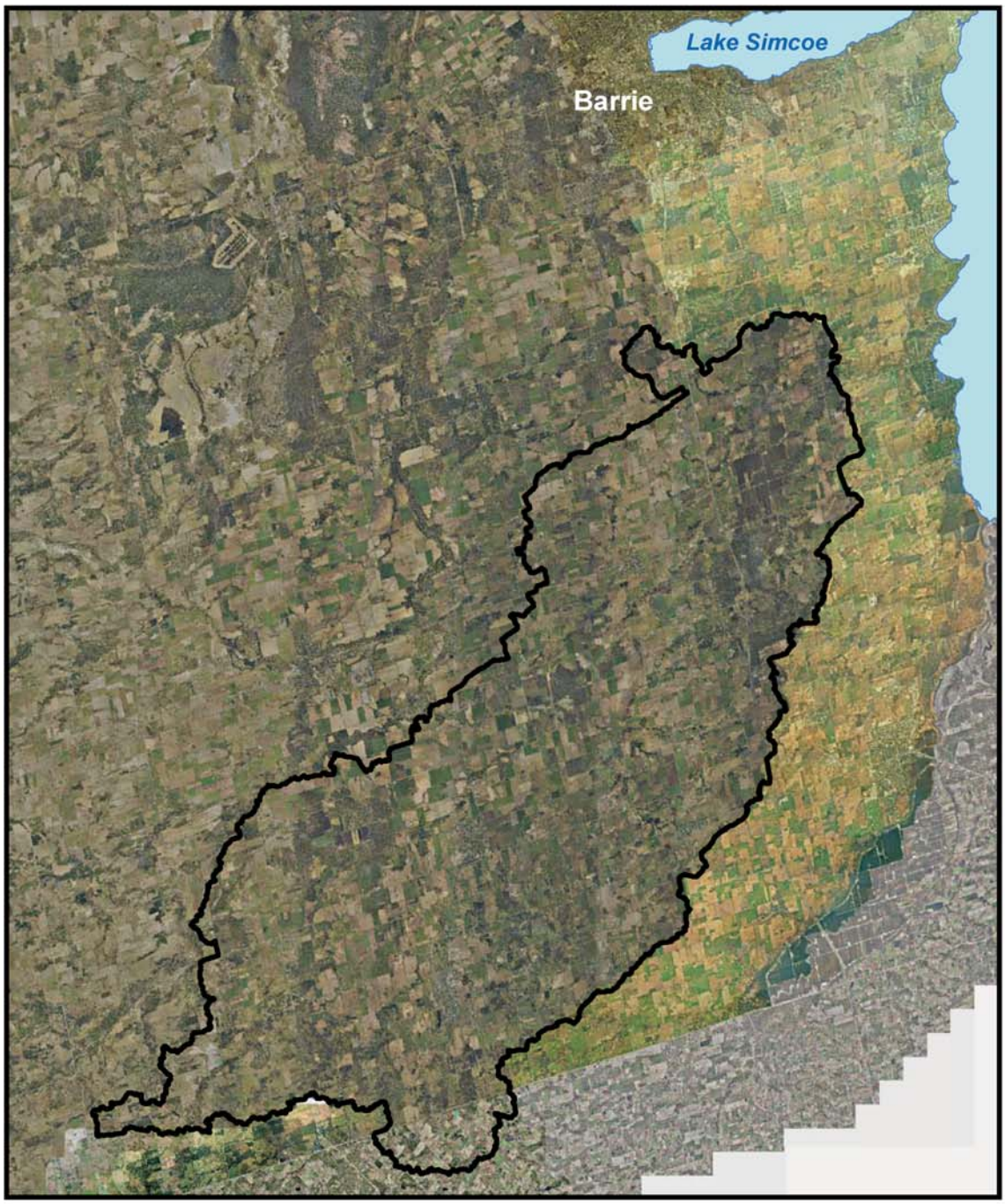
INNISFIL CREEK SUBWATERSHED PLAN



APRIL 2006

Nottawasaga Valley
Conservation Authority

Innisfil Creek

Subwatershed Plan

April 2006

Prepared by the Nottawasaga Valley Conservation Authority
for the Municipalities of
Adjala-Tosorontio
Bradford West Gwillimbury
Essa
Innisfil
New Tecumseth

ACKNOWLEDGEMENTS

The Innisfil Creek Subwatershed Plan could not have been completed without the valuable input and support from the participating municipalities, the Steering Committee and an interested public. The Nottawasaga Valley Conservation Authority would like to thank the following for their significant contribution and support throughout this project.

STEERING COMMITTEE

Adjala-Tosorontio – Gerry Caterer
Bradford West Gwillimbury – Mark Bryan, Richard Vandezande
Essa – Colleen Healey
Innisfil – Jim Hosick, Kathy Brislin
New Tecumseth – Eric Taylor, Kathleen Crawford-Patterson, Steve Naylor
Simcoe County – Gail White, June Little
OMAF – Ray Valaitis
MOE – Bill Armstrong, Hugh Geurts, Scott Abernethy

CONSERVATION AUTHORITY STAFF

Charles Burgess	Dave Featherstone
Dave Crossman	Chris Jones
Tina Desroches	Glenn Switzer
Fred Dobbs	Bob Law
Mike Dodd	Wayne Wilson

TECHNICAL CONSULTANTS

Greenland International Consulting Inc. - Mark Palmer and Bill Coffey
JTB Environmental Systems Inc. - Dr. John T. Beebe,

FUNDING

The Nottawasaga Valley Conservation Authority gratefully acknowledges the funding support for this project from the municipalities of Adjala-Tosorontio, Bradford West Gwillimbury, Essa, Innisfil, New Tecumseth and the Province of Ontario through contributions from the Ministry of Natural Resources, and Ministry of the Environment.

Table of Contents

List of Maps

List of Figures

List of Tables

APPENDICES

Executive Summary

Where is Innisfil Creek?

Innisfil Creek is located in the south-east corner of our watershed. It includes the tributaries of Bailey, Beeton, Cookstown and Penville Creeks (map 1). The subwatershed includes the following municipalities:

- Towns of Innisfil, New Tecumseth, Mono (a very small portion);
- Townships of Adjala-Tosorontio, Bradford-West Gwillimbury and Essa.

What are the water related concerns?

The primary issues raised by the Innisfil Creek subwatershed residents are as follows:

- Protection of significant natural areas and green spaces such as woodlands, wetlands, stream valleys (the habitats for their local wildlife)
- Restoration of degraded natural areas, where possible (improving wildlife habitats)
- Maintenance and where possible improvement of stream conditions (to a level capable of supporting sport fisheries)
- Low flows especially during dry summers
- Protection of ground water quality and quantity to protect their drinking water
- Protection of residents from flood and erosion damage

How can we help resolve these issues?

To provide assist in resolving these issues, we developed the following goal, objectives, measurable targets and recommendations.

Goal: The goal of the Innisfil Creek Subwatershed Plan is: "To conserve Innisfil Creek's natural resources in a cooperative, integrated manner in which human needs are met in balance with the need to sustain and, where possible, restore the health of the natural environment."

Objectives and Targets: The subwatershed plan objectives and corresponding targets that are required to achieve our goal and address the residents concerns are summarized in the chart below

Subwatershed Objectives	Subwatershed Targets
Natural Heritage System • To identify and protect the significant natural heritage system (woodlands, valleylands and wetlands etc.) and their functions (e.g. providing wildlife habitats) • To identify opportunities for restoration of degraded natural areas	• 30% of the area of any subwatershed should be in self-sustaining vegetation[1] • At least 10% of the subwatershed should be forest cover 100 metres or further from the forest edge (5% should be 200 metres or greater from the forest edge)[2] • 10% of any subwatershed should be wetlands[3].

1 Oak Ridges Moraine Conservation Plan ,2002 page 51
2 How Much Habitat is Enough, Environment Canada Great Lakes Fact Sheet
3 ibid

Aquatic Ecosystem • To identify and protect unimpaired streams, which are those capable of supporting healthy warm and cold water aquatic ecosystems, including top predator species such as bass and pike (warm water) and trout (coldwater) • To identify opportunities to restore selected impaired steams such that they would eventually be capable of again supporting cold water species	• 75% of the subwatershed's natural stream length should be naturally vegetated (30m) on both sides of the stream.[4] • Total suspended sediment concentrations should be below 25 mg/l[5] • Target -Total Maximum Yearly Load (TMYL) of phosphorus 5,427 kg/yr. (Target equals the total phosphorus load estimated under the committed growth to the year 2026, with assumed implementation of the Best Management Practices. However, even with the BMPs, the subwatershed is still impaired and does not meet the provincial water quality standard of 3603 kg/yr[6]
Water Management • To quantify surface water resources and to help ensure its use is sustainable over the long-term without harming the aquatic ecosystem • To identify and protect sensitive ground water resources • To ensure flooding and erosion impacts are minimized	• The percentage of impervious surfaces within any subwatershed should not exceed 10%.

Implementation Recommendations

To achieve our Goal, Objectives and Targets and address the issues raised by our subwatershed residents we are making the following recommendations.

Natural Heritage System:

1. Municipalities should incorporate policies in their official plans indicating that "no development or site alteration" shall be permitted within any wetland meeting provincial criteria for a wetland.

2. Municipalities that conduct a detailed natural heritage evaluation identifying their "most significant" or "key features" should place them in their most restrictive official plan designation to ensure that no development or site alteration occurs.

All municipalities within the subwatershed should conduct similar detailed natural heritage evaluations.

3. The proposed additions to the Natural Heritage System (Map 5) should be

4 How Much Habitat is Enough, Environment Canada Great Lakes Fact Sheet
5 ibid
6 Assimilative Capacity Study, Pollutant Target Loads: Lake Simcoe and Nottawasaga River Basins, Final Report, Louis Berger Group and Greenland International Inc. June 2006

incorporated into municipal planning documents. Policies should be provided to protect the natural heritage system from incompatible land use and development.

4. Landowners, environmental organizations and stewardship agencies should consider the restoration and rehabilitation areas (Map 6) when identifying potential projects.

Aquatic Ecosystem:
5. No development or site alteration should occur within a minimum of 30m on either side of a natural stream. Existing agricultural areas are encouraged to provide as much of the 30 m vegetative buffer as possible for natural streams, but no less than 3m for both streams and municipal drains. Landowners are encouraged to only disturbed one side of a drain during clean outs.

6. In addition to naturally vegetated buffers along watercourses, nutrient inputs within the subwatershed should be controlled by use of all available best management practices (as per Assimilative Capacity Study recommendations).

7. The Assimilative Capacity Study recommendations for long-term monitoring should be funded and implemented.

8. NVCA staff and their partner organizations should continue to work through the Community River Restoration Program to identify additional opportunities within the Innisfil Creek Subwatershed for focused, detailed restorations studies similar the Beeton Creek Stream Health Report.

Water Management:
9. The recommended stormwater control targets, as outlined in this report, should be adhered to.

10. The hydrologic model should be calibrated and verified using existing flow data and, if necessary, additional flow monitoring data.

11. SWM pond locations and sizing should be established at the Secondary Plan or Functional Servicing Plan stage.

12. Functional Servicing Plans should be completed as part of Secondary Plans and should be integrated with on-going water management projects by the NVCA.

13 A hydrologic computer model should be used by development proponents for calculating flows to size flood control facilities at the Functional Servicing Plan stage. Site-specific parameter values should be established during the Secondary Plan stage.

14 Efforts should be made to at least maintain the existing water balance and where possible enhance base flows throughout the Innisfil Creek Subwatershed as future development occurs.

15. The water balance model should be further refined and utilized as an assessment tool to quantify the impacts of existing and future water use practices on baseflow and to develop and evaluate strategies to minimize these impacts throughout the subwatershed.

16. Existing PTTW (surface water) should be reviewed to ensure that current water extractions do not exceed available quantities, particularly under baseflow conditions when irrigation is typically required (i.e. based on the water balance analysis, it appears that current permitted water extraction may exceed the available volume while still maintaining the minimum required flow based on the 30% Tennant's Method).

17. A method should be derived to facilitate the calculation of actual water extraction as opposed to maximum allowable extraction. This will enable a more accurate assessment of impacts of PTTW on base flow conditions and estimates of available quantities for extraction.

18 Base flow monitoring should be completed at key locations to further refine the calibration of infiltration and regional baseflow factors for the water balance model at the catchment level within the Subwatershed.

19 The Erosion Threshold Assessment (Appendix G) recommends the following requirements for detailed development applications studies, using a "best management" approach to achieve the targets:

- Undertake a pre/post development annual water budget as per the MOE stormwater manual to develop infiltration targets;
- Incorporate within the development design infiltration systems to try to meet the targets; and
- Within the SWM ponds, because of the high sensitivity to erosion in the watercourses, incorporate normal water quality first flush to be released over 48 hours.

Please see Appendix G for the details and a proposed long-term solution:

20. The Groundwater Study recommendations should be implemented and used as input to the source water protection planning process

21. It is recommended that a variety of education and incentive programs be developed promoting water conservation in rural areas for all water users (including those on private servicing), through cooperation and partnership with municipalities and all appropriate agencies. Serviced municipalities should continue to promote water conservation and ensure their water rates are structured to promote conservation and reflect the true service costs.

1. *INTRODUCTION*

The Innisfil Creek Subwatershed Plan is the third subwatershed plan developed by our Conservation Authority. It follows the Black Ash and Willow Creeks Subwatershed Plans. This subwatershed plan was undertaken because of its water quality and quantity issues and the development pressures it faces being located in south Simcoe County.

The Plan was developed in partnership with the municipalities of Adjala-Tosorontio, Bradford West Gwillimbury, Essa, Innisfil, and New Tecumseth. Staff from these municipalities, and the Ministries of the Environment and Agriculture provided a great deal of support and assistance through the steering committee.

NVCA staff were be able to collect information and monitoring data over several years, providing excellent baseline information. We were also very fortunate to be able to take advantage of provincial initiatives such as the Assimilative Capacity Study (ACS) to incorporate new water quality information, and computer modelling. ***(It should be noted that the water quality targets from the ACS and references to relevant legislation and provincial plans, have been updated in this subwatershed plan to November 2006.***

A number of subwatershed factors may make the Innisfil Creek subwatershed the logical pilot subwatershed to launch the implementation of ACS recommendations:

- existing baseline data
- understanding of subwatershed water quality and quantity issues (both within and downstream of the subwatershed)
- development pressures; and,
- identified nutrient loading targets

The Innisfil Creek Subwatershed is located south of Alliston in the south-east corner of the Nottawasaga River Watershed **(Map 1)**. It includes Innisfil Creek and these four tributaries, Bailey, Beeton, Cookstown and Penville Creeks.

Since a significant portion of Innisfil Creek's headwaters are located on the Oak Ridges Moraine, the requirements of the moraine legislation and plan have guided the development of this subwatershed plan.

This section outlines the background information and physical characteristics of the subwatershed that are relevant to this study. It describes the planning process, including community expectations for the Innisfil Creek. It identifies the water related issues specific to this subwatershed. The goal, objectives and ecosystem targets were developed to address these issues, and meet community expectations.

1.1. Why water must be managed on a watershed basis

The residents of the Innisfil Creek Subwatershed are well aware of the importance of

their water resources. Public concerns have been expressed through numerous local planning exercises regarding the impacts of land use and development on the quality and quantity of our surface and ground water.

Impacts on water resources are often not limited to the municipality in which they occur, but also affect adjacent and downstream municipalities. For example, the removal of a stream's headwater wetlands has the potential for significant impacts on downstream municipalities through reduced base flow, increased flooding, erosion, and water quality impairment.

Provincial initiatives:
The provincial government has recently initiated several programs to address the public's concerns regarding water management and to encourage its management on a watershed basis.

The provincial land use planning direction for water management is outlined in the new Provincial Policy Statement 2005 (PPS). It emphasizes wise water management on a watershed basis.

For example Section 2.2.1 of the new policy states *"Planning authorities protect, improve or restore of the quality and quantity of water by: a) using the watershed as the ecologically meaningful scale for planning."* …….[7]

More specific provincial direction stems from the Honourable Justice Dennis R. O'Connor's recommendation in part two of the Report on the Walkerton Inquiry. The report recommends that the Province adopt a watershed-based planning process led by the Ministry of the Environment and by Conservation Authorities. His first recommendation is that *"Drinking water sources should be protected by developing watershed based source protection plans. Source protection plans should be required for all watersheds in Ontario."* [8]

The province is implementing the Honourable Justice Dennis R. O'Connor's recommendations through several pieces of legislation including the *Clean Water Act, Safe Drinking Water Act, Sustainable Water and Sewage System Act* and *Nutrient Management Act*. The Clean Water Act establishes a framework for the development of source protection plans. The plans will protect human health by ensuring that current and future sources of drinking water in Ontario's inland lakes, rivers, groundwater and the Great Lakes are protected from potential contamination and depletion.

Source water protection has been defined as the first barrier is a multi-barrier approach to ensuring safe drinking water that safeguards the water in our lakes, river and aquifers.

The source water protection legislation and associated planning process will greatly

7 Provincial Policy Statement 2005 Page 16
8 Recommendation #1 of Part Two report of the Walkerton Inquiry: the Honourable Dennis R. O'Connor 2002

assist our authority in protecting our sensitive water resources. It will also provide for the creation and updating of useful technical models (hydrology, water budgets, nutrient, assimilative capacity and erosion models) that will be used in watershed and subwatershed planning. These studies will be in support of identifying and protecting the sources of both our ground and surface waters resources.

In response to growth pressures and problems associated with Urban Sprawl, the Ontario Government initiated an Intergovernmental Action Plan (IGAP) in partnership with the municipalities of Simcoe County, Barrie and Orillia. It examined the following:

- the existing water quality (nutrient loads) within our watershed;
- the existing development commitments and infrastructure requirements;
- an estimate of the appropriate level of development for the future; and
- an effective municipal governance structures.

The information from the IGAP analysis will also contribute to local growth and official plans that are required through the Places to Grow Act (June 2005) and the Growth Plan for the Greater Golden Horseshoe. One of their objectives is to curb urban sprawl and preserve valuable green spaces and agricultural lands. The implementation of this objective will greatly assist in implementing our subwatershed goal and objectives.

To provide the science for the Action Plan, it included an Assimilative Capacity Study (ACS) of the Lake Simcoe and Nottawasaga River Watersheds.

Assimilative capacity is defined as: “the relationship between water quality/quantity and land use and the capability of the watercourse or lake, to resist the effects of landscape disturbance without impairment of water quality.” The ACS builds on the technical information, and models developed for this Innisfil Creek Subwatershed Plan. The ACS study provides a model that can predict the impacts of various land use and development scenarios on water quality at the subwatershed level.

All information from the ACS and IGAP studies as is posted on the Simcoe County website at www.county.simcoe.on.ca/

Managing water issues within the context of a subwatershed helps us understand the relationships within the aquatic environment and with the terrestrial ecosystems. We now understand that in nature, “everything is connected to everything else”. This is the essence of “an ecosystems approach” and represents a holistic view of the natural environment that is a complex, interconnected, and dynamic system.

An ecosystem approach to land use planning and resource management requires that the boundaries for land use planning and management be based on biological or physiological units, not municipal boundaries. This provides a more rational context for examining the relationships between the natural environment and human activities. The primary boundary for considering water management features and functions is the watershed.

Local direction:
To provide an overview of water management and address broad water related issues, the Nottawasaga Valley Conservation Authority (NVCA) developed the "Nottawasaga Valley Watershed Management Plan (1996-2015)". It dealt with water management issues across the entire Nottawasaga River Valley, a drainage area of 3,360km^2.

The goal of this Watershed Plan is "To conserve natural resources within the watershed in a co-operative, integrated manner in which human needs are met in balance with the need to sustain the natural environment".

The preparation of this Watershed Plan was a major undertaking in the mid 1990's with extensive public consultation. The Plan was based on an ecosystems approach to water management and planning. It succeeded in coordinating the existing resource information, legislation and policies into a useful background document which supported and addressed a wide variety of land use issues; identified key responsibilities of stakeholders; and made recommendations for the implementation of resource management actions.

One of the recommendations from the watershed plan was the preparation of more detailed subwatershed studies for the "high priority subwatersheds". Criteria such as the significance of the ecological features, impacts from flooding and erosion, and stresses due to land use practices and development pressures, determined the priority. The Innisfil Creek Subwatershed was considered a high priority because of its ecological significance (headwaters in the Oak Ridges Moraine), development pressures, and water quantity and quality concerns.

The municipalities within the Innisfil Creek Subwatershed include the Townships of Adjala-Tosorontio and Essa, the Towns of Bradford-West Gwillimbury, Innisfil, and New Tecumseh. The Towns Mono and Caledon have very small portions of the subwatershed within their municipalities. The information and data from these two municipalities has been collected, but because of the small areas involved, they were not asked to contribute financially to the study. The municipalities formed a partnership with Simcoe County, the Ontario Government and NVCA to address the water management issues through this study.

This study is particularly timely considering all the recent province's legislation and regulations such as for the Oak Ridges Moraine Plan, Source Water Protection and the Intergovernmental Action Plan and Assimilative Capacity Studies. The subwatershed plan provides valuable input and baseline data, mapping and computer models to help landowners and municipalities implement the requirements of this new legislation, regulations and policies.

1.2. Oak Ridges Moraine Conservation Plan

The Oak Ridges Moraine Conservation Plan (ORMCP) was released on April 22nd 2002 as a regulation under the *Oak Ridges Moraine Conservation Act 2001*. The Plan is

deemed to have come into force on November 16, 2001. Municipal official plans and zoning by-laws in our area have been updated to conform to the ORMCP.

The purpose of the ORMCP is to provide land use planning and resource management direction to provincial ministries, agencies, municipalities, municipal planning authorities, landowners, and other stakeholders on how to protect the moraine's ecological and hydrological features and functions.

Section 24 of the ORMCP - *Watershed Plans*, states that every upper-tier and single-tier municipality shall, on or before April 22, 2003, begin preparing a watershed plan for every watershed whose streams originate within the municipality's area of jurisdiction. The watershed plan shall include, among other things, a water budget, water conservation plan, land and water management strategies, implementation and monitoring plans, and criteria for protecting surface and ground water quality and quantity. We prepared this plan to meet the ORMCP requirement for the Innisfil Creek subwatershed.

1.3. Municipal Benefits

There are many reasons to carry out this study apart from the requirements of the Oak Ridges Moraine Conservation Plan and the recommendations from the Walkerton Inquiry. Environmental protection and well-planned development are top priorities for residents within the subwatershed[9].

Residents have indicated through local planning processes and community strategic planning exercise that they wish to protect their natural environment and where possible, restore it. The subwatershed plan will assist the municipalities in achieving this community goal.

The plan facilitates dealing with complex water management issues across municipal boundaries, providing a mechanism for forming provincial and municipal partnerships to assist in sharing the costs and benefits. It will help coordinate all the many provincial, municipal and conservation authority, water management programs.

The watershed plan will assist the municipalities in making better-informed decisions related to the subwatershed's ecosystem and water management. The study will:

- provide management strategies to ensure the health of the water resources are maintained and where possible restored, so as to fulfil community goals for the watershed
- consider impacts of future development , land use and natural stresses
- provides a basis for commenting on development applications such as subdivisions and site plans (for example identifying the natural heritage system)
- develop an understanding of the current watershed health and conditions through the collection of baseline data, generation of computer models and mapping of

9 Community Strategic Planning Sessions, October 2002 Nottawasaga Community Economic Dev Corp.

resources and provide data and inputs to studies that follow such as the Assimilative Capacity, Growth Strategies, and Source Water Protection Plans. These studies will build on and add to the data and models developed for the Innisfil Creek Subwatershed Plan.

1.4. Innisfil Creek Subwatershed Issues

It is very important to scope any subwatershed study to deal with its specific water management issues that are of concern to the local residents.
Agricultural uses such as sod and potato farms, market gardens and nurseries use water for irrigation. Water usage has been an issue during summer months (particularly during dry years) as it affects stream base flows. Some residents have expressed concerns regarding the lack of Innisfil Creek base flow, particularly upstream of its confluence with Penville Creek. They are concerned that the lack of flow is having a negative impact on the fish and wildlife communities that depend on this water to survive. For example frogs, crayfish and minnows have been concentrated in small pools making them easy pray for raccoons and skunks. The lack of flows also prevented fish from migrating into portions of the creek to spawn.

Development pressures from the designated settlement areas of Beeton, Bond Head, Churchill, Colgan, Cookstown, Loretto, Newton Robinson, Penville, Tottenham, as well as several large new proposals, may impact the subwatershed.

Significant development pressure may also come from developers “leap-frogging” over the Oak Ridges Moraine and Greenbelt Plan and are attracted to the area’s transportation corridors of Hwy 400, 27, and a proposed extension to 427.

The residents within the subwatershed are well aware of these development pressures and issues. They have expressed the desire, to protect their existing natural environment (woodlands, wetlands, and trout streams) and to restore those areas that have been damaged. They have indicated that they enjoy seeing the wildlife such as songbirds, wild turkeys and deer that require these habitats to survive. The natural areas that support this wildlife combined with the rural/agricultural landscape, define the character of the subwatershed. Residents credit this rural character as a very important factor in why live in the area.

The following is a summary of the significant issues of the subwatershed and the related community expectations to be addressed by this study. It was derived from consultation with the municipalities regarding the concerns of their residents, and direct communication with subwatershed residents through an “open house” held in June, 2003. It also includes the input from the recent community strategic planning exercises and the expectations expressed in previous studies such as municipal official plans.

In order to protect their natural environment (enhancing it where possible) over the long-term and in a sustainable manner, residents expect those involved in planning and resource management to:

- Protect significant natural areas and green spaces (woodlands, wetlands, stream valleys etc.)
- Restore degraded natural areas where possible
- Maintain, and where appropriate improve, stream conditions (to a level capable of supporting sport fisheries)
- address the surface water quantity issues and impacts on base flows
- Protect ground water quality and quantity to ensure a safe and sustainable supply of drinking water
- Protect residents from flood and erosion damage

1.5. Goal, Objectives and Ecosystem Targets

The goal, objectives and targets were developed to meet the expectation of the subwatershed residents and address the issues outlined above. The plan also includes the targets prescribed in the Oak Ridges Moraine Conservation Plan as well as targets promoted by Environment Canada through *"How Much Habitat is Enough".*

We have also included the water quality target from the Assimilative Capacity Study.

These targets will help us achieve our goal and objectives by making it possible to actually measure our progress over time. The objectives and corresponding targets are provided in a chart format to make it easier to follow.

Goal: The goal of the Innisfil Creek Subwatershed Plan is: "To conserve Innisfil Creek's natural resources in a cooperative, integrated manner in which human needs are met in balance with the need to sustain and, where possible, restore the health of the natural environment."

Subwatershed Objectives	Subwatershed Targets
Natural Heritage System • To identify and protect the significant natural heritage system (woodlands, valleylands and wetlands etc.) and their functions (e.g. providing wildlife habitats) • To identify opportunities for restoration of degraded natural areas	• 30% of the area of the subwatershed should be in self-sustaining vegetation[10] • At least 10% of the subwatershed should be forest cover (interior forest habitat) that is 100 metres or further from the forest edge (5% should be 200 metres or greater from the forest edge)[11] • 10% of the subwatershed should be wetlands[12.]
Aquatic Ecosystem • To identify and protect unimpaired streams, which are those capable of supporting	• 75% of the subwatershed's natural stream length should be naturally vegetated (30m) on both sides of the stream.[13]

10 Oak Ridges Moraine Conservation Plan ,2002 page 51
11 How Much Habitat is Enough, Environment Canada Great Lakes Fact Sheet
12 ibid
13 How Much Habitat is Enough, Environment Canada Great Lakes Fact Sheet

healthy warm and cold water aquatic ecosystems, including top predator species such as bass and pike (warm water) and trout (coldwater) • To identify opportunities to restore selected impaired steams such that they would eventually be capable of again supporting cold water species	• Total suspended sediment concentrations should be below 25 mg/l[14] • The Target for Total Maximum Yearly Load (TMYL) of phosphorus is 5,427 kg/yr[15]. This target equals the total phosphorus load estimated under the committed growth to the year 2026, with assumed implementation of the Best Management Practices. However, even with the BMPs, the subwatershed is still impaired and does not meet the provincial water quality standard of 3603 kg/yr.[16]
Water Management • To quantify surface water resources and to help ensure its use is sustainable over the long-term without harming the aquatic ecosystem • To identify and protect sensitive ground water resources • To ensure flooding and erosion impacts are minimized	• The percentage of impervious surfaces within any subwatershed should not exceed 10%.

Please Note: As new information evolves from the Assimilative Capacity Study with further analysis and monitoring; it will be posted on our website at www.nvca.on.ca

Current status of Subwatershed Targets

The chart below provides a summary of the current status of our subwatershed resources in relation to achieving the above targets.

Innisfil Creek Subwatershed Current Conditions	Area km^2	Vegetated Streams %	Impervious Surfaces %	Wetlands %	Forest Cover %	Interior Forest % (at least 100m to Forest edge)	Total Suspended Sediments (baseflow) (mg/L)	Phosphorous (kg/yr)
	491.0	**23.6**	**1.7**	**8.4**	**14.9**	**2.6**	**30.64**	**7105**[17]

The following provides a short explanation on the current status of our targets across

14 ibid
15 Assimilative Capacity Study, Pollutant Target Loads: Lake Simcoe and Nottawasaga River Basins, Final Report, Louis Berger Group and Greenland International Inc. June 2006 Page 3-4 Table 3.0-1
16 ibid
17 ibid

the subwatershed

Natural Heritage System

- Forest Cover: the percentage of forest cover for Innisfil Creek subwatershed is 14.9% .This represents about half of our target so forest cover should be maintained where possible and restoration efforts increased.

- Interior Forest Habitats: These are the larger forest blocks that are capable of supporting bird species that require interior forest habitats to survive. Across the subwatershed we currently have approximately only 2.6% forest cover with at least 100 metres or further from the forest edge. This means we have only slightly more than one quarter of our target of 10%, so forest interior habitats should be retained where possible and restoration efforts increased to develop more interior habitats.

- Wetlands: The percentage of wetlands within the subwatershed is 8.4% or 1.6% below the 10% target. Wetland restoration should be encouraged wherever possible particularly in the important headwaters within the Oak Ridges Moraine.

Aquatic Ecosystem

- Riparian Stream Cover: the subwatershed plan has indicated that it is desirable to have a 30 m riparian stream corridor on both sides of all our streams. Approximately 38% of the lands within this stream corridor currently have adequate forest cover while our target is 75%. It should be noted that we do not expect that municipal drains will be able to maintain as much riparian vegetation as natural streams. We will be encouraging landowners to maintain as much riparian vegetation as possible.
- Total suspended sediments: Innisfil Creek is over the target of 25mg/L levels at 30.64mg/L during base flow conditions. We know that suspended sediments may affect aquatic habitat adversely by filling in the bottoms of lakes and streams thereby limiting habitats for aquatic invertebrates. Under extreme conditions fish eggs may be smothered.
- Nutrient Loads: Phosphorous is the key water quality parameter of interest. The Assimilative Capacity Study Report for Pollutant Target Loads, June 2006, estimates that the current yearly load of Phosphorous for this subwatershed is 7105 kg. A phosphorous target load based on the Provincial Water Quality Objectives would be 3603 kg/yr. We would be required to reduce our estimated current loads by approximately 3502kg/yr to meet this target. The June ACS report is suggesting that an achievable target would be a Total Maximum Yearly Load of 5,427 kg/yr. for phosphorus. This target equals the total phosphorus load estimated under the committed growth to the year 2026, with assumed implementation of all Best Management Practices (estimated cost $28.2 million). We would be required to reduce our estimated current loads by approximately 23.6% to meet this target.

Water Management

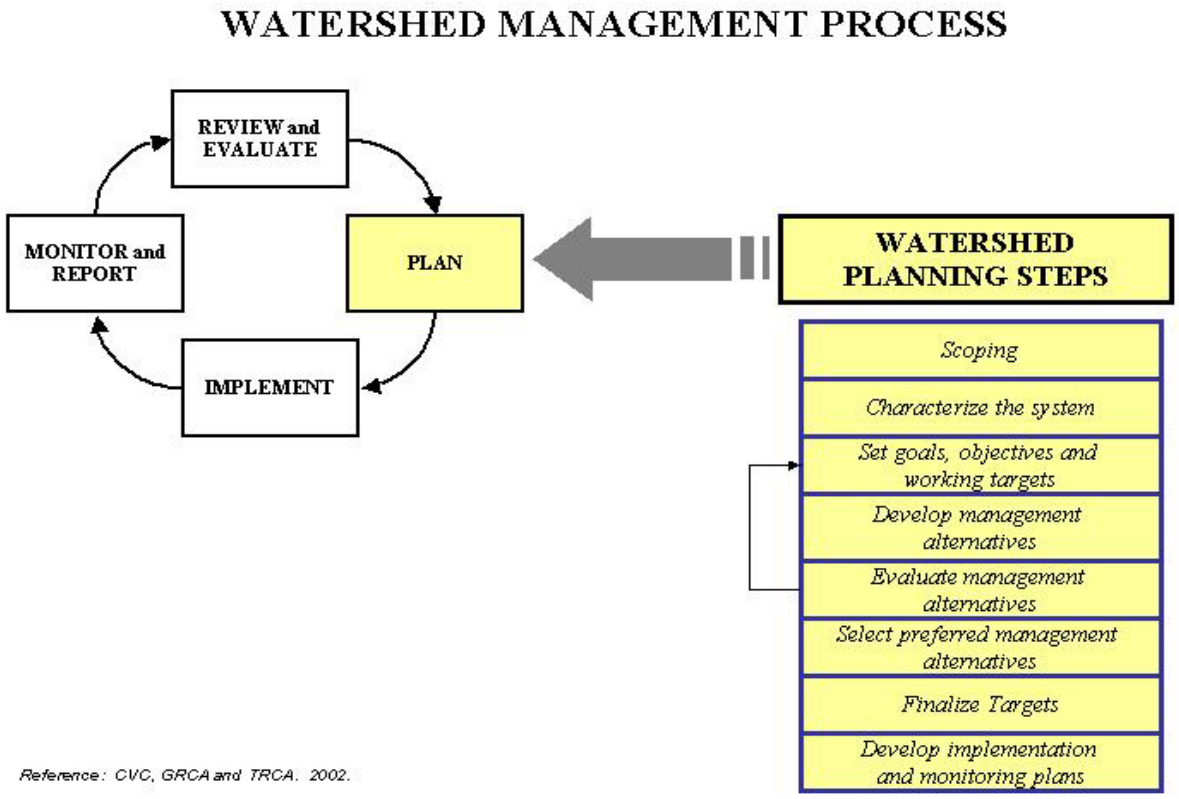
- Impervious surfaces: These are areas that do not allow for infiltration of rain and snow melt, such as roads, roof tops, parking lots etc. They are most concentrated in urban areas and if not properly managed, result in flooding erosion and water quality problems.

  Our subwatershed is predominantly rural in nature (approximately 2.0% in settlement or urban areas). However, not all of the urban area is considered to be impervious (approximately 1.7%). The target of maintaining less than 10% of impervious surfaces in every subwatershed is currently achieved.

1.6. Study Process

The approach taken in developing the subwatershed plan follows the adaptive watershed management process required for the Oak Ridges Moraine and outlined in Figure 1. This adaptive process emphasizes that the subwatershed plan is a "living document" that will change and evolve as new information, computer models and monitoring becomes available. Specifically the plan is being developed in three phases, which are described in Figure 2.

Figure 1 Watershed Management Process



The study began in March 2001 with the first organizational meeting for the study held

August 15th 2001. The first phase of scoping the issues, resource characterization and data collection began in the summer of 2001 and included the initial hydrology model development. Data Collection continued to 2004 to obtain additional information on water quality and stream flows.

Figure 2: Summary of the Study Schedule

Phases	Description	Time Frame	Report Dates
Phase I	Scoping Issues, Resource Description and Data Collection	June 2001- July 2004	Phase 1 Interim Report- Nov 2002
Phase II	Analysis and Evaluation	Jan. 2003-July 2004	Phase 11 Interim Report- May 2003
Phase III	Strategy Development and Plan Preparation	Dec. 2003 – Dec 2004	Draft Plans – April. 2005 Final- Spring 2006

The plan is written for as wide an audience as possible, in a clear and concise manner, with most of the technical data located in the appendices.

Development of the subwatershed plan and mapping was designed to make them easily accessible and updated on the NVCA's website at www.nvca.on.ca and for distributed on a CD.

1.7. Public Consultation

Public consultation is an important component of this study. The public input to date on community expectations and issues has come through a public open house held on June 18th, 2003 at the Town of New Tecumseth's council chambers. Additional input was received through the municipalities as part of their land use and strategic planning exercises.

Public input was also obtained through our participation in public meetings held by the Town of New Tecumseth, Adjala-Tosorontio and Simcoe County for their Oak Ridges Moraine official plan amendments.

In reality, public consultation will also continue for some time on the information and data from this plan through the large consultation processes established for the Assimilative Capacity and Source Protection Studies. These plans build on this study and we will take the opportunity to use their consultation processes to further consult with the public on the subwatershed plan.

1.7.1. Steering Committee

The Steering Committee has directed the study and provided a conduit for additional public inputs. The committee is made up of the subwatershed municipalities of Adjala-Tosorontio, Bradford-West Gwillimbury, Essa, Innisfil, and New Tecumseth, as well as Simcoe County, Ministry of the Environment (MOE), Ministry of Agriculture Food

(OMAF) and the Nottawasaga Valley Conservation Authority (NVCA). The Ministry of Natural Resources provided technical input and received the meeting notes and draft documents for their review and comments.

1.8. Resource Characterization

This section provides a brief summary of those physical characteristics of the subwatershed that play an important role in water management.

1.8.1. Drainage

Innisfil Creek is a large subwatershed of approx. 491 km^2 (Map 1). It has a maximum width of approximately 15km and length of 44 km. Bailey, Beeton, Cookstown and Penville Creeks are the most important tributaries and include approximately 150 km of municipal drains[18]. Innisfil creek enters the Nottawasaga River south of Alliston within Lot 9, Con. 12 of the Town of New Tecumseth, approximately 80 km from the Nottawasaga Bay at Wasaga Beach.

1.8.2. Quaternary Geology and Physiography

The subwatershed's quaternary geology and physiography indicates how the soil material was deposited during and following glaciation (Map 2. This provides useful clues regarding soil drainage characteristics including the type of material and compaction characteristics. This information along with the soils data is helpful in identifying ground water recharge areas and potential wetland restoration sites.

The Innisfil Creek Subwatershed is made of three broad physiographic features. The northern quarter of the subwatershed is primarily a drumlinized till plain. Soil material may vary in texture and may be very compacted in places. Recharge characteristics will likewise vary from good to poor.

The central half of the subwatershed is a sand and clay plain. This material was deposited in standing water and tends to be much finer material with generally poor drainage. The recharge capability of this area is much reduced because of the heavier soils.

The southern quarter of the subwatershed is a kame moraine (Oak Ridges Moraine), which indicates that the glacial material was deposited in association with water. This water removed some of the fine material (clay and silt) generally lead to good drainage and the potential for significant recharge capabilities.

1.8.3. Soils

The soils reflect the characteristics of the physiographic features which deposited the soils (Map3).For example moraine soils deposited by a glacier may be more compacted and contain a mixture of soil textures where as soils associated with water disposition are often more sorted (layered).

The soils of the Oak Ridges Moraine are primarily Tioga sandy loams, generally with good drainage and ground water recharge capability.

18 Final Report, Innisfil Creek Watershed Study ,Triton Engineering for NVCA, 1983

The soils of the central clay and sand plans are glacial lake bottoms and made up of Schomberg clay loams and Alliston sandy loams. They are heavier, layered soils and generally do not facilitate as much recharge.

The soils of the northern till plain are primarily Bondhead loam and sandy loams. They are more mixed in texture and may be compacted, but generally provide better drainage than the clay plains and facilitate more ground water recharge.

1.8.4. Land Use

The predominant land use in the subwatershed is agriculture (approximately 70%) including livestock/feedlot operations, cash crops, market gardens, tree nurseries and sod farms.

There are rural pasture lands and meadows (10%) some of which are reverting to natural vegetation, particularly on the Oak Ridges Moraine and the till plain in the north. The forest cover (approximately 15%) is concentrated within the wetlands, the Oak Ridges Moraine (ORM) and along the stream and creek valleys. There are also small woodlots located at the back of many farms.
The urban areas (less than 5%) include Beeton, Bond Head, Churchill, Colgan, Cookstown, Loretto, Newton Robinson, Penville, and Tottenham. Alliston is located approximately 2 kilometres north of the subwatershed. There are also many rural residential developments created through subdivisions and land severances scattered through out the subwatershed.

Several factors suggest that the subwatershed faces substantial development pressure. The subwatershed is located immediately north of the Oak Ridges Moraine. Since new development is very limited on the moraine, the subwatershed is experiencing a great deal of development activity. In addition the transportation corridors of highway 400, 27 and the proposed 427 run through the subwatershed making development even more attractive. For example developers are promoting the creation of a site just south of Thompsonville in the Town of New Tecumseth containing up to 50,000 residents (the town has not approved this proposal). Another development for 7000 resident (Belterra) was approved by the Town near Green Briar (approximately a kilometre north of the subwatershed). A development with a 1000 residents is proposed for just north of Tottenham. A very large development has also been proposed within the subwatershed between Bond Head and Bradford. If approved, an additional 75,000 people could eventually move to this area.

The amount of new development and where it will be located will ultimately be directed through the Intergovernmental Actions Plan, the Places to Grow Act and Growth Plan for the Greater Golden Horseshoe.

2. *PROPOSED MANAGEMENT STRATEGIES*

In order to assist the municipalities within the Innisfil Creek Subwatershed in meeting their residents' expectations and to address the specific issues of the subwatershed, the following proposed strategies were developed. They provide the details on how the broad goal, objectives and targets listed in section 1.5 will be achieved.

The strategies contain recommendations, implementation options and evaluation and monitoring programs to judge the success of implementation. The plan provides a mechanism to make adjustments to those strategies if it is found through monitoring, that the plan's goal and objectives are not being achieved.

The main ways of displaying any changes or updates to the plan will be through addendums or updates placed on our website at www.nvca.on.ca . This will ensure that our clients and the public will have immediate access to the most up-to-date information on the subwatershed plan.

The subwatershed management strategies are outlined under two major sections. The first addresses the natural heritage system, including both aquatic and terrestrial ecosystems. The second section addresses the water management strategies including water and nutrient budgets, erosion modelling, source protection and water conservation. Naturally all these strategies are linked and dependent upon each other.

The Innisfil Creek Subwatershed Plan recommendations are outlined in the plan within the related sections.

A summary of all recommendations and implementation mechanisms is provided in **Table 2** of this report.

2.1. Natural Heritage System Strategy

The natural heritage system is made up of "significant", as defined by the *Provincial Policy Statement 2005* (PPS), natural heritage features and areas linked by natural corridors and valleylands. It is very important to remember that these features are part of a large interconnected system rather than separate individual features. The plan identifies this system as well as strategies to protect them.

Priority restoration areas are also identified. These areas, once rehabilitated, will provide a significant contribution to the natural heritage system.

A "systems" approach to natural heritage identification has been promoted for some time. In 1994, Riley and Mohr stated: "*Integrated networks of conservation lands and water are the appropriate and practical method to define the natural landscape we wish to conserve*".[19]

Our natural heritage areas are valued for their long-term contribution to the quality of

19 "The Natural Heritage of Southern Ontario's Settled Landscapes", Riley and Mohr, OMNR 1994, page 32

life. They are very important to the economic and social fabric by providing tourism and recreational opportunities. In many cases, these features help to define the character of an area. For example, the Oak Ridges Moraine plays a major role in defining the natural landscape and character of the headwaters of the Innisfil Creek Subwatershed.

2.1.1. Natural Heritage System Identification

We must use two sets of provincial criteria for identifying the "significant" natural heritage feature within this subwatershed.

The first criteria apply to the Oak Ridges Moraine (ORM) using the *Oak Ridges Moraine Conservation Plan* (ORMCP) criteria.

The second set of criteria, for areas off the moraine, uses the Provincial Policy Statement (PPS) and the supporting guidelines.

Please see **Appendix A** for details on the criteria for identifying the Innisfil Creek Natural Heritage System.

On the ORM: the policies and criteria established by the *Oak Ridges Moraine Conservation Plan* and supporting *Draft Technical Papers* were used to identify the "Key Natural Heritage" and "Hydrologically Sensitive Features". Provincial mapping of some of these features (woodlands and wetlands) was used for the natural heritage system on the Oak Ridges Moraine.

Off the ORM: the natural heritage system was identified based on the provincial criteria, and policies as outlined in the *Provincial Policy Statement 2005 (PPS)*. The PPS represents the minimum standards and criteria that are to be used to identify the subwatershed's natural heritage system.
Where it is appropriate to meeting community expectations and/or necessary to maintain a healthy sustainable natural heritage system, the subwatershed plan makes recommendations that go beyond the minimum requirements of the PPS. For example, the plan recommends that all wetlands should be protected from any development or site alteration.

The Town of New Tecumseth, Essa Township and NVCA are also preparing detailed Natural Heritage Strategies that provide more information than this subwatershed plan. They use the ecological land classification system as the basis for identifying the vegetation communities within the municipalities. The strategy will identify the "most significant" or" key" areas within the municipalities that should be protected from any development or site alterations. Once these areas have been identified and agreed to by the municipality, they will be incorporated into their official plans as well as this subwatershed plan as part of the "no development areas" along with the wetlands.

The PPS supports municipalities going beyond the minimum requirements by stating that *"the policies of this Provincial Policy Statement represent minimum standards. This Provincial Policy Statement does not prevent planning authorities and decision-makers*

from going beyond the minimum standards established in specific polices, unless doing so would conflict with any policy of this Provincial Policy Statement."[20]

While the individual components that make up the Innisfil Creek Subwatershed natural heritage system have been identified, the entire interconnected system (including significant valleylands, forests, wildlife habitats, wetlands etc) has been mapped as a system (Map 5**).**

The process of developing the subwatershed's natural heritage system was started by mapping the existing system such as the Simcoe County "Greenlands" (shown on Map 5 as the "*Current Natural Heritage System")*. Supplemental information such as the forest information from Ontario Base Mapping and digital colour infrared air photos (1998) was used to identify potential "significant" areas for additions to the existing natural heritage system.

Field investigations in 2003 and 2004, assisted in verifying these additions (shown on Map 5 as "*Proposed Natural Heritage Additions")*.

The most restrictive category of the Natural Heritage System is the *"no development or site alteration areas"* which include all wetlands, mapped key natural heritage features within the ORM, plus any other "key" areas that may result from the New Tecumseth and Essa's Natural Heritage Strategies. They are shown in a separate category on the Natural Heritage System (Map 5).

Other municipalities may not have sufficiently detailed inventories or evaluation systems to support the identification of their "key" or most significant features. These areas will be added to the subwatershed's natural heritage system through updates on our web site, as other municipalities conduct similar detailed evaluations.

The Innisfil Creek Natural Heritage System includes the following "significant" natural features and areas.

2.1.1.1.Oak Ridges Moraine

The province has called the Oak Ridges Moraine one of its most significant landforms. The Oak Ridges Moraine Act and Conservation Plan is an ecologically based plan, using the most recent science, criteria and standards providing direction for land use planning and resource management to protect the moraine.

The following are the "key natural heritage features" on the moraine where no development or site alteration is permitted.

- All wetland
- Significant Portions of the habitat of endangered, rare and threatened species
- Fish habitat

20 "Provincial Policy Statement" 2005 Government of Ontario, Section 4.6 page 24

- Areas of natural and scientific interest (ANSI) -life science
- Significant valleylands
- Significant woodlands
- Significant wildlife habitats
- Sand barrens, savannahs and tallgrass prairies.

The ORM Draft Technical Papers prepared by the province provide the criteria for identifying these features. The province has also provided mapping identifying some of these key features (woodlands, wetlands, ANSIs, and rare threatened and endangered species etc.). This mapping forms the basis of our ORM *"no development or site alteration areas*" designation on Map 5.

Key natural heritage or hydrologically sensitive features that have not been mapped such as significant wildlife habitats or valleylands must be identified and protected from development or site alteration as part of any site-specific development application on the Oak Ridges Moraine.

2.1.1.2.Fish Habitats

Fish habitat: *"as defined in the Fisheries Act c F-14, means 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"*[21].

Riparian habitats are those naturally vegetated areas associated with the stream corridor or valley. The Innisfil Creek currently provides primarily warm water fish habitat, with some cool and cold water habitat in the headwaters of Bailey and Beeton Creeks (Map 7). Bailey creek has the largest percentage of cold water fish habitats.

To protect this habitat, maintaining a 30 metre vegetative buffer on either side of a natural stream is recommended as the ideal to lower water temperatures and reduces nutrients and sediments reaching the streams.[22]

Not all of the riparian zones have been mapped. Only the riparian zones of major tributaries where they are part of a significant valley lands or wildlife corridor have been shown on map 5 as additions to the natural heritage system. The maintenance of the 30m of buffer is important for all natural streams even those not shown on map 5.

For municipal drains in existing agricultural areas, we encourages landowner to leave one side of the drain in natural vegetation and carry out clean outs and maintenance on the other side. If possible, a minimum of 3 m vegetated buffer should be left on both sides of the drain. This would reduce the impacts on the stream.

Other existing agricultural areas should also provide as much of the 30 m vegetative buffer as possible on natural stream, but no less than 3 m on either side of the stream as indicated through the Nutrient Management Act..

---

21 "Provincial Policy Statement" 2005 Government of Ontario, Definitions, page 30
22 Environment Canada's "How Much Habitat is Enough" Second Edition 2004, page 8

Our target is to ultimately have 75% of the natural stream riparian areas in native vegetation. Since only approximately 20% of the stream riparian areas within the subwatershed are currently adequately vegetated on both sides of the stream. Maintaining existing riparian vegetation will be a priority.

Vegetated riparian areas provide very important wildlife habitat and travel corridor often connecting larger natural heritage blocks as well as protecting the aquatic habitats.

2.1.1.3.Significant Habitat of Endangered and Threatened Species (plus Rare Species within the ORM)

Endangered species "*means a 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".*

Threatened species "*means a species that is listed or categorized as "Threatened Species" on the Ontario Ministry of Natural Resources official species at risk list, as updated and amended from time to time".*[23]

Rare Species "means 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."[24]

Within the subwatershed, provincially rare moss was reported in 1950, damselfly/dragonfly in 1999, and a red-shouldered hawk in the early 1990s. It is the provinces' policy not to provide the location of these species for their protection. Consultants or landowners can obtain the general locations of these species through the Ministry of Natural Resources or NVCA. As part of environmental impact studies, for specific properties, developers may have access to the detailed information regarding any species of concern on the property through the same sources. At this time, there have been no reports of threatened or endangered species within the subwatershed.

2.1.1.4.Wetlands

The province defines wetlands *"as lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface. In either case the presence of abundance water has caused the formation of hydric soils and has favoured the dominance of ether hydrophytic plants or water tolerant plants.*

Periodically soaked or wet lands being used for agricultural purposes which no longer exhibit wetland characteristics are not considered to be wetlands for the purposes of this definition". [25]

---

23 "Provincial Policy Statement" 2005 Government of Ontario, Definitions page 30 and 37
24 Oak Ridges Moraine Conservation Plan, Government of Ontario, Queen's Printer, Page 11
25 "Provincial Policy Statement" 2005 Government of Ontario, Definitions page 37

Not all wetlands have as yet been identified in our watershed. There will be a significant number of our wetlands not yet identified. Some of these unidentified wetlands have been found through the Town of New Tecumseth's Natural Resource Management Plan (NVCA, 2004) within the Bailey Creek, Beeton Creek and Innisfil Creek catchments.

Addition wetlands have also been identified through the preparation of mapping for the Conservation Authorities new Generic Regulations. Once this regulation comes into force (scheduled for May 1st 2006) this new mapping will be available through our office and eventually on our website.

All wetlands are very important since they help to maintain and improve our water quality through trapping of sediments, retaining nutrients, contaminants and removing bacteria. Wetlands also moderate water temperature, maintain base flows, attenuate floods, store carbon, provide important groundwater recharge/discharge functions, control erosion and provide recreational and economic benefits.

This plan maps all wetlands including any wetlands found during this study or those identified through the Natural Heritage Inventory and Evaluation undertaken by the authority and the Town of New Tecumseth and Essa Township.

Our target is to have at least 10% of the subwatershed as wetlands. Currently only approximately 3% of the subwatershed is wetlands, therefore this plan recommends that all remaining wetlands (meeting provincial criteria to be called a wetland) be identified and protected.

2.1.1.5.Wildlife Habitats

These are *"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 cycles; and areas which are important to migratory or non-migratory species."*[26] In most cases these habitats will already be identified as important functions of the natural heritage system including wetlands, woodlands, and valley lands. For example, Cookstown Hollows wetland, and Churchill and Bailey Creek Swamps have all been identified by the Ministry of Natural Resources (MNR) as containing major deer wintering areas.

Important wildlife habitats that are not already identified within the Natural Heritage System, (significant meadows habitats etc.) will be included in the natural heritage system as they are identified.

2.1.1.6.Woodlands

These are*" treed areas, that provide environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and*

26 ibid

nutrient cycling, provision of clean air and the long term storage of carbon, provision of wildlife habitats, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed area, woodlots or forested areas and vary in their level of significance at the local, regional and provincial levels."[27]

Riley points out in *Southern Ontario's Settled Landscapes* that "*Across Southern Ontario, woodland losses have exceeded those of almost any other major ecosystem".*[28]

Our target for woodlands in the subwatershed is to maintain at least 30% of the subwatershed in forest cover. Since the Innisfil Creek Subwatershed only has approximately 15% forest cover, protecting existing significant woodlands and rehabilitating priority areas is very important.

Following provincial guidelines, significant woodlands within this subwatershed are generally those 4ha or greater (0.5 ha within the ORM Natural Core and Linkage areas).

It should be noted that the more detailed municipal assessments and evaluations of natural heritage features may result in the use of different criteria.

2.1.1.7.Valleylands

Valleylands are *"a natural area that occurs in the valley or other landform depressions that has water flowing through or standing for some period of the year"*[29]. Valley lands associated with Innisfil Creeks represent the skeleton or framework for the subwatershed's natural heritage system. They provide critical linkages and wildlife corridors and also support important fish and wildlife habitats. They act as both corridors and core areas for many different species.

Valley lands have been included as part of the Natural Heritage System. In some cases, the areas identified represent the actual defined valley; in other cases a 30 m corridor on either side of the natural stream has been identified.

2.1.2. Restoration and Rehabilitation Opportunities

Opportunities to rehabilitate the natural heritage system through wetland restoration or the planting of shrubs and trees have been identified and mapped (Map 6). Sensitive headwater areas represent a very high priority for these plantings.

Upland areas where plantings would eventually fill in open spaces making for larger interior forest blocks are also identified as priority areas. This would improve the wildlife habitats, for those species requiring larger interior forest patches.

In order to improve our surface and ground water quality, reduce flooding, and provide wildlife habitats, the plan encourages the restoration of impaired wetlands. These

27 ibid
28 "The Natural Heritage of Southern Ontario's Settled Landscapes", Riley and Mohr, MNR, 1994 page 27
29 "Provincial Policy Statement" 2005 Government of Ontario, Definitions page 37

potential wetland restoration areas are also identified.

Target Summary:

- **To meet our ultimately riparian targets of natural vegetation along 75% of the subwatershed's natural streams, we must restore a further 52% of the streams, since only 23% are currently adequately vegetated.**

- **To meet our target of 30% forest cover for the subwatershed, our restoration target is 15%, since only 15% of the subwatershed is currently woodlands.**

- **To meet our wetland target of 10% of the subwatershed area, our restoration target is an additional 2% of the subwatershed should be restored to wetlands.**

It must be emphasized that this restoration work can only be carried out through cooperative partnerships with the landowners and the various community stewardship organizations. They include groups such as youth clubs (scouts and guides), naturalist clubs, Chambers of Commerce, angler and hunter clubs, Ducks Unlimited, the Ministry of Natural Resources Stewardship Councils and NVCA stewardship programs. Naturally any rehabilitation or restoration work can only proceed with the landowner's permission and cooperation.

2.1.3. Natural Heritage System Proposed Recommendations

The following are the recommendations that stem from the need to identify and protect the subwatersheds Natural Heritage System.

……

The value and contribution of all wetlands to our natural heritage system has been well documented. As a result of the significance of these wetlands to the Innisfil Creek Subwatershed Plan, the following is recommended:

Recommendation #1:

Municipalities should incorporate policies in their official plans indicating that "no development or site alteration" shall be permitted within any wetland meeting provincial criteria for a wetland.

NVCA will implement this policy to protect all wetlands through its planning and permitting processes. In addition, NVCA will work with municipalities, MNR, Duck Unlimited and other potential partners to identify all the wetlands within the subwatershed that meeting provincial criteria to be called a wetland.

……

Detailed Natural Heritage Evaluation studies have been conducted by NVCA and the Town of New Tecumseth and Essa Township. They will be identifying their "most"

significant or "key" natural heritage features. As these areas and protection policies are approved by their council, they will be identified on our maps and posted on our website.

Recommendation #2:
Municipalities that conduct a detailed natural heritage evaluation identifying their "most significant" or "key features" should place them in their most restrictive official plan designation to ensure that no development or site alteration occurs.

All municipalities within the subwatershed should conduct similar detailed natural heritage evaluations.

……

The subwatershed plan has provided a more detailed examination of the significant natural heritage system than has previously been undertaken by the county or the municipalities. As a result there are proposed additions to the natural heritage system that have been identified based on the provincial criteria for defining significant areas as outlined in **Appendix A**.

Recommendation #3:
The proposed additions to the Natural Heritage System (Map 5), should be incorporated into municipal planning documents. Policies should be provided to protect the natural heritage system from incompatible land use and development.

It must be emphasized that the "Proposed Additions to the Natural Heritage System" **will not affect landowners existing uses or resource management of their propert**y. If a landowner is within a "proposed additions to the natural heritage system", they can continue to manage and enjoy these lands as they do now.

The additions to the natural heritage system identified in this plan are a "green flag" or an "early environmental warning system" for landowners and the municipalities for any new development that may be proposed for the area.

For example, landowners or developers applying for a subdivision development within this area would know upfront that there may be environmental constraints on the property. The municipality should require an environmental impact study identifying the natural features and functions, the possible impacts from the proposal and how these impacts can be mitigated to ensure no negative impacts.

Eliminating the potential impacts from development on our natural heritage system is a common objective of landowners, developers, municipalities, approval authorities and review agencies.

……

To assist in meeting our targets for forest cover, wetlands, and stream riparian areas

and to provide the greatest restoration benefits to our natural heritage system, the plan recommends the following:

Recommendation #4:
Landowners, environmental organizations and stewardship agencies should consider the restoration and rehabilitation areas (Map 6) when identifying potential projects.

The landowners and partner organizations should consider choosing their rehabilitation projects from the potential restoration riparian, wetland or upland sites identified on map 6. Selecting projects from these priority areas will provide the greatest benefits to the aquatic and terrestrial ecosystems. Additional potential restoration areas may be identified through other studies such as the Source Water Protection Plans. Map 6 will be updated on our website as this information becomes available.

Again, it must be emphasized that no restoration program can proceed without the permission and full cooperation of the landowners.

2.2. Aquatic Ecosystem Strategy

The aquatic ecosystem is an integral part of the natural heritage system, some of which such as fish habitats and riparian areas, have already been described in general terms in the previous section. This section discusses the aquatic ecosystems in much greater detail. It describes our efforts to monitor the health of the aquatic system, examines the fish habitat distribution (which also gives us clues regarding stream water quality), and examine restoration opportunities. All of these activities and programs assist us in monitoring the achievement of our aquatic ecosystem and water management objectives and targets.

2.2.1. Water Quality and Stream Health

Commencing in the fall of 2001, NVCA's Watershed Health Monitoring Department initiated a stream health or biological assessment of Innisfil Creek for the subwatershed study (details are provided in **Appendix B**).

Stream health is a measure of how closely a stream's habitat, water quality and living community match its historical potential. We are able to evaluate a site's potential by comparing it to other streams (reference sites) that share similar physiographic and historic attributes such as soil types, substrate, gradient, temperature, and groundwater flows, but are still in a "pristine" (unimpaired) condition.

Biological monitoring was born out of the concept that the community of living things at a site tells a lot about habitat and water quality. In a biological sense, unimpaired streams are those in which living communities are largely shaped by natural features. Impaired streams communities are a manifestation of human influences. Benthic (bottom dwelling) invertebrates are particularly useful indicators and have been used in many studies.

- To establish baseline water quality conditions prior to development or other land

use change. Various community indicators and analytical approaches can then be used to detect changes over time to habitat and water quality
- As surrogate indicators and to provide early warning of potential impacts to the fish community
- As diagnostic indicators to determine the magnitude, range of effect and cause of impairments to the aquatic system

Our approach to biological monitoring uses the NVCA reference site protocol. This protocol enables a stream health prognosis to be made based on an assessment of the aquatic invertebrate community present at a site in comparison to unimpacted reference sites.

To augment the biological surveys, water chemistry, temperature and hydrometric sampling was undertaken throughout the ice-free period from 2002 to 2004.

A technical assessment of water chemistry information is provided in **Appendix B**.

The priorities of the stream health monitoring aspect of the study were to:

- Classify the biological conditions of stream reaches as either “Impaired”, “Unimpaired”, or “Below Potential” to facilitate prioritization of stream reaches for rehabilitation and protection efforts
- Characterize water chemistry and pollutant load trends throughout the basin to guide restoration works, assist in the development of a nutrient budget and determine the frequency of pollutant exceedences of the “Provincial Water Quality Objectives” (Ontario Ministry of Environment, February, 1999)
- Classify the thermal regime of Innisfil Creek and its tributaries at the reach level and generate an understanding of base flows at nodes in the system that are important from a modeling and management perspective

2.2.1.1 Biological Conditions of Stream Reaches

Benthic invertebrate assessment was undertaken at 19 sites within the subwatershed between 1996 and 2002. Stream health at each site was evaluating using a “reference site” approach whereby the site benthic community was compared to a similar, relatively pristine reference site. Sites were identified as “Impaired” where the benthic community diverged markedly from expectations and “Unimpaired” where the benthic community was similar to the reference site condition. Sites were identified as “Below Potential” if the benthic community diverged somewhat from the reference site condition but still retained some elements of expected benthic biota.

Stream health within the Innisfil Creek Subwatershed is shown on Map 9. With the exception of some headwater areas, these systems are considered either “Impaired” or “Below Potential”. This indicates that the subwatershed is the most stressed subwatershed within the Nottawasaga Valley Conservation Authority. An overview of

stream health for the major tributaries within the subwatershed is provided below.

Innisfil Creek

Unimpaired conditions are present in the headwaters near Bethesda and downstream of Pinkerton. As the watercourse enters agricultural areas below the Simcoe Uplands, stream health declines to Impaired or Below Potential. From the Cookstown Creek confluence downstream to the Nottawasaga River, Innisfil Creek is considered Impaired with benthic assemblages markedly different from comparable pristine referene sites.

Bailey Creek

The headwaters of Bailey Creek (Oak Ridges Moraine) are considered Unimpaired but stream health declines downstream due to the presence of online ponds and increased agricultural activity in floodplain and riparian areas. Bailey Creek is considered Impaired from the west boundary of the Town of New Tecumseth downstream to its confluence with Beeton Creek.

Beeton Creek

Similar to Bailey Creek, the extreme headwaters of Beeton Creek are considered Unimpaired; however, stream health declines downstream likely due to the effects of the Tottenham Reservoir (an online pond), wastewater treatment plant/urban inputs and increased agricultural activity in floodplain and riparian areas. Beeton Creek and its east branch have been designated Below Potential in the vicinity of Tottenham with Impaired conditions extending on the main branch from 6th Line downstream to its confluence with Bailey Creek.

Penville Creek

The main branch of Penville Creek is considered Impaired from its headwaters downstream to its confluence with Innisfil Creek. Impaired status appears to be correlated with extensive agricultural activity within the subwatershed.

2.2.1.2 Phosphorus Loadings

Phosphorus appears to be the key water quality parameter of concern within the Innisfil Creek subwatershed. High phosphorus concentrations within rivers and streams can result in excessive vascular plant and algal growth (and associated biogenic turbidity) which can impair ecological and aesthetic uses. The Ministry of the Environment has established an Interim Provincial Water Quality Objective of 0.03 mg/L for Total Phosphorus (TP). Stream benthic communities are sensitive to organic enrichment with high phosphorus/nutrient concentrations resulting in a community shift to benthos that are tolerant of enriched conditions.

TP exceedances were observed in more than 90% of samples at four of the six sampling stations. The Bailey Creek station was the only sampling site where

exceedences were observed in only half of all samples. Similarly, it was the only sampling station where the mean TP concentration was less than the PWQO. Statistical analysis (ANOVA) indicates that total phosphorus concentrations at the Bailey Creek station are significantly less than all other sampling stations in the subwatershed. No statistically significant relationship was observed between the other stations.

Contributions to TP loading vary during the year. Flow and water quality sampling were broken down into three event types for analyses: spring flow, summer baseflow and summer/fall storm events. The results of this analysis are presented in tables B.2 and B.3 of **Appendix B.**

Innisfil Creek is the dominant contributor to TP loadings during spring flow conditions (62.02% of all loadings) and represents the largest contributor to loadings during summer/fall storm events (48.6% of all loadings). However, during baseflow conditions, Beeton Creek (71.19) becomes the dominant contributor to phosphorus loadings within the subwatershed. This major shift is associated with significant changes in catchment flow contributions during baseflow periods. Beeton Creek contributes approximately 73.39% of all subwatershed flows during baseflow periods as compared spring and summer/fall storm flow contribution (24.06% and 30.43%, respectively). This significant change is associated with constant baseflow inputs from the Tottenham Wastewater Treatment Plant during a period when baseflows in other catchments have declined and surface water taking for irrigation is at a maximum. Statistical analysis (ANOVA) did not indicate a significant relationship between TP concentrations and flow type.

There are MOE regulatory implications associated with phosphorus. The downstream portions of Innisfil Creek and of its contributing tributaries must be considered “Policy 2” receivers since, even at base flow, TP concentrations frequently exceed the PWQO at all water quality monitoring sites. Regulatory implications include:

- All reasonable measures shall be taken such that water quality meets PWQO.
- Where new or expanded discharges are proposed, no further degradation will be permitted and all practical measures shall be undertaken to upgrade water quality.

In addition it should be noted that the Assimilative Capacity Study Report for Pollutant Target Loads, estimates that the current yearly load of Phosphorus for this subwatershed is 7105 kg. A phosphorous target load based on the Provincial Water Quality Objectives would be 3603 kg/yr. The ACS report is suggesting that an achievable target would be a Total Maximum Yearly Load of 5,427 kg/yr. for phosphorus.

In order to meet growth pressures and implement the ACS recommendations more detailed TP sampling and modeling are required to determine phosphorus sources and a suitable remedial strategy for Innisfil Creek subwatershed.

2.2.1.3 Bacteriological Assessment

Bacteriological monitoring is used to gauge human health risks associated with recreational and consumptive use of water resources rather than as a gauge of stream ecological health.

From 1994 to 1998, summer *E. coli* sampling was undertaken at selected sites within the Innisfil Creek subwatershed. Based on the geometric mean of five samples taken over a 30 day period, the concentration of *E. coli* should not exceed 100 organisms per 100 ml of water used for recreational purposes (MOE, 1994). Sample results indicate that bacterial pollution is present at most of the sampled locations within the Innisfil Creek subwatershed. All samples at the Bailey Creek, Innisfil Creek and Penville Creek stations exceeded the MOE objective. With the exception of headwater stations at 2nd and 3rd Line, Beeton Creek samples also exceeded the 100 organism/100 ml objective.

2.2.1.4 Flow Regimes

Flow measurements were obtained from at six stations on nine separate occasions from May 2002 through October 2003 to assist with calculation of phosphorus loadings within the subwatershed. Prior to the summer baseflow period, tributary flows were roughly proportional to catchment area (i.e. Innisfil Creek > Bailey Creek > Beeton Creek > Penville Creek). However, during baseflow conditions, Beeton Creek contributed a significantly higher percentage of flows, likely due to the influence of effluent discharged from the Tottenham WWTP. During low flow periods in July, August and September, Beeton Creek accounted for the majority of the flow within the subwatershed.

Extreme low flow conditions within the Innisfil Creek subwatershed in 2002 appear to have been associated with drought conditions combined with significant water abstraction required to facilitate agricultural activities. The Tottenham WWTP appeared to contribute significantly to total baseflow within the downstream reaches of Innisfil Creek during late summer/early fall. The proposed decommissioning of the WWTP may have significant impacts on stream baseflow and associated water-taking activities in the downstream portions of the Beeton Creek, Beeton-Bailey Creek and Innisfil Creek systems.

2.2.1.5 Thermal Regimes

Instream thermal regimes are an important determinant of fish community distribution. Salmonids are strongly associated with streams that exhibit stable, cold temperatures during the summer months whereas centrarchids tend to thrive in warmwater systems.

Instream thermal regimes are largely dictated by their surrounding physiography. Streams bisecting upland areas with rolling topography and coarse soils (Oak Ridges Moraine) tend to have significant groundwater discharge and coldwater thermal regimes; however, the thermal regimes of groundwater-rich systems can be negatively affected by on-line ponds and removal of riparian vegetation. In constrast, low-lying clay plains (portion of Simcoe Lowlands; fine-textured soils) have little groundwater discharge and are characterized by warmwater thermal regimes.

An intensive study of spatial variation in thermal regime at the reach level was completed in the Innisfil Creek subwatershed during summer 2002 and 2003. Dataloggers were installed at 28 locations (as shown in figures B.8 and B.9 and described in tables B.8 and B.9 in **Appendix B**) during the months of July and August. Water temperatures were recorded every half hour. Less formal temperatures "runs" were conducted in all catchments between 1998 and 2004 to supplement datalogger monitoring.

The results of datalogger and spot temperature analyses are provided below. It is important to note that, in most situations, there is a gradual transition from coolwater to warmwater thermal regimes. Localized areas of groundwater discharge, where present, may provide refugia for coldwater biota (i.e. salmonids) even in warmwater reaches.

Beeton Creek is characterized by a coolwater thermal regime downstream to 4th Line with a transition to a warmwater regime occurring between the outlet of the Tottenham Reservoir and 6th Line. Small tributaries emanating from the Oak Ridges Moraine and the upland area south of Beeton are fed by groundwater discharge and support coldwater/coolwater temperature regimes which, in turn, moderate temperature regimes in the main branch. The middle and upstream portions of the east branch of Beeton Creek support a transitional coolwater/warmwater temperature regime.

The headwaters of Innisfil Creek (5th Line station,Bethesda tributary and the middle reaches of Cookstown Creek) are characterized by coolwater thermal regimes but rapidly grade to warmwater thermal regimes through downstream agricultural reaches. Localized areas of groundwater discharge appear to provide small areas of refugia within warmwater reaches downstream to Highway 400.

Within Bailey Creek, coolwater regimes extend downstream to 5th Line (Adjala-Tosorontio) with a transitional zone extending downstream to 7th Line. Small tributaries of Bailey Creek, emanating from the Oak Ridges Moraine, are fed by groundwater discharge and support coldwater/coolwater temperature regimes which, in turn, moderate temperature regimes in the main branch. A warmwater temperature regime extends downstream from 7th Line to the Beeton Creek confluence. Although considered warmwater, salmonids have been observed through most portions of this reach indicating that localized areas of groundwater discharge are providing important refugia in this warmwater reach during the summer months.

The headwaters of Penville Creek and its upstream tributaries support coolwater habitat. Penville Creek is characterized by a warmwater temperature regime downstream of the 6th Line. Lack of riparian vegetation cover contributes to instream warming in the downstream reaches.

2.2.2 Fisheries Assessment

Map # 7 shows the distribution of fish species within the subwatershed. The species are broadly summarized as follows:

northern pike	largemouth bass
resident brook trout	migratory rainbow trout
chinook salmon	yellow perch
pumpkinseed sunfish	common carp
white sucker	various minnow species
various darter species	trout perch

Productive coldwater habitat for brook trout is largely restricted to the headwaters of Innisfil Creek, Bailey Creek and Beeton Creek. Provided suitable access is available, rainbow trout also utilize these habitats as well as coolwater stream reaches that are less suitable for brook trout. Based on physiographic potential, cumulative impacts associated with on-line ponds, removal of riparian vegetation and stream alteration have constricted the natural extent of coldwater and coolwater habitat within the subwatershed. Restoration opportunities exist that, if implemented, would extend the range of coldwater/coolwater habitat within the subwatershed.

2.2.3 Restoration and Rehabilitation Opportunities

The potential restoration areas Map 6 identifies those riparian areas that do not have the preferred amount of vegetation cover (at least 30m of natural vegetation on either side of the stream). To achieve our target of ultimately having at least 75% of the subwatersheds natural streams with riparian vegetation, approximately 50% of the streams riparian areas must be restored or allowed to return to natural cover. It is recognised that this will take some time to achieve involving many stewardship partners and willing landowners.

More detailed riparian restoration opportunities are identified through NVCA's Community River Restoration (CRR) Program. The purpose of this program is to strategically rehabilitate rivers working in partnership with local community groups. The CRR Program coordinates projects which improve stream health, restore fish and wildlife habitat, and, enhance water quality. This program provides the technical, financial and project management support that local community groups and landowners need in order to implement effective river restoration projects. Through the CRR Program, partners are encouraged to implement long-term focused river restoration programs.

The Beeton Creek Restoration project is an example of this program within this subwatershed, which emphasizes sound watershed management principles. Although this study was not a component of this subwatershed plan, the report called the *"Beeton Creek Stream Health Report 2004"* is included as **Appendix C** as relevant information and to demonstrate what a community river restoration partnership can achieve.

There may be further opportunities for the Community River Restoration Program within the Innisfil Creek Subwatershed.

2.2.4 Aquatic Ecosystems Proposed Recommendations

The following recommendations are made to help meet the aquatic ecosystem objective and targets, and protect the fisheries resources as outlined above.

Recommendation # 5

No development or site alteration should occur within a minimum of 30m on either side of a natural stream. Existing agricultural areas are encouraged to provide as much of the 30 m vegetative buffer as possible for natural streams, but no less than 3m for both streams and municipal drains. Landowners are encouraged to only disturbed one side of a drain during clean outs.

Implementation of riparian buffers will improve aquatic habitat and significantly reduce nutrient and sediment loadings within the subwatershed. These recommended vegetative buffers may be revised depending on the recommendations from of the Assimilative Capacity Study and the Source Water Protection Plans.

……

Recommendation # 6

In addition to naturally vegetated buffers along watercourses, nutrient inputs within the subwatershed should be controlled by use of all available best management practices.

Remedial strategies should adopt a philosophy of project design that addresses the widest possible range of stream health impairments at a site or over a reach. For example, agricultural projects that reduce manure-contaminated run-off to streams should be augmented where possible with riparian works to improve shading and in-stream work to improve fish habitat and reduce erosion (where necessary). Projects on private lands may be best achieved through an incentive program such as the one offered through NVCA's "Healthy Waters" grant program (for which Innisfil Creek landowners are eligible under current guidelines)

……

Recommendation # 7

The Assimilative Capacity Study recommendations for long-term monitoring should be funded and implemented.

The Assimilative Capacity Study has provided us with a great deal of very useful data and models to assist us in better managing our watersheds. The recommendations stemming from the technical reports should be followed. The Pollutant Target Loads report prepared by Louis Berger Group and Greenland International Inc. has recommended our authority carry out a "Focused Monitoring and Assessment" program. The report suggests that NVCA develop a Watershed Water quality Monitoring Plan and then using the results, "Revisit TMML Development Effort".

Our current Environmental Monitoring classifies watershed health and by providing two essential information components: surveillance data and program performance data. Collected "surveillance" information answers questions such as: "Which streams are healthy? Which are unhealthy? How is their health changing from stream reach to stream reach and from year to year?" This type of information is vital to the authority; it identifies watershed health issues and helps to shape our programs. An excellent example of how this process works is through the Healthy Waters program which protects healthy streams and improves impaired streams, based on the results of our monitoring program.

The "performance" information we collect answers questions like: Are our programs resulting in stream health improvements? Do biological communities actually respond favourably to livestock fencing and dam decommissioning projects? Do our development and planning policies protect streams?

……

To further examine opportunities for the Community River Restoration Program within the Innisfil Creek Subwatershed the following is recommended

Recommendation # 8
NVCA staff and their partner organizations should continue to work through the Community River Restoration Program to identify additional opportunities within the Innisfil Creek Subwatershed for focused, detailed restorations studies similar the Beeton Creek Stream Health Report.

2.3 Water Management Strategy

This section will outline the water management strategies dealing with, hydrology, erosion, water balance and nutrient budgets, groundwater, and water conservation.

2.3.1 Existing Hydrologic Conditions

The Innisfil Creek Subwatershed lies in the south east corner of the Nottawasaga Watershed and consists of several tributaries including, Innisfil Creek, Penville Creek, Beeton Creek and Bailey Creek. The land use within the subwatershed is primarily agricultural and the total area of the subwatershed is 491 km^2. Innisfil Creek drains to the Nottawasaga River south east of Alliston and subsequently to Georgian Bay.

2.3.1.1 Hydrologic Modeling

Streamflows reflect the time variation in discharges and are characterized by their frequency, duration and magnitude. Streamflows include peak flows generated from surface runoff caused by rainfall and snowmelt events, as well as groundwater discharges that appear as baseflow.

The combination of streamflow characteristics (i.e. frequency, magnitude and duration) controls many of the natural and ecological functions that occur in the creeks and

streams present in the Innisfil Creek Subwatershed. Low streamflows (i.e. baseflows) sustain aquatic and terrestrial ecosystems in periods of no rain or runoff. Moderate streamflows with a return period of ½ to 1½ years contribute to the natural evolution of channel shape and form through erosion. Seasonal flooding such as that resulting from spring freshets provides nutrients and sediments to wetlands and floodplains and provides spawning opportunities for a number of fish species. High streamflows resulting from snowmelt events and extreme rainfall events such as the Timmins Storm can lead to natural hazards and a risk to human life and property.

Development within the Innisfil Creek Subwatershed will result in changes to peak flows, runoff frequency and duration, and response times to a given rainfall event. Development will also result in changes to the existing water balance component quantities such as infiltration and runoff. In order to assess the extent of these changes, it is necessary to first establish the existing conditions of the subwatershed. Peak flow modeling and water balance calculations for future conditions were not completed as this was not within the scope of the work plan.

2.3.1.2 Peak Flow Modeling

The **I**ntegrated **S**tormwater and **W**atershed **M**anagement **S**ystem (**ISWMS**®) by Greenland, was utilized to develop the existing conditions hydrologic model. The initial phase (i.e. flood forecasting) of the new software system was developed for the Nottawasaga Valley Conservation Authority, and combines the usefulness of both unit hydrograph runoff generation methods and USEPA's SWMM based models. This study applies the unit hydrograph runoff generation methods, typically used in similar subwatershed planning studies across Ontario, to model the hydrology of the Innisfil Creek Subwatershed.

Additional information regarding the hydrologic modeling methodology and technical details is provided in **Appendix D**.

2.3.1.3 Model Calibration

To improve the accuracy of the hydrologic model we initially intended to calibrate the model using available precipitation and streamflow data. Unfortunately suitable data was not available and the model was therefore not calibrated.

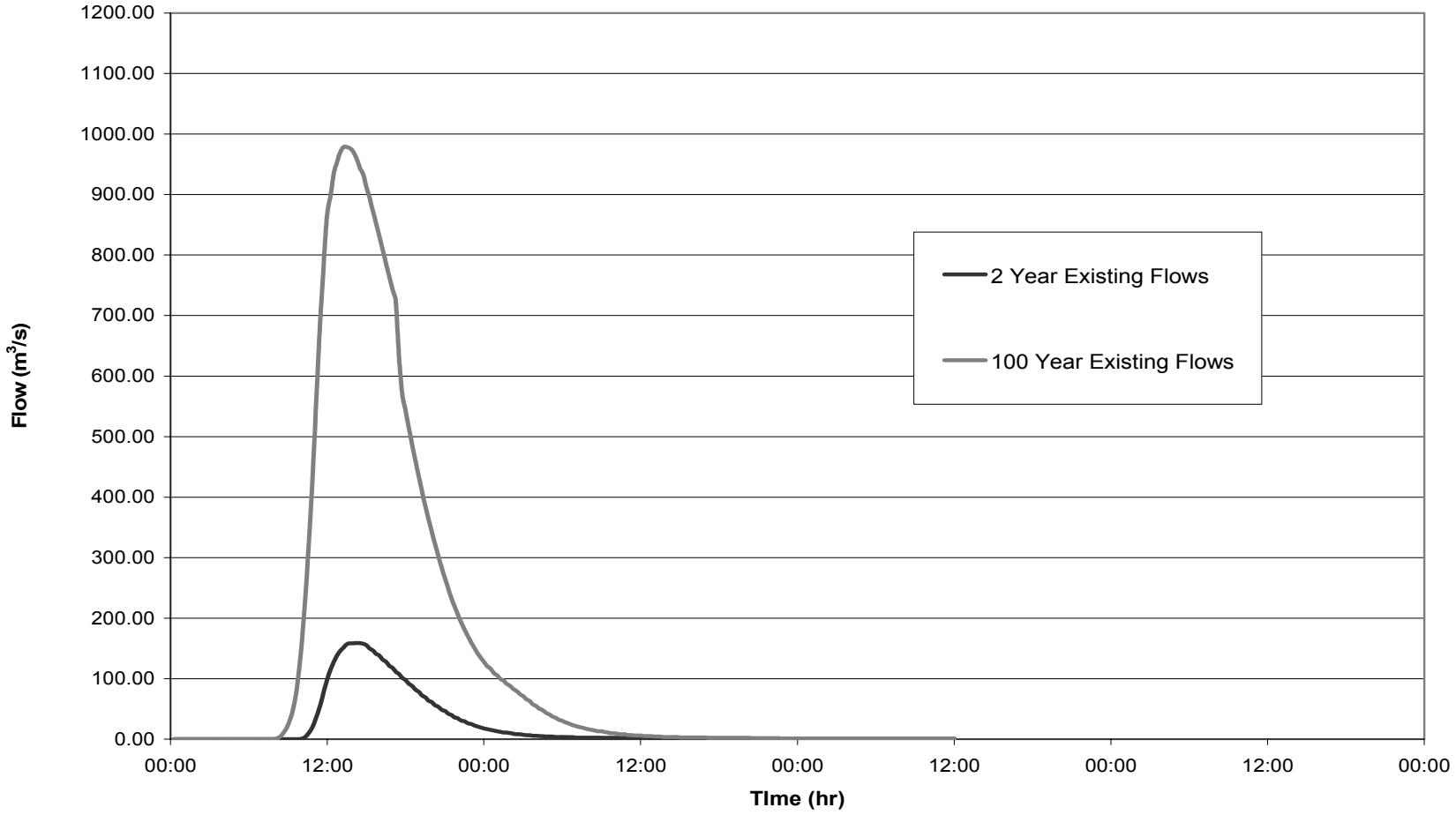
2.3.1.4 Hydrologic Model Results – Existing Conditions

The results of the single event hydrological modeling for a range of return period events and flow nodes are summarized in **Table 1**. In addition, **Figure 3** illustrates typical design storm event hydrographs at node 31 located at the bottom of the Innisfil Creek Subwatershed just prior to the confluence with the Nottawasaga River. Flow node locations for the ISWMS model are identified in **Map 10**.

Table 1: Existing Conditions Peak Flows

ISWMS NODE	TRIBUTARY AREA TO NODE (km^2)	2-Year (m^3/s)	5-Year (m^3/s)	10-Year (m^3/s)	25-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)	REGIONAL STORM (m^3/s)	TIMMINS STORM AREAL REDUCTION FACTOR (%)
2	70.2	26.2	57.4	81.0	114.2	140.4	167.8	267.4	94
6	115.1	35.4	79.5	113.2	160.9	198.8	238.7	286.3	87
8	33.5	14.1	30.4	42.7	59.6	72.8	86.5	142.1	97
9	148.6	49.4	109.9	155.9	220.4	271.5	283.4	288.6	87
11	34.7	19.8	40.8	55.9	76.6	92.5	108.9	166.2	97
13	59.4	30.9	64.7	89.5	123.5	149.8	177.1	264.9	94
10	222.3	86.3	188.4	264.6	371.0	454.5	494.4	546.6	82
17	33.8	9.2	21.2	30.3	43.3	53.6	64.5	115.8	97
19	38.6	12.6	28.1	40.0	56.6	69.6	83.4	144.8	97
20	72.4	21.8	49.3	70.3	99.9	123.2	147.8	249.1	94
22	89.9	28.0	62.6	88.9	125.8	154.7	185.2	291.1	90
24	43.9	8.3	20.4	29.9	43.6	54.6	66.4	128.1	97
28	117.9	29.4	67.8	97.3	139.1	172.1	206.9	279.4	87
29	210.2	57.6	130.9	186.9	265.9	327.8	393.3	539.8	82
30	466.4	156.9	346.5	489.2	689.3	844.8	955.9	1102.9	76
31	491.1	159.2	354.9	499.3	705.9	865.8	978.9	1138.8	76

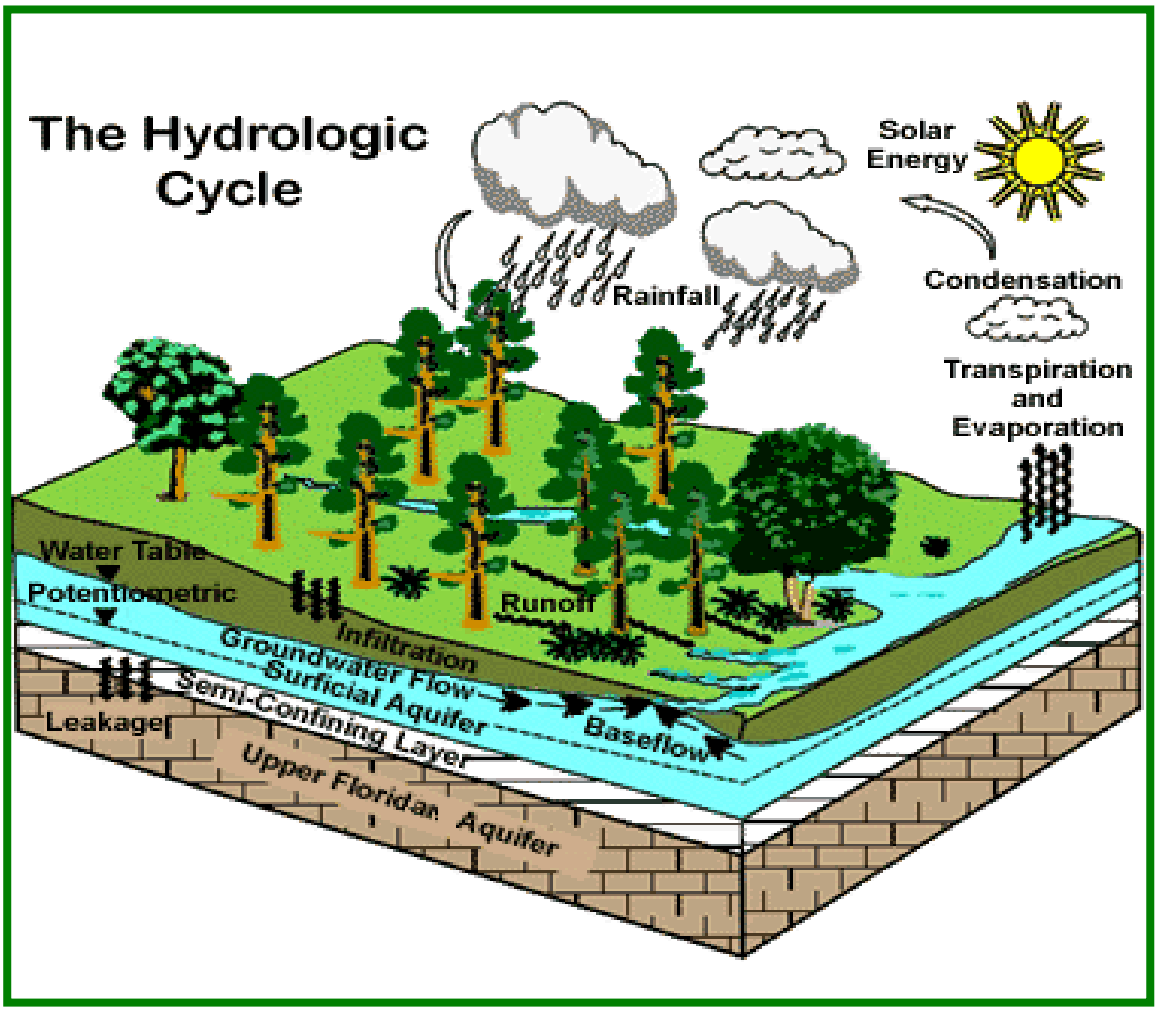
Figure3: Existing Flow Hydrograph for 2 Year and 100 Year 24 Hour AES Storm, Node 31



2.3.2 Water Balance Modeling

As per the Terms of Reference, water balance modeling was completed for existing conditions within the Innisfil Creek Subwatershed. A water balance is a form of hydrologic accounting whereby the allocation/distribution of water over a specified period is quantified for the various components of the hydrologic cycle. A sketch illustrating the different processes associated with the hydrologic cycle is provided in **Figure 4**. The primary components of the overall water balance presented in this study include rain, snowmelt, evapotranspiration, runoff, baseflow, and deep groundwater storage. Extractions of water by Permit-to-Take-Water (PTTW) for irrigation were also computed in the water balance calculations. The methodology and technical details for the water balance model are provided in **Appendix E.**

Figure 4: Processes Associated With The Hydrologic Cycle.



2.3.2.1 Water Balance Results - Existing Conditions

Results of the monthly water balance analysis accounting for pervious and impervious areas for the entire Innisfil Creek Subwatershed are presented in **Table D.5** in **Appendix E**.

Using the revised catchment areas based on the NVCA GIS shapefiles, along with GIS techniques for obtaining area-weighted parameter values, the water balance was further discretized for all individual catchments within the Subwatershed. It was only possible at this time, however, to calibrate the water balance model using available historical streamflow (HYDAT) to the Beeton Creek Gauge Station.

The model requires further calibration to enable accurate results at the catchment level within the Innisfil Creek Subwatershed. This can be achieved over time as additional baseflow data at key locations continues to be collected. The model should be broken into lumped catchments based on the location of streamflow and/or baseflow monitoring stations. The lumped area may be further broken down in the future as additional streamflow and baseflow stations are added and calibration data becomes available.

The results of the water balance analysis indicate that the permitted water extraction quantities may exceed the available volume while still maintaining the minimum required flow based on the 30% Tennant's Method.

Details of monthly water balance calculations for the Innisfil Creek Subwatershed are presented in **Appendix E**.

2.3.3 Nutrient Balance Modeling

Resource management agencies, including the NVCA, need to comprehend the complex inter-relationship between environmental health, the local economy, and social conditions. The application of computer models combined with monitoring results has been widely accepted as the standard tool used by resource managers to predict the change in water quality associated with human activities and altered landscapes.

The nutrient model for the subject study was completed in conjunction with a software development project initiated in March 2003 by the Lake Simcoe Region Conservation Authority (LSRCA), in partnership with the NVCA, Kawartha Conservation, and Conservation Ontario, Ontario Ministry of Natural Resources and Ontario Ministry of the Environment. The model was completed in November 2004 by Greenland International Consulting for three (3) pilot sites. These basins included the Innisfil Creek, Black River and Nonquon River Subwatersheds. Greenland developed the **C**anadian **A**rcView **N**utrient and **W**ater **E**valuation **T**ool (**CANWET** Version 1.0) program with value-added enhancements for not only addressing the subject study's terms of reference but also for use in source protection initiatives to accurately estimate water budgets, nutrient and sediment/erosion loadings within a watershed or subwatershed. In fact, **CANWET** was recommended in the December 2004 terms of reference for the Assimilative Capacity Studies about the Lake Simcoe and Nottawasaga Valley Watersheds, respectively, in

conjunction with instream and lake assimilation models. This other project will be completed in 2006, as part of an Ontario Intergovernmental Action Plan for Simcoe County, Barrie and Orillia, led by the Ontario Ministry of Municipal Affairs and Housing.

Appendix F includes material from the final report about the nutrient pilot project, including a nutrient and sediment/erosion modelling overview of the Innisfil Creek Subwatershed. Calibrated model data for a nearby basin (i.e. Black River in the Lake Simcoe Basin) and recommendations for further model enhancements are also provided for discussion.

CANWET will be an essential tool for the NVCA to evaluate the extent and magnitude of point and non-point source pollution problems and determining the controls of sediment and nutrient loading to surface waters. The primary bases of comparison between future and existing watersheds are the average annual nutrient and sediment loads estimated for each. The model developed for the Innisfil Creek Subwatershed is capable of assessing the impacts of future changes in land use on nutrient/sediment loads to the creeks within the subwatershed and identifying priority areas for restoration and improvement once all data gaps and further model calibrations are completed.

The results of the ACS are summarized in this plan in the form or the specific targets for our subwatershed. Please see NVCA's website for the details of the ACS study

2.3.4 Erosion Modeling

The intent of the proposed erosion modeling work was to establish required storage volumes and release rates to enable development to proceed while maintaining effective erosion control for identified growth areas within the subwatershed.

Greenland has completed the computer modeling and erosion analysis for both existing and future uncontrolled conditions, while the background fluvial geomorphology work and erosion threshold values at key locations within the subwatershed has been established by JTB Environmental Systems Inc.

Based on discussions with NVCA and JTB Environmental, and a review of Official Plans, eight (8) erosion monitoring sites were established at strategic locations within the subwatershed as follows (see **Map 11**):

SITE #	LOCATION
1	Innisfil Creek immediately upstream of its confluence with the Nottawasaga River
2	Beeton Creek immediately upstream of its confluence with Bailey Creek
3	Bailey Creek immediately upstream of its confluence with

	Beeton Creek
4	Penville Creek immediately upstream of its confluence with Innisfil Creek
5	Beeton Creek at Catchment 202 downstream of Tottenham
6	Innisfil Creek at Catchment 308 100m upstream of County Road 27
7	Cookstown Creek upstream of the confluence with Innisfil Creek
8	Bailey Creek downstream of catchment 211

Critical flows were estimated for existing conditions at each of the critical sections. Details for estimation of the 'baseline" critical flows are presented in the fluvial geomorphology report by JTB Environmental in **Appendix G**.

Unfortunately, based on an extended analysis to determine required erosion volumes, it was concluded that it is not possible to establish practical pond volumes to control erosion to existing levels for the Innisfil Creek subwatershed. One of the main reasons for this appears to be the nature of the Innisfil Creek system and the extremely low erosion thresholds found throughout the subwatershed.

Given the difficulties encountered and based upon further consultation with the project fluvial geomorphologist, it was recommended to allow some SWMP discharge in accordance with the critical discharges from the erosion study, while allowing for infiltration to supply shallow groundwater reserves. In order to determine how much stormwater to control using pond storage and how much to infiltrate, site-specific studies will need to be completed as development applications arise. This will be necessary due to site-specific soils and infiltration capacities and critical flow thresholds.

It is important to note that the design criteria, detention time and balance between pond storage and infiltration will be determined through discussions with the municipality, NVCA and the proponent.

2.3.4.1 Stormwater Control Targets for Future Development

NVCA strongly supports the development of stormwater management at the secondary plan and functional servicing plan stage. We recognition the effectiveness of developing specific master drainage plans for areas likely to be developed in the short to medium term. We suggest that master servicing plans be completed as support to secondary plan and those plans ought to address all servicing requirements, including stormwater. It is further recommended that master plans be formulated following the MEA Municipal Class Environmental Assessment to, minimise duplication.

The selection of control measures for stormwater that come out of the land use planning process should first consider lot level controls, then conveyance measures (if lot level controls are insufficient) and then end-of-pipe facilities (if still insufficient treatment).

If required, pond sizes and locations should be established at the Secondary Plan (SP) and/or Functional Servicing Plan (FSP) stage. It is appropriate at this time, however, to establish the recommended levels of stormwater control within the Innisfil Creek Subwatershed as follows:

- to protect the subwatersheds aquatic ecosystem, required SWM ponds constructed within the Innisfil Creek Subwatershed must provide a minimum Level 1 protection;
- the minimum erosion requirement shall consist of the 25 mm post-development peak flow released over a 24-hour period. Should it be identified at the SP or FSP stage that erosion control over and above the 25 mm 24-hr minimum criteria is necessary, then a site-specific erosion analysis shall be completed to determine the required level of protection.
- the minimum level of protection for quantity control shall be post-to-pre flow control for the 2-yr through 100-yr design storms, unless, it can be demonstrated that an alternate level of control can be provided while still maintaining post-to-pre flow conditions at identified flow nodes downstream of the proposed development;
- wherever possible, efforts should be made to minimize temperature impacts on receiving waters by incorporating measures such as littoral plantings and bottom draw outlet structures into the overall design of SWM facilities;
- SWM and Functional Servicing plans must conform to the guidelines as identified in the *Stormwater Management Planning and Design Manual* (MOE, 2003)

2.3.4.2 Stormwater Management Control Measures

There are three main categories of stormwater controls. These include source controls (considered first), then conveyance controls and finally end-of-pipe controls. It may be necessary to combine several stormwater controls within an overall strategy. Opportunities for combining stormwater controls with various other water needs should also be encouraged. Specific controls are recommended for control of runoff from construction sites.

Source Controls

Lot level (source controls) are measures utilized to reduce the quantity of runoff from developed properties within a subwatershed. Typical source controls include the following:

- reduced lot grading;
- roofleaders directed to ponding areas;
- roofleaders directed to soakaway pits; and
- sump pumping of foundation drains.

Conveyance Controls
Conveyance controls are designed to reduce the quantity of runoff transported from properties within a subwatershed to the receiving waters. Examples of conveyance controls include:

- pervious pipe systems;
- catchbasin modifications;
- grassed swales; and
- pervious catchbasins.

End-of Pipe Controls
End-of-pipe controls are measures used to service multiple lots, residential subdivisions and industrial/commercial areas. They can be designed to provide both quantity and quality/erosion control to meet a variety of stormwater management requirements. Examples of end-of-pipe facilities include the following:

- dry ponds;
- wet ponds;
- constructed wetlands;
- hybrid wetland/wet ponds;
- infiltration trenches;
- infiltration basins;
- buffer strips;
- filter strips; and
- oil/grit separators.

Opportunities for Re-use and Recycling of Stormwater for Irrigation and Industrial Purposes and for Maintaining and Enhancing Existing Baseflow Conditions
NVCA strongly support the concept of re-use or multiple use of stormwater. We believe treated stormwater should be considered a valuable resource to be used to achieve other relevant objectives, rather than a waste product to be disposed of as quickly and cost-effectively as possible.

Opportunities for incorporating local agricultural and recreational/industrial needs for water with stormwater management plans should be strongly encouraged within the subwatershed. As an example, irrigation needs for crops and/or golf course greens and fairways could be considered when designing and locating stormwater management ponds. With proper design skills, excess runoff that would normally be released to the stream, could be stored and used at a later time during dry periods for irrigation purposes.

For example, The Town of New Tecumseth's Class Environmental Assessment for Waste Water, approved in June 2005, includes as part of its recommendations, that the Town should initiate a study respecting the potential for effluent irrigation of golf

courses, sod farms and crops and a grey water system study to identify the issues and constraints associates with a grey water system.

Directions such as the above, along with a review of irrigation and water use practices within the subwatershed, could help reduce the impact on baseflow conditions and subsequent impacts on aquatic habitat and health, particularly during the summer months.

Another example of incorporating industry needs with site stormwater management is the collection of roof runoff for use as cooling water for equipment such as refrigeration units. Not only does this help to reduce the volume of runoff from the site but it also reduces the amount of water that would otherwise be pumped from underground aquifers.

Erosion and Sediment Controls During Construction

In order to reduce sediment loading of streams during construction of the proposed lands within the Subwatershed, it is important that erosion and sediment control measures be identified and incorporated into site plans prior to initiation of earthworks on site. Following implementation, sediment controls must be properly checked, cleaned and maintained in place during all phases of construction. Erosion and sediment control measures which should be considered for implementation into individual site plans include, but are not limited to:

- site management practices;
- construction scheduling;
- temporary sediment basins;
- temporary sediment traps;
- silt fences;
- seeding and mulching;
- drainage diversions;
- brush barriers;
- check dams;
- storm drainage inlet protection;
- vibration pads; and
- conveyance channels.

The guidelines for the design of erosion and sediment control measures (located on NVCA's website at www.nvca.on.ca under Engineering and under Library) provided in the following documents should be followed:

- *Guidelines on Erosion and Sediment Control for Urban Construction Sites* (MNR, *et al*, 1987);
- *Technical Guidelines, Erosion and Sediment Control* (MNR, 1989); and
- *Erosion and Sediment Control*. MTC. Drainage Manual, Volume 2, Chapter F (MTO, 1985).

All stormwater management facilities should adhere to the recommended design

guidelines as set out in the S*tormwater Management Planning and Design Manual* (MOE, 2003). In addition, the following should be completed for each SWMP:

- a geotechnical investigation to assess the suitability of the proposed site to accommodate a stormwater management pond, particularly in regard to groundwater levels and slope stability concerns;
- a landscape plan, including recommended plantings about the facility; and
- a construction phasing plan.

Development proponents should prepare a detailed Storm Water Management Report that discusses how storm water generated from the proposed Plan of Subdivision will be managed in accordance to the intent of the recommended master drainage plan. Likewise, any alterations to urban storm water management strategies resulting from servicing difficulties/constraints identified during the detailed design stage should be discussed and rationalized in the Storm Water Management Report.

All new development proposals must prepare site specific storm water management reports that shall include:

- the proposed drainage scheme for the development;
- the proposed Storm Water Management Practices that will be incorporated into the system; and
- the proposed methods for minimizing erosion and sedimentation during construction.

2.3.5 *Groundwater Studies*

Groundwater is a very important component of the hydrologic cycle not only providing drinking water to most of the subwatershed residents, supporting wetlands and providing the all important base flows to our rivers and streams. Maintaining this base flow is vital to achieving our aquatic ecosystem objectives and targets.

NVCA was involved in the South Simcoe Municipal Groundwater Study with many other municipal and agency partners. A brief introduction to this study is outlined below. We also included the map of the Groundwater Recharge and Discharge areas (Map 9). Please see the South Simcoe Municipal Groundwater Study for more information, the conclusions and recommendations. A link is located on NVCA's website at www.nvca.on.ca.

Naturally a great deal more information related to the protections of groundwater resources will also come from the Source Water Protection Plans that will be prepared over the next few years. This information will also be posted on the website above as the plans progress.

Background:

Groundwater begins as precipitation that infiltrates into the underlying soils until it hits a layer of bedrock or fine-grained soils which limits further downward movement. Groundwater accumulates in this area forming an aquifer which can be used for water

supplies. Where these aquifers are exposed along slopes, river valleys and low lying areas, they discharge into local streams and wetlands.

Aquifers are fed by groundwater recharge areas which are characterized by coarse-grained soils and relatively steep downward hydraulic gradients. The Oak Ridges Moraine and Simcoe Uplands are the key groundwater recharge areas within the Innisfil Creek subwatershed while the groundwater discharge areas are associated with stream systems and wetland complexes (Map 9).

Groundwater aquifers can be affected by inappropriate land use practices. Aquifer quality can be affected by contaminants infiltrating through recharge areas. Significant recharge areas should be protected from inappropriate land uses. Aquifer quantity can be affected by excessive water-taking and also by excessive development in significant recharge areas. Urban development creates areas of impermeable cover, increasing surface runoff of precipitation and correspondingly reducing the quantity of precipitation that would otherwise infiltrate into groundwater aquifers. Increased surface runoff and reduced baseflow affect water quality in streams when impervious cover in a catchment is 10% or greater.

The water supply needs of the municipalities within the County of Simcoe and the adjacent Cities of Barrie and Orillia are obtained largely from groundwater. In the South Simcoe study area, this supply is obtained from 138 municipal water wells and some 19,500 private (domestic) wells located across 11 municipalities and CFB Borden, and 28,200 across Simcoe County. Surface water supplies for the vast majority of residents in the Town of Collingwood and the Alcona area of the Town of Innisfil and is used in conjunction with a groundwater supply in Alliston. Plans are underway in the longer term to add surface water to the existing groundwater supply systems in Barrie and Bradford in order to support projected growth.

The capacity of the local aquifers to continue to meet current and future demands, and the potential for historical, current or proposed future land uses to impair groundwater quality or reduce available groundwater supplies are not well understood. The lack of understanding of local groundwater resources is of particular concern for long term planning, including the potential for expansion of existing municipal supplies to accommodate future growth and also to maintain stream flows, particularly in areas where the aquatic ecosystem is sensitive and/or of high quality. To address these concerns, the South Simcoe Groundwater Partnership was established to commission this study of local groundwater resources. The overall objectives of the Groundwater Study were:

- To delineate local aquifers and identify risks to groundwater quality and quantity;
- To complete Wellhead Protection Areas for all municipal water supplies, and
- To provide planning tools for protecting and managing groundwater.

2.3.6 Oak Ridges Moraine Water Conservation Plan

A portion of the headwaters of Innisfil Creek Subwatershed is located on the Oak

Ridges Moraine within the Town of New Tecumseth and the Township of Adjala-Tosorontio both within Simcoe County.

The Oak Ridges Moraine Conservation Plan requires that upper-tier and single-tier municipality shall begin preparation of a water budget and water conservation plan by April 22, 2003.The water conservation plans must address both municipal piped services and efficiency of private systems. This subwatershed plan will meet these requirements as it began in March of 2001 and includes a water balance for the entire subwatershed and begins water conservation plan development for the Oak Ridges Moraine Conservation Plan area.

Rationale for this requirement: "The Oak Ridges Moraine has clean and abundant water resources. The Moraine is a vital storage reservoir and recharge zone for groundwater, which feeds wetlands, lakes, streams and rivers in the Greater Toronto area. As such, it provides clean drinking water for more than 250,000 residents, as well as water supplies for agricultural, industrial, commercial and recreational facilities. The demand for water supplies from the Moraine must be balanced with the need to maintain ecological integrity on a watershed basis.

Water conservation planning contributes to a sustainable and healthy resource by recognizing water as a valuable, finite resource to be utilized efficiently, wisely and cost-effectively to sustain a high quality of social, environmental, and economic well being, for the present and the future.

Efficient water use can have major environmental, public health and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water sources. Water quality and quantity affect aquatic ecosystems and their biological integrity.

Water conservation can help systems avoid, downsize, or postpone water and wastewater projects. The facilities used to treat and deliver water and wastewater are sized to meet demand; if the level of demand is inflated by wasteful use, people may pay more in capital and operating costs than necessary to provide safe and adequate water and wastewater services. When costs are reduced, financial resources can be used to meet other needs.
Water conservation can also prevent pollution by reducing waste flows, recycling industrial process water, and reclaiming wastewater. Energy use by consumers and utilities can be reduced, saving money and reducing emissions of greenhouse gases. Reducing water withdrawals also helps improve water quality, maintain ecosystems, and protect water resources." [30]

The following are the keys Steps that are to be used to guide the water conservation program development within the Oak Ridges Moraine:

PHASE I: DEFINING CONSERVATION NEEDS

1. Develop Water Use Profile and Forecast

30 ORMCP Water Guidance Document #3 Water Conservation Planning, Aug 2003 page 2

2. Identify Water Conservation Goals - Link to Water Budget Analysis

PHASE II: CHOOSING THE APPROPRIATE MEASURES AND INCENTIVES
3. Identify and Evaluate Water Conservation Measures
4. Identify and Evaluate Water Conservation Incentives
5. Analyze Relative Benefits and Costs of Measures and Incentives
6. Select Conservation Measures and Incentives

PHASE III: DRAFTING THE PLAN
7. Prepare Water Conservation Plan - plan should be a written account of the previous 6 steps **PLUS** include:
    - Illustration of anticipated effects of conservation measures and incentives on water demand and supply capacity;
    - An implementation plan, and
    - A plan for monitoring and evaluating effectiveness.[31]

The municipal water conservation plans will evolve over time as more information becomes available. They may also be influenced by the results and technical information from several important studies including the Assimilative Capacity Studies, the Growth Plan for the Greater Golden Horseshoe and the more detailed sub-area assessments that must follow the provincial growth plan.

The water conservation plans must be completed by April 23, 2007, or all "major development will be prohibited. Major development is defined by the ORMCP as four or more lots, or building or buildings with a ground floor area of 500 $m^{2,}$ or more or major recreational uses such as golf courses, ski areas, serviced campgrounds and playing fields.

The Oak Ridges Moraine Conservation Plan land use designations within the Innisfil Creek Subwatershed are primarily Natural Core, Natural Linkage and Countryside There are no Settlement Areas and only two very small Rural Settlement Areas adjacent to the villages of Tottenham and Colgan. The communities themselves are located outside the ORM except for a small portion of the south-west corner of Tottenham.

As a result the municipalities and partner agencies may wish to focus most of their water conservation efforts on education to improve the efficiency and conservation of private water systems for residential uses and any rural commercial or agricultural water users.

Current Water Conservation efforts:
New Tecumseth is currently promoting water conservation in several ways. For example Tottenham, has a three pronged approach to water conservation?

31 ORMCP Water Guidance Document #3 Water Conservation Planning, Aug 2003 page3

The first is a Water Restriction Notice under their by-law that prohibits the watering of grass or for other landscaping purposes to odd or even days (corresponding to the house number) and only between 7:00pm and 8:30 pm. Fines for non compliance are up to $300 for each offence.

The second approach is educational through a newsletter and information on the benefits of water conservation sent out with each water bill.

The third approach is through appropriate pricing of their water resources in their water fee structure.

All of the development within Adjala-Tosorontio located within the subwatershed and on the Oak Ridges Moraine is serviced by private wells.

As a result it is recommended that a variety of other education and incentive programs promoting water conservation in rural areas for those on private servicing be developed through cooperation and partnership with the appropriate agencies.

One example of the ways watershed residents are encouraged to conserve water is through education. For example through Ontario Government website called Conserve Ontario http://www.ontarioconserves.gov.on.ca/english/water_facts.asp
The sites water conservation tips are as follows:

Rinse in cold water and wash in warm
Clothes rinsed in cold water come out as clean as those rinsed in warm water. Washing in warm rather than hot water uses 50 per cent less energy and your clothes will come out just as well rinsed and, depending on the fabric, less wrinkled.

STOP! Don't pour it out
Take old cleaning products, paints, solvents and pesticides and used oil to your local household hazardous waste depot. Never pour them down the drain or into a sewer because in many cases the toxic ingredients pass right through the sewage treatment plant and into the lake or river.

Bathroom
Use a glass to rinse your toothbrush. Rinsing a toothbrush under a tap wastes about 4,000 litres of water a year. Don't keep the tap running whilst cleaning your teeth either. A typical bath uses approximately 75 litres of hot water, while a 5-minute shower with an efficient showerhead will use about half of that, and will pay for themselves in as little as four months. Leaky toilets can also waste as much as 750 litres each day.

Kitchen
Defrost frozen foods in the refrigerator or the microwave, not under running water.

Repair
Replace all leaky tap washers, or call a plumber if the problem persists. Leaking valves and faucets can waste more than 400 litres of water a day.[32]

For water conservation communication examples in the agricultural sector, see OMAF fact sheets (1999) "*How to Prepare for Irrigation During Water Shortages" and "Private Water Well Owners – Dealing with Water Shortages"*. These fact sheets and other of interest to the Agricultural community may be found at the OMAF website at http://www.gov.on.ca/OMAFRA/english/engineer/stew/quality.htm

Other water conservation tips and fact sheets can be found on the Ministry of Environments website at http://www.ene.gov.on.ca/cons/index.htm#conservation

Another avenue for education and dissemination on water conservation information particularly to rural commercial and agricultural water users it thought the local Low Water Response Teams (See below).

2.3.7 Innisfil Creek Water Response Team

Subwatershed residents have expressed concerns over the lack of water flowing in Innisfil creek during some summer months. Recently during particularly dry summers, there has been time when it appears that there is no flow in some reaches of the creek. Other parts of Ontario have also suffered through similar drought conditions.

As a result, an "Ontario Low Water Response" plan has been prepared by the province. The plan is to assist in coordination and to support local response in the event of a drought. It is based on existing legislation and regulations and builds on existing relationships between the province and local government bodies.

The plan recognizes the partnership between provincial and local authorities and that natural resource and environmental management must be approached at both the provincial and local levels. The province provides overall direction and coordinates policies, science and information systems. In extreme circumstances support is provided where local declarations of an emergency have been made. At the local jurisdiction, the emphasis of this response plan is directed to collecting information, interpreting policy and delivering programs to minimize the effects of low water conditions.[33]

Water Response Teams (WRT) are proposed to coordinate local activities. Teams will consist of local water users and local and provincial water managers.

A WRT team has been established for the NVCA's watershed because of recent low water concerns particularly within the Innisfil Creek Subwatershed. The team is made up of local water users (farm organizations, tree nurseries, golf courses etc), municipal

32 Conserve Ontario website, Water Facts; http://www.ontarioconserves.gov.on.ca/english/water_facts.asp
33 Ontario Low Water Response, Revised July 2003 (MNR) page ii

and provincial representatives. Their objective is to identify low water conditions within the NVCA area of jurisdiction, co-ordinate the local response and facilitate provincial liaison.

The Water response team will use a combination of water data, provincial and local legislation, communication techniques and local tools to advocate conservation. Success of our WRT depends on local support and commitment to abide by the team's recommendations.

In cases of extreme drought, the WRT will ensure that key local and provincial decision-makers participate actively in the process to see that water management decisions are understood, supported and enforced.

Our water response team will focus on reacting to current low water conditions. Long term drought prevention efforts must be developed and are the responsibility of existing water management agencies and users. Drought management will only be successful through this combination of long-term preventive strategies and shorter-term crisis management actions.

Responsibilities for team members include attending meetings, communicating back to their sectors, sharing relevant data, and implementing drought management tools (e.g. municipal bylaws, coordinated irrigation, signage, public awareness communications).[34]

To assist the Team, NVCA will create a low flow monitoring and reporting strategy. This will assist the Team and our authority in providing a quickly respond to queries for low water information.

The opportunity for the water taking community of the Innisfil Creek Subwatershed to propose local management strategies through our Water Response Team will be investigated. We understand that this approach has met some success with the "Irrigation Advisory Committees" within the Long Point Watershed.

2.3.8 Water Management Proposed Recommendations

The following recommendations are made to help meet the subwatershed's goal and objective and targets, and responsibly managing our water resources in the future. Some recommendations are for additional works or studies to provide greater accuracy and improve the reliability of the models. Implementing the recommendation will assist in providing better tools for predicting impact form future developments.

Again it must be emphasised that adjustments may be made to these recommendations as additional information comes through other studies such as the Assimilative Capacity Study. Any changes will be posted on our website.

34 ibid, Page 16

Recommendation # 9
The recommended stormwater control targets, as outlined in this report, should be adhered to.

Recommendation #10
The hydrologic model should be calibrated and verified using existing flow data and, if necessary, additional flow monitoring data.

Recommendation #11
SWM pond locations and sizing should be established at the Secondary Plan or Functional Servicing Plan stage.

Recommendation #12
Functional Servicing Plans should be completed as part of Secondary Plans and should be integrated with on-going water management projects by the NVCA.

Recommendation #13
A hydrologic computer model such should be used by development proponents for calculating flows to size flood control facilities at the Functional Servicing Plan stage. Site-specific parameter values should be established during the Secondary Plan stage.

Recommendation #14
Efforts should be made to at least maintain the existing water balance and where possible enhance base flows throughout the Innisfil Creek Subwatershed as future development occurs.

Recommendation #15
The water balance model should be further refined and utilized as an assessment tool to quantify the impacts of existing and future water use practices on baseflow and to develop and evaluate strategies to minimize these impacts throughout the subwatershed.

Recommendation #16
Existing PTTW (surface water) should be reviewed to ensure that current water extractions do not exceed available quantities, particularly under baseflow conditions when irrigation is typically required (i.e. based on the water balance analysis, it appears that current permitted water extraction may exceed the available volume while still maintaining the minimum required flow based on the 30% Tennant's Method).

Recommendation #17
A method should be derived to facilitate the calculation of actual water extraction as opposed to maximum allowable extraction. This will enable a more accurate assessment of impacts of PTTW on base flow conditions and estimates of

available quantities for extraction.

Recommendation #18
Base flow monitoring should be completed at key locations to further refine the calibration of infiltration and regional baseflow factors for the water balance model at the catchment level within the Subwatershed.

Recommendation #19
The Erosion Threshold Assessment (Appendix G) recommends the following requirements for detailed development applications studies, using a "best management" approach to achieve the targets:

- **Undertake a pre/post development annual water budget as per the MOE stormwater manual to develop infiltration targets;**
- **Incorporate within the development design infiltration systems to try to meet the targets; and**
- **Within the SWM ponds, because of the high sensitivity to erosion in the watercourses, incorporate normal water quality first flush to be released over 48 hours.**

Please see Appendix G for the details and a proposed long-term solution:

……

The following is recommended as a result of the completion of the of the South Simcoe Groundwater study

Recommendation #20
The Groundwater study recommendations should be implemented and used as input to the source water protection planning process

……

The following is recommended concerns Water Conservation Plan

Recommendation # 21
It is recommended that a variety of education and incentive programs be developed promoting water conservation in rural areas for all water users (including those on private servicing), through cooperation and partnership with municipalities and all appropriate agencies. Serviced municipalities should continue to promote water conservation and ensure their water rates are structured to promote conservation and reflect the true service costs.

3. SUMMARY OF RECOMMENDATIONS, IMPLEMENTATION AND MONITORING

The plan's recommendations, implementation responsibilities and mechanisms are outlined in **Table 2**. It is a summary of management recommendations for the Innisfil

Creek Sub-watershed based on an assessment of additional requirements and actions that are necessary to further the plans goal, objectives and targets,

A great deal of the plan recommendations will be implemented through the municipal planning process. Policies and development criteria and standards may be recommended for inclusion in planning documents and utilized during the plan review processes of approval authorities and review agencies such as NVCA.

The subwatershed plan also recognizes that other agencies have a very significant role in contributing to the achievement of its goal and objectives. For example the Ministry of the Environment has legislative responsibility for stormwater management and has developed guidelines and manuals promoting best management practices. The subwatershed plan will support the efforts of these partner agencies and greatly appreciate their contributions towards implementing the plans goal and objectives.

Computer models, data and other information will be maintained and updated by the Conservation Authority. NVCA will play a major role as keeper and updater of the data and computer models, ensuring that cumulative impacts from development and cross-boundary water management issues are addressed. There will undoubtedly be significant updates to the data and models following the Assimilative Capacity Study and Source protection plans. This information will be placed on the Internet through NVCA's web site at www.nvca.on.ca.

Monitoring:

Despite our best efforts to establish a subwatershed management plan for the study area to maintain and enhance the features and functions of the natural environment, the plan is based on a finite set of information and assumptions about future land use and development. Consequently, it is very important that a set of "indicators" be established that can be monitored over time to determine the environmental health of the subwatershed. The monitoring recommendations outlined in table below will greatly assist in establishing these indicators and setting up the necessary long term monitoring programs

Table 2: Summary of Proposed Recommendations and Implementation Strategy.

Subwatershed Component	Recommendations	Lead/ Support Agencies	Implementation Mechanism	Time Frame
Natural Heritage System	#1 Municipalities should incorporate policies in their official plans indicating that "no development or site alteration" shall be permitted within any wetland meeting the provincial criteria for a wetland.	Municipalities, the province and NVCA	Provincial Growth Plans, Official Plans/Zoning By-laws and Approval Authorities reviews	On-going, Official Plan /Zoning update
	#2. Municipalities that conduct a detailed natural heritage evaluation identifying their "most significant" or "key features" should place them in their most restrictive official plan designation to ensure that no development or site alteration occurs. All municipalities within the subwatershed should conduct similar detailed natural heritage evaluations.	Municipalities, the province and NVCA	Provincial Growth Plans, Official Plans /Zoning by-laws and Approval Authorities	On-going OP updates
	# 3 The proposed additions to the Natural Heritage	Municipalities,	Provincial growth	On-going

	System (Map 5), should be incorporated into municipal planning documents. Policies should be provided to protect the natural heritage system from incompatible land use and development.	the province and NVCA	Plans, Official Plans & Zoning By-laws; Approval Authority review	Official Plan /Zoning Update
	# 4 Landowners, environmental organizations and stewardship agencies should consider the restoration and rehabilitation areas (Map 6) when identifying potential projects.	Landowners/ stewardship groups and organizations (DU, Scouts etc)	Restoration projects, Tree planting days	On-going
Aquatic Ecosystem	#5 No development or site alteration should occur within a minimum of 30m on either side of a natural stream. Existing agricultural areas are encouraged to provide as much of the 30 m vegetative buffer as possible for natural streams, but no less than 3m for both streams and municipal drains. Landowners are encouraged to only disturbed one side of a drain during clean outs.	Municipality, the province, NVCA, Approval Authorities	Assimilative Capacity Study, Source Water Protection Plans, Nutrient Management Plans, Official Plans, Health Water Programs	On-going
	#6 In addition to naturally vegetated buffers along watercourses, nutrient inputs within the subwatershed should be controlled by use of all available best management practices.	Municipality, the province, NVCA	Assimilative Capacity Study, Source Water Protection Plans, Nutrient Management Plans	On-going
	#7 The Assimilative Capacity Study recommendations for long-term monitoring should be funded and implemented.	Municipality , the province, developers and NVCA	Assimilative Capacity Study, Source Water Protection Plans, Nutrient Management Plans and development proposals	On-going
	#8 NVCA staff and their partner organizations should continue to work through the Community River Restoration Program to identify additional opportunities within the Innisfil Creek Subwatershed for focused, detail restorations studies similar the Beeton Creek Stream Health Report.	NVCA and local community organizations	Through NVCA's Community River Restoration Program	On-going
Water Management	# 9 The recommended stormwater control targets, as outlined in this report, should be adhered to.	Municipalities, MOE and NVCA	Through Functional Servicing Plans and development proposals	On-going
	#10 The hydrologic model should be calibrated and verified using existing flow data and, if necessary, additional flow monitoring data.	Municipalities NVCA and the province	Partnerships with municipalities and agencies through the Assimilative Capacity Study and Source Water Protection Plans	2005- 2006
	#11. SWM pond locations and sizing should be established at the Secondary Plan or Functional Servicing Plan stage.	Municipalities , MOE and NVCA	Functional Servicing Plans and. development proposals	On-going
	#12 Functional Servicing Plans should be completed as part of Secondary Plans and should be integrated with on-going water management projects by the NVCA.	Municipalities, MOE and NVCA	Through development proposals	On-going
	#13 A hydrologic computer model should be used by development proponents for calculating flows to size	Municipalities and NVCA	Through Functional Servicing Plans and.	On-going

	flood control facilities at the Functional Servicing Plan stage. Site-specific parameter values should be established during the Secondary Plan stage.		development proposals	
	#14 Efforts should be made to at least maintain the existing water balance and where possible enhance base flows throughout the Innisfil Creek Subwatershed as future development occurs.	Municipalities , MOE and NVCA	Through the Assimilative Capacity Study (ACS) and development proposals	Ongoing
	#15 The water balance model should be further refined and utilized as an assessment tool to quantify the impacts of existing and future water use practices on baseflow and to develop and evaluate strategies to minimize these impacts throughout the subwatershed.	Municipalities , MOE, NVCA and other partner ACS agencies	Through the Assimilative Capacity Study	2005
	#16 Existing PTTW (surface water) should be reviewed to ensure that current water extractions do not exceed available quantities, particularly under baseflow conditions when irrigation is typically required (i.e. based on the water balance analysis, it appears that current permitted water extraction may exceed the available volume while still maintaining the minimum required flow based on the 30% Tennant's Method).	MOE and the NVCA Low Water Response Team	Through the Source Water Protection Plans	2005- 2009
	#17 A method should be derived to facilitate the calculation of <u>actual</u> water extraction as opposed to maximum allowable extraction. This will enable a more accurate assessment of impacts of PTTW on base flow conditions and estimates of available quantities for extraction.	MOE and the NVCA Low Water Response Team	Through the Source Water Protection Plans	2005-2009
	#18 Base flow monitoring should be completed at key locations to further refine the calibration of infiltration and regional baseflow factors for the water balance model at the catchment level within the Subwatershed.	Municipalities NVCA and partner ACS agencies	Through the Assimilative Capacity Study and Source Water Protection Plans	2005-2009
	#19 The Erosion Threshold Assessment (Appendix G) recommends the following requirements for detailed development applications studies, using a "best management" approach to achieve the targets: -Undertake a pre/post development annual water budget as per the MOE stormwater manual to develop infiltration targets; -Incorporate within the development design infiltration systems to try to meet the targets; and -Within the SWM ponds, because of the high sensitivity to erosion in the watercourses, incorporate normal water quality first flush to be released over 48 hours. Please see Appendix G for the details and a proposed long-term solution:	Municipalities NVCA and partner ACS agencies	Through the Assimilative Capacity Study and future development proposals	On-going
	#20 The Groundwater study recommendations should be implemented and used as input to the source water protection planning process	Municipalities MOE, NVCA	Through the Source Water Protection Plans, official plans and development proposals.	On-going

	#21 It is recommended that a variety of education and incentive programs be developed promoting water conservation in rural areas for all water users (including those on private servicing), through cooperation and partnership with municipalities and all appropriate agencies. Serviced municipalities should continue to promote water conservation and ensure their water rates are structured to promote conservation and reflect the true service costs.	Municipalities, the province and NVCA	Through the Source Water Protection Plans, and municipal and provincial education programs	On-going

4.0 ***REVIEW AND EVALUATION PROCESS***

This section outlines the process for updating and evaluating the Subwatershed Plan. The primary method to achieve this update will be through NVCA's Strategic Planning Cycle as shown in figure 5. This figure demonstrates the integration of the business planning and watershed planning cycles.

The advantage of this process is that the subwatershed plan will be continuously updated and its effectiveness evaluated through the annual Business Plan Cycle. This will include the annual review and updates to the programs that will implement and monitor the subwatershed plan. It will be through the work plan and budget exercise that we can take into account the most recent changes in issues, pressures or municipal and provincial initiatives such as the Assimilative Capacity Study and local growth management plans. This means that the subwatershed plan will effectively be updated every year, as the various programs and technical components are reviewed, evaluated and updated.

Significant changes in direction or updates to the subwatershed plan will be noted and posted on our website. An example of this type of change may result from the Assimilative Capacity and Source Water Protection Plan Studies. These studies will use and build upon the information, data and models developed for this study. It may be that following these exercises, we will adjust some of our targets or recommendations based on the new science.

In addition as new monitoring information is collected, appropriate adjustments may be made to the management strategies including the recommendation and target. These updates will take the form of addendums to the plan posted on our website with electronic notices sent to affected and interested parities.

Figure 5 - Strategic Planning Cycle