formed by the current into the river-shaped land mass of Grand and Petit Presqu'île, this one anchored to the shore by the peninsula extending out from the mouth of the Petit Nation tributary. Extensive marsh habitat in adjacent Baie Noire contributes many of the habitat attributes of the Gatineau-Masson marshes. The upland habitat of the reserve, however, offers greater natural diversity and representation of both

Deschenes Rapids in winter
Photo by: Dan Brunton

typical and rare lower Ottawa Valley flora and fauna than the marshes alone. An extensive system of trails and viewing facilities make this one of the best sites for public observation and appreciation of the remarkable natural diversity of the lower watershed.

Alfred Bog - It is difficult to imagine such an immense area (4,000 ha) as a capsule, but that is what Alfred Bog is — a time capsule. Looking to the horizon across this peat-based wetland south of Alfred you can see the subarctic landscape that dominated the lower watershed shortly after the Champlain Sea receded. The bog, like Mer Bleue, its smaller, sister domed (highest in the centre) peatland in Ottawa, formed in an abandoned channel of the post-glacial Ottawa River and has remained virtually unchanged for 9,000 to 10,000 years. Aside from constituting an immensely important surface and ground water quality 'facility', the bog provides habitat for a wide variety of provincially and nationally rare plants and animals, offers wildlife corridor benefits for migratory animals, and offers a great number of scientific research opportunities concerning both particular features (e.g. endangered species) and broad environmental issues (e.g. global warming). Vankleek Hill and Ottawa naturalists successfully waged a decade long battle to stop the proposed destruction of the bog for agri-business purposes. Working with the critical support and expertise of the Nature Conservancy of Canada, they raised the necessary private and governmental funds to purchase and preserve the bog. Protection and establishment of the Alfred Bog Reserve represents the largest single habitat conservation victory to date by private citizens in the Ottawa River watershed.

Protected Areas in the Ottawa River Watershed

There is very little protected area within the watershed. Most of Algonquin Park, Ontario's oldest and most famous provincial park, is in the Ottawa River watershed. The history of this huge (7,725 km^2) park is closely tied to logging, which is still carried out in about three quarters of its area (a source of ongoing controversy). Research on Algonquin's many wolf packs was critical in bringing about changes in the management of this species in Ontario. Lady Evelyn-Smoothwater Park is also partly within the Ontario portion of the watershed, in the headwaters of the Montréal River; Bon Echo Park is in the headwaters of the Mississippi River. Consideration is currently being given to revising the legislation governing Ontario's parks, including making protection of ecological integrity an overriding consideration.

Important developments are also happening regarding protected areas in Québec. At present there are no major protected areas in the watershed apart from Mont Tremblant in the extreme east and Parc National de Plaisance in the Outaouais. La Vérendrye and Papineau-Labelle are labelled as "reserves" but they have no formal protection because they are not designated protected areas. The percentage of land protected in the Outaouais region is about 0.2%: far less than the 8% target set by the Québec government in implementing

its *Stratégie québécoise sur les aires protégées* (SQAP). Reaching this target would require creating 3000 km^2 of new parks.

Provincial and national environmental organizations are urging the Québec government to create a large new protected area in the 4400km^2 basin of the Dumoine River. Public sessions sponsored by the Canadian Parks and Wilderness Society (CPAWS) and the *Conseil Régional de l'Environnement et du Développement Durable de l'Outaouais* (CREDDO) have revealed broad support for this proposal. The Dumoine is considered as the highest priority candidate in the region owing to its large areas of roadless wilderness and high recreational value. A report prepared by CPAWS has also identified candidate areas in the basins of the Noire, Coulonge, Gatineau, and Lièvre Rivers.

While there are no national parks in the Ottawa River watershed, the federally owned Gatineau Park is important from a conservation perspective (e.g., it contains a nationally endangered fern, the blunt-lobed woodsia). Gatineau Park is not clearly designated as a protected area at present, but there is public pressure to formalize its status.

Spruce Bog, Algonquin Park
Photo by: Robert Williams

Freshwater Mussel Fauna of the Ottawa River

By André L. Martel

The Ottawa River is home to a surprising number of species of freshwater mussels *(Unionidae)*. Native freshwater mussels are filter feeders and eat tiny planktonic food particles found in the water, including bacteria, thus contributing to increasing water quality. Native mussels are also good environmental indicators, being sensitive to degradation of water quality or shoreline habitats.

The empty shells of these mussels (or clams) are commonly found along the riverbank. The native mussel fauna of the Ottawa River is as diverse as that of all rivers in Europe combined, with eleven different species reported so far. Some of these species have beautiful bright shells with contrasting greenish rays (photo), such as in the lampmussels *(Lampsilis sp.)*. Others, such as the Hickorynut mussel *(Obovaria olivaria)* are extremely rare. The Ottawa River is one of the few places where this species can be found in Canada. The Ottawa River is also home to healthy populations of other interesting species known to be uncommon or rare elsewhere in the country, including the magnificent Black Sandshell *(Ligumia recta)*, with its thick shell that can grow for over half a century. The story of how they reproduce is fascinating, since their larvae need to attach onto the fins or gills of local fish (such as bass, minnow, or perch) for dispersal.

André L. Martel (PhD) is a malacologist at the Canadian Museum of Nature. He conducts underwater research on native freshwater mussels in various rivers across Canada. Over the past three years much of his research has focused on the mussels of the Ottawa River.

Lampsilis
Photo by: André Martel

Siphons
Photo by: André Martel

Lake Sturgeon – An Ancient Species

By Tim Haxton

The Ottawa River is home to 96 species of fish, including the lake sturgeon. The lake sturgeon (Acipenser fulvescens), found only in North America, is the largest and longest lived of any of our freshwater species with the potential to reach a length of 2.5m and weigh more than 135kg. In 1953, a 154 year old, 94.6kg lake sturgeon was caught in Lake of the Woods, Canada. Prior to 1860, lake sturgeon was considered a nuisance and the fish were either killed and dumped back in the lake, piled up on shore to dry to be burned (e.g. boilers of steamboats), or fed to pigs.

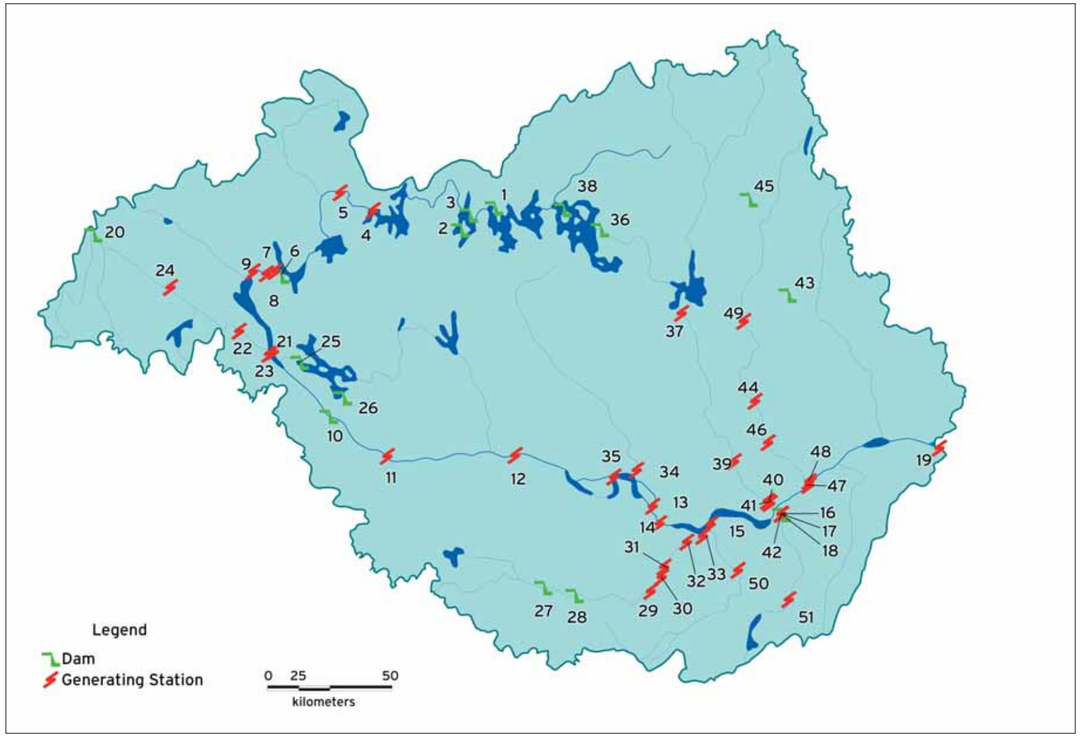
Opinions have since changed and now lake sturgeon is considered a gourmet item. The flesh, especially when smoked, is delicious although rich and oily, and the eggs are marketed as caviar with lake sturgeon eggs commanding a higher price than those of other North American sturgeon. As a result of uncontrolled commercial harvest and alterations to habitat, lake sturgeon declined across their range; it is estimated that the current population in the Great Lakes is less than 1% of historical levels. Even though commercial harvest has been regulated for some time, few populations have been able to recover to historical levels. Dams have been attributed to their poor recovery by blocking migration routes to spawning areas and by fragmenting populations.

Wisconsin, Ontario and Québec are believed to have the best populations remaining. Within the Ottawa River, the status of lake sturgeon varies by reach. Some of the reaches have a seemingly healthy population, meaning they display good recruitment, have diverse age and size classes, and decent abundance. Other reaches have poor recruitment and only few adults remaining. Vulnerability to commercial harvest is largely because of its low reproductive potential. Females generally require more than 20 years to sexually mature, and then only spawn every four to six years during their lifespan.

Not considered a major sport fish, lake sturgeon now supports minor commercial fisheries in Québec and Ontario. It is commercially fished in the Ottawa River licensed out of Québec at a quota of 0.1 kg/ha.

Tim Haxton is Fisheries Specialist for the Southern Science and Information Section of the Ontario Ministry of Natural Resources. Tim has been studying the sturgeon population of the Ottawa River for over a decade.

Lake Sturgeon
Photo by: Tim Haxton



Map 4 – Dams & Generating Stations in the Ottawa River Watershed

THREATS TO THE ECOLOGICAL HEALTH OF THE RIVER

Given the vast size of the Ottawa River watershed and the number of people who live here, it is no surprise that the river is under pressure from many different activities. Because of our dependence on our natural resources, these pressures will always be real. However, if we are to preserve and protect the ecological health of our river system, we must begin to understand and predict what the cumulative impacts of our actions are and find solutions that enable our future generations to safely eat fish and drink water from the river.

Currently, there is no understanding of the total loading of pollutants to the river system from known sources such as municipal and industrial wastewater, let alone from non-point sources such as urban stormwater, agriculture runoff or boating. In addition, there is limited understanding of how the river operates as a system — such as how the river is shaping itself, responding to the presence of many dams, increasing impervious areas or resource extraction. Our baseline data is sparse at best. As an inter-provincial river, these issues are not fully addressed by either province on its banks in terms of a comprehensive watershed study.

Those major watershed-scale pressures considered to be currently threatening the ecological health of the river are described below.

Chats Falls Hydro Dam
Photo by: Alan Todd

Dams and Generating Stations

Overview

The Ottawa River is one of the most highly regulated rivers in Canada, with over 50 major dams and hydroelectric generating stations scattered throughout its tributaries and mainstem (Map 4). If you count all the smaller water control dams in the river system, there are hundreds of dams throughout the watershed. For example, on the Mississippi River alone there are over 30 water control structures. The Dumoine River is the only tributary in the watershed that has no constructed dams and therefore benefits from a natural flow regime. Many of the major dams have been in place since the early 1900's, built at a time when environmental impacts were rarely questioned. A century later, we are witnessing the effects these dams are having on our river system[4].

Impacts from individual dams vary greatly, depending on their location, design and operating characteristics (how water is released over time). The most important distinction concerns the amount and type of storage. "Run-of-the-river" projects (dams that generate power based on whatever flows exist in the river and do not have a substantial reservoir to augment those flows) generally have fewer impacts than do projects with significant reservoirs. Approximately one-quarter of the major dams in the Ottawa Watershed are considered "run-of-the-river".

There are 13 principal reservoirs in the watershed, defined as those reservoirs with greater than 200 million cubic metres of live storage[5]. These large reservoirs store a significant portion of the spring runoff and help to reduce the magnitude of the second spring flood peak, which typically occurs in early May. The lower section of the Ottawa River is largely unregulated (there is relatively little storage provided by the many dams) and the dams have limited effect on the first flood peak that occurs about mid-April.

Table 1 – Summary of Major Dams in the Ottawa River Watershed

Map Reference N°	Name	Location - River	Type of Structure	Operator	Storage Capacity *(million cubic meters)*	Maximum Generating Capacity *(Mega Watts)*	Year of Construction
1	Bourque *(Dozois Reservoir)*	Ottawa	Dam	HQ	1870	–	1912
2	Rapid 23	Ottawa	Dam	HQ	1	–	1912
3	Rapid 24	Ottawa	Dam	HQ	1	–	1912
4	Rapid 7 *(Decelles Reservoir)*	Ottawa	Generating Station	HQ	371	48	1941
5	Rapid 2	Ottawa	Generating Station	HQ	232	48	1954
6	Quinze	Ottawa	Dam	PWGSC	1308	–	1923
7	Rapides des Quinze	Ottawa	Generating Station	HQ	–	95	1923
8	Rapides des Iles	Ottawa	Generating Station	HQ	–	147	1966
9	Première Chute	Ottawa	Generating Station	HQ	–	130	1968
10	Témiscaming	Ottawa	Dam	PWGSC	1217	–	1911-1914
11	Otto Holden	Ottawa	Generating Station	OPG	–	244	1952
12	Des Joachims	Ottawa	Generating Station	OPG	229	429	1950
13	Bryson	Ottawa	Generating Station	HQ	–	61	1925
14	Chenaux	Ottawa	Generating Station	OPG	290	140	1950
15	Chats Falls/ Chutes des Chats	Ottawa	Generating Station	OPG / HQ	175	267	1931
16	Chaudière	Ottawa	Dam	EB Eddy, City of Ottawa, OPG, Hydro Quebec	–	–	1868*
17	Chaudière	Ottawa	Generating Station	Ottawa Hydro (Energy Ottawa)	–	15	1891 (Stn. #2) 1900 (Stn. #4)
18	Centrale de Hull	Ottawa	Generating Station	Domtar	–	12	1913

principal storage reservoir
Eco-Logo Certified

HQ = Hydro Quebec
PWGSC = Public Works and Government Services Canada
OPG = Ontario Power Generation
Hydro-Pontiac = Société d'énergie Waltham Inc.
MDDEP= Ministère du développement durable, de l'environnement et des parcs
GLP = Great Lakes Power

Table 1 – Summary of Major Dams in the Ottawa River Watershed (cont.)

Map Reference N°	Name	Location - River	Type of Structure	Operator	Storage Capacity *(million cubic meters)*	Maximum Generating Capacity *(Mega Watts)*	Year of Construction
19	Carillion	Ottawa	Generating Station	HQ	–	752	1959-1963
20	Lady Evelyn Lake	Montréal	Dam	OPG	308	–	n/a
21	Lower Notch	Montréal	Generating Station	OPG	–	274	1968
22	Hound Chutes	Montréal	Generating Station	OPG	–	4	1910
23	Matabitchuan	Montréal	Generating Station	OPG	–	10	1910
24	Indian Chute	Montréal	Generating Station	OPG	–	3	1923
–	Andrews	Montréal	Generating Station	Brascan	–	42	n/a
–	Hogg	Montréal	Generating Station	Brascan	–	18	n/a
–	Gartshore	Montréal	Generating Station	Brascan	–	23	n/a
–	Mackay	Montréal	Generating Station	Brascan	–	60	n/a
25	Laniel	Kipawa	Dam	PWGSC	673	–	1912
26	Kipawa	Kipawa	Dam	PWGSC	673	–	1912
27	Bark Lake	Madawaska	Dam	OPG	374	–	n/a
28	Palmer Rapids	Madawaska	Dam	OPG	n/a	–	n/a
29	Mountain Chute	Madawaska	Generating Station	OPG	–	170	1967
30	Barrett Chute	Madawaska	Generating Station	OPG	–	176	1942
31	Calabogie	Madawaska	Generating Station	OPG	–	4	1917
32	Stewartville	Madawaska	Generating Station	OPG	–	182	1948
33	Arnprior	Madawaska	Generating Station	OPG	–	82	1976
34	Centrale Joey-Tanenbaum	Coulonge	Generating Station	Hydro-Pontiac / Brascan	–	17	1994

principal storage reservoir
Eco-Logo Certified

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Table 1 – Summary of Major Dams in the Ottawa River Watershed (cont.)

Map Reference N°	Name	Location - River	Type of Structure	Operator	Storage Capacity *(million cubic meters)*	Maximum Generating Capacity *(Mega Watts)*	Year of Construction
35	Centrale W. R. Beatty (Waltham)	Noire	Generating Station	Hydro-Pontiac / Brascan	-	12	1950
36	Cabonga	Gatineau	Dam	HQ	1565	–	n/a
37	Mercier (Baskatong Reservoir)	Gatineau	Generating Station	HQ	2345	50.5	1927
38	Barriere (Cabonga Reservoir)	Gatineau	Dam	HQ	–	–	n/a
39	Paugan	Gatineau	Generating Station	HQ	119	202	1928
40	Chelsea	Gatineau	Generating Station	HQ	17	153	1927
41	Rapides Farmers	Gatineau	Generating Station	HQ	2	100	1927
42	Centrale de Hull 2	Gatineau	Generating Station	HQ	4	27.28	1920
43	Kiamika	Lièvre	Dam	MDDEP	371	–	n/a
44	Rapides des Cèdres (Poisson Blanc Reservoir)	Lièvre	Generating Station	MDDEP	379	5	n/a
45	Mitchinamecus	Lièvre	Dam	MDDEP	554	–	n/a
46	High Falls	Lièvre	Generating Station	GLP / Brascan	150	95	1929
47	Chute Dufferin	Lièvre	Generating Station	GLP / Brascan	1	38	1957
48	Masson	Lièvre	Generating Station	GLP / Brascan	3	119	1929
49	Centrale de Daniel-Larocque	Lièvre	Generating Station	Hydroméga G.P. / Algonquin Power Fund	–	2.4	1912
50	High Falls	Mississippi	Generating Station	OPG Evergreen	–	2.7	1920
51	Merrickville	Rideau	Generating Station	OPG Evergreen	–	1.7	1915

principal storage reservoir
Eco-Logo Certified

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THREATS TO THE ECOLOGICAL HEALTH OF THE RIVER

The dams throughout the watershed were generally constructed for one of three purposes: flood control, power generation or improved navigation. Often dams are touted as providing enhanced recreational opportunities although this can be argued both ways (enhanced if you are a power boater or sailor, made worse if you are a whitewater paddler). Many of the dams in the watershed are multi-purpose, providing some combination of flood control, power generation and recreation.

The generating stations in the watershed vary from small-scale, run-of-the-river dams with a maximum daily generating capacity of a few Mega Watts (MW), to the large dams with daily generating capacities greater than 100 MW (Table 1). The combined capacity of the hydroelectric generating stations in the watershed is over 4000 MW, producing over $1 million worth of energy on a daily basis[6].

The numerous dams and generating stations throughout the watershed are operated by a small handful of corporations and government agencies (Table 1). To fulfil the important role of coordination of the operation of the dams, the Ottawa River Regulation Planning Board (ORRPB) was established in 1983 by the Governments of Canada, Ontario, and Québec to ensure integrated management of the principal reservoirs in the watershed. The goal of the ORRPB is to provide protection against flooding along the Ottawa River and its tributaries, and at the same time maintain the interests of the various users, particularly the hydroelectric energy producers. The ORRPB also works to ensure downstream communities such as Montréal have sufficient water supply at times of low flow. The ORRPB is the only inter-provincial government agency that is working in a management capacity in the watershed.

Lac Deschênes Rapids; shot from Quebec side
Photo by: Alan Todd

Impacts of Dams on Stream Ecology

According to a comprehensive study commissioned by the World Commission on Dams, the impacts of dams on ecosystems are "profound, complex, varied, multiple, and mostly negative"[7]. Dams affect both upstream and downstream ecosystems. Upstream impacts are mainly reservoir related, and downstream impacts are mainly related to the changes in the distribution and timing of stream flows.

Loss of Rapids

Upstream, the most obvious impacts of dams are the replacement of rapids, riffles, and pools with flat-water reservoirs, resulting in loss of habitat for those species adapted to fast-moving water. Rapids are an important element of any river system; they act as the "lungs" of the river. In the main channel of the Ottawa River, the Deschênes Rapids, running between west Ottawa and west Gatineau, are the only remaining unaltered rapids on the lower section of the river. As a result, in this area you will find many rare plant and aquatic species that are associated with, and adapted to, the fast flowing riffle habitat. It is no coincidence that this area offers some of the best birding on the entire river.

As any whitewater paddler knows, there are still fantastic rapids on the mainstem of the Ottawa River upstream of Beachburg, Ontario. These world-class rapids are visited by thousands of paddling and rafting enthusiasts each season. However, the river levels are greatly affected by the operations of the nearby dams that can change the water level by as much as ten feet overnight. Rafting guides have rescued stranded sturgeon and other fish from isolated pools when water levels are rapidly decreased by dam operators.

Fluctuating Water Levels

Naturally, streamflow in the Ottawa River changes as it responds to seasonal patterns of rainfall and snowmelt. Dams significantly change natural river flow patterns as they capture both high and low flows for electrical power generation and flood control and typically change the timing, frequency and duration of natural river flows. Natural streamflow variability is extremely important for sustaining native biodiversity and ecosystem integrity in rivers.

The rate of change in flow conditions can influence species persistence and coexistence. Extreme daily variations that occur quickly induce physiological stress in aquatic populations and populations are washed out during high flows, or stranded during rapid de-watering[8]. Disturbances to the natural flow regime can be tolerated within certain limits. However, many aquatic species coordinate their reproductive cycles with annual flood seasons. Fish spawn can be greatly impacted by dam operations; in some cases, eggs are dried out if flow releases are too low or they can be washed away by the force of a major release.

Most hydroelectric dams are operated in a manner that produces a well-defined pattern of daily, weekly or seasonal variation. However, as these patterns are related to power needs rather than to the natural hydrological cycle, there is little chance that local flora and fauna will be able to adapt to them. As a result, we see changes in species composition for both plant and animal communities.

Although some dam operators have recreational water levels that must be maintained, and minimum flows that must be adhered to, there are no existing guidelines for operators to protect ecosystem interests.

Dams as Barriers

Dams act as physical barriers that prevent both sediment and aquatic species such as fish and molluscs from moving in the river as they naturally do. Run-of-the-river dams allow sediment to move when the gates are wide open; other dams even prevent this natural movement of rocks, gravel and sand. This has downstream implications since the river, which is accustomed to carrying sediment, will pick up the sediment from the streambed or banks below the dam.

Dams on the Ottawa River have blocked migratory species such as American shad and eels to the degree that they are very low in numbers or absent from the river[9]. Fish passage is a concern with most dams and none of the dams in the Ottawa watershed have been built to provide adequate fish passage. Dams block upstream and downstream migration of fish, thereby preventing them from reaching spawning and feeding areas. Fish moving downstream often end up passing through dam turbines, which either kill them or leave them disoriented and an easy target for predators. Birds of prey can often be seen camping out at the bottom of dams feasting on these fish. This phenomenon is regularly observed at the foot of the Chats Falls Dam on the Québec side of the river by one of Ottawa Riverkeeper's RiverWatchers.

Reservoir Realities

As dams were built throughout the watershed, the morphology or shape of the river was significantly changed due to flooding. The details of these physical changes are well beyond the scope of this report and are documented best by air photo interpretation before and after construction. Tim Haxton and Don Chubbuck provide an excellent description of changes to the mainstem of the Ottawa River from Carillon to Lake Témiscaming[9].

The construction of the major reservoirs in the upper watershed had a significant impact particularly for the peoples of the Algonquin Nation. For the purpose of this report, we are focusing on ecological impacts; however it should be noted that the impacts of large reservoirs on societies is equally important and has had devastating results within our own watershed.

Reservoirs are known to have dramatic effects on temperature, nutrients, and dissolved oxygen. Water temperature in reservoirs will form discrete layers, with cold water sinking to the bottom. For dams with surface water releases, the released water with above average temperatures impacts the downstream aquatic community. Deep in the reservoir the water is cooler and decomposition takes place, using up oxygen. A common problem found in reservoirs is the conversion of elemental mercury to methylmercury, a highly toxic and persistent bioavailable form of mercury. This is easily taken up by small organisms like plankton and algae, which are then consumed by the next trophic level in the food chain and so on. The toxin levels bioaccumulate in animal tissue as the animal ages and consumes more contaminated food. Ottawa Riverkeeper does not have any information on the mercury levels in any of the principal reservoirs at this time, but this would be interesting information to investigate.

Reservoirs and Climate Change

Another important issue related to reservoirs that has recently gained international attention is the role they play in global climate change. It was long assumed that, since hydropower does not involve the combustion of fossil fuels, it would not contribute in any way to global warming. However, broad scientific consensus has emerged that reservoirs are in fact significant emitters of CO_2 and methane[10]. The science necessary to accurately measure greenhouse gas emissions from reservoirs is still in its infancy. Consequently, Canada and the Intergovernmental Panel on Climate Change (IPCC) do not take these reservoir emissions into account when determining climate change scenarios for the future.

Chats Falls Hydro Dam - West Side
Photo by: Alan Todd

Riverkeeper's Recommendations

Because of our dependence on hydroelectricity and our need for some flood control, solutions to the problems we have highlighted are limited. Design and operating choices, however, can be controlled at this point in time. We recommend the following actions be taken to reduce the impact dams are having on our river system:

1. Ensure no dams are constructed on the Dumoine River, as this is our only experimental control within the watershed that can characterize the natural range of variability on an undammed river.
2. Modify current operating regimes of the dams to mimic the natural flow of the river with respect to daily and seasonal variability.
3. Build fish ladders allowing fish to pass through the existing dams that are having an impact on migratory species.
4. For future projects, allow only low impact hydro on our rivers. Low impact hydro helps to protect indigenous species and habitat, mimic natural water flows, maintain good water quality, and ensure fish migration patterns.

Is Hydropower Considered "Green Power"?

Whether, or to what extent, hydropower should qualify for being marketed as "green power" is a highly contentious question. The hydropower industry argues that it is one of the "greenest" of power sources and some industry representatives go so far as to suggest that all hydropower should be certified for sale in the green power market.

However, the well-documented impacts of dams on river systems are widely recognized. There are varying degrees of impact, so that some hydro projects can be considered cleaner than others.

In Canada, Environment Canada has initiated the Environmental Choice Program to promote electrical energy sources that have greatly reduced environmental impacts. As part of this program, EcoLogo certifies electricity generators and has developed criteria for "low-impact" hydropower[11]. The program has not been without criticism, the most consistent being the lack of transparency around the certification process. In the Ottawa watershed, 13 generating facilities have been given EcoLogo certification (Table 1); however it should be noted that there is no public input or peer review assessment to determine how each facility meets the criteria. Hydro-Québec has refused to participate in the program because the criteria are too stringent.

Kipawa River Threatened by Hydropower Development

The Kipawa River flows from Lake Kipawa down to Lake Témiscaming on the upper Ottawa River in northwestern Québec. This 16 km section of river is beautiful and almost completely pristine, with towering red and white pines along its banks, many sets of rapids and a 90-foot waterfall. This river is a paddling destination for many and each spring is the site of the Kipawa River Rally, a paddling festival that draws paddlers from around the world. This paddling festival has been happening since 1987 and is considered one of the oldest whitewater events in North America.

The Kipawa River is being threatened by Hydro-Québec's Tabaret project. In 1998, Hydro Québec announced plans to build a new hydroelectric generating station between Laniel and the town of Témiscaming. This Tabaret project involves digging a new outlet from Lake Kipawa, building a 130 MW generating station and diverting the entire Kipawa River from its natural streambed.

Les Amis de La Rivière Kipawa was founded in 1998 in response to the Tabaret project and have been working to protect the Kipawa River. You can learn more about the group and how to contact them by visiting their website: http://www.kipawariver.ca

Municipal Wastewater

Sewage Ponds, Ottawa
Photo by: Alan Todd

Sewage in the form of municipal wastewater effluent is directly discharged to the Ottawa River and its tributaries on a daily basis. If sewage were simply human waste, it would be relatively simple to treat and transform into high quality fertilizer and water suitable for release back into the environment. However, typical municipal sewage also contains hundreds of chemicals and toxic pollutants that enter the sewer system from households, businesses and industrial operations. Municipal wastewater has been identified as one of the most significant sources of pollution to surface waters in Canada[12].

What is Municipal Wastewater and Why is it a Problem?

Municipal wastewater is liquid waste that is discharged to surface waters (rivers and lakes) from community sewer systems and wastewater treatment plants (WWTPs). These wastes are of two types: sanitary sewage which comes from the plumbing systems of homes, businesses, institutions and industries, and stormwater, which comes from rain or melting snow that drains off rooftops, lawns, roads, and other urban surfaces.

The materials found in sewage depend on the products consumed by residents at home (including food, pharmaceuticals, cleaning products, personal care products) and wastes generated through industrial/ commercial/ institutional sector discharges and public sector activities. Indeed, virtually any substance carried in a liquid may be present in sewage.The citizens of the watershed determine what is disposed down drains and through industrial processes. Common constituents in sewage include pathogens, nutrients, metals, oils, grease, pharmaceuticals, persistent organic pollutants (i.e. pesticides), solvents, and many other substances. Metals found in sewage can include silver, mercury, chromium, arsenic, lead, and cadmium, often as a result of industrial processes but also possible through stormwater inputs and household disposal of hazardous materials down the drain.

Municipal wastewater varies greatly with respect to its quality or potential to cause adverse effects, yet it is well documented that municipal wastewater can affect both human and ecosystem health. Impacts include changes in aquatic habitats and species composition, decreases in biodiversity, impaired use of recreational waters and shellfish harvesting areas, and contaminated drinking water[13]. These impacts all lead to a less valuable environment, a less prosperous economy, and ultimately, a diminished quality of life.

Municipal wastewaters contribute to a number of impacts on the aquatic environment of the Ottawa River. They:

- increase in nutrient levels, often leading to algal blooms;
- deplete dissolved oxygen, sometimes resulting in fish kills;
- destroy habitat from sedimentation and debris; and
- produce acute and chronic toxicity from chemical contaminants, along with bioaccumulation and biomagnification of chemicals at higher levels of the food chain.

Given the large volume of water in the Ottawa River, an attitude of "dilution is the solution to pollution" still remains – as if the large volume can naturally accommodate any quantity of pollution. However, organic chemicals and metals do not have to be discharged in large quantities to result in environmental degradation, regardless of their very low concentrations in wastewater effluent. Many of these chemicals can be toxic at low levels and can remain in the environment for very long periods. Consequently, large amounts of these substances can build up in sediments over time or be transported by water and air currents to other environments far from the original point of discharge. Some of these substances also tend to accumulate in living tissue and be passed up the food chain.

As a result, concentrations in top predators such as fish-eating birds can reach very high levels, despite very low ambient concentrations in the water.

If impact to the aquatic environment are not enough of a concern, we need to give some thought to drinking water. The same river that is receiving our municipal wastewater is also providing drinking water to millions of people. The costs of filtering our drinking water are related to the quality of the wastewater we pump into the river. Our filtration processes are not designed and operated to filter out many of the new and emerging chemicals of concern.

Flood Sunset
Photo by: Andrew Buzzell

Sewage Treatment: Ottawa east end
Photo by: Alan Todd

An Overview of Sewage Treatment within the Ottawa River Watershed

Sewage treatment has improved considerably over the past decade in the Ottawa River Watershed. Many municipalities have recently invested in sewage treatment facilities where none previously existed. Technology exists for every municipality to obtain high quality effluent with low impact to receiving waters; however, the barriers to achieving these high standards are high, particularly in smaller communities.

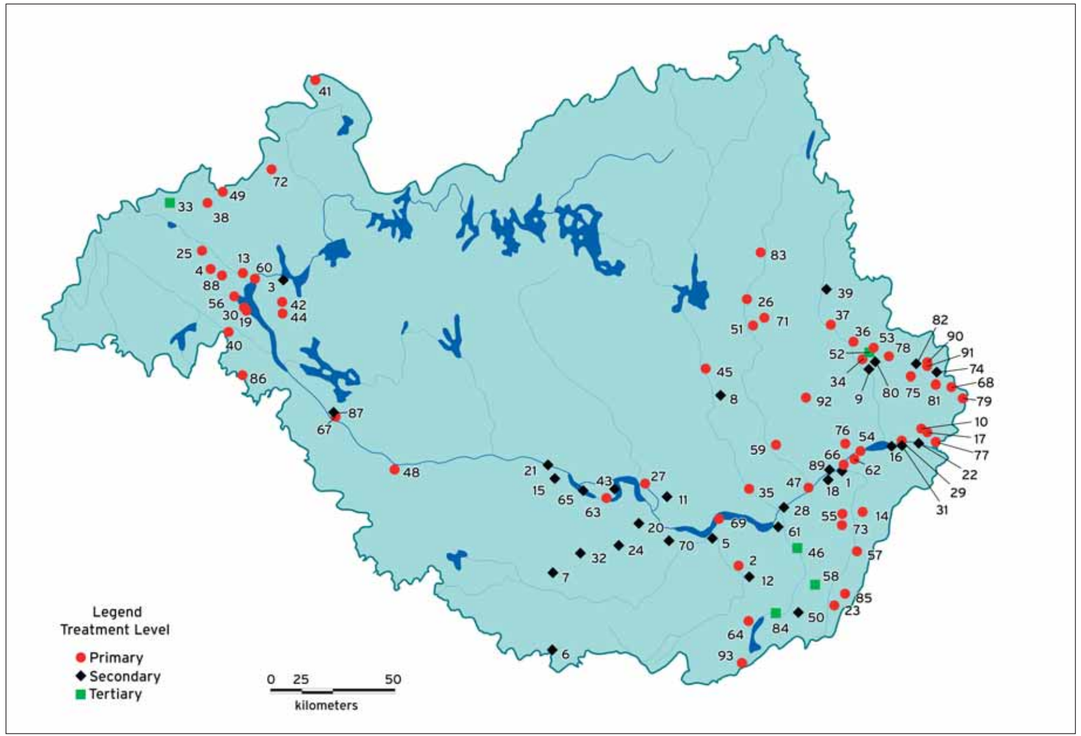
Of the 1.7 million people living in the watershed, there is an unknown percentage who rely on septic systems for sewage treatment and those who have municipal sewers. Given the vast rural area of the Ottawa River watershed, it is expected that at least 25% of the population rely on septic systems.

Each municipality in the watershed employs a wide range of both technical and pollution prevention techniques for sewage. The design and volume capacity of treatment systems depend on such things as the specific needs or objectives of municipalities, the source and quantity of the wastewater, and financial constraints. Municipalities that treat wastewater employ treatment systems that range from simple screening, to settling (known as primary treatment) to biological treatment (known as secondary treatment) to advanced processes (known as tertiary treatment) to remove a range of contaminants.

The stresses that municipal wastewater effluents place on aquatic environments depend on several principal factors including the amount of effluent discharged and the quality of the effluent. The design, operation and maintenance of a treatment facility will influence the effectiveness and efficiency of the system in removing contaminants from the wastewater discharge. For example, effluent from a properly sized and operated lagoon system can have less impact on the aquatic environment than effluent from a mechanical secondary treatment facility for a larger urban centre.

Some communities in Canada dispose untreated municipal wastewater directly to receiving waters, although no community within the Ottawa River watershed does so any longer. Surprisingly, the practice of disposing untreated waste has only recently been discontinued in the Ottawa River watershed. In Québec, the *Programme d'assainissement des eaux municipales du Québec*, has significantly reduced the amount of untreated municipal wastewater discharged into the Ottawa River in the last decade.

In the Ottawa River watershed, there are over 90 wastewater treatment facilities, consisting of a wide range of treatment types (Map 5 and Table 2). Over half of the facilities provide only primary treatment, yet fortunately several of these were in the process of upgrading to secondary at the time of writing this report. Also, all lagoons were assumed to provide only primary treatment, yet it is possible that some lagoons release effluent equivalent to that of secondary treatment plants.



Map 5 – Municipal Wastewater Treatment Facilities in the Ottawa River Watershed

Table 2: Summary of Municipal Wastewater Treatment in the Ottawa River Watershed

Map Reference N°	Name	Province	Level of Treatment
1	Alfred & Plantagenet (Wendover)	ON	Secondary
2	Almonte	ON	Primary
3	Angliers	QC	Secondary
4	Armstrong (Earlton)	ON	Primary
5	Arnprior	ON	Secondary
6	Bancroft	ON	Secondary
7	Barry's Bay	ON	Secondary
8	Bouchette	QC	Secondary
9	Brébeuf	QC	Secondary
10	Brownsburg	QC	Primary
11	Campbell's Bay	QC	Secondary
12	Carleton Place	ON	Secondary
13	Casey- Belle Vallée	ON	Primary
14	Casselman	ON	Primary
15	Chalk River	ON	Secondary
16	Champlain (L'Original)	ON	Secondary
17	Chatham-Lachute	QC	Primary
18	Clarence-Rockland	ON	Secondary
19	North Cobalt	ON	Primary
20	Cobden	ON	Secondary
21	Deep River	ON	Secondary
22	East Hawkesbury (Chute a Blondeau)	ON	Secondary
23	Edwardsburg (Spencerville)	ON	Primary
24	Eganville	ON	Secondary
25	Englehart	ON	Primary
26	Ferme Neuve	QC	Primary
27	Fort Coulonge	QC	Primary
28	Gatineau	QC	Secondary
29	Grenville	QC	Primary
30	Haileybury (Lake Tamiskaming)	ON	Primary
31	Hawkesbury	ON	Secondary
32	Killaloe Station	ON	Secondary
33	Kirkland Lake	ON	Tertiary
34	La Conception	QC	Primary
35	La Pêche (Wakefield)	QC	Primary
36	Labelle	QC	Primary
37	L'annonciation	QC	Primary
38	Larder Lake	ON	Primary
39	L'ascension	QC	Secondary
40	Latchford	ON	Primary
41	Launay	QC	Primary
42	Laverlochère	QC	Primary
43	L'Isle-aux-Allumettes	QC	Secondary
44	Lorrainville	QC	Primary
45	Maniwaki	QC	Primary
46	Manotick	ON	Tertiary
47	Gatineau (Masson Angers)	QC	Primary
48	Mattawa	ON	Primary
49	McGarry (Virginiatown)	ON	Primary
50	Merrickville-Wolford	ON	Secondary
51	Mont Laurier	QC	Primary
52	Mont Tremblant Resort (Chalet des Chutes)	QC	Secondary
53	Mont Tremblant Village	QC	Primary
54	Montebello	QC	Primary
55	Nation (Limoges)	ON	Primary
56	New Liskeard	ON	Primary
57	North Dundas (Chesterville)	ON	Primary
58	North Grenville (Kemptville)	ON	Tertiary
59	Notre-dame-de-la-salette	QC	Primary
60	Notre-dame-du-nord	QC	Primary
61	Ottawa (R.O. Picard Env. Centre)	ON	Secondary
62	Papineauville	QC	Primary
63	Pembroke	ON	Primary
64	Perth	ON	Primary
65	Petawawa	ON	Secondary
66	Plaisance	QC	Primary

Table 2: Summary of Municipal Wastewater Treatment in the Ottawa River Watershed (cont.)

Map Reference N°	Name	Province	Level of Treatment
67	Poltras (Thorne)	ON	Primary
68	Prevost	QC	Primary
69	Quyon	QC	Primary
70	Renfrew	ON	Secondary
71	Ripon (Lac des Ecorces)	QC	Primary
72	Rouyn-Noranda (Beaudry)	QC	Primary
73	Russell (Embrun)	ON	Primary
74	Saint Adèle (Mont Rolland)	QC	Secondary
75	Saint Adolphe d'Howard	QC	Primary
76	Saint André Avellin	QC	Primary
77	Saint André D'argentieul (Carillon)	QC	Primary
78	Saint Faustin Lac Carré	QC	Primary
79	Saint Jérome	QC	Primary
80	Saint Jovite	QC	Secondary
81	Saint Sauveur	QC	Primary
82	Sainte Agathe des monts	QC	Secondary
83	Sainte Anne du Lac	QC	Primary
84	Smiths Falls	ON	Tertiary
85	South Dundas (Willamsburg)	ON	Primary
86	Temagami	ON	Primary
87	Temiscaming (Tembec)	QC	Secondary
88	Thornloe	ON	Primary
89	Thurso (Papiers Fraser)	QC	Secondary
90	Val David	QC	Primary
91	Val Morin	QC	Primary
92	Ville-Marie (Duhamel)	QC	Primary
93	Westport	ON	Primary

The City of Ottawa wastewater treatment plant, the Robert O. Pickard Water Pollution Control Centre, was originally installed in the 1960's as a primary treatment facility. In 1992, an upgrade was commissioned for a secondary (biological) process with an enhancement to remove phosphorus (a nutrient). The Ottawa facility is currently being upgraded to increase its capacity so that it can receive sludge from the Lemieux water filtration plant. This aluminum-laden sludge is currently being dumped directly into the river on a daily basis despite the fact that the effluent is a pollutant and does not comply with provincial or federal regulations.

Many municipalities disinfect their wastewater effluent prior to release into surface waters to kill bacteria, viruses and other pathogens. The most common methods of disinfection in Canada are chlorination (which is acutely toxic to fish) and ultra-violet radiation (which does not leave any residue in the wastewater). The City of Ottawa wastewater facility chlorinates their effluent only during swimming season and, fortunately, wastewater facilities in the Province of Québec do not use chlorine.

The Fate of Sewage Sludge

Wastewater treatment processes result in more than just water effluents. Processes also result in air emissions and solid materials (sludge). Solid materials removed from the water column with the assistance of bacteria (i.e. biological treatment, also called secondary treatment) result in what are commonly called biosolids. Wastewater treatment facilities may have biosolids processing facilities to treat solids generated, as does the City of Ottawa facility.

Québec Shore (opposite Hawkesbury)
Photo by: Alan Todd

The question of what to do with biosolids has been, and currently is, widely debated at all government levels and by the public and scientific community in North America. Biosolids are often applied to farmers' fields because they contain nutrients which are useful for crops, and this is the cheapest and most convenient method of disposal. However, concerns arise regarding other constituents also commonly present in biosolids, such as metals, pharmaceuticals, and pathogens that have not been eliminated through treatment processes. Alternatives to land application however are limited – landfill sites are filling up. Although biosolids can be used as cover material between lifts of garbage in a landfill operation, the volume of biosolids produced by community sewage treatment exceeds this requirement and a large volume of solid material needs to be disposed in a responsible manner.

Continuing and Emerging Issues: Serious Threats

The wastewater treatment technologies currently in place in the Ottawa watershed were developed at a time when the conventional parameters discussed above were the prime concern. Oxygen depletion in the Ottawa River was a significant issue that has been addressed through the installation of the primary treatment systems in place. However, the effectiveness of these technologies to remove pollutants of emerging concern is unknown, and upgrades to improve on secondary treatment are extremely expensive.

Constituents of conventional and emerging concern include:

- Metals, such as silver, chromium, mercury, arsenic, lead and cadmium.
- Endocrine disruptors, which cause male fish to display female characteristics (such as egg sacs). Endocrine disruptors include natural hormones (secreted by women) and synthetic substances that mimic the hormone estrogen.
- Pharmaceuticals, which may also act as endocrine disruptors or create resistance. Pharmaceuticals are excreted by people taking medications.
- Personal care products, which also may act as endocrine disruptors or as toxics in the environment. Personal care products include shampoos, soaps, and moisturizers.

Research in Canada and abroad has demonstrated the persistence of some of these emerging issues in the environment and the difficulty in removing them. For example, a recent study by the National Water Research Institute[14] identified nine pharmaceuticals in drinking water samples in Southern Ontario – carried full circle back to homes.

Other continuing but noteworthy factors to consider are aging sewer infrastructure and capacity issues faced by many municipalities. According to Ontario's Environmental Commissioner, many sewage treatment facilities are being operated near the upper limit of their design capacity or are already overloaded[12]. Consider the increased burden on our sewer systems from climate change (more intense storm events) and population growth, we appear to be setting ourselves up for an increase in untreated sewage being released into the river. Major investments are necessary to address these infrastructure concerns.

Regulation of Wastewater

The Canadian Constitution divides legislative responsibility between the Federal and Provincial governments. This overlapping of duties and responsibilities has left Canada with a patchwork of laws and standards, exacerbated by lack of consistent enforcement for existing pollution laws, and inadequate funding for sewage collection and treatment facilities. The issue of stormwater is largely unaddressed through policy and programs at the federal and provincial levels. Most significantly, Canada lacks national standards for sewage treatment. This significant environmental health issue has been relegated to the haphazard standards of individual municipalities.

Provincial governments are responsible for control of the construction and operation of municipal sewage treatment facilities and generally exercise this control through licenses or permits issued to municipalities for sewage facilities. In recent years, the trend has been towards decreased funding support for municipal investments, and in some instances, this has compromised municipalities' ability to provide adequate treatment.

Provincial government regulations typically delegate responsibility to municipalities to provide sewage treatment, along with the authority to enact sewer use bylaws. Under provincial Municipal Acts, municipalities are given the power to pass local bylaws, to regulate local matters, including what is discharged into the sewer. Such sewer use bylaws limit the amount of unregulated pollutants that can be legally discharged by industries and businesses. Sewer use bylaws can be an effective tool in reducing the overall toxicity of sewage effluent and sludge, but their effectiveness generally depends on how strict the limits on pollutants are and how many pollutants are included. Many municipalities do not have any sewer use bylaws.

Effluent limits and monitoring requirements for sewage treatment plants are based on guidelines promulgated by the Provincial Ministries. All monitoring results are submitted to the Ministry for analysis of compliance. In Ontario this information is not made public, yet in Québec this information is made publicly available each year[15].

Riverkeeper's Recommendations

Given the huge variation around municipal wastewater treatment throughout the watershed, and the lack of data about total loadings into the Ottawa River, there are a number of actions we can take to improve our current situation:

1. Practice water conservation - decreasing water consumption would substantially decrease costs of wastewater treatment and address concerns of capacity.
2. Improve pollution prevention (Industrial Waste Programs, Household Hazardous Waste Programs, and Public Information Programs) - reduce chemicals of concern from the sources.
3. Carefully consider the spreading of biosolids and septage and never apply either to frozen ground to prevent pollutants from being discharged directly in the river during snowmelt.
4. Prioritize treatment facilities for upgrades based on total loadings of pollutants into the river.
5. Develop consistent sewer use bylaws to be applied to all municipalities.
6. Ensure transparent reporting on monitoring and compliance.

Alternative Wastewater Treatment Technologies – Manotick Case Study

As rural areas surrounding our urban centres become developed, we are faced with the problem of how to treat the sewage from these new developments. Often municipalities will expand their pipes and "hook" these houses up to the nearest sewage treatment plant. Often this is not the most feasible alternative and can burden existing infrastructure. In Manotick, an on-site wastewater treatment plant was built to service 75 new townhouses. The receiving body of water for this plant is the Rideau River. The Ontario Ministry of Environment issued a certificate of approval for the facility specifying a tertiary quality discharge standard. In addition, the regulator established a phosphorous discharge standard of 0.03 mg/l, which is the tightest effluent discharge standard ever applied to an operational wastewater treatment plant in Canada. The Manotick wastewater treatment plant, designed and built by Seprotech, is the most advanced tertiary wastewater treatment plant in Canada, and sets global standards for the removal of phosphorous.

The Economics of Wastewater Treatment

By Sharon Khan

Outdated municipal wastewater treatment "creates problems in terms of the environment, human health, tourism industries and shellfish/fishing industries. These detrimental effects are evident in multiple beach closures related to high coliform counts, boil water advisories due to insufficient drinking water treatment and consumption warnings related to fish raised in polluted waters," according to Gardiner Pinfold Economic Consultants, who have been studying the benefits of improving municipal wastewater treatment[16]. They chose three communities as ideal case studies for exploring the potential benefits of updated wastewater treatment methods: Ottawa, Ontario, Prince Albert, Saskatchewan and Summerside, Prince Edward Island.

"The costs of [upgrading municipal] treatment should, in principle, be borne by the system users (the polluters pay). It is often politically difficult, however, to raise surcharges enough to cover the higher treatment levels because the users do not see the benefits directly.[17]" The new research from Gardiner Pinfold shows that users are in fact willing to pay. The study presents results of the Summerside case. Survey respondents were willing to pay an average value of $39.40 per year per individual for improved wastewater treatment on top of their current water/sewer bill. We are still waiting for the results from the Ottawa case study. But if the Summerside case is any indication of what's to come, we can go ahead and do the math. The population of Summerside is 16,400. Ottawa has a population of 774,072. With 63% of the population between the ages of 20 and 64[18], Ottawa residents could be willing to pay some $19 million per year to improve their wastewater treatment. Even if we don't see the benefits immediately, we are certainly tired of seeing the costs of dirty water.

Sharon Khan is and Environmental Economist for Waterkeeper Alliance in Tarrytown, New York. Sharon leads the Clean Water Economics Initiative, providing Waterkeepers with information on the benefits of protecting our rivers, lakes and coasts from environmental damage. Sharon currently resides in New York, but grew up boating, fishing and swimming in and around Ottawa.

THREATS TO THE ECOLOGICAL HEALTH OF THE RIVER

Industrial Wastewater

Wastewater effluents from private wastewater treatment systems installed at industrial, commercial, or institutional sites are also discharged into the river. In the Ottawa River watershed, the major industrial concerns are around the pulp and paper mills and the nuclear facilities at Chalk River.

Pulp and Paper Mills

Overview of Paper and Pulp Mills in the Watershed

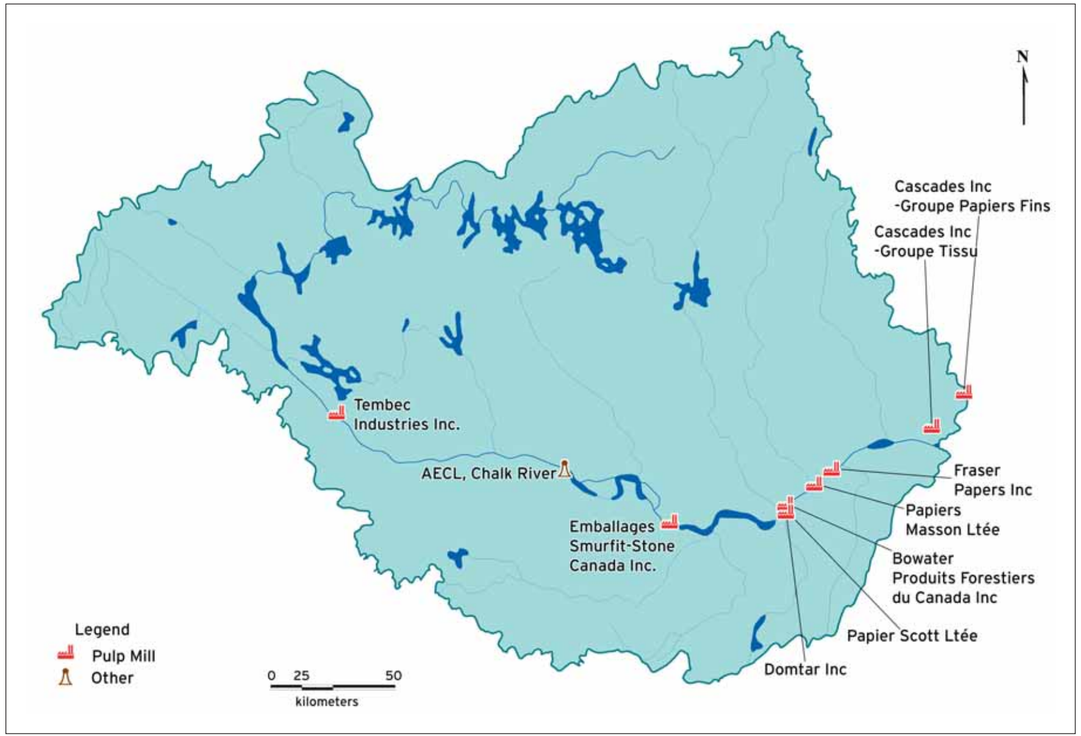
The legendary timber rafts have disappeared from the Ottawa River, but logging trucks are still a familiar sight on the highways throughout the Ottawa River watershed. From sawdust to pulp and paper effluent, the Ottawa River has been the receiving body for the wastes generated from the forestry industry. Today there are nine pulp mills in the Ottawa River watershed (Map 6).

The pulp and paper industry was once regarded as the primary source of pressure on water quality in the Ottawa. Overall this sector was responsible for discharging enormous amounts of suspended solids and organic wastes that substantially reduced oxygen levels in the river. However, since the early 1970's when water quality was at its worst, the pulp mills have cleaned up their act. Despite the dramatic improvement in wastewater effluents from pulp mills over the last two decades, today's pulp mills are still major water polluters.

In 2002, the industry released over 163,000 billion litres of toxic effluent into the Ottawa River (Table 3). Paper and pulp mill effluent contains chemicals and solids that are suspended from the wood itself and the pulping and/or bleaching processes. This wastewater is typically dark brown and contains several known carcinogens, including formaldehyde, chloroform, benzene, acrylamide, methanol, and ammonia. Due to Federal regulations, all mills are required to have a minimum of secondary wastewater treatment and to our best knowledge, all of the mills have phased out the use of elemental chlorine.

Tembec's mill in Témiscaming contributes the largest amount of wastewater by volume – approximately 35% of wastewater from all the mills combined. Unfortunately, they also have the worst record of compliance with environmental regulations. Reporting documents obtained by Sierra Legal Defence from Environment Canada under the Access to Information Act show that Tembec has continued to violate federal regulations for many years. Between 1995 and June 1999, they violated the total suspended solids (TSS), biological oxygen demand (BOD), trout and Daphnia magna lethality limits at least 970 times[19]. However, in the fall of 2005 they were fined $1 million by the Québec Government – the largest environmental fine in the history of Québec. The fine was for infractions that occurred between January 2001 and February 2003. They have yet to be fined by the Federal Government, despite their continual violations of the Federal Fisheries Act.

Thurso Pulp Mil, Québec
Photo by: Alan Todd



Map 6 – Pulp and Paper Mills in the Ottawa River Watershed

Table 3: Summary of Pulp and Paper Mills in the Ottawa River Watershed

Name	Owner	Location	Receiving Body of Water	Daily Effluent Discharge (m^3/d)**		
				2002	2001	2000
Cascades Tissue Group – Lachute Division	Cascades Canada Inc.	Lachute, QC	Rivière du Nord	1,000	1,120	1,235
Cascades Fine Papers Group Inc. – Rolland Division	Cascades Fine Papers Group Inc.	Saint-Jérôme, QC	Rivière du Nord	6,154	8,245	7,905
Fraser Thurso Pulp Division	Fraser Papers Inc.	Thurso, QC	Ottawa River	70,632	68,006	66,054
Masson-Angers Newsprint Mill	Papier Masson Ltée.	Masson-Angers, QC	Rivière du Lièvre	29,991	30,972	36,823
Bowater Gatineau Newsprint and Paper Mill	Bowater Canadian Forest Products Inc.	Gatineau, QC	Ottawa River	72,246	69,506	77,726
Domtar Ottawa/Hull Mill*	Domtar Inc.	Ottawa, ON	Ottawa River	28,900	28,845	28,464
Hull Tissue Mill	Scott Paper Limited - Kruger Inc.	Hull, QC	Discharges into the Ottawa River via treatment at the Domtar Ottawa-Hull Mill	11,965	10,299	9,870
Pontiac Mill	Smurfit-Stone Containers Canada Inc.	Portage-du-Fort, QC	Ottawa River	67,355	68,768	76,038
Complexe Industriel Tembec Industries Inc. / Spruce Falls Inc.	Tembec Inc. / Spruce Falls Inc.	Témiscaming, QC	Ottawa River	158,284	161,412	161,849

* At time of writing this mill announced plans to close
** m^3/d = cubic meters of effluent per day

Impacts of Pulp and Paper Mills on Stream Ecology

The discharge of mill effluent has been known to radically disrupt the natural balance of species abundance in receiving waters. Studies suggest mill effluent affects the size and age distribution of fish populations, interferes with the photosynthesis of plants and algae, and has a negative effect on the feeding and reproduction of other aquatic life.

It is well known that the organochlorines (such as dioxins and furans) formed during the bleaching process cause serious environmental harm. These molecules persist in the environment, and tend to accumulate as they move up the food chain, a phenomenon known as bioaccumulation. Organochlorines are also easily transported over great distances by water, air, or organisms that have consumed them. These properties have led scientists to conclude that even very small amounts of organochlorines, and in particular dioxins, can negatively affect human and animal health for several generations after their release. Studies have shown dangerously high levels of organochlorines in fish and significantly elevated levels in their predators, including otters, mink, bald eagles, peregrine falcons, and great blue herons. The level of some organochlorines in effluent, particularly dioxins and furans, has been significantly reduced in recent years as stricter government regulations caused many mills to substitute elemental chlorine for chlorine dioxide in the first stage of the bleaching process.

While secondary treatment and improvements in bleaching processes reduce the toxicity of effluent, mill wastewater remains harmful to aquatic ecosystems and animals (including humans) that draw food and water from that ecosystem[20].

Pulp and Paper Effluent Regulations

Federal standards governing the discharge of harmful substances into Canadian waters are relatively new, with the first set of regulations for the pulp and paper industry coming into force in 1971. These regulations did not limit the total amount of pollution, but rather permitted the discharge of pollutants in proportion to the production of the mill. Furthermore, the 1971 regulations applied only to new mills and to the expanded portion of old mills. As a result of enormous public pressure, the federal government announced new regulations governing pulp mill effluent in December 1991, following lengthy negotiations with the industry.

The new Pulp and Paper Effluent Regulations (PPER) are administered under the Federal Fisheries Act. Like the original pulp mill regulations of 1971, these new regulations still set no maximum limit for the known pollutants BOD and TSS; instead, they calculate the allowable BOD and TSS based on the production rate of the mill. Thus, although these regulations set limits, a mill with a very high production rate is still permitted to discharge very large amounts of organic pollution and solid wastes.

THREATS TO THE ECOLOGICAL HEALTH OF THE RIVER

The Pulp and Paper Effluent Regulations introduced in 1991 had three parts. First, mills were required to change bleaching processes to prevent the formation of dioxins and furans. Second, regulations were proposed to further reduce dioxins and furans by requiring mills to stop the use of defoamers and wood chips. Third, mills were required to implement a secondary treatment system for their effluent and to abide by limits to control the discharge of certain harmful pollutants. Many mills received extensions to complete the required changes in technology and now it has been almost a decade since the new regulations have been fully enforceable for all the mills.

However, since the new laws were introduced, Ottawa has essentially abandoned the enforcement of pulp and paper water pollution laws. Despite the flagrant and continuous violation of the Fisheries Act by so many mills, not one of these mills has been prosecuted by the Federal Government since the effluent regulations came into force. It appears that the Federal government is giving the provinces primary responsibility for monitoring and enforcing the PPER for its pulp mills, despite Canada's responsibility to enforce its own pollution laws.

Riverkeeper's Recommendations

1. Provide incentives for mills to operate closed-cycle technology that minimizes water pollution and forces industry to exploit new, cleaner methods of sludge disposal.
2. Implement totally chlorine free bleaching processes.
3. Publish monitoring and compliance data from all pulp mills. The regulatory agencies should make the data publicly available.
4. Increase pressure on governments to enforce the existing regulations.

Shirley's Bay
Photo by: Robert Williams

Chalk River Nuclear Facilities

The Chalk River Laboratories (CRL) is the major research facility of Atomic Energy of Canada Ltd. (AECL), a federal crown corporation dedicated to nuclear power. Located on the Ottawa River, 180km upriver from Ottawa (Map 6), the nuclear laboratories were created in 1944 as the Commonwealth's contribution to the U.S. Manhattan Project. Nuclear physicists from the major Allied nations (England, France, and Russia) trained at CRL and later led their domestic nuclear weapons programs.

The NRX reactor at CRL, which operated from 1947 to 1994, was the most powerful research reactor of its day. It provided much of the plutonium used during the early years of the U.S. nuclear weapons program, and later became a workhorse for production of medical isotopes and reactor physics experiments. The NRU reactor, built in 1957, is CRL's main research reactor, and still produces over half the medical isotopes used in the world. It was scheduled to be closed in 2005. AECL's proposal to extend its operation until 2012 is being reviewed by the Canadian Nuclear Safety Commission (CNSC).

The NRX experienced the world's first major reactor accident involving fuel melting in December 1952. Although a hydrogen explosion occurred, a Chernobyl-like fuel combustion catastrophe was avoided by flooding the reactor with Ottawa River water. A pipeline was built to pump and discharge 4.5 million litres of highly contaminated water to a sand pit 0.5 kms away from the river. Disposal of contaminated water via the pipeline continued until 2000. The radioactive plume from this waste site empties into Perch Lake and radionuclides (mainly tritium, cesium-137, and strontium-90) pass through Perch Creek into the Ottawa River.

Radionuclides are also discharged into streams and lakes at CRL from two abandoned plutonium extraction facilities where accidents occurred in the 1950s, and from three Waste Management Areas. Three of these plumes are intercepted and treated to limit the extent of contaminated areas and the migration of contaminants off site.

The storage bays for high-level waste fuel rods from the NRX and NRU reactors directly discharge radionuclides to the Ottawa River. The NRX fuel bay leaked up to 1000 gallons of water each day for over 35 years, and a plume of tritium and strontium-90 intersects the river over several hundred meters of shoreline.

The Ottawa River provides secondary coolant for the NRU reactor through an open loop system. Cooling water is drawn from the river and returned via the Process Sewer, which also discharges liquid wastes from CRL's Waste Treatment Centre. It is the largest source of inputs of radionuclides to the Ottawa River, which are monitored on an ongoing basis. More details can be found in AECL's Ecological Effects Review of Chalk River Laboratories[21].

Recent upgrades to the Waste Treatment Centre, and installation of the three plume treatment facilities, have reduced radioactive contaminants from the CRL site, but unacceptable practices are still being corrected. In November 2004, it was discovered that liquid radioactive sewage sludge was routinely dumped in one waste management area. The sludge is now dewatered and stored on site.

Five decades of improper management of radioactive wastes at CRL have led to widespread contamination. This will be a legacy for generations to come, long after the site ceases operation. AECL estimates the cost of cleaning up CRL at around $3 billion. Certain clean-up options under consideration, such as underground disposal in a shallow rock cavity, could have negative impacts on the Ottawa River. A decommissioning plan for the site and funding for its implementation are being considered by the CNSC.

Shoreline alteration, Rockland
Photo by: Alan Todd

Non-Point Source Pollution

Non-point source pollution comes from many diverse sources, as opposed to discharges from specific pipes from paper and pulp mills or wastewater treatment plants. Non-point source pollutants are transported overland and through the soil by rainwater and melting snow, finally depositing into lakes, rivers, wetlands, and even underground sources of drinking water.

Non-point source pollution is often overlooked by regulators and municipalities, yet it can be more detrimental than effluent from mills or sewage treatment plants because these overland pollutants are not undergoing any treatment whatsoever before they enter our lakes and rivers.

The major types of pollutants carried by runoff include pathogens, nutrients, and toxic contaminants.

- **Pathogens** are disease-causing microorganisms, such as bacteria and viruses. Pathogens wash off the land from wild animal, farm animal and pet waste, and can also enter the watershed from improperly functioning septic systems, leaky sewer lines and sanitary disposal systems of boats.

- **Nutrients** are compounds that stimulate plant growth, like nitrogen and phosphorous. In high concentrations, they can become both an environmental and health threat. Nutrients in polluted waters can come from agricultural fertilizers, septic systems, home lawn care products, and yard and animal wastes.

- **Toxins** (heavy metals, pesticides and organic compounds such as PCBs) are substances that can harm aquatic and human life. Many toxins are resistant to breakdown and tend to bioaccumulate. They are created by a wide variety of human practices. Oil, grease and gasoline from roadways, and chemicals used in home, gardens, yards and on farm crops, are major sources of toxic contaminants.

The major non-point sources and their specific pollutants are described below. The impacts of non-point source pollutants on the Ottawa River watershed have been largely ignored. However, these pollutants have known harmful effects on fish, birds and mammals, drinking water supplies, human health, and recreation activities.

Urban or stormwater runoff is one of the leading sources of water quality impairment to surface water. In the United States, the issue of stormwater is treated as a high priority water threat under the Clean Water Act. While the U.S. Environmental Protection Agency has identified stormwater runoff as their most common cause of water pollution[22], no comprehensive approach to recognize or address stormwater has yet been developed in Canada. Stormwater is simply rain and snowmelt, but it becomes a threat to surface waters because of the changes made to land use across the country: urbanization, agriculture and industrial activities. Contaminants in stormwater can include any substance found on roads or properties, including pesticides, fertilizers, heavy metals, hydrocarbons, pet wastes, etc.

Septic systems that are not properly maintained can cause drain fields to become plugged and partially-treated wastewater to surface onto the lawn and/or to flow to nearby water bodies. Wastewater from improperly constructed or located septic systems can also pollute ground water.

Agricultural runoff is generally regarded as the largest contributor of non-point source nutrient loading to Canada's freshwater ecosystems. Livestock manure, sediment and improperly applied pesticide and fertilizers can contaminate local water bodies. Livestock movement near and in streams can erode stream banks, destroy fish habitat and impair water quality.

Recreational boating can have an impact on water quality and shoreline erosion if boaters are not diligent. Activities such as dumping of sewage and garbage, leaking fuel and oil, and the use of toxic cleaning products will degrade water quality. Also, the wake from large, fast boats or jet skis can have an impact on shoreline nesting habitat.

Riverkeeper's Recommendations

Polluted runoff is largely the result of the way we develop, use and maintain our land. The sources are many, and how we respond to clean up non-point source pollution will take the concerted efforts of everyone.

1. Encourage municipalities to review and improve their stormwater management plan.
2. Undertake a comprehensive evaluation of septic systems throughout the watershed to determine their cumulative impact on the river system and solutions for improving the situation.
3. Reduce agricultural runoff by improving riparian buffers, on-site manure management and reducing use of pesticides and fertilizers.
4. Refrain from non-essential use of lawn and garden chemicals including pesticides, herbicides, insecticides and fertilizers.

Urban and Shoreline Development

Development along the Ottawa River abounds, despite the importance an intact floodplain plays in preserving important ecological qualities of the river. Development brings with it a general hardening of the watershed with homes, streets, soil compaction and the destruction of the natural vegetation of wetlands and floodplains. The consequence is a watershed that loses its capacity to absorb rainfalls and snow melts, resulting in less ground water and more flooding and stream erosion.

In urban centres, paved surfaces (i.e. roads and parking lots) and roofs cause large volumes of water to run off where it used to soak into the ground. This water slams into rivers or creeks, changing the shape of the stream, bringing warmer water and pollution with it. Thus, entirely different biological groups are supported by the 'new' watercourse. This is the reason we do not find trout in urban streams. To add to the problem, less water soaking into the ground means a lower groundwater table. This poses a threat to smaller creeks or rivers, as they risk drying up during peak summer months.

Paved surfaces are only part of the problem of urbanization. Wetland destruction greatly affects the ecological integrity of a river system. Wetlands sustain more life than any other ecosystem – as much as many tropical forests and more than good farmland. The high plant productivity of wetlands supports hundreds of different species and provides the critical breeding and rearing habitat for a wide diversity of wildlife. Wetlands act as natural water purification systems removing sediment, nutrients, and toxins from flowing water. They also reduce the effects of flooding.

The City of Ottawa has special challenges in maintaining the health of the watershed because of the competing interests of preservation or destruction of wetlands that exist at its urban fringe. Many wetlands have been preserved as a result of being designated as Provincially Significant Wetlands by the Ontario Ministry of Natural Resources (MNR), but other wetlands that serve important local ecological functions can command only "natural areas" status in the City's Official Plan, and thus are vulnerable to future development.

The current concern is that some owners of land in these natural areas undertake vegetation clearing and watercourse alteration to avoid having their property designated as Provincially Significant Wetlands. In fact, landowners can petition their local Council to drain wetlands by constructing "municipal drains" under the Drainage Act – and the Province of Ontario has historically subsidized this program by offering landowners grants of as much as 33-66% of the project costs in the Ottawa River watershed. Because the drainage works constructed under the Drainage Act are not considered "development" under the Planning Act, Provincially Significant Wetlands are vulnerable to programs that are subsidized by the Provincial government. The Province of Ontario is currently examining this program.

The impacts of urbanization are obviously concentrated in our cities throughout the watershed, with the large cities of Ottawa and Gatineau of biggest concern. However, inside and outside our cities, from Témiscaming to Montréal, development along the Ottawa River shoreline continues to increase.

Carp River
Photo by: Dan Brunton

Many small summer cottages are being torn down and replaced with large year-round houses and agricultural land and brown-fields are being subdivided and developed. Poor shoreline development includes clearing the natural vegetation, planting a lawn to the water's edge and removing rocks and weeds in shallow water. Consequently, the resulting bare, unstable shore cannot withstand the forces of erosion, and the valuable shoreline is slowly eaten away. To stop this process, owners often erect retaining walls and back fill, which severs the ecologically important connection between land and water.

Regulations governing shoreline development exist in both provinces and are enforced by municipalities. In Ottawa, the three conservation authorities issue permits for shoreline development. Despite the regulations for 30 metre setbacks, riparian buffers and floating docks (among many other regulations), there are still new developments throughout the watershed that get around such regulations.

Carp River Floodplain Development

In 1910, part of the upper reach of the Carp River was dredged into a drainage ditch. Almost 100 years later, plans are underway to restore the river. A consortium of developers who will be developing the new community of Kanata West have agreed to fund the restoration project providing they are allowed to build homes on the floodplain.

Ottawa Riverkeeper has been reviewing the plans for developing and restoring the Carp River. Riverkeeper does not believe the City and the Conservation Authority should give permits to allow development in the floodplain because floodplains provide natural storage areas to handle seasonal fluctuations in river levels. We also have concerns about the precedent that will be created by allowing development in the floodplain.

Despite provincial regulations that caution against building on a floodplain and previous flooding in the Glen Cairn community located just upstream of the Kanata West development, the City of Ottawa continues to support the floodplain development in Kanata West.

If you are interested in the health of the Carp River, please consider contacting the Friends of the Carp River (www.friendsofthecarpriver.com). They have been spearheading numerous tree-planting projects and are currently working with landowners to encourage stream stewardship.

Riverkeeper's Recommendations

1. No development in the floodplain should be permitted unless there is scientific evidence that there will be no significant impact on fish habitat or river hydrology.

2. Watershed management plans should be completed and publicly approved for each major tributary of the Ottawa River – plans should include ecologically sensitive areas to protect from development.

3. New urban development should minimize impact on the hydrologic regime by implementing 'smart growth' designs.

4. Both the provinces and the municipalities should enforce shoreline development regulations.

THREATS TO THE ECOLOGICAL HEALTH OF THE RIVER

The Coulombe Commission: "harvesting the forests of our children"

Forests comprise most of the area within the Ottawa River watershed and forestry is a major industrial activity, both in Québec and Ontario. In 2003, partly as a result of the public furore created by Richard Desjardins' documentary exposé of forestry practices in Québec, the provincial government put in place the Coulombe commission for the study of public forest management in Québec. Its mandate was to examine the management of publicly-owned forest lands in the province and offer recommendations of how forest management could better meet the needs and expectations of the public. The Commission held many public hearings across Québec, read over 300 submitted briefs from interested parties, and listened to many invited experts. In its final report released in December 2004, the Commission concluded, not surprisingly, that Québec's forests are a vital resource critically important for the social, environmental and economic well-being of Québec's citizens.

More surprisingly, the Commission reported some serious flaws in how the forest resource is being managed, especially in regard to the setting of annual targets of timber harvest. The Commission concluded that current rates of harvesting are unsustainable in the long term, that southern hardwood forests are being high-graded, and that the natural capital of the boreal forest is being depleted. As Desjardins recently stated in an op-ed article in Le Journal de Montréal, it appears that we are indeed "harvesting the forests of our children." In addition, the Commission concluded that protected areas are inadequate to represent the full range of forest biodiversity. Its final recommendations included a 20% reduction in harvest volumes for the boreal forest, an expansion of protected areas, and that ecosystem-management become central to the management Québec's public forest.

Managed Landscape
Photo by: Ronnie Drever

THREATS TO THE ECOLOGICAL HEALTH OF THE RIVER

Climate Change

There is general scientific consensus that the climate is warming and we will likely experience a "more vigorous hydrological cycle"[23]. According to Environment Canada, surface air temperatures in the Ottawa River watershed have already increased by about 0.5°C since 1950 and recent climate models forecast an increase in mean temperature by 3° to 4° C by 2100, and in precipitation by 0.1 mm/day[24].

It might be hard to imagine how such small changes can be a threat to the ecological health of the river. However, a change in the frequency and magnitude of flood events, particularly relatively infrequent large flows that move sediment and determine channel form might have an important impact on the river[25].

"Our urban infrastructure, especially sewers and wastewater treatment plants, are not designed to accommodate the predicted larger storm events."

Meredith Brown, Riverkeeper

Annual maximum daily flow in the Ottawa River is driven by snowmelt processes, but large flows in smaller tributaries, particularly in the lower valley, are driven by summer and fall rain events. Moreover, for rivers in and near the Ottawa River watershed, spring snowmelt and river-ice break-up are occurring earlier in the year, with the consequence that spring freshet flows are decreasing in magnitude[26]. Large flows in the northern part of the watershed, and for the Ottawa River itself, will decrease in frequency and magnitude.

For tributaries in the southern part of the watershed, extreme rainfall driven flow events will likely increase in frequency and magnitude. Further, many of these rivers flow through relatively erodible glaciomarine clays. It is likely that these rivers will undergo widening and channel incision in response to increased large flows.

While annual precipitation did not change during the 20th century[27], warmer years produced more intense storm events, presumably due to increased convective and cyclonic activity. Climate change may impact the ecological health of the river because our urban infrastructure, especially sewers and wastewater treatment plants, are not designed to accommodate the predicted larger storm events, especially as we have designed our sewers and treatment plants based on average regional climate data. Failure from our urban infrastructure means more untreated stormwater and sewage into our river.

INDICATORS OF CHANGE

The extent of the threats to the ecological health of the river is not always clear and the research is limited. Unfortunately, there are no government agencies or organizations studying the health of the Ottawa River and prioritizing research activities in the watershed. Ideally, we need long-term baseline data from the watershed to analyse specific trends (i.e. water quality, land use, fish populations) to gain a more accurate understanding of the health of the river system and how it is changing. Given the enormity of that task and the lack of long-term or baseline data, it is important to look at indicators that give insight into the health of the ecosystem. For example, a working group tasked to study the health of the great lakes ecosystem has developed ecological health indicators capable of describing environmental conditions in the Great Lakes. Examples of some indicators being studied include: deformities, eroded fins, lesions and tumours in nearshore fish, contaminants affecting productivity of bald eagles and brownfield redevelopment[28]. We have provided indicators or clues in this report that we (humans) are negatively affecting two obvious gauges of the river's health: water quality and biodiversity. Below is further discussion about these indicators.

In the future, other indicators that would be useful to study are shorelines, land cover, sediments (where many of the metals and persistent organic pollutants reside) and hydrology. In addition to the science-based evidence of changes to the river, there are countless stories of change from those who have closely observed the river for many years. This anecdotal ecological knowledge can also provide important insights into the changing health of the river system.

Lavergne Bay Blooms
Photo by: Meredith Brown

Water Quality

At one time you could scoop water from almost any location in the river and drink without a worry. Today most cottagers, canoeists, and shoreline residents treat their river water before drinking it.

Long-term water quality data for the Ottawa River are limited and scattered. The most extensive water quality monitoring study that we are aware of was completed in 1996 by Québec's Environment Ministry (*Le ministère du développement durable, de l'environnement et des parcs du Québec* or MDDEP)[29]. Their analysis is based on data gathered between 1979 and 1994 at 30 monitoring stations located throughout the Ottawa River watershed. It would be worthwhile to compare data from this study to more recent data since it was around 1994 that the pulp mills upgraded to secondary treatment and this significantly reduced the amount of organic pollution into the river. Also, there have been improvements in municipal sewage treatment in many communities since the early 1990s.

However, water quality is constantly changing in the river as sources and components of pollution change over time. New chemicals are consistently finding their way to our river and we do not fully understand the consequences. Canadian researchers at the National Water Research Institute have identified a list of 13 water quality related threats to sources of drinking water and aquatic ecosystem health: nutrients, acidification, endocrine disrupting substances (EDS), genetically modified organisms (GMOs), pathogens, algal toxins, pesticides, long-range atmos-

Canada Geese, Mud Lake
Photo by: Dan Brunton

pherically transported pollutants, municipal wastewater effluents, industrial wastewater discharges, urban runoff, solid waste management practices, and water quantity changes affecting water quality due to climate change, diversions and extreme events[30].

We know that these threats exist in the Ottawa River system and we have identified two water quality indicators that tell us the ecological health of the river is being threatened: fish consumption advisories and beach closures.

Carleton University Investigates Endocrine Disruptors in Ottawa River

By Christina Mancini

There is growing concern about the chemical compounds we discharge into our river systems. One such class of chemical, known as Endocrine Disrupting Compounds (EDCs), has recently been of particular interest. EDCs are compounds that affect the hormone system within the body[31]. Pesticides, fertilizers, pharmaceuticals and personal body care products have been found to be EDCs.

Many of these chemicals enter the environment through a variety of human activities such as through the use of pesticides or through industrial processes. Also, wastes from farm animals are often loaded with antibiotics and fertility hormones.

Hormones within the body are essentially message-carriers with commands for body functions. Problems arise when EDCs are shaped similarly enough to be mistaken by the body for a natural hormone such as estrogen.

Humans naturally secrete estrogen in their waste, and it may not always break down during the sewage treatment process. This would imply that municipalities throughout the world are discharging estrogen into rivers along with their treated sewage. The estrogen in the environment may then enter the bodies of fish, humans and other organisms, resulting in excessively high quantities of the hormone, leading possibly to sperm reduction, lower fertilities and various cancers[32]. The increased use of oral contraceptives has also lead to a greater amount of highly potent synthetic estrogen to enter our water systems.

Carleton University is currently attempting methods to analyze Ottawa River water samples for estrogen near the Robert O. Pickard Environmental Centre, where the city's treated sewage is released. It is hoped that a successful method derived by Carleton University may lead to an increased interest to investigate the levels of EDCs within the Ottawa River.

Christina Mancini is a student in the Environmental Sciences Program at Carleton University.

Fish Consumption Advisories

The Ontario and Québec governments monitor contaminants in sport fish throughout the Ottawa River Watershed and provide consumption information to the public through their Guide to Eating Sport Fish[33]. The results of the contaminant testing are reported in terms of fish consumption restrictions based on guidelines from Health Canada.

For testing purposes, the Ottawa River is divided into five reaches and numerous tributaries and lakes. Inland lake fish are tested only for mercury as this is likely to be the only contaminant to cause consumption restrictions. Fish tested from the river are tested for mercury and other metals, PCBs, pesticides, chlorinated phenols, chlorinated benzenes, dioxins, furans, and polycyclic aromatic hydrocarbons (PAHs).

Some fish in the Ottawa River contain levels of contaminants that are harmful to humans. Health Canada recommends that people limit sport fish consumption to no more that eight meals a month (eight ounces is considered to be one meal). Women of childbearing age and children under 15 should restrict their consumption of most sport fish caught in the watershed.

Because of bioaccumulation effects of many contaminants, species such as perch, sunfish, and crappie tend to have much lower contaminants than larger predator fish such as walleye and pike. In addition, younger and smaller fish also tend to have lower contaminants than older and bigger fish of the same species. Consequently, the consumption advisories are species specific and size specific.

The lower reach of the Ottawa River (from Chaudière Falls to Carillon Dam) appears to have the highest consumption restrictions, indicating that the fish in this reach are exposed to higher levels of contaminants.

Beach Closures

Beach closings are complex environmental issues with both public health and economic consequences. When bacteria levels at public beaches are found to be "unsafe" for human exposure, local municipal health departments may issue a "no swimming advisory".

In Ontario, when the provincial standard of 100 colony-forming units (cfu) of e-coli per 100 ml is exceeded, the provincial health officer must close the beach. In Québec, beaches are closed when e-coli counts exceed 200 cfu per 100 ml.

E-coli are an "indicator" bacteria used to assess the potential public health risk of the water. Their presence in surface waters is an indication of fecal pollution. Indicator bacteria do not necessarily pose a direct health risk to humans but do suggest the likely presence of harmful pathogens, such as salmonella, shigella, noraviruses, enteroviruses, cryptosporidium, and giardia, that are found in both human and non-human sources of fecal pollution and are considered health threats.

Petrie Island
Photo by: Andrew Buzzell

Common Loon on Nest
Photo by: Dan Brunton

Exposure to water-borne bacteria increases the risk of adverse health effects such as gastroenteritis, ear, eye and skin infections, and acute respiratory illness. The likelihood of contracting these symptoms increases with the concentration of pollution and length of exposure to polluted water.

High e-coli counts may be caused by stormwater runoff after heavy rain, overflows from combined sewers that carry untreated sewage and stormwater, sewage spills or leaking sewage pipes. Large bird populations have also been blamed for high e-coli counts. Consequently, beach closure signs during the summer are not unusual at the urban beaches in the Ottawa River watershed.

For example, the public beach at Petrie Island in Ottawa was closed 11 of 71 days due to high e-coli readings in 2005. Of the beaches in Ottawa, Westboro Beach seems to have the most frequent beach closures; the cause is baffling city staff who still have not determined the predominant source of e-coli after years of monitoring sewer outfalls near the beach.

As a comparison, the beaches in Renfrew County upstream from Ottawa never closed from 2001 to 2004. Public beaches in Arnprior closed six days in 2003 as a precautionary measure due to a large sewage spill in the Madawaska River.

Beach closures are only one result of waterborne pathogens in our waters. These pathogens can also pose threats to our drinking water as well as to aquatic ecosystems and biodiversity [30].

Biological Diversity

The earth is experiencing its sixth mass extinction. The other five had physical causes (comet impacts, abrupt climate shifts, etc.), but the present one is attributable to the actions of a single species: man. Biological diversity – the variety of genes, species and ecosystems – is being lost at unprecedented rates.

Scientists recognize five major global drivers of biodiversity loss. All are affecting the Ottawa River and its watershed:

- **Habitat loss** – Dams have blocked major rapids used by freshwater mussels and other aquatic invertebrates, preventing migrations of shad, eel, and sturgeon. Extensive drainage of wetlands for agricultural development has occurred in the downstream, low-elevation portions of the watershed that were formerly part of the Champlain Sea.

- **Over-harvesting** – Illegal harvesting is a factor in the decline of some endangered species in the watershed (American ginseng, spotted turtle, wood turtle). Sought-after tree species (white and red pine, yellow birch, hemlock, white spruce) have declined due to harvesting pressures; lesser-value species (poplar, white birch, balsam fir) have increased in abundance.

- **Pollution** – Long-range transport of pollutants is a pervasive problem. Some lakes in the watershed are poorly buffered and sensitive to acid rain, and have lost fish populations. Species such as smallmouth bass, walleye, and brook trout are more sensitive to acidity and tend to disappear first. Mercury is deposited in the watershed and magnified through food chains, making large fish unsafe for consumption.

- **Invasive species** – Zebra mussels are having devastating impacts on native freshwater mussel species in the lower Ottawa River and especially in its tributary, the Rideau River. A number of trees, most famously the White Elm, are under attack by introduced fungal diseases. Dozens of invasive wood-feeding insects are established in the watershed, and several highly destructive new pests (e.g., emerald ash borer, hemlock woolly adelgid, Asian long-horned beetle) threaten to spread from areas to the south of the watershed.

- **Human-caused climate change** – White spruce, a boreal species, is exhibiting high mortality at the southern edge of its range in the watershed. Gray jay, a boreal bird species closely associated with coniferous habitats, also appears to be declining in some areas in Ontario along the southern edge of its range.

Many nationally-listed species at risk are associated with the Ottawa River watershed (Table 4). Lake sturgeon, a species of special concern, is declining in parts of the Ottawa River and disappearing from many of its tributaries due to dams. It is a representative of a very ancient order of fishes, most of which are endangered around the world.

The channel darter, a fish species listed as threatened, has recently been found in downstream portions of the Rouge, Blanche, Petite Nation, Kinonge, and Gatineau Rivers. The copper redhorse, listed as endangered, is found in the two main channels of the Ottawa passing through the northern parts of Montréal (Rivière des Milles Isles; Rivières des Prairies). Two other fish species at risk – bridle shiner and grass pickerel – are also found in areas near the mouth of the Ottawa.

The Ottawa River watershed is noteworthy for its large number of nationally-listed turtle species. The spotted turtle is endangered, while blanding's, spiny softshell, stinkpot, northern map, and wood turtles all have significant populations in the watershed.

Several bird species at risk are associated with aquatic habitats within the Ottawa River watershed. Least bittern and yellow rail nest in extensive cattail and sedge marshes in the lower valley. The eastern Canada populations of Barrow's goldeneye and harlequin duck breed to the north of the watershed, but individuals of both species regularly use major rapids along the Ottawa River as wintering habitat. Peregrine falcons again breed in the watershed (a reintroduction success story) and hunt ducks and shorebirds year-round along the river.

Painted Turtle Sunbathing on a Log
Photo by: Meredith Brown

Table 4: Species at Risk Currently or Formerly Associated with the Ottawa River Watershed [34]

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

❋ *Zebra Mussels - Invasive Species in the Watershed* ❋

By André L. Martel

The zebra mussel, *Dreissena polymorpha*, is a highly invasive bivalve with a shell length no larger than about one inch (2.5cm). Originating from Europe and first introduced to the Laurentian Great Lakes, it has become well known to Canadians over the past 10-15 years as it spread to various watersheds of Ontario and Québec. Where it has been introduced, the zebra mussel is impossible to remove. It has a negative impact on local species, especially our native freshwater mussels (clams), which they smother and eventually eliminate from our rivers and lakes. Unfortunately, the distribution of zebra mussels continues to expand, mostly through pleasure boat traffic. As boats move upstream, or switch to other water bodies via canal locks or boat trailers, tiny zebra mussels can cling onto the hull or onto plants or algae that sometimes get entangled onto the trailer axle system. This is how this pest commonly spreads from one location to the next.

Boat owners should clean boat hulls, remove all plant material or debris entangled underneath the trailer, or dry the entire boat-trailer unit under the sun for several days. These efforts can drastically reduce the likelihood of introducing this pest animal to new locations.

André L. Martel (PhD) is a malacologist at the Canadian Museum of Nature. He conducts underwater research on native freshwater mussels in various rivers across Canada. Over the past three years much of his research has focused on the mussels of the Ottawa River.

Zebra Mussel on Buoy
Photo by: André Martel

Zebra Mussel on Falling Mussel
Photo by: André Martel

❋ *The Mississippi River - A "Fish Story"* ❋

By Alan Todd

Framed by a pastoral Lanark County, the quiet dark flow of the ancient Mississippi River slides by beneath willow bough and evening. The water view from my historic island home above the rapids on Glen Isle seemed complete; within reach a slow moving pool alive with countless shining small mouth bass; airborne, feeding, showing off, all playful jokers rising and falling swallowed by brilliant watery circles drawn in a surface of fading light. Then, not a moment passed when the water was still and in this swirl a natural harmony of connection seemed evident in all. The robust fish-play connected my sense of wonder in nature with a deep personal commitment to remain in this island paradise forever where I could witness the peacefulness in each summer evening; always!

It seemed sudden, even after seventeen years as an observer in this environment, when it became apparent that there was a profound decline in fish numbers. This wild place was now transformed; not one fish could be seen where there were hundreds and in the process my idyllic life on the island would lose its great context. The real nature of the river to the common eye had not changed but in the practice of agriculture and habitat destruction the change was inevitable; it was preventable but beyond our willingness to understand and act in defence of a world out of sight. This separation between nature and society; this dislocation, prevents us from acknowledging the effects of loss.

Alan Todd and his family left their home on Glen Isle in August of 1987. Alan has a renewed sense of good stewardship and is currently volunteering with Ottawa Riverkeeper.

WATERSHED CONSERVATION AND PROTECTION

Given the importance of the Ottawa River and its tributaries, and the impact we are having on the river system, it is essential that we act now to protect and conserve our children's inheritance. There are important initiatives underway that are being driven by individuals, businesses and governments, but with no long-term plan to protect the watershed. We must do more if we are serious about protecting our rights to swim, drink water, and eat fish from the river.

With the exception of a federal planning board concerned with regulating water levels on the river, no agency looks at the watershed in its entirety. Dotted lines are all over the watershed with jurisdiction divided among two provinces, four conservation authorities, numerous provincial and federal agencies, and over a hundred municipalities. Consequently, it is often difficult to understand "who is in charge of what".

Regulatory Agencies Within the Watershed

There are very few water courses in Canada with a greater jurisdictional complexity governing the management, protection and enhancement of its resources than the Ottawa River. Various levels of government create a bewildering variety of authorities with responsibility for parts of the river and its functions. None, however, has comprehensive resource protection authority along the whole river system and that causes major difficulties.

For example, municipalities control items such as the use of cosmetic pesticides, shoreline development and sewage treatment. As a result, there are varying degrees of impacts on the river as you travel across municipalities.

In Ontario, there are conservation authorities whose jurisdiction falls within sub-watersheds and therefore can span several municipalities. These conservation authorities were spawned to ensure major storms like Hurricane Hazel would not cause major flooding. Now they have authority to enforce the Fisheries Act and at the same time issue permits for shoreline and floodplain alterations.

Provincial regulations on opposite sides of the river can be very different. Examples of these differences include:

- Québec releases brown trout into the river whereas, in Ontario, this has been prohibited.
- Water quality standards governing the operation of swimming beaches are different in the two provinces.
- In one notorious case in the 1990s, proponents of a proposed mini hydro dam used provincial water level data to estimate flooding levels for the residential areas surrounding the proposed dam. They eventually discovered that the two provinces had floodplain mapping that differed by almost one meter.
- The Federal Government has authority to enforce the Fisheries Act, yet rarely does so.

A major task of Ottawa Riverkeeper is not only to sort out this maze of variable and contradictory regulations and plans, but also to provide a clearer vision of what constitutes feasible and desirable water quality and rivershore management across the watershed. This is no minor task. However, making this information available to citizens on a case by case basis and working with public and private partners to encourage integration of appropriate, watershed scale resource protection regulations and standards is vital for the long-term well-being of the Ottawa River.

Government Initiatives in Ontario

Improved Legislation

Bill 133, better known as "the Spills Bill" became law on June 13, 2005. The new bill was introduced after widely publicized spills into the St. Clair River occurred from industrial facilities near Sarnia. With each spill the public was losing out in two ways: they had to live with the polluted river water and their taxes were paying to clean up after these spills. Bill 133 is intended to encourage spills prevention and get "tough on polluters". The regulations target industrial facilities already subject to the Municipal/Industrial Standard for Abatement regulations (that is, approximately 140 facilities in the petroleum refining, iron and steel, pulp and paper, metal mining, metal casting, organic chemical, industrial minerals, inorganic chemical and electric power generating sectors).

Key provisions of Bill 133 impose a new environmental penalties regime, expand directors' and officers' duties, reduce the adverse effect threshold, increase fines and require regulated industries to implement spill prevention and contingency plans.

Penalties can require payment of as much as $100,000 per day and will be assessed by the Ministry of the Environment (MOE) rather than the courts. These penalties may be imposed by the MOE in addition to quasi-criminal prosecutions in the courts for the same unlawful discharge. The penalties regime also imposes liability regardless of fault. In other words, the regime is one of absolute liability and allows for the imposition of a penalty even if the corporation took all reasonable care to prevent the discharge. Due diligence will not be a defence and will only be considered to determine the amount of the penalty.

Bill 133 also provides a new definition of "deemed impairment" in the Ontario Water Resources Act so as to align it more closely with the threshold in the federal Fisheries Act. For example, the quality of water will now be deemed to be impaired if a scientific test indicates that the discharged material is toxic. This means that the Crown will not have to prove that the discharged material actually impaired the quality of the water into which it was discharged – a task that is typically very difficult.

Two other important amendments that Ottawa Riverkeeper applauds are that the MOE will now be required to publish annual and five-year reports and will now publish every agreement made to reduce or cancel an Environmental Penalty on the Environmental Bill of Rights Registry. Together, these amendments will help to ensure transparency and efficacy of environmental penalties.

Source Water Protection Planning

As part of its strategy to protect Ontario's drinking water from source to tap, the government of Ontario released legislation to develop and implement watershed-based source water protection plans. Watershed-based source protection was a key recommendation of the Walkerton Inquiry.

The proposed legislative provisions are the first part of the government's approach to protecting drinking water at its source. The provisions have been drafted based on the responses received on a white paper the government released in February 2004 and are in keeping with recommendations in the O'Connor Report.

The government has released the recommendations of two expert advisory committees on watershed-based source protection for public comment. Finally, the Clean Water Act was introduced for first reading on December 5, 2005. We anticipate the Act may receive third reading and Royal Assent in late spring 2006; regulations should be implemented shortly thereafter.

Ottawa Riverkeeper has concerns regarding the implementation of source water protection planning. Our primary concern is the lack of an interprovincial committee to address the Ottawa River, a source of drinking water to over a million people. Currently, plans are in place to divide the province of Ontario into sub-watersheds. Given the interprovincial nature of the Ottawa River, our needs are not being addressed.

We believe it is imperative that an interprovincial Source Protection Committee (SPC) be established for the entire Ottawa River watershed, which is independent of the committees that are working on the sub-watersheds of the Ottawa River. This committee must study the entire watershed to determine the ecological risks and cumulative impacts of the many threats that continue to pollute the Ottawa River. The SPC for the entire Ottawa watershed would compile and analyse data collected from the sub-watershed committees as well as data from Québec.

Government Initiatives in Québec

Water Policy and Watershed Basin Committees

In 2002, Québec launched its Water Policy to protect this unique resource, to manage water in a sustainable manner and in doing so, to protect the health of the public and the ecosystems.

After reaffirming that water is an essential element of the collective heritage of Québecers, the government presented measures that fall within five main orientations reforming water governance, including:

1. Reform water governance by creating watershed basin committees
2. Put in place the integrated management of the St. Lawrence River
3. Protect water quality and aquatic ecosystems
4. Pursue the cleaning of polluted water and improve water management
5. Favour aquatic "recreotouristic" activities

There were 33 rivers identified as priority watersheds. In the Outaouais, the Gatineau and the Lièvre Rivers were singled out. Watershed committees were established for each river; COBALI *(Comité du bassin versant de la rivière du Lièvre)* was officially created in December 2003 for the Lièvre River and COMGA *(Comité du bassin versant de la rivière Gatineau),* in September 2004 for the Gatineau River.

The objective is to have local and regional stakeholders become leaders in the decisions to be taken in reference to the management of this valuable resource. Having them all at the same table also allows them to understand the impact of each other's activities on everyone and to develop a long term and ecosystem perspective. Watershed management will permit a more coherent

coordination and a greater accountability. It will also give citizens a voice in the planning process. Finally, it will link problems associated with lakes, groundwater or human health to that of the river in order to develop a full vision of the watershed.

The government insists that members of the committees include elected officials, economic representatives (i.e. industry such as forestry and hydro, Chamber of Commerce, etc.) and environmental, educational or citizens' groups. Experts from the Ministries of Agriculture, Environment, Natural Resources, and Public Security, act as consultants to the committee. The government has also pledged to finance the committees.

The first task of the committees is to create a picture of the watershed that identifies current problems and natural assets. This first portrait is a partial one and is done in collaboration with the different ministries, municipal and local governments, groups, lake associations, etc. Once this is done they must consult the population and try to single out priorities to focus on. Then they must establish a watershed master plan, which is also subject to consultation. Once the plan is finished it is incorporated into the "Schéma d'aménagement" (urban plan) of the MRCs (Regional County Municipalities).

The Role of Citizens and Stewardship Groups

The role citizens and stewardship groups play in the conservation of our river is underestimated by many. Groups and individuals can play an important role when they are involved in local and regional decision-making. For example, a development proposal to build and operate a boat bypass around the Chats Falls Dam has changed significantly over the years, thanks to strong opposition from local citizen groups and Ottawa Riverkeeper. Although we did not stop the project, we were able to influence the downstream location for the bypass and insist on plans to reduce the potential for long-term degradation of the aquatic ecosystem.

With government cutbacks to the environment, an increasing number of conservation and restoration projects are being initiated by stewardship groups and individuals. The river is a public resource and collectively we must do our part to maintain the ecological health of the river. We cannot assume the government is taking care of the river; however, we can do our best to ensure the government helps by enforcing the laws and regulations that are currently in place to protect our environment and our health.

We all have diverse levels of time and expertise to offer our river and it is important to know that you can make a difference in many different ways. Consider some of the ways we can make a difference individually.

Boaters

- Whenever possible, give your business to a Green Marina[35]. Choose an Eco-Rated Marina or Yacht Club to house your boat.
- Remember what you clean your boat with ends up in the river so be sure to use non-toxic and phosphate-free cleaners.
- Always consider a four-stroke engine. Older 2-stroke engines can dump up to 30% of their unburned fuel into the water.
- Never dump untreated sewage into the river. Remember throwing trash overboard is illegal.
- Be respectful of where you travel – stay out of ecologically sensitive areas. Proceed slowly in shallow areas and watch your wake.
- Prevent the introduction of non-native species by thoroughly cleaning your boat before travelling a new water body.

Fishermen

- Fish for the thrill of the catch and safely release your fish to allow them to be caught again.
- Don't use lead sinkers or jigs. Many alternatives are available.
- Be careful of what you eat; always check the "Guide to Eating Sport Fish" in your region.

Homeowners

- Remember your pipes are linked to the river so use environment-friendly household cleaners and dispose of hazardous materials properly.
- Refrain from non-essential use of lawn and garden chemicals including pesticides, herbicides, insecticides and fertilizers.
- Conserve water – treating drinking water and sewage is costly.

Shoreline residents

- Keep your shoreline natural to minimize erosion and runoff and protect the shoreline habitat for aquatic life[36].
- Remember to use safe septic practices; a malfunctioning septic system allows phosphorous and bacteria to leach into the river.
- The river needs trees on its banks; consider planting native species.

Everyone – *YOU can make a difference*

- Get involved and participate actively in local decisions that may impact the river where you live.
- Participate in the Ottawa Riverwatch Program. Check our website at www.ottawariverkeeper.ca/programs/river_watch.
- Support a group that is actively involved. You will find a list of the active Ottawa River Watershed stewardship groups on our website at www.ottawariverkeeper.ca/resources.
- Volunteer your time and skills. For current Ottawa Riverkeeper volunteer opportunities, check our website at www.ottawariverkeeper.ca/get_involved/volunteer.
- Show your support for a healthy river by participating in shoreline clean-ups or other community events that focus on the river.
- Call our toll-free Pollution Hotline 1-888-9KEEPER to report pollution or development in your local area that maybe impacting the river system.
- Become a member of Ottawa Riverkeeper, join us and protect the Ottawa River! Our voice gets stronger with each new member.

Ottawa Riverkeeper's RiverWatch Program

Given the enormity of the Ottawa River watershed, the diversity of its communities and limited resources of Ottawa Riverkeeper, it is impossible for the Riverkeeper to be aware of everything that is happening on and around the river. Ottawa RiverWatch is a program designed to build a network of citizens and stewardship groups interested in the Ottawa River who work cooperatively with Ottawa Riverkeeper to maintain and enhance its overall ecological integrity and health. This program demonstrates the importance of working together to promote environmental sustainability throughout the watershed.

A RiverWatcher spends a significant amount of time on or near the Ottawa River or one of its tributaries and can make observations. A RiverWatcher listens to local residents who have concerns about the river, listens to local news to inform themselves about potential impacts on the river, and a RiverWatcher listens to the river. A RiverWatcher may organize a local meeting, shoreline cleanup in their community, or a paddle on the river with others to appreciate the river's beauty. A RiverWatcher tells others about their observations and concerns about the river, helps others understand the importance of having a clean and healthy river and how we can work together to protect the river. A RiverWatcher reports to Ottawa Riverkeeper with observations, news, or photos from their area.

We currently have eight RiverWatch groups from Petrie Island to Petawawa, including the Ottawa Riverkeeper Air Force – a group of pilots who frequently fly over the river and are concerned with some of the changes they are seeing on the river. A bird's eye view of the river is extremely valuable and our pilots are an excellent example of individuals who are dedicated to the river and willing to give back.

Each RiverWatcher has a page on our website that gives details about the history and ecological significance of their area as well as local issues or concerns. We are striving to implement a water quality monitoring component to the RiverWatch program in the future.

Look Out For Your Local Stream

The Jock River runs through suburban Ottawa and empties into the Rideau River. To the folks who live nearby, it is a piece of paradise. Every spring, enthusiastic canoeists compete in the Jock River Canoe Race. Occasionally, sewage spills into the river but it rarely goes unnoticed. The Friends of the Jock River are a stewardship group dedicated to preserving the health of their local river. This requires vigilance but it pays off. For example, a golf course situated on the river recently applied for a permit to take water from the Jock River. They already had a permit to take some water, but they wanted more. When the Friends of the Jock River studied the application, they realized the Jock could not take such a large water withdrawal. Already the summer flows were getting dangerously low. The stewardship group communicated their concerns to the appropriate authorities as well as Ottawa Riverkeeper. Letters were written to the Environment Minister, urging her to refuse the application based on the science. Eventually the application to take water was denied. This is one small success story that demonstrates how groups like the Friends of Jock River and Ottawa Riverkeeper are influencing decisions that impact our rivers.

If you are interested in the health of the Jock River, or enjoy its beauty, consider supporting the Friends of the Jock River www.geocities.com/jockriver

Conservation and Education in McLaurin and Clément Bays

By Nicole DesRoches

When the Carillon dam was built in the late sixties, extensive shoreline areas were flooded. In the ensuing years wetlands developed with abundant organic matter. In the last 20 years, Faune Québec and Ducks Unlimited purchased a 50 km stretch of wetlands, starting in the City of Gatineau (old Templeton) to Plaisance National Park (Thurso). Work was done to improve water circulation, which created better water habitat for waterfowl and fauna. Many species of amphibians and turtles inhabit these, some endangered species among them.

These wetlands vary from marshes, tall grass wetlands and forested wetlands. Silver maples and nettle trees cover a good part of the western section of the wetlands. This is the northern most area where nettle trees can be found in North America. Beef cattle used to roam some wetlands and farmers cultivated hay close by. With the agreement signed with Faune Québec, cattle can graze in certain fields after the nesting period and grasses in the wetlands keep the geese out of the farmers hay fields.

Ducks Unlimited maintains the Marais Trépanier as a demonstration site for marshes in an agricultural setting while the Conseil Régional de l'Environnement et du Développement Durable de l'Outaouais is constructing a 1.3 km pedestrian path which consists of floating docks, boulders and wooden sidewalks at the western edge of McLaurin Bay. The first path was completed in October 2005. There is a bicycle access and parking on Hurtubise street along the river and a car park in Martin Park on Notre-Dame street.

This is a first of a series of pathways planned along the different marshes to permit observation of wildlife and avian species, some of which are on the endangered list. The Outaouais is one of the only regions of Québec where certain species can be found in great numbers.

One marsh named Les grenouillettes, is literally teaming with frogs in the spring while others accommodate many mating duck couples. The project over the years will give access to people so they can observe the abundance of fauna and flora. Observation towers, other walking paths and floating docks are planned, but it all depends on financing. Another activity in the planning is the revival of the Festival des bernaches (Canada Goose Festival) and the linking with Plaisance National Park and the different bike paths planned along Highway 148.

Conservation is of course the first and foremost reason for the creation of this project; therefore, there are areas where access will be forbidden. Education is second. Interpretation panels will be erected and eventually guides or self-guided tours will be available. Wetlands are an integral part of watershed management; they serve as sponges to control overflow, filter contaminants and of course they are natural habitat for countless species.

Nichole DesRoches is the Executive Director for the Council on the Environment and Sustainable Development of the Outaouais (CREDDO), President of the Comité du bassin versant de la Rivière Gatineau (COMGA), co-chair of the Ottawa River Heritage Designation Committee and Vice-President of Ottawa Riverkeeper.

Heritage River Designation for the Ottawa River

Canada honours and respects its leading rivers by distinguishing them as Canadian Heritage Rivers. Having outstanding natural and/or cultural values, and offering quality recreational opportunities, these rivers showcase the benefits and enjoyment of healthy river environments, now and in the future. Rivers in the Canadian Heritage Rivers System must have their heritage values and integrity protected. In the Ottawa River system there are currently two tributaries with heritage status: the Mattawa River and the Rideau River.

Currently a group comprised of representatives from the Ontario and Québec sides of the river, including First Nations is actively pursuing Heritage Designation for the Ottawa River.

The group has completed a background study of the river and now a Nomination Document must be prepared for presentation to the Canadian Heritage Rivers Board, who will hopefully recommend approval. The Board meets once a year and if the river is nominated for Heritage Status, the Ontario government has three years to come up with a management plan for the river. Québec has yet to officially sign onto the project, as they are worried it interferes with their protected areas program.

Ottawa Riverkeeper supports the designation of the Ottawa River as a Heritage River. However, we feel that we cannot rely on such a title to provide adequate protection or conservation for the river. The designation is a stepping-stone that will communicate the richness and significance of the Ottawa River and bring people together to think about a management strategy for the river.

Rocks and Ice
Photo by: Andrew Buzzell

CONCLUDING REMARKS

The Ottawa River is both regionally and globally significant. We take for granted the prominent role the river plays in our lives, providing us with drinking water, power, biological diversity, and a recreation haven. With this report, we have only just begun to piece together a complicated and intricate puzzle that depicts the state of the river.

One could write volumes on the incredible ecosystems and biological diversity found throughout the watershed as well as the impacts of our cities and industries on the river. Given the extent of the pressures we are placing on these ecosystems, we may never know the full extent of the damage. We have described some of the major threats to the ecological health of the river such as dams, municipal and industrial wastewater, urban and shoreline development and climate change. Omitted but not forgotten are impacts from industrial farming, mining, forestry, and landfills to name a few.

Although we have not presented a complete picture, there is evidence enough to understand that the river system is changing. Change and variability is natural and the river is resilient, but how much can the river take? How much of the river can we continue to drink without risk?

Now is the time to take action to prevent further degradation of our river system. We cannot be complacent or make assumptions that governments are protecting our river. Permits to pollute are issued to industries and municipalities. Wetlands are destroyed on a regular basis. Cows are wandering in our streams. Fish contain unsafe levels of mercury and dioxins. Pharmaceuticals and pesticides have been found in drinking water.

The river belongs to the citizens of the watershed. We must act collaboratively at all levels – individual, business, municipal, provincial, and federal – to protect the health of our river and ultimately our own health. At the very minimum, everyone must work within existing legislation to protect the river. Our future generations are counting on us to leave them a healthy river.

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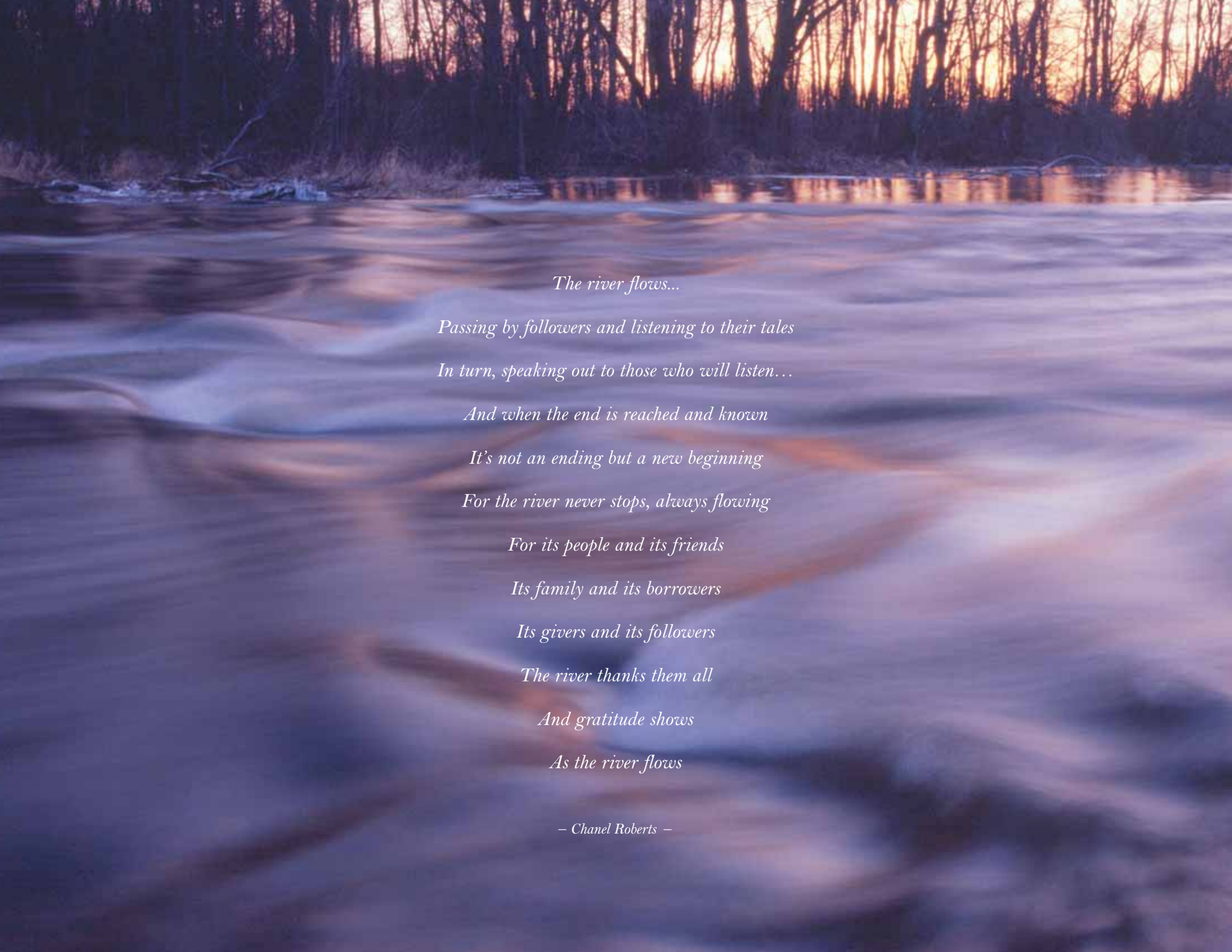

The river flows...

Passing by followers and listening to their tales

In turn, speaking out to those who will listen…

And when the end is reached and known

It's not an ending but a new beginning

For the river never stops, always flowing

For its people and its friends

Its family and its borrowers

Its givers and its followers

The river thanks them all

And gratitude shows

As the river flows

– Chanel Roberts –

Contributors:

MOUNTAIN EQUIPMENT CO-OP

OTTAWA Field Naturalists

MapInfo
Where Opportunity Is Located℠

THE ONTARIO TRILLIUM FOUNDATION
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