

Watershed-based Resource Management Strategy

2024, Version 1

Grand River Conservation Authority



Contents

Introduction	4
Vision.....	4
Mission	4
Guiding Principles	4
Purpose of the Resource Management Strategy	4
Consultation	5
The Grand River Watershed.....	6
The Landscape	6
The Groundwater System	8
The Surface Water System	8
Watershed Drivers and Stressors	9
People and population growth.....	9
Agricultural production	10
Climate change.....	10
Watershed Issues and Challenges	10
Flooding and drought	10
Water quality and supply	11
Natural areas	12
Resource Management Strategy	13
Objectives.....	13
Programs and Services	13
Monitoring watershed conditions	13
Watershed sciences and collaborative planning	14
Managing the risk of natural hazards	15
Conserving and managing lands	16
Providing outdoor recreational opportunities	16
Protecting drinking water sources.....	17
Improving water quality.....	17

Providing conservation services to landowners and residents	18
Providing outdoor environmental education.....	18
Looking Forward	19
Updates to the Strategy	20
Appendix A: Summary of technical studies, monitoring programs, and other information that guide the GRCA’s programs.....	21

Introduction

The Grand River Conservation Authority (GRCA) manages water and other natural resources on behalf of 38 municipalities and about one million residents of the Grand River watershed. The GRCA is a partnership of watershed municipalities and provides an avenue to work together, addressing environmental issues and opportunities that serve to benefit the entire Grand River watershed. Through programs that balance human, environmental and economic needs, the GRCA works collaboratively with all levels of government, various organizations, and members of the community to ensure the conservation, restoration and responsible management of water, land, and natural habitats in the watershed.

Vision

A healthy watershed where we live, work, play and prosper in balance with the natural environment.

Mission

We will work with local communities to reduce flood damage, provide access to outdoor spaces, share information about the natural environment, and make the watershed more resilient to climate change.

Guiding Principles

The GRCA's approach to watershed-based resource management and the development of the organization's programs and services is guided by 5 principles:

- The watershed is the appropriate scale for managing water and the linkages between water and other natural resources.
- A well-managed river system is crucial for a healthy watershed, sustaining prosperity, growth, well-being, and climate change resiliency.
- Collaboration is essential, as the management of water and land is a shared responsibility among the conservation authority, municipalities, First Nations, government agencies, landowners, residents, and other interest holders.
- When making decisions, the GRCA considers the broad range of water uses and values, and the needs of natural and human communities.
- The GRCA's programs adapt and respond to changing conditions, priorities, vulnerabilities, and pressures.

Purpose of the Resource Management Strategy

Under the *Conservation Authorities Act*, each Conservation Authority in Ontario is required to prepare a Watershed-based Resource Management Strategy (Strategy). The goal of the Strategy is to ensure that the GRCA's programs and services respond to watershed issues and reflect the organization's mandate under the *Conservation Authorities Act*. In developing the Strategy, watershed health and trends, program effectiveness, and other GRCA plans

and strategies that guide the organization's activities, were considered, including the following:

- The GRCA's Strategic Plan
- The Grand River Watershed Water Management Plan

Consultation

The GRCA posted a draft of the Strategy on-line and consulted with municipalities, First Nations, and the public on the draft Strategy. The consultation included:

- Letters to participating municipalities, Six Nations of the Grand River, and the Mississaugas of the Credit First Nation advising of the consultation period and offering council presentations on the draft Strategy, upon request.
- Presentation of the draft Strategy for discussion to the Grand River Water Managers Working Group. The Working Group is a network of municipal, First Nations, provincial, and federal water managers that align water supply, wastewater, stormwater, and water quality objectives and actions to achieve common watershed goals.
- A public webinar information session on the draft Strategy.
- An online survey to gather feedback on the draft Strategy.

The Grand River Watershed

The Grand River watershed is the largest in southern Ontario. It's about the size of Prince Edward Island – 6,800 square kilometres – but with more than 5 times the population (about 1 million). The Grand River begins as a small stream in the Dufferin Highlands and travels about 300 kilometres before emptying into Lake Erie at Port Maitland. Along the way, it picks up its major tributaries, the Conestogo, Nith, Speed, and Eramosa rivers, and Whitemans and Fairchild creeks.

Indigenous Peoples have been deeply connected to the land and water in the Grand River watershed since time immemorial. The watershed and river were sources of water, transportation, and habitat for the terrestrial and aquatic plants and animals Indigenous Peoples relied on. Roughly three centuries ago European settlement began, and communities grew along the river as it provided a source of water and power for mills. Today about 80% of the watershed's population lives in the cities of Kitchener, Waterloo, Cambridge, Guelph, and Brantford. The Grand River is home to the Six Nations of the Grand River and the Mississaugas of the Credit First Nation.

The Grand River was designated a Canadian Heritage River in 1994. The designation recognizes the outstanding human heritage and excellent recreational opportunities along the river and its tributaries.

The Landscape

The biophysical characteristics, namely the soils, geology, and the location and extent of natural areas within the watershed, have determined how water moves through the landscape and how humans have used the land.

European settlement led to rapid deforestation and the draining of wetlands. Tile drainage was and continues to be prevalent within the northern and western portions of the watershed, where groundwater tends to be close to the ground surface. Private and municipal drains were deemed necessary to create conditions suitable for agricultural production within these areas.

In the central and eastern watershed, moraines deposited during glacial periods have created a hilly landscape with large sand and gravel deposits, which have led to the development of aggregate extraction operations. The rich, well-drained soils of the moraines have also supported extensive agricultural production and the growth and expansion of urban areas within the Region of Waterloo and portions of Wellington and Brant counties. About 14% of the watershed's land area has been urbanized.



The Norfolk Sand Plain, in the southwestern part of the central watershed, is also rich in water and is intensively used for both mixed farming and cash crops. Finally, much of the clay plain in the southern watershed is poorly drained and is used predominantly as livestock pasture and for soybean, corn, and hay production. Agriculture remains the largest land use in the watershed with 61% of the total watershed area.

About 16% of the watershed is covered by woodlands, which include upland forests and lowland swamps. Woodlands are most extensive in the Speed River and McKenzie Creek basins and least extensive in urban areas and the agricultural clay plains. Wetlands cover just 10% of the watershed and are most widespread in the northeast and Whitemans Creek basin.

The Groundwater System

A key feature of the watershed is its major moraine systems, including the Orangeville, Waterloo, and Paris and Galt moraines. The moraines have extensive sand and gravel deposits, and their overburden aquifers provide groundwater for municipal and private use. The extensive sand and gravel deposits associated with the Norfolk Sand Plain also yield substantial water supplies to local users. Bedrock aquifers are also an important source of water for municipalities and private water users, including the Gasport, Guelph, and Salina formations.

Municipal and private well supplies, and the baseflows in many cold water creeks and wetlands, are reliant upon groundwater recharge and discharge. Groundwater discharge also supports the Grand River itself, particularly between Cambridge and Brantford, providing a significant portion of the river's flow during summer months. In the reach between Cambridge and Paris, groundwater discharge, in combination with the river's steep gradient and limited direct drainage, contributes to water quality improvements downstream, including moderating temperatures and increasing dissolved oxygen levels.

The Surface Water System

There are about 9,900 kilometres of rivers and streams draining the Grand River watershed. Streamflow is a result of runoff from precipitation (rainfall or snowmelt), discharges from storage features (wetlands, ponds and reservoirs) and groundwater discharge. Streams that are primarily runoff-fed tend to be flashy with quick transitions from high flood flows to low baseflow. Streams that are primarily groundwater-fed tend to be slower to respond during a flood event and maintain high baseflow throughout the year.

The upper watershed till plains generate high surface runoff that results in high flood flows, but little to no flow in watercourses during sustained dry periods. Multi-purpose reservoirs were built on the fringe of these till plains to manage surface runoff following significant floods and droughts in the 1930s. The reservoirs capture runoff during spring snow melt and heavy rain events. Dams at each of these reservoirs release stored water during the summer and fall to augment or maintain flow in the river system.

In the central portion of the watershed, stream flows are maintained by groundwater discharge and flow augmentation from upstream reservoirs. Urbanization prior to stormwater

management requirements in this part of the watershed has led to an increase in surface runoff from impervious areas.

The southern clay plains produce extremely high surface runoff. In this area, Grand River flows are sustained by upstream flow augmentation and groundwater discharge while smaller watercourses have very little flow during dry periods.

About 100 native and non-native fish species and 30 native mussel species live within the Grand River and its tributaries. Of these, 20 species (11 fishes and 9 mussels) are listed as aquatic species at risk in Ontario or Canada.

Groundwater helps sustain cold water fish species such as native brook trout and non-native brown trout and rainbow trout, which are highly valued by the angling community. Important cold water tributaries include Blair Creek, Blue Springs Creek, Laurel Creek, Strasburg Creek, Mill Creek (Puslinch) and Whiteman's Creek. The Conestogo River and Grand River both support brown trout tailwater fisheries. Cool water discharged from the bottom of the reservoirs provides oxygenated water to sustain these populations.

Watershed Drivers and Stressors

The Grand River watershed, a highly diverse and interconnected system, has been altered by activities such as deforestation, tile draining, agricultural production, and urbanization. As human communities grew, flood control, municipal drinking water supply, and wastewater management were necessary to protect local communities from flooding and erosion hazards and pollution.

The health of the watershed and its communities continues to be influenced by drivers and stressors that shape and change ecosystem functions and conditions. These include population growth-related changes to land cover and resource use, extensive agricultural production, and climate change.

People and population growth

The watershed's urban centres are within the outer ring of the Greater Golden Horseshoe area – one of the fastest growing regions in North America. The watershed's population will grow to over 1.5 million by 2051 with annual municipal growth rates of between 1.3 and 1.6%. Municipalities will accommodate growth through a mixture of intensification of existing urban areas and urban area expansions. Some of the growth is projected to occur in smaller communities in sensitive areas of the watershed. This growth will put pressure on the quality and supply of water resources. More people need more water and generate more treated wastewater.

As the population grows, it will be important to have sufficient water supplies for communities, economies, and ecosystems. While the watershed's communities remain heavily reliant on groundwater for drinking water, four communities draw drinking water from the Grand River, and three communities rely on water from a Great Lake. A lot of the urban growth is on moraines, the source of drinking water for many communities.

Urban areas are growing at the expense of farmland and urban stormwater is an important pressure to manage regionally. Many of the old urban centres in the watershed do not have

stormwater management, which can result in erosion, poor water quality, and localized flooding.

An increasing population means continued pressure on the river's ability to absorb nutrients and other pollutants. The same inland river that supplies drinking water also receives treated effluent from 30 wastewater treatment plants and supports thriving agricultural lands.

As communities grow, land use changes from a more rural or naturalized environment to an urban environment. New developments and intensification can reduce the area of permeable surfaces for water infiltration, and result in habitat loss, fragmentation, or alteration, including the establishment of invasive species, all of which impact biodiversity and the quality and resilience of natural areas.

As southern Ontario's population grows, so too does the demand for open, natural spaces, nature-based recreation, and outdoor experiences. This places pressure on the ecosystems and infrastructure of the GRCA's passive-use conservation lands and active-use conservation areas.

Agricultural production

The Grand River watershed accounts for about 30% of the farmland and a third of the farms in the Greater Golden Horseshoe, and about a tenth of the farmland in Ontario. Livestock producers in the watershed contribute more than half of the cattle, swine, and poultry raised in the Greater Golden Horseshoe area, and almost a quarter of what is produced in the entire province. Water is needed for livestock production and irrigating crops. Wetland removal and tile drainage reduces landscape water storage. Surface runoff from agricultural landscapes can affect soil health and water quality and quantity by transporting nutrients and sediment.

Climate change

Climate change is a global issue that has already started impacting us locally. In the Grand River watershed, rising air temperatures and a shift from traditional spring high flows to more mid-winter melts, early winter floods, and later spring and summer high flows have been observed. Winter snowpacks are shrinking but winter rainfalls are more common. As the climate changes, it will have implications for water temperature, ice cover, and the frequency and extent of flooding and drought.

Watershed Issues and Challenges

There is a long history of watershed planning in the Grand River basin. Over the past century, many plans have been implemented to deal with critical problems such as flooding, drought, poor water quality, and loss of natural areas. While decades of collaborative work have resulted in some gains, such as in forest cover and improvements in water quality, critical challenges remain and must be addressed to ensure the watershed can continue to support growing communities and healthy ecosystems.

Flooding and drought

The Grand River system has a long history of flooding. Floods can occur in all seasons: during the spring melt, following major rainstorms in summer and fall, and during a rapid

snowmelt or because of an ice jam in the winter. The Grand River downstream of Cayuga to Port Maitland and the Lake Erie shoreline are also subject to flooding from Lake Erie.

The GRCA operates seven multi-purpose dams and reservoirs that are vital to protecting the health and safety of watershed communities. The major dams, Shand, Luther, Conestogo and Guelph, are operated as a system to reduce flood damages and augment river flows to support municipal water supply withdrawals and improve the capacity of the Grand River to receive treated wastewater. The other dams, Woolwich, Laurel Creek and Shade's Mills, influence the local tributary on which they are situated.

While efforts have been made to reduce flood risk, there remain 17 flood damage centres within the watershed – communities that have several structures located within the floodplain and have a higher risk of riverine flooding. The risk of flooding can never be completely eliminated, and climate change may alter the frequency and severity of flooding experienced by watershed communities. It remains critical to regulate development in the floodplain to prevent the loss of life and property damage due to flooding and erosion.

The large water management reservoirs add water to the Grand, Conestogo, and Speed rivers during low-flow periods. The GRCA operates the dams to achieve flow targets to support downstream municipal water supply and wastewater assimilation. Between 2011 and 2017, reservoirs provided sufficient water to meet the operational river targets more than 95% of the time. However, in exceptionally dry years, flows can be lower than the targets for short periods. Further, creeks and streams in the “uncontrolled” areas of the watershed lack upstream reservoirs to provide flow augmentation. At these times, voluntary water conservation by all users is important.

Water quality and supply

The Grand River empties into Lake Erie which is connected to one of the most important freshwater systems in the world. In 2022, the governments of Canada and the United States assessed the state of Lake Erie as “poor” due to elevated nutrient concentrations and algal blooms. The Grand River is the largest tributary that discharges into the eastern basin of Lake Erie, and it contributes more than half of the total phosphorus load to the eastern basin.

Although the background or natural water quality across the watershed varies considerably due to geology, runoff from urban and rural areas and waste assimilation from 30 wastewater treatment plants heavily influence the water quality issues seen in both surface and groundwater.

Agricultural nonpoint sources account for over 90% of the total load of phosphorus, a nutrient, in the upper middle part of the watershed. Because of this, supporting farmers and rural landowners as stewards of land and water resources helps protect the drinking water sources and wastewater assimilation capacity for downstream municipalities.

While substantive progress has been achieved through wastewater treatment plant upgrades and operational improvements, continued effort is required to maintain the reductions realized through optimization as technology and personnel change. More work is required to help reduce non-point sources of total phosphorus and other nutrients including improving urban and rural stormwater management.

In some areas, aquifers are vulnerable to land-based activities, including urban development, agriculture, and management practices such as the application of road salt, manure, or fertilizer. Elevated levels of nitrates, chlorides, sodium, and industrial contaminants in groundwater are issues in some parts of the watershed.

Through the drinking water source protection program, 17 municipal drinking water systems or wellfields have been identified as having known issues for chloride, nitrate, sodium, or trichloroethylene. Protection of the quantity of groundwater also is needed to ensure municipal drinking water systems can meet future water demand under drought conditions in the City of Guelph, townships of Centre Wellington and Guelph-Eramosa, Regional Municipality of Waterloo, and Oxford and Brant counties.

Natural areas

Forests and wetlands in the watershed help to clean the air and water, store and release water, and provide habitat for a wide variety of plants and animals. However, the watershed has changed dramatically over the past 200 years and most of the forests and wetlands have been cleared. Forest cover in the Grand watershed is generally low, especially in urban areas and productive farmlands.

Many wetlands and woodlots are small and isolated but remain important for wildlife, water storage, and nutrient removal. Smaller natural areas may be more vulnerable to adjacent land practices and development pressure. Habitat loss and fragmentation prevents the movement of animals and plants, which become less abundant and more geographically restricted. In contrast, invasive plants and animals are becoming more abundant and widespread, threatening native species.

Large and relatively diverse natural areas help make the watershed more resilient in the face of climate change and human-induced disturbances. Some larger and biologically diverse natural areas remain in the Grand watershed. Noteworthy natural areas include the forests located on the Six Nations of the Grand River and Mississaugas of the Credit reserves, forested valleys along the Grand River and some tributaries, the Dunnville Marsh, and the Beverly, Oakland, and Roseville Swamps. Luther Marsh, a popular birding and hunting destination, is designated a provincially significant wetland, an area of natural and scientific interest, and a nationally important bird area.

Additional information on Grand River watershed conditions and issues can be found in the Water Management Plan, the State of Water Resources report, Natural Heritage Characterization Reports, and other technical resources available on the GRCA's website www.grandriver.ca.

Resource Management Strategy

The future prosperity, growth and sustainability of the communities in the watershed depend on a healthy river system. Population growth, greenfield development and urbanization, agricultural production and a changing climate will continue to exert pressure on the quality and supply of water and land resources. Addressing existing and emerging resource management issues is critical for all who live, work and recreate here. Water and ecosystems are shared resources and consequently, responsibility is shared for their management.

The GRCA's resource management strategy is driven by the organization's legislative mandate under the *Conservation Authorities Act*, watershed issues, and municipal needs.

The GRCA's programs and services have been developed to address these needs.

Objectives

The objectives of the GRCA's Resource Management Strategy are to:

1. Protect life and minimize property damage from natural hazards, including drought, flooding, erosion, dynamic beaches, and hazardous lands and sites.
2. Manage water to ensure sustainable water supplies for communities, economies and ecosystems.
3. Improve water quality to enhance river health and reduce the river's impact on Lake Erie.
4. Protect, enhance, and restore natural areas to improve ecosystem health and resilience.
5. Protect drinking water sources from contamination and overuse.
6. Connect people to the environment through outdoor experiences.
7. Manage the GRCA's landholdings in a responsible and sustainable way.

Programs and Services

The GRCA's programs and services contribute to achieving the watershed-based resource management strategy's objectives. Programs and services are summarized below and additional information on the programs and the technical studies, monitoring, and other information that guide implementation of the programs, can be found in Appendix A.

Monitoring watershed conditions

The GRCA maintains a system of monitoring stations that collects information on weather, river flows, reservoir and lake levels, groundwater levels and quality, ice conditions, and surface water quality. Data obtained through several monitoring programs provides the information needed to understand current conditions, identify trends, and project future changes.

Monitoring infrastructure plays a key role in public safety, as it supports the GRCA's flood forecasting and warning program and other services. The information supports day-to-day decisions about reservoir operations as well as low water response and long-range water

management planning. Gauges and monitoring stations are located throughout the watershed. These include:

- Fifteen air temperature stations, 25 rainfall stations, and four precipitation stations capable of measuring snow, rain, and mixed precipitation. This information is supplemented by snow surveys conducted at 12 locations and weather radar data.
- Sixty real-time flow gauges measure changes in water levels in streams, rivers, reservoirs, and Lake Erie.
- Surface water quality is measured at 34 locations under the Provincial Water Quality Monitoring Network and at nine automated stations that provide continuous reports on water temperature, pH levels, conductivity, and dissolved oxygen. Some stations have the ability to monitor nitrate levels continuously.
- Groundwater levels and quality are measured at 38 wells under the Provincial Groundwater Monitoring Network. Groundwater levels are measured at an additional 16 GRCA-owned wells across the watershed to inform groundwater and drought management.

Visual observations of flood and ice jam conditions are also important sources of information. A River Watch program uses field staff to confirm and report conditions during flood events and additional information is provided by cameras installed at main ice jam areas like West Montrose and Brantford, for continuous monitoring.

Some of the GRCA's monitoring data is shared on the website so that watershed residents and municipal staff can view near-real time information and make decisions based on conditions being reported.

Watershed sciences and collaborative planning

Protecting and improving watershed health is a shared responsibility among municipalities, First Nations, industry, landowners, residents, organizations, and the GRCA.

There is a long history of watershed planning in the Grand River basin. Over the past century, many plans have been implemented to deal with critical problems such as flooding, poor water quality and low flows. The studies were a response to the serious problems threatening the health and economic vitality of communities in the early part of the 20th century.

The GRCA supports and facilitates a collaborative Water Management Plan with municipalities, provincial and federal government agencies, and First Nations to tackle water management challenges and to develop best-value solutions. The Plan is similar to a municipal master plan in that it is a system-wide, or watershed-wide, approach to addressing needs and achieving common goals. It provides a framework for collective and collaborative action on water management that goes beyond municipal boundaries.

The goals of the Water Management Plan are to:

1. Ensure water supplies for communities, economies and ecosystems,
2. Improve water quality to improve river health and reduce the river's impact on Lake Erie,
3. Reduce flood damage potential, and

4. Increase resiliency to deal with climate change.

The Integrated Action Plan includes more than 40 strategies and almost 300 voluntary actions to achieve the plan's goals. These actions will also collectively serve to advance the objectives of the GRCA's Resource Management Strategy.

The GRCA facilitates watershed water management by convening the Water Managers Working Group. This group is made up of senior managers of municipal water, wastewater, and stormwater utilities, First Nations, and government water programs. The group reports on the actions that their agencies have committed to and discusses issues that cross municipal boundaries.

The GRCA also partners with municipalities on subwatershed (i.e., smaller river and stream) plans and studies, which provide background on surface water, groundwater, natural hazards and natural heritage systems, and recommend sustainable solutions for urban growth and servicing, and ecosystem restoration.

Managing the risk of natural hazards

The GRCA has programs and services to manage risks related to natural hazards, including flooding, drought, erosion, wetlands, dynamic beaches, and other hazardous sites and lands. The GRCA's natural hazard risk reduction program includes structural and nonstructural methods of reducing flooding and other damages. Structural methods include water control structures such as dams, dikes, and channel works. Non-structural methods include flood forecasting and warning, emergency preparedness, and planning and regulation of development in floodplains and other hazard lands.

The GRCA's programs include:

- Flood forecasting and warning: The GRCA collects and maintains data from dams, streamflow gauges, rainfall gauges and snow courses to monitor and forecast conditions, issue warnings for riverine and ice jam flooding, and maintain communications and emergency response systems. The GRCA also provides support to municipal emergency management personnel.
- Water control structures: The GRCA operates and maintains 7 major flood control structures, 5 major dike systems, and 21 small dams. The GRCA has established daily reservoir target levels – called “rule curves” – to guide reservoir operations. The rule curves provide guidance on balancing the competing objectives of having sufficient water available for flow augmentation while maintaining space available to help manage downstream flooding.
- Low water response: The GRCA coordinates and supports delivery of the provincial Ontario Low Water Response Program within the Grand River watershed.
- Natural hazard mapping: The GRCA updates and maintains mapping of rivers, streams, floodplains, and other natural hazards, such as wetlands, steep slopes and the Lake Erie shoreline.
- Planning and regulations: A permit is required under Section 28 of the *Conservation Authorities Act* for development and other activities in regulated areas such as floodplains, wetlands, steep slopes along waterways, watercourses and the Lake Erie

shoreline. About one-quarter of the land area of the Grand River watershed is regulated. The GRCA processes permits and also reviews municipal planning documents and development applications under the *Planning Act* and other legislation to manage natural hazards.

- The GRCA generates hydro revenue from turbines at four dams (Shand, Conestogo, Guelph, and Drimmie dams).

Conserving and managing lands

The GRCA owns approximately 19,900 hectares of land, which represents about 3% of the watershed. The GRCA's landholdings are used for a variety of purposes that support the organization's programs and services including lands for water control infrastructure, outdoor recreation, environmental education, natural areas, agricultural and commercial leases, rental properties, and lands under maintenance agreements. The landholdings include fee-for-use conservation areas, conservation lands with no entrance fees, and lands with limited or restricted access, including about 750 cottage lots at Belwood Lake and Conestogo Lake.

GRCA-owned lands make important contributions to biodiversity and ecosystem functions within the watershed. GRCA land acquisition policies and priorities, along with significant ecological restoration activities, have resulted in a land holding with a high concentration of natural areas, including many that contain sensitive or rare species and communities. Although the GRCA's lands cover 3% of the watershed, they contain 11% of the watershed's wetlands and 7% of its forests. More than half of the GRCA's lands contain natural hazard features such as floodplain, wetlands, or waterbodies. The GRCA undertakes multi-scale projects to conserve, restore, and enhance natural areas for biodiversity, to improve ecological connectivity and resiliency, to protect drinking water sources, and to mitigate the impacts of flooding and erosion.

Providing outdoor recreational opportunities

The GRCA manages the oldest and one of the largest networks of conservation areas in the province. The 11 fee-for-use conservation areas and the Luther Marsh Wildlife Management Area are collectively called Grand River Conservation Areas. Many of these areas have been established surrounding the multi-purpose reservoirs, offering aesthetic lakeside appeal and access to water-based recreation. They provide a wide range of recreational opportunities such as camping, hiking, swimming, fishing, and picnicking. The GRCA offers the second-largest camping program in Ontario and houses two of the province's largest outdoor pools at Brant and Byng Island Conservation Areas. Six Grand River Conservation Areas are open year-round and offer additional winter programs such as hiking, skiing, and snowshoeing.

The Luther Marsh Wildlife Management Area offers a different, and more limited, range of activities and facilities. The GRCA's conservation areas are vital parts of the recreational infrastructure in their communities, providing locations for a wide range of events and activities.

In addition to the Grand River Conservation Areas, the GRCA's landholdings include Conservation Lands which have no controlled entrances, no entrance fees, and no onsite staff, and offer passive recreational experiences such as hiking, birding, and photography. These include about 75 kilometers of GRCA-owned trails formed on old railway corridors.

Protecting drinking water sources

The Grand River Conservation Authority is a Source Protection Authority (SPA) with responsibilities for protecting municipal and First Nations drinking water sources. Under the *Clean Water Act, 2006*, the GRCA is the lead SPA for the Lake Erie Source Protection Region, consisting of the Grand River, Kettle Creek, Catfish Creek, and Long Point Region source protection areas.

The GRCA maintains the multi-interest holder Lake Erie Region Source Protection Committee and ensures the science-based Assessment Reports and Source Protection Plans are kept current for each source protection area. The SPA supports municipalities and other implementers of source protection policies and reports annually on progress towards implementing the source protection plans.

The Grand River Assessment Report identifies areas around wells and surface intakes that are vulnerable to contamination or overuse for residential drinking water systems in the counties of Grey, Dufferin, Wellington, Perth, Oxford, Brant, Haldimand; the cities of Brantford, Guelph, Hamilton; the regional municipalities of Waterloo and Halton; and Six Nations of the Grand River. The Assessment Report also summarizes water budget studies that assess water quantity risk to current and future municipal drinking water sources. A variety of scenarios, such as future increased municipal water needs and drought, are evaluated. Additional information on the drinking water source protection program can be found at www.sourcewater.ca.

Improving water quality

The quality of the waters that flow in streams and rivers, and in groundwater, is vitally important to the people, communities, and aquatic plants and animals in the watershed:

- The majority of the population of the watershed relies on groundwater for water supply and four communities get some or all of their drinking water from the river,
- Municipalities and First Nations operate wastewater treatment plants that discharge treated effluent into the rivers,
- Farmers depend on the river for water for irrigation and livestock,
- Many watershed residents and visitors recreate in and near the river, and
- The rivers, streams and wetlands are rich ecosystems. More than 80 types of fish, representing half of the species in Canada, live in the river system.

The GRCA uses information gained through water quality monitoring, modelling, and applied research to better understand and manage the river. This allows the GRCA, municipalities, the province, and other agencies to take action to improve surface water and groundwater quality and the health of streams, rivers, and Lake Erie. The GRCA's water quality program includes:

- Surface water quality monitoring, modelling, analysis and reporting, and groundwater quality analysis and reporting.
- Providing technical support for municipal wastewater studies. The Grand River Simulation Model (GRSM) is a computer model that gives GRCA, municipalities and

the Ontario Ministry of the Environment, Conservation and Parks a better understanding of the potential impact of proposed sewage treatment plant improvements. The model covers the Grand River from the Shand Dam to Six Nations of the Grand River, and the Speed River from Guelph Lake to Cambridge.

- The Watershed-wide Wastewater Optimization program enables and engages operators and managers of wastewater treatment plants with tools and approaches to improve wastewater treatment process control. This is accomplished through knowledge sharing workshops, hands-on training, technical advice, and delivering a recognition program. By working together, the amount of phosphorus and ammonia discharged in the Grand River watershed has been reduced.
- The GRCA also engages the provincial and federal governments to develop programs to reduce nutrient loads in rivers and streams, and ultimately Lake Erie. Implementation of the Water Management Plan is a key action in the Canada-Ontario Lake Erie Action Plan.

Providing conservation services to landowners and residents

The GRCA works closely with rural landowners to help them conserve and enhance natural resources on their land and improve and protect water quality and watershed health. The GRCA delivers municipal and partnership cost-share programs to support private land stewardship.

Through the Rural Water Quality Program and other grant programs, GRCA provides information, resources, and financial grants to landowners related to stewardship action, including agricultural best practices, private water well maintenance, tree planting and naturalization projects. The GRCA also facilitates private land, municipal and community partner tree planting, and coordinates education and outreach activities to promote actions to improve water quality and watershed health.

Providing outdoor environmental education

Since 1973, the GRCA has been actively connecting children and adults with nature by offering outdoor education programs. These programs provide people of all ages with an opportunity to engage with the local environment of the Grand River watershed. The hands-on, experiential, curriculum-based field trips for students from preschool to grade 12 form the core of the GRCA's outdoor environmental education program. The GRCA's programs encourage exploration and discovery to foster a connection to the local environment. Students spend at least 60 per cent of their field trip outdoors and educators bring classroom learning to life.

The GRCA currently provides outdoor environmental education to almost 30,000 students each year, through field trips by school groups to five nature centres, along with at-school visits and some virtual program delivery.

In addition to the school programming, the nature centres currently offer limited opportunities for nature-based activities for families, organizations and community groups. These programs focus on outdoor skills and nature discovery.

Looking Forward

The Grand River Conservation Authority plays important roles in protecting people and property from natural hazards, improving the health of the watershed, and connecting people to the environment through outdoor experiences. In preparing this Strategy, strategic risks and issues affecting the GRCA's resource management objectives were considered.

Through development of the Strategy, the GRCA's mandatory programs for managing the risk of natural hazards, conserving and managing the organization's lands, protecting drinking water sources, and delivering provincial surface water and groundwater monitoring programs were reviewed. The GRCA's programs comply with regulatory requirements and provide value to watershed municipalities, landowners, and residents. No currently unfunded priority actions were identified as needed to ensure the effectiveness of the GRCA's mandatory programs.

As communities continue to grow, climate changes, and competing pressures rise on lands and waters, programs and priorities must adapt to continue to be effective. The GRCA's programs are reviewed and collaborative plans, such as the Water Management Plan, are updated to incorporate new information and directions as needed.

The outcomes of many programs are reviewed periodically against established criteria. For instance, the Water Management Plan and related reports document the flood reduction benefits of the GRCA's dams and dikes and the reliability with which reservoir operations have been able to meet flow targets during dry weather. Annual reports from the Watershed-wide Wastewater Optimization Program document reductions in nutrient loading to the Grand River resulting from infrastructure investments and operational improvements. Implementation of the drinking water source protection plan is assessed annually. Finally, the GRCA assesses and reports on watershed conditions regularly.

Strong relationships with local, municipal, First Nations, provincial, and federal partners are critical for the GRCA to achieve its resource management objectives. It remains particularly important to engage and collaborate with provincial and federal agencies, as they establish guidelines and standards, and provide essential funding for core program areas (e.g., floodplain mapping, water infrastructure, drinking water source protection). With almost 90 years of watershed management experience, the GRCA has a lot of knowledge to offer to partners to inform efforts to address new challenges, like climate change.

The GRCA's watershed-based resource management priorities are to:

- Continue to deliver effective watershed programs that respond to watershed issues, municipal needs, and regulatory requirements,
- Continue to collaborate with municipalities, First Nations, provincial and federal agencies, and watershed organizations, landowners, and residents,
- Assess and respond to the impacts of population growth, land use change, and resource use on the health of the Grand River watershed, and
- Assess and respond to the impacts of climate change on natural hazards and the health of the Grand River watershed.

These priorities will be advanced through the GRCA's existing programs and budgets, as approved annually by the Grand River Conservation Authority. Key actions will include update of the GRCA's Strategic Plan and the Grand River Water Management Plan and Implementation Action Plan. Since endorsement of the Water Management Plan in 2014, new technical information has become available to improve understanding of watershed conditions and stressors (e.g., monitoring of nitrate concentrations, regional water quantity studies) and the GRCA and partners have completed most of the identified actions. The Water Managers Working Group will identify emerging issues and new management strategies that should be considered.

A final priority is to build relationships among organizations through participation in working groups and committees that align with the GRCA's programs and services. These include the Provincial Flood Forecasting and Warning Committee, Dam Owners Advisory Committee, Canadian Dam Association, Canadian Standards Association (Climate Change and Dam Operations), Ontario Water Power Association, the Great Lakes Water Quality Agreement and related Lake Erie teams, and various program-specific Conservation Ontario-led working groups.

Updates to the Strategy

The Strategy will be reviewed every 5 years and updated as needed. Municipalities, First Nations, other partners and interest holders will be engaged in future updates to the Strategy. Prior to publication of any updates to the Strategy, interest holders and the public will be consulted in a method that is appropriate at the time of the update.

Appendix A: Summary of technical studies, monitoring programs, and other information that guide the GRCA's programs

Programs and Services	Description	Program Guidance
Category 1 – Mandatory		
Watershed management	<ul style="list-style-type: none"> • Operate monitoring stations. • Complete field sampling in support of the Provincial Water Quality Monitoring Network (PWQMN) and Provincial Groundwater Monitoring Network (PGWN). • Maintain water budget to support sustainable water use in the watershed. • Operate a drought response program. • Provide advice on water use permits to province. • Report on emerging climate change impacts. 	<ul style="list-style-type: none"> • Watershed-based Resource Management Strategy • Natural Hazard Infrastructure Operational Plans • Natural Hazard Infrastructure Asset Management Plan • Water Management Plan and historical water management plans as listed on the GRCA's website: Historical Documents • Data collected under the PWQMN, PGMN • Data on precipitation, river flows, reservoir and lake levels, from 56 stream flow gauges, 24 rainfall gauges, and 12 snow courses • Data on groundwater levels from 52 dedicated monitoring wells to inform drought response • Geospatial data
Flood forecasting and warning and floodplain mapping	<ul style="list-style-type: none"> • Maintain computerized (Flood Forecasting and Warning) FFW system. • Operate 24 hour on call/duty officer system to respond to flooding events. • Maintain Communications and Emergency Response systems. 	<ul style="list-style-type: none"> • Data on precipitation, river flows, reservoir and lake levels, from 56 stream flow gauges, 24 rainfall gauges, and 12 snow courses • Flood and ice observations and data gathered from River Watch program and webcams • Digital elevation models and other geospatial data

Programs and Services	Description	Program Guidance
	<ul style="list-style-type: none"> • Collect and maintain data from dams, streamflow gauges, rainfall gauges, and snow courses, as well as collect weather forecast from various sources • Issue flood warnings • Operate reservoirs to reduce flooding. • Update and maintain flood line mapping. • Develop natural hazards mapping. 	<ul style="list-style-type: none"> • Watercourse and floodplain mapping • Hydrologic and hydraulic models • Natural Hazard Infrastructure Operational Plans • Natural Hazard Infrastructure Asset Management Plan • Ice Management Plan • Reservoir Operation • Water Management Plan and historical water management plans as listed on the GRCA's website: Historical Documents
Water control structures – flood control, small dams and ice management	<p><u>Flood Control Structures</u></p> <ul style="list-style-type: none"> • Operate and maintain 7 major flood control structures, 5 major dike systems. • Perform dam safety reviews, inspections, monitoring, and capital maintenance and upgrade projects. • Develop and implement public safety plans for structures. <p><u>Small Dams</u></p> <ul style="list-style-type: none"> • Operate and maintain 21 small dams and surrounding lands. <p><u>Ice Management</u></p> <ul style="list-style-type: none"> • Perform Ice Management Activities and respond to Flooding from ice jams by issuing flood warnings and providing support to municipal emergency management personnel 	<ul style="list-style-type: none"> • Natural Hazard Infrastructure Operational Plans, Operational, Maintenance and Surveillance Manuals • Natural Hazard Infrastructure Asset Management Plan • Ice Management Plan • Dam Safety Maturity Matrix Evaluation – Dam Management Program Priorities • Reservoir Operating Policy, Maintenance of Water Control Structures Policy • Data on precipitation, river flows, reservoir and lake levels, from 56 stream flow gauges, 24 rainfall gauges, and 12 snow courses • Flood and ice observations and data gathered from River Watch program and webcams • Inspections, dam and dike safety studies

Programs and Services	Description	Program Guidance
		<ul style="list-style-type: none"> Water Management Plan and historical water management plans as listed on the GRCA's website: Historical Documents
Resource planning – plan input and review, permitting and solicitor inquiries	<ul style="list-style-type: none"> Process permits related to development, alteration or other activities in regulated areas. Review official plans, secondary and community plans, zoning bylaws, development applications and other proposals (i.e., environmental assessments) Enforce applicable regulations. Develop and maintain policies and guidelines to manage natural hazards. Provide advisory services to the province and municipalities. 	<ul style="list-style-type: none"> Conservation Authorities Act and related regulations, including O. Reg. 41/24: Prohibited Activities, Exemptions and Permits GRCA Policies for the Administration of the Prohibited Activities, Exemptions and Permits Regulation (O. Reg. 41/24) Mapping of natural hazards (e.g., watercourses, wetlands, unstable soil or bedrock, shoreline areas affected by flooding, erosion of dynamic beach hazards) and regulated areas and other geospatial data Shoreline Management Plan for Lake Erie Various subwatershed studies and plans as listed on the GRCA's website: Watershed Planning
Conservation lands management	<ul style="list-style-type: none"> Maintain passive conservation areas. Maintain property integrity (i.e., encroachments) and security (unauthorized use) Develop and maintain trail networks on GRCA owned land. Manage natural hazards on GRCA properties Capital and operational support services provided to maintain the built infrastructure on GRCA owned land. 	<ul style="list-style-type: none"> Conservation Area Strategy Land Inventory GRCA Forest Management Plan Ecological Land Classification, Hazard Tree Database and other Geospatial data Property-specific management plans and master plans, including those for Dumfries Conservation, Puslinch Tract, Snyder's Flats, Dunnville Marshes, and the Niska Land Holdings

Programs and Services	Description	Program Guidance
	<ul style="list-style-type: none"> • Create and maintain Asset Management Plan for built infrastructure on GRCA owned land. • Dispose of lands declared surplus and plan for disposition of other surplus lands. • Acquire environmentally significant conservation lands (greenspace management). • Operate hazard tree management program on GRCA owned land. • Deliver forest management, tree planting, woodlot thinning, selective harvesting, and naturalization projects on GRCA owned land. • Maintain the Managed Forest Tax Incentive Program. • Invasive Species Management on GRCA owned land. • Provide planning services/assistance to enhance, restore, rehabilitate, and protect aquatic and terrestrial ecosystems on GRCA owned lands. 	
Source protection planning	<ul style="list-style-type: none"> • Deliver the provincial source protection planning program under the <i>Clean Water Act, 2006</i> for the Lake Erie Source Protection Region made up of four watersheds. 	<ul style="list-style-type: none"> • Clean Water Act, 2006 and associated regulations • Grand River Assessment Report • Grand River Source Protection Plan • Geospatial data
Category 2 – Municipal		
Subwatershed services	<ul style="list-style-type: none"> • Identify and recommend where subwatershed or watershed studies are needed 	<ul style="list-style-type: none"> • Various subwatershed studies and plans as listed on the GRCA's website: Watershed Planning

Programs and Services	Description	Program Guidance
	<ul style="list-style-type: none"> • Review and provide input to subwatershed studies or other regional-scale technical studies • Undertake subwatershed monitoring to support municipal studies under agreement 	<ul style="list-style-type: none"> • Geospatial data • Water Management Plan and related reporting on watershed conditions as listed on the GRCA's website: Studies and Reports
Conservation services	<ul style="list-style-type: none"> • Deliver municipal and partnership cost-share programs to support private land stewardship action • Facilitate private land, municipal and community partner tree planting • Coordinate education and outreach activities to promote watershed health 	<ul style="list-style-type: none"> • Water Management Plan and related reporting on watershed conditions as listed on the GRCA's website: Studies and Reports • Geospatial data
Water quality programs	<ul style="list-style-type: none"> • Support optimization of wastewater treatment plant operations through workshops, hands-on training, technical advice, and recognition awards • Provide technical support for municipal assimilative capacity studies and water/wastewater services • Surface water quality monitoring, modelling, analysis and reporting, groundwater quality analysis and reporting 	<ul style="list-style-type: none"> • Water Management Plan and related reporting on watershed conditions as listed on the GRCA's website: Studies and Reports • Annual reports on wastewater treatment plant performance • Data collected under the Provincial Water Quality Monitoring Network and the Provincial Groundwater Monitoring Network • Data collected at 9 automated water quality stations provide continuous reports on water temperature, pH levels, conductivity and dissolved oxygen • Additional surface water quality or groundwater quality data collected for special studies • Geospatial data

Programs and Services	Description	Program Guidance
Watershed sciences and collaborative planning	<ul style="list-style-type: none"> • Watershed and landscape scale science and reporting • Support cross-disciplinary integration and inform municipal watershed planning and water, wastewater, and stormwater master planning through the Grand River Water Management Plan and Water Managers Working Group • Liaise with provincial, federal agencies, NGOs 	<ul style="list-style-type: none"> • Watershed-based Resource Management Strategy • Water Management Plan and related reporting on watershed conditions as listed on the GRCA's website: Studies and Reports • Natural Heritage Characterization Reports • Grand River Fisheries Management Plan • A Watershed Forest Plan for the Grand River • Geospatial data
Category 3 - Other		
Burford Tree Nursery and Planting Operations	<ul style="list-style-type: none"> • Provide services to private and public landowners and community groups to engage in tree planting activities. • Operate the Burford Tree Nursery. 	
Conservation services – special projects	<ul style="list-style-type: none"> • Deliver special projects that study and/or provide awareness and education related to improving and protecting water quality and related initiatives. This may include special events such as water festivals. • Develop and deliver GRCA volunteer activities to enable public participation in GRCA environmental activities. 	<ul style="list-style-type: none"> • Geospatial data
Environmental education	<ul style="list-style-type: none"> • Deliver outdoor education sessions: school classes, day-camp program (under review), community groups, private groups. 	

Programs and Services	Description	Program Guidance
	<ul style="list-style-type: none"> • Operate five outdoor education centres: Apps Mill, Laurel Creek, Shades Mills, Guelph Lake, Taquanyah 	
Property rentals	<ul style="list-style-type: none"> • Lease of about 750 cottage lots at Belwood Lake and Conestogo Lake. Not applicable. • Lease agricultural lands. • Lease 8 residential units. • Over 50 miscellaneous commercial agreements for use of GRCA lands. 	<ul style="list-style-type: none"> • Lease rates based on current market values
Hydro production	<ul style="list-style-type: none"> • Generate hydro revenue from turbines at four dams (Shand, Conestogo, Guelph, and Drimmie). 	<ul style="list-style-type: none"> • River level and flow monitoring
Conservation Areas	<ul style="list-style-type: none"> • Operate 11 active Conservation Areas (8 camping and 3 day-use only). • Operate Luther Marsh Wildlife Management Area • Offer hunting on certain designated GRCA Lands 	<ul style="list-style-type: none"> • Conservation Areas Strategy • Property-specific management plans and master plans, including those for Laurel Creek Conservation Area, Luther Marsh Wildlife Management Area