News for the residents of the Grand River watershed

Watershed report

The GRAND

GRAND RIVER CONSERVATION AUTHORITY

Fall 2007

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The new challenges

Population growth and the potential for climate change are two big challenges facing the Grand River watershed. What strategies can be used to make sure the natural systems remain strong and can adapt to the future?

Along the Grand

THE GRAND RIVER
A Canadian Heritage River

The GRCA
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A Message FROM THE CHAIRMAN AND THE CAO

There's an old adage that advises people to "think globally and act locally" when confronted by environmental problems.

It was coined in the days before "global warming" and "climate change" became part of day-to-day conversation. But the ideas summed up in the slogan are even more relevant today, when environmental issues are among the top concerns of many Canadians.

We all know there are things we can do as individuals to reduce the potential for climate change. Hybrid cars, long-lasting light bulbs, energy efficient appliances – they're among the strategies that many individuals have adopted as they think globally.

As important as that is, we also have to keep in mind the need to "think locally," too. The natural systems and resources of the Grand River watershed are going to be strained by the twin pressures of climate change and population growth.

We need to think about ways to make the natural systems of our watershed stronger in order to face those pressures. In a word, we need to make our watershed more resilient.

Growing population will increase the demand for water. What can we do to conserve the water resources we have to make sure they're used in the most appropriate way?

Growing population will mean more sewage to be treated and more effluent from sewage plants going into our rivers. How can we make sure the rivers remain healthy?

Climate change could mean changes in weather patterns – bigger rainstorms, drier summers. What do we need to do to our infrastructure as well as our monitoring and warning systems to cope?

The forests and wetlands of the watershed have been under pressure for centuries, virtually disappearing to make way for the cities and farms of today. How can we protect the remaining natural areas and develop new ones, while making them hardy enough to withstand new threats?

There are a lot of things we can do to meet these challenges. We have to limit the expansion of our urban footprint, to protect remaining natural areas and farmland. That will mean higher density in our cities, a fact which municipal councils are already addressing.

The way we build our cities will have to change. We need to make sure that water can still infiltrate the ground to replenish our important groundwater aquifers. That will mean fewer impermeable surfaces and more stormwater management systems to get runoff to the right places.

We'll need to change the ways we build our homes, factories, offices and shops. Recycled water and green roofs will be among the ways we conserve water and save energy.

We'll need to protect our agricultural base and also ensure that farmers continue to adopt methods that will protect the environment. Just as we talk about "smart growth" for our cities, we need to talk about "smart agriculture" for our rural areas.

The bottom line is that we all need to become advocates for a more sustainable way of life. That doesn't mean a poorer life. In fact, it can mean a richer one where we live an environmentally sound lifestyle today without impoverishing our future.

Alan Dale
Chairman

Paul Emerson
Chief Administrative Officer

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.

They speak on your behalf at the GRCA.

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, Sean Strickland

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

Regional Municipality of Halton: (Halton Hills and Milton) – Barry Lee

City of Hamilton: Anna Kramer

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

Facing the new challenges

Population growth and climate change are putting more pressure on natural systems. Making the Grand River watershed more resilient is a way to deal with both.

Everybody's talking about climate change. And lots of people are doing something about it.

Yet there are more questions than answers about what climate change will mean, especially on a local level.

Climatologists are still building computer models to help them map out what the future might hold for the world's weather patterns. However, even the most sophisticated model can't predict what will happen in an area that is as small as the Grand River watershed.

More flexible

That's why environmental experts talk about making a watershed more "resilient." That means the natural systems are strong and flexible enough to cope with a wide range of potential changes while maintaining their structure and function.

In the Grand River watershed we have seen what can happen when natural systems lose their resiliency. When the settlers cleared the land in the 19th century to develop farms and towns, they sapped the watershed of its ability to adapt. The results were higher floods, groundwater springs that dried up, significant soil erosion, a decline in water quality and the loss of many species of birds, animals and plants.

Over the past century, a lot of effort has gone into trying to restore the resiliency of the watershed. More than 25 million trees have been planted through GRCA programs to rebuild the forests. Wetlands have been protected and some lost ones have been restored. Farmers have adopted new methods to reduce erosion. Local, provincial and federal laws now protect many natural areas and the creatures that live in them.

However, as we race to rebuild the resiliency that was lost, the natural systems of the watershed face new levels of stress not only from the prospect of climate change, but also from the reality of population growth.

Growth area

The Grand River watershed is an area destined for significant population growth in the next 25 years. It's driven, in part, by spillover from the Greater Toronto Area.

However, the cities of the Grand River are also attracting residents in their own right, from across the country and around the world. Waterloo Region has been identified as one of the "primary economic drivers within Ontario" with much of its growth coming from international immigration.

A study done by the provincial government to support its Places To Grow planning policies, shows the population of the urban areas of the watershed will rise by 57 per cent by 2031, compared to 2001.

The study took a look at Brantford and Brant County, Guelph and Wellington County and the Region of Waterloo. Combined, they had a population of 780,000 in 2001. By 2031, those same communities are projected to have a population of 1.2 million. Waterloo Region and Guelph-Wellington would see population growth in excess of 60 per cent, while Brantford-Brant was projected to grow by 34 per cent.

Affects environment

The provincial study noted the potential effect on the environment as municipalities work to cope with the additional demand for drinking water and sewage treatment. It noted that in these communities "there are both water and wastewater limitations associated with groundwater and the Grand River. Addressing these limitations could, potentially, be very expensive."

Municipalities are conducting studies of their long-range needs for water and wastewater systems in order to meet the additional demand. Not only are they thinking about where they will get enough water to deal with future growth, they're also implementing water conservation programs to make sure the water is used as efficiently as possible.

When it comes to sewage treatment, municipalities are not only looking at increasing the capacity of their plants, they're also looking at higher treatment standards in order to limit the impact on the river from the treated effluent.

The Places to Grow document said that it will be important to recognize the linkages among the natural features of the watershed "which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems."

Changing landscape

Two aerial photos taken of the same section of southwest Brantford show how rapidly urban growth has changed the landscape in just six years. This section of Brantford was designated for residential development more than 25 years ago,but little construction took place until this decade.

Mapping out climate change scenarios

Even though there is no certainty about what climate change may do to the Grand River watershed, it is possible to project some likely scenarios.

Start with the assumption that the average temperature will be slightly warmer in this part of the world. What might be expected to follow?

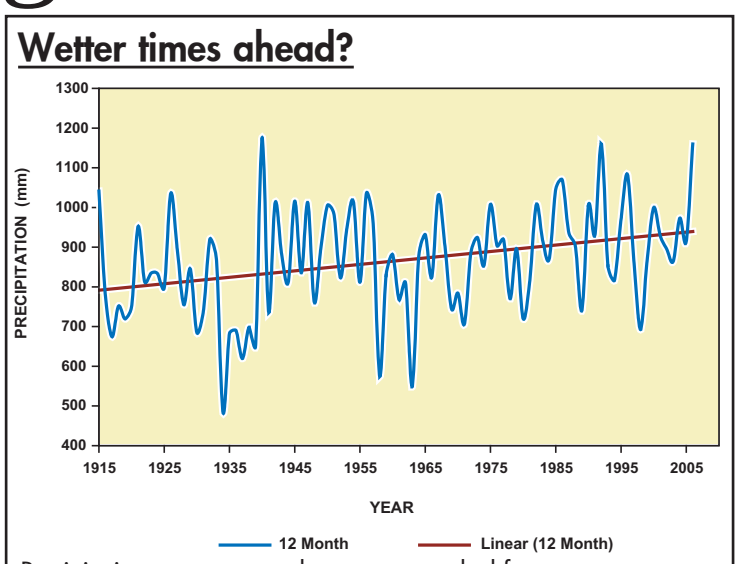
The answer isn't always the obvious. For example, it's quite possible that warmer weather could actually lead to more snowfall. Similarly, warmer weather could bring both longer dry spells and more rainfall.

Those seeming paradoxes point to the importance of building a "resilient watershed" that can cope with both droughts and deluges.

The climate of the Grand River watershed has always been marked by a great degree of variability. Not only is there the natural progression of the seasons, there are also some longer term cycles that affect our weather.

For example, in the past century the watershed has seen extended dry periods every 30 years or so – in the 1930s, the 1960s and the 1990s.

In each case, there was a human response. The drought of the 1930s led to adoption of reforestation and soil conservation programs in many parts of the province. After the drought of the 1960s, new reservoirs were built, including several in the Grand River watershed. The long dry spell of the 1990s encouraged municipalities to adopt lawn watering restrictions and other water conservation programs.



Precipitation amounts can change a great deal from year to year, but this graph shows an upward trend over the past 100 years. This may point to wetter weather ahead as a result of climate change.

The question researchers ask is whether a warmer climate would result in more frequent or longer droughts.

More snow?

They wonder, as well, about precipitation in its various forms. One line of thought is that a warmer climate could lead to more snowfall. Winter winds coming off unfrozen Lake Huron and Georgian Bay could pick up more moisture, dropping it as snow in the northern sections of the watershed. If that snow were to melt more rapidly during a warmer spring, that would create the potential for more, and bigger, spring floods.

Similarly, a warmer overall climate could extend the thunderstorm season into the spring and fall. Violent storms can cause localized flooding, particularly in urban areas, as the storm sewers are pressed to their limit to carry the water away from streets and buildings. For example, massive thunderstorms hit the area west of Elmira in June 2004 and Cambridge in September 2006. In those storms about two to three months worth of rain fell in just a few hours.

Storms that strike in the spring, before vegetation has established itself for the year, could result in more erosion.

The 2004 Elmira storm provided some good lessons about the benefits of a more resilient landscape. Specifically, it showed what a strong riparian buffer can do. (A riparian buffer consists of the trees and shrubs along the edge of a stream or river.)

Many farmers in this part of the watershed have adopted techniques to protect the watercourses flowing through their land. They've planted fences to keep cattle out, which reduces bank erosion. They've planted trees and shrubs along the banks to shore them up even more. On some farms, land close to the water courses is no longer farmed and has been allowed to naturalize.

When close to 200 mm of rain fell in the area on the evening of June 14, 2004 the usually placid streams turned into raging torrents. The water ran chocolate brown as it carried soil washed off ploughed fields.

However, after the waters receded, it became evident that the areas that had been fenced and planted held up remarkably well.

Building a resilient watershed

Building a more resilient landscape means, in part, continuing with many of the tried and true conservation methods that have been in place for many years.

By following those practices we can build a resilient watershed that will continue to function even in a time of climate change.

Some of the ways to build a more resilient landscape to reduce flooding include:

■ Building strong riparian buffers along streams and rivers

■ Enhancing and restoring wetlands. Wetlands will often fill up following the spring thaw or after rainstorms. That's water that is kept on the land rather than running down to the stream or river.

■ Reforestation. The shade provided by trees will slow the spring snow melt, reducing the amount of water run off the land when the warm weather arrives.

■ Building our urban areas in such a way that water can still soak into the ground rather than running off to the storm sewers

■ Implementing stormwater management programs. Stormwater management plans are a part of most new development these days. They hold water back from streams and rivers.

Many of these elements are pulled together in subwatershed plans which are used to map out the best ways to protect the natural environment in areas subject to urban development.

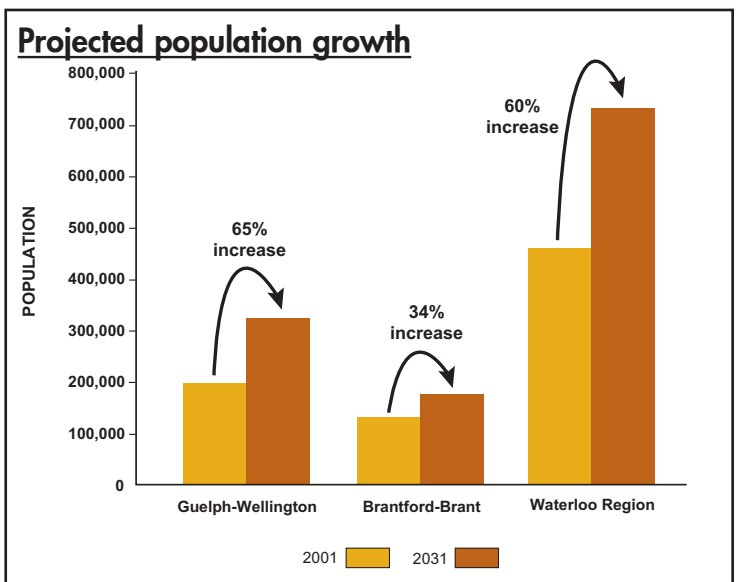
More benefits

However, the benefits of these activities go far beyond their impact on flood control. A more resilient landscape is also a healthier one.

■ Reforestation and wetland programs enlarge the habitat of birds and animals putting them in a better position to withstand long-term changes in the climate.

■ Trees help clean and cool the air. They also sequester carbon which helps to limit the buildup of greenhouse gases.

■ Allowing water to get into the ground recharges aquifers which provide much of our drinking water. Springs from these aquifers also feed many rivers and streams, keeping them flowing even during dry weather.



A study of population patterns in the Grand River watershed, commissioned by the provincial government as part of its Places To Grow planning strategy, shows rapid growth in the urban areas over the next 25 years.

Fish story

They tell a tale about water quality

A practice called "electrofishing" is used to find out what types of fish live in a stream. An electric current in the water momentarily stuns the fish allowing researchers to collect them and record their species, size and weight. The information is useful when developing plans to improve a fish habitat and monitor changes.

Want to know the temperature of the water flowing through your favorite stream?

Ask the fish.

Or, to be more precise, study the fish species in the stream. Some species like their water cold while some like it warm.

If you spot brook trout swimming beneath the surface, odds are that the water temperature is less than 18C. But if you see a school of carp, the water may be a lot warmer, perhaps 30C or higher.

The reason is a combination of chemistry and biology: some fish (brook trout) are more active and need a lot of oxygen; others species (carp) live a more sedate lifestyle, so they don't need as much oxygen to get along. Cold water holds more dissolved oxygen than warm water. In a laboratory setting, water that is 15C will hold about one-third more oxygen than water that is 30C.

Aquatic biologists, who worry about protecting species in the Grand River watershed, pay a lot of attention to water temperature because they want to make sure that every native species has a home.

But water temperature matters to people too, because there's a link between water temperature, dissolved oxygen and the role watercourses play in our sewage treatment processes.

29 sewage plants

There are 29 sewage treatment plants in the Grand River watershed, handling the sewage from 700,000 residents. The treatment plants get rid of almost all of the material in raw sewage, eliminating more than 90 per cent of most pollutants such as phosphorus, suspended solids and organic material. The treated effluent flows from the sewage plants into a receiving river or stream.

Brook trout need cold, clean water to survive, so their presence in a stream is an indicator of good water quality.

The clean up process doesn't end there. It carries on in the river. Plants and algae in the river absorb phosphorus and other nutrients. As the river tumbles over rocks and through rapids it is aerated – takes in oxygen – which aids the breakdown of pollutants. Naturally-occurring bacteria will consume organic material, a process that uses up oxygen.

However, there's a limit to what the river can do and only so much effluent it can handle. Excessive levels of nutrients can result in too much plant growth, which reduces oxygen during the night. When oxygen levels drop too low, fish will swim away to waters richer in oxygen; in extreme cases, they may literally suffocate to death.

Need oxygen

The volume of pollutants that a river or lake can deal with is called its "assimilative capacity." There are many factors rolled up into assimilative capacity, including water temperature. Cold water has more oxygen to break down pollutants, support a diverse aquatic community and still give fish what they need to survive.

Unfortunately, during the last 200 years, the waters of the Grand system have lost some of their assimilative capacity as they have warmed up because of the many changes human beings have made to the landscape.

The prospect of population growth and warmer weather brought on by climate change raises the possibility that the assimilative capacity of the river system will be stretched even further if water temperatures rise.

It could also put more pressure on the river system as a habitat for coldwater species.

On the other hand, if steps can be taken to keep water cooler, then it will be is easier to adapt to the possibility of warmer, dryer weather without causing significant changes to the ecosystem.

One of the most effective ways to do that is to protect existing coldwater streams and restore others. That will make the Grand River system more resilient in the

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Taking action

Here are some actions that will help keep water cool:

- Provide shade: Trees and shrubs along a stream will shade the water, keeping it cooler. If a stream already has good tree cover, leave it in place. If it needs more cover, plant some trees and bushes.
- Keep the water moving: Dams and ponds slow the water down, giving it a chance to heat up in the sun. Unneeded dams and ponds should be removed.
- Naturalize the stream channel: Stream beds that have been straightened or lined with concrete can lead to warmer water. Narrow and deep stream channels will keep water moving faster and allow cold groundwater to seep into the stream from the banks. Water will also pick up more oxygen as it tumbles over rocks.
- Encourage water to seep into the ground: Water needs to get into the ground so it can be naturally cleansed and cooled before it resurfaces in a spring or seep. In urban areas, that means using a stormwater collection system to channel water from rooftops, parking lots and streets into areas where it can enter the ground. In rural areas it means protecting wetlands and woodlots and affecting the amount of land that is drained.

Continued from Page 5

face of a challenging future.

The geographic range of many cold water species has shrunk dramatically in the last 200 years.

There is evidence that brook trout were found throughout the Grand River watershed in the middle 1800s. Today, you'd be hard pressed to find a brook trout anywhere in the main channel of the Grand; for the most part, they are restricted to the remaining cold water rivers and tributaries, mostly in the middle section of the watershed.

Based on that, it's possible to conclude that the water temperature in the Grand is at least 10C warmer than it was 150 years ago.

(The brown trout that are the object of angler's attention in the Fergus-Elora section of the Grand and the Conestogo River are a European species that was introduced to the Grand system in the 1980s because they can tolerate higher temperatures, up to 24C.)

What caused the Grand River system to warm up?

Most cold water streams are fed by springs or seeps – places where water oozes from the ground.

In the Grand River watershed, many of the coldwater streams are fed by water coming from the Waterloo and Galt-Paris moraines, which are major features of the central part of the watershed.

Water coming from springs tends to be about the same temperature year round, usually between 8C and 12C.

Of course, once the water gets to the surface and enters the streams and rivers, it is warmed by the sun.

That's where human activities enter the picture.

Two hundred years ago, the Grand River watershed was almost entirely covered by trees and wetlands. The trees shaded the streams and the wetlands added a regular supply of cool water.

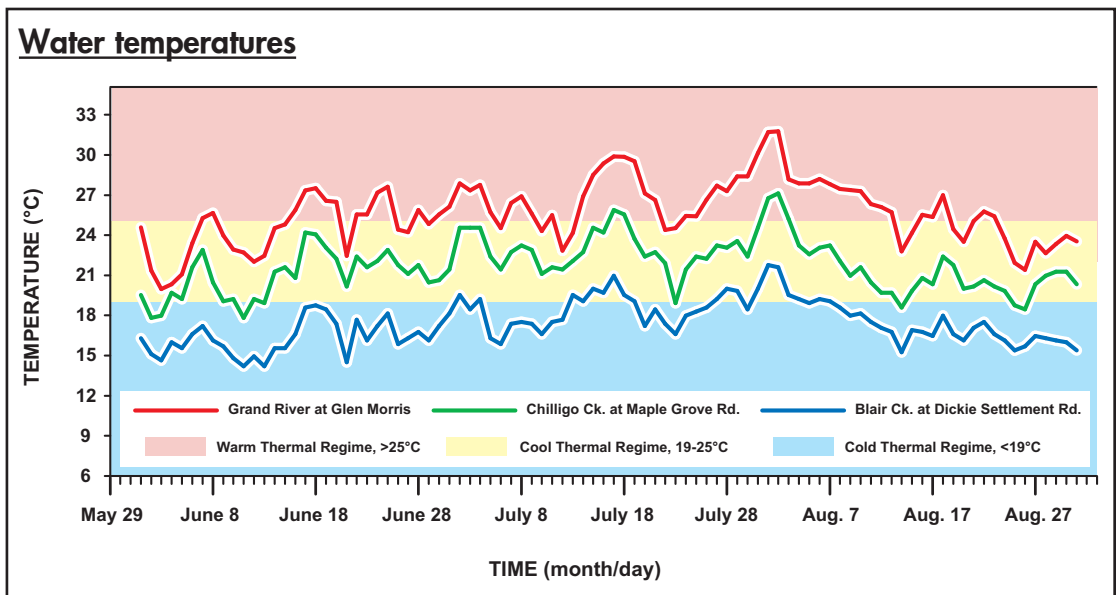
But during the 1800s, the watershed was virtually stripped bare of trees, and most of the wetlands were drained.

Other human actions pushed up water temperatures, too. More than 150 dams were built which stop streams from flowing, giving the water a good long bake in the sun. Some streams were straightened or lined with concrete which had a similar effect.

On farm fields and in cities, drainage systems and stormwater sewers were built to carry water directly across warm surfaces to the river, rather than letting it sink into the ground where it could cool off.

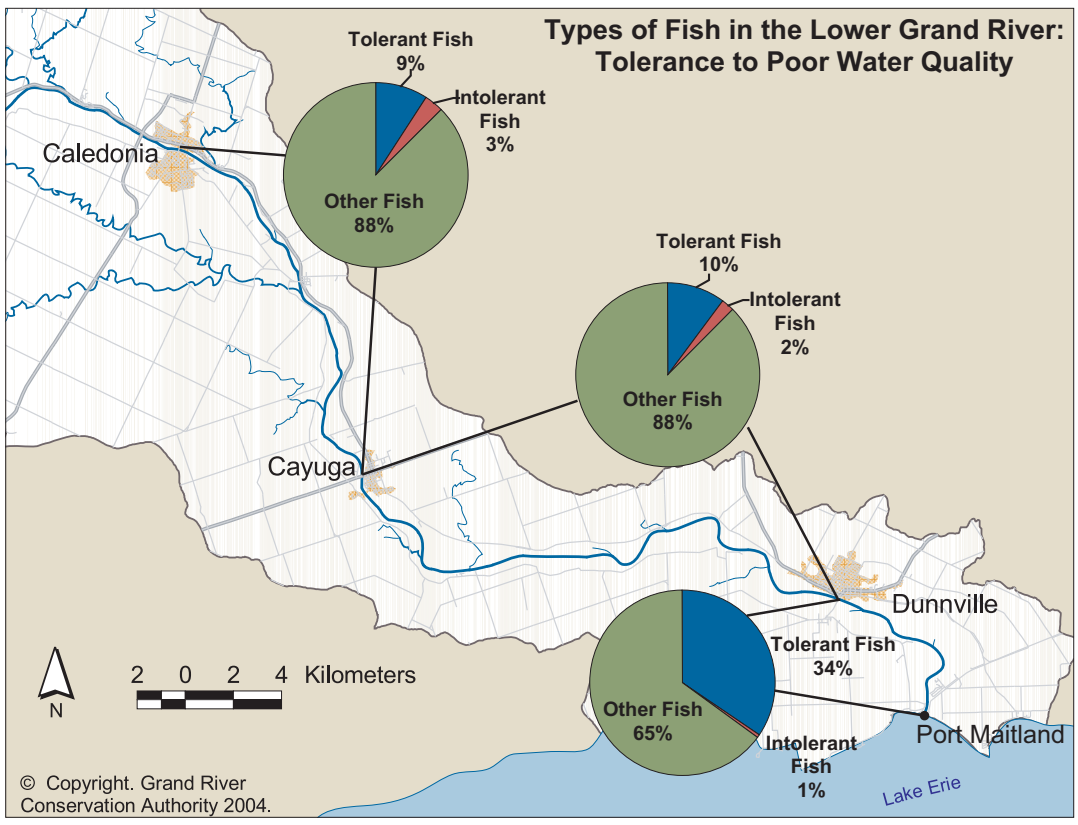
Some studies have estimated that the impact of urban activities can raise water temperature by 5C to 8C.

Water temperatures



Aquatic biologists have divided streams and rivers into three categories, called "thermal regimes" based on the type of fish that will inhabit water of that temperature.

Degrees of tolerance



Different fish have different abilities to tolerate adverse water conditions, such as high temperatures or a narrow range of food supply. These "tolerant" fish do better in areas of lower water quality. The share of tolerant fish increases as you move downstream through the lower Grand River.

Finding advice

- The Rural Water Quality Program: This program, managed by the GRCA and financed by watershed municipalities, provides advice and grants to rural landowners who want to plant trees or fence off streams on their land. For more information, go to the GRCA website at www.grandriver.ca
- Community groups which undertake stream and habitat restoration programs to implement the Grand River Fisheries Management Plan such as the Friends of the Grand River (www.friendsofthegrandriver.com), the Brantford Steelheaders (www.ontariosteelheaders.ca), the Dunnville District Hunters and Anglers, the Ontario Federation of Anglers and Hunters (www.ofah.org) and Trout Unlimited Canada (www.tucanada.org).
- Ontario Stewardship Network: Local stewardship councils, which are supported by the Ontario Ministry of Natural Resources, link landowners with funding, information and expertise to encourage good land management practices and help protect water quality. See the website at www.ontariostewardship.org
- The federal Department of Fisheries and Oceans publishes a series of fact sheets, pamphlets and primers with information on how to protect and enhance streams and rivers. Use your Internet browser to search "working around water Ontario".

A temperature tour of the Grand watershed

Cold water: Blair Creek

Blair Creek flows into the Grand River at the north end of Cambridge after a nine-kilometre journey. Its headwaters are in the Waterloo Moraine, where it is fed by groundwater. It also picks up more cool water as it passes through the Roseville Swamp.

In summer the water is less than 19C on most days and is cold enough to support brook trout.

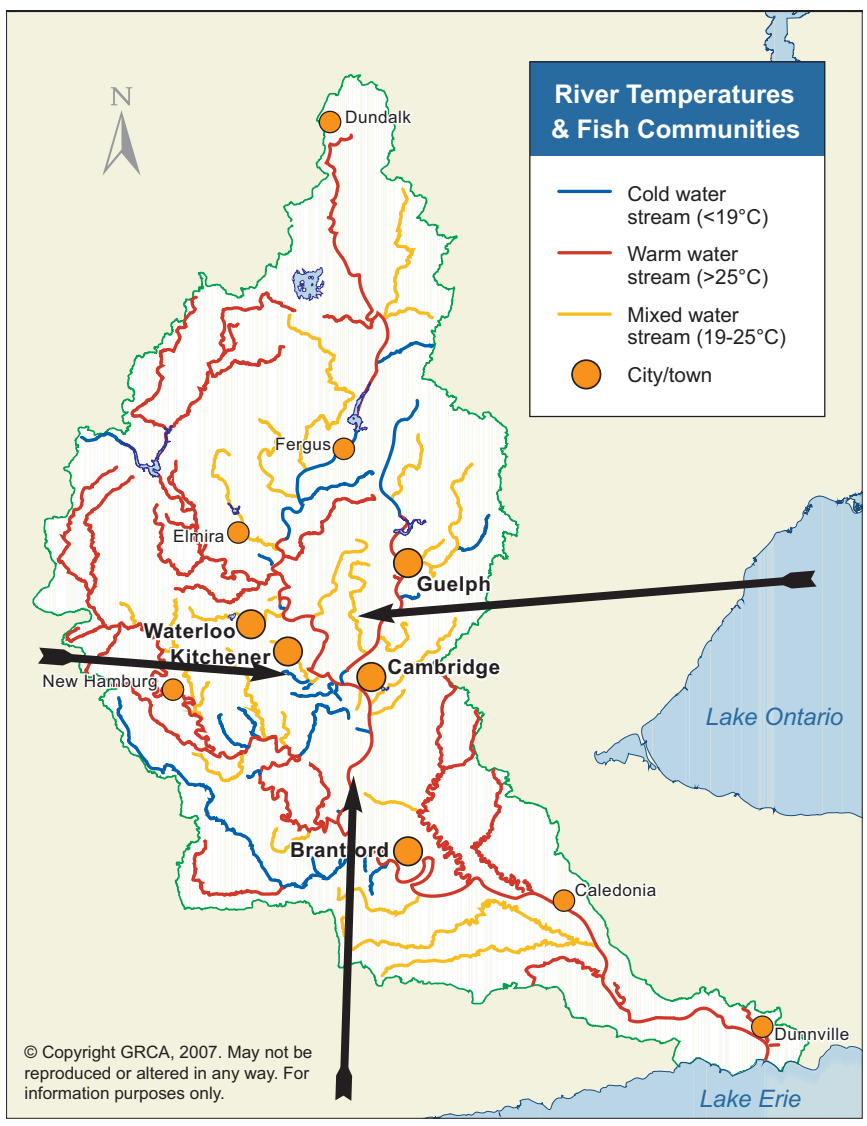
There is some farmland in the Blair Creek watershed, but not much urban development – yet. The stream banks are well-vegetated and there are many forested patches of land in the area. The stream and nearby land support deer, several varieties of hawks, and many species of amphibians and reptiles.


The historic Sheave Mill

Urbanization of some parts of the Blair Creek watershed is starting to occur, but it will take place within carefully developed guidelines in a subwatershed plan that will protect the stream and its nearby natural areas.

The stream valley and nearby wooded areas will be protected from development. There will be limits on the amount of "impervious cover" – roads, sidewalks, parking lots, roofs – allowed in the area in order to maximize the amount of water entering the ground.

Some of the water from eave troughs and streets will travel through stormwater collection systems to "infiltration galleries" to soak into the ground. The stormwater management system will also help take out impurities from the water before it enters the ground or stream.




There's little shade along parts of Chilligo Creek.

Mixed water: Chilligo Creek

Chilligo Creek flows 44 kilometres and drains about 55 square kilometres of territory in the triangle between Kitchener, Guelph and Cambridge. It flows into the Speed River near Cambridge (Hespeler).

Chilligo Creek would be a cold water creek today were it not for the many human activities that have resulted in a higher water temperature. Water runs off the land from farms and a golf course into the stream. In many areas, there are no trees or shrubs to shade the stream from the summer sun. There are several ponds along its length where the water warms up before moving along.

The water temperature in the stream fluctuates between 19C and 25C.

Some steps are being taken to help lower the temperature of Chilligo Creek and improve water quality.

When a small dam started to fail a few years ago, it was not replaced which meant that Fisher Mills Pond disappeared. Chilligo has carved a new, meandering path through the area and vegetation has sprouted up to shade it.

Some farmers in the area have taken advantage of grants from the Rural Water Quality Program to fence off the stream or plant trees and shrubs along its bank.

Warm water: Grand River at Glen Morris

As the Grand River flows through Glen Morris – a hamlet midway between Cambridge and Paris – it's not unusual to see water temperatures exceed 30C during the hottest stretches of summer, which is five degrees above the definition of warm water.

The river is wider here, so much of it is exposed to the heat of the summer sun.

The Grand has covered a lot of ground by the time it hits Glen Morris. It's received the water from large and small tributaries, many of them warmwater streams. The water has passed through cities such as Guelph, Waterloo, Kitchener and Cambridge where it has picked up a lot of runoff from city streets.

It's been through a lot of prime agricultural areas where land is plowed or cattle are pastured right up to the river's edge, with hardly a tree to shade the water.

Two views of Mill Creek

The aerial view of the Taquanyah reservoir site in 2005 (left) shows the mud flats that were left when the reservoir was drained the previous winter. The photo at right shows Mill Creek in 2006 after the natural recovery of the stream channel.

Down by the cold Mill stream

Water temperature dropped in stream after dam removed

Mill Creek is a rarity in the southern end of the Grand River watershed.

It's a cold water stream in Haldimand County, a part of the watershed where warm water is the norm.

Water from Mill Creek enters the Grand River just north of Cayuga. The stream is fed by cold water coming from a crack in limestone bedrock close to the surface.

However, until two years ago, the water that flowed from Mill Creek into Rogers Creek and then into the Grand was anything but cold.

That's because before it could get to the river, the water first had to sit in the 37 hectare (90 acre) reservoir created by the construction of the Taquanyah Dam in the 1960s.

The dam was built by the GRCA on the heels of a prolonged dry spell to store water for both recreation and irrigation.

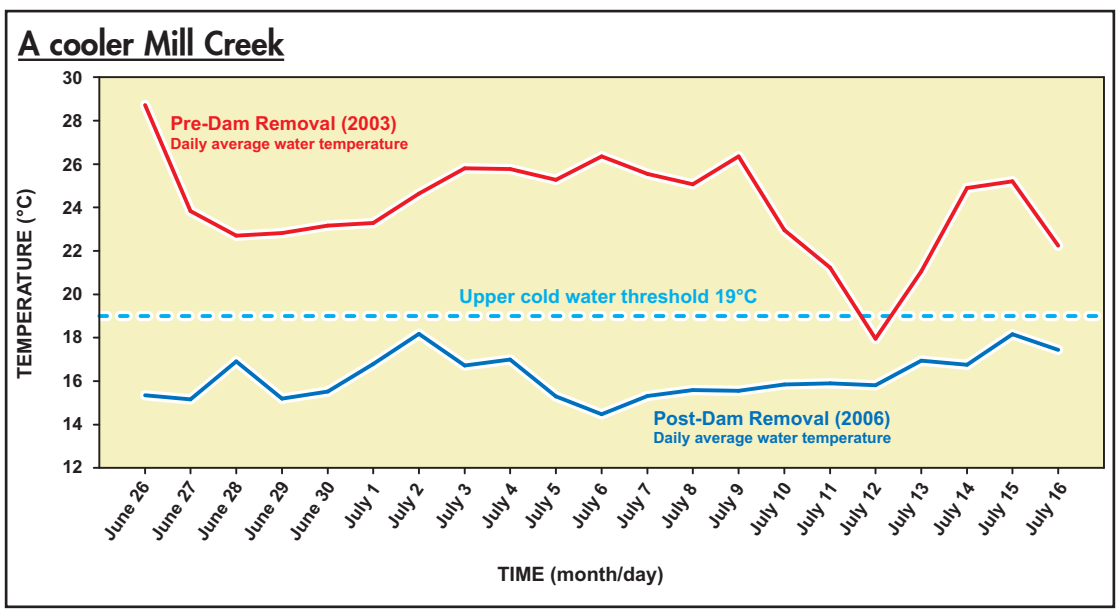
However, sometime in the 1980s somebody put some carp in the reservoir; they flourished, aquatic vegetation was dislodged and the water became turbid and murky. The wildlife value of the reservoir deteriorated.

In the late 1990s, a local group called Habitat Haldimand pursued a plan to revitalize the creek. They worked with representatives of the GRCA the Ministry of Natural Resources, fishing, hunting, nature and community groups to develop a plan to drain the reservoir and naturalize the creek.

The drawdown of the reservoir occurred during the winter of 2004-05. Since then the stream has carved out a new course across the former bed of the reservoir.

More than 2,000 trees and shrubs – natives species such as cedar, oak, hickory and soft maple – have been planted along the new stream's meandering course. Other plans are in the works to build new wetlands near the stream and restore the slough forest.

Landowners in the area have played an important part in the restoration of Mill Creek. Downstream landowners have planted trees and shrubs along the creek and fenced it to keep livestock out.



This chart shows the change in summer water temperatures in Mill Creek as a result of the decomissioning of the Taquanyah Dam and the drawing down of the reservoir.

Temperature dropped

As a result of this work, the water temperature in Mill Creek reaching the Grand has dropped by about 8C, enough to turn it from a warm water stream back to a cold water stream.

The cooling effect of this oxygen-rich water can be measured where it enters the Grand River. That will help this section of the Grand where it's not unusual to have water temperatures of 30C or higher in the summer and where some spots are very low in oxygen.

Mill Creek could sometime become a spawning stream for pike, walleye, rainbow trout and suckers.

Finding water in your backyard

Lawn watering bylaws have put a big dent in summer water use

The population of the Grand River watershed is growing and municipalities are thinking about where they'll get the water to serve all of their new residents.

Over the long term – 25 years or more – some are looking at tapping into new sources of water, from additional wells to a Lake Erie pipeline.

There are, though, some short-term issues facing the municipal water systems. Long dry summers, tighter provincial regulations and infrastructure limitations have led municipal water managers to think about ways of making better use of existing resources.

The payoff for tackling those issues now is that it gives the municipalities more flexibility as they think ahead to their long-term solutions.

In their search for answers they're finding one – literally – right in their own backyards.

It's the significant savings that have come with lawn watering rules.

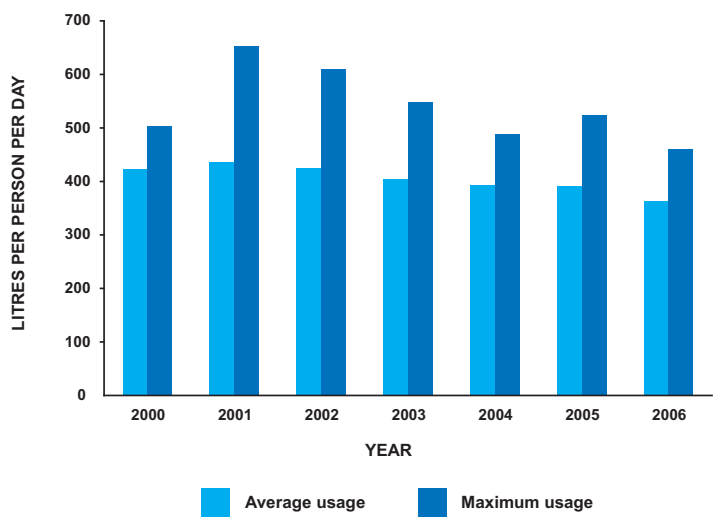
To borrow a phrase, a litre of water saved is a litre earned. It's far cheaper and easier to save a litre of water than it is to find, treat and distribute a new one.

Outdoor water use restrictions have already put a big dent in water demand in the five cities of the Grand River watershed, especially in the hot dry days of summer when systems are strained by sprinklers.

The programs have worked so well that water conservation is now an important part of municipal long-term water strategies. The three major urban areas – the Region of Waterloo, Brantford and Guelph – have seen total water demand remain steady, or even drop, while their populations have grown.

Homeowners probably aren't aware of how much water they're putting on their lawns when they turn on their sprinklers three or four times a week.

Water use in Grand River cities



Per capita water demand has dropped steadily in the cities of the Grand River watershed as a result of water conservation activities, especially lawn watering rules. "Average usage" is the amount used for normal day-to-day activities in homes, businesses, industry and institutions. "Maximum usage" is the peak flow on the busiest day of the year which usually occurs in summer.

But it's a lot, and in the years before the watering restrictions were imposed, it was enough to push some municipal water systems to their limit.

A water use study prepared by the GRCA in 2005 showed that over the course of a year, all of the municipal water systems in the Grand River watershed pumped out about 103 billion litres of water a year to meet the day-to-day needs of houses, factories, businesses and institutions. That's about 280 million litres a day.

(The water use statistics in the report were collected in 2001 and 2002, before current lawn watering bylaws came into effect.)

Climbs in the summer

However, from May through October, water consumption went up significantly. In July, total water consumption was about 30 per cent higher, rising to about 360 million litres a day. The extra water totaled more than seven billion litres. Municipalities estimate that as much as 70 per cent of the extra goes into lawn watering. That means as much as five billion litres of water a year in the Grand River watershed could have gone into lawn watering.

To put those five billion litres into perspective, it's not that much less than the amount of water that all of the rural households in the entire Grand River watershed get from their own wells – about 6.7 billion litres a year. It's about three times all of the well water used by water bottlers – about 1.7 billion litres a year.

Most of the water going into lawns was simply wasted. Lawn experts agree that 25 mm (one inch) of water a week is enough to keep grass healthy. That's the amount from a one or two hour watering session.

But before the restrictions, most homeowners were watering a lot more than that, judging from the big drop in consumption since the bylaws came into effect.

Experts say that most lawns need about 25 mm (one inch) of water a week. Sprinklers would have to run about one or two hours a week to put that much water on a lawn.

Municipal water systems can quite easily handle day-to-day water demands but they have to be a lot bigger to take care of summertime peaks.

Supplies can meet needs

The supply of raw water in the Grand River watershed is not a major hurdle. A water budget prepared by the GRCA shows that there is plenty of water in both the river and groundwater systems to meet projected needs for many years to come, provided the water is used carefully. *(See related story on Page 11.)*

Rather, the issue arises after the water has been pulled out of the well or river. There are limits to how much water can be treated, stored and delivered in a day.

Building a system that is big enough to meet unlimited summertime demand means more water has to be taken out of the environment, treatment plants have to be bigger and more storage reservoirs have to be built. It is an expensive proposition to do

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Lawn watering programs differ, but all show results

Here's a rundown on how the lawn watering programs have worked in the cities of the Grand River watershed.

Waterloo Region

Waterloo Region implemented its current outdoor water use controls in 2005 as a temporary measure after some wells became contaminated. The bylaw limits lawn watering to once a week between May 31 and Sept. 30, which matches the recommendation of lawn care experts.

The results were dramatic. During the summer of 2005, peak water demand dropped by more than eight per cent, more than enough to make up for the loss of the contaminated wells.

Another way to look at it is by comparing the change in the "peaking factor." That's the number that describes the difference in water consumption between the busiest day of the year and an average day.

In 2001, before the bylaw, the peak day was 48 per cent higher than an average day – a peaking factor of 1.48. By 2006, the peaking factor was down to 1.22.

Based on the success of the program so far, Waterloo Region has now made the system permanent, which means it will be in place even after the contaminated wells are cleaned up and brought back on line.

Guelph

Guelph had a similar experience when it passed its current bylaw in 2002. The preceding summers were particularly dry, and the water system was pushed to its limit several times, leaving little capacity to handle emergencies such as a major fire.

Guelph gets almost all of its water from wells, although it sometimes takes water from the Eramosa River in the summer.

Guelph's bylaw allows watering every other day in normal circumstances. However, the city can move to an outright ban when the weather is exceptionally dry. It had to do that in 2002. The result was a drop in consumption of 25 per cent.

The benefits of the program have shown up in lower water use, even in years where there is no ban. Guelph's peaking factor was about 1.33 in 2001 and has now slipped to 1.2.

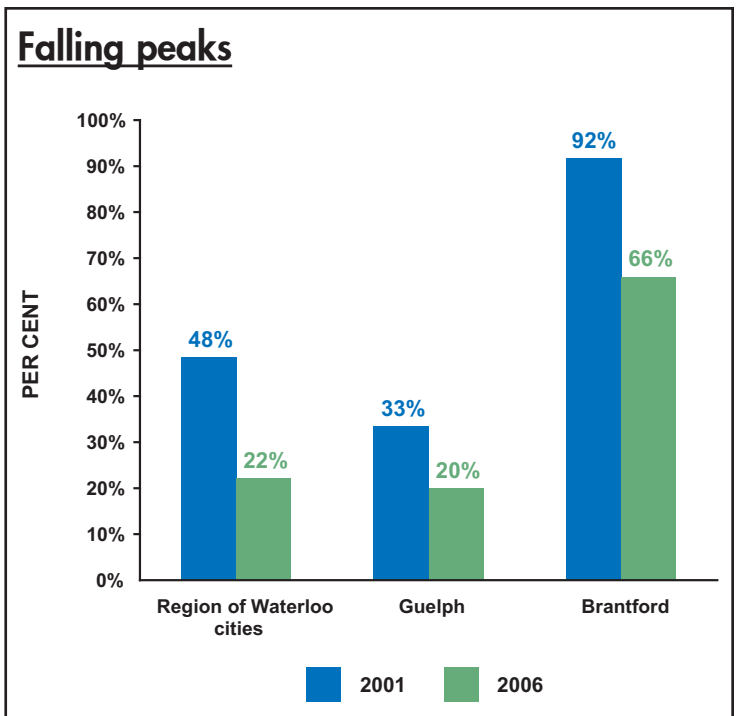
Brantford

Brantford draws all of its water from the Grand River so its supply of raw water is much greater. On an average day, Brantford takes less than three per cent of the water in the Grand.

The Brantford water system has its limitations, too. There are times when the city shuts down its intake because of upstream spills. At those times it depends on stored water. If the city were forced to close its intake during a hot dry spell, the storage system could be pushed to its limit.

Brantford introduced its current outdoor water use bylaw in 2003, which allows watering every other day from June to August. It has seen a sizeable savings, with a 23 per cent drop in the amount of water going into lawns.

Brantford's peaking factor was higher than those of the Waterloo and Guelph systems, but it has also recorded a big decline. Before the bylaw it was 1.92 and now it has dropped to 1.66.



Municipal water managers keep track of the relationship between the average day water use and the peak day water use. In Waterloo Region, for example, peak day consumption was 48 per cent higher than average day consumption in 2001. The major urban areas have all seen significant declines in their "peaking factors" since lawn watering bylaws came into effect.

Finding water

Continued from Page 9

all of that to support a few days or weeks of high demand linked to lawn watering.

The City of Guelph has estimated that it would have to spend as much as $22 million to upgrade its water system to meet the demand from unlimited outdoor water use. Water rates would rise up to 32 per cent to cover the costs.

On top of that, without lawn watering limits, municipalities would have to expand their systems even sooner to meet future demand from population growth.

The Region of Waterloo has already seen benefits from lawn watering restrictions and other conservation efforts. It has concluded it can hold off building a proposed Lake Erie pipeline.

Waterloo Region gets about 75 per cent of its water from wells and the remainder from the Grand River. It operates several systems with one – the Integrated Urban System – serving the bulk of the region's residents in Waterloo, Kitchener, Cambridge, Elmira and St. Jacobs.

Those are high growth areas and the region is working with several other municipalities to study a $700 million Lake Erie pipeline as a way to meet water needs in the second half of this century.

Based on current population projections, regional officials figure they will need the pipeline by 2035. But if it weren't for the lawn watering controls and other conservation programs, the pipeline would be needed by 2029 – six years earlier.

Residents accept need for bylaws

When the lawn watering bylaws were introduced for the cities of the Grand River watershed, municipal governments took care to implement advertising and public education programs to explain both the rules and why they were needed. Still, the rules attracted criticism that they were unnecessary or reflected poor management of water resources.

However, an independent study of the attitudes of Guelph residents found that the criticism was not shared by most residents.

Their study showed "broad support for and satisfaction" with the outdoor water use program.

The study was done by two professors at the University of Guelph – Reid Kreutzwiser and Rob de Loe – plus Christine Atwood, an environmental consultant from Ottawa. Entitled "Resident's Assessment of an Urban Outdoor Water Conservation Program in Guelph," it was published in the Journal of the American Water Resources Association.

'Recognized necessity'

"An overwhelming majority of the respondents recognized the necessity of the water use restrictions and bans," said the study, which reported that 87 per cent of the residents interviewed tried to cut their indoor and/or outdoor water use.

"This contrasts sharply with impressions that one would have formed based on media reports, letters to the editor of local newspapers and resident complaints to municipal politicians," concluded the authors.

Similar results showed up in a survey conducted in Waterloo Region in 2005 in which 87 per cent of the respondents said they were aware of the restrictions and 80 per cent "strongly" or "somewhat" agreed with them.

A high level of public education and consistent enforcement are important to the success of watering bylaws, noted the Guelph report.

The Region of Waterloo, Guelph and Brantford invest tens of thousands of dollars each year in advertising and promotion of the restrictions. They also investigate hundreds of complaints about individuals and businesses watering in violation of the bylaws. Waterloo and Guelph have laid charges against the violators with fines ranging from $130 to $250 for each infraction.

Living within our water budget

Water budget takes a look at water supply and demand

Any discussion about water in the Grand River watershed inevitably leads to one key question: Is the supply big enough to meet the demand?

To get an answer to that question, the GRCA has developed a "water budget" for the Grand River watershed. The water budget is going through its final stages of review and should be published later this year.

The researchers found that even in those areas where the demand is the highest – generally, the central portion of the watershed near the cities – demand is still less than half the available supply.

Just like a household budget, the purpose of the water budget is to measure how much water is entering the Grand River system – which represents "income" – and where it goes — the "expenditures."

The "income" side of the budget consists of the amount of precipitation over the year.

Some of that water runs off into streams and rivers, making its way to Lake Erie. Some of it goes into the ground where it eventually fills areas of loose soil or broken bedrock called aquifers. Those are places where there is enough water to supply wells.

Many factors

Figuring out the "expenditure" side is more complicated because there are several ways withdrawals take place. Developing accurate numbers involves a lot of research using data collected over decades, to get a picture of these factors:

- the amount of water that evaporates or is taken up by vegetation
- the amount of water flowing into rivers and streams
- the amount of water entering the ground to recharge aquifers
- the amount of water that leaves the ground, through springs, to feed rivers and streams
- the amount of water moving around underground from one part of the watershed to another, or even in and out of the watershed.

The water budget shows that over the watershed as a whole, an average of 933 mm of precipitation hits the ground each year. Of that, about 491 mm evaporates or is taken up by plants. About 262 mm runs off through the Grand River's streams and rivers.

About 180 mm makes its way into the ground to recharge the aquifers.

That last number is a significant one in the Grand River watershed. About 82 per cent of the water used by the watershed's 925,000 residents comes from wells, either through municipal systems or private wells. The recharge function helps determine how much water is available.

However, it's not enough to look at the watershed as a whole. The Grand is really a collection of 18 smaller areas, called subwatersheds, each with its own characteristics.

Different soil conditions produce different recharge rates. For example, water soaks into the ground more easily in places where the soils are loose, such as the Waterloo Moraine and the Galt-Paris Moraine. There's more runoff in places where the soils are tighter, such as the western part of Wellington County near Conestogo Lake.

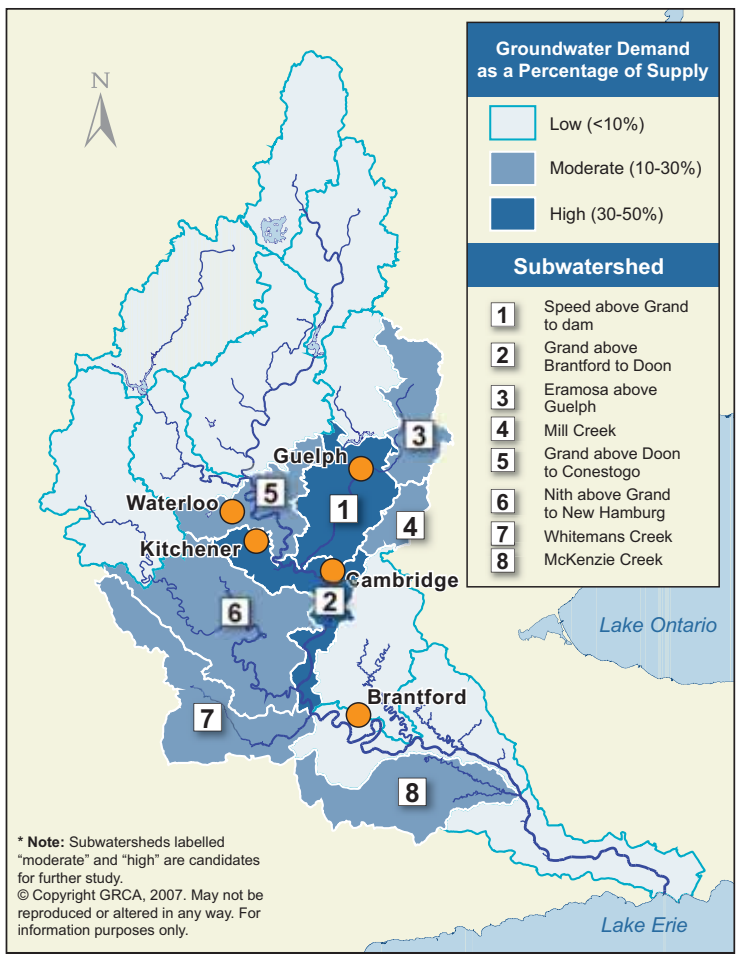
Withdrawals differ, too, in each subwatershed, depending on the population size and the types of businesses and industry.

Low demand

The researchers found that in 10 of the 18 subwatersheds, the demand for groundwater was low compared to the amount available.

Most of these subwatersheds are rural, dotted with towns and villages, and the demand was less than 10 per cent of the water available annually or less than 25 per cent of water available in any one month.

In eight subwatersheds in the central portion of the watershed where the population is greatest, the demand for water is higher. Even in these subwatersheds the peak demand is still less than half of the available water.



The Grand River Water budget highlights areas where water demand is "moderate" or "high" relative to the supply of groundwater. These areas will be the subject of further study to analyze the impact that drought and growing population will have in the future.

More study proposed in some areas

Eight subwatersheds in the Grand River watershed were identified as candidates for further study when the water budget showed high or moderate levels of demand.

High groundwater demand:

- The subwatershed for the Grand River between Doon (Kitchener) and Brantford where groundwater demand is about 44 per cent of the available supply. The Region of Waterloo and Brant County have wells in that area.
- The subwatershed for the Speed River, between the Guelph Dam and the Grand River, where groundwater demand is about 33 per cent of the available supply. That's where the Region of Waterloo, Guelph and Guelph/Eramosa Township have wells.

Moderate groundwater demand

- Eramosa River (17 per cent), with municipal wells serving Guelph and Rockwood.
- Mill Creek, which enters the Grand at Cambridge (24 per cent). It has no municipal wells.
- Grand River between Conestogo and Doon (13 per cent) with municipal wells serving the Region of Waterloo.
- Nith River from New Hamburg to Paris (11 per cent) with municipal wells serving the Region of Waterloo, Drumbo and Plattsville.

High surface water demand

There were only two subwatersheds which showed high demand for surface water because of high rates of agricultural irrigation in the summer. These two subwatersheds also showed moderate demand for groundwater.

- In the Whitemans Creek subwatershed (including Horner and Kenny Creeks) in Brant and Oxford counties, surface water demand can go as high as 76 per cent of supply during peak irrigation periods. Groundwater demand represents 29 per cent of supply in the summer. Princeton and Bright in Oxford County also have municipal wells in this subwatershed.
- In the McKenzie Creek subwatershed, which takes in parts of Brant, Norfolk and Haldimand counties, as well as most of the Six Nations Territory, surface water demand can hit 53 per cent and groundwater demand can reach 33 per cent of supply during irrigation periods. There are no municipal systems in this subwatershed.

New technology gives weather watchers a better picture of storms

New technology is being used in the Grand River watershed to try to predict the unpredictable — the weather.

The engineers in charge of the GRCA's dams and water infrastructure are always watching the weather as they work to turn potential front-page stories about floods and drought into back-page briefs. At stake are human lives and thousands of buildings, to say nothing of the dams, dikes and other flood protection works worth somewhere between $500 million and $1 billion.

It is a delicate balancing act to ensure there is enough water for the growing communities in the watershed while also minimizing flooding. One severe incident could mean major property losses or even loss of life.

With better weather information at hand, the flood prevention team could learn about a severe storm sooner and take steps to minimize the impact. More accurate rainfall and river level information will help them uncover problems and develop solutions.

It is particularly important to stay on top of weather issues if, as some experts predict, climate change brings an increase in extreme weather, with more violent and localized storms.

The GRCA has 15 rain gauges in different parts of the watershed that measure rain, but some summer storms have been so localized that the gauges don't pick them up. This happened in 2005 and 2006, when intense rain washed out the sidewalks and damaged property on Coronation Boulevard in Cambridge. Another big storm in 2004 near Conestogo Lake was so intense it literally stripped the soil off the landscape but the GRCA gauges reported only a portion of the estimated rainfall of 200 mm.

Water pours across Coronation Boulevard in Cambridge following a massive rainfall in 2005 that took out part of the roadway. A similar flood occurred in the same location a year later.

Over the next two years the GRCA will add 10 new rain gauges upstream of large dams and in the southern and central parts of the watershed. In the future, weather information from Waterloo International Airport and other organizations will also be added into the monitoring system.

Network of observers

An informal network of Grand Observers — people with weather equipment and expertise, such as farmers, is envisioned for the future. They would be able to upload their observations to the GRCA's computer network.

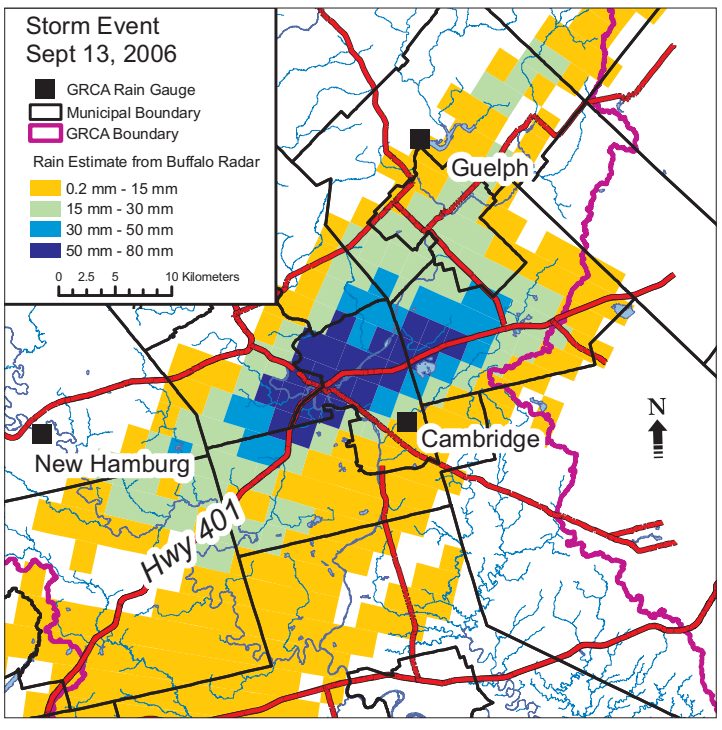
The GRCA already puts weather data on its website, but it's in table form. Information will be available on maps, hopefully by next spring, so watershed residents will be able to see how much rain has fallen around the watershed while the storm is still occurring. Municipalities and the police will find it useful for their emergency planning; farmers will also find it helpful.

But that's only the beginning.

"A little radar dome in Buffalo could someday save someone's life in our watershed," says Graham Smith, the GRCA's geomatics coordinator.

He is part of a GRCA team working on an innovative computer application that will use weather radar information from stations in Exeter, Buffalo and Newmarket to create a "big picture" of weather in the Grand River watershed. The data will be broken into a one-kilometre grid so it will fill in the gaps in the local rain gauge network. The 2006 storm that washed out Coronation Boulevard wasn't picked up by the rain gauges, but it was picked up by the radar station in Buffalo.

But there are some problems with weather radar. It tends to underestimate rainfall during some weather conditions. It can also mistake a flock of geese for a rain storm. This is why rain gauges are still important. Some details still need to be worked out to make the radar information work with watershed maps — if one small thing doesn't



Charting a storm

A big summer thunderstorm in 2006 flooded basements and damaged Coronation Boulevard in Cambridge but it was so tightly focused that it was not picked up by the GRCA's rain gauges in New Hamburg, Cambridge and Guelph.

Using radar information from Buffalo, NY, GRCA staff were able to estimated the amount of rain that fell during the storm.

Similar techniques are being developed to chart rainfall across the watershed.

work, the whole system fails – but it will be added to the GRCA website next spring. Testing to also add flood forecasting and analysis will start this fall.

Like the rain gauges, this information will be connected to the GRCA's voice alert system. Rain and river level gauges are set up so a sudden increase will trigger a computer to send out an alert to the GRCA's flood managers. They can jump into action within minutes to start managing a flood. When the radar information is added to the system, it will be set up to trigger alerts as well.

Information archived

The combination of rain gauge information and weather radar overlaid on maps will be very helpful in understanding the possible changes caused by climate change..

All this information will be archived and available to researchers looking for patterns that show how climate change has affected weather patterns. This will help in many ways, including identifying areas that need more or different flood infrastructure.

Another piece of new technology the GRCA is introducing is the "bubbler gauge."

They're a new type of river level gauge. They send a bubble out into the river and then take a reading on the amount of pressure needed to send out the bubble. That shows how deep the water is.

Bubblers are easier to install and cause less environmental disruption than the traditional river gauges. Bubblers also use much less energy and can be powered by solar panels. Not only does this save money, but it means this important safety equipment can operate even if a big storm knocks out the power grid.

The first one was installed in 2004 and there are now eight, but all 60 river gauges will be replaced by bubblers by 2011. As with any new technology, it has taken time to work out the quirks in a few locations before the technology is used across the watershed.

Adopting new technologies while keeping the current system fully functional is a little like renovating your home while you are living in it.

Like the rain gauges, the flow gauge network is connected to a voice alert system. Another step to make this system even stronger is to move to satellite communication so it will work even if the phone lines or power are knocked out.

Taking action

■ Help rain and snow find its way into the ground on your property by using permeable material, such as gravel for driveways and landscaping, instead of pavement.

■ If a stormwater grate near your home has debris around it, clear it to ensure it can function during a heavy rain.

■ Instead of washing your car in the driveway, take it to your local car wash, where the water may be treated on site or sent to the municipal sewage treatment system, rather than the storm drain system.

■ Storm sewers drain directly into rivers and streams so they are not the place to put oil and chemicals.

■ Consult your municipality before undertaking a building project that may impact the nearby waterways.

■ If you have weather equipment and expertise, consider becoming part of the GRCA's Grand Observer network of weather watchers.

■ Prepare for an emergency and visit www.getprepared.ca for information on how best to do this. Waterloo Region has a site on emergency preparation called www.wrem.ca)

■ Visit www.yellowfishroad.org to find more tips on protecting local water

Stormwater management ponds help prevent flooding and improve water quality.

Big storms of the past guide future development

Weather records from the past don't just provide interesting tidbits about the hottest or frostiest day.

Engineering standards and floodlines are based on past weather events. Hurricane Hazel in 1954 was dubbed the "storm of the century" and hit Toronto the hardest. But the Grand River peaked about six meters above normal that day and the Galt Reporter described it as one of "the worst fall floods on record."

Flood level would double

If a Hazel-sized storm scored a direct hit on the Grand River watershed, the water levels would be double what they were in 1954. Hazel is the "regulatory storm" for this watershed, so the floodlines here are based upon this high standard. Floodplain development rules are enforced by the GRCA and municipalities and the technical guidelines for these rules are in a thick, detailed document.

Hurricane Hazel set the standard for floodlines in Ontario

Managing runoff from urban areas has become an important part of planning. In most urban areas, there are fewer natural areas for rain to soak into the ground. Each year there are more roads, parking areas, buildings and patios. But rain still needs to get into the ground to minimize flooding.

Municipal drainage standards are based on five-year, 10-year, 25-year and 100-year storms which correspond to specific amounts of rain. Those amounts vary from place to place.

New subdivisions include a stormwater management plan to handle runoff from storms. The goal is to slow the water down on its way from streets to streams, in order to reduce flood peaks. However, stormwater management plans have other components which help clean water up and find ways for it to soak into the ground. Even the impact on fish habitat and other ecological factors are considered.

New digital maps

Advances in computer mapping and hydraulic modeling are all coming together to allow digital maps to be created that depict the extent and depth of flooding, useful in many ways including storm water management.

In 1997 the GRCA started the detailed process of converting flood line information from paper maps onto digital ones that are easy to use in various computer programs.

These maps haven't yet been created for all parts of the watershed, but they are available for the most frequently flooded areas.

Eight ways to protect natural areas

There's a lot to be done to make natural areas more resilient

The twin pressures of population growth and climate change pose risks to the natural areas of the watershed – river valleys, forests, wetlands and fields.

Preserving and improving these areas will be a challenge, but it's a challenge that has to be met if the broad range of plants, animals, fish, birds and other creatures living in these natural areas are to survive.

It's important, too, for people that the natural areas continue to thrive because of the role they play in keeping our air and water cooler and cleaner. On a larger scale, plants soak up carbon which helps reduce the threat of global warming.

Problems posed by population growth can be addressed in land use plans, where rules can be put in place to protect natural areas.

It's more complicated, though, to address climate change issues. For one thing, it's hard to predict with any certainty what the precise effects would be in the Grand River watershed. Many of the computer models used to study climate are not refined enough to deal with an area that is, in global terms, quite small.

So, there are far more questions than answers. Will non-native plants and animals push out native species? How will ecosystems cope with more varied weather? Will insects and diseases take a bigger toll on our forests? What will happen if natural areas get smaller because more land is developed?

The best way to cope with the unknown is to ensure that the natural system is as robust as possible so that when stresses and strains do develop, the natural system will be able to cope.

Here are eight strategies that will help the natural system of the Grand River watershed cope with an uncertain and unsettled future.

Trees by the numbers

90%
- Privately owned land in the watershed

5% to 6%
- Forest cover in the watershed in 1900

19%
- Current forest cover in the watershed

30 %
- Tree cover needed for a healthy watershed

1,000,000
- Trees planted annually by GRCA planting programs during the 1980s

100,000
- Trees planted annually by GRCA planting programs since 2000

1. Protect natural core areas

Big blocks of land that are 400 hectares (1,000 acres) or more are a hedge against the adverse effects of climate change. For many reasons, the bigger these areas, the healthier they are.

A severe storm or drought can wipe out an isolated patch of habitat, but not a larger area. A bigger forest will have less interference from people, especially in the interior. Some plants and animals need the seclusion and microclimate of a large forest to survive. In core areas they have a broad genetic base which is a good insurance policy that will help them adapt to change.

A youngster readies a tree for planting at a Sunoco Earth Day event in Waterloo. Planting trees is a way to revitalize the natural systems of the watershed and to give them extra resiliency to combat pressures from climate change and population growth.

There aren't many big core areas within the watershed — Luther Marsh in the headwaters, Six Nations in the south and the Eramosa River valley in the central area. It is getting harder to find available land to create more of these areas. While it is expensive, land can be purchased around a large area to make it bigger. Private landowners can voluntarily convert land from other uses to natural areas.

Ontario Power Generation, which recognizes the importance of core areas, is funding tree planting on 222 hectares of retired agricultural land to increase the size of the Luther Marsh Wildlife Management Area.

2. Build natural corridors

Core areas alone are not enough. The forest around Conestogo Lake, for example, is cut off from other natural areas by agricultural land. The range of plants and animals becomes restricted to isolated, which would make them more vulnerable to disease, pests, changes in the length of the growing season or other factors.

Wider is better in natural corridors (even hundreds of metres wide) to properly connect core areas to each other. Disconnected habitats tend to have a smaller variety of plants and animals that are less genetically diverse.

A joint project between the GRCA and the Rotary Club of Guelph is planned by Guelph Lake Conservation Area to link existing forests and wetlands along the Speed River. About three hectares a year will be taken out of agricultural production on GRCA-owned land. By 2020 about 40 hectares of land will have been turned into a natural corridor.

3. Plant more trees

Forests once blanketed about 90 per cent of the watershed, but these were cleared by early settlers until only five per cent of the land was covered in forests. Concerted effort and natural regeneration over the last century brought forest cover up to 19 per cent, but Environment Canada recommends 30 per cent to sustain a healthy watershed.

While private landowners used to plant a million trees a year through the GRCA, a drop in government incentive programs has led to a reduction in tree planting. Now, the GRCA plants only about 100,000 trees a year. The Grand River Watershed Forest Plan, released in 2004, warned ominously that the forest is not on a sustainable path, "particularly on account of population growth and the spread of urbanization in the watershed."

Trees also help offset greenhouse gas emissions which cause climate change. Many organizations and landowners recognize this and are planting trees, but these efforts need to be stepped up significantly. Fortunately in August the provincial government announced a plan to plant 50 million trees by 2020. While the details of this have not yet been worked out, it will bring more funding to plant trees in the Grand River watershed.

4. Encourage biodiversity

When a wide variety of native plants and animals live in one area, it is stronger and more resilient. Biodiversity is especially important when a natural area is under pressure.

Foresters have learned the importance of planting a variety of tree species, instead of a monoculture tree plantation. If a disease or insect attacks one tree species, it leaves the other trees standing. More complex natural areas with a wide variety of species are a hedge against climate change and urbanization.

Watershed organizations, like Guelph Eramosa Tree Planters, are planting a variety of species, even though it is more complicated and costly to do so.

5. Minimize invasive exotics

Invasive exotics have been introduced from other parts of the world and these are causing serious problems.

The Forest Plan says in some cases we have either completely destroyed or degraded natural forest habitat by introducing exotic species from our gardens and farms. Some exotic plants are so aggressive that they are pushing out native plants and excluding all other species. Often the only way to eliminate them is to physically remove them by hand, which is very costly or requires lots of volunteers.

Non-native invasives threaten natural areas, since they reproduce in ways that allow them to travel long distances. Garlic mustard was introduced for culinary use and is now a serious problem in open forests where it can completely cover the forest floor.

Christine Korol takes measurements of a tree as part of a forest monitoring program, the Ecological Monitoring and Assessment Network.

Buckthorn was often used for hedges and now it is replacing trees which are native to the watershed, while Norway maples reproduce very well and can displace native trees in the forest understorey.

Heritage plants offer many benefits, since they support native insects and wildlife in a complex ecosystem.

6. Limit the impact of development

As we understand more about the impacts of development, regulations to protect natural areas have been strengthened, so that many types of development that were allowed in the past are not permitted today. These changes have come slowly over many years to gradually add more protection to natural areas.

Development proposals are very thoroughly considered by the GRCA and municipalities — from how rain will get into the ground to the impact on fish habitat.

New policies call for more intensive development — more housing units on the same amount of land — to limit sprawl and help protect farmland and natural areas. Builders are transforming old factories into downtown lofts in urban areas throughout the watershed. This means using existing sewer and water connections and also roads.

Some developers are also trying out new ideas like solar power and rainwater harvesting that could one day be used in entire subdivisions.

7. Develop a shared sense of stewardship

It is probably a fair guess that each community in the watershed has at least one group working to preserve and enhance natural areas and many communities have numerous groups putting time and money into this.

As these groups improve the landscape, they also educate people about natural heritage. The Adopt-A-Riverside project in Guelph, getting underway this fall, will see volunteers rehabilitate the urban river banks one neighbourhood at a time. Private landowners are transforming their own properties while municipalities are all paying close attention to natural heritage.

8. Monitor environmental health

Forest health is a good indicator of overall watershed health — when forests are struggling, so are other natural areas.

The GRCA began monitoring forest health two years ago and will spot changes over many years. Eleven forest plots were set up as part of a nationwide Ecological Monitoring and Assessment Network (EMAN), a program developed by Environment Canada.

Every tree in the plot is tagged and marked on a map. The size, species and general health are recorded. The monitoring looks at other plants, invasive species, lichen (which provides clues about air quality), and salamander.

Over time, monitoring will give us answers to the questions about the conditions of today's forests and the changes taking place in them. This in turn will help reveal more specific strategies to help ensure the health of natural areas.

Taking action

■ Plant native species in your garden. You can learn more about these from local garden clubs and field naturalist groups.

■ Remove non-native invasive species from your property. Check the GRCA's website for more information on these.

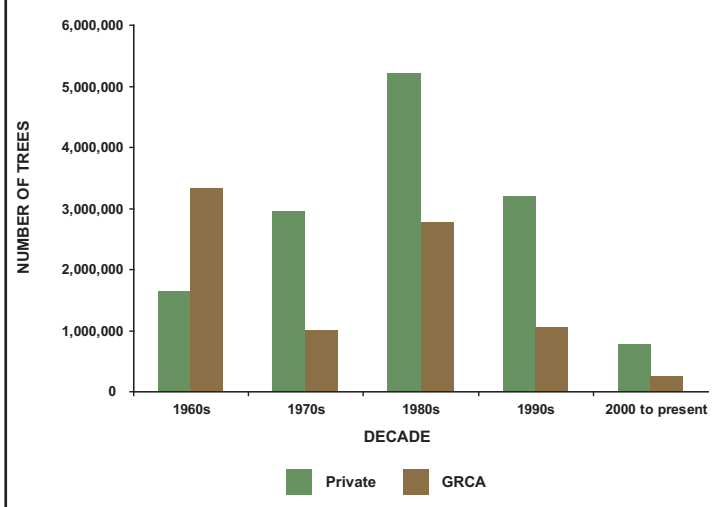
■ Volunteer your time to restore degraded habitats and naturalize urban areas.

■ Encourage the municipality you live in to enact bylaws that encourage naturalization.

■ Applaud the efforts of friends, neighbours and companies that spend time and money improving natural areas.

■ When you visit natural areas, be careful not to disturb them by staying on paths, taking only photos and bringing any garbage out with you.

Tree planting



A drop in grants for tree planting programs has led to a decline in the number of trees planted during the past decades. Since the GRCA was founded in the 1930s it has planted more than 25 million trees.

The GRAND RIVER CONSERVATION FOUNDATION

Rooftop learning at Laurel Creek

Since 1977, the GRCA's Laurel Creek Nature Centre in northwest Waterloo has provided hands-on, curriculum-based outdoor education programs to more than 360,000 students.

At almost 30 years of age, the centre is need of a new roof, and with this comes a unique opportunity. The GRCA can now provide a new dimension of environmental learning for the children through the installation of a 200-square-metre green roof at the front of the centre, as part of the overall roof replacement.

A green roof incorporates living material, such as grasses and flowers. The green roof will help clean the air, supply habitat for wildlife, and, most importantly, it will be an active new learning tool for the benefit of the thousands of children who visit the nature centre each year.

The roof's features will be illustrated through experiments that show differences between it and traditional roofs. For example, thermometers will show temperature variation and rain barrels will illustrate the amount of water retained on the roof.

Seeing "green technology" in action at the centre will help students to relate environmental learning principles to their world outside of school and develop a lifelong respect for our natural world.

The GRCF is grateful to the many donors that have made an investment in this new dimension of green learning:

- ❑ Roof Greening Systems Inc.
- ❑ Canadian General-Tower Ltd.
- ❑ BMO Financial Group
- ❑ The Kitchener & Waterloo Community Foundation
- ❑ CHYM-FM
- ❑ CBM Aggregates
- ❑ Conestoga-Rovers & Associates
- ❑ TD Friends of the Environment, KW Chapter
- ❑ Aecon Construction and Materials Ltd.
- ❑ CIBC
- ❑ Virginia Harris
- ❑ Ian MacNaughton
- ❑ The Florence Louise Marsland Fund of the KW Community Foundation
- ❑ Waterloo Nissan (whose President, Ian Murdoch, led the Campaign Effort)
- ❑ Planning & Engineering Initiatives Ltd.
- ❑ Brian Ruby
- ❑ Shell Environmental Fund
- ❑ Steed & Evans
- ❑ Scotiabank
- ❑ KW Car & Truck Dealers Association
- ❑ MerSynergy Foundation
- ❑ Bullfrog Power
- ❑ Dave Paleczny
- ❑ Alan Dale
- ❑ Tom Land
- ❑ J. Crawford Reid
- ❑ Kerry Long

The project will be completed this autumn. If you would like to contribute to this exciting project, contact the Foundation at 1-877-29-GRAND.

A new green roof will be installed on the Laurel Creek Nature Centre this fall.

About the foundation

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.grandriver.ca/foundation

Outdoor ed campaign a natural success

With the ending of school in June, the funding provided by the Living Classroom Campaign of the Grand River Conservation Foundation came to a successful close. Over the past five years, foundation donors helped raise more than $2 million. This money was used to fund more than 150,000 visits by school children to local outdoor education programs, as well as to improve the nature centre lands and facilities.

Foundation praised

Students from all six watershed school boards participated in the program. All school boards praised the foundation for its funding support, which was given at a time when many of their outdoor education programs were threatened with reductions or closure.

The foundation and GRCA have been working with Conservation Ontario and other education sector partners to let the province know the importance of outdoor education. It was therefore gratifying when the Ministry of Education announced that for the new school year, funding eligible for outdoor education programs was being made available to schools throughout the province and that environmental studies in general are to be included more fully in students' learning.

In our increasingly hi-tech world, where children are often insulated from contact with the environment, it is important that they be exposed to the wonders of nature and the out-of-doors. Understanding environmental principles through outdoor education, is an important facet of their learning. As our future decision-makers, their quality of life will depend on making wise choices to sustain a healthy environment.