Graham Creek Watershed Plan 2010

GRCA Board Approval April 15, 2010
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DURHAM REGION

The Municipality of Port Hope

Ganaraska CONSERVATION

Clarington
Leading the Way

Northumberland county

The Graham Creek Watershed Plan was written to provide guidance and recommendations for the conservation, enhancement and sustainable management of the Graham Creek watershed and its resources. Recommended management actions are based on scientific data presented in the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features*, as well as municipal, stakeholder and public input.

The Graham Creek Watershed Plan was written by Pam Lancaster, B.Sc., Stewardship Technician and Mark Peacock, P. Eng., Director, Watershed Services with technical assistance from staff of the Ganaraska Region Conservation Authority (GRCA).

Brian Morrison, B.Sc., Fisheries Biologist
Ken Towle, M.E.S., Ecologist
Magdi Widaatalla P.Geo., M.Sc., Manager, Watershed Services

Maps were created by the GRCA GIS Department.

Brian Curran, B.Sc., GIS Technician
Jeff Moxley, Manager GIS/IT
Steve Nowak, B.A., GIS Technician

Photo Credits: GRCA staff, Sally Walsh and Kris Vande Sompel

This document was created for the residents, communities, municipalities and stakeholders of the Graham Creek watershed. Review and input into this document by the Technical Review Committee, Community Advisory Committee, stakeholders and residents occurred through the watershed planning process.

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The Graham Creek Watershed Plan was written with review and input from members of the Technical Review Committee and the Community Advisory Committee.

Technical Review Committee

Mark Peacock	Ganaraska Region Conservation Authority
Pam Lancaster	Ganaraska Region Conservation Authority
Brian Morrison	Ganaraska Region Conservation Authority
Janice Szwarz	Municipality of Clarington
Ron Warne	Municipality of Port Hope
Christina Harvey	Northumberland County
Carla Pierini	Regional Municipality of Durham
Jacques Perreault	Durham Region Health Department
Atul Jain	Haliburton, Kawartha Pine Ridge District Health Unit
Peter Doris	Ontario Ministry of Agriculture, Food and Rural Affairs
Jim Martherus	Ontario Ministry of the Environment
Louis Bitonti	Ontario Ministry of Municipal Affairs and Housing, Central
Amanda McLachlan	Ontario Ministry of Municipal Affairs and Housing, Eastern
Warren May	Ontario Ministry of Natural Resources, Aurora
Dan Tallion	Ontario Ministry of Natural Resources, Peterborough
Marc Desjardins	Lake Ontario Fisheries Unit
Stephen Haayen	Fisheries and Oceans Canada

Community Advisory Committee

Alex Cannings	Resident
Brian Reid	Resident, Samuel Wilmot Nature Area Advisory Committee
Bruce Blight	Resident
Chris Cloutier	Dufferin Aggregates
Colin Abernethy	Resident
David Best	Landowner, Samuel Wilmot Nature Area Advisory Committee
Emily Gruyters	Durham College Student
Gary Vandergast	Resident
Hugh Beauchamp	Resident
Janelle Andrews	Durham Sustain Ability
Jim Cleland	Resident, Samuel Wilmot Nature Area Advisory Committee
Jim Kamstra	Landowner
Corry Kamstra	Landowner
Jim Yaki	Resident
Karin Murphy	Resident, Samuel Wilmot Nature Area Advisory Committee
Sasha Lambrinos	Caring for the Moraine, Oak Ridges Moraine Foundation

The Graham Creek Watershed Plan
Executive Summary

The Graham Creek watershed is recognized for its fisheries, aquatic habitat, terrestrial natural heritage and recreational opportunities. The Graham Creek Watershed Plan has been developed to conserve, enhance and manage the watershed and its resources for current and future generations. The purpose of the Graham Creek Watershed Plan includes the following:

- Fulfill the watershed planning requirements of the *Oak Ridges Moraine Conservation Plan* (Appendix C).
- Create community awareness and ownership of the Graham Creek watershed and its plan.
- Provide recommendations that conserve the ecological and hydrological integrity of the watershed.
- Encourage land and resource uses that maintain, improve or restore the ecological and hydrological functions of the watershed.
- Provide recommendations that maintain or improve the elements that contribute to the ecological and hydrological functions of the watershed, including the quality and quantity of water, and aquatic and terrestrial resources.

Written for the municipalities, communities, residents and resource users of the watershed, this watershed plan outlines recommended management actions required to conserve this valuable resource for current and future generations. Recommended actions have been derived from scientific data outlined in the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* (Ganaraska Region Conservation Authority 2009), local knowledge, municipal and agency input and review, and public consultation. Formal processes were carried out with direct review and input from the Technical Review Committee and the Community Advisory Committee.

As a result of a year-long initiative, management actions, targets, monitoring and reporting activities have been formulated. The foundation of management actions is based on the goals and objectives of each watershed component, which is defined by the associated science. Each objective addresses multiple issues or opportunities in the Graham Creek watershed. Management actions have been defined in terms of regulation and planning, stewardship, education and awareness, and land acquisition. A summary of goals, objectives and management actions are found below.

Approval, adoption and implementation of the Graham Creek Watershed Plan are the most important steps in this initiative. Participation and co-operation by the Ganaraska Region Conservation Authority (GRCA), the Regional Municipality of Durham, Municipality of Clarington, the Municipality of Port Hope and Northumberland County are needed to ensure adoption of the Graham Creek Watershed Plan. In addition, participation by residents, businesses and stakeholders of the Graham Creek watershed is required to see the desired outcomes and successes of the Graham Creek Watershed Plan.

Summary of Goals, Objectives and Management Actions

General Recommendations

Regulations and Planning

- Implement future policies recommended in the Source Protection Plan created through the *Clean Water Act*.
- Implement *Oak Ridges Moraine Conservation Plan* policies across the Graham Creek watershed.
- Subwatershed level investigations
- Implement future policies recommended in a Ganaraska Region Climate Change Strategy.

Stewardship: implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program and partner programs throughout the Graham Creek watershed.

Education and Awareness: provide information pertaining to all aspects of the Graham Creek watershed. In addition, the Ganaraska Forest Centre should be used to its full educational potential.

Land Acquisition: environmental features may be acquired by a public authority for protection through the purchase of land, donation of land, land rental, conservation easements and land use covenants.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed. It is also important to review and report on watershed plan implementation.

Groundwater Quantity

Groundwater Quantity Goal 1.0: protect and enhance groundwater quantity for ecological functions and human use.

Objective 1.1: maintain or enhance groundwater recharge and discharge for ecological functions and human use.

Regulations and Planning

Recommended policies:

- Map groundwater features.
- Identify groundwater features not yet known.
- Restrict development within and in proximity to groundwater features.
- Protect recharge rates.
- Set urban infiltration targets.

Support for:

- Current plan review mechanisms

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Increase natural cover in and adjacent to groundwater features.
- Achieve the natural heritage system as the primary means of protecting groundwater features.
- Enhance and protect groundwater features through best management practices conducted on the land.
- Encourage the adoption of urban land use practices that increase groundwater recharge.

Education and Awareness: provide information pertaining to groundwater quantity.

Land Acquisition
Recommended policy:

- Protect groundwater features through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 1.2: manage and avoid actions that negatively affect aquifers (artesian, shallow and deep) and changes in groundwater flow.

Regulations and Planning
Recommended policies:

- Minimize groundwater flow alteration.
- Minimize and manage artesian and flowing wells.

Education and Awareness: provide information pertaining to aquifers and groundwater quantity.

Objective 1.3: ensure sustainable rates of groundwater use.

Regulations and Planning
Recommended policies:

- Restrict development in groundwater features needing a Permit to Take Water.
- Restrict consumptive water takings.

Support for:

- Existing review mechanisms and by-laws
- Water conservation plan creation.

Education and Awareness: provide information regarding water takings.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Surface Water Quantity

Surface Water Quantity Goal 2.0: maintain and improve the hydrologic function of the watershed.

Objective 2.1: maintain and enhance the water balance and baseflow of the Graham Creek watershed.

Regulations and Planning
Recommended policies:

- Map features contributing to natural flows of Graham Creek.
- Identify features contributing to natural flows of Graham Creek not yet known.
- Restrict development within and in proximity to features contributing to natural stream flows.
- Limit cumulative hard surfaces in the Graham Creek watershed.
- Require development setbacks from Graham Creek.
- Restrict development in features contributing to natural flows in Graham Creek needing a Permit to Take Water.
- Restrict consumptive water takings.
- Require urban stormwater best management practices.
- Limit online ponds and impoundment structures.
- Limit site alterations.

Support for:

- Existing legislation
- Review mechanisms
- Existing program implementation.

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Increase natural vegetation using the natural heritage system throughout the watershed, in groundwater recharge areas, and to compensate for changes in imperviousness of the watershed.
- Increase riparian buffers to reduce variability of overland runoff.
- Increase water infiltration, storage and use on individual lots.
- Protect, restore and enhance wetlands.
- Carry out an urban stewardship program to address altered flows caused by stormwater management.
- Increase channel stability using bioengineering in urbanized areas to mitigate erosion caused by altered flows.

Education and Awareness: provide information regarding surface water quantity and the protection and enhancement of the form and function of streams.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 2.2: maintain and improve the level of flood hazard protection for residents, and for existing and proposed development.

Regulations and Planning
Recommended policies:

- Limit cumulative hard surfaces in the Graham Creek watershed.
- Limit online ponds and impoundment structures.
- Stormwater quantity control.

Support for:

- Existing policies and programs

Recommended program:

- Flood recovery program

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Manage or decommission online ponds to ensure they do not pose a flood hazard risk.
- Implement re-vegetation to attenuate flood flows (e.g., riparian plantings, grass swales and waterways).

Education and Awareness: provide information regarding flood forecasting and warning and emergency response.

Land Acquisition
Recommended policy:

- Protect floodplains through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Groundwater Quality

Groundwater Quality Goal 3.0: protect groundwater quality to ensure safe drinking water supplies and to protect ecological functions.

Objective 3.1: protect and enhance the quality of groundwater by addressing existing pathways and contaminant sources.

Regulations and Planning
Recommended policy:

- Ensure that wells or boreholes are properly maintained or abandoned.

Policy investigation and creation:

- Require private sewage system upgrades during redevelopment.

Recommended program:

- Septic re-inspection program

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Upgrade or decommission wells and boreholes.
- Repair septic systems and provide for septic inspections.
- Upgrade or newly construct fuel and chemical storage facilities.
- Support septic re-inspection program.

Education and Awareness: provide information regarding groundwater quality and drinking water protection.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 3.2: manage the quality of groundwater through the implementation of best management practices throughout the watershed.

Regulations and Planning
Recommended policies:

- Map highly vulnerable aquifers.
- Identify areas vulnerable to groundwater contamination not yet known.
- Restrict development in highly vulnerable aquifers.

Support for:

- Existing legislation and programs

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, encourage and provide incentives for best management practices in highly vulnerable aquifers and significant groundwater recharge areas.

Education and Awareness: provide information regarding groundwater quality and best land use practices.

Land Acquisition
Recommended policy:

- Protect vulnerable groundwater features through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Surface Water Quality

Surface Water Quality Goal 4.0: protect and improve surface water quality.

Objective 4.1: manage and enhance rural water quality.

Regulations and Planning
Recommended policies:

- Set development back from Graham Creek.

- Use “enhanced” level stormwater quality controls.

Support for:

- Existing legislation
- Existing and new programs.

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Decrease and mitigate non-point pollution sources (e.g., overland runoff).
- Enhance, restore and properly manage riparian areas to buffer overland runoff.
- Promote and encourage best management practices to protect water quality.
- Increase natural cover as recommended by the natural heritage system.

Education and Awareness: provide information regarding rural surface water quality.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 4.2: manage and enhance urban water quality.

Regulations and Planning

Recommended policies:

- Set development back from Graham Creek.
- Reduce chloride concentrations.
- Use “enhanced” level stormwater quality controls.
- Maintain existing stormwater control structures.

Support for:

- Existing legislation
- Existing programs.

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Work with local businesses to carryout practices that do not negatively impact surface water quality.
- Ensure public space management practices do not negatively impact surface water quality.
- Ensure all public spaces management practices have a set back distance from the stream edge (e.g., a natural riparian area).
- Create and implement an urban stream restoration and stewardship program that will benefit surface water quality.

Education and Awareness: provide information regarding urban surface water quality.

Land Acquisition

Recommended policy:

- Protect surface water quality through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 4.3: create a spills action plan.

Regulations and Planning
Plan creation: spills action plan

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Aquatic Habitat and Species

Aquatic Habitat and Species Goal 5.0: protect aquatic habitat and species.

Objective 5.1: protect and restore existing and native aquatic species and communities.

Regulations and Planning
Recommended policy:

- Adopt the Graham Creek Fish Habitat Management Plan.

Support for:

- Existing review mechanisms and programs

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Remove man-made instream barriers.
- Remove online ponds.
- Improve stream temperature.

Education and Awareness: provide information regarding aquatic species.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 5.2: protect and enhance the form and function of instream habitat and riparian areas.

Regulations and Planning
Recommended policies:

- Map aquatic habitats in the Graham Creek watershed.
- Identify aquatic habitats in the Graham Creek watershed not yet known.
- Restrict development within and in proximity to aquatic habitats.
- Adopt the Graham Creek Fish Habitat Management Plan.

Support for:

- New programs
- Existing review mechanisms and policies.

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:

- Instream habitat creation.
- Erosion control projects.
- Increase of natural vegetation in riparian areas.

Education and Awareness: provide information regarding aquatic habitat.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Terrestrial Natural Heritage

Terrestrial Natural Heritage Goal 6.0: maintain the native biodiversity and ecological function of the landscape within the watershed.

Objective 6.1: reduce habitat fragmentation and promote connectivity.

Regulations and Planning
Recommended policies:
- Identify and map terrestrial features in the Graham Creek watershed.
- Identify terrestrial features in the Graham Creek watershed not yet known.
- Reduce the impact of development on the natural heritage system and significant features.
- Produce net gains within the natural heritage system.

Recommended planning strategy:
- Create a regional terrestrial natural heritage system and strategy

Support for:
- Existing plan review mechanisms

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:
- Increase the diversity of natural cover in the Graham Creek watershed in target areas define by the natural heritage system.
- Increase natural cover throughout the watershed.
- Increase and encourage sustainable land uses.
- Increase and enhance tallgrass prairie habitats.
- Restore degraded sites such as Brownfields or aggregate extraction sites.

Education and Awareness: provide information regarding terrestrial natural heritage.

Land Acquisition
Recommended policy:
- Protect natural heritage features through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 6.2: maintain, enhance and restore the natural diversity of vegetation communities in the watershed.

Regulations and Planning
Recommended policies:
- Net gains in the natural heritage system
- Harvesting of resources from wetlands

Support for:
- Existing by-laws

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:
- Increase the diversity of natural cover in the Graham Creek watershed using the natural heritage system.
- Increase natural cover throughout the watershed.
- Protect and increase cover of old growth forest.
- Increase and encourage sustainable land uses.

Education and Awareness: provide information regarding vegetation communities.

Land Acquisition
Recommended policy:
- Protect vegetation communities through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 6.3: maintain, enhance and restore the diversity of native species in the watershed.

Regulations and Planning
Recommended policy:
- Net gains within the natural heritage system

Support for:
- Existing legislation

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following:
- Increase the diversity of natural cover within the natural heritage system.
- Increase natural cover throughout the watershed with a focus on interior habitat.
- Enhance and increase specific habitat types such as wetlands, vernal pools and old growth forest.
- Assist in invasive species control or removal.

Education and Awareness: provide information regarding native species, their status, and threats to these species.

Land Acquisition
Recommended policy:

- Protect species habitats through land acquisition.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 6.4: mitigate and reduce negative impacts of urban and rural land use.

Regulations and Planning
Recommended policy:

- Net gains in the natural heritage system

Plan creation:

- Urban natural heritage system

Education and Awareness: provide information regarding native species and threats to these species. Include information on how to deal with the threats.

Public Health and Well-being

Public Health and Well-being Goal 7.0: promote healthy communities in relation to the environment.

Objective 7.1: manage and improve the environmental quantity, quality and social benefits of existing and future public spaces.

Regulations and Planning
Recommended policies:

- Increase of public spaces

Support for:

- Existing programs and initiatives

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, accomplish the following in public spaces:

- Increase natural, native vegetation.
- Increase healthy lifestyle infrastructure.
- Increase educational aspects of the public space.

Education and Awareness: provide information regarding public spaces.

Monitoring and Reporting: monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed.

Objective 7.2: encourage sustainable communities.

Regulations and Planning
Recommended policy:
- Increase in public transportation

Support for:
- Existing initiatives

Stewardship: through the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program, and partner programs, increase actions around sustainable living.

Education and Awareness: provide information regarding sustainable living and development for residents and local businesses.

Community Heritage

Community Heritage Goal 8.0: preserve and interpret our community heritage.

Objective 8.1: increase awareness and appreciation of our community heritage.

Education and Awareness: provide information regarding cultural heritage using partner programs.

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Figures and Tables

1.0 Introduction

Throughout the Province of Ontario there is a need to manage and plan for the appropriate use of the natural environment and its resources. As development continues across the landscape, sustainable management and appropriate planning are required to ensure that current and future actions do not degrade, negatively alter or destroy the natural environment. A watershed plan is an effective planning tool used to ensure that current and future generations are able to progress while acknowledging and addressing changes to the local ecosystem.

The planning boundary of a watershed plan is a watershed: an area of land that drains into a particular point such as a lake or river. Defined by topographical boundaries (heights of land), watersheds may cross many political jurisdictions. The Graham Creek watershed within the Ganaraska Region Conservation Authority (GRCA) drains to Lake Ontario as it passes through the Municipality of Clarington, within the Regional Municipality of Durham, and the Municipality of Port Hope within Northumberland County (Figure 1.0). The watershed is a dynamic and unique place with complex webs of natural features, functions, and interactions among the soil, water, air, plants and animals. These features and functions in a watershed need to be conserved for the benefit of the local environment, watershed and community.

Partnerships and public input are integral to the creation, adoption and implementation of a watershed plan. The watershed plan process is open and transparent, allowing public and local opinions, interests and concerns to shape the understanding and recommended management actions of the watershed. The public, landowners, farmers, resource users and naturalists as well as municipalities, government agencies, health agencies and utilities are crucial partners in this watershed planning process. In the end, a watershed plan is created for the conservation and sustainable management of the local watershed by the community and current generation for the future community and generations.

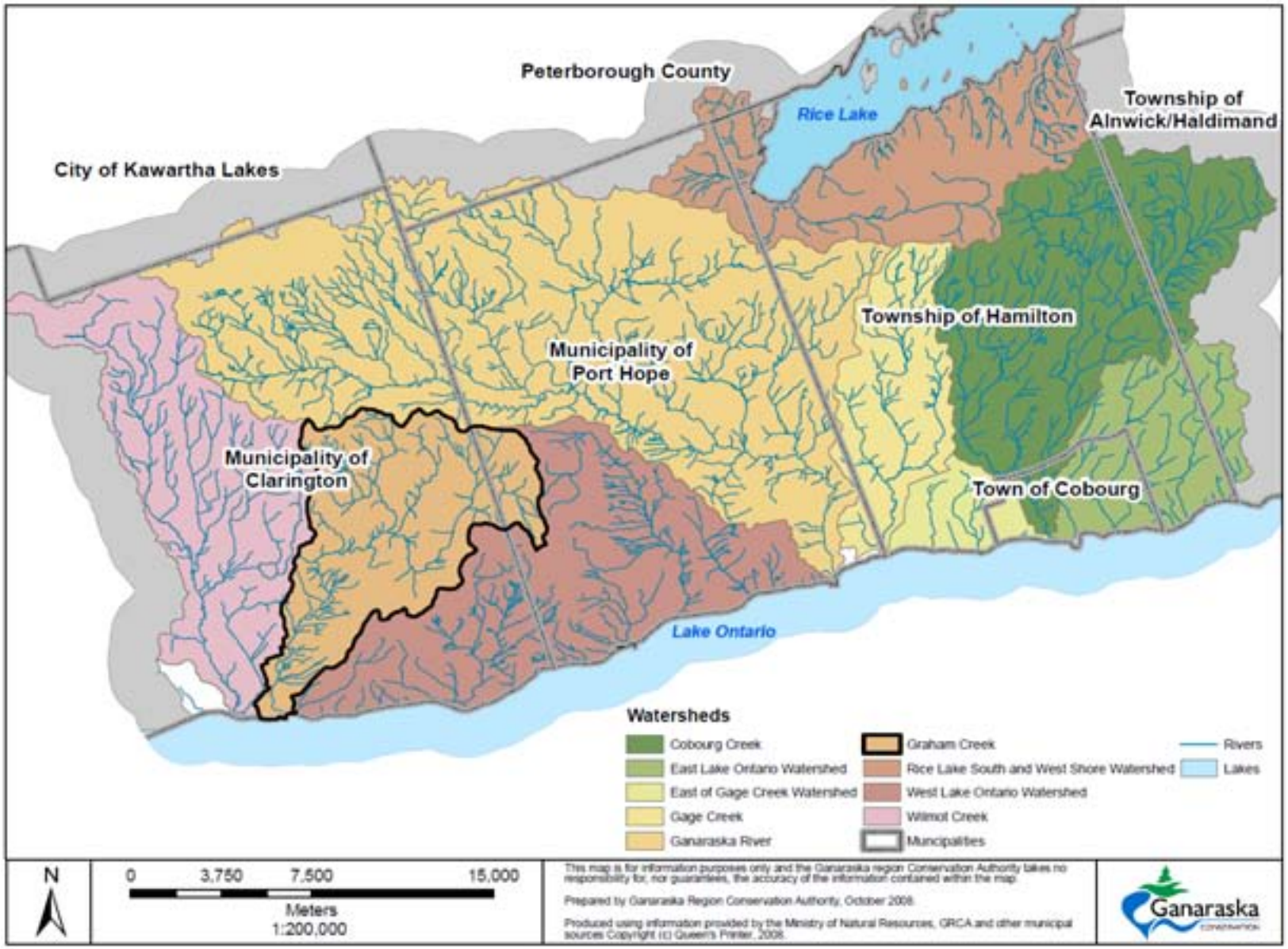


Figure 1.0: Graham Creek watershed within the Ganaraska Region Conservation Authority

1.1 Local History of Watershed Planning and Management

A. H. Richardson

The conservation movement in Ontario dates back to 1936 with the formation of the Ontario Conservation and Reforestation Association (Richardson 1974). During its existence, the Association furthered conservation in Ontario with the establishment of a soils department at the Ontario Agricultural College, a Conservation Branch within the Department of Planning and Development, two tree nurseries, and district foresters throughout Ontario (Richardson 1974). However, the most instrumental addition to the conservation movement was the passing of the *Conservation Authorities Act* in 1946.

The *Conservation Authorities Act* was driven to legislation by a group of conservationists named the Guelph Conference. This group was formed out of a conference in 1941, organized by the Ontario Conservation and Reforestation Association, and the Federation of Ontario Naturalists (Shrubsole 1989). In order to build a case for conservation in Ontario, the Guelph Conference decided that a pilot survey should be carried out and funded by the provincial and federal governments (Richardson 1974). The selected survey site was the Ganaraska River watershed, with the survey being conducted from 1942 to 1943 (Richardson 1944). The Ganaraska River watershed survey, the work carried out by the founding conservation associations, and the *Conservation Authorities Act* paved the way for the creation of the 36 Conservation Authorities that exist today.

The resulting report from the pilot study entitled "*Ganaraska Watershed: A study in land use with recommendations for the rehabilitation of the area in the post war period*" by A.H. Richardson, provided the necessary plan for managing the Ganaraska River watershed, and also other local watersheds. Under the *Conservation Authorities Act*, the Ganaraska River Conservation Authority was formed on October 8, 1946 (Richardson 1974).

In 1962 with the addition of Wilmot Creek, Graham Creek and smaller streams flowing to Lake Ontario in the west, and again in 1970 with the addition of Gage Creek, Cobourg Creek and streams flowing to Lake Ontario and Rice Lake in the east, the Ganaraska River Conservation Authority was enlarged and renamed the Ganaraska Region Conservation Authority (GRCA) (Richardson 1974). Over the last 60 years, the GRCA has managed its watersheds under the direction of the *Conservation Authorities Act*, relevant acts (Appendix A), historic management documents (Richardson 1944; Department of Energy and Resources Management 1966; and Ontario Ministry of Natural Resources 1976), and municipal and community direction and input.

1.2 Municipal Recognition of Watershed Planning

Recognition of the importance of watershed plans, the planning process, and the implementation of watershed plans by municipalities is critical to the conservation and sustainable management of local watersheds. Although many needs for a watershed plan may exist, the local requirement and adoption of a watershed plan by a municipality is considered to be the most influential.

In the Graham Creek watershed, the Regional Municipality of Durham, through its official plan (Durham Regional Official Plan 2008 Consolidation), recognizes the need for a watershed plan, as does the Municipality of Clarington through its official plan (Municipality of Clarington 2007) and the Municipality of Port Hope (Municipality of Port Hope 2009).

Durham Regional Official Plan 2008 Consolidation:

> ***Policy 2.3.8*** *The preparation and implementation of watershed plans is supported as an effective planning tool in the protection of the Region's natural resources.*
>
> ***Policy 2.3.9*** *It is the intent of this [official] Plan that watershed plans will be prepared or updated for each watershed on a priority basis recognizing development pressures, environmental urgency and fiscal constraints. Watershed plans shall be prepared or updated in accordance with currently accepted practices.*
>
> ***Policy 2.3.11*** *The Region, in co-operation with the conservation authorities, shall, where necessary, ensure that the appropriate policies to implement individual watershed plans are incorporated into the Regional and area municipal official plans.*

Municipality of Clarington Official Plan:

> ***Policy 4.3.1*** *The Municipality supports the need to undertake multi-stakeholder watershed planning studies in order to protect the integrity of ecological and hydrological functions, and shall establish priorities for the preparation of watershed plans. In this regard, the Municipality will work in partnership with the Ministry of Natural Resources, Conservation Authorities and other agencies in the preparation of watershed plans.*

Municipality of Port Hope Official Plan:

> ***Policy C7*** *The Municipality shall protect, improve or restore the quality and quantity of water where feasible. Council may delineate watersheds and/or subwatersheds and authorize the preparation of watershed or subwatershed plans.*

Watershed planning is not only recognized in current municipal official plans, but has been supported as far back as the 1990s. In 1998 and in response to increased development pressures, the Municipality of Clarington and the

Regional Municipality of Durham, in partnership with the Ganaraska Region Conservation Authority initiated a watershed planning process for the Graham Creek watershed. Technical Steering Committee meetings and public meetings were held in order to work toward a watershed plan. However, at the end of 2000 the process was put on hold due to provincial discussions regarding the *Oak Ridges Moraine Act* and *Conservation Plan*, which among other things would recommend the need for and direction of watershed plans.

1.3 Watershed Planning under the *Oak Ridges Moraine Conservation Act*

In 2001 the Province of Ontario enacted the *Oak Ridges Moraine Conservation Act*, which established Regulation 140/02, the *Oak Ridges Moraine Conservation Plan,* in 2002. The purpose of the *Oak Ridges Moraine Conservation Plan* is to provide land use and resource management planning direction to provincial ministers, ministries, agencies, municipalities, municipal planning authorities, landowners and other stakeholders on how to protect the Moraine's ecological and hydrological features and functions (Ontario Ministry of Municipal Affairs and Housing 2002). Under Section 24, of the *Oak Ridges Moraine Conservation Plan* requirements are given for watershed plans.

> *(1) Every upper-tier municipality and single-tier municipality shall, on or before April 22, 2003, begin preparing a watershed plan, in accordance with subsection (3), for every watershed whose streams originate within the municipality's area of jurisdiction.*
>
> *(2) The objectives and requirements of each watershed plan shall be incorporated into the municipality's official plan.*
>
> *(3) A watershed plan shall include, as a minimum,*
> - *(a) a water budget and conservation plan as set out in section 25;*
> - *(b) land and water and management strategies;*
> - *(c) a framework for implementation, which may include more detailed implementation plans for smaller geographic areas, such as subwatershed plans, or for specific matter, such as environmental damage;*
> - *(d) an environmental monitoring plan;*
> - *(e) provisions requiring the use of environmental management practices and programs, such as programs to prevent pollution, reduce the use of pesticides and manage the use of road salt; and*
> - *(f) criteria for evaluating the protection of water quality and quantity, hydrological features and hydrological functions.*

As a result of the legislative requirements, the Municipality of Clarington and the Regional Municipality of Durham are required to create a watershed plan for the Graham Creek watershed, which originates on the Oak Ridges Moraine (Figure 1.1). The Municipality of Port Hope, although not under legislative requirements, require a watershed plan for sound environmental management practices. The role of the Ganaraska Region Conservation Authority is to coordinate the watershed plan process in partnership with the municipalities.

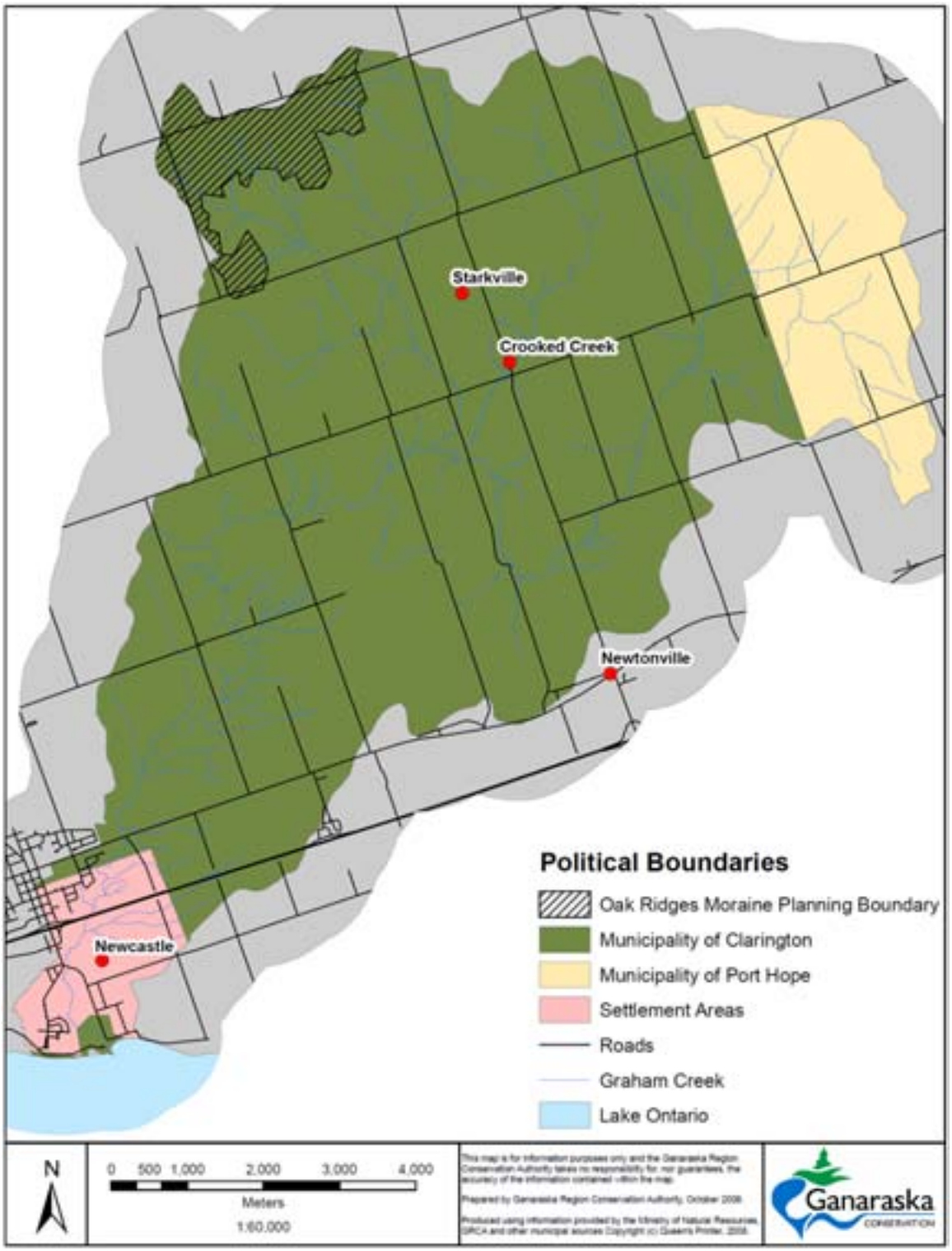
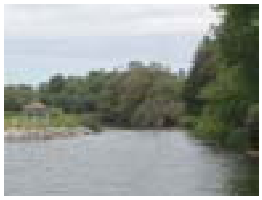


Figure 1.1: Oak Ridges Moraine planning boundary in the Graham Creek watershed



2.0 Watershed Plan Process

The watershed plan process is one step in the ongoing process of watershed management. The basic principles of watershed management have changed little since formally described in the early 1990s (Ontario Ministry of Environment and Energy and Ministry of Natural Resources 1993). As illustrated in Figure 2.0, the process of watershed management has four phases (Conservation Ontario 2003). Conservation Authorities in Ontario commonly follow these processes, although adaptations may occur to suit local watershed needs.

Plan: develop watershed, subwatershed or other watershed based environmental plans.

Implement: apply programs, policies or projects that are recommended in the plan.

Monitor and Report: assess whether goals, objectives and targets are met and communicate the results to decision makers and the public.

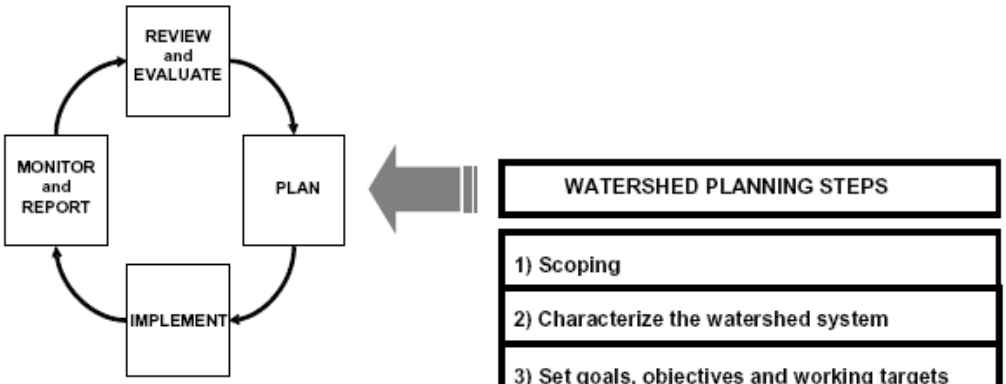
Review, Evaluate and Update: regularly review the watershed plan and assess if changes are needed in the plan.

Watershed plans are usually prepared in response to a trigger, such as public concerns about environmental conditions, a municipal official plan requirement, or provincial directions such as the requirements set out by the *Oak Ridges Moraine Conservation Plan*. Watershed plans also complement and take into consideration other government acts, regulations and policies (Appendix A). Not only is watershed management and planning a technical process, it must also consider social aspects. To be relevant, watershed management must be based on solid science, and reflect the preferences of the people living in the watershed (Conservation Ontario 2003).

The “plan” phase of watershed planning can be described according to eight steps as shown in Figure 2.0. The specific Ganaraska Region Conservation Authority planning process is shown in Figure 2.1. Figure 2.2 lists the types of questions to be answered through the watershed plan process (Conservation Ontario 2003). The key to success is public, community and stakeholder input into all planning steps. Steps 1 and 2 were completed prior to the creation of this watershed plan. Scoping requires choosing a study area, creating a Terms of Reference (Ganaraska Region Conservation Authority 2005, updated in 2009) and managing data.

Characterization of the watershed is required to present the historical and current conditions of the study area. The *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* (Ganaraska Region Conservation Authority 2009) contains the necessary scientific and local knowledge needed to assist in the

creation of the Graham Creek Watershed Plan. It contains information needed to make informed management decisions regarding the protection and environmentally sound management of the Graham Creek watershed.



(Conservation Ontario 2003)

Figure 2.0: Watershed management phases and watershed planning steps

The Graham Creek Watershed Plan will address steps 3 to 8 using information presented in the Background Report and computer modeling results, which will be used to evaluate changes in the watershed in response to changes in land use. Current information and model results will be used to develop the plan that will contain issues and opportunities, goals, objectives, targets, recommended management actions, and monitoring and reporting recommendations. The plan will also address requirements of the *Oak Ridges Moraine Conservation Act* and *Conservation Plan*.

Many benefits result from watershed planning and management. Summarized by Conservation Ontario (2003), benefits include the following:

- Protection and management of natural resources, including their functions and linkages, for current and future generations
- Reflection of the local environmental and community
- Use of an integrated interdisciplinary approach
- Consideration of the environment, economy and communities
- Use of a partnership approach to planning and management
- Use of adaptive environmental management approaches that aim for continuous improvement.

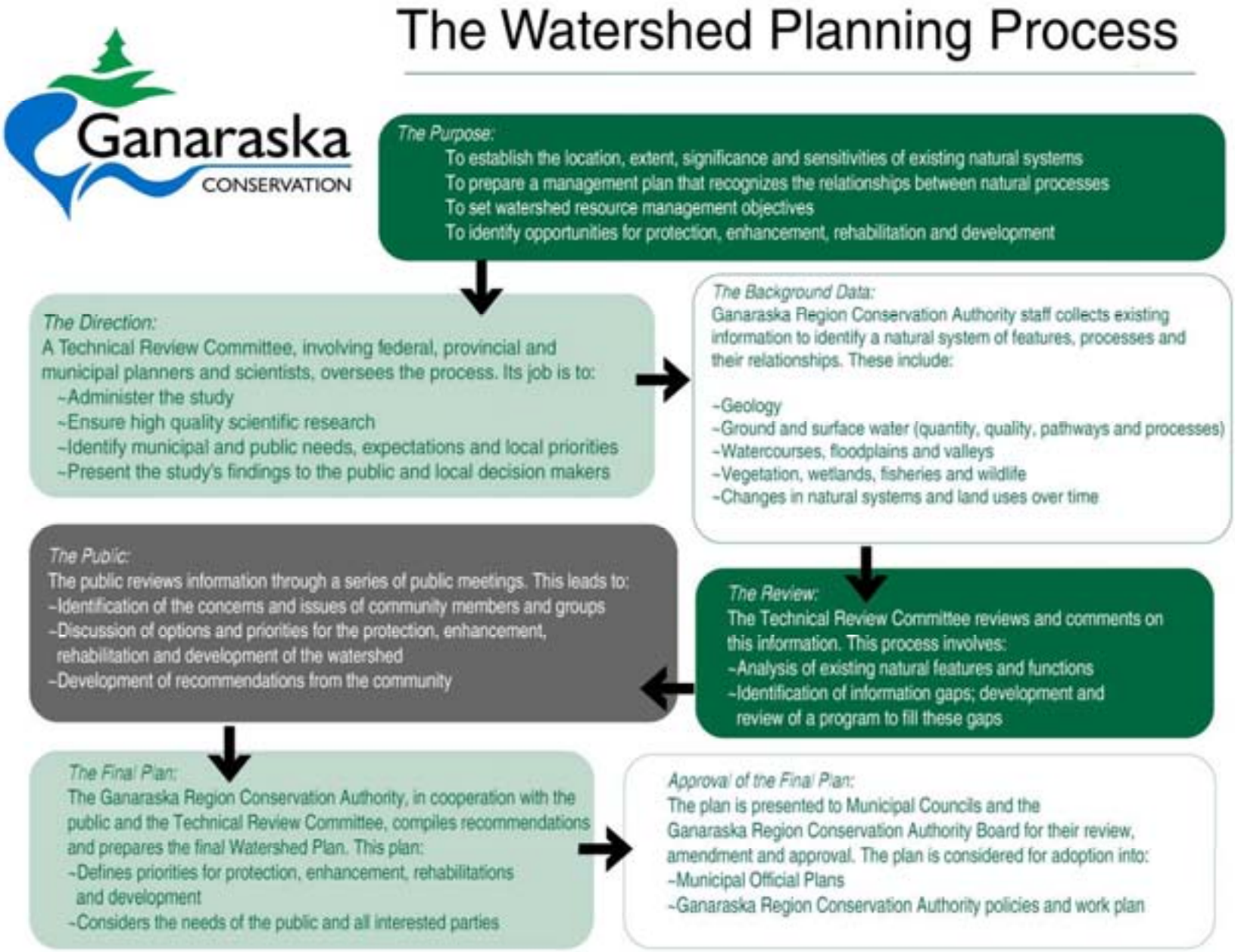


Figure 2.1: Ganaraska Region Conservation Authority defined watershed plan process

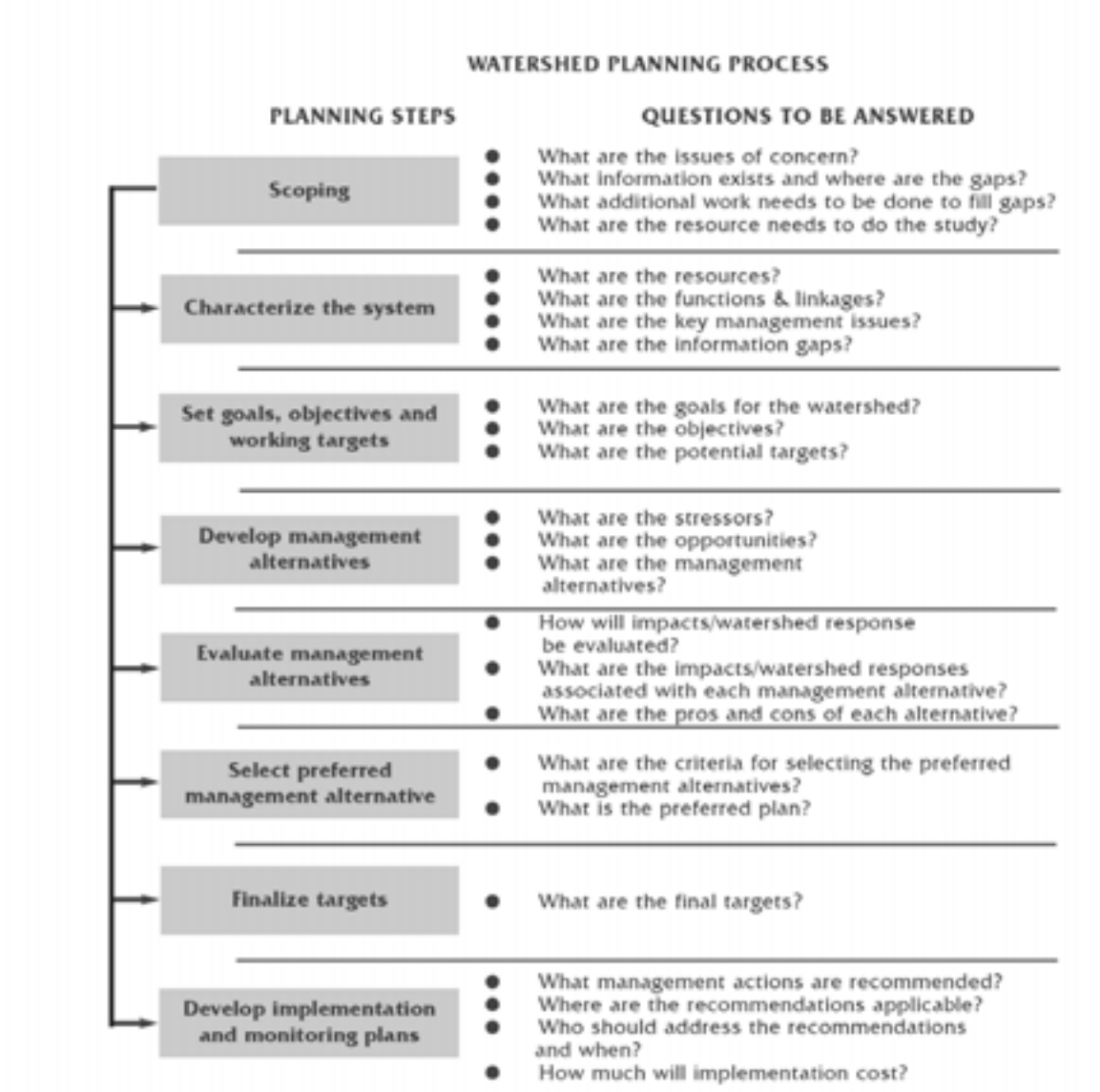


Figure 2.2: Questions to be answered in the planning process

2.1 Watershed Management Philosophy

The management of watersheds in the Ganaraska Region Conservation Authority is rooted in the vision and mission of the authority. The GRCA vision involves “working together for responsible stewardship of the ecosystem.” The GRCA mission is to “protect and enhance our watershed’s ecosystem” (Ganaraska Region Conservation Authority 1999). The Graham Creek Watershed Plan complements the vision and mission by providing an environmentally focused, science-based, and locally developed document to guide decision makers on balancing diverse interests while providing for the sustainable management and use of this important watershed.

The watershed management philosophy for the Graham Creek watershed promotes five facets:

- *Environmental first*: management of the watershed will occur based on environmental features and functions, with the environment as the first step in a hierarchy of management decisions. Emphasizing prevention over environmental rehabilitation or remediation will occur.
- *Net gain*: decisions and actions will build and improve upon existing watershed features and functions.
- *Community ownership*: demonstrations of sustainable living and community growth will occur while promoting conservation of the watershed through community action and partnerships.
- *Balanced land use*: acknowledgment of diverse land uses in the watershed will occur, while ensuring a balance between community and environmental needs.
- *Human well-being*: recognizing links between human health (and well-being), and the environment will occur, with attempts made to minimize risk to human health and safety.

The Graham Creek Watershed Plan has been developed to conserve, enhance and manage the watershed and its resources for current and future generations. The purpose of the Graham Creek Watershed Plan includes the following:

- Fulfill the watershed planning requirements of the *Oak Ridges Moraine Conservation Plan* (Appendix C).
- Create community awareness and ownership of the Graham Creek watershed and its plan.
- Provide recommendations that conserve the ecological and hydrological integrity of the watershed.
- Encourage land and resource uses that maintain, improve or restore the ecological and hydrological functions of the watershed.
- Provide recommendations that maintain or improve the elements that contribute to the ecological and hydrological functions of the watershed, including the quality and quantity of water, and aquatic and terrestrial resources.

2.2 *Graham Creek Background Report: Abiotic, Biotic and Cultural Features*

In order to develop a watershed plan for the Graham Creek, scientific information and local knowledge was compiled into the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features*. Staff at the Ganaraska Region Conservation Authority examined the abiotic, biotic and cultural features of the Graham Creek watershed using locally collected data. The Background Report forms the foundation for recommending management actions.

The *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* reports on many aspects of the watershed:

- History of the Graham Creek watershed
- Regional climate
- Geologic characteristics
- Groundwater systems
- Groundwater and surface water interactions
- Surface water hydrology
- Natural hazards
- Water budget and stress assessment
- Groundwater quality
- Surface water quality
- Fisheries
- Instream habitat
- Surface water temperature
- Benthic macroinvertebrates
- Riparian areas
- Terrestrial natural heritage
- Species of concern
- Invasive species
- Cultural characteristics
- Potential climate change effects
- Drinking water source protection
- Lake Ontario connection.

2.3 Consultation and Public Involvement

Watershed planning and management require partnerships among Conservation Authorities, municipalities, agencies and local communities. Conservation Authorities coordinate plan development by bringing together various interests and ensuring appropriate opportunities for input. Experience has shown that those who have been involved in the development of the plan are more likely to participate in implementation. Therefore, effective involvement of all partners throughout the process is vital for success.

A Technical Review Committee was created to assist in the watershed plan process. Membership of the committee is as follows:

- Ganaraska Region Conservation Authority
- Municipality of Clarington
- Municipality of Port Hope
- Northumberland County
- Regional Municipality of Durham
- Durham Health Department
- Haliburton, Kawartha, Pine Ridge District Health Unit
- Ontario Ministry of Agriculture, Food and Rural Affairs
- Ontario Ministry of the Environment
- Ontario Ministry of Municipal Affairs and Housing
- Ontario Ministry of Natural Resources
- Fisheries and Oceans Canada.

The role of the committee was to review and provide input into the Background Report, identify issues and opportunities in the Graham Creek watershed, develop and review recommended management actions, participate in the

development and review of the watershed plan, ensure *Oak Ridges Moraine Conservation Plan* legislative requirements were met, and provide watershed plan endorsements. In the future, members may choose to participate in or lead aspects of implementation.

A Community Advisory Committee was also formed, comprised of interested members from the community. The role of this committee was to promote awareness of the planning process and solicit input from a broader constituency group. In addition, members provided input and advice on watershed issues, goals, objectives and recommended management actions contained in the watershed plan.

In order to create the Graham Creek Watershed Plan, numerous opportunities for public and stakeholder input occurred throughout 2009. Key milestones were presented at public open houses that occurred in Newcastle on June 24, 2009 and on October 24, 2009 and in Port Hope on October 26, 2009. At these meetings, information was presented and feedback was received regarding the results of the *Graham Creek Background Report*, watershed issues, goals, objectives and proposed recommended management actions.

In addition to media correspondence and hosting public meetings, the GRCA pursued meetings with local institutions and attended public events. Events included the Durham Central Fair, Port Hope Fair and Family Safety Day. On Saturday, July 18, 2009, the Ganaraska Region Conservation Authority and Citizens Environment Watch hosted the annual Check Your Watershed Day in Graham Creek. This allowed residents to learn more about Graham Creek while collecting stream baseflow information. Staff of the GRCA also kept municipal councils and the Ganaraska Region Conservation Authority Board informed on activities and milestones associated with the Graham Creek Watershed Plan.


Check Your Watershed Day 2009

3.0 Applicable Planning Initiatives

Many planning initiatives have occurred in the Graham Creek watershed. Some have been completed, while others are ongoing. This watershed plan can provide recommendations to be considered within ongoing planning initiatives. Each of these initiatives has its own process, in which the Ganaraska Region Conservation Authority, municipalities and agencies are involved.

The watershed plan supports the creation and integration of local natural heritage policies with larger regional and broader-scale planning initiatives. It is important that watershed activities and land use changes are considered and relate to larger areas and connections outside of the watershed. For example, this watershed plan should be considered in the context of the larger Lake Ontario basin.

3.1 Graham Creek Fish Habitat Management Plan

While the Graham Creek Watershed Plan is being created, a Fisheries Habitat Management Plan is being developed. The Fisheries Habitat Management Plan, the Graham Creek Watershed Plan and respective background documents will be created simultaneously. This will make certain that results and information presented in the documents will complement each other and avoid unnecessary duplication. In addition, to ensure that public and stakeholder consultation and involvement is effective, public meetings and consultation of both background documents and plans will occur at the same time. The end result of both plans will be the conservation, enhancement and proper management of the Graham Creek watershed and its resources, with emphasis and focus on the biotic aquatic resources in the Fisheries Habitat Management Plan.

3.2 *Clean Water Act*

The Ontario government has given Royal Assent to the *Clean Water Act, 2006,* aimed at protecting sources of municipal drinking water as part of the government's overall commitment to human health and the environment. A key focus of the legislation is the production of locally developed, science based assessment reports and protection plans (Ontario Ministry of the Environment 2007). The need for legislation such as the *Clean Water Act* was spurred on by the tragic events that occurred in Walkerton, Ontario in May 2000 when seven people died and thousands became sick from drinking municipal water that was contaminated with *E. coli*.

Assessment reports and source protection plans will be written for specific planning regions, known as source protection regions or areas. The local source protection region that includes the Ganaraska Region Conservation Authority is

the Trent Conservation Coalition Source Protection Region (TCC SPR). Under the *Clean Water Act*, the Ganaraska Region Conservation Authority becomes a source protection area within the TCC SPR.

For Graham Creek, the source protection plan will be created for the Ganaraska Region Source Protection Area and the planning areas of interest are vulnerable areas. These include municipal surface water intake zones, wellhead protection areas, significant recharge areas and highly vulnerable aquifers. These areas have been defined using defensible, science-based methods.

While the Graham Creek watershed plan process is taking place, work under the *Clean Water Act* framework will be occurring. A 24-member source protection committee will prepare terms of reference, an assessment report and a source protection plan for the Ganaraska Region Source Protection Area. The committee membership represents municipalities, farmers, small business representatives and a range of other stakeholders in the TCC SPR[1]. Through the source protection committee, work will be completed to identify, assess and address risks to drinking water within municipal sources (i.e., wellhead and intake protection areas). Stakeholders such as local property owners can also participate through a number of different mechanisms.

Specifically, the Terms of Reference set out who is responsible for carrying out different activities. The Terms of Reference include strategies to consult with potentially affected property owners, to involve the public and to resolve disputes. While the committee creates an assessment report, the committee will identify threats, issues and concerns in the planning region. This knowledge will be represented as implementation actions in the source protection plan.

As described by the Ontario Ministry of the Environment (2007), source protection plans will generally be implemented through required changes to existing regulatory requirements or approvals, zoning by-laws, official plan amendments, education or voluntary initiatives. Source protection committees may decide that existing programs and activities, voluntary or otherwise, may not be enough to address some significant threats to municipal drinking water supplies.

If a scientific assessment shows that an activity poses a significant risk to a drinking water source, an approved source protection plan may restrict or limit certain activities on properties located in designated wellhead protection areas and intake protection zones. Activities that pose a significant risk to drinking water sources may be prohibited or may require a risk management plan before they can be carried out.

The source protection plan may be very similar to the Graham Creek Watershed Plan, but will differ in the fact that the source protection plan addresses issues

[1] For information on the committee membership please visit www.trentsourceprotection.on.ca

surrounding municipal water sources, whereas the watershed plan will address watershed wide ecosystem-based concerns and issues. Plan implementation may occur simultaneously in some instances, when the action will protect similar resources or environmental features and achieve similar outcomes. While working with municipalities, the Ganaraska Region Conservation Authority will strive to reduce duplication between the plans and the resultant implementation tools and resources.

3.3 Lake Ontario Shoreline

In the late 1980s, focus was given to the Lake Ontario shoreline in relation to land use, hazard land identification and proper management. Sandwell Swan Wooster Incorporated (1990) completed a Lake Ontario Shoreline Management Plan for the Central Lake Ontario, Ganaraska Region and Lower Trent Region Conservation Authorities. The overall objective of the study was to develop a comprehensive shoreline management plan to allow the Conservation Authorities to implement long-term development objectives. Sandwell Swan Wooster Incorporated (1990) listed specific objectives of the study that were intended to:

- Establish a program for the prevention of flooding and erosion damages and the protection of existing development from flooding and erosion.
- Evaluate hazard areas, investigate littoral processes, and to identify and assess potential damage centres and protection strategies along the shoreline.
- Provide background information useful to planning authorities in developing waterfront plans.
- Assess the characteristics of the shoreline including sensitive areas, recreational opportunities, wildlife habitat and the Lake Ontario fishery in terms of potential use or preservation of these resources.
- Determine the optimum management strategy for the shoreline in terms of flood and erosion mitigation and other resource management concerns.
- Identify the role of Conservation Authorities and that of other relevant agencies in managing the shoreline.

Along with the identification of erosion setback limits, 100-year flood lines, erosion rates, sediment characteristics, damage centres and erosion monitoring stations, Sandwell Swan Wooster Incorporated (1990) recommended the following actions, many of which have been enacted:

- Municipalities should recognize shoreline hazard lands in appropriate official plan and zoning provisions.
- Measures should be taken to protect environmentally sensitive areas along the shoreline.
- Acquisition of the shoreline should be considered in order to protect the environmental characteristics and acquired lands should include the limits of erosion and/or flooding setbacks.

- Implementation of shoreline protection structures should be examined on a site-specific scale, and carried out using coastal engineering studies.
- Conservation Authorities should operate existing shoreline monitoring stations and establish additional sites.

In 2008, the Ganaraska Region Conservation Authority began updating the shoreline management plan to include greater understanding of the natural ecology found in the Lake Ontario shoreline. It is anticipated that this work will be completed in 2011.

3.4 Climate Change

Climate change is defined as a change of climate, which can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (Environment Canada 2006). Climate change is not a localized phenomenon. Occurring across the globe, effects have been felt by many different ecosystems and in many different countries.

Within the Great Lakes basin, ecosystems changes due to climate change have been noted, and are outlined by Chiotti and Lavender (2008):

- The ice cover season on the Great Lakes has been shortened by about 1 to 2 months during the last 100 to 150 years.
- Nearshore lake temperatures have increased at several locations since the 1920s. These increases are likely associated with extensive algae blooms and invasion of non-native species.
- Shifts in fish communities are expected to occur with declines in coldwater species in the Great Lakes. Warm water species such as Bigmouth Buffalo and Flathead Catfish are already being seen more frequently in the Great Lakes basin.
- Additional stressors on already fragile habitats such as coastal wetlands and terrestrial ecosystems may results in these habitats to be unable to maintain their functions under increased climate change.

Changes are also expected to occur in water resources in the Great Lakes basin, and will affect both groundwater and all surface water sources (Great Lakes, inland lakes, rivers, streams and ponds). Spring freshet (river flow from snowmelt) and extreme rainfall events will also change the way streams respond under a flood. Increasing winter temperatures will possibly cause the spring freshet to occur earlier and because of more frequent winter thaws, the freshet will likely be lower, reducing the risk of spring flooding (Chiotti and Lavender 2008). In addition, projected increases in the frequency and intensity of extreme rainfall events will result in increased summer flood risks.

On a watershed scale, some of the expected effects of climate change include:

- Overall increase in risk of extreme and erratic weather
- Increase in risk of heavy-rapid rainfalls

- Increase in number of freeze-thaw cycles
- Increase in risk of flooding and drought events
- Increase in risk for bank erosion
- Increase in water turbidity and decrease in water quality
- Higher concentration of contaminants in lakes and streams, impacting water quality and human health
- Redistribution, reduction and/or loss of wetlands
- Increase in stress on aquatic and terrestrial biodiversity
- Increase in stress on water management structures.

The Ganaraska Region Conservation Authority understands that climate change will exacerbate the stresses already present in local watersheds and believes that a comprehensive approach, including mitigative and adaptive actions is needed to reduce and cope with the effects of climate change. Policies in the Graham Creek Watershed Plan will need to be brought in line with mitigative and adaptive actions recommended in local climate change strategies. In addition, during the creation of a local strategy, other local initiatives will be consulted. One such initiative is the Durham Region Roundtable on Climate Change.

Durham Region Roundtable on Climate Change
On April 16, 2008, Durham Regional Council approved the Terms of Reference for the Durham Region Roundtable on Climate Change (DRRCC). The role of the DRRCC is to position the Regional Municipality of Durham (the Region) as a leader in addressing climate change issues. This will be achieved by preparing and recommending a comprehensive strategy with detailed actions that can be undertaken across the Region to address climate change.

This group will provide advice and recommendations to Regional Council on how the Region can assist in dealing with this global phenomenon. This committee will advise on strategies, both internal and external, to mitigate and adapt to the challenges caused by climate change and in particular, global warming.

The DRRCC's mandate focuses on three areas:

- Committee Education: broadening members' knowledge of climate change issues
- Corporate Response: reviewing measures identified by a Regional Staff Working Group that the Region, as a corporation and as community service provider, can take in its day to day business practices and operations to mitigate and adapt to climate change
- Outreach/Advocacy: encouraging Durham residents, area municipalities, industries, corporations, businesses, institutions and senior levels of government to address climate change in their respective practices and operations.

4.0 The Graham Creek Watershed Study Area

This section is a summary from the Graham Creek Background Report: Abiotic, Biotic and Cultural Features (Ganaraska Region Conservation Authority 2009). Please refer to this document for additional information.

The Graham Creek Background Report: Abiotic, Biotic and Cultural Features documents historic and current conditions of the Graham Creek watershed. This document creates the foundation for the Graham Creek Watershed Plan. It is envisioned that the *Graham Creek Background Report* and the forthcoming Graham Creek Watershed Plan will serve to aid in the conservation, enhancement and sustainable management of the Graham Creek watershed and its resources.

The Graham Creek watershed flows through Ward 2, Municipality of Port Hope and Ward 4, Municipality of Clarington (Figure 4.0). Historic events have shaped the watershed into present-day condition. Most notable are the effects of settlement patterns caused by the location of road and rail corridors. Today, the watershed supports a population of 3,538 people, a productive agricultural community, and a mix of natural resources and recreational uses. In addition, residents depend on water from the Graham Creek watershed for domestic and economic use, although the residents in Newcastle rely on Lake Ontario for its source of water.

Shaped thousands of years ago by glacial activity, the Graham Creek watershed lies on Paleozoic bedrock. Its topographic and hydrogeological features include the Oak Ridges Moraine, South Slope and Iroquois Plain physiographic regions (Figure 4.1). Corresponding surficial geology and soils help dictate where groundwater flow, where aquifers lie, and where groundwater is recharged and discharged (Figure 4.2 and Figure 4.3).

The Graham Creek watershed drains an area of 78 square kilometres (km^2). Mulligan Creek is the largest tributary of Graham Creek; however, other tributaries such as Crooked Creek and Lytle Creek also exist. Protection of the Graham Creek watershed has been influenced by surface water studies such as floodplain mapping and hydraulic studies. Regulations are also in place to protect people and property from flood waters, and to protect some of the natural features of the watershed.

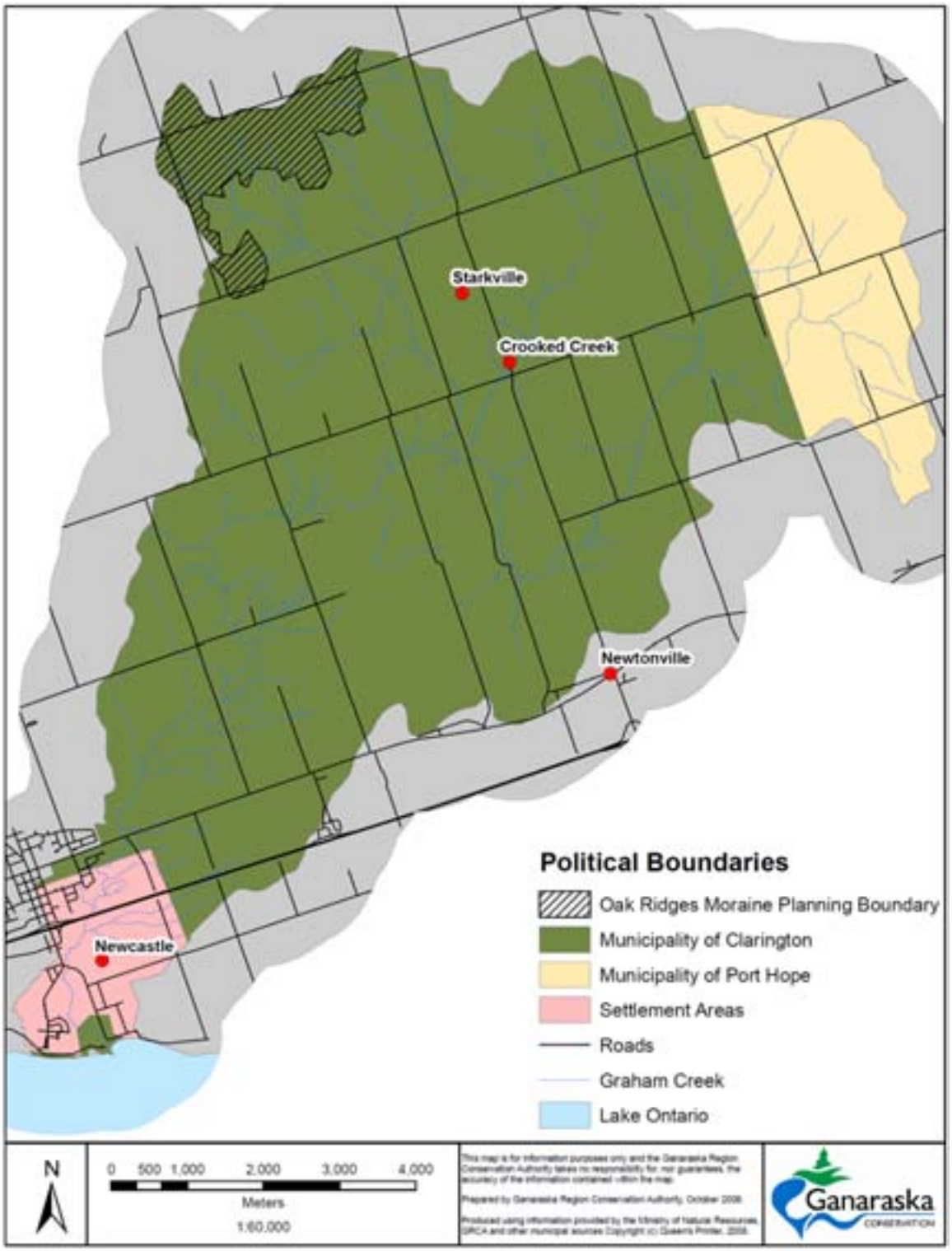


Figure 4.0: Graham Creek watershed

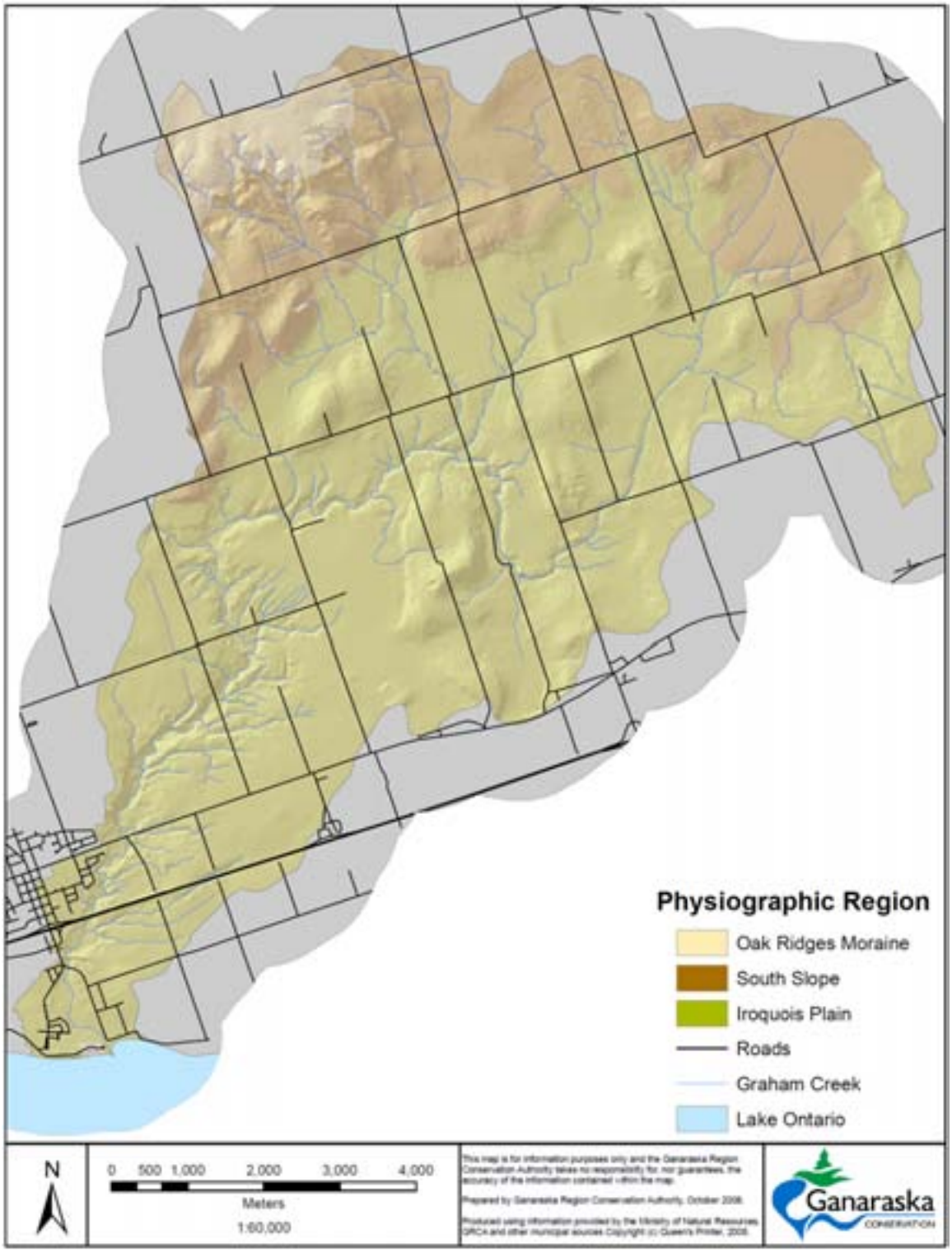


Figure 4.1: Physiographic regions

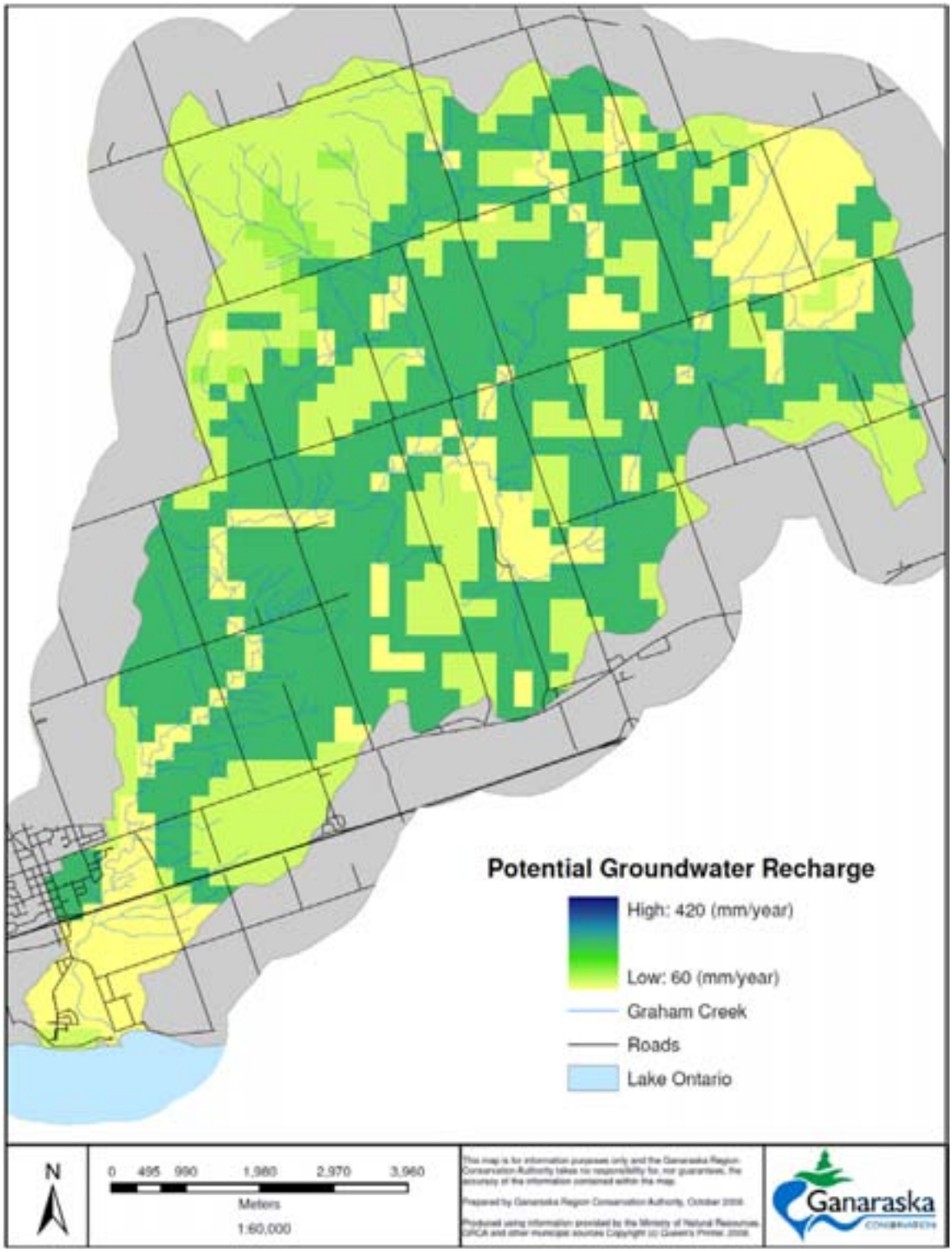


Figure 4.2: Potential groundwater recharge

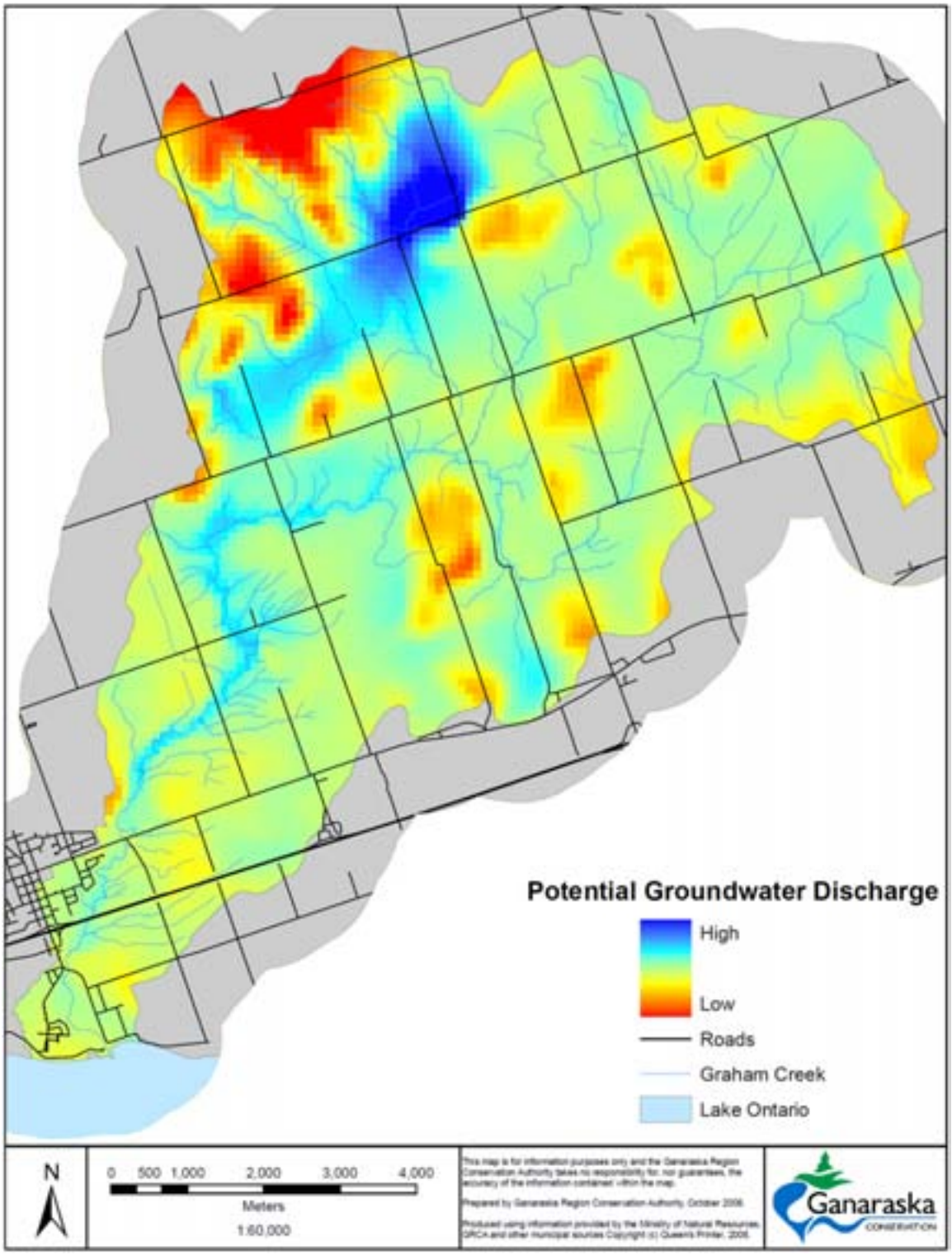


Figure 4.3: Potential groundwater discharge areas

Surface water quality as a whole in is generally good, with only localized problems. Physical parameters (dissolved oxygen, pH, conductivity and alkalinity) indicate that surface water quality can be resilient to acidification, eutrophication and chemical additions. Chloride has been increasing since 1965, as indicated at a long-term provincial monitoring station. Nutrients such as total phosphorus and nitrate-N can be considered the surface water quality parameter most capable of fluctuating beyond recommended guidelines. However, there has been a decline in total phosphorus since 1965 at the long-term provincial monitoring station, and exceedences may be related to high runoff due to storm events or land use. Groundwater quality data is limited in the Graham Creek watershed, however quality is influenced by geology and land uses in the area.

40 species of fish have been sampled in the Graham Creek watershed. Five or 13% of the species are not native to the Lake Ontario basin. Stream quality based on Steedman's IBI calculated one site being excellent (6%), 11 sites good (69%), four sites fair (25%), and zero (0%) poor sites (Figure 4.4).

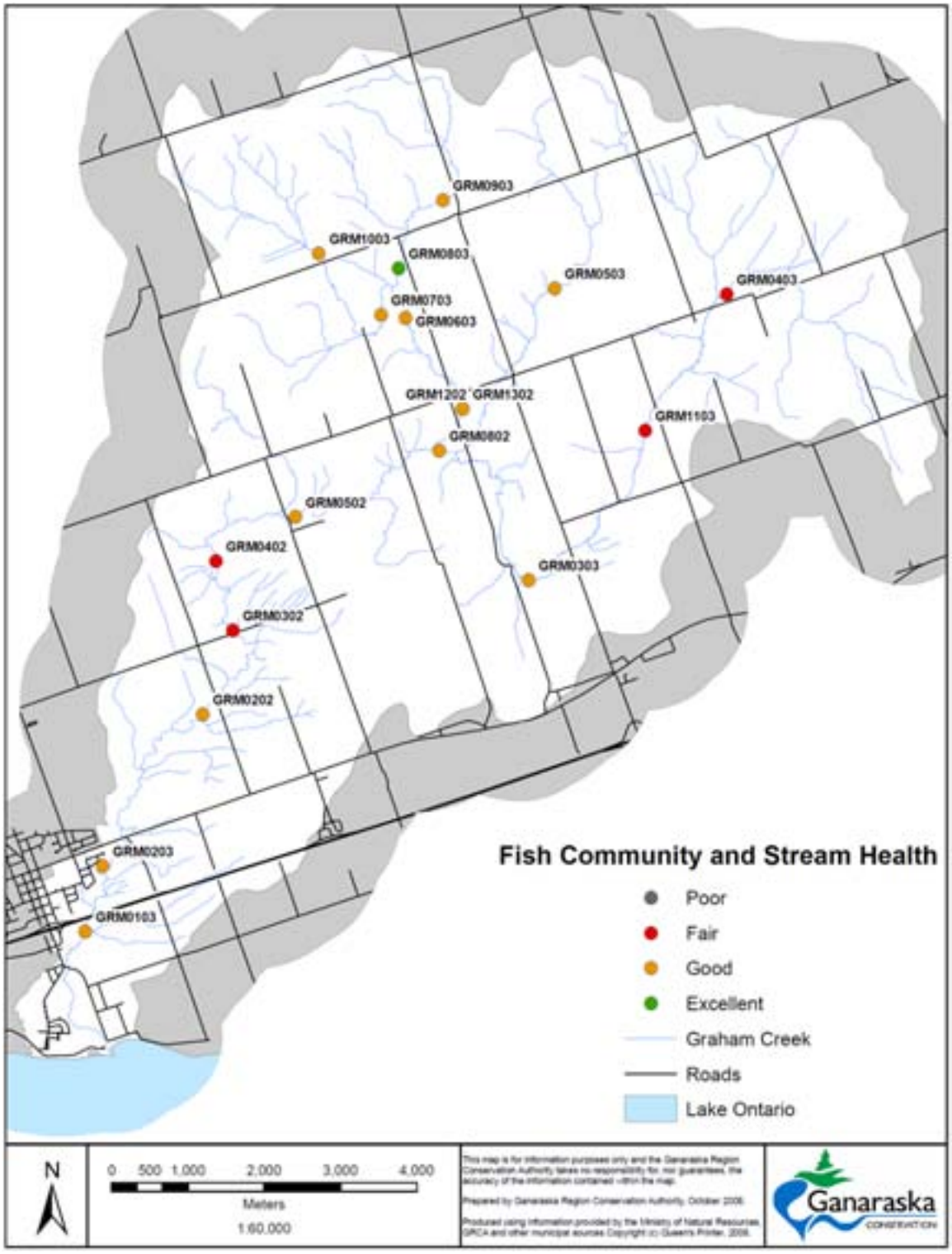


Figure 4.4: Stream quality based on Steedman's Index of Biotic Integrity

The terrestrial natural habitat of the Graham Creek watershed includes forest, meadows and wetlands (Figure 4.5). At 33.5%, forest cover, which includes treed wetlands, exceeds the commonly used guideline of 30%. However, higher quality interior forest habitat is found in only about 23% of the forested watershed. In addition, much of these natural heritage features are in private ownership. Indicator species such as birds and frogs can indicate the health of forest and wetland habitats. Numerous Species at Risk may inhabit the Graham Creek watershed and therefore, should be considered in management planning. Invasive species such as Dog-strangling Vine (*Cynanchum rossicum)*, European Buckthorn (*Rhamnus cathartica)*, and Garlic Mustard (*Alliaria petiolata)* pose a threat to terrestrial habitat health.

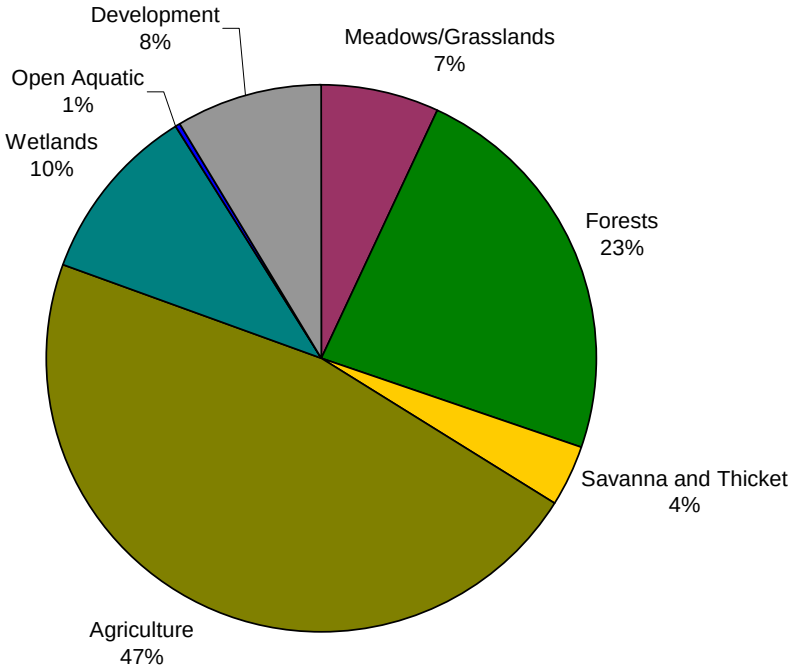


Figure 4.5: Land cover based on ecological land classification

The Graham Creek watershed is not only an important environmental feature to the communities of the Municipality of Clarington and Municipality of Port Hope, it also plays an important role in a larger context. For example Graham Creek contributes to the health and resources of Lake Ontario. In addition, Lake Ontario is a drinking water source for thousands of Ontario residents. However, the watershed has the potential to be influenced by future stresses such as climate change and increased development.

The Graham Creek watershed is recognized for its aquatic habitat, terrestrial natural heritage and recreational opportunities. In addition, the watershed provides drinking water to the majority of watershed residents. The development of a watershed plan will aim to conserve and sustainably manage the Graham Creek watershed for current and future generations.

5.0 Management Recommendations for the Graham Creek Watershed

The Graham Creek watershed is currently in good condition. However, a watershed is neither static nor isolated. Even with historic and current watershed management efforts, the watershed does have some identifiable issues and exhibits signs of stress in certain areas that can be attributed to current land use.

In order to anticipate changes to current watershed conditions, staff at the Ganaraska Region Conservation Authority have evaluated current and future land use scenarios. Future development areas have been identified through municipal official plans. These computer-modeled scenarios provide an indication of watershed responses in relation to increased development. This evaluation has been conducted with surface water hydrology and water budgets. Natural heritage modeling has defined priority areas and targets for increasing terrestrial habitat and species (see Section 5.1).

Coinciding with these modeling initiatives, the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* was created to document historic information and current conditions of the watershed. Results from the Background Report and modeling initiatives guide the recommended management actions for the watershed.

Features of the watershed have been broken into components to facilitate the presentation of issues and opportunities related to current watershed conditions, goals, objectives, recommended management actions, and monitoring and reporting recommendations (Sections 5.1 to 5.9). The watershed components include the following:

- Groundwater Quantity
- Surface Water Quantity
- Groundwater Quality
- Surface Water Quality
- Aquatic Habitat and Species
- Terrestrial Natural Heritage
- Public Health and Well-being
- Community Heritage

In order to better understand the recommended management actions, the following describes the identification process of issues and opportunities, goals, objectives, management actions and watershed integration related to each watershed component. All aspects of the process were reviewed by the Technical Review Committee and the Community Advisory Committee.

1. Identifying Issues and Opportunities
Issues and opportunities were identified through the *Graham Creek Background Report*, input and review from the Technical Review Committee and Community Advisory Committee, and public input. Issues are defined as current or future actions and situations that could negatively impact the Graham Creek watershed. These issues are either occurring currently or have the potential to occur. Opportunities are current actions and situations that are positive that need to be protected or enhanced.

2. Setting Goals
A goal statement has been created for each watershed component to identify a desired outcome to be achieved through the implementation of the Graham Creek Watershed Plan. The goal statement was defined at a broad scale to allow for consideration of all aspects of the watershed.

3. Establishing Objectives
Objectives were created for each goal statement in order to facilitate and achieve the desired watershed component goal. One or more objective statements were determined depending on the complexity of the watershed feature. Objectives are based on the natural features or functions of the watershed and/or on a human use of that particular feature. All identified issues and opportunities are addressed by one or more objective statements.

4. Determining Management Actions
Activities that need to be implemented in order to achieve the goal of each watershed component are listed under the heading of management actions. For ease of reading and implementation, management actions have been defined in four categories.

1. **Regulations and Planning:** recommendations can be based on actions carried out through regulations or land use planning. Regulations tend to be specific and enforceable, while planning defines areas where certain land uses may or may not take place. Regulations at a federal, provincial, municipal or Conservation Authority level can be used, whereas planning generally occurs at a provincial level (e.g., the *Greenbelt Plan* or *Oak Ridges Moraine Conservation Plan*) and a municipal level (e.g., official plan).

   Recommended policies listed under “regulations and planning” are recommended by the watershed plan and are intended to be incorporated into municipal, Conservation Authority and other agency planning and regulation documents, where most appropriate. The recommended management actions were created to be compatible with the *Oak Ridges Moraine Conservation Plan* (Appendix C), *the Provincial Policy Statement, 2005* (Appendix D), and the *Greenbelt Plan, 2005* (Appendix E). **The term “development” used in the**

recommended policies is defined as the creation of a new lot, a change in land use, the construction of buildings and structures, and site alterations. Further definitions of development will be defined and elaborated upon within the context of the specific planning or regulation document where the recommended policy is placed. **The term "existing use" in the recommended policies is defined as an existing lot, land use, building or structure, and/or site configuration.**

2. **Stewardship:** actions undertaken by property owners, residents and the community are recommended by the watershed plan. Stewardship actions can consist of technical assistance or financial support. An example of one such stewardship program is the GRCA Clean Water – Healthy Land Financial Assistance Program. This program is delivered in partnership with local municipalities and the Ganaraska Region Conservation Authority to local residents, landowners, community groups, schools and businesses.

3. **Education and Awareness:** certain recommendations rely heavily on increasing public and community knowledge and awareness of environmental and watershed topics. Workshops, seminars, presentations and media use can be used to facilitate change across the watershed.

4. **Land Acquisition:** certain recommendations also rely on public land management for environmental protection. Land acquisition includes the acceptance of land donations, direct purchase, conservation easements or land use covenants (i.e., restrictions through agreements). Land acquisition requires fair landowner compensation.

Monitoring and Reporting

In addition to the four management action categories, further information or regular monitoring of environmental conditions needs to occur prior to and after management actions. Monitoring and communication of results are required to ensure that the watershed plan and its implementation actions are achieving the desired outcome. Actions associated with implementation also need to be monitored and reported.

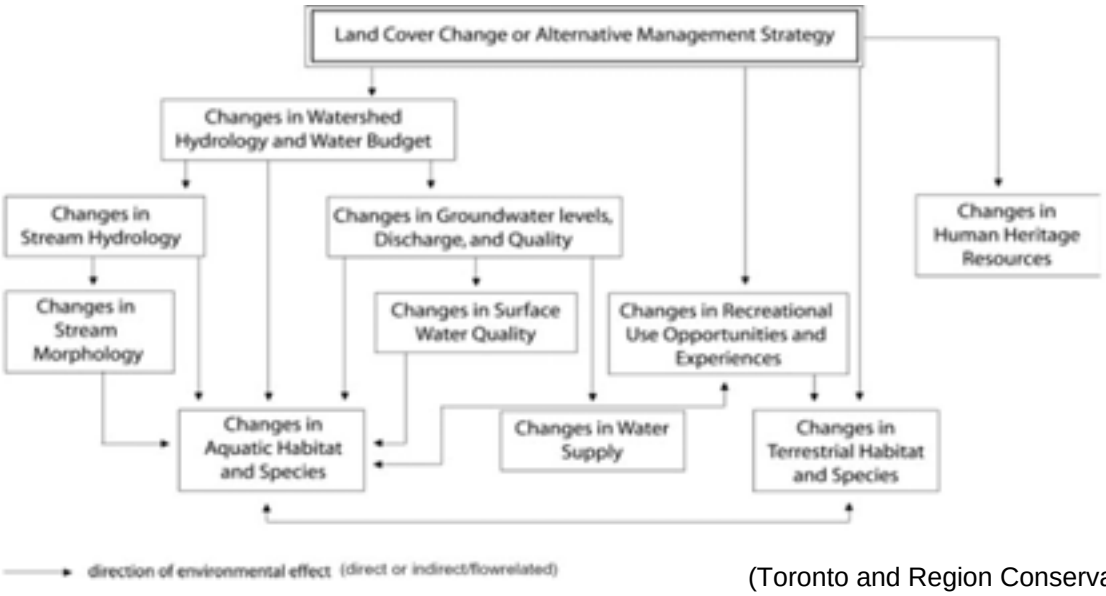
Partnership Implementation

In order to implement the recommended management actions and achieve successes in the Graham Creek watershed, organizations, groups and programs must be utilized in partnership with the Ganaraska Region Conservation Authority and municipalities. Many of these provincial and municipal based partnerships and programs exist (Appendix B). However, new opportunities may occur in the future. In addition, many locally significant and important organizations exist that contribute valuable resources and volunteers to local

watersheds. Partnerships in these organizations are identified in recommended management actions with the phrase “partner programs.”

5. Watershed Integration

A watershed is a dynamic and unique place with complex webs of ecological features and functions. Results of an action considered beneficial for a particular feature or function could potentially influence another feature or function (Figure 5.0). The integration of management actions is identified to highlight the net watershed gains of implementing a particular recommended management action.



(Toronto and Region Conservation 2003)

Figure 5.0: Potential watershed response to management actions

6. Setting Targets

In order to measure changes in a watershed in relation to the implementation of management actions, targets must be considered so that comparisons can be made to determine a watershed’s response. Targets in the watershed plan are listed under “Targets for Success”. Targets are quantitative and qualitative in nature. Quantitative targets are normally associated with federal or provincial guidelines, as is the case with groundwater and surface water quality targets. Others are seen in a measure of implementation (e.g., reduction in the number of abandoned wells). Qualitative targets are those with measurements that are difficult to collect. Qualitative targets are normally associated with the implementation of a program (e.g., implementation of a local spills action plan), realization of a certain condition (e.g., increased protection of headwater and intermittent streams), or changes in societal behaviour and understanding (e.g., adoption of sustainable land use practices).

The watershed plan does not define specific timelines in which a target has to be realized. The intent of the watershed plan recommendations is to allow

opportunities to present themselves for the realization of targets. In addition, funding constraints and program priorities can negatively affect targets associated with timelines. The key for reaching targets is a defined implementation plan and cooperative work throughout the community and the watershed.

5.0.1 Natural Heritage System

A natural heritage system is a network of natural features that traditionally has a series of large, high quality core areas connected by habitat corridors (Noss 1983; Noss and Cooperrider 1994). The goal of a natural heritage system is to ensure ecological function and the long-term representation and population viability of all species that are native to a given area.

A short-term incremental target and a long-term target natural heritage system have been defined for the Graham Creek watershed (Figures 5.1 and 5.2). The purpose was to define potential priority areas and targets for terrestrial habitat and species, as well as to define priority areas for protection, acquisition or stewardship. This is part of an effort by the Ganaraska Region Conservation Authority to define a “regional” natural heritage system for its entire jurisdiction, plus individual systems for each watershed, so that the system can be implemented through watershed plans. In addition local municipalities, through official plans, acknowledge the need and support the creation of a natural heritage strategy in order to protect natural heritage features and functions.

The natural heritage system is defined based on updated Ecological Land Classification mapping for the Graham Creek watershed. Geographic Information Systems (GIS) software was used to evaluate habitat patch characteristics and a model was applied to identify areas with high existing and potential ecological values. A summary of this detailed approach is available in a separate document (Ganaraska Region Conservation Authority 2009).

The two conceptual natural heritage systems would increase natural cover by increments of approximately 10% over the entire Ganaraska Region Conservation Authority to a total of 52%. The actual targets by watershed may be more or less than this amount. In the case of the Graham Creek watershed the incremental target would move natural cover from the existing 35% to 43% while the long-term target would result in 52% natural cover.

It should be emphasized that the intent is not to actively promote taking land out of production to reach natural heritage system targets. Policies around the system should reflect restoring habitat within the target areas as opportunities arise, such as when a landowner has a desire to plant trees (which is still a productive use of land). Nevertheless, as a planning tool the target natural heritage system should be protected from incompatible development to help ensure that the targets might eventually be achieved.

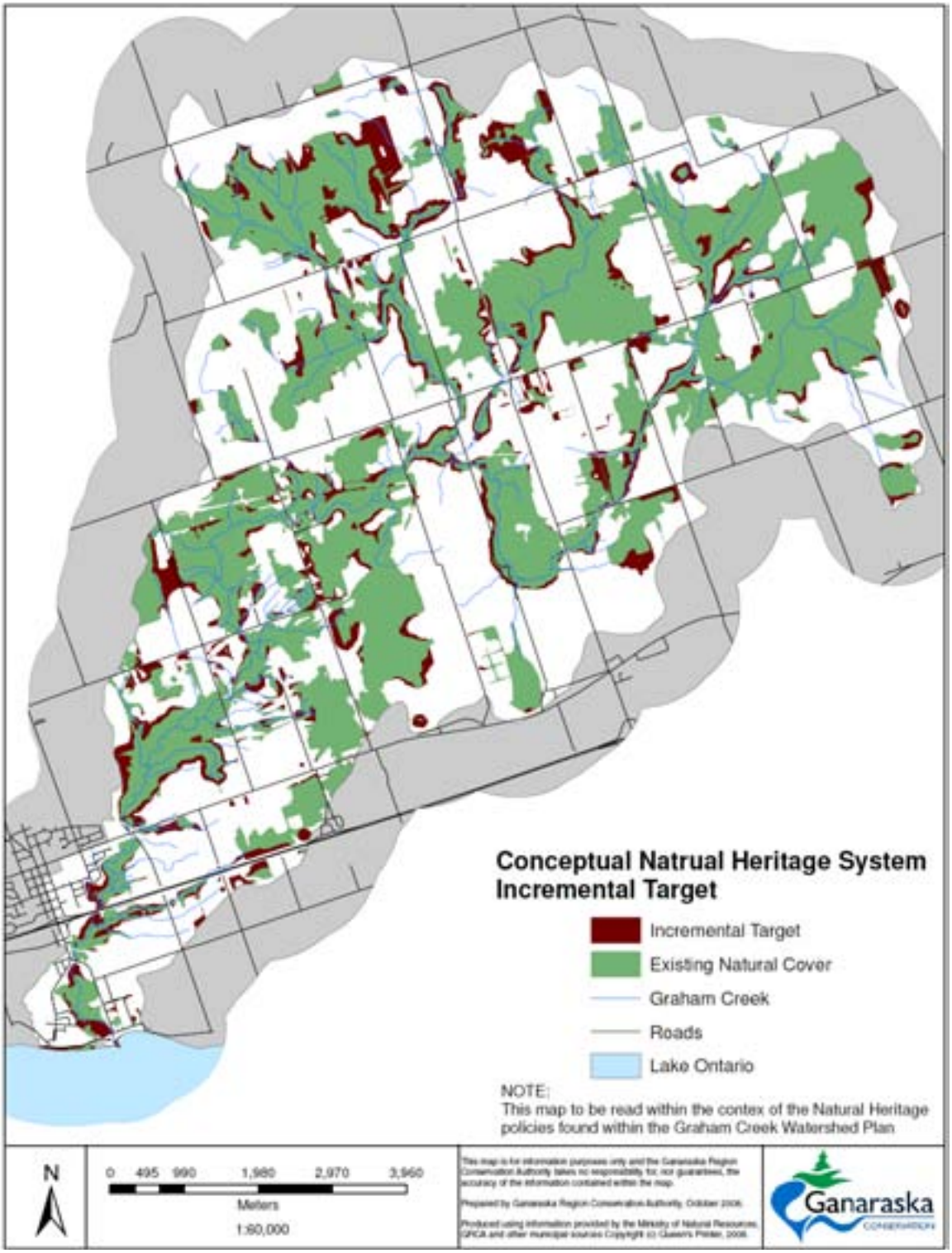


Figure 5.1: Graham Creek watershed short-term incremental target natural heritage system

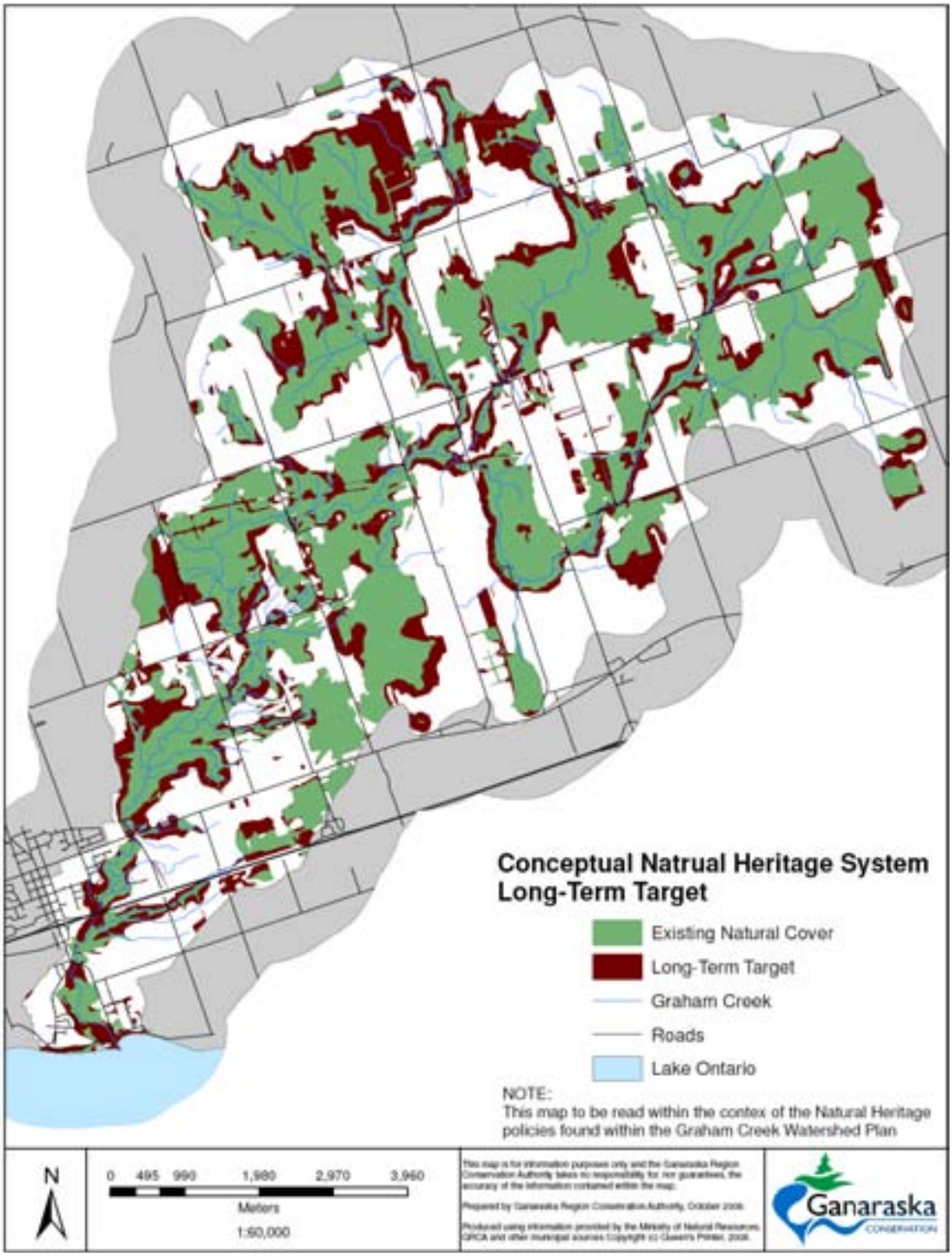


Figure 5.2: Graham Creek watershed long-term target natural heritage system

5.1 General Graham Creek Watershed Recommendations

Recommendations for management actions in the Graham Creek watershed can occur across the watershed and influence many or all watershed components. For ease of reading and to reduce repetition, the following recommendations are encouraged for adoption and implementation for the benefit of the entire watershed. These recommendations are further defined under each watershed component when necessary.

It is understood that where regulations or standards of other agencies or levels of government exceed the recommendations contained in this watershed plan, such as may occur under the Federal *Fisheries Act* or the forthcoming Source Protection Plan, the most restrictive provision or standard will apply.

Regulations and Planning

Recommended Policy: Implement future policies recommended in the Source Protection Plan created through the *Clean Water Act*

- Implement future Source Protection Plan policies if greater protection is recommended in the following watershed components:
    - Groundwater quantity
    - Groundwater quality
    - Surface water quantity
    - Surface water quality.
- Implementation will occur in the following vulnerable areas:
    - Municipal wellhead protection areas (currently none in the Graham Creek watershed)
    - Municipal intake protection zones
    - Significant groundwater recharge areas
    - Highly vulnerable aquifers.

Rationale and Integration: This policy allows for the consideration of required policies created through the source protection planning process, which are aimed at protecting sources of drinking water.

Recommended Policy: Implement *Oak Ridges Moraine Conservation Plan* policies across the Graham Creek watershed

- The implementation of Oak Ridges Moraine policies across the watershed is encouraged. Specific policies are listed under each watershed component.

Rationale and Integration: This policy allows for consistent watershed planning policies, which are aimed at protecting the natural environment.

Recommended Policy: Subwatershed level investigations

New large and multi-lot development may require subwatershed level investigations before proceeding. These investigations include, but are not limited to:

- Geomorphological investigation of the receiving water body in regards to stormwater discharge
- Site-specific infiltration targets
- Stormwater management conveyance
- Flood reduction targets
- Environmental Impact Study for natural heritage features and functions.

Rationale and Integration: This policy allows for greater environmental protection during local implementation of large development proposals. This policy will benefit all watershed components.

Recommended Policy: Implement future policies recommended in a Ganaraska Region Climate Change Strategy

- Implement future climate change strategy policies if greater protection is recommended in the following watershed components:
    - Groundwater quantity
    - Groundwater quality
    - Surface water quantity
    - Surface water quality
    - Aquatic habitat and species
    - Terrestrial natural heritage
    - Public health and well-being

Rationale and Integration: This policy allows for the consideration of actions recommended in a local climate change strategy.

Stewardship

It is acknowledged that many organizations exist that offer stewardship services, both technically and financially. However, it is recommended that the Ganaraska Region Conservation Authority Clean Water – Healthy Land Financial Assistance Program be continually implemented by the Ganaraska Region Conservation Authority in partnership with member municipalities. Technical and financial assistance is offered to watershed residents, community groups, businesses and schools. Specific priorities of stewardship activities are further expanded in relation to each watershed component.

Education and Awareness

Each watershed component indicates specific recommendations associated with education and awareness activities. It is recommended however, that an education and awareness program be developed by the Ganaraska Region Conservation Authority to deliver consistent and continual messaging related to

general watershed management, health and science. It is further recommended that a volunteer program be created for the implementation of the Graham Creek Watershed Plan to ensure community involvement and ownership.

Land Acquisition

Environmental features may be acquired by a public authority for protection through the purchase of land, donation of land, land rental, conservation easements and land use covenants. Specific polices regarding the need to acquire land are expanded upon in relation to each watershed component. The watershed plan acknowledges that municipalities and other organizations may have defined land acquisition targets and strategies. All groups acquiring lands should coordinate their efforts to maximize environmental protection.

Monitoring and Reporting

Monitoring and reporting are required to continually assess environmental health and to allow for increased scientific understanding of the watershed. It is also important to review watershed plan implementation to understand and report on the following:

- Adoption of policies into planning and regulation documents
- Uptake and participation in stewardship projects aimed at protecting and enhancing the watershed.
- The use of education and awareness initiatives and their effects
- Land acquisition activities
- Implementation of watershed monitoring activities.

5.2 Groundwater Quantity

The movement and location of groundwater in the subsurface are controlled by land cover, sediment types, geology and topography. Porous surficial materials generally comprise groundwater recharge areas in the middle part of the watershed. Rainfall and snowmelt percolate through these sediments and replenish the aquifers that form important groundwater supply sources for many watershed residents. Some aquifers in the watershed are under artesian conditions, meaning that pressure in the aquifer creates an upward gradient or flowing condition.

Aquifers contribute water to streams of the Graham Creek watershed through groundwater discharge. Groundwater discharge contribution during periods of time without precipitation and during critical summer low flow periods is essential in sustaining the ecosystem of the watershed. Areas of the watershed that lack porous surficial materials experience higher surface runoff than groundwater recharge.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to groundwater quantity. In addition, the following issues and opportunities were identified, and reviewed by the Technical Review Committee and Community Advisory Committee. The following will be the focus of current and future management actions.

Opportunity	**Artesian Aquifers and Flowing Artesian Wells:** in the Graham Creek watershed there are known artesian aquifers and many water supply wells under artesian or flowing artesian conditions. There is a high potential to encounter these conditions when drilling new wells. Uncontrolled flowing artesian wells have the potential to create negative impact to the surrounding environment, such as significant drawdown in aquifers and/or increased erosion and sedimentation in receiving surface water courses. Artesian aquifers in most cases (e.g. an upward gradient) have a crucial function in preventing surface contaminants from reaching water supply wells and deeper aquifers.
Opportunity	**Groundwater Recharge:** it is essential to manage groundwater recharge areas in order to maintain a high quality and quantity of water for domestic water supplies, and to sustain baseflow for the aquatic resources in the watershed. Protecting all areas of recharge is important to ensure that there are limited declines in current water supply. It is also important to enhance recharge areas where possible.

Opportunity	**Groundwater Discharge:** groundwater discharge locations, springs, and upwelling areas are important for human and ecological functions. Maintenance of baseflow and groundwater discharge to wetlands and watercourses is an important function of groundwater in the watershed. From a quantity perspective, volumes, flow direction and distribution of groundwater are critical for aquatic life and wetlands. Protecting all areas of discharge is important to ensure that declines in current ecological water use are prevented. It is also important to enhance discharge areas where possible.
Opportunity	**Shallow and Deep Aquifers and Aquitards:** groundwater found in shallow and deep aquifers is important as a water supply source for many residents. Protecting and managing the quantity of water in aquifers and protective aquitards needs to occur.
Issue	**Maintaining Flow Direction:** groundwater flow has the potential to change direction or leave the area to neighbouring watersheds as a result of human actions. For instance, groundwater flow directions can be altered by below watertable aggregate extraction, interception or exposure of the watertable, and continuous pumping of considerable amounts of groundwater. These negative impacts need to be avoided.
Opportunity/ Issue	**Permits To Take Water and Unregulated Water Takings:** extraction of groundwater that exceeds 50,000 litres per day must be done under a Permit To Take Water, acquired from the Ministry of the Environment. Current permitted groundwater takings and private residential water taking in the watershed have little effect on groundwater quantity. Future permits must be given with local data and knowledge considered through the process. Unregulated water takings (i.e., no permit required or illegal takings) are unknown.
Opportunity/ Issue	**Knowledge Gaps:** increased knowledge needs to occur in relation to the influence of geology on distribution and occurrence of groundwater (e.g., importance of the Iroquois Plain). The effects of new technologies on groundwater such as geothermal energy need to be better understood. Effects of climate changes on groundwater resources need to be continually studied. Tile drain interactions with groundwater also need to be locally understood.

GOAL 1.0: PROTECT AND ENHANCE GROUNDWATER QUANTITY FOR ECOLOGICAL FUNCTIONS AND HUMAN USE.

Objective 1.1: maintain or enhance groundwater recharge and discharge for ecological functions and human use.

Issues Addressed:
- Groundwater recharge
- Groundwater discharge.

Targets for Success:
- Maintain or enhance significant or sensitive groundwater recharge areas
- Maintain or enhance seasonal and annual groundwater discharge.

Groundwater Quantity Objective 1.1 Management Actions

Regulations and Planning

Recommended Policy: Map groundwater features

- Groundwater features that contribute to groundwater quantity include the following, all of which should be mapped for the Graham Creek watershed:
    - Significant or sensitive groundwater recharge areas[2]
    - Significant or sensitive groundwater discharge areas.

Rationale and Integration: This policy allows for the identification and mapping of groundwater features that contribute functionally to groundwater quantity. Once identified, protection of these features can occur through regulations and planning. This policy also benefits surface water quantity, groundwater and surface water quality, and aquatic habitats and species.

Recommended Policy: Identify groundwater features not yet known

- Identify groundwater features that have not been mapped or identified in the Graham Creek watershed, but have come to the attention of the Ganaraska Region Conservation Authority or the municipality through new information or correction of previous inaccurate or incomplete information.

[2] Groundwater recharge areas in urban areas need to be further defined from existing modeling initiatives to acknowledge impervious surfaces.

Rationale and Integration: This policy allows for the identification of groundwater features that are currently unknown and allows for the integration of new sciences and future research into regulation and planning.

Recommended Policy: Restrict development within and in proximity to groundwater features

- Existing policies specified by the *Oak Ridges Moraine Conservation Plan* currently in municipal official plans in relation to seepage areas and springs are supported (Appendix F).
- Development within and in proximity to groundwater features throughout the Graham Creek watershed is prohibited or restricted for the protection of groundwater quantity in accordance with the following:
    - All development with respect to land within a groundwater feature and a 30-metre vegetation protection zone is prohibited or restricted except for the following:
        - Forest, fish and wildlife management
        - Conservation and flood or erosion control projects, but only if determined to be necessary in the public interest after all alternatives have been considered
        - Transportation, infrastructure and utilities as described in Section 41 of the *Oak Ridges Moraine Conservation Plan*, but only if the need for the project has been demonstrated and there is no reasonable alternative
        - Low-intensity recreational uses as described in Section 37 of the *Oak Ridges Moraine Conservation Plan*
        - Development related to existing urban, rural and agricultural uses, subject to area-specific policies.
    - An application for development with respect to land within the 120-metre area of influence to a significant groundwater discharge area shall be accompanied by a hydrologic evaluation as specified in the *Oak Ridges Moraine Conservation Plan*.
    - An application for development with respect to land within a 120-metre area of influence to a significant groundwater recharge area shall be accompanied by a hydrologic evaluation to ensure that the development:
        - Maintains or enhances the volume and rate of recharge in the post-development condition.
        - Does not limit the volume and rate of recharge in the post-development condition.
        - Will not affect the discharge feature or the groundwater system providing water to that feature.
        - Considers best management practices in urban areas related to groundwater recharge.

Rationale and Integration: This policy allows for the restriction of development within or adjacent to groundwater features that contribute functionally to

groundwater quantity. This policy also benefits surface water quantity, groundwater and surface water quality, and aquatic habitats and species.

Recommended Policy: Protect groundwater recharge rates

- Development should maintain or enhance pre-development groundwater recharge rates through onsite mitigation efforts. In addition, investigation into low impact development stormwater management techniques must occur.

Rationale and Integration: This policy allows for the maintenance or improvement of groundwater recharge rates. This policy also benefits surface water quantity, groundwater and surface water quality, and aquatic habitats and species.

Recommended Policy: Urban infiltration targets

- Before large development occurs, achievable groundwater infiltration targets should be developed in urbanized sections of the watershed to allow for natural groundwater recharge to occur post development.

Rationale and Integration: This policy allows for the restriction of development within or adjacent to groundwater features that contribute functionally to groundwater quantity. This policy also benefits surface water quantity, groundwater and surface water quality, and aquatic habitats and species.

Plan Review Mechanisms

The continual implementation of GRCA and municipal development plan review process to protect groundwater features and functions is supported. Current municipal official plan requirements of subwatershed plans are also supported.

Stewardship

- Implementation of the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program throughout the Graham Creek watershed is recommended in order to assist residents and landowners in stewardship actions that benefit groundwater recharge and discharge:
    - Increase natural cover within and adjacent to groundwater features.
    - Achieve the natural heritage system as the primary means of protecting groundwater features and functions.
    - Enhance and protect groundwater features through best management practices conducted on the land.
    - Encourage the adoption of urban land use practices that increase groundwater recharge (e.g., reduce permeable surfaces).
- Work with partnership programs to increase stewardship actions that protect and mitigate negative influences on groundwater recharge and discharge.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection and enhancement of groundwater quantity.

These actions will also benefit surface water quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Education and Awareness

- Through GRCA and partner programs, provide information and education using workshops and the media on the importance and local scientific knowledge of groundwater features.
- Create and make available print material on the science and local information regarding groundwater recharge and discharge, as well as actions people can take on their own property to improve and protect groundwater recharge and discharge.
- Consider development of a children's groundwater festival in the Ganaraska Region Conservation Authority.

Rationale and Integration: Implementation of education and awareness recommendations along with partnership programs will aid in the protection and enhancement of groundwater quantity. These actions will also benefit surface water quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Land Acquisition

- Significant or sensitive groundwater features may be acquired by a public authority for protection through the following methods:
    - Purchase of land
    - Donation of land
    - Land rental
    - Conservation easements
    - Land use covenants.

<u>Recommended Policy: Protection of groundwater features through land acquisition</u>

- The following groundwater features are priority lands for acquisition by a public authority:
    - Significant or sensitive groundwater features and functions that are under threat from proposed development
    - Significant or sensitive groundwater features and functions that are not or cannot be adequately protected from the impacts of development by planning policy or stewardship agreements.

Rationale and Integration: Implementation of a groundwater feature land acquisition policy will aid in the protection and enhancement of groundwater quantity. These actions will also benefit surface water quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting
Create and implement a GRCA integrated watershed monitoring program to achieve and report on the following:

- Groundwater quantity monitoring on a regional scale. Programs include the Provincial Groundwater Monitoring Network, piezometer monitoring, and data sharing through the Ministry of the Environment Water Well Records Database.
- Increased baseflow monitoring to measure spatial and temporal changes in groundwater discharge and trends in discharge to Graham Creek.

It is recommended that research on the following topics among others occurs:

- The contribution of groundwater discharge into wetlands
- The influence of geology, especially the Iroquois Plain on the distribution and occurrence of groundwater recharge and discharge in the watershed
- The effects of field drainage on groundwater quantity
- The spatial extent of aquifers.

Objective 1.2: manage and avoid actions that affect aquifers (artesian, shallow and deep) and changes in groundwater flow.

Issues Addressed:	***Targets for Success:***
• Artesian aquifers and flowing artesian wells • Shallow and deep aquifers and aquitards • Maintaining flow direction.	• Establish and maintain baseline watertable levels (shallow aquifer) • Establish and maintain baseline piezometric level (deep aquifer).

Groundwater Quantity Objective 1.2 Management Actions

Regulations and Planning
<u>Recommended Policy: Minimize groundwater flow alteration</u>

- Development within groundwater features may be permitted only if the direct alteration of groundwater flows will be minimized, the feature will be protected and its related hydrological functions maintained:
    - Undertaking no construction at a depth greater than 1.5 metres above an identified high watertable or at a depth that has been determined at a site-specific level, or
    - Undertaking a hydrogeological and/or geotechnical study to the satisfaction of the municipality and GRCA, or
    - Fulfilling applicable approval requirements under the *Aggregate Resources Act*, *Environmental Assessment Act* and/or *Ontario Water Resources Act*.

Rationale and Integration: This policy allows for the restriction of development within sensitive or significant groundwater features and functions. This policy also benefits surface water quantity, and aquatic habitats and species.

Recommended Policy: Minimize and manage artesian and flowing wells

- Development of wells in areas of known artesian and flowing well conditions is not recommended. If flowing well conditions are created, the conditions must be managed in a way that fulfills requirements under the *Ontario Water Resources Act*.

Rationale and Integration: This policy discourages development in artesian groundwater conditions. If flowing conditions are created, this policy ensures that appropriate management techniques occur. This policy also benefits surface water quantity, and aquatic habitats and species.

Education and Awareness

- Through GRCA and partner programs, provide information and education using workshops, print material and the media on the importance and issues of artesian, shallow and deep aquifers, and appropriate regulations.
- Through GRCA and partner programs provide information and education to homebuyers on well management issues.

Rationale and Integration: Implementation of education and awareness recommendations along with partnership programs will aid in the protection and enhancement of groundwater quantity. These actions will also benefit surface water quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting

- Create and implement a GRCA integrated watershed monitoring program to measure changes in groundwater quantity and flow direction.

Objective 1.3: ensure sustainable rates of groundwater use.

Issues Addressed:	***Targets for Success:***
• Permits to Take Water and unregulated takings	• Maintain sustainable rates of groundwater use in relation to ecological needs

Groundwater Quantity Objective 1.3 Management Actions

Regulations and Planning

Recommended Policy: Restrict development in groundwater features needing a Permit to Take Water

- Development that would require a Permit to Take Water under the *Ontario Water Resources Act* may be permitted in a significant or sensitive groundwater feature only if the water withdrawal, in conjunction with previously approved or known unregulated withdrawal, will not cumulatively alter the groundwater feature or function.

Recommended Policy: Restrict consumptive water takings

- Development or land uses that do not require a groundwater Permit to Take Water under the *Ontario Water Resources Act* and are consumptive takings may be permitted only if the water withdrawal amount, in conjunction with previously approved or known unregulated withdrawal, will not cumulatively alter the groundwater feature or function.

Rationale and Integration: These policies allow for development and land uses to occur, with a restricted withdrawal of groundwater determined by ecological needs and cumulative water taking effects throughout the watershed. These policies also benefit surface water quantity, and aquatic habitats and species.

Existing Review Mechanisms and By-laws

- Continued reviews by the GRCA and municipalities in the Permit to Take Water process are supported, as are required PTTW monitoring requirements.
- The watershed plan supports the Regional Municipality of Durham *By-law 72-2008* that limits the amount of water used by those serviced by Regional water supply systems.
- The watershed plan supports the development of a water use by-law in the Municipality of Port Hope.

Plan Creation: Water Conservation Plan

- Create a water conservation plan that addresses water use throughout the watershed. This includes water use for domestic, agricultural, industrial and commercial use, regardless of the amount used (refer to Section 7).

Education and Awareness

- Provide education to water users who require a Permit to Take Water.
- Provide information and education through workshops, print material and the media on the importance of properly managing permitted water takings and water taking less than 50,000 litres per day.
- Promote existing water conservation by-laws and a future water conservation plan (refer to Section 7).

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of groundwater quantity. These actions will also benefit surface water quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to monitor and report on the number and conditions of Permits To Take Water, changes in groundwater quantity in relation to water takings, and the actual takings related to a permitted water taking.

Encourage research to establish the total amount of water takings, both regulated and non-regulated.

5.3 Surface Water Quantity

The Graham Creek watershed is a fifth order stream, consisting of two main tributaries, and it drains an area of 78 km^2. Originating on the Oak Ridges Moraine and South Slope, Graham Creek is characteristic of a rural watershed with minimal imperviousness in the headwaters and mid reaches of the watershed. As Graham Creek flows through south of Highway 401, impervious land uses increase, altering surface runoff pathways and flow rates.

Analyzing surface water can be done from a flow and a use perspective. Knowledge of water quantity, characteristics, and effects of flow and water resources allows for the protection of surface water. Understanding hydrology, which determines the amount of flow generated by a particular storm, aids in protecting people and property. Natural hazard mapping defines boundaries where there is a concern for public health and safety associated with hazards such as flooding, erosion or unstable organic soils.

In order to determine sustainable surface water quantity, water budgets are used to determine how much water leaves and enters the watershed. Through this analysis, it has been determined that Graham Creek has low stress to current and future surface water use and provides necessary flows for ecosystem functions.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to surface water quantity. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Opportunity	**Floodplain Management:** in order to protect people and property, future new development needs to be restricted from the floodplain. Current development areas in the floodplain need to be managed and enhanced to avoid negative flood impacts.
Issue	**Maintaining Natural Flow Regime:** natural flow variation (baseflow and high flows) in Graham Creek needs to be better understood in order to be protected. Negative flow impacts from land uses need to be mitigated or avoided. There are limited erosion problems in the Graham Creek.
Opportunity	**Land Cover and Imperviousness:** impervious land cover, both natural and man-made, can cause increased peak flows and extreme flows. Impervious cover in the Oak Ridges Moraine is less than the maximum amount of 10%. Imperviousness needs to be kept below 6% from a stream response perspective.

Opportunity	**Wetlands:** existing wetlands need to be protected and enhanced where needed to ensure that natural flow regime and water storage are adequately addressed.
Opportunity	**Water Structures and Ponds:** water structures such as dams need to be addressed to ensure that the natural flow regime is not being compromised. Construction of new online ponds needs to be avoided and current online ponds (a stream connected to a river or stream) need to be taken offline where possible. Offline ponds (not attached to a river or stream) will be encouraged as long as they do not impact negatively on surface water. Education needs to occur in regard to beaver management.
Opportunity/ Issue	**Permits To Take Water and Unregulated Water Takings:** surface water can be extracted for human use. When extraction amounts exceed 50,000 litres per day, a permit must be acquired. Current and future water takings cannot affect surface water quantity. Unregulated water takings (i.e., no permit required or illegal takings) are unknown.
Issue	**Stormwater Management:** stormwater management infrastructure may cause extreme peak flows that can result in flooding or affect stream structure. Rural ditch maintenance and urban stormwater development, design and retrofitting should be managed accordingly.
Opportunity/ Issue	**Knowledge Gap:** the effects of climate change on surface water quantity are unknown. Channel form needs to be better understood in relation to changes in extreme flows.

GOAL 2.0: MAINTAIN AND IMPROVE THE HYDROLOGIC FUNCTION OF THE WATERSHED.

Objective 2.1: maintain and enhance the water balance and baseflow of the Graham Creek watershed.

Issues Addressed:

- Maintaining natural flow regime
- Land cover and imperviousness
- Wetlands
- Water structures and ponds
- Permits to Take Water and unregulated water takings
- Stormwater management.

Targets for Success:

- Total watershed imperviousness less than 10% and site-specific reduction in imperviousness
- Reduction in peak flows
- Maintenance of baseflow
- Reduction in the number of online ponds and impoundment structures.

Surface Water Quantity Objective 2.1 Management Actions

Regulation and Planning

Recommended Policy: Map features contributing to natural flows of Graham Creek

- Features contributing to natural flows include the following, all of which should be mapped for the Graham Creek watershed:
    - Significant or sensitive groundwater discharge areas
    - Significant valleylands
    - Watercourses including headwater, permanent and intermittent streams
    - Wetlands.

Rationale and Integration: This policy allows for the identification of features that contribute functionally to surface water quantity. Once identified, protection of these features can occur through regulations and planning. This policy also benefits surface water quality, and aquatic habitats and species.

Recommended Policy: Identify features contributing to natural flows of Graham Creek not yet known

- Identify features contributing to natural flows that have not been mapped or identified in the Graham Creek watershed, but come to the attention of the GRCA and municipalities through new information or correction of previous inaccurate or incomplete information.

Rationale and Integration: This policy allows for the identification of features that contribute functionally to surface water quantity that are currently unknown and allows for the integration of new sciences and future research into regulation and planning.

Recommended Policy: Restrict development within and in proximity to features contributing to natural stream flows

- Existing policies specified by the *Oak Ridges Moraine Conservation Plan* currently in municipal official plans in relation to permanent and intermittent streams, significant valleylands, and seepage areas and springs are supported (Appendix F).
- Development within and in proximity to features contributing to natural flows throughout the Graham Creek watershed is prohibited or restricted for the protection of natural stream flows in accordance with the following:
    - Development with respect to land in a feature contributing to natural flows and the 30-metre vegetation protection zone (as indicated in Appendix F) is prohibited or restricted except for the following:
        - Forest, fish and wildlife management
        - Conservation and flood or erosion control projects, but only if they are determined to be necessary in the public interest, after all alternatives have been considered
        - Transportation, infrastructure and utilities, as described in Section 41 of the *Oak Ridges Moraine Conservation Plan*, but only if the need for the project has been demonstrated and there is no reasonable alternative
        - Low-intensity recreational uses, as described in Section 37 of the *Oak Ridges Moraine Conservation Plan*
        - Development related to existing urban, rural and agricultural uses, subject to area-specific policies.
    - An application for development on lands within the 120-metre area of influence of a feature contributing to natural flows (as indicated in Appendix F) shall be accompanied by a hydrologic evaluation, as specified in the *Oak Ridges Moraine Conservation Plan*.

Rationale and Integration: This policy allows for the restriction of development within or adjacent to features contributing to natural flows. This policy also benefits surface water quality, and aquatic habitats and species.

Recommended Policy: Limit cumulative hard surfaces in the Graham Creek watershed

- Development may be permitted only if the development will not cause the total cumulative impervious surface area of the Graham Creek watershed to exceed 10% of the watershed area and if the total cumulative impervious surface area within the Graham Creek Oak Ridges Moraine planning boundary does not exceed 10%.

- Surface hardening associated with development is not permitted within a significant or sensitive feature contributing to natural flows of Graham Creek if the development will significantly affect groundwater linkages to natural flows in Graham Creek.
- Where direct connection from an impervious surface to a watercourse currently exists, all attempts shall be made to disconnect that connection through a pervious surface. New direct connections shall be restricted.
- It is recommended that the GRCA and municipalities create subwatershed impervious surface limits.
- Subwatershed level investigation should occur when new large developments are proposed to ensure that the geomorphic features of the receiving water bodies are maintained or improved to pre-development levels.

Rationale and Integration: This policy allows for the restriction of development that increases impervious surfaces in the watershed. This policy also benefits groundwater quantity, surface water quantity (Objective 2.1) surface water quality and, aquatic habitats and species, and terrestrial natural heritage.

Recommended Policy: Development setbacks from Graham Creek

- All new development will be setback from a watercourse to a minimum of 30 metres defined by:
    - The meander belt
    - A site-specific determined stream feature
    - The natural heritage system
- Development related to existing urban, rural and agricultural uses may be restricted within the 30-metre setback, subject to area-specific policies.
- Within the watercourse setback, lands must remain undisturbed except for the minimum area required for approved development or if the setbacks have been disturbed by past activities, restoration may be required. Restoration includes re-naturalization of the setback area and planting native vegetation.

Rationale and Integration: This policy allows for restricted development in close proximity to a watercourse. This policy also benefits surface water quality, and aquatic habitats and species.

Recommended Policy: Restrict development in features contributing to natural flows in Graham Creek needing a Permit to Take Water

- Development that would require a Permit to Take Water under the *Ontario Water Resources Act* may be permitted in a feature contributing to natural flows to Graham Creek only if the water withdrawal, in conjunction with previously approved or known unregulated withdrawal, will not cumulatively alter the natural stream flow, function and form.

Recommended Policy: Restrict consumptive water takings

- Development or land uses that do not require a surface water Permit to Take Water under the *Ontario Water Resources Act* may be permitted if the water

withdrawal amount, in conjunction with previously approved or known unregulated withdrawal, will not cumulatively alter the natural stream flow, function and form.

Rationale and Integration: These policies allow for development and land uses to occur with a restricted withdrawal of surface water determined by ecological needs and cumulative water taking effects throughout the watershed. Changes to natural stream flow, function and form includes but are not limited to, changes in variability and quantity of flow, ecological function of the stream, and channel shape or form. These policies also benefit aquatic habitats and species.

Recommended Policy: Require urban stormwater best management practices

- All development will meet or exceed municipal and Conservation Authority development standards at the point of discharge in order to protect and enhance natural flows in Graham Creek. Alternative design standards and technologies will be researched and utilized, together with the use of stormwater management practices, in new and existing developments as a means of attenuating runoff volumes and peak flow rates, and maintaining infiltration to pre-development conditions or a natural state.
- The GRCA and municipalities will investigate and work towards implementation of low impact development practices (including green building technologies) in new developments.
- Stormwater management targets must be evaluated on a subwatershed basis.
- Proposed stormwater infrastructure must include plans for future management and maintenance of the stormwater infrastructure.

Rationale and Integration: This policy allows for development and land uses to take place while using methods that reduce negative impacts and variability of surface water flows from stormwater management. This policy also benefits aquatic habitats and species.

Recommended Policy: Limit online ponds and impoundment structures

- The development and construction of online ponds or impoundment structures are prohibited, except for the following:
    - Public forest, fish and wildlife management
    - Conservation and flood or erosion control projects, only if determined necessary and in the public interest after all alternatives have been considered.

Rationale and Integration: This policy allows for the restriction of online structures that have negative effects on instream form and function. This policy also benefits surface water quality, and aquatic habitats and species.

Recommended Policy: Limiting site alterations

- Cut and fill operations are discouraged within or adjacent to features that contribute to natural flows in Graham Creek, particularly where perched groundwater may contribute to a hydrologic function of a wetland or watercourse.

Rationale and Integration: This policy limits the amount of site disturbance next to a surface water feature. This policy also benefits surface water quality, and aquatic habitats and species.

Existing Legislation

- Implement policies where applicable from the *Drainage Act* to address surface water quantity issues associated with agricultural drainage.

Review Mechanisms

- The GRCA and municipal staff will continue to review development plans and request changes where necessary to ensure that runoff volumes, peak flow rates and impervious surfaces are minimized. In addition, groundwater recharge should be maintained in new development areas, thereby reducing surface runoff.
- The GRCA and municipal staff will continue to review Permit to Take Water applications to ensure water takings are done using local watershed-based data and knowledge.

Existing Program Implementation

- The GRCA will continue to work with the Ganaraska Region Low Water Response Team to implement the Provincial Low Water Response procedures when required.
- The GRCA and municipalities will investigate and work toward implementation of low impact development practices

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship Program and partner programs to assist landowners and residents in stewardship activities that accomplish the following:
    - Increase natural vegetation using the natural heritage system to compensate for changes in imperviousness of the watershed.
    - Increase riparian buffers to reduce variability of overland runoff.
    - Increase water infiltration, storage and use on individual lots (i.e., green roofs, rain barrels and cisterns, and permeable parking lots and driveways.
    - Protect, restore, and enhance wetlands.
    - Carry out an urban stewardship program to address altered flows caused from stormwater management.
    - Increase channel stability using bioengineering in urbanized areas to mitigate erosion caused by altered flows.

- Assist in the implementation of a water conservation plan through the Clean Water – Healthy Land Stewardship Program (refer to Section 7).
- Work with partnership programs to increase stewardship actions that protect and enhance features that contribute to natural flows in Graham Creek.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection and enhancement of surface water quantity. These actions will also benefit groundwater quantity, surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Education and Awareness

- Increase information and community involvement through workshops, volunteer opportunities, the media, print material and site visits regarding features that contribute to natural flows (headwater, first order, intermittent streams, wetlands and groundwater discharge areas).
- Focus education on the uniqueness of wetlands in the Graham Creek watershed.
- Provide education through GRCA and partner programs on reducing stormwater runoff and increasing natural infiltration in urban areas.
- Increase education and knowledge on the Permit to Take Water process and assist applicants through the process.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of surface water quantity. These actions will also benefit groundwater quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to achieve the following:

- Monitor stream flow through the stream gauge network program.
- Monitor baseflow in Graham Creek to understand changes within the watershed and over time.
- Monitor aspects of the surface water system that will allow development of natural flow/ecological flow targets.
- Monitor and study channel morphology.
- Continue to study and understand local impacts from climate change through computer modeling and climate change initiatives.

It is recommended that research on the following topics occurs:

- Establish the total amount of water takings, both regulated and non-regulated.

- Understand the relationships between storm flows and urban watercourses, particularly in relation to bank erosion and changes in channel structure.
- Develop natural flow targets for subwatersheds of the Graham Creek watershed.
- Understand the quantity and location of tile drainage, which will assist in understanding changes in stream flows as a result of field drainage.
- Study the effects of climate change on surface water quantity.

Objective 2.2: maintain and improve the level of flood hazard protection for residents, and for existing and proposed development.

Issues Addressed:
- Floodplain management
- Land cover and imperviousness
- Water structures and ponds
- Stormwater management.

Targets for Success:
- Total watershed imperviousness less than 10%
- Reduction in peak flows
- Reduction in the number of online ponds and impoundment structures.

Surface Water Quantity Objective 2.2 Management Actions

Regulation and Planning

<u>Recommended Policy: Limit cumulative hard surfaces in the Graham Creek watershed</u>

- Development may be permitted only if the development will not cause the total cumulative impervious surface area of the Graham Creek watershed to exceed 10% of the watershed area and if the total cumulative impervious surface area in the Graham Creek Oak Ridges Moraine planning boundary does not exceed 10%.
- Where direct connection from an impervious surface to a watercourse currently exists, all attempts shall be made to disconnect that connection through a pervious surface. New direct connections shall be discouraged.
- It is recommended that the GRCA and municipalities create subwatershed impervious surface limits.

- Subwatershed level investigation should occur when new large developments are proposed to ensure that the geomorphic features of the receiving water bodies are maintained or improved to pre-development levels.

Rationale and Integration: This policy allows for the restriction of development that increases impervious surfaces in the watershed for the reduction of flooding potential. This policy also benefits groundwater quantity, surface water quality (Objective 2.0), and aquatic habitats and species, and terrestrial natural heritage.

Recommended Policy: Limit online ponds and impoundment structures

- The development and construction of online ponds or impoundment structures are prohibited except for the following:
    - Public forest, fish and wildlife management
    - Conservation and flood or erosion control projects, only if determined necessary and in the public interest after all alternatives have been considered.

Rationale and Integration: This policy allows for the restriction of online structures that have the potential to increase flooding through a failed structure. This policy also benefits surface water quality, and aquatic habitats and species.

Recommended policy: Stormwater quantity control

- All new development, excluding minor development as defined by the GRCA and municipalities, must provide control of post-development stormwater to pre-development levels for all storms up to and including the 100-year event or other significant storm events.
- Assessment of outlet and channel constraints is required for areas draining through existing developed areas and through ill-defined watercourses and depressions throughout the watershed.

Rationale and Integration: This policy allows for the management and design of storm flows from impervious surfaces that have the potential to increase flooding. This policy also benefits aquatic habitats and species.

Existing Policies and Programs

- Continue to implement Section 28 (Generic Regulations) of the *Conservation Authorities Act* to ensure that a development occurs only if it is not affected by a potential natural hazard.
- Continue to implement the GRCA flood monitoring and warning program to ensure that flood protection is provided to local communities.

Recommended Plan: Flood Recovery Program

Create a plan that addresses recovery from floods for public and private property. This program would outline services offered by the GRCA, municipalities, health units and departments, and others to those affected by floods.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship Program and partner programs to assist landowners and residents in stewardship actions that accomplish the following:
    - Manage or decommission online ponds to ensure that they do not pose a flood hazard.
    - Implement re-vegetation to attenuate flood flows (i.e., riparian plantings, grass swales and waterways).

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the reduction of natural hazards. These actions will also benefit surface water quantity (Objective 2.0), surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Education and Awareness

- The GRCA will continue to deliver the Spring Water Awareness Program (SWAP) to educate Grade 4 classes at local schools on the importance of using caution and avoiding spring melt and stormwater flows.
- Increase education around GRCA programs aimed at flood warning and forecasting.
- Increase education around emergency response to floods.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of surface water quantity. These actions will also benefit groundwater quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Land Acquisition

- Floodplains where existing hazards are deemed to be excessive may be acquired by a public authority for protection through the following methods:
    - Purchase of land
    - Donation of land
    - Land rental
    - Conservation easements
    - Land use covenants.

<u>Recommended Policy: Protection of floodplains through land acquisition</u>

- Floodplains that pose a significant hazard to property and citizens, or properties that may limit the hazard are priority lands for acquisition by a public authority.
- Floodplains that have been expanded as a result of climate change predictions are potentially priority lands for acquisition by a public authority.

Rationale and Integration: Implementation of a surface water feature land acquisition policy will aid in the protection and enhancement of surface water quantity. These actions will also benefit groundwater quantity, groundwater and surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program that includes the maintenance of the stream flow gauging program to ensure calculated flood peaks match those being experienced in the watershed.

5.4 Groundwater Quality

Groundwater quality naturally varies from place to place, is affected by seasonal changes and local climate, and also by the types of soils and rocks through which it moves. When water from rain or snowmelt moves overland and through the ground, it dissolves minerals found in rocks and soils, percolates through organic material such as roots and leaves, and reacts with algae, bacteria and other microscopic organisms. Each of these natural processes changes groundwater quality. In addition, human influences such as contamination can alter the quality of groundwater. Quality groundwater is required by aquatic environments and habitats and is important to the environment and as a source of drinking water. Therefore, it is important to reduce or eliminate the risks to groundwater quality.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to groundwater quality. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Issue	**Unused, Poorly Maintained, and Abandoned Wells:** the number of abandoned or unused wells is unknown. All abandoned, poorly maintained or unused wells need to be upgraded for use or decommissioned to protect groundwater quality and human safety.
Issue	**Unused, Poorly Maintained Septic Systems:** the number of septic systems and the state that they are in is unknown. Septic systems that are in disrepair need to be fixed to avoid groundwater contamination. Unused septic systems should be removed.
Issue	**Unused, Poorly Maintained Fuel/Chemical Storage:** the number of facilities that store fuel or chemicals on private or commercial properties and the state that they are in is unknown. Storage facilities that are in disrepair need to be fixed to avoid groundwater contamination. Unused storage facilities should be removed.
Issue	**Landfills:** proper management of historic landfills needs to occur to ensure leachate is monitored and controlled. The numbers of private and unmanaged historic landfills are unknown.
Issue	**Spreading and Storing of Salts, Biosolids, Fertilizers and Nutrients, Pesticides and other Chemicals within High Recharge Areas:** contamination to groundwater can occur from spreading and unmanaged or poorly stored biosolids, pesticides, fertilizers, and salts. Prevention and proper management of these potential contaminants should occur throughout the watershed.

GOAL 3.0: PROTECT GROUNDWATER QUALITY TO ENSURE SAFE DRINKING WATER SUPPLIES AND PROTECT ECOLOGICAL FUNCTIONS.

Objective 3.1: protect and enhance the quality of groundwater by addressing existing pathways and contaminant sources.

Issues Addressed:
- Unused, poorly maintained and abandoned wells
- Unused and poorly maintained septic systems
- Unused and poorly maintained fuel/chemical storage.

Targets for Success:
- A reduction in abandoned and unmaintained wells
- A reduction of poorly maintained septic systems and an increase in septic inspections
- A reduction in poorly maintained fuel and chemical storage facilities
- Maintenance and enhancement of groundwater quality to Ontario Drinking Water Standards
- Maintenance of current quality of groundwater supplies
- Implementation of best management practices in the Graham Creek watershed.

Groundwater Quality Objective 3.1 Management Actions

Regulation and Planning

Recommended Policy: Ensure that wells or boreholes are properly maintained or abandoned

- Development may be considered on a lot where there is an abandoned well or borehole, or where the applicant demonstrates that actions have been taken to decommission the well or borehole in accordance with the *Ontario Water Resources Act*.

Rationale and Integration: This policy ensures proper abandonment or management of unused wells, thereby protecting groundwater quality. This policy also benefits surface water quality.

Policy Investigation and Creation: Require private sewage system upgrades during redevelopment

- Investigate and create a policy that requires the proper abandonment or upgrade of on-site sewage systems.

Recommended Program: Septic re-inspection program

- Investigate and create a re-inspection program of on-site sewage systems.

Rationale and Integration: These policies will allow for the reduction of groundwater contamination risks from abandoned, unmaintained wells and septics. This policy also benefits surface water quality.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship Program and partner programs to assist landowners and residents in stewardship actions:
    - Upgrade or decommission wells and boreholes.
    - Repair septic systems and provide for septic inspections.
    - Upgrade or newly construct fuel and chemical storage facilities.
- Support the implementation of a volunteer septic system inspection program.
- Work with local building officials, and health departments/units in regards to septic system repairs and inspections.
- Work with local partners and funding programs such as the Ontario Drinking Water Stewardship Program to increase stewardship actions that protect and mitigate negative effects on groundwater quality.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of groundwater quality. These actions will also benefit surface water quality, and aquatic habitat and species.

Education and Awareness

- Host safe water seminars in a partnership of the GRCA, health units/departments, municipalities and others.
- Promote private water well testing in partnership with the local health units/departments.
- Use print material, the media and workshops to educate the public on the importance of groundwater contamination prevention.
- Through GRCA, the health units/departments and partner programs provide information and education to homebuyers on well management issues and septic system management.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of groundwater quality. These actions will also benefit groundwater and surface water quantity, surface water quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to achieve the following:

- Create a program that inventories wells and boreholes through voluntary notification. Work with municipalities and the heath unit to create an inventory of septic systems and storage facilities.

- Continue implementing the Provincial Groundwater Monitoring Network on a regional scale to monitor groundwater quality.
- Continue data sharing with municipalities in relation to municipal well raw water supply and treated water quality.

Objective 3.2: manage the quality of groundwater through implementation of best management practices throughout the watershed.

Issues Addressed:

- Spreading and storing of bio-solids, pesticides and other chemicals in high recharge areas
- Highly vulnerable aquifers
- Landfills.

Targets for Success:

- Maintenance of groundwater quality supplies to Ontario Drinking Water Standards
- Identification of highly vulnerable aquifers
- Regulation and proper management of land application and storage activities in high recharge areas and vulnerable aquifers.

Groundwater Quality Objective 3.2 Management Actions

Regulation and Planning

Recommended Policy: Map highly vulnerable aquifers

- Highly vulnerable aquifers[3] should be mapped for the protection of groundwater quality.

Rationale and Integration: This policy allows for the identification, through mapping, of features at risk from groundwater contamination. Once identified, protection of these features can occur through regulations and planning. This policy also benefits surface water quality.

Recommended Policy: Identify vulnerable areas to groundwater contamination not yet known

- Identify vulnerable areas to groundwater contamination that have not been mapped or identified in the Graham Creek watershed, but come to the attention of the GRCA and municipalities through new information or correction of previous inaccurate or incomplete information.

Rationale and Integration: This policy allows for the identification of features at risk from groundwater contamination that are currently unknown and allows for the integration of new sciences and future research into regulation and planning.

[3] Highly vulnerable aquifers in urban areas need to be further defined from existing modeling initiatives to acknowledge impervious surfaces.

Recommended Policy: Restrict development in highly vulnerable aquifers

- Existing policies specified by the *Oak Ridges Moraine Conservation Plan* currently in municipal official plans in relation to development in highly vulnerable aquifers are supported (see below).
- Development in highly vulnerable aquifers throughout the watershed is prohibited if the land use is for the following:
    - Generation and storage of hazardous waste or liquid industrial waste
    - Waste disposal sites and facilities, organic soil conditioning sites, and snow storage and disposal facilities
    - Underground and above-ground storage tanks that are not equipped with a required secondary containment device
    - Storage of contaminants listed in Schedule 3 of *Ontario Regulation 347* of the *Environmental Protection Act*
    - Development is further restricted or prohibited in accordance with municipal policies.

Rationale and Integration: This policy allows for the protection of highly vulnerable aquifers from potential groundwater contamination associated with high risk land uses. This policy also benefits surface water quality.

Existing Legislation

Implement policies and regulations under the *Nutrient Management Act* associated with the protection of groundwater supplies from contamination associated with biosolids.

The watershed plan supports education and regulations regarding the purchase of pesticides and herbicides for agricultural use through the Grower Pesticide Safety Course.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship Program and partner programs in order to encourage and provide incentives for best management practices within highly vulnerable aquifers.
- Work with local partners and through other funding programs such as the Ontario Drinking Water Stewardship Program to increase stewardship actions that protect and mitigate negative effects on groundwater quality.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of groundwater quality. These actions will also benefit surface water quality, and aquatic habitat and species.

Land Acquisition

- Highly vulnerable aquifers may be acquired by a public authority for protection through the following methods:
    - Purchase of land

- Donation of land
- Land rental
- Conservation easements
- Land use covenants.

Recommended Policy: Protection of vulnerable groundwater features through land acquisition

- Highly vulnerable aquifers are priority lands for acquisition by a public authority when the following occurs:
  - Highly vulnerable aquifers are under threat from proposed development.
  - Highly vulnerable aquifers are not or can not be adequately protected from the impacts of development by planning policy or stewardship agreements.

Rationale and Integration: Implementation of a vulnerable groundwater feature land acquisition policy will aid in the protection and enhancement of groundwater quality. These actions will also benefit surface water quality, and aquatic habitat and species.

Monitoring and Reporting

- Monitor the extent of biosolid applications and activities.
- Monitor development activities within highly vulnerable aquifers.

It is recommended that research occurs on the effects of field drainage on groundwater quality.

5.5 Surface Water Quality

Quality surface water is required for various water uses, including recreation, aquatic habitat, potable water supply and irrigation. The quality of surface water is influenced by the surrounding landscape and instream transformations. Land use and cover in a watershed can influence water chemistry and integrity of the stream environment. Non-point sources (e.g., runoff) that enter surface water contain components of the watershed. Surrounding land use and cover therefore play an important role in the type and amount of nutrient, bacteria, chemical and metal loading that occurs in a water system.

Land use and cover in Graham Creek not only affects the quality of surface water, but also the quality of Lake Ontario and the nearshore area. Although no surface water drinking system exists in Graham Creek, water from the river potentially influences the Lake Ontario municipal water treatment system that services Newcastle and Newtonville In addition, a number of water quality parameters such as phosphorus, suspended sediment and chloride affect aquatic species by impairing physical habitat conditions or organism health.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to surface water quality. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Issue	**Rural Non-Point Pollution:** overland runoff to surface water poses the greatest risk to surface water quality. Reduction and management of nutrients (synthetic and organic), sediment and chloride must occur to avoid degraded surface water quality. Education is needed on biosolids.
Issue	**Urban Point and Non-Point Pollution:** the quality of stormwater entering the streams increases concentrations of sediments, nutrients and chloride. Current stormwater management design does not manage dissolved particulates. Urban land uses need to be managed to decrease spikes in water quality parameters.
Issue	**Transportation Corridors:** roads provide a pathway to constituents that negatively impact water quality including litter, household waste, salt, heavy metals and petroleum products.
Opportunity/ Issue	**Riparian Buffer Fragmentation and Function:** riparian buffers play an important role in mitigating surface runoff. Land use within riparian buffers needs to be comprised of natural cover. The functions of riparian buffers need to be better understood. Developed sections are lacking natural riparian areas and often have non-natural bank components. Urban streams are often abused by such activities as dumping organic and non-organic wastes.

Issue	**Bacteria:** total coliform and *E. coli* are naturally occurring in the environment. Bacterial inputs from human waste management and livestock need to be managed to avoid extreme concentrations of bacteria. Excess bacteria cause negative impacts on recreational activities, and potable water use, and can cause negative impacts on surface water uses.
Issue	**Spills:** currently, information on spills is unknown. An emergency plan needs to be developed and carried out in order to reduce the effects of spills of any kind.
Issue	**Future Potential Issues:** the extent of pharmaceuticals in surface water is unknown, as are their potential effects on environmental and human health.

GOAL 4.0: PROTECT AND IMPROVE SURFACE WATER QUALITY.

Objective 4.1: manage and enhance rural water quality.

Issues Addressed:

- Rural, non-point pollution
- Transportation corridors
- Riparian buffers
- Bacteria

Targets for Success:

- Surface water quality parameter concentrations remain below Provincial Water Quality Objectives (PWQO) for aquatic life and recreation during baseflow conditions.
- Surface water quality after storm or runoff events should see minimal increases in concentrations.
- Pesticides should not be detected in the surface water quality of Graham Creek.
- Declines in nutrients or maintenance of a steady state at a level less than the PWQO over time should be observed.
- Continual declines in chloride should be observed, and variability of chloride concentrations during winter months should be reduced.

Surface Water Quality Objective 4.1 Management Actions

Regulations and Planning

<u>Recommended Policy: Development setback from Graham Creek</u>

- All new development will be setback from a watercourse to a minimum of 30 metres defined by:
  - The meander belt
  - A site-specific determined stream feature
  - The natural heritage system.

- Development related to existing rural and agricultural uses may be restricted within the 30-metre setback, subject to area-specific policies.
- Within the watercourse setback, lands must remain undisturbed except for the minimum area required for approved development or, if the setbacks have been disturbed by past activities, restoration may be required. Restoration includes re-naturalization of the setback area and planting native vegetation.

Rationale and Integration: This policy allows for the restriction of development in close proximity to a watercourse for the benefit of reducing negative effects on surface water quality. This policy also benefits surface water quantity, and aquatic habitats and species.

Recommended Policy: "Enhanced" level stormwater quality controls

- All rural subdivision development will meet development standards at the point of discharge to protect and enhance surface water quality. Alternative design standards and water quality treatment technologies will be explored and utilized in stormwater management in new and existing developments as a means of improving or maintaining surface water quality including instream temperature, to pre-development conditions or natural conditions.
- Stormwater management approaches should consider control and treatment on a hierarchical system:
    1. Onsite control and treatment
    2. Conveyance control and treatment.
    3. End of pipe treatment and control.
- Where possible, best management practices should be considered on all stormwater infiltrated. Water should be pre-treated to an extent feasible prior to groundwater infiltration. Attempts should be made to infiltrate runoff not contaminated by roads, parking lots and impervious surfaces.

Rationale and Integration: This policy allows for the maintenance and enhancement of surface water quality by limiting the need for stormwater management facilities through alternative designs and treatment methods. This policy also benefits groundwater quantity.

Existing Legislation

- Implement existing provincial acts and regulations to protect surface water quality. Such acts include the *Clean Water Act*, *Oak Ridges Moraine Act*, *Nutrient Management Act* and *Pesticide Act*.

Existing and New Programs

- Encourage watershed municipalities to create a best management practice plan for drainage ditch maintenance and construction.
- Encourage the implementation of municipal salt management plans
- Implement and support municipal dumping by-laws and programs to discourage illegal dumping and littering.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program to assist landowners and residents in stewardship actions:
    - Decrease and mitigate non-point pollution sources.
    - Enhance and restore riparian areas to buffer against overland runoff and properly manage land use in the riparian area.
    - Promote and encourage best management practices for rural residential and agricultural land uses including reduction of pesticide use and livestock access restriction to watercourses.
    - Increase natural cover utilizing terrestrial natural heritage modeling.
- Work with local partners and through funding programs such as the Ontario Drinking Water Stewardship Program to increase stewardship actions that protect and mitigate negative effects on groundwater quality.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of surface water quality. These actions will also benefit aquatic habitat and species, and terrestrial natural heritage.

Education and Awareness

- Utilize GRCA programs in conjunction with municipalities, stewardship partners and provincial programs to increase education in relation to the protection of surface water quality and stream-side littering.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of surface water quality. These actions will also benefit groundwater and surface water quantity, groundwater quality, aquatic habitat and species, and terrestrial natural heritage.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to achieve the following:

- Continue partnering with the Ministry of the Environment to monitor surface water quality through the Provincial Water Quality Monitoring Network.
- Create dedicated surface water quality monitoring stations including a storm (high flows) event sampling station in Graham Creek that will complement monitoring initiatives implemented by the GRCA.

It is recommended that research occurs related to the pharmaceuticals potential in the surface water of Graham Creek. In addition, greater understanding should be had on the effects of wetlands on surface water quality.

Objective 4.2: manage and enhance urban water quality.

Issues Addressed:

- Urban point and non-point pollution
- Transportation corridors
- Bacteria.

Targets for Success:

- Surface water quality parameter concentrations below Provincial Water Quality Objectives (PWQO) for aquatic life and swimming recreation during baseflow conditions.
- Surface water quality after storm or runoff events should see only slight increases in concentrations.
- Declines in nutrients or a steady state at a level less than the PWQO over time should be observed.
- Continual declines in chloride should be observed at and variability of chloride concentrations during winter months should be reduced.

Surface Water Quality Objective 4.2 Management Actions

Regulations and Planning

Recommended Policy: Development setbacks from Graham Creek

- All new development will be setback from a watercourse to a minimum of 30 metres defined by:
  - The meander belt
  - A site-specific determined stream feature
  - The natural heritage system
- Development related to existing urban uses may be restricted within the 30-metre setback, subject to area-specific policies.
- Within the watercourse setback, lands must remain undisturbed except for the minimum area required for approved development or, if the setbacks have been disturbed by past activities, restoration may be required. Restoration includes re-naturalization of the setback area and planting native vegetation.

Rationale and Integration: This policy allows for the restriction of development in close proximity to a watercourse for the benefit of reducing negative effects on surface water quality. This policy also benefits surface water quantity, and aquatic habitats and species.

Recommended Policy: “Enhanced” level stormwater quality controls

- All subdivision developments will meet development standards at the point of discharge to protect and enhance surface water quality in Graham Creek. Alternative design standards and water quality treatment technologies will be explored and utilized in conjunction with stormwater management. This will apply to new and existing developments as a means of improving or

maintaining surface water quality including instream temperature to pre-development conditions or natural conditions.

- Stormwater management approaches should consider control and treatment on a hierarchical system:
    1. Onsite control and treatment.
    2. Conveyance control and treatment.
    3. End of pipe treatment and control.
- Where possible, best management practices should be considered on all stormwater infiltrated. Water should be pre-treated to an extent feasible prior to groundwater infiltration. Attempts should be made to infiltrate runoff not contaminated by roads, parking lots and impervious surfaces.
- The GRCA will work to enforce sediment controls to limit discharges to existing water courses.

Rationale and Integration: This policy allows for the maintenance and enhancement of surface water quality by limiting the need for stormwater management facilities through alternative designs and treatment methods. This policy also benefits groundwater quantity.

Recommended Policy: Existing stormwater control structures

- Existing stormwater infrastructure retrofitting and improvement during new development is encouraged.
- Stormwater infrastructure should be retrofitted on an as-needed basis and where surface water quality is known to be degraded as a result of urban runoff and stormwater contributions.
- Management and maintenance plans should be developed for existing and future urban stormwater infrastructure.

Rationale and Integration: This policy allows for the improvement of existing urban stormwater discharges. This policy also benefits groundwater quantity.

Existing Legislation

- Implement existing provincial acts and regulations to protect surface water quality associated with urban areas. Such acts include the *Clean Water Act*, *Nutrient Management Act* and *Pesticide Act*.

Existing Programs

- The watershed plan supports the provincial *Cosmetic Pesticide Ban Act* to address cosmetic pesticide use in urban areas.
- The watershed plan supports the existing sewer use by-laws to mitigate negative impacts on sewer discharge to Graham Creek.
- Ensure that Ministry of Environment and municipal standards governing the protection of and discharge into surface water are being met in relation to municipal infrastructure and development.

Stewardship

- Implement an urban GRCA Clean Water - Healthy Land Stewardship Program that addresses urban residential, industrial, commercial and institutional effects on surface water quality. This program would address protection of water quality both within buildings and on the property.
    - Work with local businesses to carry out practices that do not negatively impact surface water quality.
    - Ensure public space management practices have a setback distance from the stream edge to allow for a natural riparian area.
    - Encourage projects (e.g., community stream clean-ups) that deal with urban stream use and the negative effects that result from littering, organic waste inputs, synthetic fertilizers, salt application and discharge to streams.
    - Implement projects aimed at limiting erosion in an urban stream setting for the benefit of surface water quality.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of surface water quality. These actions will also benefit aquatic habitat and species and terrestrial natural heritage.

Education and Awareness

- Increase education on the connection of stormwater infrastructure to surface water quality. Programs to be implemented include the Yellow Fish Road program (partnership program with Trout Unlimited Canada and the GRCA) and education on pet waste management.
- Focus education on the uniqueness of wetlands in relationship to water quality in the Graham Creek watershed.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of surface water quality. These actions will also benefit groundwater and surface water quantity, groundwater quality, aquatic habitat and species, and terrestrial natural heritage.

Land Acquisition

- Lands that are associated with protection of surface water quality may be acquired by a public authority for protection through the following methods:
    - Purchase of land
    - Donation of land
    - Land rental
    - Conservation easements
    - Land use covenants.

Recommended Policy: Protection of surface water quality through land acquisition

- Land that protects surface water quality can be obtained through acquisition by a public authority when the following occurs:
    - Land that protects surface water quality from contamination that is under threat from proposed development
    - Land that is required for natural water treatment such as wetlands
    - Land that protects surface water quality from contamination that is not or cannot be adequately protected from the impacts of development by planning policy or stewardship agreements
    - Riparian buffers that protect surface water quality.

Rationale and Integration: Implementation of a surface water feature land acquisition policy will aid in the protection and enhancement of surface water quality. These actions will also benefit groundwater quality, and aquatic habitat and species.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to achieve the following:

- Continue partnering with the Ministry of the Environment to monitor surface water quality through the Provincial Water Quality Monitoring Network.
- Create dedicated surface water quality monitoring stations in Graham Creek that will complement previous monitoring initiatives implemented by the GRCA, and sample for appropriate water quality parameters.
- Create a stormwater infrastructure water quality monitoring program.

It is recommended that research be conducted on the effectiveness and efficiency of stormwater management ponds for treating surface water.

Objective 4.3: create a spills action plan.

Issues Addressed:	*Targets for Success:*
• Spills	• The creation of a local spills action plan

Surface Water Quality Objective 4.3 Management Actions

Regulations and Planning

Plan Creation: Spills Action Plan

- Create a local spills action plan that aims at mitigating negative effects from spills in surface water. These negative effects can also impact groundwater and drinking water sources in Lake Ontario. This plan is not intended to replace the spills action program through the Ministry of the Environment, but to allow for a fast response from local emergency response agencies.

Monitoring and Reporting

- Implement when required a monitoring program that monitors the conditions of surface water quality after a spill.
- Create a yearly report on the number of spills that have occurred throughout the watershed and how they were addressed.

5.6 Aquatic Habitat and Species

42 species of fish have been sampled in the Graham Creek watershed. Five or 12% of the species are not native to the Lake Ontario basin. Naturally vegetated riparian areas contribute to the health of the aquatic habitat. Native Brook Trout (*Salvelinus fontinalis*) are present along with larger game fish. Naturally vegetated riparian areas contribute to the health of the aquatic habitat. Habitat substrate is comprised of a mix of fines to gravel/cobble, while stream temperatures range from cool to cold.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to aquatic habitat and species. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Issue	**Instream Connectivity, Fragmentation and Permeability:** dams, water structures and perched culverts prevent fish movement upstream and disconnect upstream functions such as sediment and organic transport. Graham Creek is also disconnected in some areas from its floodplain, preventing necessary interaction in the terrestrial environment.
Issue	**Invasive Species:** currently, the Round Goby is presumed to be present in Graham Creek. Zebra Mussels, Rusty Crayfish, and aquatic vegetation also have the potential to be in the Graham Creek.
Issue	**Species at Risk:** species at risk have the potential to inhabit the Graham Creek (e.g., Atlantic Salmon). Species at risk must be considered during management planning and review.
Opportunity	**Sensitive Species:** many habitat specialists or sensitive species exist in Graham Creek. One such species is the Brook Trout. These sensitive species must be properly managed.
Opportunity	**Riparian Area Form and Function:** riparian areas influence instream water temperature, and contribute necessary organic matter, insects and woody debris to instream habitat. As well, there is an important interaction between aquatic and terrestrial habitats. These riparian areas need to be protected and enhanced where appropriate.

Opportunity	**Stream Temperature:** sample sites in Graham Creek have been identified as cold and cool water. If appropriate, stream temperatures should be decreased from cool or warm to cold waters. Land use must not cause temperature fluctuations outside normal ranges.
Issue	**Angling:** the ecological effects of angling on the Graham Creek watershed are unknown (e.g. use of live bait, frogs, and lead-based tackle).
Opportunity/ Issue	**Fisheries Management:** future fisheries-based stocking has the potential to alter present fisheries communities. Future stocking must occur with consideration of the existing fisheries community.
Issue	**Ponds:** downstream temperatures can increase as a result of impounded water. Shifts in fish communities or changes in genetic diversity may result from pond stocking of fish species. Sediment, organic matter, woody debris movement and food web structure can be altered or restricted.
Opportunity	**Lake Ontario: a** connection of Graham Creek to Lake Ontario provides a link for fish communities and aquatic species among the lake, the creek and adjacent watersheds. This linkage must be better understood given the barrier beach nature and protected.
Issue	**Urban Influences:** urban landscapes can negatively affect instream habitat and fish communities through altered flow conditions (e.g., rapid removal of water from the landscape), channelization and pollution.
Issue	**Harbour Dredging:** dredging of the marina situated within the coastal wetland has the potential to negatively affect aquatic organisms and habitats.
Issue	**Headwater and Intermittent Streams:** the importance of headwater, intermittent and ephemeral streams is not appreciated by the community. Therefore, these streams are often altered through development and land use changes. Understanding and protection of these streams must increase.
Opportunity/ Issue	**Knowledge Gaps:** there is a general lack of information on aquatic species other than fish (e.g., benthic invertebrates, mussels, crayfish, etc.) or seasonal use of habitats by different species. The effects of climate change on fisheries and instream habitat are unknown. More information is needed on the fluvial geomorphology of the three streams, including their outlets to Lake Ontario.

GOAL 5.0: PROTECT AQUATIC HABITAT AND SPECIES.

Objective 5.1: protect and restore existing and native aquatic species and communities.

Issues Addressed:

- Invasive species and pathogens
- Species at risk
- Sensitive species
- Angling
- Fisheries management
- Lake Ontario.

Targets for Success:

- Implementation of the Graham Creek Fish Habitat Management Plan

Aquatic Habitat and Species Objective 5.1 Management Actions

Regulation and Planning

Recommended Policy: Adoption of the Graham Creek Fish Habitat Management Plan

- The recommendations of the Graham Creek Fish Habitat Management Plan should be implemented where opportunities exist to improve fish species and communities in Graham Creek.
- Municipalities should adopt the Graham Creek Fish Habitat Management Plan recommendations into official plans or other planning documents.

Rationale and Integration: This policy allows for specific management recommendations regarding the Graham Creek fisheries to occur through implementation of the Fish Habitat Management Plan.

Existing Review Mechanisms and Programs

- Continue the administration and regulation of works in and around fish habitat for the protection of habitat and species through provisions of the federal *Fisheries Act*.
- Enforce angling regulations through Ministry of Natural Resources programs.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program in order to assist landowners and residents in implementing projects that protect or enhance the health of the fisheries:
    - Removal of man-made instream barriers
    - Removal of online ponds

    - Improvement of instream temperature.
- Work with local partners and programs to increase stewardship actions that protect fish and fish habitat.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of aquatic species. These actions will also improve surface water quality and aquatic habitat.

Education and Awareness

- Increase education regarding local aquatic species and species at risk for the community, local fishing clubs and anglers who fish in the Graham Creek watershed.
- Implement the existing Ontario Federation of Anglers and Hunters Aquatic Invasive Species Program, with an emphasis on local aquatic invasive species.
- Increase angler education with respect to responsible resource use and the Graham Creek fisheries.
- Host quarterly or semi-annual partner workshops on habitat and species project updates.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of aquatic habitat and species.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to achieve the following:

- Conduct spawning habitat surveys.
- Inventory non-fish species and organisms in Graham Creek.
- Monitor invasive species movement.
- Create dedicated fish and aquatic organism (i.e., benthic macroinvertebrates and mussels) sampling sites to monitor trends over time.

Objective 5.2: protect and enhance the form and function of instream habitat and riparian areas.

Issues Addressed:

- Instream connectivity
- Stream temperature
- Riparian areas
- Ponds
- Urban influences
- Stream form and function
- Headwaters and intermittent streams
- Harbour dredging.

Targets for Success:

- Increased instream connectivity
- Increased natural riparian areas
- Maintenance or shifts of stream water temperature to cold water
- Increased protection of headwater and intermittent streams.

Aquatic Habitat and Species Objective 5.2 Management Actions

Regulation and Planning

Recommended Policy: Map aquatic habitats in the Graham Creek watershed

- Aquatic habitats include the following, all of which should be mapped for the entire Graham Creek watershed:
    - Habitat of endangered and threatened species
    - Habitat of species of special concern
    - Important fish habitat
    - Watercourses including headwater, intermittent and permanent streams
    - Wetlands.

Rationale and Integration: This policy allows for the identification of aquatic habitats. Once identified, protection of these features can occur through regulations and planning. This policy also benefits surface water quantity and quality.

Recommended Policy: Identify aquatic habitats in the Graham Creek watershed not yet known

- Identify aquatic habitats in the Graham Creek watershed that have not been mapped or identified in the Graham Creek watershed, but come to the

attention of the GRCA and municipalities through new information or correction of previous inaccurate or incomplete information.

Rationale and Integration: This policy allows for the identification of aquatic habitats that are currently unknown and allows for the integration of new sciences and future research into regulation and planning.

Recommended Policy: Restrict development within and in proximity to aquatic habitats

- Existing policies specified by the *Oak Ridges Moraine Conservation Plan* currently in municipal official plans in relation to aquatic habitats are supported (Appendix F).
- Development within and in proximity to aquatic habitats is prohibited or restricted for the protection of aquatic habitat in accordance with the following:
    - All development with respect to land within aquatic habitats and the 30-metre vegetation protection zone as indicated in Appendix F is prohibited or restricted except for the following:
        - Forest, fish and wildlife management
        - Conservation and flood or erosion control projects, but only if they are determined to be necessary in the public interest after all alternatives have been considered
        - Transportation, infrastructure and utilities as described in Section 41 of the *Oak Ridges Moraine Conservation Plan*, but only if the need for the project has been demonstrated and there is no reasonable alternative
        - Low-intensity recreational uses, as described in Section 37 of the *Oak Ridges Moraine Conservation Plan*
        - Development related to existing urban, rural and agricultural uses, subject to area-specific policies.

Rationale and Integration: This policy allows for the restriction of development within or adjacent to aquatic habitats. This policy also benefits groundwater and surface water quantity, and groundwater and surface water quality.

Recommended Policy: Adoption of the Graham Creek Fish Habitat Management Plan

- The recommendations of the Graham Creek Fish Habitat Management Plan should be implemented where opportunities exist to improve fish species and communities in Graham Creek.
- Municipalities should adopt the Graham Creek Fish Habitat Management Plan recommendations into official plans or other planning documents.

Rationale and Integration: This policy allows for specific management recommendations regarding the Graham Creek fisheries to occur through implementation of the Fish Habitat Management Plan.

New Programs

- Municipalities with assistance from the GRCA are encouraged to create a best management practice plan for ditch maintenance and construction.
- Municipalities with assistance from the GRCA are encouraged to create a best management practice plan for addressing perched culverts and other road crossings.

Existing Review Mechanisms and Policies

- Continue administration and regulation of works in and around fish habitat through provisions of the federal *Fisheries Act*. This mechanism should be used to address harbour dredging within the mouth of Graham Creek.
- Continue implementing Section 28 (Generic Regulations) of the *Conservation Authorities Act*, and continue for the protection of riparian areas and instream habitat.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program to assist residents in implementing projects that protect and enhance aquatic habitat:
    - Instream habitat creation
    - Erosion control projects
    - Increase in natural vegetation in riparian areas.
- Work with local partners and through other funding program to increase stewardship actions that protect and enhance instream habitat and riparian areas.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of aquatic habitats. These actions will also benefit surface water quality and quantity, aquatic species, and terrestrial natural heritage.

Education and Awareness

- Utilize GRCA and partner programs to increase awareness and education around instream habitat and riparian areas through workshops, volunteer opportunities, the media and print material.
- Provide education around the use of the harbour as potential fish and wildlife habitat.
- Provide education around the coastal wetland and its features and functions.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of aquatic habitat and species.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to monitor and inventory aquatic habitat conditions and changes over time.

5.7 Terrestrial Natural Heritage

The terrestrial natural habitat of the Graham Creek watershed includes forest, meadows and wetlands. At 35%, forest cover exceeds the commonly used guideline of 30%. However, higher quality interior forest habitat is found in only about 23% of the forested areas of the watershed, primarily in the rural landscape and associated with treed swamps.

Indicator species such as birds and frogs can help us to understand the health of forest and wetland habitats. Numerous species at risk may inhabit the Graham Creek watershed, and therefore, should be considered in management planning. Invasive species such as Dog-strangling Vine (*Cynanchum rossicum)*, European Buckthorn (*Rhamnus cathartica)*, and Garlic Mustard (*Alliaria petiolata)* pose a threat to terrestrial habitat health. Many actions related to the Graham Creek watershed need to be linked to the rest of the Ganaraska Region Conservation Authority, since many issues are large scale.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to terrestrial natural heritage. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Opportunity	**Diversity of Habitat Types:** the Graham Creek watershed contains a mix of natural habitats such as meadows, forests and wetlands. Forest cover and interior forest habitat can be enhanced. Current natural land cover should be protected and enhanced where appropriate, with a special focus on wetland protection. Protection should also be given to old growth forests.
Issue	**Pets and Feral Animals:** there is a general lack of community awareness on the negative effects of domestic pets on the health of the Graham Creek watershed (e.g. domestic cats, dogs and other pets, and their effects on natural populations).
Issue	**Habitat Connectivity and Fragmentation:** although more than a third of the Graham Creek watershed is forested, forest habitat could be better connected to reduce habitat fragmentation, promote species diversity and population viability, and improve ecological function. This connectivity needs to occur among watersheds of the Ganaraska Region Conservation Authority, not just within a particular watershed.
Issue	**Invasive Species:** invasive exotic species such as Dog-strangling Vine and Garlic Mustard pose one of the greatest threats to biodiversity. Priority species and opportunities for management need to be identified.

Issue	**Species at Risk:** the numbers, distribution, and habitat requirements of species at risk must be better understood. This information will be used in planning and watershed management.
Issue	**Sensitive Species:** habitats that are required by sensitive species and by those experiencing population declines across their range should be identified and enhanced.
Issue	**Roads:** roads fragment habitats, create barriers to wildlife movement and contribute substantially to wildlife mortality. The extent of this problem should be assessed, and key crossing "hot spots" identified for possible mitigation measures.
Issue	**Trails and Recreation:** recreational trails have high social values; however, they have associated activities that often cause negative impacts to both habitat and species. For example, these corridors create pathways for invasive species. Improved public awareness of this problem is required, and the impact of existing and planned trails should be assessed. Rural trails are often an issue in relation to property rights and trespassing.
Issue	**Urbanization and Development:** development results in habitat loss and negative impacts on protected areas. The role of the urban forest in enhancing natural heritage values should be evaluated, for example, with an Urban Forest Management Plan. Environmentally friendly yard and garden management options and green roofs should be promoted. Urban and rural roadside tree planting could benefit the Graham Creek watershed.
Opportunity	**Ponds and Vernal Pools**: vernal pools are vital breeding habitats for a number of amphibians and other species. Improved mapping and protection of these habitats are needed.
Opportunity	**Wetlands:** the extent of historical wetlands in the watershed should be evaluated, and opportunities for restoration identified. Existing wetland protection needs to be stressed.
Opportunity	**Sustainable Land Use:** sustainable agricultural land use and alternatives, and woodlot management should be key issues in education and awareness programs.
Opportunity/ Issue	**Knowledge Gaps:** the local effects of climate change are unknown, as are pollinating species interactions with the local ecosystem.

GOAL 6.0: MAINTAIN THE NATIVE BIODIVERSITY AND ECOLOGICAL FUNCTION OF THE LANDSCAPE IN THE WATERSHED.

Objective 6.1: reduce habitat fragmentation and promote connectivity.

Issues Addressed:

- Habitat connectivity and fragmentation
- Roads
- Sustainable land use.

Targets for Success:

- Improved habitat patch size, shape and connectivity
- Adoption of sustainable land use practices in association with urban and agricultural land use and woodlot management.

Terrestrial Natural Heritage Objective 6.1 Management Actions

Regulations and Planning

Recommended Policy: Identify and map terrestrial features in the Graham Creek watershed

- Terrestrial features include, but are not limited to the following, all of which should be mapped for the entire Graham Creek watershed, where data exists:
    - Significant wildlife habitat (includes species at risk habitat)
    - Significant woodlands
    - Savannas, tallgrass prairie and sand barrens
    - Wetlands (provincially significant and non-evaluated)
    - Locally rare species habitat
    - Lake Iroquois Beach.

Rationale and Integration: This policy allows for the identification and classification of terrestrial features and systems. Once identified, protection of these features and associated functions can occur through regulations and planning. This policy also benefits groundwater and surface water quantity and quality, and aquatic habitats and species.

Recommended Policy: Identify terrestrial features in the Graham Creek watershed not yet known

- Identify and map terrestrial features in the Graham Creek watershed through continual data collection or through new information or correction of previous inaccurate or incomplete information.

Rationale and Integration: This policy allows for the identification of terrestrial features and systems that are currently unknown and allows for the integration of new sciences and future research into regulation and planning.

Recommended Policy: Reduce the impact of development on the Terrestrial natural heritage system and significant features

- Existing policies specified by the *Oak Ridges Moraine Conservation Plan* currently in municipal official plans in relation to terrestrial features are supported (Appendix F).
- Development within and in proximity to terrestrial features throughout the Graham Creek watershed is prohibited or restricted for the protection of terrestrial habitat in accordance with the following:
    - All development with respect to land within terrestrial features and the 30-metre vegetation protection zone (or as determined otherwise as indicated in Appendix F) is prohibited or restricted except for the following:
        - Forest, fish and wildlife management
        - Conservation and flood or erosion control projects, but only if they are determined to be necessary in the public interest after all alternatives have been considered
        - Transportation, infrastructure and utilities as described in Section 41 of the *Oak Ridges Moraine Conservation Plan*, but only if the need for the project has been demonstrated and there is no reasonable alternative
        - Low-intensity recreational uses as described in Section 37 of the *Oak Ridges Moraine Conservation Plan*
        - Development related to existing urban, rural and agricultural uses, subject to area-specific policies.
- Development practices should not impede the movement of flora and fauna within the natural heritage system.
- Site-specific environmental impact assessment may be required to protect natural heritage features or functions.

Rationale and Integration: This policy allows for the restriction of development within or adjacent to terrestrial features for the protection of the feature and its associated functions. This policy also benefits groundwater and surface water quantity, groundwater and surface water quality, and aquatic habitat and species.

Recommended Policy: Net gains within the natural heritage system

- Major development, as defined by the GRCA and municipalities, within the natural heritage system should not create net losses of terrestrial habitat in the Graham Creek watershed.

Rationale and Integration: This policy allows for the restriction of development within the natural heritage system. It also mitigates cumulative net loss of forest and other natural habitats in the Graham Creek watershed. This policy also

benefits groundwater and surface water quantity, groundwater and surface water quality, and aquatic habitat and species.

Recommended Planning Strategy: Creation of a regional terrestrial natural heritage system and strategy

- The GRCA and member municipalities will develop a regional terrestrial natural heritage system and strategy to provide a target for regional natural heritage and to create planning policies that will benefit terrestrial natural heritage on a regional scale.

Rationale and Integration: This planning tool allows for a landscape scale system analysis and strategy of terrestrial natural heritage. It is important to acknowledge terrestrial natural heritage components outside of a particular watershed. This policy satisfies the requirements of municipal official plans and benefits groundwater and surface water quantity, groundwater and surface water quality, and aquatic habitat and species.

Plan Review Mechanisms

- Continual implementation of GRCA and municipal development plan review to protect terrestrial natural heritage features and functions is supported.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program in the Graham Creek watershed in order to assist landowners in implementing projects that protect and enhance terrestrial features and functions:
    - Increase the diversity of natural cover in the Graham Creek watershed in target areas defined by the natural heritage system.
    - Increase natural cover throughout the watershed.
    - Increase and encourage sustainable land uses.
    - Increase and enhance tallgrass prairie habitat.
    - Restore degraded sites such as Brownfields and aggregate extraction sites.
- Work with local partners and through other funding programs such as the Trees Ontario Foundation and Oak Ridges Moraine Foundation to increase stewardship actions that protect and enhance terrestrial features and functions within the conceptual natural heritage system.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of terrestrial natural habitat. These actions will also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

Education and Awareness

- Utilize GRCA and partner programs to increase awareness and education around terrestrial functions and features, including principles of ecology and conservation biology through workshops, community involvement, print material and the media.
- Promote the natural heritage system for targeted stewardship and education.
- Create a localized education program in relation to conservation biology and ecology.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of terrestrial natural heritage. These actions will also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

Land Acquisition

- Terrestrial features may be acquired by a public authority for protection through the following methods:
    - Purchase of land
    - Donation of land
    - Land rental
    - Conservation easements
    - Land use covenants.

Recommended Policy: Protection of natural heritage system features through land acquisition

- Terrestrial features include priority lands for acquisition by a public authority when the following occur:
    - Natural heritage system features and functions are under threat from proposed development.
    - Natural heritage system areas and functions are not or cannot be adequately protected from the impacts of development by planning policy or stewardship agreements.

Rationale and Integration: Implementation of a terrestrial natural feature land acquisition policy will aid in the protection and enhancement of terrestrial natural heritage. This policy will also benefit groundwater and surface water quantity and quality, and aquatic habitat and species.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to monitor and inventory terrestrial natural heritage features in relation to current conditions and trends over time.

Objective 6.2: maintain, enhance and restore the natural diversity of vegetation communities in the watershed.

Issues Addressed:

- Diversity of habitat types
- Old growth forests
- Invasive species
- Trails and recreation
- Ponds and vernal pools
- Wetlands.

Targets for Success:

- Increase in appropriate and natural diversity of habitat types
- Control and reduction in current invasive species distribution and density, and a reduction in potential introductions and vectors
- Trails and recreational facilities that complement natural areas and reduce negative effects
- Increase in education for and protection of vernal pools and wetlands
- Protection of and increase of in rare communities.

Terrestrial Natural Heritage Objective 6.2 Management Actions

Regulations and Planning

Recommended Policy: Net gains within the natural heritage system

- Development in the natural heritage system should not create net losses of vegetation communities in the Graham Creek watershed. Development applications should be accompanied by a natural heritage evaluation to ensure limited impacts to vegetation communities.

Rationale and Integration: This policy allows for the restriction of development in vegetation communities. This policy also benefits groundwater and surface water quantity, groundwater and surface water quality, and aquatic habitat and species.

Recommended Policy: Harvesting of resources from wetlands

- Development within wetlands for the purposes of harvesting resources should not negatively affect the vegetative community and must include an environmental impact assessment.

Existing By-laws and Policies

- The watershed plan supports municipal tree conservation and cutting by-laws for the protection of vegetation communities in the Graham Creek watershed. It is recommended that removal of trees along transportation routes is done using sound forestry practices.
- The watershed plan supports the Municipality of Clarington's official plan policies regulates to the Lake Iroquois Beach.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program in the Graham Creek watershed in order to assist landowners in implementing projects that protect and enhance vegetation communities:
    - Increase the diversity of natural cover in the natural heritage system through the use of native species and appropriate plant stock for plantings.
    - Protect and increase cover of old growth forest.
    - Increase natural cover throughout the watershed.
    - Increase and encourage sustainable land uses.
- Work with local partners and through other funding programs such as the Trees Ontario Foundation and Oak Ridges Moraine Foundation to increase stewardship actions that protect and enhance vegetation communities.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program and partnership programs will aid in the protection of vegetation communities. These actions also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

Education and Awareness

- Utilize GRCA and partner programs to increase awareness and education in regard to vegetation communities such as wetland, forest, and meadow/grassland.
- Focus education on the uniqueness of wetlands in the Graham Creek watershed.
- Promote the natural heritage system for targeted stewardship and education.
- Create a localized education program in relation to terrestrial invasive species. Material could include print material and signage.
- Create a localized education program in relation to conservation biology and ecology.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of terrestrial natural heritage. These actions will also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

Land Acquisition

- Vegetation communities may be acquired by a public authority for protection through the following methods:
    - Purchase of land
    - Donation of land
    - Land rental
    - Conservation easements
    - Land use covenants.

Recommended Policy: Protection of vegetation communities through land acquisition

- Vegetation communities are priority lands for acquisition by a public authority when the following occurs:
    - Vegetation communities and functions are under threat from proposed development.
    - Vegetation communities and functions are not or cannot be adequately protected from the impacts of development by planning policy or stewardship agreements.

Rationale and Integration: Implementation of a terrestrial natural feature land acquisition policy will aid in the protection and enhancement of terrestrial natural heritage. This policy will also benefit groundwater and surface water quantity and quality, and aquatic habitat and species.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program in order to accomplish the following:

- Monitor specific vegetative community conditions and changes over time.
- Inventory significant invasive species infestation.

Objective 6.3: maintain, enhance and restore the diversity of native species in the watershed.

Issues Addressed:

- Invasive species
- Species at risk
- Sensitive and uncommon species
- Old growth forests
- Trails and recreation
- Ponds and vernal

Targets for Success:

- Increase in sensitive species and uncommon species
- Control and reduction in current invasive species distribution and density and a reduction in potential introductions and vectors
- Trails and recreational facilities that complement species habitat and reduce negative effects
- Increase in education, protection and abundance of species habitats, including vernal pools, wetlands and old growth forests.

Terrestrial Natural Heritage Objective 6.3 Management Actions

Regulations and Planning

Recommended Policy: Net gains within the natural heritage system

- Development in the natural heritage system should not create net losses of species habitat in the Graham Creek watershed. Development applications should be accompanied by a natural heritage evaluation to ensure limited impacts to species habitat and its functions.

Rationale and Integration: This policy allows for the restriction of development within habitats. This policy also benefits aquatic habitat and species.

Existing Legislation

- Implement the provincial *Endangered Species Act* and federal *Species at Risk Act* for the protection of identified species and their associated habitats.

Regional Programs

- The watershed plan supports a regional invasive species strategy that will provide direction to local initiatives.
- The watershed plan supports a program to increase local seed availability for ecological restoration.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program in the Graham Creek watershed to assist landowners in implementing projects that protect and enhance habitats:
    - Increase the diversity of natural cover in the natural heritage system.
    - Increase natural cover throughout the watershed with a focus on interior habitat.
    - Enhance and increase specific habitat types such as wetlands, vernal pools, and old growth forests.
    - Assist in invasive spices control or removal.
- Work with local partners and through other funding programs such as the Trees Ontario Foundation and Oak Ridges Moraine Foundation to increase stewardship actions that protect and enhance species habitat.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of terrestrial natural habitat. These actions will also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

Education and Awareness

- Create a localized education program in relation to native species.
- Create a localized education program in relation to terrestrial invasive species. Material could include print material and signage.
- Create a localized education program in relation to conservation biology and ecology.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of terrestrial natural heritage. These actions will also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

Land Acquisition

- Species habitat may be acquired by a public authority for protection through the following methods:
    - Purchase of land
    - Donation of land
    - Land rental
    - Conservation easements
    - Land use covenants.

Recommended Policy: Protection of species habitat through land acquisition

- Species habitats are priority lands for acquisition by a public authority when the following occur:
    - The identified species or associated habitats are under threat from proposed development.
    - The identified species or associated habitats are not or cannot be adequately protected from the impacts of development by planning policy or stewardship agreements.

Rationale and Integration: Implementation of a terrestrial natural feature land acquisition policy will aid in the protection and enhancement of terrestrial natural heritage. This policy will also benefit groundwater and surface water quantity and quality, and aquatic habitat and species.

Monitoring and Reporting

Create and implement a GRCA integrated watershed monitoring program to achieve the following:

- Monitor bird and amphibian communities.
- Monitor species at risk.
- Inventory locations of significant invasive species infestation.

Objective 6.4: mitigate and reduce negative impacts of urban and rural land use.

Terrestrial Natural Heritage Objective 6.4 Management Actions

Issues Addressed:

- Pets and feral animals
- Trails and recreation
- Roads
- Urban growth and urbanization (links to population growth)
- Sustainable land use.

Targets for Success:

- Increased awareness around the negative impacts of urban and rural use on terrestrial systems
- Adoption of sustainable land use practices
- Trails and recreational facilities that complement natural areas and reduce negative effects
- Reduction in negative impacts of roads.

Regulations and Planning

Recommended Policy: Net gains within the natural heritage system

- Development in the natural heritage system should not create net losses of forest cover in the Graham Creek watershed. Development applications should be accompanied by a natural heritage evaluation to ensure limited impacts to terrestrial features and their functions.

Rationale and Integration: This policy allows for the restriction of development in the natural heritage system in order to mitigate negative effects from development. This policy also benefits groundwater and surface water quantity, groundwater and surface water quality, and aquatic habitat and species.

Plan Creation: Urban natural heritage system

- Create an urban natural heritage system and strategy to protect and enhance terrestrial features and functions within Orono and Newcastle.

Education and Awareness

- Implement a school-based “adopt a public space” to increase natural cover and decrease negative impacts in the respective public space.
- Work with municipal animal control officers, humane societies, animal shelters and pet stores to create material and provide information on the influences of feral animals and pets influences on the environment.

- Increase awareness on the negative effects associated with urban and rural residential land uses and growth on the terrestrial environment of the Graham Creek watershed.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of terrestrial natural heritage. These actions will also benefit groundwater and surface water quality and quantity, and aquatic habitat and species.

5.8 Public Health and Well-being

The Graham Creek watershed and its resources have the ability to influence human health and well-being. The quality and quantity of resources such as water, air and food dictate the health of the community. Enjoyment and use of the watershed and its features not only provide for a healthy lifestyle but also contribute to personal well-being. Parks, green spaces and natural areas all influence our social, mental, emotional and spiritual well-being.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to public health and well-being. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Opportunity	**Public Spaces (Water Access, Parks, Urban Trail Systems and Recreational Areas):** these areas need to be managed to ensure protection of the natural environment through proper use and management, and enhance public health and well-being through nature appreciation and outdoor recreation. Additional areas should be created in the Graham Creek watershed where appropriate.
Opportunity	**Public Transportation:** increased opportunities for public transportation need to be encouraged such as bike lanes, busses, car pooling, etc.
Opportunity	**Waste Reduction, Energy and Water Use:** the effects of energy and water use and waste production on the Graham Creek watershed need to be shared with the community. Ways to reduce waste and energy use need to be a focus for appropriate authorities and community groups.
Opportunity	**Agriculture and Food Production:** a connection between agricultural resources in Graham Creek and the community needs to be fostered and developed. The focus on local food and fibre production needs to be enhanced.
Opportunity	**Social and Economic Value of a Healthy Environment**: there is a need to address issues of green capital and social value in a local healthy environment.

GOAL 7.0: PROMOTE HEALTHY COMMUNITIES IN RELATION TO THE ENVIRONMENT.

Objective 7.1: manage and improve the environmental quantity, quality and social benefits of existing and future public spaces.

Issues Addressed:
- Public spaces

Targets for Success:
- Increase public spaces
- Improve environmental conditions of public spaces
- Increase social benefits.

Public Health and Well-being Objective 7.1 Management Actions

Regulations and Planning

Recommended Policy: Increasing public spaces

- New public spaces[4] should be created with a new major development. The area will be a ratio of the size of the development area to a specific public space size. These new public spaces will be created in a way that reduces environmental impacts of invasive species and other negative effects.
- Public spaces should include a mix of active and passive recreational activities and nature appreciation opportunities.
- New public spaces should be obtained outside of a new major development trigger. Properties may be obtained through direct purchase or the acceptance of land donations.
- All public spaces should consider linkages to other existing public land holdings.
- Public spaces should be created and managed in consideration of the value of health and well-being to the local community, effects on local ecosystems, additions to recreational and tourism value, and impacts to surrounding landowners.
- The development of a conservation area in the Graham Creek watershed should be explored and implemented.

Rationale and Integration: This policy allows for the development of environmentally friendly public spaces.

[4] Public spaces include water access areas, parks, urban trail systems, recreational areas and conservation areas.

Existing Programs

- The watershed plan supports municipal plans for increasing and managing public spaces.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program in order to enhance the natural features and social benefits of public spaces:
    - Increase natural, native vegetation.
    - Increase healthy lifestyle infrastructure.
    - Increase educational aspects of the public space.
- Work with local partners, municipalities, and the health unit/department to increase environmental and social characteristics of public spaces.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of the entire watershed.

Education and Awareness

- Increase awareness of public spaces through partnerships with the GRCA, municipalities, and the health unit/department.
- Increase awareness programs regarding the threat and vectors of invasive species.
- Increase educational signage at public spaces.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of the entire watershed.

Monitoring and Reporting

Monitor the environmental condition and use of public spaces.

Objective 7.2: encourage sustainable communities.

Issues Addressed:

- Public transportation
- Waste reduction, and energy and water use
- Agriculture and food production.

Targets for Success:

- Increased accessibility and use of public transportation
- Behavioural changes in regards to increased uptake of waste reduction, and conservation of energy and water
- Increased purchasing of local products and programs dedicated to associated activities.

Public Health and Well-being Objective 7.2 Management Actions

Regulation and Planning

Recommended Policy: Increase in public transportation

- Development of transportation infrastructure should occur with equal focus on public transportation infrastructure such as bike lanes, bus services and train services.

Rationale and Integration: This policy allows for the development of public transportation.

Existing Initiatives

- The watershed plan supports the protection of prime agricultural lands through municipal official plans and zoning by-laws.
- The watershed plan support the implementation of agricultural programs including buy local initiatives, developed through the Regional Municipality of Durham, Northumberland County and agricultural organizations.

Stewardship

- Implement the GRCA Clean Water – Healthy Land Stewardship and Financial Assistance Program in order to enhance the uptake of waste reduction as well as water and energy conservation measures.
- Work with local partners, municipalities, and the health unit/department to increase environmental and social characteristics of public spaces.

Rationale and Integration: Implementation of the Clean Water – Healthy Land Stewardship and Financial Assistance Program, along with partnership programs, will aid in the protection of the entire watershed.

Education and Awareness

- Increase awareness of sustainable living and local businesses through partner programs and events.
- Increase education to children and adults regarding local food production. Children's education can utilize programs such as 4-H or school based programs, while adult education can be in the form of increased consumer education (e.g., grocery store signage).

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection and enhancement of the entire watershed.

5.9 Community Heritage

Historic events have shaped the present-day condition of the watershed. Most notable are the effects on the watershed from dam construction and settlement patterns caused by the location of road and rail corridors. Today, the Graham Creek watershed supports a population of approximately 3,500 people, a diverse industrial and commercial sector, a productive agricultural community, and a mix of natural resources and recreational uses. In addition, residents depend on water from the Graham Creek watershed for domestic and economic use, although Newcastle relies on Lake Ontario for its source of water.

The *Graham Creek Background Report* (Ganaraska Region Conservation Authority 2009) provided insight into the potential issues and opportunities related to community heritage. In addition, the following issues and opportunities were identified and reviewed by the Technical Review Committee and the Community Advisory Committee. The following will be the focus of current and future management actions.

Issue	**Link to Natural History:** there is a lack of community understanding regarding our past natural history. As a result, there is little understanding of what we did have, what we currently have, and what we might not have in light of watershed threats (e.g., invasive species and climate change).
Issue	**Loss of Ownership of Where We Came From:** there is a lack of understanding of community history and heritage.
Opportunity	**Education to New Residents regarding History and Watershed:** new residents in the Graham Creek watershed are provided limited information on the watershed and its current management requirements (e.g., agencies affiliated with watershed or environmental management, permitting, by-laws, history etc.).

GOAL 8.0: PRESERVE AND INTERPRET OUR COMMUNITY HERITAGE.

Objective 8.1: increase awareness and appreciation of our community heritage.

Issues Addressed:
- Lack of watershed knowledge
- Lack of cultural history knowledge.

Targets for Success:
- Increased awareness and education around the heritage of the Graham Creek watershed and its communities

Community Heritage Objective 8.1 Management Actions

Education and Awareness
- Provide education such as interpretive signs on the history of the Graham Creek in key public spaces.
- Increase local knowledge and action in the Graham Creek watershed through the use of social-based programs and partnerships.
- Create a self-guided natural tour of the Graham Creek watershed through partnerships with heritage committees in the municipalities.
- Install signage on roads for identification of Graham Creek and its tributaries.

Rationale and Integration: Implementation of education and awareness recommendations, along with partnership programs, will aid in the protection, enhancement and understanding of the entire watershed.

6.0 Watershed Plan Implementation

Many specific management actions have been identified to achieve the goals and objectives of each component of the watershed plan. Implementation of the Graham Creek Watershed Plan is dependent on the adoption and facilitation of recommended management actions relating to regulations and planning, stewardship, education and awareness, land acquisition, and monitoring and reporting. The Graham Creek Watershed Plan is intended to inform and guide municipalities, provincial and federal governments, and the Ganaraska Region Conservation Authority (GRCA) in updating applicable policies and programs for protection, conservation and enhancement of the Graham Creek watershed.

The Graham Creek Watershed Plan provides direction to local organizations and residents in the watershed in regard to best management practices and suggested actions for watershed stewardship. Implementation of these stewardship actions will be effective if existing and future organizations coordinate efforts in the watershed. Finally, monitoring and reporting of environmental conditions and implementation of the watershed plan are needed to ensure that steps to reach the goals and objectives of the watershed components are occurring and are effective. The following sections outline the implementation mechanisms and timelines for each management action mechanism.

6.1 Regulations and Planning

The Regional Municipality of Durham, Municipality of Clarington, the Municipality of Port Hope and Northumberland County, as well as provincial and federal ministries and departments will play a significant role in the implementation of the Graham Creek Watershed Plan. Many of these governmental agencies have policies, by-laws and programs in place and the ability to implement management actions recommended in this watershed plan. It is suggested that recommended policies are considered for inclusion in municipal official plans, by-laws or specific programs over the next five years. However, given that the Municipality of Clarington and the Regional Municipality of Durham are undergoing official plan reviews starting in 2009, it is practical to consider as many recommended policies as possible through these planning processes. In addition, the Ganaraska Region Conservation Authority is committed to updating its policies in accordance with the Graham Creek Watershed Plan by 2011.

Many provincial initiatives provide a foundation for the protection and sustainable use of natural resources in the Graham Creek watershed. The Graham Creek Watershed Plan builds upon many of the development policies implemented at a provincial scale in order to make the policies place-specific. These initiatives

include the *Oak Ridges Moraine Conservation Plan*, *Greenbelt Plan, Growth Plan for the Greater Golden Horseshoe*, the *Provincial Policy Statement* and the *Clean Water Act*.

6.2 Stewardship

Many recommended management actions can be achieved through voluntary actions by landowners, residents, rural agricultural and non-agricultural businesses, and urban businesses. It is recommended that a coordinated approach with various partners be adopted to enhance the delivery of stewardship projects across the watershed. It is also recommended that the GRCA, through the Clean Water – Healthy Land Stewardship Program facilitate and coordinate partner communication through regular meetings and updates.

Certain stewardship actions are encouraged and deemed a priority when the implementation of a project benefits many ecological functions. Table 6.0 addresses the priority stewardship actions that should be continuously encouraged over a long time frame, as well as stewardship actions that may address site-specific needs as they arise. It is recommended to implement the GRCA Clean Water-Healthy Land Financial Assistance Program in the Municipality of Clarington/Regional Municipality of Durham and Municipality of Port Hope to facilitate rural stewardship actions, as well as an urban-based program in Newcastle.

6.3 Education and Awareness

In order to achieve the goals and objectives associated with each watershed component, education and awareness initiatives need to be employed. In addition, communication, in the form of education and awareness, is required to see successful implementation of recommended regulations and planning, stewardship and land acquisition management actions. It is also recommended that partner activities be coordinated in consultation with the GRCA to ensure consistent messaging, avoid duplication, and facilitate integration of funds and other resources.

Education and awareness initiatives will be delivered to a variety of audiences including urban and rural residents and landowners, the agricultural community, business and industry, schools, community organizations and municipalities. Avenues for implementation of initiatives will include, but not be limited to, workshops, seminars, watershed tours, the GRCA website, print material and the use of media. Initiatives will be geared toward topics that help to achieve each watershed component goal and objective.

Table 6.0: Stewardship action implementation

Stewardship Action	Priority and Timeline	Integrated Ecological Benefits	Delivery Agents*	Potential Funders*
Increase natural native cover in the natural heritage system	High, long term	• Groundwater quantity and quality • Surface water quantity and quality • Aquatic habitats and species • Terrestrial natural heritage	GRCA DSC/NSC OFAH	CWHLFAP TOF ORMF EFP CFWIP COA
Increase natural cover associated with groundwater features	High, long term	• Groundwater quantity and quality • Surface water quantity and quality • Aquatic habitats and species • Terrestrial natural heritage	GRCA DSC/NSC OFAH	CWHLFAP TOF ORMF EFP CFWIP COA
Increase natural cover in riparian areas	High, long term	• Surface water quantity and quality • Aquatic habitats and species • Terrestrial natural heritage	GRCA DSC/NSC OFAH	CWHLFAP TOF ORMF EFP CFWIP COA
Increase and enhance specific habitat types (wetlands, tallgrass prairie, interior forest)	High, long term	• Groundwater quantity and quality • Surface water quantity and quality • Aquatic habitats and species • Terrestrial natural heritage	GRCA NCC	CWHLFAP TOF ORMF CFWIP COA
Encourage and assist with rural best management practices associated with land uses (woodlot management, agricultural practices, rural residential practices)	High, long term	• Groundwater quantity and quality • Surface water quantity and quality • Aquatic habitats and species • Terrestrial natural heritage	GRCA DSC/NSC OFAH DSA	CWHLFAP ORMF EFP CFWIP COA ODWSP
Encourage and assist with urban best management practices associated with land uses (lot level water management, urban stream management, water and energy conservation)	High, long term	• Groundwater quantity and quality • Surface water quantity and quality • Aquatic habitats and species • Public health and well-being	GRCA Municipalities DSA	CWHLFAP ODWSP

Stewardship Action	Priority and Timeline	Integrated Ecological Benefits	Delivery Agents*	Potential Funders*
Encourage private well upgrades and decommissioning to protect groundwater quality and domestic drinking water supplies	High, long term	• Groundwater quality • Surface water quality • Aquatic habitats and species	GRCA DSA	CWHLFAP ODWSP
Enhance environmental features in public spaces	High, long term	• Groundwater quantity and quality • Surface water quantity and quality • Aquatic habitats and species • Terrestrial natural heritage • Public health and well-being	GRCA Municipalities DSA	CWHLFAP CFWIP
Encourage private septic and chemical or fuel storage best management practices	Medium, long term	• Groundwater quality • Surface water quality • Aquatic habitats and species	GRCA DSA	CWHLFAP ODWSP
Removal of online ponds and man-made instream barriers	Medium, site- or situation-specific	• Surface water quality and quantity • Aquatic habitats and species	GRCA	CWHLFAP COA
Enhance or restore instream habitat including bank stabilization and erosion control	Medium, site- or situation-specific	• Aquatic habitats and species	GRCA OFAH	CWHLFAP ORMF CFWIP COA

TOF - Trees Ontario Foundation
ORMF- Oak Ridges Moraine Foundation
EFP - Environmental Farm Plan
CFWIP - Community Fisheries and Wildlife Involvement Program
COA - Canadian Ontario Agreement
ODWSP – Ontario Drinking Water Stewardship Program

GRCA – Ganaraska Region Conservation Authority
DSC – Durham Stewardship Council
NSC – Northumberland Stewardship Council
OFAH – Ontario Federation of Anglers and Hunters
NCC – Nature Conservancy of Canada
CWHLFAP - Clean Water – Healthy Land Financial Assistance Program
DSA – Durham Sustain Ability

6.4 Land Acquisition

Land acquisition management actions are an important means of protecting natural features that provide significant functions to the watershed. Land acquisition for the purpose of the watershed plan refers to acquiring the rights to manage lands for the protection of features and functions of the watershed. Land acquisition can be accomplished through a variety of methods:

- Purchase of land
- Donation of land
- Land rental
- Conservation easements (Managed Forest Tax Incentive Program, Conservation Land Tax Incentive Program, etc.)
- Land use covenants.

In addition, the recommended lands to acquire in 1966 (Department of Energy and Resources Management 1966) should be reviewed and prioritized for a local Graham Creek watershed land acquisition plan.

Historically, acquisition of lands by a public authority was seen as a primary mechanism for protecting natural heritage features in a watershed (Richardson 1944; Department of Energy and Resources Management 1966). More recently however, limited public funds or priority use of public funds has limited the financial capacity of public agencies to acquire land outright. A shift is also occurring that allows private ownership to remain accompanied by restrictive land use, but with incentives for doing so (i.e., tax incentives or capital gains). Land acquisition for the purpose of this plan is seen as a long-term management action. Land acquisition will occur when funds are available or when opportunities arise that allow acquisition of management rights.

6.5 Monitoring and Reporting

Graham Creek has been studied over the years through programs administered by the Ganaraska Region Conservation Authority, federal and provincial governments, municipalities and local non-governmental agencies. Three aspects of monitoring and research will need to occur to ensure that the watershed plan is achieving stated goals and objectives related to each watershed component.

- The creation and implementation of a GRCA integrated watershed monitoring program are required to monitor and analyze conditions and trends throughout the watershed. Monitoring topics include groundwater quantity and quality (on a regional and site-specific scale), surface water quantity and quality, aquatic organisms and habitat (including stream temperature) and terrestrial natural heritage. This monitoring program will also evaluate the effectiveness of watershed and municipal planning actions in achieving respective plan objectives (i.e., effectiveness monitoring).

- The review of watershed implementation is required to understand the adoption and implementation of the watershed plan. Monitoring will specifically address the actions undertaken to implement management actions as they relate to regulations and planning, stewardship, education and awareness, and land acquisition.

- Special research projects by the Ganaraska Region Conservation Authority and other agencies in partnership with academia, local schools, and local groups and agencies will be encouraged to study new initiatives and to fill large-scale knowledge gaps such as potential local effects of climate change, pharmaceuticals, location of wells, septics, fuel and chemical storage facilities, and water taking information.

Along with monitoring and research, the reporting of results to the public, partners, municipalities and stakeholders is a valuable tool to ensure that the watershed plan is being implemented and positive changes are being realized in the Graham Creek watershed. Reporting can occur in many formats including research papers and reports, annual monitoring reports and summaries, watershed report cards, newsletters and media materials.

Reporting will be done in a way that focuses on the intended target audience and provides recommended improvements for future monitoring and research programs, and the watershed plan. The use of monitoring and reporting will be necessary to allow for adaptive management, whereas changes will be made in future updates to the Graham Creek Watershed Plan to allow for focused and improved implementation of techniques and programs.

7.0 Water Budget and Water Conservation Plan

A water budget is a scientific modeling tool used to define the hydrologic system of a watershed. Results of a water budget provide an understanding of how water flows onto and over the surface, and through and below the ground. Water budgets expand beyond the quantification of components in the water balance equation (precipitation, evapotranspiration, groundwater and surface water flow), and include human and ecological water use.

Once a water budget is defined for a watershed, the amount of water needed for ecological functions and the amount that is remaining for human use are better understood. This information can then be used to create a water conservation plan. Water conservation plans aid in providing for a sustainable, natural environment by recognizing water as a valuable, finite resource to be utilized efficiently and wisely.

As part of the Graham Creek Watershed Plan initiative, a water budget has been defined (Ganaraska Region Conservation Authority 2008). Results indicate that given existing water takings and water uses, the Graham Creek watershed has low surface water use stress. Figure 7.0 indicates the lumped annual water inputs and outputs for existing land use conditions. Under a scenario of future conditions (increased development) with climate change effects, the Graham Creek watershed is expected to receive more precipitation, and experience higher evapotranspiration rates and greater surface flows (due to increased precipitation). This analysis provides a glimpse of climate change effects, with additional research and modeling required.

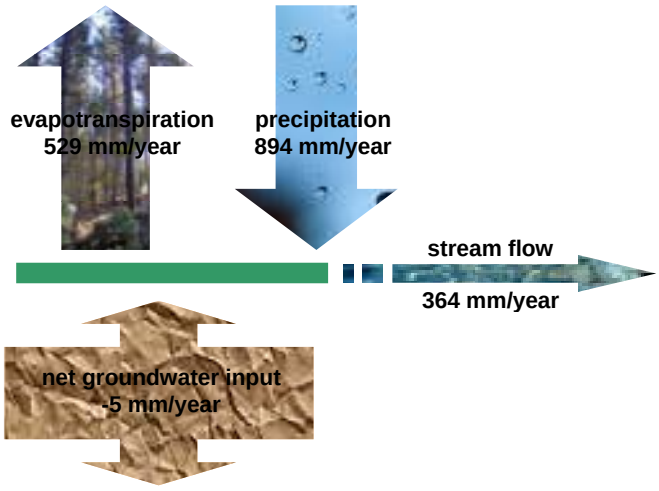


Figure 7.0: Graham Creek watershed existing condition water budget

The Graham Creek watershed has a total population of 3,583 people. Of this, 2,472 people receive municipal water from Lake Ontario. The population of Graham Creek that relies on private water wells for drinking water totals 1,111 people. Although generally there is an adequate groundwater supply, local issues and conditions do occur, causing water shortages in private wells during certain periods.

Many programs and initiatives are already in place to address water conservation and wise management. A water conservation plan will aim to build upon and strengthen these current initiatives.

- The Regional Municipality of Durham *By-Law 72-2008* which limits the amount of water used by those serviced by municipal water supply systems.
- The Regional Municipality of Durham is involved in many initiatives to reduce water use from Lake Ontario.
- The Ganaraska Region Conservation Authority, in partnership with member municipalities, provides outreach and education on water conservation techniques and operates the Ontario Low Water Response Program that responds to drought events.

7.1 Recommended Water Conservation Plan

A water conservation plan is recommended in two phases for the Graham Creek watershed. As outlined in Section 5.0, many management actions are geared toward the conservation of ground and surface water for human and ecological uses. These management actions are focused around stewardship, and education and awareness. However, an in-depth water conservation plan is recommended on a regional scale, addressing all watersheds, residents and municipalities in the Ganaraska Region Conservation Authority.

Phase 1 Water Conservation Plan

The first phase of a watershed conservation plan for the Graham Creek watershed is focused on behaviour-based actions promoted through stewardship, and community outreach and awareness. Given that phase 1 will be geared to water used from the Graham Creek watershed, areas that are serviced from Lake Ontario will not be the direct focus.

The GRCA Clean Water – Healthy Land Stewardship Program will be the primary mechanism for promoting water conservation behaviour-based actions along with education and awareness. The GRCA will partner with member municipalities to deliver messaging around methods to reduce water use. Delivery mechanisms to all watershed residents include mail-outs in water bills, press releases and news articles, workshops and seminars, web-based information and print material. Topics include technology-based actions (i.e., low-flush toilets, water efficient appliances, and water system maintenance) and behaviour-based actions that promote the wise use of water.

Phase 2 Water Conservation Plan

The second phase of a water conservation plan will be the creation of a GRCA water conservation plan. The focus of phase 2 will be based on partnership with member municipalities and water utilities to develop a regional water conservation plan. This regional plan would address large-scale topics such as water takings less than 50,000 litres per day, Lake Ontario water takings and water efficiency measures. Water efficiency measures will be beneficial to municipalities, potentially enabling large capital costs of water and waste water services upgrades to be deferred, given a shift in water use, thus reducing loadings to waste service systems. Creating a water conservation plan on a regional basis is needed to ensure initiatives are done consistently across the GRCA, while still having the ability to focus on local watershed-scale issues and conditions.

8.0 Conclusions

The need for a watershed plan for the Graham Creek watershed was recognized by local municipalities, the Ganaraska Region Conservation Authority and the community. Triggers that prompted the need for a watershed plan included the continual growth and development pressures in the Regional Municipality of Durham and the Municipality of Clarington; the use of current settlement areas within the watershed; and the increase in awareness of natural resource and environmental issues by the community. Along with the local needs for the Graham Creek Watershed Plan, a legislative requirement under the *Oak Ridges Moraine Conservation Plan* needed to be fulfilled.

After many years of intensive monitoring, data collection and research, the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* was authored to aid in the understanding of the Graham Creek watershed. The data presented in the Background Report, along with local knowledge and input, allowed for the compilation of the Graham Creek Watershed Plan. An ambitious, year-long watershed plan planning process was initiated with the support, invaluable assistance and input from the Technical Review Committee and the Community Advisory Committee.

The process and techniques built upon historic watershed management processes and documents (Department of Energy and Resources Management 1966; Ontario Ministry of Natural Resources 1976), current watershed processes (Ontario Ministry of Environment and Energy and Ontario Ministry of Natural Resources 1993; Conservation Ontario 2003), legislative requirements (Ontario Ministry of Municipal Affairs and Housing 2002) and tested watershed policies (Ogilvie, Ogilvie and Company, and Anthony Usher Planning Consultant 2005). More importantly, the process and end product are in line with the Ganaraska Region Conservation Authority vision and mission, and municipal and community needs and requests.

Each watershed component, also referred to as a watershed science, addresses numerous issues and opportunities in the Graham Creek watershed. A goal and objectives were created for each watershed component in order to organize methods to address the identified issues and opportunities. Using the objective statements, management actions were formulated in order to achieve the desired goal of each watershed component. Finally, in order to provide direction for the watershed plan, an implementation framework was provided to guide member municipalities, the Ganaraska Region Conservation Authority, partners and the public in actions that will benefit the Graham Creek watershed.

Many management actions have been recommended for adoption and implementation. However, it is necessary to put priority actions into context with the current condition of the watershed. Through this watershed planning process it has been concluded that the Graham Creek watershed is a valuable resource to the local community, especially given its location in southern Ontario, the Lake Ontario basin and its proximity to the Greater Toronto Area. The headwaters of Graham Creek are still relatively undeveloped with the natural cover and water abundance typical of a rural watershed. Groundwater and surface water quantity and quality provide adequate supplies and conditions of water for human and ecological use. Aquatic habitat and species are abundant and diverse including significant populations of native Brook Trout.

Protection of current natural features and functions is a priority, with many recommended management actions identifying this need. A key tool that requires implementation is the use of the conceptual natural heritage system, as well as the development of a regional natural heritage system and strategy. Currently, 35% forest cover exists in the Graham Creek watershed. The long-term targeted natural heritage system aims for 52%. The implementation of a conceptual natural heritage system benefits many watershed components such as groundwater quantity and quality, surface water quantity and quality, aquatic habitat and species, and terrestrial natural heritage.

It has also been identified that existing urban and rural residential land uses, along with future development, can result in harmful changes to the water balance, water quality, natural cover, and aquatic and terrestrial communities. These changes can cause increased surface runoff, increased water pollution, extreme variability in stream flow, increased erosion and sedimentation, channel instability, reduced groundwater recharge and the loss of natural habitats. Policies implemented through regulation and planning processes and rehabilitation through stewardship will be needed to address these issues.

Growth, development and the use of natural resources for human needs are inevitable in the Graham Creek watershed. Yet, these actions can occur in a sustainable and responsible manner. Actions can take place with focus on regulations and planning, stewardship, education and awareness, and land acquisition that will aid in the protection, enhancement and sustainable use of the Graham Creek watershed. To accomplish the recommended management actions, collaboration among all who have a connection with the Graham Creek watershed needs to occur. Working together, we can protect the Graham Creek watershed and its resources for generations to come.

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Glossary

Acquisition: any form of conveyance of title or interest in land. It is the right to the use or management of land.
Anthropogenic: human induced or caused.
Aquifer: a water bearing formation that is capable of transmitting water in sufficient quantities to serve as a source of water supply.
Aquitard: a low-permeability unit that contains water but does not readily yield water to pumping wells. Aquitards can restrict contaminant movement.
Area of high aquifer vulnerability: on the Oak Ridges Moraine, an area of high aquifer vulnerability is prescribed in the *Oak Ridges Moraine Conservation Plan*. Elsewhere, lands whose uppermost aquifer is most vulnerable to contamination as a result of surface activities or sources, due to the thickness and permeability of the rock and soil above the aquifer.
Area of natural and scientific interest: areas of land and water containing natural landscapes or features that have been identified as having life science or earth science values related to protection, scientific study or education.
Artesian aquifer: an aquifer that contains water under pressure resulting in a hydrostatic head above ground level.
Baseflow: streamflow that results from groundwater seeping into a stream. Baseflow represents the discharge of groundwater to streams, supports flow in dry weather. The flow of streams composed solely of groundwater discharge.
Best management practice: non-regulatory methods designed to minimize harm to the environment. This term is also referred to as beneficial management practice.
Capture zone: the area surrounding a well that will supply groundwater to that well when pumped at a specified rate for a specified period of time.
Cold water species/habitat: aquatic species with narrow thermal tolerance levels that is usually restricted to cold, highly oxygenated water. The temperature range for these species is from 10ºC to 18ºC.
Connectivity: the degree to which key natural heritage features are connected to one another by links such as plant and animal movement corridors, hydrological and nutrient cycling, genetic transfer and energy flows through food webs.
Confined aquifer: an aquifer that is bound above and below by deposits with a significantly lower hydraulic conductivity.
Development: for the purpose of this plan, the creation of a new lot, a change in land use, or the construction of buildings or structures, and site alteration.
Ecological features: natural land features, water and biotic features that contribute to ecological integrity.
Ecological functions: natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems and landscapes, including hydrological functions and biological, physical, chemical and socio-economic interactions.

Ecological integrity: includes hydrological integrity, means the condition of ecosystems in which the structure, composition and function of the ecosystems are unimpaired by stresses from human activity, natural ecological processes are intact and self-sustaining and the ecosystems evolve naturally.
Effectiveness monitoring: watershed and municipal plans are put in place to limit future or address existing land use impacts responsible for impairment of watershed and municipal planning areas. Effectiveness monitoring is put in place to determine if implemented measures effectively limit or reduce these impairments.
Endangered species: species that is listed or categorized as an "Endangered Species" on the Ontario Ministry of Natural Resources' official species at risk list, as updated and amended from time to time.
Environmental impact study: a study that demonstrates that there will be no negative impacts on a valued natural feature or related ecological functions and whose name and requirements are prescribed in an applicable official plan.
Existing use: for the purpose of this plan, existing use refers to an existing lot, land use, building or structure, and/or site configuration. Within the Oak Ridges Moraine existing "land use" refers to uses lawfully used for that purpose on or before November 15, 2001 as indicated by the *Oak Ridges Moraine Conservation Plan.* Existing "land use" in areas outside of the Oak Ridges Moraine is as defined by municipal policies.
Fish: includes fish, shellfish, crustaceans and marine animals, at all stages of their life cycles.
Fish habitat: spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.
Flooding hazard: the inundation, under the conditions specified below, of areas adjacent to a shoreline or a river or stream system and not ordinarily covered by water.
Floodlines: lines on a watershed map depicting regional flow conditions based on a specific historical event (i.e., Hurricane Hazel).
Floodplain: the area, usually low lands adjoining a watercourse, which has been or may be subject to flooding hazards.
Gauging station: is a site located on a stream, lake or canal where surface water data is collected.
GIS (Geographic Information System): a map based database management system, which uses spatial reference system for analysis and mapping purposes.
Groundwater: water occurring in the zone of saturation in an aquifer or soil.
Groundwater discharge: the outflow from a groundwater reservoir.
Groundwater flow: the movement of water through the pore spaces of overburden material or through faults and fractures in bedrock.
Groundwater model: a computer model in which groundwater flow is characterized by numerical equations.
Groundwater recharge: the inflow to a groundwater reservoir.
Groundwater reservoir: an aquifer or aquifer system in which groundwater is stored.

Headwaters: the origins of streams and rivers**.**
Hydrogeology: the study of water below the ground surface.
Hydrology: the study of surface water flow systems.
Impervious surface: a human made surface that does not permit the infiltration of water, such as a rooftop, or a paved, non-permeable sidewalk, roadway, driveway, or parking lot.
Hydrological evaluation: a study that demonstrates that there will be no adverse effects on an important ground or surface water feature or related hydrological functions, and identifies planning, design and construction practices that will protect, and where possible enhance or restore, the health, diversity and size of the feature. Specific methods and requirements may be established in the watershed plan.
Infrastructure: physical facilities that form the foundation for development, consisting of the specific uses listed in Section 41(1) of the *Oak Ridges Moraine Conservation Plan*, but local roads or local sewage and water lines not subject to Municipal Class Environmental Assessment requirements.
Infrastructure corridor: an infrastructure facility, or components of that facility, that are by necessity linear and the right-of-way required for the facility. An infrastructure corridor includes facility components, such as interchanges and transit stations that may not themselves be linear but are required for the use and operation of the linear facility.
Infiltration: the flow of water from the land surface into the subsurface.
Impoundment Structures: man-made structures that regulate or stop the flow of water.
Low-intensity recreational uses: recreational uses that have minimal impact on the natural environment and require very little terrain or vegetation modification, including but not limited to non-motorized trail uses, natural heritage appreciation and unserviced camping on public and institutional land; accessory uses; and accessory small-scale structures such as trails, boardwalks, footbridges, fences, docks and picnic facilities.
Meander belt: the land across which a stream shifts its channel from time to time.
Municipal sewage services: means a sewage works within the meaning of Section 1 of the *Ontario Water Resources Act* that is owned or operated by a municipality.
Municipal water services: means a municipal drinking-water system within the meaning of Section 2 of the *Safe Drinking Water Act*.
Municipal wellhead protection area: lands surrounding existing water well or well field, or a future well or well field site identified by the municipality, that supplies or will supply a municipal water service and the outer limit of which is the limit of the groundwater capture zone. These lands are divided into zones based on distance from the well or well field and groundwater travel time.

Natural heritage: a system made up of natural features, linked by natural corridors which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species and ecosystems. These systems can include lands that have been restored and areas with the potential to be restored to a natural state.
Oak Ridges Moraine: a knobby ridge of sand deposited at the edge of a glacier by escaping meltwater; the Oak Ridges Moraine was formed by the Simcoe and Lake Ontario Ice Lobes meeting.
Ontario Drinking Water Objectives (ODWO): a set of regulations and guidelines developed by the Ontario government to help protect drinking water sources.
Provincial Groundwater Monitoring Network (PGMN): a groundwater monitoring program operated with the Ministry of the Environment to record groundwater level changes over time, record groundwater quality and quantifies groundwater-surface water interactions.
Provincial Water Quality Monitoring Network (PWQMN): a water chemistry monitoring program operated by the Ministry of the Environment in cooperation with municipal governments and agencies.
Provincial Water Quality Objectives (PWQO): numerical criteria that act as chemical and physical indicators for a satisfactory level of surface water quality to protect all forms of aquatic life.
Prime agricultural land: land that includes specialty crop areas and/or Canada Land Inventory Classes 1, 2 and 3 soils, in this order of priority for protection.
Private communal sewage services: sewage works within the meaning of Section 1 of the *Ontario Water Resources Act* that serves six or more lots or private residences and is not owned by a municipality.
Private communal water services: a non-municipal drinking-water system within the meaning of Section 2 of the *Safe Drinking Water Act* that serves six or more lots or private residences.
Rare species: a native species that is not currently at risk of becoming threatened but, because of its limited distribution, small population or specialized habitat needs, could be put at risk of becoming threatened through all or part of its Ontario range by changes in land use or increases in certain types of human activity.
Recharge area: areas where the water is absorbed into the ground and added to the zone of saturation.
Recreation: leisure time activity undertaken in built or natural settings for purposes of physical activity, health benefits, sport participation and skill development, personal enjoyment, positive social interaction and the achievement of human potential.
Riparian area: the land adjacent to a watercourse that is not normally submerged, which provides an area for vegetation to grow as a buffer to the land use alongside to the stream. It acts as a transitional area between aquatic and terrestrial environments and is directly affected by that body of water.
Runoff: water that reaches surface watercourses via overland flow.

Settlement Areas: urban areas and rural settlement areas within municipalities (such as cities, towns, villages and hamlets) where development is concentrated and a mix of land uses are present and have been designated in an official plan for development. Where there are no lands that have been designated, the settlement areas may be no larger than the area where the development is concentrated.
Sensitive: in regard to surface water features and ground water features, means areas that are particularly susceptible to impacts from activities or events including, but not limited to, water withdrawals, and additions of pollutants.
Significant discharge area: lands of particular importance for the natural replenishment of surface water by groundwater. These may be identified either through watershed-wide studies or site-specific study, using methods established by the Conservation Authority.
Significant recharge area: lands of particular importance for the natural replenishment of groundwater. These may be identified either through watershed-wide studies or site-specific study, using methods established by the Conservation Authority.
Site alteration: means activities, such as grading, excavation and the placement of fill that would change the landform and natural vegetative characteristics of a site.
Site restoration plan: a plan that provides for restoration and enhancement of valued features and functions at an altered or disturbed site as nearly as possible to natural conditions, while recognizing what is achievable and appropriate in the context of existing and approved development on the site. Specific methods and requirements may be established in the watershed plan.
Species of special concern: a species so designated by the Ministry of Natural Resources.
Stream: a permanent or intermittent stream, river, or other watercourse that has a measurable or predictable response to a single runoff event.
Stream corridor: a stream plus all lands adjacent to it.
Streamflow: the surface water discharge that occurs in a natural channel.
Subwatershed: a geographical area defining a single drainage zone within the watershed.
Surface runoff: water flowing over the land surface in streams, ponds or wetlands.
Surface water: includes water bodies (lakes, wetlands, ponds, etc.), watercourses (rivers and streams), infiltration trenches and temporary ponds.
Tallgrass prairie: a globally rare habitat that is comprised of non-woody vegetation that is maintained by seasonal drought and disturbances such as fire.
Threatened species: a species that is listed or categorized as a “Threatened Species” on the Ontario Ministry of Natural Resources’ official species at risk list, as updated and amended from time to time.
Time of Travel: the length of time it takes groundwater to travel a specified horizontal distance.
Unconfined aquifer: an aquifer whose upper boundary is the watertable.

Valley corridor: a stream, plus all lands adjacent to it as far as the stable top of bank, delineated using methods established by the Conservation Authority.
Warm water species/habitat: aquatic warm water habitat is classified as waters with temperatures above 25^{o}C. Warm water species are tolerant to these water conditions.
Water budget: a summation of input, output and net changes to a particular water resources system over a fixed period of time.
Watercourse: an identifiable depression in the ground in which a flow of water regularly or continuously occurs.
Watertable: the top of the saturated zone in an unconfined aquifer.
Watershed: the land within the confines of drainage divides.
Watershed Plan: a framework in the form of a planning document for how, where and when management tools will be applied for the protection and enhancement of a watershed.
Wellfield: an area containing more than one pumping well that provides water to a public water supply system or single owner (i.e., a municipality).
Wellhead protection area: the area surrounding a well through which contaminants are reasonably likely to move toward and eventually reach the water well.
Wetlands: lands that are seasonally or permanently covered by shallow water, as well as lands where the watertable is close to or at the surface. In either case the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophytic plants or water tolerant plants. The four major types of wetlands are swamps, marshes, bogs and fens.
Wildlife habitat: areas where plants, animals and other organisms live and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle; and areas which are important to migratory or non-migratory species.

Appendix A: Influential federal, provincial and municipal legislation

Federal – Fisheries and Oceans Canada

Fisheries and Oceans Canada (DFO) has ultimate responsibility for the management of fisheries resources in Canada. In Ontario, there exists a unique multi-agency approach in the delivery of the provisions of the *Fisheries Act*. Conservation Authorities, the Ontario Ministry of Natural Resources and Parks Canada all assist DFO with the proactive delivery of the fish habitat management program in Ontario. DFO's Conservation and Protection Branch provides the lead response to potential *Fisheries Act* violations relating to physical fish habitat changes, while Environment Canada maintains its national role in enforcing the pollution prevention provisions in the *Fisheries Act*. Other regulatory functions related to the management of fish populations (such as setting angling limits, fishing seasons and fish stocking) are administered through the Ontario Ministry of Natural Resources.

In addition to the above functions, DFO has been given the responsibility for the administration of the federal *Species at Risk Act* (SARA), as it relates to aquatic species. Section 32 of SARA protects the habitat and individuals that are extirpated, endangered or threatened species from negative impacts resulting from human activities or works.

Federal – Transport Canada, Navigable Waters Protection Program

Transport Canada is responsible for administration of the federal *Navigable Waters Protection Act*. The Act is designed to protect the public right of navigation by prohibiting the construction or placement of any work in navigable water without the approval of the Minister.

Federal – Environment Canada

Environment Canada (EC) has responsibility for the enforcement of the pollution prevention provisions of the *Fisheries Act* (i.e., protection against discharges that could be deleterious to fish). Although the Ontario Ministry of the Environment will often provide the first response and background data collection for spills that may represent violations under the *Fisheries Act*, responsibility for the actual prosecution of such potential *Fisheries Act* violations remains with Environment Canada. In Ontario and in cases where a spill is due to a sediment discharge rather than a chemical spill, DFO may take back the lead role of investigating and/or prosecuting such violations, especially if there may be other violations under the habitat protection provisions in the *Fisheries Act*.

In addition to the above functions, EC has been given the responsibility for the administration of the federal *Species at Risk Act* (SARA), as it relates to terrestrial species. Section 32 of SARA protects the habitat and individuals that are extirpated, endangered or threatened species from negative impacts resulting from human activities or works.

Provincial – Ontario Ministry of Natural Resources
The Ontario Ministry of Natural Resources (MNR) is the provincial agency responsible for the protection and management of Ontario's natural resources. The MNR has primary administration and enforcement responsibilities for a considerable number of provincial statutes. The *Lakes and Rivers Improvement Act* plays a specific role in contributing to the protection of fish habitat. Other legislation that considers the protection of habitats includes the *Public Lands Act* and the *Aggregate Resources Act*.

The *Fish and Wildlife Conservation Act* enables the MNR to provide sound management to fish and wildlife. Further to this, the *Endangered Species Act* ensures the conservation, protection, restoration or propagation of flora and fauna species that are threatened with extinction in Ontario.

Provincial - Ontario Ministry of the Environment
The Ontario Ministry of the Environment (MOE) is the provincial agency responsible for enforcing the *Environmental Protection Act*, *Environmental Assessment Act*, *Nutrient Management Act*, *Pesticide Act*, *Ontario Water Resources Act* and the *Clean Water Act*.

The *Environmental Protection Act* prohibits the discharge of anything that causes or has the potential to cause an adverse environmental effect. The *Environmental Assessment Act* provides for the protection, conservation and best management of the environment. The *Nutrient Management Act* provides for the management of nutrients applied to agricultural lands and requires compliance with nutrient management strategies and plans.

The *Pesticides Act* and its regulations provide the regulatory framework for pesticide management to protect human health and the natural environment. The MOE, through the legislation, regulates the sale, use, transportation, storage and disposal of pesticides. The *Ontario Water Resources Act* prohibits the discharge of any substance that may impair the quality of any water. Section 34 of the same Act requires a person to obtain a water taking permit if they are taking more than 50,000 litres of water per day from any watercourse.

The *Clean Water Act* was created to protect municipal drinking water sources (surface water and groundwater) from contamination and overuse, currently and for the future. It was also ensured through the Act that communities are able to identify potential risks to their supply of drinking water and take action to reduce or eliminate these risks on a local scale.

Municipalities, Conservation Authorities, landowners, farmers, industry, community groups and the public will all work together to meet common goals to protect municipal sources of drinking water. Locally, the Ganaraska Region Source Protection Area and Authority is the planning area for the Clean *Water Act*, in the Trent Conservation Source Protection Region.

Provincial - Ontario Ministry of Agriculture, Food and Rural Affairs
The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) works closely with agricultural producers and other agencies to enhance the protection of aquatic and terrestrial environments. Many best management practices have been developed to assist farmers in the protection of habitats and water quality and quantity. OMAFRA has legislative responsibilities for the protection of the environment in the *Drainage Act* and the *Nutrient Management Act*.

The *Drainage Act* is a legislative tool that allows landowners to petition their municipalities to resolve drainage problems. The municipality administers the legislative process used to develop drainage works and assesses project cost to landowners in the drainage system watershed. The process ensures public involvement through consultative meetings and appeal procedures.

The *Nutrient Management Act* was developed by MOE and OMAFRA, as part of the provincial Clean Water Program. The Act provides a framework for setting clear, consistent standards and environmental protection guidelines for nutrient management on farms, by municipalities and by other generators of materials containing nutrients. It builds on the existing system by giving current best management practices the force of law and creating comprehensive, enforceable, province-wide standards to regulate the management of all land-applied materials containing nutrients. When first introduced, affected operations were required to conform to the Act and currently, the *Nutrient Management Act* Regulations are limited to new farms and farms that are expanding to become large operations (over 300 nutrient units).

Provincial - Ontario Ministry of Municipal Affairs and Housing
The Ontario Ministry of Municipal Affairs and Housing (MMAH) identifies and protects provincial interests and promotes sound infrastructure planning, environmental protection, economic development and safe communities. To achieve this, MMAH is responsible for several statutes that legislate acceptable land use direction in Ontario including the *Planning Act*, *Green Belt Act* and the *Oak Ridges Moraine Conservation Act*.

The *Planning Act* establishes the foundation for land use planning in Ontario and describes how land uses may be controlled and by whom. To promote provincial interests, such as protecting farmland, natural resources and the environment, the provincial government has released a *Provincial Policy Statement* under the authority of Section 3 of the *Planning Act*. It provides direction on matters of provincial interest related to land use planning and development, and promotes the provincial “policy-led” planning system.

The new *Provincial Policy Statement* came into effect on March 1, 2005. This coincides with the effective date of Section 2 of the *Strong Communities (Planning Amendment) Act, 2004*, which requires that planning decisions on

applications that are subject to the new *Provincial Policy Statement* “shall be consistent with” the new policies.

The *Greenbelt Act* came into effect on February 24, 2005. It enables the Lieutenant Governor in Council to make a regulation creating a Greenbelt Area in the Golden Horseshoe area and to establish a *Greenbelt Plan* by Order in Council, which contains land use designations and policies to govern the lands in the Greenbelt Area. The purpose of the Greenbelt is to protect key environmentally sensitive land and farmlands from urban development and sprawl.

The *Oak Ridges Moraine Conservation Plan* governs specific land uses to protect the ecological and hydrological integrity of the Oak Ridges Moraine and to ensure a continuous natural environment for future generations, while providing compatible social and economic opportunities. *The Oak Ridges Moraine Conservation Act* directs municipalities to bring their official plans into conformity with the Plan and to ensure that the decisions they make on development applications conform to the Plan. As such, the Plan will be implemented mainly at the municipal level. However, where municipal official plans or zoning by-laws conflict with the provincial policy, the provincial policy will prevail.

Provincial - Ontario Ministry of Public Infrastructure Renewal
The Ontario Ministry of Public Infrastructure Renewal (MPIR) is responsible for providing a broad framework for planning and coordinating the government’s investments in public infrastructure and for growth planning in the province. MPIR has the overall responsibility for fostering and implementing the government’s long-term plan for growth.

The *Places to Grow Act* provides a legal framework necessary for the government to designate any geographic area of the province as a growth area and develop a growth plan in collaboration with local officials and stakeholders to meet specific needs across the province. The *Places to Grow Act* enables the government to plan for population growth, economic expansion and the protection of the environment, agricultural lands and other valuable resources in a coordinated and strategic way. The legislation is provincial in scope and allows for growth plans in any part of Ontario.

A regulation was also passed identifying the Greater Golden Horseshoe as the first area in the province for which a growth plan would be prepared under the *Places to Grow Ac*t. The growth plan for the Greater Golden Horseshoe was finalized and released in June of 2006.

Conservation Authorities
Ontario’s Conservation Authorities are empowered by the *Conservation Authorities Act* to undertake programs to further the conservation, restoration,

development and management of natural resources on a watershed basis. The *Conservation Authorities Act* allows for regulations that address the following:

- [Actions that] Pertain to the use of water
- Prohibit or require permission to interfere in any way with the existing channel of a watercourse or wetland
- Prohibit or require a permit to undertake development (construction, structural alterations, grading, filling) in areas where the control of flooding, erosion, dynamic beaches, pollution or the conservation of lands may be affected.

Conservation Authorities have indirect responsibility to participate in aquatic habitat management through the *Conservation Authorities Act*, particularly Section 28. This regulation requires a permit from the Conservation Authority prior to various works taking place (e.g., altering a watercourse, constructing any building in the floodplain or placing fill in a regulated area). Conservation Authorities are also responsible for watershed planning and stewardship and play an important role by providing “first on the scene” support and by referring potential occurrences to primary agencies.

Municipalities

At the municipal level, watersheds receives protection through official plan designations and policies, zoning and other by-laws, stormwater management, site plan and subdivision approval, and through development reviews and requirements. Municipalities work closely with local Conservation Authorities through watershed planning, the development of watershed-level Fish Habitat Management Plans and/or Fisheries Management Plans, the plan review process and through support of Authority policies and programs.

The Regional Municipality of Durham, the Municipality of Clarington and the Municipality of Port Hope Official Plans regulate land use in the Graham Creek watershed under the authority of the *Planning Act*. An official plan sets out local or regional council's policies on how land in a community should be used and developed. It is prepared with input from citizens and helps to ensure that future planning and development will meet the specific needs of the community. The *Provincial Policy Statement* requires that planning decisions (official plans) be consistent with the provincial directives.

Appendix B: Current Partnerships

Durham Sustain Ability
Durham Sustain Ability (DSA) is a non-profit organization based in the Regional Municipality of Durham that links local sustainable actions to larger global issues. Durham Sustain Ability has been creating community based tools for change since 1982. Building on its success with the blue box Durham Sustain Ability uses conservation education to increase the number of residents involved in environmental practices in their homes, workplaces, and communities.

Ontario Federation of Anglers and Hunters (O.F.A.H): is the oldest and largest non-profit, non-government fish and wildlife conservation organization in Canada. The O.F.A.H. represents thousands of members and hundreds of member clubs. Provincially and locally, the O.F.A.H. delivers, manages and administers programs such as the Lake Ontario Atlantic Salmon Restoration Program Partnership, Community Stream Steward Program, Invasive Species Public Education and Outreach, and the Tackle Share Program. These programs are delivered locally in partnership with the Ganaraska Region Conservation Authority, and local agencies and organizations. For more information, please visit http://www.ofah.org/.

Durham Stewardship Council and Northumberland Stewardship Council (Ontario Stewardship): the Ministry of Natural Resources' Ontario Stewardship program is a community-based initiative that brings together landowners, associations, resource agencies and individuals who share an interest in responsible land care and sustainable resource use. The program advocates stewardship as a tool for land management. The Durham Stewardship Council has worked to improve and protect the Regional Municipality of Durham natural resources through the support of stream improvement projects, tree planting and related education for landowners and students, as has the Northumberland Stewardship Council in Northumberland County. The Ganaraska Region Conservation Authority works in partnership with the Durham Stewardship Council and Northumberland Stewardship Council. For more information, please visit http://www.ontariostewardship.org.

Oak Ridges Moraine Foundation: is governed by a vision for the future of the moraine as a vibrant, healthy ecosystem that is widely acknowledged as a model for successful preservation, protection and restoration of landscapes; where land owners, users of the Moraine and all levels of government are actively engaged; where a scenic trail along the Moraine is secured; and where the Foundation is regarded as an essential partner. The Caring for the Moraine project has delivered the support of 30 conservation and environmental organizations to more than 80,000 landowners across the Oak Ridges Moraine, in a collaboration that aims to conserve the important and sensitive environmental features of the moraine. Locally, the Graham Creek watershed is situated in the Ganaraska Hills Project Area. For more information please visit http://www.moraineforlife.org/.

Trees Ontario: is a gathering of experts from science, forestry, government, community groups and the business world that plants trees and forests throughout Ontario. Trees Ontario works with local tree planting agencies in Ontario, including Conservation Authorities and Ontario Stewardship Councils to implement its tree planting subsidy programs. Planting agencies then work directly with landowners to determine site eligibility, allocate funding and coordinate tree planting. To date, funding has been received by landowners in the Graham Creek watershed and throughout the Ganaraska Region Conservation Authority to assist tree planting projects. For more information please visit http://www.treesontario.on.ca/.

Nature Conservancy of Canada (NCC): is Canada's leading national land conservation organization. NCC is a private, non-profit group that partners with corporate and individual landowners to achieve the direct protection of our most important natural treasures through property securement (donation, purchase, conservation agreement and relinquishment of other legal interests in land) and long-term stewardship of the NCC portfolio of properties. For more information please visit http://www.natureconservancy.ca.

Environmental Farm Plan (EFP): is an assessment that is voluntarily prepared by farm families to increase their environmental awareness in up to 23 different areas on their farm. Through the EFP local workshop process, farmers highlight their farm's environmental strengths identify areas of environmental concern, and set realistic action plans with time tables to improve environmental conditions. Environmental cost-share programs are available to assist in implementing projects and are delivered through the Ontario Soil and Crop Improvement Association. A local Environmental Farm Plan representative assists farmers in the EFP process. For more information please visit http://www.ontariosoilcrop.org/.

Ontario Drinking Water Stewardship Program: funding is available through the Ganaraska Region Conservation Authority and the Environmental Farm Plan program to carry out projects that benefit and protect municipal sources of drinking water. Created under the *Clean Water Act*, this program is designed to fund landowners, businesses, farmers and residents who live in municipal wellhead protection areas and intake protection zones. Eligible projects include well and septic management and best management practices associated with land uses within the eligible project areas.

Appendix C: *Oak Ridges Moraine Conservation Plan* watershed plan requirements conformity assessment

This report documents how requirements of sections 24 and 25 of the *Oak Ridges Moraine Conservation Plan* (Ontario Ministry of Municipal Affairs and Housing 2002) have been satisfied for the portions of the **Graham Creek Watershed** located in the Oak Ridges Moraine planning boundary, based on direction provided by the provincial technical guidance documents (Ministry of the Environment 2007)[1].

Subsection	Requirement	Conformity Assessment	Document Reference
24.(1)	Every upper-tier municipality and single-tier municipality shall, on or before April 22, 2003, begin preparing a watershed plan, in accordance with subsection 24.(3), for every watershed whose streams originate within the municipality's area of jurisdiction.	Watershed planning and ongoing watershed management have been activities the Ganaraska Region Conservation Authority (GRCA) has carried out in partnership with member municipalities for a number of years. Therefore a watershed plan was deemed to have been initiated prior to April 22, 2003, although study components required updates to varying degrees. Approval of the Graham Creek Watershed Plan by the GRCA Board occurred on April 15, 2010. The Graham Creek Watershed Plan was submitted to municipal councils for information and consideration. The Municipality of Port Hope and the Municipality of Clarington passed resolutions to refer the Graham Creek Watershed Plan to staff.	Refer to the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features.* Approval of the Graham Creek Watershed Plan by the GRCA Board occurred on April 15, 2010. Resolution Number FA 17/10. Referral of the Graham Creek Watershed Plan by the Municipality of Port Hope to staff occurred on March 16, 2010. Refer to minutes from March 16, 2010 Committee of the Whole meeting. Referral of the Graham Creek Watershed Plan by the Municipality of Clarington to staff occurred on April 12, 2010. Resolution Number GPA-212-10.

Subsection	Requirement	Conformity Assessment	Document Reference
24.(3)	A watershed plan shall include, as a minimum, (a) a water budget and conservation plan as set out in section 25;	See conformity assessments for sections 25.(1) and 25.(2).	See document references for sections 25.(1) and 25.(2).
	(b) land and water use and management strategies;	The Graham Creek Watershed Plan describes recommended management actions regarding existing and future land and water use that will help to protect the ecological and hydrological features and functions of the watershed and the Oak Ridges Moraine.	Refer to Section 5.0 Management Recommendations for the Graham Creek Watershed.
	(c) a framework for implementation, which may include more detailed implementation plans for smaller geographic areas, such as subwatershed plans, or for specific subject matter, such as environmental management plans;	Implementation direction and initial considerations for priority actions and areas accompany the management actions in the Graham Creek Watershed Plan.	Refer to Section 6.0 Watershed Plan Implementation.
	(d) an environmental monitoring plan;	The Graham Creek Watershed Plan includes recommendations regarding changes or enhancements to existing environmental monitoring programs and other area, site-or issue-specific monitoring requirements.	Refer to Section 5.0 Management Recommendations for the Graham Creek Watershed and Section 6.0 Watershed Plan Implementation.
	(e) provisions requiring the use of environmental management practices and programs, such as programs to prevent pollution, reduce the use of pesticides and manage the use of road salt; and,	The Graham Creek Watershed Plan includes recommendations regarding the use of environmental practices and programs.	Refer to Section 5.0 Management Recommendations for the Graham Creek Watershed

Subsection	Requirement	Conformity Assessment	Document Reference
	(f) criteria for evaluating the protection of water quality and quantity, hydrological features and hydrological functions.	The Graham Creek Watershed Plan includes watershed goals, objectives and targets. The Graham Creek Watershed Plan sets out recommended policies for the review of land use proposals to evaluate the protection of groundwater and surface water quality and quantity, hydrological features and functions, as well as terrestrial features and functions and aquatic communities and habitat.	Refer to Section 5.0 Management Recommendations for the Graham Creek Watershed and Section 6.0 Watershed Plan Implementation.
24.(4)	Major development is prohibited unless, (a) the watershed plan for the relevant watershed, prepared in accordance with subsection 24.(3), has been completed;	Not applicable	Not Applicable
	(b) the major development conforms with the watershed plan; and	See conformity assessment for section 24.(3)	See document references for section 24.(3)
	(c) a water budget and conservation plan, prepared in accordance with section 25 and demonstrating that the water supply required for the major development is sustainable, has been completed.	See conformity assessments for sections 25.(1) and 25.(2).	See document references for sections 25.(1) and 25.(2)
24.(8)	An application for major development to which this subsection applies shall not be approved unless, (a) the relevant municipality has complied with clause (c) of subsection 24.(4); or	See conformity assessment for section 24.(4)	See document references for section 24.(4)

Subsection	Requirement	Conformity Assessment	Document Reference
	(b) the applicant, (i) identifies any hydrologically sensitive features and related hydrological functions on the site and how they will be protected, (ii) demonstrates that an adequate water supply is available for the development without compromising the ecological integrity of the Plan Area, and (iii) provides, with respect to the site and such other land as the approval authority considers necessary, a water budget and water conservation plan that, (A) characterizes groundwater and surface water flow systems by means of modeling, (B) identifies the availability, quantity and quality of water sources, and (C) identifies water conservation measures.	For any applications received prior to completion of watershed plans, in accordance with the ORMCP, conformity will have been reviewed and confirmed through applicant submitted studies.	Not applicable

Subsection	Requirement	Conformity Assessment	Document Reference
25.(1)	Every upper-tier municipality and single-tier municipality shall, on or before April 22, 2003, begin preparing a water budget and conservation plan, in accordance with subsection 25.(2), for every watershed whose streams originate within the municipality's area of jurisdiction.	Data collection by the GRCA for water budget development was initiated in 2002 to complement historic data. A water budget study was initiated in 2005 by the Ganaraska Region Conservation Authority through source water protection initiatives, in partnership with municipalities of the Graham Creek Watershed. A water conservation plan was initiated during the development of the Graham Creek Watershed Plan and complements water conservation initiatives already in place.	Refer to *Graham Creek Background Report: Abiotic, Biotic and Cultural Features.* Refer to Section 7.0 Water Budget and Water Conservation Plan. Ganaraska Region Conservation Authority. 2007. Conceptual Understanding - Water Budget: Watersheds Draining to Lake Ontario, Final Draft Report Version 2.5, September 27, 2007.
25.(2)	A water budget and conservation plan shall, as a minimum, (a) quantify the components of the water balance equation, including precipitation, evapotranspiration, groundwater inflow and outflow, surface water outflow, change in storage, water withdrawals and water returns;	The Graham Creek Watershed Plan includes a quantitative description of the major components of the water balance equation on an average annual basis over the watershed surface area. The water budget was developed based on land use characteristics, interception abstractions, vegetation, surficial soil characteristics and spatial variations in long term average precipitation, temperature and evaporation across the watershed using CANWET.	Refer to *Graham Creek Background Report: Abiotic, Biotic and Cultural Features.* Refer to Section 7.0 Water Budget and Water Conservation Plan. Refer to Ganaraska Region Conservation Authority. 2008. Tier 1 Water Budget and Stress Assessment. Version 1.0 Draft. Ganaraska Region Conservation Authority, Port Hope, Ontario.

Subsection	Requirement	Conformity Assessment	Document Reference
	(b) characterize groundwater and surface water flow systems by means of modeling;	The groundwater flow system of the Graham Creek watershed has been characterized by development and calibration of a groundwater flow model that utilizes MODFLOW software. Surface water flow systems of the Graham Creek watershed has been characterized by development and calibration of a hydrologic model based on Visual OTTHYMO software.	Refer to *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* and Ganaraska Region Conservation Authority. 2008. Tier 1 Water Budget and Stress Assessment. Version 1.0 Draft. Ganaraska Region Conservation Authority, Port Hope, Ontario.
	(c) identify, (i) targets to meet the water needs of the affected ecosystems, (ii) the availability, quantity and quality of water sources, and (iii) goals for public education and for water conservation;	The Graham Creek Watershed Plan includes management actions for the protection of groundwater and surface water quality and quantity, hydrological features and functions, terrestrial features and functions, and aquatic communities and habitat. A water conservation plan was initiated during the development of the Graham Creek Watershed Plan and complements water conservation initiatives already in place.	See 24(3)(f) above for targets. Refer to *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* for a summary of the availability and quality of water sources. Refer to Section 5.0 Management Recommendations for the Graham Creek Watershed and Section 7.0 Water Budget and Water Conservation Plan.
	(d) develop a water-use profile and forecast;	Water budgeting initiative outlines water-use profiles and forecasts. Forecasts are based on current and future conditions and future development under climate change.	See the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features.*

Subsection	Requirement	Conformity Assessment	Document Reference
	(e) evaluate plans for water facilities such as pumping stations and reservoirs;	A water conservation plan was initiated during the development of the Graham Creek Watershed Plan and complements water conservation initiatives already in place. This requirement will be completed as needed.	Refer to Section 7.0 Water Budget and Water Conservation Plan.
	(f) identify and evaluate, (i) water conservation measures such as public education, improved management practices, the use of flow restricting devices and other hardware, water reuse and recycling, and practices and technologies associated with water reuse and recycling, (ii) water conservation incentives such as full cost pricing, and (iii) ways of promoting water conservation measures and water conservation incentives; (g) analyze the costs and benefits of the matters described in clause (f); (h) require the use of specified water conservation measures and incentives; (i) contain an implementation plan for those specified measures and incentives that reconciles the demand for water with the water supply; (j) provide for monitoring of the water budget and water conservation plan for effectiveness.	A water conservation plan was initiated during the development of the Graham Creek Watershed Plan and will address all necessary water conservation measures and initiatives.	Refer to Section 7.0 Water Budget and Water Conservation Plan.

Subsection	Requirement	Conformity Assessment	Document Reference
27.(1)	Except with respect to land in Settlement Areas, all development and site alteration with respect to land in a subwatershed are prohibited if they would cause the total percentage of the area of the subwatershed that has impervious surfaces to exceed, (a) 10 per cent; or	The Graham Creek Hydrology study assessed the current and projected future percent impervious cover for each Oak Ridges Moraine subwatershed (based on methods suggested in draft Technical Paper #13 which excludes Settlement Areas, utilizing subwatershed boundaries defined in draft Technical Paper #9). These estimates indicate that no Oak Ridges Moraine subwatersheds in the Graham Creek Watershed exceed the 10% impervious cover criteria for current conditions (based on 2002 land use), nor will they exceed 10% upon build-out of municipal official plans approved as of 2002.	See the *Graham Creek Background Report: Abiotic, Biotic and Cultural Features* Ganaraska Region Conservation Authority. 2008. Graham Creek Hydrology Update Report Flood Line Mapping Update & Flood Damage Reduction Project. Draft. Ganaraska Region Conservation Authority, Port Hope, Ontario Refer to Section 5.0 Management Recommendations for the Graham Creek Watershed.
	(b) any lower percentage specified in the applicable watershed plan.	No lower percentage is specified.	Not Applicable

1. Ministry of the Environment (2007) *Oak Ridges Moraine Conservation Plan* – Watershed Plans, Technical Paper #9.
Ministry of the Environment (2007) *Oak Ridges Moraine Conservation Plan* – Water Budgets, Technical Paper #10.
Ministry of the Environment (2007) *Oak Ridges Moraine Conservation Plan* – Water Conservation Plans, Technical Paper #11.
Ministry of the Environment (2007) *Oak Ridges Moraine Conservation Plan* – Subwatersheds (Impervious Surfaces), Technical Paper #13.

Appendix D: *Provincial Policy Statement, 2005* conformity assessment

This report documents how requirements of sections 2.1 and 2.2 of the *Provincial Policy Statement* (Ontario Ministry of Municipal Affairs and Housing 2005) have been satisfied in the Graham Creek watershed Plan.

Section	Requirement	Conformity Assessment
2.1	***Natural Heritage***	
2.1.1	Natural features and areas shall be protected for the long term.	The Graham Creek Watershed Plan and ongoing watershed management enables the long term protection of natural features through regulation and planning, stewardship, education and awareness and land acquisition initiatives.
2.1.2	The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features.	Management actions associated with *objective 6.1: reduce habitat fragmentation and promote connectivity* relates to maintaining restoring and improving the diversity and connectivity of natural heritage features and ecological functions. All management actions are interrelated between ecological features have been created to be as integrated as possible for best results.
2.1.3	Development and site alteration shall not be permitted in: (g) significant habitat of endangered species and threatened species;	Management actions associated with *objective 6.1: reduce habitat fragmentation and promote connectivity* relates to development and site alterations associated with wildlife habitats.
	(h) significant wetlands in Ecoregions 5E, 6E and 7E; and	Not applicable
	(i) significant coastal wetlands.	There are no policies in the Graham Creek watershed Plan that deals with the mouth of Graham Creek. A shoreline management plan is recommended to deal with the Lake Ontario Shoreline within the GRCA.
2.1.4	Development and site alterations shall not be permitted in: (d) significant wetlands in the Canadian Shield, north of Ecoregions 5E, 6E and 7E;	Not applicable
	(e) significant woodlands south and east of the Canadian Shield	Management actions associated with *objective 6.1: reduce habitat fragmentation and promote connectivity* relates to development and site alterations associated with significant woodlands.
	(f) significant valleylands south and east of the Canadian Shield	Management actions associated with *objective 2.1: Maintain and enhance the water balance and baseflow of the Graham Creek watershed* relates to development and site alterations associated with significant valleylands.
	(g) significant wildlife habitat; and	Management actions associated with *objective 6.1: reduce habitat fragmentation and promote connectivity* relates to development and site alterations associated with wildlife habitats.

Section	Requirement	Conformity Assessment
	(h) significant areas of natural and scientific interest.	There are no policies in the Graham Creek watershed Plan that deals with areas of natural and scientific interest. These policies are already within municipal official plans.
	Unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.	All recommended policies indicate that a hydrologic evaluation or natural heritage evaluation must be completed to ensure ecological features and functions are protected from development.
2.1.5	Development and site alteration shall be permitted in fish habitat except in accordance with provincial and federal requirements.	Management actions associated with *objective 5.2: Protect and enhance the form and function of instream habitat and riparian areas* acknowledges the legislative requirements of provincial and federal requirements.
2.1.6	Development and site alteration shall not be permitted on adjacent lands to the natural heritage feature and areas identified in policies 2.1.3, 2.1.4 and 2.1.5 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.	All recommended policies indicate that a hydrologic evaluation or natural heritage evaluation must be completed to ensure ecological features and functions are protected from development. Consideration of adjacent lands is included.
2.1.7	Nothing in policy 2.1 is intended to limit the ability of existing agriculture uses to continue.	Policies that are associated with development permit work associated with existing urban, rural and agricultural uses.
2.2	***Water***	
2.2.1	Planning authorities shall protect, improve or restore the quality and quantity of water by: (k) using the watershed as the ecologically meaningful scale for planning;	All surface water and ground water quantity and quality management actions have been created on a watershed scale.
	(l) minimizing potential negative impacts, including cross-jurisdictional and cross-watershed impacts;	The Graham Creek Watershed Plan recommends management actions regardless of political jurisdiction and acknowledges regional planning needs (i.e., groundwater quantity modeling).
	(m) identifying surface water features, ground water features, hydrologic functions and natural heritage features and areas which are necessary for the ecological and hydrological integrity of the watershed;	Recommended management actions carried out with regulations and planning requires the identification of ecological features and functions. The identification of these features is a requirement of the Graham Creek Watershed Plan.
	(n) implementing necessary restrictions on development and site alteration to: a. protect all municipal drinking water supplies and designated vulnerable areas; and b. protect, improve or restore vulnerable surface and ground water, sensitive surface	Recommended management actions under *objective 3.2: Manage the quality of groundwater through implementing best management practices throughout the watershed* address the protection of municipal groundwater drinking water supplies and highly vulnerable aquifers. Surface water quality objectives 4.1 and 4.2 identify the importance of drinking water source protection

Section	Requirement	Conformity Assessment
	water features, and sensitive ground water features and their hydrologic functions;	work associated with municipal surface water intake protection zones. Management actions have also been recommended for the use of stewardship associated with protecting municipal sources of drinking water and vulnerable areas.
	(o) maintaining linkages and related functions among surface water features, ground water features, hydrologic functions and natural heritage features and areas;	All management actions have been created to be as integrated watershed management actions.
	(p) promoting efficient and sustainable use of water resources, including practices for water conservation and sustaining water quality; and	Management actions recommended under *objective 1.3: ensure sustainable rates of groundwater use* and *objective 2.1: maintain and enhance the water balance and baseflow of the Graham Creek watershed* relates to efficient and sustainable sues of water resources.
	(q) ensuring stormwater management practices minimize stormwater volumes and contaminant loads, and maintain or increase the extent of vegetative and pervious surfaces.	Management actions recommended under *objective 2.1: maintain and enhance the water balance and baseflow of the Graham Creek watershed*, *objective 4.1: manage and enhance rural water quality* and *objective 4.2: manage and enhance urban water quality relates* to stormwater management volumes and contaminant loads.
2.2.2	Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored. Mitigative measures and/or alternative development approaches may be required in order to protect, improve or restore sensitive surface water features, sensitive ground water features, and their hydrologic functions.	Management actions recommended under *objective 1.1: maintain or enhance groundwater recharge and discharge for human needs and ecological functions*, *objective 1.2: manage and avoid actions that affect aquifers (artesian, shallow and deep) and changes in groundwater flow* and *objective 2.1: maintain and enhance the water balance and baseflow of the Graham Creek watershed* addresses development and site alterations near surface and ground water features for the protection of ecological functions.
3.0	***Protecting Public Health and Safety***	
3.1	Natural Hazards	All applicable natural hazard policies stated in section 3.1 are addressed through current floodplain planning and regulation processes at the GRCA and municipalities. New policies have been created and are listed under *objective 2.2: maintain and improve the level of protection of existing and proposed development and residents from flooding hazards*.

Appendix E: *Greenbelt Plan, 2005* conformity assessment

This report documents how requirements of sections 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.3.2 and 3.3.3 of the *Greenbelt Plan* (Ontario Ministry of Municipal Affairs and Housing 2005b) have been satisfied in the Graham Creek watershed Plan.

Requirement	Conformity
3.2.2 Natural Heritage System Policies For lands within the natural heritage system of the Protected Countryside the following policies shall apply: **General conformity:** the watershed plan contains the recommendation for a regional Terrestrial Natural Heritage system and strategy that will contain recommendations that will address no net loss, connectivity and system enhancement.	
1. The full range of existing and new *agricultural, agricultural-related* and *secondary uses* and *normal farm practices* are permitted subject to the policies of 3.2.2.2 below.	The watershed plan does not prohibit existing and new agricultural, agricultural-related and secondary uses and normal farm practices.
2. New buildings or structures for *agriculture*, *agricultural-related* and *secondary uses* are not subject to the natural heritage system policies below, but are subject to the policies on *key natural heritage features* and *key hydrologic features* as identified in the natural features policies of section 3.2.4.	The watershed plan provides recommended policies regarding development requirements associated with natural heritage features and hydrologic features. The watershed plan does not provide exceptions for new agricultural uses (Objective 1.1, 2.1, 5.2 and 6.1).
3. New *development* or *site alteration* in the natural heritage system (as permitted by the policies of this Plan) shall demonstrate that: a. There will be no negative effects on *key natural heritage features* or *key hydrologic features* or their functions;	The watershed plan provides recommended policies regarding development or site alteration requirements including environmental impact assessments. The watershed plan does not provide exceptions for new agricultural uses (Objective 1.1, 2.1, 5.2 and 6.1).
b. *Connectivity* between *key natural heritage features and key hydrologic features* is maintained, or where possible, enhanced for the movement of native plants and animals across the landscape;	Section 5.7 provides recommendations regarding connectivity of natural heritage features. Section 5.2 and 5.3 provides recommendations regarding the connectivity of hydrologic features on a spatial and functional scale. Section 5.6 provides recommendations regarding aquatic habitat connectivity.
c. The removal of other natural features not identified as *key natural heritage features and key hydrologic features* should be avoided. Such features should be incorporated into the planning and design of the proposed use wherever possible; and	The watershed plan allows for the identification of natural features (Objective 1.1, 2.1, 5.2 and 6.1) not identified by the province. Recommended protection measures are given for the protection of these features.
d. The disturbed area of any site does not exceed 25 percent, and the impervious surface does not exceed 10 percent, of the *total developable area,* except for uses described in and governed by sections 4.1.2 and 4.3.2. With respect to golf courses, the disturbed area shall not exceed 40 percent of the site.	The watershed plan recommends a site specific determination of disturbed and impervious areas within a developable area. A 10 percent impervious threshold for a site specific local and on a watershed scale is recommended (Objective 2.1 and 2.2).

Requirement	Conformity
4. Where non-agricultural uses are contemplated within the natural heritage system, applicants shall demonstrate that: a. At least 30 percent of the *total developable area* of the site will remain or be returned to *natural self-sustaining vegetation,* recognizing that section 4.3.2 establishes specific standards for the uses described there; b. *Connectivity* along the system and between *key natural heritage features* or *key hydrologic features* located within 240 metres of each other is maintained or enhanced; and c. Buildings or structures do not occupy more than 25 percent of the *total developable area* and are planned to optimize the compatibility of the project with the natural surroundings.	The watershed plan recommends a site specific determination of vegetation retention within a developable area. Setbacks from natural features are recommended to avoid the removal of existing vegetation (Objective 1.1, 2.1, 5.2 and 6.1). These recommendations are based on the Oak Ridges Moraine Conservation Plan, or site specific needs. Setbacks from natural features are recommended to avoid the removal of existing vegetation. These recommendations are based on the Oak Ridges Moraine Conservation Plan, or site specific needs. Continual implementation of existing planning and development review procedures allow for site specific building or structure siting.
5. The natural heritage system, including the natural features policies of section 3.2.4, does not apply within the existing boundaries of settlement areas, but does apply when considering expansions to settlements as permitted by the policies of this Plan. Municipalities should consider the natural heritage systems connections within settlement areas when implementing municipal policies, plans and strategies.	The watershed plan provides recommendations for all existing and future land uses within all land use areas.
6. When official plans are brought into conformity with this Plan, the boundaries of the natural heritage system may be refined, with greater precision, in a manner that is consistent with this Plan and the system shown on Schedule 4.	The watershed plan recommends a locally developed regional natural heritage system to allow for appropriate refinement to existing provincially developed natural heritage systems.
Where regulations or standards of other agencies or levels of government exceed the standards related to key natural heritage features or key hydrologic features in this Plan, such as may occur with hazardous lands under section 28 of the Conservation Authorities Act or with fisheries under the Federal Fisheries Act, the most restrictive provision or standard applies.	The watershed plan recognizes that implementation of the most restrictive provision or standard will apply.

Requirement	Conformity
3.2.3 Water Resource System Policies The following Water Resource System policies apply throughout the Protected Countryside:	
1. All planning authorities shall provide for a comprehensive, integrated and long-term approach for the protection, improvement or restoration of the quality and quantity of water. Such an approach will consider all hydrologic features and functions and include a systems approach to the inter-relationships between and/or among recharge/discharge areas, aquifers, headwaters and surface waters (e.g. *lakes* as well as rivers and streams, including *intermittent streams*).	The development, implementation and future update of a watershed plan satisfies this requirement.
2. Watersheds are the most meaningful scale for hydrological planning, and municipalities together with conservation authorities should ensure that watershed plans are completed and used to guide planning and development decisions within the Protected Countryside.	The development, implementation and future update of a watershed plan satisfies this requirement.
3. Cross-jurisdictional and cross-watershed impacts need to be considered in the development of watershed plans. The development of watershed plans and watershed management approaches in the Protected Countryside should be integrated with watershed planning and management in the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan areas and beyond the Greenbelt.	The watershed plan integrates planning and management across the Oak Ridges Moraine and beyond the Greenbelt.
4. Municipalities shall, in accordance with provincial direction related to the protection of source water, protect vulnerable surface and ground water areas, such as wellhead protection areas, from development that may adversely affect the quality and quantity of ground and surface waters.	The watershed plan provides recommendations for protecting sources of water (Section 5.2 to 5.5), and further recommends the adoption of policies created under future Source Protection Plans (Section 5.1).
3.2.4 Key Natural Heritage Features and Key Hydrologic Features Policies For lands within a *key natural heritage feature* or a *key hydrologic feature* in the Protected Countryside, the following policies shall apply:	
1. *Development* or *site alteration* is not permitted in *key hydrologic features* and *key natural heritage features* within the natural heritage system, including any associated *vegetation protection zone*, with the exception of: a. Forest, fish and wildlife management; b. Conservation and flood or erosion control projects, but only if they have been demonstrated to be necessary in the public interest and after all alternatives have been considered; or c. Infrastructure, aggregate, recreational, shoreline and existing uses, as described by and subject to the general policies of section 4 of this Plan.	The watershed plan supports similar recommendations (Objective 1.1, 2.1, 5.2 and 6.1).
2. Beyond the natural heritage system within the Protected Countryside (as shown on Schedule 4), *key hydrologic features* are defined by and subject to the natural features policies of section 3.2.4.	The watershed plan provides recommended policies associated with the protection of hydrologic features across the entire watershed (Objective 1.1, 2.1, 5.2 and 6.1).

Requirement	Conformity
3. Beyond the natural heritage system within the Protected Countryside (as shown on Schedule 4), key natural heritage features are not subject to the natural features policies of section 3.2.4 of this Plan, but are to be defined pursuant to, and subject to the policies of, the PPS.	The watershed plan allows for the identification of hydrologic features (Objective 1.1, 2.1, 5.2 and 6.1) not identified by the province. Recommended protection measures are given for the protection of these features.
4. In the case of wetlands, seepage areas and springs, fish habitat, permanent and intermittent streams, lakes, and significant woodlands, the minimum vegetation protection zone shall be a minimum of 30 metres wide measured from the outside boundary of the key natural heritage feature or key hydrologic feature.	The watershed plan supports similar recommendations (Objective 1.1, 2.1, 5.2 and 6.1).
5. A proposal for new development or site alteration within 120 metres of a key natural heritage feature within the natural heritage system or a key hydrologic feature anywhere within the Protected Countryside requires a natural heritage evaluation and hydrological evaluation, which identify a vegetation protection zone which: a. Is of sufficient width to protect the key natural heritage feature or key hydrologic feature and its functions from the impacts of the proposed change and associated activities that may occur before, during, and after, construction, and where possible, restore or enhance the feature and/or its function; and b. Is established to achieve, and be maintained as natural self-sustaining vegetation.	The watershed plan supports similar recommendations (Objective 1.1, 2.1, 5.2 and 6.1).
6. Expansions to existing agricultural buildings and structures and farm and non-farm dwellings, together with accessory uses, are permitted in key natural heritage features, subject to the existing use policies of section 4.5 of this Plan.	The watershed plan supports similar recommendations regarding existing uses (Objective 1.1, 2.1, 5.2 and 6.1).
7. Notwithstanding the natural features policies of section 3.2.4 of this Plan, new buildings and structures for agricultural uses will be required to provide a 30 metre vegetation protection zone from a key natural heritage feature or key hydrologic feature, but may be exempted from the requirement of establishing a condition of natural self-sustaining vegetation if the land is, and will continue to be, used for agricultural purposes. Despite this exemption, agricultural uses should pursue best management practices to protect and/or restore key hydrologic features and functions.	The watershed plan supports similar recommendations (Objective 1.1, 2.1, 5.2 and 6.1).

Requirement	Conformity
3.2.5 External Connections To support the connections between the Greenbelt's Natural System and the local, regional and broader scale natural heritage systems of southern Ontario, …, the federal government, municipalities, conservation authorities, other agencies and stakeholders should:	
1. Consider how activities and land use change both within and abutting the Greenbelt relate to the areas of external connections identified in this Plan;	Recommendations contained within the watershed plan considered how activities and land uses changes both within and adjacent to the entire watershed affects components of the watershed.
2. Promote and undertake appropriate planning and design to ensure that external connections are maintained and/or enhanced; and	Watershed planning aims to ensure that connections are maintained or enhanced where appropriate.
3. Undertake watershed based planning, which integrates supporting ecological systems with those systems contained in this Plan.	The development, implementation and future update of a watershed plan satisfies this requirement.
The river valleys that run through existing or approved urban areas and connect the Greenbelt to inland *lakes* and the Great Lakes are a key component of the long-term health of the Natural System. In recognition of the function of the urban river valleys, municipalities and conservation authorities should: 1. Continue with stewardship, remediation and appropriate park and trail initiatives which maintain and, to the extent possible, enhance the ecological features and functions found within these valley systems;	The watershed plan recommends numerous stewardship and public health and well-being based activities on private and public lands throughout the watershed.
2. In considering land conversions or redevelopments in or abutting an urban river valley, strive for planning approaches that: a. Establish or increase the extent or width of *vegetation protection zones* in *natural self-sustaining vegetation*, especially in the most ecologically sensitive areas (i.e. near the stream and below the *stable top of bank*); b. Increase or improve fish habitat in streams and in the adjacent riparian lands; c. Include landscaping and habitat restoration that increase the ability of native plants and animals to use valley systems as both wildlife habitat and movement corridors; and d. Seek to avoid, minimize and/or mitigate impacts associated with the quality and quantity of urban run-off into the valley systems; and	Recommendations found within the watershed plan associated with land conversions or redevelopment supports planning and development decisions and actions that acknowledge connections and effects on natural features and functions. The watershed plan also supports net increases to natural features. The watershed plan also supports development activities that avoid, minimize or mitigates water quantity and quality impacts associated with urban development (Section 5.2 and 5.3).
3. Integrate watershed planning and management approaches for lands both within and beyond the Greenbelt.	The watershed plan has been created for the entire watershed as it exists both inside and outside of the Greenbelt.

Requirement	Conformity
In addition to the urban river valleys, portions of the former Lake Iroquois shoreline, particularly within Durham Region, traverse existing or approved urban areas. Municipalities should consider planning, design and construction practices that maintain or where possible enhance the size, diversity and *connectivity* of *key natural heritage features* and *key hydrologic features* and functions of those portions of the Lake Iroquois shoreline within their approved urban boundaries.	The watershed plan has been created for the entire watershed. The watershed plan recommends monitoring and research needs associated with increasing the understanding of the Lake Iroquois shoreline to allow for refined management recommendations and actions. Existing municipal policies regarding the protection and consideration of the Lake Iroquois shoreline are supported.
3.3.2 Parkland, Open Space and Trail Policies The Province should, in partnership with municipalities, conservation authorities, non-government organizations, and other interested parties:	
1. Encourage the development of a system of publicly accessible parkland, open space and trails where people can pursue the types of recreational activities envisaged by this Plan, and to support the connectivity of the natural heritage system;	The watershed plan encourages the development of a system of publicly accessible public spaces that supports the natural heritage system of the watershed (Objective 7.1).
2. Encourage the development of a trail plan and a coordinated approach to trail planning and development in the Greenbelt to enhance key existing trail networks and to strategically direct more intensive activities away from sensitive landscapes; and	The watershed plan encourages the development of a trail plan and trail development (Objective 7.1).
3. Promote good stewardship practices for public and private lands within the Greenbelt, including clear demarcation of where public access is permitted.	The watershed plan supports good stewardship practices within public spaces (Objective 7.1).
3.3.3 Municipal Parkland, Open Space and Trail Strategies For all lands falling within the Protected Countryside, municipalities should:	
1. Provide for a full range of publicly accessible, built and natural settings for recreation including facilities, parklands, open space areas, trails and water-based activities;	The watershed plan supports the development of a full range of publicly accessible areas (Objective 7.1).
2. Develop and incorporate strategies (such as community-specific levels of provision) into official plans to guide the adequate provision of municipal recreation facilities, parklands, open space areas and trails;	The watershed plan supports municipal strategies for developing public spaces (Objective 7.1).

Requirement	Conformity
3. Include the following considerations in municipal parkland and open space strategies: a. Providing for open space areas for current and future populations and promoting stewardship of open space areas; b. Providing facilities, parklands, open space areas and trails that particularly support an active, healthy community lifestyle; c. Identifying key areas or sites for the future development of major facilities that avoid sensitive landscapes; d. Identifying and targeting under-serviced areas for improved levels of protection; and e. Protecting the recreation and tourism values of waterfront areas as a high priority; and	The watershed plan supports plans for public spaces that consider many societal and environmental aspects of the space (Objective 7.1).
4. Include the following considerations in municipal trail strategies: a. Preserving the continuous integrity of corridors (e.g. abandoned railway rights-of-way and utility corridors); b. Planning trails on a cross-boundary basis to enhance interconnectivity where practical; c. Incorporating the existing system of parklands and trails where practical; d. Restricting trail uses that are inappropriate to the reasonable capacity of the site (notwithstanding the ability to continue existing trails/uses); e. Providing for multi-use trail systems which establish a safe system for both motorized and non-motorized uses; f. Supporting and ensuring compatibility with agriculture; and g. Ensuring the protection of the sensitive key natural heritage features and key hydrologic features and functions of the landscape.	The watershed plan supports plans trail systems that consider many societal and environmental aspects of the space (Objective 7.1).
Provincial parks and conservation authority lands are also important components in the development of parkland, open space and trail strategies. Ongoing management of these lands for publicly accessible recreation, in keeping with environmental management plans and strategies for such areas and the policies of this Plan, is important in providing access to this system. Where geographic-specific park or public land management plans exist, municipalities, agencies and other levels of government must consider such plans when making decisions on land use or infrastructure proposals.	The watershed plan supports the management and creation of provincially owned lands and conservation areas (Objective 7.1).

Appendix F: Oak Ridges Moraine minimum areas of influence and minimum vegetation protection zones

KEY NATURAL HERITAGE FEATURES, HYDROLOGICALLY SENSITIVE FEATURES AND AREAS OF NATURAL AND SCIENTIFIC INTEREST (EARTH SCIENCE): MINIMUM AREAS OF INFLUENCE AND MINIMUM VEGETATION PROTECTION ZONES

Column 1	**Column 2**	**Column 3**	**Column 4**
Item	**Feature**	**Minimum Area of Influence (21)**	**Minimum Vegetation Protection Zone (21, 23, 26 (4), 30 (12))**
1.	Wetlands	All land within 120 metres of any part of feature	All land within 30 metres of any part of feature, subject to clause 23 (d) if a natural heritage evaluation is required
2.	Significant portions of habitat of endangered, rare and threatened species	All land within 120 metres of any part of feature	As determined by a natural heritage evaluation carried out under Section 23
3.	Fish habitat	All land within 120 metres of any part of feature	All land within 30 metres of any part of feature, subject to clause 23 (1) (d) if a natural heritage evaluation is required
4.	Areas of natural and scientific interest (life science)	All land within 120 metres of any part of feature	As determined by a natural heritage evaluation carried out under Section 23
5.	Areas of natural and scientific interest (earth science)	All land within 50 metres of any part of feature	As determined by an earth science heritage evaluation carried out under Subsection 30 (12)
6.	Significant valleylands	All land within 120 metres of stable top of bank	All land within 30 metres of stable top of bank, subject to clause 23 (1) (d) if a natural heritage evaluation is required

Column 1 Item	Column 2 Feature	Column 3 Minimum Area of Influence (21)	Column 4 Minimum Vegetation Protection Zone (21, 23, 26 (4), 30 (12))
7.	Significant woodlands	All land within 120 metres of any part of feature	All land within 30 metres of the base of outermost tree trunks within the woodland, subject to clause 23 (1) (d) if a natural heritage evaluation is required
8.	Significant wildlife habitat	All land within 120 metres of any part of feature	As determined by a natural heritage evaluation carried out under Section 23
9.	Sand barrens, savannahs and tallgrass prairies	All land within 120 metres of any part of feature	All land within 30 metres of any part of feature, subject to clause 23 (1) (d) if a natural heritage evaluation is required
10.	Kettle lakes	All land within 120 metres of the surface catchment area	All land within the surface catchment area or within 30 metres of any part of feature, whichever is greater, subject to clause 26 (4) (c) if a hydrological evaluation is required
11.	Permanent and intermittent streams	All land within 120 metres of meander belt	All land within 30 metres of meander belt, subject to clause 26 (4) (c) and Subsection 26 (5) if a hydrological evaluation is required
12.	Seepage areas and springs	All land within 120 metres of any part of feature	All land within 30 metres of any part of feature, subject to clause 26 (4) (c) and Subsection 26 (5) if a hydrological evaluation is required

(Ontario Ministry of Municipal Affairs and Housing 2002)


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