Environmental news for the residents of the Grand River watershed

Watershed Report

The GRAND

GRAND RIVER CONSERVATION AUTHORITY

Fall 2009

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Grand Connection

Exploring the links between the Grand River and Lake Erie

The Port Maitland pier at the mouth of the Grand River

Along the Grand

THE GRAND RIVER
A Canadian Heritage River

A Message FROM THE CHAIRMAN AND THE CAO

There's a saying that when it comes to the environment "everything is connected to everything else."

In this edition of The Grand, we tell the story of how the Grand River and the Great Lakes are connected and the implications for both bodies of water.

While the idea may seem obvious to anyone looking at a map, it's not always reflected in provincial, national or international environmental policies. Indeed, it's not always on the mind of decision makers here in the Grand River watershed.

Go back a few hundred years, before the modern era of settlement in the Grand, and the two bodies were clearly, inextricably linked as parts of one large ecosystem.

What happens on the river affects the lake. The story of the Grand River-Lake Erie fishery on Page 8 illustrates that link. Two centuries ago, sturgeon, muskellunge and walleye moved effortlessly from lake to river and back. The ability to travel in both bodies of water was critical to the life cycle of those species that spawned in the Grand and its tributaries.

That connection was severely limited after small power and navigation dams were built in the Lower Grand, from Brantford down to Dunnville, in the 1800s. Cut off from their spawning grounds, some species disappeared from the river and eventually from the lake. Others were reduced to a tiny fraction of their previous numbers and carry on only with human help.

What happens in the lake, affects the river. That fact becomes clear in the story of invasive species that have made their way from Lake Erie into the Grand River system (See Page 10). Some of these invasive species, such as the rusty crayfish and round goby, have already found a home in the Grand and threaten to force out native species.

The human impact on the Grand River and Lake Erie was so profound that there were times when both were on death's door, the natural balance destroyed.

Both bodies of water have bounced back as a result of concerted efforts by many. The construction of new and improved sewage treatment plants has had a major effect. Tree-planting, protection of wetlands, bans on chemical use and other factors have helped the Grand-Erie ecosystem recover.

The story is not finished, though. Rising population, agricultural intensification and climate change are putting new pressures on the Grand-Erie system.

And that has led to calls for a new approach to Great Lakes issues – one that recognizes that everything is connected to everything else.

Making progress on improving the Great Lakes is a complicated process that involves a multitude of players and agencies – national, state and provincial governments, municipalities, watershed management agencies, environmental organizations and so on.

Traditionally, the focus of action was on polluted hot spots on the shores of the Great Lakes or in wide-ranging action such as the phosphate ban in the 1970s.

That approach has had its successes, but didn't always take into account what was happening along the tributaries, such as the Grand. The Grand River watershed is 6,800 square kilometers and has a population approaching one million people. Eventually, the treated effluent from sewage plants serving most of those people enters the Grand River and ultimately Lake Erie. In a sense, it's as if those million people were all living in one city where the Grand hits Lake Erie. From that vantage point, the connection between river and lake is undeniable and significant.

Fortunately there has been a shift in thinking and the realization that the effort to clean up Lake Erie has to take into account what's going on 50, 100 or 300 kilometres upstream.

Canada and the U.S. are in the early stages of discussing the renewal of the Great Lakes Water Quality Agreement, which is the key document guiding governments on both sides of the border as they work to restore the lakes.

There are signs that the broader ecosystem approach, which ties together the lakes and the rivers, will be given a stronger place in the document.

That's good news, but that vision has to be translated into action. That means new programs and projects that look beyond the shores of the lakes to the headwaters.

That's the best way to ensure that we secure the progress we've already made and continue to move forward in the effort to protect the Great Lake ecosystem.

Alan Dale
Chairman

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WHO SPEAKS FOR YOU?

The municipality where you live appoints one or more representatives to the GRCA board to oversee the budget and activities of the conservation authority.

Townships of Amaranth, East Garafraxa, East Luther Grand Valley, Melancthon, Southgate: Tom Nevills

Townships of Wellington North and Mapleton: Pat Salter

Township of Centre Wellington: Shawn Watters

Town of Erin, Townships of Guelph/Eramosa and Puslinch: Brad Whitcombe

City of Guelph: Vicki Beard, Mike Salisbury

Regional Municipality of Waterloo: (Cambridge, Kitchener, Waterloo, North Dumfries, Wellesley, Wilmot and Woolwich) – Jane Brewer, Kim Denouden, Jean Haalboom, Ross Kelterborn, Claudette Millar, Jane Mitchell (GRCA 1st vice-chair), Wayne Roth, Jake Smola, Bill Strauss, Lynne Woolstencroft

Town of North Perth, Township of Perth East: George Wicke

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City of Hamilton: Jeanette Jamieson

County of Oxford: (Blandford-Blenheim, East Zorra-Tavistock, Norwich) – Alan Dale (GRCA chair)

City of Brantford: Robert Hillier, Vic Prendergast (GRCA 2nd vice-chair)

County of Brant: Robert Chambers, Brian Coleman

Haldimand and Norfolk counties: Lorne Boyko, Craig Grice

River and lake: the Grand connection

The ties are tight – and growing tighter – between the Grand and Lake Erie

When a hiker leave the trail in Paris, or a canoeist pulls her boat out of the water at Bridgeport, it's easy to lose sight of the Grand River as it disappears around the next bend.

But stand on the pier at the mouth of the river in Port Maitland and you get an entirely new and different perspective on the Grand. You're nearly surrounded by water – river on one side, Lake Erie on the other. At this spot, where they merge, it's easy to see how closely they are connected.

One ecosystem

They are tightly bound in one big ecosystem and it quickly becomes clear that anything done to improve the health of one body of water has to involve the other. The Grand River is the largest Canadian river feeding Lake Erie. Water flowing out of the Grand has a big impact on the health of the eastern basin of the lake. Conversely, changes in the lake, whether its water levels or invasive species, can have an impact on the Grand.

Almost every community in the Grand makes use of Lake Erie to some degree. The treated effluent from 28 sewage treatment plants in the Grand River watershed eventually makes its way into the lake.

And the ties may get tighter in the future.

Right now, Dunnville is the only watershed community to take its water from Lake Erie. But someday, if a proposed pipeline is built from Nanticoke to Waterloo Region, more than half of the watershed's million people will be drinking water from Lake Erie. It's hard to conceive of a closer connection than that.

The river and lake both had their origins in the melting of the glaciers 10,000 years ago. The rushing water carved out the Grand River valley and the water from the river helped fill the basin that eventually became Lake Erie.

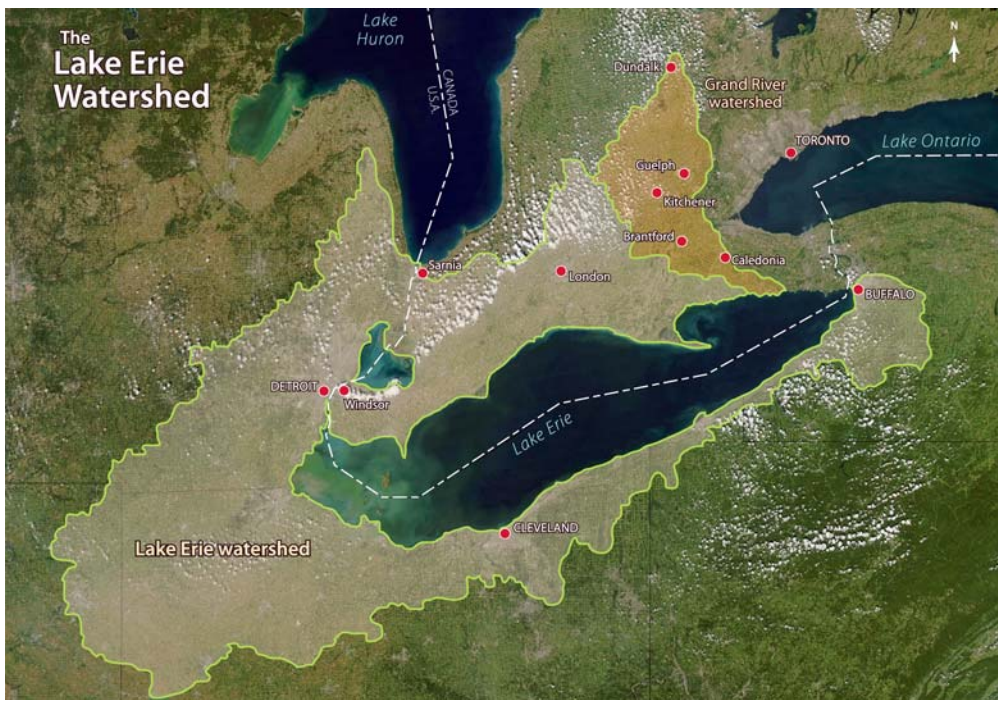
Today the Great Lakes are the world's largest storehouse of fresh water. But for all of their size, they are somewhat fragile bodies. Their drainage areas are relatively small compared to the surface area of the lakes. Their waters turn over slowly; only one per cent of their contents is renewed each year. That makes them susceptible to problems caused by the buildup of contaminants over time.

And of all the lakes, Erie is the most delicate. It is the smallest, shallowest and warmest lake.

Most populous

Its watershed has the largest population of any of the lakes. About 12 million people – one third of the population of the Great Lakes region – live around Lake Erie. Canadian cities such as Kitchener, London and Windsor sit on rivers that flow into Lake Erie.The American shore hosts Buffalo, Cleveland and Detroit – along with all of the pollution problems they generate.

The basin is also home to some of the richest farmland on the continent, particularly the fertile farmland of southern Ontario. That brings with it another set of pollution problems linked to nutrients coming from manure and fertilizers.



The Grand River is one of the largest tributaries of Lake Erie and contributes about 25 per cent of the water coming from the Canadian side.

That combination of physical and human characteristics means that Lake Erie is usually the first to be affected by pollution problems. It's like an early warning siren for the entire Great Lakes basin.

After years of decline Lake Erie was on the verge of being written off as a "dead" lake in the 1970s, driven to the brink by an overload of nutrients that spurred algae growth. A much publicized event – the day the Cuyahoga River caught fire in Cleveland – crystallized the decline in the public's mind.

Action on both sides of the border helped pull it back. New laws designed to cut down on nutrient levels in the lakes paid off, as did investment in sewage treatment plants.

However, alarm bells are ringing again. Nutrient levels are starting to rise, particularly in the areas closest to shore and algae blooms are reappearing. The Grand River has been cited as a major contributor to that problem and will undoubtedly be part of the solution.

Great Lake water quality – a guide to who does what

The Great Lakes are the world's largest reservoir of fresh water and vitally important to the people who live in their watersheds.

But the fact that the watershed straddles an international border has made the job of caring for the lakes that much more difficult. Water doesn't know political boundaries so efforts to stem pollution on one side will be less effective if action isn't co-ordinated with the people living on the other side.

The unique circumstances of the Great Lakes were recognized a century ago when the U.S. and Canada got together to sign the Boundary Waters Treaty.

But the cross-border efforts really picked up steam in the 1970s when there was the realization that the lakes, particularly Lake Erie, were on a downward spiral that needed urgent attention.

Since then a host of agencies, agreements and plans have been developed to address Great Lakes issues. For the uninitiated it can be confusing trying to sort out the alphabet soup of treaties, agencies and agreements. Here's a guide:

IJC: The International Joint Commission. It was established by Canada and the U.S. as a result of the 1909 Boundary Waters Treaty. It has jurisdiction over cross-border water issues such as flows and pollution. The commission is conducting public consultation on the review of the Great Lakes Water Quality Agreement.

GLWQA: Great Lakes Water Quality Agreement. This Canada-U.S. agreement was signed in 1972 to control pollution in the Great Lakes and to clean up waste waters from industries and communities. One of its notable successes was the banning of phosphates from laundry detergent which had a major impact on water quality. It also outlines goals for reducing pollutants, preservation of habitat and dealing with invasive species. Lead agencies for implementation of the agreement are Environment Canada and the U.S. Environmental Protection Agency. A review of the agreement is now taking place.

AOC: Areas of Concern. These are heavily polluted areas on both sides of the border targeted for cleanup as a result of the GLWQA. There are 43 AOCs, with 12 on Lake Erie although only one, Wheatley Harbour, is on the Canadian side.

RAP: Remedial Action Plan. A plan outlining how pollution will be reduced in the AOCs.

COA: Canada-Ontario Agreement. This agreement sets out how the federal and Ontario governments will work together to improve the Great Lakes basin and meet their obligations under the GLWQA. It outlines how they will address the AOCs, deal with pollutants, improve water quality, protect biodiversity and respond to invasive species. It's administered by federal and provincial ministries overseeing environment, fisheries, agriculture, natural resources and transportation.

LaMP: Lakewide Management Plan. There are LaMPs for the thee cross-border lakes (Superior, Erie and Ontario) and a Bi-National Partnership for Lake Huron. They're administered by federal, provincial and state governments on both sides of the border. Conservation Authorities, such as the GRCA, also have a voice at the table. The goal of the LaMPs is to maintain, restore and enhance the Great Lakes ecosystems.

Erie and Grand share water quality issues

Contaminants build up in river on its long journey to Lake Erie

When Environment Canada released a report in 2007 on the state of Ontario's rivers, one newspaper headline summed it up this way: "Grand River not so grand."

The survey of more than 300 rivers and streams showed that water quality in the Grand, measured near its mouth in Dunnville, was the third worst in the province.

The news didn't surprise experts who study the Grand. Data collected over the years by the GRCA in conjunction with the Ontario Ministry of the Environment, had consistently noted the poor quality of water in the lake-like area upstream of the Dunnville Dam. The dam sits astride the river eight kilometres upstream of the river's mouth at Port Maitland.

It is, though, important to put statistics in their proper context and this one is no exception.

First, there's the geographical context. Water quality reports done by the GRCA have pointed out that most of the upstream areas of the Grand watershed were in better shape. Water quality in the headwaters of the Grand and its major tributaries was judged to be fair or better.

Second, there's the historical context. Just 50 years ago water quality was even worse but concerted efforts at many levels of government resulted in dramatic improvements. Everything from the construction of sewage treatment plants to massive tree planting efforts helped turn the Grand around.

Still, the Environment Canada report highlighted the fact that there is still a lot of work to be done to help the Grand become a cleaner waterway.

The problem in the Grand River is one of the cumulative impact of thousands of individual sources of pollution. While each on its own may not have a huge effect, the cumulative impact of many sources means that by the time the Grand has traveled 300 kilometres to Lake Erie, it has been stressed to the limit.

In addition to the problem that poses for the river, it also hurts water quality in Lake Erie, spreading the Grand's problem far beyond the end of the river.

Discussions of water quality usually focus on a few key pollutants:

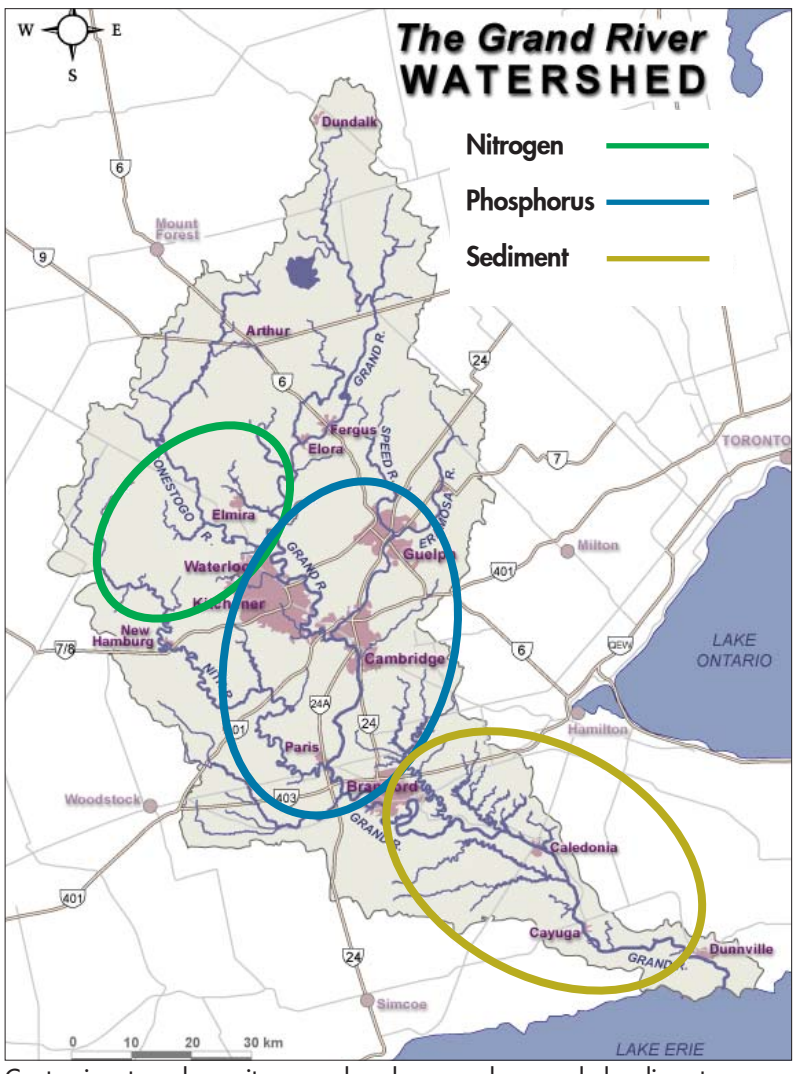
■ **Nutrients.** These are chemicals such as nitrogen and phosphorous and are the natural byproducts of the decay of organic material, from rotting leaves to animal manure and human waste. They're also found in commercial fertilizers. A river ecosystem needs some nutrients, because they feed the algae at the foundation of the food chain. However, too much of a good thing results in excessive plant and algae growth. The plants soak up oxygen at the expense of fish and other aquatic life.

■ **Suspended sediments.** These are fine particles of dirt that wash into streams and rivers from the land and float in the water, turning it cloudy. Excessive amounts can make a watercourse less suitable for species that need clear water.

These pollutants were present in limited amounts in the Grand River before the era of settlement began in the early 1800s, but human activity has resulted in a huge increase in their presence.

Studies of the Grand River have shown that nutrient and sediment levels are generally low in the headwaters of the Grand River and its tributaries. But as the rivers flow south down to the lake, they pick up more pollutants. Farmland and sewage treatment plants are two important sources of nutrients. Soil erosion from farms and river banks can lead to high levels of suspended sediments.

Although all these pollutants can be found throughout the watershed, there are areas that contribute more of one than the others.



Contaminants such as nitrogen, phosphorus and suspended sediments are found throughout the watershed, but some areas contribute relatively more.

Nitrogen

As the Grand and Conestogo rivers and their tributaries pass through the rich farmland of Wellington County and Waterloo Region,nitrate levels climb rapidly. One hypothesis, which needs more study to be confirmed, is that nitrogen-based chemicals are entering surface waters from the groundwa-

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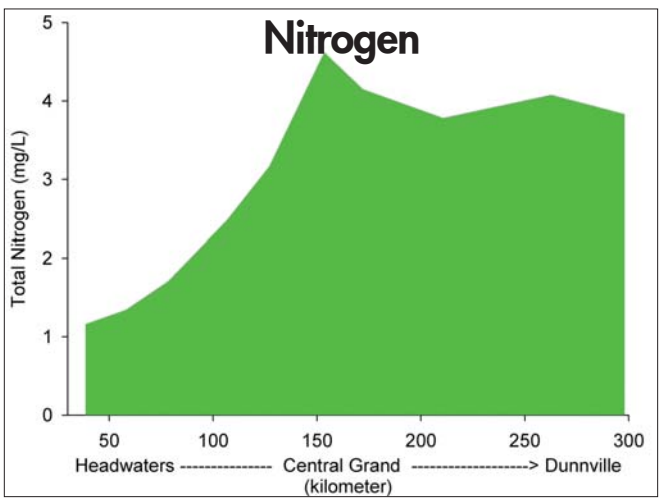

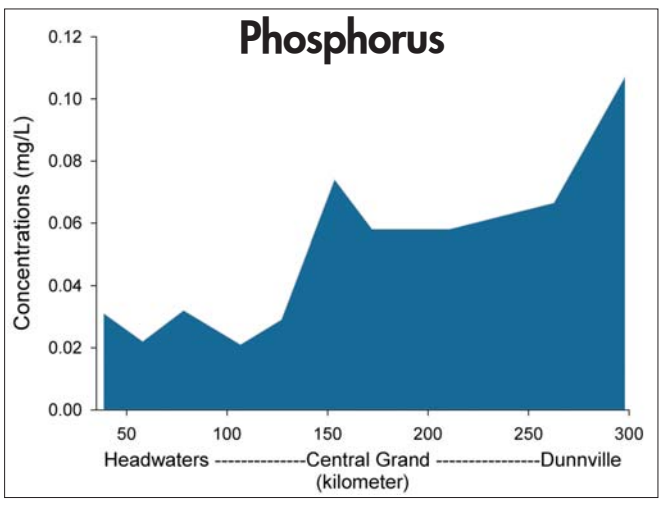

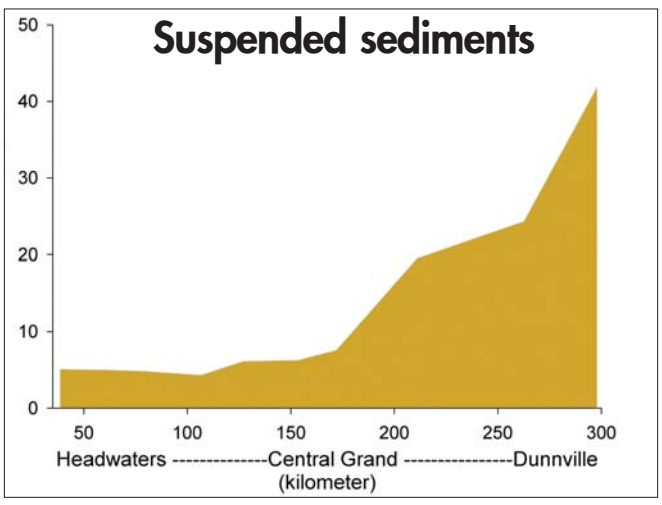

Charts show the presence of contaminants in the Grand River at different locations between the headwaters and the mouth. The distances correspond to water quality testing locations near these communities: Grand Valley (50 km); West Montrose (100 km), Cambridge (150 km), Brantford (200 km), Caledonia (250 km) and Dunnville (300km). *Data: MoE Provincial Water Quality Monitoring Network*

Contaminated plume add to lake's woes

Scientists call it *Cladophora glomerata*. It's also been called the "wall of green."

Most people know it as plain old algae — the stringy, stinky green stuff that is rooted in the shallow water along the shore, or lies rotting on the beach.

Lake Erie is prone to algae outbreaks. They're a sign that the lake is overloaded with nutrients such as phosphorus, which is food to algae and other plants. In the eastern part of the lake, Cladophora is the principle problem. In the western part of the lake outbreaks of blue-green algae are more common.

Water from the Grand can be detected up to 3 km from shore

The algae problem is also becoming worse because of the influence of an invasive species, zebra mussels, which filter particulate matter out of the water, allowing sunlight to reach deeper into the lake. (See Page 10)

Every river and lake carries some nutrients. They're the byproduct of the decay of organic material, such as leaves and trees. But they're also found in manure, fertilizers and the effluent from sewage treatment plants.

The Grand River and its tributaries pick up a lot of nutrients as they wind toward the lake. Some of the nutrients are absorbed by plants along the way, or settle to the bottom.

But a lot of them float into Lake Erie in a plume of water that can be detected up to 12 kilometres along the shore and up to three kilometres out into the lake, depending on the volume of the flow coming from the river.

People strolling along the pier at the mouth of the Grand at Port Maitland can easily see the plume arcing into the lake. It's even more noticeable after the spring runoff or

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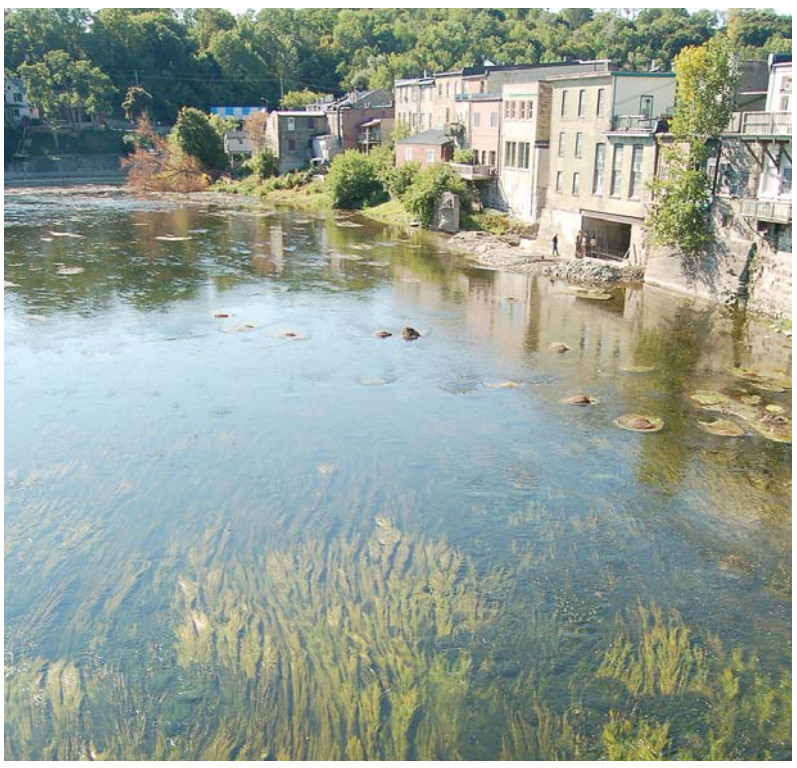


Excessive algae growth, such as this in the Grand near Paris, is usually a sign of an overabundance of nutrients, such as phosphorus.

Sediment-loaded water from the Grand River spills into Lake Erie.
Photo by Carl Hiebert

Quality

Continued from Page 4

ter system in the Waterloo Moraine. The moraine is an area of loose, gravelly soil left behind as glaciers retreated 10,000 years ago. Water moves easily from the surface deep into the ground, carrying pollutants with it. Water returns to the surface through springs, or seeps directly into rivers from river banks and upwellings.

The theory is that nitrogen-based components of manure and fertilizers were carried into the groundwater system, perhaps decades ago, and are now making their way back to the surface water system.

Phosphorus

Sewage treatment plants are a significant source of phosphorus. The 28 municipal plants in the watershed remove much of the phosphorus in sewage before the treated effluent is released into rivers and streams. However, some phosphorus remains in the effluent so the amount accumulates over the length of the river. Phosphorus levels in the Grand climb as it passes through the highly urbanized central part of the watershed which includes the cities of Waterloo, Kitchener, Guelph, Cambridge and Brantford.

During the spring runoff, the river system also gets a shot of phosphorus as organic material from the surface is washed into streams and rivers.

Suspended sediments

The water in the Grand River remains relatively clear as far south as Brantford. But as the river leaves the city it enters an area known as the Haldimand Clay Plain. The river and its tributaries, especially Fairchild and Big creeks, pick up clay particles from their own banks, as well as particles that wash off farm fields.

By the time the river reaches Caledonia, it has become rich in all three types of contaminants.

River characteristics

The section of the river downstream of Caledonia has some other characteristics that magnify the impact of these pollutants.

This is the flattest and widest part of the Grand River, which means the water is more exposed to the hot summer sun, causing the water to warm up. The warm water and lower oxygen level make it inhospitable for many species of fish and aquatic life that once lived in this area.

The presence of the Dunnville Dam also has an impact. It creates a lake-like stretch that extends several kilometres upstream toward Cayuga. The water slows down even more, so nutrients and sediment from the entire watershed collect in this area.

Prior to the construction of the dam, there were large wetland areas along the banks of the river with plants that absorbed the nutrients from the water. However, many of those wetlands were submerged when the dam was built in 1829 so today there are fewer plants to do that job.

The result is that the Lower Grand, which was once a healthy and productive ecosystem, is now significantly degraded.

A group of agencies interested in the Lower Grand did an extensive study of the area earlier this decade. Called the Southern Grand River Ecosystem Rehabilitation Working Group, it included representatives of the GRCA, Fisheries and Oceans Canada, the Ontario Ministry of Natural Resources, the Ontario Ministry of the Environment, Environment Canada and Six Nations.

In a summary report of its findings, the group said "the historic record describes a species richness that indicates much has degraded over the past 100 years."

The report described this section of the Grand as "highly eutrophic" which means it is excessively rich in nutrients and low in oxygen.

"The fish community is indicative of degraded aquatic habitat. Tolerant or generalist species (which can live in poor conditions) dominate," said the report.

Dunnville Marsh: the connecting link

The Dunnville Marsh is an important feature of the Grand River watershed, though it's not as large or healthy as it was prior to the settlement of the region.

Rehabilitation of key wetland benefits both bodies of water

By Janet Baine
GRCA Communications Specialist

The warm, tranquil waters of the Dunnville Marsh hide a murky challenge for the future.

In the past, the southern Grand River was cooler, narrower and deeper. The marshlands were wider. Countless biological processes took place there, thanks to diverse marsh inhabitants that made up the complex ecosystem. The marsh remains an essential link between Lake Erie and the Grand River.

The marsh is still the largest section of coastal wetlands in the Grand River watershed. The GRCA is the owner and caretaker of part of the marshland. A coalition of organizations had the foresight to buy 376 hectares of the 1,600 hectare marsh in 1992. This land was turned over to the GRCA and since then the protected area has grown to 450 hectares.

A management plan was approved in 1997 to maintain, restore and enhance biological diversity.

Creating 'pits and mounds'

The GRCA's terrestrial resources department is in the process of restoring 45 hectares of the marshland which had been used for agriculture. Excavators were brought in to create what conservationists call "pits and mounds." They dug desk-size holes and left a pile of earth beside each hole to mimic what would happen if a large tree had fallen over, pulling up earth with its roots. Water collects in these holes, providing habitat for new life.

The first pits were dug in December 2005 and by the following spring, the pits were already teeming with tadpoles. Native seeds were planted and are returning the fields to nature. Salamanders from

River plume

Continued from Page 6

a major storm when the water looks like chocolate milk as it carries sediments washed into the river from farm fields.

Largest river

The Grand River is, by far, the largest watercourse on the Canadian side of Lake Erie. It contributes about 25 per cent of the water entering from the Canadian side. It's also the most heavily developed watershed on the Canadian side, with some of the province's best farmland and several of its fastest growing cities.

By the time the Grand hits Lake Erie, it has passed through almost 2,000 square kilometres of farmland and received effluent from 28 sewage treatment plants serving about 800,000 people.

It's estimated that the Grand River contributes 40 per cent of the phosphorus found in the eastern basin of Lake Erie, which takes in an area from Long Point in the west to the Niagara River in the east.

A report issued by the Ontario Ministry of the Environment in 2008 said the Grand River had one of the highest levels of phosphorus of any river in Ontario. The report, named "Water Quality in Ontario," said the Grand carried 108 micrograms per litre. The Provincial Water Quality Objective, set by the ministry to protect aquatic life, is 30 micrograms per litre.

The water from the Grand contains 10 times more phosphorus than the rest of the water in the eastern basin of the lake.

Only the Don River in Toronto, and the Thames River, which flows through London and the fertile farmland of southwestern Ontario, were higher.

Lake Erie has been afflicted by high nutrient levels for decades. This is the reason Lake Erie was considered to be on the verge of death in the 1970s.

"The lake almost choked to death on masses of decaying algae," said a report called Lake Erie: a Lake in Flux, issued by the Ontario and federal governments.

It was a big problem for people too. The odour of the rotting Cladophora turned people away from beaches and shorelines. Property values dropped and tourism-based businesses were hurt.

Governments on both sides of the lake realized that something had to be done. As a result of the Canada-U.S. Great Lakes Water Quality agreement they acted to reduce the volume of nutrients entering the lake.

Banned phosphates

The most noticeable, and most effective, action was banning phosphates (a form of phosphorus) from laundry detergents in the 1970s.

The turnaround was dramatic.

Historically, the total amount of phosphorus in the lake was about 3,000 tonnes.

Phosphorus levels climbed during the 19th and 20th centuries and by 1972 the phosphorus load was eight times greater – 25,000 tonnes. The phosphate ban and other efforts, such as improved sewage treatment, cut it to 15,000 tonnes by 1980.

However, phosphorus levels started to climb again in the 1990s, particularly in areas closest to shore, leading to more algae outbreaks.

That general increase reflects what was happening in the Grand. The 2008 provincial water quality report showed phosphorus levels at the intake for the Dunnville water treatment plant, which is in Lake Erie just west of the river's mouth. The area is affected by the flow of water coming out of the Grand, as well as the general movement of water around the lake as a result of wind and waves.

The numbers showed a rough trend. Phosphorus levels dropped from the 1970s to the 1990s and then bottomed out before a slight upward movement in the 1990s.

New nutrient strategy

That has led water quality experts to look further afield for new ways to cut phosphorus loads. More specifically, they're looking to the rivers and streams that feed the lake.

A bi-national group of experts has drafted a nutrient management strategy for Lake Erie. It says work needs to be done to lower the amount of phosphorus coming from large watersheds feeding Lake Erie, such as the Grand.

More attention needs to be given to farmland and septic systems, said the group's draft report. Surface runoff, which is called a "non-point source," accounts for about 60 per cent of the phosphorus in Lake Erie.

In the Grand River watershed, the Rural Water Quality Program has been addressing nutrient issues for a decade. It provides farmers with grants to undertake projects to keep water clean on the land. That includes building manure storage tanks, to reduce manure runoff, and planting trees and shrubs along streams to soak up nutrients before they get into the water.

Many farmers have nutrient management plans to manage the amount of manure or chemical fertilizers used on fields to ensure there's just enough to feed the crops and nothing left to wash off into water courses.

the nearby slough forest have moved into the pits to breed. Carolinian trees, including shagbark hickory, red oak, bitternut hickory and many other species, have been planted. What the newly-created area needs now is time.

Unfortunately, the waters in the marsh are the landing place for all that comes down the river from the populated areas. This means there are too many nutrients and a heavy sediment load. Because the wetlands are shallow, warm and quiet, these contaminants come to rest in the marsh and are only flushed out when there is a big flood.

Important to fisheries

Even in its current state, the marsh is especially important to the fisheries both in Lake Erie and in the Grand River. Walleye and other native fish spawn in the river, but once the eggs hatch, the current pushes the tiny fish into the marsh. The still, warm water and high nutrient level make it an excellent fish nursery during the spring. The young fish grow until they are big enough to move back into the river and lake.

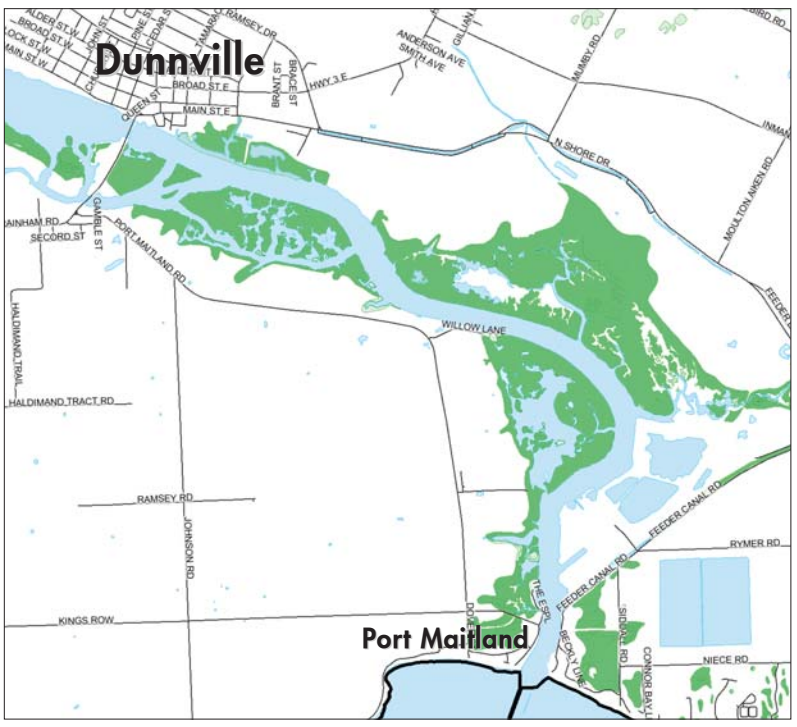
But habitat disturbance means the water is so warm that only two invasive fish species and no native fish remain in the marsh during the summer.

"During the summer we think the water quality is so poor that only goldfish and carp can live there. They tolerate poor conditions and warm water," explained Warren Yerex, former supervisor of aquatic resources for the GRCA. These species stir up the water making it murky so light can't penetrate the water and aquatic plants can't grow. The destructive carp also dislodge aquatic plants that would be food to other species.

Best accessed in a canoe or kayak from the east side of the Grand River, the small passageways through the marsh are surrounded by tall bulrushes and cattail. There are few other plants — hairy willow herb, burr reed, water lily and not much more. This is a simple ecosystem.

"There is huge potential to rehabilitate the marsh. We know there are examples of what it could be in the future," Yerex said. But fixing these problems is a complicated task. It will take money, a good plan, leadership and co-operation from several organizations, including Environment Canada, the Ministry of Natural Resources and the GRCA.

A plan similar to the Grand River Fisheries Management plan, which received a national award from the Ministry of Fisheries and Oceans in May, is needed for the southern Grand River as well. These projects can and do succeed, but they are an immense undertaking, Yerex said.



The Dunnville Marsh lines the banks of the Grand River from Dunnville to the river's mouth at Port Maitland.


The best way to see the Dunnville Marsh is from the water. Members of the Waterloo Wellington Canoe Club, which has paddled the entire Grand River this year, explore the marsh. *GRCA photo by Janet Baine*

Carp are hurting Lower Grand

Carp and goldfish are believed to be the only two species of fish that actually thrive in the warm waters of the Dunnville Marsh during the summer and both are non-native invasive fish.

Carp were first introduced into the U.S. in 1787 from Europe and were considered a "super fish." By 1892, they were found in the Grand River and now they are part of the river ecology to the point that few people know they are an invasive species.

In some parts of eastern Europe, carp is sought after and in countries including the Czech Republic, it is the traditional Christmas Eve dinner.

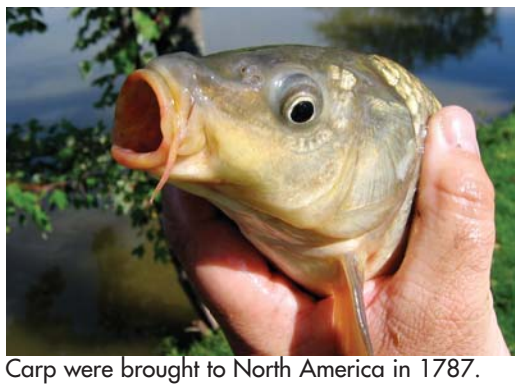
This species has adapted well to the Grand River. For canoeists paddling through the Dunnville marsh during the summer, the sound of birds and wind through the reeds is occasionally interrupted with a big splash of a carp or goldfish.

Both these species tolerate poor water quality and aren't picky about what they eat. They tend to thrive in areas that challenge species that are intolerant of poor conditions, such as those with specialized diets. They are considered "generalists" because they don't need specific types of food or habitat.

Hurt water quality

They have had a role to play in the deteriorating water quality conditions in the Grand River watershed and the Dunnville Marsh, because they are big and tend to stir up the sediments and nutrients as well as uproot plants. This leads to murky water that sunlight can't penetrate so submerged aquatic plants that are food for other aquatic species can't grow. Carp are detrimental to biodiversity, since they play a role in creating poorer water quality conditions that make it harder for native species of plants and fish to survive.

Goldfish, which are related to carp, lose their gold colour as they grow large. They are commonly kept as pets and in backyard ponds but people often release them into stormwater ponds or creeks because they don't know what else to do with them. Releasing them into the Grand River watershed is a concern, since they reproduce and disturb the unique ecosystem.


Carp were brought to North America in 1787.

The lost fish of the Grand River

Changes on the land and water doomed many species that once lived in the Grand

Imagine the sight of tens of thousands of fish fighting their way up the Grand River from Lake Erie to return to their spawning grounds, renewing the cycle of life that had existed for untold millennia.

Walleye, northern pike, brook trout, muskellunge, and sturgeon – they were all at home in an ecosystem that linked river and lake 200 years ago.

Many of them disappeared in the 1800s and 1900s, or their numbers declined significantly. Some species managed to survive, but only with human support. Walleye literally get a helping hand from people who catch them below the Dunnville Dam and then move them above the dam so they can swim on to their spawning areas.

There has been resurgence in the Grand River fishery in the past 50 years as it has recovered some of its health. There are 82 species of fish in the river system and some sections are rated among the top fishing streams in North America. Water quality and quantity improvements helped pike, bass and other species to bounce back and today they are the prime targets of anglers in much of the Grand River system.

Ecosystem has changed

However, many of the species lost in the first century of settlement will likely never come back, or certainly not in the same numbers that once existed. The ecosystem that allowed sturgeon, white fish, brook trout and muskies to thrive in much of the Grand two centuries ago, has been lost.

The early decline of the fishery was directly linked to changes that followed the opening of the Grand River watershed to settlement in the 1800s. As people adapted the river and surrounding land to their needs, water quality suffered and the links between river and lake were weakened.

The recovery that started in the mid-20th century can be directly tied to human efforts to restore water quality, moderate quantity, reforest the land and protect wetlands and other natural areas.

Explorers who visited the mouth of the Grand in 1640 reported large and productive fishing camps established there by First Nations people. Sturgeon – a huge fish that grows to two metres long and 100 kilograms or more – were caught by natives as far north as Cambridge.

The watershed was a much different place then. Forests and wetlands covered most of the watershed. Shade from the trees slowed down the melting of snow in the spring. The wetlands absorbed a lot of the runoff, releasing it slowly to the river.

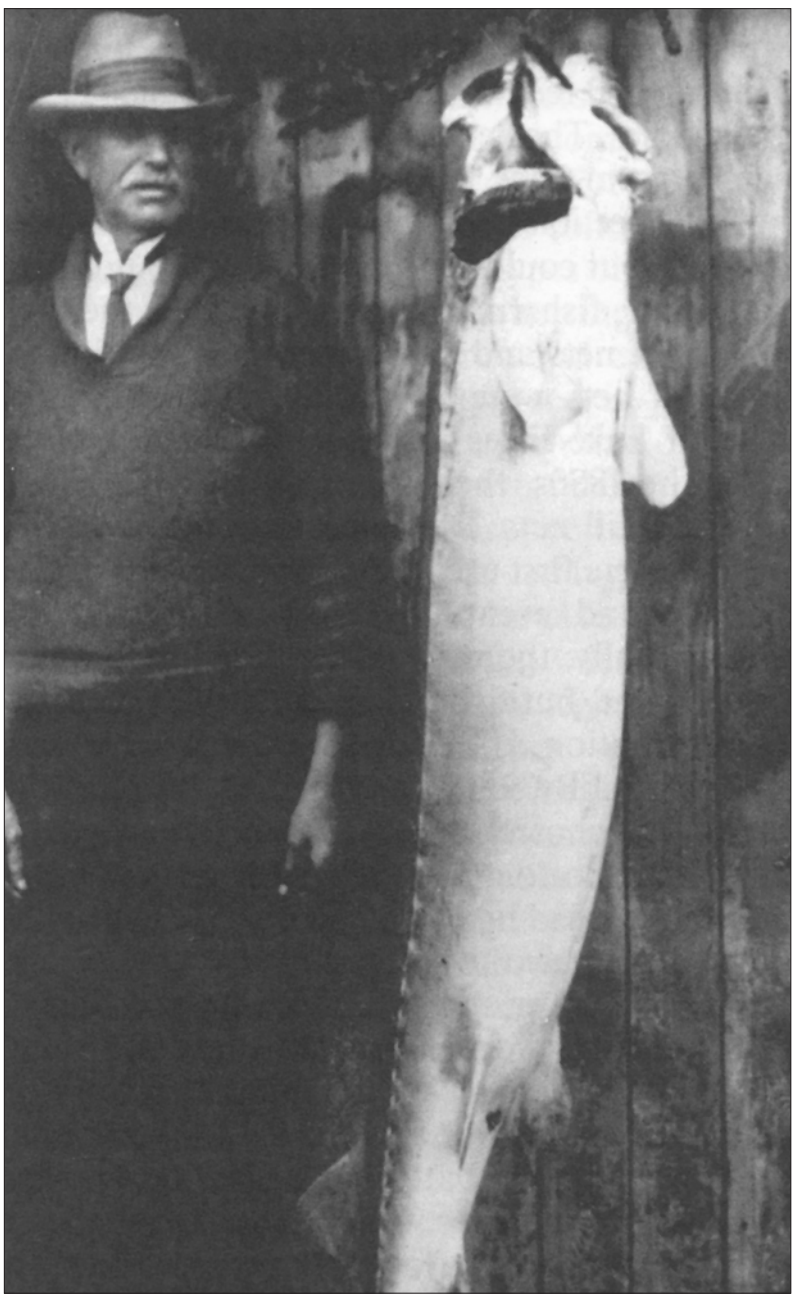
Longer floods

As a result, spring floods were longer and the flood level were lower than we experience today.

Floods sometimes lasted a few weeks, with water filling the floodplain for extended periods of time. Adult fish would spawn in the calm backwaters, and their young would feed on algae and plants that were fertilized by naturally-occurring nutrients such as phosphorous and nitrates.

It all started to change in the early 1800s.

The Grand River was reshaped to fit the needs of early inhabitants. A dam was built at Dunnville in 1829, a few miles upstream of the mouth of the Grand. Over the next 20



Giant sturgeon, such as this one caught a century ago in Sulphur Creek near Dunnville, were once common in the Grand River.

A helping hand for walleye

Walleye are an important sport fish on Lake Erie and in the Grand River, but some need human help to get around the Dunnville Dam in the spring. Volunteers catch walleye and move them upstream so they can carry on the trip to their spawning grounds. A fish ladder built into one weir of the dam complex in the mid-1990s was supposed to solve the migration problem, but the walleye don't use it as much as had been hoped.

Grand Fishery

years more dams and locks were built by the Grand River Navigation Company to allow barges and sailing ships to reach Brantford.

The dams prevented many fish from swimming upstream from the lake to their spawning grounds on the Grand.

The deep water behind the dams wiped out many shallow spawning areas. The Grand became "a series of murky, languid pools," in the words of Felix Barbetti of the Ontario Federation of Anglers and Hunters.

Some fish could jump the dams and other species could survive in the areas between dams or in free-flowing tributaries. However, plummeting water quality caused by farm manure, raw sewage and industrial waste hurt many species. With forest stripped away and wetlands drained, water temperature in the river rose, to the detriment of fish species that need cold water.

Meanwhile, on Lake Erie, commercial fishing continued with fishers unaware that stocks were in rapid decline.

By the 1900s white fish, sturgeon and muskellunge had essentially disappeared from the Grand and walleye were barely surviving. Brook trout were hanging on in a few coldwater tributaries. Foreign species such as carp, which had been introduced to North America, survived because they could tolerate the polluted, warm water.

By the 1930s there was a realization in the Grand River watershed that the problems that had destroyed the fishery were also creating intolerable problems for people – highly polluted water flowing down a river that surged with floods in the spring and dried up to a trickle in summer.

Took action

Municipalities, senior levels of government and the new Grand River Conservation Commission (as the GRCA was known then) tackled those problems in a variety of ways. Reservoirs were built to moderate floods and keep rivers flowing during droughts. Millions of trees were planted, municipalities invested in sewage treatment plants and new regulations protected remaining wetlands and other natural areas. Farmers tackled erosion and runoff problems.

By the last few decades of the 20th century, all this work started to pay off as the fishery rebounded.

In the past decade, many projects have been carried out following a road map called the Grand River Fisheries Management Plan, a community-based plan developed in the 1990s with the support of the GRCA and the MNR. This year, the committee implementing the plan was honoured by the federal government for its work.

Some new fish were introduced to replace the lost species. Brown trout (originally from Europe) could live in the cool water flowing out of the GRCA's Belwood Lake reservoir near Fergus, although they found it difficult to reproduce. A brown trout stocking programs has made the section of the Grand from Fergus to West Montrose into a prime fly-fishing area.

Rainbow trout, another introduced species, have adapted well, living in Lake Erie and then swimming upstream – jumping the dams – to spawn in the central part of the watershed in coldwater streams such as Whitemans Creek and D'Aubigny Creek (near Brantford) and creeks feeding the Nith River.

Rainbow trout are a Pacific coast fish introduced into the Great Lakes and have done well in the Grand River.

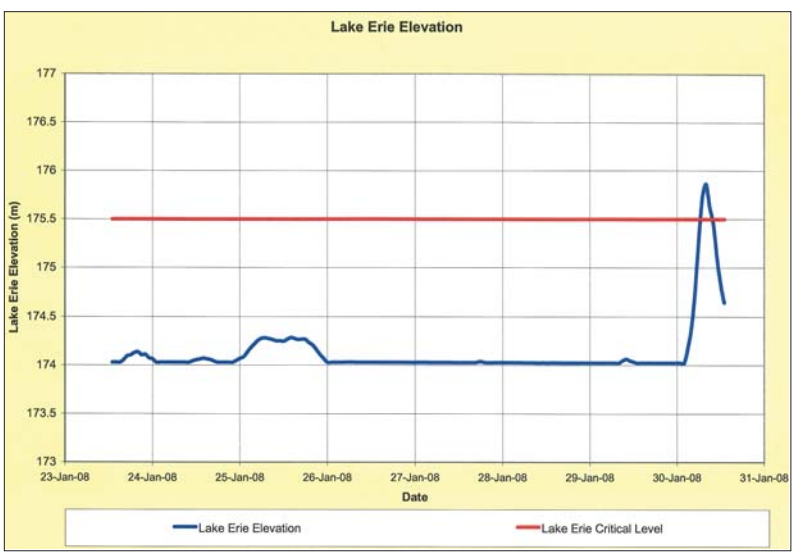
Lake Erie winds can make the Grand flow backward

The Lower Grand River is a two-way street.

Most of the time, the Grand flows lazily down to the river's mouth on Lake Erie at Port Maitland.

But every now and then, when conditions are right, the Grand will actually flow backward, with lake water pushing its way upstream eight kilometres to Dunnville.

It happens when Lake Erie is hit by a storm surge. That's when strong winds, blowing from the southwest, literally push water to the eastern end of the lake. Water sloshes around in the lake like a bathtub, rising in the east and dropping in the west.



This graph shows the sudden rise in the height of Lake Erie near Port Maitland during a storm surge in January 2008

Storm surges occur regularly but most are so small that they are barely noticed. However, when conditions are right, they can flood Port Maitland and low-lying land along the Lower Grand.

Rose in hours

For example, a storm surge on Jan. 30, 2008 raised the lake level at the mouth of the Grand at Port Maitland by about 1.75 meters (about five feet) in just a few hours. Frigid water flowed through the lakeside community and left a coating of ice on buildings, cars and utility poles.

Storm surges that are big enough – and especially if they occur when lake levels are already high – can actually send water flowing backwards over the Dunnville Dam.

That doesn't happen very often, but it shows the strong connection between the Lower Grand River and Lake Erie. Storm surges are an important part of the life of the Lower Grand River. They can send floodwaters into wetlands along the river's edge, leaving behind nutrients that feed aquatic plants. These plants provide a rich habitat for aquatic creatures as well as birds and other animals.

Water pushed up the Grand River by winds blowing across Lake Erie floods a street in Port Maitland.

The reverse flow also flushes out debris and moves sand and sediment around, helping to enrich the habitat for aquatic life.

Before the Dunnville Dam was built, water driven by the storm surges would have made its way as far upstream as Cayuga, about 40 kilometres from the river's mouth. That reach of the river was lined with rich, productive wetlands which would have benefited from the high water.

However, most of the wetlands disappeared when they were flooded by the construction of the Dunnville Dam in 1829.

Invasive species attack the Grand

Native species find it hard to compete against exotics

By Janet Baine
GRCA Communications Specialist

Each exotic invasive species has its own unique tale of arrival, displacement of native species and damage to the local ecosystem.

These stories are as diverse as the species themselves. Sometimes they come to our attention with a sudden blast of media attention, such as with zebra mussels. But most don't garner much attention as they change the ecosystem to suit their own needs.

These invaders travel by land, water and air. Some were introduced intentionally while others arrived by accident. A parent may think nothing of releasing a pet goldfish into a stream or pond, not realizing that goldfish displace native fish and disturb their habitat. A homeowner digs up a plant — garlic mustard — with delicate white flowers for her backyard without knowing it will kill her native wildflowers and tree seedlings and then move on to a nearby forest.

The goal of the GRCA and other concerned organizations is to prevent further invasion of exotic invasive species and to control existing ones where this is possible.

Invasive species lead to simpler, less complex ecosystems. They often have no natural predators. They may quickly replace local species that provide animals with food, helping to create a microhabitat. In this way, one new invasive species may lead to a multitude of changes.

"Biological diversity is very important. The more diverse the ecosystem, the more resilient and flexible it is. Without biological diversity, the environment will not adapt as well to climate change and population growth," says Warren Yerex, the former supervisor of aquatics at the GRCA.

Weaken ecosystem

Because the Grand River is connected to Lake Erie, many aquatic invasive species are on our doorstep without much to keep them from taking residence upstream. These include round goby, sea lamprey, rusty crayfish and zebra mussels. All of these have made their way into the southern Grand River, and some are further upstream.

One non-native species weakens the complexity of the aquatic ecosystem. It becomes less complex, less adaptable, and less able to meet the challenges of the future.


Garlic mustard in the early stage of growth.

Invasives on the land

The Grand has also been hit by the arrival of many plants and trees, as well. They're having an impact on forests, wetlands and other natural areas.

Plant seeds are often blown by the wind or carried by birds and animals to new locations. Invasive exotic plants reproduce in ways that allow them to travel and replace native plants that are essential to the local ecosystem. Whenever a natural area is disturbed due to development or other land use and then it reverts back to vegetation, or even when it's not disturbed, invasive plants have an opportunity to move in.

"One of the best ways to control further spread of invasive plants is to minimize disturbance of natural areas, because invasive plants thrive in disturbed areas," said GRCA ecologist Tony Zammit.

For this reason, when the GRCA is naturalizing areas, native seeds or plant seedlings are spread early in the process. This gives native plants a better chance to become established, helping to create a biologically diverse area.

Some invasive species can devastate forests. The gypsy moth was introduced into North America in 1981. While the greyish-white moth is harmless, the caterpillar stage is very destructive to many native tree species. The gypsy moth population peaked in 1991 and 1992 and the Ministry of Natural Resources responded with a province-wide spraying program to prevent the insect from destroying Ontario's deciduous forests.

Gypsy moth populations are cyclical and were increasing in 2008 to the point that the GRCA had to spray Brant and Byng Island conservation areas to prevent further damage. They can completely defoliate

Sea lamprey

Sea lamprey are parasitic and attach to fish. A lamprey is about half a metre long and can kill 18 kilograms (40 pounds) of fish during its 12 to 20 month adult stage.

They made their way from the Atlantic Ocean to the Great Lakes via canals in the 1800s, and were present in all the lakes by the 1930s. They are devastating local fish populations. They now live in the southern Grand to the area above the Dunnville Dam.


Sea lamprey attached to a lake trout with their sharp teeth.

Although lamprey numbers have been reduced since the 1960s in the Great Lakes, if they move further upstream in the Grand, beyond the Caledonia Dam, the results could be devastating for the Grand River fishery. It would cost millions of dollars to chemically treat and kill them, yet this would be necessary.

Round goby

Round goby live in the southern Grand River, and extend upstream to Middleport between Caledonia and Brantford. They were inadvertently released into Belwood Lake, near Fergus, a couple of years ago and are expected to move beyond the reservoir. On July 25, an angler captured a goby downstream of the Wilkes Dam in Brantford — the first indication that gobies that were in the lower Grand River have made it that far upstream. Often used as bait, it is easy for people to unknowingly move them into new areas where they take hold quickly.


Round goby have made their way into the Grand River.

Round gobies are 10 to 25 cm long and are an aggressive fish. They also spawn several times a year, so their numbers can grow rapidly.

Anglers and boaters can slow the spread of gobies in several ways: don't release live bait in the water; drain your boat before leaving any water access; and don't transfer fish from one location to another.

a tree, requiring it to use energy reserves to grow new leaves. After repeated attacks, the tree dies.

Researchers are now discovering that some plants produce chemicals that are toxic to native plants.

For example, research at the University of Guelph has found that garlic mustard is "waging underground chemical warfare" on native Canadian trees. This discovery was made by University of Guelph professor John Klironomos and scientists from the United States and Germany.

Klironomos noticed few tree seedlings in watershed forests where garlic mustard flourished. His research found the invasive targets and poisons the fungi in the soil that helps nourish many native trees, such as maple, ash and other hardwoods. Once garlic mustard has invaded an area and released this deadly chemical compound, even removing the weed doesn't help much.

"The compound is still in the soil and it's hard to plant any native plants in the area and have them establish properly," Klironomos says.

But the combined impact of all of the invasive exotics on land and in the water presents a huge challenge to restore the lost biodiversity.

"The problem is widespread and it sometimes feels like a losing battle," said Zammit. "The exotic species that displace native species are especially problematic."

Common buckthorn grows so densely that it crowds out native species, such as maple trees, because maple seedlings are deprived of light.

More info

One of the best ways to combat the impact of invasive species is to learn about them. Here are some websites:

- www.invadingspecies.com
- www.treecanada.ca/tree-killers

Loosestrife meets it match

Once an invasive species takes up roots it can be difficult to move it out.

But there are success stories and purple loosestrife is one of them.

Purple loosestrife was introduced to North America in the 1880s as an ornamental plant or for beekeeping. However, it spread throughout the continent and eventually became a significant threat to wetlands.

Purple loosestrife grows best in marshes and other wetlands. It quickly crowds out most native vegetation and soon there is little food or shelter for native wildlife. By the 1990s it was becoming a significant problem in Ontario as it threatened to upset the natural ecosystem in the province's wetlands.

The beetle introduced to control purple loosestrife.

It's a hardy plant and there were few ways to deal with it. No herbicides are approved to treat it and digging it out didn't work.

On top of that, it had no predators on the continent.

So scientists started looking at importing some predators from the plant's home base in Europe and Asia. Two leaf-eating beetles were identified and were put to the test to see if they could be safely introduced into North America without causing a whole new series of headaches.

Released beetles

In 1992 the University of Guelph released the first beetles into the wild and eventually 400 release sites were set up across the province.

Forty of them were in the Grand River watershed and the release took place under the Grand River Watershed Management Plan for Purple Loosestrife. The plan brought together the university, GRCA, Environment Canada, the Grand River Conservation Foundation and volunteers to work together to eradicate loosestrife.

By 2004 the beetles had spread throughout the watershed and purple loosestrife was gone along the banks of the Grand and much of the Speed rivers. However, there are still large stands further away from the rivers and the beetle program continues.

Purple loosestrife

Zebra mussels

Zebra mussels not only replace other mussels, but they also eat the food of fish, devastating fish and aquatic insects. In Lake Erie, they have altered the ecosystem. They consumed algae, upsetting the normal food chain, which ultimately resulted in reductions in the number of yellow perch, walleye and white perch in the lake. They also filter out some of the suspended solids from the water column, making it cleaner. That allows sunlight to penetrate deeper into the lake, encouraging algae growth.

They are only about three centimetres long and will cover any hard surface: rock, metal, rubber and even other living things such as clams and plants.

If zebra mussels manage to move upstream of Dunnville, they could damage water intakes including those at Six Nations, Brantford and the Region of Waterloo. GRCA dam operations would be impaired, since the mussels could attach to the gates and hydro intakes. Their control or removal from concrete and metal infrastructure using chlorination and other means to prevent build up could cost thousands of dollars.

Zebra mussels cling to a water gauge.

Rusty crayfish

Rusty crayfish were first spotted in Ontario in the 1960s. The risk is that they will push out native crayfish, which are an important food source for fish in the Grand River.

Rusty crayfish, which are about10 cm long excluding the claws, were first observed in the Grand River watershed in 1987. The invasive species consumes twice as much food as native crayfish and will eat just about anything, including aquatic vegetation, fish eggs, benthic invertebrates, small fish, and decaying plants and animals.

They compete with juvenile game fish and forage fish species for food and eat up their habitat. They are easy to spot, since they are much bigger than native species.

One way to control their spread is to never move bait buckets full of crayfish from one body of water to another.

Rusty crayfish are hungry, aggressive creatures.

High flows can be good for the Grand

Researchers are looking at how changes in flows can help keep the river healthy

The Grand River goes through some mighty changes every year.

It cycles through spring melt, summer dry spells and soggy autumns, with flows rising and falling dramatically over the course of the year.

During the height of a flood, flows can be 100 times greater than during the summer in the Central Grand. On some tributaries, such as the Nith and Conestoga rivers, flows can regularly rise to 200 or 300 times summer flows. In 1974, during one of the largest floods on record, the flows in the Irvine River near Elora were 1,000 times summer flows.

It could be worse. The GRCA operates seven reservoirs to smooth out the highs and lows; if the reservoirs didn't exist, spring flood waters would be even greater and during dry periods, the river system would be reduced to a mere trickle in some places.

For the GRCA, like most water management agencies, the goal has always been to moderate extreme flows to the benefit of people, in order to protect lives and property and to keep their drinking water and sewage treatment plants working.

But in recent years, aquatic biologists, hydrologists and water quality scientists have wondered if moderation is always a virtue.

They took a fresh look at how rivers work and concluded that variations in flows – including the extreme flows that occur during a flood – can help maintain a river as a healthy habitat for aquatic creatures and human needs.

The GRCA and several other conservation authorities looked at the concept of "ecological" or "environmental flows" in their own watersheds in studies financed by the Ontario Ministry of Natural Resources.

The studies were done after a long series of dry years in the late 1990s and early 2000s that stressed aquatic life in many parts of the watersheds.

During those years, the GRCA ensured the minimum flow targets were met throughout the summer and fall months.

But long periods of steady flows may not be the best thing for the river. As the GRCA study pointed out "a single flow value cannot simultaneously meet the requirements of all species in an aquatic community."

Fish, bugs and other aquatic species evolved amid cycles of high and low flows. They need changing flows to survive. As much as humans dislike them, high flows have many beneficial effects.

In effect, a flood can be a "spring housecleaning" for a river.

Many rivers, such as the Grand, are actually a series of pools and riffles. Pools are sections of slow moving, deeper water. Riffles are shallow, rocky-bottomed areas where the water moves more quickly.

When dams were built in the 1800s and 1900s, many of the riffle areas were submerged. The rivers upstream of the dams turned into small lakes, collecting sediment from upstream. Years of managed, steady flows have buried some of those riffles.

The study gave GRCA staff a better understanding of how water stored in the reservoirs might be released over the course of a year, or from year to year, to mimic more natural flows. Of course, it would be done in a way that wouldn't threaten people or interfere with sewage and water treatment plant operation.

Four flow levels

The study described four different kinds of flows that are part of normal cycles:

- **Connectivity flow**: A flow high enough to link the pools and riffles in a watercourse. It's not an issue on the Grand and the major rivers, but there have been some streams – particularly in areas where a lot of water is used for irrigation – where flows can become too low to connect the pools and riffles.
- **Flushing flow**: A flow that has enough force to sweep sediment from riffles and move out debris.
- **Bed mobilizing flow**: A flow that moves half or more of the bed material (stones, dead vegetation, algae, etc.)
- **Riparian flow**: When water spills through the floodplain to clear out dead material and help revitalize the areas alongside the river.

The study provided a better understanding of the amount of water needed to meet those flow levels in several parts of the Grand River system.

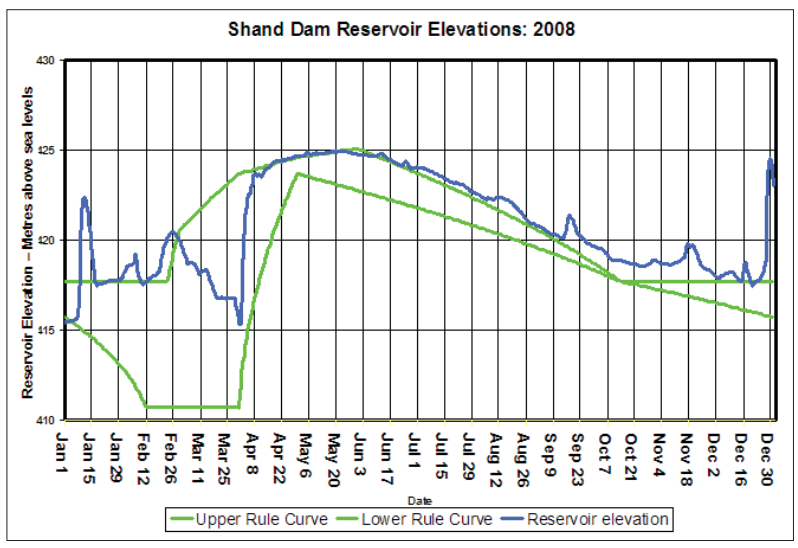
But, ironically, there hasn't been a need to put the theory to the test. Since the study was completed the watershed has gone through a particularly wet period and flows have fluctuated significantly, even during the summer. Two major floods in late 2008 and early 2009 gave the river a good cleaning, stirring up sediment, revitalizing floodplains and pushing debris downstream.

High water pushes water into the floodplain where nutrients feed vegetation, enhancing its value as a habitat for many species.

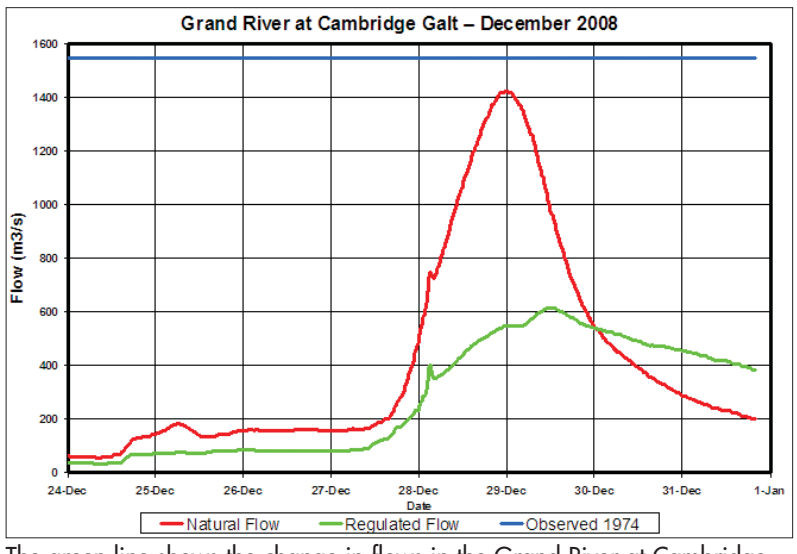
High water benefits

Floods and high flows are a part of the natural life cycle of rivers and provide a number of benefits to the ecosystem. High flows can:

- flush out rotting vegetation, which helps improve the amount of oxygen in the water
- sweep sediment away from shallow, rocky areas known as "riffles" which are used as spawning areas by many fish
- deposit fresh layers of nutrient-rich mud in wetlands and floodplains, which sustain plant growth, creating a green buffer area along the river
- move fallen trees and other heavy objects around, creating new habitat
- get rid of a lot of human debris that has accumulated in the river or on river banks.



The blue line shows the change in water levels in the Shand Dam reservoir during 2008. The green lines show the upper and lower targets used by GRCA dam operators to help them decide how much water to keep in the reservoir and how much to release. Sudden spikes follow storms or melts.



The green line shows the change in flows in the Grand River at Cambridge (Galt) during the flood of December 2008. Normal summertime flows are about 15 cubic metres per second (m^3/s), but they rose to 600 m^3/s during the flood. Flows would have been much higher – about 1,400 m^3/s – if not for the moderating effect of GRCA reservoirs.

A tale of two dams

Small dams can add to water quality issues

There are more than 100 dams in the Grand River system. Seven owned by the GRCA, such as the Shand and Conestogo dams, are critical to reducing flood damages and maintaining minimum river flows in dry months.

Most of the rest are legacies of the 19th and early 20th centuries, built for power, transportation or water supply. Most of them no longer have their original function, though many are prized because of their aesthetic, heritage or recreational values.

Built for canal project

One of the oldest is the Dunnville Dam, built in 1829 to supply water to the Welland Canal via the Feeder Canal. It was a vital part of the development of the Grand as a transportation corridor linking Lake Erie to Grand River communities as far north as Brantford. The dam remains a important feature of the community.

In Brantford, the Lorne Dam was built about 20 years later to funnel water to a canal which cut through the centre of the city. Much of the canal was filled in during the 1950s, though the eastern segment still exists. By the 1980s the Lorne Dam was in an advanced state of deterioration so it was removed in 1989.

While these dams were a boon to the early development of their communities, they also had a negative impact on the natural heritage of the Grand River, interfering with fish movement, impairing water quality and sometimes making flooding worse.

The Dunnville Dam has been both a roadblock for fish trying to move upstream to spawn and a straitjacket to the old wetlands upstream. A fish ladder built by the GRCA in the mid-1990s has had limited success, especially for walleye, which are an important commercial fish on Lake Erie.

The Dunnville Dam actually is four separate structures. The main dam joins the east river bank to Grand Island, while three smaller weirs link a series of islands lining the west bank. The aging structures were upgraded in the 1990s.

The first Dunnville Dam was constructed in 1829 as part of the Welland Canal project.

A 2007 report done by the Lake Erie Management Unit of the Ministry of Natural Resources endorsed removing the Dunnville Dam to allow fish movement and to raise water quality in the Lower Grand River and Lake Erie. Removing the dam would also moderate flooding from ice jams, high river flows and high water from Lake Erie that pushes back up the river channel. This surge of water would also rejuvenate the wetlands dramatically increasing the potential for waterfowl and fish habitat.

The study acknowledged, though, that earlier proposals to remove the dam have been met with objections from those who put a high value on the historic, economic, recreational and aesthetic values of the dam. The river would be shallower, narrower and lined with wetlands compared to the lake-like vista today.

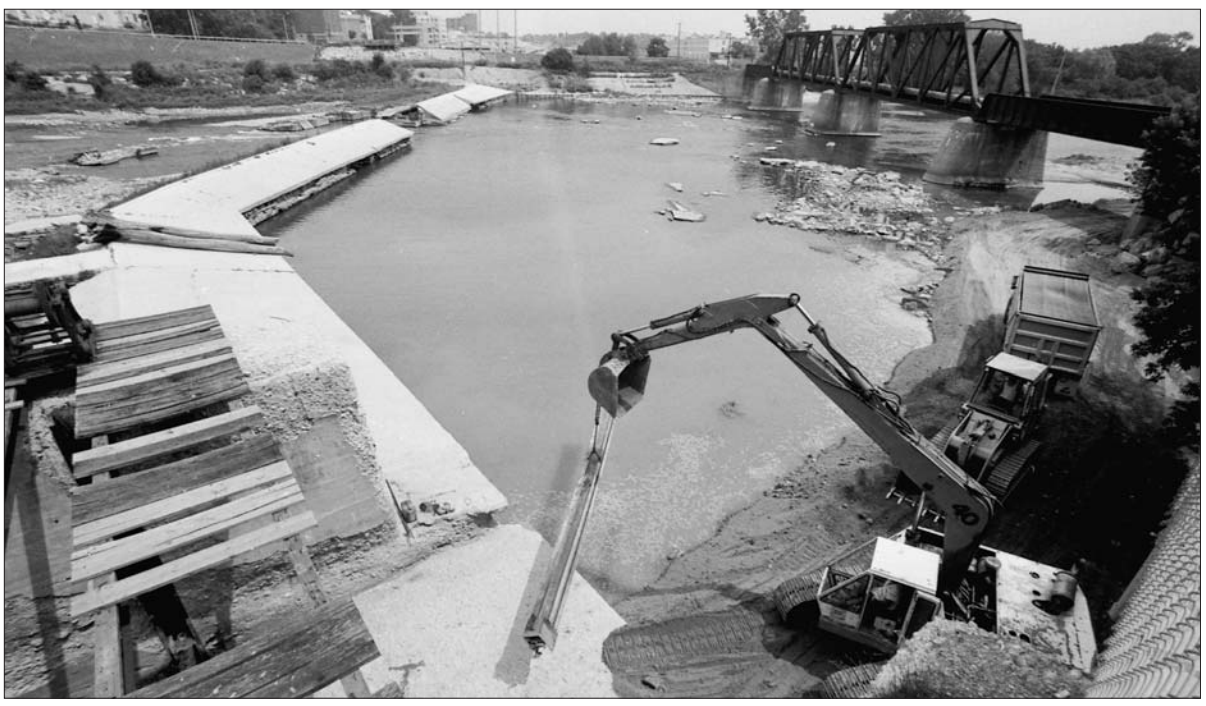
Was opposition

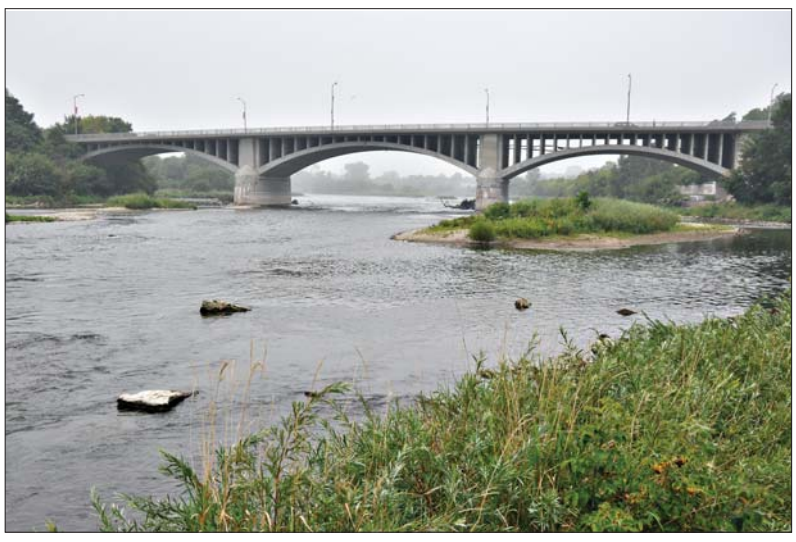
A plan to remove the failing Lorne Dam in Brantford in the 1980s met with some of the same concerns. Even 20 years later there are occasionally suggestions that it be rebuilt.

When the Lorne Dam was finally removed, the change was felt many kilometres up and down the Grand.

Cooler water from the middle Grand River could flow south, raising water quality and making it better habitat for some fish species, notably rainbow trout. Eliminating the physical barrier of the dam allowed the trout to reach rich spawning grounds such as Whitemans Creek and in just five years a robust rainbow trout fishery took hold.

This section of the Grand has been designated an "Exceptional Waters" reach because of its water quality and other characteristics. It has drawn attention across the province; recently Whitemans Creek was dubbed one of the 10 best fishing spots in Ontario by a fly-fishing magazine.


The Lorne Dam was in bad shape before it was removed in 1989. *Photo courtesy The Brantford Expositor*


The former site of the Lorne Dam in Brantford. The channel has naturalized since the dam was removed.

Rebuilding our green infrastructure

Members of the Mill Creek Rangers pull the springs of an old mattress out of the stream as part of a river cleanup project. The Rangers are students hired each summer to do projects to improve the coldwater stream in the Guelph-Cambridge area.

By Janet Baine
GRCA Communications Specialist

When it comes to Grand River forests, the Joni Mitchell song rings true: you don't know what you've got 'til it's gone.

Trees and forests are green infrastructure. They are as essential to communities as bridges, schools, roads and municipal buildings. Some would argue that they are even more essential, since communities depend on living systems, including trees, for their very existence. Climate change and population growth add more compelling reasons to plant trees than there were 40 years ago when Mitchell wrote her song.

The GRCA and its partners are focused on rebuilding green infrastructure that has been lost. At the end of the 1800s, only about five to seven per cent of the forest cover in the watershed remained. This was the low point. Now forest cover is up to about 19 per cent. A Watershed Forest Plan for the Grand River (2004) sets a framework for action and targets to work toward. These are key targets from the plan:

Forests and other natural areas help keep the watershed healthy

- 30 per cent forest cover for the Grand River watershed
- 95 per cent of streams and wetlands buffered by natural vegetation, three quarters with trees;
- 40 per cent canopy cover in urban areas (currently between 23 per cent and 30 per cent in the Grand's five large urban areas)
- A minimum of one big block (more than 400 hectares) of forest per ecoregion

During the heyday of tree planting in the 1980s, the GRCA planted almost a million trees annually. Big cutbacks in government funding for tree planting mean that the GRCA now plants less than 200,000 trees annually, even after funding has crept up. But this is not nearly enough to meet the green infrastructure needs of the nearly one million residents and the ecosystems we depend upon.

Trees for the future

Governments are making tree planting a priority and are setting targets. The first two municipalities to set targets are Brantford and Guelph/Eramosa Township.

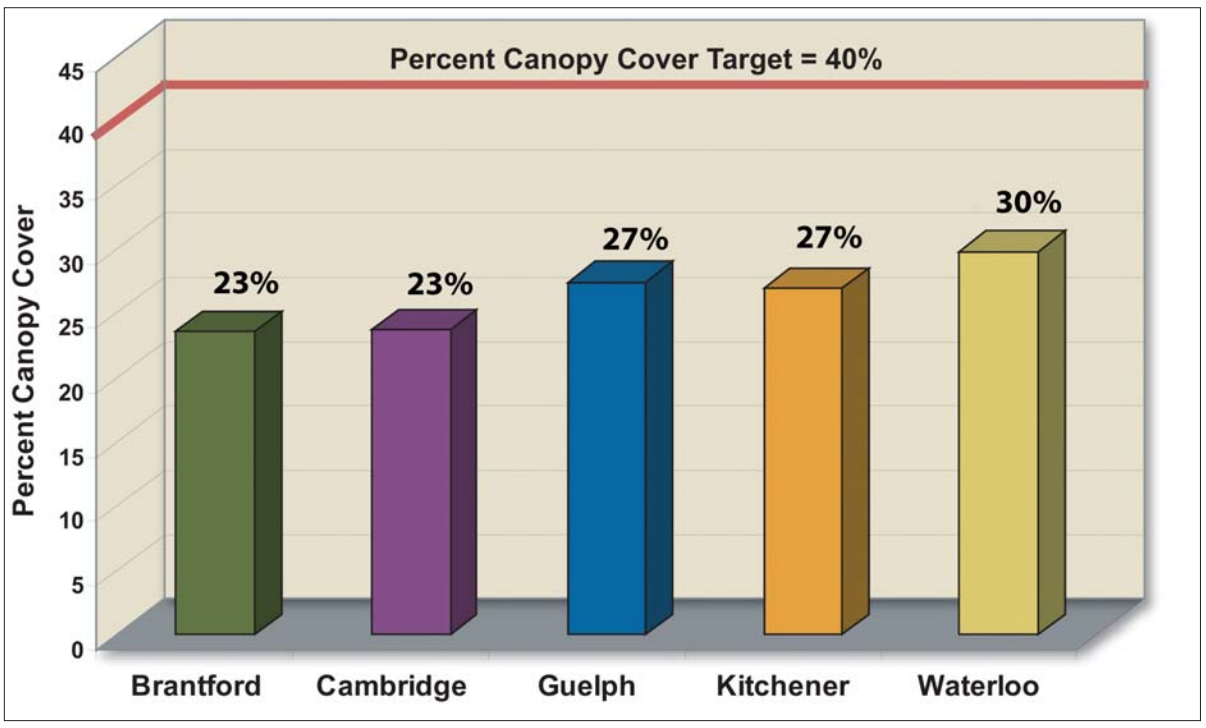
In 2008 Brantford adopted a 40 per cent canopy cover target. Guelph/Eramosa Township has set the same target for urban areas and a 30 per cent forest cover target in rural areas.

Wellington County is planting 150,000 trees annually grown at its new tree nursery. The province has committed funds to plant more trees through the Trees Ontario Foundation by providing incentives. Schools, landowners, community groups and corporations are all increasing their efforts to plant trees. Still, it is not enough.

"We need to severely accelerate the rate that we are planting trees. At the current rate, it is going to be a few lifetimes before we get to 30 per cent forest cover. This is just not going to be fast enough to keep pace with climate change," said Martin Neumann, GRCA supervisor of terrestrial resources. "The need to bolster watershed resilience in the face of climate change suggests we must reach 30 per cent within one lifetime."

The GRCA is a leading force in watershed tree planting, extension, and support of community planting efforts. This leadership position creates an obligation and an opportunity for the GRCA to increase efforts in this area, and to motivate and support others to do the same, Neumann said.

Trees provide many benefits including making the landscape more resilient in the face of severe weather events. They moderate temperatures, slow down erosion and slow the movement of water during and after storms to help resolve water quality and quantity problems. They also sequester carbon, holding it in their trunks, branches and foliage so that it does-



Urban canopy cover
The graph shows the canopy cover in the five cities of the Grand River watershed, based on information compiled in 2004 from satellite images. Canopy cover is the the percentage of a city's area underneath tree leaves.

Working trees

Due to the many benefits of trees to farms, businesses, parks, forests and school yards, people sometimes call them working trees. The 2004 Grand River Forest Plan lists 28 benefits of trees including:

- Clean water
- Provide and clean air
- Store carbon
- Shade and wind protection
- Save energy
- Are food and homes for insects, birds and animals
- Moderate stream flows and storm water
- Provide social calming and healing
- Many products such as furniture and paper come from trees

n't re-enter the atmosphere.

Since it was founded 75 years ago, the GRCA has planted more than 26 million trees, about half of these on private land working with thousands of landowners. Recent plantings have been through the Rural Water Quality Program (RWQP) on stream banks and windbreaks. This has been a great success, but these tend to be relatively small plantings that are also relatively expensive.

Since 90 per cent of the land in the watershed is privately owned, there are huge opportunities to increase forest cover on private land.

Restore habitat

The GRCA owns about 1,400 hectares of leased agricultural land, much of which is destined for tree planting. Even though most GRCA land is already forested, there is still opportunity to restore habitat on these lands, as well as acquire areas to naturalize. New acquisitions near existing GRCA land increases the size of large core natural areas, and this is an important goal of the GRCA's land acquisition program.

Many community-based organizations have sprung up over the past decade that plant trees and these organizations continue to proliferate. Thousands of students, employees, group members and their families are engaged by these programs as they get their hands dirty to improve the environment in their own communities.

There is nothing more satisfying than going back a few years later to see the forest taking shape and feeling the sense of satisfaction that you helped make this happen.

"Engaging the community is really important because this increases community stewardship," said Neumann.

Trees and C02

Climate change is the result of releasing excessive amounts of carbon dioxide (CO_2) and other greenhouse gases into the atmosphere. Carbon dioxide is absorbed by trees, plants and crops through photosynthesis. It is stored as carbon in trees and plants — in tree trunks, branches, foliage and roots. It is also held in soil.

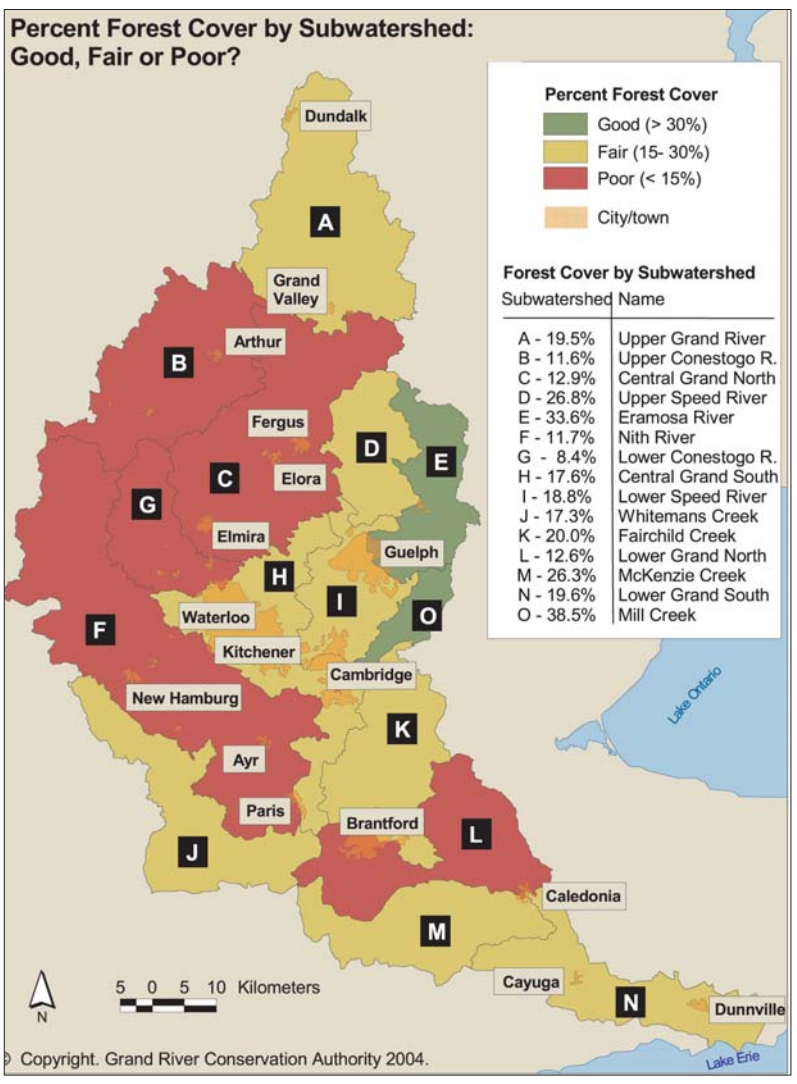
Because trees store carbon, planting more trees is a way to lessen the impact of climate change — but this means planting trees at a much quicker pace than is currently being done.

According to research in North America, the average rate at which a growing forest sequesters carbon is 6.5 tons/ha/year (estimated as trees being spaced at 3m x 3m spacing).

The goal of the GRCA planting program is to put at least 200,000 trees into the ground each year.

That many trees would sequester 1172 tons of carbon per year. The amount would grow each year as the first trees matured and new trees were added. By the 20th year, 246,120 tons of carbon would be sequestered.

Volunteers plant trees at Laurel Creek Conservation Area in Waterloo as part of the Sunoco Earth Day event in 2008. They were replanting an area cleared of pine trees after they became infested by pine shoot beetles.



Forest cover across the watershed

Environment Canada recommends that a healthy watershed should have forest cover of 30 per cent. This map shows the forest cover in the subwatersheds of the Grand River based on data compiled in 2004.

Controlled burns, such as this one at the GRCA's Apps Mill property near Brantford, help to restore prairie landscapes that were once common in the area. Fire is a natural part of the life cycle of prairie areas.

The GRAND RIVER CONSERVATION FOUNDATION

Foundation, partners work to restore natural areas

One of the most important goals of the Grand River Conservation Foundation is to give people the opportunity to enjoy, and learn, from nature.

Two recent projects developed by the foundation and community partners in Cambridge and Woolwich Township are great examples of that.

The Cambridge project is the construction of two new ponds near Fishermills Creek to replace a larger pond that was lost when an old dam failed in 2000.

The Woolwich Township project is the rehabilitation of old gravel pits in the Snyder's Flats area, across the river from Kitchener.

"The mandate of the foundation is to enrich the natural values of the Grand River watershed," said Sara Wilbur, the foundation's executive director. "We are delighted that the community is contributing to do just that."

The Fishermills project was a case of the foundation working with a neighbourhood to meet its objectives in an environmentally-friendly fashion.

When the dam failed, residents in the area lost the old mill pond which had been a focal point of their community. From an environmental point of view, though, the loss of the pond helped improve water quality in the stream and made it a better habitat for coldwater fish and other species.

A study showed that it was possible to protect the newly restored stream and also provide some of the amenities provided by the old pond. Two new, smaller ponds would be created "offline," that is they would not be linked directly to the stream so it could continue to flow without obstruction.

The foundation and neighbourhood residents, led by Brian Hiff, launched a campaign that raised more than $158,000 for the work, including an Ontario Trillium Foundation grant that was landed by the Cambridge North Rotary Club. The GRCA also contributed $30,000. One of the ponds will be named Schiedel Pond to recognize the support of Schiedel Construction and the GreenHorizons Group of Companies. Stantec Engineering donated its services to manage the work which started in August.

Naturalizing gravel pit area

At Snyder's Flats, work is progressing on naturalizing areas near former gravel pits thanks to a donation of $180,000 from the Kitchener-Conestoga Rotary Club as well as support from the Trees Ontario Foundation and the Good Foundation Inc., in memory of Milton R. Good.

Snyder's Flats is owned by the GRCA which extracted gravel from the property between 1979 and 1987. The work was done in such a way as to facilitate the restoration of the property when extraction ended.

Several ponds were developed to provide habitat for fish, birds and other creatures.

This new phase of work involves construction of a trail called the Rotary Walk and creation of a Rotary Forest. About 56,000 native trees and shrubs will be planted to restore forests and grasslands.

The new native species will eventually push out invasive species that took root after the gravel extraction was complete.

The opening up of the Fishermills and Snyder's Flats area to public use is an important goal of both projects, noted Wilbur.

These projects are a natural extension of the work the foundation has been doing for years to support the outdoor education programs of the GRCA, noted Wilbur.

"As our communities grow, we are going to need places like this, especially for kids," she said.

Members of the RBC's Southwestern Regional Team help out during a tree planting at Snyder's Flats in July.

Partners in the Fishermills Project with the plans for new ponds along the creek: Sara Wilbur, executive director of the GRCF (left); Warren Yerex, retired aquatic supervisor of the GRCA; Catherine Collins of the Trillium Foundation; area resident Brian Hiff, and Steve Witteveen, retired president of the Cambridge North Rotary Club.

You can help, too!

For more than 40 years, the Grand River Conservation Foundation has improved our quality of life by enriching the natural values of the Grand River watershed and encouraging people to enjoy, and to learn from, the great outdoors.

For more information:

- phone toll-free 1-877-29-GRAND
- e-mail foundation@grandriver.ca
- click on www.grcf.ca

Learn more about the Grand River Conservation Foundation at *www.grcf.ca*